ADMINISTRAÇÃO NACIONAL DE ESTRADAS

Final Report
COST COMPARISON STUDY

MOZAMBIQUE REGIONAL ROADS

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Prepared for the
DIRECÇÃO DE ESTRADAS REGIONAIS
By

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ILO

ASDI

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LIST OF ACRONYMS AND ABBREVIATIONS

ANE	National Roads Administration
ASDI	Swedish International Development Agency
ASIST	Advisory Support, Information Services and Training for Employment-Intensive Infrastructure Development
CFE	Centro de Formação de Estradas (Roads Training Centre)
CIF	Cost insurance and freight
DEN	Directorate of National Roads
DEP	Provincial Road Departments
DER	Directorates Regional Roads
DET	Departamento de Estradas Terciarias (Tertiary roads department of ECMEP)
DFID	Department for International Development of the UK
DNEP	Departamento Nacional de Estradas e Pontes (Department of Roads and Bridges)
DPOPH	Provincial Departments of Public Works and Housing
EB	Equipment-based
ECMEP	Empressa Comercial Manetenção de estradas e Pontes
EIRR	Economic Internal Rate of Return
EM	Emergency maintenance
ERP	Economic Rehabilitation Program
FOB	Free on board
FR	Full rehabilitation
FRELIMO	Frente de Libertação de Moçambique
FRP	Feeder Roads Programme
GDP	Gross Domestic Product
GOM	Government of Mozambique
IFPRI	International Food Policy Research Institute
ILO	International Labour Organisation
IMT	Intermediate Means of Transport
IRI	International Roughness Index
IRR	Internal Rate of Return
LB	Labour-based
MOP	Ministry of Planning
MZM	Mozambique Meticais (Mozambiquan Currency)
NIS	National Institute of Statistics
NPV	Net Present Value
PARPA	Action Plan for the Reduction of Absolute Poverty
PIR	Poverty Impact Ratio
PM	Periodic Maintenance
RM	Routine Maintenance
RMI	Road Maintenance (now Management) Initiative
SCF	Standard Conversion Factor
SI	Spot Improvement
SWK	Scott Wilson Kirkpatrick & Partners
UEM	Eduardo Mondlane University
UNESCO	United Nations Educational, Scientific and Cultural Organisation
US$ or $	United State Dollar
VAT	Value Added Tax
VOC	Vehicle Operating Cost
WB	World Bank
ZAR	South Africa's Currency

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CURRENCY EXCHANGE RATE

1 US$ = Approx. 24,000 Mozambique Meticais (MZM)

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1 EXECUTIVE SUMMARY

The National Roads Administration of Mozambique (ANE) formerly (DNEP) has been running a labour-based feeder roads programme since 1982. From small beginnings the programme has grown to one of the largest labour-based programmes in Africa. Over the years from 1999 along with the reforms of the roads authorities in Mozambique the programme has been institutionalised within the Directorate of Regional Roads (DER) of ANE which is responsible for strategy formulation and implementation throughout the country. The reforms have also meant a shift from force account operations to private contracting for the feeder roads programme. The contracts for feeder roads are awarded through the Provincial Departments of Public Works and Housing (DPOPH) who are also responsible for awarding all contracts for repair, rehabilitation, improvement and maintenance of Tertiary roads within the respective Province.

It is imperative for ANE to have a clear picture of the financial and economic implications of the choice of technology for carrying out roads works in order that it should advise both government and roadwork implementing agencies. ANE and its directorates DER and Directorate of National Roads (DEN) also need to be fully aware of opportunities of technology choice for planning and budgeting purposes. With these imperatives in mind ANE approached the International Labour organisation (ILO) to carry out a cost comparison study between roadworks done by labour-based (LB) methods and those done by equipment-based (EB) methods. The ILO, especially the ASIST programme has experience in performing these comparison studies in a number of countries and programmes throughout Africa. The ILO-ASIST appointed I.T. Transport Ltd. to carry out the study and this document forms the study report.

A team of four people carried out the study. This team consisted of two international experts and two local experts. The international staff were used to design the study, oversee data collection, carry out final analysis of the results and finalise the report. The local experts collected and collated the data and made inputs into the report. Detailed data on cost of all projects undertaken over the period 1997 to 2002 by the four Provinces of Nampula, Zambezia, Manica and Gaza were collected and studied.

While most of the contracts had good records, a certain number presented inconsistencies that needed to be adjusted or, in some cases, data that had to be eliminated. Difficulties were experienced with the road project data in three ways: the availability of data differed between the provinces and between different contractors; the floods in 2000 had destroyed all data for Gaza so good data were only available after that date; and some contract descriptions were not consistent with the data recorded. There were a total of 87 contracts for which data were made available for this study. The data were from four provinces (Gaza, Manica, Nampula and Zambezia) and spanned over a period of 6 years (1997-2002). The contracts involved a total length of 4,255 km of roads. A total of 67 schemes (77% of the total schemes) have been found suitable for a full analysis. Those schemes which were excluded from the full analysis either have incomplete data or have data of questionable quality.

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The schemes were implemented using different types of technologies – LB, EB and mixed.[1] The use of LB methods constitutes approximately 44% of the overall number of schemes and 51% of the schemes found suitable for full analysis.

To overcome the difficulties with the collected data the anomalous data were rejected and projects giving consistent data were used in the analysis. The collated data were standardised by including the averaged basis cost figures calculated from the filed data collected into a model road project for the different investments and technologies. Thus ensuring that comparison of costs is like to like. A large amount of National financial data were also collected and input onto the overall analysis to enable the team to calculate annual price indices, standard equipment ownership costs, shadow prices etc.

The main results of the study show that for different types of intervention from full rehabilitation to routine maintenance LB methods have both a financial and an economic advantage over EB methods ranging from 31% (economic advantage routine maintenance) to 64% (financial advantage Periodic Maintenance) with the advantage for full rehabilitation falling in between at around 50%. Further analysis shows the break even wage rate for unskilled labour to be between US$3.98 and US$4.12 per day. This figure is consistent with studies conducted by the ILO in other countries which also came to figures around US$4.00

Other economic indicators for the standard 6m wide gravel surface road with standard interventions and typical traffic are calculated at EIRR of 34% for LB option and 17% for EB, NPV of 0.324 for LB and 0.104 for EB and NPV/cost ratio 0.36 for LB and 0.09 for EB. This together with a 20% advantage to LB methods in the poverty impact ratio and a 400% to 600% advantage in employment generation would indicate that under present economic conditions in Mozambique LB methods should be seriously favoured by Government, Financiers, ANE and contractors. ANE may wish to consider setting targets for a proportion of work to be done by LB methods as it has already done successfully for competitive tendering of roads projects by the Provinces.

Graphs indicating appropriate levels of investment for different interventions and traffic volumes exist in the “economist guide to Appraisal of investments in improved rural access” (DFID 2001). ANE may wish to consider production of similar charts specific to the Mozambique conditions to assist planners within road fund, ANE and the DPOPH in their work.

As part of the study, the team looked at three main previously conducted social impact studies from Mozambique. The purpose of this review was to draw together common issues and conclusions that would also influence the choice of technology from a social perspective. The results of this review show consensus between the previous studies on certain key factors that relate to road work investments. All the studies agree that road improvement is necessary for social change but that it is not in itself an engine of change but a “catalyst”, a “pre-requisite” or “facilitator” of that change. The studies also agree that social and socio-economic change affected by road improvement or rehabilitation takes time- up to 5 years for objectively verifiable effects. During this time maintenance of the roads is vital to the fragile development in the hinterland of the road.

[1] The terminology “mixed” came from the organisation that provided the data. No consistent basis for such classification could be established after the examinations of different criteria used to differentiate road construction technologies (for example, proportion of labour, proportion of equipment etc.)

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Of the positive effects observed within communities after road rehabilitation the most significant are to do with a reduction in vulnerability, improved access to social services, increased food production, increased availability and use of transport including IMTs and small increases in employment opportunities. All these factors are observed (by the studies investigating this issue) to be enhanced and expedited when the original roadwork initiative and subsequent maintenance is carried out by cash paid LB methods.

The expected marketing improvements for the rural farmers had not been observed since market forces and outsider traders and middlemen have taken quicker advantage of the improved road access to enter the area to purchase agricultural produce at lower farm prices. Other observed negative influences of improved access to isolated communities were increased illegal logging, charcoal burning, and higher incidence of HIV/AIDS.

The biggest single effect of road rehabilitation is positive and is the slow and increasing realisation on the part of the members of the community that opportunities exist and a consequent willingness to invest the time and effort required to change, having seen that the effort can now bring reward. Utilising LB methods can increase the stimulus to development by injecting initial amounts of cash into the local system.

Overall this report recommends that, due to the determined benefits, financial, economic and social, of using LB methods for road rehabilitation and maintenance, road authorities in Mozambique should encourage the utilisation of this technology wherever possible. This can be done by using incentives for the use of labour in the contract documents, further training of both contractors and provincial staff and study tours for ANE staff to visit successful programmes in other countries.

The report further recommends that contract descriptions be standardised to make data collected easier to analyse and that the reporting system be amended so that provinces can better track the advantages of technology choice.

2 INTRODUCTION

2.1 Background

The report details the results of a study undertaken in Mozambique between October 2002 and May 2003 to determine the differences in both financial and economic cost of roadworks carried out by labour-based (LB) methods on the one hand and equipment-based (EB) methods on the other. This study was undertaken as part of the baseline information for planning for the Directorate of Regional Roads (DER) of the National Roads Administration (ANE) of Mozambique. The study was managed by the ILO-ASIST programme for Africa and funded by the Swedish International Development Agency (ASDI) as part of the grant for support to the Feeder Roads Programme (FRP) of DER. Appendix I presents the terms of reference for the study.

DER needs a sound basis on which to take decisions about technology choice for different rehabilitation and maintenance investments on roads of different categories under its mandate. DER also has the responsibility to advise Provincial and municipal authorities on technology choice among other matters for road work in their areas. The report of this study will give an objective basis from which to do this and will aid the decision making process.

In addition the study complements other similar studies undertaken by the ILO-ASIST programme in other countries and adds to the growing bank of information about the relative costs of LB and EB roadwork in various African countries. As such the study supports the work of ILO-ASIST in its advocacy of employment generating technology and gives financing agencies a firm basis from which to justify LB programmes and inputs with a direct link to good governance, economic viability and pro-poor decisions.

The labour-based roads programme (FRP) in Mozambique has enjoyed the support of the Ministry of Public Works and Housing (MOPH) and of senior staff in the National Road Administration (ANE) since its inception in 1982. Due to this high-level support, it has grown into one of the largest institutionalised LB road programmes in sub-Saharan Africa. The recent development of the FRP has been accompanied by major changes over the past years in the way that the road network is managed in Mozambique. As part of the World Bank sponsored ROCS programme, reforms based on the Road Maintenance (now Management) Initiative (RMI) have been introduced. Under these reforms, a Road Board with public and private representation was created in mid 1999. This board manages ANE. The Directorates of National (DEN) and Regional (DER) Roads as well as the Road Fund (FE) were established as components of ANE at the end of 1999. Tertiary, Urban and Unclassified roads fall under the responsibility of DER.
The GOM is committed to a policy of decentralisation in the management of Tertiary and other Regional Roads. Authorities at the Provincial, Municipal and District levels will be responsible for all work to be carried out on Regional Roads including the choice of technology and the selection of contractors, whilst DER will have a co-ordinating and advisory role. The FRP has started to work on the institutional strengthening of both the DER and the Provincial Road Departments (DEP). Asdi and DFID are together planning a successor programme to the FRP.

2.2 Study Objectives and Purpose

LB methods have been demonstrated to be viable and practical in creating a national

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resource for the rehabilitation and maintenance of rural roads. The use of employment-friendly techniques in infrastructure provision forms a part of the government's Road Policy, and this is reflected in the aims and objectives of the Road Administration. The practical implementation of this policy requires that it is supported by sound evidence, both to confirm the decisions taken to use LB techniques where appropriate, and to demonstrate to those involved in the choice of construction method at provincial and district level that they can offer significant political, social, economic and technical benefits.

The objective of the study is to establish evidence of the financial and economic cost-competitiveness of LB technology used in rural road construction and maintenance. The study will also review the socio-economic impact studies of the road sector that have been carried out under the FRP and draw out common conclusions about the socio-economic benefits of using LB methods.

2.3 Methodology

The study was carried out through the collection of data from road work contracts carried out between 1997 and 2002 on National and Regional roads in the provinces of Nampula, Manica, Zambezia and Gaza in Mozambique. Data concerning the cost of the contracts both from the client and the contractors' points of view was collected. The sources of this data were the Roads Fund records of contracts awarded and contract payments made, DER records of contracts awarded and physical and financial progress reports, The DPOPH records of contracts, contractors and physical and financial progress. Finally by far the largest amount of data was collected from the contractors records of work carried out.

Contractors were visited and asked to provide information from their records of contract type and choice of technology used (LB or EB) inputs and expenditures to the various contracts and payments received. These inputs included manpower (split into skilled, unskilled, and supervisory), overheads associated with each contract, machine hours of input (including records of downtime, maintenance and repair expenditure), profit margin and payments received. Not all contractors were able to provide such detailed records and those that could were not able to provide full sets of information for all contracts under consideration.

All these data were consolidated by the study team members collecting the data onto an Excel spreadsheet for transmission to the analysis team members in UK.

In addition to the contract data collected considerable economic data for Mozambique needed to be collected for the analysis. This data were collected by specialised team members and entered into special computerised forms for analysis. Data included inflation and growth rates for the country, depreciation data, population and poverty data among other economic figures covering the period of the study.

It was assumed that the data collection phase would be logistically difficult and sensitive since contractors were being asked to reveal how they spent their money, and that this phase would take the majority of the time of the study. It was further assumed that once the data were collected it would be a complicated but short term task to analyse the data to produce the required results. In the event the opposite proved to be closer to the fact.

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3 SOCIO-ECONOMIC BACKGROUND OF MOZAMBIQUE

During the course of the study a synoptic description of the socio-economic situation pertaining in Mozambique was elaborated. This description is reproduced in full as Appendix II of this report. Here in this chapter some of the key features and charts have been extracted to give a summary of the situation.

3.1 Country Profile

3.1.1 Independence, civil war and political process

Mozambique is a large country in the Southern African region with an area of 799,390 Km^2 (13,000 Km^2 of inland waters), and a population of 18,082,523 inhabitants. The modern independent nation-state of Mozambique was formed after independence in 25, June 1975. The General Peace Agreement established in 04, October 1992 was the culmination of a wide ranging dialog in which various social sectors took part.

3.1.2 The Economic Reform Program

It is estimated that between 1980 and 1987, total GDP fell by at least 25 % in real terms and exports declined by 75%. The Government introduced an *Economic Rehabilitation Program (ERP)* in January 1987. The major policy changes include movement toward market-determined prices and a greater interplay of market forces; movement toward a more realistic exchange rate; restructuring of certain institutions; tightening monetary and fiscal policy; and restraining growth in wages (GOM & WB, 1992). Average real GDP increased at an estimated 5.3% per year, despite worsening security. The main source of this growth was small-scale agriculture and manufacturing. The reform program, however led to an initial jump in prices, with the overall domestic price level increasing by 163% in 1987, 50% in 1988, 42 % in 1989, and 49% in 1990 (GOM & WB, 1992).

3.1.3 Government strategy for poverty alleviation

To deal with the situation of poverty, its determinants, and economic constraints, the government decided to develop a comprehensive and integrated poverty reduction strategy.

In concrete terms, the poverty reduction strategy in Mozambique is based on six "fundamental areas of action" namely: (i) education; (ii) health; (iii) agriculture and rural development; (iv) basic infrastructure; (v) good governance; and (vi) macro-economic and financial management.

> "A fundamental role of the State in stimulating a market economy and expanding opportunities for the poor lies in the development of basic infrastructure. Improvements in the road network will permit better access to market and a reduction in costs, and will facilitate communication and mobility, especially for those who live in rural areas and depend on agriculture. In parallel, the provision of water and energy is fundamental to the development of human capital and the expansion of national output. Priority in the rehabilitation and construction of basic infrastructure will be given to those areas of the country with largest population and highest levels of poverty" (GOM, 2001).

3.2 Macroeconomic Performance

Table 3.1: Trend in real GDP and inflation

	1996	1997	1998	1999	2000	2001
GDP real growth rate (1996=100)	6.4	11.1	12	12.6	1.6	13.9
Inflation	16.3	5.8	-1.3	4.8	11.4	21.9

Source: Ministry of Planning and Finance, Mozambique **&** National institute of Statistics (http://www.ine.gov.mz/Ipc2/indprec.htm)

Table 3.1 shows that the real GDP growth rate was 11.1 %, in real terms, between 1996 and 1997. The main sources of this growth were the increase of external investment, the expansion in the electricity and water network across country, the introduction of fiscal incentives for private investments, and the increase of output.

Table 3.2 shows that Mozambique's economy relies heavily on external finance to meet the gap in State Budget. Actually, about 60% of the State Budget is support by external financing.

Table 3.2: Investment and saving as percentage of GDP

	1999	**2000**	**2001**	**2002**
Gross investment	23.6	19.9	26.6	41.8
Private investment	14.2	8.3	11.5	29.2
Public investment	9.3	11.5	15.0	12.5
Domestic Saving	1.2	0.6	5.7	0.4
Private Saving	2.3	2.2	9.8	4.0
Public Saving	-1.1	-1.6	-4.1	-3.6
External Saving	22.4	19.3	20.9	41.4

Source: Ministry of Planning and Finance, 2001

3.2.1 Inflation, exchange rate and rate of interest

During 1987-1996 there was an upward trend in the exchange rate of (Meticais *vis-a-vis* US$). The exchange rate remained stabilized around 11700 on average over the period 1996-1999. Since then the exchange rate picked up, reaching 20,454 MZM/US$, in 2001. The exchange rate between Meticais against South Africa currency (Rand) remained flat around 2,400 MZM/ZAR on average over the period 1996-2001.

3.2.2 Public finance

One of the most critical issues for long term macroeconomic stability is public revenue mobilisation. Although revenue improved since 1991, total revenue to GDP ratio remains at about 13% of GDP in 2001.

Real expenditure peaked in 1994 owing to food aid and other assistance after the end of civil war. As food aid declined from 1994, both current and total expenditure declined. The increase in spending in the latter half of the nineties was supported by swift growth of concessional assistance (grants plus net external borrowing): 20 percent per year from 1996 to 1999. (MOP & WB, 2000).

GDP also grew strongly during the latter half of the nineties, but not as swiftly as did expenditures. The expansionary trend initiated in 1996 was aggravated in 2000, when expenditures rose by 16 percent in real terms compared to the previous year.

In general, Mozambique has been able to swiftly expand its spending program in the latter half of the 1990's while improving macroeconomic stability, party due to the high levels of

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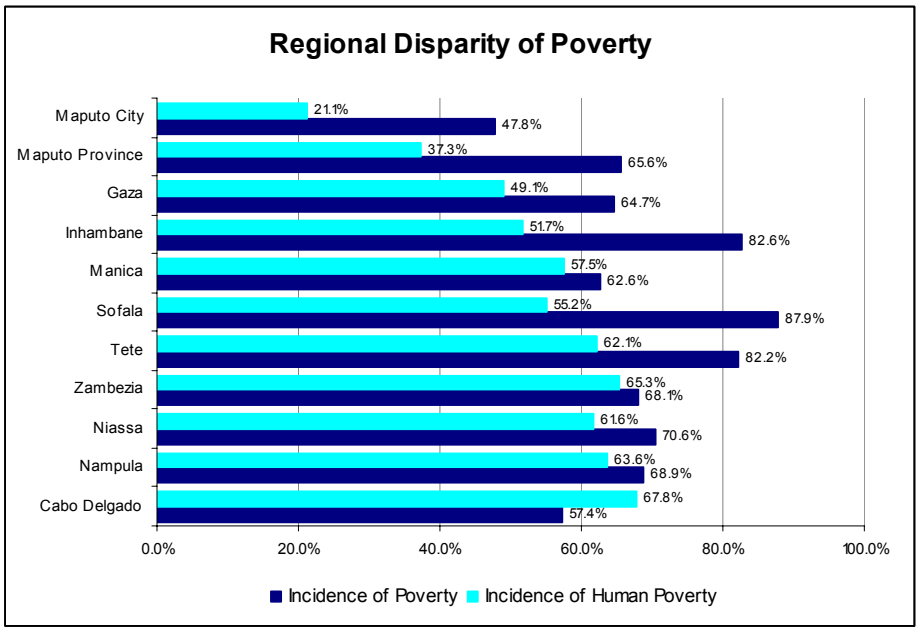
donor assistance, while revenues have remained relatively flat as percentage of GDP since 1995 *(World Bank, 2001).*

One critical element that has helped to offset the large trade deficit has been the improvement in the capital account due mainly to increasing the external borrowing, the foreign direct investment and the savings under the debt relief initiatives.

3.3 Poverty, Population and Employment Situation

3.3.1 Poverty situation in Mozambique

Figure 3.1: Regional disparity of poverty



Source: Action Plan for the Reduction of Absolute Poverty (2001-2005)

It can be seen here that the Provinces of Sofala and Inhambanae have the highest incidence of poverty measured by the percentage of the population having an annual income of less than the equivalent of $1 per day while Cabo Delgado and Zambezia Provinces have the highest incidence of Human poverty measured by the methods of Human poverty index of UNDP. The human poverty index scores against a matrix of indicators based on a variety of social factors. These factors include housing, land holding, stock holding, Life expectancy, literacy, access to health and social services, education. The human poverty index is considered to be a more comprehensive measure of overall poverty than a simple income poverty analysis.

Population characteristics

Between 1950 and 2002 the population growth rate rose from 1.5% per year in 1950-1955 to 1.8% in 1960, 2.3% in 1970, 2.7% in 1980, 2.6% in 1991, and 2.4% in 2002. This means that at the start of the 1980s, the population growth rate reached its highest level of the past five decades, and probably of the entire 20th century (NIS, 1997).

The average density as a whole for the country is 23 inhabitants per square kilometre. But density varies greatly from Maputo City, with the highest population density, of around 3482

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inhabitants per square kilometre, to Niassa province, of lowest, just seven inhabitants per square kilometre.

The 1980 census found an average of 4.3 persons per household, and the 1997 census showed a slight reduction to 4.2. However, Demography and Health Survey 1997 gave an average household size of 4.6 persons.

3.3.2 Employment in Mozambique

Economically active labour force

According to the most recent estimates drawn by the National Institute of Statistics (NIS), 62% of the Mozambican population of seven years of age and above is economically active (NIS, 1998). The percentage of population that is economically active is markedly higher in rural areas than urban areas (66.6% versus 40%). In the view of the NIS, this result is to be ascribed to the fact that in rural areas almost all females work on the machambas (fields), while in urban areas there are more women who carry out "domestic work" and who are students. In the urban areas, in fact, only 32% of women are considered economically active, against 69% in rural areas (NIS, 1998).

The wage labour force and employment trends

On the basis of the National Household Survey, it is possible to calculate tentatively the size of the country's wage labour force. The 1997 census counted 15.7 million people although, due to census omissions, the total 1997 population is estimated at over 16 million (NIS, 1999). The economically active population was estimated at 7.4 million. On the basis of estimates presented in *Understanding Poverty in Mozambique: the First National Assessment*, around 10% of these 7.4 million people can be defined as working for a wage or some form of payment during the week preceding the interview (DPDS, UEM and IFPRI, 1998). According to the IAF97/97 data, therefore, the wage labour force consists of about 740.000 people. (UNDP, 1999).

A 1997 study prepared by UNESCO, in collaboration with the ILO, based on official statistics and "rough estimates", maintained that around 1.9 million individuals were employed for some sort of wage in Mozambique. Although the study assumed a total population of 18 million, the reported figure exceeded the estimate derived from the IAF96-97 data (740.000) by a factor of 2.5. It is also interesting to note that this estimate is biased towards formal sector employment. (UNDP, 1999).

Table 3. 3: Estimated wage labour by categories

Private sector formal employment	500.000
Non agricultural	460.000
Agricultural	40.000
Public service	100.000
Domestic service	150.000
Non-household agricultural enterprises	250.000
Non-agricultural informal	250.000
Migrant workers	150.000
Total	**1.900.000**

Source: ILO/UNESCO 1997: Table 3, in UNDP (1999)

Whether the DPDS estimate or the UNESCO estimate is correct still means that between 80% to 90% of the working population is not employed either formally or informally for any sort of wage. In both Urban and Rural areas of the country there is a high need for cash paid employment to stimulate economic activity.

