PD-ABC-430 PB

Regional Transportation Development II

Kafue-Lusaka Road Rehabilitation

(690-0254)

(This document contains cost information)

CY FOR INTERNATIONAL DEVELOPMENT

PROJECT DATA SHEET

1. TRANSACTION CODE: A (A = Add, C = Change, D = Delete)

Amendment Number

DOCUMENT CODE: 3

2. COUNTRY: Africa Regional

3. PROJECT NUMBER: 690-0254

4. BUREAU/OFFICE: USAID/Zimbabwe 06

5. PROJECT TITLE (maximum 40 characters): Regional Transport Development II Kafue-Lusaka Road Rehabilitation

6. PROJECT ASSISTANCE COMPLETION DATE (PACD): MM 12 DD 31 YY 94

7. ESTIMATED DATE OF OBLIGATION (Under 'B.' below, enter 1, 2, 3, or 4)

A. Initial FY 90 B. Quarter 4 C. Final FY 92

8. COSTS ($000 OR EQUIVALENT $1 =)

A. FUNDING SOURCE	FIRST FY B. FX	C. L/C	D. Total	LIFE OF PROJECT E. FX	F. L/C	G. Total
AID Appropriated Total	12,000		12,000	19,586	3,254	22,840
(Grant)	(12,000)	( )	(12,000)	(19,586)	(3,254)	(22,840)
(Loan)	( )	( )	( )	( )	( )	( )
Other U.S. 1.						
Other U.S. 2.						
Host Country					3,064	3,064
Other Donor(s)						
TOTALS						25,904

9. SCHEDULE OF AID FUNDING ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH. CODE 1. Grant	2. Loan	D. OBLIGATIONS TO DATE 1. Grant	2. Loan	E. AMOUNT APPROVED THIS ACTION 1. Grant	2. Loan	F. LIFE OF PROJECT 1. Grant	2. Loan
(1) DFA	800	821				22,840		22,840	
(2)									
(3)									
(4)									
TOTALS								22,840	

10. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each): 220

11. SECONDARY PURPOSE CODE

12. SPECIAL CONCERNS CODES (maximum 7 codes of 4 positions each)

A. Code

B. Amount

13. PROJECT PURPOSE (maximum 480 characters)

To improve the efficiency of the inter-regional transport system by reducing operating costs and by extending the life of the Kafue-Lusaka Road.

14. SCHEDULED EVALUATIONS

Interim MM 01 YY 93 MM YY Final MM 12 YY 94

15. SOURCE/ORIGIN OF GOODS AND SERVICES

☐ 000 ☐ 941 ☐ Local ☒ Other (Specify) 935

16. AMENDMENTS/NATURE OF CHANGE PROPOSED (This is page 1 of a ____ page PP Amendment.)

Controller: Hulliung/Harmon memo dated 6/15/90

17. APPROVED BY

Signature: Fred E. Winch

Title: Director, USAID/Zambia

Date Signed: MM 07 DD 26 YY 90

18. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION

MM DD YY

AID 1330-4 (8-79)

ACTION MEMORANDUM FOR THE DIRECTOR, USAID/ZAMBIA

DATE: July 26, 1990

FROM: Jim Harmon, PDO, USAID/Zambia JH

SUBJECT: Regional Transport Development II, Kafue-Lusaka Road Rehabilitation (690-0254) - Project Paper Approval

ACTION REQUESTED: You are requested to approve the attached Project Paper which recommends your authorization of a grant to the Government of the Republic of Zambia (GRZ) for rehabilitation of the Kafue-Lusaka road. If authorized, the grant will be funded from the Development Fund for Africa (DFA) appropriation, in the life-of-project amount of $22,840,000. The FY 1990 obligation for the project will be $12 million, with obligations of $6,735,000 in FY 1991 and $4,105,000 in FY 1992.

DISCUSSION: Rehabilitation of the Kafue-Lusaka road will complete a program of road improvement between Zambia and Zimbabwe begun under project 690-0209, Regional Transport and Storage Development. Under that project, two sections of road were rehabilitated: Makuti-Chirundu in Zimbabwe and Kafue-Chirundu in Zambia. When the final section from Kafue to Lusaka is completed, this multi-phase rehabilitation program will provide an improved road transportation system for traffic destined for intraregional markets and the Mozambican port of Beira. Successful project implementation will remove existing traffic bottlenecks between Lusaka, Harare and the Beira port, thereby: a) accommodating projected annual increases in traffic and increasing the life of the road; b) reducing accident and breakdown rates; and c) reducing transportation costs.

This project, along with others in the USAID/Zimbabwe, Southern Africa Regional Program portfolio, will contribute to the SADCC transport sector objective of assisting the majority-ruled nations of southern Africa to overcome regional transport constraints that constitute a serious obstacle to the region's economic growth and development. Rehabilitation of the Kafue-Lusaka road has been identified as a priority project for donor assistance by the SADCC Council of Ministers and appears in the transport sector Programme of Action as Project 1.8.3. It has also been given a high priority in the USAID/Zimbabwe-sponsored assessment of regional transportation projects based on such criteria as economic feasibility, regional impact and absorptive capacity.

The purpose of the project is to continue to expand efforts to improve the efficiency of the inter-regional transport system by reducing operating costs and by extending the life of the road. The road from the Kafue River to the Lusaka city suburb of Makeni is 49.4 kilometers long. Assistance provided under this project will reduce the roughness of the Kafue-Lusaka road and

thereby substantially reduce vehicle operating costs, and place the Kafue-Lusaka road under effective maintenance by improving the maintenance capability of the Roads Department.

Project-funded road rehabilitation will take place during two consecutive dry seasons in 1992 and 1993, followed by a one-year period during which the construction contractor will be responsible for remedying any defects. Road rehabilitation and reconstruction activities will include:

-9.85 kilometers of reconstruction;
-29.85 kilometers of overlay and seal;
-9.70 kilometers of patch and seal;
-minor road realignment in two locations;
-drainage structure repair and new drainage culverts; and,
-shoulder widening to conform to Zambia road standards 1A and 1B.

Project road reconstruction and rehabilitation have been designed to 10 year (minimum maintenance) life specifications. This standard was chosen as the alternative which produces the highest rate of return for the investment, in comparison with other possible road maintenance and rehabilitation options. An internal rate of return for this rehabilitation option was estimated to be approximately 26%.

Project funds will also be used to procure construction supervision services and project management support. The project will include a road maintenance financing mechanism to provide a Zambian kwacha sinking fund to ensure adequate funding of recurrent costs and foreign exchange to purchase spares for the repair of on-hand maintenance equipment. Funding of recurrent costs has been determined to be in accordance with A.I.D. policy guidance in light of:

(a) Government of the Republic of Zambia (GRZ) efforts under the current structural adjustment program to move toward the provision of adequate maintenance financing;

(b) strict adherence to A.I.D. policy which will ensure financial integrity in the payment, monitoring and reporting systems; and

(c) a determination by the design team that financial support will not be provided for salary supplements.

Other components of the project will include local and international training for Zambia Roads Department personnel and the provision of equipment to help ensure post-project maintenance of the rehabilitated road.

The authorized source/origin for project procurements is geographic code 935, as authorized under the DFA. However, the procurement of design and supervision and construction services and training will be limited to countries included in geographic code 941 and Zambia. Code 941 is justified for the procurement of design/supervision and construction services because

several of the regional beneficiary countries are RLDCs. Code 941 and Zambian training facilities are more suitable for local conditions. Furthermore, restricting procurements of construction services to U.S. firms only would not provide adequate competition. Although U.S. procurement of equipment and spares will be maximized to the greatest extent practicable, the source/origin for commodity procurements will be geographic code 935 to ensure that certain equipment items and a number of spares are compatible with on-hand equipment and are not inconsistent with departmental standardization plans.

Project beneficiaries will include private and public sector users of the road, particularly those involved in intraregional export activities. A target for the employment of women has been established at 20% of all project-funded roadworkers.

Although FAA Section 110(A) requiring a 25 percent host country contribution is not applicable to this regional project, the GRZ will contribute the dollar equivalent of $3,064,000 (kwacha 122,560,000 at K40=$1.00) toward the achievement of project objectives. These local currency funds will be used to finance the sinking fund, several items of locally produced equipment, in-country training, land acquisition costs and disruption compensation to a few people living near the project site. Although the highest lawful exchange rate as of March 1990 is kwacha 40 = $1.00, negotiations are underway with the international finance community that will require a gradual devaluation of the kwacha to a considerably higher level by 1993. These negotiations are expected to be completed within this calendar year. Except for an insignificant amount to be provided for local training in 1990, kwacha disbursements by the GRZ and contractors are expected to begin in 1991 when the highest lawful kwacha to dollar rate of exchange is expected to be higher than the current K40 = $1.00.

The GRZ Roads Department will have primary implementation responsibility for the work to be carried out under this project. All services, with the exception of a project engineer to be assigned to USAID/Zambia, will be procured on a host-country contract basis. The capability of the Roads Department to assume this responsibility has been demonstrated by its performance in a similar capacity under the A.I.D.-funded Kafue-Chirundu project. Contracting will be in accordance with standard GRZ and A.I.D. host-country contracting procedures and A.I.D. will approve the Request for Technical Proposals (RFTP) and contract documents before issuance.

The institutional capacity of the Roads Department and its ability to maintain the Kafue-Lusaka road after project-funded rehabilitation is completed has been assessed as part of the Project Paper analyses. Though it had some initial concern based upon historic budgetary and staffing constraints, the design team has concluded that the GRZ will have the necessary institutional capacity, resources and commitment to properly maintain the road. This conclusion is based on experience on the previous A.I.D. funded road project and in view of project interventions and the efforts of other donors to

improve departmental institutional maintenance capability, particularly in Lusaka Province where this project is located.

The project will undertake several initiatives to improve the institutional capacity of the Roads Department. Specifically, the project will provide the aforementioned kwacha and foreign exchange financing mechanism, training for Department mechanics and engineers, maintenance equipment and spare parts, contract project construction supervision and technical assistance to facilitate project monitoring and administration. Moreover, Conditions Precedent to disbursement of project funds will require, inter alia, that the GRZ develop an appropriate maintenance plan for the project road, dedicate sufficient staff and budgetary resources through the establishment of a "sinking fund" to achieve the plan's objectives. Covenants in the Project Grant Agreement will record, inter alia, the government's commitment to provide additional funds, above those amounts otherwise required by the Conditions Precedent to ensure adequate maintenance of the A.I.D. investment in road rehabilitation from Lusaka to Chirundu.

Other donors, notably FINNIDA, NORAD, DANIDA and Japan, are providing major contributions to strengthen the institutional capability of the Roads Department. An AfDB road rehabilitation project contains a major component to improve the capacity of the Department of Roads to maintain all trunk roads under its jurisdiction.

Summary Project Budget
(000)

Budget Line Item (A.I.D. Funds)	Estimated Cost
A. Final Design	$ 350
B. Construction Supervision	$ 1,100
C. Construction	$16,270
D. Maintenance Equipment	$ 860
E. Training	$ 20
F. PSC Engineer	$ 735
G. Maintenance Spares	$ 425
H. Evaluations and Audits	$ 100
I. Contingency (15%)	$ 2,980
TOTAL A.I.D.	$22,840

Budget Line Item (GRZ Funds)	Estimated Cost	
A. Sinking Fund	$3,000.00	(K120,000)
B. Maintenance Equipment	$ 11.25	(K 450)
C. Training	$ 18.25	(K 730)
D. Land Acquisition, Displacement of Persons	$ 2.50	(K 100)
Contingency for inflation (100% of the sum of items B, C and D)	$ 32.00	(K 1,280)
Total GRZ funds (at ZK40 = US$1.00)	$3,064.00	(K122,560)

It has been concluded from the analysis in the project paper that:

1. the project is technically and economically sound and socially acceptable;
2. the technical design and cost estimates are reasonable and adequately planned, thereby satisfying the requirements of Section 611(a) of the Foreign Assistance Act of 1961, as amended;
3. the timing and funding of project activities are appropriately scheduled;
4. sufficient planning has been done for the implementation, monitoring and evaluation of project progress; and,
5. all statutory criteria have been satisfied.

The Initial Environmental Examination, contained in Annex I(F) of the Project Paper, has been reviewed and a negative determination has been approved by the AFR Bureau Environmental Officer.

Conditions and covenants applicable to this project are to insure sound project implementation and maintenance after the road rehabilitation is completed. Conditions Precedent to Disbursement and Covenants include:

Conditions Precedent to First Disbursement

1. The GRZ will provide to A.I.D. a letter of commitment, in form and substance satisfactory to A.I.D. allocating to the Kafue-Lusaka road first priority use of any maintenance equipment previously financed by A.I.D. for road maintenance activities, to the extent that such equipment is not required under the previously-financed activities.

2. The GRZ will commence operation of the weighbridge station financed by A.I.D. under the Kafue-Chirundu Road Rehabilitation Project (690-0209.02).

3. The GRZ will provide a written statement setting forth the names, titles and specimen signatures of persons who have the authority to act as Grantee's representative.

Conditions Precedent to Award of Construction Contract

1. The GRZ shall, except as A.I.D. may otherwise agree in writing, establish a sinking fund in an interest bearing account at a commercial bank, no later than November 15, 1990, with deposit and disbursement procedures as agreed to by A.I.D.

2. The GRZ shall, except as A.I.D. may otherwise agree in writing, provide a deposit of not less than kwacha 60 million into the account specified in Condition 1 above no later than January 15, 1991.

3. The GRZ shall, except as A.I.D. may otherwise agree in writing, provide a deposit of not less than kwacha 60 million into the account specified in Condition 1 above no later than November 15, 1991.

4. The GRZ will provide A.I.D. with a plan, in form and substance satisfactory to A.I.D., describing the steps it plans to take to ensure proper maintenance of the Kafue-Lusaka and Kafue-Chirundu roads after project-funded rehabilitation is completed, as well as the schedule of resources to be made available for this purpose. The plan will detail how all equipment financed under A.I.D. road rehabilitation projects will be allocated to the maintenance of the Kafue-Lusaka and Kafue-Chirundu roads and sources of funding for continued maintenance activities.

5. The GRZ will complete and provide A.I.D. with a thorough study of the whole system for enforcing weight limitations, with resultant effects including reduced axle loads and reduced wear and tear to roads.

6. The GRZ will complete resealing of the sections of roadway originally rehabilitated by Nello L. Teer under Phase I of the Kafue-Chirundu Road Rehabilitation Project.

5. The GRZ will provide to A.I.D. a letter of commitment, in form and substance satisfactory to A.I.D., providing assurances that all land required to complete the proposed road rehabilitation has been acquired.

Covenants

(a) The GRZ covenants to carry out appropriate maintenance on the Kafue-Lusaka and Kafue-Chirundu roads and to make provisions for the necessary staffing, training and funding to achieve this purpose, utilizing the sinking fund established under the project to support the annual budget.

(b) The GRZ covenants that it will provide additional funds, above those amounts otherwise required by Conditions Precedent, to the extent necessary to ensure adequate maintenance of the T2 road from Lusaka to Chirundu.

(c) The GRZ covenants that maintenance equipment provided under this project shall be allocated on a first-use basis for maintenance of the T2 Road from Lusaka to Chirundu.

(d) The GRZ covenants to provide, in a timely manner, the import licenses, work permits/temporary resident visas required by personnel of the design/construction supervision contractor and construction contractor.

(e) The GRZ covenants that it will provide appropriate and timely compensation to those persons who become displaced as a result of road construction activities.

A project review meeting was held with USAID/Zambia senior staff on May 11, 1990. With respect to Zambia-specific issues, the RLA has determined that the legislation under which SADCC funds are appropriated specifically exempts projects funded with these resources from compliance with the terms of the Brooke-Alexander Amendment and Section 620(q) of the Foreign Assistance Act.

On May 14, 1990 a Mission Executive Committee Project Review (ECPR) was held by USAID/Zimbabwe to review the PP. There were some issues brought up during the ECPR and it was agreed that these issues would be clarified in the PP before the Mission Director's approval.

The Kafue-Lusaka Road Rehabilitation Project Paper development is justified on the basis of an "umbrella" PID approved in 1986, which established the rationale for a sector-wide approach to alleviating transportation constraints in the SADCC region. That PID (690-0237) establishes criteria for the selection of subproject activities to be carried out under the rubric of this regional sector-wide approach. A discussion of the project's conformance to those criteria is included in the Project Paper section 2.2 and in the Economic Analysis in Annex III(B).

RECOMMENDATION: That, in accordance with the delegation of authority in State 203775 dated 06/22/90, you sign the attached Project Authorization, thereby approving the Kafue-Lusaka Road Rehabilitation Project in the amount of $22,840,000.

APPROVED : Fred E. Winch
Mission Director

DISAPPROVED : _____
Fred E. Winch
Mission Director

DATE : July 26, 1990

Attachments:

1. Project Authorization
2. Project Paper with Annexes

Clearances: RLA REDSO/ESA, (Draft)
Director, USAID/Zimbabwe (draft)
J. Harmon, PDO, USAID/Zambia
B. Wallach, PDO, USAID/Zimbabwe (draft)
REDSO/ESA/RFMC (draft)
Controller, USAID/Zimbabwe (draft)

PROJECT AUTHORIZATION

REGIONAL TRANSPORT DEVELOPMENT II
KAFUE-LUSAKA ROAD REHABILITATION PROJECT NO. 690-0254

1. Pursuant to Title II of the Foreign Operations, Export Financing, and Related Programs Appropriations Act of 1990 (Development Fund for Africa) and the Foreign Assistance Act of 1961, as amended, I hereby authorize the Kafue-Lusaka Road Rehabilitation Project for the Republic of Zambia involving planned obligations not to exceed twenty two million eight hundred forty thousand dollars in grant funds over a five year period from the date of authorization, subject to the availability of funds in accordance with the A.I.D. OYB/Allotment process, to help in financing foreign and local currency costs for the Project. The planned life of the Project is approximately five years from the date of initial obligation, with a Project Assistance Completion Date of December 31, 1994.

2. The Project consists of reconstruction and rehabilitation of approximately 50 kilometers of road between Kafue and Lusaka. Interventions include design, construction and supervision services; maintenance financing, training and the supply of equipment and materials.

3. The Project Agreement, which may be negotiated and executed by the officers to whom such authority is delegated in accordance with A.I.D. regulations and Delegations of Authority, shall be subject to the following essential terms and covenants and major conditions together with such other terms and conditions as A.I.D. may deem appropriate.

4. Source and Origin of Commodities, Nationality of Services

   Except as A.I.D. may otherwise agree in writing:

   (a) Commodities financed by A.I.D. under the Project shall have their source and origin in countries included in A.I.D. geographic code 935. All reasonable efforts will be used to maximize U.S. procurement whenever practicable. Air travel and transport to and from the U.S. shall be upon certified U.S. flag carriers.

   (b) Except for ocean shipping, the suppliers of commodities or services financed by A.I.D. under the project shall have countries included in A.I.D. geographic code 935 as their place of nationality. All reasonable efforts will be used to maximize U.S. procurement whenever practicable. Air travel and transport to and from the U.S. shall be upon certified U.S. flag carriers.

   (c) Ocean shipping financed by A.I.D. under the Project shall be financed only on flag vessels of the countries included in A.I.D. geographic code 935, subject to the 50/50 shipping requirements under the Cargo Preference Act and the regulations promulgated thereunder.

5. Conditions Precedent

Condition Precedent to First Disbursement

Prior to the first disbursement, or the issuance by A.I.D. of documentation pursuant to which disbursement will be made, the Government of the Republic of Zambia (GRZ) shall, except as A.I.D. may otherwise agree in writing:

(a) provide to A.I.D. a letter of commitment, in form and substance satisfactory to A.I.D., allocating to the Kafue-Lusaka road first priority use of any maintenance equipment previously financed by A.I.D. for road maintenance activities, to the extent that such equipment is not required under the previously-financed activities.

(b) commence operation of the weighbridge station financed by A.I.D. under the Kafue-Chirundu Road Rehabilitation Project (690-0209.02).

(c) provide a written statement setting forth the names, titles and specimen signatures of the persons who will have the authority to act as Grantee's representative.

Condition Precedent to Construction Contract

Prior to award of the construction contract, the GRZ shall, except as A.I.D. may otherwise agree in writing:

(a) establish a sinking fund in an interest bearing account at a commercial bank, no later than November 15, 1990, with deposit and disbursement procedures as agreed to by A.I.D.

(b) provide a deposit of not less than kwacha 60 million into the account specified in Condition (a) above, no later than January 15, 1991.

(c) provide a deposit of not less than kwacha 60 million into the account specified in Condition (a) above, no later than November 15, 1991.

(d) provide A.I.D. with a plan, in form and substance satisfactory to A.I.D., describing the steps it plans to take to ensure proper maintenance of the Kafue-Lusaka and Kafue-Chirundu roads after project-funded rehabilitation is completed, as well as the schedule of resources to be made available for this purpose. The plan will detail how all equipment financed under A.I.D. road rehabilitation projects will be allocated for the maintenance of the Kafue-Lusaka and Kafue-Chirundu roads and sources of funding for continued maintenance activities.

(e) complete and provide A.I.D. with a thorough study of the whole system for enforcing weight limitations, with resultant effects including reduced axle loads and reduced wear and tear to roads.

(f) complete resealing of the sections of roadway originally rehabilitated by Nello L. Teer under Phase I of the Kafue-Chirundu Road Rehabilitation Project.

(g) provide to A.I.D. a letter of commitment, in form and substance satisfactory to A.I.D., providing assurances that all land required to complete the proposed road rehabilitation has been acquired.

6. Covenants

(a) The GRZ covenants to carry out appropriate maintenance on the Kafue-Lusaka and Kafue-Chirundu roads and to make provisions for the necessary staffing, training and funding to achieve this purpose, utilizing the sinking fund established under the project to support the annual budget.

(b) The GRZ covenants that it will provide additional funds, above those amounts otherwise required by Conditions Precedent, to the extent necessary to ensure adequate maintenance of the T2 road from Lusaka to Chirundu.

(c) The GRZ covenants that maintenance equipment provided under this project shall be allocated on a first-use basis for maintenance of the T2 Road from Lusaka to Chirundu.

(d) The GRZ covenants to provide, in a timely manner, the import licenses, work permits/temporary resident visas required by personnel of the design/construction supervision contractor and construction contractor.

(e) The GRZ covenants that it will provide appropriate and timely compensation to those persons who become displaced as a result of road construction activities.

7. Negotiating Status

The aforementioned conditions precedent and covenants have been discussed with the Ministry of Finance and the Director of the GRZ Department of Roads who have agreed to them both in form and in content.

FRED E. WINCH
MISSION DIRECTOR

July 26, 1990
DATE

Regional Transportation Development II

Kafue-Lusaka Road Rehabilitation

(690-0254)

Table of Contents

	Page No.
Project Data Sheet	i
Action Memorandum to the Director, USAID/Zimbabwe	ii
Project Authorization	x
Table of Contents	xiii
Glossary	xvii
1. Summary and Recommendations	1
1.1 Project Summary	1
1.2 Recommendation	2
2. Project Rationale	3
2.1 Problem Statement	3
2.2 Relation to A.I.D. and SADCC Priorities	3
2.3 Other Donor Activity	6
2.4 Previous A.I.D. Experience with Road Rehabilitation Projects in Southern Africa	9
2.4.1 Selection of the Construction Contractor	9
2.4.2 Monitoring of Project Implementation by A.I.D.	12
2.4.3 Engineering Design	12
2.4.4 Payment Procedures	13
3. Project Description	14
3.1 Project Objectives	14
3.2 Project Components	14
3.2.1 Final Design and Construction Supervision	14
3.2.2 Construction	15
3.2.3 Training	15
3.2.4 Maintenance Equipment	16
3.2.5 Maintenance Financing	16
3.2.6 Project Administration	17
3.2.6.1 Implementing Agency Responsibilities	17
3.2.6.2 A.I.D. Responsibilities	18
3.3 Cost Estimate and Summary Financial Plan	19

Page No.

4. Project Implementation 22

4.1 Implementation Responsibilities 22
4.1.1 Department of Roads 22
4.1.2 A.I.D. 23
4.2 Implementation Schedule 25
4.3 Procurement Plan 28
4.3.1 Final Design and Construction Supervision 30
4.3.2 Construction Services 31
4.3.3 Road Maintenance Equipment 31
4.3.3.1 Responsible Agency 31
4.3.3.2 Source/Origin 31
4.3.3.3 Procurement Method 34
4.3.3.4 Financing Method 35
4.3.4 Shipping 35
4.3.5 Receipt and Utilization of Commodities 35
4.3.6 Personal Services Contractor 36
4.3.7 Gray Amendment 36
4.3.8 Procurement Schedule for Equip., Audit and Eval. 37
4.4 Training Plan 38
4.4.1 Objectives 38
4.4.1.1 Mechanical Training 38
4.4.1.2 Road Maintenance and Construction Management 38
4.4.2 Institutions 38
4.4.2.1 Mechanical Training 38
4.4.2.2 Road Maintenance and Construction Management 39
4.4.3 Participants 39
4.4.3.1 Mechanical Training 39
4.4.3.2 Road Maintenance and Construction Management 39
4.4.4 Training Costs 40
4.4.4.1 ITC 40
4.4.4.2 ESAMI 40
4.4.5 Training Administration 40
4.5 Monitoring, Evaluation and Audit Plan 41
4.5.1 A.I.D. Project Monitoring 41
4.5.2 Project Evaluation 41

5. Summaries of Analyses 45

5.1 Engineering Technical Analysis Summary 45
5.1.1 Current Status of the Project Road 45
5.1.2 Proposed Interventions, Design Standards and Methodology 45

Page No.

5.1.3 Reconstruction and Rehabilitation 46
5.2 Economic Analysis 49
5.2.1 Methodology 49
5.2.2 Principal Findings 50
5.3 Social Soundness Analysis 53
5.3.1 Intraregional Context of the Road 53
5.3.2 National Context of the Road 53
5.3.2.1 The Immediate Impact Zone 53
5.3.2.2 The Zambian Context 53
5.3.3 Direct Beneficiaries 54
5.3.3.1 Road Construction Workers and Supervisors 54
5.3.3.2 Commercial Transporters 54
5.3.3.3 Other Commercial Users 54
5.3.3.4 Passengers 54
5.3.3.5 Pedestrians 55
5.3.4 Indirect Beneficiaries 55
5.3.4.1 Malawi, Zaire and Zimbabwe 55
5.3.4.2 Zambian Companies 55
5.3.4.3 Zambian Consumers 55
5.3.5 Sociocultural Feasibility 55
5.3.5.1 Female Road Workers 55
5.3.5.2 Disruption and Displacement 55
5.3.5.3 Diversion of Traffic 56
5.3.5.4 Realignments 56
5.4 Institutional Analysis Summary 56
5.4.1 Overview of the Department of Roads 56
5.4.2 Organization of the Department of Roads 57
5.4.3 Institutional and Management Capability 57
5.4.4 Equipment 58
5.5 Environmental Analysis Summary 59
5.6 Road Maintenance and Sustainability Analysis 59
5.6.1 General Constraints 59
5.6.2 Assessment of A.I.D.-Financed Road Rehabilitation 60
5.6.3 Recommendations of Assessment-Maintenance Interventions 61

6. Conditions, Covenants and Negotiating Status 63

6.1 Conditions Precedent to First Disbursement 63
6.2 Conditions Precedent to Award of Construction Contract 63
6.3 Covenants 64
6.4 Negotiating Status 64

ANNEX I: Legal Exhibits

A. PID Approval Cable (690-0237)
B. Statutory Checklist
C. GRZ Request for Assistance
D. SADCC Programme of Action Listing
E. FAA, Section 611(e) Justification and Certification
F. Environmental Determination
G. Proprietary Procurement and DFA Source/Origin Determinations
H. Gray Amendment Certification
I. Certification of Host Counrty Contracting Capability

ANNEX II: Technical Exhibits

A. Logical Framework
B. Department of Roads Organizational Chart
C. Scope of Work for PSC Engineer
D. Road Maintenance Equipment List

ANNEX III: Project Analyses

A. Technical Analysis
B. Economic Analysis
C. Social Soundness Analysis
D. Institutional and Administrative Analysis
E. Financial Analysis
F. Road Maintenance and Sustainability Analysis

Glossary

AfDB	African Development Bank
A.I.D.	Agency for International Development
AIDS	Acquired Immune Deficiency Syndrome
CIDA	Canadian International Development Agency
CP	Condition Precedent
DANIDA	Danish International Development Agency
DBM	Dense Bitumen Macadam
DFA	Development Fund for Africa
EC	European Community
ESAMI	Eastern and Southern Africa Management Institute
FINNIDA	Finnish Development Agency
FOREX	Foreign Exchange
GDO	General Development Officer
GRZ	Government of the Republic of Zambia
GTZ	Gemeinschaft fur Technische Zusammenarbeit
HB	Handbook
HDM III	World Bank Highway Design and Maintenance Standard Model
IFB	Invitation for Bids
ILO	International Labor Organization
IQC	Indefinite Quantity Contract
IRR	Internal Rate of Return
ITC	Industrial Training Centre
MOWS	Ministry of Works and Supply
NCZ	Nitrogen Chemicals of Zambia
NORAD	Norwegian Agency for Development
ODA	Overseas Development Assistance (British)
PDO	Project Development Officer
PID	Project Identification Document
PIP	Public Investment Program
PFP	Policy Framework Paper
PRE	Provincial Roads Engineer
Pro Ag	Project Agreement
PSC	Personal Services Contractor

REO	Regional Engineering Officer
RFTP	Request for Technical Proposals
RDSS	Regional Development Strategy Statement
RLA	Regional Legal Advisor
RLDC	Relatively Less Developed Country
SADCC	Southern Africa Development Coordination Conference
VOC	Vehicle Operating Costs
ZCCM	Zambia Consolidated Copper Mines
ZIMCO	Zambia Industrial and Mining Corporation

1. SUMMARY AND RECOMMENDATION

1.1 Project Summary

The project will finance the reconstruction and rehabilitation of 49.4 kilometers of road between the Kafue River bridge and a point of intersection with a four-lane highway ten kilometers inside Lusaka city. The project will be implemented primarily through a host-country contract between the Government of the Republic of Zambia and a construction contractor who will undertake the complete reconstruction of 9.8 kilometers of the project road and widening and repairing on the remaining 39.55 kilometers.

Project funds will also be used to procure construction supervision services and project management support. Other components of the project will address the key issue of road maintenance by providing both a foreign exchange and local currency financing mechanism to ensure that adequate funds are available to support the efforts of the Roads Department over time. The major share of maintenance financing is from a sinking fund established with GRZ counterpart funds sufficient to cover all kwacha maintenance costs through the year 2000. A lesser amount of foreign exchange will be provided by A.I.D. to ensure the necessary funding for spares over approximately the same period. This financing mechanism, although adequate to protect A.I.D.'s investment in the mid-term, only provides breathing space until a more long lasting solution to maintenance constraints can be achieved through the current comprehensive structural adjustment program of the GRZ. This strategy was developed in full recognition of the need for the GRZ to carry out necessary policy reforms such as the provision of adequate financing for road maintenance and the effective enforcement of limitations on axle loads. In conjunction with the World Bank and other donors, USAID/Zambia will continue its dialogue with the GRZ to achieve a long term policy reform solution to adequate maintenance. USAID/Zimbabwe will also continue its dialogue with SADCC and SATCC to achieve regional coordination on policies such as standardized axle load limitations.

To date the primary constraints to an optimum maintenance program have been: (a) a lack of kwacha to adequately finance the routine operations of the Lusaka Provincial Engineer (PRE) who is responsible for maintenance of the entire segment of trunk road from Lusaka to Chirundu, and (b) a lack of foreign exchange needed to maintain a stock of spares needed to keep on-hand equipment in continual operation. The kwacha sinking fund will augment regular Government of Zambia financing to required levels. The foreign exchange will be provided through the project for the procurement of spares, on behalf of the Roads Department, by the design/supervision contractor or by a procurement agent to be determined. Due to the strategic importance, the resultant high visability of the road from Lusaka to Chirundu and significant inputs from the donor community, the Roads Department has done a satisfactory job in protecting A.I.D.'s investment to date in rehabilitation of the Kafue to Chirundu Road. Yet, maintenance could and undoubtedly would have been better if the Roads Department had been provided with adequate funding to cover recurrent costs proposed under the financing mechanism included in this project.

Training to improve specific managerial and technical skills of the Departmental maintenance staff will be provided for Roads Department personnel. Equipment will also be provided that will, in conjunction with a sizeable infusion of capital equipment and technical assistance from other donors, more than adequately address the current foreign exchange crunch in the mid term. However, solutions to these long-term constraints will only be achieved when necessary policy reforms are enacted to provide adequate financing for equipment and competitive salary/benefit packages for Roads Department employees.

