RURAL ROAD MAINTENANCE THROUGH LABOUR-BASED LENGTHMEN SYSTEM IN ZAMBIA

by

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ABSTRACT

Rural road maintenance has received little or no attention in Zambia for a long time, resulting in an adverse impact on the economy. Meanwhile Road Authorities have continued to use traditional capital-intensive periodic and routine maintenance at the expense of scarce foreign exchange. The system has not performed well, hence the current state of roads.

Labour-based methods for routine maintenance under the Lengthmen System used in Kenya, Lesotho and other developing countries in the Sub-Saharan Africa have proved to be technically and economically viable.

In this report the author examines the desirability of using the Labour-Based Lengthmen System as an alternative to the existing capital-intensive methods in Zambia. This is done through reviewing rural road maintenance in Zambia and then carrying out a comparative analysis of the same between Zambia, Kenya and Lesotho

The comparative analysis shows that Zambia is not performing well when compared to Kenya and Lesotho. Meanwhile, the Lengthmen System is more desirable compared to other methods under the current economic conditions. Recommendations, based on the comparative analysis, have been given to improve rural road maintenance in Zambia.

PREFACE

This dissertation is the author's own work unless specifically indicated to the contrary in the text and has not been submitted in part, or in whole to any other University. The research was carried out at the University of Natal in Durban.

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ABBREVIATIONS AND ACRONYMS

CWS	- Civil Works Section
DC	- District Council
DDCC	- District Development Co-ordinating Committee
DES	- Director of Engineering Services
DISS	- Department of Infrastructure and Support Services
DMIE	- District Maintenance and Improvement Engineer
DOW	- Director of Works
DRIMP	- District Roads Improvement and Maintenance Programme
EU	- European Union
GDP	- Gross Domestic Product
GNP	- Gross National Product
GRZ	- Government of the Republic of Zambia
IA	- Irish Aid
IDA	- International Development Agency
ILO	- International Labour Organisation
KfW	- Kredistanstalt fur wiederaufbau
km	- Kilometre
km/h	- Kilometres per Hour
LCU	- Labour Construction Unit
LHDA	- Lesotho Highlands Development Authority
LHDF	- Lesotho Highlands Development Fund
LHRF	- Lesotho Highlands Revenue Fund
MCT	- Ministry of Communication and Transport
MLGH	- Ministry of Local Government and Housing
MOW	- Ministry of Works
MRP	- Minor Roads Programme
MRs	- Minor Roads
MWS	- Ministry of Works and Supply
NORAD	- Norwegian Agency for International Development

NRB	- National Roads Board
OIC	- Officer in Charge
PDCC	-Provincial Development Co-ordinating Committe
RARP	- Rural Access Roads Programme
RD	- Roads Department
RDTS	- Roads Department Training School
ROADSIP	- Road Sector Investment Programme
ROMAR	- Routine Maintenance and Regravelling
RRMP	- Rural Road Maintenance Programme
SIDA	- Swedish International Development Agency
SSA	- Sub-Saharan Africa
SSCP	- Small-Scale Contractor Programme
TETAP	- Technical Engineering and Transport Assistance Project
UNDP	- United Nations Development Programme
US$	- United States Dollar
vpd	- Vehicles per day
WFP	- World Food Programme
ZNTB	- Zambia National Tender Board

CHAPTER ONE

1 INTRODUCTION

1.1 General

In the last two decades, there has been a shift in road planning away from major road networks towards secondary and feeder roads, in a number of developing countries.

There is justified concern of governments and donors to invest the limited funds in the most effective way or manner. This has led to useful developments in which planners view and analyse rural roads (Edmonds, 1983).

In economic terms, rural roads are important elements of a road network. Without them any idea of improving a country's economy through the exploitation of agriculture is of little hope. Edmonds further acknowledges that rural roads have sometimes been perceived only in terms of their economic or strategic and political role, rarely in their potential for social development.

Given the various financial, technical and administrative restraints of governments in the Sub-Saharan Africa (Harral et al, 1983; Heggie, 1994) and in particular Zambia, it is clear that the best one can hope for as far as rural road maintenance is concerned is a minimum level of maintenance service.

There is no doubt whatever that, as far as section improvement and routine maintenance of rural roads are concerned, labour-based methods, in general, provide the least cost alternative (Howe and Bantje, 1995).

With equipment-intensive maintenance, it is usually fuel, spare parts and foreign exchange constraints, which restrict operations whereas in labour-based programmes, it is the timely payment and close supervision which ensure proper maintenance. The system is therefore

ideal for implementation by local authorities, which lack sophisticated support services required for equipment-based maintenance (Beenhakker et al, 1987).

Through a blend of research, experimental work and pilot projects, doubts especially among engineers and planners as to the feasibility of labour-based methods have been gradually resolved and the conditions under which labour-based methods represent the most appropriate choice of technique can now be specified (Hagen and Relf, 1988). Moreover, labour-based methods have gained additional importance owing to the international debt crisis, the stagnation in capital aid flows, the dismantling of policies, which previously had over-valued developing country currencies and the process of structural adjustment. These developments have tended to strengthen the comparative advantage of local resources, including labour, in relation to evermore-expensive imported equipment.

In Zambia, rural road routine maintenance has received little or no attention for a long time. While urban roads continue to be rehabilitated and maintained using equipment-intensive methods, rural roads have remained unattended to and have deteriorated over the years to the extent were they are impassable during the wet season. Rural roads play a major role in facilitating agriculture in Zambia. It is therefore important that they are given due attention in order to reduce the current adverse effects, which have fallen on the farming community and the rural population at large. These include inadequate and high cost of road transport services, and lack of affordable means of transport, which seriously constrains rural economic and social development.

Zambia's Provincial and District Road Authorities have been relying on the traditional capital-intensive methods for periodic and routine maintenance operations. This kind of system has not worked well as it is difficult and expensive to maintain as alluded to earlier on. Meanwhile, weak institutional arrangements and ineffective weak methods are negative factors which also contribute to poor performance of rural road agencies (Thagesen, 1996).

Considering the lack of income opportunities in many rural areas and the intractable problems inherent in the deployment and operation of mechanical equipment for small-scattered work, labour-based methods should be considered as the normal choice for rural road maintenance works. However, the development of a labour-based capability for road works is a long-term undertaking requiring considerable up-front inputs in technical assistance and training. The future development of labour-based capability would also benefit greatly from the transfer of expertise among SSA countries (Riverson et al, 1991; Riverson and Carapetis, 1991; Tambatamba, 1999). Problems of supervision, the poor motivation of workers and the inherent lack of flexibility of public sector operations, have proven very difficult to overcome in force account work. Contract operation although not without any problems, is a preferred alternative. The weakness of domestic contracting capability in Zambia, is a major obstacle. Therefore, a long-term rural programme would provide the opportunity to build up the capability of the domestic construction industry. Policy decisions to favour the use of a labour-based lengthmen system for rural road maintenance are therefore necessary.

Given the severe lack of resources at local level, rural road development in Zambia will continue to require central funding, a large proportion of which will be provided from external sources.

1.2. Aim of the Study

The aim of the study was to review the Rural Road Maintenance System in Zambia and compare it with those of other Sub-Saharan African countries, in particular Lesotho and Kenya.

1.3. Specific Objectives of the Study

The specific objectives of the study were;

a) To examine the desirability of using a Labour-Based Lengthmen System as an alternative to the existing capital-intensive methods for rural road maintenance in Zambia.
b) To produce recommendations for improving rural road maintenance in Zambia.

1.4. Scope, Definitions and Limitations of the Study

The author discusses the suitability of using labour-based methods in rural road maintenance. Although other types of maintenance are mentioned, emphasis is on routine maintenance being the most neglected in Zambia.

Rural roads in this thesis refer to the public roads functionally classified below primary, trunk or secondary roads in most countries. They include roads often described as rural access, feeder, agricultural and unclassified roads. They may include tertiary roads if these are functionally grouped as rural roads as here defined.

Limitations of the study were mainly due to the prohibitively long distances between the place of study (South Africa) and the countries studied in this thesis (Zambia, Kenya and Lesotho). In fact, only written material was consulted in the case of Kenya. Other limitations included financial and time constraints. Information in this report is valid for the time of study (1999).

1.5. Study Approach

The following methods were adopted and used for carrying out investigations in this thesis;

- Study of literature, government and World Bank documents, journals, manuals, reports and magazines.

- Collection of information on rural road maintenance systems for Zambia, Lesotho and Kenya.
- Visiting labour-intensive sites in Zambia and Lesotho.
- Interviewing officers in charge of rural roads in Zambia and Lesotho.

1.6. Structure of the Report

The report starts with an introduction in chapter one which gives an overview of the state of rural roads in the SSA and Zambia in particular, and how labour-based methods are regarded for rural road maintenance in the current economic conditions.

The literature review in chapter two gives a general view of road maintenance and labour-based methods. The suitability of labour-based methods for rural road maintenance is outlined. The chapter also discusses the origin and various lengthmen systems practiced in SSA.

To examine the suitability of labour-based methods and the lengthmen system in particular, for rural road maintenance in Zambia, a review of Zambia's rural road maintenance (chapter three) was carried out. Since cross-pollination and horizontal transfer of expertise is also vital among SSA countries, case studies of rural road maintenance on two countries advanced in the application of labour-based techniques were also carried out. The countries are Kenya and Lesotho, discussed in chapters four and five respectively. A comparison of the three countries appears in chapter six. An analysis of the situation follows in chapter seven.

Finally, the main findings and conclusions are outlined in chapter eight, which also includes recommendations for improving rural road maintenance in Zambia.

CHAPTER TWO

2 LITERATURE REVIEW

2.1 Road Maintenance-General Review

Highway maintenance is a problem affecting both rich and poor nations but the situation is worse in developing countries in Sub-Saharan Africa (World Bank, 1988).

Another World Bank Paper (Cook et al, 1985) stated that low-volume rural road maintenance typically suffers most from the institutional, financial and human resource constraints hampering the maintenance of national highway systems. It further goes on to say that the failure to maintain highways is tantamount to an act of disinvestment, for it implies the sacrifice of past investment in roads. The loss of physical infrastructure is only part of the picture. Not only do bad roads deter users or curb the volume of traffic, but also raise the cost of road transport which is the dominant mode for both people and freight in most countries. One unit of currency reduction in road maintenance expenditure can increase the cost of vehicle operation by more than one unit of the respective currency. Insufficient spending for maintenance thus exacts hidden costs several times the cost of maintaining and restoring roads. Road users bear the brunt of these additional costs, which dwarf the savings to a road agency from deferring or neglecting maintenance.

In his book, Thagesen (1996) writes that the main causes of the road maintenance problem in most developing countries are; insufficient funds, lack of foreign exchange, shortage of qualified staff, absence of machines and spare parts, deficient institutional arrangements and poor management capability.

The situation is serious since developing countries have lost precious infrastructure worth billions of dollars through the deterioration of their roads. They are likely to lose billions more if they do not immediately begin to do much more to preserve their roads (World Bank, 1988). Large road networks, built at great expense, have been undermaintained or

received no maintenance at all, as is the case with most rural roads. Most rural roads now need complete reconstruction and restoration to maintainable standard before any form of meaningful routine maintenance can be established.

The urgency of the situation has not always been fully appreciated by most donors and lending agencies, some having been readier to provide funds for new construction than maintenance and restoration. New construction has sharp political visibility while maintenance little glamour.

2.2 Rural Road Maintenance and Labour-Based Methods

As mentioned earlier, rural road maintenance typically suffers most as priority is given to maintenance of national, urban and other paved roads. Maintenance responsibilities require the development of community capabilities complemented by effective technical and financial support from the central government. Lack of investment in rural road maintenance has had adverse effects on the transport sector and on agriculture, forestry, irrigation and overall rural development (Dhir, 1995; ILO, 1996).

Many maintenance activities are carried out by labour using many technologies. Due to the dispersed nature of most maintenance activities on rural access infrastructure, these activities are best carried out by small local contractors, force account groups or self- help efforts (Beenhakker et al, 1987). Since routine maintenance of all access road infrastructure requires a small but continuous flow of resources over a large number of separate points, labour-based is particularly cost effective where population is high. Labour-based routine maintenance should be able to provide minimum level of maintenance services to maximum number of kilometres of road as well as depending to the minimum extent possible on external financial and material resources (Beenhakker et al, 1987).

The main advantages of using labour-based methods in rural road maintenance are:

- low overall cost
- low capital costs
- less foreign exchange requirements
- more local employment
- improved income distribution
- flexibility to operate on many sites
- development of local skills
- appropriate use of local resources
- local participation
- large percentage of maintenance cost flows into the hands of the community; and
- multiplier effect on other social and economic factors

(Beenhakker et al, 1987; Anderson et al, 1996; Thagesen, 1996).

However, there are other potential sources of problems that need to be carefully examined with respect to the environment. These are:

- motivated labour not available everywhere in sufficient numbers
- labour-based works are management and supervision intensive
- labour availability may vary according to season in terms of costs and sensitivity
- competes with other rural development and agricultural activities

(University of Natal, 1999).

2.3 Labour-Based Routine Maintenance

2.3.1 Need for Rural Road Maintenance

The main reasons and need for rural road maintenance are;

- increasing the life of the road and therefore postponing the day of renewal
- reducing the vehicle operating costs and hence promoting public mobility
- reducing travel times, safety, regular movement and openness

(TRL, 1994; Anderson et al, 1996)

2.3.2 Basic Causes of Deterioration of Rural Roads

Deterioration is the worsening of the road over a long time due to various causes leading to defects. The three most important deterioration types are;

- degradation of the carriageway
- erosion of the drainage system
- silting of the drainage system

The major causes causes of deterioration are rainfall, steep gradients, flat gradients, traffic and vegetation.

2.3.3 Basic Maintenance Operations for Rural Roads

The basic maintenance operations for rural roads are routine maintenance, periodic and emergency maintenance. These distinctions are important in setting priorities and planning, organising, quantifying of maintenance work, estimations for funding purposes and allocation to maintenance personnel (TRL, 1994; Anderson et al, 1996).

2.3.3.1 Routine Maintenance

Normally small-scale operations with little or limited requirements are usually done over a year. They mainly consist of unskilled activities, with the exception of grading. Most road

agencies usually contract out routine maintenance, as it is difficult to do the work economically using direct labour or force account. Centralisation of road authorities makes it difficult for them to control dispersed maintenance activities effectively. Small contractors near the locations are likely to offer cheaper, reliable service and continuous, steady workload (Beenhakker et al, 1987)

2.3.3.2 Periodic Maintenance

Under periodic maintenance, activities are carried out on a road or section after a number of years (3-5 years) and require resources from the client to implement. Activities include reshaping, installation, reconstruction of small structures, rehabilitation of major structures and provision of gravel stocks.

2.3.3.3 Emergency Maintenance

Emergency maintenance involves sudden or unforeseen damages, e.g. washouts, serious erosion, landslides, rockfalls etc.

Out of these routine maintenance can be shown to be the most cost-effective activity in the road sector, along with emergency maintenance (Anderson et al, 1996). Its cost-benefit ratio is normally far higher than for new construction or periodic maintenance roads (about 1% of the asset value per year). Failure to carry out proper routine maintenance can lead to earth or gravel roads becoming unserviceable in a period as little as five years. The consequence would then be total rehabilitation requirement at substantial additional costs representing a rate of asset depreciation of up to 20% per annum. This cost-benefit relationship in terms of the road asset alone is significant, without considering direct user costs and consequences of delays and so on.

From the above, it is therefore imperative to give higher priority to routine maintenance in terms of financial and physical resources, and management effort. Rehabilitation and periodic maintenance can be adjusted within the balance of available funds.

2.3.4 Rural Road Routine Maintenance Activities

Rural road routine maintenance activities (in order of priority) are;

- inspection and removal of obstructions and debris
- cleaning of culverts, including inlets and outlets
- cleaning and repairing of drifts and splashes, including inlets and outlets
- repairing of culvert walls and wingwalls
- cleaning of side drains and excavating to original size
- repairing and constructing of scour checks
- cleaning and repairing of mitre drains and excavating to original size
- filling of potholes and ruts along the carriageway
- repairing of shoulders and slopes
- grubbing of edge and reshaping of carriageway
- cutting of grass
- clearing of bushes

(Anderson et al, 1996).

2.3.5 Routine Maintenance Planning and Monitoring

Since routine maintenance has to be carried out along the entire road network (widely scattered activities), it is not easy to control. Therefore it is important that the organisation structure for the road agency is in line with the particular needs of routine maintenance so that work can be carried out anywhere on the entire network at anytime. Also the priorities must be established at particular times.

2.3.5.1 Priorities for Maintenance Activities

Drainage should always be considered first, since neglected drainage can quickly lead to the deterioration of the road. The main objective is to ensure that rain water runs off the road as quickly as possible while causing as little damage as possible. The condition of the

road surface depends on the function of the drainage system. The workload on the carriageway is therefore greatly reduced if the drainage system is in good shape.

The ROMAR Handbook (Anderson et al, 1996) suggests the following activities in their priorities as follows:

a) Before the rains;
- clean culverts/splashes/bridges/drifts
- clean mitre drains
- clean side drains
- repair side drains erosion and scour checks

b) During the rains;
- inspect and remove obstructions
- clean culverts
- clean side drains
- repair side drain erosion and scour checks

c) End of rains;
- fill potholes and ruts on carriageway
- reshape carriageway
- repair erosion on shoulders, on backslopes and in drains
- reinstate scour checks
- cut grass

d) Dry season;
- clear bush
- repair structures
- repair carriageway

2.3.5.2 Work planning, supervision and monitoring

The following data or requirements (Anderson et al, 1996) are needed to develop a good work plan:

- the quantity of work to be carried out over a specified period of time
- the work standards to be achieved
- the resources (of the contractor) available
- the productivity rates for each activity
- supervisors and gang leaders (contractor only)
- labourers (contractor only)
- hand tools and measuring aids for gang leaders
- simple equipment if necessary, e.g. tractor, towed grader etc
- transport, bicycle, pickup for material and supervision

Research has shown that supervision and monitoring labour-based routine maintenance is more important than any technical aspects (Taylor, 1992). Thus supervision and monitoring is very important and has the following purposes:

- to ensure that work is carried out in accordance with the contract specification and standards
- to control the productivity at the site
- to correct and instruct where and when necessary
- to be able to arrange for the operational inputs
- to control costs
- to receive sufficient feedback in order to prepare further bids

It is also recommended (Anderson et al, 1996) that the site be visited weekly in order to:

- collect reports from gang leaders
- check the quality of work and discuss problems arising
- carry out job training on site
- issue instructions and work plans for subsequent week.

2.3.6 Type of Contracts involving Labour-Based Rural Road Routine Maintenance

The type of contracts involving labour-based rural road routine maintenance includes;

- single length-person contracts for a road (1-2 kms)
- petty contract (or labour group) where a contract is given to a very small-scale contractor who in turn employs a small team (5 to 10 kms)
- small-scale contract for a particular road (20 to 100 kms)
- small-scale contract for a specified road network (100 to 300 kms)

These contracts can be specified in different ways, i.e. standard, quantity-based and lump-sum (Anderson et al, 1996).

a) Standard-based

The contract defines the standards of the specified road features that have to be maintained over a certain period. The contractor has the responsibility of continuously assessing the road conditions and maintenance work that needs to be done.

b) Quantity-based

The contract defines the exact quantity of work for each feature of the road to be maintained over a specified period of time.

c) Lump-sum-based

The contract defines the standards of the specified road features that have to be maintained and the total amount of money (lump-sum) the contract covers over a specified period of time. This kind of contract is based on cost assumptions made by the client.

2.4 Labour-Based Routine Maintenance of Rural Roads under the Lengthmen System

2.4.1 The Lengthmen System

The Lengthmen System can be described as a form of road maintenance that involves the allocation of various portions of the roads to specific individuals or small-scale contractors for regular maintenance (Taylor, 1993).

The Lengthmen System is on contract basis between a government agency responsible for rural roads and a local individual or small-scale contractor (normally residing close to the infrastructure) to carry out all routine maintenance over a fixed length of the road using hand tools. Hand tools may either be furnished by government or the contractor depending on the agreement. Payment is contingent on satisfactory performance. The system operates well in populated areas where the lengthmen contractors are close the road. Further, the system is suitable for rural roads of low traffic volumes (<50 vpd), above which it needs some help of light equipment. Lengthmen are motivated because of the income they earn.

Contracts of up to 2 km (for single-person contractors, as is the case in Kenya) and up to 40 km (for small-scale contractors, as is the case in Lesotho) are given. The agency responsible normally appoints supervisors who monitor the condition of the road, direct operations, make reports and authorise payment upon satisfactory performance (Anderson et al, 1996).

The advantage of the Lengthmen System is that a continuous maintenance of the entire road can be guaranteed at all times. It is cheap, requires little training of workers and requires no equipment (Howe and Bantje, 1995). About 85% of the costs are local, so the money remains in the country.

The length of the section to be maintained by each lengthman contractor depends on the terrain, rainfall, traffic, vegetation, number of drains, quality of construction, type and size

of road and gradients. Maintenance tasks (see section 2.3.4) vary according to the factors above.

The standard set of tools is:

- hoe;
- shovel;
- grass-cutter;
- bush knife;
- rake or spreader;
- wheel barrow (may be shared);
- earth rammer;
- tape measure;
- ditch template;
- spirit level (may be shared); and
- strings and pegs.

Transport is only required by supervisors (bicycles or pick-up depending on the distance from the supervisor's office or home).

However, the lengthmen system, like any other systems of maintenance has limitations. It needs a lot of commitment in terms of supervision and timely payment. It may also be subject to nepotism. Despite these drawbacks, it remains one of the most popular methods of rural road maintenance using labour-based methods in some developing countries like Kenya and Lesotho. The programmes in these two countries will therefore be discussed in depth in the chapters four and five respectively.

The Kenyan system involves single-person contractors who are employed on a contract basis to carry out maintenance on specific sections of the road (Agingu, 1990). In Lesotho contracts are given to small-scale contractors to maintain specific sections of the road. The lengthmen system used depends largely on the country's capabilities and environmental factors.

However, uncertainty still exists over its effectiveness despite the fact that it has been in use for almost two decades. The Kenyan Rural Access Programme (RARP/MRP) has a total of over twenty years experience with the system and it is currently used on a network of over 9,000 km of gravel roads throughout the country.

2.4.2 The Original Concept of the Lengthmen System

The original concept was that the lengthmen should;

- be recruited from the original construction gang
- be responsible for a fixed section of the road
- reside adjacent or close to the road
- work three days of their choice per week
- choose what work to do themselves
- be paid if the standard of the work of the section were satisfactory

Taylor (1993) notes that due to experience over time these fundamental principles have changed. The need for close supervision and monitoring have been identified to be important and critical. The lengthmen (RARP Project in Kenya) were working in uncoordinated ways and concentrating on less important work. There was no prioritisation of activities. Drainage activities were especially neglected. This has led to the introduction of headmen and overseers. Also working alone made the lengthmen complacent in their work and hence needed further training. Correct scheduling of activities throughout the year has been seen to be important. For instance, it is vital that lengthmen concentrate on the cleaning of the drainage system in advance of the rain season. Lengthmen also needed specific training and supervision for different activities. The original assumption that lengthmen recruited locally would receive pressure from the community has not worked in practice as the community only gets aroused by major defects which implies that the road is not undergoing maintenance (University of Natal, 1999).

2.4.3 Different Lengthmen Systems in Operation in the Sub-Saharan Africa

A number of Sub-Saharan Africa have had experience with labour-based maintenance with most programmes starting as pilot projects and have since grown into sustained national programmes (ILO, 1990; ILO ASIST, 1999).

a) Kenya

The programme started in 1978 when the Technology Unit of Rural Access Road Programme (RARP) devised the system, whereby labourers living near the road (often former construction workers on RARP projects) would be contracted to maintain a specific stretch of the road on a semi-continuous basis. The lengthmen system was found to compare well to the traditional equipment-based system in terms of physical output because of its continuous nature.

Currently, there are more 6000 lengthmen covering more than 9,000 km of roads for routine maintenance. Maintenance units involve maintenance inspectors, overseers, headmen and lengthmen. About 100 lengthmen cover a length of about 150 km. The cost is about US$300/km per year. Studies carried out in Kenya (Taylor, 1992, 1993) show that overseers spent more of their time travelling than supervising. The lengthmen were also not utilised properly. These notions have however changed for the better through research (Petts and Jones, 1989).

b) Botswana

Between 1980 and 1992 a district pilot project of labour-intensive road construction and maintenance was run, modelled on the Kenya RARP. This was later developed into a national programme including maintenance. Problems experienced were not exactly the same as that of Kenya. Nevertheless, the lengthmen system maintained roads at an average standard that was higher than that of roads maintained by the Roads Department with

equipment (Howe and Bantje, 1995). Various alternative routine maintenance organisations were tried out such as lengthmen supervised by technical assistants and gang leaders on bicycles. Most of the districts in Botswana now operate in groups of maintenance workers and a few on the single-person lengthmen system. People prefer to work in groups of five under a team leader. These groups are called gangs. The team leader would have attended a training course. Tasks are assigned and arranged to ensure good productivity. Each group covers about 7 km of road at an annual cost of US$ 483/km.

The major problems are: weak and inconsistent management of trained staff, leading to strong negative effect on productivity and problematic disbursement of funds from district bank accounts (Howe and Bantje, 1995).

c) Lesotho

Lesotho started the system in 1984 under force account (Howe and Bantje, 1995). A length-person was appointed to maintain 1-2 km of road, depending on the terrain. The Regional Engineer's supervisor, who visited the site on a weekly basis, depending on transport availability, supervised him. The planning and allocation of work was done as the supervisor travelled along the road. The length-person was a full-time employee and paid on a monthly basis. The cost (including supervision and overheads) was about US$ 1450/km per annum of which labour accounted for US$ 800/km (based on the average of 1.5 km per worker per year).

In 1994, the single-person system under force account was abandoned in preference to the small-scale contractor system. A contractor is given 30 to 40 km of road to maintain on an annual contract. The work is scheduled on a monthly basis by the contracts supervisor, who also monitors the progress on a fortnightly or monthly basis. This programme is based on task rates which are set by the client (Government of Lesotho-Labour Construction Unit) and the number of worker-days per month. Suppose a contractor maintains 40 km of road, the average number of worker-days he has available per month is based on 26.6 workers (40/1.5) working 22 days, or 587 worker days per month. Payment of the

contractor is done on the basis of the actual work performed. The contract supervisor measures the work at the end of the month and pays the contractor for the tasks covered only. The annual cost is around US$ 1300/km.

d) Malawi

Malawi became aware of the district councils inability to maintain rural roads in the mid 1970's. Road Improvement and Maintenance Units (DRIMP units) were thus established at a number of district councils in the early 1980's. The roads were selected on fairly strict economic criteria and were mainly village roads carrying 5-50 vehicles per day. The methods and techniques used were similar to those used in Kenya. Each maintenance unit has an officer-in-charge and a number of foremen based at sub-depots (Hagen and Relf, 1988).

The lengthmen system has been adopted, routine and periodic maintenance being carried out by gangs of 5-6 labourers under a foreman. Employed as maintenance contractors they are still casual labourers, usually living adjacent to the road they are working on.
The main divergence from the Kenyan system is the prominence given to gangs. Each labourer theoretically maintains 2 km. An overseer who keeps records and transmits instructions is responsible for supervising each gang.

e) Mozambique

Labour-based road construction and maintenance started in 1981 with the assistance of NORAD and ILO. As construction work progressed, men were detached from the main labour force and put to regular maintenance on the completed section as lengthmen. They were employed on a full-time basis and each was responsible for the maintenance of a 1.6 km stretch of road. The system operated well on some sections such as the Lugela-Limbue section, until withdrawal in August 1982. The major problems experienced were the heavy rains in the wet season, which made work difficult for the lengthmen (Geddes, 1987).

Political instability greatly contributed to the lack of consistency in the programme. By 1990, Lengthmen were working for five days every week covering a length of 2.5 km each for the maintenance of gravelled roads.

f) Tanzania

Tanzania uses both the single-person and the gang systems. The gangs of 7 to 8 people are assisted by headmen. The foremen or overseers visit the site twice a week. Tanzania and in particular Mbeya have had better results from single-person contractors (MOW, 1987; ILO, 1990).

The major obstacles to most of the maintenance programmes are the high costs involved in sustainability. Developing countries in the Sub-Saharan Africa are still struggling to finance maintenance programmes even when using the economic lengthmen system and are mostly donor aided. Supervision is also hampered by lack of vehicles in most district councils. In this kind of scenario it is still imperative for governments to maintain or look for maintenance systems, which are best and affordable (University of Natal, 1999).

CHAPTER THREE

3 RURAL ROAD MAINTENANCE IN ZAMBIA

3.1 Country Background

Zambia is a landlocked southern African country. It has a surface area of 752,614 square kilometres (see figure 3.1) and a relatively small population of about 9.5 million people (1999). Zambia is highly urbanised with about 40% of its population living in urban areas. It has an average population density of about 13 people per square kilometre. The country is endowed with abundant land for agricultural expansion, a resource base which includes minerals, abundant wildlife and a high tourism potential (Europa, 1999a, 1999b).

The present state and future development of its economy is supported by a multi-modal transportation system operated through various infrastructure including roads, railways, airways, inland waterways and pipelines. However, the road infrastructure is the most significant in terms of network extent and dispersion across the country.

The total length of the road network was estimated at about 66,000 km, made up of 36,761 km of roads gazetted and designed under various functional classes and about 30,000 km of ungazetted roads (MCT, 1997).

The original infrastructure was developed during the first half of the century to access mineral resources on the Copperbelt Province along what is locally known as the "line of rail" between Livingstone in the Southern Province and Chingola on the Copperbelt Province. Later, road and rail systems were extended to open up other parts of the country and establish better communication links with Zambia's neighbours, notably in the north and east.

As the population has grown and new areas opened up to agriculture, the road network has generally been extended. Currently, Zambia has one of the highest lengths of the road network per capita in Africa (Jhala, 1999).

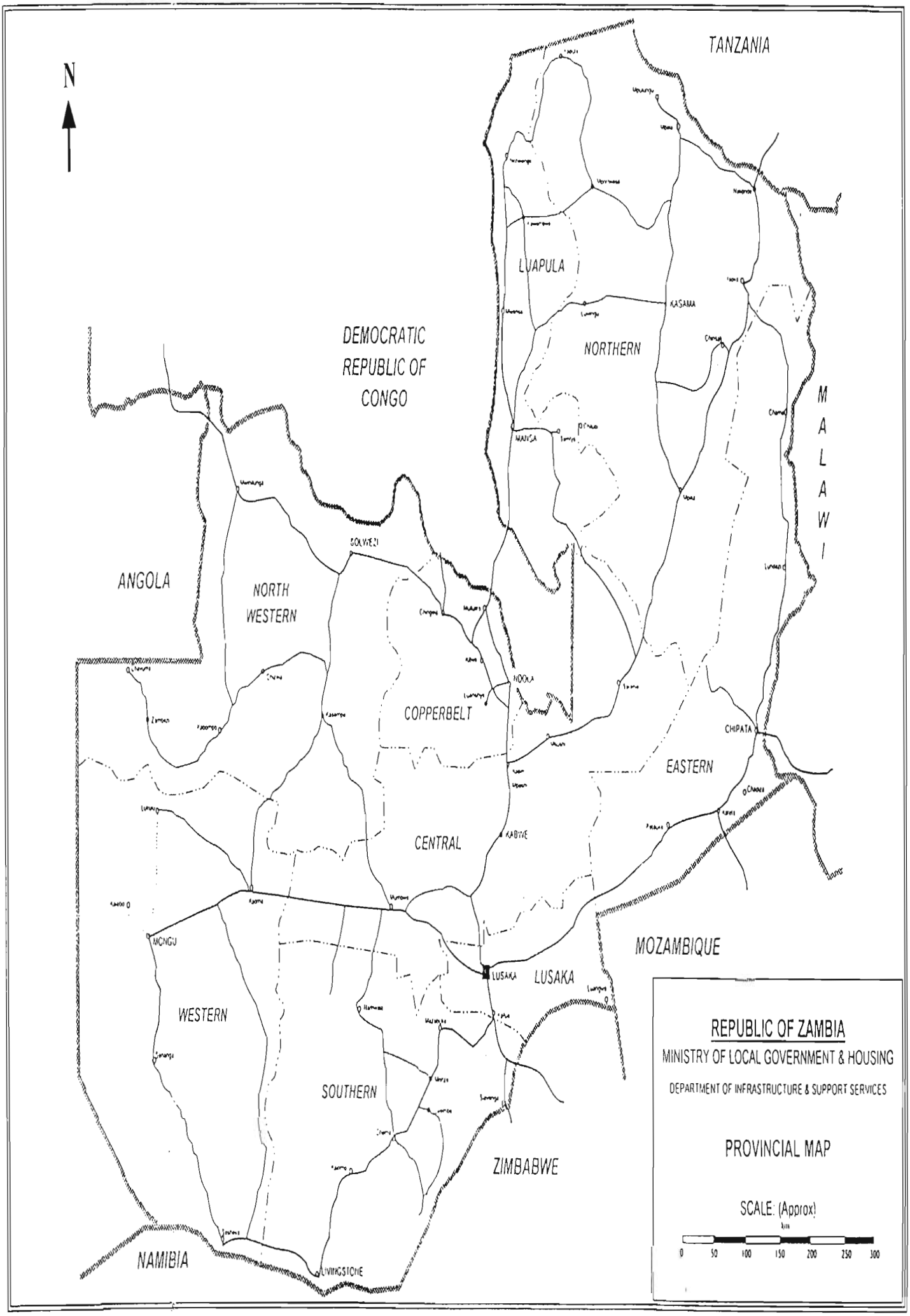

Figure 3.1 Map of Zambia

3.2 Past and Current Performance

The Zambian economy has depended mainly on the mining industry and copper exports in particular. About a third of the GDP and over two thirds of annual foreign exchange earning in the 1970's and 1980's originated from the mining sector. During this period, the National Development plans focussed on the construction of the road links to neighbouring countries and from provinces to the capital, Lusaka. The length of the road network increased but there was little money for road maintenance (MCT, 1997).

According to the Road Sector Investment Programme Document (MCT, 1997), the production and price of copper declined gradually resulting in overall economic decline. Over the 25 years since 1970, Zambia's GDP per capita dropped from one of the middle-income to one of the lowest in the World. The current account of the balance of payments continued to deteriorate due to the shortfalls in export revenues, delays in adjustment of imports, and mounting debt service requirements. Zambia is now one of the most highly indebted countries in the World today.

Despite a significant portion of the running surplus being invested locally, the choice of investment projects or programmes did not reflect the long term comparative advantage of Zambia, nor were the alternatives to copper (agriculture, tourism) adequately considered. Copper revenue started dwindling, leaving the country with no alternative foreign exchange generating activities nor sufficient foreign exchange to import raw materials, equipment and spare parts to keep its import and capital-intensive sectors running. The economic decline caused the deterioration of social and physical infrastructure especially transport infrastructure.

The country recognised the precarious macro-economic situation and made several efforts at reforming policies and formulating programmes to address the deteriorating physical infrastructure. For example, in the Fourth National Development Plan (1989-1993) (MCT, 1997), recognised the deterioration of the existing network as a major constraint to economic recovery. Until recently, either the implementation of these policies and programmes was weak, or they were completely abandoned immediately. However, since 1992 a more consistent and serious effort has been underway. Under the Structural Adjustment Programme, the transport sector like the rest of the Zambian

economy has had to operate within the context of the economic liberalisation founded on the tripod of three key inter-related economic policy thrusts, i.e. deregulation, commercialisation and privatisation.