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4 FINANCIAL COST COMPARISON

4.1 Introduction

This chapter compares the costs of different types of road interventions using labour and equipment-based methods at market prices. Next sections discuss: (i) the main characteristics of the schemes that have been analysed in the study along with the steps taken to make the data useable; (ii) results of the initial analysis; (iii) justifications and descriptions of a more practical approach; and (iv) the comparative costs of labour and equipment-based methods.

4.2 Main Characteristics of the Schemes Considered in the Study and Making the Data Useable

There were a total of 87 contracts for which data were made available for this study. The data were from four provinces (Gaza, Manica, Nampula and Zambezia) and spanned over a period of 6 years (1997-2002) (Table 4. 1). The contracts involved a total length of 4,255 km of roads. While Appendix III provides a summary of the schemes, Appendix IV provides a full list of the schemes. The main data source was the ECMEP (61%), although DET (LB brigades of ECMEP) and CFE (Roads training Centre) provided data on some schemes in Manica and Nampula provinces respectively. However, a total of 67 schemes (77% of the total schemes) have been found suitable for a full analysis. Those schemes which were excluded from the full analysis either have incomplete data or have data of questionable quality.

The schemes were from different types of roads – national, rural or unclassified roads (Table 4. 2). A majority of the data were from rural roads – in the case of both total number of schemes (57%) and the number of schemes found suitable for further analysis (60%). The schemes were implemented using different types of technologies – LB, EB and mixed[2] (Table 4. 3). The use of LB methods constitutes approximately 44% of the overall number of schemes. In the case of schemes found suitable for further analysis they comprise some 51% of the schemes.

Table 4. 1: Sources of data, number of schemes, length and suitability of data

Province	Total scheme (total length in km)	Suitable scheme (total length in km)	Comments
Gaza	6 (123)	5 (113)	Data from ECMEP
Manica	2 (117)	2 (117)	From CFE
Nampula	45 (1,932)	41 (1,655)	DET 31 & ECMEP 14
Zambezia	34 (2,083)	19 (1,109)	ECMEP
Total	87 (4,255)	67 (2,994)	

[2] The terminology “mixed” came from the organisation that provided the data. No consistent basis for such classification could be established after the examinations of different criteria used to differentiate road construction technologies (for example, proportion of labour, proportion of equipment etc.)

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Table 4. 2: Number of schemes and the road type

Province	Total Scheme			Suitable scheme		
	National Roads	Rural Roads	Unclassified Roads	National Roads	Rural Roads	Unclassified Roads
Gaza	0	4	2	0	3	2
Manica	0	2	0	0	2	0
Nampula	13	32	0	12	29	0
Zambezia	14	12	8	7	6	6
Total	27	50	10	19	40	8

Table 4. 3: Number of schemes and technology type

Province	Total Scheme			Suitable scheme		
	EB	LB	Mixed	EB	LB	Mixed
Gaza	0	5	1	0	5	0
Manica	1	1	0	1	1	0
Nampula	11	28	6	9	27	5
Zambezia	13	4	17	8	1	10
Total	25	38	24	18	34	15

4.2.1 Availability of types of information

Apart from the road names, contractors' names, contract numbers, types of technology used, types of interventions undertaken, road lengths, the data comprised the following information (except in the case of Gaza province; in this case the available information was in the form of summary costs without any costs break-up):

- Total working hours for different categories of skilled and unskilled labour against each contract including average salaries/wages for different types of labour in different years;
- Equipment utilisation, including supervision vehicles, data for different schemes;
- Amount and types of fuel, lubricants and tyres consumed by the equipment per hour of operations with their unit costs. Costs of repairs of equipment per hour of operation were also available; and
- Amount and types of materials used in the implementation of the schemes with their unit costs.

4.2.2 Making the data useable for further analysis

- **Calculation of unit costs of owning and operating the equipment**

  Although the data contained the unit costs related to equipment's depreciations and operations, no rational basis of establishing such figures was found. This required us to calculate the unit operating costs, including owning and maintenance costs. This involved the following steps:

  - Using the collected financial purchase costs, working hours per year, operating life of the equipment, interest rate of borrowing the per hour costs of equipment depreciation and interest payments were calculated for each piece of equipment;
  - Unit costs of fuel and lubricants, maintenance, overheads, tyres, operators' wages were then added to the depreciation and interest payment costs to calculate the total operating costs for different types of equipment.

Appendix V presents the list of equipment, including their makes and models, and the disaggregated financial costs to own and operate them. A spreadsheet model developed as a part of the study helped in the cost calculations.

- **Calculation of costs of labour input, material, overheads, tax**

  As mentioned in the previous section, annual staff and labour input data were available along with wages and salaries. Labour costs, unskilled, skilled and supervision labour, were calculated using the available information. Disaggregate information on wages and salaries for different types of labour and staff helped in the calculation of total costs of skilled, unskilled and supervision labour. Materials costs calculation used a similar approach.

  Unfortunately, the field data did not have any information on the overheads. Faced with this problem Nampula ECMEP was approached for detailed data on annual revenue and overheads. Table 4. 4 provides the summary of the information provided by Nampula ECMEP in different years. It can be seen that the overheads of Nampula ECMEP has a range of 6.7% to 12.3% of the total revenue between years 1997 and 2001. The average overhead cost is approximately 9%. A round figure of 10% of the total equipment, material and labour costs is used in the calculation of overheads.

Table 4. 4: Annual revenues and overheads of Nampula ECMEP (Million MZM)

Year	1997	1998	1999	2000	2001	Total
Total Revenue	7,661	10,172	9,912	31,794	22,988	82,526
Total Overheads	605	879	948	2,128	2,819	7,378
Overheads as a % of Total Revenue	7.9%	8.6%	9.6%	6.7%	12.3%	8.9%

A 10% profit margin for contractors was added to the labour, materials, equipment, supervision vehicles and overheads costs calculated in order to calculate the total before-tax costs of the contract. The after-tax costs of the contracts were calculated by adding an extra 5% to the before-tax costs of contract for schemes implemented on or before 1998. For contracts after 1998 Value Added Tax (VAT) of 17% was added to the pre-tax contract amount. As these calculated costs were at current prices; they were subsequently converted to 2002 prices (or constant prices) using conversion factors. The conversion factors were calculated with the help of rates of inflation in Mozambique in different years. Appendix VI provides the details of the calculated conversion factors. The 2002 costs were then converted to US dollar figures by using an exchange rate of 1 US $ equal to 24,000 MZM.

4.3 Results of the Initial Analysis

As discussed earlier, reliable data from a total of 67 schemes were available for analysis. They types of interventions included full rehabilitation, periodic maintenance, spot improvements, emergency maintenance and routine maintenance. However, for the sake of proper comparison spot improvements and emergency maintenance schemes were excluded from the unit costs analysis. There were a total of 29 such schemes. Table 4. 5 presents the results of the unit costs analysis of the 38 schemes (under full rehabilitation or periodic maintenance or routine maintenance) that came with complete data. In the case of full rehabilitation data were only available for rural roads – with 2 and 11 roads respectively used EB and LB methods. While in the case of EB methods the average per kilometre cost of full rehabilitation was US$ 2,144 (costs ranged from US$1,114 to US$3,114 per km), in the case of LB methods the average per kilometre cost was US$2,945 (costs ranged from US$ 1,479 to US$8,271). Periodic maintenance costs data were available for a total of 6 roads – 1 from national roads, 2 from rural roads and 3 from unclassified roads. The average costs of periodic maintenance ranged from US$498 (national roads) to US$1,807 (rural

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roads). Data for routine maintenance were available in the case of all types of roads. However, except in the case of rural roads there were no data available for routine maintenance that used LB methods. The average routine maintenance cost of rural roads that used LB methods was US$618 (costs ranged from US$218 to US$979). In overall terms, the average costs of full rehabilitation were US$2,114 and US$2,945 for EB and LB methods respectively; similar costs for periodic maintenance were US$973 and US$626 respectively. In the case of routine maintenance the average costs were US$829 for EB methods and US$758 for LB methods.

Table 4. 5: Units costs of different types of roads for different technology types

	EB		LB	
	Number of schemes	Av. Cost per km in US$ (Range)	Number of schemes	Av. Cost per km in US$ (Range)
National Roads				
FR	N.A	N.A	N.A	N.A
PM	1	498 (498-498)	N.A	N.A
RM	4	493 (194-796)	5	925 (194–1605)
Rural Roads				
FR	2	2,114 (1,114-3,114)	11	2,945 (1,479 – 8,271)
PM	1	1,807 (1,807-1,807)	1	626 (626-626)
RM	4	1,165 (400-1,554)	6	618 (221–979)
Unclassified Roads				
FR	N.A	N.A	N.A	N.A
PM	3	855 (463–1,628))	N.A	N.A
RM	N.A	N.A	N.A	N.A
Overall				
FR	2	2,114 (1,114-3,114)	11	2,945 (1,479–8,271)
PM	5	973 (463-1,807)	1	626 (626-626)
RM	8	829 (194-1,554)	11	758 (194-1605)

Note: FR- Full Rehabilitation; PM – Periodic Maintenance; RM – Routine Maintenance and N.A – No such scheme is available for analysis

A closer look at the results presented above poses the following problems:

(i) The unit costs of full rehabilitation and periodic maintenance of roads were too low if they are compared to unit costs data from other countries. For example, the average unit cost of rural feeder road rehabilitation in Uganda was US$8,000 at 1999 price (Taylor and Bekabye, 1999). Recent analysis shows the average cost of full rehabilitation of similar types of roads[3] using LB methods in Uganda is approximately US$14,000 (I T Transport, 2002). A similar figure from Zimbabwe (1997-2000) is US$ 13,000 per km. The Uganda analysis also suggests an average unit cost of US$ 7,800 for periodic maintenance. This shows that the calculated full rehabilitation and periodic maintenance unit costs figures (the average full rehabilitation figures are US$2,114 for EB methods and US$2,945 for LB methods; the average periodic maintenance figures are US$973 for EB methods and US$626 for LB methods) are much lower than the Uganda figure of US$7,800;

[3] The roads involved in such analysis were national gravel roads in Northern Uganda. Although they differ from rural feeder roads (known as district roads in Uganda) in terms of their functions, their geometric features are similar to district roads.

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(ii) The ranges of unit costs values are too high in most of the cases (for example, in the case of full rehabilitation using LB methods the range is approximately US$6,800). This means that the level of interventions differs considerably from one road to another although they are categorised under a similar type of intervention;

(iii) Full rehabilitation data are only available in the case of rural roads for unit costs comparison between LB and EB methods. The unit cost of full rehabilitation of rural roads using LB methods is some 40% higher than its EB counterpart[4]. This is contrary to the findings from other studies. For example, in the case of Uganda the average unit cost of EB methods was found to be roughly 25% higher than its LB counterpart (Taylor and Bekabye, 1999).

4.4 Description of a More Practical Approach

The above sections presented the problems experienced in the comparison of costs between LB and EB methods. These problems forced us to find a more practical approach to calculate the unit costs of road improvements or maintenance using LB and EB methods. While devising such an approach the following strategies were pursued:

(i) the approach will facilitate the comparison of the LB and EB methods in very similar situations that could not be done directly using the field data;

(ii) the approach will make maximum use of the data collected from the field;

(iii) the approach will be as detailed as possible in terms of activities that are undertaken for different types of improvements and maintenance.

4.4.1 Calculation of unit costs for different types of interventions

The following describes the steps undertaken to calculate the unit costs for different types of interventions, full rehabilitation, periodic maintenance and routine maintenance using LB as well as EB methods:

(i) At the onset the items of work based on the types of interventions under both the LB and EB methods were identified along with their quantities;
(ii) Then the input from unskilled and skilled labour and equipment was calculated based on their productivity rates;
(iii) Labour costs, both skilled and unskilled, were calculated using the unit labour costs collected from the field (Appendix VII) provide the details of the calculations);
(iv) Unit machine operating costs calculated from the field data (Appendix V) and the machine usage provided the financial cost of machine input;
(v) Estimated quantities of materials and the unit costs of different materials used in the calculation of the materials costs;
(vi) Costs of supervision labour and supervision vehicles were calculated using the average proportions of labour costs used by these items. Field data provided the basis for calculation of such proportions;
(vii) Overheads (10% of the labour, material and machine costs) and contractors' profits (10% of the labour, material, machine and overheads costs) are added to give the pre-tax costs of improvements and maintenance. A 17% amount of Value Added Tax (VAT) is added to the pre-tax costs that provided the total improvement or maintenance costs.

[4] The average unit cost of full rehabilitation using LB methods may have been influenced by some extreme values.

Appendix VIII provides the details of the costs calculations of the following interventions:

(i) Full rehabilitation using LB methods;
(ii) Full rehabilitation using EB methods;
(iii) Periodic maintenance using LB methods;
(iv) Periodic maintenance using EB methods;
(v) Routine maintenance using LB methods that makes no use of equipment;
(vi) Routine maintenance using LB methods that makes the optimum use of equipment; and
(vii) Routine maintenance using EB methods.

4.5 Financial Costs Comparison of LB and EB Methods

This section compares the costs using LB and EB methods for different types of interventions. While Table 4. 6 presents the unit financial costs of different types of interventions using LB and EB methods, Table 4. 7 presents a proportional breakdown of different financial cost items. It can be seen from Table 4. 6 that the unit cost of full rehabilitation using EB methods is 54% more expensive than the LB methods for comparable roads that involve similar items of works. In the case of periodic maintenance the LB methods have even a higher cost advantage – unit cost of periodic maintenance using EB methods is 64% higher than the LB methods. In the case of routine maintenance the unit cost of EB methods is slightly cheaper than the LB methods that involve no machine use. However, unit cost of LB methods making best possible use of machine is considerably cheaper than its EB counterpart – LB methods have a cost advantage of 40% over their EB counterparts. The intention of using LB methods is to use an optimum mix of labour and machines to achieve a financial objective of cheaper costs and a social objective of generation of maximum employments. Therefore, the case of routine maintenance without the use of machines is irrelevant in our case and is not discussed further in this report.

Table 4. 6: Unit financial costs of different types of interventions using LB and EB methods and cost advantages of LB methods (US$/km)

	LB	EB	Cost difference	Cost Advantage
Full rehabilitation	10,114	15,618	5,504	54%
Period Maintenance	6,635	10,852	4,218	64%
Routine Maintenance [a]	547	516	-32	-6%
Routine Maintenance[b]	362	516	154	43%

Note: [a] – Without the use of any equipment;
[b] – Making cost-effective use of the equipment where feasible

Figure 4. 1, Figure 4. 2 and Figure 4. 3 graphically compare the proportions of different financial costs items between LB and EB methods under different improvements and maintenance options. The proportion of wages and salaries in the case of LB methods in all cases is 24% (although there are differences in the proportions of skilled and unskilled labour costs). This means that approximately a fourth of the road improvement costs are expected to be spent on wages and salaries if the LB methods are employed. Conversely, other than routine maintenance (18%), an insignificant proportion of costs go towards wages and salaries (4% in the case of full rehabilitation and 3% in the case of periodic maintenance) for EB methods.

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Table 4. 7: Financial costs breakdown for different types of interventions

Cost components	Full Rehabilitation		Periodic Maintenance		Routine Maintenance	
	LB	EB	LB	EB	LB	EB
Labour (unskilled)	18%	2%	18%	1%	15%	10%
Labour (skilled including supervision)	6%	2%	6%	1%	10%	7%
Total Labour	**24%**	**4%**	**24%**	**3%**	**25%**	**18%**
Supervision (vehicle)	9%	0.3%	9%	1%	9%	10%
Equipment	34%	64%	34%	66%	37%	43%
Materials	3%	2%	3%	1%	0%	0%
Overheads	7%	7%	7%	7%	7%	7%
Contractors profit & VAT	22%	22%	22%	22%	22%	22%

Figure 4. 1: Financial cost breakdown of full rehabilitation using LB and EB methods

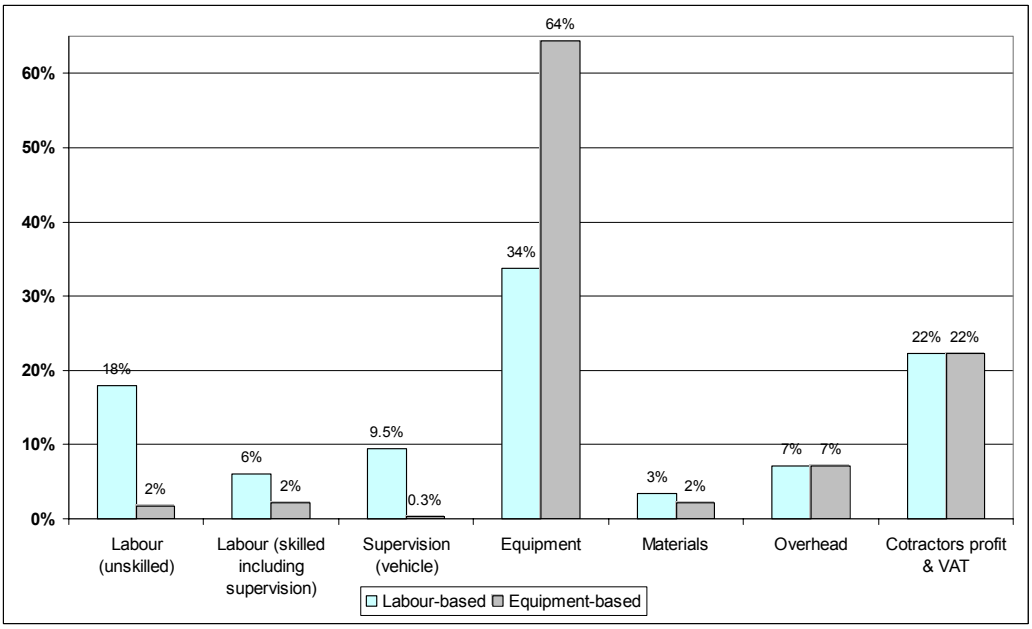

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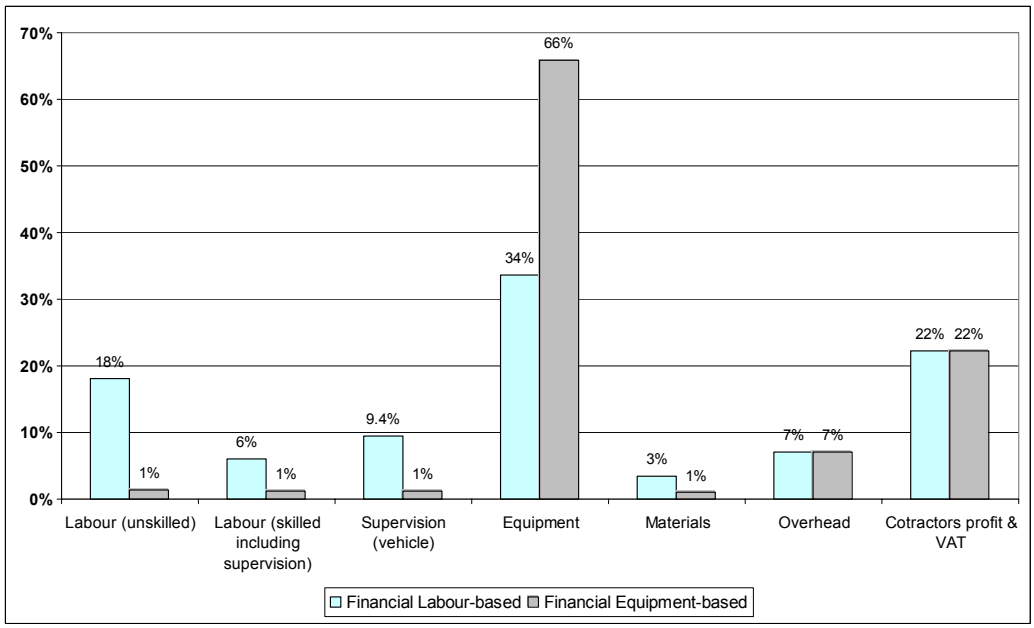
Figure 4. 2: Financial cost breakdown of periodic maintenance using LB and EB methods



The proportions of costs of equipment range from 43% (routine maintenance) to 66% (periodic maintenance) in the case of EB methods. Costs of equipment comprise 64% of the total costs in the case of full rehabilitation. On the other hand the costs of equipment in the case of LB methods range from 34% (full rehabilitation and periodic maintenance) to 38% (routine maintenance) of the total costs. These proportions are approximately a half of the proportions for EB methods. The type of equipment utilised by the two methods of implementation is different. In the case of LB methods the minimum amount of equipment is used. For rehabilitation and periodic maintenance this normally comprises only haulage and compaction equipment appropriate to keep pace with the speed of construction of the labour gangs. On sites with short haul distances and average monthly programmed outputs (1 to 1.5km per month) this equipment would be comprised of 3 or 4 sets of tractor and trailer combinations with an appropriate number of pedestrian vibrating rollers or deadweight tractor towed rollers and towed water bowers. On sites with long haul distances and high output rates (4 to 5 km per month) tipper trucks (5 or 6 number) and self propelled rollers would be utilised. The labour force would then be increased to match the required output. In all the schemes analysed the level of output and haulage distance was low and therefore the first type of equipment combination was used, with tractor and trailer used for haulage and tractor towed rollers for compaction.

On the EB projects analysed the equipment utilised was a combination of mechanical dozers, front end loaders, tipper trucks, motor graders and self propelled rollers with the addition of self propelled bowsers for water and fuel.

Apart from overheads and contractor profits and taxes, supervision vehicle costs involve other significant costs. While in the case of LB methods costs of work supervision vehicles is 9% in the case of all types of interventions, such costs range from 0.3% (full rehabilitation) to 10% (routine maintenance) of the overall costs for EB methods. The findings concerning supervision costs seem justified as it is well known that LB methods need more supervision

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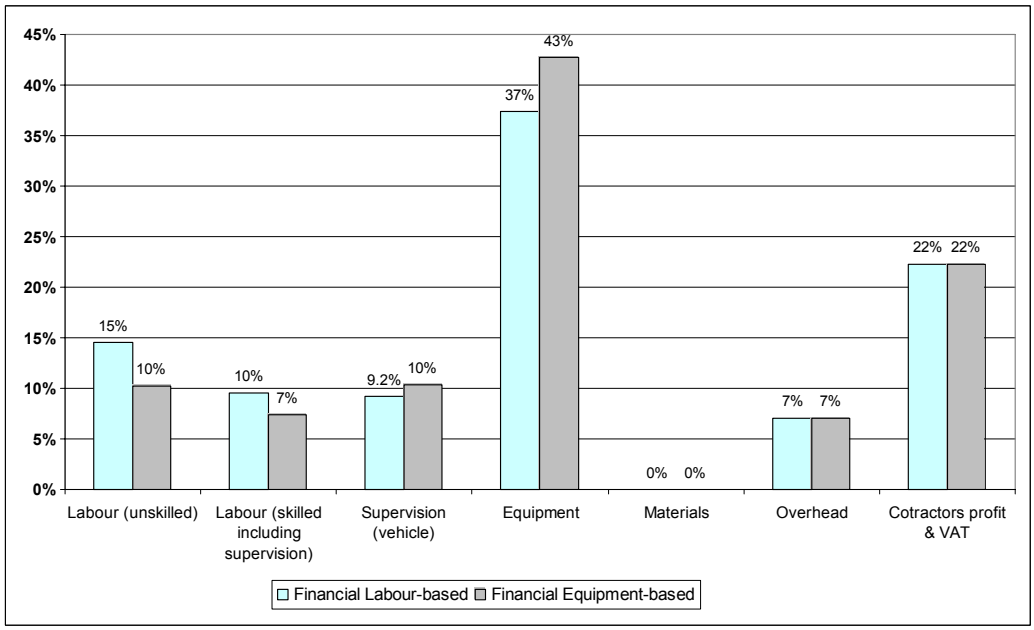
compared to its EB counterparts. The case of higher proportion of supervision vehicle costs in the case of EB methods for routine maintenance can also be explained if considered from the point of economies of scale – in this case the supervision vehicle costs are substantial compared to the low total scheme costs.

Figure 4. 3: Financial cost breakdown of routine maintenance using LB and EB methods



4.6 Summary

LB methods have significant financial advantage over EB methods for rehabilitation and maintenance of a standard 6m wide gravel road. This advantage that ranges between 43% (routine Maintenance) and 64% (Periodic Maintenance) has not been reflected in the contract tenders in most of the programmes and projects in the Provinces.