Rehabilitation of the Kafue-Lusaka road will complete a program of road improvement between Zambia and Zimbabwe begun under project 690-0209, Regional Transport and Storage Development. Under that project two sections of road were rehabilitated: Makuti-Chirundu in Zimbabwe and Kafue-Chirundu in Zambia. When the final section from Kafue to Lusaka is completed, this multi-phase rehabilitation program will provide an improved road transportation system for traffic destined for intra-regional markets and the Mozambican port of Beira. Successful project implementation will remove existing traffic bottlenecks between Lusaka, Harare and the Beira port, thereby: a) allowing a higher volume of heavy traffic to travel at higher speeds; b) reducing accident and breakdown rates; and c) reducing transportation costs.

Benefits will accrue to private and public sector users of the road, particularly those involved in intra-regional export activities.

Rehabilitation of the Kafue-Lusaka road has been identified as a priority project for donor assistance by the SADCC Council of Ministers and figures in the SADCC Programme of Action (project 1.8.3). The project has also been given a high priority in the USAID/Zimbabwe-sponsored assessment of regional transportation projects based on such criteria as economic feasibility, regional impact and absorptive capacity.

1.2 Recommendation

That the Director of the A.I.D. Mission to Zambia, approve the project as described to provide a grant of $22,840,000 (twenty-two million, eight hundred forty thousand dollars) from the Development Fund for Africa (DFA) to the Government of the Republic of Zambia (GRZ) to implement rehabilitation of the Kafue-Lusaka road.

2. PROJECT RATIONALE

2.1 Problem Statement

Several major road systems serve intra-regional and overseas trade of the Southern Africa Development Coordination Conference (SADCC) region. Botswana, Zambia, Malawi, Zimbabwe and Tanzania are linked through a series of road connections including the Lusaka-Kafue-Chirundu-Harare-Beira network. Although built to satisfactory standards, many of the regional trunk roads which serve international trade require rehabilitation. This is the result of less than adequate maintenance, excessive vehicle loads, civil disturbances and general neglect associated with a historical lack of emphasis on regional development.

Efficient transportation within the region is vitally important for economic growth and regional integration. SADCC intra-regional trade is compromised by unreliable deliveries and costs associated with deteriorating road and rail infrastructure. SADCC trade with the outside world is highly dependent on expensive alternative transportation routes. The present high cost of transporting the region's commodities to external markets through the ports of the Republic of South Africa, compared with potentially lower costs through efficiently operating SADCC corridors, significantly increases the delivered price of SADCC goods and renders them less competitive on international markets.

Although much of the region's international trade is shipped by rail, certain types of cargo can be more efficiently moved by road. In Zimbabwe and Zambia, a missing rail link between Harare and Lusaka is supplanted by road, and a road also parallels the Livingstone-Lusaka railway. The two roads combine at Kafue for the final leg into Lusaka. Rehabilitation of the Kafue-Lusaka segment is necessary because the road is not in a maintainable state due to serious deterioration of the existing surface from heavy traffic and lack of maintenance.

2.2 Relation to A.I.D. and SADCC Priorities

A.I.D.'s support to SADCC and its programs began in 1982. In 1984, A.I.D. first articulated a regional strategy for providing assistance to the SADCC region that focussed on three sectors: transport, agricultural research and training. The Southern Africa Regional Program, Regional Development Strategy Statement (RDSS) for the period FY 1991-1995 retains the emphasis on transportation and includes plans to allocate more than half of all A.I.D. resources available during the planning period to this sector. The selection of this project for funding under the regional program strategy is fully consistent with the RDSS objective "to install capacity and improve efficiency in infrastructure that serves regional cooperation, provides access to regional and external markets and fosters economic growth". In the USAID-sponsored assessment of regional land transportation projects, rehabilitation of the Kafue-Lusaka section of road ranked first among road

projects and within the top ten infrastructure rehabilitation and capital projects.

This project contributes to the SADCC transport sector objective of "assisting the majority ruled nations of southern Africa to overcome regional transport constraints which are a serious obstacle to the economic growth and development of the region".

The proposed project, along with others in the regional program portfolio, will contribute to the A.I.D. Africa Bureau goal of sustainable, broad-based economic growth in Africa. In contributing to this overarching goal, the project purpose reflects the Africa Bureau's FY 1989-91 Action Plan, Strategic Objective 1-3: "to improve equity and efficiency in providing key goods, including transportation".

A.I.D.'s support of regional efforts in Southern Africa complements existing and planned A.I.D. bilateral programs. Although regional by virtue of its impact and linkages with other SADCC member-countries, the project implementation activities will occur exclusively within the Republic of Zambia. As such, it has been developed in close collaboration with USAID/Zambia and is consistent with the Zambia Mission's bilateral strategy, as described in the FY 1989 Country Development Strategy Statement, to "increase production (especially for export) and real income from both a) small farms and b) small scale rural and agri-business enterprises". Insofar as the project seeks to reduce transportation constraints for Zambian exporters and increase the profitability of Zambian exports through transport cost savings, the Kafue-Lusaka Road Rehabilitation Project is consistent with and responsive to the Mission's strategic priorities.

The Kafue-Lusaka Road Rehabilitation Project Paper development is justified on the basis of an "umbrella" PID approved in 1986, which established the rationale for a sector-wide approach to alleviating transportation constraints in the SADCC region. That PID (690-0237) sets out the following criteria for selection of subproject activities to be carried out under the rubric of this regional sector-wide approach:

1. short to medium term importance of transportation constraints to the import/export sector of SADCC countries;

2. relative priority within SADCC countries;

3. economic feasibility of the project as measured by the estimated internal rate of return;

4. total system reliability within the proposed project corridor;

5. capability of host country to finance recurrent costs and maintain the project;

6. medium to long term impact of the transportation system on economic growth in the region;

7. priority of the project within SADCC programs; and

8. system security within the proposed project corridor.

Justification for the Kafue-Lusaka road project has been measured against these parameters and determined to be fully appropriate. The basis for this determination is as follows, in the order of the eight criteria listed above (see also the Economic Analysis attached in Annex III(B):

1. Constraints on transport to the ports of the Indian Ocean and an inability to use the transport route to Lobito on the Atlantic Ocean resulted in excessive freight costs to the countries of SADCC for imports and exports. For example, a UNDP study estimates that in 1982, freight costs as a percentage of value of imports were 16.42%, 11.96% and 12.84% for Zambia, Malawi and Zimbabwe respectively. Although major donor and host-country commitments have been made to rehabilitate the major transport corridors, overall improvements in performance will begin to be seen only in the medium term. For Zambia in particular, the road to Zimbabwe (and thence road or rail to the port of Beira) is essential, as the TAZARA railway system is not able to accommodate its exports, particularly copper, and imports, particularly fertilizer and industrial goods.

2. The Southern Africa Transport and Telecommunications Commission (SATCC) has included the road from Harare to Lusaka as a priority project in its program of action since its inception in 1981. This section of road is included in the Beira Port Transport System Development Plan, Project 1.5.1, as the highest priority project to get traffic from the landlocked countries of SADCC to the nearest ocean port. The road also serves the traffic from Kazungula to Lusaka and is included in Project 1.8.3 that serves the Botswana-Zambia corridor. The section from Kafue north to Lusaka is the only section of either road route still requiring rehabilitation.

3. The internal rate of return for the project will be approximately 26% (see Annex III(B), 3.4).

4. A simultaneous approach to rehabilitation of the major elements of the transport system from Zambia to Beira in Mozambique was organized by SADCC in the early 1980's: harbor depth, cargo handling at the port, civil works at the port, rehabilitation of the railway and its motive power and rolling stock, and rehabilitation of the road into Zimbabwe. No part of the system is currently an impediment to the system as a whole.

5. See Maintenance and Sustainability Analysis, Annex III(F) and the 611(e) Justification and Certification, Annex I(E).

6. The existence of a reliable Zambia-Beira transport system will contribute to economic growth in the region by facilitating importation, at lower cost, of industrial goods, perishable consumer goods and agricultural inputs, enabling more efficient distribution of food grains from within and without the region and carrying exports to the nearest Indian Ocean port.

7. See (2) previous page.

8. There are no external threats to the road corridor from Lusaka, Zambia to Harare, Zimbabwe. The corridor from Zimbabwe to Beira in Mozambique is operating in daylight only, because of threats from insurgency, but transit traffic has nonetheless increased from 0.7 million tons in 1984 to 1.3 million tons in 1988.

2.3 Other Donor Activity

A number of other donors are either actively implementing or considering major road rehabilitation projects in Zambia.

The Government of the Peoples' Republic of China and the German technical assistance program (GTZ) are rehabilitating national "feeder" roads in the Central and North Western provinces. The Chinese project covers 400 kms from Lusaka to Kaoma. The Germans are rehabilitating approximately the same length of road further north and west (M8) connecting the town of Zambezi with the Mutanda Mission (see map in Section 2.4.1).

The Danish foreign assistance program, DANIDA, is appraising a project to reconstruct a road through the Copperbelt connecting Chillabombwe with Kapiri Mposhi and then veering north towards Tanzania, from Kapiri Mposhi to Mkushi. A decision on this project is expected in calendar year 1990.

Somewhat further along in the design and mobilization stages are European Community (EC) and Norwegian foreign assistance (NORAD) trunk-road rehabilitation project initiatives on the main road between the Copperbelt in the north and Lusaka and the front line states to the south. The Norwegian assisted-effort will cover part of the distance (115 kms) between the border town of Livingstone and the city of Kafue, connecting north, over the A.I.D.-rehabilitated road to Lusaka, or south, over the A.I.D.-rehabilitated road to Chirundu and Zimbabwe. Selection of a construction contractor for the NORAD project has been finalized. The EC project will provide 200 kms of major road reconstruction between Lusaka and Kapiri Mposhi, passing through the provincial capital of Kabwe. The EC has selected an Italian firm, Initec, as the principal construction contractor for this work, however, the final tendering process is not expected to be completed until the end of 1990.

The longest and most technically-difficult stretch of road under consideration for donor-funded rehabilitation runs due east from Lusaka to the Malawi border town of Mchinji, some 600 kms in all. Negotiations between the African Development Bank and the GRZ are expected to be completed shortly for the funding of this project.

Other donor-funded activities involving the Roads Department but not directly focussed on road rehabilitation include an Italian project underway since 1985 to construct 320 kms of new road in the Northern Province. This project is 80% completed, with a life-of-project budget estimated at over $51 million.

Both the Japanese and the Canadians have provided plant and equipment for road works. The Japanese contributed $2 million in 1982 and $1.2 million in 1987/8 for the purchase of heavy trucks and resealing units. Under a current agreement Japanese graders and tipper trucks valued at $5 million were scheduled to arrive by the end of July 1990. In January 1990 the Japanese signed an agreement to provide $6.7 million in new equipment for road maintenance and repair. The Canadian CIDA Program donated 80 road graders in 1978 and has just signed a $1.1 million agreement to rehabilitate 20 graders owned by the Roads Department. In 1989 DANIDA donated $1 million for the procurement of a road resealing unit and NORAD provided $1 million in spare parts for on-hand equipment. Additionally, FINNIDA has already provided equipment valued at $2.5 million and is scheduled to provide approximately $1.6 million more in equipment from 1990 funding in conjunction with current road maintenance project interventions in Zambia. All equipment provided by FINNIDA is dedicated to the Lusaka Province (which includes the Kafue-Lusaka road).

Other donor activities that improve the institutional capacity of the GRZ Roads Department include a very effective road maintenance project currently being implemented by FINNIDA and the road rehabilitation component of the AfDB project to reconstruct the road from Lusaka to the Malawi border.
In 1988, FINNIDA launched a pilot road maintenance activity in Lusaka Province in which three experienced road maintenance engineers work with and train departmental road maintenance crews in patching, compaction of the road base, road resealing, proper drainage techniques and other essential activities. Since the Kafue-Lusaka road runs directly through Lusaka Province, A.I.D.'s investment under the project will benefit from this sustained departmental effort to improve its institutional maintenance capacity. As one of the roads of primary economic importance in Lusaka Province, the Kafue-Lusaka road will be guaranteed a significant level of effort under this FINNIDA project. Its proposed expansion into other provinces also confirms commitment to developing sustainable Roads Department maintenance capabilities.

As indicated above, and on the map which follows, the African Development Bank has approved funding to rehabilitate an approximate 600 km stretch of trunk road from Lusaka to the Malawi border at Chipata. Resulting from their mutual awareness of the critical importance of road maintenance, the AfDB/GRZ project will include a major road maintenance component which will include a fully-equipped resealing unit, a crusher plant to provide crushed stone for pothole patching, and training of staff located in the project area to conduct routine and periodic maintenance.

Since 1989, NORAD has provided a senior maintenance engineer who heads up the maintenance section of the GRZ Department of Roads. The objective of this activity is two-fold. In addition to supplying planning and management expertise, he provides on-the-job training to departmental staff in planning, budgeting, and monitoring road maintenance activities. The presence of the NORAD engineer allows the department to upgrade the skills of people already within the organization and to promote from within, thereby helping alleviate problems recruiting and retaining new management staff. He made a significant contribution to maintaining the A.I.D. investment in the Kafue-Chirundu road by working closely with the Lusaka Provincial Roads Engineer in planning the recent resealing of various sections rehabilitated under Phase I. In addition he provides a great deal of flexibility in staffing at the Department because he has a facility to provide additional technical assistance and plans to second four Norwegian engineers with experience in various disciplines for six months duty in Zambia during 1990.

Approximately eight years ago, the World Bank financed the Mumbwa workshop for in-house maintenance of equipment. The workshop, discussed in section 2.1 of the Institutional Analysis, is a departmental facility located near Lusaka that provides maintenance and overhaul services for engines, plant and vehicles owned by the department and serves as a central spare parts facility. The Kafue-Lusaka road rehabilitation project will provide mechanical training at a Federal Republic of Germany (FRG) facility for mechanics, many of whom will be placed at Mumbwa as well as Lusaka Province. This training, at a local facility established by the World Bank and staffed by the FRG, is a good example of coordination among donors to achieve common objectives.

All of these activities are coordinated by the GRZ Department of Roads and reflect the high priority that donors have ascribed to the rehabilitation of the road transportation network within and through the Republic of Zambia. Extensive discussions on road maintenance strategies have been carried out between the World Bank, various bilateral donors and the GRZ. However, to date each rehabilitation project has been a discrete activity, wholly-funded by the sponsoring donor agency and the GRZ. Coordination of related maintenance intervention strategies has mainly been in the provision of equipment. Co-financing of road rehabilitation work has not been attempted by the various donors assisting the Roads Department. The primary reason has been identified as a difficulty in coordinating the approval and contracting processes. Furthermore, the Bank's recommended approach, based on in-country discussions, places emphasis on each donor providing for the adequate maintenance of its particular rehabilitation activity.

Other donor activities, the majority of which have begun in the last few years, are viewed by the Project Paper design team as appropriate and timely complements to A.I.D's road rehabilitation efforts.

2.4 Previous A.I.D. Experience with Road Rehabilitation Projects in Southern Africa

A.I.D. has implemented several transportation projects in southern Africa, including the Botswana-Zambia (BOTZAM) road, the Blantyre-Tete-Harare road, the Southern Perimeter road in Lesotho and the Makuti-Chirundu-Kafue road connecting Zimbabwe and Zambia.

General experience with transport infrastructure projects financed by A.I.D. and other donors has revealed that economic returns are highest for rehabilitation and maintenance projects. This has been consistently borne out in the economic analyses of projects in southern Africa and is demonstrated to be the case for the Kafue-Lusaka road rehabilitation as well.

To a great extent this project is based on lessons learned from the recently completed Kafue-Chirundu Road Rehabilitation Project (690-0209.02). The proposed project is very similar to Kafue-Chirundu in terms of the type of work required, proposed contracting procedures, monitoring of project implementation and financing and the economic environment in which the activity will be undertaken.

In addition to a strong technical similarity to Kafue-Lusaka, the Kafue-Chirundu project is an especially good example of lessons learned because the latter experienced several implementation problems that were successfully resolved. A project evaluation carried out in November 1987 was particularly useful in highlighting issues and providing guidance for corrective actions. Specific examples of lessons learned and corrective measures taken are described below.

2.4.1 Selection of the Construction Contractor

A major problem under Kafue-Chirundu stemmed from the selection of a construction contractor that had neither the technical capability nor the financial resources to perform in accordance with the contract. In spite of a mobilization advance and up-front financing of equipment by A.I.D., the construction firm did not have sufficient capital or expertise to carry out the work to the satisfaction of the engineering consultant. From the April 1983 commencement of the contract through February 1986 when the contractor was expelled from the job, the contractor completed only 25 to 30 percent of the work, even though the total contract period was scheduled for only 20 months.

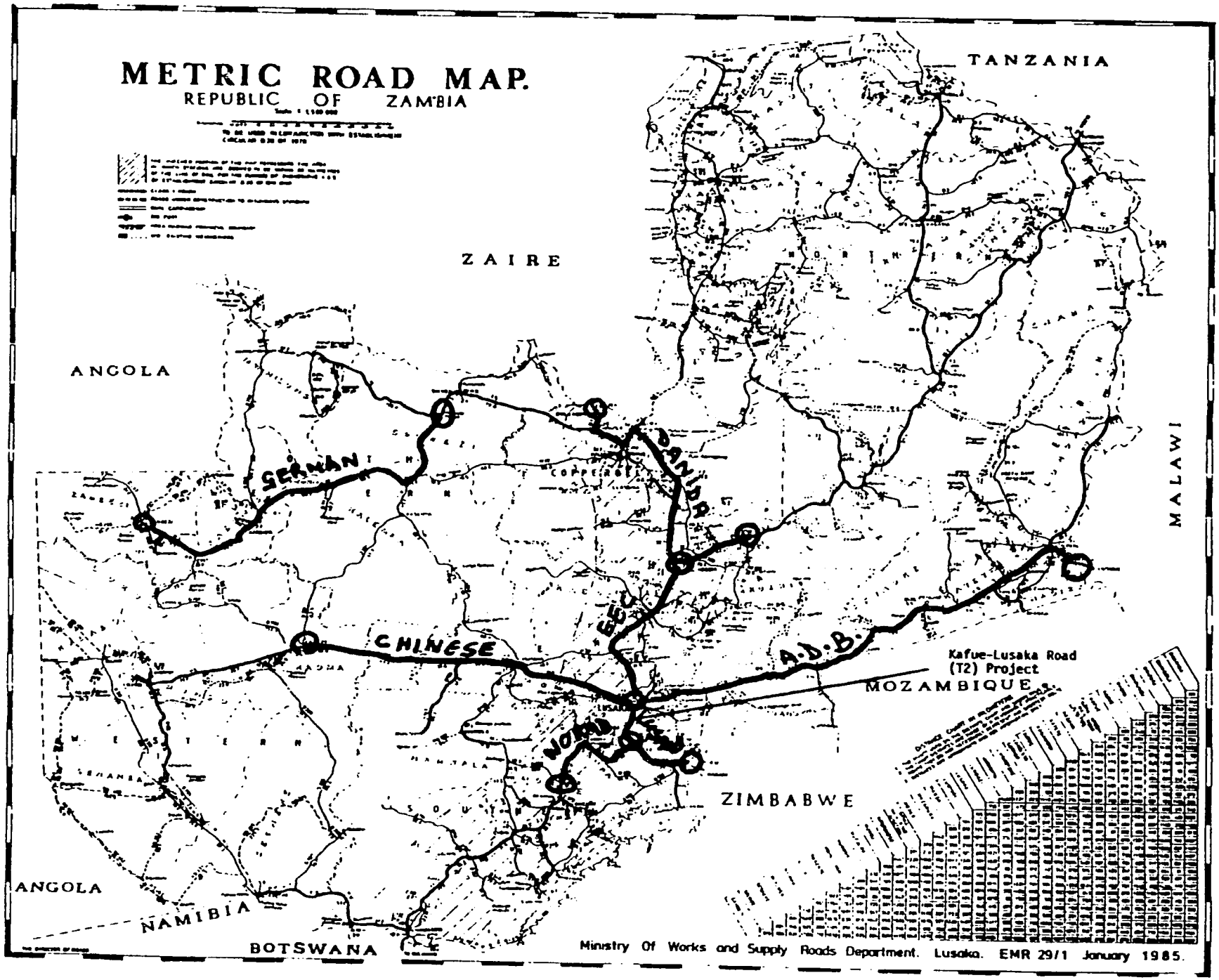
In retrospect, it appears that the problem was related to an insufficient analysis of contractors' technical competence and financial responsibility at the prequalification stage. The primary mistake was probably made in prequalifying construction contractors without the help of the engineering consultant financed by A.I.D. to supervise the work. For reasons of time pressure, both the engineering consultant and construction contractor had been hired simultaneously. The critical technical expertise of the engineering consultant was therefore not available to assist the Department of Roads and

A.I.D. to properly prequalify construction contractors and eliminate those with insufficient credentials, including the availability of necessary financial resources.

For the selection of a second construction contractor, the construction supervision engineering consultant and the Roads Department diligently evaluated prequalification documentation and their recommendations were thoroughly reviewed by USAID/Zambia, the RLA and the Regional Engineer. To avoid a repetition of the previous experience, under a collaborative approach between the GRZ and A.I.D., a qualified group of construction companies was short-listed. The resulting award to a locally-based construction contractor produced a job that was completed on schedule, at a cost below the original project budget.

In the project implementation section of this Project Paper, emphasis has been placed on the selection process for both the construction supervision consultant, and the construction contractor. Responsibilities of the Roads Department and A.I.D. are spelled out in detail, along with a step-by-step description of the complete contracting procedure. Further, all the required inputs from A.I.D. technical advisors are laid out in the implementation schedule. These inputs must be identified and sequenced early to facilitate timely scheduling due to the reliance of the host country contracting process on approvals by the A.I.D. Regional Engineer and Legal Advisor.

ACTUAL OR PROSPECTIVE
DONOR-FUNDED
ROAD REHABILITATION



2.4.2 Monitoring of Project Implementation by A.I.D.

A second significant problem encountered during the Kafue-Chirundu project implementation was a lack of continuous, day-to-day monitoring by A.I.D. when serious implementation problems occurred during the tenure of the first construction contractor. It is likely that A.I.D. could have reduced the negative impact by staying more closely abreast of issues before they turned into serious implementation problems. The November 1987 evaluation of the project indicated that the slow decision to terminate the first contractor was caused by a lack of "rigorous or thorough technical evaluation of the project to date".

The level of project monitoring of the Kafue-Chirundu project was dictated by the staff assigned to USAID/Zambia. Due to understaffing and other considerations at that time, the project was assigned to the Mission's Executive Officer, along with his full complement of regular duties. Adding to the difficulty with project oversight, the Mission had three Executive Officers during the period. In hindsight, this experience indicates that monitoring of project implementation should not be underemphasized by A.I.D.

In order to assure that the importance of close monitoring by A.I.D. of the Kafue-Lusaka project is recognized, and considering the continuing understaffing at USAID/Zambia, a PSC Engineer position has been included in the project budget to assure adequate coverage by the Mission. The Roads Department has agreed to this use of project funds because they appreciate timely, accurate guidance on A.I.D. host-country contracting procedures and any assistance A.I.D. can provide in coordinating project activities.

2.4.3 Engineering Design

The Kafue-Chirundu road project was criticized for the lack of adequate up-front technical design work. In fact, there were very few design drawings when the first construction contractor was ready to commence work at the site. Consequently, the engineering consultant, who was hired at approximately the same time as the construction contractor, had to prepare drawings on an ad hoc basis in an attempt to keep the construction contractor working and avoid claims for standing time.

Adequate engineering design work was provided for the second Kafue-Chirundu construction contractor. Due to the major delay resulting in the termination of the first contractor, the engineering consultant had sufficient time to complete all design work before the signing of the second construction contract in April 1987.

Preliminary work on the Kafue-Lusaka project design included a very thorough, up-front feasibility study and cost analysis. This study, which closely resembles a low-level engineering design, provided a detailed, realistic estimate of project costs and was the basis of the engineering technical analysis for the Project Paper. The project also provides for essential final design work by thoroughly detailing the duties of the engineering consultant in the project implementation responsibilities section and procurement plan. Adequate time to select the consultant has been built into the project implementation schedule to ensure that all design work will be completed early enough to allow construction to commence on schedule.

2.4.4 Payment Procedures

The lack of timely payments was identified as a major problem under the first construction contract for the Kafue-Chirundu road project. The A.I.D.-approved contract stated that disbursements were to be made to the construction contractor within 30 days of the receipt by USAID/Zambia of an invoice approved for payment by the Roads Department. According to USAID/Zambia, very few payments were made on time. The primary reason was that the 30 day payment period was unrealistically short. However, the problem was compounded by a rather hit-or-miss system of transmitting payment documentation to the Regional Financial Management Center (RFMC) in Nairobi for certification of disbursements. Problems also existed with the subsequent follow-up by USAID/Zambia on documentation sent to RFMC for payment and the lack of feedback to Zambia once the paperwork was received for processing and certification.

This problem was corrected during the A.I.D. review of the IFB for the selection of the second construction contractor for Kafue-Chirundu. The Director of RFMC visited Zambia and established a more realistic payment period, with a promise that payments to the construction contractor would receive expedited review and approval for payment. This agreement, along with a general improvement in the USAID/RFMC system to process and track payments, ensured that all payments to the second construction contractor were made on time. This was one of the most important actions to reduce misunderstandings and hostilities which developed between the first construction contractor, the Roads Department and A.I.D.

RFMC will be the responsible accounting station for this project until the A.I.D. Mission to Zambia gets its own controller in August 1990. Procedures are in place to ensure timely administration of payments and accounting data.

3. PROJECT DESCRIPTION

3.1 Project Objectives

The goal of the project is to support the development of a stronger foundation for economic growth in southern Africa. This goal will be achieved through:

1) increased regional exports as a function of improved road reliability and concommitant transportation cost savings making regional products more competitive in SADCC markets;

2) increased extra-regional trade using more cost-effective SADCC transportation corridors; and,

3) foreign exchange savings as vehicle mechanical wear, breakdown and accident rates are reduced.

The project purpose is to improve the efficiency of the inter-regional transport system by reducing operating costs and by extending the life of the road. Project-financed road reconstruction and rehabilitation will: reduce the roughness of the Kafue-Lusaka road and thereby substantially reducing vehicle operating costs, and place the Kafue-Lusaka road under effective maintenance by improving the maintenance capability of the Roads Department.

Following completion of the project there will be: 49.4 kms of rehabilitated road; a projected annual increase in road traffic of 2.5%; better trained and equipped personnel at the Zambia Department of Roads; and a decrease in road accidents and vehicle breakdowns.

3.2 Project Components

3.2.1 Final Design and Construction Supervision

The project will provide funding for final engineering design and construction supervision services. A consulting engineering firm will be hired to carry out final road reconstruction design (including the preparation of appropriate tender documents), soils collection and analysis, and continuous site inspections to ensure that the construction contractor adheres to design standards and specifications. The consulting engineering firm will provide monthly reports to the USAID/Zambia Project Officer, through the Ministry of Works and Supply. These reports will provide objective assessments of the performance of the construction contractor and recommendations for the improvement of project implementation. A representative of the consulting engineering firm will participate in periodic meetings with the GRZ Department of Roads and the construction contractor to discuss and resolve any issues arising from inspection site visits or implementation progress reports.

3.2.2 Construction

The project will undertake to reconstruct 9.85 kms of road, to overlay and seal 29.85 kms and to patch and seal 9.7 kms. Additional project-funded construction will include a minor realignment of 2 stretches of road to improve visibility and road widening to ensure conformance with Zambia road specifications. The contractor will be responsible for completing all proposed roadwork in accordance with final design drawings and specifications. This construction work will be procured through a host-country construction services contract with a U.S., Zambian or geographic code 941 firm. (A detailed explanation of and rationale for this eligibility requirement is contained in the procurement plan and Annex I(G), Proprietary Procurement and Source/Origin Determinations.) Based upon previous A.I.D. experience in southern Africa, it appears that a sufficient number of technically qualified firms can be drawn from those located in the U.S., Zimbabwe, Botswana, Malawi, Zambia, or other geographic code 941 countries. However, specific experience with the recently completed Kafue-Chirundu Road Project strongly indicates that Zimbabwe and Zambia will be the primary source countries of regionally owned firms offering competitive bids. A recent survey indicates that several other code 941 firms currently working in Botswana would also be interested in bidding. There are no U.S. construction firms located in Zambia or the southern Africa region.

3.2.3 Training

The project will provide specialized training to Roads Department personnel as part of an effort to ensure that the Kafue-Lusaka road will be properly maintained after project-funded rehabilitation is completed.

Ten field mechanics, selected by the Department, will attend a four-week training program offered in Lusaka twice a year. The curricula will be tailored to meet the requirements of the Roads Department and will focus on heavy equipment maintenance and repair, including: engines, gearboxes, brakes and hydraulic systems. This training is intended to reinforce and broaden the skills base of field mechanics working on a wide variety of roadwork equipment. This training has been identified as a primary need of the Department by the Director and is consistent with a departmental policy to upgrade the skills of personnel who maintain equipment. The curriculum will specifically include the maintenance and repair of equipment to be procured for the Kafue-Lusaka road rehabilitation.

The project will also sponsor one Roads Department engineer each year, to attend a four-week Road Maintenance and Construction Management course at ESAMI in Tanzania. Participants will be selected on a rotating basis, in collaboration with other-donor sponsored candidates, to ensure that the entire Roads Department engineering staff will eventually have an opportunity to attend the course. Course curriculum focuses on management rather than technical issues and is intended for senior road engineers from the SADCC

region. It allows participants the opportunity to learn how construction and maintenance management techniques are applied in practice to improve the overall planning and management of road maintenance.

3.2.4 Maintenance Equipment

Project funds will be provided for the procurement of road maintenance equipment to be used, on a priority basis, for the maintenance of the Kafue-Lusaka road after rehabilitation is completed. This equipment will be consigned to the GRZ Roads Department, which will be responsible for its periodic maintenance and repair. Moreover, a letter of commitment from the GRZ, attesting that the project road will be given first priority use of the equipment provided under the Kafue-Chirundu Road Rehabilitation Project, has been established as a Condition Precedent to Disbursement of project funds.

Maintenance equipment to be procured will include:

- a mechanical horse (truck tractor) and spares
- a roller unit and spares
- a semi-trailer
- 2 tippers (dumptrucks)
- a truck-mounted bitumen distributor
- 2 chip spreaders
- a sweeper
- a line striper
- a bitumen storage tank
- a farm tractor and spares
- a vibratory (or impact) compactor, and
- a fuel storage tank.

This set of equipment is similar in nature and composition to that provided under the Kafue-Chirundu project. It is envisaged that the bitumen and fuel storage tanks will be procured locally with kwacha provided as part of the GRZ contribution. This equipment is the minimum sufficient for project road maintenance and is not in excess of project requirements. Maintenance equipment procured for Kafue-Chirundu will be at or near the end of its useful life by the time it would be required for Kafue-Lusaka maintenance.

3.2.5 Maintenance Financing

The project identifies three primary weaknesses of road maintenance as: a shortage of forex for spares and new capital equipment, a shortage of operating expenses to cover recurring costs, and a difficulty in retaining staff at the Roads Department due to low salaries. The project will address these concerns through a joint GRZ/A.I.D. financing strategy which will ensure adequate maintenance. To provide a realistic estimate of financing requirements, an engineering firm was hired to assess maintenance needs over time and recurring cost estimates for the complete section of road from Lusaka to Chirundu. Based on estimates of requirements and corresponding costs

projected outward for 10 years, an estimate of the required kwacha and foreign exchange budgeting was calculated. In view of these estimates, a two part financing solution was developed in which: (a) K120 million in GRZ-owned counterpart funds will be provided in a sinking fund to supplement the normal budget levels available and (b) $425,000 will be provided in project funds to procure and ship spare parts needed to keep on-hand equipment in continuous operation. The sinking fund will ensure adequate funding for recurring maintenance costs and a new GRZ subsistence scheme designed to make take home pay more realistic. (Subsistence allowance rates for travel away from an officer's designated location of assignment are detailed in a relevant excerpt from the GRZ Personnel Division Circular No. B1 of 1990, discussed further in Annex III.F, Road Maintenance Analysis.) The foreign exchange to finance spares will be provided to the Provincial Roads Engineer (PRE) of Lusaka Province. The required spares will be procured on behalf of the Department of Roads by the design and supervision consultant or another procurement agent to be determined. Complementary training to maximize the utility of the spares will be provided by FINNIDA which has an ongoing road maintenance project to educate the staff of the PRE of Lusaka Province in proper maintenance techniques and management procedures. As part of its activity, FINNIDA has established an office at departmental headquarters with a complete staff to procure equipment and spares.

These efforts are recognized to provide only short term solutions to financing and personnel constraints. The intent of these measures is to provide breathing space to allow the GRZ to implement the current structural adjustment program. USAID/Zambia will continue its dialogue with the GRZ in areas such as adequate maintenance financing and the critical issue of enforcement of axle load weight limitations, which will be studied by the GRZ to satisfy a CP in the project agreement. USAID/Zambia will coordinate its efforts with the World Bank and other donors who are currently engaged in dialogue with the GRZ on the structural adjustments including reforms in the budgetary allocation process, civil service and parastatal sectors, and foreign exchange allocation system.