The dilapidated state of Zambia's transport infrastructure (see figure 3.2) is a serious obstacle both economically in terms of growth, because of the country's distance from the export markets, and to poverty reduction, because of its widely dispersed rural population.

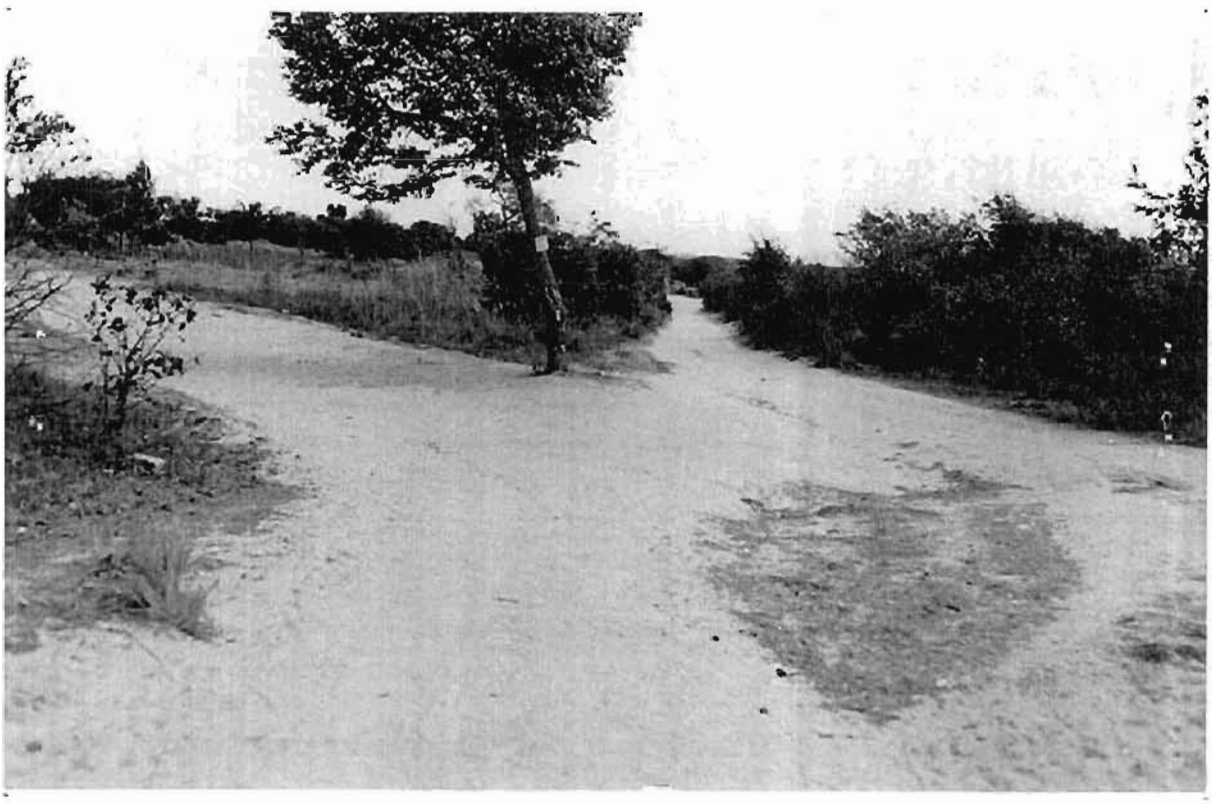

Figure 3.2: A typical state of one of Zambia's rural roads in Central Province.

3.3. The Transport Sector

3.3.1 Transport Sector and the Economy

In 1994, the Economic Report for Zambia indicated that the contribution of the transport sector to the GDP had fluctuated around 5% in recent years with the road sector leading in 1990. Zambia's economy seems to have impinged on the growth of the transport sector as reflected in the stagnation of the sector's contribution to GDP (around 5%) (MCT,1997).

The transport and communication sector further provides about 25,000 to 30,000 formal sector jobs which is about 6% of the total formal sector employment, of which 67% is accounted for by the transport sector alone.

There has been a general deterioration in road and railway infrastructure, making certain parts of the country impassable especially during the rainy season. The situation is worse in the rural areas whose roads have received very little or no maintenance at all since they were constructed (MCT, 1997, 1998).

3.3.2 Transport Policy

3.3.2.1. Past Policy

Prior to 1992 Zambia's transport policy was based on the belief that the transport sector should be viewed as a public utility, basic, essential and necessary to meeting essential needs, and generating social benefits rather than profit. Ownership and funding were in governments hands or at least subject to government control (MCT, 1997)

3.3.2.2 Current Policy Framework

The major thrust in the current transport policy is to promote and facilitate the development of a more efficient transport network and transport services, based on two principal elements –privatisation and deregulation.

The primary objectives (MCT, 1997) are to:

- ensure the availability of sufficient resources from the private and public sectors commensurate with the requirements of the economy
- allocate available resources among modes to meet requirements at minimum cost to society and
- establish a system of pricing that will ensure a reasonable return on the transport investment.

3.3.2.3 Rural Travel and Transport

At the time the data collection was being conducted for this thesis, rural travel and transport was going through a reform process. However, the Government's views for this sub-sector (M CT, 1999) were:

- Establish an institutional framework for the development and management of rural transport and travel in the country
- Improve the planning, management and financing of rural road transport as well as upgrading the infrastructure such as community roads, paths, tracks, trails and footbridges through community participation
- Facilitate the rural communities with the establishment of sustainable approaches to the construction and maintenance of the rural transport infrastructure
- Produce appropriate motorised and non-motorised means of transport aimed at improved mobility in rural areas
- Encourage the development of industries for the design, manufacture, repair and maintenance of intermediate motorised and non-motorised means of transport in rural areas; and
- Ensure that gender issues are considered in rural travel and transport.

3.4. The Road Sector

3.4.1. The Road Network – Extent and Classification

The total length of the entire road network is not yet accurately established. The total length of designated road is about 37,000 km whereas undesignated roads may be up to 30,000 km according to an estimate produced by IDA and TETAP. The latter includes some 5,000 km of roads in Zambia's national parks which fall normally under the responsibility of the Department of Parks and Wildlife and an estimated 1,500 km of urban roads. Estimates of the total length of the road network (especially the length of rural and urban roads) vary from source to source.

The size of the vehicle fleet is estimated to be around 130,000 vehicles. Traffic levels are low, even on the trunk road network. Many trunk roads carry less than 500 vehicles per day.

Designated roads are classified according to their construction design standard with regard to the formation width, carriageway width and surface type. Class I roads in the three subcategories are also bitumenised whereas Class II and III are gravel surfaced.

At the moment there is no official decision on the classification of all roads. There is also no status attached to community roads and other minor roads at village level.

In Zambia, Feeder Roads are defined as 'all those roads in rural areas which do not form part of the trunk, main and district road network which are the responsibility of the Roads Department in the Ministry of Works and Supply'.

The Feeder Road Network (all referred to as Rural Roads in this thesis) consists of the following categories:

- RD roads (rural district roads)
- R roads (rural roads)

- B roads (branch roads)
- E roads (estate roads)
- U roads (unclassified – ungazetted).

(MLGH, 1997; Gitec Consult, 1998).

Table 3.1 below summarises the road network by road class, road surface type and responsibility (MCT,1999).

TABLE 3.1: ZAMBIA'S ROAD NETWORK (km)

ROAD CLASS	ROADS	ROAD SURFACE		
		Paved	Unpaved	Gravel
Roads Department				
Trunk Roads	3,225	3,085	140	
Main Roads	3,943	2,008	216	1,719
District Roads	13,696	1,489	5,670	6,537
Sub-Total	20,864	6,582	6,026	8,256
Local Authorities				
RD-Roads	10,184		9,096	1,088
R-Roads	5,714		5,714	
Urban Roads	1,543	700		843
Sub-Total	17,441	700	14,810	1,931
Parks and Wildlife				
Parks Roads	5,162		4,000	1,162
Other Roads	22,483		22,483	
Grand Total	65,950	7,282	47,319	11,349
Designated	36,762	6,582	20,836	9,344

Source: Roads Department

3.4.2 Condition of the Roads

A large part of the road network (both paved and unpaved) was constructed in the decade between 1965 and 1975. For a long time routine and periodic maintenance have been neglected due to lack of funding and other institutional factors. These roads are now in the last part of their design life. For the paved network, in 1984 the proportion in good, fair and poor condition was 40%, 30% and 30% respectively. However, by 1995 (Table 3.2) these proportions of the same roads had worsened to 20%, 29% and 51% respectively according to a survey of just over 8,800 km of main trunk and district roads. In addition little or no maintenance has been carried out on feeder roads and the condition of these is even worse, an estimated 90% being in poor condition (MCT, 1998, 1999).

TABLE 3.2: CONDITIONS OF SOME MAIN ROADS (km) - 1995

ROAD CLASS	ROAD QUALITY			TOTAL
	Good	Fair	Poor	
Trunk Roads	454	694	1,188	2,336
Main Roads	771	939	1,782	3,492
District Roads	514	893	1,620	3,027
Total Length	1,739	2,526	4,590	8,855
%	20%	29%	51%	100%

Source: Roads Department

3.4.3 Management and Technical Capacity of Road Institutions

3.4.3.1 Management Institutions

In accordance with the existing pieces of legislation (MCT, 1997) the highway authorities responsible for management of classified roads under their jurisdiction are:

a) The Roads Department (RD) in the Ministry of Works and Supply (MWS) which manages the main road network.
b) Local Authorities under the auspices of the Ministry of Local Government and Housing (MLGH) who manage the main urban and feeder roads.
c) The Department of National Parks and Wildlife Service in the Ministry of Tourism which manage roads in the parks and tourist areas; and
d) The Ministry of Agriculture, Food and Fisheries, which is responsible for a limited network of roads leading to mainly agricultural camps, farmers' training institutions, etc.

There are other agencies participating in the management of roads directly or indirectly despite the fact that they are not designated highway authorities. These institutions are responsible for the legislation and policy on road transport, budgeting and planning and administration of funds for road maintenance programmes etc. These include the Ministry of Communication and Transport (MCT) which defines policy on road transport, the National Roads Board which was constituted in 1994 for the purpose of managing and administering the Road Fund, and the Ministry of Finance and Economic Development which to some extent controls the planning and budgeting processes.

The capacity of the Roads Department to manage roads under its jurisdiction effectively has long been recognized as inadequate. Until recently main posts in the Roads Department were not filled and even now many of them are occupied by staff of limited experience (MCT, 1997, 1998, 1998).

Meanwhile, the MLGH has no operational arm for implementation of rehabilitation and maintenance works and provides only administrative and planning services to the

District Councils through the Department of Infrastructure and Support Services (DISS).

The existing road management institutions (essentially all government institutions), are constrained by inadequate capacity due to unfavourable conditions of service prescribed for civil servants, delays in tendering procedures for purchase of goods and services, delays in making payments for completed works, low road plant and equipment serviceability due to limited capacity to repair, and inability to replace salvaged road plant and equipment, due to shortage of capital funding (Siame, personal communication, 1999).

The management and operation of the road maintenance programmes are generally undertaken through force account. This approach has deficiencies in that it depends strongly on the experience and motivation of the personnel in charge. In addition to using poorly trained and motivated staff, this approach also suffers from weak accounting and financial control which may subject funds to misuse and diversion.

3.4.3.2 Technical Capacity

a) Roads Department (RD)

Due to poor employment conditions, engineers are reluctant to join the public service in preference to the private sector which is offering better packages. Though the situation has improved in recent years, the quality of technical staff in terms of experience to be able to plan, programme, supervise, manage and control the work activities is yet to be attained. Apart from the maintenance unit or zones which carry out limited routine maintenance, the RD has little capacity for carrying out civil works (Zulu, personal communication, 1999).

b) Ministry of Local Government and Housing (MLGH) and District Councils

No technical capacity has previously existed in the MLGH and it is only now that it is in the process of being addressed. At District Council level, technical posts (Director and Deputy Director of Works) are usually only 50% filled and the incumbents are

often untrained and inexperienced. The lower levels of staff have had very little exposure to road works and their capacity is correspondingly limited. Equipment is virtually all broken down and works capacity is effectively nil. The MLGH is undergoing some reforms and this has seen the establishment of the Department of Infrastructure Support Services (DISS) within the Ministry as a facilitator for rural road maintenance programmes (MLGH, 1999; Chirwa, personal communication, 1999).

c) Private Sector

There are very few consulting firms registered with the RD of which a small number are specialized in road works. The consulting industry has suffered from a shortage of work in the roads sector and this has affected the experience base of most firms. Little is known regarding the technical competence of the technical staff employed in the contracting industry. Moreover, the industry suffers from a lot of constraints such as high capital costs of plant and equipment, lack of expertise, high interest rates and bureaucratic contract administration (Kasula, 1996; Bui, 1996).

3.4.4 Financing of Road Rehabilitation and Maintenance

Funding for road activities is characterised by lack of reliable needs assessment, inadequate financing, heavy dependence on external sources and erratic budgetary releases (NRB, 1999a).

Road maintenance budgets are usually cut or deferred. In the Road Sector, Zambia continued to spend disproportionately high amounts of the budget on the capital programmes which left insufficient funds for maintenance. Consequently, while new roads were being constructed, the constructed network was being neglected resulting in deterioration of significant lengths of the network.

There are currently three major sources of funds for road programmes namely; Government, Donors and the Road Fund.

3.4.4.1 Government

The Government has constantly underfunded the road sector network requirements, e.g. the estimated Government expenditure was normally 12% of the required (Heggie, 1994). The Government expenditure on maintenance of main roads was not well established in the entire 1980's and early 1990's. Spending on constructing new roads and rehabilitating the existing network was several times more than that of road maintenance. For example, the amount budgeted for maintenance was only US$ 5.4 million for the fiscal year 1995 against an annual requirement estimated at US$ 50 million for total road expenditure (Heggie, 1994).

3.4.4.2 The Road Fund

The Road Fund was established in 1993 and is administered by the National Roads Board (NRB). It is financed through a fuel levy which is 15% of the wholesale fuel price, and accrues to the Road Fund for the purpose of funding road maintenance. The fuel levy generates approximately US$ 12 million per year and this is distributed on a regular basis to the road authorities in the proportions; Roads Department 40%, District Councils 40% and Urban Councils 20%. However, the amount generated through fuel

levy (US$ 12 million) is at present insufficient to meet maintenance needs (MCT, 1997).

3.4.4.3. Shortfall in Funding

It has been estimated that the annual budget for the maintenance of the core road network (Table 3.5 on page 40) in Zambia should be of the order of US$ 40-50 million. These estimates assume that the roads have been rehabilitated to a maintainable standard. The actual funding for road maintenance has been less than 10% of this level resulting in serious backlog of maintenance and the need for extensive rehabilitation.

The World Bank Report (Heggie, 1994) states that in the 1990's, there has been implementation of ambitious reform policy in an effort to stimulate the sector and diversify economic activity away from copper production. In the road sector reforms have been supported and guided by the World Bank under the Sub-Saharan Transport Programme (SSTP) based on:

a) Ownership - involve private sector
b) Funding- secure sources of funds, and introduce " fee for service" concept
c) Responsibilities – establish clear lines of responsibilities
d) Management – introduce sound management principles

The result in Zambia has been the establishment of the Road Fund and the National Roads Board (NRB).

3.4.4.4 The National Roads Board – Role and Functions

The National Roads Board was set up in 1994, primarily to administer and manage the Road Fund and acts under MCT (Jhala, 1999).

Its role is:

- defining the maintenance policy and deciding where and how the Road Fund money should be spent;
- monitoring the procurement and the implementation process; and
- management of the Road Fund.

Figure 3.3 below shows the NRB institutional structure and its relationship to other road agencies and components.

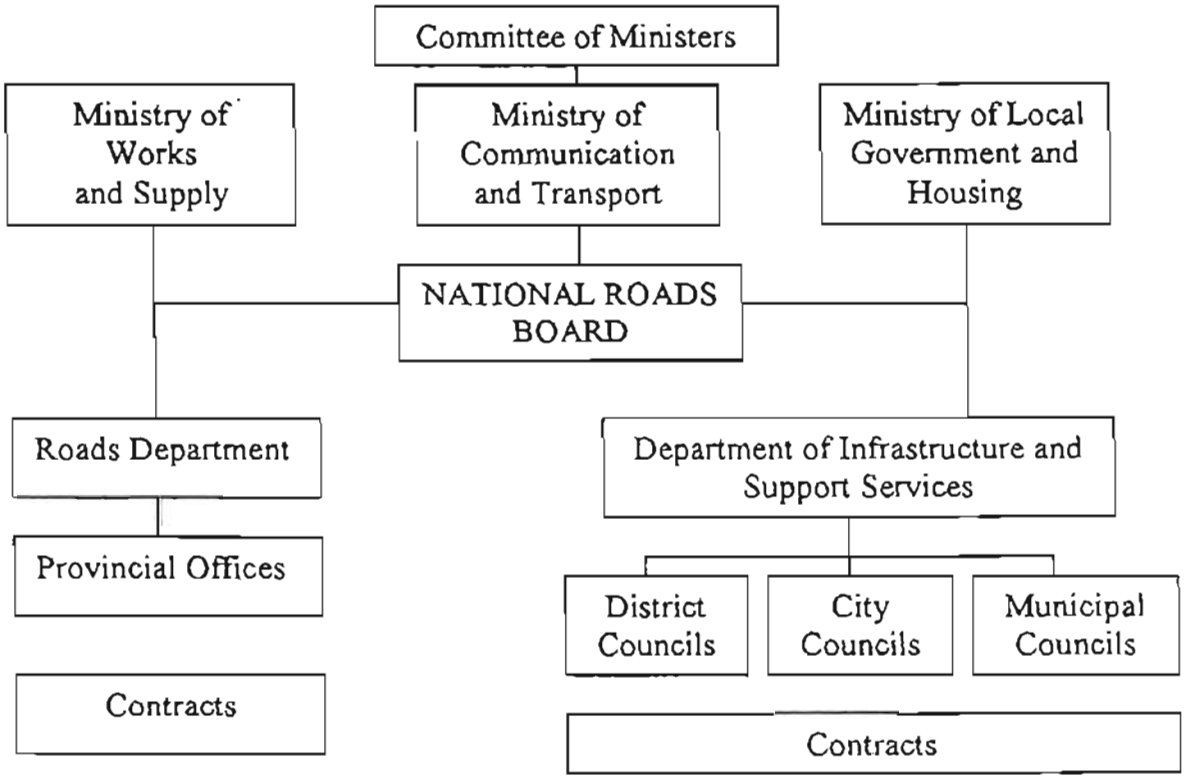

Figure 3.3: Institutional Structure of the National Roads Board (Jhala, 1999)

Under the policy guidelines of NRB, funds are distributed in the proportions outlined earlier. Under these guidelines, priority is given to roads in fair conditions through contracted programme. Roads that have recently been rehabilitated are automatically included. Second priority is given to emergency repairs to arterial roads which are in good condition but require to be attended to immediately in order to increase accessibility (NRB, 1999b).

3.4.5 The Road Sector Investment Programme (ROADSIP)

This is a 10 year programme (1997 to 2007), currently under progress, whose strategy has been to define the core road network of priority roads on which improvements and maintenance are to be targeted. A network of about 30,000 km has been chosen.

According to the Road Sector Investment Project Report (MCT, 1997) the main objectives of ROADSIP are:

- bring a core network of roads into a maintainable condition
- improve the network to at least 50% good condition and no more than 10% poor condition
- broaden the revenue base for maintenance funding
- strengthen the managerial and technical capacity of the road authorities
- create employment opportunities in the road sector
- improve road safety and reduce accidents by at least 25%
- improve environmental management in the road sector
- improve transport services in rural areas; and
- develop a community framework for the management of community roads

The costs involved in bringing even this 'core network' of roads back to a maintainable standard and keep them in good shape or condition are considerable. Maintenance costs are estimated at US$ 40-90 million per annum (see Table 3.3 on the next page).

TABLE 3.3: ESTIMATED ANNUAL COSTS UNDER ROADSIP

ROAD TYPE	SURFACE	km	ANNUALISED COSTS (US$ MILLIONS)	
			ROUTINE	PERIODIC
Main Roads	Paved	5,093	5.1	10.9
	Unpaved	2,075	1.7	3.6
District Roads	Paved	1,289	1.0	2.3
	Unpaved	3,711	2.2	5.3
Urban Roads	Paved	1,022	1.0	1.8
Feeder Roads	Unpaved	16,810	6.7	
Total		30,000	17.7	23.9

Source: MCT, 1997

Road maintenance requirements are quite extensive. Table 3.4 on page 39 shows the total estimated costs required to bring the core road network (Table 3.5 on page 40) into a maintainable standard during the 1998-2006 period.

TABLE 3.4: TOTAL ESTIMATED COSTS – ROADSIP (1998-2006)

ANNUAL FINANCING REQUIREMENTS UNDER ROADSIP (MILLION US$)								
	MTCE	REHAB	TA & CB	RC	TOTAL	TO BE FINANCED BY		
						RF	RF& GOVT	FA
1997	22.88	26.64	9.097	1.32	59.94	22.88	4.99	32.16
1998	25.13	39.99	7.051	1.49	73.66	25.13	6.20	42.34
1999	28.81	50.98	4.312	1.72	85.82	28.81	7.25	49.76
2000	32.16	47.56	4.708	1.87	86.30	32.16	7.10	47.04
2001	35.92	64.25	3.674	2.14	105.98	35.92	8.93	61.13
TOTAL	**144.90**	**229.42**	**28.842**	**8.53**	**411.69**	**144.90**	**34.36**	**232.43**
2002	41.00	76.43	2.904	2.45	122.78	41.00	10.38	71.40
2003	41.00	70.84	2.904	2.42	117.16	41.00	9.79	66.37
2004	41.00	56.48	2.904	2.35	102.73	41.00	8.29	53.45
2005	41.00	18.74	0.704	2.15	62.59	41.00	4.09	17.50
2006	41.00	0	0	2.05	43.05	41.00	2.05	0
GRAND TOTAL	**349.90**	**451.91**	**38.258**	**19.95**	**860.01**	**349.90**	**68.96**	**441.15**

Source: MCT, 1997

Legend:

MTCE – Maintenance

REHAB - Rehabilitation

TA & CB – Technical assistance and capacity building

RC – Running cost

RF – Road fund

GOVT- Government

FA – Foreign aid

TABLE 3.5: CORE ROAD NETWORK (km) - ROADSIP

ROAD TYPE	TOTAL	REHAB	HEAVY MTCE	ROUTINE MTCE
Paved Roads				
Trunk	2,979	2,093	55.00	
Main	2,008	1,466	341.00	
District	1,489	30	351.50	
Total	6,476	3,589	747.50	2163.50
Unpaved Roads				
Main	2,039		1626.25	
District	8,461		1683.50	
Total	10,500		3309.75	7190.25
Feeder Roads				
Total	15,000	10,000	5000.00	
Urban Roads				
Total	1,500	500	500.00	500.00
Grand Total	33,500	14,089	9557.00	9853.75

Source: MCT, 1997

3.4.6 Road Maintenance and ROADSIP

3.4.6.1 Maintenance and Rehabilitation of the Core Road Network

The entire road network of 67,000 km, if were in maintainable condition, would require about US$80 million per annum to cover routine and periodic maintenance requirements. But at present, most roads are not in a maintainable condition. It is estimated that about 40% of the main roads are in poor condition and an even greater percentage for feeder roads (MCT,1997).

For the main road network, the roads identified as forming part of the core network are of the total length of about 17,000 km. For the feeder roads network, it is estimated that it is essential to bring 15,000 km into maintainable condition within the 10 year programme. Community roads are not considered to form part of the core road network, but it is envisaged that they will be brought into a maintainable state in the long term. This implies that a large number of rural roads is still outside the core network, and also need maintenance.

A five-year technical training programme (1997-2002) in routine maintenance is underway and is expected to support the development of small-scale contractors (see section 3.6.3.3)

The programme includes:

- The elaboration of descriptive specifications for basic labour-based workmanship suitable for routine maintenance, periodic maintenance, rehabilitation and spot improvement of gravel and earth roads.
- The preparation of simplified bidding documents incorporating these descriptive specifications for procurement of Lengthmen contracts for routine road maintenance.
- The selection of demonstration sites to test labour-based workmanship and the conducting of on-job-training of domestic small-scale contractors in these methods
- The carrying out of tendering for Lengthmen contracts including bid evaluation and contract awards.
- The elaboration of a handbook of procedures for supervision of labour-based maintenance works by contract; and

- The elaboration of training materials suitable for domestic contractors and consultants.

3.4.6.2 Rehabilitation and Maintenance Costs

The unit costs of the various treatments are based upon available data from the Roads Department's Highways Management System and from the Feeder Road Support Programme in the Ministry of Local Government and Housing (MCT, 1997).

Estimated costs based on the present condition of the network and justifiable interventions are:

- Rehabilitation costs for the paved road network vary from US$32,000/km to US$120,000/km with an average of US$75,000/km. For feeder roads network it is about US$60,000/km.
- Heavy maintenance costs;
  Paved roads: US$11-31,000/km (average: US$14,300/km)
  main gravel: US$4-12,000/km (average: US$5,300/km)
  feeder roads: US$5,000/km
  urban roads: US$12,000/km
- Routine Maintenance;
  Routine Maintenance has been calculated based on the normal needs. Routine maintenance costs have also been differentiated for roads in good condition and roads in fair condition.
  The total annual routine maintenance costs have therefore been estimated as follows:
- paved roads: US$3,000/km (good condition) and US$3,200/km (fair condition)
- main gravel: US$1,400/km (good condition) and US$1,600/km (fair condition)
- feeder roads: US$650/km (good condition) and US$750/km (fair condition)
- urban roads: US$3,000/km (good condition) and US$3,200/km (fair condition)

3.4.7. Comments

Zambia has suffered economically partly due to bad physical infrastructure of the transport system, especially roads. The main reasons being lack of foreign exchange, lack of funds, shortage of qualified staff, lack of spares and equipment and deficient institutional arrangements and management. This is evident from the overview of the previous sections in this chapter.

Rural roads have particularly been neglected in the past. However, the current attitude of Government towards rural road maintenance, coupled with action to counteract the negative factors above, could bring about a turn round likely to improve rural travel and transport. This view is supported by the author of this thesis, who in his quest to see an improvement of rural road maintenance has carried out an analysis of the lengthman system of rural road maintenance and its suitability for Zambia's rural network.

A large part of the rural network still remains outside the core road network. The total length of rural roads is 15,898 km of which over 50% are in bad condition. Most of the rural roads actually need rehabilitation before maintenance can be established.

Though an estimated 40% of the Road Fund is meant for the maintenance of feeder and urban roads, this is still vastly inadequate. Most of the rural road maintenance is actually donor funded at present (NRB, 1999b).

Rural transport and travel has been hampered, as rural roads are not fit for use. Accessibility and mobility in rural Zambia has become very low and fluctuates with seasons. The cost of transport and travel has also gone up, adding a further adverse impact on the rural community.

The only hope (author's view) lies in the re-organisation in the Ministry of Local Government and Housing (MLGH) to improve management and technical capacity since its current capacity is ineffective.

3.5 Existing Structures and Procedures for Rural Road Management in Zambia

3.5.1 Existing Rural Road Organisational Structure

The existing rural roads management institutional framework structure is shown in Figure 3.5 below. This diagram is indicative and not complete due to current restructuring.

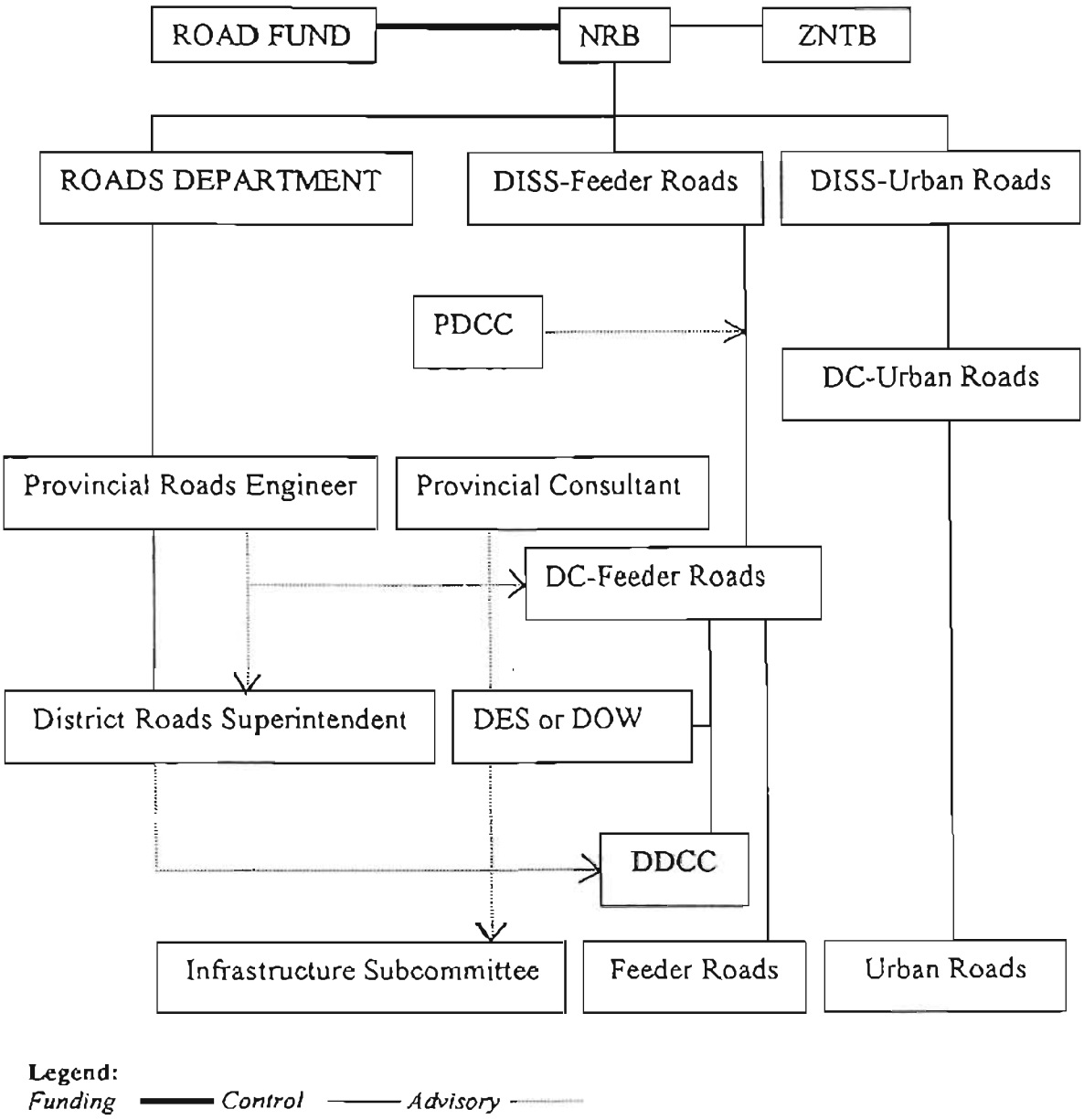

Figure 3.4: Existing Rural Roads Management and related components (Source: MLGH-DISS)

3.5.1.1 District Councils

The key component in the organisational structure is the District Council. There are 72 Councils in Zambia. The Councils are technically the owners of rural roads. These Councils vary considerably in respect of their staff and capacities for managing their own affairs. They depend heavily on assistance from MLGH's DISS in overseeing technical matters and administration of contracts, while in general, depending on consultants for technical matters and the supervision of civil works (including maintenance works contracts). The Road Sector Investment Programme (ROADSIP) Implementation Manual (MCT, 1999) describes the Councils' responsibilities thus: deciding on land acquisition and environmental issues with guidance from NRB and DISS; conducting procurement of works and services with assistance from DISS and NRB; facilitating handover of project sites and conducting final inspections, in co-ordination with DISS and consultants; oversight of consultants; assisting with financial and technical audits.

3.5.1.2 Department of Infrastructure Support Services (DISS)

DISS provides direct support to Councils. DISS is charged with providing technical assistance and support to local authorities' Directors of Works, Directors of Engineering Services and to the District and Urban Councils. The ROADSIP manual (MCT, 1999) describes DISS's responsibilities as: co-ordination of Councils' road and bridge work; establishing technical standards for urban and rural roads; assisting with Councils' planning for execution of roads and bridge work; preparing Councils' quality control guidelines; preparing supplementary information for urban and rural roads data bank; approving Councils' annual work programmes; advising MLGH and Councils on fund allocations; reviewing Councils' procurement actions; assisting Councils with land acquisition; assisting Councils with engagement of consultants and issuing bids and contracting; overseeing supervision of consultants and other contracted services. DISS is also responsible for infrastructure components such as water and sanitation, as well as roads. An important issue is the size and placement of DISS staff to satisfy the needs of the Councils (MLGH, 1999).

3.5.1.3 National Roads Board (NRB)

NRB provides the linkage between the rural roads implementing agencies and the Road Fund. The major issues have been: the inability of NRB to consistently fund Councils' rural road maintenance programmes during the past three years and the inadequate size of the Road Fund relative to maintenance needs.

3.5.1.4 Zambia National Tender Board (ZNTB)

Since rural road management is done by contracting with the private sector, tender boards are part of the rural road management organisational structure. Of interest to rural roads management is the provision that District Tender Committees are authorised to approve the tenders between ZMK 5 Million (US$ 2000) and up to ZMK 15 Million (US$ 6000). These are considered informal tenders. Formal tenders are those valued at ZMK 15 Million and above. The obligation for most rural roads maintenance projects to go through the ZNTB has caused delays and is considered a major obstacle (ZNTB, 1997; Zambia National Farmers Union, 1999).

3.5.2 Current Communications and Planning Procedures

3.5.2.1 Communication Procedures

The communications channels of the main rural roads management entities are diagrammed in Figure 3.5 on the next page.

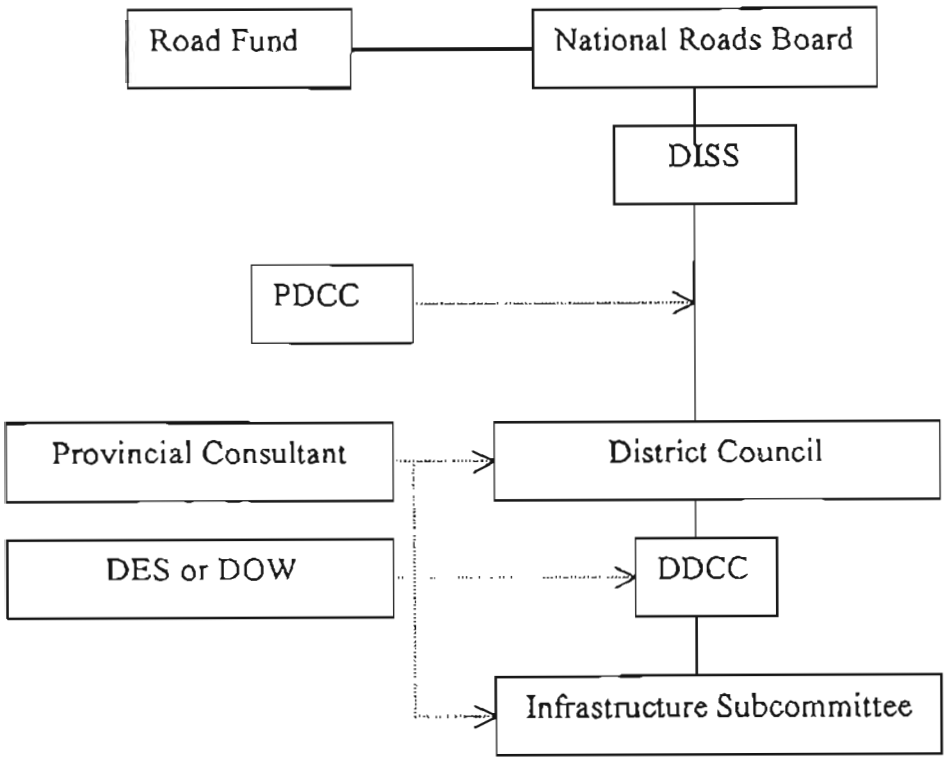

Figure 3.5: Communications and Planning channels (Source: MLGH-DISS)

The communications links which cause the most problems for the Councils, however are those with DISS, and with NRB (through DISS) (Siame, personal communication, 1999).

a) Communications between Councils and DISS

Communication is slow as a result of lack of capacity and proper organisation, at both DISS and DCs. DISS lacks staff to handle the communications in a timely manner and has no adequate fleet of vehicles. In addition, the office is not well organised to deal with communications efficiently. On DCs' side the problem is worse.