The proportion of the project cost used on labour in LB technologies is around 25% overall for each type of intervention while for EB methods it is about 4% for rehabilitation and 18% in routine maintenance. The portion of skilled labour and supervision on LB jobs is between 6% and 10% of the overall costs, while only 2% or 3% on EB methods. This level of intensity of supervision on LB projects may go some way to explaining the apparent inertia preventing the uptake of LB methods.

There is a clear need and advantage in supporting further expansion of LB methods in Mozambique. More experience on the part of the contractors and more competition is expected to lead to a general reduction in tendered prices.

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5 ECONOMIC COST COMPARISON

5.1 Introduction

The financial cost comparison in the previous chapter is based on the market costs for all types of inputs – labour, materials, equipment etc. These costs do not represent the costs to the economy. This is mainly due to the existence of taxes, subsidies, overvalued exchange rates, under-employment or unemployment in the economy. For example, the shadow wage rate is used instead of market wage rate to capture the opportunity cost of labour, i.e. the marginal output of the labour forgone elsewhere in the economy because of its use in the project. This is necessary mainly to correct for the existence of unemployment and underemployment in the economy. Usually the shadow price is calculated using the accounting ratio – a ratio of the shadow price and the market price.

The following sections explain the procedures for shadow pricing the labour, equipment etc., compare the economic and financial costs of EB and LB methods in road interventions and finally summarise the contents of the chapter.

5.2 Shadow Pricing of Labour and Equipment

The study uses the following steps in the shadow pricing of labour, equipment, fuel and other costs:

- A Standard Conversion Factor (SCF) was first calculated from the 7 years (1995-2001) data on total import, export, import duties/subsidies and export duties/subsidies in Mozambique. Appendix IX presents details of the calculation of the SCF;

- Shadow wage rates were calculated for both skilled and unskilled labour using methodology proposed by Shahabuddin & Rahman (1992) and Squire & van der Tak (1975). The methodology also used the value of the SCF calculated using the step mentioned above. Appendix X presents the details of the calculation of shadow wage rates;

- The SCF, shadow wage rates, shadow price of fuel and shadow equipment price helped in the calculation of the shadow unit operational price of different types of equipment. Appendix XI presents the details of shadow pricing of fuel. The accounting ratios of equipment price are calculated using the existing taxing regime for different types of equipment. The taxes include import duties, sales tax, VAT etc. Appendix V presents the economic equipment operating costs calculated using the procedure mentioned above. The following accounting ratios are used in the calculation of economic operating costs from the financial operating costs of the equipment:
    - Equipment procurement cost – different accounting ratios calculated from the existing taxing regime on for different types of equipment;
    - Fuel: accounting ratio of 0.59 (Appendix XI)
    - Shadow wage rate of the operators: weighted average accounting ratio shadow wage rate of 0.66 (Appendix X)
    - Other cost items – SCF value of 0.95 (Appendix IX)

5.3 Economic Cost Comparison of LB and EB Methods.

Table 5. 1 compares the unit economic costs of roads rehabilitation and maintenance using LB and EB methods. It can be seen that in all cases the unit economic costs of LB methods are lower than the EB methods. The cost advantages of the use of LB methods range from 58% (periodic maintenance) to 31% (routine maintenance). Close examination of Appendix VIII reveals that the difference of routine maintenance unit costs between LB and EB methods is due to the use of different sets of equipment for grading purpose, use of towed roller and self-propelled roller in the case of LB and EB methods respectively. The other costs are identical.

Table 5. 1: Unit economic costs of different types of interventions using LB and EB methods and cost advantages of LB methods (US$/km)

	Labour-based	Equipment-based	Cost difference	Cost Advantage
Full rehabilitation	6,401	9,656	3,255	51%
Periodic maintenance	4,198	6,640	2,442	58%
Routine Maintenance [a]	245	322	77	31%

Note: [b] – Making cost-effective use of the equipment where feasible

Table 5.2: Economic cost breakdown (percentage) under different types of interventions

Cost components	Full Rehabilitation		Periodic Maintenance		Routine Maintenance	
	LB	EB	LB	EB	LB	EB
Labour (unskilled)	16%	2%	16%	1%	12%	9%
Labour (skilled including supervision)	10%	4%	10%	2%	14%	12%
Total Labour	**26%**	**5%**	**26%**	**3%**	**26%**	**21%**
Supervision (vehicle)	10%	0.3%	10%	1%	9%	11%
Equipment	37%	69%	37%	71%	44%	46%
Materials	5%	3%	5%	2%	0%	0%
Overheads	11%	11%	11%	11%	10%	11%
Contractors profit & VAT	12%	12%	12%	12%	11%	12%

Table 5.2 presents the proportional economic costs breakdown of different costs items. Figure 5. 1, Figure 5. 2 and Figure 5. 3 compare graphically the proportions of economic costs of different cost items between LB and EB methods. The following conclusion can be made by taking a careful look at Table 5.2, Figure 5. 1, Figure 5. 2 and Figure 5. 3:

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- The proportions of labour costs are higher in the case of LB methods compared to EB methods. Although the proportionate differences in the case of full rehabilitation and periodic maintenance are substantially higher (26% against 5% for full rehabilitation, 26% against 3% for periodic maintenance), the difference is only marginally higher in the case of routine maintenance (26% against 21%);

- The proportions of equipment costs are higher in all cases for EB methods than their LB counterparts. While, the range of proportions of equipment costs for EB methods is 71% (periodic maintenance) to 46% (routine maintenance), the range for LB methods is 37% (full rehabilitation and periodic maintenance) to 44% (routine maintenance);

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- Proportional costs of supervision vehicles are considerably higher in the case of full rehabilitation and periodic maintenance for LB methods compared to their EB counterparts. However, in the case of routine maintenance the proportional cost is slightly lower than the EB methods.

- Overheads and contractors profits (VAT is not relevant here as the costs we are discussing are economic costs) comprise about a fourth of the overall costs. This is true both for LB and EB methods.
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Figure 5. 1: Economic cost breakdown of full rehabilitation using LB and EB methods

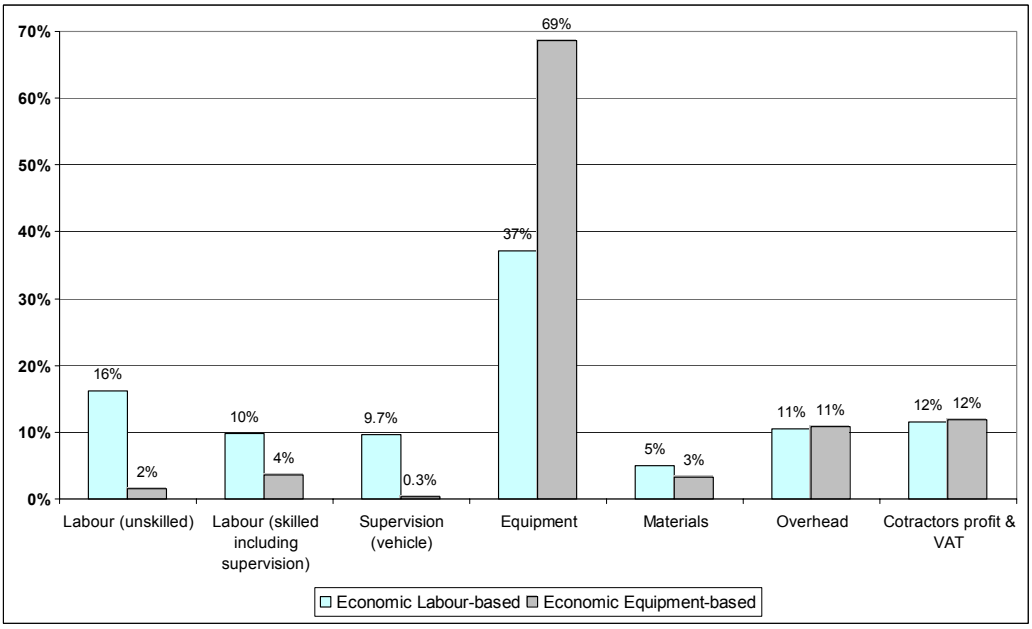

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Figure 5. 2: Economic cost breakdown of periodic maintenance using LB and EB methods

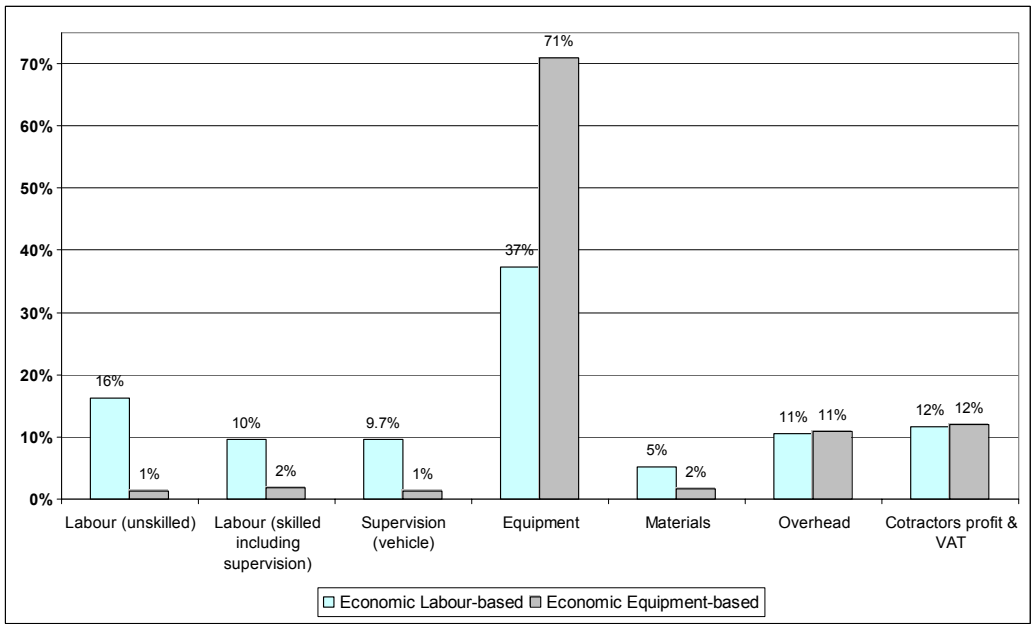
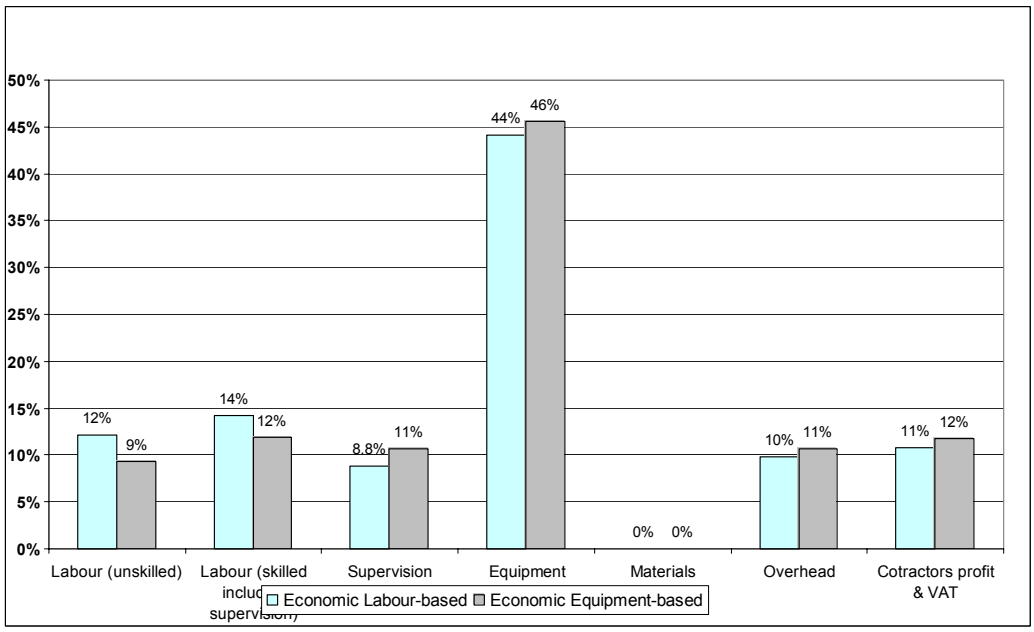


Figure 5. 3: Economic cost breakdown of routine maintenance using LB and EB methods



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5.4 Summary

The economic analysis shows that LB methods have a high advantage over EB method for standard rehabilitation and periodic maintenance for a standard regional road with 6m wide gravel carriageway. It is more difficult to standardise the routine maintenance operations between the equipment and labour-based technologies because the normal activities are different. EB methods concentrate on the carriageway with grading of the road and LB methods concentrate on the off carriageway works with cleaning of side drains and culverts. When all activities are included in both methods in order to standardise the projects for the full routine operation the activities become the same and the only difference becomes whether a motor grader or a towed grader is used for grading of the carriageway and labour or motor grader is used to clean the side drains. This analysis shows LB methods have an economic cost advantage of some 31% for routine maintenance (lower advantage than rehabilitation).

For routine maintenance a technology decision should be taken at the activity level rather than the whole contract level. Drainage work and grass cutting should be done by Labour on a taskwork basis and carriageway work grading by machine.

The relatively high levels of taxation on fuel and equipment imports in Mozambique make the financial advantages of LB methods even higher than the economic advantages. This is generally different from other countries in the region.

6 DIRECT EMPLOYMENT, BREAK-EVEN WAGE RATES, SENSITIVITY ANALYSIS, ECONOMIC RATE OF RETURNS AND POVERTY IMPACTS

6.1 Introduction

Chapter IV and Chapter V compared the unit costs, both financial and economic, of rehabilitation and maintenance between LB and EB methods. They also compared the proportions of different cost items. This chapter presents the opportunities of employment creation under these methods, the break-even wage rate at which the advantage of LB methods over its EB counterparts will be nullified, the sensitivity of total costs due to the potential increase of different costs parameters, and it finally compares economic rate of returns and the poverty impacts of the two methods.

6.2 Direct Employment Generation

One of the arguments of preferring LB methods over the EB methods is that LB methods can generate a considerably higher number of direct employment and a considerably higher proportion of the employment generated goes to the poor. Table 6. 1 presents the comparison of generation of direct employment and the proportion of the generated employment going to unskilled labour. Table 6. 1 shows that in the case of full rehabilitation and periodic maintenance the use of LB methods generates considerably higher number of employment. The employment creations for routine maintenance under these methods are very similar. This is due to the fact that in the case of routine maintenance the only difference between the LB methods over EB methods is the use of towed graders against self-propelled graders. Therefore, although for routine maintenance works using the LB methods are financially and economically cheaper, there is no difference in the creation of the number of employment. In the case of full rehabilitation and periodic maintenance works the LB methods approximately create four and a quarter times and six times higher employment than their EB counterparts.

Table 6. 1: Comparison of generation of direct employment, proportion of labour and proportion of unskilled labour

		Labour-based	Equipment-based	Employment generation advantage
Full rehabilitation	Total work days/km	1,813	346	424%
	Labour component	25%	4%	
	Proportion of unskilled workdays	89%	68%	
Periodic maintenance	Total work days/km	1,190	169	604%
	Labour component	24%	3%	
	Proportion of unskilled workdays	90%	81%	
Routine Maintenance	Total work days /km	59	60	-1%
	Labour component	24%	18%	
	Proportion of unskilled workdays	79%	78%	

Note: Employment generation advantage: a ratio of the difference between numbers of days of employment generated from LB and EB methods to the number of days of employment generated from EB methods.

Table 6. 1 also shows that the proportions of unskilled labour, who are most likely to be the poor, employed under LB methods for different types of improvements and maintenance

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options are higher than EB methods. The proportions of workdays going to the unskilled labour for LB methods range from 79% to 90%. Similar figure for EB methods is 68% to 81%.

6.3 Break-even Wage Rates and Sensitivity Analysis

Chapter IV and Chapter V show that rehabilitation and maintenance costs of rural roads using LB methods are cheaper – both in terms of financial and economic costs – than their EB counterparts. This section examines to what extent the LB methods is cheaper than its EB counterparts. In order to examine it, the study used the concept of break-even wage rates. Appendix XII presents the details of the method used in such calculations. The study calculated both weighted average break-even wage[5] rates and break-even wage rates of unskilled labourers. This section also examines the sensitivity of escalation of costs when factor costs (like costs of fuel and lubricants, purchase costs of equipment and costs of labour) go up.

Table 6. 2 presents the break even wage rates and the sensitivity of overall costs due to the escalation of costs of different factors. The break even wage rates calculations assume that the equipment costs will remain constant. Table 6. 2 shows that the LB methods will be a cheaper option than EB methods till the weighted average wage rates per day remain below US$5.00 for full rehabilitation and US$ 5.42 for periodic maintenance. This means that the LB methods will still be cheaper than the EB methods if the current weighted average wage rates increase by more than three and a half times in the case of full rehabilitation and three and a quarter times in the case of periodic maintenance. A separate calculation of the break-even wage rates shows that in the case of unskilled labour the corresponding break-even wage rates will be US$ 4.13 and US$ 3.8 respectively.

Table 6. 2 shows that with a 100% increase of the purchase price of equipment, the increase of total costs of improvements and maintenance of roads using EB methods are considerably higher than LB methods. This is true both for both financial and economic costs. In the case of EB methods the proportional financial costs increases range from 33% (routine maintenance) to 44% (periodic maintenance); such increases range from 22% (full rehabilitation and periodic maintenance) to 26% (routine maintenance) for LB methods. The ranges are not very dissimilar in the case of economic costs. This shows that the EB methods are more sensitive to equipment purchase cost escalations than their LB counterparts, i.e. the cost elasticities of EB methods are higher.

Table 6. 2 also shows that the proportional increase of financial and economic costs for different rural roads rehabilitation and maintenance options will be higher for EB methods than the LB methods due to the increase of fuel and lubricants costs, except in the case of routine maintenance works. The cost escalations are marginally higher for LB methods in the case of routine maintenance. While, the range of rates of increase of financial costs is from 19% to 21% for the LB methods, the range is from 19% to 36% for EB methods. The figures for economic costs for LB and EB methods are from 17 to 18% and 17% to 33% respectively.

The cost elasticities for LB methods in the case of increase of wage rates are higher than EB methods as anticipated. The rates of increase of total financial costs of rehabilitation and maintenance of a road range from 46% to 48% in the case of LB methods and from 5% to 39% in the case of EB methods. While the rate of increase of economic costs is 46% for LB methods for different rehabilitation and maintenance options, the rates of increase range from 6% to 41% in the case of EB methods.

[5] Taking into consideration of all types of labour – skilled, unskilled and supervision labour.

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Table 6. 2: Break-even wage rates and sensitivities

	Full Rehabilitation		Periodic Maintenance		Routine Maintenance	
Method	**LB**	**EB**	**LB**	**EB**	**LB**	**EB**
Weighted average financial break even wage[6] (US$/day)	5.00		5.42		N.A	
Financial break even wage rate for unskilled labour (US$/day)	4.12		3.80		N.A	
Up to what weighted average wage rate can be raised?	367%		337%		N.A	
Financial cost escalation due to 100% increase in equipment purchase cost	22%	43%	22%	44%	26%	33%
Economic cost escalation due to 100% increase in equipment purchase cost	23%	42%	23%	43%	27%	31%
Financial cost escalation due to 100% increase in fuel & oil price	20%	35%	19%	36%	21%	19%
Economic cost escalation due to 100% increase in fuel & oil price	17%	32%	17%	33%	18%	17%
Financial cost escalation due to 100% increase in wages and salaries	48%	6%	47%	5%	46%	39%
Economic cost escalation due to 100% increase in wages and salaries	46%	7%	46%	6%	46%	41%

6.4 Imports Savings and Related Macroeconomic Benefits

The study has not done any analysis of the portion of the road improvement costs that involves imports. Such an analysis would have required detailed data. However, there is no doubt that the EB methods require substantially higher amount of imports of goods and equipment than LB methods. The overwhelming majority of the import costs would involve: equipment costs, fuel and lubricants costs, costs of spare parts for the repair of the equipment and costs of replacement tyres; material costs (e.g. cement, steel). Whereas the LB road construction methods involve lesser imports of goods and equipment, the potential macroeconomic benefits of the use of LB methods are the following:

(i) It may help to reduce the overall balance of payment and trade deficits. Trade balance figures of Mozambique are chronically negative and the overall balance of payment figures, except in 1998, are also negative;

(ii) As the GOM adopts a flexible exchange rate policy, a reduction of imports of goods and equipment will help in the stability of the Meticais against the currencies of the countries from where they are imported. Although a counter-argument could be that depreciation of the Meticais may help the Mozambican exports, such an argument is not valid in the case of Mozambique as Mozambique has a narrow export base and the value of exports is substantially less than the value of imports (e.g. in 2002 the value of exports is only 53% of the value of imports). A depreciation of the value of currency may also worsen the terms of trade;

(iii) It will lessen the pressure on the interest rates increase as the increasing payment imbalances may compel the GOM to raise interest rates. The chronic

[6] Includes skilled, unskilled and supervision labour

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balance of payment imbalances may also require the GOM to take other monetary measures (e.g. increase of income taxes) to reduce the domestic demand which in turn may stifle the economic growth; and

(iv) It will have positive effects on the foreign exchange reserve of the country. 2001 figure shows that the foreign exchange reserve of Mozambique can cover seven and a half months of imports. Apparently the figure may seem acceptable as it is higher than many other developing countries' figures. However, a higher figure is required for Mozambique due to her vulnerability to natural disasters (e.g. floods) that requires may trigger higher level of imports.

6.5 Economic Indicators and Impact on Poverty

This section reports on the comparative results of an economic analysis to find the economic viability of roads improvements and maintenance using both LB and EB methods. The analysis considers an average road of 48 km long[7] and uses the calculated unit costs of improvements and maintenance for LB and EB methods. Appendix XIII provides the salient features and assumptions of the economic analysis.

Table 6. 3: Comparison of Economic Rate of Return and other economic indicators

	Economic Indicators		
	Economic Internal Rate of Return (EIRR)	Net Present Value (NPV) in Million US$	NPV/Economic Agency Cost
LB Methods	34%	0.324	0.36
EB Methods	17%	0.104	0.09

Table 6. 3 shows that all the relevant economic indicators (Economic Internal Rate of Return (EIRR), Net Present Value (NPV) and a ratio of NPV to cost) favours the LB methods than EB methods. Therefore, when it comes to the decision of the choice of technology in rural road investments for similar type of improvements, LB methods far outweigh the EB methods.

However, an investment may be economically efficient but still may fail to satisfy the equity objective. This means that the proportion of project benefits may disproportionately be accrued by the non-poor in the society. There is a recent serious emphasis on the reduction of poverty by developing country governments and international development organisations. The poverty reduction objective of the Government of Mozambique is manifested in the recently published Action Plan for the Reduction of Absolute Poverty (2001-2005)[8], PARPA, (Government of Mozambique, 2001). Therefore, the recent general consensus is that an investment analysis should not only investigate the efficiency aspects of the project but also the distribution of project benefits/costs on the rich and the poor. The investment decision should not only be based on the efficiency but also on the equity aspects.

The following section reports the results of the analysis that has been undertaken in the study to compare the poverty impacts of roads investments using LB and EB methods. The study uses the concept of the Poverty Impact Ratio (PIR) in accordance with Asian Development Bank guidelines (Asian Development Bank, 1997; Asian Development Bank, 2001) to assess the impact of investments on poverty. PIR is an indicator that estimates the

[7] An average length of road considered in this study
[8] As per the PARPA the objective of the Government of Mozambique is to reduce absolute poverty from 70% in 1997 to less than 60% by 2004 and less than 50% by the end of the decade (Government of Mozambique, 2001).

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proportion of the net economic benefits of an investment that are expected to accrue to the poor[9]. The PIR is defined as:

Definition of Poverty Impact Ratio (PIR)

$$PIR = \frac{Benefits\ to\ the\ poor}{Total\ economic\ benefits}$$

The value of the PIR is compared with the proportion of population below the poverty line within the context of the country or an area. If the PIR is higher than the proportion of the poor people, then the project can be considered to have positive poverty reducing impacts or *vice versa.*

However, one particular difficulty with this methodology is that the calculation of the PIR requires the share of current government income of the concerned country going to those below the poverty line[10] and proportion of users' benefits from project investments accruing to the poor. Therefore, to facilitate the comparison between LB and EB methods, the PIRs are calculated for different levels of share of government income going to the poor and users' benefits reaching the poor. The analysis uses the following assumptions to calculate the PIRs presented in Table 6. 4:

- for LB works, average labour cost is 24% of which 10% skilled, 90% unskilled;
- for EB works, average labour cost 4% of which 30% skilled and 70% unskilled;
- shadow wage rate factor for skilled labour: 1.1; and shadow wage rate factor for unskilled labour: 0.57[11]
- Standard Conversion Factor (SCF): 0.95 [12]
- proportion of poor among unskilled labourers: 90%

Appendix XIV presents a sample calculation of the PIR for roadworks using LB methods.