This financing program, detailed in the Road Maintenance Analysis, is designed to protect A.I.D.-financed rehabilitation efforts under Phases I and II of the Kafue-Chirundu Road Rehabilitation Project, as well as the upcoming Kafue-Lusaka Road Rehabilitation Project. In carrying out the analysis, the Roads Department's maintenance efforts to date on the Kafue-Chirundu road have been evaluated to provide a realistic benchmark of performance as well as costs that may be expected in the future on the complete stretch of road from Lusaka to Chirundu.

3.2.6 Project Administration

3.2.6.1 Implementing Agency Responsibilities

The Roads Department of the GRZ Ministry of Works and Supply will have primary implementation responsibility for the work done under this project. The Director of the Roads Department, will serve as the GRZ Project Coordinator

and Engineer. He will be assisted by the Roads Department administrative and technical staff and by an engineering consulting firm engaged to supervise final engineering design and construction.

The scope of work and request for technical proposals (RFTP) for the engineering consultancy will be developed by the Department with some assistance from the USAID/Zambia Project Officer. Contracting will be in accordance with standard GRZ and A.I.D. host-country contracting procedures and A.I.D. will approve the RFTP and contract documents before issuance.

All services to be provided under the project, with the exception of international training, audits/evaluations and a project engineer to be assigned to the A.I.D. Mission to Zambia, will be procured on a host-country contract basis. The capability of the Roads Department to assume this responsibility has been demonstrated by its performance in a similar capacity under the Kafue-Chirundu project (690-0209). Their capability to implement host country contracts under this project has also been reviewed and approved by the Controller of the Zimbabwe A.I.D. Mission, the design team, and the A.I.D. Mission to Zambia. Preparation of the invitation for bids (IFB) for construction services will be done jointly by the Roads Department and the consulting engineers. The contract documents will be prepared in the standard GRZ format with appropriate A.I.D. regulatory clauses appended as required. Prior to A.I.D. approval of any host country contracts, the Director of the A.I.D. Mission to Zambia will certify in writing that the Roads Department has adequate host country contracting capability. Disbursements will be made in local currency to Zambian contractors and in dollars to non-Zambian firms. Project monitoring, reporting and financial arrangements will remain as established for the Kafue-Chirundu project.

3.2.6.2 A.I.D. Responsibilities

Although this is a Southern Africa regional project, project implementation authority will be delegated by the Director, of the A.I.D. Mission to Zimbabwe, to the Director, of the A.I.D. Mission to Zambia. A Project Officer will be designated by the Director of the A.I.D. Mission to Zambia. He/she will be responsible for project monitoring, periodic reporting, management of A.I.D. project evaluations and audits, and liaison between the A.I.D. Mission to Zambia and the GRZ Project Coordinator on matters relating to project implementation.

The project accounting station will be RFMC (until the A.I.D Mission to Zambia gets a controller in August 1990). Engineering support will be provided by the REDSO/ESA Regional Engineering Officer (REO), as required. A schedule of routine engineering oversight will be established by the A.I.D. Mission to Zambia Project Officer and the REDSO/ESA, REO. Legal assistance will be provided as necessary, by the Regional Legal Advisor (RLA) at the REDSO/ESA office in Nairobi, Kenya. The Regional Contracting Officer (RCO) located in REDSO/ESA, Nairobi or the A.I.D. Mission to Swaziland, will be involved in consultations on contract preparation and approvals. The A.I.D. project development backstop officer (AFR/PD/SA) will assist in arrangements for CBD publications and receipt of prequalification data, as required.

A summary cost estimate and financial plan follows.

3.3 Summary Cost Estimate and Financial Plan
($000)

ACTIVITY	AID		Host Country		Total	
	US $	Local Currency US$ Equivalent	US $	Local Currency US$ Equivalent	US $	Local Currency US$ Equivalent
Final Design	350.00 (A)	0.00	0.00	0.00	350.00	0.00
Construction Supervision	1100.00 (A)	0.00	0.00	0.00	1100.00	0.00
Construction	13016.00 (A)	3254.00 (H)	0.00	0.00	13016.00	3254.00
Maintenance Equipment	860.00 (B)	0.00	0.00	11.25 (J)	860.00	11.25
Training	20.00 (C)	0.00	0.00	18.25 (K)	20.00	18.25
PSC Engineer	735.00 (D)	0.00	0.00	0.00	735.00	0.00
Spares (procured by agent of Roads Dept)	425.00 (E)	0.00	0.00	0.00	425.00	0.00
Evaluations, Audits	100.00 (F)	0.00	0.00	0.00	100.00	0.00
Land Acquisition	0.00	0.00	0.00	2.50 (L)	0.00	2.50
Sinking Fund	0.00	0.00	0.00	3000.00 (M)	0.00	3000.00
Contingency/Inflation	2492.00 (G)	488.00 (I)	0.00	32.00 (N)	2492.00	520.00
TOTAL	19098.00	3742.00	0.00	3064.00 (O)	19098.00	6806.00

3.3 Summary Cost Estimate and Financial Plan

(Notes to table on the proceeding page):

(A) Taken from Section 14.3 of Feasibility Study/Cost Analysis, prepared by John Burrow and Partners, dated August 1989. Amount represents an adjustment to the John Burrow estimate to eliminate work on 3.9 km from Lusaka (roundabout at Independence Avenue and Cairo Road) to Makeni. A further adjustment was made by the design team to account for a one year delay (to 1992 and 1993) in project implementation from that (1991 and 1992) envisaged by Burrow. For details see Section 5.3.1, Project Cost Table and the Costs Section of Annex III.A, Technical Analysis.

(B) Taken from actual costs of similar equipment procured competitively by the Roads Department in Nov/Dec 1989 using A.I.D. Handbook 11 procedures. Prices were adjusted upward to reflect estimated costs at the time of the proposed procurement. See illustrative Equipment List, Annex II.D.

(C) Taken from cost estimates provided by Roads Department and the designated training institutions.

(D) Taken from actual long-term PSC costs provided by the Executive Office, of the A.I.D. Mission to Zambia.

(E) Taken from Maintenance Study by John Burrow and Partners, dated March 1990. The required amount of $325,000 was stated in current costs by the consultant. These costs have been escalated by 8% per annum to allow for inflation and slight errors in original estimated values. Shipping costs will be covered in a 15% contingency.

(F) Based on contract TA to supplement REDSO/ESA staff on 1 mid-term and 1 final evaluation ($60,000), and 1 non-federal Final Audit ($40,000).

(G) 15% contingency for inflation is based on line items for design, construction supervision and construction services, which comprise the major share of project dollar costs. For these 3 items, John Burrow included a standard 10% contingency in the feasibility/preliminary engineering study based on a survey of several firms which provided illustrative rates for bill of quantity items. Based on on a review of actual bill of quantity rates in the current construction contract for a NORAD road rehabilitation project, this estimate was adjusted to 15% by the design team to correct an underestimation by Burrow.

(H) Estimate of local currency cost component of the construction contract taken from the Feasibility Study/Cost Analysis prepared by John Burrow and Partners.

(I) The 15% contingency is also used for the local cost component of the construction contract since it is envisaged that these funds will most likely be disbursed in dollars to non-Zambian owned firms. If a Zambian owned firm is awarded the construction contract, all contract financing will be disbursed in kwacha that was purchased in dollars; thus the 15% contingency associated with dollar cost increases will still be applicable.

(J) Funds to be provided through standard A.I.D./GRZ Counterpart Agreement. Amount is taken from actual cost of similar equipment previously procured by Roads Dept, adjusted upward to estimated cost at time of proposed procurement. Kwacha in this and all other line items are converted at the rate of K40 = US$1.00, the highest legal rate in Zambia as of March 1990.

(K) Funds to be provided through standard A.I.D./GRZ Counterpart Agreement. Amount is taken from actual costs provided by Roads Dept and training institution, adjusted upward to estimated cost at time of proposed procurement.

(L) Taken from Maintenance Study by John Burrow and Partners, dated March 1990.

(M) Taken from March 1990 Maintenance Study by John Burrow in which maintenance costs for years 1990-2000 were estimated (in current kwacha) and converted in this table, to a dollar equivalent. GRZ funding will be provided from counterpart funds.

(N) Escalation factor of K1,280,000 which equals the loss of kwacha purchasing power for training, equipment and land acquisition from expected inflation during 1990-1993 (inflation contingency is estimated at 100% of costs based on current estimates). The highest lawful exchange rate as of March, 1990 is K40 = US$1.00, however, negotiations are underway with the international finance community which will require a gradual devaluation of the kwacha to a considerably higher level by 1993. These negotiations are expected to be completed within the year. Except for an insignificant amount for local training in 1990, kwacha expenditures under the project are expected to begin in 1991, a time when the highest legal kwacha to dollar rate of exchange is anticipated to increase. Escalation factors have been built into the project contingency to reflect the predicted devaluation of local currency and related inflation during this period.

(O) Represents a GRZ contribution of K122,560,000 (equivalent to US$ 3,064,000, converted at the current exchange rate of K40 = US$1).

4. PROJECT IMPLEMENTATION

4.1 Implementation Responsibilities

4.1.1 Roads Department/Ministry of Works and Supply

The Roads Department of the Ministry of Works and Supply (MOWS) will have the primary responsibility for rehabilitation work to be done under this project. The work will be carried out using A.I.D.-approved host country contracting procedures. Rehabilitation work will be completed by a construction contractor which will be supervised on-site by a consulting engineering/construction supervision contractor. The consulting engineers will complete final design, and provide construction supervision services. As Engineer in charge of the works, the Director of Roads will direct the construction supervision services contractor. The Director will delegate necessary powers to the construction supervision contractor to effectively monitor and control the quality, pace and cost of construction work. Upon completion of final design and tender documents by the consulting engineer, construction services will be procured by the MOWS under a separate host country construction contract.

The Director of Roads is an experienced, competent engineer with knowledge of both field operations and contract administration. Actual project management will be delegated to the Deputy Director, or another senior engineer, both of whom have extensive experience in managing major road rehabilitation projects. This experience includes the successful management of the recently completed A.I.D.-financed Kafue-Chirundu Road Rehabilitation Project (690-0209.02). The Deputy Director or his designee will have direct line management authority over the final design and supervisory engineering firm hired to monitor construction work. Due to the large number of major planned trunk road rehabilitation projects during the time frame of the Kafue-Lusaka project, it is envisaged that the supervisory engineering firm will be delegated a wide range of powers by the Director of Roads. This is the normal mode of operations employed by the Roads Department to maximize their limited staff resources. With close coordination between the chief engineer of the construction supervision firm and the Roads Department project manager, this procedure has been proven effective on the Kafue-Chirundu Road Rehabilitation Project.

The Roads Department has demonstrated the ability to effectively administer host country contracts for both construction supervision and construction services under the Kafue-Chirundu Road Rehabilitation Project. A key to this success was a recognition by the Director of Roads that both the construction supervision firm and the A.I.D. Mission to Zambia as the financier were integral team members in achieving project objectives. Throughout the duration of construction, the Roads Department maintained a spirit of cooperation and open communication with the A.I.D. Mission to Zambia and adhered to guidelines established with regard to required A.I.D. approvals, payment procedures, etc. In the audit of the Kafue-Chirundu Road Rehabilitation Project, "Audit Report No. 3-690-89-17", RIG/A/N stated:

"The audit disclosed that the project objective of facilitating movement of key commodities between Zambia and Zimbabwe was achieved, as construction was substantially complete, the overall quality of construction was excellent, and provisions were made for future maintenance of the road. In addition, internal controls over $12.1 million of disbursements were adequate to ensure that work was satisfactorily completed in conformance with applicable contractual requirements and A.I.D. regulations."

A prequalification solicitation for final design/construction supervision services will be prepared by the Roads Department, in consultation with A.I.D., RLA and the Regional Engineer (REO). The solicitation, requesting expressions of interest, qualifications, financial capability, details of ownership, etc., will be advertised in both the Commerce Business Daily and regional newspapers. The Roads Department will provide prequalified firms with an A.I.D.-approved Request for Technical Proposals. Upon receipt of A.I.D. approval of the Department's evaluation of technical proposals, the Roads Department will negotiate with the highest ranked firm, and subject to successful completion of negotiations, will submit a draft contract to A.I.D. for review, comment and approval. After approval by A.I.D. the contract will be submitted to the GRZ Central Tender Board for approval. Pursuant to Tender Board approval, the contract will be signed and funds committed by A.I.D.

Construction services will be procured using Handbook 11 formal competitive bidding procedures. The Roads Department will receive and evaluate bids and propose an award to A.I.D. for approval. Following approval by A.I.D., and subsequently by the GRZ Central Tender Board, the contract will be signed, and funds will be committed.

In addition to contract administration, Roads will review documentation and approve all payments to both the construction supervision and construction contractors. Payment documents will be reviewed by the Department's Executive Engineer for Contracts, and approved by the Director of Roads prior to submission to A.I.D. for payment. Payment procedures will be in accordance with standard A.I.D. procedures.

Maintenance equipment will be procured using A.I.D.-approved host country contracting procedures. However, the procurement will be carried out on behalf of the Roads Department by the design/supervision contractor. Handbook 11 (HB 11) procedures will be utilized.

4.1.2 A.I.D.

The Project Officer will be the A.I.D. Mission to Zambia General Development Officer (GDO). To assist in daily monitoring and implementation activities, the project will fund an experienced engineer under a personal services contract (PSC) who will report to the GDO. The PSC engineer's primary tasks will be on-site monitoring, advice to Mission management on technical issues and implementation progress, resolution of implementation problems and assistance in the preparation of project related documentation. The role of

the PSC engineer will be particularly important during the period of project implementation for several reasons. For the next five years, it appears that the Roads Department will be under an unusually heavy workload of monitoring and contract administration actions resulting from a massive GRZ trunk road rehabilitation program. In addition to normal activities for road maintenance and rehabilitation activities, four other major rehabilitation efforts will be funded by NORAD, EEC, AfDB and DANIDA. Thus, it will be prudent for A.I.D. to maintain especially close contact with the Department to stay abreast of critical events and to assist in averting or minimizing potential bottlenecks.

As shown in the implementation schedule, the REO and RFMC in REDSO/ESA will be critical to effective project implementation. The REO will make routine visits to monitor construction progress, advise Mission management on technical issues, assist with the preparation of project documentation and provide required clearances for implementation actions by the Mission. The assistance of the REO will be especially critical during the early stage of the project to provide necessary inputs on the review of advertisements, prequalification documentation, and host country contracts.

REDSO/ESA/RFMC will be the accounting station for both dollar and local currency disbursements financed under the USAID grant. Direct Letters of Commitment will be issued to the final design and construction supervision contractor, the construction contractors, suppliers of road maintenance equipment for the Roads Department and the institution providing international training. Host government local currency disbursements will be made by MOWS under a standard GRZ/A.I.D. counterpart funds agreement and will be monitored by the A.I.D. Mission to Zambia and the RFMC.

The RLA, REDSO/ESA will provide legal assistance throughout the duration of project implementation. He/she will confirm the satisfaction by the GRZ of Conditions Precedent, review and approve advertisements, prequalification documentation, and host country contracting procedures and contract documents, and review and clear project implementation documentation, and advise Mission management if legal issues such as host country contractual disputes arise.

The RCO, REDSO/ESA or the A.I.D. Mission to Swaziland will provide assistance as needed for the A.I.D. review of host country contracts for design and construction supervision and for construction contracts. It should be noted that the Roads Department is familiar with procedures and appreciates the rationale behind Handbook 11 contracting procedures due to recent experience in the Kafue-Chirundu Road Rehabilitation Project. It is therefore unlikely that issues related to a lack of understanding of A.I.D. rules and regulations will arise.

Necessary administrative arrangements for training will be made by the USAID/Zambia project and training officers.

4.2 Implementation Schedule

The timetable of implementation actions that follows has been divided into four principal areas. Several actions will be taken to compress the contracting period for the procurement of both final design and construction supervision services and construction services. Advertisements for the prequalification of both contractors will be made at the earliest possible times. Advertisement will request expressions of interest and qualifications from firms eligible for rehabilitation work, subject to the availability of funds.

Implementation Schedule

Proposed Dates	Activity	Responsible Organization
1. Initial/General		
05/90	Project Paper completed	USAID/Zimbabwe
07/90	Project authorized	USAID/Zimbabwe
07/90	Project Grant Agreement signed	USAID/Zambia, GRZ
07/90	Initial Condition Precedent satisfied	USAID/Zambia, GRZ
01/91	Condition Precedent for first K60 million satisfied	USAID/Zambia, GRZ
06/91	Conditions Precedent to construction contract award satisfied	USAID/Zambia, GRZ
11/91	Condition Precedent for second K60 million tranche satisfied	USAID/Zambia, GRZ
12/94	PACD (12/31/94)	
2. PSC for Monitoring Project		
10/89	Issue world wide cable, place advertisement in Engineering News Record and Civil Engineering Magazine	AID/W, USAID/Zambia
12/89	Receive CV's and SF-171 from interested applicants	USAID/Zambia
03/90	Review CV's and issue recommendation for prospective candidate for PSC	USAID/Zambia, REO

Proposed Dates	Activity	Responsible Organization
06/90	Draft PIO/T for PSC engineer	USAID/Zambia, REO
07/90	Issue PIO/T for PSC engineer	USAID/Zambia
08/90	PSC contract signed	USAID/Zambia
09/90	PSC candidate arrives in Zambia	USAID/Zambia, PSC
12/93	PSC departs Zambia	USAID/Zambia, PSC
3. Engineering Supervision Final Design Consultant		
09/89	Draft ad for prequalification	USAID/Zambia, REO, GRZ
10/89	Publication of advertisement for expressions of interest and prequalification data.	USAID/Zambia, GRZ
10/89	Publication in Commercial Business Daily (CBD) and local/regional newspapers	AID/W
03/90	Draft Scope of Work/RFTP and A.I.D. review	USAID/Zambia, REO, GRZ
03/90	Review of prequalification documents completed by A.I.D.	USAID/Zambia, RLA
07/90	RFTP issued to prequalified firms	Roads Department
09/90	Receipt of technical proposals by Department of Roads	GRZ/CTB
10/90	A.I.D. approval of evaluation and authcrization to Roads to negotiate with No. 1 firm.	GRZ/CTB, USAID/Zambia, REO
11/90	Roads negotiates and submits draft contract to A.I.D.	GRZ, USAID/Zambia/ RLA
11/90	AID approval of contract provided	USAID/Zambia, RLA

Proposed Dates	Activity	Responsible Organization
01/91	Preliminary design drawings complete	Contractor
01/91	Preliminary tender documents completed	Contractor
04/91	Final design drawings/tender documents completed	Contractor
05/91	Final design drawings/tender documents reviewed and approved by A.I.D.	USAID/Zambia USAID/Zimbabwe, GRZ
11/91	Mobilize engineering supervision personnel at construction site	Contractor
12/93	Complete construction supervision	Contractor

4. Prequalification of Construction Contractor

12/90	Prequalification documents drafted	GRZ, REO, USAID/Zambia
12/90	Prequalification questionnaire reviewed/approved	USAID/Zambia, REO
12/90	Draft advertisement for prequalification	GRZ, USAID/Zambia
12/90	Publication of prequalification advertisement in CBD and regional/local newspapers	AID/W, USAID/Zambia, Regional USAID, GRZ
02/91	Receipt of prequalification data	GRZ, USAID/Zambia
02/91	Review/recommend shortlist	GRZ, USAID/Zambia, REO
03/91	Approval of shortlist	GRZ, USAID/Zambia, REO

5. Construction Contractor Selection

05/91	IFB approved	REO, USAID/Zambia, RLA
05/91	IFB issuance	GRZ , USAID/Zimbabwe USAID/Zambia, RLA

Proposed Dates	Activity	Responsible Organization
06/91	Site visit	GRZ, REO, USAID/Zambia, Prospective Contractors
08/91	Bids received	GRZ/CTB
09/91	Evaluate/recommend contractor award	GRZ/CTB
10/91	Review and approval of contract	USAID/Zambia, RLA, REO
11/91	Award contract and notify contractor to proceed	GRZ
03/92	Mobilization complete/start work	Contractor
12/93	Complete construction	Contractor
01/94	Start maintenance period	Contractor
12/94	End maintenance period	Contractor

4.3 Procurement Plan

The Project Paper design team has determined that the Roads Department has the institutional capability to effectively implement host country contracts for the three basic elements included in the project: final design/construction supervision services, construction services and the procurement of road maintenance equipment/spares. A certification that the Roads Department is capable of implementing required host country contracts, in compliance with A.I.D. regulations in HB 11 and State 185082, has been made in writing by the Director of the A.I.D. Mission to Zambia as Annex I(I) to this project paper. As discussed in the institutional analysis, it is the standard practice of the Roads Department to contract for major trunk road rehabilitation such as the rehabilitation of the Kafue-Lusaka road.

Host country contracting is the only practical alternative to carry out major construction such as the rehabilitation of the Kafue-Lusaka road. Only the Roads Department has the required expertise and authority in Zambia to direct construction, issue variation orders, provide engineer's decisions, acquire land, and a host of other day-to-day actions. A.I.D. has neither the expertise on Zambian laws and regulations nor the authority to administer a construction contract in Zambia. Further, Handbook 11, Chapter 2 states that it is usually appropriate that the borrower/grantee, acting through a designated contracting agency other than A.I.D., contract for construction services required to implement projects. The construction supervision contractor acts as an extension of the Director of Roads in monitoring the quality, cost and schedule of construction so it would not be practical to attempt an A.I.D. direct contract.

A contract will be finalized at the beginning of project implementation with an engineering consultancy firm for final design and construction supervision. The maintenance equipment/spares will be procured under Handbook 11 host country procedures. Purchasing will be carried out by the design/construction supervision firm on behalf of the Roads Department.

It has been demonstrated under the Kafue-Chirundu project that the most critical element in construction project implementation is the thorough and thoughtful selection of both a final design/construction supervision and a construction services contractor. The Kafue-Chirundu project foundered under a weak construction contractor but proceeded on to successful completion once a capable contractor was hired. It is therefore imperative that the Roads Department exert the utmost care and diligence in the prequalification and selection of both contractors. It is equally important that A.I.D. provide sufficient technical expertise to complete necessary reviews and approvals at critical points in the procurement process. As detailed in the Implementation Schedule, RFMC, the RLA and REO are being programmed by the Mission to provide TDY assistance at appropriate times to review and approve host country documents and procedures. These include prequalification, solicitation and contract documents, as well as the GRZ evaluation of bids and award proposals. The process of timely review by A.I.D. will be facilitated by specifying that copies of prequalification data, technical proposals, and bids be sent to the A.I.D. Mission to Zambia along with original submissions to the Roads Department. In addition, the Mission will hire an experienced PSC engineer under a Personal Services Contract to coordinate closely with the Department during all phases of project implementation. The PSC will advise the GRZ on A.I.D. Handbook 11 contracting procedures and keep the Mission's Project Officer informed of implementation progress at all times. Given the size and complexity of the proposed host country contracting process, recent experience of the Mission dictates that close monitoring of implementation is a critical element to achievement of project objectives.

The source and origin of procurement of design and supervision and construction services under the project has been designated as A.I.D. geographic code 941 and Zambia. The RLA will review prequalification documents, to establish the eligibility of interested firms under code 941. Although the authorized source/origin under this DFA funded activity is geographic code 935, per DFA guidance, expansion of procurement authority to code 935 will be exercised only for certain commodities based on reasons of compatibility with on-hand equipment and consistency with departmental standardization plans.

4.3.1 Final Design and Construction Supervision

With the assistance of the A.I.D. Mission to Zambia, the RLA and the REO, the Roads Department will place an advertisement in the Commerce Business Daily, local and regional newspapers for expressions of interest and qualifications to conduct final design and construction supervision. The advertisements will be placed prior to obligation to expedite the prequalification and contracting for design and supervision services. Subject to obligation and availability of funds, it is anticipated that a final design and supervision contract will be signed by November 1990. The objective is to complete the design, preparation of A.I.D.-approved IFB's for construction services, and prequalification of construction contractors by March 1991.

These activities must be completed thoroughly to ensure satisfactory road rehabilitation, and on schedule to allow enough time to complete the selection process and signing of a construction contract by November 1991.

An RFTP for design and supervision services will be prepared by the Roads Department in close consultation with the Regional Engineer. The document will be reviewed by RLA and RCO prior to issuance to prequalified contractors.

The Roads Department will receive and evaluate technical proposals from prequalified engineering consultants and submit its ranking to the Mission for review and approval. If the evaluation methodology is judged sound by the A.I.D. Mission to Zambia, the Regional Engineer and the RLA, the Roads Department will be instructed to negotiate with the firm ranked number one technically. The Roads Department and this firm will negotiate and propose a draft design and supervision contract for A.I.D. approval.

The contracting process will be implemented by the host country, yet it will nevertheless be essential for the Mission's project officer and PSC engineer to be in close contact with the Roads Department at all times during the prequalification, selection, contract negotiation and award process to ensure that Handbook 11 contracting rules and regulations are adhered to. Timely TDY's by the Regional Engineer and RLA will be critical. Close coordination with RCO and RFMC will be essential on the negotiation and formulation of the draft contract by the Roads Department so that A.I.D. will be able to approve the document without a serious delay in project implementation. For instance, it is anticipated that the construction supervision contract format should reflect monthly billing rates for the provision of manpower and reimbursement for items such as travel, communications and household effects. It is critical that A.I.D. provide this type of input at the beginning of negotiations to ensure that the Roads Department knows the parameters acceptable to A.I.D. An A.I.D. representative will act as an observer during negotiations to answer questions on rules and regulations.

4.3.2 Construction Services

A.I.D.-approved advertisements advising construction firms of the availability of prequalification forms will be placed in the CBD, local and regional newspapers. Prequalification forms, approved by the RLA and the Regional Engineer, will be available from the Zambian Embassy in Washington and various A.I.D. Missions around the SADCC Region. It is anticipated that A.I.D. will approve the Roads Department's prequalification of contractors and that IFB's developed by the Roads Department and approved by A.I.D. will be sent to prequalified firms by May 1991. As in the final design and construction supervision contracting process, copies of prequalification data and bids will be sent to A.I.D. along with original submissions to the Roads Department.

Prior to the submission of bids, all firms receiving IFBs will be advised of a pre-bid site visit and follow-up meeting at which the Roads Department will receive questions and provide official responses. It is anticipated that the Roads Department will receive bids in August 1991 and that A.I.D. will approve a contract by October 1991. The Roads Department will then seek GRZ Central Tender Board approval and a contract will be signed by November 1991. This will allow the contractor 3 to 4 months to mobilize, with construction work starting in March 1992.

Adherence to the timing of events detailed in the Implementation Schedule is critical to allow the contractor two full dry seasons to complete the work. As in the procurement of construction supervision services, it is essential that the Mission coordinate closely with the Roads Department to ensure that all host country procurement documentation and procedures conform to Handbook 11 regulations. This will be especially critical on the development of prequalification forms and the IFB. Although the Roads Department has previously developed documents in conformance with A.I.D. rules, A.I.D. administrative procedures are sufficiently complex that the Roads Department will require intensive assistance from the Mission to facilitate their work. It is anticipated that the PSC engineer hired under the project will concentrate his efforts on coordination with the Roads Department during this phase of implementation. Timely assistance from RLA and the Regional Engineer will be required to review documentation and provide necessary approvals. The controller from the A.I.D. Mission to Zambia will assist in the approval of the contract, and in particular, finalizing and explaining payment procedures to all contractors.

4.3.3 Road Maintenance Equipment

4.3.3.1 Responsible Agency

The Roads Department will be the responsible agency for the procurement of road maintenance equipment and spares for on-hand equipment which will be procured under Handbook 11 host country contracting procedures. The Roads Department has demonstrated its capability to administer A.I.D.-financed procurements under the Kafue-Chirundu Road Project for which a similar set of

equipment/spares were competitively procured using HB 11 host country procedures. Even though the Roads Department was faced with an extremely tight time schedule imposed by the Kafue-Chirundu Road Project PACD, all units were procured and shipped on time and all equipment has arrived in country.

However, due to an anticipated heavy workload at the Roads Department (monitoring a number of major country-wide road rehabilitation projects), the procurement will be carried out by the engineering consulting firm contracted to provide final design and construction supervision services or other agent to be determined. Procurement capabilities of potential contractors will be assessed in the prequalification of consultants. A further examination of procurement capabilities will be made during the Roads Department's evaluation of technical proposals and the A.I.D. review of award proposals.

Responsibilities of the final design and construction supervision contractor or other procurement agent will include the review and refinement of specifications prepared by the Roads Department. Due to the dollar amount and rather standard nature of the required equipment, it is anticipated that formal bidding (IFBs) will be utilized. It will therefore be important to define specifications more precisely than is normally done by the Roads Department, which generally procures competitively through an informal solicitation of quotes. The procurement agent will develop IFBs, advertise the procurements in the appropriate A.I.D. bulletin, receive and evaluate bids, and submit results of the evaluation to the Roads Department for approval. Due to the value and proposed frequency of purchases of spares for on-hand equipment, it is anticipated that Handbook 11, Chapter 3 small value procurement procedures will be used. The procurement agent will arrange for insurance and CIF Lusaka shipments, and ensure that the necessary information and clearance documentation is received by the buyer in a timely manner. The procurement agent must also process insurance claims on behalf of the Roads Department if necessary.

It is anticipated that a fixed price for the above services will be negotiated with the final design and construction supervision consultant. (Although it is not anticipated at this point, the design team believes that an alternate procurement services agent could handle the procurements in a satisfactory manner if arrangements with the design/supervision consultant are not advantageous to A.I.D. and the GRZ.)

4.3.3.2 Source and Origin

The rationale underlying this procurement plan is to maximize U.S. procurement to the maximum extent practicable, while utilizing the flexibility authorized under the DFA sparingly to expand eligibility for the procurement of goods and services on an item by item basis, as needed to achieve project objectives. Pursuant to an individual assessment of each procurement item, the authorized source will be first expanded to geographic code 941 and Zambia, and as required to achieve project objectives, finally expanded to geographic code 935 for the procurement of a selected few commodities.

Procurement from code 941 countries was authorized in 86 State 074147 for countries in the SADCC region. A number of SADCC countries will benefit from better inter-regional trade resulting from improvements to the Harare-Lusaka corridor.

The anticipated source of the goods and services to be procured follows below. Additional details on the rationale for the choice of source/origin for project procurements is included as Annex II.G, Proprietary Procurement and Mission Director's Determination for DFA Source/Origin.

Equipment

Out of 13 items comprising a road resealing unit, valued at approximately $600,000 F.O.B. not including spares, eight items with an approximate value of $230,000 are expected to be procured from the U.S. (for details see Annex IID, Equipment List). For these items, U.S. source/origin units are very competitive and sufficiently compatible with on-hand equipment at the Department. For the two items valued at approximately $75,000, the source/origin will be either the U.S. or code 941. The U.S. is a competitive source of supply for these units which include a farm tractor and truck trailer. However, units from code 941 sources of supply may offer stronger local dealerships and local service capability, and therefore may be easier for the Roads Department to maintain. Two tipper trucks and a truck-mounted bitumen distributor valued at approximately $195,000 must be procured from geographic code 935 sources because the Roads Department has standardized on either Mitsubishi or Mercedes Benz models. Spares valued at approximately $100,000 will be procured for all items.

Under the Kafue-Chirundu project, a source/origin waiver was approved to permit the procurement by the construction contractor of various soils testing equipment from code 935 because project equipment had to be compatible with on-hand British equipment at the Roads Department. Additional British equipment, valued at approximately $75,000, will be required to ensure the required compatibility to achieve the objectives of this project.

Approximately four right-hand-drive vehicles (pick-ups) will be procured by the construction supervision contractor for use in completing final design and construction supervision. The authorized source of procurement for these vehicles will be geographic code 935, due to the unavailability of right-hand-drive units made in the U.S. and the suitability of Japanese light duty vehicles in Zambia.

Approximately $425,000 in spares will be procured by the design and supervision contractor or other procurement agent from code 935 source and origin because most on-hand Roads Department equipment is of European or Japanese origin.

A proprietary procurement justification for the bitumen distributor and tippers is included as Annex II.G, Proprietary Procurement and Mission Director's Determination for DFA Source/Origin.

Training

Short-term local mechanical training for 10 departmental staff per year will be provided for four years at the GTZ-operated Industrial Training Center (ITC) in Lusaka at a cost of approximately kwacha 730,000. This type of training is best carried out at a local facility where programs can be tailored to suit the needs of the Roads Department and local conditions, and where the number of participants can be maximized. Short-term international training in road maintenance and construction management will be provided by the Eastern and Southern Africa Management Institute (ESAMI) in Tanzania. This four week course will be provided for one engineer per year during the four year life of project, at a total cost of approximately $20,000.

Final Design and Construction Supervision

U.S. engineering consultancy firms traditionally have been strong competitors for design and supervision and are expected to provide the primary competition under this project. U.S. firms are familiar with A.I.D. regulations and have been proven to assure quality workmanship. However, to provide for the possibility of associations between U.S. and local or regional firms with specific relevant experience in Zambia, the eligibility to bid will be expanded to include geographic code 941 and Zambian firms.