Poor communication also results in inadequate explanation, and subsequent misunderstanding of programmes.

b) Communications between DISS and NRB

This communication link also suffers from slow speed in both directions, mostly caused by the need to go through several levels of bureaucracy. Certain decisions are delayed due to slow feedback between the two agencies.

c) Communication between Councils and NRB (through DISS)

There are delays or lack of response from NRB. Delays last 1 to 2 years, most often relating to programme approval, late payment or misunderstanding of NRB procedures. There is also dissatisfaction related to lack of consultations between NRB and Councils.

3.5.2.2 Planning Procedures

a) District Councils' Planning Procedures

Planning procedures involving rural roads usually start in an infrastructure or planning sub-committee (in many Councils) then go to DDCC, then to DC and then to DISS, and finally to NRB. The DOW (or DES) advises the DDCC and DC. The Provincial Consultant advises DC (and the DOW or DES). The DC provides a copy of the Plan to the PDCC.

According to the National Roads Board Annual Report (NRB, 1999a), Councils are suppose to make choices for rural roads maintenance from the list of roads which are maintainable (i.e. recently rehabilitated roads).

During the four years (1996,1997,1998 and 1999), Councils have had substantial rural roads programme for only one year (1996), resulting in the disillusionment with the Road Fund programme. Councils have gone through the required procedures, based on promises, and submitted their lists of priority projects, but then there has been little or no funding. Councils are now sceptical about the programme, have reduced roads related staff because of no projects, yet the problem of maintaining rural roads remains (MLGH, 1999).

b) DISS Planning Procedures

DISS capacity to plan and manage rural roads rehabilitation projects is limited by the small number of staff and large number of demands for assistance to Councils. This has resulted in insufficient amount of consultation with Councils regarding the planning of their programmes. Normally, DISS receives plans from Districts and assembles them into a combined National and Rural Road Maintenance Programme.

c) NRB Planning Procedures

Four issues, involving the NRB, negatively affect rural roads management and planning. These are:

- Late approval of projects by NRB sometimes coincides with bad weather conditions. NRB sometimes has no choice since it is restricted by timing of the funds it receives.
- Delayed consultations with DISS and DCs as mentioned in section 3.5.2.1
- Lost opportunity, namely, to develop long-term Rural Roads Maintenance Contracts which would yield more maintenance work for less money. Unit equipment costs for contractors would be lower than under short-term contracts. This would also help build a more stable group of contractors. Unfortunately, the unpredictable flow of funds to NRB makes such contracts impossible at the present time.

(MLGH, 1998, 1999).

3.5.2.3 Functions and Linkages in the Planning Phase

Table 3.6 on the following page lists 23 functions included in the planning phase being carried out by the six major entities. At present there are some duplications in performance of some of the functions like project estimates, design, planning and supervision among Councils, Provincial Consultants and DISS.

TABLE 3.6: FUNCTIONS AND LINKAGES – PLANNING PHASE

PLANNING PHASE FUNCTIONS AND LINKAGES		ENTITIES					
		DCs DDCCs	PROVINCIAL CONSULTANT	PROVINCIAL ADMINSTRATION	DISS/MLGH	NRB	ZNTB
1	Provide guidelines for annual plan				x		
2	DOW advises DDCC	x					
3	DDCC makes recommendations to DC	x					
4	Identify and prioritise projects	x					
5	Do engineer's estimates	x	x				
6	Conduct feasibility studies, if needed		x				
7	Design projects (if maintenance)	x	x				
8	Provide planning support to DCs		x		x		
9	Provide project list to PDCC	x					
10	Submit project list to DISS	x					
11	Receive project lists from DCs			x	x		
12	Stay informed about DCs activities			x	x		
13	Screen and approve DCs projects				x		
14	Submit DCs projects to NRB				x		
15	Assess project priorities				x	x	
16	Assess technical aspects				x	x	
17	Screen projects against budget, annual plans and priorities				x	x	
18	Approve for tender and inform DISS					x	
19	Prepare annual work plan, co-ordinate activities with NRB, ZNTB and Donors				x		
20	Facilitate process				x		
21	Provide technical backstopping		x		x		
22	Finance planning process	x			x	x	
23	Supervise consultants	x			x		

Source: DISS-MLGH

3.5.3 Provincial Planning and Supervision of Consultants

Problems have developed, since 1994 when the Road Fund was introduced. Revenues are much less than anticipated while costs were greater for many of the consultants:

- The typical maintenance contracts were smaller than expected (2.5% of the total value of contract was the supervision fee)
- The total volume of work in the Districts was much less than expected, resulting in lower total fees.
- Many of the contracts were not completed in a timely manner by the contractors, often stretching out for months, thus requiring more trips and higher costs, for the consultants than originally envisioned.
- The consultants had not envisioned the remoteness of much of the work which meant time consuming, costly trips over rough roads to reach job sites.
- Most of the firms did not have offices in the provinces and thus had to make long expensive journeys from the capital.

The fee was raised to 5%, but is still considered insufficient. This has generally contributed to poor supervision.

3.5.4 Current Contract Administration Procedures

Interviews (see also section 3.5.6) reveal that Councils believe that they can successfully manage Rural Road Maintenance contracts, based on past experience. Payment procedures are the source of most friction. Councils believe that they can competently manage the payment procedures themselves. Most Councils have not, in fact, been tested recently on their Rural Roads Maintenance administration abilities because there have been no rural road maintenance activities for several years. Recent contract management activities in the UNDP Rural Roads Projects (labour-based) in the Eastern Province, however, demonstrate that Councils can competently manage most of the steps.

3.5.4.1 Functions and Linkages in the Design, Tendering and Implementation Phases.

There are a number of duplications on a number of functions between different entities in the design, tendering and implementation phases. Table 3.7 on the following page shows the functions and linkages in the implementation phase. Lack of capacity at council level has contributed to the problems related to implementation.

TABLE 3.7: FUNCTIONS AND LINKAGES – IMPLEMENTATION PHASE

IMPLEMENTATION PHASE FUNCTIONS AND LINKAGES		ENTITIES DCs DDCCs	PROVINCIAL CONSULTANT	PROVINCIAL ADMINISTRATION	DISS/MLGH	NRB	ZNTB
1	Provide supervision support to DCs		x		x		
2	Report to PDCC	x					
3	Receive reports from DCs			x	x		
4	Stay informed about DCs activities			x	x		
5	Supervise projects	x	x		(x)		
6	Monitor projects	x	x		x	(x)	
7	Report on progress	x	x		x		
8	Certify progress payments	x	x				
9	Approve certificates for submission to NRB				x		
10	Manage funds					x	
11	Make payments to contractors				(x)	x	
12	Certify completion	x	x		x	(x)	
13	Co-ordinate activities with NRB, ZNTB and Donors				x		
14	Facilitate				x		
15	Provide technical backstopping		x		x		
16	Supervise consultants	x			x		
17	Finance supervision costs	x			(x)	x	

(x) Indicates partial function or role

Source:MLGH-DISS

3.5.4.2 Contract Management Units

In order to focus attention, and concentrate efforts, on the fact that Councils will be maintaining rural roads through contractors and not by force account, MLGH has proposed the idea of setting up a contract management unit in each Council (Clifton, 1998).

3.5.5 Existing Planning and Management Capacity

3.5.5.1 Existing Council Staffing Levels

There is a high degree of vacancies in the management of rural district councils. Only four of the twenty DCs have more than one management staff person; three of them have none (1999). This is indicative of the difficulties that rural Councils have in attracting technical staff; their poor financial condition prevents them from offering attractive salaries and conditions of service. Their remoteness is also a negative factor. Difficulties also arise in ascertaining the appropriate size of staff to meet the needs of Rural Road Maintenance Programmes. These needs vary due to lack of consistent funding (Siame, personal communication, 1999).

3.5.5.2 Capabilities of Existing Staff

Most existing staff have the capabilities of handling maintenance contracts to some extent. This has been demonstrated in the UNDP project in the Eastern Province. Current abilities to manage rural road maintenance are reduced due to lack of practice. As opposed to City Councils, Municipalities and DCs can not afford to employ highly qualified staff, because of poor conditions of service.

3.5.5.3 Small-Scale Contractors

The policy of government is to use the private sector to carry out works. One goal of the Rural Road Maintenance Programme is to maintain roads through the use of small-scale contractors in the private sector rather than force account using government employees, thus building up a group of experienced contractors. The reality, however, is that there are few small-scale contractors in many of the rural Districts (MLGH, 1999).

The main issues are:

- Small-scale contractors who have completed formal contractor training have had to go for other business pursuits to survive because of lack of opportunities for road work because the Road Fund has not financed roads for several years.
- A major constraint for the small-scale contractor is that they lack equipment and financial ability to acquire sufficient equipment, even the less expensive equipment for labour-based work.
- The small-scale contractor has limited cash flow and cannot tolerate long delays which seem to occur in payments for rural road maintenance projects.
- The small-scale contractor has limited opportunities because of the large size of many road contracts which require large guarantees which are more expensive than the small-scale contractor can offer (see appendix B).

Other constraints include high interest rates from lending institutions and lack of plant and equipment pools from which to hire equipment.

3.5.5.4 Availability of Facilities

Councils are in poor financial positions. Some DCs have only one vehicle. Moreover there are limitations on the use of the vehicle because some DCs cannot afford to buy fuel or pay allowances for staff to make trips.

Lack of transport makes managing rural road maintenance contracts very difficult. This is one of the more serious gaps in the capacity at the district level and has affected contract supervision.

Another aspect of facilities is plant capacity. Limited resources are spent on repair of old plant and equipment.

3.5.6 Existing Rural Road Maintenance Constraints

An investigation carried out (Chitumbo, personal communication, 1999; Chungwa, personal communication, 1999) at the MLGH's DISS and Kabwe Municipal Council and Kapiri Mposhi District Council in Central Province revealed the following:

- Local Governments have skills but have had no chance to prove their expertise due to lack of resources e.g. plant and financial resources.
- Local communities do not posses capabilities to undertake maintenance due to lack of resources in terms of equipment and money. However, small works organised in conjunction with the Ministry of Agriculture Food and Fisheries, using hand tools have had good results
- That maintenance needs and related tasks have been adequately articulated. Both local government and communities are aware of the need to maintain rural roads.
- That maintenance needs not only appear excessive but actually are, compared to funds allocated.
- That maintenance responsibilities have been clearly defined.
- That local communities do not identify themselves as main beneficiaries to some extent. This is because politicians seem to have an upper hand in decision making.
- The backlog due to prolonged lack of maintenance makes maintenance programmes excessive in relation to local resources. This often defeats both the local communities and local government in undertaking routine maintenance works and has led to substandard work at times.
- Current maintenance techniques are not balanced in relation to local resources. Despite the local government having the basic knowledge for the programmes, they lack

machinery (there are no graders). Plans are there to shift from equipment to labour-intensive methods.

- To a large extent, maintenance tasks were not adequately executed due to the above reasons.
- Local resource base is high in terms of labour and materials. The main problem is funding which has been compounded by the hard economical situation of local government in recent times.
- Local resource mobilisation is inadequate and there is always plea for donor assistance.
- That the resources allocated by the Central Government are far too insufficient.
- Its not true that maintenance workers have inadequate skills but rather they are demotivated due to lack of tools and equipment.
- Maintenance resources are never diverted to other purposes but are used accordingly.

3.5.7 Comments

The existing structures and procedures for rural road maintenance management in Zambia are a source of concern. Moreover, this is compounded by the number of constraints listed in section 3.5.6, which have surfaced as a result of deficiencies in the system.

3.6 Labour-Based Road Works in Zambia

3.6.1 Introduction

Experience with labour-based roadwork methods goes back as far as 1987, when the Districts Roads Improvement and Maintenance Project (ZAM 026) in Kasama, Northern Province was initiated. This project however expanded in 1994. It operated under the auspices of the Ministry of Local Government and Housing and was supported by the Norwegian Agency for International Development (NORAD) (MWS, 1995).

The objectives of the project were to demonstrate and establish labour-based methods of road construction and maintenance to improve access to agriculturally productive areas in the Northern Province. Further more, the project aimed to provide equal opportunities to both men and women for employment in this field.

In 1994, the project was transferred to Lusaka as part of the road sector programme supported by NORAD operating under the Roads Department in the Ministry of Works and Supply. Currently, the programme has expanded extensively and has resulted in a number of roads being rehabilitated in the Eastern Province UNDP project.

3.6.2 Previous projects

Zambia has had experiences from the first two pilot projects in the use of labour-based methods of road rehabilitation and maintenance. These projects are:

a) The District Road Improvement and Maintenance project, as mentioned above, and
b) The Road Maintenance Programme supported by the Finnish Development Agency between 1991 and 1993. This programme was executed by RD under MWS Lusaka Province, with technical guidance from the ILO.

The objectives of the pilot projects were:

- to demonstrate the cost effectiveness of using labour-based methods in the construction and maintenance of roads especially feeder roads
- demonstrate and establish labour-based methods of road construction and maintenance whenever appropriate
- improve accessibility to agriculturally productive areas
- provide equal employment opportunities to both men and women in this field.

Since the initiation of the two pilot projects and informed by the results thereof, and with the liberalisation of the economy, the Government through the MWS (RD) and supported by NORAD has carried out training for road sector personnel from both public and private sectors. The Roads Department Training School (RDTS) has since 1994 accumulated considerable experience in training of the road sector personnel in labour-based methods for both force account and contracting works, i.e. development of small and medium contractors. Considerable potential does exist (MWS, 1995) for the development of small-scale contractor sub-sector for road works as there is currently very limited domestic contracting capacity especially in the Districts. The Roads Department Training School has also constructed some rural roads for demonstrative purposes (see fig 3.6).

Labour-based Methods for road works which maximise the use of local resources (labour, material, locally manufactured light equipment, etc) are seen as appropriate in mobilising domestic contractors and the creation of local employment opportunities. It is envisaged that 30,000 jobs will be created under the current ROADSIP programme mainly through labour-based road maintenance (MWS, 1996; MCT, 1997). The labour-based contracting study (MCT, 1997) carried out in 1995 estimated that about 15,000 km of the road network could easily benefit from the routine maintenance using small-scale labour-based contractors. It was further ascertained that the biggest immediate potential in terms of the number of contractors is for routine maintenance. This meant that 15,000 km of the road network would require about 300 new small-scale contractors if assigned annual contracts of 50 km each to maintain. Assuming that each employer employs about 30-60 workers, this implies an average of 13,500 jobs would be created in rural areas.

The figure below shows a rural road which was constructed using labour-based methods in Kasisi-Ngwerere area in Lusaka.

Figure 3.6: A Labour-based constructed road in Kasisi-Ngwerere, Zambia (1999)

3.6.3. Current Labour-based Road Pilot Projects

There are a number of labour-based projects in Zambia which are mostly small scale. The most significant (according to RDTS) are discussed in the sections below.

3.6.3.1. Chongwe-Kanakantapa

Chongwe-Kanakantapa is situated in the north-east of Lusaka. The labour-based section of RDTS embarked on the rehabilitation in 1996 and completed it in 1997. The site was opened up as a demonstration site for small-scale contractors attending labour-based courses in rehabilitation, spot improvement and maintenance.

The 9 km stretch passes through bad terrain. The focus is on the improvement of drainage. The road has now been rehabilitated to feeder standard with a carriageway width of 5m. An average of 10 vpd was recorded prior to rehabilitation but has increased to 30 vpd.

Maintenance is currently being done by small-scale labour-based contractors. The objective of this maintenance programme is twofold:

- to preserve the road quality, safety and condition of the road
- to use the site as a training site for trial contracts of maintenance contractors. One contractor is actually carrying out routine maintenance on this site.

The NRB is financing the trial contracts and the client is MLGH (DISS). RDTS is the project manager. The employer has supplied the hand tools to the contractors which will be recovered through deductions in the interim payment certificates. The trial contracts take three months to complete and are based on a priced bill of quantities.

3.6.3.2. Kasisi-Ngwerere

Kasisi Road leads to the catholic mission and the orphanage near Lusaka. Kasisi-Ngwerere is famous for arable farming. Over the years the maintenance of this road was neglected. This road serves as a demonstration site for training of labour-based small-scale contractors from the Eastern Province of Zambia (see next section). A total of 13 km has been rehabilitated and gravelled. Currently, there are extension works

going on using labour-based methods. Traffic counts show a rise in traffic. Routine maintenance of side and mitre drains is achieved using labour-based methods.

Other small and isolated labour-based sites exist countrywide, most of them funded by the World Food Programme (WFP) and are relief (food for work) in nature.

3.6.3.3 Rehabilitation and Maintenance of Feeder Roads in the Eastern Province

This is the biggest pilot project in terms of length and cost currently in progress. Staff of the District Works Departments have been trained in the selection, planning, design, implementation and management of contracts for rehabilitation and maintenance by local small-scale contractors. Supervisory site staff have been trained in the effective supervision and inspection of labour-based rehabilitation and maintenance works carried out by the private sector (GRZ-UNDP, 1999).

Routine maintenance through small-scale contractors is slowly being established on roads that have been rehabilitated. The biggest problem is lack of continuous support from the Government. Funds from the Government and NRB are erratic and sporadic and the situation is not likely to change. About US$750/km per annum is normally required.

A system for contract management has been tested and established within the Councils, including tender procedures, contract documentation and payment procedures. A monitoring and reporting system, describing up to date details has also been established. Nine small-scale contracting firms and 25 maintenance contractors were trained.

About 580 km of selected feeder roads have been rehabilitated. A further 700 km is under regular routine maintenance in the province by contract using labour-based methods to a standard providing all weather access throughout the year. Road selection and priority ranking criteria are based on the road condition inventories, traffic counts, and key socio-economic data such as agricultural production.

A total of about 900,000 worker-days of direct employment created during rehabilitation and maintenance works was undertaken by the private sector (UNDP, 1998).

3.6.4. Comments

Though Zambia has more than 10 years of experience with labour-based road works, a lot of effort is needed in order to realise the objectives outlined in the initial pilot projects. Funding is another area of concern that needs to be addressed. Pilot projects need a continuous flow of funds if they are to be successful and also be appreciated by the community. This is also crucial for sustainability.

As far as labour-based routine maintenance is concerned, there are prospects in sight especially with the incorporation of labour-based programmes in ROADSIP. However slow implementation of improved policy needs to be addressed.

CHAPTER FOUR

4 RURAL ROAD MAINTENANCE IN KENYA

4.1. Introduction

Kenya is a non-landlocked East African country with an area of about 580,367 square kilometres and a population of around 31,806,000 people (1996). The country's main economic activities are tourism and agriculture, with the latter making a contribution of 25% to GDP (Europa, 1999a, 1999b).

Kenya is one of the leading countries in Africa in terms of Labour-Based Technology (Simpson, 1981). The country's experience with labour-based technology goes back to 1974 when the Government of Kenya (GOK), through the Ministry of Public Works launched the Rural Access Programme (RARP) with the purpose of constructing 14,000 km of access roads using labour-based technology in districts with high agriculture potential (de Veen, 1980). In 1986 RARP underwent restructuring and became known as the Minor Roads Programme (MRP) (MCT, 1986). During this time about 8,000 km of roads had been completed, most of them gravelled and brought under regular maintenance using labour-based methods (Ministry of Public Works, 1992; Howe and Bantje, 1995).

By 1991 MRP was operating in 26 Districts and its main objective were to carry out the improvement of 4,500 km of classified 'D' and 'E' roads and take care of the existing network of roads by ensuring that they received regular maintenance. By 1992 Proposals had been developed for the expansion of labour-based methods into maintenance of a significantly larger proportion of the classified network (Ministry of Public Works, 1992).

Casual labour is utilised to carry out nearly all improvement and maintenance operations. Agricultural tractors and heavy duty trailers are used to haul gravel for the initial surfacing of the roads and subsequent maintenance regravelling.

Routine maintenance of rural access and minor roads is carried out using the Single-person Lengthmen System by contract. These operations are supported by various periodic maintenance activities.

4.2. Road Network and Maintenance problems

The road network is classified as shown in the Table 4.1 below. Kenya's about 61,688 km of classified roads (7,689 km bitumen surfaced) are concentrated mainly in more agriculturally productive areas.

TABLE 4.1: KENYA'S ROAD NETWORK (km)

LENGTH OF ALL CLASSIFIED ROADS BY SURFACE TYPE				
Class of Road	**Type of Surface**			**Total**
	Bitumen	Gravel	Earth	
Trunk A	2,607.0	644.3	326.7	3,578.9
Trunk B	1,171.2	928.3	641.0	2,740.5
Primary C	2,242.9	3,255.0	2,279.7	7,777.6
Secondary D	968.6	6,134.6	3.892.9	10,996.1
Minor Roads	696.2	14,304.0	21,594.0	36,594.6
All Classes	7,686.8	25,266.2	28,734.7	61,687.7
	12%	41%	46.5%	100%

Recent surveys of classified surfaced roads indicated that 32% were in good condition, 39% in fair condition requiring some form of resurfacing and strengthening and that 28% were in critical condition. The latter exhibited extensive amount of failure, needed almost complete reconstruction (Heggie, 1994). Unpaved roads were 66%, 15% and 19% in good, fair and poor condition respectively during the same period (1992).

The amount of regravelling carried on the 25,266 km of gravel roads (113 km in 1989) suggest that many have reverted to earth road standards. Traffic levels on the majority of gravel levels were very low and generally gravelling could not be justified, especially in view of the shortage of materials. The unsatisfactory network condition was brought about by insufficient road maintenance over an extended period of time (Beusch, 1993).

Basic routine maintenance of the whole network is inadequate due to a range of funding, equipment and manpower constraints. To maintain classified roads to a reasonable standard, the annual expenditure should be about K£ 66.5 million (US$1.33 million (mid 1990's), made up of K£ 26.25 million (US$ 525,000) for routine maintenance and K£ 40 million (US$ 800,000) for periodic maintenance. This level of expenditure is estimated as sufficient to keep in good condition those roads where traffic warrants full maintenance, but others where there is little maintenance could receive only minimal maintenance. Full maintenance of all roads is estimated to be about K£ 140 million (US$ 2.8 million) per annum.

These estimates assume that:

- roads have been rehabilitated where necessary to a maintainable condition; and
- maintenance is carried out efficiently

As an illustration, the financial year 1990/1991 budget allocation, including new construction and improvements was about K£ 66.3 million (US$ 1.33 million) from all sources. Planned expenditure in the same financial year showed that K£ 8.3 million (US$ 166,000) was required for routine and periodic maintenance in the recurrent budget. This excludes personal emoluments and equipment. This amount was only a third of that required for routine maintenance (Beusch, 1993).

The existing vehicle and equipment fleet is generally aged and availability rates are assessed to be low (<20% for heavy plant). The existing maintenance system relies on transport to take supervisory labour force to sites everyday. Low transport availability restricts the amount of work that labour can achieve (Beusch, 1993).

The problem of inappropriate staffing, inadequate training and lack of funds for operating expenses further constrains road maintenance performance. Subordinate staff make up 60% of the 15,000 permanent work force of the Roads Department the majority of which are assigned to road maintenance activities (Ministry of Public Works and Housing, 1994).

4.3. Kenya's "Roads 2000" Concept and the Future

4.3.1 General

The problem of inadequate road maintenance was recognised as a major factor behind the state of Kenya's roads. This led to the launch of the "Roads 2000" in 1993. This project concept was to build on the good experience of previous labour-based projects to institutionalise and integrate the overall maintenance of Kenya's roads by the year 2000 (Akute, 1993)

Two main policy areas were identified, i.e. strategies and operational:

a) Strategic policy options. These were;
- provision of adequate funds for road maintenance
- establishment of an appropriate institution to manage the roads subsector

b) Operational policies. These were;
- rationalisation of available resources to ensure optimal implementation of maintenance programmes
- identification and subsequent application of appropriate technologies to ensure minimal costs

The "Roads 2000" project involves:
- the application of purely labour-based methods to low traffic roads
- a mixed technology of labour-based methods and tractor towed graders for more heavily used roads
- the use of tractor-based equipment in areas were labour is not available.

4.3.2 Outline of the "Roads 2000" approach (Ministry of Public Works, 1992)

The three operational components of this project to bringing roads back under effective maintenance are:

a) Preparation: bring roads back to minimum maintainable standard (partial rehabilitation)
b) Routine maintenance: Establish a labour-based routine maintenance system

c) Spot improvement: plan and carry out a follow up programme of selected and limited spot improvements on the network under maintenance.

The key principles of this approach are:

- maintenance of the whole network rather than project approach
- expand routine maintenance by lengthmen from 11,000 km to 40,000 km
- support lengthmen with tractor equipment on highly trafficked roads (>50 vpd)
- provide mobile units for routine maintenance in low population areas
- minimum initial rehabilitation to make roads maintainable: labour only or labour and tractor
- limited spot improvement to ensure passability
- periodic maintenance to be programmed and managed separately
- reduce substantial non-productive subordinate staff cadre
- improve manpower motivation and management
- provide adequate training for cadres
- develop appropriate management system
- develop appropriate equipment for local fabrication; and
- develop local small-scale contractor sector for periodic road maintenance.

4.4. Routine Maintenance of Minor Roads and the Lengthmen System in Kenya

4.4.1 Introduction

By 1992 there were about 9000 km of rural roads under routine maintenance carried out by more than 6000 lengthmen contractors. Each lengthman was given the responsibility of an average of 1.5 km of road (Taylor, 1992). The average cost of this maintenance was US$ 200/km per annum (1992) where 65% of the costs accounted for wages, 12% supervision and 20% transport.

Studies carried out in Kenya have shown that 45% of the maintenance requirements were drainage related, 40% were carriageway related and 15% accounted for bush clearing and grass cutting. A principal attraction of the system was the comparatively low level of equipment required and lessened support problems. This results in a low foreign exchange component, which in 1982 was estimated to be only 10%. This amount compares with a typical foreign exchange component for equipment-based routine maintenance systems of 50% (Petts and Jones, 1989).

Studies have show that improving planning, supervision and motivation were far more important to the effectiveness of the programme than technical or other factors. The result was the introduction of the headmen. There was also improvement in the timing of maintenance inputs. It was also found appropriate to concentrate most of the maintenance in the wet season (Taylor, 1992; ILO ASIST, 1996).

4.4.2 The Lengthmen System and Its Key Features

Under the Minor Roads Programme (MRP), a lengthman (usually a former construction worker who can be a man or woman) is appointed on a contract basis for each section of the road, typically 1.5 km to 2.0 km in length. He/she is provided with hand tools and supervised regularly by a headman and an overseer who monitors the condition of the road, directs operations, make reports and authorises payments for satisfactory work. The payment is based on the contractor carrying out work three days a week, on days specified by the District Maintenance and Improvement Engineer (DMIE). The

contract is terminated if the lengthman consistently performs unsatisfactorily (Ministry of Public Works, 1992).

The contractor normally resides adjacent to the road and therefore doesn't require government accommodation or transport, which consume considerable resources in a traditional equipment-based maintenance system.

The lengthmen system also creates productive paid employment in rural areas where there are few opportunities for such work. The contractor is able to live at home with his family and the part-time terms gives him/her the opportunity to work on other activities as well.

Approximately 75% of the direct costs of the system are estimated to be paid directly to the lengthmen contractors. The system also enables maintenance to be achieved throughout the year on each portion of the road. The responsibility for the maintenance of each road section lies basically with one person who requires minimal logistic support. On some highly trafficked roads (>50 vpd), the lengthman may be supported with occasional tractor towed grading for reshaping the running surface.

Routine maintenance operations are normally funded from an account nominated for that purpose.

The MRP-Road Maintenance Manual lists the key features of the lengthmen system of routine maintenance as follows:

- One person is responsible for all manual routine maintenance activities on a section of the road, typically 1.5 to 2.0 km long
- Lengthman works on three specified days per week
- Lengthman walks on each workday from his/her home
- Lengthman is provided with necessary construction hand tools (e.g. hoe, shovel, bushknife, grass slasher, rake and shared wheelbarrow). Other occasional tools are provided by the headman or overseer
- Road section is assigned to the length-person according to maintenance needs due to surface type, traffic, topography and rainfall

- Lengthman's section is sub-divided with marker posts to aid work setting and monitoring
- Lengthman works through his/her section completing one selected activity at a time, using task-based system to simplify supervision and control
- Priorities for maintenance activities set according to the section
- Headman with (preferably his own) bicycle and living at home setting tasks and supervising length-person at least once per workday.
- Routine maintenance supervisor with motorcycle supervising headmen and lengthmen at least once per fortnight to direct, control and report on work done.
- Quality of work done controlled with the help of simple measuring aids
- Lengthmen paid at monthly intervals subject to satisfactory work output (otherwise work terminated)
- Terms of service for lengthmen and headmen are contract-based and renewed annually if performance is satisfactory.
- An objective method of assessment of routine maintenance performance is incorporated in an annual inspection system. The system also allows for periodic maintenance and spot improvement work to be identified and monitored.
- The system allows planned reduction of lengthman inputs during the dry season in arid areas if necessary
- Initial and on-going training on-the-job tuition of lengthmen and headmen by their overseers; and finally

The system depends on the mobility of the routine maintenance overseers and highest priority is given to the procurement and maintenance of their motorcycles.

4.4.3 Maintenance Objectives of the Minor Roads Programme

The primary objectives of maintenance of rural access and minor roads are:

a) To provide a continued all-weather vehicular access at a level of service appropriate for the role of the road, i.e. for:
- rural access roads – access only
- minor roads – access with better standard surface to serve the higher traffic levels and distances involved (lower surface roughness reduces vehicle operating costs)

b) To preserve the initial investment in the road as near to its original as-built condition as possible

Both of these objectives will have to be achieved with the resources available.

4.4.4 Technical Standards

The standards to be achieved through the on-going maintenance programme are those used for the construction and improvement of RARs and MRs (see appendix D).

Maintenance is aimed at keeping the roads as close as possible to the requirement of the standards

Where sections of RARs or MRs may be poor or even impassable the road is rehabilitated to standards set out in the MRP-Road Maintenance Manual.

MRP roads are expected to allow for traffic volumes of up to about 50 vpd and speeds of about 60 km/h (RARs are designed for traffic of up to 25 vpd.) However, for some road sections in hilly terrain lower geometrical standards and consequently lower speeds will apply.

The maintenance of rural access and minor roads are carried out on existing vertical and horizontal alignment.

It is the DMIE's responsibility to ensure that the standards set out are adhered to when carrying out work.

4.4.5 Maintenance Organisation and Responsibilities

4.4.5.1 Organisation Structure

The Minor Roads Programme has several work positions complete or partial responsibilities for road maintenance. These are as follows:

Headquarters MRP:	Programme Co-ordinator
	Deputy Programme Co-ordinator
	Planning/Monitoring Engineer
Provincial:	Provincial Road Engineer (unpaved roads)
District:	District Maintenance and Improvement Engineer (DMIE)

In general the district is split into Zones according to the characteristics of the RAR and MR network to be maintained. (see also appendix E).

4.4.5.2 Responsibilities

The roles and responsibilities of all personnel within the maintenance system and the details of duties to be carried out on a regular basis, starting at site level are:

a) Lengthman Contractor

The lengthman contractor is ideally a person who has worked on the construction or improvement of the road. There is need for on-the-job training for new lengthmen.
The lengthman lives near the road and is responsible for all routine maintenance activities.

To facilitate supervision and control the lengthman is suppose to work on specified days each week, arranged by the overseer and recorded in the inventory maintenance book. The lengthman is directed to carry out specific activities each week and task rates are laid down. The standard engagement form has been designed in MRP format. All references to "employment" have been made "engagement". In this way it is as clear as possible that the work is on "contract" and not on "employment" conditions.

The overseer or headman ensures that the lengthman fully understands the requirements of each maintenance task and the contract before it is signed.

b) Headman

The supervision workload of the routine maintenance overseer is eased by setting up appropriate headman arrangements. In this way daily site supervision is possible in between visits of the overseer. The overseer can give directions through the headman and delegate some day to day control and productivity to the headman. The headman is responsible for day to day supervision of the lengthman. He physically sets out tasks for each lengthman and checks productivity and quality of work and makes a report to the overseer. The headman is responsible for the supervision of 7 to 10 lengthmen working on the same road or adjacent roads within a maintenance zone. He is not a Ministry of Public Works employee.

c) Routine Maintenance Overseer

The Routine Maintenance Overseer (or zonal maintenance supervisor) is responsible for the organisation and control of all routine maintenance activities within his maintenance zone. He is also responsible for identifying the need for urgent work. He is a Ministry of Public Works employee.

d) Officer-in-Charge, Maintenance (OIC)

This is the key position within the maintenance organisation. He is responsible for the day to day running and functioning of MRP network in the District. He is a Ministry of Public Works employee.

e) District Maintenance and Improvement Engineer (DMIE)

The DMIE is responsible for all MRP maintenance activities in the District. He is a Ministry of Public Works employee (see also appendices E and F).

4.4.6 Routine Maintenance – Organisation and Management

Routine maintenance is based on the lengthmen system. The management of this system is difficult to organise in logistical terms but potentially cost-effective. This section sets out the most important aspects of organisation and management which are normally considered under the lengthmen system. See appendix H.

These aspects are:

a) Establishment of fair contract lengths

The need for allocation of fair lengths of road for each contractor is important for the efficient operation of the system and motivation of the lengthman.

To enable this to be achieved, the following is normally considered:

- Maintenance requirements of RARs and MRs vary according to a range of conditions, the principal physical factors being rainfall, traffic, soil type, gradient and topography.
- Productivity

b) Establishment of Contract Sections and Divisions

Permanent reference points are established to indicate the start and end of each lengthman's section in order to plan and instruct work to each lengthman. The start and end of each lengthman's section are marked with permanent section markers. Each section is then divided into divisions.

c) Maintenance Inventory Field Book

The maintenance inventory field book is used to record the details of the lengthman section and divisions and is carried by the overseer on inspections for reference.

d) Programming of Work

The principal guidelines with regard to programming routine maintenance work are:

- The lengthman must concentrate on usually one, but a maximum of two activities in a two week period
- The lengthman commences work on the activity at the start of his section and works through the section until that section is complete.
- Daily or weekly tasks are set whenever possible.
- Priorities for maintenance activities are set according to season.

Only a small number of activities have to be carried in the dry season to safe guard the road. Most of the work is delayed till the rainy season.

The lengthman receives a fixed and regular income throughout the year.

e) Routine Maintenance Priorities

Routine maintenance activities are carried out according to priorities. This is to ensure that only those activities which are considered vital at a particular time are dealt with.

f) Work Instructions and Reporting

On each site visit, the overseer gives instructions to the headman using the routine maintenance plan, and achievement report forms.

g) Productivity

The task work system is used wherever possible for both lengthmen and other MRP operations. It is based on both the output and what would be achieved if working steadily for a period of 8 days. The system enables high productivity rates to be achieved and also allows the workers to be released for their own activities as soon as they have satisfactorily completed their task (by quality and quantity). The daily paid method is used occasionally, for activities that are difficult to measure.