Table 6. 4: Poverty Impact Ratios (PIRs) of investments

Proportion of users' benefit to poor	Proportion of Government spending for poor		
	30%	40%	50%
30%	0.53 (0.33)	0.26 (0.09)	-0.02 (-0.15)
40%	**0.86** (0.67)	0.59 (0.43)	0.32 (0.19)
50%	**1.20 (1.00)**	**0.93 (0.76)**	0.65 (0.52)
60%	**1.53 (1.34)**	**1.26 (1.10)**	**0.99 (0.86)**

Notes: Figures outside brackets show the PIR in the case of LB methods; figures inside bracket show the PIR in the case of EB methods; figures in bold are expected to have positive poverty impacts.

[9] For example, if 70% of the net economic benefits accrue to poor then the PIR will be 0.70. The PIR can have values over unity. This is true only when the poor share disproportionately high benefits but share disproportionately low costs.
[10] This is required to apportion the government's net project benefits between the poor and the non-poor.
[11] Appendix X.
[12] Appendix IX .

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The conclusions from Table 6. 4 are the following:

- in all cases LB methods have a higher impact on poverty than EB methods as the PIRs are higher;
- in 50% of the cases, the investment will have positive impact on poverty reduction if LB methods of construction are used as the PIR is higher than the 0.71, proportion of rural population below the poverty line in Mozambique (Government of Mozambique, 2001); and
- for EB methods the chances of the investments having positive effects on poverty reduction are less as in more than 50% of the cases the PIRs are lower than 0.71%.

6.6 Summary

The analysis in this chapter shows that the potential of employment generation in roadworks using the LB methods is far higher than for the EB methods. The proportional increase of overall costs due to the increase of initial purchase price of equipment or price of fuel and lubricants are considerably higher for EB methods than LB methods. However, as anticipated the cost elasticities for an increase of wage rates are higher in the case of LB methods. The wage rates can be raised considerably before the financial and economic roadworks cost advantage of LB methods is nullified. Results of the economic analysis of the road investments using the unit costs calculated in this study show that the LB approach is a better economic option that its EB counterpart. The potential impacts on poverty of the use of LB methods are higher than EB methods.

7 REVIEW OF SOCIAL IMPACT REPORTS

7.1 Reports Reviewed

Three major reports were reviewed for this study all of which were compiled under the auspices of DNEP and ANE during the period from 1995 to 2002. All attempted to looked into the socio-economic impact of road rehabilitation in the rural areas. The divergence of study areas, type of Road rehabilitated and indeed the type of rehabilitation undertaken makes it difficult to generalise the conclusions of these reports for the whole of Mozambique or for road rehabilitation across the sector. However the points of agreement are striking and would tempt us into generalising at least some of the results. No statistical analysis has been undertaken to justify this type of generalisation however in the absence of any large scale Nationwide survey addressing this point specifically the convergence of these three diverse surveys must be considered significant.

The three surveys are:-

- Socio-economic impact assessment of Rehabilitation of National roads in Mozambique- Austral consultoria e projectos Lda. 1999-2001
- O impacto socio-economico da reabilitação da estradas distrital ER510- Gunilla Åkesson 1995-2002
- Social impact study Feeder road project Zambezia—Scott Wilson 1996-2001

The Austral report covers selected roads in the three zones of the country, North Central and South and through household surveys and questionnaires attempts to measure the impact of rehabilitation of those roads on the economic and social aspects of life at the household level. All the roads selected were national roads, that is major roads. Samples were taken from households close to the road and others farther away for comparison. The timing and location of the surveys was designed to give a before and after comparison across the three economic zones of the country. The report covers only a 3 year period and problems were experienced with the timing and planning of the road works so that some survey locations had to be changed, disturbing the survey methodology.

The Gunilla Åkesson report is robust although limited in scope. It looks at the effects of one road only over an extended period of 7 years. The road is classified as a regional road having the number R510 although it connects the district headquarters of Mecuburi to the regional capital Nampula in the north of the country. The rehabilitation work took place during 1995 to 1996 and the study started in January 1995, by this time the rehabilitation of the road was already underway. The road work was undertaken by the Feeder Roads Programme of the then DNEP using LB methods. This also allowed the study to investigate the effects of the impact of employment creation and the employment of women on the households surveyed.

The third major study is the one undertaken by Scott Wilson as part of their management of the FRP and contractor development programme in Zambezia province. The study tracked 5 communities in the province throughout the life of the project from 1996 to 2001. The report is comprehensive and well supported by statistical data and analysis. The road works influencing the study areas are all feeder roads with the work being done by private contract using LB methods. The study was able to look into the effects of employment and women's employment on the communities as well as the impact of the road itself. The independence of the study could be questioned since the organisation carrying out the study was the same as the organisation managing the roads project and was required to show a positive socio-economic impact. The study must be seen as a monitoring exercise not an evaluation and as such is a comprehensive, deep study with good statistical basis and fair analysis.

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Considering these issues this review now attempts to bring together and highlight the points of similarity in the findings and those of divergence from these reports.

7.2 General Findings

A major point of convergence of all the reports and studies is on the subject of timing of the impact of road rehabilitation or road improvement on socio-economic aspects of life. Both the GA and SW reports indicate that impacts of road rehabilitation do not take place immediately after the work is done but take a number of years to manifest themselves. The AU reports support this view in the fact that little impact could be objectively verified during the short period of the study (2-3 years). All three reports seem to agree that sustainable socio-economic developments can only be observed some 5 years after the road rehabilitation takes place and that maintenance of the road during that time is critical to support the often fragile perceptions of the benefits of increased effort (farming more land, making more market trips, setting up a kiosk).

Many areas of the country are still under a period of recuperation and re-settlement some 10 years after the peace agreement of 1992. Re-settlement boosts the need for more access and feeder roads. Without these roads the resettled areas will not begin to develop even in the most fertile areas of highest potential. Any road rehabilitation or development will require a 5 year maintenance plan before any economic returns from the investment begin to be shown. All three studies emphasise the observed result that the socio-economic changes supported by road rehabilitation take time to manifest themselves. Changes in agricultural and social practises are slow and fragile. People need to be very sure that they are not wasting their extra efforts in clearing more land, planting more crops, changing crops or buying a bicycle before they will make the investment.

The GA report makes a strong case for the influence of improved access for socio-economic development but shows clearly that the road work is a pre-requisite for development not a driving force in itself. The three reports talk variously of Road rehabilitation being “a facilitator”, “pre-requisite” and “a catalyst” of the changes necessary for development but the potential in terms of inward investment and inherent local economic growth must exist for the impacts to be realised.

The Reports that looked into impact of road rehabilitation in the North of the country both reported the stabilising effect observed and the psychological influence that the work had on the individuals in the community. This had the effect of encouraging people to make an effort to improve their own situation since there was now some glimmer of hope that things were getting better and that a less vulnerable future could be envisaged.

The longer studies (SWK and AG) both noted a positive change in the vulnerability status of the communities close to the improved roads. Through a number of factors including the small increases in transport, diversification of crops, the increased use of bicycles, the cash wages and other small employment opportunities life near the improved roads is somewhat more stable, as long as the road remains in fair condition. Another factor to affect vulnerability is the road safety issue; both studies reported a decrease in traffic accidents after road rehabilitation. Other studies have shown this to be a significant factor in both poverty and vulnerability indices.

7.3 Access

The austral study reported no correlation between road improvement generally and improved access for the households surveyed and no link between the availability of services (in terms of time of travel) and the roads improvement work. It did show a gradation of availability of services favouring the south of the country, but this was unaffected by the road improvement. The other two studies both basically investigating projects in the North of

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the country reported a significant improvement in accessibility to services and in the case of the SWK report the most significant social change to be the increased use of bicycles for transport of goods and people. Both the SWK and AG reports indicate an increase in service provision by the provincial authorities some years after the road rehabilitation and a significant reduction in journey time to school and health centres.

The availability of motorised transport is also seen, in all three studies, to increase in all situations after the roads have been improved. This equates to improved access to both social networks (relatives etc.) and commercial markets. This improved access does not always lead to advantages for the local communities. It is seen to be the case across all the studies that motorised transport comes in from outside the region and prices are high. In some cases the prices are beyond the capacity of the majority of the community. Transporters from outside the area benefit from the new or increased use and local transporters face more competition. Middlemen get the advantage from better access into the areas to buy farm produce at reduced rates directly from the local farmers instead of the farmers being able to transport their goods to market. Many of the small producers preferred to take their goods by bicycle to local points of sale to obtain a better price

Ease of access works in both ways. While local perhaps isolated communities are able to access markets and services due to improved access and connector roads, the outside world also has access to those communities. Increased logging, charcoal production, environmental degradation and incidence of HIV/Aids also go hand in hand with the improved road access. People have more access to consumer goods which also leads to increased expectations as well as increased scope of trade.

7.4 Employment

The socio-economic effect of the construction process itself was significant. The studies covered road rehabilitation of both EB and LB technologies. The impact of EB work was minimal in terms of employment for the local communities. Most EB contractors brought workers from outside the area and only petty opportunities to sell to the workers presented themselves to the local people. LB work both by force account brigades and later private contracts provided cash paid work for local people.

The Austral study reported that most of the work was carried out using equipment and imported (from outside the local area) workers. This was the work done on National Roads. Both the AH and SWK studies included the use of LB methods and reported the advantages realised by families who were able to participate in the cash paid work. Obvious benefits accrued to families who were employed, creating tensions between participating and non-participating families. Both reports mention the ability of these families to “employ” other community members to work on their land using the Ganho-Ganho[13] informal system thus expanding part of the benefits to non-participating households. The SWK report also indicates the re-emergence of the Xitique[14] system of community based micro-credit.

Both reports highlight the vulnerability of the LB systems to late payment. Workers seem willing to wait for their pay for about 2 months, but beyond that they are forced to return to their mashambas[15] and forego the cash paid work in preference to prosumer (mainly subsistence) activities. Women and female headed households in particular are susceptible to late payments. The interviews conducted among the female workers cited late payment and pressure of other duties as the most common combination of reasons for withdrawal

[13] “win-win” informal system of passing on benefits through casual employment on family based activites.
[14] Rotational loan pooling groups; As long as nobody defaults and groups are kept small system is effective.
[15] Fields or small farms

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from work. Across the surveys of road rehabilitation cash wages was seen as the single biggest benefit from the work. The knock on effect of these wages was also the biggest benefit to the community at large. Other effects such as improved access to services and increased business opportunities took in excess of 3 years from the time of road improvement to be realised.

The SWK study looks closely at the employment of female workers and finds that there seem to be many barriers to their initial recruitment and then retention in the job. Women already have a heavy burden of work in the home and especially in female headed households any disturbance in the regularity or timeliness of payment from the road work makes the position untenable. The lack of female supervisors at site level and lack of promotional possibilities tends to act against the increased recruitment and retention of female workers.

7.5 Agro-economic Impact

The life of the communities in most rural areas of Mozambique revolves around agriculture. Most families are subsistence farmers and rely on their own ability to grow enough food to feed themselves. The farming methods are labour intensive and therefore the size of the family and its social links with the surrounding community limits the size of the land area that can be cultivated. This fact coupled with transport problems and lack of market opportunity for isolated communities determines the type and amount of crops that are grown. All three studies noted that after road rehabilitation changes to agricultural practices were very slow, but did seem to take place. In some cases this change came about through outsiders moving into the area as settlers and clearing land for agriculture. The ineffective control of land use, and the diversity of control systems at local level is an item highlighted by the studies but is beyond the scope of this report.

All three studies agree on the fact that changes in land use and commercialisation of agricultural activities in rural areas after road improvement will take time. The Austral study did not cover a long enough period to observe any such change although positive indications existed after the 3rd year. Both the SWK and AH studies found significant improvement in food security from crop diversification and increased land area. However the marketing of agricultural produce to the benefit of local farmers did not take place. Where transport increased and marketing of farm produce was taking place the market forces with price fluctuations and increased supply left the local farmer in much the same position financially as before. When middlemen using outside transporters came to buy the local produce they did so at a price that gave them the advantage and left the local farmer no better off. The studies that noted that although the increased transport and improved perceived market potential did lead to limited increased agricultural production other influencing national economic and marketing factors detracted from any advantage. The SWK study indicates that the most positive local response to these situations was for the families to invest in their own intermediate means of transport and take the produce to more local markets. The AH study found that in Mecuburi the financially best response seemed to be to change in part to different crops or produce, (animal husbandry or poultry production); although this requires more investment capital.

7.6 Summary

The table below gives a summary of the communities' expectations and the assessed actual result from the road rehabilitation. This table is based on the Mecuburi report of AH but the "source" column shows the points were the other reports agree. Items of significance from the other reports not included in the AH study have been added and the source noted.

ITEM	EXPECTATION OF COMMUNITIES FROM ROAD REHABILITATION	ACTUAL OBSERVED RESULT AFTER REHABILITATION	SOURCE
1	Better Marketing, better prices for crops	Marketing easier, more crops sold but not to the advantage of the poor farmer. Middlemen get advantage.	AH SWK Austral
2	Transport increased, easier social visits	Yes, more motorised transport available, prices out of reach to many.	AH SWK Austral
3	Access to medical services improved	YES. Immediate more transport available, Mecuburi hospital acquired ambulance, Later medical authority building more clinics	AH SWK
4	Increase in Local Shops	Initial increase, later closures due to market pressure. Roadside Kiosks increase long term.	AH SWK Austral*
5	Fares Go down	Initially yes, also more varied means of transport available, preferred mode is bus (safety) but fares high.	AH
6	Safer travel and safer walking	Yes! Bus now available, walking on road preferred for safety reasons.	AH SWK
7	More visits from officials	Yes , both district and provincial after first year	AH
8	More families open new fields	Yes. Also outside farmers moving in under Cadastre authority. Also unauthorised lumbering and hunting causing problems	AH SWK Austral
9	More Employment opportunities	Initially yes with LB methods. Redistribution of Rehab. wages through Ganho-Ganho. later a slow increase observed over time.	AH SWK
10	-	Increase in incidence of HIV/SIDA	Austral
11	-	People move towards the rehabilitated road	Austral
12	-	Increased use of Bicycles	SWK
13	-	Food production increased observed as most significant long term change.	AH

* Subjective positive indications only

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8 GENERAL CONCLUSIONS AND RECOMMENDATIONS

8.1 Methodology

It proved very difficult to carry out this study in the way it was envisioned in the terms of reference. A certain amount of data were not available and data were compiled in different ways in different organisations. Even within the same organisation data were found to be compiled in different ways in different provinces. As long as the same basic data were available the analysis could still be done but in some cases the fact that different items were included under different heading meant that data could not be de-segregated to allow the comparison of like with like. This proved particularly difficult when trying to compare EB work with LB work. Even within the ECMEPS different provinces are following different systems of record keeping and the equipment brigades are keeping different records from the labour brigades. Equipment brigade records show details of equipment costs and usage but summarise manpower costs while the labour brigades detail manpower usage and summarise machine costs. In addition some of the macro-economic data needed for a full analysis could not be obtained.

Basing the comparison of technology on project cost alone does not give any indication of the variable profit margins, overheads and mobilisation portions of different contracts or projects. While two different road projects may appear to have the same cost to the client one project may have afforded the contractor a 40% profit while another may have cost the contractor a massive loss. It is also important to ensure that the scale of the activities under taken on both projects is similar and that the quality of the results is the same in order to have an objective comparison. The fact that two different contracts for two similar roads are both called rehabilitation does not guarantee that a straight comparison of the contract prices is a fair comparison of the cost of the technology employed.

In most countries in Sub-Saharan Africa, and Mozambique is no exception, routine maintenance of roads by EB methods means little more than grading of the carriageway, while a routine maintenance contract carried out by LB methods usually means cleaning of the drainage system and cutting grass. To compare these two contracts because they are both called routine maintenance makes no sense. To rule out these difficulties by statistical analysis from a study of contract price alone would require the sample of both LB and EB contracts to be very large indeed. At present there are probably not enough LB contracts on the continent of Africa to provide sufficient data.

The methodology, utilised in this study to arrive at a fair financial comparison, was an analysis of the combination of field data collected from the 4 provinces and 87 projects and theoretical estimates of typical contracts based on the filed data collected. This has proved to be a successful and robust analytical method. Improvements to the overall method could be made with additional data from the field on productivities for various activities and improved macro-economic data.

For Mozambique the collection of cost data for the future should be done by standardised work item (Codigo) as the content of the item is fixed by the contract and constant across contracts thus giving a point of reference for comparison.

A number of cost comparison studies have now been carried out in a number of countries. There is enough experience to standardise a methodology and to make recommendations as to the format and type of data necessary for best results.

ANE, both DEN and DER, collect data from the field on a monthly basis. This data are initially collected by the DPOPH and collated for transmission to ANE. The analysis of this field data will be made much easier and comparisons better if the format and the way the data are put together right from the field level is standardised. The data can then be collected and stored at ANE Maputo for analysis and comparison. The figures should be submitted by the DPOPH and not directly by the contractors. This can be done by insisting that the monthly payment certificates are accompanied by the required reporting data and pass through the appropriate directorate DEN or DER before proceeding to Roads Fund for payment. The technical audit unit of ANE would then have to hand all the data necessary to proceed to the regions on a regular rotational basis to verify the actual quality and progress of the contracts against the payments approved.

8.2 Financial Comparison

The road work carried out in Mozambique under the Provincial department of works and housing is now almost all done on a contract basis although only just over half of these contracts are awarded through competitive tendering. The field data collected under this study shows that the expected financial advantages of the private sector approach cannot be confirmed from an investigation of the project costs in recent years. At the same time no clear indication of differences between LB methods and EB methods shines out from the actual contract values. A deeper investigation of these values shows that we are not comparing the same type of contract and the study went to great lengths to come up with an analysis that would allow the comparison of like projects with the actual field costs collected in the Provinces.

The results of this analysis shows that when all items are put on a level playing field and real costs are used for labour and equipment, LB methods give a financial advantage of between 43% for routine maintenance and 64% for periodic maintenance with full rehabilitation of roads coming in between at 54% advantage. The question then remains as to why the contract prices do not reflect this financial advantage to LB methods. The answer lies in a combination of factors that include :-

a) Most contractors do not cost the equipment to include the full ownership costs.
b) In the ECMEPs higher profit margins possible from the LB brigades may be used to mask the true costs of EB work.
c) There is still not sufficient experience of tendering among LB contractors to be competitive.
d) LB methods require a high level of supervision which is normally only possible and effective in small organisations. Once a contractor grows in size and begins to take on more than one contract at a time the tendency is to adopt EB methods to ease the supervision burden. A LB contract will then be weighted with a “hassle factor”.

In order to realise the financial benefits of using LB methods MOPH and ANE would need to undertake a number of actions. The tendering and contract award procedures used in the Provinces should be strengthened to assure that competitive prices from competent contractors are being supported by contract awards. This

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does not mean only accepting the lowest price. This requires further capacity building and training activities both for the provincial staff and the contractors, as well as looking critically at the procedures themselves.

In Mozambique, with the current levels of pay, LB methods for road rehabilitation and maintenance are financially cheaper if the contractor works efficiently and supervises the job properly. The potential savings made will only be passed on to the client when the contract award procedure is seen to be fair and contract payments are made promptly and regularly. The inclusion of the contractor's estimated allowance for late payment and cost of chasing contract awards and payment certificates distorts all tender prices. This tends to favour larger contract packages and EB jobs.

Care needs to be taken in the description of contracts. Having a contract described as Routine maintenance when it includes 5 Km of full rehabilitation only clouds the issue of costing and will make realistic budgeting for road maintenance in the future very difficult.

More support and encouragement towards the use of LB methods would help to establish a wider base of experience among Provincial engineers and contractors. The use of standardised contract documents with incentives towards the use of labour for certain items of work would help as long as Provincial engineers and contractors are trained in its application. The latest versions of the standard contract documents of DER include such clauses and items. The exposure of Provincial engineers and ANE representatives to successful LB programmes in other countries would also help to convince them as to what can be achieved. Corresponding training programmes for both ANE staff, enterprises and consultants, would need to be established simultaneously in order to progressively increase the local level capacity for the implementation of LB works.

8.3 Economic Comparison

Adjusting the financial figures to take account of the economic situation pertaining to Mozambique and the construction industry a slightly different picture emerges. Having deducted for taxation on fuel and equipment and adjusted for the opportunity cost of labour and many other factors explained in previous sections and the appendices, LB methods still have a cost advantage over EB methods for all the types of intervention considered.

The advantage now ranges from 31% to 58% slightly lower than for the raw financial cost advantage. The Advantage of using LB methods is still highly significant even after the government foregoes all the taxes from the import of equipment and fuel tax. The government would still make a saving of between 30 and 50% on all types of roadwork investments.

The highly interesting analysis comes from the calculation of break even wage rate and the sensitivity analysis of the calculated costs. In this respect only the financial cost are relevant since the wages paid are a financial outlay to the contractors. The analysis shows that for full rehabilitation the wage rate for unskilled workers could be increased to US$4.12 before both LB and Equipment work begin to compete in price, that is an increase of some 360%.

In addition to these financial figures the economic analysis shows that LB methods will provide a better rate of return (IRR) and improved Net present value (NPV) than EB methods all else being equal. When it comes to economic effects on the poor and poverty impact ratio the economic figures show that in Mozambique LB methods has an approximate 20% advantage across the board over EB technologies. This means

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that whenever possible road investment should be carried out by LB methods if the government's poverty reduction plan (PARPA) is to be supported.

All of the economic indicators assessed lead to the conclusion that ANE should insist as a matter of implementation strategy under its mandate that LB methods should be preferred. One way of putting such a strategy into practice would be to set targets for the Provinces in terms of percentage of work value to be done by LB methods. Such a target would then need to be monitored regularly through the monthly reporting system by the ANE representatives and checked by technical audit.

REFERENCES

Asian Development Bank, 1997, *Guidelines for the Economic Analysis of Projects*, ADB, Manila.

Asian Development Bank, 2001, *Handbook for Integrating Poverty Impact Assessment in the Economic Analysis of Projects*, Economics and Development Resource Centre (EDRC), Manila.

Department for International Development (DFID), 2001, *Economist Guide: Appraisal of Investments in Improved Rural Access*, DFID, London. (Also available online at: www.transport-links.org/Economist%20Guide/English/Intro.htm)

Department of Population and Social Development (DPDS), Eduardo Mondlane University (UEM) and International Food Policy Research Institute (IFPRI), 1998, *Understanding Poverty and Well-Being in Mozambique, The First National Assessment (1996-97)*], DPDS, Maputo.

Government of Mozambique (GOM) & World Bank (WB), 1992, *Mozambique, Financial Sector Study*, GOM, Maputo.

Government of Mozambique (GOM), 2000, *Action Plan for the Reduction of Absolute Poverty (2000-2004),* GOM, Maputo.

Government of Mozambique, 2001, *Action Plan for the Reduction of Absolute Poverty (2001-2005) (PARPA),* Government of Mozambique, Maputo.

I T Transport, 2002, *Feasibility and Formulation Report Uganda: Road Sector Programme Support - Phase 2 (District Roads Component, National Gravel Roads Component, National Labour Based Training Component),* Danida, Copenhagen.

Ministry of Planning and Finance and World Bank, 2001, *Public Expenditure Review, Ministry of Planning and Finance,* Maputo.

National Institute of Statistics (NIS), 1997, *II Recenseamento Gerald a População e Habitação. Resultados Preliminares,* NIS, Maputo.

National Institute of Statistics (NIS), 1998, *Demography and Health Survey 1997,* NIS, Maputo.

National Institute of Statistics (NIS), 2000, *Annual Projections of the Population by Provinces and by Areas of Residence, 1997-2010,* NIS, Maputo.

Shahabuddin Q and Rahman K M, 1992, *Estimation of Economic Prices for Use in FAP Planning Studies*, Dhaka.

Squire L & van der Tak H G, 1975, *Economic Analysis of Projects*, Johns Hopkins University Press, London.

Taylor G and Bekabye M, 1999, *An Opportunity for Employment Creation, Labour-based Technology in Roadworks: The Macro-Economic Dimension*, International Labour Organisation, Geneva.

United Nations Development Program (UNDP), 1999. *National Human Development Report 2001,* UNDP, Maputo.