Construction Services

It will not be practical to restrict the eligibility to bid on construction services to U.S. firms only. There are not any U.S. construction firms based in Zambia or southern Africa so it is very doubtful that they could ensure adequate competition unless they bid in association with Zambian or geographic code 941 firms. Industry sources indicate that there are approximately five construction companies of code 941 ownership working in neighboring countries, with sufficient size and capabilities to complete the work. In addition it is possible that several other firms currently working in Botswana may satisfy code 941 ownership requirements. It appears that two locally-based firms would meet the ownership requirements to qualify as Zambian firms. One of these firms has indicated a desire to form an association with a U.S. firm if a suitable opportunity arose and it is conceivable that similar arrangements between U.S. and regional or Zambian-owned firms could significantly enhance competition to the benefit of the project.

4.3.3.3 Procurement Method

All procurements will be made under host country contracts in conformance with rules contained in Chapter 3 of Handbook 11. The design team and the Controller of the A.I.D. Mission to Zimbabwe have reviewed and approved the

Roads Department's host contracting procedures. Furthermore, a written certification that the Roads Department has sufficient contracting capability has been made by the A.I.D. Mission Director to Zambia, (see Annex I(I)). Details of the Roads Department's contracting procedures and the review already carried out by A.I.D. are contained in Annex III.E., Financial Analysis. Formal competitive bidding will be utilized to procure construction services and, in all probability, road maintenance equipment with advertisements placed in the appropriate A.I.D. bulletin. Competitive negotiated procedures will be used to procure design/supervision services. The equipment/spares procurement will be carried out by the design and supervision contractor or an alternative procurement agent to be determined later. The Regional Commodity Management Officer assigned to assist the A.I.D. Mission to Zambia will coordinate closely in drafting and placement of advertisements, drafting of IFB's, review of procurement procedures and other A.I.D. requirements such as approval of awards.

4.3.3.4 Financing Method

RFMC will issue Direct Letter(s) of Commitment to host country contractors, who require such, under contracts financed with U.S. government funds.

4.3.4 Shipping

The eligible source for ocean shipments financed under the project will be A.I.D. Geographic Code 935. The GRZ will monitor 50/50 cargo preference shipping requirements through the Roads Department's procurement agent in accordance with instructions issued by A.I.D. in a Project Implementation Letter (PIL). Shipments on appropriate vessels will be arranged on behalf of the GRZ by the design/supervision contractor (or other procurement agent of the Roads Department).

4.3.5 Receipt and Utilization of Commodities

The road maintenance equipment includes a complete periodic maintenance resealing unit. The equipment will be consigned to, received and utilized by the Roads Department. Upon completion of customs clearance, the equipment will first be checked by a representative of the Director of Roads and then included in the Roads Department's master inventory. Pursuant to a covenant in the Grant Agreement, the equipment will be allocated on a first use basis to maintenance of the Kafue-Lusaka road. The road maintenance equipment detailed in the equipment list in Annex II.D is the minimum requirement sufficient to maintain the project road. The units to be financed are not in excess of project requirements, even though some of the units have a capacity somewhat in excess of minimum requirements. For instance, the bitumen distributor will allow for the resealing of many kilometers, but obviously, it is not divisible to match its capacity exactly with that of project requirements. The equipment will be deployed by the Director of Roads to a province where a section of trunk road is scheduled for resealing. The Provincial Roads Engineer in that Province will be responsible for the

maintenance and safeguarding of the equipment until the resealing unit is deployed by the Director of Roads to another resealing maintenance activity.

The soils testing equipment, procured by the construction contractor will be initially entrusted to the construction supervision firm. The equipment will be utilized by the supervision contractor, at a temporary laboratory set up at the construction camp, to test the quality of materials used in the construction works. During construction, the construction contractor will be responsible for the maintenance and repair of the equipment. Upon completion of the works, the equipment will revert to the Roads Department and be deployed to the Roads Department's laboratory at its headquarters in Lusaka.

The vehicles used by the supervision firm will be maintained and repaired by either the design/supervision or construction contractor throughout construction and will revert to the Roads Department upon completion of supervision. At that point, they will be logged into the departmental inventory and deployed by the Director of Roads as needed to carry out the normal functions of road maintenance.

4.3.6 Personal Services Contractor

An engineer will be hired under a personal services contract (PSC) to assist the A.I.D. Mission to Zambia with project implementation. It is anticipated that offers will be received and evaluated, and a contract signed by August, 1990. The contractor should be on the job in Zambia by September, 1990. The duration of the contractor's services is anticipated to be three and a half years.

Household furnishings, housing and other support services for the Personal Services Contractor will be procured by the Executive Officer, A.I.D. Mission to Zambia, and paid for from project funds.

4.3.7 Gray Amendment

The nature of the design, supervision and construction services, and the institutional relationships under which the contractors for those services will operate, dictate that the contracts be host country, rather than A.I.D. direct contracts. The contractors who will carry out the final design and construction supervision and the construction services will both be under contract to the GRZ. Only the GRZ Roads Department has the required expertise and authority in Zambia to direct road construction, issue construction contract variation orders, provide engineer's decisions, acquire land and carry out other required actions. There is no formal mechanism for A.I.D. to direct that the Government award a contract to a firm covered by the Gray Amendment. However, the Requests for Technical Proposals (RFTPs) and the

Invitations for Bids (IFBs) for construction will state that responding firms of U.S. origin or consortia of U.S. and geographic code 941 are encouraged to sub-contract, wherever possible, with Gray Amendment firms. The eventual prime contractors will also be encouraged to sub-contract with Gray Amendment firms for any procurement of U.S.-origin goods or services subsequent to the award of the prime contracts.

4.3.8 Procurement Schedule for Maintenance Equipment, Audit and Evaluations

Proposed Dates	Activity	Responsible Organizations
06/92	PIO/T issued for mid-term evaluation team	USAID/Zambia
10/92	PSC/institutional contracts signed with evaluation contractors	USAID/Zambia
10/92	Ads placed in A.I.D. Bulletin for road maintenance equipment	USAID/Zambia AID/W
11/92	Competitive procurement IFBS issued for road maintenance equipment on behalf of GRZ utilizing Handbook 11 procedures	Construction supervision contractor
04/93	Road maintenance equipment contracts signed	Construction supervision contractor
01/94	Road maintenance equipment begins to arrive in Zambia and is cleared through customs	Roads Dept.
05/94	PIO/T issued for final project evaluation	USAID/Zambia
05/94	PIO/T issued for contractor to carry out Non-Federal Audit	USAID/Zambia
06/94	PSC/institutional contracts signed with evaluation contractors	USAID/EXO
07/94	Contract signed with Non-Federal auditor	RCO/ESA

4.4 Training Plan

4.4.1 Objectives

4.4.1.1 Mechanical Training

The GRZ Roads Department places a high priority on the continuing education of staff mechanics and engineers. The Roads Department is responsible for the routine maintenance and repair of a wide variety of equipment obtained from different donor agencies and GRZ sources. The mechanical equipment under their charge, including bulldozers, graders, compressors, tractors, stone crushers, dumptrucks, loaders and tippers, is a matter of particular concern, as mechanics must continually upgrade their skills to effectively service this varied physical plant.

Training provided under the project will be tailored to the requirements of Department of Roads mechanics and cover engines, gearboxes, brakes and hydraulic systems. It will be conducted bi-annually in Lusaka for a duration of 3 to 4 weeks. This training is intended to reinforce and broaden the skills base of field mechanics working on Roads Department equipment in every province in the Republic of Zambia. The curriculum will include the maintenance and repair of equipment to be procured for the Kafue-Lusaka road rehabilitation.

4.4.1.2 Road Maintenance and Construction Management

One engineer, designated by the Director, Roads Department, will attend a four-week road maintenance, planning and management course during each year of project activities. The course will focus on management rather than technical issues for an intended audience of senior road engineers. The objectives of the course will be: 1) to bring together those involved in the management and planning of road maintenance; 2) to improve skills and knowledge of the participants in the management and planning of road maintenance; and 3) to indicate how various techniques, including vehicle operating cost calculations, management systems and others, are applied in practice to improve the overall planning and management of road maintenance.

4.4.2 Institutions

4.4.2.1 Mechanical Training

The mechanical training will be conducted at the Industrial Training Centre (ITC), based in Lusaka. ITC is a training institute registered with the Department of Technical Education and Vocational Training in Zambia. It was founded in 1985 as a cooperative venture between the Federal Republic of Germany and the GRZ. It is governed by a Board of Directors which includes representatives from private industry and Government of Zambia enterprises. The ITC is run independently in management, finance and program administration, is staffed with qualified Zambian and German expatriate

lecturers and operates both long and short-term courses focussing on theoretical (25%) and practical (75%) mechanical training. The training centre is equipped with new and modern maintenance and testing equipment provided by the German foreign assistance program.

4.4.2.2 Road Maintenance and Construction Management

Training in road maintenance and construction management will be provided by the Eastern and Southern African Management Institute (ESAMI) in Tanzania. ESAMI is a management training institute specializing in continuing education for engineers and management professionals. It was established in 1976 as a joint venture between the Government of Tanzania and the International Labor Organization (ILO). ESAMI offers an annual four-week course on road maintenance, planning and management which has been attended in the past by engineers from the GRZ Roads Department. The Roads Department has requested that project funds be provided to finance the attendance of one engineer at the annual course, during each year of project activities. The project-financed engineer will be accompanied by two other Roads Department engineers funded by NORAD and ODA respectively.

4.4.3 Participants

4.4.3.1 Mechanical Training

One Roads Department mechanic from each province in Zambia will be selected to participate in each ITC course. The course curricula will be modified or varied as a function of Roads Department requirements. Therefore, selection of course participants will be made on the basis of 1) the particular types of equipment being maintained by the prospective participants, and 2) their respective workloads and availability during the training periods. Participants may be allowed to attend more than one project-funded course.

4.4.3.2 Road Maintenance and Construction Management

The project will provide funding for an engineer, chosen from the Roads Department staff, to attend the ESAMI Road Maintenance and Planning Management Course in Tanzania. As the course content does not vary from year to year, different individuals will be chosen to participate in each of the four years of training covered within the life of project. Other donors are expected to continue to fund additional participants at the ESAMI course. Participants will be selected on a rotational basis, and by the end of the four years of project-financed training, virtually the entire engineering field staff (numbering 22 in August, 1989) will have attended the course under financing provided by either A.I.D. or another donor.

4.4.4 Training Costs

4.4.4.1 Industrial Training Centre (Lusaka)(ITC)

ITC presently charges 600 Zambian kwacha per participant, per week, for tuition only. Lunch for participants costs 30 kwacha per day. The ITC director estimates that tuition and other costs will escalate by 50% per year for each of the next five years to cover inflation, kwacha devaluation and to allow for the eventual elimination of German foreign assistance subsidies. ITC training costs for 1990 can therefore be estimated as follows:

10 participants @ K900/week X 8 weeks (two 4-week sessions) =K72,000 + 400 lunches X K45 = K18,000. Total 1990 = K90,000.

Applying the cost escalator for subsequent years yields: 1991 = K135,000; 1992 = K202,500; 1993 = K303,750.

Total estimated ITC training costs: kwacha 731,250 ($18,282 as of the March 1, 1990 rate of exchange).

The GRZ will contribute transportation costs, housing and salaries for training participants.

4.4.4.2 ESAMI

The four-week ESAMI course currently costs $3,200 per participant. This includes: roundtrip transportation from Zambia, housing, food, insurance, tuition and a pocket allowance. These costs are based on a 1989 NORAD-funded course participant. Assuming a 20% annual cost escalation for the Tanzania-based institute, total ESAMI training costs will amount to $20,612.

The GRZ will contribute all transportation costs, housing within Zambia and salaries for training participants.

4.4.5 Training Administration

The implementing agency for project-funded training activities will be the GRZ Roads Department. The selection of participants, establishment of curricula at ITC, enrollment and registration payments and logistical arrangements will be coordinated from the Roads Department headquarters in Lusaka. Foreign exchange components of the ESAMI training will be payable from A.I.D. Mission to Zambia project accounts upon request and certification by the Director, Roads Department.

4.5 Monitoring, Evaluation and Audit Plan

4.5.1 A.I.D. Project Monitoring

The A.I.D. Mission to Zambia Project Officer will review monthly implementation reports prepared by the construction supervision contractor and submitted to the A.I.D. Mission to Zambia through the GRZ Ministry of Works and Supply. Monthly implementation reports will include at least the following:

-assessment of progress to date;

-problems encountered during the reporting period;

-recommended solutions to problems identified;

-adherence to work plan and schedule;

-comparison of project construction expenditures with physical progress of the work and any related recommendations; and

-general recommendations.

The Project Officer, accompanied by the PSC engineer and/or the Regional Engineering Officer (REO), will make on-site inspections and verify progress toward meeting project objectives. These inspections will generally be made on a monthly basis, in conjunction with scheduled site visits by the GRZ Roads Department Project Manager or his designee. Follow-up meetings, chaired by the Roads Department Project Manager and attended by the construction supervision contractor, will be held to discuss any implementation issues arising from the site visits and to allow the construction contractor an opportunity to respond to those issues. The A.I.D. Mission to Zambia Project Officer and REO will endeavor to attend these meetings as observers.

4.5.2 Project Evaluation

Two project evaluations will be held prior to the PACD. A mid-term evaluation will be conducted after the first dry-season construction period, and a final evaluation will be scheduled one year after construction has been completed.

The evaluation will: (1) measure the achievement of the project purpose "to continue and expand efforts to improve the efficiency (making the best use of the existing resources) of the inter-regional transport system by reducing operating costs and by extending the life of the road", and (2) evaluate the effectiveness of the project inputs and outputs.

The project evaluation will consist of the following:

1. Introduction (including discussion of planned informant and eventual users).

2. Project goals/purpose/outputs/inputs (goals and purpose should be explicit, stated with respect to what is to change in terms of results). Among criteria to be addressed concerning this section are:

A. Adequacy of the resealing and rehabilitation design;
B. Performance of the engineering construction;
C. Performance of the construction contractor, specifically, whether the construction work was carried out to specification and in a timely manner;
D. Performance of the GRZ Roads Department in project administration;
E. Re-evaluation of the GRZ road maintenance capabilities;
F. Performance of the PSC engineer to facilitate project monitoring and implementation; and
G. Performance of the A.I.D. Mission to Zambia Project Officer, Controller, etc.

The project purpose will be analyzed by examining the road roughness. Road roughness is a commonly accepted engineering standard of the quality of the pavement and the effectiveness of the maintenance of the pavement. It is measured using a bump integrator and is expressed in centimeters per kilometer. Pavements in good condition have a roughness of about 1500 centimeters per kilometer. Severely deteriorated pavements will have a roughness index of about 7000 to 8000 centimeters per kilometer.

Baseline data on existing road roughness were collected by the consultant and the GRZ during the development of the project paper, and projections of the road roughness with and without the project were made by the consultant for the years 1989-2012. These data will provide the basic measure of the achievement of the project purpose. If the evaluation shows that the roughness is at or below the rate projected by the consultant, it can be accepted that the purpose of the project was achieved. If the measured roughness exceeds that projected by the consultant, the implication is that the project purpose is not being achieved.

3. Managers' questions: What are the major decisions which might have to be made during project implementation for which information is needed for informed decision-making? What are the major areas of uncertainty about inputs and outputs and the likelihood of purpose/goal achievement?

4. Illustrative criteria for measuring progress and impact. Progress will focus on monitoring construction activities during the implementation of the project. Impact, as defined, relates to how the road project will change people's lives, livelihoods, and behavior.

It is characteristic of projects involving rehabilitation and maintenance of primary roads that the impact is scattered widely and unlike the impact for agricultural roads, cannot be easily traced to final recipients.

The direct beneficiaries will be the commercial transporters who benefit from reduced vehicle operating costs. However, since international road transport is competitive, and will become even more competitive in future years, the savings in vehicle operating costs will be largely passed on to users, such as bus passengers and shippers of freight. However, the impact will be difficult to measure.

Though the benefits are large in the aggregate, the benefits are small on an individual basis. For example, the reduced cost of transport because of the road improvement may decrease from $100 per ton to $95 per ton. This reduction in transport cost may be obscured by a change in another important factor that influences cost, such as the use of more modern trucks. However, it will be almost impossible to assess the impact of this road project directly. Fortunately, the impact can be calculated indirectly by using well known engineering relations between road roughness and vehicle operating costs for the basic vehicle types such as private car, taxi, bus, pickup truck, small truck, and large articulated truck. Since the users of each vehicle type are also known (high income groups use car, low income groups go by bus) estimates can be prepared of the benefits accruing to each user type.

Road roughness data therefore can serve two purposes: (1) measure the achievement of project purpose, and (2) assess the impact of the project on beneficiary groups. Impact will be monitored during the life of project and assessed at its conclusion (or afterwards). Impact will also focus on social soundness issues such as:

- employment of women in project-funded activities;
- identification and distribution of project beneficiaries; and
- performance of the construction contractor in minimizing disruption and destabilization of the physical and cultural environment in the immediate impact zone of the project.

5. Methodology: Data collection and analysis methods will be specified early in project implementation.

6. Evaluation team composition: The evaluation team will be composed of the following technical specialists:

- A project Evaluation Officer;
- A Civil Engineer;
- A Social/Behavioral Scientist;
- A Transportation Economist; and
- Appropriate GRZ Officials.

Project funds will be allocated for the purposes of conducting two proposed evaluations. Additional funds will be earmarked for a non-federal audit of the effectiveness of project controls over expenditures, and related issues. It is anticipated that the evaluation teams will be comprised of REDSO/ESA specialists and supplemented, where necessary, by contract technical assistance procured through a REDSO/ESA or an AID/W project evaluation IQC.

5. SUMMARIES OF ANALYSES

5.1 Engineering Technical Analysis Summary

5.1.1 Current Status of the Project Road

The project road consists of the Zambia trunk road T2 between Lusaka and the Kafue bridge. The total length of the road is 53.3 kms, linking the capital, Lusaka, with the important industrial town of Kafue and continuing to the bridge crossing at the Kafue River. The dual carriageway section of road between km 0.0 and km 3.9 will not be part of this project.

The road has been in service approximately 20 years. It has not been properly maintained during this period, and as a consequence, it is now in varying stages of distress. There are some sections where the pavement condition is relatively good, with only limited areas of block cracking and good riding quality. However, there are sections of road where the pavement exhibits cracking at the surface which permits moisture to penetrate the protective surface membrane, affecting the base, sub-base and sub-grade causing road failure at these sections. Contributing to the general road deterioration is a growth of vegetation and silting of side and mitre drains which resulted in failure of the underlayers and deformation of the surface, evidenced by block cracking in the pavement. Lack of shoulder maintenance has resulted in dangerous dropoffs and edge ravelling on virtually the entire length of the project road. Longitudinal cracking and edge failures are also evident.

In order to assess the current condition of the road and the rehabilitation requirements, engineering consultants, John Burrow and Partners Zambia Ltd., were hired to perform an engineering feasibility, preliminary design and cost analysis in June, 1989. As part of the engineering design, pavement deflections (Benkelman beam test), soil analysis (test pits and dynamic cone penetration tests), roughness, potholes and drainage surveys were conducted. In addition to the surveys, a pavement assessment and economic analysis using HDM III, The World Bank Highway Design and Maintenance Standard Model, were undertaken and rehabilitation proposals were formulated.

5.1.2 Proposed Interventions, Design Standards and Methodology

The information obtained from the Burrow's report has been incorporated into the Technical Analysis. The rehabilitation program proposed in the Burrow's report will upgrade the road with a pavement design life of 10 years to its original class standard, adequate to handle the projected 2.5% annual traffic increases. The Burrow's report was reviewed by USAID/Zimbabwe REO and REDSO/ESA engineer and found to be based on sound road engineering principles. Traffic data was obtained from a traffic study conducted by Coopers and Lybrand Associates, Zambia Ltd., and available traffic data from the GRZ Roads Department.

Standard axle surveys were obtained from a Kampsax Carl Bro study conducted in 1985/1986. That study indicated that approximately 10% of all truck traffic was overloaded. This overloading factor was used by John Burrow and Partners in developing design criteria and the various design options included in the technical and economic analyses in this project paper. The traffic data and standard axle surveys have been reviewed and the resultant design criteria are based on the Zambia Roads Department standard road design for the weight and number of axle loadings, with the 10% overload factor built in. Design criteria were also based on a number of other reliable sources which can be found in the reference section of the Technical Analysis.

Road sections which have extensive damage in the form of severe pavement deformation, extensive cracking and potholing have high Benkelman beam deflections. These sections will either require reconstruction or strengthening by overlaying with additional layers of pavement material. The analysis has identified which sections require strengthening and which require overlay. Overlay thickness requirements greater than 120 mm will be reconstructed by removing and discarding the existing bituminous layer, scarifying and recompacting the roadbase and adding a 300mm selected gravel sub-base and 150 mm crushed stone roadbase, with a double bituminous surface treatment. Sections where the lower pavement layers are structually sound but require strengthening as indicated by high Benkelman beam deflections will be overlaid with a dense bitumen macadam (DBM) base course material (50-120 mm thickness depending on deflection readings and subgrade strength) including a single surface bituminous treatment as a crack reflection layer before the DBM is placed and a double surface bituminous treatment afterwards to improve riding quality and reduce oxidation effects on the DBM layer. Finally, sections which are structurally sound and have a rough riding surface and surface cracking will have any potholes patched and will receive a double bituminous surface treatment.

5.1.3 Reconstruction and Rehabilitation

The proposed rehabilitation will conform to the Zambian Road Department's Design Classes as discussed in Section 2.1B in the Technical Analysis.

The project will finance the reconstruction (including drainage structure modification and replacement where necessary) of 9.85 kms, overlay and seal of 29.85 kms and patch and seal of 9.70 kms of the Kafue-Lusaka Road during the 1992 and 1993 dry seasons ending in mid-December, 1993. The existing alignment is generally acceptable, however, there are two locations (km 7.5 and km 12.5) where realignment will be necessary. The chart shown on page 48 identifies the section of road and the type of rehabilitation proposed. The estimated costs to perform the rehabilitation (including realignment and drainage structure work) are shown on the following page.

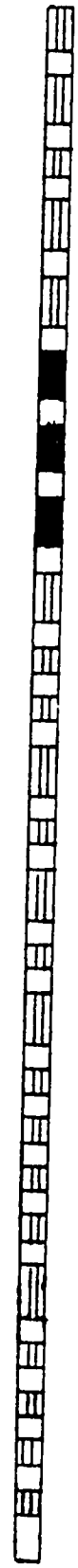
Project Cost Estimate*

		U.S. $
1.	Preliminaries	2,893,950
2.	Accommodation of traffic	1,191,050
3.	Borrow pits	384,800
4.	Site Clearance	583,000
5.	Earthworks	1,091,800
6.	Shoulders to Existing Pavement	406,000
7.	Existing Pavement Preparation	404,900
8.	Sub-base and base	2,936,200
9.	Dense Bituminous Macadam Base	2,382,900
10.	Surface Treatment/Crack Sealing	2,155,000
11.	Pavement Repair Work	206,700
12.	Drainage Improvement	1,256,400
13.	Miscellaneous Items	373,100
	(A) Subtotal	16,265,800
	(B) Detailed Design	350,000
	(C) Construction Supervision	1,100,000
	(D) Total (A)+(B)+(C)	17,715,800
	Contingency 15% of (D)	2,657,400
	Total Construction Cost	20,373,200
	Rounded to	20,500,000

*For an explanation of how the project cost was arrived please refer to tables 9 and 10 in ANNEX III(A).

Kafue-Lusaka Road (Phase I)

Rehabilitation Program



KAFUE BRIDGE	53.5		1.15	
	52.15	.2		
	51.95		1.75	
	50.2	.2		
	50.0		.3	
	49.7	.2		
	49.5		5.0	
	44.5	.45		
	44.05		1.45	
	42.6	.2		
	42.4			2.8
	39.6	.2		
	39.4			3.75
	35.65	.2		
	35.45			3.15
	32.3	.6		
	31.7		4.7	
	27.0	.5		
	26.5		1.0	
	25.5	.2		
	25.3		.3	
	25.0	.2		
	24.8		2.3	
	22.5	.2		
	22.3		.2	
	22.1	.6		
	21.5		3.0	
	18.5	.4		
	18.1		.8	
	17.3	.5		
	16.8		1.3	
	15.5	.2		
	15.3		.1	
	15.2	.1		
	15.1		.3	
	14.8	.2		
	14.6		1.0	
	13.6	.3		
	13.3		.6	
	12.7	.6		
	12.1		1.3	
	10.8	.7		
	10.1		1.0	
	9.1	.3		
	8.8		1.0	
	7.8	.3		
	7.5		.4	
	7.1	.4		
	6.7		.9	
	5.8	1.9		
	3.9			
Total		9.85km (Reconstruct)	29.85km (Overlay & Seal)	9.70km (Patch & Seal)
LUSAKA	0.0			

□ = Reconstruct

▥ = Overlay & Seal

The Foreign Assistance Act, Section 611(a) requires that no agreement or grant involving an obligation of over $500,000 of U.S. funds shall be made until engineering, financial and other plans necessary to carry out such assistance and a reasonably firm estimate of the cost has been made. The cost estimate for the reconstruction and rehabilitation program was reviewed and adjusted for inflation and contingency by the Regional Engineering Officer. The base cost estimates were prepared by a consulting engineering firm (John Burrow and Partners) located in Lusaka, Zambia. The firm undertook comprehensive site surveys of the existing road alignment, drainage areas and roadway platform and pavement. The firm also investigated water and quarry sites to ascertain the availability of construction materials. The work performed by the Burrow's consultants will serve as the basis for the final construction drawings and contract documents, supplemented as appropriate by Roads Department estimates to be prepared at the time of the construction contract tender.

The consultant which prepared the feasibility/preliminary engineering study had included a 10% contingency (standard) in the cost estimate based on a survey of which several firms provided illustrative rates for bill of quantity items. However, after review of tender documents, current actual bill of quantity rates confirmed in documents for a Norwegian Agency for Development (NORAD) financed road project (Kafue-Monze), the contingency was adjusted to 15% to correct a slight under estimation in estimate rates used by the consultant.

In view of the above the Regional Engineering Officer has determined that 611(a) requirements have been satisfied.

5.2 Economic Analysis

5.2.1 Methodology

In its economic analysis of the Kafue-Lusaka road segment, the consulting firm used the usual with-and-without-project analysis to arrive at an estimate of the total system cost for a number of investment alternatives. Total system cost is defined as the sum of economic construction cost, maintenance cost and vehicle operating cost. To accomplish the task, the World Bank's Highway Design and Standards Model (HDM III) was used to produce a set of alternative construction scenarios. Traffic figures were taken from the Department of Roads while the vehicle operating costs (VOC) were based on experience in other parts of Africa, especially Kenya, on similar roads under similar conditions. The relationships between the various VOC variables, the road type, and their consequent values are incorporated in the model as default values.

The official rate of exchange of US$1 = K10 was used for the financial analysis and a weighted shadow price of US$1 = K50 for the economic analysis. The US$ 1 = K10 rate was used to accumulate and convert current locally based costs into dollars for purposes of calculating project costs for design,

supervision and construction services. The US$1 = K10 rate was the highest legal rate of exchange when the project was designed. It is estimated by the consultant and design team that at least 80% of these costs are foreign exchange, and therefore not subject to fluctuations in the value of local currency. The remaining 20% are kwacha related, mostly for labor and locally purchased materials, and have undoubtedly been subject to some fluctuation as the kwacha continues to be devalued. However, labor rates and material costs continue to rise in a close relationship to devaluations, so the overall effect on total project costs related to devaluations of the kwacha will be negligible. The shadow price of US$1 = K50 was arrived at by adjusting the existing parallel market rate of US$1 = K60 by about 80 percent to take into account the fact that road construction of the type contemplated in the project consist of about 80% foreign costs.

The average shadow rate used in the evaluation is not significantly affected by the devaluation of the kwacha to US$1 = K40 which occurred in March 1990, because the parallel market rate did not change. It still stands at US$1 = K60. Since the local cost element in the total cost is only 20% of total cost, the devaluation has only a marginal effect on the weighted shadow rate of US$1 = K50. Therefore, the economic analysis on the Kafue-Lusaka road performed prior to the devaluation is still valid.

Under the HDM III model, 6 alternatives were considered: 3 maintenance alternatives starting from a bare minimum of just maintaining the existing road, through normal maintenance and 100% pothole patching, to intensive maintenance which includes some surface dressing; and 3 design alternatives which widen the road to Class IA and IB standards, and apply thicker pavements which have useful lives ranging from 10, 15, and 20 years. The alternatives were applied to two one-kilometer sample lengths of road representing average conditions: one on the Makeni-Chilanga section and the other on the Chilanga-Kafue section.

5.2.2 Principal Findings

As the following table indicates, the 2 least cost options of the 6 considered were the high end option of the maintenance alternatives (Option 3) and the 10 year design alternative (Option 4), with the total system cost of the former being slightly lower. It should be noted, however, that the financial cost for constructing the Option 4 road is about 15% higher than that for Option 3. The consultant recommended dropping Option 3 because it was not deemed realistic to assume that the required high level of road maintenance would immediately materialize. Instead, Option 4 which is much less maintenance intensive was recommended, USAID concurs with that recommendation.

The other rehabilitation options (Options 5 and 6) would require significantly higher up-front capital costs and yield little, if any, incremental savings in maintenance costs or vehicle operating costs. The 15 and 20 year design lives (Options 5 and 6) yield a longer "structural" road life, however the requirement for periodic maintenance is not reduced as a result of a longer "structural" road life. Resealing would still have to be done at 7 year intervals. On the basis of HDM III data shows no cost savings on both vehicle operating costs and maintenance costs as a result of preferring Options 5 and 6 to Option 4.

To verify that the least cost option, Option 4, would produce enough transport savings to justify the road expenditure, USAID calculated the economic internal rate of return (IRR). The other rehabilitation options (5 and 6) were included in the IRR calculations, for comparative purposes. The minimum maintenance alternative (Option 1) was considered to represent the without-project case. That is, the analysis assumes that the GRZ will carry out the expenditures contained in the minimum alternative, even in the absence of the project.

The incremental benefits were assumed to be the reduction in transport costs resulting from the road improvement while the incremental costs were those associated with the higher costs required to raise the standard of the road design. Based on this approach, the IRR for Option 4, 25.8%, was the highest for the rehabilitation options. (see Annex III(B) for calculations for IRRs).

This high IRR was obtained using rather conservative values for costs and traffic flows. It would take unrealistic changes in the variables to reduce the IRR below 12%, the point at which we might begin to question the feasibility of the investment. For that reason, no sensitivity analysis was deemed necessary. Furthermore, no attempt has been made to quantify the benefits that are likely to occur as a result of a decrease in road accidents.

Based on the least cost and the internal rate of return analyses conducted for this project, the Mission is confident that the whole project will provide a rate of approximately 26%.

Average Annual Economic Road Costs (Millions of Zambian Kwacha)
Per Year Per Kilometer for the Two Sections of Road

Option	Section A (Makeni - Chilanga) per Km	Section B (Chilanga - Kafue) per Km	Whole Road per Km
	Cost	Cost	Cost
1 (do minimum)	10.117	3.823	5.250
2 (periodic maintenance)	9.283	3.437	4.772*
3 (periodic maintenance)	8.557	3.060	4.316*
4 (rehabilitation 10 year design life)	8.783	3.287	4.543*
5 (rehabilitation 15 year design life)	8.840	3.327	4.587*
6 (rehabilitation 20 year design life)	8.893	3.370	4.632*

* Whole road economic costs, include technical assistance, project supervision and evaluation costs estimated at ZK100 million (economic costs) for the whole road length (49.4 km).

Source: Kafue-Lusaka Project Feasibility Study/Cost Analysis, John Burrow & Partners, 1989.

5.3 Social Soundness Analysis

5.3.1 Intra-regional Context of the Road

The Kafue-Lusaka road directly contributes to the intra-regional flow of commodities in southern Africa. This is especially true for Zimbabwe, Zambia, Malawi, Botswana and eastern Zaire which utilize the road for imports and exports. While most of the commodities originate from and are destined for countries within the region, a small proportion of the traffic consists of international trade outside the region. The road also facilitates the movement of passengers from one country to the next.

Information on traffic crossing the Chirundu, Kazungula and Victoria Falls border posts indicates the importance of the Kafue-Lusaka road in intra-regional trade. Out of a total of 354,859 tons of cargo which passed through the three posts in 1988, 58 percent was transit cargo, that is, not from or for Zambia.

The major importance of this and all SADCC transport routes is to lessen the countries' dependency on routes through the Republic of South Africa and to strengthen trade between SADCC nations.

5.3.2 The National Context of the Road

5.3.2.1 The Immediate Impact Zone

The immediate impact zone is from the Lusaka suburb of Makeni to the Kafue River bridge, approximately 50 kms.

Chilanga, 14 kms from Lusaka, is the only town between Lusaka and Kafue. It is the site of Chilanga Cement Ltd, an agricultural research station, a botanical garden, shops and normal social facilities.