The Technology Unit Study on routine maintenance developed productivity standards for RARs and MRs. They represent the best productivities that can be achieved with a well-organised and managed lengthmen system. These productivities are only applicable to Kenya (Ministry of Public Works, 1992).

h) Supervisor's Inspection Programme

The success of the lengthmen system depends on the frequent visits of the supervisory personnel to the dispersed work locations on the road network. High priority should be given to the mobility of the Routine Maintenance Overseers and Officers-in-Charge of maintenance

i) Employment of Lengthmen and Headmen

Particular attention is given to the employment process of lengthmen and headmen. Possible candidates for lengthmen and headmen positions are proposed by the Overseer Improvement to the Overseer Maintenance. However, the final appointment is made by the Officer-in-Charge.

The guidelines are:

- To check for candidates who previously worked for MRP on an improvement site.
- To check whether the potential candidates live near the particular road for which the lengthmen are being recruited.
- To make sure that there is gender equality.
- To provide comprehensive information on the terms and conditions of employment as a lengthman; and
- To explain clearly that any candidate will be under close observation for the first few weeks of employment and that anybody not performing will be dismissed from work without prior warning.

Both lengthmen and headmen are subject to disciplinary action whenever they violate the conditions of contract.

4.4.7 Comments

Kenya's Lengthmen System for rural road maintenance is able to provide at least a minimum maintenance service. It also ensures that every part of the road network receives attention throughout the year.

The system has proved to be cost-effective (better than equipment based-methods) and sustainable provided the right institutional arrangements are put in place to suit a specific environment. Cost comparisons carried out in Kenya between lengthmen system and conventional methods show that the system is cheaper. Most of the costs are in form of wages.

The Kenyan experience shows that a lot of effort in terms of supervision and monitoring is required in order to maintain high standards and achieve good productivity. Research has shown the importance of getting maintenance programmes correct first time. Thus pilot projects are very essential especially when large-scale programmes are to be established.

CHAPTER FIVE

5 RURAL ROAD MAINTENANCE IN LESOTHO

5.1 Country Background

Lesotho is a small mountainous country (30,355 square kilometres in area) completely surrounded by the Republic of South Africa. Only a third of the total area is non-mountainous. Agriculture accounts for 11% of the total land area (Europa, 1999a, 1999b).

Like other developing countries in the Sub-Saharan Africa (Coukis, 1983), Lesotho has an unstable employment situation. Many of the people are poor as a result of unemployment.

5.2. Major Problems facing Rural Communities in Lesotho

There is an increase in poverty characterised by:

a) Inaccessibility

There is inadequate rural infrastructure in the form of roads resulting in severe communication problems. A major problem in the economic and social development of the remote areas is the isolation of these areas from any economic and social services like markets, schools and clinics.

b) Unemployment

Unemployment and underemployment are major problems in Lesotho. It is estimated that out of the total population of about 2 million people, with a labour force of 988,700 people, 340,000 are unemployed (35%). The yearly increase in labour force is about 20,000. There is continuing decline of employment opportunities for Basotho in South Africa, especially in the mines which used to employ about 40% of Lesotho's labour force as migrant labourers (MOW, 1985, 1986, 1987, 1998).

All road construction works were in the past done by international contractors and consultants specialised in equipment-intensive methods and hence there was a massive foreign exchange drain.

Roadwork activities were mainly carried out by force account units. Activities, especially routine maintenance were neither operating effectively or efficiently.

There is a continuous brain drain of technical staff in Lesotho who prefer to work in other countries for better pay.

The combination of the above problems create a serious employment challenge for Lesotho. For a poor, labour surplus economy like Lesotho, labour-intensive construction is a viable alternative for a wide variety of different public works schemes. Moreover, a World Bank poverty assessment study stressed the need for a major expansion of labour-based road works, to provide isolated areas with year-round access which would facilitate economic development and flow of social services (World Bank, 1994).

5.3. Government Policy

The overall Government policy in the fifth (91/92-95/96) and the sixth (96/97-98/99) development plans is the reduction of poverty amongst the targeted poorest in Lesotho through social economic and environmental projects based on a community led approach (Pama, 1999).

The Government decided to follow a number of strategies to reduce poverty. Some of these were:

- Development of the private sector, this was to be the growth engine of the economy.
- Creation of employment in all activities which could be carried out by labour.

The major Government policy in construction is the development of the construction industry. This involves the use of local consultants, suppliers and contractors in construction.

Privatisation of all activities which can be carried out efficiently by the private sector is also highly regarded by the Government.

5.4. Road Sector Activities and Organisation

Responsibility for the construction and maintenance of the road network in Lesotho is divided between four agencies, but is highly centralised since the first three of the agencies below are within the Ministry of Works (MOW).

These road agencies are:

a) The Roads Branch

The Roads Branch is responsible for the most important and heavily trafficked roads within the network.

b) The Labour Construction Unit (LCU)

LCU is responsible for upgrading the more heavily trafficked earth roads to gravel road standard and maintaining them using labour-based methods. Most of the roads upgraded were initially constructed by the Civil Works Section.

c) The Civil Works Section (CWS)

CWS was formerly part of the Ministry of Home Affairs, but since 1996 became part of the MOW responsible for the construction and maintenance of minor village and District roads using labour-intensive, usually work for food methods. It remains operationally separate from LCU because of its continuing dependence on food aid from the World Food Programme (WFP). Both the Government of Lesotho (GOL) and the Lesotho Highlands Development Fund (LHDF) provide support to CWS.

d) The Lesotho Highlands Development Authority (LHDA)

LHDA is responsible for the construction of key roads leading to dam sites and temporarily for certain links in the network though maintenance works have been delegated to LCU as at present.

Only LCU will be given much emphasis in this report because of its role in labour-based maintenance of rural roads.

5.5. Labour Construction Unit

LCU is one of the labour-based road construction and maintenance departments in Lesotho. It is the largest and main unit in this type of methods. The department implements some of the Government policies mentioned earlier in order to reduce poverty.

5.5.1 LCU Objectives

The primary objective of the LCU is to provide functional rural road communication in order to promote the social-economic conditions of rural people. The second objective is to promote and propagate the use of efficient labour-based construction and maintenance in Lesotho thus creating both assets and employment (MOW, 1998).

5.5.2. LCU Establishment

According to Pama (1999), LCU was established in 1977 with the objective of creating employment for retrenched mineworkers from South Africa. It started as a pilot project and then expanded gradually. All construction and maintenance works were carried out by force account terms until 1993. In 1993, the GOL entered into agreement with IDA and one of the objectives was to develop small-scale contractors. Under this agreement 20 contractors were trained for a period of two years. There are more than 30 contractors who have been trained at present.

All road rehabilitation, periodic and routine maintenance works are now carried out by contractors. All routine maintenance contracts are allocated to all trained contractors using the ballot system. All rehabilitation and periodic maintenance are allocated to contractors under standard procedures. However, road construction and upgrading are carried out by force account teams.

5.5.3. Responsibilities

The original responsibility was upgrading and maintenance of 2,300 km of feeder roads. However, in 1997 LCU was given additional responsibilities of construction and maintenance of some of Lesotho Highlands Revenue Funded (LHRF) roads project and also the maintenance of LHDA feeder roads around dams.

5.5.4. Current Status of LCU

LCU has a 20 year work programme of road construction, upgrading and maintenance with the following aims:

- improved rural road communication
- large-scale employment of rural people
- increased and improved agricultural produce; and
- increased social services e.g. health centres, shops, etc.

This 20 year work programme is divided into four phases, namely;

a) Phase I (1990-1992): Improving Rural Road Communication

The major concentration was research, and the development of standards, specifications and work methods.

b) Phase 2 (1993-1998): Providing Large-Scale Employment Opportunity for Rural People

c) Phase 3 (1999-2004): Expansion Phase.

Involves the expansion of LCU activities throughout country.

d) Phase 4 (2005-2010): Rehabilitation and Maintenance Phase

Involves the shift from construction and upgrading.

5.5.5. Funding

LCU receives funds from the GOL and aid agencies like IDA, KFW, EU, and IA. LHRF has an input for community roads. There is an additional fuel levy on fuel and is administered through the Road Fund to fund road maintenance. The Road Fund funds some of LCU's routine maintenance works. Fuel levy is at 8 US cents per litre which is below the 10 US cents thought sufficient to fund maintenance adequately (Metschies and Rausch, 1996).

5.5.6.Existing Challenges

In additional to being given additional responsibilities, LCU has insufficient capacity to implement additional funded road projects which have to be constructed and maintained. Also the rate of construction is low in comparisons to plans.
These challenges are being dealt with through strategies like;

- orienting and using local consulting firms
- development of small-scale contractors in road construction and maintenance; and
- training of more force account technicians

5.5.7. The Use of Consultants

LCU has been using consultants in order:

- to increase in-house capacity for implementation of expanded programmes
- to reduce the design and supervision burden of roadworks on over-stretched technical and managerial staff of LCU
- to allow LCU to act solely as a client as opposed to the current situation of a combination of client and consultant.

The type of consultants' contracts used include lump-sum and time-based contracts.

The roles of consultants include;

- survey and design of selected roads to suit labour-based method of implementation
- preparation of bill of quantities, contract documentation and invitation of bids
- contract administration and mentorship; and

- training of LCU technical staff and contractors

Selection procedure for consultants is depended on the selection procedure for road construction and rehabilitation based on experience, resources and legal status of each firm. Selection for rehabilitation and periodic maintenance is based on manpower, legal and other minor resources.

The figure below shows a regularly maintained rural road in Lesotho.

Figure 5.1: A regularly maintained rural road using labour-based methods, in Lesotho.

5.5.8. Donor funding

a) Irish Aid

Irish aid assistance to LCU started in 1994, the objective being financial assistance in Lesotho to reduce poverty for rural people. Assistance aims at creating employment and rural infrastructure in form of roads. Recently, Irish Aid has been involved funding some road projects (see Table 5.1 below).

TABLE 5.1: IRISH AID FUNDED PROJECTS – PHASE TWO

DISTRICT	CODE	LENGTH (km)	REVISED COST (Maluti)	CONSTITUENCY
Mohale's Hoek	MH01	23.75	4,393,946	Ketane
Mohale's Hoek	MH16	14	3,306, 637	Qaqatu
Mokthotlong	MK07	16.8	5,038,451	Khubelu -Bobatsi

Source: MOW, 1998

b) KfW Funded Projects

Since the 1980's KfW has been assisting LCU with the main aim of promoting labour-intensive upgrading of rural roads in order to create employment and rural infrastructure for the rural communities. It has so far funded four phases and is currently funding Phase 5 as shown in the Table 5.2 on the next page.

TABLE 5.2: KfW FUNDED ROADS – PHASE FIVE

DISTRICT	CODE	LENGTH (km)	ORIGINAL COST (Maluti)	CONSTITUENCY
Thaba – Tseka	TT03	23	4,114,000	Thaba – Chitja
Leribe	LB18	15	2,951,000	Pitseng
Mafeteng	MF13 (north)	13	2,309,000	Mafeteng and Qalabane

Source: MOW, 1998

c) SIDA Funded Projects

SIDA has been assisting LCU since 1977. It has funded field activities and training, construction of buildings.

d) IDA Funded Projects (RRMP)

The Roads Branch, LCU and CWS are responsible for the implementation of the Road Rehabilitation and Maintenance Project (RRMP) which commenced in 1998.

RRMP has three components:

- A civil works programme focusing on maintenance including rehabilitation of sections of roads of the road branch and LCU networks and upgrading of selected priority roads
- Design engineering and supervision services in support of the programme; and
- Institutional reform capacity building and logistic support.

There are other projects funded by Lesotho Highlands Revenue Development Fund (LHRDF) as shown in Table 5.3 below.

TABLE 5.3: ROADS FUNDED BY LHRDF

DISTRICT	CODE	LENGTH (km)	COST (Maluti)	CONSTITUENCY
Leribe	LB06	12	1,560,000	Hleoheng
Maseru	C511	11.5	4,300,000	Sengangane
Maseru	B205	10	1,400,000	Thab-Bosiu
Leribe	LB05 (B)	15	1,830,245	Nqechane
Berea		7.6	500,000	Khafung

Source: MOW, 1998

5.5.9. Administration

a) Staff and Labour

By 1998, LCU had a labour force of about 1546 people. This figure comprised 1280 labourers and 266 staff. Of the former only 17 labourers were permanent employees paid from various capital projects. Of the 266 staff, 66% were employed and paid from capital projects whilst the remainder were holding established positions. The permanent labour force has decreased as compared to previous years, the reason being that as in the preceding years all roads under maintenance were taken over by small-scale contractors trained under the World Bank and GOL funded Small Scale Contractor Programme (SSCP) (MOW, 1998).

b) Finance

Table 5.4 below shows a breakdown of the total commitment on LCU, which was M29, 980,983 (US$ 5 million) for the 1997/98 financial year. Maintenance of public assets (roads and airstrips) cost about 15.7% of the above figure. The rest was for construction, training and support. The table does not include contributions by European Union and World Bank.

TABLE 5.4: FINANCIAL COMMITMENT TO LCU (1997/98)

SOURCE OF FUNDING	%
Government of Lesotho	44
Lesotho Highlands Development Fund (LHDF)	21
Irish Aid	15
Kredistanstalt Fur Wiederaufbau (KfW)	11
Swedish International Development Agency (SIDA)	5
International Development Agency (IDA)	4
Total	100

5.5.10 Activities of the Technical Section

The technical section is divided into three sections; Training, Planning and Control, and Operations. Operation is further divided into Regions and Contracts.

a) Operations

By 1998 all road routine maintenance had been fully contracted out to private contractors. LCU has fully transformed itself into a contract monitoring department regarding maintenance works. In addition, periodic maintenance by contract has also been introduced.

However, upgrading and construction work is still carried out by force account units.

LCU has a large fleet of plant and vehicles used on construction and maintenance of roads. Most are aged but there is gradual replacement by donors and project funding.

b) Field Activities

The major field activities of LCU are maintenance of roads and rural airstrips, rehabilitation of roads, upgrading and construction of rural roads and airstrips using labour-based methods through force account and contracting.

The distribution of work between force account units and contracting during 1997/98 term is shown in the Table 5.5. Table 5.6 on the following page shows the sources of funding for LCU field activities during the 1997-98 reporting period.

TABLE 5.5: DISTRIBUTION OF WORK BETWEEN FORCE ACCOUNT AND CONTRACTING

CATEGORY OF WORK		DISTRIBUTION OF WORK (%)	
		Force Account	**Contracting**
Routine Maintenance:	Roads	0	100
	Rural Airstrips	71	29
Rehabilitation:	Roads	0	100
Periodic Maintenance:	Roads	0	100
Upgrading/Construction:	Roads	100	0
	Rural Airstrips	100	0

Source: MOW, 1998

TABLE 5.6: SOURCE OF FUNDING OF LCU FIELD ACTIVITIES (1997/98)

SOURCE OF FUNDING	%
Government of Lesotho (Recurrent)	33.30
Lesotho Highlands Revenue and Development Fund (LHRDF)	26.64
Irish Aid	22.57
Rural Road Maintenance Programme (RRMP	8.43
Kredistanstalt Fur Wiederaufbau (KfW)	6.11
Government of Lesotho (Capital)	2.95
Total	100

5.6. Routine Maintenance

5.6.1 General

As stated earlier, LCU has been involved in labour-based works since 1977 and is one of the most experienced organisations in the world in this type of activity. A recent evaluation concluded that LCU was " a solid and well balanced institution that effectively demonstrates the main advantages of the labour-based approach to infrastructure provision in low-wage economies" (Stiedl et al, 1997).

Routine maintenance by force account has been phased out and has been replaced by small-scale contractor system using locally recruited labour. Currently, there are 30 contractors each handling routine maintenance of 11-45 km of roads and small airfields, depending on the grouping of the work. About 80% of the contractors are capable of undertaking periodic maintenance works and are being introduced in the more complicated aspects of rehabilitation. Although LCU is planning to contract out an increasing share of the work to the private sector, it may keep a small direct labour unit for activities in remote and more difficult areas, where there is a high concentration of poverty.

As the 1997 SIDA evaluation noted, maintenance of LCU roads has been contentious technically because of lack of regular periodic maintenance (Stiedl et al, 1997).

The establishment of the lengthmen routine maintenance system on most of the network, and the diversion of some of the recurrent maintenance budget for spot improvement purposes to repair damaged sections, undoubtedly slowed the rate of deterioration, but could not postpone it indefinitely. This is due to gradual emergence of the underlying bedrock (on some roads) as the gravel layer wore down, resulting in steadily rougher travel conditions. Regravelling varies from 3-5 year intervals depending on the terrain.

LCU has been within the World Bank financed road maintenance programme with a five year action plan, starting in 1997 to clear the backlog of regravelling (535 km, with

gravel of 60mm or less) and rehabilitation (194 km, with gravel below 20mm or nothing left and visible deterioration) on the existing network.

Due to economic stagnation, governments in the Sub-Saharan Africa have systematically failed to deliver on funding arrangements that require them to assume a steadily increasing maintenance burden from donors (Thagesen, 1996). Lesotho is no exception in this regard.

5.6.2 Operations of the Lengthmen System for Routine Maintenance in Lesotho

The lengthmen system has been used in Lesotho since 1984. Most of the rural roads were built in the 1970's using labour-based method approach. Up to 1984 maintenance was done by force account using LCU staff. The system proved ineffective (Pama, personal communication, 1999).

The lengthmen routine maintenance system was then introduced and followed the Kenyan pattern but still using force account. Labourers were employed and deployed on the network.

Under routine maintenance each labourer was given a section of the road, about 1.5 km long to maintain. He was issued with the basic hand tools, such as pick-axe, shovel, and wheelbarrow. Each day the labourer would walk from his home to his road section. Supervision was supposed to be on a day to day basis by a senior labourer (about 1 per 10 km) who was issued with a bicycle for transport. The senior labourer kept attendance records, directed work and from time to time would gather men into gangs to tackle more intensive maintenance works. Activities included the filling of potholes, cleaning of culverts and ditches, repairs to masonry works and excavation and loading of gravel for stockpiles.

However, roads continued to deteriorate under this system despite being under a maintenance programme. There are many reasons why the lengthmen sytem (using length-persons) under force account failed.

The most significant reasons that led to failure were that:

- Due to the vast network and few supervisors, it was difficult to supervise the workers effectively. This left a lot of labourers without supervision.
- Monitoring was minimal and progress difficult to assess
- There was also dampened morale and low motivation among workers.

Monitoring and supervision under the lengthmen routine maintenance system by force account were found to be the more important and critical than technical issues.

As a result of the failure of the length-persons, LCU changed its strategy by introducing the lengthmen system of routine maintenance by small-scale contractors, thereby replacing the force account system. This system has proved to be efficient. Labourers are employed by the contractor whose contract is lump-sum based (see section 2.3.6) and allocated work depending on the extent of deterioration (Ntoi, personal communication, 1999).

The change from force account to the contract system was inevitable and propagated as a result of the following factors; -

- ineffectiveness of force account
- lack of supervision and monitoring in force account
- Government policy of privatisation and development of local construction industry

These changes have resulted in reduced number of supervisors. There is also no direct control of workers as these are under the control of contractors. The burden on LCU has been eased up but at least roads are now in good and maintainable state. There is value for money. Performance is the main criteria for payment as opposed to attendance.

Each supervisor (LCU staff) can handle up to four contracts, depending on the type of work, and supervises at least twice a week. The total length a supervisor can handle can be as much as 40 km. Most of the present supervisors were previously working under the force account but have since been trained alongside contractors to enhance their construction knowledge and skills. About 95% of all work is contracted out through a ballot system for transparency though plans are underway for competitive bidding.

LCU has also established its own task rates, which have been developed and adjusted over the years.

In the 1998/1999-term 780 km of roads are under routine maintenance out of the network of 2300 km which is increasing by 70 km per annum. The balance is under rehabilitation or periodic maintenance. About M9000 (US$ 1500) per km per annum is used in routine maintenance work. This figure is average and subject to fluctuations depending on the condition of the road to be maintained. The amount is sufficient for the reasonable profit for the contractor. Lesotho has high wage rates compared to other Sub-Saharan African countries. The minimum wage rate is US$4/day. The rates in the contract include supervision (transport allowance for work in the mountains), 10% profit mark-up, 10% overheads, 5% tax and insurance (Ntoi, personal communication, 1999).

5.7 Comments

Lesotho's experience of avoiding the traditional capital-intensive routine maintenance operations in favour of labour-based lengthmen system through small-scale contractors is worth replicating. A lesson learnt is that force account can be problematic both under equipment and labour-based methods. Under the current system routine maintenance works are only paid for on satisfactory performance. Though donor funding is still prominent, there is a benefit to the community through the employment which has been created and improved access.

CHAPTER SIX

6 SUMMARY OF COMPARISONS OF RURAL ROAD MAINTENANCE BETWEEN ZAMBIA, KENYA AND LESOTHO

This chapter deals with comparisons in Rural Road Maintenance Systems between Zambia, Kenya and Lesotho. It focuses on general information, performance parameters, institutional strength and management, existing constraints in rural road maintenance programmes, and finally routine maintenance techniques and work methods.

a) General

ITEM OF COMPARISON	ZAMBIA	KENYA	LESOTHO
Physical:	Landlocked with 752,614 sq kms. Generally plateau.	Non-landlocked with 580,367 sq kms. Varying terrain.	Landlocked with 30,347 sq kms, Mountainous.
Climate:	Tropical climate modified by altitude. Average temperature is from 18°C to 24°C. Annual rainfall ranges from >1200mm in the north to <750mm in the south.	Temperature ranges from 20-32°C in the coastal region to 7-27°C inland. Annual rainfall ranges from 1000-1250mm in in the highlands to about 250mm in the north.	Generally mild; cooler in the highlands (<-7 to 22°c). Temperature ranges from -7°C to 32°C in lowlands. Annual rainfall is 725mm and falls mostly in summer.
Population (1999):	9.6 million people (13 people per sq km). Increased by 2.8% per annum (1990-97).	32 million people (55 people per sq km) Increased by 2.6% per annum (1990-97).	2 million people (66 people per sq km) Increased by 2.1% per annum (1990-97).
Unemployment:	High (over 25%)	High	High (35%)

Underemployment:	High	High	High
Labour availability:	High	High	High
Agriculture potential:	High (almost all parts of Zambia)	High	11% potential of total area as most of the area is mountainous
Daily wage Levels:	US$ 1.50	US$ 1.20	US$ 4.00
Main economic sectors:	Mining and agriculture.	Agriculture and tourism.	Agriculture and manufacturing.
GNP per capita:	US$ 360 (1994-96). US$ 370 (1997).	US$ 320 (1994-96). US$ 330 (1997).	US$ 660 (1994-96). US$ 670 (1997).
GNP growth rate (1990-97):	- 4.8 % per annum.	- 0.5% per annum.	+ 0.9% per annum.
GDP growth in real terms (1990-97):	1% per annum.	2% per annum.	8% per annum.
Agricultural contribution to GDP:	18.8% contribution to GDP in 1996 and employed 71.1% of labour force in 1997.	30% contribution to GDP in 1996 and employed 76.7% of labour force in 1997.	13.9% contribution to GDP in 1996 and employed 38.6% of labour force in 1997.
Agricultural GDP growth:	- 5% per annum (1990-97).	+0.8% per annum (1990-97).	+16% per annum (1992-96).
External debt (1996):	US$ 7,113 million or US$ 790 per capita.	US$ 6,893 million or US$ 229.8 per capita.	US$ 654.1 million or US$ 327 per capita.

(Europa, 1999a, 1999b; EIU Country Report, 2000).

b) Indicators For Road Agency Performance (Rural Roads)

	ZAMBIA	KENYA	LESOTHO
ITEM OF COMPARISON			
Expenditure:			
Routine maintenance (per km per annum):	<US$ 160 (required is US$ 650 for roads in good condition).	US$ 300	US$ 1,500
Network Size:			
Area thousand sq.km:	753	580	30
General total network length:	65, 950 km	154,490 km	5,425 km
Length per sq.km:	0.088 km	0.266 km	0.181 km
Length per 1000 persons:	6.7 km	4.8 km	2.7 km
Main network length:	36,762 km	61,688 km	2,346 km
Main paved:	6,582 km	7,686 km	600 km
Main unpaved:	9,344 km	54,000 km	1,746 km
Main rural network:	15,898 km	87,276 km	2,904 km
Urban Network:	1,543 km	3,890 km	175 km

Condition of rural network:

1992:	Good (30%) Fair (35%) Poor (35%)	Good (66%) Fair (15%) Poor (19%)	Good (16%) Fair (57%) Poor (27%)
1998-99:	More than 50% of the network was in poor condition. The roads deteriorated.	Over 9000 km under regular maintenance by single-person contractors. Fairly good and passable.	Condition of network under routine maintenance described as good and has 780 km under routine maintenance in 1999 through private small-scale contracting. Rest of the Network under Rehabilitation.
Km backlog of routine maintenance:	Excessive	Fair	Almost nil
Condition of bridges and culverts (structurally and functionally).	Poor state	not known	Good

Utilization of the Network:

Traffic flow:	Traffic flow range from 1 to 30 vpd and has declined over the years.	Up to 50 vpd	1-30 vpd (has increased over the years).
Vehicle size and Weight:	Mixed traffic (motorised and non-motorised).	Mixed traffic (motorised and non-motorised).	Mixed traffic (motorised and non-motorised).

c) Institutional Strength And Management
(Structures And Procedures, Funding And Organization)

ITEM OF COMPARISON	ZAMBIA	KENYA	LESOTHO
Funding			
Availability:	40% of the Road Fund goes towards maintenance of roads under MLGH. However, its not clear how much is reserved for rural roads (unpaved). Funds are inadequate and availability is low. Almost nil in 1997 and 1998. (see appendix C)	Low.	Fair. Routine and Periodic maintenance activities are adequately funded. The whole network is attended to at all times.
Sources:	Sources of funds are the Road Fund, Government and Donors. Councils are unable to generate money by themselves and all of them are in deficit situations. (See section 3.4.4)	Government and Donors	Road Fund, Government and Donors. There are a good number of donor funded projects. (See sections 5.5.5 and 5.5.8)
Policy Environment			
Government and transport Policy:	Government is pursuing a decentralisation policy (under review).	Kenya has a favourable policy environment as far as maintenance of	The overall government policy in the fifth five year (1991-1996) and the

	Transport policy (draft) is addressing the state of roads well but needs speed implementation. (see sections 3.3.2.3 and 3.4.6).	unpaved roads are concerned. This is evident in ROADS. 2000 objectives. There is high support from Government for using labour-intensive-methods as much as possible. (See section 4.3)	sixth three year (1996-1999) development plans is the reduction of poverty from among the targeted poorest in Lesotho through social economic and environmental projects based on community led approach (See section 5.3)
Existing Organisational Structure			
Components of Rural Roads Management Structure:	The main components: are DCs (also referred to as road agencies), DISS, Road Fund, NRB and ZNTB. ZNTB is seen as an obstacle by DCs. (See section 3.5.1)	Organisational Structure of MRP is well outlined. It's related components and linkages at District, regional and headquarters well articulated. (See section 4.4.5 and Appendix E).	The main components responsible for more earth and gravel roads are LCU and CWS sections. LCU is divided into sections, which include a technical section. The Technical Section is subdivided into three Sections i.e. Planning , Control, and Operations. Operations are divided into Regions and Contracts headed by Senior Engineers. (See section 5.5.10).

Existing Communications And Planning Procedures

Communication Procedures:	Basic organizational structure for communication is simple but with problems. DCs prefer to deal with NRB directly. There is lack of two way communication between DCs and DISS. DISS's capacity is very low to handle DCs demands. There is slow speed communications in both directions between DCs and DISS. There is slow speed communication between DISS and NRB in both ways. Delays or lack of response from NRB to DCs through DISS. Lack of consultations by NRB with DCs. (See section 3.5.2).	Communication procedures are fair.	Communication Procedures and links are good. There is a direct flow of authority and responsibility in LCU. LCU is independent from other agencies within MOW.
Planning Procedures:	Lack of faith in the system. DCs have misunderstanding of procedures and objectives of the Road Fund. Poor timing causes some projects to start in the rainy	Well outlined in the MRP- Maintenance manual (1992). (See also section 4.4.6).	LCU has planning and control section.

	season. Duplication of functions does exist. (See section 3.5.2.3).		
Supervision of Work:	Poor performance by consultants due to to fixed fees and misunderstanding of obligations. Uneven performance by Provincial Engineers due to pressure of work low fee structure and and lack of control. The use of provincial planning and supervision department to provide technical assistance has not worked well and has sometimes shifted to private consultants. (See section 3.5.3).	Supervision is done with the help of headmen, who report to overseers. Overseers report to Officers-in-charge of maintenance and final authority rests with the District Maintenance Engineer (DMIE). See appendices F, G. (See section 4.4.5.2).	The use of consultants in Lesotho has worked in line with government policy to develop local consulting industry and increase LCU's capacity. The use of consultants is however at initial stage. Contracts are awarded on open tender basis for transparency.
Current Contract Administration Procedures:	Plans are there to change from using force account methods to private contracting for rural roads and thus focused attention on contract administration procedures. Due to lack of capacity at DCs, provincial consultants , DISS and NRB are filling in some of the management functions. This has caused problems	Lengthmen are employed on a contract basis. Procedures and contract conditions are outlined in employment forms. See also appendix G.	Though a small amount of jobs are done through force account (special projects), a large percentage is through private contracting. There is a well established contract section in LCU. Contract procedures are well documented and promote labour-intensive methods.

	in terms of duplications. Formation of contract management Units at DCs is under discussion. (See section 3.5.4)		
Existing Planning And Management Capacity			
Staffing levels:	Difficulties exist in ascertaining appropriate size of staff to meet the needs of rural road maintenance programmes. There are a number of unfilled staff positions. Councils rely on the MWS for technical assistance.	Not Known	There is a well established structure to manage rural rural roads. Staff positions are filled in and localised.
Capabilities of Staff:	DCs are limited by the low levels of DOW's technical training and experience.	Fair.	Fair
Qualifications:	DCs are unable to employ highly qualified staff due to low salaries and lack of incentives. (see section 3.5.5)	Qualifications are high (e.g DMIE must have a BSc in Civil Engineering). (see appendix F)	LCU has managed to to employ high calibre staff (graduates). Most of them have received training in labour-intensive work.
Small-Scale Contractors:	Very small number of small-scale contractors in many districts. Most of them lack equipment and are hindered by high	Lengthmen are well established and provided with necessary tools.	More than 30 small-scale contractors, each handling routine maintenance of 11-45 km. About 80% of them are capable of handling

interest rates and lack of plant pools.

periodic maintenance using labour-intensive methods. They are moreover equipped with the necessary tools.

d) Existing Constraints In Rural Road Maintenance Programmes

ITEM OF COMPARISON	ZAMBIA	KENYA	LESOTHO
Local government maintenance skills:	Skills are there.	Skills are there	Skills are there
Capability of local Communities to undertake routine maintenance:	To a large extent. Small-scale works using labour-based methods have shown that capabilities can be developed.	Local communities do possess capabilities. They have been involved in the construction and maintenance of over 11, 000 km of rural roads through labour-intensive methods.	Local communities do possess skills to undertake maintenance. They have been involved in labour-based programmes.
Definition of maintenance needs and related tasks have not been adequately defined:	Well defined	Well defined	Well defined
Maintenance needs:	Maintenance needs are actually excessive due to backlog as a result of prolonged neglect of maintenance and inadequate funding.	Not known but donor assistance has been prominent since the inception of MRP/ RARP programme	Maintenance needs are not excessive, and roads are at least given a minimum maintenance standard.

Maintenance responsibility (Articulation of responsibilities)	Responsibilities are well articulated.	Responsibilities are well articulated.	Responsibilities are well articulated.
Local communities do not identify themselves as beneficiaries:	To some extent due to political interference. Farmers do identify themselves as main beneficiaries and as such formed associations to air their views.	Not true. Local communities do identify themselves as as beneficiaries.	Not true. Local communities identify themselves as beneficiaries.
Maintenance techniques not balanced in relation to local resources:	Very true. Though there is a shift from force to private contract, this is only preliminary, capital-intensive methods continue to dominate maintenance programmes.	Maintenance techniques are well balanced in relation to available resources. Labour is well utilised	Maintenance techniques are labour-based and are balanced to available resources.
Maintenance tasks are not adequately being executed:	Maintenance tasks are not adequately or not executed at all in many cases.	Maintenance tasks are fairly well executed. Supervision is highly employed to ensure high productivity.	Maintenance tasks are adequately executed.
Local resource base is inadequate:	Local resource base is	Inadequate in monetary	Inadequate in monetary

	adequate in terms of labour and materials. It's the funding problem which continues to to persist due to harsh economic conditions.	terms only.	terms only.
Local resource mobilisation:	Inadequate	There is local resource mobilisation.	Local resource mobilisation is there but inadequate in terms of funding.
Central Government is allocating insufficient funds:	Yes- Insufficient by far See appendix C.	Not known	Fund allocation is not sufficient, hence donor assistance.
Maintenance workers have inadequate skills:	Maintenance workers are demotivated due to lack of projects. They have had little opportunity to prove their worth.	Workers have developed skills and are able to work independently.	Small-scale contractors responsible for maintenance have developed skills through LCU programmes.
Maintenance resources are diverted for other purposes:	Resources are never diverted for other purposes but are used accordingly.	Not known	Not known

e) Routine Maintenance Techniques And Work Methods

ITEM OF COMPARISON	ZAMBIA	KENYA	LESOTHO
Technology:	Capital-intensive methods through force account and contracting. Labour-intensive methods are however receiving some attention but mainly through community food for work programmes.	Labour-intensive methods based on the lengthmen system (single-person contractors). A combination of labour and equipment is used on highly trafficked roads (>50 vpd).	Labour-intensive methods based on lengthmen system (small-scale contractors) A small percentage of force account maintenance team has been retained to deal with very isolated cases.
Equipment:	Usually graders are used. Very few DCs have graders and mainly rely on hired equipment. Utilisation is very low.	Tractor towed graders are used on heavily trafficked roads. Otherwise, hand tools are mainly used.	For routine maintenance only handtools are used. Minor plant like the BOMAG BW 90s rollers are used on bigger projects such as periodic maintenance and rehabilitation. Tractors are also used.
Quality and quantity of work:	Little data exists on quality and quantity of rural road maintenance concerned. Quality can however be described as low and quantity as almost nil. Substandard work is as	Quality can be described as fair and compares well with machine-based work. Quantity on routine maintenance is high. Over 10,000 km of rural roads receive attention under the lengthmen system.	Quality compares well with machine-based work. Quantity (output) has been impressive, e. g in 1998/ 1999 term 780 km of the total network of 2,300 km (increasing by 70km per year) was under routine maintenance with rest

	a result of inadequate supervision due to poor funding. Performance under ROADSIP has not been good due to economic hardship, e.g. during the period 1/1/99 to 22/10/99 ROADSIP national achievement was: Routine maintenance; -US$ 1.8 million (approved budget) -US$ 0.01 million (approved contract). This translates to 0.8% of approved budget. Routine maintenance was 0.4% of US$ 2.43 million expenditure on road maintenance. See appendix C.		under periodic or rehabilitation.
Technical Standards (Design Specifications and Conditions of Contract)			
Procurement Procedures:	Procurement procedures are biased towards equipment-intensive methods. In fact small-scale contractors find themselves in difficult situations	Technical standards have been developed and set out in the MRP road maintenance and technical manuals. They are appropriate to local conditions.	Procurement procedures are designed to suit small-scale (labour-based) contractors. Two contract documents have been developed, for routine and rehabilitation to local

	because they have no equipment and also face competition from large contractors. Other problems include: -designs suited to equipment –based methods -Bills of Quantities that are in line with traditional work methods which favour the use of equipment. -Conditions of contract favour equipment-based methods. -Bidding procedures that are lengthy and demanding in terms of fees and securities.	standards. Designs, Bill of Quantities and conditions of contract foster the development of small-scale contractors. Productivity rates have also been incorporated in the contract documents.
Specification of Works:	Design specifications do not favour the use of hand tools. Quality and performance standards favour the use of equipment-based technology. (See appendix B)	Specifications of Works are outlined in the MRP Maintenance Manual and support labour-based technology. (See appendix H)	Specifications and methods of work favour and support labour-based technology. (See appendix I)
Typical cross-sections of rural roads			
Formation width:	5000mm	4500mm	6000mm
Gravel course:	4500mm	4000mm	5000mm

Gravel thickness layer compacted:	120mm	100-150mm	150mm
Slope before compaction:	10%	5-8%	7%
	(See appendix A)	(See appendix D4)	(See appendix I5)

CHAPTER SEVEN

7 DISCUSSION

7.1 Introduction

Maintenance technology covers a range of maintenance methods using mixes of labour and equipment. Maintenance methods are characterised as equipment or labour-based depending on the source of motive power used. Labour-based methods are often called employment-intensive because they contribute to employment creation. Appropriate technology, i.e. the most suitable mixture of labour and equipment is preferred by some practitioners. Before carrying out a comparative analysis (section 7.3) between Zambia, Kenya and Lesotho, existing practices, trends and factors of viability for labour-based work will be examined.