World Bank, 2001. *Análise da Gestão da Despesa Pública. Relatório* N°22985 – MOZ, World Bank, np.

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Appendix I

TERMS OF REFERENCE FOR A LABOUR BASED AND EQUIPMENT BASED COST COMPARISON STUDY IN MOZAMBIQUE

BACKGROUND

Since 1982 various donors have supported the Government of Mozambique (GOM) in the development of the Feeder Road Programme (FRP), a programme for the rehabilitation and maintenance of tertiary roads in Mozambique using labour based techniques. As a result of this assistance, LB methods have been established countrywide as a viable technology for the execution of work on gravel roads in rural Mozambique. Over 4400 km of road has been rehabilitated. The programme has enjoyed the support of the Ministry of Public Works and Housing (MOPH) and of senior staff in the National Road Administration (ANE). Due to this high-level support, it has grown into one of the largest institutionalised labour based road programmes in sub-Saharan Africa. The Government of Mozambique´s Road Policy recognises the need to use employment intensive nationally-based methods where appropriate.

The recent development of the FRP has been accompanied by major changes over the past two years in the way that the road network is managed in Mozambique. As part of the World Bank sponsored ROCS programme, reforms based on the Road Maintenance (now Management) Initiative (RMI) have been introduced. Under these reforms, a Road Board with public and private representation was created in mid 1999. This board manages ANE. The Directorates of National (DEN) and Regional (DER) Roads as well as the Road Fund (FE) were established as components of ANE at the end of 1999. Tertiary, Urban and Unclassified roads fall under the responsibility of DER. At the level of tertiary and unclassified roads, the implementation of these reforms is now starting to be felt.

The GOM is committed to a policy of decentralisation in the management of Tertiary and other Regional Roads. Authorities at the Provincial, Municipal and District levels will be responsible for all work to be carried out on Regional Roads including the choice of technology and the selection of contractors, whilst DER will have a co-ordinating and advisory role. The FRP has started to work on the institutional strengthening of both the DER and the Provincial Road Departments (DEP). Asdi and DFID are together planning a successor programme to the FRP. It is expected that this programme will include:-

- Institutional development and capacity building of the Directorate of Regional Roads (DER) to effectively manage the Regional Road network
- Strengthening of Provincial Roads Departments (DEP)
- Expansion of ANE´s Poverty HIV/AIDS and Gender Unit to fulfil new and wider responsibilities
- Development of local contractor and consultant capacity to support road maintenance activity and subsequently to expand into other works

- Short term budgetary support for the Road Fund to tackle a back-log of periodic maintenance of Regional Roads and allow some rehabilitation of roads to take place in priority areas.

For the major part of the life of the FRP, implementation of works on tertiary roads has been carried out by parastatal companies (ECMEP), until recently responsible for the bulk of the country's road maintenance. With the introduction of road sector reforms, the tertiary road market is being opened up to competitive tendering at provincial level, with increasing participation by small scale Mozambican contracting companies.

OBJECTIVES OF THE STUDY

Principal objective of the study is to establish adequate evidence of the financial and economic cost-competitiveness of Labour-Based Technology used in rural road construction and maintenance. The results of the study will be used to inform decision makers and programme implementers at national and provincial levels, enabling them to take into account both financial and social issues when planning their activities.
The study will also review the socio-economic impact studies of the road sector, identifying conclusions related to the local economic multiplier and targeted social effects that are derived from LBT investments in rural roads. Institutional proposals for the future monitoring of social and economic benefits will also be made.

JUSTIFICATION FOR THE STUDY

Labour-based methods have been demonstrated to be viable and practical in creating a national resource for the rehabilitation and maintenance of rural roads. The use of employment-friendly techniques in infrastructure provision forms a part of the government's Road Policy, and this is reflected in the aims and objectives of the Road Administration.
The practical implementation of this policy requires that it is supported by sound evidence, both to confirm the decisions taken to use labour-based techniques where appropriate, and to demonstrate to those involved in the choice of construction method at provincial and district level that they can offer significant political, social, economic and technical benefits.

SCOPE OF STUDY

The proposed scope of the study is to include analyses of road rehabilitation and maintenance costs.

Rehabilitation
In the case of road rehabilitation, the scope of the study is to include Steps 1 and 2 as described in the attached technical structure to this ToR, to:-
1. Establish the financial cost-competitiveness of LBT
2. Establish the economic cost-competitiveness of LBT

Steps 3 and 4 as outlined in the technical structure are included for the information of the consultants, and do not form part of the present study.
In addition to items 1 and 2 above, the consultant shall carry out a review of the extensive socio-economic impact studies that have been carried out for the road sector to:-

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- Identify conclusions that can be drawn related to the quantity and quality of local economic multiplier and targeted social effects that are derived from LBT investments in rural roads.
- Identify any additional fieldwork that could usefully complement existing data, allowing further conclusions to be drawn
- Make proposals for the institutionalisation of the future monitoring of social and economic benefits

Maintenance

For the comparison of routine maintenance costs the consultant will carry out a comparison of the various maintenance systems that are in common use in Mozambique. Overall methodology for the comparison of costs and economic impact should follow that outlined above for rehabilitation works with modifications as described in Annex 2 of the attached technical structure.

METHODOLOGY

The methodology of the study will include, but not limited to the following,

- Pre-assessment of workload and availability of information
- Confirmation of suitable projects to be analysed in 4 target provinces
- Information gathering at ANE/DER and Road Fund on current contract costs and policies
- Agreement of standard costing methodologies and macro economic modelling options with ANE
- Development of questionnaires which address the issues envisaged to be done under scope of work above
- Finalisation of workplan and visit programme
- Visit initial province, reviewing methodology in the light of results
- Desk study of available socio-economic data
- Completion of remaining visits
- Discussion of findings and conclusions with ANE
- Submission of draft report
- Completion of report on receipt of comments

COMPOSITION OF THE TEAM

The composition of the team is envisaged to be as follows

Title	Qualifications	Estimated time input
Team leader	Civil engineer with relevant experience in a) LB and EB road provision methods b) transport economics issues	5 days in the office 5 days in Mozambique
International Civil Engineer	Civil Engineer with experience in transport economics issues including micro and macro economic modelling	12 days in Mozambique 15 days in the office in UK

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Regional Civil Engineer	Civil engineer a) with relevant experience in LB and EB road provision methods b) familiar with Mozambican road sector issues c) able to speak and read Portuguese	36 days in various parts of Mozambique
Regional Social Scientist	At least a bachelor's degree in social sciences and with relevant experience in soci-economic applied research and able to speak read and write in English and Portuguese	5 days in Maputo
Project Manager	Project Management experience	In charge of reimbursable costs

The team leader will be responsible for the outcome of the assignment. The team members will be assigned tasks by the team leader as envisaged in the proposal submitted by the team leader.

TIMING

The assignment is envisaged to commence in October and be completed by end of December 2002

INPUTS

The project manager will be responsible for making all necessary logistical arrangements including accommodation, air and land transport, translation and copying for the study. ANE will provide support in the planning of meetings and visits, making reservations, and accompany the consultant to meetings. ANE will nominate a member of technical staff to act as liaison officer for the study. ILO/ASIST will provide technical backstopping to this assignment and act as the client on behalf of ANE. The team leader will keep the client informed about the progress of the assignment.

PRESENTATION OF THE REPORT

The report will be presented in draft and final versions in both Portuguese and English in MS Office 97 compatible format. The report will be submitted in both hard copy (ten bound and one unbound in each language) and in electronic format in floppy diskette(s) or CD ROM.

The report should include a list of contacts made, interviews held, and written and other sources relied upon in its preparation and for its conclusions. It may also refer to further work, which should be considered in addressing issues uncovered.

Appendix II

ECONOMIC PERFORMANCE IN MOZAMBIQUE SINCE 1990

1. Country Profile

1.1. Independence, civil war and political process

Mozambique is a large country in the Southern African region with an area of 799,390 Km^2 (13,000 Km^2 of inland waters), and a population of 18,082,523 inhabitants. After a long period of civil war in the fight for independence against Portuguese rulers, the modern independent nation-state of Mozambique was formed after independence in 25, June 1975. At this time FRELIMO (Frente de Libertação de Moçambique), became a political party and took control of the Government.

The government pursued socialist policies which centralised the system of economic planning. The ownership of most of the means of production and most of the land came under the control of the State in the years immediately following independence.(GOM & WB, 1992:1-2).

The transition from war to peace began in mid-1980s and was consolidated with the end of the armed conflict. The General Peace Agreement established in 04, October 1992 was a culmination of a wide range of dialog in which various social sectors took part. The multiparty elections system was launched under the New Constitution in 1990.

1.2. The Economic Reform Program

It is estimated that between 1980 and 1987, total GDP fell by at least 25 % in real terms and exports declined by 75%.

As a result of the deteriorating economic position, the Government introduced an *Economic Rehabilitation Program (ERP)* in January 1987. The thrust of the program was to arrest the economic decline and commence restoring production and income levels by reducing distortions in the economy. The government strategy aimed at creating an economic strategy that differed fundamentally from the socialist system in place since 1975. The major policy changes include movement toward market-determined prices and a greater interplay of market forces; movement toward a more realistic exchange rate; restructuring of certain institutions; tightening monetary and fiscal policy; and restraining growth in wages (GOM & WB, 1992: 2-3).

Implementation of the ERP appears to have some positive results, with the 1982-85 decline in GDP having arrested and reversed. From 1987 to 1989, average real GDP increase at an estimated 5.3% per year, despite worsening security. The main source of this growth was small-scale agriculture and manufacturing. The reform program, however led to an initial jump in prices, with the overall domestic price level increasing by 163% in 1987, 50% in 1988, 42 % in 1989, and 49% in 1990 (GOM & WB, 1992: 3).

1.3. Government strategy for poverty alleviation

The fight against poverty in Mozambique has been a critical priority since the first days of independence, when high priority was given to expenditure on health and

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education, to improve human development. Significant investment s were also made in rehabilitating basic infrastructure.

There have been notable successes. Over the last five years Mozambique achieved annual economic growth rates of around 8% in real terms, in the context of economic and political stabilisation. Democracy and peace were strengthened, and the Mozambican people continued their struggle for progress. However, these achievements have not resolved the grave social and economic problems facing the country. The country remains one of the poorest in the world, and poverty remains as the key challenge facing the country. The country's ability to address this challenge is still limited by a severe scarcity of resources resulting from a serious structural weakness of the economy.

To deal with this situation of poverty, its determinants, and economic constraints, the government decided to develop a comprehensive and integrated poverty reduction strategy.

The Central objective of government is a substantial reduction in the levels of absolute poverty in Mozambique through the adoption of measures to improve the capacities of, and the opportunities available to all Mozambicans, especially the poor. The specific objective is to reduce the incidence of absolute poverty from 70% in 1997 to less than 60% by 2005 and less than 50% by the end of this decade (*GOM, 2000. Action Plan for Reduction of Absolute Poverty (2001-2005)).*

In concrete terms, the poverty reduction strategy in Mozambique is based on six "fundamental areas of action" namely: (i) education; (ii) health; (iii) agriculture and rural development; (iv) basic infrastructure; (v) good governance; and (vi) macro-economic and financial management.

> "A fundamental role of the State in stimulating a market economy and expanding opportunities for the poor lies in the development of basic infrastructure. Improvements in the road network will permit better access to market and a reduction in costs, and will facilitate communication and mobility, especially for those who live in rural areas and depend on agriculture. In parallel, the provision of water and energy is fundamental to the development of human capital and the expansion of national output. Priority in the rehabilitation and construction of basic infrastructure will be given to those areas of the country with largest population and highest levels of poverty" (GOM, 2001).

2. Macroeconomic Performance

2.1. Performance of Real Sectors

Table 1: Trend in real GDP and inflation

	1996	1997	1998	1999	2000	2001
GDP real growth rate (1996=100)	6.4	11.1	12	12.6	1.6	13.9
Inflation	16.3	5.8	-1.3	4.8	11.4	21.9

Source: Ministry of Planning and Finance & National institute of Statistics (http://www.ine.gov.mz/Ipc2/indprec.htm)

Table 1. shows that the real GDP growth rate was 11.1 %, in real terms, between 1996 and 1997. The main source of this growth were the increase of external investment, the expansion in the electricity and water network across country, the introduction of fiscal incentives for private investments, and the increase of the output in following sectors: manufacturing by 31.8% between 1996-97, in the construction by 18.1% between 1996-97, in the restaurants and hotels by 35.5, in 1996-97 and in financial services by 29.9% between 1996-97. The expansionary trend in the real growth of GDP over the period 1996-1999 was characterised by downward trend in the rate of inflation. From 16.3%, in 1996, the rate of inflation decreases sharply since then on, reaching -1.3% in 1998. Since then on, the general level of the prices increases severally, reaching 4.8% in 1990, 11.4 in 2000 and 21.9% in 2001. The major sources of this upward trend in the rate of inflation in 1999, was the excess demand of goods and services during the floods, and the expansionary trend in public spending after 2001 to meet the reconstruction of the socio-economic infrastructure in post-flood period.

Table 2: GDP growth rates for the period 1996/97-2000/01

Period	**1996/97**	**1997/98**	**1998/99**	**1999/2000**	**2000/01**
Agriculture, livestock and forestry	9.6%	9.5%	6.5%	-10.8%	10.8%
Fishing	2.1%	-11.0%	-2.1%	9.5%	10.6%
Mining	21.1%	20.6%	-6.5%	52.8%	12.6%
Manufacturing	31.8%	14.4%	14.7%	20.3%	30.5%
Electricity and Water	37.9%	279.0%	78.3%	-6.1%	11.5%
Construction	18.1%	26.2%	3.4%	4.7%	13.8%
Commerce and Repairing Services	8.2%	12.1%	2.5%	2.4%	7.5%
Restaurants and Hotels	35.5%	-2.1%	5.4%	6.4%	-0.7%
Transport and Communication	17.3%	4.8%	9.0%	1.2%	24.6%
Financial Services	29.9%	-17.4%	-26.9%	41.9%	9.6%
House Rents and Corporate Services	2.3%	9.1%	3.0%	-1.9%	4.2%
Overall Valued Added growth rates (%)	**12.6%**	**10.7%**	**6.8%**	**1.9%**	**13.7%**

Source: National Institute of Statistics. National Directorate of National Accounts and Global Indicators, 2002

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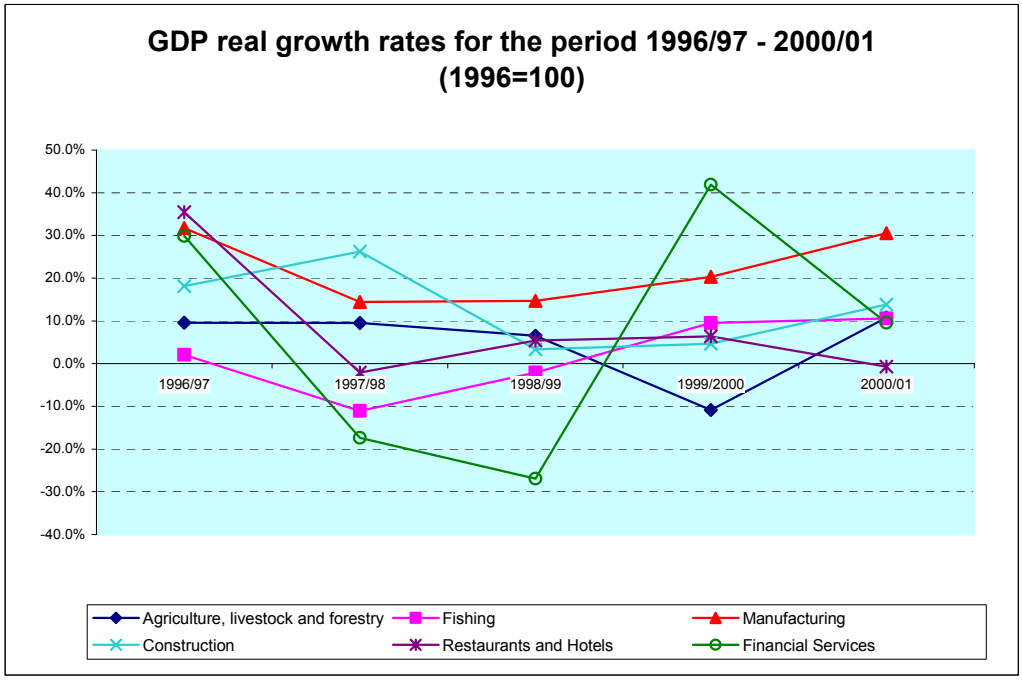
The figure below gives a brief background on the trend of value added, between 1996/97 and 200/01, for a sample of sectors.

Figure 1: GDP growth rates



Source: National Institute of Statistics, 2001

The statistics on private and public investment as a share of GDP, as well as the domestic and external saving as share of GDP for the period 1999 and 2002 are summarised in Table 3. Mozambique's economy relies heavily on external finance to meet the gap in State Budget. Actually, about 60% of the State Budget is support by external financing. The saving investment gap in Mozambique remains extremely high. As reported in the table below, the gross investment as a percentage of GDP grew from around 23.6% in 1999, to 26.6% in 2001, and to 41.8% in 2002. However, the ratio of domestic saving to GDP remains extremely low, reaching 0.4% in 2002. From 1999 to 2002 in average, there was a deterioration in public saving as a share of GDP, while the external saving as a share of GDP grew from 22.4 in 1999, to around 41.4% in 2002.

Table 3:Investment and saving as percentage of GDP

	1999	2000	2001	2002
Gross investment	23.6	19.9	26.6	41.8
Private investment	14.2	8.3	11.5	29.2
Public investment	9.3	11.5	15.0	12.5
Domestic Saving	1.2	0.6	5.7	0.4
Private Saving	2.3	2.2	9.8	4.0
Public Saving	-1.1	-1.6	-4.1	-3.6
External Saving	22.4	19.3	20.9	41.4

Source: Ministry of Planning and Finance, 2001

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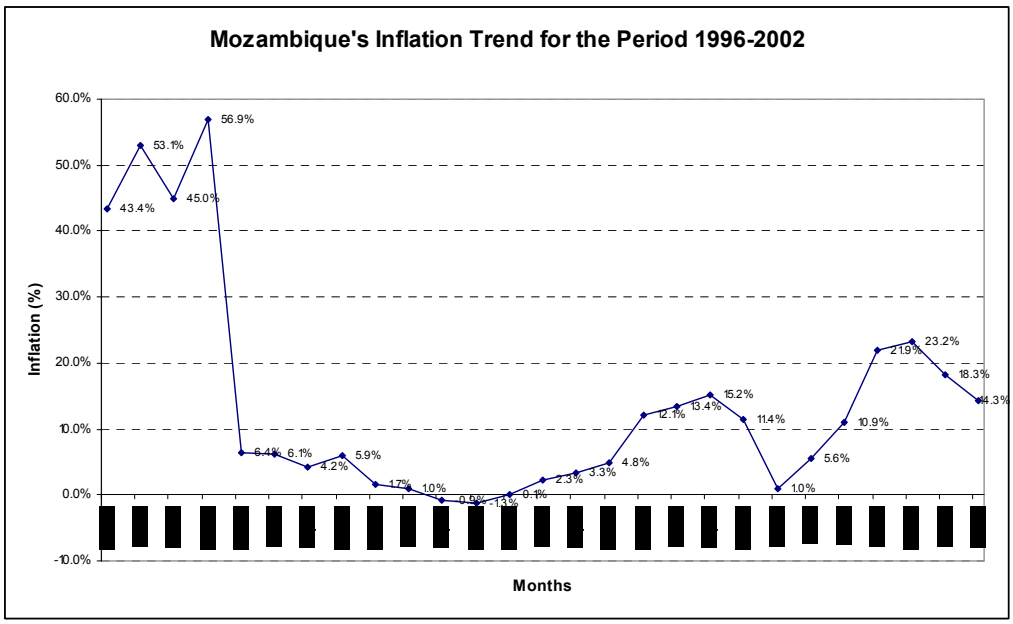
2.2. Inflation, Exchange Rate and Rate of Interest

Figure 2: Overall situation concerning inflation over the period 1996-2002



Source: NIS, Directorate of National Account and Global Indicators
Note: Inflation (% change from the same period of the previous year)
1994=100
1998=100

Figure 3. shows that there was a upward trend in the exchange rate of (Meticais *vis-a-vis* US$). The exchange rate remains stabilize around 11700 on average over the period 1996-1999. Since the on the exchange rate picked up , reaching 20454.4 MZM/US$, in 2001. The depreciation of the Mozambican currency against the US$ are due to behavioural change of individuals expectations concerning the trend of domestic inflation immediately after the floods. On other hand, the increase of demand of external currency to support the import of goods and services during the floods, and the turmoil after the September,11 in international financial market can be pointed out as the main reasons for the trend in exchange rate (MZM/US$) illustrated on graph 1.3 since 1999.

The exchange rate between Meticais against South Africa currency (Rand) remains flat around 2,400.0 MZM/ZAR on average over the period 1996-2001.

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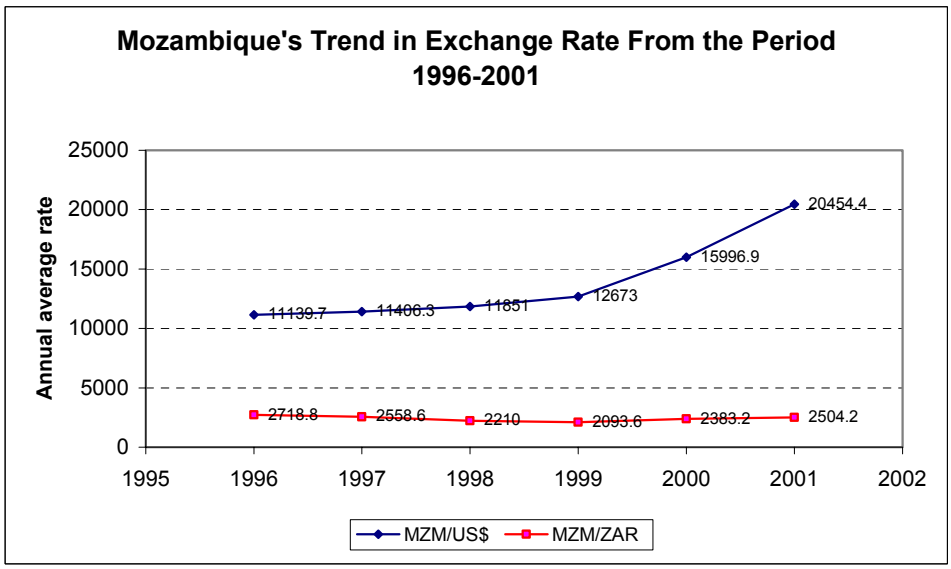
Figure 3: Exchange rate trends



Source: Bank of Mozambique, 2002: Boletim Mensal de Conjuntura, Maputo, Junho 2002

- *rate of interest and reasons of high interest rate. Is government taking any steps to lower the interest rate? Is there any financial sector adjustment programme taken up by the GOM? If yes, please describe in brief (one para)*

The figure below gives an overview of trend of the average quarterly interest rate for lending and deposit operations, as well as the spread between the quarterly average interest rate for lending and deposit operations. Over the period considered the quarterly average interest rate for lending operation fluctuates between 27% and 21%. One of the reasons of high interest rates for lending operations in Mozambique's financial market is high level of uncertainty concerning the macro environment. In general the marginal cost of capital for projects with high maturity periods and high level of risk are extremely high. Over the same period the trend of the average quarterly rate for deposit operation remains flat between 9% and 10%. The decreases in the rate for lending operations has led to reduction of the spread between the average quarterly rate for lending and for deposit operations, over the period considered.