Kafue town currently has a population of some 21,000 people. The largest employers are Kafue Textiles and Nitrogen Chemicals of Zambia.

Several businesses are adjacent to the road outside of city limits. These include a soybean oil processing plant, a stone quarry and other medium-size manufacturers. Some 15 sellers of crushed stones line the road in front of the quarry and a few people sell handicraft items and food.

5.3.2.2 The Zambian Context

Kafue-Lusaka is part of the major road route which connects southern and northern Zambia. This section of road will effectively be an extension of the recently completed Kafue-Chirundu Road Rehabilitation Project (690-0209) and will complete an unbroken stretch of high standard trunk road between Lusaka and Harare. It plays a role in Zambian imports and exports as well as in domestic traffic.

An analysis of cross-border traffic movements at Chirundu, Kazungula and Victoria Falls for the year 1988 reveals that 147,536 tons of Zambia's external trade passed through the three border posts. Sixty-one percent of the volume of imports was destined for locations other than Kafue or Lusaka and 66 percent of the export tonnage originated in locations other than Lusaka and Kafue. Virtually all of the traffic used the project road.

In addition to the external trade traffic on the road, the Kafue-Lusaka road also plays a major role in domestic marketing of agricultural commodities. Commercial farmers in the Southern Province and the sections of the Central Province within the road catchment area produce cash crops and rely on commercial agricultural inputs such as fertilizer. Since nearly 50 percent of the population of Zambia is urban based, road transport of food to the urban areas is an integral part of the agricultural marketing system. Conversely farmers purchase fertilizer and other agricultural inputs from Nitrogen Chemicals of Zambia (NCZ), most of which will be hauled by road to ten regional depots. Up to seventy-five percent of Zambia's fertilizer use occurs in Southern, Central and Eastern provinces with direct or indirect linkages from the NCZ plant in Kafue, over the project road.

5.3.3 Direct Beneficiaries

5.3.3.1 Road Construction Workers and Supervisors

An estimated 500 jobs will be created to implement the project. Twenty percent of the new jobs created will be targeted for women. Discussions with large construction firms in Zambia have confirmed that this target is feasible.

In addition, members of the Roads Department will receive short-term out of country training to improve mechanical services and management of road maintenance crews.

5.3.3.2 Commercial Transporters

Commercial transporters will benefit in terms of: a) reduced hauling time, b) fewer accidents, c) reduced operating costs.

5.3.3.3 Other Commercial Users

Besides the commercial transporters, there are numerous other types of companies which use the Kafue-Lusaka road with their own vehicles. This traffic is primarily domestic rather than intra-regional and involves commercial farmers, wholesale traders and manufacturers.

5.3.3.4 Passengers

All passengers will benefit from an improved flow of traffic due to better road surface and improved shoulders and laybys which should lessen travel time. People living within the immediate impact zone will benefit from better bus stops.

5.3.3.5 Pedestrians

Currently the road shoulder is often less than a meter wide. Under the project the shoulder shall be two meters wide, except for a stretch of some 7 kms in the Chilanga area which will be three meters wide. The extension of the shoulders will make walking along this major highway much safer for pedestrians.

5.3.4 Indirect Beneficiaries

5.3.4.1 Malawi, Zaire and Zimbabwe

All socioeconomic classes in neighboring countries will indirectly benefit from the rehabilitated road facilitating external trade. The poor shall benefit when food is imported (such as relief food supplies to Malawi in 1988) and from the availability of essential products like kerosene for lighting. Owners of medium and large scale farming operations will acquire imported fertilizer more cost-effectively and should be able to export their cash crops more efficiently. Vehicle owners will have better access to petrol and diesel fuel.

5.3.4.2 Zambian Companies

The main Zambian company utilizing the project road is Zambia Consolidated Copper Mines (ZCCM), owned by the Zambia Industrial and Mining Corp. (ZIMCO). A large proportion of the imports transported on the project road are directly or indirectly for ZCCM and its 94 principal subsidiaries. As of March, 1988 employment in ZIMCO and its subsidiaries accounted for some 38 percent of formal sector employment.

5.3.4.3 Zambian Consumers

Rural and urban consumers will benefit from improved efficiency in marketing.

5.3.5 Sociocultural Feasibility

5.3.5.1 Female Road Workers

The target of 20 percent for employment of women on the roadworks is deemed feasible based on conversations with representatives of construction firms and rural men and women in the immediate impact zone.

5.3.5.2 Disruption and Displacement

Some trading stalls of semi-permanent materials which are selling fruits and vegetables are in the road corridor. In addition, a maximum of approximately 30 family compounds are reported to be within the corridor. Legally, these people who have built houses and other structures within the road corridor do not have to be compensated if their presence impinges on the rehabilitation of the road. However, past practice indicates that the contractor, on behalf of

the Department, will offer to compensate the people affected utilizing GRZ funds covered by a project covenant to be included in the ProAg. The contractor may also offer casual employment to a member of a displaced family. The estimated cost of this compensation is less than kwacha 100,000 in total.

5.3.5.3 Diversion of Traffic

Diversion of traffic will necessitate a path parallel to the existing road and within the road corridor. Seven sites have been identified where the deviation road could pose a threat to the inhabitants of compounds near the diversion road. The project contractor will take measures to minimize the disruption caused by deviations located in the proximity of existing households and will provide, on behalf of the Roads Department, compensation as required to those most affected to allow them to build houses further from the flow of traffic. The GRZ normally funds this type of expenditure from its operations budget and has agreed to covenant to this compensation procedure for disruption/displacement in the ProAg.

5.3.5.4 Realignments

Two minor realignments will occur near Lusaka to eliminate dangerous blind spots. It is important to note that realignments will make the existing curves a bit smoother but will not significantly encroach on lands outside the existing right of way. If required, minor compensation will be paid to three or four smallscale farmers where the realignment cuts through existing fields. A condition precedent to disbursements for construction services will be included in the project agreement to ensure that the GRZ has taken all necessary actions to purchase required land. As is the case in all minor disruptions to residents along road rehabilitation activities, the GRZ uses a reasonable approach to provide compensation as needed. However, any compensation in this case will be very minimum and will be paid out of the GRZ operations budget. In consideration of intrahousehold social dynamics, the amount of compensation will be made known to all adult family members, not just to the male head of the affected household.

5.4 Institutional Analysis Summary

5.4.1 Overview of the Department of Roads

The Roads Department of the Ministry of Works and Supply is responsible for the planning, construction and maintenance of 21,000 kms of primary and secondary roads. The Department is comprised of a headquarters in Lusaka and nine provincial organizations. The headquarters is responsible for coordination, planning and centralized provision of services. The provincial organizations carry out the Department's primary task of road maintenance.

5.4.2 Organization of the Roads Department

Headquarters is comprised of the Offices of the Director and Deputy Director of Roads and functional Sections of Planning and Design, Maintenance, Administration and Contracts. Headquarters also is directly responsible for the Soils Testing Laboratory, the Training School and the Mumbwa Workshop. The Director of Roads will be the engineer in charge of project construction works, but will delegate powers necessary to monitor road rehabilitation to the construction supervision contractor. A senior executive engineer will be delegated project management responsibilities by the Director. Contracts will be the only functional section with major project implementation responsibilities. The Executive Engineer for Contracts is experienced in A.I.D. host country contracting and will have the primary responsibility for the development of prequalification, solicitation and contract documents as well as selection of both the final design/construction supervision and construction services contractors. Contracts will review and certify all payments to these contractors prior to requesting dollar disbursements by A.I.D.

Training is provided for road foremen at the Departmental facility located in Lusaka. By the end of September 1989, 90 road foremen will have graduated and been deployed to supervise road maintenance crews in the provinces.

Provincial organizations headed by Provincial Roads Engineers are responsible for the maintenance of primary and secondary roads within each of the nine provinces. Each province is broken down into districts and further subdivided into maintenance zones. (There are 127 zones country wide.) Each district and zone has a manager, functional staff and a basic complement of maintenance equipment. Periodic maintenance is done in-house, whereas major maintenance and rehabilitation/reconstruction works are contracted out.

5.4.3 Institutional and Management Capability

Adequate staffing is a serious ongoing problem at the Roads Department, particularly at the managerial and professional level. The main cause is the low salary and weak benefit package imposed on the Department by GRZ regulations. Therefore, the Roads Department must rely on expatriates provided through foreign assistance or local contracts to fill most senior engineering positions. For instance, the Deputy Director, Senior Engineers in the Contracts and Maintenance Sections and 7 of 8 Provincial Roads Engineers are expatriates. Three experienced expatriate roads engineers are working closely with the Provincial Roads Engineer (PRE) in Lusaka Province under the long-term FINNIDA Road Maintenance Project. These engineers have and will continue to provide needed technical and maintenance management training to the staff of the Lusaka PRE, responsible for the maintenance of both the Kafue-Chirundu and the Kafue-Lusaka roads. The Roads Department has experienced more positive results in the hiring and retention of technicians and clerical staff, due possibly to a salary/benefit package at this level which is more competitive with the private and parastatal sectors.

Training is provided in maintenance management at ESAMI in Tanzania for Provincial Roads Engineers and other mid to senior level managers. In-house training for road foremen at the Lusaka school has proven successful and has developed into the cornerstone of a bottom-up training philosophy employed by the Director of Roads. Since retention of road foremen has been higher than professional level staff, the bottom-up staff development program has proved beneficial.

While the Roads Department faces major obstacles in hiring and maintaining adequate staff, this will not be a major constraint to project implementation. Since the Kafue-Lusaka Road Rehabilitation Project involves major rehabilitation, all works will be contracted out to a construction firm which will be supervised by an engineering consulting firm. Further, the Contracts Section, with primary responsibility for project implementation responsibilities, is headed by an expatriate engineer who is experienced both with Zambian and A.I.D. procedures. Road maintenance is a problem area, as it is in most developing countries. However, in addition to on the job training under the major FINNIDA Road Maintenance Project in Lusaka Province, the project will provide training in both maintenance management and shop floor procedures for mechanics.

5.4.4 Equipment

Equipment is deployed by the Director of Roads to the provinces as needed. The Department has a sizable inventory of plant/vehicles/equipment but experiences problems with repair, periodic maintenance and stocking of spare parts. However, road maintenance equipment with sufficient capacity to maintain the Kafue-Lusaka road will be financed by the project. This will complement ongoing major equipment procurements by FINNIDA that support their current maintenance activity in Lusaka Province. In addition to maintenance equipment, the FINNIDA procurements have included a major stone crushing facility, with three long-term technical advisors, which has alleviated the major constraint of adequate supplies of crushed stone in the maintenance of the trunk road from Lusaka to Chirundu. A significant amount of spares will be procured along with A.I.D.-financed road maintenance equipment to ensure an adequate safety stock of parts for several years of operations. Also, the project will provide foreign exchange to be used by the design/supervision consultant or other agent to procure a safety stock of spares, on behalf of the Lusaka PRE, to ensure that equipment is kept in continual operation. This foreign exchange maintenance intervention, in conjunction with ongoing procurements under the FINNIDA project, will adequately provide for necessary spares to alleviate a major constraint experienced by the Department and ensure that the Roads Department has sufficient operational plant in the out years. The Roads Department will therefore be able to continually manage the major impediment of providing sufficient equipment to protect the A.I.D. investment in road rehabilitation from Kafue to Lusaka as well as the recently completed works from Kafue to Chirundu.

5.5 Environmental Analysis

On July 27, 1989, in consultation with the Africa Bureau Environmental Officer, the USAID/Zimbabwe Regional Engineer completed an Initial Environmental Examination and determined that the project would not have a detrimental affect on the environment (see ANNEX I.F). Following that initial examination, consulting engineers, John Burrow and Partners, Zambia, Ltd., who completed the technical analysis of the project, determined that suitable gravels and stone for construction would be available from borrow pits already existing along the road alignment, and that use of those borrow pits would be most economic for the project. Thus, the borrow pits will be opened by clearing bush cover of recent years, the topsoil and overburden will be stripped, the gravels scraped up for use and the pits recovered after use. There will be, therefore, no detrimental effect on the environment in the area of road construction and no further environmental analyses are deemed necessary.

5.6 ROAD MAINTENANCE AND SUSTAINABILITY

5.6.1 General Constraints

A primary concern of this and most other road rehabilitation projects in developing countries is sustainability. Except for certain rural roads under the auspices of the district councils, maintenance throughout Zambia is carried out by the Roads Department. As identified in the Institutional Analysis, there are a number of general constraints to effective road maintenance country wide, including insufficient funding for recurrent Departmental costs and detrimental GRZ employment policies.

However, the primary constraint to adequate maintenance on a national level, as identified by a recent World Bank mission to Zambia, is inadequate funding. The purpose of the mission was to carry out preliminary analytical work in several sectors in preparation for the proposed structural adjustment program. As a result of their preliminary investigation, the World Bank representative in charge of the road assessment advised he would recommend that adequate funding for maintenance be provided before any more Roads Department capital projects are started. A brief analysis of the Department's country wide budget line item for resealing and regravelling roads will illustrate the World Bank's concern. The Bank's recommended levels of adequate funding are: K398.6 million (1991), K446.6 million (1992), and K446.6 million (1993), as opposed to only K132 million actually budgeted in 1990. A major step to assure adequate road maintenance was achieved when these funding levels were included in the GRZ Public Investment Program (PIP). It is expected that the Bank will continue to strongly encourage bilateral donors involved in road rehabilitation projects to concentrate on financing mechanisms to protect their own investments.

It is with this in view that a maintenance intervention strategy to protect the A.I.D. investment in road rehabilitation has been developed. Within the scope of a 50 km stretch of road, it is doubtful that A.I.D. can effectively address each and every constraint to adequate road maintenance throughout Zambia. For instance, A.I.D. does not have as much leverage as the Bank to effect any significant macro level changes in the salary/benefits package offered to all Zambian civil servants. Therefore, the design team believes it is not practical for A.I.D. to attempt to leverage macro structural changes that will be most effectively encouraged by the Bank and IMF. Given the indications of the Bank's proposed strategy, it seems most practicable for this project to limit interventions to maintaining the road from Kafue to Lusaka as well as the recently completed A.I.D.-financed section from Kafue to Chirundu. The focus of the Maintenance Analysis is to assess whether a limited maintenance strategy would be effective, and if so, how best to achieve desired results.

5.6.2 Assessment of A.I.D.-Financed Road Rehabilitation

A consulting engineering firm was hired to carry out the required assessment. Their scope of work included an evaluation of the Department's performance to date in maintaining the Kafue-Chirundu Road, much of which was originally rehabilitated approximately eight years ago under A.I.D.-financing. An additional task was to specifically evaluate the maintenance operation of the Lusaka PRE, who is responsible for maintaining the A.I.D. investment. Due to the strategic importance of the Lusaka-Harare corridor and the resultant high visibility of the A.I.D.-financed road work, it was felt by the design team that the general assessment of departmental capabilities in the Institutional Analysis might not accurately reflect the actual maintenance of A.I.D.'s investment. The engineering consultant was also requested to detail personnel, equipment and funding maintenance requirements to protect the A.I.D. investment in road maintenance and to provide realistic recommendations on how the project might best address the issue of maintenance of the T2 road from Lusaka to Chirundu.

The consultant's report, included in Annex III.F, Road Maintenance and Sustainability Analysis, concluded that, contrary to generally held assumptions, maintenance carried out by the Roads Department to date on Phases I and II of the Kafue-Chirundu project was better than might have been, given the serious resource constraints faced by the GRZ. For instance, prior to the assessment by John Burrow engineers, the Department had already completed resealing of approximately one half of the Phase I work. This significant periodic maintenance effort was carried out on schedule within the regular maintenance allocation of the Lusaka PRE. The remaining periodic maintenance of the Phase I sections was started after the end of the last rainy season in April and is currently approximately 75% complete.

The consultant's report highlighted inadequate funding as the primary constraint to effective routine (continual) and periodic (resealing every 7 or 8 years) maintenance. This shortage of financing was primarily in the area of local currency needed to pay subsistence allowances for technicians and operational level personnel and to procure locally refined bitumen, petroleum, cement, etc. It was interesting to note that operational level management was assessed to be experienced and adequate, in sharp contrast to general assumptions. A glaring need was identified for a minimum amount of foreign exchange funding and a procurement mechanism to purchase spares on a timely basis to keep equipment in continual operation. This was highlighted by a lack of routine maintenance beyond walking distance from the maintenance camp which had occurred during a three week period while a truck was out of operation due to the lack of spares.

The consultants worked closely with the Lusaka PRE to develop estimates of levels of kwacha funding required by the Roads Department from 1990 to 2000 to adequately maintain the Kafue-Lusaka road as well as the Kafue-Chirundu road. An estimate of required foreign exchange for spares for on-hand equipment to augment funds expected from other donors and regular GRZ sources was also developed. On the contrary foreign exchange for the initial procurement of capital equipment did not appear to be a major constraint. This is primarily because of a major ongoing FINNIDA road maintenance project scheduled to be continued for approximately nine years which provides a great deal of equipment dedicated to the Lusaka Province. In addition, the foreign exchange burden to purchase capital equipment has been reduced due to equipment to be provided under this project as well as units provided by A.I.D. under the Kafue-Chirundu project and from other donors.

The limited compensation package which the Roads Department is able to offer is and will continue to be a major constraint to hiring and retaining managerial and professional staff. The issue of remuneration for civil servants is government wide and beyond the control of the Roads Department. Fortunately, the FINNIDA maintenance project will provide long-term technical assistance in Lusaka province where A.I.D.'s investment in road rehabilitation is located. A recent increase in the GRZ subsistance allowance promised to provide a much more remunerative package for GRZ operational level staff in the field. In sum, the Burrow report indicated the Department would now be able to offer a major inducement to field supervisors to more effectively manage and monitor road maintenance, if sufficient budgeting was available.

5.6.3 Recommendations of Assessment-Maintenance Interventions

The overall conclusion of the report was that the Roads Department has the capability to properly maintain the T2 Road from Lusaka to Chirundu if sufficient funding was provided. This is in contrast to other areas in the country where a number of constraints to effective maintenance by the Department exist. These constraints, including a lack of trained staff and departmental stone crushing capacity, might possibly make the choice of contract maintenance more attractive in a number of provinces. However, in

Lusaka Province where the Kafue-Lusaka road is located, the critical elements of of departmental crushing capability, maintenance management/supervision and major inputs of equipment/spares are being provided by the long-term FINNIDA maintenance project.

The consultant worked closely with the Roads Department to develop: (a) required kwacha budget levels to provide for adequate routine and periodic maintenance of the A.I.D. investment until the year 2000, and (b) estimates of required foreign exchange over the next ten years to top-up amounts expected to be provided by the Bank of Zambia and other donors for spare parts. These estimates of required local currency and foreign exchange form the basis of a financing strategy which is the primary maintenance intervention of the project. The financing package, in conjunction with the provision of training and road maintenance equipment, will provide adequate safeguards for the A.I.D. investment in the rehabilitation of the Kafue-Lusaka and the recently completed Kafue-Chirundu roads.

The local currency financing mechanism is based on the concept of a sinking fund. The GRZ has agreed to provide K120 million in GRZ-owned counterpart funds to be deposited in an interest-bearing sinking fund account. This sum will ensure adequate funding for routine and periodic maintenance, given a set of realistic assumptions on future rates of inflation, increases in GRZ budgeting and interest paid on the sinking fund. The GRZ will finance the sinking fund through a standard local currency counterpart fund agreement currently used to support a number of A.I.D. projects. The fund will top-up funding levels that would have been otherwise expected, based on an analysis of trends in the GRZ budget. Further details, including a table summary of the sinking fund, are included in Annex III.F, Road Maintenance Analysis.

The consultant's report recommends that $425,000 be provided to the Lusaka PRE over the next 10 years to top-up expected foreign exchange inputs and ensure that spares are available to keep equipment in continual operation. This foreign exchange will be utilized to procure a safety stock of spares. The design and supervision contractor (or other procurement agent to be determined) will use the A.I.D. foreign exchange to procure necessary spares on behalf of the Department of Roads (Lusaka PRE). The spares will be procured on an as needed basis, with the final disbursement made for a bulk purchase prior to the PACD in December 1994.

6. CONDITIONS, COVENANTS AND NEGOTIATING STATUS

6.1 Conditions Precedent to First Disbursement

1. The Grantee will provide to A.I.D. a letter of commitment, in form and substance satisfactory to A.I.D., allocating to the Kafue-Lusaka road first priority use of any maintenance equipment previously financed by A.I.D. for road maintenance activities, to the extent that such equipment is not required under the previously-financed activities.

2. The GRZ will commence operation of the weighbridge station financed by A.I.D. under the Kafue-Chirundu Road Rehabilitation Project (690-0209.02).

3. The GRZ will provide a written statement setting forth the names, titles and specimen signatures of persons who have the authority to act as Grantee's representative.

6.2 Conditions Precedent to Award of Construction Contract

The Grantee shall, except as A.I.D. may otherwise agree in writing:

1. establish a sinking fund in an interest bearing account at a commercial bank, no later than November 15, 1991, with deposit and disbursement procedures as agreed to by A.I.D.

2. provide a deposit of not less than kwacha 60 million into the account specified in Condition 1 above no later than January 15, 1991.

3. provide a deposit of not less than kwacha 60 million into the account specified in Condition 1 above no later than November 15, 1991.

4. provide A.I.D. with a plan, in form and substance satisfactory to A.I.D., describing the steps it plans to take to ensure proper maintenance of the Kafue-Lusaka and Kafue-Chirundu roads after project-funded rehabilitation is completed, as well as the schedule of resources to be made available for this purpose. The plan will detail how equipment financed by USAID road rehabilitation projects will be allocated for the maintenance of Kafue-Lusaka and Kafue-Chirundu roads and sources of funding for continued maintenance activities.

5. complete and provide A.I.D. with a thorough study of the whole system for enforcing weight limitations, with resultant effects including reduced axle loads and reduced wear and tear to roads.

6. complete resealing of the sections of roadway originally rehabilitated by Nello L. Teer under Phase I of the Kafue-Chirundu Road Rehabilitation Project.

7. provide to A.I.D. a letter of commitment, in form and substance satisfactory to A.I.D. providing assurances that all land required to complete the proposed road rehabilitation has been acquired.

6.3 Covenants

1. The GRZ covenants to carry out appropriate maintenance on the Kafue-Lusaka and Kafue-Chirundu roads and to make provisions for the necessary staffing, training and funding to achieve this purpose, utilizing the sinking fund established under the project to support the annual budget.

2. The GRZ covenants that it will provide additional funds, above those amounts otherwise required by Conditions Precedent, to the extent necessary to ensure adequate maintenance of the T2 road from Lusaka to Chirundu.

3. The GRZ covenants that maintenance equipment provided under this project shall be allocated on a first-use basis for maintenance of the T2 Road from Lusaka to Chirundu.

4. The GRZ covenants to provide, in a timely manner, the import licenses, work permits/temporary resident visas required by personnel of the design/construction supervision contractor and construction contractor.

5. The GRZ covenants that it will provide appropriate and timely compensation to those persons who become displaced as a result of road construction activities.

6.4 Negotiating Status

The aforementioned conditions precedent and covenants have been discussed with the Ministry of Finance and the Director of the GRZ Department of Roads who have agreed to them both in form and in content.

ANNEX I: LEGAL EXHIBITS

A. PID Approval Cable (690-0237)

B. Statutory Checklist

C. GRZ Request for Assistance

D. SADCC Programme of Action Listing

E. FAA, Section 611(e) Certification

F. Environmental Determination

G. Proprietary Procurement and DFA Source/Origin Determinations

H. Gray Amendment Certification

I. Certification of Host Country Contracting Capability

ACTION: AID-2 INFO: AMB DCM ECON

VZCZCLG0416
RR RUEHLG
DE RUEHC #6125/01 1472316
ZNR UUUUU ZZH
R 2723122Z MAY 86
FM SECSTATE WASHDC
TO RUEHSL/AMEMBASSY HARARE 0098
RUEHLG/AMEMBASSY LILONGWE 9556
INFO RUEHMB/AMEMBASSY MBABANE 7992
RUEHRU/AMEMBASSY MASERU 9616
RUEHLS/AMEMBASSY LUSAKA 0825
RUEHCR/AMEMBASSY GABORONE 9255
IT
UNCLAS SECTION 01 OF 03 STATE 166125

LOC: 36/37 395
24 MAY 86 2330
CN: 24995
CHRG: AID
DIST: AID

AIDAC NAIROBI, FOR REDSO

E.O. 12356: N/A
TAGS:
SUBJECT: SOUTHERN AFRICA REGIONAL TRANSPORT PID (690-0237)

1. ECPR FOR SUBJECT PID TOOK PLACE ON MAY 5 UNDER CHAIRMANSHIP OF DAA SAIERS. PID WAS APPROVED, BOTH WITH RESPECT TO THE OVERALL FRAMEWORK FOR A CONTINUING SERIES OF TRANSPORT DEVELOPMENT ACTIVITIES IN THE SADCC REGION, AS WELL AS THE TWO SPECIFIC ACTIVITIES PROPOSED IN THE PID. THE SARP/HARARE OFFICE IS AUTHORIZED TO PROCEED WITH FINAL DESIGN OF THESE TWO ACTIVITIES, THE MALAWI NORTHERN CORRIDOR AND THE UNCTAD GRANT FOR TECHNICAL ASSISTANCE AND TRAINING. THE FOLLOWING CONCLUSIONS EMERGED FROM ISSUES DISCUSSED AT THE ECPR MEETING AND SHOULD SERVE AS GUIDANCE FOR PREPARATION OF THE TWO PROJECT PAPERS.

-- A. PROJECT FORMAT AND PROCEDURES - AGREEMENT WAS REACHED THAT THE TRANSPORT SECTOR IS SUFFICIENTLY CRITICAL FOR THE SADCC REGION TO LAY CLAIM TO A MAJOR PORTION OF THE FUNDS LIKELY TO BE AVAILABLE TO THE SA REGIONAL PROGRAM OVER THE NEXT FIVE YEARS. THE SECTOR

CONCEPT OF THE PID WAS ACCEPTED, AND THE COMMITTEE AGREED THAT THE PID PROVIDED A GOOD RATIONALE FOR MAJOR AID ASSISTANCE IN THE TRANSPORT SECTOR FOR THE NEXT SEVERAL YEARS. IT WAS NOTED THAT THE LOLS 50 MILLION LCP TOTAL IN THE PID WILL NOT ACTUALLY BE AUTHORIZED AT ONCE, BUT WILL BE DEPENDENT ON THE PIECEMEAL APPROVAL OF EACH INDIVIDUAL ACTIVITY. THE MISSION SHOULD TAKE CARE TO ENSURE CONSISTENT TREATMENT OF FUTURE ACTIVITIES, SINCE A POTENTIAL FOR CONFUSION IN PROJECT ACCOUNTING EXISTS FOR THIS KIND OF UMBRELLA ACTIVITY. AID/W UNDERSTANDS THE MISSION INTENDS TO TREAT EACH ACTIVITY AS A SEPARATE PROJECT, INCLUDING SEPARATE PROJECT NUMBERS AND CNS INDICATING THAT EACH PROJECT IS AN

INDEPENDENT ENTITY. IN THIS CASE THE FIELD CAN EXERCISE DOLS 10 MILLION AUTHORITY FOR EACH ACTIVITY. ALTERNATIVELY, IF A SINGLE DOLS 50 MILLION PROJECT WITH SUB-ACTIVITIES IS INTENDED, AN AD HOC DOA MUST BE REQUESTED ONCE THE CUMULATIVE TOTAL OF ACTIVITIES EXCEEDS DOLS 10 MILLION. SINCE THIS AMOUNT IS EXCEEDED WITH THE FIRST TWO PROJECTS, EFFECTIVELY THIS MEANS AN AD HOC DOA WITH EACH SUBSEQUENT ACTIVITY. THE TWO FORTHCOMING PPS, AND FUTURE PPS, SHOULD BE BOTH CLEAR AND CONSISTENT ON THIS POINT.

UUUU THE PROPOSAL FOR SYNOPSIS CABLES ON FUTURE ACTIVITIES, WITH FIELD APPROVAL LIKELY FOR MOST PPS, WAS ACCEPTABLE TO THE COMMITTEE AND CHAIRMAN, WHO CONSIDERED THAT POLICY CONSIDERATIONS AND THE RELATIVE RANKING OF PROPOSALS COULD BE ADDRESSED ON THE BASIS OF THE SYNOPSIS CABLES, AND THAT TECHNICAL FACTORS COULD BE DEALT WITH MOST EFFECTIVELY IN THE FIELD BY SARP/HARARE, REDSO AND THE MISSIONS INVOLVED.

-- B. PROHIBITED COUNTRIES - OF THE TWO ACTIVITIES IN THE PID, THE MALAWI NORTHERN CORRIDOR, ON THE BASIS OF FACTS KNOWN TO THE ECPR, APPEARS TO POSE NO PROBLEM
UUUU REGARDING PROHIBITED COUNTRIES. CARE SHOULD BE TAKEN, HOWEVER, THAT THE TA GRANT TO UNCTAD DOES NOT PROVIDE DIRECT ASSISTANCE TO THE PROHIBITED COUNTRIES. AS IS STANDARD WITH THE REGIONAL PROGRAM, A LEGAL OPINION PREPARED BY THE RLA SHOULD BE ANNEXED TO THE PP FULLY REVIEWING THE RELEVANT FACTS AND DEMONSTRATING THAT UNDER THE PROJECT AS DESIGNED, DIRECT AID ASSISTANCE WILL NOT BE PROVIDED TO THE PROHIBITED COUNTRIES. THE ISSUE OF THE PROHIBITED COUNTRIES SHOULD ALSO BE DISCUSSED IN THE SYNOPSIS CABLE FOR EACH ACTIVITY.

C. DONOR COORDINATION - ALTHOUGH THIS IS BASICALLY A
UUUU WORLD BAN RESPONSIBILITY, THE MALAWI NORTHERN CORRIDOR PP DESIGN SHOULD ENSURE THAT AID REQUIREMENTS ARE BUILT INTO BID DOCUMENTS. THIS WILL REQUIRE CLOSE MONITORING BY SARP ENGINEER, RLA AND IQC ENGINEERS. THE WORLD BANK IS EXPECTING TO MANAGE AND FINANCE A&E AND SUPERVISION OF CONSTRUCTION FOR THE NORTHERN CORRIDOR AS A WHOLE. DESPITE A SUGGESTION BY AFR/TR/ENG THAT AID ASSUME RESPONSIBILITY FOR THIS FUNCTION ON THE PORTION OF THE OVERALL PROJECT WHICH WE ARE FINANCING, THE CHAIRMAN SAW NO COMPELLING REASON TO DISTURB THE ARRANGEMENTS MADE BY THE WORLD BANK FOR A&E WORK AND CONSTRUCTION SUPERVISON. THIS ALTERATION WOULD COST AID MORE, COULD COMPLICATE
UUUU AND DELAY PROJECT IMPLEMENTATION, AND IN ANY CASE WAS DEEMED TO BE UNNECESSARY IN VIEW OF THE PROPOSED USE OF A U.S. IQC FIRM TO REVIEW SPECIFICATIONS AND BID DOCUMENTS PREPARED BY THE BANK-FINANCED FIRM. AS A MULTI-DONOR EFFORT, ASSURANCES MUST BE SOUGHT FROM OTHER ET

#6125

NNNN

DONORS THAT THEIR PLEDGED INPUTS WILL BE DELIVERED ON TIME. CP PRIOR TO DISBURSEMENT CAN BE USED AS SAFEGUARD, BUT THE PP SHOULD ALSO STATE, WITH SUPPORTING FACTS, THAT WE HAVE REASONABLE ASSURANCES PRIOR TO OBLIGATION THAT OTHER DONOR AID WILL BE FORTHCOMING IN A TIMELY MANNER. BANK AND GOM ARE IN BEST POSITION TO COORDINATE THIS MATTER.

-- D. TECHNICAL HELP ON DESIGN - PER DISCUSSION WITH MORRIS AND LIGHT, WE ARE PROCEEDING WITH IQC HELP ON PREPARATION OF BID DOCUMENTS AND RFP. WOULD APPRECIATE CABLED SCW FROM SARP TO EXPEDITE PROCESSING OF WORK ORDER. ALSO AFR/TR/ENG IS EXPLORING POSSIBILITY OF SENDING ENGINEER WITH PORT CONSTRUCTION EXPERIENCE IN MID-JUNE TO SERVE ON PP TEAM.