Equipment-based road maintenance methods developed in the industrialised countries are extensively used in many developing countries, including Zambia because of the following reasons:

- Politicians, planners and engineers are strongly influenced by the technology used in developed countries and there is very effective pressure lobby and sales pressure from heavy equipment manufacturers;
- Most road contractors are used to equipment-based working methods;
- Heavy equipment is often supplied at no apparent cost to ministries as part of foreign funded packages. Tax exemptions distort the real cost of machine-based methods and play a role in influencing the choice of technology towards the use of heavy equipment;
- Local sustainability of road projects is rarely considered when projects are designed;
- Employment creation is rarely taken into account when decisions are made at project implementation; and finally
- Lending criteria of financial institutions generally favour large-scale programmes, which have higher disbursement levels than projects, which are executed with local resources.

The promotion of the use of local resources for infrastructure programmes especially roads have been emphasised in development plans in third world countries in recent years (Thagesen, 1996; ILO, 1999). Both governments and financing agencies treat this issue much more seriously than they did a few years ago. Two most important circumstances, which have caused this change of attitude, are:

a) Lack of foreign exchange

Increasing debt-servicing obligations, particularly in SSA, have had crippling effects on national economies, forcing countries to adopt structural policies with repercussions on most sectoral activities. Restrictions on importation, often accompanied by frequent devaluations of local currencies have resulted on foreign goods becoming extremely expensive or outrightly unobtainable. The effect on operations in the road sector with its traditional dependence on foreign equipment, skills and goods has been devastating. In many countries in the SSA, transport constraints are very common due to the poor state of the rural network.

b) Unemployment

In the SSA, annual population growth figures are in the order 2-3%. At the same time employment opportunities particularly in the agricultural sector are on the decline. The combined effect has been rising unemployment or underemployment.

In most cases the choice between labour and machines is not an either or situation. For every road works activity there is a choice of technological approach. Each situation will usually demand a particular combination of labour and equipment resources to achieve the most cost-effective solution depending on the range of local factors. Experience around the world has demonstrated that it is important to develop appropriate organisational arrangements to achieve optimum use of the available local resources.

7.2 Choice of Technology

Whether (in a particular country) labour-based road construction and maintenance techniques will be viable or not, depends on several factors. The most important (Thagesen, 1996; Bentall et al, 1999; Bentall, 1999) of these are:

- Government attitude;
- Economic level;
- Comparative costs (tools and equipment availability);
- Establishment of appropriate administrative and financial procedures;
- Establishment of relevant management and training;
- Labour availability;
- Labour attitude; and
- Type and location of projects.

The ILO expresses indicators of viability to judge whether or not labour-based methods might be economically viable as:

- Gross National Product (GNP) per capita, as a readily available proxy for wage levels;
- Population density;
- Annual growth of the labour force;
- Minimum daily wage rate in agriculture;
- Road density;
- Maintenance expenditure as a percentage of GNP;
- Maintenance expenditure per km, among others.

However, an agreed methodology for assessing the viability of labour-based methods of road works is yet to emerge. There is still, at present, no consensus among governments and donor agencies as to the most appropriate methodology for appraising the prospects for labour-based operations because:

a) Agencies and most countries are still on the starting side of the learning curve so far as labour-based methods are concerned. Many countries, including Zambia, are doing

pilot projects and there are often seminars for assessing the viability of labour-based methods.

b) Conditions vary from country to country, e.g. execution in terms of force account; contracting or both may vary. Failure of pilot projects in some countries may have left a legacy of prejudice that will need to be overcome. Some countries still doubt the viability of labour-based methods.

The Government and administration at different levels must have a positive attitude towards assessing alternative technologies, which are not presently used in the country. Preconceived ideas and attitudes, particularly of government engineers, militate against the introduction of labour-based construction and maintenance.

In a free market situation, the level of equipment intensity or labour intensity of a particular activity should be governed by the prices given to various factors of production. When screening countries with a view to identifying those with the best potential for labour-based methods, the general economic level would give some indication of the type of technology that is appropriate. One factor is GNP per capita.

In choosing the most appropriate technology for road construction and maintenance it is necessary to make cost comparisons. The estimates should analyse the cost of alternative approaches taking into account costs of labour, staff, material, tools and equipment and overheads.

The daily wage rate is a very important factor in the assessment of whether labour-based methods are economically appropriate. Research has indicated that at less than US$4 per day (1994), labour-based methods should be seriously considered (Edmonds and Ruud, 1984).

When calculating the cost of labour and equipment, the productivity of labour and equipment needs to be known. Labour productivity data may be taken from international

sources (with caution) if no systematically organised labour-based work has been done recently in the country. Utilisation of equipment should be determined.
Output and productivity levels of labour-based works are heavily influenced by the degree of confidence of small-scale contractors and workers of their employers. Successful labour-based works, therefore, must have good administrative and financial procedures, which are relevant to working with large numbers of local workers. The difficulties of organising, administering and controlling large labour forces are many and require special skills. Reasonable production can only be obtained by appropriately trained management and technical staff.

The availability of labour, in sufficient numbers, is a prerequisite for labour-based construction and maintenance programmes. Normally, the level of unemployment or underemployment is used as an indicator of labour availability. These figures are difficult to obtain, in particular in relation to non-wage economy in rural areas. The population density can be used as a rough proxy for labour availabilty. In general the ILO suggests that 25 persons per square km is a figure above which labour supply would not normally be a problem. This factor has not affected the viability of labour-based construction in Zambia (see section 7.4). Attitudes of the available labour towards work and local customs should be taken into consideration.

7.3 Comparative Analysis of Rural Road Routine Maintenance Between Zambia, Kenya and Lesotho

7.3.1 General

a) Physical and Climate

All the three countries are in the SSA with Kenya being the only one with access to the sea. While Lesotho is mountainous, Zambia and Kenya have favourable terrain and land. Compared with Kenya and Lesotho, Zambia's climatic conditions (tropical) lie between the extremes of the two countries.

b) Economic Affairs

Though Zambia's population per square km (13 persons per square km) is low compared to that of Kenya and Lesotho with 55 and 66 persons per square km each respectively, it has a higher population growth. About 43% of Zambia is actually under forest, with an additional 8% under national park reserves. This means that the land occupied by people is 49% of the total area. This gives a population density of 26 persons per square km.

Unemployment is at more than 25% and underemployment is high in Zambia. This is also true for Kenya and Lesotho. Lesotho's unemployment is at 35%. In Zambia, unemployment continues to rise due to privatisation of most industries in the last few years and more recently of the Zambia Consolidated Copper Mines.

Developing countries are summarily divided into: Low-income economies, with 1992 GNP per person of US$ 675 or less; and middle-income economies, with 1992 GNP per person of US$ 676-8355. A few developing countries belong in the group of high-income economies with 1992 GNP per person of more than US$ 8355 (Thagesen, 1996). Analysis of Zambia, Kenya and Lesotho on this basis clearly shows that they belong to the low-income group. However, Zambia's GNP per capita is the lowest in terms of growth and

shows a poor performance with a decline of 4.8% per annum (1990-97). This trend is alarming. A comparison of Gross Domestic Product (GDP), another economic indicator, shows a lower figure for Zambia during the same period.

Agriculture is undoubtedly a big contributor to the economy in the three countries, with Kenya leading. This is evident from agricultural GDPs. The sector is also one of the largest employers. During the period from 1990 to 1997, agricultural GDP declined at 0.5% per annum in Zambia as opposed to growth in Kenya and Lesotho during the same period. Zambia's agricultural sector needs a positive growth to contribute more to the economy.

Structural adjustment in developing countries by IMF and the World Bank has resulted in debt burden. Compared with Kenya and Lesotho, Zambia has a higher debt burden of US$ 790 per capita.

7.3.2 Indicators of Road Agency Performance

A World Bank technical paper (Heggie, 1994) states various indicators, which are normally used to judge the performance of road agencies. These indicators include maintenance expenditure per km per annum; physical condition of the network; utilisation and management of the network; and administration and productivity. Administration and productivity will be discussed in section 7.3.3.

a) Expenditure per km

Zambia's expenditure on routine maintenance of rural roads (<US$ 160 /km/annum) is lower than that of Lesotho and Kenya. Though the three countries are going through the same financial difficulties typical to SSA, priorities in terms of sectoral expenditure may differ depending on government policy. The required expenditure for routine maintenance of rural roads in good condition in Zambia, has been estimated (MCT, 1997) at about US$ 650 per km per annum (see section 3.4.6.2.).

b) Road Network Length, Density, Condition and Utilisation

The road network in Zambia is estimated at 65,950 km, yielding a density of 0.088 km per square km. Zambia's density is lower when compared to Kenya and Lesotho each with 0.266 km per square km and 0.181 km per square km respectively. Density per population yields 6.7 km/1000 persons, 4.8 km/1000 persons and 2.7 km/1000 persons for Zambia, Kenya and Lesotho respectively. This gives an indication that Zambia has a higher density per capita (one of the highest in the SSA), and should rather concentrate on maintenance rather than construction.

Latest percentages on the conditions of the rural network are difficult to obtain. However, over 9000 km of earth roads in Kenya are under regular maintenance by single-person contractors and conditions are fair and passable. The entire rural road network in Lesotho is under maintenance. LCU described the condition of the network as good in 1999. On the contrary the condition of the rural road network in Zambia is poor. The figures obtained from two DCs, i.e. Kabwe and Kapiri Mposhi in central Zambia (with the highest concentration of agriculture), were 10% (good), 30% (fair), 60% (poor) and 10% (fair), 90% (poor) respectively. Zambia generally shows a poor performance in the sector. This indeed needs to be reversed.

Importance of the rural network in the three countries is high. Kenya has the highest traffic in terms of vpd. This can be attributed to good roads and activity in the agricultural sector. Since only 11% of Lesotho has potential in agriculture (as most of the country is mountainous), traffic is moderate. Utilisation in terms of vpd for rural roads can be misleading as a good number of peasant farmers especially in Zambia rely on non-motorised transport such as animal drawn carts and bicycles. Walking is also predominant in all the three countries.

7.3.3 Institutional Strength

a) Policy Environment

General policy environment, that is, overall government objectives and strategies, for national development, in which rural road agencies operate are favourable for both Kenya and Lesotho (see sections 4.3 and 5.3 respectively). Zambia's policy environment on rural roads is focused at pursuing a decentralisation policy (under review in 1999). The Government is seriously engaged in creating an atmosphere suitable for improving rural transport and travel through locally available resources (see sections 3.3.2.3 and 3.4.6).

b) Funding

All the three countries are heavily burdened by external debt (see section 7.3.1). This means that a lot of money generated is spent on repaying this debt and hence a big drain on foreign exchange. The result is low availability of funds and consequently the impact is felt on public infrastructure such as rural roads. Sources of funds for road agencies are central governments and donors. DCs in Zambia are in deficit situations.

c) Organisational Structures

The organisational Structure in Kenya under MRP (Roads 2000) is well articulated (see appendix E). The re-organisation in the LCU and CWS in Lesotho has resulted in good planning, control of operations and training. On the contrary, Zambia's rural road organisation is characterised by duplications and problems related to communication and planning procedures. Poor supervision is another characteristic (see sections 3.5.3 and 3.5.4). Studies of road operations in developing countries have consistently highlighted deficient institutional arrangements as a contributor for poor performance in the road sector (Riverson et al, 1991).

d) Contract Administration

In Kenya, the lengthmen are employed on a contract basis (see appendix G) while Lesotho's LCU has a well established contract section which gives a large number of contracts to small scale contractors to carry out rural road routine maintenance. Contract

procedures are well documented in both Kenya and Lesotho and promote the use of locally available resources. Contract administration, in Zambia, is not very much applied as most rural road maintenance works are done through force account. The Government is, however, in the process of establishing contract management units at DCs to improve capacity. A survey conducted (by the author) in Kabwe in Central Province revealed that only about 5% of all routine maintenance is contracted to private contractors per year. LCU on the other hand had 100% of all routine maintenance of rural roads contracted out to small-scale contractors in 1998 (see Table 5.5).

e) Management Capacity

LCU has no major problems with regard to management and currently has no vacancies. It has employed a good number of graduates and most of its staff has technical know how in appropriate technology. Though the programme in Kenya was affected by supervision problems in the past, operations have improved through research and are now successful. On the contrary, Zambia's DCs fail to attract graduates due to financial constraints. There are a lot of vacancies especially in remote areas. DCs are also limited by low levels of technical training and experience. Small-scale contractors who are supposed to help in road maintenance are hindered by lack of equipment and high interest rates.

7.3.4 Constraints in Rural Road Maintenance Programmes

Before potential solutions can be realised, it's important to examine the existing constraints in order to identify the sources of problems. A successful maintenance programme must function within the level of resources that are available on a sustainable basis (Beenhakker, et al, 1987), if some of the constraints are to be eliminated.

A comparison of constraints between Zambia, Kenya and Lesotho shows that Zambia has more constraints. A common constraint in all the three countries is the inadequacy in funding as mentioned in the previous sections.

Constraints typical to Zambia are:

- lack of capabilities to undertake maintenance by DCs;
- excessive maintenance needs due to backlog;
- lack of community participation;
- capital-intensive maintenance techniques instead of appropriate techniques;
- inadequacy in the execution of maintenance works;
- lack of local-resource mobilisation.

Under the existing economic circumstances its important to find ways of reducing these constraints in one way or the other to give rural roads at least a minimum maintenance service.

7.3.5 Routine Maintenance Techniques and Work Methods

a) Technology

A World Bank Report (Riverson et al, 1991) revealed that there have been difficulties in achieving efficient use of equipment in Lesotho, Botswana, Madagascar, Kenya, Malawi and Ghana, as well as Benin. The report further states that under suitable conditions, labour-based rehabilitation of rural roads has been reported to be 15% cheaper than using equipment, with a 40% saving in foreign exchange. In Kenya, the World Bank and ILO found that labour-based force account construction was 40 to 50% cheaper than equipment-based methods, and 50 to 60% less in economic terms. Kenya and Lesotho have adopted the labour-based lengthmen system for rural road routine maintenance. Zambia on the other hand, is still using the traditional capital- intensive methods through force-account with a very small percentage through contracting. There are nevertheless pilot projects in the Eastern Province (see section 3.6.3.3) involving small-scale labour-based contractors.

b) Equipment

Chronic foreign exchange shortages in SSA, are a good reason to reduce equipment use whenever possible. This is true considering that fuel shortages, delays in procurement for

equipment and spares, unbalanced and heterogeneous fleet, inappropriate types of equipment, poor work planning, lack of understanding of equipment use and poorly trained and demotivated operators, have all been reported in Zambia. Kenya and Lesotho rely on hand tools (locally made) for routine maintenance of rural roads. However, minor plant like BOMAG BW 90s rollers (in Lesotho) are used in rehabilitation works and tractor towed-graders (in Kenya) for heavily trafficked roads. This gives an appropriate mix of labour and equipment. Even though Zambia relies on equipment, price indicators show that equipment is expensive. Graders cost as much as US$ 250,000 (1997) while utilisation per annum is as low as 200-400 hours mainly due to difficulties associated with equipment-based methods.

c) Quality and Quantity of Work

MRP (now Roads 2000) is managing over 9,000 km of rural roads in routine maintenance with over 4000 length-person contractors. Quality is fair. About 780 km of the total network of 2,300 km is under regular maintenance with the rest under rehabilitation in Lesotho. In Zambia, productivities are very low and almost insignificant. Quality is also reported to be very low due to poor supervision. Accessibility is difficult especially in the rain season.

d) Technical Standards

Technical Standards play an important role in construction and maintenance of roads. They give limitations, definitions, and specify methods that should be employed in the works. However, standards need to be appropriate to local conditions. Kenya and Lesotho have developed appropriate standards ensuring a good mix of labour and equipment, and therefore promote the emergence of small-scale contractors. Zambia continues to use design specifications and conditions of contract which tend to favour large scale-contractors (see appendices B, H and I).

7.4 Prevailing conditions in Zambia

There is a favourable government attitude in Zambia at present. This is evident through the current policy framework, which is changing to suit appropriate technology as mentioned in the previous section.

The economic performance has been poor as we saw in section 7.3.1. Both the overall and agricultural GNPs have been on the decline. GDP has shown little growth as well. Further, the heavy debt burden Zambia is carrying is a source of concern. Foreign exchange will continue to be drained to service foreign debts leaving no hope for an increase in expenditure on road maintenance.

Zambia's population density per square km of 26 persons (less forests and game reserves) is a viable indication that labour-based routine maintenance is feasible. (Note that the 25 persons per square km recommended by ILO is normally applied for labour-based construction). This means that as far as maintenance is concerned labour is sufficient. Moreover, the population is growing at a fast rate and therefore contributing to the rising unemployment and underemployment.

Zambia is in the process of establishing appropriate administrative and financial procedures, in addition to management and technical training currently conducted at the Roads Department Training School in Lusaka.

Labour attitude towards labour-based work is very impressive. Many people who have worked in pilot projects express satisfaction and see labour-based works as a means of job creation and a source of livelihood. This can be attributed to increasing poverty in rural areas. The daily wage rate of US$ 1.5 is below US$ 5, which is a limit for labour-based works.

Physical and climatic conditions in Zambia are favourable from the comparative analysis. However, heavy rains in the north, between December and March could cause some

problems for labour-based works and would therefore need proper planning. Major works such as reshaping of the carriageway, filling of potholes, repair of bridges and culverts, repair of side drains and scour checks should be maximised during the dry season.

7.5 Rural Road Maintenance Through Labour-Based Lengthmen System in Zambia

Implementing methods for rural road routine maintenance may be undertaken through various ways (Beenhakker et al, 1987). These are:

a) Force account using own forces only:
- by central government
- by local government

b) Force account assisted by:
- contractors
- local communities

c) Contract using:
- regular contractors
- lengthmen contractors
- local communities
- state or private enterprises

d) On a self-help basis

In summary, these methods fall under three major categories, i.e. force account, contracting and self-help. Which method to consider may depend on government policy. However, the method used should not just be chosen because it's best. Affordability should be taken into account to achieve a sustainable maintenance programme.

In trying to examine the desirability of employing the lengthmen system in Zambia, a review of advantages of the system will be done and then examine the conditions in Zambia and rural road maintenance in particular. Zambia is currently using force account under local government with funds from the central government.

Traditionally, most maintenance activities are undertaken by the road agency itself using direct labour. However, the responsibility of recruiting, mobilising and sustaining a large work force is a burden on the public sector. In fact the major drawback is that workers are paid regardless of whether the road is maintained or not. Experience has shown (Thagasen, 1996) that force account work has often been of poor quality due mainly to weak management, poor equipment maintenance and lack of properly trained staff, and carried out at higher costs. This is true in the Zambian situation (see section 7.3.3). Performance is not a major issue under this system. Under the current economic conditions in Zambia, this system may not be suitable, as it does not promote the efficient use of resources. Moreover, it lacks local participation.

Regular contractors (medium to large-scale) provide an alternative method to routine maintenance. However, simple works involved in routine maintenance tend to discourage these contractors from participating and prefer more substantive work (periodic maintenance and rehabilitation) involving large sums of money. These contractors have also a tendency to favour the use of equipment. Unless the works are broken down to small contracts, small-scale contractors are likely to be suppressed. As Zambia needs to develop her contracting capacity, she needs methods that would allow small-scale contractors to emerge especially through routine maintenance of rural roads.

Another alternative could be self-help, where the local population undertakes maintenance voluntarily, without payment. This kind of maintenance however depends on government assistance and willingness of people. Under the current conditions in Zambia, its highly unlikely that this kind of programme which does not offer incentives would succeed considering the poverty situation due to the high unemployment and underemployment in rural areas. A programme offering some incentives is likely to be welcome by the local people.

Lengthmen contractors would be desirable for Zambia (though not the sole solution) for the routine maintenance of rural roads involving small scattered works. Unlike the other methods above, the lengthmen system has a lot of benefits suited to the Zambia situation.

The labour-based lengthmen system for rural road routine maintenance is suitable (in addition to general advantages of labour-based methods) because it is:

- Cost-effective (based on performance);
- Relatively simple to administer (suitable even where local institutions are less developed);
- Immune to increasing fuel and equipment costs;
- Independent of externally induced shortages;
- Capable of visible accomplishments;
- A decentralised approach to the necessity of developing a local capability for maintenance which is the most viable way or option for continuing infrastructure maintenance programmes in rural areas; and finally
- Is appropriate to locally available resources like labour and therefore reduces maintenance constraints.
- Best for contractor development.

(Beenhakker et al, 1987).

Section 7.3 points out the many difficulties Zambia's rural road maintenance system is going through. It is actually trailing behind when compared to Kenya and Lesotho. The main problems can be summarised as:

- Inability by DCs to maintain rural roads due to inadequate staff, funds and maintenance capacity;
- Weak institutional strength;
- Maintenance constraints, some of which could be avoided if appropriate methods are used; and finally
- Inappropriate maintenance techniques and work methods.

Based on the above information, the labour-based lengthmen system is capable of improving rural road maintenance in Zambia and hence a desirable solution. Its not being suggested that the lengthmen system is the sole solution, but rather a suitable option given the current poor performance of the economy and in particular rural road maintenance in Zambia as a result of the factors stated above. The use of an available labour resource for

maintenance, however, requires adjustments to conventional maintenance concepts (see recommendations in section 8.3).

CHAPTER EIGHT

8 CONCLUSIONS AND RECOMMENDATIONS

8.1 Main Findings

Though Zambia, Kenya and Lesotho are located in different parts of Africa and have different climatic conditions, they have notable similarities economically, typical to Sub-Saharan Africa.

Based on comparative analysis, Zambia's physical and climatic conditions are not a problem to labour-based maintenance works. The population density is also high enough to support the system.

In terms of economic affairs, Zambia's performance is not impressive and is worsened by the heavy debt burden. Agriculture seems to be a major economic contributor and employer. There is also high unemployment and underemployment in Zambia.

A look at road agency performance parameters however, show some striking differences. On comparative basis, Zambia shows a poor performance in road investment in maintenance terms. The condition of its rural road network is generally poor, with declining utilisation and low productivity. The current expenditure per km is inadequate. Funding is also almost not available for routine maintenance.

A comparison of institutional strength and management of rural road maintenance shows a similar problem in funding with regard to availability and adequacy in the three countries. Zambia however has other problems such as transitional policies, which are taking long to implement and thereby making the environment somehow unstable. The management of rural roads is characterised by communication problems and duplications in planning procedures between various entities in rural road maintenance resulting in delayed funding and approval of contracts. Poor supervision of works, vacancies in technical positions, demotivated staff and low number of small-scale contractors further compound these

problems. In short poor funding, weak organisational structure, and inadequate management capacity weaken the institutional strength. The main problems are lack of technical and managerial expertise, poor motivation and poor financial performance. Thus Zambia's institutional strength continue to be a source of concern as far as rural road routine maintenance is concerned.

Though Kenya and Lesotho also suffer from financial constraints and are partly donor supported, they have managed to avoid other constraints related to technology and work methods, and their rural roads have at least received a minimum maintenance standard. Zambia on the other hand suffers from other constraints such as lack of local participation and lack of local resource mobilisation as a result of too much dependence on conventional maintenance methods.

Perhaps the most astonishing aspect, despite the poor economic performance (in rural road maintenance) by Zambia, is its continued reliance on capital-intensive methods, which are a drain on foreign exchange, at the expense of abundant local resources such as labour. There are also constraints in equipment procurement and low utilisation of plant due to lack of projects as a result of erratic funding. The quality and quantity of rural road maintenance work in Zambia has declined. Performance on the same by District Councils in terms of national output is almost nil. The result has been a heavy backlog in maintenance.

Moreover, Zambia's conditions of contract and specifications of works for rural road maintenance activities are prohibitive to small-scale contractors and favour large-scale contractors and capital-intensive methods. On the contrary, Kenya and Lesotho have employed labour-intensive methods in rural road maintenance and have developed contract documents, appropriate to local resources and thus performed better than Zambia.

8.2 Conclusions

The overall comparative analysis (section 7.3) shows that the current rural road maintenance programme in Zambia is not performing well as opposed to Kenya and Lesotho. This is despite the fact that all the three countries have almost the same economic problems such as unemployment and heavy debt burdens, typical to developing countries in the Sub-Saharan Africa. There are many reasons, which can be attributed to this dismal performance, among of which are insufficient funds, including lack of foreign exchange, shortage of qualified staff, absence of spares and equipment, deficient institutional arrangements and poor management capabilities. Lack of local participation and inappropriate use of resources are also contributing factors.

The prevailing conditions in Zambia (see section 7.4) suggest that labour-based rural road maintenance is feasible. A comparison of the lengthmen system with other methods (force account and self-help) of implementing rural road routine maintenance does favour the system (single-person or small-scale contracting) under current economic conditions.

8.3 Recommendations

The recommendations discussed below are primarily concerned with routine maintenance (see section 2.3) essential to keep rural roads in Zambia operating until the need for periodic maintenance or rehabilitation is established. They are also aimed at ensuring that an appropriate level of maintenance is justified.

a) Maintenance activities are best carried out by labour (manual tasks) under most technologies. Technology choice in rural road maintenance is limited to the manner in which the travelled surface and areas immediately adjacent to it, including standard ditches on rural roads are to be maintained. Government (both central and local) must consider, during evaluation of equipment-based surface maintenance activities, the problem of maintaining, i.e. procurement, servicing and repairing of maintenance equipment. In Zambia the largest untapped or under-utilised available maintenance resource is local labour. This could be particularly useful for maintenance of rural roads due to high unemployment and underemployment in rural areas.

b) Technology implementation include force account, contracting or self help (see section 7.5). As described in section 7.5, routine maintenance has dispersed activities, which are suited to small-scale contractors, such as lengthmen. As routine maintenance requires small but continuous inputs of resources over a large number of separate points, labour-based maintenance is cost-effective where population densities are high enough so that workers living adjacent to the roads obviate the need for expensive transport. Specific data on population density along rural roads should be obtained and updated.

c) Government should never undertake construction before the method and funding for rural roads have been established. There should be a realisation that labour-based maintenance stresses supervision and prompt payment. Therefore, there must be in-service training programmes for supervisors. Financial resources to pay the maintenance workers must be properly allocated and be available as soon as

maintenance is completed. Maintenance operations must begin with clear lines of responsibility. Under the lengthmen system, maintenance deficiencies can therefore be discussed with persons responsible. This system of responsibility also encourages competitiveness and improved performance. Future maintenance needs should be evaluated and the most appropriate solutions determined concerning maintenance technology, organisation and funding, with emphasis on developing systems and procedures, which are sustainable.

Moreover, the use of an available labour-resource for maintenance, requires certain adjustments to conventional maintenance concepts, such as:

- accepting a construction methodology that will be conducive to labour-based maintenance;
- accepting a limited routine maintenance capability that must be supplemented or assisted as soon as an increase in transport demand occurs;
- providing a steady supply of trained supervisors; and
- maintaining a steady cash flow to promptly meet all financial obligations.

A large dispersed labour-based maintenance operation is very fragile and without motivation, in the form of supervision, and a steady cash flow, it will disappear.

The use of available labour-resources for rural road maintenance is beneficial to both the local currency which stays within the local community, and because the employment of local labour shows the concern of Government for the well being of the local population by providing both cash and better access.

d) Another aspect of major concern is that of institutional strengthening. This issue covers:
   - the general policy environment, that is, overall government objectives and strategies for national development, in which the organisation operates; and
   - functions, responsibilities and operating procedures of rural road authorities.

The determination of appropriate institutional arrangements and strengthening of institutional capacity are necessary towards achieving a sustainable rural road maintenance programme.

As the Government wishes to implement a large-scale rural road programme, using labour-based techniques it should consider key issues such as:

- fiscal policies and use of shadow prices (economic instead of market) for labour or surcharges for equipment;
- discriminatory tariffs on equipment intended to build roads with equipment-based techniques;
- interest rate policies that encourage labour-based construction, that is, do not subsidise the import of construction equipment;
- tendering procedures which are not biased towards the use of equipment; and
- equal status between staff of technical departments working on labour-based or equipment-based techniques.

The Government should also consider and support the following strategies:

- special training programmes for engineers, technicians, local government officials, community leaders and others involved in rural road works such as farmers;
- simplified administrative standards and procedures;
- simplified engineering preparation, contract documents, bidding and disbursement procedures to be applied to rural roads; and
- development of a domestic contracting industry, starting with simple works such routine maintenance of rural roads.

The administrative arrangements for rural roads in Zambia involve many stakeholders as shown in figure 3.4, and have many problems (see section 3.5). The following should be considered:

- Government should make necessary changes so that funds are consistent and dependable. This is possible through the reorganisation of NRB and the Road Fund;

- Acceleration of the decentralisation process so that DCs have the authority to raise sufficient revenues to fund rural road maintenance;
- Functions, linkages and communication guidelines (for major entities like DCs, DISS and NRB) should be improved to avoid friction;
- Improve capacity at DISS so that more site visits to DCs would be possible; and finally
- Break-up large maintenance contracts to encourage small-scale contractors, particularly labour-based ones a better opportunity, so that awards are made by DISS or DCs.

e) The mobilisation of local resources is an important element for future operations in rural road maintenance, especially with the continuing lack of finance and trained manpower. Local participation should be considered and improved by setting-up appropriate channels for participation. Labour-based methods, particularly the lengthmen system provides a very good opportunity to involve local communities in maintenance programmes so that they are able to see the costs and benefits involved in rural road maintenance. The Government should emulate the programmes in Kenya and Lesotho by considering appropriate maintenance techniques, which are beneficial to both the road agencies and the community.

Finally, if labour-based programmes such as the lengthmen system are to be considered, the Government should carry out pilot projects in different parts of the country in order to:

- establish routine maintenance productivity standards specific to regions; and
- establish routine maintenance requirements of rural roads.

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APPENDICES

APPENDIX – A Typical cross-sections of rural roads in Zambia.

APPENDIX – B Extracts from contract document (MLGH-DISS, Zambia)

APPENDIX – C Budget and commitment for maintenance during the 1998-99 period (an extract from NRB-Annual review, 1999)

APPENDIX – D Typical cross-sections of rural roads in Kenya (MRP- Road Maintenance Manual, 1992)

- D1 Alignment Standards
- D2 Standard cross-section
- D3 Reduced cross-section, severe terrain
- D4 Rural access road section

APPENDIX – E Maintenance organization structure (MRP-Road maintenance manual, 1992)

- E1 Typical district maintenance unit
- E2 Typical district organization
- E3 Regional organization
- E4 Regional responsibilities
- E5 Headquarters organization
- E6 MRP Organization within ministry

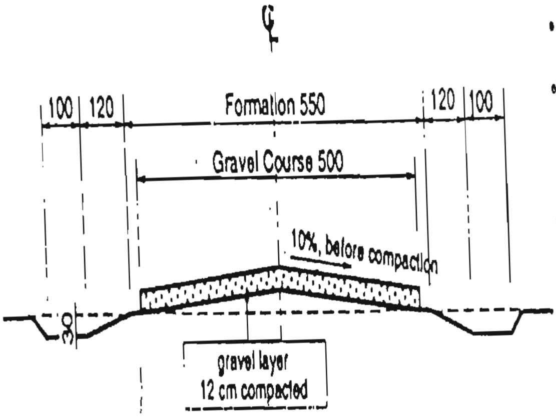
APPENDIX – F Job descriptions (MRP-Road maintenance manual)

- F1 District Maintenance and Improvement Engineer (DMIE)
- F2 Officer in charge (OIC)
- F3 Overseer

APPENDICES

APPENDIX – A Typical cross-sections of rural roads in Zambia.

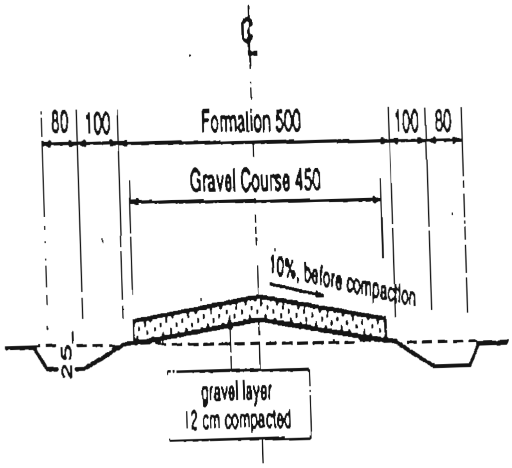
Typical Cross Section for Unclassified District Roads (RD/MWS)



Typical Rehabilitation Data

- av. worker days / km = 3000
- indicative average costs / km (incl. gravel and equipment) = US $ 9,000 - 10,000
- av. construction speed / month (using 160 labourers) = 2000 m
- gravel required / km (15cm loose) = 750 m^3

Typical Cross Section for Feeder Roads (under MLGH/DISS)



Typical Rehabilitation Data

- av. worker days / km = 2500
- indicative average costs / km (incl. gravel and equipment) = US $ 8,500 - 9,000
- av. construction speed / month (using 145 labourers) = 2000 m
- gravel required / km (15cm loose) = 675 m^3

APPENDIX – B Extracts from contract document (MLGH-DISS, Zambia)

A. INSTRUCTIONS TO BIDDERS/TENDERERS

1. GENERAL

The Ministry of Local Government and Housing wishes to contract out the work for maintenance/rehabilitation of urban and feeder roads.

1.1 Tender Authority

The Zambia National Tender Board on behalf of the Ministry of Local Government and Housing (MLGH) hereby invites sealed tenders from suitably qualified Contractors for Road Works.

1.2 Tender Document Fee

1.2.1 Interested Bidders are hereby requested to collect the bidding documents from the Town Clerk/Council Secretary of each respective council, Lusaka on payment of a non-refundable fee of K150,000.00 or it's equivalent in any freely convertible currency at the prevailing exchange rate, in Cash or by Bank-certified cheque.

1.3 Bid Security

1.3.1 Tenders must be submitted in accordance with the General Instructions to bidders contained in these Tender Documents. All tenders must be accompanied by a bid security of not less than 2% of the tendered sum duly signed and sealed by the Guarantor(s), the format to be used is attached hereto.