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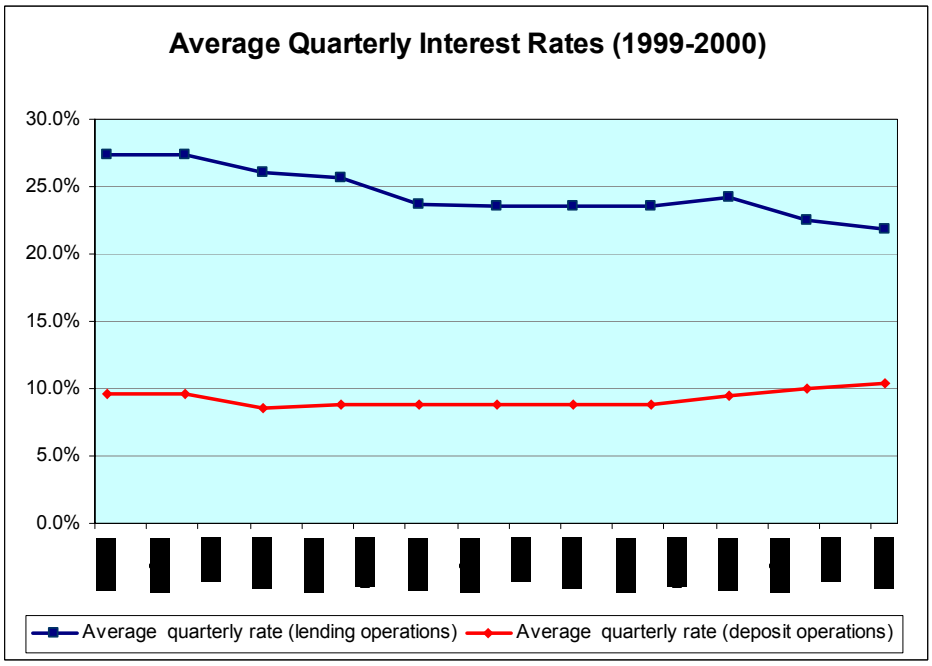
Figure 4: Interest rates (1999-2000)



Source: Banco de Moçambique, 1999,2000,2001

2.3. Public finance

The developments in public finances since 1992 are summarised in Table 4.

Table 4: Mozambique public finances, 1992-2000

	1992	1993	1994	1995	1996	1997	1998	1999	2000
In constant 2000 MZM (10^12):									
Total expenditure and net lending[a]	9.5	10.4	11.3	9.2	8.4	11.1	11.7	14.4	16.7
Of which Current expenditure	4.9	5.3	5.5	3.9	3.8	5.0	6.1	7.1	7.8
Total revenue	4.2	4.9	4.4	4.3	4.3	5.3	6.2	7.0	7.5
Budget balance before grants	-5.3	-5.5	-6.9	-4.9	-4.1	-5.8	-5.5	-7.4	-9.2
Grants plus net external borrowing	4.8	5.1	7.3	5.2	4.5	7.0	6.9	7.8	9.1
As a % of GDP									
Budget balance before grants	-21	-19	-23	-13	-10	-12	-10.5	-14.2	-16.1
Grants	17	15	17	9.8	7.1	9.1	8.1	11.7	11.6
Budget balance after grants	-4.4	-4.4	-6.1	-4.1	-4.1	-2.6	-2.4	-1.5	-4.5
Primary balance 1/	-0.3	-1.0	-4.2	-1.6	-1.4	-1.3	-1.4	-0.8	-4.3
Financing:									
Net external borrowing[b]	2.6	4.2	7.3	3.8	4.3	5.7	4.6	1.8	2.8
Net domestic borrowing	1.8	1.2	-1.2	-0.8	-1.2	-4.1	-2.3	-0.3	-0.8

Source: Ministry of Planning and Finance & World Bank, 2001. *Public Expenditure Management Review*
Notes:
1/ Defined as overall balance after grants excluding interest payments.
[a] Excluding unallocated expenditure
[b] Net foreign borrowing = project & non-project disbursements – cash amortization

One of the most critical issue for long term macroeconomic stability is public revenue mobilisation. Although revenue improvement since 1991, total revenue to GDP ratio remains at about 13% of GDP in 2001. (Figure 5).

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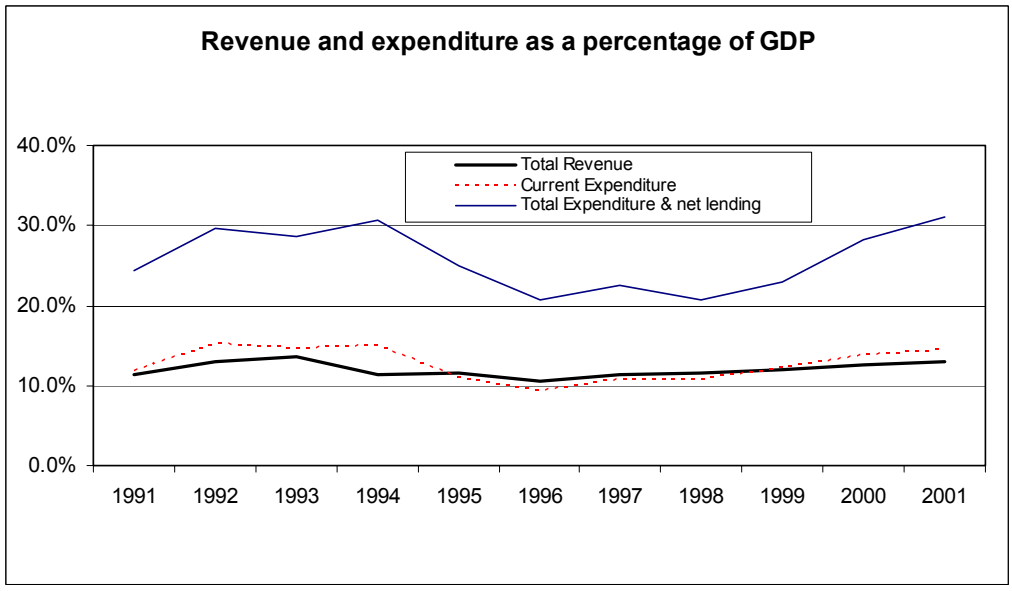
Real expenditure peaked in 1994 owing to food aid and other assistance after the end of civil war. As food aid declined from 1994, both current and total expenditure declined. But after 1996 expenditures picked up again, and real total expenditures grew a vertiginous 20 percent annually during the period 1996-99, against a negative annual growth of -3 percent between 1992-96. On other hand, revenues rose at slower pace -18 percent annually – during the period 1996-99. The increase in spending in the latter half of the nineties was supported by swift growth of concessional assistance (grants plus net external borrowing): 20 percent per year from 1996 to 1999. (MOP & WB, 2001:4).

GDP also grew strongly during the latter half of the nineties, but not as swiftly as did expenditures. Figure 5 below illustrates these trends.

Figure 5: Revenue expenditure as a proportion of GDP



Source: Ministry of Planning and Finance

The expansionary trend initiated in 1996 was aggravated in 2000, when expenditures rose by 16 percent in real terms compared to the previous year. This increase is only partly related to flood reconstruction as these expenditures are taking place mostly in 2001.

In general, Mozambique has been able to swiftly expand its spending program in the latter half of the 1990's while improving macroeconomic stability, party due to the high levels of donor assistance, while revenues have remained relatively flat as percentage of GDP since 1995. In 2000, a significant deterioration in fiscal position took place resulting from an increase of expenditures partly linked to post-flood reconstruction, but which was the culmination of an expansionary period that started in 1996. For the future, the fact that donor assistance is unlikely to continue growing at the pace of the last five to six years, and the need to develop a post-HIPC public debt strategy, militate in favour of a more forceful fiscal adjustment that will improve fiscal sustainability in the medium run *(World Bank, 2001:5).*

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2.4. The external sector

Details of recent development in the external sector are given in Table 5. The overall balance of payments position improved from an overall deficit of 22.6% of GDP (-457.9 millions US$), in 1991 to a small surplus of 0.2% of GDP (7.2 millions US$), in 1998. Since then, the overall position of the balance of payments deteriorating severally, the deficit rises sharply from 8 % of GDP (-326.4 millions US$) in 1999, to 14.3 % of GDP (- 516.1 millions US$), in 2001. Since 1995, there has been an increased of exports earnings, especially from the cashew, prawns, cotton, sugar, coconut and wood. In 1999, the international prices of the main exports products of Mozambique, became favourable, which led to an increase of exports earnings from 283.8 millions US$ in 1999, to 703.7 millions US$ in 2001. However, the imports levels were extremely huge, over the period 1995 -2001, due mainly to adverse impact of external shocks, which led to an increases of international oil prices, which accounts for a large share of Mozambique's imports. This environment led to an deterioration of the trade balance from, -552.7 millions US$ in 1995, to -620.1 million US$ in 1998, and -798.3 million in 2000.

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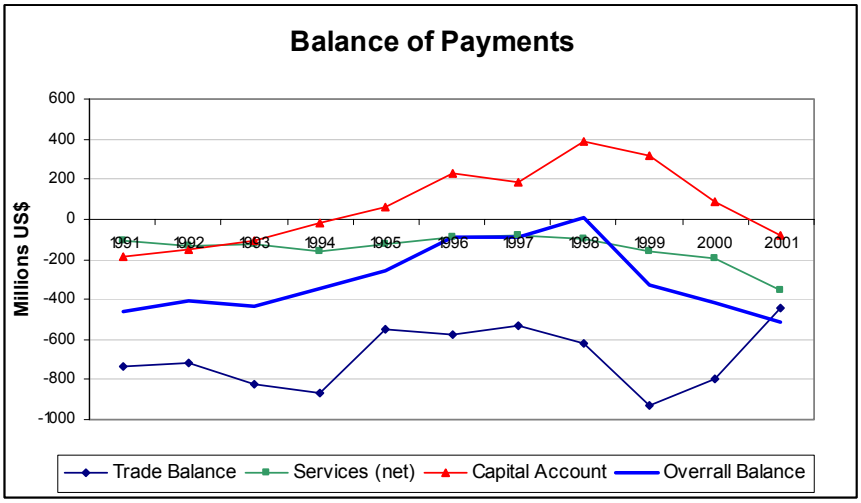
One critical element that has helped to offset the large trade deficit , has been the improvement in the capital account due mainly to increasing the external borrowing, the foreign direct investment and the savings under the debt relief initiatives.

Figure 6: Balance of payments



Source: Ministry of Planning and Finance

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Table 5: Balance of payments, 1991-2001

Millions US$	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Trade Balance	-736.5	-715.7	-822.9	-869	-552.7	-575.6	-530	-620.1	-927.3	-798.3	-447.1
Exports (FOB)	162.3	139.3	131.8	149.5	174.3	225.9	230	248.2	283.8	364	703.7
Imports (CIF)	898.8	855	954.7	1018.5	727	801.5	760	868.3	1211.1	1162.3	1150.8
Services (net)	-109.6	-132.8	-126.7	-160.5	-127.3	-89.3	-80.3	-96	-158.4	-199.8	-355.5
Current Account, Excluding Unreq/Transf.	-846.1	-848.5	-949.6	-1029.5	-680	-664.9	-610.3	-716.1	-1085.7	-998.1	-802.6
Current Account, Including Unreq. Transfers	-236.8	-239.1	-321.3	-327.4	-340.8	-382	-297.4	-402.9	-651.7	-434.2	-333.3
Capital Account	-187.5	-155.1	-107	-22.1	57.6	224.4	184.1	387.9	314.1	84.2	-80.3
Overall Balance	-457.9	-406.6	-436.1	-346.6	-256.1	-90.2	-91.1	7.2	-326.4	-416.5	-516.1

Source: Ministry of Planning and Finance, Mozambique

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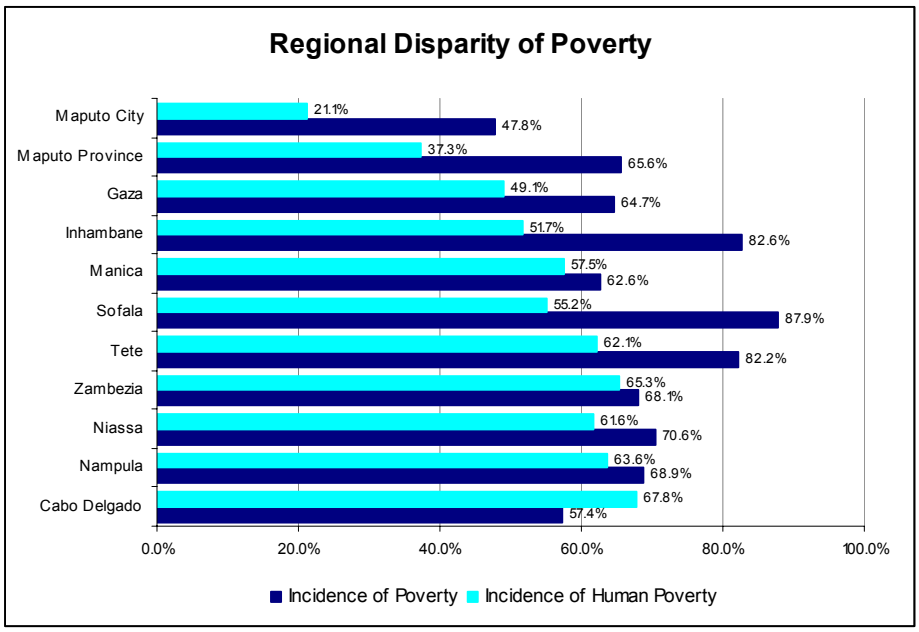
3. Poverty, Population and Employment Situation

4.1. Poverty situation in Mozambique

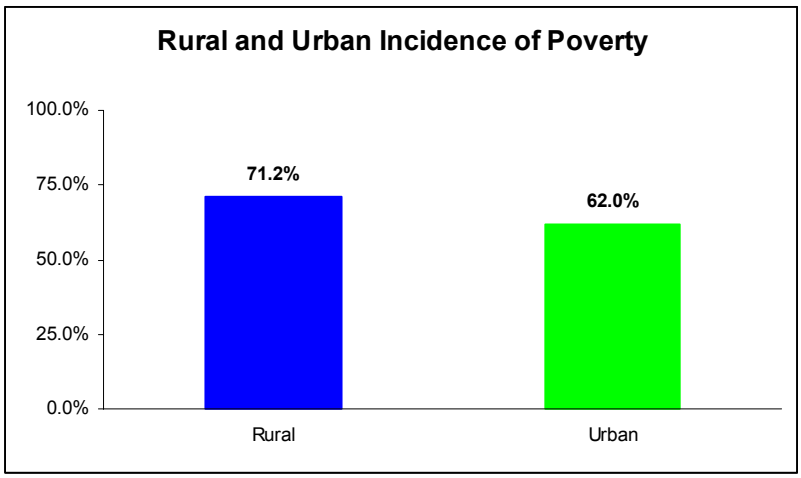
Note: *More details about the poverty situation in Mozambique can be found on page 2 about Government Strategy for Poverty Reduction*

Figure 7: Regional disparity of poverty



Source: Action Plan for the Reduction of Absolute Poverty (2001-2005)

Figure 8: Urban-rural poverty incidence



Source: Action Plan for the Reduction of Absolute Poverty (2001-2005)

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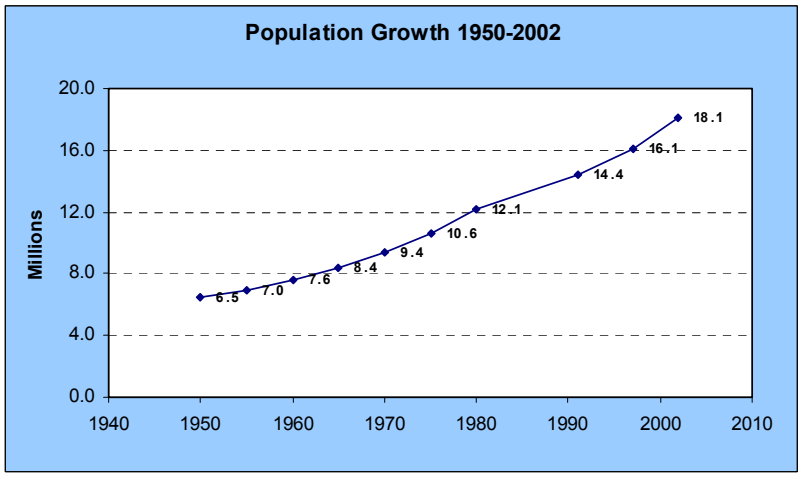
4.2. Population characteristics

The available national demographic data enable us to describe the historical evolution, of at least the second half of 20th century. In 1950 the Mozambican population was about 6.5 million. From then on the population has grown at an accelerated pace, reaching 7.6 million in 1960, 9.4 million 1970, 12.1 million in 1980, 14.4 million in 1991 and 18.1 million in 2002. (Table 6).

Figure 9: Population growth, 1950-2002



Source: National Human Development Report, 1998:15
National Institute of Statistics, *Annual Projections of the Population by Province and by Area of Residence, 1997-2010.*

The table below shows that between 1950 and 2002 the population growth rate rose from 1.5% per year in 1950-1955 to 1.8% in 1960, 2.3% in 1970, 2.7% in 1980, 2.6% in 1991, and 2.4% in 2002. This means that at the start of the 1980s, the population growth rate reached its highest level of the past five decades, and probably of the entire 20th century (NIS, 1997:7).

Table 6: Evolution of the population by gender and growth rate (1950-2002)

Population (thousands)				Growth rate
Year	Total	Men	Women	(%)
1950	6465.5	3130.7	3334.8	
1955	6953.7	3368.6	3585.1	1.5
1960	7595.3	3682.7	3912.6	1.8
1965	8406.8	4080.8	4326.0	2
1970	9407.7	4572.2	4835.5	2.3
1975	10627.3	5170.9	5456.4	2.4
1980	12130.0	5908.5	6221.5	2.7
1991	14419.9	6976.9	7443.0	2.6
1997	16075.7	7703.0	8372.7	
2002	18082.5	8700.9	9381.6	2.4

Source: National Human Development Report, 1998:15
National Institute of Statistics, *Annual Projections of the Population by Province and by Area of Residence, 1997-2010*

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The Table 7.provides information on how the population is distributed, in terms of density. The average density as a whole in country is 23 inhabitants per square kilometre. But density varies greatly from Maputo City, with the highest population density, of around 3482 inhabitants per square kilometre, to Niassa province, of lowest, just seven inhabitants per square kilometre.

Women account for the majority of the Mozambican Population. According to population projections for the period 1997-2010, in 2002, 51.9% of the population were women, while the men accounts for 48.1% of the total population.

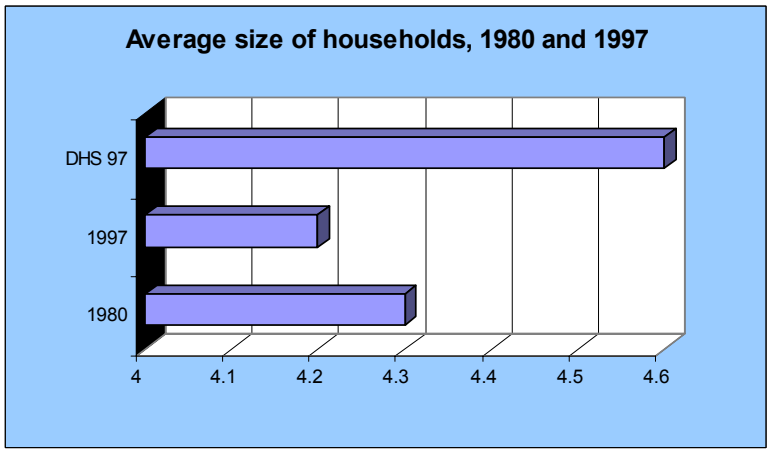
Table 7: Total Population by provinces, 2002

Provinces	Population Total	Percent of Total		Population Density (Inhabitants/Km^2)
		Men	Women	
Niassa	916672	2.5	2.6	7
Cabo Delgado	1525634	4.1	4.3	18
Nampula	3410141	9.4	9.5	42
Zambézia	3476484	9.3	9.9	33
Tete	1388205	3.7	4.0	14
Manica	1207332	4.2	3.5	20
Sofala	1516166	4.1	4.3	22
Inhambane	1326848	3.3	4.1	19
Gaza	1266431	4.1	3.9	17
Maputo Province	1003992	2.7	2.9	39
Maputo City	1044618	2.8	3.0	3482
Total	10082523	48.1	51.9	23

Source: National Institute of Statistics, *Annual Projections of the Population by Provinces and Area of Residence, 1997-2010*

The figure above shows household composition. The 1980 census found an average of 4.3 persons per household, and the 1997 census showed a slight reduction to 4.2. However, Demography and Health Survey 1997 gave an average household size of 4.6 persons.

Figure 10: Average size of households, 1980 and 1997



Source: NIS, 1997; DHS, 1997

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4.3. Employment in Mozambique

4.4.1. Economically active labour force

according to the most recent estimates drawn by the National Institute of Statistics (NIS), 62% of the Mozambican population of seven years of age and above is economically active (NIS, 1998:38). The percentage of population that is economically active is markedly higher in rural areas than urban areas (66.6% versus 40%). In the view of the NIS, this result is to be ascribed to the fact that in rural areas almost all females work on the machambas (fields), while in urban areas there are more women who carry out "domestic work" and who are students. In the urban areas, in fact, only 32% of women are considered economically active, against 69% in rural areas (NIS, 1998).

4.4.2 The wage labour force and employment trends

On the basis of National Household Survey, it is possible to calculate tentatively the size of the country's wage labour force. The 1997 census counted 15.7 million people although, due to census omissions, the total 1997 population is estimated at over 16 million (NIS, 1999). The economically active population was estimated at 7.4 million. On the basis of estimates presented in *Understanding Poverty in Mozambique: the First National Assessment*, around 10% of these 7.4 million people can be defined as working for a wage or some form of payment during the week preceding the interview (DPDS, UEM and IFPRI, 1998). According to the IAF97/97 data, therefore, the wage labour force consists of about 740.000 people. (NHDR, 1999:53).

A 1997 study prepared by UNESCO, in collaboration with the ILO, based on official statistics and "rough estimates", maintained that around 1.4 million individuals were employed for some sort of wage in Mozambique (Table 8). Although the study assumed a total population of 18 million, the reported figure exceeded the estimate derived from the IAF96-97 data (740.000) by near a factor of two. It is also interesting to note that this estimate is biased towards formal sector employment. (NHDR, 1999:53).

Table 8: Estimated wage labour by categories

Private sector formal employment	500.000
Non agricultural	460.000
Agricultural	40.000
Public service	100.000
Domestic service	150.000
Non-household agricultural enterprises	250.000
Non-agricultural informal	250.000
Migrant workers	150.000
Total	**1.400.000**

Source: ILO/UNESCO 1997:Table 3, in NHDR, 1999:53

Appendix III

MOZAMBIQUE: COST COMPARISON STUDY
SUMMARY OF AVAILABLE DATA

Province	Implemented by	Number of Schemes	Total length (Km.)	Implementation years (between)	Technology			Improvement type				Remarks
					Number of LB schemes	Number of EB schemes	Number of mixed technology	FR	PM/SI	ER	RM	
GAZA	ECMEP	6	123	2001- 2002	5	0	1	1	0	4	1	1 scheme was not included in the analysis due to incomplete or doubtful data. No costs break-ups were available
MANICA	CFE	2	117	2000- 2001	1	1	0	2	0	0	0	No break-ups of fuel and lubricant costs were available for the schemes.
NAMPULA	DET	31	961	1997- 2001	26	0	5	13	9	0	9	1 scheme was not included in the analysis due to incomplete or doubtful data. Equipment owning and maintenance costs were calculated separately.
NAMPULA	ECMEP	14	971	1997- 2001	2	11	1	1	0	3	10	3 schemes were not included in the analysis due to incomplete or doubtful data. Equipment owning and maintenance costs were calculated separately.
ZAMBEZIA	ECMEP	34	2083	2000- 2002	4	13	17	6	14	0	14	15 schemes were not included in the analysis due to incomplete or doubtful data. Equipment owning and maintenance costs were calculated separately.