-- E. GOM-GOT AGREEMENT - WHAT IS STATUS OF GOM-GOT AGREEMENT ON THE AUTONOMOUS USE OF PORT FACILITIES AT DAR, SIMILAR TO AGREEMENT WITH ZAMBIA? MISSION SHOULD CHECK TO DETERMINE WHETHER THIS AGREEMENT WILL BE SIGNED BY THE TIME THE PP IS COMPLETED. WORLD BANK EAST AFRICA TRANSPORT OFFICE PREDICTS A JUNE SIGNING OF GOM-GOT AGREEMENT, BUT THIS SHOULD BE MONITORED CLOSELY BY THE MISSION AND DESCRIBED IN THE PP, INCLUDING ASSESSMENT OF HOW MUCH AUTONOMY MALAWI WILL HAVE. SINCE A SUCCESSFUL GOM-GOT AGREEMENT ON PORT FACILITIES IS ONE OF THE MAJOR PILLARS ON WHICH THE ECONOMIC RATIONALE OF THE OVERALL NORTHERN CORRIDOR CONCEPT RESTS, THE PP MUST STATE THE BASIS FOR ASSURANCES THAT THE GOM-GOT PORT AGREEMENT WILL BE SUCCESSFULLY REACHED AND SIGNED WITHIN A

REASONABLE TIME PERIOD WHICH WILL NOT ADVERSELY AFFECT THE PROJECT'S IMPLEMENTATION SCHEDULE. FURTHERMORE, IF THE GOM-GOT PORT AGREEMENT IS NOT SIGNED BY THE TIME OUR PROJECT IS OTHERWISE READY TO BE OBLIGATED, A CONDITION PRECEDENT TO DISBURSEMENT WILL BE MADE PART OF THE GRANT AGREEMENT, REQUIRING A SATISFACTORY PORT AGREEMENT BETWEEN THE TWO GOVERNMENTS.

-- F. MISSION RESPONSIBILITY - COMMITTEE CONSENSUS, SUPPORTED BY CHAIRMAN, WAS THAT QUESTION OF MISSION VS REGIONAL MANAGEMENT RESPONSIBILITY IS A MATTER TO BE DECIDED FOR EACH PROJECT ON A CASE-BY-CASE BASIS. IN MALAWI NORTHERN CORRIDOR PROJECT, THE COMMITTEE AGREED THAT CIRCUMSTANCES SUPPORT GIVING USAID/MALAWI OVERALL MANAGEMENT RESPONSIBILITY, WITH ONGOING HELP FROM SARP AND REDSO AS NEEDED. PP SHOULD REFLECT THIS DECISION, ALONG WITH A FULL EXPLANATION OF THE DIVISION OF LABOR AMONG AID MANAGEMENT ENTITIES. SINCE PROJECT APPROVAL AND IMPLEMENTATION AUTHORITY FOR THE SARP PROGRAM IS FORMALLY DELEGATED TO THE DIRECTOR OF USAID/ZIMBABWE, A REDELEGATION BY USAID/Z TO USAID/MALAWI WOULD BE REQUIRED.

-- G. FINAL TECHNICAL DESIGN AND COST ESTIMATE - SINCE THE OVERALL FINAL DESIGN AND BUDGET FOR MALAWI CORRIDOR

ARE BEING DONE BY GERMAN FIRM OF GITEC AND WILL NOT BE READY BEFORE THE END OF JUNE AND PERHAPS LATER, OUR PP BUDGET WILL PROBABLY HAVE TO BE BASED MAINLY ON PRELIMINARY TECHNICAL DESIGN. HOWEVER, SINCE CHANGES IN TECHNICAL OPTIONS CAN AFFECT COSTS SUBSTANTIALLY AND SINCE BUDGET NOW BEING PREPARED BY GITEC MAY BE SIGNIFICANTLY ABOVE EARLIER ESTIMATES (ACCORDING TO BANK'S EAST AFRICA TRANSPORT DIVISION), THE PP TEAM SHOULD INSURE THAT THE LATEST AVAILABLE TECHNICAL AND COST INFORMATION IS TAKEN INTO ACCOUNT AND SHOULD MAINTAIN CLOSE COORDINATION WITH WORLD BANK AND GOM ON THE MATTER OF THE CONSTRUCTION DESIGN AND COST ESTIMATES. IN LIGHT OF THESE ANTICIPATED COST INCREASES BEYOND THE PAIP ESTIMATE OF DOLS 9.5 MILLION FOR THE NORTHERN CORRIDOR, THE DOA IN PARA 3 BELOW IS WRITTEN WITH SOME FLEXIBILITY TO PERMIT AUTHORIZATION OF A MAXIMUM AMOUNT OF DOLS 11.5 MILLION, IF NECESSARY, TO AVOID THE NEED FOR AN AMENDED DOA.

-- H. PROJECT SELECTION CRITERIA - CRITERIA OF PAGE 9 OF PID WERE GENERALLY ACCEPTED, BUT SHOULD BE EXPANDED, REFINED, RANKED AND REVIEWED PERIODICALLY IN THE COURSE OF SARP DISCUSSIONS WITH SATCC. FUTURE SYNOPSIS CABLES SHOULD DEMONSTRATE HOW SELECTED ACTIVITIES MEET THESE CRITERIA BETTER THAN POSSIBLE ALTERNATIVE CHOICES.

-- I. INVOLVEMENT OF OTHER AID MISSIONS - RELEVANT AID MISSIONS IN SADCC COUNTRIES SHOULD BE CONSULTED AT THE FORMATIVE STAGE OF PROPOSALS FOR FUTURE TRANSPORT ACTIVITIES UNDER THIS PROJECT.

-- J. PROJECT ANALYSES FOR NORTHERN CORRIDOR PP - THE PROJECT PAPER SHOULD INCLUDE FINANCIAL AND ADMINISTRATIVE ANALYSES, NOT MENTIONED IN PID OUTLINE OF

BT
#6125

NNNN

PP REQUIREMENTS. COSTS ASSOCIATED WITH RELATED ACTIVITIES IN TANZANIA SHOULD BE TAKEN INTO ACCOUNT. ECONOMIC ANALYSIS SHOULD PROVIDE REASONABLE BASIS FOR ASSUMPTION THAT REDUCTION IN TRANSPORTATION COSTS WILL HAVE A WIDESPREAD IMPACT ON DEVELOPMENT AND GROWTH.

-- K. PROCUREMENT AND CONTRACTING GUIDELINES - PER PRINCIPLES ESTABLISHED IN STATE 74107 ON REGIONAL MANPOWER MANAGEMENT PROJECT (MADREC), THE APPROPRIATE AUTHORIZED GEOGRAPHIC CODE FOR THE NORTHERN CORRIDOR PROJECT WOULD BE CODE 941 FOR FOREIGN EXCHANGE COSTS AND ANY BENEFICIARY SADCC COUNTRY FOR LOCAL COSTS. HOST COUNTRY CONTACTING IS CONSIDERED APPROPRIATE IN VIEW OF MALAWI'S FAVORABLE PAST RECORD IN MANAGING AID-FUNDED CONSTRUCTION CONTRACTS.

-- L. 611(E) CERTIFICATION - THE MISSION IS REMINDED OF THE NEED FOR AA/AFR CONCURRENCE IN THE DIRECTOR'S 611(E) CERTIFICATION, WHICH IS NOT INCLUDED IN THE DOA. THIS CAN BE ACCOMPLISHED BY AN EXCHANGE OF CABLES.

M. IEE - APPROVAL OF INITIAL ENVIRONMENTAL EXAMINATION WILL FOLLOW BY SEPTEL.

2. SARP, AND IN THE CASE OF THE NORTHERN CORRIDOR ACTIVITY, USAID/MALAWI, SHOULD TAKE ACCOUNT OF ABOVE COMMENTS DURING PREPARATION OF PPS. UNDER NORMAL DOA 140 PROCEDURES, DIRECTOR OF USAID/ZIMBABWE, IN CAPACITY AS DIRECTOR OF SARP, MAY AUTHORIZE THESE TWO PROJECTS WITH REDSO CONCURRENCE WHEN DESIGN IS COMPLETED, WITH THE GRANT AGREEMENT FOR NORTHERN CORRIDOR EXECUTED WITH THE GOVERNMENT OF MALAWI. HOWEVER, IN THIS INSTANCE, IN VIEW OF OUR DESIRE TO HAVE THESE TWO ACTIVITIES AUTHORIZED BY JUNE 30 IF AT ALL POSSIBLE, WE BELIEVE

THAT MISSION APPROVAL WITHOUT FORMAL REDSO CONCURRENCE IS WARRANTED. THIS EXCEPTION IS BASED ON THE MISSION'S FULL CAPACITY TO REVIEW AND APPROVE THE PROJECTS AND THE EXTENSIVE REDSO INVOLVEMENT IN THE ECONOMIC ANALYSIS AND ENVIRONMENTAL ASSESSMENT FOR THE NORTHERN CORRIDOR AND THE PARTICIPATION OF AN AID/W PROJECT OFFICER AND PERHAPS AN AID/W PORT ENGINEER ON THE PP TEAM.

3. AA/AFR HEREBY DELEGATES AUTHORITY TO THE DIRECTOR, USAID/ZIMBABWE, TO AUTHORIZE THE NORTHERN CORRIDOR PROJECT IN AN AMOUNT NOT TO EXCEED DOLS 11.5 MILLION AND THE REGIONAL TECHNICAL ASSISTANCE AND TRAINING PROJECT IN AN AMOUNT NOT TO EXCEED DOLS 1.5 MILLION. THESE AD HOC DELEGATIONS OF AUTHORITY SHALL BE EXERCISED ON ALL THE TERMS AND CONDITIONS OF DOA 140 EXCEPT FOR THE AMOUNT IN THE CASE OF THE NORTHERN CORRIDOR PROJECT AND THE REQUIREMENT FOR REDSO CONCURRENCE. SHULTZ
ET
#6125

NNNN

5C(1) - COUNTRY CHECKLIST

Listed below are statutory criteria applicable to: (A) FAA funds generally; (B)(1) Development Assistance funds only; or (B)(2) the Economic Support Fund only.

A. GENERAL CRITERIA FOR COUNTRY ELIGIBILITY

1. FY 1990 Appropriations Act Sec. 569(b). Has the President certified to the Congress that the government of the recipient country is failing to take adequate measures to prevent narcotic drugs or other controlled substances which are cultivated, produced or processed illicitly, in whole or in part, in such country or transported through such country, from being sold illegally within the jurisdiction of such country to United States Government personnel or their dependents or from entering the United States unlawfully? **No**

2. FAA Sec. 481(h); FY 1990 Appropriations Act Sec. 569(b). (These provisions apply to assistance of any kind provided by grant, sale, loan, lease, credit, guaranty, or insurance, except assistance from the Child Survival Fund or relating to international narcotics control, disaster and refugee relief, narcotics education and awareness, or the provision of food or medicine.) If the recipient is a "major illicit drug producing country" (defined as a country producing during a fiscal year at least five metric tons of opium or 500 metric tons of coca or marijuana) or a "major drug-transit country" (defined as a country that is a significant direct source of illicit drugs significantly affecting the United States, through which such drugs **N/A**

are transported, or through which significant sums of drug-related profits are laundered with the knowledge or complicity of the government): (a) Does the country have in place a bilateral narcotics agreement with the United States, or a multilateral narcotics agreement? and (b) Has the President in the March 1 International Narcotics Control Strategy Report (INSCR) determined and certified to the Congress (without Congressional enactment, within 45 days of continuous session, of a resolution disapproving such a certification), or has the President determined and certified to the Congress on any other date (with enactment by Congress of a resolution approving such certification), that (1) during the previous year the country has cooperated fully with the United States or taken adequate steps on its own to satisfy the goals agreed to in a bilateral narcotics agreement with the United States or in a multilateral agreement, to prevent illicit drugs produced or processed in or transported through such country from being transported into the United States, to prevent and punish drug profit laundering in the country, and to prevent and punish bribery and other forms of public corruption which facilitate production or shipment of illicit drugs or discourage prosecution of such acts, or that (2) the vital national interests of the United States require the provision of such assistance?

3. 1986 Drug Act Sec. 2013. (This section applies to the same categories of assistance subject to the restrictions in FAA Sec. 481(h), above.) If recipient country is a "major illicit drug producing country" or "major drug-transit country" (as defined for the purpose of FAA Sec 481(h)), has the President submitted a report to N/A

72

Congress listing such country as one: (a) which, as a matter of government policy, encourages or facilitates the production or distribution of illicit drugs; (b) in which any senior official of the government engages in, encourages, or facilitates the production or distribution of illegal drugs; (c) in which any member of a U.S. Government agency has suffered or been threatened with violence inflicted by or with the complicity of any government officer; or (d) which fails to provide reasonable cooperation to lawful activities of U.S. drug enforcement agents, unless the President has provided the required certification to Congress pertaining to U.S. national interests and the drug control and criminal prosecution efforts of that country?

4. FAA Sec. 620(c). If assistance is to a government, is the government indebted to any U.S. citizen for goods or services furnished or ordered where: (a) such citizen has exhausted available legal remedies, (b) the debt is not denied or contested by such government, or (c) the indebtedness arises under an unconditional guaranty of payment given by such government or controlled entity? **No**

5. FAA Sec. 620(e)(1). If assistance is to a government, has it (including any government agencies or subdivisions) taken any action which has the effect of nationalizing, expropriating, or otherwise seizing ownership or control of property of U.S. citizens or entities beneficially owned by them without taking steps to discharge its obligations toward such citizens or entities? **No**

12

6. FAA Secs. 620(a), 620(f), 620D; FY 1990 Appropriations Act Secs. 512, 548. Is recipient country a Communist country? If so, has the President: (a) determined that assistance to the country is vital to the security of the United States, that the recipient country is not controlled by the international Communist conspiracy, and that such assistance will further promote the independence of the recipient country from international communism, or (b) removed a country from applicable restrictions on assistance to communist countries upon a determination and report to Congress that such action is important to the national interest of the United States? Will assistance be provided either directly or indirectly to Angola, Cambodia, Cuba, Iraq, Libya, Vietnam, South Yemen, Iran or Syria? Will assistance be provided to Afghanistan without a certification, or will assistance be provided inside Afghanistan through the Soviet-controlled government of Afghanistan?

No to all parts

7. FAA Sec. 620(j). Has the country permitted, or failed to take adequate measures to prevent, damage or destruction by mob action of U.S. property?

No

8. FAA Sec. 620(l). Has the country failed to enter into an investment guaranty agreement with OPIC?

No

9. FAA Sec. 620(o); Fishermen's Protective Act of 1967 (as amended) Sec. 5. (a) Has the country seized, or imposed any penalty or sanction against, any U.S. fishing vessel because of fishing activities in international waters? (b) If so, has any deduction required by the Fishermen's Protective Act been made?

No

10.	FAA Sec. 620(q); FY 1990 Appropriations Act Sec. 518 (Brooke Amendment). (a) Has the government of the recipient country been in default for more than six months on interest or principal of any loan to the country under the FAA? (b) Has the country been in default for more than one year on interest or principal on any U.S. loan under a program for which the FY 1990 Appropriations Act appropriates funds?	Yes
11.	FAA Sec. 620(s). If contemplated assistance is development loan or to come from Economic Support Fund, has the Administrator taken into account the percentage of the country's budget and amount of the country's foreign exchange or other resources spent on military equipment? (Reference may be made to the annual "Taking Into Consideration" memo: "Yes, taken into account by the Administrator at time of approval of Agency OYB." This approval by the Administrator of the Operational Year Budget can be the basis for an affirmative answer during the fiscal year unless significant changes in circumstances occur.)	N/A
12.	FAA Sec. 620(t). Has the country severed diplomatic relations with the United States? If so, have relations been resumed and have new bilateral assistance agreements been negotiated and entered into since such resumption?	No
13.	FAA Sec. 620(u). What is the payment status of the country's U.N. obligations? If the country is in arrears, were such arrearages taken into account by the A.I.D. Administrator in determining the current A.I.D. Operational Year Budget? (Reference may be made to the "Taking into Consideration" memo.)	As of May 11, 1990, not in arrears.

75

14.	FAA Sec. 620A. Has the President determined that the recipient country grants sanctuary from prosecution to any individual or group which has committed an act of international terrorism or otherwise supports international terrorism?	No
15.	FY 1990 Appropriations Act Sec. 564. Has the country been determined by the President to: (a) grant sanctuary from prosecution to any individual or group which has committed an act of international terrorism, or (b) otherwise support international terrorism, unless the President has waived this restriction on grounds of national security or for humanitarian reasons?	No
16.	ISDCA of 1985 Sec. 552(b). Has the Secretary of State determined that the country is a high terrorist threat country after the Secretary of Transportation has determined, pursuant to section 1115(e)(2) of the Federal Aviation Act of 1958, that an airport in the country does not maintain and administer effective security measures?	No
17.	FAA Sec. 666(b). Does the country object, on the basis of race, religion, national origin or sex, to the presence of any officer or employee of the U.S. who is present in such country to carry out economic development programs under the FAA?	No
18.	FAA Secs. 669, 670. Has the country, after August 3, 1977, delivered to any other country or received nuclear enrichment or reprocessing equipment, materials, or technology, without specified arrangements or safeguards, and without special certification by the President? Has it transferred a nuclear explosive device to a non-nuclear weapon state, or if such a state, either received or detonated a nuclear explosive device? (FAA Sec. 620E permits a special waiver of Sec. 669 for Pakistan.)	No

19.	FAA Sec. 670. If the country is a non-nuclear weapon state, has it, on or after August 8, 1985, exported (or attempted to export) illegally from the United States any material, equipment, or technology which would contribute significantly to the ability of a country to manufacture a nuclear explosive device?	No
20.	ISDCA of 1981 Sec. 720. Was the country represented at the Meeting of Ministers of Foreign Affairs and Heads of Delegations of the Non-Aligned Countries to the 36th General Assembly of the U.N. on Sept. 25 and 28, 1981, and did it fail to disassociate itself from the communique issued? If so, has the President taken it into account? (Reference may be made to the "Taking into Consideration" memo.)	**While Zambia was represented and failed to disassociate itself from the communique, this was taken into consideration by the Administrator at the time of approval of the Agency OYB.**
21.	FY 1990 Appropriations Act Sec. 513. Has the duly elected Head of Government of the country been deposed by military coup or decree? If assistance has been terminated, has the President notified Congress that a democratically elected government has taken office prior to the resumption of assistance?	No
22.	FY 1990 Appropriations Act Sec. 539. Does the recipient country fully cooperate with the international refugee assistance organizations, the United States, and other governments in facilitating lasting solutions to refugee situations, including resettlement without respect to race, sex, religion, or national origin?	Yes

B. FUNDING SOURCE CRITERIA FOR COUNTRY ELIGIBILITY

1. Development Assistance Country Criteria

a. FAA Sec. 116. Has the Department of State determined that this government has engaged in a consistent pattern of gross violations of internationally recognized human rights? If so, can it be demonstrated that contemplated assistance will directly benefit the needy? — No

b. FY 1990 Appropriations Act Sec. 535. Has the President certified that use of DA funds by this country would violate any of the prohibitions against use of funds to pay for the performance of abortions as a method of family planning, to motivate or coerce any person to practice abortions, to pay for the performance of involuntary sterilization as a method of family planning, to coerce or provide any financial incentive to any person to undergo sterilizations, to pay for any biomedical research which relates, in whole or in part, to methods of, or the performance of, abortions or involuntary sterilization as a means of family planning? — No

2. Economic Support Fund Country Criteria

a. FAA Sec. 502B. Has it been determined that the country has engaged in a consistent pattern of gross violations of internationally recognized human rights? If so, has the President found that the country made such significant improvement in its human rights record that furnishing such assistance is in the U.S. national interest? — N/A

b. FY 1990 Appropriations Act Sec. 569(d). Has this country met its drug eradication targets or otherwise taken significant steps to halt illicit drug production or trafficking? — N/A

78

5C(2) - PROJECT CHECKLIST

Listed below are statutory criteria applicable to projects. This section is divided into two parts. Part A includes criteria applicable to all projects. Part B applies to projects funded from specific sources only: B(1) applies to all projects funded with Development Assistance; B(2) applies to projects funded with Development Assistance loans; and B(3) applies to projects funded from ESF.

CROSS REFERENCES: IS COUNTRY CHECKLIST UP TO DATE? HAS STANDARD ITEM CHECKLIST BEEN REVIEWED FOR THIS PROJECT?

A. GENERAL CRITERIA FOR PROJECT

1. FY 1990 Appropriations Act Sec. 523; FAA Sec. 634A. If money is to be obligated for an activity not previously justified to Congress, or for an amount in excess of amount previously justified to Congress, has Congress been properly notified?

   Yes
   CN expired on November 1, 1989.

2. FAA Sec. 611(a). Prior to an obligation in excess of $500,000, will there be: (a) engineering, financial or other plans necessary to carry out the assistance; and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?

   Yes

3. FAA Sec. 611(a)(2). If legislative action is required within recipient country with respect to an obligation in excess of $500,000, what is the basis for a reasonable expectation that such action will be completed in time to permit orderly accomplishment of the purpose of the assistance?

   N/A

4. FAA Sec. 611(b); FY 1990 Appropriations Act Sec. 501. If project is for water or water-related land resource construction, have benefits and costs been computed to the extent practicable in accordance with the principles, standards, and procedures established pursuant to the Water Resources Planning Act (42 U.S.C. 1962, et seq.)? (See A.I.D. Handbook 3 for guidelines.)	N/A
5. FAA Sec. 611(e). If project is capital assistance (e.g., construction), and total U.S. assistance for it will exceed $1 million, has Mission Director certified and Regional Assistant Administrator taken into consideration the country's capability to maintain and utilize the project effectively?	Yes
6. FAA Sec. 209. Is project susceptible to execution as part of regional or multilateral project? If so, why is project not so executed? Information and conclusion whether assistance will encourage regional development programs.	Yes. It is a regional project under Southern African Development Assistance
7. FAA Sec. 601(a). Information and conclusions on whether projects will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions.	(a) Yes, a major objective is to increase imports and exports (b) N/A (c) N/A (d) N/A (e) Yes, the project will increase efficiency of market -ing by reducing transport times and costs (f) N/A
8. FAA Sec. 601(b). Information and conclusions on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).	N/A

9. FAA Secs. 612(b), 636(h). Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized in lieu of dollars.	The host country is contributing local currency to finance local costs of land acquisition, training maintenance and equipment procurement
10. FAA Sec. 612(d). Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release?	No
11. FY 1990 Appropriations Act Sec. 521. If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar or competing commodity?	N/A
12. FY 1990 Appropriations Act Sec. 547. Will the assistance (except for programs in Caribbean Basin Initiative countries under U.S. Tariff Schedule "Section 807," which allows reduced tariffs on articles assembled abroad from U.S.-made components) be used directly to procure feasibility studies, prefeasibility studies, or project profiles of potential investment in, or to assist the establishment of facilities specifically designed for, the manufacture for export to the United States or to third country markets in direct competition with U.S. exports, of textiles, apparel, footwear, handbags, flat goods (such as wallets or coin purses worn on the person), work gloves or leather wearing apparel?	No
13. FAA Sec. 119(g)(4)-(6) & (10). Will the assistance: (a) support training and education efforts which improve the capacity of recipient countries to prevent loss of biological diversity; (b) be provided under a long-term agreement in which the recipient country agrees to protect ecosystems or other	No

wildlife habitats; (c) support efforts to identify and survey ecosystems in recipient countries worthy of protection; or (d) by any direct or indirect means significantly degrade national parks or similar protected areas or introduce exotic plants or animals into such areas?

14. FAA Sec. 121(d). If a Sahel project, has a determination been made that the host government has an adequate system for accounting for and controlling receipt and expenditure of project funds (either dollars or local currency generated therefrom)? N/A

15. FY 1990 Appropriations Act, Title II, under heading "Agency for International Development." If assistance is to be made to a United States PVO (other than a cooperative development organization), does it obtain at least 20 percent of its total annual funding for international activities from sources other than the United States Government? N/A

16. FY 1990 Appropriations Act Sec. 537. If assistance is being made available to a PVO, has that organization provided upon timely request any document, file, or record necessary to the auditing requirements of A.I.D., and is the PVO registered with A.I.D.? N/A

17. FY 1990 Appropriations Act Sec. 514. If funds are being obligated under an appropriation account to which they were not appropriated, has the President consulted with and provided a written justification to the House and Senate Appropriations Committees and has such obligation been subject to regular notification procedures? N/A

18. State Authorization Sec. 139 (as interpreted by conference report). Has confirmation of the date of signing of the project agreement, including the amount involved, been cabled to State L/T and A.I.D. LEG within 60 days of the agreement's entry into force with respect to the United States, and has the full text of the agreement been pouched to those same offices? (See Handbook 3, Appendix 6G for agreements covered by this provision). N/A

19. Trade Act Sec. 5164 (as interpreted by conference report), amending Metric Conversion Act of 1975 Sec. 2. Does the project use the metric system of measurement in its procurements, grants, and other business-related activities, except to the extent that such use is impractical or is likely to cause significant inefficiencies or loss of markets to United States firms? Are bulk purchases usually to be made in metric, and are components, subassemblies, and semi-fabricated materials to be specified in metric units when economically available and technically adequate? Yes

20. FY 1990 Appropriations Act, Title II, under heading "Women in Development." Will assistance be designed so that the percentage of women participants will be demonstrably increased? Yes

21. FY 1990 Appropriations Act Sec. 592(a). If assistance is furnished to a foreign government under arrangements which result in the generation of local currencies, has A.I.D. (a) required that local currencies be deposited in a separate account established by the recipient government, (b) entered into an agreement with that government providing the amount of local currencies to be generated and the terms and conditions under which the currencies so deposited may be utilized, and (c) established by agreement the responsibilities of A.I.D. and that government to monitor and account for deposits into and disbursements from the separate account?

(a) N/A
(b) N/A
(c) N/A

93

Will such local currencies, or an equivalent amount of local currencies, be used only to carry out the purposes of the DA or ESF chapters of the FAA (depending on which chapter is the source of the assistance) or for the administrative requirements of the United States Government?	N/A
Has A.I.D. taken all appropriate steps to ensure that the equivalent of local currencies disbursed from the separate account are used for the agreed purposes?	N/A
If assistance is terminated to a country, will any unencumbered balances of funds remaining in a separate account be disposed of for purposes agreed to by the recipient government and the United States Government?	N/A

B. FUNDING CRITERIA FOR PROJECT

1. Development Assistance Project Criteria

a. FY 1990 Appropriations Act Sec. 546 (as interpreted by conference report for original enactment). If assistance is for agricultural development activities (specifically, any testing or breeding feasibility study, variety improvement or introduction, consultancy, publication, conference, or training), are such activities: (1) specifically and principally designed to increase agricultural exports by the host country to a country other than the United States, where the export would lead to direct competition in that third country with exports of a similar commodity grown or produced in the United States, and can the activities reasonably be expected to cause substantial injury to U.S. exporters of a similar agricultural commodity; or (2) in support of research that is intended primarily to benefit U.S. producers? N/A

b. FAA Sec. 107. Is special emphasis placed on use of appropriate technology (defined as relatively smaller, cost-saving, labor-using technologies that are generally most appropriate for the small farms, small businesses, and small incomes of the poor)? N/A

c. FAA Sec. 281(b). Describe extent to which the activity recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civic education and training in skills required for effective participation in governmental and political processes essential to self-government.

The program will improve transportation within the country.

d. FAA Sec. 101(a). Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase of productive capacities and self-sustaining economic growth?

e. FAA Secs. 102(b), 111, 113, 281(a). Describe extent to which activity will: (1) effectively involve the poor in development by extending access to economy at local level, increasing labor-intensive production and the use of appropriate technology, dispersing investment from cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained basis, using appropriate U.S. institutions; (2) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward a better life, and otherwise encourage democratic private and local governmental institutions; (3) support the self-help efforts of developing countries; (4) promote the participation of women in the national economies of developing countries and the improvement of women's status; and (5) utilize and encourage regional cooperation by developing countries.

(1) The project will employ 400-500 laborers to carry out intensive road rehabilitation. Advertisements for construction supervision and construction services will be placed in the U.S.
(2) N/A
(3) The rehabilitated road will support self-help efforts to increase efficiency of ag. marketing
(4) The construction contract will have a 20% target for employment of women
(5) Improved regional road network will stimulate intra-regional trade.

f. FAA Secs. 103, 103A, 104, 105, 106, 120-21; FY 1990 Appropriations Act, Title II, under heading "Sub-Saharan Africa, DA." Does the project fit the criteria for the source of funds (functional account) being used?

Yes

g. FY 1990 Appropriations Act, Title II, under heading "Sub-Saharan Africa, DA." Have local currencies generated by the sale of imports or foreign exchange by the government of a country in Sub-Saharan Africa from funds appropriated under Sub-Saharan Africa, DA been deposited in a special account established by that government, and are these local currencies available only for

N/A

use, in accordance with an agreement with the United States, for development activities which are consistent with the policy directions of Section 102 of the FAA and for necessary administrative requirements of the U. S. Government?

h. FAA Sec. 107. Is emphasis placed on use of appropriate technology (relatively smaller, cost-saving, labor-using technologies that are generally most appropriate for the small farms, small businesses, and small incomes of the poor)? N/A

i. FAA Secs. 110, 124(d). Will the recipient country provide at least 25 percent of the costs of the program, project, or activity with respect to which the assistance is to be furnished (or is the latter cost-sharing requirement being waived for a "relatively least developed" country)? N/A. This is a regional project under Southern Africa, Development Assistance. The GRZ, however, is contributing over K48,000,000 to the project

j. FAA Sec. 128(b). If the activity attempts to increase the institutional capabilities of private organizations or the government of the country, or if it attempts to stimulate scientific and technological research, has it been designed and will it be monitored to ensure that the ultimate beneficiaries are the poor majority? N/A

k. FAA Sec. 281(b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civil education and training in skills required for effective participation in governmental processes essential to self-government. The program will improve transportation within the country.

l. FY 1990 Appropriations Act, under heading "Population, DA," and Sec. 535. Are any of the funds to be used for the performance of abortions as a method of family planning or to motivate or coerce any person to practice abortions? No

Are any of the funds to be used to pay for the performance of involuntary sterilization as a method of family planning or to coerce or provide any financial incentive to any person to undergo sterilizations?	No
Are any of the funds to be made available to any organization or program which, as determined by the President, supports or participates in the management of a program of coercive abortion or involuntary sterilization?	No
Will funds be made available only to voluntary family planning projects which offer, either directly or through referral to, or information about access to, a broad range of family planning methods and services?	N/A
In awarding grants for natural family planning, will any applicant be discriminated against because of such applicant's religious or conscientious commitment to offer only natural family planning?	N/A
Are any of the funds to be used to pay for any biomedical research which relates, in whole or in part, to methods of, or the performance of, abortions or involuntary sterilization as a means of family planning?	No
m. FAA Sec. 601(e). Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise?	Yes
n. FY 1990 Appropriations Act Sec. 579. What portion of the funds will be available only for activities of economically and socially disadvantaged enterprises, historically black colleges and universities, colleges and universities having a student body in which more than 40 percent of the students are Hispanic Americans, and	Because host country contractors will be utilized, it is likely that little or no portion of the funds will be available for such groups.

private and voluntary organizations which are controlled by individuals who are black Americans, Hispanic Americans, or Native Americans, or who are economically or socially disadvantaged (including women)?

o. FAA Sec. 118(c). Does the assistance comply with the environmental procedures set forth in A.I.D. Regulation 16? Does the assistance place a high priority on conservation and sustainable management of tropical forests? Specifically, does the assistance, to the fullest extent feasible: (1) stress the importance of conserving and sustainably managing forest resources; (2) support activities which offer employment and income alternatives to those who otherwise would cause destruction and loss of forests, and help countries identify and implement alternatives to colonizing forested areas; (3) support training programs, educational efforts, and the establishment or strengthening of institutions to improve forest management; (4) help end destructive slash-and-burn agriculture by supporting stable and productive farming practices; (5) help conserve forests which have not yet been degraded by helping to increase production on lands already cleared or degraded; (6) conserve forested watersheds and rehabilitate those which have been deforested; (7) support training, research, and other actions which lead to sustainable and more environmentally sound practices for timber harvesting, removal, and processing; (8) support research to expand knowledge of tropical forests and identify alternatives which will prevent forest destruction, loss, or degradation; (9) conserve biological diversity in forest areas by supporting efforts to identify, establish, and maintain a representative network of protected tropical forest ecosystems on a worldwide basis, by making the establishment of protected areas a

Yes
1-11: N/A

condition of support for activities involving forest clearance or degradation, and by helping to identify tropical forest ecosystems and species in need of protection and establish and maintain appropriate protected areas; (10) seek to increase the awareness of U.S. Government agencies and other donors of the immediate and long-term value of tropical forests; and (11)/utilize the resources and abilities of all relevant U.S. government agencies?

p. FAA Sec. 118(c)(13). If the assistance will support a program or project significantly affecting tropical forests (including projects involving the planting of exotic plant species), will the program or project: (1) be based upon careful analysis of the alternatives available to achieve the best sustainable use of the land, and (2)/take full account of the environmental impacts of the proposed activities on biological diversity? N/A

q. FAA Sec. 118(c)(14). Will assistance be used for: (1) the procurement or use of logging equipment, unless an environmental assessment indicates that all timber harvesting operations involved will be conducted in an environmentally sound manner and that the proposed activity will produce positive economic benefits and sustainable forest management systems; or (2) actions which will significantly degrade national parks or similar protected areas which contain tropical forests, or introduce exotic plants or animals into such areas? No

r. FAA Sec. 118(c)(15). Will assistance be used for: (1) activities which would result in the conversion of forest lands to the rearing of livestock; (2) the construction, upgrading, or maintenance of roads (including temporary haul roads for logging or other extractive industries) which pass through relatively undergraded forest lands; (3) the N/A

colonization of forest lands; or (4) the construction of dams or other water control structures which flood relatively undergraded forest lands, unless with respect to each such activity an environmental assessment indicates that the activity will contribute significantly and directly to improving the livelihood of the rural poor and will be conducted in an environmentally sound manner which supports sustainable development?

s. FY 1990 Appropriations Act Sec. 534(a). If assistance relates to tropical forests, will project assist countries in developing a systematic analysis of the appropriate use of their total tropical forest resources, with the goal of developing a national program for sustainable forestry? N/A

t. FY 1990 Appropriations Act Sec. 534(b). If assistance relates to energy, will such assistance focus on improved energy efficiency, increased use of renewable energy resources, and national energy plans (such as least-cost energy plans) which include investment in end-use efficiency and renewable energy resources? N/A

Describe and give conclusions as to how such assistance will: (1) increase the energy expertise of A.I.D. staff, (2) help to develop analyses of energy-sector actions to minimize emissions of greenhouse gases at least cost, (3) develop energy-sector plans that employ end-use analysis and other techniques to identify cost-effective actions to minimize reliance on fossil fuels, (4) help to analyze fully environmental impacts (including impact on global warming), (5) improve efficiency in production, transmission, distribution, and use of energy, (6) assist in exploiting nonconventional renewable energy resources, including wind, solar, small-hydro, geo-thermal, and advanced

91

biomass systems, (7) expand efforts to meet the energy needs of the rural poor, (8) encourage host countries to sponsor meetings with United States energy efficiency experts to discuss the use of least-cost planning techniques, (9) help to develop a cadre of United States experts capable of providing technical assistance to developing countries on energy issues, and (10) strengthen cooperation on energy issues with the Department of Energy, EPA, World Bank, and Development Assistance Committee of the OECD.

u. FY 1990 Appropriations Act, Title II, under heading "Sub-Saharan Africa, DA" (as interpreted by conference report upon original enactment). If assistance will come from the Sub-Saharan Africa DA account, is it: (1) to be used to help the poor majority in Sub-Saharan Africa through a process of long-term development and economic growth that is equitable, participatory, environmentally sustainable, and self-reliant; (2) being provided in accordance with the policies contained in section 102 of the FAA; (3) being provided, when consistent with the objectives of such assistance, through African, United States and other PVOs that have demonstrated effectiveness in the promotion of local grassroots activities on behalf of long-term development in Sub-Saharan Africa; (4) being used to help overcome shorter-term constraints to long-term development, to promote reform of sectoral economic policies, to support the critical sector priorities of agricultural production and natural resources, health, voluntary family planning services, education, and income generating opportunities, to bring about appropriate sectoral restructuring of the Sub-Saharan African economies, to support reform in public administration and finances and to establish a favorable environment for individual enterprise and self-sustaining development, and to take

N/A (1-5)

into account, in assisted policy reforms, the need to protect vulnerable groups; (5) being used to increase agricultural production in ways that protect and restore the natural resource base, especially food production, to maintain and improve basic transportation and communication networks, to maintain and restore the renewable natural resource base in ways that increase agricultural production, to improve health conditions with special emphasis on meeting the health needs of mothers and children, including the establishment of self-sustaining primary health care systems that give priority to preventive care, to provide increased access to voluntary family planning services, to improve basic literacy and mathematics especially to those outside the formal educational system and to improve primary education, and to develop income-generating opportunities for the unemployed and underemployed in urban and rural areas?

v. <u>International Development Act Sec. 711, FAA Sec. 463.</u> If project will finance a debt-for-nature exchange, describe how the exchange will support protection of: (1) the world's oceans and atmosphere, (2) animal and plant species, and (3) parks and reserves; or describe how the exchange will promote: (4) natural resource management, (5) local conservation programs, (6) conservation training programs, (7) public commitment to conservation, (8) land and ecosystem management, and (9) regenerative approaches in farming, forestry, fishing, and watershed management. N/A

w. <u>FY 1990 Appropriations Act Sec. 515</u>. If deob/reob authority is sought to be exercised in the provision of DA assistance, are the funds being obligated for the same general purpose, and for countries within the same region as originally obligated, and have the House and Senate Appropriations Committees been properly notified? N/A

2. Development Assistance Project Criteria (Loans Only)

a. FAA Sec. 122(b). Information and conclusion on capacity of the country to repay the loan at a reasonable rate of interest. N/A

b. FAA Sec. 620(d). If assistance is for any productive enterprise which will compete with U.S. enterprises, is there an agreement by the recipient country to prevent export to the U.S. of more than 20 percent of the enterprise's annual production during the life of the loan, or has the requirement to enter into such an agreement been waived by the President because of a national security interest?

c. FAA Sec. 122(b). Does the activity give reasonable promise of assisting long-range plans and programs designed to develop economic resources and increase productive capacities?