1.3.2 The Bid security as required in clause 1.3.1 above, shall be valid for a period of not less than 30 days beyond the tender validity period stated in clause 1.9 below.

1.3.3 Any Tender not accompanied by an acceptable Bid Security will be rejected by the Employer as non-responsive.

1.3.4 The Bid Security of the unsuccessful Tenderers will be repaid or returned as promptly as possible, but not later thirty (30) days after the expiration of the period of tender validity.

1.3.5 The Bid Security of the successful Tenderer will be repaid or returned when the Tenderer has signed the Agreement and furnished the required Performance Surety.

1.4 Closing Date

The closing date for receipt is ..... at ..... hours local time. Late offers by bidders or their representatives shall not be accepted.

1.5 Pre Tender Meeting

Tenderers are advised that there will be a pre-tender meeting on ..... at ..... hours in the Office of the Council Secretary/Town Clerk.

1.6 Acceptance or Rejection of Bids

1.6.1 The Employer reserves the right to accept or reject any bid and to annul the bidding process and reject any or all bids at any time prior to award of contract without thereby incurring any liability to the affected bidder(s) or any obligation to inform the affected bidder/bidders of the grounds for the Employer's action

1.6.2 Tenderers who do not submit schedules for "Major plant to be used on the Contract" and " Relevant Experience" will be rejected.

D. SPECIFICATION OF PARTICULAR APPLICATION

Section D is to provide the Tenderer/Contractor with details of specific construction works required. It should be read with Section E "Bill of Quantities" and Section F "Drawings". In cases where no specification is given for any work or material to be used the "Standard Specifications for Roads and Bridges" published by the Roads Department of the Ministry of Works and Supply dated December 1994, shall apply.

1. SCOPE OF CONTRACT

The contract comprises of MAINTENANCE AND REHABILITATION OF URBAN AND FEEDER ROADS as specified in the Bill of Quantities.

2. BILL OF QUANTITIES

The numbers, quantities and measurements set out in the Bill of Quantities are estimates and their accuracy or inaccuracy shall in no way affect the validity of the tender or contract based thereon. The sum to be paid to the contractor shall be determined by measuring the work actually done and valuing at the rates and prices inserted by the contractor in the bill of quantities. Although the quantities are estimated, under no circumstances shall contractor carry out additional work without the written approval of the employer.

3. LABOUR, PLANT, EQUIPMENT AND MATERIALS

The contractor shall be responsible for the provision of all labour, plant, equipment and materials necessary to execute the works and is deemed to be included these in the tendered unit rates.

4. TESTING OF MATERIALS

The contractor shall be responsible for all costs associated with the necessary testing of materials, control testing on site and laboratory and is deemed to have included these in the tendered unit rates.

5. MEASUREMENT AND PAYMENT

5.1 Establishment

5.1.1 Mobilisation

Payment for mobilisation will be made once the Contractor has brought on to site all personnel and the items of plant required for forming (and gravelling when required) of the roadway.

5.1.2 Demobilisation

Payment for demobilisation will be made once the Contractor has cleared the site on completion of the Works to the satisfaction of the Project Manager.

5.2 Clear Vegetation

5.2.1 Verge to ground level

This activity involves clearing of all trees, bush grass, etc to ground level for a width of 4m Formation width plus side drains. Where private properties, lands or orchards are adjacent to the road, clearing if necessary will be instructed.

Measurement is per area (m^2) of roadway cleared.

5.2.2 Reshaping and grading

Reshaping of the camber including smoothing of corrugations, filling of depressions irregularities and windrows shall be required.

Measurement is per linear metre of roadway

APPENDIX – C **Budget and commitment for maintenance during the 1998-99 period (an extract from NRB-Annual review, 1999)**

National Programme of Road Maintenance - Budget and Commitments as at 22 October 1999

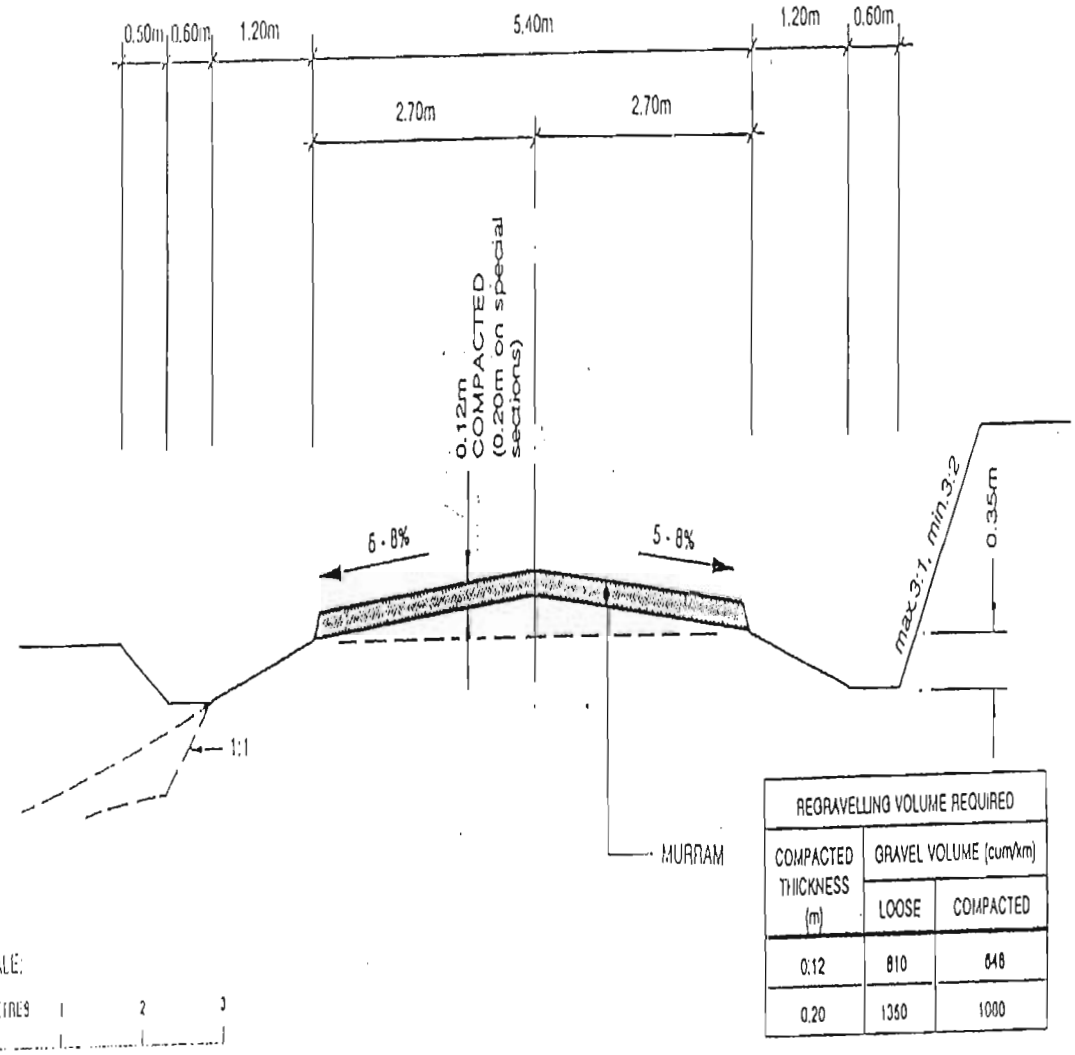
Category	Description	Approved Budget ZMK (millions)	Approved Contracts	
			Description/No. of contracts	ZMK (millions)
Trunk, Main and District Roads – Roads Department				
Off-carriageway (by contract)				
	Luapula	118.02	15	110.46
	Copperbelt	406.65	7	77.07
	Southern	135.10	4	73.10
	Lusaka	465.10	7	84.04
	Central	594.50	0	0.00
	North Western	248.10	10	156.00
	Northern	322.80	6	112.41
	Eastern	551.20	49	551.20
	Western	243.30	4	48.30
	Supervision of above	205.63	Southern	3.53
			Western	2.50
	Subtotal	3,290.41		1,218.61
On-carriageway (contract)				
	T1 Livingstone-Zimba	180.00		
	T4 Nylmba-Mwami	500.00		
	M1 Mpika-Kasama	460.00		
	M10 Mongu-Senanga	430.00		
	D 775 Batoka-Maamba	280.00		
	D 356 Choma-Masuku	300.00		
	M4/M5 Ndola-Mfulira-Mwambashi/Mokombo	500.00		
	M12 Chipata-Lundazi	640.00		
	T4 Luangwa Bridge-Nyimba	1,500.00		
	T5 Chingola-Solwezi	564.20		
	D39 Lunte-Zacharia	250.00		
	T2 Kafue-Lusaka-Kabwe	115.00		
	Supervision of above	349.45		
	Subtotal	6,068.65		0.00
On-carriageway (force account)				
	T3 Chingola-Kasumbalesa	190.00		190.00
	M7 Kitwe-Kalulushi	139.00		139.00

	T2 Kafue-Kabwe	2.80		2.80
	T3/D74/78/80/89/94/100(Lua pula)	71.60		71.60
	T5 Mutanda-Mwinilungu	117.60		117.60
	M1/M2 Kasama-Mbala-Mpulungu	60.00		60.00
	T2 Kabwe-Kapiri Mposhi	28.00		28.00
	D235 Serenje-Mukuku	21.70		21.70
	M10 Livingstone-Shesheke	78.80		78.80
	T2 Kafue-Lusaka-Chisamba	115.00		0.00
	Subtotal	824.50		709.50
Periodic maintenance				
	T2 Chirundu-Kafue	454.00	1	454.00
	On-going contracts from 1998	1,201.05	6	1,201.05
	Subtotal	1,655.05		1,655.05
Total for MWS		11,838.61		3,583.16
Feeder and Urban Roads - MLGH				
Routine maintenance				
	Various	2,800.00	14	22.90
	Supervision of above	168.00		
	Subtotal	2,968.00		22.90
Periodic maintenance				
	Various (63 contracts)	2,782.00	14	829.33
	Various (to be negotiated)	5,184.00		
	Supervision of above	474.84		
	On-going contracts from 1998	458.65	23	458.65
	Subtotal	8,899.49		1,287.98
Urban Roads				
	Urban Road Maintenance (various)	1,600.93	1	100.00
			Lusaka patching	259.00
			Luanshya patching	21.60
	Various Community Initiatives	1,200.00	Chingola - Community	800.00
	Subtotal	2,800.93		1,180.60
Total for MLGH		14,668.42		2,491.48
Grand Total		26,507.03		6,074.63

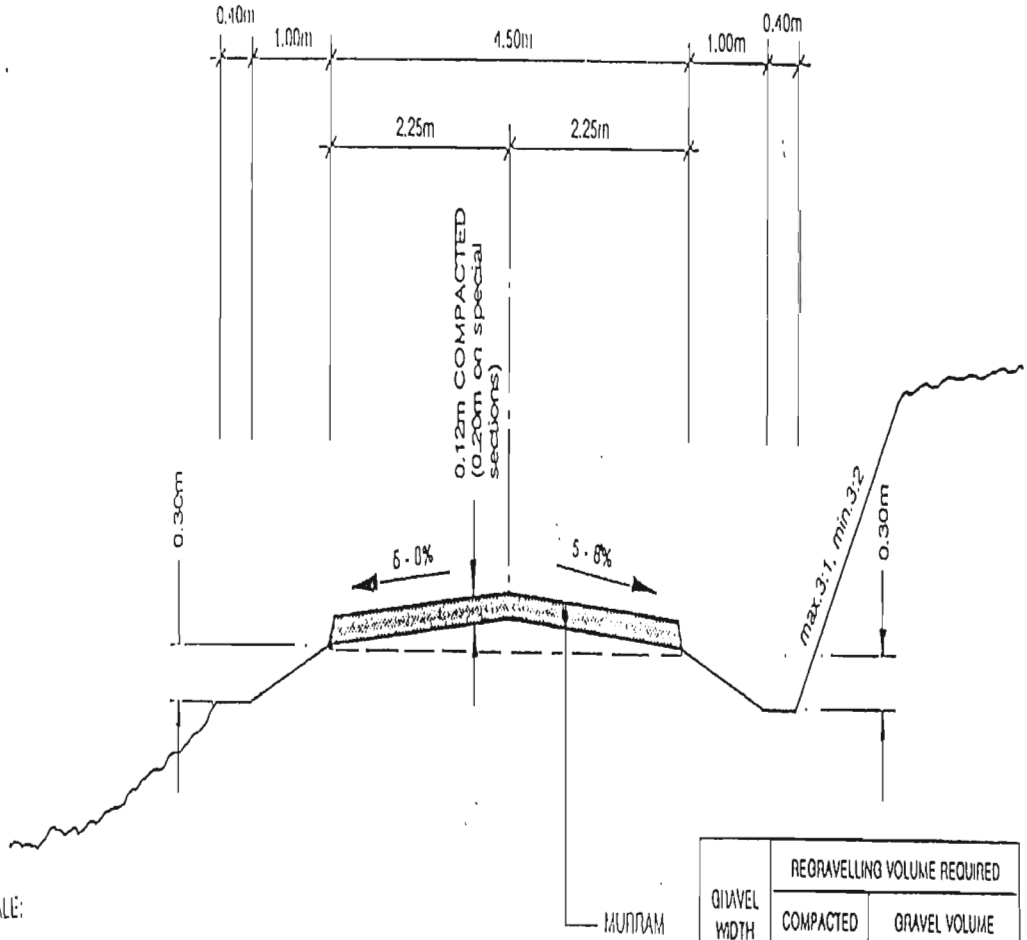
APPENDIX – D Typical cross-sections of rural roads in Kenya (MRP- Road Maintenance Manual, 1992)

D1 Alignment Standards

STANDARD MRs AND RARs	FLAT AND ROLLING TERRAIN	HILLY TERRAIN
HORIZONTAL CURVES		
DESIRABLE MINIMUM RADIUS	100m	50m
GRADIENTS		
DESIRABLE MINIMUM	2%	2%
DESIRABLE MAXIMUM	6%	10%
ABSOLUTE MAXIMUM	10%	12%
STOPPING SIGHT DISTANCE		
DESIRABLE MINIMUM	80m	80m
ABSOLUTE MINIMUM	40m	40m
CROSS FALL		
COMPACTED	5%	5%
UNCOMPACTED	MAXIMUM 8%	MAXIMUM 8%



REGRAVELLING VOLUME REQUIRED		
COMPACTED THICKNESS (m)	GRAVEL VOLUME (cum/km)	
	LOOSE	COMPACTED
0.12	810	648
0.20	1350	1000

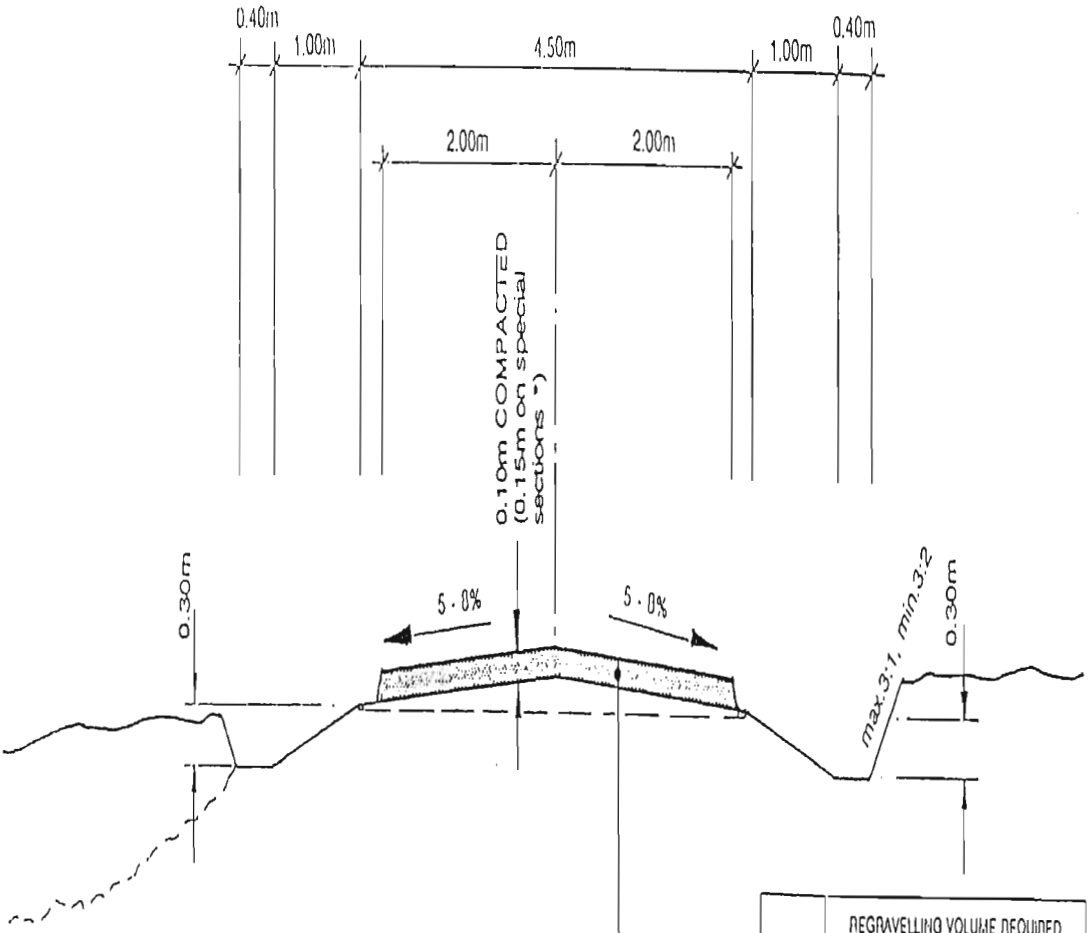


SCALE:

0 METRES 1 2 3

* e.g. steep hill sections

GRAVEL WIDTH (m)	REGRAVELLING VOLUME REQUIRED		
	COMPACTED THICKNESS (m)	GRAVEL VOLUME (cum/km)	
		LOOSE	COMPACTED
4.5	0.12	675	540
	0.20	1125	900

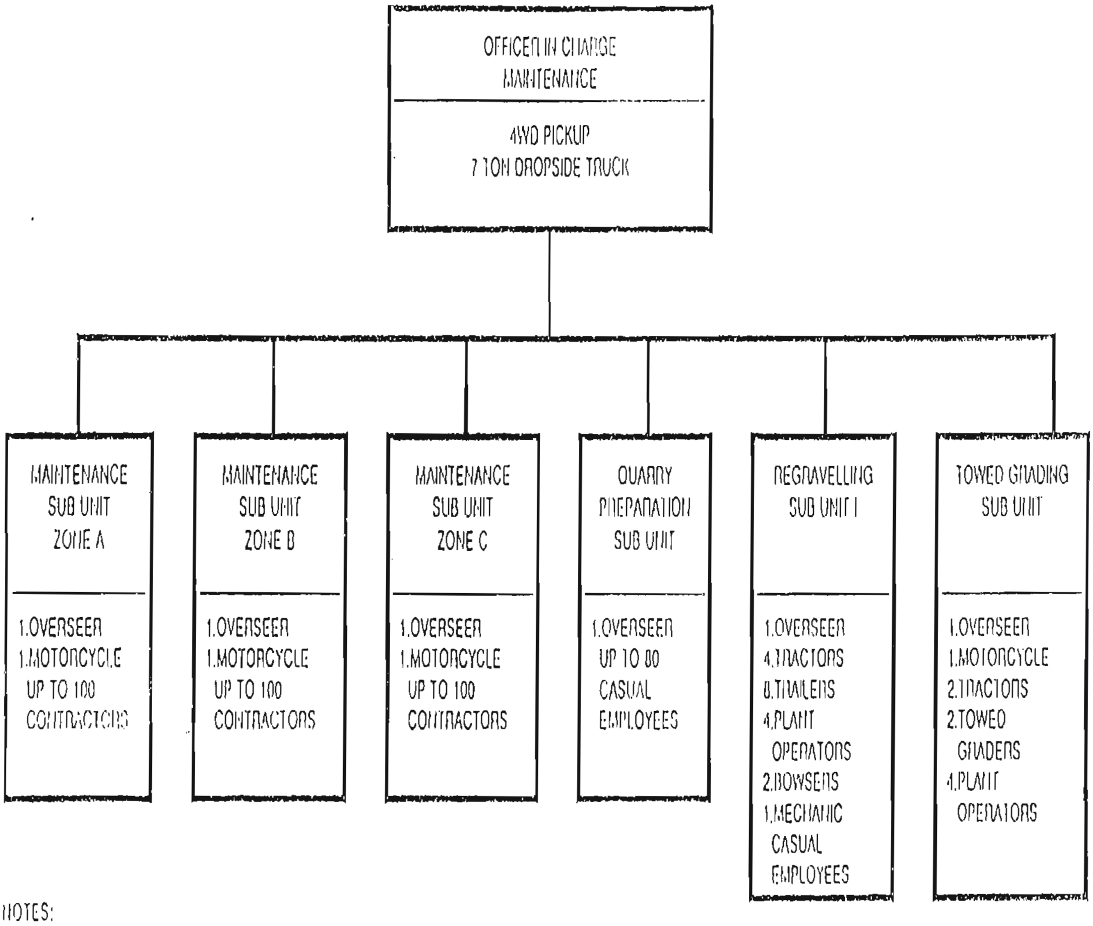


GRAVEL WIDTH (m)	REGRAVELLING VOLUME REQUIRED		
	COMPACTED THICKNESS (m)	GRAVEL VOLUME (cum/km)	
		LOOSE	COMPACTED
4.0	0.10	500	400
	0.15	760	600

* e.g. steep hill sections
For traffic more than 25 vpd
consider use of Minor Road cross section

APPENDIX – E Maintenance organization structure (MRP-Road maintenance manual, 1992)

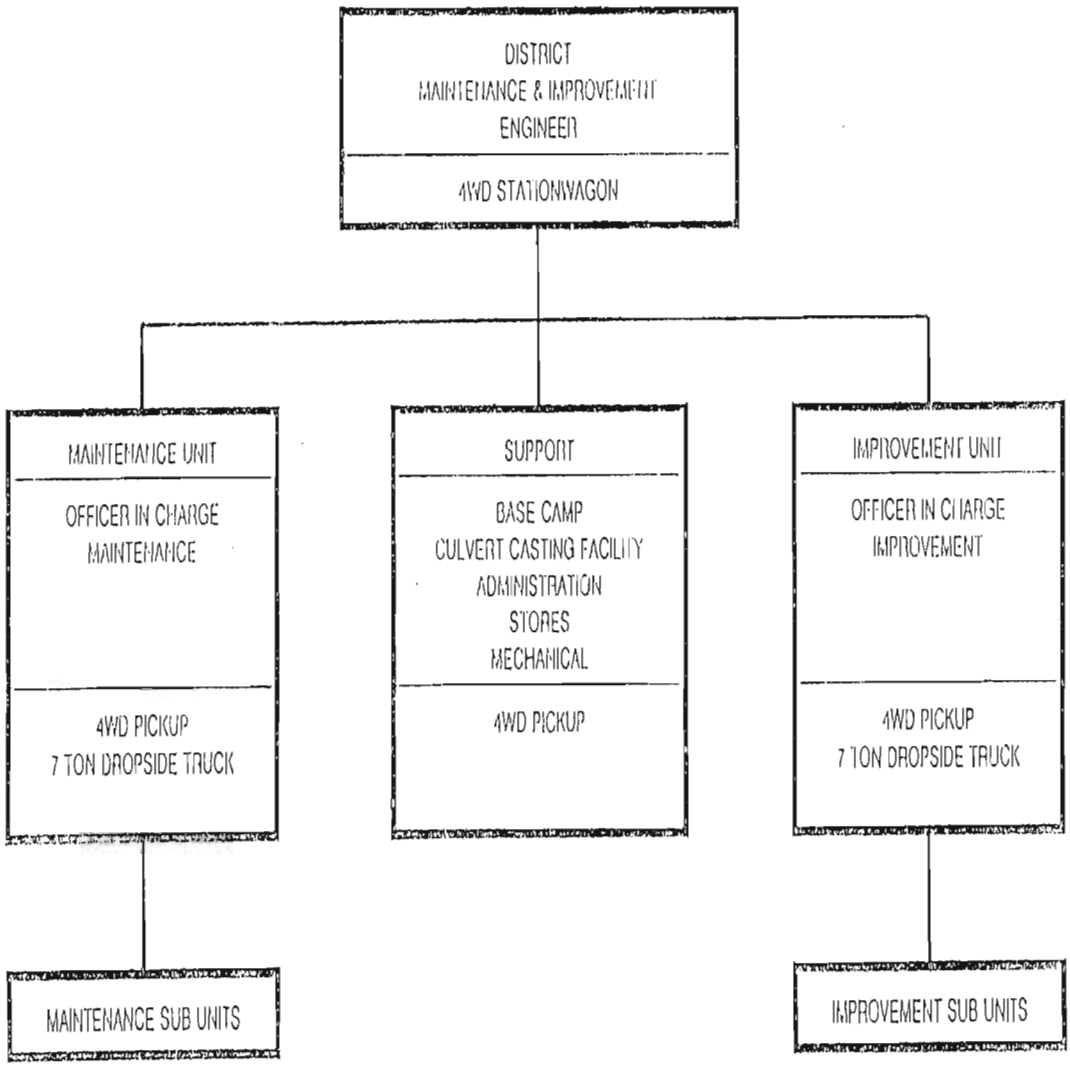
E1 Typical district maintenance unit



NOTES:

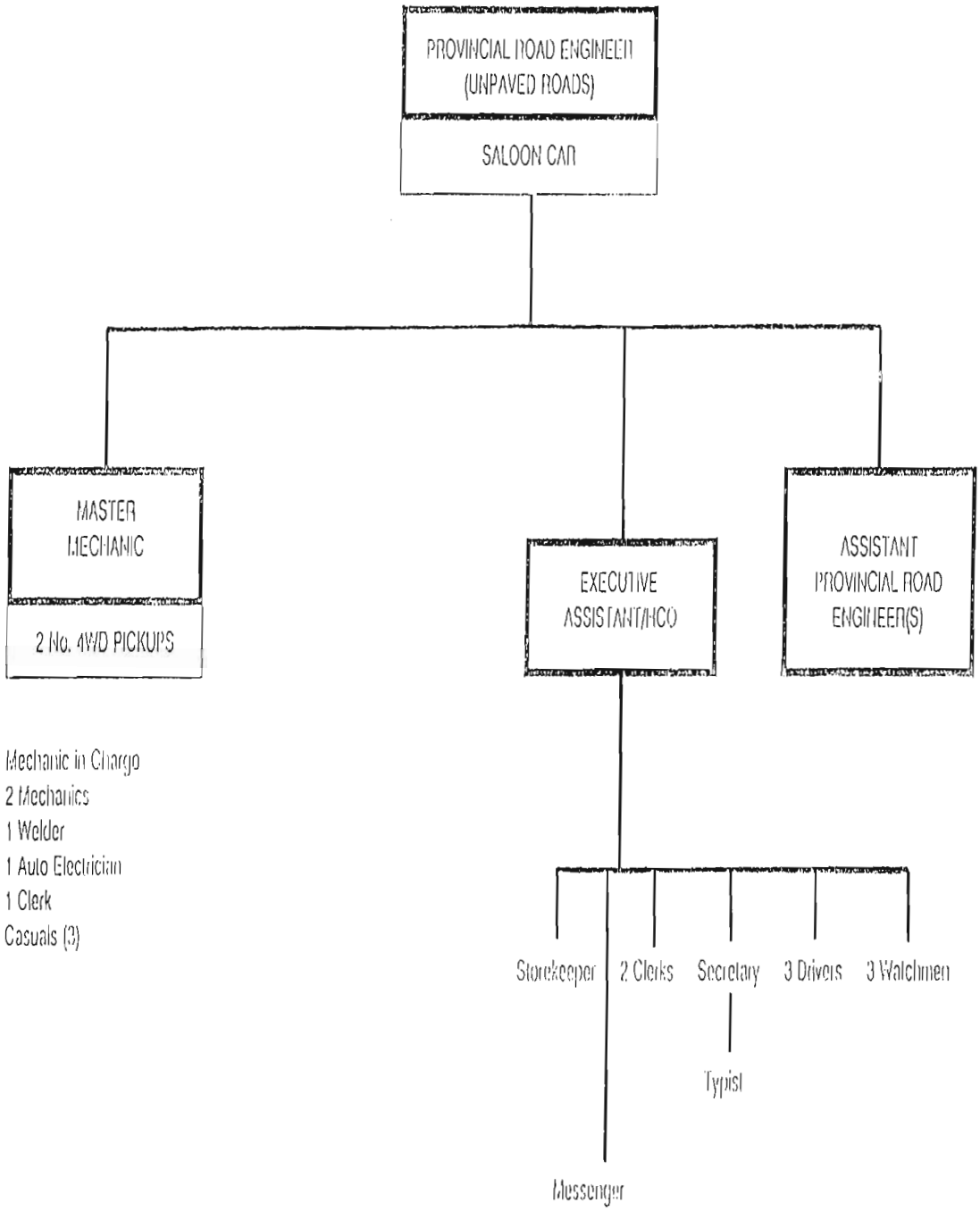
1. Maintenance Sub Units as required.
2. Additional regravelling units if required.
3. Regravelling Sub Units to also replenish contractor stockpiles.
4. Towed Graders may be provided for high traffic roads.
5. Officer in Charge Maintenance responsible for a network of up to 500 km.

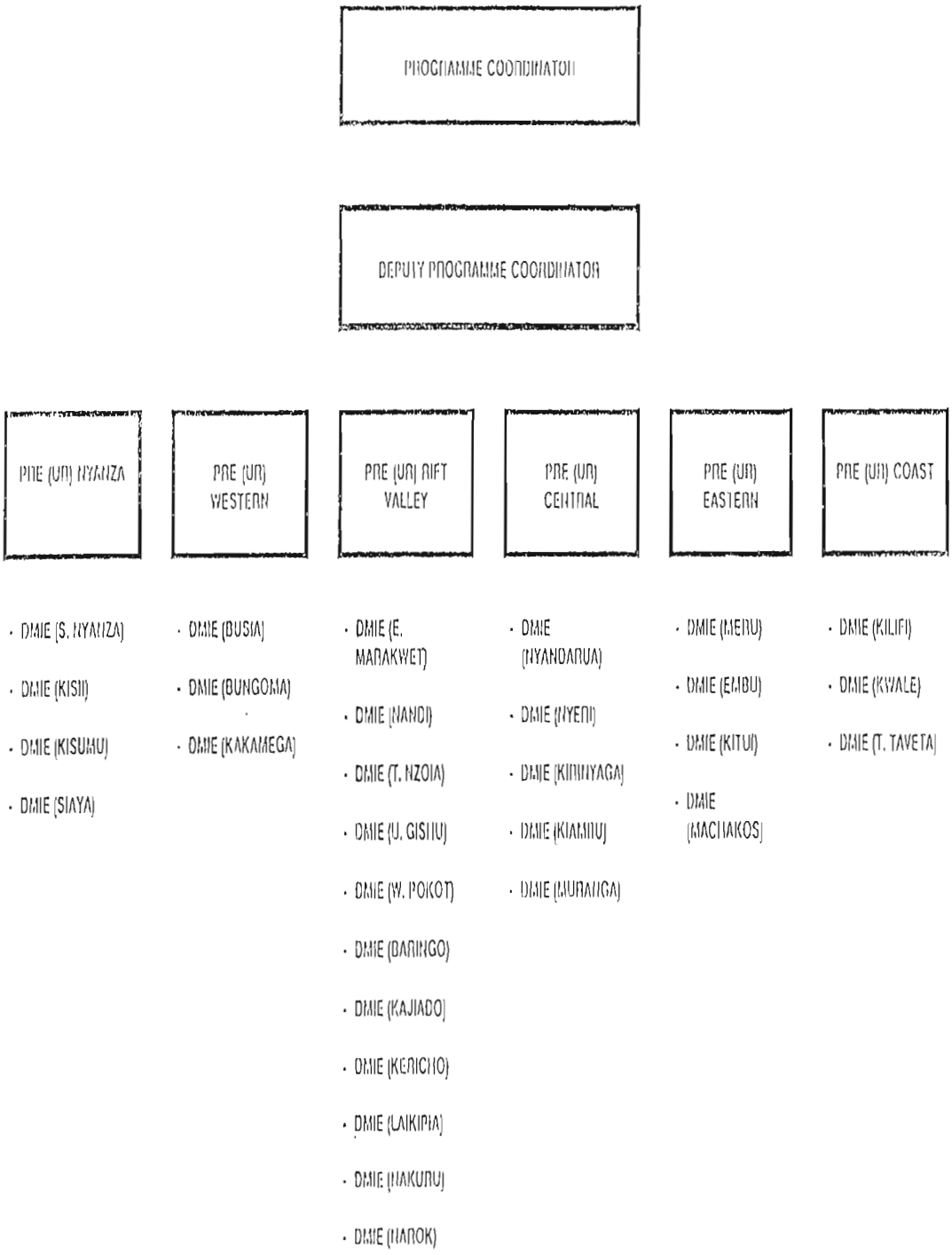
E2 Typical district organization

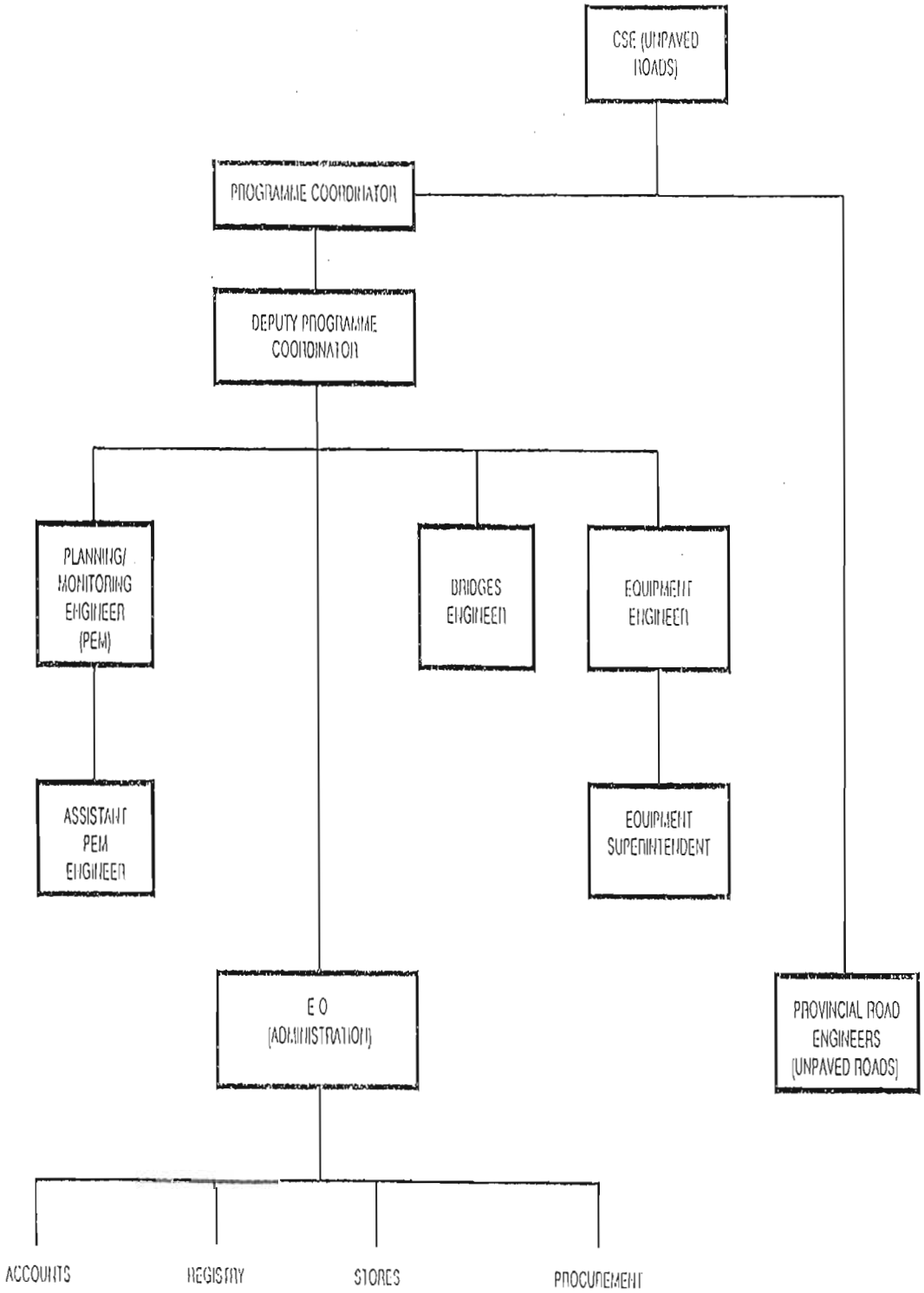


NOTES:

1. In some districts additional maintenance or improvement units will be required.


PROVINCIAL ROAD ENGINEER (UNPAVED ROADS)
SALOON CAR
MASTER MECHANIC
2 No. 4WD PICKUPS
EXECUTIVE ASSISTANT/HCO
ASSISTANT PROVINCIAL ROAD ENGINEER(S)
Mechanic in Charge
2 Mechanics
1 Welder
1 Auto Electrician
1 Clerk
Casuals (3)
Storekeeper
2 Clerks
Secretary
3 Drivers
3 Watchmen
Typist
Messenger


PROGRAMME COORDINATOR
DEPUTY PROGRAMME COORDINATOR
PRE (UR) NYANZA
PRE (UR) WESTERN
PRE (UR) RIFT VALLEY
PRE (UR) CENTRAL
PRE (UR) EASTERN
PRE (UR) COAST
• DMIE (S. NYANZA)
• DMIE (KISII)
• DMIE (KISUMU)
• DMIE (SIAYA)
• DMIE (BUSIA)
• DMIE (BUNGOMA)
• DMIE (KAKAMEGA)
• DMIE (E. MARAKWET)
• DMIE (NANDI)
• DMIE (T. NZOIA)
• DMIE (U. GISHU)
• DMIE (W. POKOT)
• DMIE (BARINGO)
• DMIE (KAJIADO)
• DMIE (KERICHO)
• DMIE (LAIKIPIA)
• DMIE (NAKURU)
• DMIE (NAROK)
• DMIE (NYANDARUA)
• DMIE (NYERI)
• DMIE (KIRINYAGA)
• DMIE (KIAMBU)
• DMIE (MURANGA)
• DMIE (MERU)
• DMIE (EMBU)
• DMIE (KITUI)
• DMIE (MACHAKOS)
• DMIE (KILIFI)
• DMIE (KWALE)
• DMIE (T. TAVETA)


CSE (UNPAVED ROADS)
PROGRAMME COORDINATOR
DEPUTY PROGRAMME COORDINATOR
PLANNING/ MONITORING ENGINEER (PEM)
BRIDGES ENGINEER
EQUIPMENT ENGINEER
ASSISTANT PEM ENGINEER
EQUIPMENT SUPERINTENDENT
E O (ADMINISTRATION)
PROVINCIAL ROAD ENGINEERS (UNPAVED ROADS)
ACCOUNTS
REGISTRY
STORES
PROCUREMENT

MINISTER
ASSISTANT MINISTERS
PERMANENT SECRETARY
ENGINEER IN CHIEF
FINANCE DIVISION
ADMINISTR. DIVISION
PERSONNEL DIVISION
MATERIALS BRANCH (C.M.E.)
MECHANICAL + TRANSPORT (C.M.T.E.)
ROADS DEPT. CE(R)
DEPT. OF STAFF TRAINING PRINCIPAL
STRUCTURAL BRANCH
QUANTITIES BRANCH
ELECTRICAL BRANCH
BUILDING BRANCH
PROVINCIAL WORKS OFFICERS
CONSTRUC-TION BRANCH CSE(C)
DESIGN BRANCH CSE(D)
CSE UNPAVED ROADS 51000 KM
CSE PAVED ROADS 8000 KM
CSE SPECIAL DUTIES
DEVELOPMENT + PLANNING DIVISION CE(P)
SSE. (GDCP)
SSE (MRP RARP)
SSE (R & RM)

APPENDIX – F Job descriptions (MRP-Road maintenance manual)

F1 District Maintenance and Improvement Engineer (DMIE)

REPUBLIC OF KENYA
MINISTRY OF PUBLIC WORKS
MINOR ROADS PROGRAMME

JOB DESCRIPTION

SHEET 1 OF 3

POSITION	DISTRICT MAINTENANCE AND IMPROVEMENT ENGINEER (DMIE)

REPORTING TO	REPORTED TO BY
PROVINCIAL ROAD ENGINEER (UNPAVED ROADS)	• O/C, IMPROVEMENT • O/C, MAINTENANCE • O/C, MECHANICAL WORKSHOP • ADMINISTRATIVE AND STORE STAFF

REPRESENTS	REPRESENTED

SCOPE OF WORK/JOB OBJECTIVE	PLACE OF WORK
• to effectively manage the District RAR/MRP Improvement and Maintenance Units in order to achieve the set targets and standards • to control the required resources (finances, personnel, material, equipment)	• RAR/MRP District Office and Base Camp • All District Improvement and Maintenance Sites

MAIN TASKS

- to plan and control all improvement and maintenance operations
- to plan for and control the required resources (finances, material, manpower, equipment)
- to supervise the operations and maintenance of all unit equipment and vehicles
- to have the overall control of all administrative activities
- to monitor and report the unit's performance according to Management Reporting System
- to organise and ensure timely and correct payment of salaries for the casual labourers
- to guide and assist Unit and Site Supervisors in technical and operational aspects
- to liaise with district authorities and attend meetings as required
- to liaise with the Provincial Road Engineer (Unpaved Roads) and DST on matters related to training

AUTHORITY : you are empowered

- to incur expenditures as delegated by the District Works Officer
- to implement the programme as per the approved work plan
- to nominate staff for training at DST
- to employ casual labourers as and when necessary in accordance with the current Government regulations

REQUIRED QUALIFICATIONS	OTHER REQUIRED ABILITIES
• Degree in Civil Engineering • Minimum of 2 years practical professional experience • Managerial skills • Attendance on 'Engineer's Orientation Course MRP' at DST	• to be co-operative • to be decisive • to lead and train personnel • to be flexible • to work independently • to be creative

NAME OF DMIE:	(for official use only) COUNTERS. OFFICER: .....
SIGNATURE:	NAME: .....
DATE:	DESIGNATION: .....
	DATE: .....

REPUBLIC OF KENYA
MINISTRY OF PUBLIC WORKS
MINOR ROADS PROGRAMME

JOB DESCRIPTION

POSITION	DISTRICT MAINTENANCE AND IMPROVEMENT ENGINEER (DMIE)

TASKS

1. PERSONNEL AND ADMINISTRATIVE ACTIVITIES

1.1. To control MRP allocated funds according to specific procedures laid down by the Government and MRP, and to direct, guide and assist the clerical staff in charge of accounts

1.2. To be in overall control of all administrative activities of the MRP district unit

1.3. To prepare and analyse monthly, quarterly and annual reports according to the MRP Management Reporting System and the relevant Government reporting procedures

1.4. To plan, initiate and control the procurement of construction materials, handtools, equipment, spares, POL and other goods required to be able to implement the work

1.5. To direct, control and guide the store staff in all matters relating to store activities and in accordance with the specific procedures laid down by the Government and MRP

1.6. To control and administer all matters relating to personnel management according to the specific procedures laid down by the Government and MRP

1.7. To control and monitor the use of all accountable documents

2. ORGANISATIONAL AND CO-ORDINATION ACTIVITIES

2.1. To organise, direct and co-ordinate all operational activities required to implement the approved maintenance work

2.2. To organise, direct and co-ordinate all operational activities required to implement the approved improvement work

2.3. To inform the public about casual recruitment through Chiefs and local organisations

2.4. To organise and carry out casual recruitment in accordance with the current Government regulations

2.5. To organise and control the monthly pay days for casual labourers

2.6. To attend and participate at all District Development Committee (DDC) meetings

2.7. To control and monitor the availability and utilisation of equipment and vehicles

2.8. To attend and advise the District Tender Board on all matters relating to procurement of goods and services for the programme's specific requirements

2.9. To attend and participate at all District Executive Committee (DEC) meetings

2.10. To organise regular meetings with the Unit and Site Supervisors to co-ordinate activities, and to discuss and direct as necessary, as well as carrying out on-the-job training

2.11. To implement and control the MRP mechanical standard service and repair systems

2.12. To supervise and guide the officer in charge of the workshop on all activities relating to mechanical services

REPUBLIC OF KENYA
MINISTRY OF PUBLIC WORKS
MINOR ROADS PROGRAMME

JOB DESCRIPTION

POSITION	DISTRICT MAINTENANCE AND IMPROVEMENT ENGINEER (DMIE)

TASKS

1. TECHNICAL ACTIVITIES

1.1. To supervise and monitor all improvement and maintenance work in progress and direct corrective measures if and when required

1.2. To prepare and maintain the annual workplan for routine maintenance, based on the engineering maintenance requirements assessment and with the assistance and guidance of the Provincial Road Engineer (Unpaved Roads)

1.3. To prepare and maintain the annual workplan for periodic maintenance, based on the engineering maintenance requirements assessment and with the assistance and guidance of the Provincial Road Engineer (Unpaved Roads)

1.4. To prepare and maintain the annual workplan for improvement, based on the engineering road improvement plans and with the assistance and guidance of the Provincial Road Engineer (Unpaved Roads)

1.5. To guide and assist the Unit and Site Supervisors about approved work methods, procedures and technical know-how

1.6. To prepare all engineering road improvement plans and to design appropriate structures according to the MRP technical standards

4. LIAISON ACTIVITIES

4.1. To liaise through the Provincial Road Engineer (Unpaved Roads) with the MRP HQ on the allocation of funds and equipment

4.2. To assist the Kisii Training School in identifying training needs and to ensure that all the staff attend the training courses as required

4.3. To advise the DEC and DOC on the engineering feasibility of roads proposed for improvement and maintenance

4.4. To liaise with the District Accountant (DA) and the DWO on all matters relating to vote and accounts control

4.5. To liaise with the District Supplies Officer (DSO) on all matters relating to the supply of stores and the boarding of stores and equipment

4.6. To liaise with other Government Departments when required

4.7. To liaise and inform the District Works Officer (DWO) on work which has been planned or being carried out by the MRP in the district

4.8. To attend regional and national Engineer's meetings

4.9. To liaise with politicians to provide programme information

F2 Officer in charge (OIC)

REPUBLIC OF KENYA
MINISTRY OF PUBLIC WORKS
MINOR ROADS PROGRAMME

JOB DESCRIPTION

POSITION	OFFICER IN CHARGE, MAINTENANCE

REPORTING TO	REPORTED TO BY
DMI ENGINEER	• OVERSEERS, ROUTINE MAINTENANCE • REGRAVELLING SITE SUPERVISORS • DRIVERS AND PLANT OPERATORS

REPRESENTS	REPRESENTED

SCOPE OF WORK/JOB OBJECTIVE	PLACE OF WORK
• To efficiently plan, organise, co-ordinate and supervise all routine, periodic and urgent maintenance activities of the unit • To control the required resources (personnel, material, equipment)	• RAR/MRP District base camp • All roads under maintenance • All regravelling sites

MAIN TASKS

- To deal with all casuals and permanent staff matters of the unit as delegated by the DMI Engineer
- To assist the DMI Engineer in preparing the work plans for routine, periodic and urgent maintenance
- To assist the DMI Engineer in updating the road inventories
- To organise, coordinate and supervise all routine, periodic and urgent maintenance operations as directed by the DMIE
- To organise and control the unit's equipment
- To plan for and control the physical resources required to carry out the unit's operations
- To guide and assist the site supervisors on approved work methods and procedures
- To liaise with the Improvement Unit Supervisor and Local Administration as required
- To assist the DMIE in identifying suitable maintenance contractors (lengthpersons)

AUTHORITY : you are empowered

- To control the utilisation of equipment assigned by the DMIE to the unit
- To control and guide the unit's staff and labourers in accordance with the current regulations and as directed by the DMIE
- To employ casual labourers as and when necessary in accordance with the current Government regulations and as directed by the DMIE

REQUIRED QUALIFICATIONS	OTHER REQUIRED ABILITIES
• Min. Form IV, Div. III or KCPE Grade D+ • Ordinary Diploma in Civil Engineering or Overseer Grade I with min. of 1 year practical professional experience, or • Foreman with min. 3 years experience in LB. methods and outstanding qualifications • Induction Course on LB. methods at DST • Unit Supervisor Course on LB. methods at DST • Maintenance Supervisor Course at DST	• To be cooperative • To be flexible • To work independently • To lead and train personnel • To be creative

NAME OF OIC:	(for official use only) COUNTERS. OFFICER
SIGNATURE:	NAME: DESIGNATION:
DATE:	DATE

REPUBLIC OF KENYA
MINISTRY OF PUBLIC WORKS
MINOR ROADS PROGRAMME

JOB DESCRIPTION

POSITION	OFFICER IN CHARGE, MAINTENANCE

TASKS
1. PERSONNEL AND ADMINISTRATIVE ACTIVITIES
1.1. To collect and analyse the weekly / monthly site returns and to prepare the unit monthly returns for forwarding to the DMIE
1.2. To collect, check and authorise muster rolls for all unit lengthmen and labourers
1.3. To organise and authorise lengthman and labourer employment for the district as directed by the DMIE
1.4. To inform the unit staff about the pay day and to organise the pay day in the field
1.5. To negotiate the acquisition of quarries in cooperation with the Agricultural Officer
1.6. To check the attendance and performance of the lengthmen and labourers against the daily site records
1.7. To carry out any other administrative work as directed by the DMIE
2. ORGANISATIONAL AND TECHNICAL ACTIVITIES
2.1. To organise, direct and co-ordinate all activities required to implement the approved routine, periodic and urgent maintenance work in the district as directed by the DMIE
2.2. To direct, supervise and guide all maintenance staff in all matters relating to routine, periodic and urgent maintenance work
2.3. To plan the physical resources required to carry out all routine and periodic maintenance work
2.4. To order, issue and control the consumption of materials and tools required to carry out the maintenance work
2.5. To organise and control the movements of all maintenance vehicles and plant
2.6. To implement and control the MRP mechanical standard service and repair systems for all maintenance equipment under the guidance of the DMIE
2.7. To plan and to carry out on-the-job training for Headmen and Lengthmen for routine Maintenance
2.8. To plan and to carry out on-the-job training for Zonal Overseers
2.9. To check and monitor all site stores, their activities and procedures as laid down by GOK and MRP
2.10. To plan and organise zonal / site camp allocations and installations
3. LIAISON ACTIVITIES
3.1. To direct, supervise and monitor all routine maintenance operations in the district and direct corrective measures if and when required
3.2. To direct, supervise and monitor all periodic maintenance operations in the district and direct corrective measures if and when required
3.3. To direct, supervise and monitor all urgent maintenance operations in the district and direct corrective measures if and when required

REPUBLIC OF KENYA
MINISTRY OF PUBLIC WORKS
MINOR ROADS PROGRAMME

JOB DESCRIPTION

POSITION	OFFICER IN CHARGE, MAINTENANCE

TASKS
3.4. To assist the DMIE with the annual inspection to assess the defect rating and maintenance requirements
3.5. To update the RARP/MRP road inventories after the annual inspection is carried out
3.6. To assist the DMIE in the preparation of the annual district routine and periodic maintenance work plans
3.7. To guide and assist the Overseers (routine, periodic and urgent maintenance) on approved work methods, procedures and technical know-how
3.8. To ascertain the quality of gravel for regravelling operations under the guidance of the DMIE
3.9. To organise and control the demarcation of contract sections and divisions
3.10. To assist the DMIE in the establishment of fair contract lengths for routine maintenance of new roads
4. LIAISON ACTIVITIES
4.1. To liaise with the Chiefs about labour recruitment in the particular locations
4.2. To liaise with the Improvement Unit Supervisor for the handing over of completed roads
4.3. To liaise with other Government Departments as and when required
4.4. To liaise and inform the Divisional / Locational Administration and Development Committees about the maintenance work in the respective Divisions / Locations
4.5. To participate on the Locational and Divisional Development Committees on behalf of the DMIE
4.6. To inform the public through the Chiefs about the importance of road maintenance and the Ministry's maintenance work

F3 Overseer

REPUBLIC OF KENYA
MINISTRY OF PUBLIC WORKS
MINOR ROADS PROGRAMME

JOB DESCRIPTION

SHEET 1 OF 2

POSITION	OVERSEER ROUTINE MAINTENANCE

REPORTING TO	REPORTED TO BY
OIC MAINTENANCE	• SUBORDINATE STAFF AT CAMP • ROUTINE MAINTENANCE HEADMEN • ROUTINE MAINTENANCE LENGTHMEN • CASUAL LABOURERS FOR SPECIAL MTCE

REPRESENTS	REPRESENTED

SCOPE OF WORK/JOB OBJECTIVE	PLACE OF WORK
• to efficiently plan, organise, direct, control and report all routine maintenance activities of the maintenance zone on a daily basis • to control the required resources (personnel, material, equipment)	• All roads under routine maintenance in the zone • Zonal maintenance camp

MAIN TASKS

- to deal with all matters regarding staff and casual labourers in the zone and as delegated by the OIC Maintenance and OMIE
- to plan, organise, set-out, supervise and approve all maintenance activities on a daily basis
- to issue and approve task rates and to record the achieved performance
- to guide and train headmen and lengthmen on approved maintenance work methods and procedures
- to order and control all site stores and to issue appropriate hand tools to lengthmen
- to liaise with the OIC Maintenance and Local Administration on official matters as required

AUTHORITY : you are empowered

- to control and guide the headmen and lengthmen in accordance with the current regulations and as directed by the OIC Maintenance and OMIE

REQUIRED QUALIFICATIONS	OTHER REQUIRED ABILITIES
• Form IV, Div. III or KCPE Grade D+ • Induction Course on Lb. methods at CST • Minimum of 3 years practical experience as improvement site supervisor • Maintenance Course on Lb. methods at CST • Motorcycle Riding Course at CST	• to be cooperative • to lead and train personnel • to work independently • to be flexible • to adapt to the local environment

NAME OF ORM:	(for official use only) COUNTERS. OFFICER: . . . . .
SIGNATURE:	NAME: . . . . .
DATE:	DESIGNATION: . . . . .
	DATE: . . . . .

REPUBLIC OF KENYA
MINISTRY OF PUBLIC WORKS
MINOR ROADS PROGRAMME

JOB DESCRIPTION

POSITION	OVERSEER ROUTINE MAINTENANCE

TASKS
1. PERSONNEL AND ADMINISTRATIVE ACTIVITIES
1.1. To compile and submit weekly / monthly zonal returns to the OiC Maintenance
1.2. To check the attendance of headmen and lengthmen and to record it in the muster roll
1.3. To recommend to the OiC, Maintenance and to the DMIE any lengthman or headman for dismissal due to unsatisfactory service:
1.4. To inform the lengthmen about the pay day and to organise the pay day in the zone
1.5. To assist the DMIE and OiC Maintenance in appointing lengthmen
1.6. To carry out any other administrative work as directed by the DMIE or OiC Maintenance
2. ORGANISATIONAL AND TECHNICAL ACTIVITIES
2.1. To plan, organise, direct and control all routine maintenance activities in the zone as explained in the Maintenance Manual
2.2. To issue task rates to all lengthmen as agreed with the OiC Maintenance
2.3. To check the performance of all lengthmen and headmen of the zone and to record the achieved work (task rate achieved) in the muster roll and site reports
2.4. To plan and to carry out on-the-job training for Headmen and Lengthmen for routine maintenance under the guidance of the OiC Maintenance
2.5. To demarcate lengthmen sections and divisions as directed by the OiC Maintenance
2.6. To arrange for any urgent maintenance work as need arises and in consultation with the OiC Maintenance
2.7. To issue the lengthmen with the appropriate maintenance tool set according to procedures
2.8. To issue the headmen with the appropriate measuring aids
2.9. To order, issue and control the consumption of materials and tools required to carry out the Routine and Urgent maintenance works
2.10. To maintain and control the site store, its activities and procedures as laid down by GOK and MRP
2.11. To ensure that the motorcycle is serviced and maintained according to the established service schedule
2.12. To maintain the zonal maintenance camp and to ensure its security
3. LIAISON ACTIVITIES
3.1. To liaise with the local Administration on administrative matters relating to the maintenance works (e.g. security, use of public land for the site camp, labour problems, pay days, etc.)
3.2. To liaise with the local Administration on public relations matters, e.g. information to the public about the road maintenance procedures, demonstrations on road maintenance, etc.

APPENDIX – G Employment forms (MRP-Road maintenance manual)

G1 Casual employment form

MINISTRY OF PUBLIC WORKS	ROADS DEPARTMENT
MINOR ROADS/RURAL ACCESS ROADS PROGRAMME	
CASUAL EMPLOYMENT FORM	
PROJECT:	EMPLOYMENT NO:
REF. NO:	DATE:
NAME: MR/MRS	I.D. NO.:

1. You are hereby offered employment with casual conditions as

   a .....

   with effect from .....

2. The terms and conditions of employment are as follows:

   a. You will be paid Ksh.....per day for an eight hour working day or an equivalent task rate. You will not be paid for public holidays or any day not worked regardless of the reason i.e. heavy rains, sickness, etc.

   b. You will be paid at the end of each month for the days worked.

   c. You are not entitled to annual leave, housing, transport or any allowances.

   d. Your employment will be terminated by any of the following:

   - at the end of the three months period starting on the date mentioned above.
   - at the completion of the project for which you were engaged.
   - at any time at the discretion of the DMI Engineer.
   - when you absent yourself from work without permission from your supervisors.
   - when you do not follow instructions from your supervisors.
   - when you behave in a disorderly manner.

   e. You are responsible for any loss or damage of tools issued to you and the cost of such will be deducted from your pay.

3. By signing the acceptance you indicate that you agree with the terms and conditions of employment set out above.

DMI ENGINEER	DATE .....

I have read/have had read to me, and I understand the above terms.
I hereby accept the casual employment on the terms and conditions on this form.

SIGNATURE OF EMPLOYEE .....

To be completed in triplicate: Original to Employee,
Duplicate to Personnel Officer, DMIE's office,
Triplicate to the DMIE.

G2 Lengthman contract form

MINISTRY OF PUBLIC WORKS	ROADS DEPARTMENT
MINOR ROADS/RURAL ACCESS ROADS PROGRAMME	
LENGTHMAN CONTRACT FORM	PAGE 1 OF 2
NAME:*MR/MRS/MISS (* DELETE AS APPROPRIATE)	ID/NO.:
DISTRICT:	MAINTENANCE ZONE:
ROAD NAME:	
ROAD No.:	SECTION No.:
PERIOD FROM:	UNTIL: (12 MONTHS)

1. You are hereby engaged as a Lengthman Contractor on the road section specified.

2. The terms and conditions of engagement are as follows:

   a. You will be paid Ksh.....per day for an eight hour working day or an equivalent task rate. You will not be paid for public holidays or any day not worked regardless of the reason i.e. heavy rains, sickness, etc.

   b. You will normally work on the following specified THREE days each week (ticked), or as directed by the Overseer:

      MONDAY ☐ TUESDAY ☐ WEDNESDAY ☐ THURSDAY ☐ FRIDAY ☐

   c. You will start work at a time directed by the Headman. You will be released from work when the set task is completed, or after 8 hours, and the work has been checked by the Headman.

   d. You will be paid for each monthly period approximately two weeks in arrears, and at a time and place in your location to be advised in advance.

   e. You are not entitled to annual leave, housing, transport or any allowances.

   f. Occasionally, for example in the dry season, your weekly work MAY be reduced according to the maintenance needs or other reason as directed by the District Maintenance and Improvement Engineer (DMIE).

   g. You will be responsible for the routine maintenance of the above mentioned Section of road according to the instructions and task rates given by your supervisors.

   h. The maintenance work includes the following activities as directed by the Headman:

      R1 GENERAL INSPECTION AND REMOVE ALL OBSTRUCTIONS
      R2 CLEAN CULVERTS, INLETS AND OUTFALLS
      R3 REPAIR CULVERT STONE HEADWALLS
      R4 CLEAN MITRE DRAINS
      R5 CLEAN SIDE DRAINS
      R6 REPAIR SCOUR CHECKS AND SIDE DRAIN EROSION
      R7 REPAIR EROSION ON SHOULDERS AND PLANT GRASS
      R8 FILL POTHOLES AND RUTS IN CARRIAGEWAY
      R9 GRUB EDGE AND RESHAPE CARRIAGEWAY
      R10 CUT GRASS IN THE SIDE DRAINS
      R11 CLEAR BUSH

      You may be occasionally directed to carry out other maintenance activities.

MINISTRY OF PUBLIC WORKS	ROADS DEPARTMENT

MINOR ROADS/RURAL ACCESS ROADS PROGRAMME

LENGTHMAN CONTRACT FORM (Continued)

i. You will immediately report any damage of culverts or bridges to the Headman.

j. Should you fail to perform your work, your given task, or should you not attend during the working time stated above, then no payment will be made.

k. Your term of engagement is 12 months in the first instance. The contract MAY be renewed annually IF your work is satisfactory. However, your contract may be terminated or suspended by the DMIE at ANY TIME due to one of the following:-

   i) When you absent yourself from work without good reason more than 2 days in any one month period.

   ii) When you do not follow the instructions from your supervisors.

   iii) When you behave in a disorderly manner.

   iv) When you fail to fulfil the set tasks for 3 days in any month.

l. In the case of cancellation of the contract, you will be paid all amounts due to you for work carried out according to instructions.

m. On termination or completion of the contract, you will not be entitled to any further payments, benefits or obligations from the Ministry of Public Works beyond those specified in this document.

n. During the course of the contract, you will be provided with Government tools to enable you to carry out the road maintenance work. The tools issued to you are as follows (tick as appropriate):

Jembe ☐	Panga ☐	Rake ☐	Shovel ☐
File ☐	Slasher ☐	☐	☐

From time to time you will be temporarily issued with other tools by the Headman to carry out specific tasks.

o. You are responsible for any loss or damage of tools issued to you and the cost of replacement of such loss or damage will be deducted from your payments.

p. When tools become worn out, arrangements will be made for replacement by the supervisors.

3. By signing the acceptance you indicate that you agree with the foregoing terms and conditions of engagement under this contract.

DMI ENGINEER	DATE .....

I have read/have had read to me, and I understand the above terms.
I hereby accept the terms, conditions and obligations of this Lengthman Contract.

SIGNATURE OF LENGTHMAN CONTRACTOR: .....

To be completed in triplicate: Original to Lengthman,
Duplicate to Overseer,
Triplicate to the DMIE.

11/92

G3 Headman contract form

MINISTRY OF PUBLIC WORKS	ROADS DEPARTMENT

MINOR ROADS/RURAL ACCESS ROADS PROGRAMME

HEADMAN CONTRACT FORM

NAME: *MR/MRS/MISS (* DELETE AS APPROPRIATE)	ID NO.:
DISTRICT:	MAINTENANCE ZONE:

ROAD NAME(S): ..... No:. ..... SECTION(S): .....
ROAD NAME(S): ..... No:. ..... SECTION(S): .....
ROAD NAME(S): ..... No:. ..... SECTION(S): .....

PERIOD FROM: UNTIL: (12 MONTHS)

1. You are hereby engaged as a Contract Headman for the road sections specified.

2. The terms and conditions of engagement are as follows:

   a. You will be paid Ksh.....for each working day. You will not be paid for public holidays or any day not worked regardless of the reason i.e. heavy rains, sickness, etc.

   b. You will normally work on the following specified THREE days each week (ticked), or as directed by the Overseer.

   MONDAY ☐ TUESDAY ☐ WEDNESDAY ☐ THURSDAY ☐ FRIDAY ☐

   c. You will work the hours necessary each working day to instruct and supervise the Lengthman on the road sections as directed by the Overseer.

   d. You will be paid for each monthly period approximately two weeks in arrears, and at a time and place in your location to be advised in advance.

   e. You are not entitled to annual leave, housing, transport or any allowances.

   f. Occasionally, for example in the dry season, your weekly work MAY be reduced according to the maintenance needs or other reason as directed by the District Maintenance and Improvement Engineer (DMIE).

   g. You will be responsible for supervising the routine maintenance of the above mentioned Sections of road according to the instructions given by the Overseer.

   h. You will direct the Lengthmen and maintenance work, including the following activities according to the priorities and season as shown in the Headman's Handbook or as directed by the DMIE.

   R1 GENERAL INSPECTION AND REMOVE ALL OBSTRUCTIONS
   R2 CLEAN CULVERTS, INLETS AND OUTFALLS
   R3 REPAIR CULVERT STONE HEADWALLS
   R4 CLEAN MITRE DRAINS
   R5 CLEAN SIDE DRAINS
   R6 REPAIR SCOUR CHECKS AND SIDE DRAIN EROSION
   R7 REPAIR EROSION ON SHOULDERS AND PLANT GRASS
   R8 FILL POTHOLES AND RUTS IN CARRIAGEWAY
   R9 GRUB EDGE AND RESHAPE CARRIAGEWAY
   R10 CUT GRASS IN THE SIDE DRAINS
   R11 CLEAR BUSH

   You may occasionally be directed to organise the Lengthmen to carry out other maintenance activities.

MINISTRY OF PUBLIC WORKS	ROADS DEPARTMENT

MINOR ROADS/RURAL ACCESS ROADS PROGRAMME

HEADMAN CONTRACT FORM (Continued)

k. Your term of engagement is 12 months in the first instance. The contract MAY be renewed annually IF your work is satisfactory. However, your contract may be terminated or suspended by the DMIE at ANY TIME due to one of the following:-

i) When you absent yourself from work without good reason more than 2 days in any one month period.

ii) When you do not follow the instructions from your supervisors.

iii) When you behave in a disorderly manner.

l. In the case of cancellation of the contract, you will be paid all amounts due to you for work carried out according to instructions.

m. On termination or completion of the contract, you will not be entitled to any further payments, benefits or obligations from the Ministry of Public Works beyond those specified in this document.

n. During the course of the contract, you will be provided with Government tools to issue to the Lengthmen from time to time on a temporary basis. The tools issued to you are as follows (complete with number as appropriate)

☐ .... ☐ ..... ☐ ..... ☐

☐ ..... ☐ ..... ☐ ..... ☐

o. You are responsible for any loss or damage of tools issued to you and the cost of replacement of such loss or damage will be deducted from your payments.

p. When tools become worn out, arrangements will be made for replacement by the Overseer.

3. By signing the acceptance you indicate that you agree with the foregoing terms and conditions of engagement under this contract.

DMI ENGINEER	DATE .....

I have read/have had read to me, and I understand the above terms.
I hereby accept the terms, conditions and obligations of this Headman Contract.

SIGNATURE OF CONTRACT HEADMAN: .....

To be completed in triplicate: Original to Headman,
Duplicate to Overseer,
Triplicate to the DMIE.

APPENDIX – H Routine maintenance (MRP-Road maintenance manual)

H1 Routine maintenance activities and priorities

	PRIORITY	ACTIVITY NUMBER	DESCRIPTION
BEFORE RAINS	1	R2	CLEAN CULVERTS + INLETS/OUTFALLS
	2	R4	CLEAN MITRE DRAINS
	3	R5	CLEAN SIDE DRAINS
	4	R6	REPAIR SCOUR CHECKS + SIDE DRAIN EROSION
RAINY PERIOD	1	R1	INSPECTION & REMOVE OBSTRUCTIONS
	2	R2	CLEAN CULVERTS & INLET/OUTFALLS
	3	R5	CLEAN SIDE DRAINS
	4	R6	REPAIR SCOUR CHECKS + SIDE DRAIN EROSION
	5	R4	CLEAN MITRE DRAINS
	6	R7	REPAIR EROSION ON SHOULDERS/PLANT GRASS
END OF RAINS	1	R8	FILL POTHOLES IN CARRIAGEWAY
	2	R9	GRUB EDGE & RESHAPE CARRIAGEWAY
	3	R7	REPAIR EROSION ON SHOULDERS/PLANT GRASS
	4	R10	CUT GRASS
DRY SEASON	1	R11	CLEAR BUSH
	2	R3	REPAIR CULVERT STONE HEADWALLS
	3	*R8	FILL POTHOLES IN CARRIAGEWAY
	4	*R9	GRUB EDGE & RESHAPE CARRIAGEWAY

* NOT TO BE CARRIED OUT ON SOME ROADS IN DRY AREAS

These priorities ensure that the most important activities are tackled first in the pre-rains and rainy season. However each activity will be achieved at some time of the year as it rises in priority.