Note: LB: Labour-based; EB: Equipment-based; FR: Full Rehabilitation; PM or SI: Periodic Maintenance or Spot Improvements; ER: Emergency Repairs; and RM: Routine Maintenance

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Appendix IV

LIST OF SCHEMES

Contract Number	Project Name	Province	Year	Road Type	Suitable for Analysis?
01/REA-MAN/01	ER405: Guija-Fronteira c/ Maputo	GAZA	2001	R	Yes
03/MR/01	ER411: Manjacaze-Machulane	GAZA	2001	R	Yes
02/PAP/2002	NC: Magul-Veape	GAZA	2002	UC	Yes
03/PAP/2002	ER410: Chicumbane-Novela	GAZA	2002	R	No
06/PAP/2002	ER412: Macarretane-Dindiza	GAZA	2002	R	Yes
08/PAP/2002	NC: Crz EN1-Maciene	GAZA	2002	UC	Yes
EP2000/3	Sambasoca-Mabzissanga	MANICA	2000	R	Yes
EP2001/1	Nhacolo-Sabeta II	MANICA	2001	R	Yes
01/REA-MAN/NPL/97	EN241: Nacala a Velha-Memba	NAMPULA	1997	N	Yes
02/REA-MAN/NPL/97	ER542: Murrupula-Luluti	NAMPULA	1997	R	Yes
04/MR/NPL/97	EN236: Crz EN236/239-Fronteira de Monapo	NAMPULA	1997	N	No
04/REA-MAN/NPL/97	ER514: Minguri-Itoculo	NAMPULA	1997	R	Yes
05/REA-MAN/NPL/97	ER499: Naguema-Lunga	NAMPULA	1997	R	No
07/MR/NPL/97	EN237: Nacavala-Muecate	NAMPULA	1997	N	Yes
10/MR/NPL/97	EN239: Fronteira de Angoche-Fronteira de Nampula	NAMPULA	1997	N	Yes
11/MR/NPL/97	EN239: Fronteira de Mogovolas-Nampula	NAMPULA	1997	N	Yes
19/MR/NPL/97	ER509: Muecate-Imala	NAMPULA	1997	R	No
20/MR/NPL/97	ER510: Mecuburi-Namapatua	NAMPULA	1997	R	No
22/MR/NPL/97	ER512: Ribaue-Lalaua	NAMPULA	1997	R	Yes
01/MR-MP/NPL/98	EN241: Nacala a Velha-Memba	NAMPULA	1998	N	Yes
01/REA-MAN/NPL/98	ER514: Minguri-Itoculo	NAMPULA	1998	R	Yes
03/REA-MAN/NPL/98	ER542/502: Morrupula-Iuluti-Chalaua	NAMPULA	1998	R	Yes
001/REA-MAN/NPL/99	EN235: Naguema-Mossuril	NAMPULA	1999	N	Yes
002/REA-MAN-DPOPH/NPL/99	ER514/567: Minguri-Itoculo	NAMPULA	1999	R	Yes
003/REA-MAN-DPOPH/NPL/99	ER542/502: Murrupula-Iuluti-Chalaua	NAMPULA	1999	R	Yes
005/REA-MAN-DPOPH/NPL/99	ER552:Chalaua-Metil	NAMPULA	1999	R	Yes
03/MR-DPOPH/NPL/99	ER510: Mecuburi-Muite	NAMPULA	1999	R	Yes
04/MR-DPOPH/NPL/99	ER512: Ribaue-Lalaua	NAMPULA	1999	R	Yes
04/REA-MAN/DPOPH/NPL/99	ER572: Meconta-Corrane	NAMPULA	1999	R	Yes
07/MR-UIMO-DPOPH/NPL/99	EN241: Nacala a Velha-Memba	NAMPULA	1999	N	Yes

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Contract No.	Project Name	Province	Year	Road Type	Suitable for Analysis?
06/MR-UIMO/DPOPH/NPL/99	ER510: Rapale-Mecuburi	NAMPULA	1999	R	Yes
11/MR-MP/NPL/99	ER483: Rio Ligonha-Nametil	NAMPULA	1999	R	Yes
01/REA-MAN/NPL/2000	ER552:Chalaua-Metil	NAMPULA	2000	R	Yes
02/REA-MAN/NPL/2000	ER572: Meconta-Corrane	NAMPULA	2000	R	Yes
03/REA-MAN/NPL/2000	EN235: Naguema-Chocas	NAMPULA	2000	N	Yes
04/REA-MAN/NPL/2000	ER514/567: Minguri-Itoculo	NAMPULA	2000	R	Yes
05/REA-MAN/NPL/2000	ER510: Rapale-Mecuburi	NAMPULA	2000	R	Yes
06/REA-MAN/NPL/2000	ER542: Murrupula-Iuluti	NAMPULA	2000	R	Yes
07/REA-MAN/NPL/2000	ER502: Iuluti-Chalaua	NAMPULA	2000	R	Yes
08/REA-MAN/NPL/2000	EN241: Nacala a Velha-Memba	NAMPULA	2000	N	Yes
18/REP-EMERG/2000	EN241: Crz EN8/241-Memba	NAMPULA	2000	N	Yes
20/REP-EMERG/2000	ER510: Muite-Mecuburi	NAMPULA	2000	R	Yes
21/REP-EMERG/2000	ER512: Ribaue-Lalaua	NAMPULA	2000	R	Yes
01/REAB-MAN/NPL/2001	ER506: Mossuril-Matibane	NAMPULA	2001	R	Yes
02/REAB-MAN-DPOPH/NPL/2001	ER507: Matibane-Nacala	NAMPULA	2001	R	Yes
03/REAB-MAN-DPOPH/NPL/2001	ER572: Meconta-Corrane	NAMPULA	2001	R	Yes
04/MR-DET-DPOPH/NPL/2001	ER572: Meconta-Corrane	NAMPULA	2001	R	Yes
06/MR-DET-DPOPH/NPL/2001	ER552: Chalaua-Metil	NAMPULA	2001	R	Yes
07/MR-DET-DPOPH/NPL/2001	ER542: Murrupula-Iuluti	NAMPULA	2001	R	Yes
08/MR-DET-DPOPH/NPL/2001	ER514/567: Minguri-Monapo	NAMPULA	2001	R	Yes
11/MR-DET-DPOPH/NPL/2001	EN241: Nacala a Velha-Memba	NAMPULA	2001	N	Yes
12/MR-DET-DPOPH/NPL/2001	EN237: Nacavala-Muecate	NAMPULA	2001	N	Yes
17/REAB-DPOPH/NPL/2001	ER504: Quixaxe-Namige	NAMPULA	2001	R	Yes
01/MBR-UIMO/2000	ER471: Namacurra-Macuse	ZAMBEZIA	2000	R	Yes
01/MBR-UIMO/2000	ER480: Maria-Mulevala	ZAMBEZIA	2000	R	No
01/MP-UIMO/2000	EN228: Mopeia-Zero	ZAMBEZIA	2000	N	No
01/MP-UIMO/2000	EN229: Mocuba-Cha Madal	ZAMBEZIA	2000	N	Yes
01/MP-UIMO/2000	ER479: Mocuba (Bive)-Maganja	ZAMBEZIA	2000	R	Yes
01/MP-UIMO/2000	ER480: Moneia-Mamala	ZAMBEZIA	2000	R	Yes
01/MP-UIMO/2000	NC: Mepinha-Sapemo	ZAMBEZIA	2000	UC	Yes
01/MP-UIMO/2000	NC: Pinda-Chire	ZAMBEZIA	2000	UC	Yes

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Contract Number	Project Name	Province	Year	Road Type	Suitable for Analysis?
1-2/MBR-TIPO A/2000	EN230: Mugeba-Toco Km40	ZAMBEZIA	2000	N	Yes
01/MR/TPL/01	EN224: Quelimane-Abreu	ZAMBEZIA	2001	N	Yes
01/MR/TPL/01	EN228: Zero-Mopeia	ZAMBEZIA	2001	N	No
01/MR/TPL/01	EN229: Mocuba-Nibalaga	ZAMBEZIA	2001	N	Yes
01/MR/TPL/01	EN230/234: Mugeba-Tuco Km 40	ZAMBEZIA	2001	N	Yes
01/MR/TPL/01	EN231/238: Gurue-Cuamba	ZAMBEZIA	2001	N	Yes
01/MR/TPL/01	ER471: Namacurra-Macuse	ZAMBEZIA	2001	R	Yes
01/MR/TPL/01	ER474/EN225: Milange-Lioma	ZAMBEZIA	2001	R	Yes
01/MR/TPL/01	ER477: Morrumbala-Pinda	ZAMBEZIA	2001	R	No
01/MR/TPL/01	ER483: Alto Molocue-Gile	ZAMBEZIA	2001	R	No
01/MR/TPL/01	ER485/EN230: Maganja da Costa-Pebane	ZAMBEZIA	2001	R	Yes
01/MR/TPL/01	NC: Lioma-Rio Lurio	ZAMBEZIA	2001	UC	Yes
01/REA-TR/01	EN104: Vacha-Rio Ligonha	ZAMBEZIA	2001	N	Yes
01/REA-TR/01	ER469: Rio Cuacua-Mopeia/Luabo	ZAMBEZIA	2001	R	No
01/REA-TR/01	ER486: Maganja-Mabala	ZAMBEZIA	2001	R	No
01/REA-TR/01	NC: Ceramica-Marrongane	ZAMBEZIA	2001	UC	No
01/REA-TR/01	NC: Mepinha-Sapemo-Chire	ZAMBEZIA	2001	UC	Yes
01/MP/02	EN224: Quelimane-Abreu	ZAMBEZIA	2002	N	No
01/MP/02	EN230/ER485: Maganja da Costa-Pebane	ZAMBEZIA	2002	N	No
01/MP/02	EN230/ER485: Mocuba-Pebane	ZAMBEZIA	2002	N	No
01/MP/02	EN255/ER474: Milange-Lioma	ZAMBEZIA	2002	N	No
01/MP/02	EN299: Mocuba-Nibalaga	ZAMBEZIA	2002	N	No
01/MP/02	ER472: Alto Benfica-Derre	ZAMBEZIA	2002	R	No
01/MP/02	NC: Muceia-Rio Ligonha	ZAMBEZIA	2002	UC	Yes
01/MP/02	NC: Sapemo-Chire	ZAMBEZIA	2002	UC	Yes
01/UIMO/2002	NC: Tacuane-Muabanama-Lugela	ZAMBEZIA	2002	UC	No

Appendix V

EQUIPMENT OPERATING COSTS (FINANCIAL)

Equipment/Vehicle	Make	Model	Costs (MZM/hr)						Total Operating Cost (MZM/hr)	Total Operating Cost (US$/hr)
			Depreciation, Interest Payments	Mainte-nance	Tyres	Fuel & Lub.	Wages & Overhe-ads	Owning & Maint.		
3 Tons Flat Bed Truck (4x2)	Toyota	Hilux 2.4	68,141	15,472	800	182,667	17,829	87,234	284,909	11.87
3 Tons Flat Bed Truck (4x4)	Toyota	PRMRS	95,126	21,917	800	182,667	18,163	120,998	318,672	14.28
Tipper Truck	Toyota	DA 115-3	127,183	29,122	1,250	293,467	19,668	162,215	470,689	19.61
Flat Bed Truck	Toyota	DA 116-3	99,501	22,512	1,250	293,467	19,325	127,580	436,055	18.17
Water Tank Truck (6.000 l)	Toyota	DA116-H3	184,834	42,889	1,250	293,467	20,382	234,348	542,822	22.62
Fuel Tank Truck (8000 l)	Toyota	DA115-3	177,901	41,234	1,250	293,467	20,296	225,673	534,147	22.26
Asphalt Truck	Toyota	DA115-H3	199,249	46,332	1,250	293,467	20,561	252,383	560,858	23.37
Crane Truck	Tadano	TL-250F/KW	235,237	54,926	1,250	293,467	21,007	297,412	605,886	25.25
Agricultural Tractor 2WD	Massey Fergusson	MF375	104,555	17,197	663	106,667	17,449	124,856	246,530	10.27
Agricultural Tractor 4WD	Massey Fergusson	MF390	133,567	22,152	663	106,667	17,788	159,163	280,837	11.70
Bulldozer	Komatsu	D65E	947,721	224,821	2,813	373,333	33,296	1,191,018	1,581,984	65.92
Self Propelled Grader	Komatsu	GR511R	608,979	144,875	5,553	345,867	28,862	770,636	1,134,135	47.26
Wheel Loader	Komatsu	WA180-1	504,250	119,038	1,380	230,667	23,711	633,372	879,046	36.63
Self Propelled Roller 5 ton	Sakai	WM7706	180,917	43,204	-	68,000	18,079	227,192	310,200	12.93
Self Propelled Roller 10 ton	Sakai	SV70	188,467	45,007	-	121,600	18,708	237,174	373,782	15.57
Self Propelled Roller (sheep feet)	Sakai	SV70	188,467	45,007	-	121,600	21,360	237,201	376,433	15.68
Towed Vibrating Roller	Bomag	BW 6	104,625	24,985	-	26,667	4,403	131,201	160,680	6.69
Pedestrian Vibrator Roller	Sakai	HV 510	46,817	7,997	-	66,667	3,866	56,056	125,347	5.22
Towed Grader	Arthur Garden	AG4000	26,618	6,056	300	-	2,981	33,330	35,955	1.50
Water Pump	Yanmar	YKC-4DF	13,641	2,330	-	17,333	333	16,304	33,637	1.40
Concrete Mixer	KYC	KND(2)-1111	34,397	5,876	-	66,667	1,069	41,342	108,009	4.50
Concrete Vibrator	Vibromax	W501	243,812	41,648	-	66,667	3,521	288,981	355,648	14.82
Crusher	Nakayama	PKV-3M 2	843,580	144,099	-	266,667	12,543	1,000,223	1,266,889	52.79
Air Compressor	Komatsu	EC50Z-5	17,432	2,915	62	146,667	1,671	22,080	168,747	7.03
Cargo Trailer	Herculano	DIE F 6000	16,537	2,025	800	-	194	19,555	19,555	0.81
Tank Trailer	Herculano	RT 4000	38,405	5,760	800	-	450	45,415	45,415	1.89

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EQUIPMENT OPERATING COSTS (ECONOMIC)

Equipment/Vehicle	Make	Model	Costs (MZM/hr)						Total Operating Cost (MZM/hr)	Total Operating Cost (US$/hr)
			Depreciation, Interest Payments	Mainte-nance	Tyres	Fuel & Lub.	Wages & Overhe-ads	Owning & Maint.		
3 Tons Flat Bed Truck (4x2)	Toyota	Hilux 2.4	45,470	14,699	760	107,773	12,585	63,608	181,287	7.55
3 Tons Flat Bed Truck (4x4)	Toyota	PRMRS	63,476	20,821	760	107,773	12,902	88,055	205,733	8.57
Tipper Truck	Toyota	DA 115-3	84,155	27,666	1,188	173,145	14,332	117,435	300,486	12.52
Flat Bed Truck	Toyota	DA 116-3	66,396	21,386	1,188	173,145	14,007	93,071	276,122	11.51
Water Tank Truck (6.000 l)	Toyota	DA116-H3	122,301	40,745	1,188	173,145	15,011	169,339	352,390	14.68
Fuel Tank Truck (8000 l)	Toyota	DA115-3	117,714	39,172	1,188	173,145	14,929	163,097	346,148	14.42
Asphalt Truck	Toyota	DA115-H3	131,839	44,015	1,188	173,145	15,180	182,317	365,368	15.22
Crane Truck	Tadano	TL-250F/KW	155,652	52,180	1,188	173,145	15,604	214,718	397,769	16.57
Agricultural Tractor 2WD	Massey Fergusson	MF375	80,551	16,337	630	62,933	12,224	99,836	172,675	7.19
Agricultural Tractor 4WD	Massey Fergusson	MF390	102,902	21,045	630	62,933	12,547	127,218	200,057	8.34
Bulldozer	Komatsu	D65E	601,804	213,580	2,672	220,267	26,518	832,936	1,064,840	44.37
Self Propelled Grader	Komatsu	GR511R	386,702	137,631	5,275	204,061	22,305	540,277	755,975	31.50
Wheel Loader	Komatsu	WA180-1	322,803	113,086	1,311	136,093	18,173	445,468	591,467	24.64
Self Propelled Roller 5 ton	Sakai	WM7706	114,883	41,044	-	40,120	12,823	158,844	208,869	8.70
Self Propelled Roller 10 ton	Sakai	SV70	119,677	42,757	-	71,744	13,421	165,949	247,598	10.32
Self Propelled Roller (sheep feet)	Sakai	SV70	119,677	42,757	-	71,744	15,178	165,974	249,355	10.39
Towed Vibrating Roller	Bomag	BW 6	66,437	23,736	-	15,733	3,368	91,684	109,274	4.55
Pedestrian Vibrator Roller	Sakai	HV 510	29,729	7,597	-	39,333	2,912	38,505	79,571	3.32
Towed Grader	Arthur Garden	AG4000	16,902	5,754	285	-	2,071	23,279	25,012	1.04
Water Pump	Yanmar	YKC-4DF	10,509	2,214	-	10,227	316	13,039	23,266	0.97
Concrete Mixer	KYC	KND(2)-1111	22,760	5,582	-	39,333	1,016	29,358	68,691	2.86
Concrete Vibrator	Vibromax	W501	161,326	39,565	-	39,333	3,345	204,237	243,570	10.15
Crusher	Nakayama	PKV-3M 2	535,675	136,894	-	157,333	11,916	684,485	841,818	35.08
Air Compressor	Komatsu	EC50Z-5	11,069	2,770	59	86,533	1,587	15,485	102,018	4.25
Cargo Trailer	Herculano	DIE F 6000	11,035	1,924	760	-	184	13,902	13,902	0.58
Tank Trailer	Herculano	RT 4000	25,628	5,472	760	-	427	32,287	32,287	1.35

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Appendix VI

Yearly Rate of Inflation and Calculated Conversion Factor

Year	Yearly Rate of Inflation (%)	Conversion Factors
1997	5.8%	154.2
1998	-1.3%	155.3
1999	4.8%	148.2
2000	11.4%	133.0
2001	21.9%	109.1
2002	9.1%	100.0

Source: National Institute of Statistics, Mozambique (URL: www.ine.gov.mz/Ipc2/indprec.htm)

Appendix VII

Unit Costs of Labour Input

Data Source	Year	Number of Days			Cost (Million MZM at 2002 price)			Average (MZM/day)		
		Skilled staff	Unskilled staff	Supervision staff	Skilled staff	Unskilled staff	Supervision staff	Skilled staff	Unskilled staff	Supervision staff
Nampula ECMEP	1997-2001	4,400	12,595	1,637	225.18	307.36	165.71	51,178	24,403	101,231
Nampula DET	1997-2001	12,026	252,782	19,857	638.65	6,668.57	2,120.98	53,106	26,381	106,813
Zambezia ECMEP	2000-2002	2,343	28,735	2,871	127.27	969.26	197.51	54,319	33,731	68,792
	Weighted Average (wage or salary/day)							**52,805**	**27,014**	**101,957**

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Appendix VIII

COST OF FULL REHABILITATION
FOR 6m WIDE ROAD BY LABOUR BASED METHODS (AVERAGE THICKNESS 15 CM)
FOR 1KM OF ROAD WITH 3 CULVERTS PER KM AND HAUL DISTANCE OF 5KM

ITEM	QUANTITY	UNITS	PRODUCTIVITY (TASK RATE)	MANDAYS REQUIRED UNSKILLED	SKILLED MANDAYS	MACHINE DAYS TRACTOR & TRAILER	MACHINE DAYS ROLLER	UNSKILLED LABOUR COST Mts'000	SKILLED LABOUR COST Mts'000	MACHINE COSTS Mts'000	MATERIALS COSTS	TOTAL LABOUR, MACHINE & MATERIAL COST (Mts.'000)
BUSH CLEARING	3,000	M^2	250	12	0	0	0	324	0	0	2	2
SLOTTING	100	No.	4	17	8	0	0	452	436	0	3	438
EXCAVATION	1,800	M^3	3	600	5	0	0	16,208	264	0	91	355
DITCHING	800	M^3	3	267	2	0	0	7,204	106	0	40	146
CAMBER FORMATION	6,000	M^2	200	30	3	0	0	810	158	0	5	163
SCOUR CHECKS	20	No.	4	1	4	1	0	27	211	2,129	0	2,340
CULVERTS	3	No.	0	20	10	2	0	543	523	4,257	5,760	10,540
HEADWALLS	6	No.	0	13	7	1	0	362	349	2,129	2,160	4,637
GRAVEL EXC.	990	M^3	3	330	17	0	0	8,915	871	0	50	921
LOADING	990	M^3	9	110	6	0	0	2,972	290	0	17	307
HAULING	990	M^3	30	0	0	33	0	-	0	70,246	-	70,246
OFFLOADING	990	M^3	9	110	6	0	0	2,972	290	0	17	307
SPREADING	990	M^3	9	110	6	0	0	2,972	290	0	17	307
COMPACTION	1,800	M^3	75	0	24	0	3	-	1,267	3,008	-	4,276

Unit Labour Costs (Mts. per day)	
Skilled Labour	52,805
Unskilled labour	27,014

	Financial Costs	Economic Costs	% Financial Costs	% Economic Costs
Total unskilled labour costs (Mts. '000)	43,761	24,815	18%	16%
Total skilled labour costs (Mts. '000)	5,056	5,123	2%	3%
Total machine costs (Mts. '000)	81,769	57,137	34%	37%
Total material costs (Mts. '000)	8,160	7,715	3%	5%
Supervision @ 20% of labour costs (Mts. '000)	9,763	9,893	4%	6%
Supervision vehicle @ 47% of labour costs (Mts. '000)	22,944	14,914	9%	10%
Overhead @ 10% (Mts. '000)	17,145	16,209	7%	11%
Contractors profit (10%) (Mts. '000)	18,860	17,830	8%	12%
VAT @ 17%	35,268	0	15%	0%
Total Cost (Mts. '000)	**242,727**	**153,635**	100%	100%
Total Cost (US$)	**10,114**	**6,401**		

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COST OF FULL REHABILITATION
FOR 6m WIDE ROAD BY EQUIPMENT BASED METHODS (AVERAGE THICKNESS 15 CM)
FOR 1KM OF ROAD WITH 3 CULVERTS PER KM AND HAUL DISTANCE OF 5KM

ITEM	QUANTITY	UNITS	PRODUCTIVITY (TASK RATE)	MANDAYS REQUIRED UNSKILLED	MANDAYS SKILLED	MACHINE DAYS GRADER	MACHINE DAYS DOZER	MACHINE DAYS LOADER	MACHINE DAYS ROLLER	MACHINE DAYS TRUCK	UNSKILLED LABOUR COST (Mts. '000)	SKILLED LABOUR COST Mts'000	MACHINE COSTS Mts'000	MATERIALS COSTS	TOTAL LABOUR, MACHINE & MATERIAL COST (Mts.'000)
BUSH CLEARING	3,000	M^2	500	30	6	0.00	2.00	0.00	0.00	0.00	810	317	25,312	5	26,444
SETTING OUT	1,000	No.	250	3	1	0.00	0.00	0.00	0.00	0.00	72	70	-	0	143
EXCAVATION	1,800	M^3	900	10	2	3.00	0.00	0.00	3.00	0.00	270	106	36,190	2	36,567
DITCHING	800	M^3	700	6	1	1.14	0.00	0.00	0.00	0.00	154	60	10,369	1	10,585
CAMBER FORMATION	6,000	M^2	5,000	6	1	1.20	0.00	0.00	3.00	0.00	162	63	19,858	1	20,085
SCOUR CHECKS	20	No.	4	3	2	0.00	0.00	0.00	0.00	1.00	90	87	3,766	1	3,944
CULVERTS	3	No.	0	34	17	2.00	0.00	0.00	0.50	0.20	905	871	20,394	5,760	27,931
HEADWALLS	6	No.	0	13	7	1.00	0.00	0.00	0.00	0.20	362	349	9,826	2,160	12,697
GRAVEL EXC.	990	M^3	600	8	2	0.00	1.65	0.00	0.00	0.00	223	87	20,882	1	21,193
LOADING	990	M^3	900	6	1	0.00	0.00	1.10	0.00	0.00	149	58	7,736	1	7,943
HAULING	990	M^3	60	83	17	0.00	0.00	0.00	0.00	16.50	2,229	871	62,131	13	65,243
OFFLOADING	990	M^3	600	8	0	0.00	0.00	0.00	0.00	0.00	223	-	-	1	224
SPREADING	990	M^3	700	7	1	1.41	0.00	0.00	0.00	0.00	191	75	12,832	1	13,099
COMPACTION	1,800	M^3	450	20	4	0.00	0.00	0.00	4.00	0.00	540	211	11,961	3	12,716

Unit Labour Costs (Mts. per day)	
Skilled Labour	52,805
Unskilled labour	27,014

	Financial Costs	Economic Costs	% Financial Costs	% Economic Costs
Total unskilled labour costs (Mts. '000)	6,381	3,619	2%	1.6%
Total skilled labour costs (Mts. '000)	3,225	3,268	1%	1.4%
Total machine costs (Mts. '000)	241,257	159,135	64%	68.7%
Total material costs (Mts. '000)	7,949	7,515	2%	3.2%
Supervision @ 51% of labour costs (Mts. '000)	4,899	4,964	1%	2.1%
Supervision vehicle @ 11% of labour costs (Mts. '000)	1,057	687	0%	0.3%
Overhead @ 10% (Mts. '000)	26,477	25,031	7%	10.8%
Contractors profit (10%) (Mts. '000)	29,125	27,534	8%	11.9%
VAT @ 17%	54,463	0	15%	0.0%
Total Cost (Mts. '000)	**374,832**	**231,753**	100%	100%
Total Cost (US$)	**15,618**	**9,656**		