3. Economic Support Fund Project Criteria N/A

a. FAA Sec. 531(a). Will this assistance promote economic and political stability? To the maximum extent feasible, is this assistance consistent with the policy directions, purposes, and programs of Part I of the FAA?

b. FAA Sec. 531(e). Will this assistance be used for military or paramilitary purposes?

c. FAA Sec. 609. If commodities are to be granted so that sale proceeds will accrue to the recipient country, have Special Account (counterpart) arrangements been made?

Communications should be addressed to the Permanent Secretary

Telephone: LUSAKA 213822

Telegrams: FINANCE, RIDGEWAY

REPUBLIC OF ZAMBIA

MINISTRY OF FINANCE

ACTION | DATE 9/6
TRANSFER | INFO
ACTION TAKEN Project Paper
DATE 8/30 | INITIALS

In reply please quote: No. MFAL/102/12/607

AUG 30 1989

P.O. BOX 50062
LUSAKA

23rd August, 1989.

Mr. Leslie A. Dean,
Mission Director,
USAID/Zambia,
LUSAKA.

Dear Sir,

SUBJECT: ZAMBIA: **REGIONAL TRANSPORT DEVELOPMENT, KAFUE-LUSAKA ROAD REHABILITATION PROJECT (690-0254)**

Zambia welcomes support from donors to help the Government and the Zambian people to update and rehabilitate existing trunk road links. The Roads Department in the Ministry of Power, Transport and Communications is charged with the responsibility for the construction, maintenance and rehabilitation of these vital roads.

The Kafue-Lusaka Road Rehabilitation Project addresses key Regional and Zambian Government priorities in a number of respects. Particularly, the project will:

- reduce shipment time, alleviate vehicle operation costs and other related problems which are currently very detrimental to economic development;
- stimulate import/export activity within the Region;
- reduce the current high levels of effort and expenditure presently required to maintain this section of seriously deteriorated road; and
- complement other major rehabilitation planned efforts of Zambian trunk roads.

On behalf of the Government of the Republic of Zambia, therefore, I would like to request that the United States Government provide funding for the Kafue-Lusaka Road Rehabilitation Project in order to carry out the rehabilitation work on the vital section of road from Kafue-Lusaka. In view of the importance and urgency of this project, the Government of the Republic of Zambia earnestly hopes that the Agency for International Development will take immediate steps to provide funds as soon as possible. I hope this request will meet with favourable consideration, and we look forward to our

continuing warm and productive relationships during the implementation of the project.

Yours faithfully,

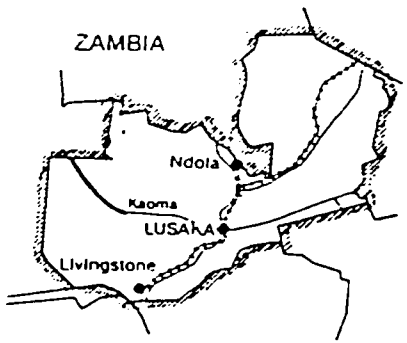
L. Nkhata
SENIOR PERMANENT SECRETARY
MINISTRY OF FINANCE

c.c. Mr. N. B. Nyoni,
Permanent Secretary,
Ministry of Power, Transport and Communications,
LUSAKA.

c.c. Director,
Department of Roads,
LUSAKA

LN/dm.

1.8.1 Study on Angola-Zambia Road Link, Zambia



Estimated Costs
Total : USD 0.2 million
Foreign : USD 0.2 million
Local : USD 0.0 million

Funding Secured
Foreign : USD 0.2 million
Local : USD 0.0 million

Funding Under Negotiation
Total : USD 0.0 million

Financing Gap:
Total : USD 0.0 million

Executing Agency:
Ministry of Works and Supply, Zambia
Start :
Duration:

Objectives : Feasibility study on the construction of an all-weather heavy traffic road connecting Kaoma in Zambia with Lumbala in Angola, about 370 km.

The proposed road Kaoma - Borderpost at Cariparde - Lumbala - Luena will be one of the few road links between Zambia and Angola and will be essential for road transports to the Lobito Port.

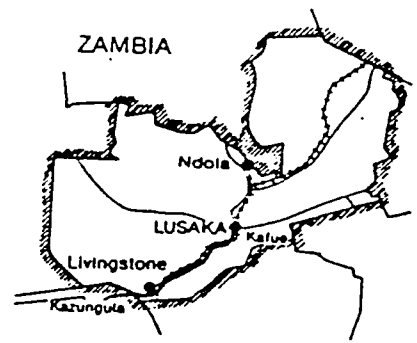
Progress : In Angola the road section Luena - Lucusse has been completed and the section Lucusse - Lumbala is under construction up to paved standard. About 50km to the Borderpost at Cariparde remains to be upgraded.

In Zambia the road follows mainly existing unclassified gravel or earth roads.

Construction costs are estimated roughly at USD 80 million (1983 prices)

Status : The feasibility study financed by EEC was started in 1980. Preliminary findings based on work in Zambia were presented in 1981. Further work adjourned for the time being. The project to be reviewed in the context of the Lobito Port Transport System, as a potential road connection between Angola and Zambia.

1.8.3 Rehabilitation of the Lusaka- Kafue-Livingstone-Kazungula Road, Zambia



Estimated Costs
Total : USD 30.1 million
Foreign : USD 19.0 million
Local : USD 11.1 million

Funding Secured
Foreign : USD 12.5 million
Local : USD 11.1 million

Funding Under Negotiation
Total : USD 0.0 million

Financing Gap:
Total : USD 6.5 million

Executing Agency:
Ministry of Works and Supply, Zambia
Start : 1988
Duration: 3 years

Objectives : Rehabilitation and upgrading of the road Lusaka - Kafue - Livingstone - Kazungula, 478 Km.

Description: Upgrading work has been completed in 1986 on the section Zimba-Livingstone (4 Km) with financing from Norway. This road section has been upgraded from a 3.5 wide surface to a 6.1 - bitumen surface with 2 m shoulders (USD 5 million). The remaining sections are of varying standards and show signs of deterioration. The normal recurrent maintenance funds are not sufficient for the necessary works.

Status : Denmark has financed feasibility and engineering studies (USD 0.7 million) together with 3 other roads in Zambia (projects 1.8.5, 1.8.6, 1.8.7). Studies have been completed in early 1986.

Recently, Norway has pledged USD 7.0 million for the section Kafue-Mazabuka (approx. 100Km). The works on this section are to start towards the end of 1989. Denmark has also been approached.

The section Lusaka-Kafue junction (54 Km) is included in the Beira Port Transport System Development Plan (see Project 1.5.1).

611(e) Justification

The institutional capacity of the Department of Roads and their ability to effectively maintain and utilize the Kafue-Lusaka road after completion of project-funded rehabilitation has been assessed as part of the Project Paper analyses. The design team and REDSO/ESA engineers have concluded that the GRZ will have the necessary institutional capacity, resources and commitment to effectively maintain and utilize the road, based on the considerations summarized below.

USAID has been involved in Road Construction in Zambia for 10 years. A detailed review of the level of maintenance conducted on the AID-financed Kafue-Chirundu road rehabilitation project showed that routine maintenance was satisfactory and that long term maintenance, such as resealing, was being undertaken as scheduled and at the expense of the GRZ. Furthermore, some widening of the paved area, an improvement, was being included, again at GRZ expense and initiative. The GRZ has been meeting their commitments to maintain the past A.I.D. investments and are expected to continue to do so.

Recognizing that the GRZ has had constraints in finance and skills, the project will undertake several initiatives to supplement the resources available to the Department of Roads. Specifically, the project will provide both a foreign exchange and kwacha financing mechanism that will be sufficient to ensure adequate maintenance until the year 2000 of the Kafue-Lusaka road as well as the Kafue-Chirundu road, recently rehabilitated under A.I.D. financing. This financing strategy was recommended by the engineering consultant, John Burrow and Partners, who made a thorough assessment of the Department's past performance in maintaining A.I.D.'s investments in road rehabilitation and GRZ resources and constraints to adequate road maintenance. A "sinking fund" account with an initial funding of K120 million to be provided over 2 years will supplement expected GRZ foreign exchange and kwacha funding to cover costs of adequate maintenance. The fund will supplement the normal budget resources which are used primarily to cover salaries and administrative costs. The fund is expected to be used primarily for transport, and locally purchased inputs such as gasoline and bitumen.

Foreign exchange otherwise provided under the project will finance spares to assure that on-hand equipment of the Department is equipped for continual operation. The Department will have a sufficient stock of new equipment due to the provision of two resealing units by A.I.D. and substantial financing of other equipment by FINNIDA and other donors. The project will provide training for Roads Department mechanics and engineers, contract project construction supervision and administrative support.

Covenants and Conditions Precedent will commit the GRZ to develop an appropriate maintenance plan for the project road and to dedicate sufficient staff and budgetary resources to achieve the plan's objectives. The GRZ will also agree to carry out a study to provide recommendations for improving the current vehicle weight control program.

The measures proposed under the project are sufficient to assure effective maintenance of the Kafue-Lusaka Road. However, in addition to efforts proposed by A.I.D., other donors, notably FINNIDA and NORAD, are currently involved in the upgrading of departmental maintenance capability. FINNIDA has funded a pilot road maintenance project in the Lusaka Province under which three long-term technical advisors are training the staff of the Provincial Roads Engineer in maintenance procedures and techniques. The project will be ongoing through 1993 and is currently envisaged to be expanded to other provinces, with the life of project extended accordingly. NORAD is actively involved in road maintenance planning, coordination and administration by providing long-term technical assistance at the Headquarters in Lusaka. Additionally, the AFDB has approved financing of the rehabilitation of the Great East Road from Lusaka to Chipata. This project will also include a road maintenance component.

Both REDSO/ESA and USAID/Harare Regional Engineers have reviewed past A.I.D. road investments in Zambia and the capacity of the Roads Departments to maintain these as well as the proposed new projects. Both have concluded that with the establishment of the sinking fund and the training to be provided under the project, the GRZ and Road Department will have the financial and human resources capacity to effectively maintain and utilize the proposed rehabilitation to be carried out under this project. This conclusion is supported by the Engineering Consultants report for Maintenance of the Lusaka-Chirundu Road (see Annex III(F)).

SECTION 611(e) CERTIFICATION

REGIONAL TRANSPORTATION DEVELOPMENT II - KAFUE-LUSAKA ROAD

Allison B. Herrick, the principal officer of the Agency for International Development in the Republic of Zimbabwe, and Leslie A. Dean, the principal officer of the Agency for International Development in the Republic of Zambia having taken into account, among other things:

-the maintenance and utilization of projects in Zambia previously financed or assisted by the United States;

-commitments by the Government of the Republic of Zambia to provide, by the end of the project, adequate resources to maintain the project road;

-the likelihood of A.I.D. and/or other donor support for projects to improve Zambia's road maintenance capability; and

-the Government of the Republic of Zambia's present commitment of financial and other resources to road maintenance activities;

do hereby certify that in our judgement the Government of the Republic of Zambia has both the financial capability and human resources capability to effectively maintain and utilize the capital assistance to be carried out under this project.

Allison B Herrick

Allison B. Herrick
Mission Director

Date: 24 May 1990

Leslie A Dean

Leslie A. Dean
Mission Director

Date: 5/11/90

Cable concurrence: Nairobi 013717 attained.

INITIAL ENVIRONMENTAL EXAMINATION

Project Location: Southern Africa Regional (Zambia)

Project Title: Regional Transport Development II - Kafue-Lusaka Road (Project 690-0254)

Funding: FY 90 Obligation - $18.0 Million
FY 91 Obligation - 0 - Million

Life of Project: FY(S) 90-94

IEE Prepared By: Ernest R. Rojas, Assistant Regional Engineer, USAID/Zimbabwe

Environmental Action Recommended: Negative Determination

See attached justification

Action Requested By: Allison B. Herrick
Director, USAID/Zimbabwe

Approved: _____

Disapproved: _____

Date: 22 Sept 1989

Bureau Environmental Officer Concurrence: Approved: X
Bessie L. Boyd, AFR/TR/ANR Disapproved: _____
Date: 7/27/89

Clear: RLA _____

Clearances:
_____ FDL, REO
_____ FAZ, DD

Regional Transport Development II - Kafue-Lusaka Road

Project Description

The road from Lusaka to the Kafue Bridge crossing is 53.3 kilometers in length and is in varying stages of distress. The road links the capital city of Lusaka with the industrial town of Kafue, and continues southward to the bridge crossing at the Kafue River. AID will finance the resealing, pavement strengthening and or complete reconstruction of 49.4 kilometers of this road. The section of road (dual carriageway) which starts from downtown Lusaka and runs to km 3.9 will not be rehabilitated as part of this project.

The Government of the Republic of Zambia will use road maintenance equipment provided by an earlier project (Kafue-Chirundu Road Project 690-0209.02) to provide maintenance of this sector of Road. The Project Grant Agreement will include conditions Precedent and Covenants which will address this road maintenance issue.

The road to be rehabilitated passes through flat and rolling terrain. Rainfall averages 33 inches per year with the heaviest rains occurring in the December through March period. The area varies from densely populated, 3500 to 5000 people per square kilometer in Lusaka and nearby vicinity to sparsely populated, 5 to 10 people per square kilometer near the Kafue River bridge crossing. From Lusaka to Kafue the vegetation is comprised of maize, wheat, soyabeans and vegetables grown mostly on commercial farms. After the town of Kafue the vegetation is primarily bush with very little economic value.

The project road provides a vital economic and social link between Zambia and Zimbabwe and is also a transit road link for the countries to the north and south of Zambia. Current average traffic flows (1989 estimates) average 900 vehicles per day, made up of 66% light vehicles, 2% buses, 18% single trucks and 14% articulated vehicles including commercial vehicles. It is estimated that 24% of all trunk traffic using the road is "international" and 9% is "transit." On average traffic flows over the past 7 years have been fairly even, except for commercial traffic which has more than doubled over the same period.

Discussion of Environmental Impacts

A. Land Use

The work proposed will require minimal additional land use since the existing right-of-way will be used. However there will be two locations where the existing road will be realigned, that is in the vicinity of km 7.5 and km 12.5. However none of the realignment will be outside the existing right of way.

There will also be a deviation constructed for road traffic during rehabilitation of the road between km 3.9 and km 14.0 however this deviation will be along the existing road within the existing right-of-way. Other deviations will be along existing roads. Runoff in the flat terrain has been a problem causing flooding over the existing road. The proposed work will improve the drainage ditches and channels, culvert inlets and outlets and result in controlled runoff which will eliminate problems with flooding. Fill material to be imported will be from existing or extension of gravel and borrow pits and is unlikely that major additional land will be used for such purposes.

B. Water Quality

Minimal impact on water quality is expected because no change in natural water ways is anticipated. In addition, controlled drainage will minimize the flow of sediment. Drainage will be improved as discussed in A above.

C. Atmosphere

Pollution due to dust can be expected during the reconstruction period, but will not be excessive. In areas which are heavily populated, attempts will be made to keep dust down to a minimum. Noise and exhaust fumes from the construction effort will not be more objectionable than that being experienced from the cement trucks and other heavy goods trucks now using the road. In addition, traffic deviations will be alongside the existing road or on other existing roads. The road improvement is not anticipated to generate major quantities of new traffic.

D. Natural Resources

The project will not cause any inefficient utilization or wastage of natural resources in the area. Usage will be limited to gravel or borrow pits. Wildlife in the area have adjusted to the existing road and no additional obstruction to their movement will occur. Some dislocation of local residents may take place during construction, but the effects will be temporary. With the exception of temporary changes, no negative impact on vegetation is anticipated.

E. Cultural

No additional dilution of cultural patterns will occur as a result of this road improvement.

F. Socio-Economic

Positive changes will result from improved, year-round access of the population to regional markets and government social services.

Recommendations for Environmental Action

The proposed improvements of this road will have numerous positive effects of a socio-economic nature, not only on the population within the road's zone of influence, but also in terms of food availability to the population of Zambia. Other environmental impacts will either be minimally negative (land use), temporarily negative (water quality, atmospherics, natural resources) or neutral (cultural). Since the proposed improvements including realignments envisage total utilization of the existing road's right of way, the overall impact of the project will be negative. In the event that any major realignments are developed during engineering design, the REDSO Regional Environmental Officer will examine the acceptability of the proposed changes to ensure that appropriate corrective measures are incorporated into the final plans and specifications. In view of the preceding a negative determination is requested.

PROPRIETARY PROCUREMENT AND DFA SOURCE/ORIGIN DETERMINATIONS

I.G(1) Proprietary Procurement Approval

PROBLEM:

Your approval is requested for proprietary procurement approval to allow the purchase of two tipper trucks manufactured by either Mitsubishi or Mercedes, one truck mounted bitumen distributor manufactured by either Mitsubishi/Hotta or Mercedes/Benninghoven and related spare parts for the three units.

(a)	Authorization Document:	Project Paper
(b)	Nature of Funding:	Grant
(c)	Source of Funding:	SADF
(d)	Description of Goods:	One truck-mounted bitumen distributor, two dumptrucks and spares
(e)	Approximate Value:	$240,000 (FOB)
(f)	Probable Source:	Japan, Germany
(g)	Probable Origin	Japan, Germany

DISCUSSION:

Proprietary procurement approval is required to permit the purchase of one truck-mounted bitumen distributor, two dumptrucks and related spare parts. This equipment has been identified in a maintenance assessment by a professional engineering firm as a critical input to increase the Roads Department's inventory of road maintenance equipment. An adequate inventory of maintenance equipment is needed to enhance the institutional maintenance capacity of the Department and prolong the useful life of the road being rehabilitated under the subject project.

A proprietary procurement of the aforementioned equipment is required to ensure compatibility with on-hand equipment and achieve substantial benefits in maximizing economies in maintenance of spare parts inventories. The Roads Department has stated that it currently owns Mitsubishi and Mercedes tipper trucks and Mitsubishi/Hotta of Japan and Mercedes Benz/Benninghoven of West Germany truck mounted bitumen distributors. This equipment has proven reliable and is familiar to Road Department operators. The Department wishes to standardize on these units to achieve economies in spare parts by capitalizing on compatibility with on hand equipment. This equipment is relatively sophisticated and the Department believes it would not be a prudent use of funds to acquire a variety of different makes and models. Given the difficulty in maintaining equipment in Zambia, mixing other models of trucks and truck-mounted bitumen distributors into the existing fleet would cause an unmanageable maintenance problem.

JUSTIFICATION:

HB 11 chapter 3.2.2.5 provides for proprietary procurement for reasons such as a requirement for compatibility with equipment on-hand and achievement of substantial benefits such as economies in the maintenance of spare parts inventories and greater familiarity of operating personnel through standardizing on a particular brand.

You have the authority to approve this waiver provided that appropriate technical review has been undertaken. This waiver justification has been cleared by RLA, REDSO/ESA and the REO, USAID/Zimbabwe.

RECOMMENDATION:

In accord with the above discussion and justification, it is recommended that you approve proprietary procurement of either Mercedes or Mitsubishi tipper trucks and either Mercedes/Benninghoven or Mitsubishi/Hotta bitumen distributor, and related spare parts for all units, at a total cost of approximately $240,000 FOB.

Approved: _____

Disapproved: _____

Date: July 26, 1990

Clearance: J. Borns, RLA, REDSO/ESA _____

I.G(2) DFA Source/Origin Determinations

PROBLEM:

You are requested to provide source/origin determinations for the procurement of equipment and spares, training and design/supervision and construction services.

DISCUSSION:

The rationale underlying this procurement plan is to maximize U.S. procurement to the maximum extent practicable, while utilizing the flexibility authorized under the DFA sparingly to expand eligibility for the procurement of goods and services on an item by item basis, as needed to achieve project objectives. Pursuant to an individual assessment of each procurement item, the authorized source will be first expanded to geographic code 941 and Zambia, and as required to achieve project objectives, finally expanded to geographic code 935 for the procurement of a selected few commodities. An assessment of each of the goods and services to be procured and rationale of the appropriate geographic code for source/origin and nationality follows. Prior to including Southern Africa Development Funds under the DFA, the source/origin code for procurements was code 941. The rationale was that code 941 could be authorized when a number of SADCC countries, several of which are RLDCs, were beneficiaries. This rationale holds true under the current activity since the logical extension of the Lusaka-Harare corridor is the Mozambique port Beira. Other SADCC countries will also benefit from improved regional trade resulting from the road rehabilitation.

Equipment

U.S. Procurement: Out of 13 items comprising a road resealing unit, valued at approximately $600,000 F.O.B., eight items with an approximate value of $230,000 are expected to be procured from the U.S. (for details see Annex II. D, Equipment List). For these items, U.S. source/origin units are very competitive and will not cause any problems in terms of compatibility with on-hand equipment at the Department.

Code 941 Procurement: For 2 items valued at approximately $80,000, it is envisaged that the source/origin will be either the U.S. or code 941. While the U.S. is a competitive source of supply for these units which include a farm tractor and truck trailer, units from code 941 sources of supply may offer stronger local dealerships and local service capability, and therefore may be easier for the Department to maintain.

Code 935 Procurement: Two tipper trucks and a truck-mounted bitumen distributor and related spares, valued at approximately $240,000, must be procured from geographic code 935 sources because the Department has

standardized on either Mitsubishi or Mercedes Benz models. Bitumen distributors mounted on Mitsubishi trucks are manufactured by Hotta of Japan and those mounted on Mercedes Benz trucks are manufactured by Benninghoven of West Germany. As stated in Annex I.G(1), the Roads Department wishes to standardize on these units to achieve economies in the maintenance of spare parts and substantial benefits from the added familiarity of the units to operational staff. It would not be prudent to provide equipment outside their standardization plan.

Under the Kafue-Chirundu project, a source/origin waiver was approved to permit the procurement by the construction contractor of various soils testing equipment from code 935. Geographic code 935 was the source/origin because project equipment reverted to the Department after the completion of road rehabilitation and had to be compatible with on-hand British equipment. British equipment, valued at approximately $75,000, is still required for reasons of standardization and familiarity with operational staff at the Department to ensure efficient use and achieve project objectives.

Approximately four right-hand-drive vehicles (pick-ups) will be procured by the construction supervision contractor for use in completing final design and construction supervision. These vehicles will be maintained by the construction services contractor throughout construction and will revert to the Department after the completion of supervision services. The authorized source of procurement for these vehicles will be geographic code 935, due to the unavailability of right-hand-drive units made in the U.S. and the suitability of Japanese light duty vehicles in Zambia. Code 935 is also authorized under the current right hand drive vehicle waiver in State 83178.

Approximately $425,000 in spares will be procured by the design/supervision contractor, or other procurement agent of the GRZ, between 1990 and 1994. DFA code 935 source origin authority must be exercised because most on-hand Roads Department equipment is of European or Japanese origin. The source/origin of the spares will be determined by the type of equipment with which it must be compatible, so certain U.S. procurements will undoubtedly be made. The procurement agent will be instructed to ensure that only commodities with their source/origin in countries included in code 935 are procured.

Training

Zambia: Short-term local mechanical training for 10 departmental staff per year will be provided for four years at the KfW operated Industrial Training Center (ITC) in Lusaka at a cost of approximately kwacha 730,000. This type of training is best carried out at a local facility where programs can be tailored to suit the needs of the Roads Department and local conditions, and where the number of participants can be maximized.

108

Code 941: Short-term international training in road maintenance and construction management will be provided by the Eastern and Southern Africa Management Institute (ESAMI) in Tanzania. This four week course will be provided for one engineer per year during the four year life of project, at a total cost of approximately $20,000. This training is tailored for local conditions and is much more advantageous to the project in terms of course content and costs.

Final Design/Construction Supervision

Code 941: U.S. engineering consultancy firms have been traditionally strong competitors for design/supervision and are expected to provide the primary competition under this project. U.S. firms are familiar with A.I.D. regulations and have been proven to assure quality workmanship. However, to provide for the possibility of associations between U.S. and local or regional firms with specific relevant experience in Zambia, the eligibility to bid will be expanded to include geographic code 941 and Zambian firms. The possible beneficial associations between U.S. and regional or local firms will significantly help to achieve the project objective of producing high quality rehabilitation work.

Construction Services

Code 941: It will not be practical to restrict the eligibility to bid on construction services to U.S. firms only. There are not any U.S. construction firms based in Zambia or Southern Africa so it is very doubtful that they could ensure adequate competition unless they bid in association with Zambian or geographic code 941 firms. Industry sources indicate that there are approximately five construction companies of code 941 ownership, with sufficient size and capabilities to complete the work. In addition it is possible that several other firms currently working in Botswana may satisfy code 941 ownership requirements. It also appears that two locally-based firms would meet the ownership requirements to qualify as Zambian firms. One of these firms has indicated a desire to form an association with a U.S. firm if a suitable opportunity arose. It is conceivable that similar arrangements between U.S. and regional or Zambian-owned firms could significantly enhance competition to the benefit of the project. As was the case with design/supervision services, geographic code 941 is the logical source for the procurement of construction services because SADCC countries are the true beneficiaries of an improved regional transportation network.

AUTHORITY/JUSTIFICATION:

Under the DFA Special Procurement Policy Rules, the principal officer of A.I.D. field missions has the authority to determine the authorized source/origin for procurements, while maximizing U.S. procurement whenever practicable.

RECOMMENDATION:

It is recommended that you approve the source/origin determination for procurements financed by this project.

Approved: _____

Disapproved: _____

Date: July 26, 1990

Clearance: J.Borns, RLA, REDSO/ESA in draft 03/29/90_

Certification of Compliance with Gray Amendment

I, Fred E. Winch, Director, USAID/Zambia certify that the procurement plan for the Kafue-Lusaka Road Rehabilitation Project (690-0254) was developed with full consideration of maximally involving Gray Amendment organizations in the provision of required goods and services. As more fully discussed in the Project Paper, the nature of the required design, supervision and construction services and the desirability of continuing with Host Country Contractors as was done under the Kafue-Chirundu Road Rehabilitation Project (690-0209) do not make the project appropriate for Gray Amendment organization contracting.

Fred E. Winch
Director, USAID/Zambia

Certification of Host Country Contracting Capability

I, Fred E. Winch, Director, USAID/Zambia certify that the Roads Department of the Government of the Republic of Zambia has the capability to successfully implement all host country contracts included under this project. This decision is based on: (1) the recent performance of the Roads Department in successfully administering an almost identical set of host country contracts under the Kafue-Chirundu Road Rehabilitation Project and a positive finding on the effectiveness of those procedures by RIG/A/N in Audit Report No. 3-690-89-17, (2) a current review of host country contracting procedures by the Controller, USAID/Zimbabwe and the design team, and (3) the analysis contained in Annex III.E of this project paper that incorporates recent AID/W guidance in STATE 185082 on host country contracting and provides a Mission plan to monitor and control required GRZ procedures.

Fred E. Winch
Director, USAID/Zambia

ANNEX II: TECHNICAL EXHIBITS

A. Logical Framework

B. Roads Department Organizational Chart

C. Scope of Work for PSC Engineer

D. Road Maintenance Equipment List

LOGICAL FRAMEWORK

KAFUE-LUSAKA ROAD REHABILITATION (690-0254)

GOAL	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
To support the development of a stronger foundation for economic growth in Southern Africa.	1. Increased regional exports as a function of improved road reliability and concommitant transportation cost savings making regional products more competitive in SADCC markets.	1. A) National and regional statistics. B) Survey of export industries.	1. Transportation corridor investments maintained by SADCC countries.
	2. Increased extra-regional trade using more cost effective SADCC transportation corridors.	2. A) National and regional statistics. B) Survey of export industries.	2. No major disruption of social and political stability in the SADCC region generally and in Zambia in particular.
	3. Foreign exchange savings as vehicle mechanical wear, breakdown and accident rates are reduced.	3. A) Transportation industry cost analysis. B) National budget accounts.	3. Continued regional cooperation.

LOGICAL FRAMEWORK

KAFUE-LUSAKA ROAD REHABILITATION (690-0254) cont'd.