ACTIVITY		UNIT	PRODUCTIVITY STANDARDS FOR ROUTINE MAINTENANCE				
			TASK DIFFICULTY				NOTES
			1	2	3	4	
R2A: CLEAN CULVERT + INLETS		AS SHOWN	4 CULVERTS/DAY	1 CULVERT/ DAY	2 DAYS/ CULVERT	4 DAYS/ CULVERT	DIFFICULTY = SILT DEPTH IN CULVERT - 1. UP TO ¼ 2. ¼ TO ½ 3. ½ TO ¾. 4. OVER ¾ TASKS FOR 600 DIA. CULVERTS WITH 7 RINGS
R2B: CLEAN CULVERT OUTFALLS		M/DAY	55	40	25		DIFFICULTY = SILT DEPTH - 1. UP TO 10CM. 2. 10 TO 20CM 3. OVER 20CM
R3: REPAIR CULVERT HEADWALLS		No/DAY	7	4			DIFFICULTY = TYPE OF REPAIR - 1. MINOR REPAIRS 2. MAJOR REPAIRS
R4: CLEAN MITRE DRAINS		M/DAY	60	45	30		DIFFICULTY = SILT DEPTH - 1. UP TO 10CM. 2. 10 TO 15CM 3. OVER 15CM
R5: CLEAN SIDE DRAINS		M/DAY	WET AREAS 65 DRY SOFT SOIL 55 DRY HARD SOIL 30	45 40 23	30 30 18		DIFFICULTY = SILT DEPTH - 1. UP TO 10CM 2. 10 TO 15CM 3. OVER 15CM.
R6A: REPAIR SCOUR CHECKS		No/DAY	5	7			DIFFICULTY = TYPE OF SCOUR CHECK - 1. WOOD 2. STONE
R6B: REPAIR SIDE DRAIN EROSION		M/DAY	WET AREAS 100 DRY AREAS 100	80 50	60 23		DIFFICULTY = DEPTH OF EROSION - 1. UP TO 15CM 2. 15 TO 30CM 3. OVER 30CM
R7A: REPAIR SHOULDER EROSION		M/DAY	100	80	65		DIFFICULTY = DEPTH OF EROSION - 1. UP TO 10CM 2. 10 TO 15CM 3. OVER 15CM
R7B: GRASS PLANTING		M/DAY	100	80	65		DIFFICULTY = PLANTING WIDTH - 1. UP TO 0.5M 2. 0.5 TO 1.0M 3. OVER 1.0M
R8A: FILL POTHOLES IN CARRIAGEWAY		W.BRWS /DAY	25	18	13	8	DIFFICULTY = HAULING DISTANCE - 1. NO HAUL 2. UP TO 100M 3. 100M TO 200M 4. OVER 200M
R8B: FILL RUTS IN CARRIAGEWAY		M/DAY	WET AREAS 70 DRY AREAS 50	50 30	35 15	15 7	DIFFICULTY = HAULING DISTANCE - 1. NO HAUL 2. UP TO 100M 3. 100 TO 200M 4. OVER 200M
R9A: GRUB EDGE OF CARRIAGEWAY		M/DAY	WET AREAS 270 DRY AREAS 190	200 120	130 70		DIFFICULTY = WIDTH OF GRUBBING - 1. UP TO 0.5M 2. 0.5 TO 1.0M 3. OVER 1.0M
R9B: RESHAPE CARRIAGEWAY*		M/DAY	70	50			DIFFICULTY = TYPE OF RESHAPING - 1. LIGHT (UP TO 75MM) 2. HEAVY (OVER 75MM)
R10: GRASS CUTTING	LIGHT	M/DAY	WET AREAS 425 DRY AREAS 310	260 230	190 170		DIFFICULTY = WIDTH OF GRASS CUTTING 1. UP TO 1.0M 2. 1.0 TO 2.0M 3. OVER 2.0M
	DENSE	M/DAY	310	240	175		
R11: BUSH CLEARING	LIGHT	M/DAY	425	260	190		DIFFICULTY = WIDTH OF BUSH 1. UP TO 1.0M 2. 1.0 TO 2.0M 3. OVER 2.0M
	DENSE	M/DAY	275	225	175		

* ALL TASKS EXCEPT RESHAPING ARE MEASURED ALONG ONE SIDE OF THE ROAD ONLY

H3 Task rates

TASK RATES				
NO	ACTIVITY	PRODUCTIVITY RANGE PER MANDAY	UNITS	NORMAL TASK RATE
R1	INSPECTION AND REMOVE OBSTRUCTIONS	COMPLETE SECTION		
R2	CLEAN CULVERTS + INLETS/OUTFALLS	TO	NO	
R3	REPAIR CULVERT STONE HEADWALLS	TO	CULVERTS	
R4	CLEAN MITRE DRAINS	TO	LIN. M.	
R5	CLEAN SIDE DRAINS	TO	ROAD M.	
R6	REPAIR SCOUR CHECKS & SIDE DRAIN EROSION	TO	ROAD M.	
R7	REPAIR EROSION ON SHOULDERS/PLANT GRASS	TO	ROAD M.	
R8	FILL POTHOLES AND RUTS IN CARRIAGEWAY	TO	ROAD M.	
R9	GRUB EDGE & RESHAPE CARRIAGEWAY	TO	ROAD M.	
R10	CUT GRASS, SIDE DRAINS	TO	SQ. M.	
R11	CLEAR BUSH	TO	ROAD M.	

NOTE:

1. ROAD M. denotes linear metres of road including both sides if applicable.

2. Figures to be agreed between the OiC Maintenance and the Overseer.

H4 Lengthman deployment form

LENGTHMAN DEPLOYMENT PLAN, HIGH RAINFALL AREA MRP-M1A

DISTRICT	ROAD NAME .....
ZONE	ROAD No ..... SECTION km ... TO km .....

ACTIVITY NUMBER	ROUTINE MAINTENANCE ACTIVITY	ESTIMATED LENGTHMAN DAYS PER KM PER YEAR					
		BASIC INPUTS OVER 12 MONTHS	ADDITIONAL INPUTS				D: PLAN
			A: SURFACE TYPE	B: AVERAGE GRADIENT		C: ADT	
			EARTH	LOW 2.5%	HIGH 5.0%	HIGH 50 VPD	
R1	INSPECT ROAD, REMOVE OBSTRUCTIONS	4				4	
R2	CLEAN CULVERT INLETS & OUTFALLS	6		7			
R3	REPAIR CULVERT HEADWALLS	1					
R4	CLEAN MITRE DRAINS	5					
R5	CLEAN SIDE DRAINS	23		12			
R6	REPAIR SCOUR CHECKS, SIDE DRAIN EROSION	4			7		
R7	REPAIR SHOULDER EROSION/PLANT GRASS	2					
R8	FILL POTHOLES AND RUTS IN CARRIAGEWAY	11	8		5	6	
R9	GRUB EDGE AND RESHAPE CARRIAGEWAY	15	8				
R10	CUT GRASS	5					
R11	CLEAR BUSH	5					

HIGH RAINFALL : (RAINFALL IN ALL MONTHS > 25 MM) TOTAL (E)

INSTRUCTIONS:

Decide which columns A, B and/or C are applicable to the road under consideration. In the selected columns circle all figures and ADD them to the BASIC INPUTS, the total estimated requirements for each activity are then summed in column D: PLAN.
Column D is added vertically to obtain the estimated annual mandays per km for all routine maintenance activities: E.

ROAD LENGTH (F) _____ KM

NUMBER OF DAYS PER YEAR THAT CONTRACTORS WORK (G) _____ (NORMALLY 150)

NUMBER OF CONTRACTORS REQUIRED = (F x E)/G _____ TO THE NEAREST WHOLE NUMBER

LENGTHMAN DEPLOYMENT PLAN, MEDIUM RAINFALL AREA MRP-M1B

DISTRICT	ROAD NAME .....
ZONE	ROAD No ..... SECTION km .... TO km .....

ACTIVITY NUMBER	ROUTINE MAINTENANCE ACTIVITY	ESTIMATED LENGTHMAN DAYS PER KM PER YEAR					
		BASIC INPUTS OVER 12 MONTHS	ADDITIONAL INPUTS				D: PLAN
			A: SURFACE TYPE	B: AVERAGE GRADIENT		C: ADT	
			EARTH	LOW <2.5%	HIGH >5.0%	HIGH >50 VPD	
R1	INSPECT ROAD, REMOVE OBSTRUCTIONS	2				3	
R2	CLEAN CULVERT INLETS & OUTFALLS	4		5			
R3	REPAIR CULVERT HEADWALLS	1					
R4	CLEAN MITRE DRAINS	4					
R5	CLEAN SIDE DRAINS	12		8			
R6	REPAIR SCOUR CHECKS, SIDE DRAIN EROSION	6			5		
R7	REPAIR SHOULDERS, EROSION, PLANT GRASS	2					
R8	FILL POTHOLES AND RUTS IN CARRIAGEWAY	5	6		3	4	
R9	GRUB, EDGE AND RESHAPE CARRIAGEWAY	13	6				
R10	CUT GRASS	4					
R11	CLEAR BUSH	2					
	MEDIUM RAINFALL : (RAINFALL IN 6 MONTHS > 25 MM)					TOTAL (E)	

INSTRUCTIONS:

Decide which columns A, B and/or C are applicable to the road under consideration. In the selected columns circle all figures and ADD them to the BASIC INPUTS. The total estimated requirements for each activity are then summed in column D: PLAN.
Column D is added vertically to obtain the estimated annual mandays per km for all routine maintenance activities: E.

ROAD LENGTH (F) _____ KM

NUMBER OF DAYS PER YEAR THAT CONTRACTORS WORK (G) _____ (NORMALLY 155)

NUMBER OF CONTRACTORS REQUIRED = (F x E)/G _____ TO THE NEAREST WHOLE NUMBER

LENGTHMAN DEPLOYMENT PLAN, LOW RAINFALL AREA MRP-M1C

DISTRICT	ROAD NAME .....
ZONE	ROAD No ..... SECTION km .... TO km .....

ACTIVITY NUMBER	ROUTINE MAINTENANCE ACTIVITY	ESTIMATED LENGTHMAN DAYS PER KM PER YEAR					
		BASIC INPUTS OVER 12 MONTHS	ADDITIONAL INPUTS				D: PLAN
			A: SURFACE TYPE	B: AVERAGE GRADIENT		C: ADT	
			EARTH	LOW <2.5%	HIGH >5.0%	HIGH >50 VPD	
R1	INSPECT ROAD, REMOVE OBSTRUCTIONS	1				2	
R2	CLEAN CULVERT, INLETS & OUTFALLS	3		3			
R3	REPAIR CULVERTS, HEADWALLS	0					
R4	CLEAN MITRE DRAINS	2					
R5	CLEAN SIDE DRAINS	5		5			
R6	REPAIR SCOUR CHECKS, SIDE DRAIN EROSION	2			3		
R7	REPAIR SHOULDER EROSION, PLANT GRASS	2					
R8	FILL POTHOLES AND RUTS IN CARRIAGEWAY	7	3		2	4	
R9	GRUB EDGE AND RESHAPE CARRIAGEWAY	6	3				
R10	CUT GRASS	2					
R11	CLEAR BUSH	1					

LOW RAINFALL : (RAINFALL IN 4 MONTHS > 25 MM) TOTAL (E) [ ]

INSTRUCTIONS:

Decide which columns A, B and/or C are applicable to the road under consideration. In the selected columns circle all figures and ADD them to the BASIC INPUTS. The total estimated requirements for each activity are then summed in column D: PLAN.
Column D is added vertically to obtain the estimated annual mandays per km for all routine maintenance activities: E.

ROAD LENGTH (F) [ ] KM

NUMBER OF DAYS PER YEAR THAT CONTRACTORS WORK (G) [ ] (UP TO 150 MAXIMUM)

NUMBER OF CONTRACTORS REQUIRED = (F x E)/G [ ] TO THE NEAREST WHOLE NUMBER

NOTE: MAXIMUM CONTRACT LENGTH TO BE 3.0 KM

MAINTENANCE INVENTORY FIELD BOOK

ROAD NUMBER	ROAD NAME	CONTRACT SECTION	CHAINAGE SECTION START	CHAINAGE SECTION END	CONTRACT LENGTH	DIVISION DETAILS START	1	2	3	4	END	LENGTHMAN CONTRACTORS NAME AND IDENTIFICATION	APPOINTMENT DATE	WORKING DAYS

H6 Overseer's monthly routine maintenance work

OVERSEER'S MONTHLY ROUTINE MAINTENANCE WORK PROGRAMME MRP - M7

DISTRICT:	MONTH: .....
OVERSEER:	ZONE: .....

	No. OF DAYS
TOTAL WORKING DAYS THIS MONTH	
OVERHEAD AND ADMINISTRATION:	
MOTORCYCLE SERVICE	
PAY DAY	
PLANNING AND REPORTING	
OTHERS (MEETINGS, PUBLIC HOLIDAYS, ETC.)	
TOTAL DAYS NOT AVAILABLE FOR INSPECTION	
TOTAL DAYS AVAILABLE FOR INSPECTION	

DATE	ROADS TO INSPECT	DATE	ROADS TO INSPECT

REMARKS:	SIGN OVERSEER: ....
	SIGN INSPECTOR: .....

H7 OIC's monthly routine maintenance work

OIC MAINTENANCE MONTHLY MAINTENANCE WORK PROGRAMME MRP - M8

DISTRICT:	MONTH .....
OIC MAINTENANCE	ZONES: .....

	No. OF DAYS
TOTAL WORKING DAYS THIS MONTH	
OVERHEAD AND ADMINISTRATION:	
DAYS FOR PERIODIC MAINTENANCE	
ORGANISATION OF PAY DAY	
PAY DAY	
VEHICLE SERVICE AND ADMINISTRATION	
PLANNING AND REPORTING	
OTHERS (MEETINGS, PUBLIC HOLIDAYS, ETC.)	
TOTAL DAYS NOT AVAILABLE FOR INSPECTION	
TOTAL DAYS AVAILABLE FOR INSPECTION	

DATE	ROADS TO INSPECT	DATE	ROADS TO INSPECT

REMARKS:	SIGN OIC .....
	SIGN OMIE .....

H8 Routine maintenance road visit programme

ROUTINE MAINTENANCE ROAD VISIT PROGRAMME MRP - M9

DISTRICT			MONTH & YEAR	
ROADS TO BE VISITED				
DATE	ZONE A OVERSEER	ZONE B OVERSEER	ZONE C OVERSEER	OIC MAINTENANCE
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
OIC MAINTENANCE ..... DATE			APPROVED OMIE ..... DATE	

MOPW ED.1 MINOR ROADS PROGRAMME

H9 Lenthmen costs and tools

A. ANNUAL COSTS PER LENGTHMAN			
ITEM			ANNUAL COST K£
1. ANNUAL COST OF LENGTHMEN @ 3 DAYS/WEEK, 50 WEEKS/YEAR PAYMENT RATE (KSH/DAY) = 50			375.00
2. HEADMEN SUPERVISION @ 15% OF LENGTHMAN COSTS			56.25
3. ALLOWANCE FOR URGENT WORKS (SPECIAL MTCE) TO BE ARRANGED ON AN AD HOC BASIS BY DMI ENGINEER, ASSUMING 10% OF CONTRACTORS PAYMENTS			37.50
SUBTOTAL MANPOWER			468.75
4. PROVISION OF HAND TOOLS PER CONTRACTOR			
ITEM	UNIT COST KSH	EXPECTED LIFE MONTHS	
PANGA (BUSH KNIFE)	90	24	
GRASS SLASHER	80	24	
JEMBE (HOE)	180	24	
SHOVEL	70	24	
RAKE	70	24	
WHEELBARROW (1)	800	60	16.40
PLUS 10% FOR MISCELLANEOUS TOOLS			
ANNUAL COSTS/LENGTHMAN:			485.15

NOTES:
1. ONE WHEELBARROW FOR THREE CONTRACTORS.
2. BASED ON 1992 WAGE AND PRICE LEVELS.
3. EXCLUDES OVERHEADS OF OVERSEER, OIC, TRANSPORT AND ACCOMMODATION.

B. DIRECT ANNUAL COST PER KM					
CONTRACT LENGTH (KM)	1.0	1.5	2.0	2.5	3.0
DIRECT ANNUAL LENGTHMAN COSTS (K£)	486	324	243	195	162

ITEM	No.
LENGTHMAN	
PANGA (BUSHKNIFE)	1
GRASS SLASHER	1
JEMBE (HOE)	1
SHOVEL (ROUND NOSE)	1
RAKE	1
SHARPENING FILE	1
HEADMAN	
WHEELBARROW	3
LONG HANDLE TROWEL	2
LONG HANDLE SHOVEL	2
HAND RAMMER	1
MASONS HAMMER	2
DITCH + SLOPE, SCOUR CHECK TEMPLATE	1
SPIRIT LEVEL	1
KNOTTED ROPES FOR SETTING OUT	2

APPENDIX – I Labour construction Unit (Extracts from contract documents)

I1 Productivity rates

Annex I

The undermentioned productivity rates are agreed by both the Employer and Contractor for use under this agreement.

Code	Activity	Unit	Productivity rate, Unit/pd
RM-1	Inspection and removal of obstruction	To be agreed at the site	
RM-2	Disilting culverts, Cleaning culvert inlets and outlets	culvert	1 - 4
RM-3	Clean side, catch water and mitre drains	lm	50 - 100
RM-4	Repair erosion on shoulders and in all drains	lm	60 - 100
RM-5	Repair / build scour checks	no	4 - 8
RM-6	Grub road way	lm	80 - 120
RM-7	Fill potholes and ruts on the carriage way	lm	80 - 120
RM-8	Reshape road and reinstate camber	lm	50 - 100
RM-9	Cut grass	lm	80 - 120
RM-10	Rebuild dry stone retaining wall	m^3	2.5 - 3.5
RM-12	Removal of protruding stones	lm	40 - 100
	Excavate and load gravel	m^3	1.5 - 3.0
	Excavate soil	m^3	2.5 - 4.0

To facilitate the use of Article 4.1(v), the following rates have been agreed for gravel haulage.

Haulage distance, km	Unit	Agreed unit rate, M/Unit
0.5 - 4	m^3	10.84
4 - 6	m^3	14.74
6 - 8	m^3	18.64
8 - 10	m^3	23.30
10 - 14	m^3	29.69

I2 Contract data

CONTRACT DATA

Roads included in Contract (Clause 3.1)
Region in which works are undertaken .....

ROAD NO.	ROAD NAME	FROM KM TO KM
i)		
ii)		
iii)		

Other Contract Data

	From Clause No.	
Contract Price	4.1	M .....
Payment Breakdown	4.1(i)	★Monthly Lump Sum M.....
	4.1(ii)	★Insurance M..... One of payment on presentation of proof of purchase of insurance policy.
	4.1(iii)	★Protective Clothing M..... one off payment on presentation of proof of supply of protective clothing to the workers.
	4.1(iv)	★Leave Pay M..... Reimerusable item on presentation of proof of annual leave payment to the workers at the end of the Contract.
	4.1(v)	★Gravel Haulage M..... Payment for gravel haulage when instructed by the Engineer
Commencement Date	7.1	..... / ..... / .....
Contract Duration	7.1	..... months
Number of workers to be employed on site	3.3	i) ..... ii)..... iii)..... iv)..... v).....
Maintenance free period	7.1	i).....months ii).....months iii).....months

I3 Monthly site instructions

ANNEX 2

ROUTINE MAINTENANCE: MONTHLY SITE INSTRUCTIONS AND ACHIEVEMENTS FORM (TRIPLICATE)

REGION ..... ROAD NAME ..... ROAD NO. .....

CONTRACTOR'S NAME AND ADDRESS:

.....

.....

.....

CONTRACT DURATION. FROM. ..... TO .....

INSTRUCTION PERIOD: FROM ..... TO

ROAD LENGTH: ..... KM (A)

NO. OF LABOURERS ..... (A) / 1.5 = ... (B)

WORKING DAYS THIS PERIOD ..... NO (C)

TOTAL PERSON DAYS AVAILABLE THIS PERIOD (B X C = D) ..... NO (D)

PLAN								REPORT
CODE	ACTIVITY	UNIT	QUANTITY (E)	FROM:	TO:	AGREED TASK RATE(F)	ESTIMATED PERSON DAYS (E/F)	ACTUAL QUANTITY ACHIEVED
TOTAL		XXX	XXXXXXX	XXXXX	XX	XXXXXXX	G = D	XXXXXXXXXXXXXXXXX

PLAN CERTIFIED BY:

SUPERVISOR: NAME ..... SIGNATURE ..... DATE .....

CONTRACTOR: NAME ..... SIGNATURE ..... DATE .....

MEASUREMENTS CERTIFIED BY:

SUPERVISOR:

NAME .....

SIGN ..... DATE ...

COMMENTS/REMARKS:

.....

.....

.....

CONTRACTOR:

NAME .....

SIGN ..... DATE

I4 Contractor's handtools and equipment inventory form

ANNEX 3

CONTRACTOR'S HANDTOOLS AND EQUIPMENT INVENTORY FORM

Region _____ Date of Inventory: _____

Road Name: _____ Road No: _____

Contractor's Name and Address: Contract No: _____

_____

_____

Date of Commencement: _____ Expiry Date: _____

Name of Supervisor: _____

Item	Description	Minimum Required Quantity	Available on Site		
			Good Condition	Poor Condition	Total
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12					

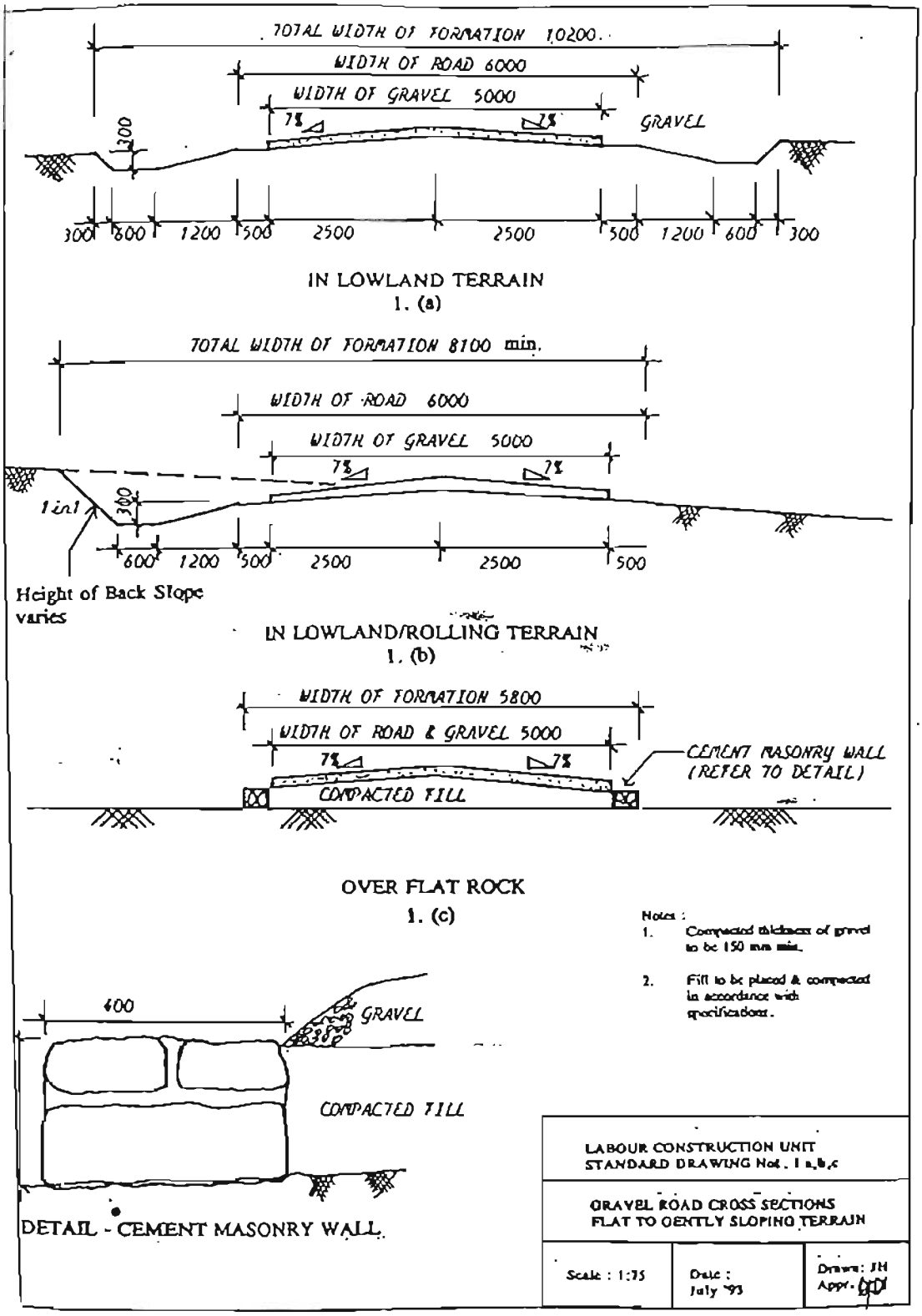
Remarks: _____

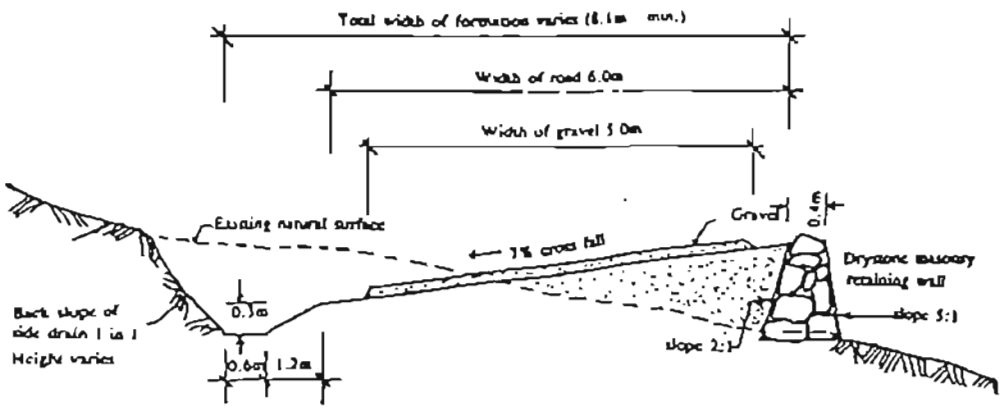
_____

_____

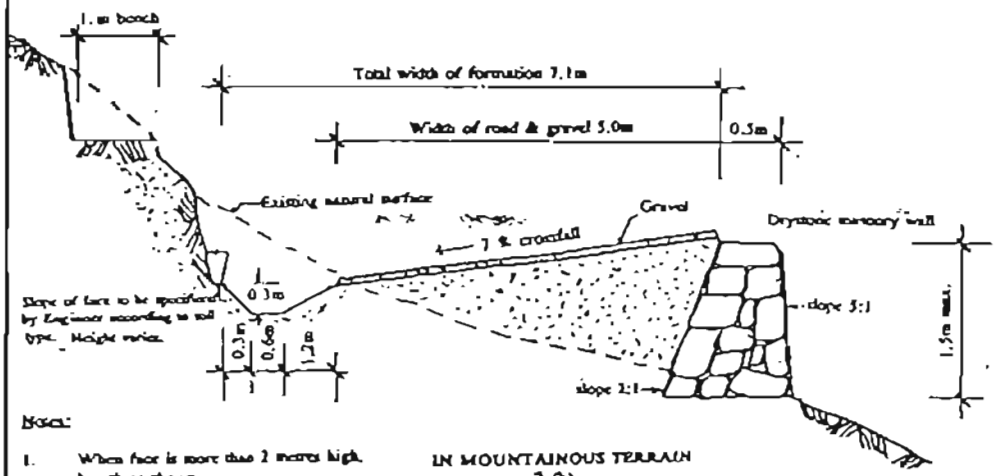
Signature of Supervisor: _____ Signature of Contractor: _____

I5 Drawings - typical cross-sections





IN ROLLING / HILLY TERRAIN
2.(a)



IN MOUNTAINOUS TERRAIN
2.(b)

Notes:

1. Where face is more than 2 metres high, bench as shown.
2. Where height of retaining wall exceeds 1.5m the wall is to be constructed from stepped gabions in accordance with Engineer's instructions.
3. Where erosion to the formation may occur in the inside drain, rock protection may be specified by the Engineer.
4. Fill to be placed and compacted in accordance with specifications.
5. Gravel thickness to be 150mm min.

LABOUR CONSTRUCTION UNIT STANDARD DRAWINGS Nos. 2.a.b.		
GRAVEL ROAD CROSS SECTIONS - HILLY TO STEEP TERRAIN.		
Scale	Date July '93	Drawn JH Approved:

APPENDIX – J Extracts from LCU annual report (1997-98)

J1 Volume of work carried out by contractors

Reg. No.	Contractor	Routine Maintenance		Rehabilitation		Periodic Maintenance		Total paid to date, M
		Length km	Paid to date, M	Length km	Paid to date, M	Length km	Paid to date, M	
95/01	Bokang Morena Const.	15.4	114,246	18	939,383	0	0	1,053,629
95/02	G. M. T. Civils	30.8	141,967	5.6	315,753	0	0	457,720
95/03	Tiro Const.	33.7	189,272	1	59,984	0	0	249,256
95/04	Nu-Build Const.	18.4	107,902	0	0	0	0	107,902
95/05	Molefe Brick Const.	19.1	100,833	2.4	152,996	0	0	253,829
95/06	Mocha Const.	23.4	113,222	0	0	0	0	113,222
95/07	MOPS Const.	19.8	118,251	1.2	75,095	0	0	193,346
95/08	Boss Const.	24.9	113,385	6	287,734	0	0	401,119
96/01	Champ Const.	31.2	157,529	0	0	0	0	157,529
96/02	Spectrum Const.	29.1	161,483	0	0	0	0	161,483
96/03	T. M. Consultants	25.8	108,530	0	0	0	0	108,530
96/04	Top Tech Const.	33	176,864	2.7	173,760	0	0	350,624
96/05	Tej Civils pty ltd	36.2	257,846[1]	7.4	369,305	0	0	627,151
96/06	Samco pty. Ltd	35	162,910	4.5	234,595	0	0	718,227
96/07	Maphiri Const.	34.1	138,054	0	0	0	0	449,202
96/08	MEM Const.	20	144,930[2]	1.6	81,490	1.1	39,155	914,104
96/09	Letmak Const.	43.5	199,264	0	0	0	0	199,264
96/10	Greenland pty. Ltd	27.7	157,435	0	0	0	0	157,435
96/11	Elem Const.	31.5	171,794	0	0	0	0	171,794
97/01	Keeka RM & RB	34.2	162,618	0	0	0	0	162,618
97/02	M.K.L. Civil &Build.	26.5	139,316	0	0	0	0	139,316
97/03	Molisana Const.	29.9	163,454	0	0	0	0	163,454
97/04	Marigold Const.	18.7	107,705	0	0	0	0	107,705

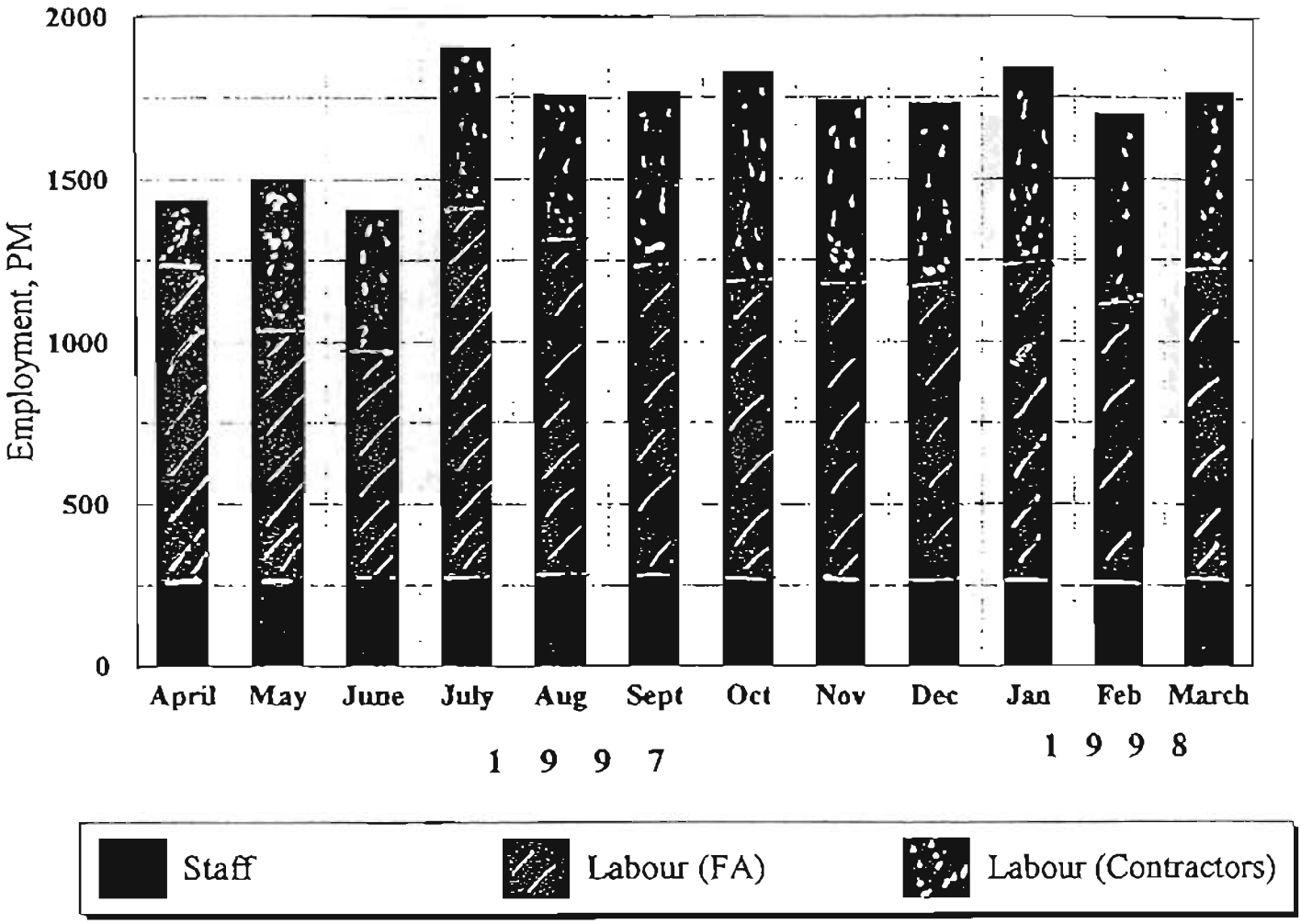
Reg. No.	Contractor	Routine Maintenance		Rehabilitation		Periodic Maintenance		Total paid todate, M
		Length km	Paid todate, M	Length km	Paid todate, M	Length km	Paid todate, M	
97/05	N.T.L Services	20.0	118,817	0	0	0	0	118,817
97/06	Ten Construction	17.2	158,124[2]	0	0	0	0	158,124
97/07	Mamaebana Const.	19.8	110,816	0	0	0	0	110,816
97/08	Tsunyane & Sons	38.1	187,505	0	0	0	0	187,505
97/09	MCT Construction	23.3	137,739	0	0	0	0	137,739
97/10	Qhomane Const.	21.9	115,954	0	0	0	0	115,954
97/11	Bafula Const.	17.6	66,075	0	0	0	0	66,075
97/12	Mphanya Const.	22	128,924 [4]	0	0	0	0	128,924
Total		821.8	4,432,764 [5]	50.4	2,690,095	1.1	39,155	7,162,014

[1] - Includes maintenance of Manamaneng, Mantsonyane and Lesobeng airstrips
[2] - Includes maintenance of Sehonghong airstrip
[3] - Includes maintenance of Qacha's Nek and Sehlatebe airstrips
[4] - Includes maintenance of Semonkong airstrip
[5] - Amount does not include the value of all contractor works for the last month of contract as it was paid in the new financial year

Details of capital development projects carried out by force account units

Road No	Road Name	Length km	Cost Estimate, M	Funded by	For the period 01/04/97-31/03/98			Total to date			Progress to date %
					Output, km	Labour input, PD	Commitment, M	Output, km	Labour input, PD	Commitment, M	
LB05/2	Matlakeng -Ha Monase	12.5	1,883,270	LHRDF	8.9	26,650	1,540,997	11.7	36,538	2,190,955	97
MH03	Nohana - Ha Thetsinyane	15.4	2,732,000	KfW	0.5	2,892	0	14.9	55,722	2,479,083	100
MH01	Ha Kori-Ha Tsiu	23.8	4,393,946	IA	9.6	31,144	1,650,973	12.4	39,497	2,432,668	51
MH16	Shalane-Ha Moena	14.0	2,570,638	IA	3.8	28,591	1,766,289	6.8	38,039	2,436,915	48
LB06	Ha Kotola - Pobeng	11.0	1,429,952	LHRDF	4.1	9,637	658,677	11.5	28,493	1,712,712	100
MK07	Tlokeng-Ha Molikaliko	16.8	3,934,111	IA	0.0	11,334	963,813	7.5	48,970	3,376,846	46
B205	Rakotsoane- Ha Mokotso	10.0	1,497,965	LHRDF	6.0	10,722	798,960	10.0	22,922	1,310,511	100
135	Braakfontein-Ha Mokotso	12.4	1,755,287	KfW	7.7	17,910	1,602,253	7.7	17,910	1,258,446	62
B204	Ha Matela-Ha Baroana	3.4	555,300	MOT	1.9	5,070	310,506	1.9	5,070	310,506	55
C511	Setibing-St. Bernard	11.5	4,215,806	LHRDF	8.1	46,111	3,044,376	8.1	46,111	3,028,031	70
Total		130.8	24,968,275		50.6	190,061	12,336,844	92.5	339,272	20,536,673	

J2 Employment generated by category



J3 Overall physical progress