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COST OF PERIODIC MAINTENANCE
FOR 6m WIDE ROAD BY LABOUR BASED METHODS (AVERAGE THICKNESS 10 CM)

ITEM	QUANTITY	UNITS	PRODUCTIVITY (TASK RATE)	MANDAYS REQUIRED UNSKILLED	SKILLED MANDAYS	MACHINE DAYS TRACTOR & TRAILER	MACHINE DAYS ROLLER	UNSKILLED LABOUR COST Mts'000	SKILLED LABOUR COST Mts'000	MACHINE COSTS Mts'000	MATERIALS COSTS	TOTAL LABOUR, MACHINE & MATERIAL COST (Mts.'000)
BUSH CLEARING	2,000	M^2	250	8	0	0.0	0.0	216	0	0	1	1
SLOTTING	0	No.	4	0	0	0.0	0.0	-	0	0	-	-
EXCAVATION	900	M^3	3	300	5	0.0	0.0	8,104	264	0	45	309
DITCHING	800	M^3	3	267	2	0.0	0.0	7,204	106	0	40	146
CAMBER FORMATION	6,000	M^2	200	30	3	0.0	0.0	810	158	0	5	163
SCOUR CHECKS	10	No.	4	1	4	0.5	0.0	27	211	1,064	0	1,276
CULVERTS	2	No.	0	13	7	1.3	0.0	362	349	2,838	3,840	7,027
HEADWALLS	4	No.	0	9	4	0.7	0.0	241	232	1,419	1,440	3,091
GRAVEL EXC.	660	M^3	3	220	11	0.0	0.0	5,943	581	0	33	614
LOADING	660	M^3	9	73	4	0.0	0.0	1,981	194	0	11	205
HAULING	660	M^3	30	0	0	22.0	0.0	-	0	46,831	-	46,831
OFFLOADING	660	M^3	9	73	4	0.0	0.0	1,981	194	0	11	205
SPREADING	660	M^3	9	73	4	0.0	0.0	1,981	194	0	11	205
COMPACTION	900	M^3	75	0	12	0.0	1.5	-	634	1,504	-	2,138

Unit Labour Costs (Mts. per day)	
Skilled Labour	52,805
Unskilled labour	27,014

	Financial Costs	Economic Costs	% Financial Costs	% Economic Costs
Total unskilled labour costs (Mts. '000)	28,851	16,360	18%	16%
Total skilled labour costs (Mts. '000)	3,116	3,157	2%	3%
Total machine costs (Mts. '000)	53,657	37,524	34%	37%
Total material costs (Mts. '000)	5,438	5,141	3%	5%
Supervision @ 20% of labour costs (Mts. '000)	6,393	6,478	4%	6%
Supervision vehicle @ 47% of labour costs (Mts. '000)	15,024	9,766	9%	10%
Overhead @ 10% (Mts. '000)	11,248	10,634	7%	11%
Contractors profit (10%) (Mts. '000)	12,373	11,697	8%	12%
VAT @ 17%	23,137	0	15%	0%
Total Cost (Mts. '000)	**159,237**	**100,758**	100%	100%
Total Cost (US$)	**6,635**	**4,198**		

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COST OF PERIODIC MAINTENANCE
FOR 6m WIDE ROAD BY EQUIPMENT BASED METHODS (AVERAGE THICKNESS 10 CM)
FOR 1KM OF ROAD WITH 3 CULVERTS PER KM AND HAUL DISTANCE OF 5KM

ITEM	QUANTITY	UNITS	PRODUCTIVITY (TASK RATE)	MANDAYS REQUIRED UNSKILLED	MANDAYS SKILLED	MACHINE DAYS GRADER	MACHINE DAYS DOZER	MACHINE DAYS LOADER	MACHINE DAYS ROLLER	MACHINE DAYS TRUCK	UNSKILLED LABOUR COST (Mts. '000)	SKILLED LABOUR COST Mts'000	MACHINE COSTS Mts'000	MATERIALS COSTS	TOTAL LABOUR, MACHINE & MATERIAL COST (Mts.'000)
BUSH CLEARING	2,000	M^2	500	20	4	0.00	1.00	0.00	0.00	0.00	540	211	12,656	3	13,410
SETTING OUT	1,000	No.	250	3	1	0.00	0.00	0.00	0.00	0.00	72	70	-	0	143
EXCAVATION	900	M^3	900	5	1	3.00	0.00	0.00	0.00	0.00	135	53	27,219	1	27,408
DITCHING	200	M^3	700	1	0	0.29	0.00	0.00	0.00	0.00	39	15	2,592	0	2,646
CAMBER FORMATION	6,000	M^2	5,000	6	1	1.20	0.00	0.00	3.00	0.00	162	63	19,858	1	20,085
SCOUR CHECKS	10	No.	4	2	1	0.00	0.00	0.00	0.00	1.00	45	44	3,766	0	3,855
CULVERTS	1	No.	0	11	6	2.00	0.00	0.00	0.50	0.20	302	290	20,394	1,920	22,906
HEADWALLS	2	No.	0	4	2	1.00	0.00	0.00	0.00	0.20	121	116	9,826	720	10,783
GRAVEL EXC.	660	M^3	600	6	1	0.00	1.10	0.00	0.00	0.00	149	58	13,921	1	14,129
LOADING	660	M^3	900	4	1	0.00	0.00	0.73	0.00	0.00	99	39	5,157	1	5,295
HAULING	660	M^3	60	55	11	0.00	0.00	0.00	0.00	11.00	1,486	581	41,421	8	43,496
OFFLOADING	660	M^3	600	6	0	0.00	0.00	0.00	0.00	0.00	149	-	-	1	149
SPREADING	660	M^3	700	5	1	0.94	0.00	0.00	0.00	0.00	127	50	8,555	1	8,732
COMPACTION	900	M^3	450	10	2	0.00	0.00	0.00	2.00	0.00	270	106	5,981	2	6,358

Unit Labour Costs (Mts. per day)	
Skilled Labour	52,805
Unskilled labour	27,014

	Financial Costs	Economic Costs	% Financial Costs	% Economic Costs
Total unskilled labour costs (Mts. '000)	3,695	2,096	1%	1%
Total skilled labour costs (Mts. '000)	1,695	1,718	1%	1%
Total machine costs (Mts. '000)	171,346	113,036	66%	71%
Total material costs (Mts. '000)	2,658	2,513	1%	2%
Supervision @ 25% of labour costs (Mts. '000)	1,348	1,366	1%	1%
Supervision vehicle @ 60% of labour costs (Mts. '000)	3,235	2,102	1%	1%
Overhead @ 10% (Mts. '000)	18,398	17,393	7%	11%
Contractors profit (10%) (Mts. '000)	20,238	19,132	8%	12%
VAT @ 17%	37,844	0	15%	0%
Total Cost (Mts. '000)	**260,457**	**159,356**	100%	100%
Total Cost (US$)	**10,852**	**6,640**		

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COST OF ROUTINE MAINTENANCE
FOR 6m WIDE ROAD BY LABOUR BASED METHODS WITHOUT THE USE OF EQUIPMENT

ITEM	QUANTITY	UNITS	PRODUCTIVITY (TASK RATE)	MANDAYS REQUIRED UNSKILLED	SKILLED MANDAYS	MACHINE DAYS TRACTOR & TRAILER	MACHINE DAYS ROLLER	UNSKILLED LABOUR COST Mts'000	SKILLED LABOUR COST Mts'000	MACHINE COSTS Mts'000	MATERIALS COSTS	TOTAL LABOUR, MACHINE & MATERIAL COST (Mts.'000)
INSPECTION & REMOVAL OF OBSTRUCTION	1,000	M	1,000	0.85	0.15	0.0	0.0	23	8	0	0	31
GRASS CUTTING	6,000	M^2	150	34.00	6.00	0.0	0.0	918	317	0	0	1,235
DE-SILTING OF CULVERTS AND CLEARING CULVERT/BRIDGE INLETS & OUTLETS	2	No.	0.25	6.80	1.20	0.0	0.0	184	63	0	0	247
CLEAN SIDE, CATCH WATER AND MITRE DRAINS	2,000	M	75	22.67	4.00	0.0	0.0	612	211	0	0	824
REPAIR EROSION ON SHOULDER AND DRAINS	1,000	M	50	17.00	3.00	0.0	0.0	459	158	0	0	618
REPAIR SCOUR CHECKS	2	No.	2	0.85	0.15	0.0	0.0	23	8	0	0	31
GURB ROADWAY	1,000	M	20	42.50	7.50	0.0	0.0	1,148	396	0	0	1,544
FILL POTHOLES AND RUTS ON THE CARRIGEWAY	600	M^2	20	25.50	4.50	0.0	0.0	689	238	0	0	926

Unit Labour Costs (Mts. per day)	
Skilled Labour	52,805
Unskilled labour	27,014

	Financial Costs	Economic Costs	% Financial Costs	% Economic Costs
Total unskilled labour costs (Mts. '000)	4,057	2,300	31%	27%
Total skilled labour costs (Mts. '000)	1,399	1,418	11%	17%
Total machine costs (Mts. '000)	0	0	0%	0%
Total material costs (Mts. '000)	0	0	0%	0%
Supervision @ 23% of labour costs (Mts. '000)	1,255	1,272	10%	15%
Supervision vehicle @ 47% of labour costs (Mts. '000)	2,564	1,667	20%	20%
Overhead @ 10% (Mts. '000)	928	877	7%	10%
Contractors profit (10%) (Mts. '000)	1,020	965	8%	11%
VAT @ 17%	1,908	0	15%	0%
Total Cost (Mts. '000)	**13,131**	**8,498**	100%	100%
Total Cost (US$)	**547**	**354**		

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COST OF ROUTINE MAINTENANCE
FOR 6m WIDE ROAD BY LABOUR BASED METHODS USING TOWED GRADER

ITEM	QUANTITY	UNITS	PRODUCTIVITY (TASK RATE)	MANDAYS REQUIRED UNSKILLED	SKILLED MANDAYS	MACHINE DAYS TRACTOR & TRAILER	MACHINE DAYS GRADER	UNSKILLED LABOUR COST Mts'000	SKILLED LABOUR COST Mts'000	MACHINE COSTS Mts'000	MATERIALS COSTS	TOTAL LABOUR, MACHINE & MATERIAL COST (Mts.'000)
INSPECTION & REMOVAL OF OBSTRUCTION	1,000	M	1,000	0.85	0.15	0.0	0.0	23	8	0	0	31
GRASS CUTTING	6,000	M^2	150	34.00	6.00	0.0	0.0	918	317	0	0	1,235
DE-SILTING OF CULVERTS AND CLEARING CULVERT/BRIDGE INLETS & OUTLETS	2	No.	0.25	6.80	1.20	0.0	0.0	184	63	0	0	247
CLEAN CATCH WATER AND MITRE DRAINS	2,000	M	400	4.25	0.75	0.0	0.0	115	40	0	0	154
GRADING WITH TOWED GRADER	6,000	M^2	6,000	0.00	0.00	1.0	1.0	-	0	2,260	0	2,260
DRAGING	6,000	M^2	12,000	0.00	0.00	0.5	0.0	-	0	986	0	986
REPAIR SCOUR CHECKS	2	No.	2	0.85	0.15	0.0	0.0	23	8	0	0	31

Unit Labour Costs (Mts. per day)	
Skilled Labour	52,805
Unskilled labour	27,014

	Financial Costs	Economic Costs	% Financial Costs	% Economic Costs
Total unskilled labour costs (Mts. '000)	1,263	716	15%	12%
Total skilled labour costs (Mts. '000)	436	441	5%	7%
Total machine costs (Mts. '000)	3,246	2,601	37%	44%
Total material costs (Mts. '000)	0	0	0%	0%
Supervision @ 23% of labour costs (Mts. '000)	391	396	4%	7%
Supervision vehicle @ 47% of labour costs (Mts. '000)	798	519	9%	9%
Overhead @ 10% (Mts. '000)	613	580	7%	10%
Contractors profit (10%) (Mts. '000)	675	638	8%	11%
VAT @ 17%	1,262	0	15%	0%
Total Cost (Mts. '000)	**8,683**	**5,891**	100%	100%
Total Cost (US$)	**362**	**245**		

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COST OF ROUTINE MAINTENANCE
FOR 6m WIDE ROAD BY EQUIPMENT BASED METHODS

ITEM	QUANTITY	UNITS	PRODUCTIVITY (TASK RATE)	MANDAYS REQUIRED UNSKILLED	SKILLED MANDAYS	MACHINE DAYS TRACTOR & TRAILER	MACHINE DAYS GRADER	UNSKILLED LABOUR COST Mts'000	SKILLED LABOUR COST Mts'000	MACHINE COSTS Mts'000	MATERIALS COSTS	TOTAL LABOUR, MACHINE & MATERIAL COST (Mts.'000)
INSPECTION & REMOVAL OF OBSTRUCTION	1,000	M	1,000	0.85	0.15	0.0	0.0	23	8	0	0	31
GRASS CUTTING	6,000	M^2	150	34.00	6.00	0.0	0.0	918	317	0	0	1,235
DE-SILTING OF CULVERTS AND CLEARING CULVERT/BRIDGE INLETS & OUTLETS	2	No.	0.25	6.80	1.20	0.0	0.0	184	63	0	0	247
CLEAN CATCH WATER AND MITRE DRAINS	2,000	M	400	4.25	0.75	0.0	0.0	115	40	0	0	154
GRADING WITH SELF-PROPELLED GRADER	6,000	M^2	18,000	0.00	0.00	0.0	0.3	-	0	3,024	0	3,024
DRAGING	6,000	M^2	24,000	0.00	0.00	0.0	0.3	-	0	2,268	0	2,268
REPAIR SCOUR CHECKS	2	No.	2	0.85	0.15	0.0	0.0	23	8	0	0	31

Unit Labour Costs (Mts. per day)	
Skilled Labour	52,805
Unskilled labour	27,014

	Financial Costs	Economic Costs	% Financial Costs	% Economic Costs
Total unskilled labour costs (Mts. '000)	1,263	716	10%	9%
Total skilled labour costs (Mts. '000)	436	441	4%	6%
Total machine costs (Mts. '000)	5,293	3,528	43%	46%
Total material costs (Mts. '000)	-	0	0%	0%
Supervision @ 28% of labour costs (Mts. '000)	476	482	4%	6%
Supervision vehicle @ 75% of labour costs (Mts. '000)	1,274	828	10%	11%
Overhead @ 10% (Mts. '000)	874	826	7%	11%
Contractors profit (10%) (Mts. '000)	961	909	8%	12%
VAT @ 17%	1,798	0	15%	0%
Total Cost (Mts. '000)	**12,374**	**7,731**	100%	100%
Total Cost (US$)	**516**	**322**		

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Appendix IX

Calculation of the Standard Conversion Factor (SCF)

	Million US$ (Current (Nominal) Price)							Average
	1995	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	
1. Value of total Imports CIF (Million US$)	727.00	801.50	760.00	868.30	1211.10	1162.30	1150.80	954.4
2. Value of total Exports FOB (Million US$)	174.30	225.90	230.00	248.20	283.80	364.00	703.70	318.6
3. Import and Export	901.30	1027.40	990.00	1116.50	1494.90	1526.30	1854.50	1,273.0
4. Import Duty (Million US$)	62.09	61.36	73.55	79.48	84.47	80.23	73.51	73.5
5. Total Export Duty (Million US$)	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
SCF = row 3/[row 3 + row 4+row 5]								**0.95**

Source: Ministry of Planning and Finance, Mozambique

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Appendix X

Calculation of the Shadow Wage Rates

		Rural Unskilled Labour	Skilled Labour
SW	Mp+[w-m]*[1-1/v]*c	56.7	101.3
M	Value of Marginal product of labour at market price [a]	66.7	106.0
P	Border/domestic price ratio [b]	0.95	0.95
Mp	Opportunity cost of labour	63.0	100.2
W	Actual wage rate [c]	100	100
C	Border/domestic consumption [d]	1	0.95
V	Value of investment relative to consumption [the shadow price of investment relative to consumption or the social cost of consumption]	0.84	0.84
	= k[1-s]/CRI-[k*s]]		
	Where k = marginal product of capital [e]	0.269	0.269
	s=rate of savings [f]	0	0.04
	CRI=consumption rate of interest [g]	0.320	0.320
SWR=SW/W		**0.57**	**1.01**
Weighted average SWR [h]		**0.66**	

Sources: Shahabuddin & Rahman (1992); Squire & van der Tak (1975)

Notes:

[a] Assumed a total of 8 out of 12 months of employment for an average rural unskilled labourer. i.e. 0.667. Assumed public private sector mix is 60:40 for skilled labour. Assumed public sector rate is 10% higher for skilled labour [60*1.1+40]=106

[b] the SCF

[c] Expressed in terms of 100

[d] For unskilled labourers import content assumed to be negligible

[e] The weighted average annual interest rate for lending operations with different maturity period

[f] Savings as a proportion of GDP (GOM, 2001, Action Plan for Absolute Poverty Reduction (2001-2005)); A 0% rate of savings is assumed for unskilled labour

[g] Average lending rate of banks in rural areas. Field investigations suggest that the lending rates in rural areas range from 24% to 40% depending on the type of activities undertaken by the borrowers. An average lending rate of 32% is assumed.

[h] [SWR of skilled labour]*[r]+[SWR of unskilled labour]*[1-r]); where r= proportion of skilled labour assumed = 0.2

Appendix XI

Calculation of the Financial and Economic Costs of Fuel

Row		Financial Cost (MZM)		Economic Cost (MZM)	
		Petrol	Diesel	Petrol	Diesel
1	CIF price(MZM/litre)	2,993	4,253	2,993	4,253
2	Direct import costs (Mt/litre)	240	240	240	240
3	Basic Cost (Mt/litre) [row 1+ row 2]	3,233	4,493	3,233	4,493
4	Import tariff (5%)*[row 1]	150	213	0	0
5	Cost on the import process [row 3+ row 4]	3,383	4,706	3,233	4,493
6	VAT on the import [row 5*0.17]	575	800	0	0
7	Distributors margin (Mt/ litre)	1,298	1,298	1,233	1,233
8	VAT on distributor (@17%)	221	221	0	0
9	Sales tax (Mt/litre)	3,308	1,825	0	0
10	Price at the door of the distribution company	8,784	8,629	4,466	5,726
11	Transportation cost (Mt/litre)	54	54	51	51
12	VAT on transport cost	9	9	0	0
13	Dealers' Margin	266	265	253	252
14	VAT on dealers' margin (@17%)	45	45	0	0
15	Price at pump per litre (Mt/litre)	9,159	9,223	4,770	6,029
Average cost of fuel		**9,191**		**5,400**	
Accounting Ratio		**0.59**			

Note: Reference year – 2001; Standard Conversion Factor (SCF) is used to covert financial values to economic values for rows 7, 11, 13

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Appendix XII

Break Even Wage Rate

The break even wage rate gives an indication of the maximum limit to which wages can be raised before labour methods become financially or economically uncompetitive compared to the EB approach. An assumption is that the equipment costs will remain constant. In other words, this is the maximum wage rate per day below which LB methods will have a competitive edge over using machines. For this Study, the Break-Even Wage per day is calculated using the following formula:

Average Break-Even Wage (BEW) = $[COST_{EQ}*(1-LC_{EQ})-COST_{LB}*(1-C_{LB})]$ $/(MD_{LB}-WD_{EQ})$

Where,

$COST_{EQ}$	=Unit cost per km of EB methods
LC_{EQ}	=Labour component of EB methods
$COST_{LB}$	=Unit cost per km of LB methods
LC_{LB}	=Labour component of LB methods
MD_{LB}	=Workdays per km in LB methods
WD_{EQ}	=Workdays per Km in EB method.

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Appendix XIII

Salient Features and Assumptions for Economic Analysis and Road Improvement Costing

- Computations made using the World Bank's RED Model (version 2.0)
- RED Model is calibrated with RED - HDM-III VOC (version 2.0) using vehicle usage & characteristics data collected from Mozambique
- Discount rate used 12%
- Evaluation period: 8 years
- Existing roughness (IRI): 15
- Average post-improvement roughness (IRI) of 7.6 for LB methods and 8.0 for EB methods as calculated from the following table:

	A typical road section improved using LB method	A typical road section improved using EB method
Yr. 1	6	6
Yr. 2	7	7
Yr. 3	8	8
Yr. 4	9	9
Yr. 5	10*	10
Yr. 6	6	11*
Yr. 7	7	6
Yr. 8	8	7
Average	7.6	8

Note: * Year of periodic maintenance

- Maintenance and Improvement Costs

	LB			EB		
	Rehabilitation	Routine Maint.	Periodic Maint.	Rehabilitation	Routine Maint.	Periodic Maint.
Yr. 0	10,100			15,600		
Yr. 1		370	0		520	0
Yr. 2		370	0		520	0
Yr. 3		370	0		520	0
Yr. 4		0	6,600		520	0
Yr. 5		370	0		0	10,800
Yr. 6		370	0		520	0
Yr. 7		370	0		520	0
Yr. 8		0	6,600		520	0
Average			1,928			1,805

Note: All figures in US$; Frequency of periodic maintenance : every 4 years for

- Frequency of periodic maintenance: every 4 years for road rehabilitated using LB methods and every 5 years for road rehabilitated using EB methods
- Normal traffic growth rate 4% per annum
- Price elasticity of demand = 1

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- Passenger time value of 2,200 MZM/hour (0.09 US$/hr)
- Level of traffic – 50 motorised vehicles per day

- Proportion of different types of motorised vehicles on a typical rural road:

Car	4%
Utility	30%
Light bus	3%
Medium Bus	0%
Heavy bus	0%
Light truck	4%
Medium truck	3%
Heavy truck	0%
Motorcycle	56%

Note: figures calculated from a 1999 traffic count survey on a rural road conducted in Nampula province by the Save the Children Fund project.

- Number of bicycles are 3 times the number of motorised vehicles
- No accident cost savings considered
- No benefit from modal shift considered
- Scope of works under different rehabilitation and maintenance options:
    - **Full Rehabilitation:**
        - Gravelling
            - Full gravelling (av. 15 cm) of the entire road length.
        - Drainage
            - Complete restoration of drainage system for the entire road length.
        - Drainage structures
            - Repair and replacement of all drainage structures except bridges and culverts in good condition, and installation of culverts on gaps without culverts.
            - Repair of large bridges.
        - Reshaping
            - Full re-shaping of the entire road length.
    - **Periodic Maintenance:**
        - Gravelling
            - Full gravelling (av. 10 cm) of the entire length of the road.
        - Drainage
            - Provision of complete drainage system in the case of non-existent of drainage or extremely poor existing drainage.
            - Partial rehabilitation of drainage system if the existing drainage system is in fair to poor condition.
            - No interventions if the existing drainage system is in good condition.
        - Drainage structures

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- Repair of repairable culverts, re-installation of non-repairable culverts and installation of culverts on gaps without culverts.
- Repair of large bridges.

- Reshaping
  - Light to full re-shaping of the entire road length.

- **Routine Maintenance:**

  - Grass cutting
  - Culvert and drain cleaning
  - Inspection and repair of scour checks.
  - Grading

Appendix XIV

Sample Calculations of Distribution of Net Benefits and Poverty Impact Ratio (US$ in Present Value at 12% Discount Rate)

	FNPV	CF	ENPV	Difference (ENPV-FNPV)	Government	Skilled Labour	Unskilled Labour	Consumer
Benefits								
Consumer Surplus		1	1,084,822	1,084,822	-	-	-	1,084,822
Government Agency Costs	104083		0	-1,040,839	-1,040,839	-	-	-
Costs								
Material Costs	-24,029	0.95	-22,827	1,201	1,201			
Skilled Labour	-18,081	1.1	-18,262	-181	-	-181	-	-
Unskilled Labour	-288,344	0.57	-164,356	123,988	-	-	123,988	-
Equipment	-398,013	0.65	-258,709	139,305	139,305	-	-	-
Other costs	-312,373	0.95	-296,754	15,619	15,619	-	-	-
Net Present Value	0		323,915	323,915	-884,714	-181	123,988	1,084,822

Note: FNPV – Financial Net Present Value; ENPV; Economic Net Present Value

	Government	Skilled Labour	Unskilled Labour	Consumer	Total
Gain or Losses (NEB-NFB)	-884,714	-1,81	123,988	1,084,822	323,915
Proportions shared by poor	40%	0	90%	40%	
Benefits to poor	-353,886	0	111,589	433,929	192,632
Poverty Impact Ratio			**0.59**		

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