PURPOSE	(End of Project Status)	Means of Verification	Assumptions
To improve the efficiency of the inter-regional transport system by reducing operating costs and by extending the life of the road.	1. Roughness of the Kafue Lusaka road & corresponding vehicle operating costs are substantially reduced.	1. Road roughness by end of construction should be approx. 1500 mm per km (BI).	1. Percentage of overloaded trucks will not increase above the 1985 levels.
	2. Kafue-Lusaka road placed under effective maintenance.	2. Road roughness in the year 2000 should be less than 1800 mm per km (BI).	2. Seasonal climate patterns and meteorological events (flooding, extreme heat) fall within anticipated norms and do not negate or diminish effectiveness of road resealing.
	3. Road maintenance capability of Dept. of Roads improved.	3. Dept. of Roads institutional analysis and review of operation of sinking fund and efficiency of supply/utilization of A.I.D. financed equipment and spares.	3. GRZ will successfully implement policy reforms such as adequate financing of road maintenance included in current structural adjustment program.

LOGICAL FRAMEWORK

KAFUE-LUSAKA ROAD REHABILITATION (690-0254)

OUTPUTS	Magnitude	Means of Verification	Assumptions
1. Rehabilitation of 49.4 kms between Lusaka and Kafue.	1. 9.85 kms complete reconstruction. 2. 29.85 kms pavement strengthening. 3. 9.7 kms pavement repair.	1. Construction supervision contractor progress reports. 2. Construction contractor reports. 3. Site inspections. 4. Payment vouchers. 5. Project evaluations. 6. Traffic counts.	1. Demographic and economic activity trends remain within forecast limits.
2. Road maintained.	4. Road roughness in the year 2000 reduced to 1800 mm/km (BI) from present 5802 mm/km (BI).	7. A.I.D. Project Manager oversight.	2. Training recipients remain with Dept. of Roads upon completion of training.
3. Trained and equipped personnel at Dept. of Roads.	5. A) 84 persons from the Dept. of Roads trained and installed in strategic maintenance positions. B) Maintenance equipment to provide incremental capability for 100 kms of road resealing per year made available to the Lusaka Provincial Roads Engineer who is responsible for maintenance of the Kafue-Lusaka Road.		3. Unforeseen factors do not increase costs beyond the capacity of the project.

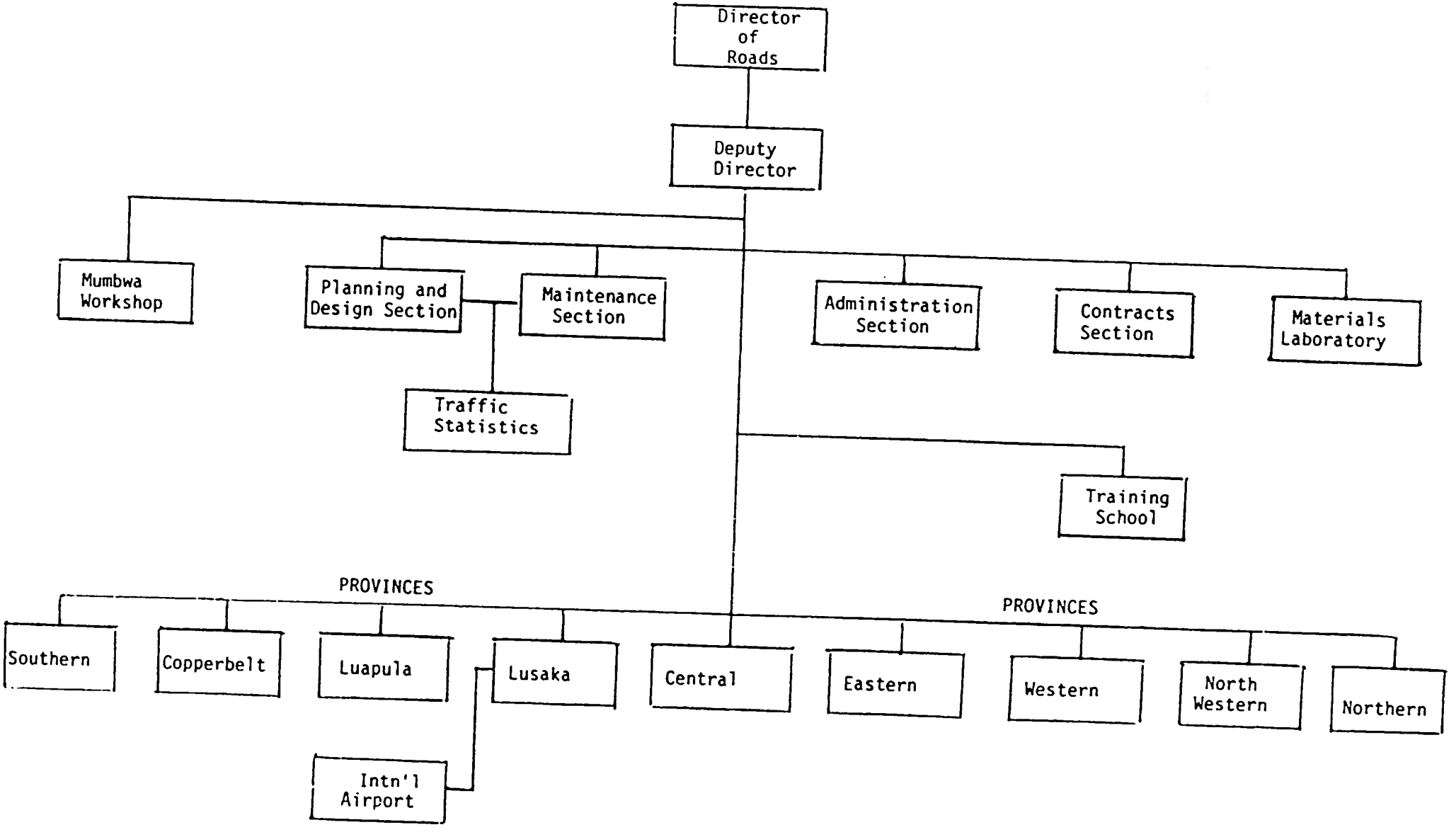
116

LOGICAL FRAMEWORK

KAFUE-LUSAKA ROAD REHABILITATION (690-0254)

INPUTS	FUNDING TARGETS ($ Million)	Means of Verification
1. Road construction services.	1. 16.27	1. Project Manager reports.
2. Final design/construction supervision services.	2. 1.45	2. Contract document.
3. Maintenance equipment.	3. .86	3. Payment vouchers.
4. Training.	4. .02	4. Site inspections.
5. PSC Project Management Assistancee equipment.	5. .74	
6. Spares for Maintenance.	6. .42	
7. Evaluations.	7. .10	
8. Contingency.	8. 2.98	
	22.84	

ROADS DEPARTMENT ORGANIZATIONAL CHART



ANNEX II.B

11P.

Scope of Work for Personal Services Contractor

A. Representative Duties

1. Report to the Direct Hire Project Officer. Responsibilities are comprised of monitoring activities under the Kafue-Lusaka Road Rehabilitation Project (690-0254) and other duties as directed by USAID/Zambia Mission management.

2. Carry out the following specific project monitoring activities:

   i. Monitor Progress of engineering consultant performing final design and preparation of tender documents for future contractor to be responsible for rehabilitation of Kafue-Lusaka Road.

   ii. Coordinate final design activities with GRZ Roads Department, final design consultant, USAID/Zambia and REO, USAID/Zimbabwe.

   iii. Assist GRZ Roads Department with issuance of prequalification documents for construction contractor.

   iv. Assist GRZ Roads Department and USAID/Zambia with evaluation of prequalification documentation.

   v. Assist GRZ Roads Department, USAID/Zambia and REO, USAID/Zimbabwe with IFB approval and issuance.

   vi. Assist GRZ Roads Department, USAID/Zambia and REO, USAID/Zimbabwe with evaluation of bids and recommendation of contractor award.

   vii. Monitor progress of construction contractor by making regular site visits, meeting with GRZ Roads Department, consultant responsible for construction supervision and contractor's project management personnel.

   viii. Review monthly progress reports prepared by the contractor responsible for construction supervision and make appropriate comments.

   ix. Assist USAID/Zambia Project Officer with approval of monthly invoices submitted by both the construction contractor and construction supervision contractor.

   x. Assist GRZ Roads Department with evaluating variation orders (VOs).

3. Advise USAID/Zambia management on the performance of project-funded contractors. Maintain continuing surveillance of performance, progress and effectiveness of work. Provide professional engineering guidance where required. Notify the Project Officer, the USAID/Zambia Mission Director or other responsible officials of problem areas.

4. Work with auditors and foreign assistance inspectors in resolving questions raised in audit findings on contractor performance and submit necessary documentation and reports for audit evaluation.

5. Assist in the preparation of evaluation plans and drafting of official documentation for engineering activities, and any required A.I.D. approvals t engineering host-country contracts.

B. Qualifications

1. Education

A B.S. degree in civil engineering or equivalent field of engineering from an accredited college or university is required.

Registration in the United States as a professional engineer is desirabl

2. Experience

Experience in developing and designing civil engineering plans is required.

Experience in the construction and direction of the construction of various structures and civil engineering systems is required.

Experience in the planning and management of complex civil engineering projects is desirable.

Experience in the planning and management of rural, urban, industrial, health and other development areas is highly desirable.

Knowledge of A.I.D. regulations is highly desirable.

A minimum of ten years professional experience is required.

3. Knowledge and Abilities

Ability to advise and consult on the planning, design, and management of engineering projects in any of the specialized civil engineering disciplines is required.

Ability to advise on the money, men and materials requirements required to plan and implement civil engineering projects is required.

Annex II.D

Illustrative Road Maintenance Equipment List

Equipment	Quantity	Estimated Cost (FOB)	Probable Source/Origin	Waiver
Mechanical Horse (Truck Tractor)	1 ea	$98,000.00	U.S.A.	N/A
Semi-trailer	1 ea	$50,000.00	U.S.A., Code 941	N/A
Pneumatic Tire Roller	1 ea	$42,000.00	U.S.A.	N/A
Tipper Truck(Dump Truck)	2 ea	$100,000.00	W.Germany, Japan	Proprietary Procurement
Truck-mounted Bitumen Distributor	1 ea	$95,000.00	W.Germany, Japan	Proprietary Procurement
Chip Spreaders & acces-ories (Truck-mounted)	2 ea	$32,000.00	U.S.A.	N/A
Mechanical Sweeper	1 ea	$21,000.00	U.S.A.	N/A
Line Painting Machine	1 ea	$30,000.00	U.S.A.	N/A
Farm Tractor	1 ea	$30,000.00	U.S.A., Code 941	N/A
Spare Parts		$100,000.00	U.S.A., Code 941, W. Germany, Japan	N/A
Vibrating Plate Compactor	2 ea	$5,000.00	U.S.A.	N/A
Contingency for Inflation (20 %)		$119,600.00		
Total FOB		$722,600.00 (a)		
Freight & Insurance		$137,400.00 (b)		
Total CIF Lusaka		$860,000.00		

Notes:

(a) Based on actual costs for similar equipment procured in Nov/Dec 1988 by Roads Dept under A.I.D.- financed host country contracts.

(b) Based on actual Freight and Insurance charges incurred in Nov/Dec 1988 procurement.

ANNEX III: PROJECT ANALYSES

A. Engineering Technical Analysis

B. Economic Analysis

C. Social Soundness Analysis

D. Institutional Analysis

E. Methods of Financing

F. Maintenance and Sustainability Analysis

ANNEX III(A)

ENGINEERING TECHNICAL ANALYSIS

1. General

1.1 Introduction

The project road consists of the Zambia trunk road T2 between Lusaka and the Kafue Bridge. The total length of the road is 53.3 km linking the capital city, Lusaka with the important industrial town of Kafue, and continuing southwards to the bridge crossing at the Kafue River.

The dual carriageway section of road between km 0.0 (traffic circle at the junction of Kafue Road, Ben Bella Road, Cairo Road and Independence Avenue) and km 3.9 (suburb of Makeni) will not be part of this project.

1.2 Existing Condition

The road was constructed in 1968 except for the one km by-pass which was constructed in 1978. The road design was in accordance with the Zambian Highway Design Standards of 1971.

The existing pavement construction generally consists of 150 mm lateritic gravel sub-base and 150 mm stabilized lateritic gravel roadbase and a double surface dressing layer as wearing surface.

On the dual carriageway section, between the Kafue roundabout (km 0.0) and Makeni (km 3.0), the pavement condition is generally good, with only limited evidence of surface cracking or deformation. The riding quality is good, however the lane widths are narrow and should be widened. Since this road has recently been resealed, involves land acquisition, Lusaka City Council involvement (besides Zambia Roads Department) and traffic circle redesign, it will be considered for project development as a subsequent phase. The section of road between km 3.9 and km 7.0 has sections consisting of extensive block cracking and some deformation in the wheeltracks. From km 7.0 to km 11.0 the incidence of cracking is not so extensive, however there is an area of settlement at km 7.7 and extensive potholing in the vicinity of km 10.5.

Between km 11.0 and km 12.0 the pavement condition is reasonably good with only limited areas of block cracking and good riding quality. At km 12.5 there is extensive potholing, and as far as km 14.3 (Chilanga Police Station) the road exhibits quite a lot of fine cracking, however maintains a reasonable riding quality. At km 14.3 there are extensive potholes, some of which have been temporarily backfilled with rock material protruding from the road surface.

From km 14.3 to 16.8 the pavement condition is fairly good. Between km 16.8 and km 23.0 the topography is rolling with dips in the alignment at km 17.0, km 18.3 and km 21.8. Extensive potholing is present in these dips, and there is extensive patching and block cracking from km 18.5 to km 23.0.

Between km 23.0 and km 30.0 there are three long flat low-lying stretches of road (separated by hills at km 25.0 and km 27.2) which exhibit extensive areas of patching and block cracking. From km 30.0 to km 33.0 the vertical alignment is gently rolling and the pavement condition still exhibits significant lengths of patching and block cracking.

The pavement condition and riding quality improve significantly between km 33.0 and km 41.0, although there are considerable lengths of block cracking. The block cracking is more extensive between km 41.0 and km 44.0 (in the vicinity of Kafue), with evidence of surface deformation. After km 44.0, the pavement condition is fairly good as far as km 48.0. Thereafter (from km 48.0 to Kafue Bridge at km 53.3) there are significant lengths of block cracking and patching.

1.3 Topography

The dual carriageway section (km 0.0 to km 3.9) is flat and low-lying. From km 3.9 the vertical alignment remains flat and low-lying until km 6.0 when the road level rises above the surrounding ground.

Between km 10.0 and km 11.0 the road level dips significantly in the vicinity of a stream crossing at km 10.5. The vertical alignment then rises slowly and falls again in the vicinity of km 12.5 where another stream crossing exists. The road rises significantly between 12.5 and km 13.0 and then remains fairly flat until km 16.0 (Chilanga).

From km 16.0 to km 23.0 the vertical alignment is generally rolling with dips occurring at km 17.0, 18.3 and km 21.8. Between km 23.0 to km 30.0 the vertical alignment is predominantly flat and low-lying.

From km 30.0 the horizontal alignment starts to vary as the road passes around several hilly areas, with a short escarpment section between km 37.0 and km 38.0.

Between Kafue (km 43.0) and Kafue Bridge (km 53.3) the vertical alignment remains predominantly flat, with a short rolling section near km 50.0.

1.4 Geology

The city of Lusaka is underlaid by Late Pre-Cambrian and Lower Palaezoic rocks of the Katanga System, which in turn overlie the Pre-Cambrian Basement Complex. They consist mainly of metamorphosed gneisses, schists, quartzites, limestone, and shales. The area south from Lusaka (km 8.0) to Kafue (km 43.0) consists of dolomite, limestone, gabbro, and schists.

Kafue is situated at the margin of the Kafue Flats, which consist of alluvium. Hills to the east of Kafue are of Muva schists and quartzites. The area south of Kafue consists of quartzites and slates of the Katanga-Kundelungu System (mostly to the southwest) and paragneisses of the Basement Complex.

1.5 Vegetation and Land Use

The Lusaka-Kafue Road is situated towards the southern margin of the Central Plateau which, in common with all plateau areas of Zambia is predominantly covered with a form of dry deciduous woodland called 'miombo'.

Miombo woodland covers not only areas of plateau around Lusaka, but also covers a large portion of the dissection hill and escarpment country to the south and south-east side of the city, specially between Chilanga and Kafue.

Much of the road south of Lusaka is covered with a more open savanna woodland, called 'munga' which descends to open grassland on the 'flats' of the Kafue valley.

The soils beneath munga vegetation tend to be alluvial and more fertile than the plateau and escarpment soils beneath miombo. As a result much of this vegetation was cleared and the area was used for farmland and grazing.

Within the built-up area of Lusaka and as far as Chilanga, little of the original vegetation (munga) is left. Vacant land within the built-up area and considerable areas of land on the periphery of the road are intensively cultivated for maize and vegetables. South of the town of Kafue is a patch of dense deciduous thicket growing on excessively drained sandy soil which is of little use for farming.

1.6 Rainfall and Climate

The climate of Zambia is typified by one defined wet and one dry season each year. The rain falls between November and March, with these months accounting for approximately 93% of the average annual rainfall. Temperatures are generally not excessive, the hottest months being October and November and the coolest months June and July.

Climatological details for the Lusaka/Chilanga area are summarized as follows:

Mean Monthly Temperature	:	15.7 - 24.6 deg C (centigrade)
Absolute Max Temperature	:	31.1 deg C
Absolute Min Temperature	:	-1.6 deg C
Mean Relative Humidity	:	37 - 83 %
Mean Monthly Evaporation	:	111 - 284 mm
Mean Monthly Rainfall	:	0 - 219 mm
Average Annual Rainfall	:	836 mm

1.7 Drainage

A detailed survey has been carried out for the road from Lusaka to the Kafue Bridge. It has been generally observed that the capacity of the existing culverts are in general adequate with little or no topping being recorded in recent years. The main problem with the drainage on the road has been the lack of preventative maintenance. The side drains have been allowed

to be totally covered with vegetation and mitre drains have become blocked an have not been cleaned out. In addition to these problems, some cross drainag culverts are too low and have been allowed to silt up.

2. Proposed Rehabilitation

2.1 Alignment

The existing alignment of the study road is generally acceptable and complies with the Zambian Roads Department Standards. However there are two locations on the more heavily traveled section of the road (between Makeni an Chilanga), where the overtaking sight distances can be improved by realignmen of the carriageway. Since at both locations, the road level requires raising to facilitate surface drainage, it is reasonable to consider a change in horizontal alignment at the same time.

The two locations are as follows:

Location	Details
km 7.5	Left hand bend (Eureka Corner)
km 12.5	Left hand bend

2.1A Geometric Design Standards

A traffic volume based on focusted annual traffic increases of 2.5% for 20 years commencing in 1992 (completion of construction) was used in determining the geometric design standards.

2.2 Road Cross Sections

The proposed Road Design Class is summarized below:

Section	Road Class	Width (m)	
		Carriageway	Shoulder
00.0 - 03.9*	Dual 2-lane	2 x 7.3	3.0
03.9 - 15.1	1A	7.3	3.0
15.1 - 43.7	1B	6.7	2.0
43.9 - 53.3	1B	6.7	2.0

*Not included in rehabilitation schedule.

2.3 Drainage

Many of the existing drainage structures will be retained, however some will have to be added or modified. A schedule of drainage proposals is shown on Tables 1 (A) - (F).

2.4 Pavement Rehabilitation

A schedule of road (pavement) rehabilitation for 49.4 km is shown on Table 1.

2.4A Reconstruction - Single Carriageway Sections

At those sections requiring raising or reconstruction, the existing bituminous layer will be removed to expose the roadbase which will be scarified and recompacted. The new pavement construction (for both Class 1A and Class 1B Sections) will be comprised of 300 mm selected gravel subbase and 150 mm crushed treatment. The carriageway roadbase and subbase layers will be continued across the shoulders, and a sand seal surfacing applied to the shoulders.

Reconstruction details are shown in Figures 1 and 2.

2.4B Overlay and Seal

On the sections of the road which are to be overlaid, all existing poor quality patchwork must be removed and redone and any potholes must be repaired. Existing cracks shall be sealed with bitumen and if the crack width exceeds 1 mm, the existing surface shall be removed and replaced. Before application of the overlay, the existing surface (repaired where necessary) shall be sealed with a single surface dressing which will help to delay the initiation of reflection cracking.

Considerable research has been done recently concerning the problem of reflection cracking and possible ways to avoid this problem. The general conclusion is that the only way to avoid reflection cracking is to completely remove or reconstruct the existing pavement, or by applying very thick overlays.

Another way to address the problem would be to provide a partial shear break between the existing surface and the overlay. That would delay the progression of reflection cracks. A single spray and chip surface dressing would be used as a partial shear break.

The overlays for the road would be constructed using dense bitumen macadam base course material (binder course not roadbase) laid over a single spray and chip surface dressing to repair reflection cracking, and with a double bituminous road surface treatment as a final wearing surface to resist environmental oxidation of the bitumen. Overlay and seal details are shown in Figure 3.

2.4C Patch and Seal

The sections of the road which are structurally sound will have all potholes repaired and then receive a double bitumen surface treatment. Potholes are repaired by squaring up the sides of the distressed areas, cutting the sides vertically to the depth of the loose material removing all

loose materials, applying a tack coat (single-surface dressing) to the edges, then compacting a new asphalt mixture into the hole with a mechanical tamper. A double bituminous surface treatment is then applied to the whole road surface area once the potholes have been repaired. First seal consists of 19 mm stone chippings while the second seal consists of 13 mm stone chippings resulting in a nominal thickness of approximately 19 mm. Patch and Seal details are shown in Figure 4.

2.5 Traffic Circle

Severe traffic congestion occurs at this circle specially during business hours. It is clear that the size of the traffic circle is insufficient for traffic levels the intersection is required to handle. Nonetheless, for reasons cited previously, reconstruction of the traffic circle will not be part of this project.

2.6 Other Junctions, Accesses and Railway Crossing

The junction and access design standard used by the Zambian Roads Department is considered adequate. The existing junction layouts will be retained with little or no width modification. The only railway crossing on this road is near Kafue at km 40.0. The crossing is on the left hand bend on the approach from Lusaka and on the right hand bend past the crossing. The bend in itself reduces vehicle speed on approach to the crossing. This together with rumble strips on the road currently provide the control at this crossing.

2.7 Miscellaneous

2.7A Traffic Signs

All existing signs should be replaced and upgraded to international standards.

2.7B Crash Barriers and Guard Rails

Crash barriers will be provided at the edge of the shoulder where the height of the fill above adjacent ground level exceeds 2 meters. Also, crash barriers will be provided on the outside of bends through the escarpment section (km 37.0 - km 38.0) and guard rails will be provided at bridges.

2.7C Pedestrian Crosswalks

A pedestrian crosswalk will be provided at the school crossing located in the town of Chilanga.

2.7D Lay-Bys

Lay-bys will be provided at approximately km 28.0 and 50.0.

2.8 Pavement Design/Assessment

2.8A Introduction

The first stage of formulating rehabilitation proposals is the assessment of the condition of the existing pavement. The pavement of the project road was examined both visually and by performing non destructive testing methods. Test pits were also excavated and the samples recovered were tested in the laboratory to establish the subgrade and pavement layer properties and condition. The visual assessment established the condition of the pavement and shoulder surfaces as well as the condition of the drainage system.

No proven method of overlay design exists for tropical conditions similar to those which this project road is subjected. However, an assessment of the likely performance of a bituminous overlay can be made by consulting studies such as those carried out by the United Kingdom Transport and Road Research Laboratory (TRRC) in Kenya. This study concludes that the principal mode of failure was cracking which began at the top surface and propagated downwards through the overlay.

The explanation given for this type of cracking in tropical environments is one of age hardening of the bitumen in the mix with the top few mm hardening much more, giving a very weak surface skim which easily fractures under stress. A suggested method of reducing the cracking problem is to brace bitumen rich coating on top of the overlay. This effectively protects the bituminous surface dressing overlay from harsh environmental conditions which lead to age hardening. This coating will need to be replaced periodically.

2.8B Reflection Criterion

For the project road the overlay design is based on mechanistic methods discussed in Section V, Mechanistic Analysis. This approach requires a design criterion, typically a deflection-life relationship, in order to estimate the design life from a known deflection level after overlaying has been completed. This deflection-life relationship has been derived for the Lusaka-Kafue Road. The basic approach is to classify the pavement condition for each point at which the deflection is measured, as sound, critical or failed, on the basis of observed cracking intensity. The average critical condition is then used in conjunction with historical traffic data to establish points on the deflection-life relationship.

For the project road, axle equivalence factors (number of equivalent standard axles per commercial vehicle) have been used in assessing the design life of the roads. The cumulative number of standard axles over the 25 year life of the road has been estimated based on the 1989 traffic levels (using a 2.5% annual growth rate).

Details are given in Table 2(A). The condition classification is based on intensity of cracking alone, as defined in Table 2(B).

The "critical" points have been plotted on a deflection vs life chart taken from TRRL Laboratory Report 833 (Ref 2) as shown on Figure 5. It is clear that the points lie on a line parallel to the TRRL "critical condition" line.

However, it must be noted that with the data produced from the Lusaka-Kafue Road surveys, the demarkation between sound, critical and failed deflection levels is not well defined. There is some uncertainty surrounding the location of the "critical condition" on the deflection-life plot. Consequently the deflection-life relationship adopted for this study is based on the 50% probability curve presented in Figure 5. As the deflection over the life of the pavement is not uniform, a simple transformation (Figure 6) has been applied to give a direct relationship between early life deflection and expected life (msa) which is defined by the relationship:

$$N = \frac{262100}{d2.69}$$

Where N = Cumulative traffic (msa) to reach a defined failure condition.

Where d = Early life deflection (mm/100) measured under a 31 kN wheel load moving at creep speed.

This relationship is shown in Figure 7.

2.8C Drainage Considerations

One of the most important aspects of the design of a road is the provision made for protecting the road from both surface water and ground water. This is provided for by ensuring that the road in general is above the adjacent ground level, ensuring that the pavement is constructed with sufficient camber so that it sheds rainwater quickly, and by providing an adequate drainage system to dispense the collected water away from the road.

At several locations on this road, the level of the road requires raising to provide adequate drainage. These sections are listed in Tables 1(A) - 1(F). Consequently the deflection analysis has not been carried out for these sections of road as it is intended that the pavement will be reconstructed. However, the extent of the pavement reconstruction at each location has been based on local deflection levels, which in general are relatively high at the sections requiring raising. The high deflection measurements also confirm that a problem exists at these locations.

2.8D Deflection Analysis

The pavement deflection data for the project road has been collected in two phases. In late 1985, Kampaz/CarlBro (Ref 3) collected data for the section between Chilanga Police Station and Kafue Bridge (km 14.3 - km 53.3). In May 1989, John Burrow & Partners carried out the field data collection (Ref 4) for the remaining section between Lusaka and Chilanga (km 0 - km 14.3), and in addition collected data at several control sections (between km 14.3 and km 53.3) in order to update the information collected by Kampsax/CarlBro in 1985. Details of the surveys carried out at the control sections are given in Section 5.4 (Ref 1).

The design of the pavement strengthening overlays has been based primarily on the measured Benkelman Beam deflection updated where necessary to appropriate 1989 and 1991 levels. The economic analysis was based on 1989 deflection levels while the final overlay design was based on deflection levels expected in 1991, the date when rehabilitation works are programmed to commence. Additional data on existing layer thicknesses and subgrade strengths have been deduced from the test pits and DCP test results.

A design deflection has been deduced for each successive length of road having a uniform level of deflection. The design value has been taken at the 95th percentile, given by:

Design deflection = Mean + (1.645 x Standard deviation)

The 1989 design deflections are indicated on the deflection profiles contained in Appendix A (Ref 1). The growth factors used to project these deflections to 1991 levels are given in Section 5.4 (Ref 1).

2.8E Mechanistic Analysis

The overlay thickness design has been based on mechanistic analysis in preference to the direct use of overlay charts (Ref 2) derived under different environmental and material conditions. The mechanistic approach to overlay design is summarized in Figure 8 and is based on the micro-computer elastic analysis program PAN (Ref 5). A typical pavement model representing the existing construction is shown in Figure 9.

The existing construction is represented by three layers, the roadbase, sub-base and subgrade. The existing surfacing layer (generally 25 - 35 mm thick) is not included in the model as a layer of this thickness contributes very little structural strength to the overall pavement structure, acting merely as a protective seal coat. The existing construction is defined in terms of layer thicknesses and material properties represented by the Resilient Modulus (Mr) and Poisson's Ratio (v). Values for Resilient Modulus are assigned to each layer as follows:

<u>Subgrade</u>

$Mr3\ (MN/m2) = 17.6\ (CBR)^{0.64}$
where CBR - in situ CBR (%)

Maximum value 120 MN/m2, typical of in situ CBR 20% or greater.

This relationship is based on U.K. experience (Ref 6), and gives a more conservative estimate of the resilient modulus than the Shell relationship (Ref 7) given by:

$Mr3\ (MN/m2) = 10\ (CBR)$

The two relationships are shown in Figure 10.

Sub-Base — Mr2 (MN/m2) = 2 Mr 3
Maximum value 240 MN/m2
This relationship is based on the findings of Shell researchers (Ref 7).

Roadbase — The resilient modulus for the roadbase layer is deducted by a back analysis procedure in the analysis program PAN. Simply, if all material properties are known except Mr1, then this value is found based on the measured deflection under a known wheel load. Typical values for a lightly cemented roadbase layer are in the range 400 to 1000 MN/m2.

For each layer, the value assigned to Poisson's Ratio was 0.35.

The reduction in surface (Benkelman Beam) deflection achieved by the addition of a bituminous overlay is predicted by the addition of an extra layer to the pavement model. The resilient modulus assigned to this layer was 2500 MN/m2, representing a vehicle speed of 3 kph, corresponding to the creep speed of the Benkelman Beam vehicle. The design life of the overlaid pavement is estimated using the deflection - life relationship described in the deflection criteria.

By applying increasing thicknesses of overlay, the corresponding deflection and associated life of the overlaid pavement can be deduced, and an overlay chart produced relating design life to overlay thickness. Different design deflections (deflection before overlaying) are characterized by variations in the resilient modulus of the roadbase layer, and thus a family of curves can be produced for a range of design deflections.

2.8F Overlay Thickness Design

Based on analysis of the material laboratory test results and Dynamic Core Penetrometer (DCP) test results, the road can be represented by three different pavement models (A, B and C), based primarily on three values of design CBR, 8%, 12% and 20%. A sensitivity study has indicated that the predicted overlay thickness is not particularly sensitive to variations in existing layer thicknesses, but rather to variations in material properties. Details of the three models are given in Table 2(C), and details of the DCP results can be found in Section 6 and Appendix 13 of (Ref 1).

Using the approach outlined in Section IV, design deflections have been assigned to successive lengths of the study road. Overlay requirements for three values of design life (10, 15 and 20 years) have been predicted using the mechanistic approach described in the previous section.

For each of the three pavement models, a corresponding design chart has been produced which relates design life after overlaying to applied overlay thickness. The derivation of a typical overlay chart is summarized in Table 3, and the design charts (A, B and C) are presented in Figures 11 to 13.

The predicted overlay requirements based on 1989 deflection levels are given in Table 4. These values have been used for the economic evaluation of different maintenance strategies discussed in section 11 (Ref 1). As the rehabilitation works are programmed to commence in 1991, the final overlay thickness design is based on deflection levels for that year (using growth factors given in Table 5.2 shown in section 5.4 (Ref 1), and a design life of 10 years. Details are given in Table 5. Reconstruction has been recommended where the final overlay thickness was found to exceed 120mm, based on economic considerations. It was found that it would cost more to provide an overlay thickness greater than 120 mm than to provide a complete reconstruction because of bitumen costs.

The estimation of overlay requirements based on DCP Structure Number is described in Section 6.4. (Ref 1). However, this approach does not give good correlation with the estimated overlay requirements based on deflection analysis. It is considered that the DCP approach (as used in Section 6.4) gives only a general indication of overlay needs since the DCP tests were carried out at intervals of 2 km or more. The adopted overlay design approach is that based on deflections measured at intervals of 100 - 200 m. Test results for soil analysis and pavement analysis can be found in Appendixes C and D (Ref 1).

2.8G New Pavement Design

At those sections requiring reconstruction, it is envisaged that the existing roadbase layer will form the subgrade for the new construction (see Section 2.4C). The in situ CBR value of the existing roadbase, as determined from the DCP tests (refer to Section 6.4 of Ref 1) varies from 40% to 100%. At those sections where the road level requires raising from drainage considerations, the in situ CBR of the new subgrade (selected fill) is taken to be at least 15%.

The new pavement design is based on the recommendations of Road Note 31 (Ref 8) and TRH4 (Ref 9). The design is based on a minimum subgrade CBR of 15% and a life of 10 years (refer Table 6).

The new pavement for the dual carriageway section comprises 300 mm cemented natural gravel sub-base, 150 mm crushed stone roadbase and 60 mm DBM surfacing with a double surface treatment. Details are given in Figure 14.

A common design is indicated (Figure 14.) for the Road Class 1A and 1B sections, comprising 300mm natural gravel sub-base and 150 mm crushed stone roadbase with a double surface treatment.

3. Traffic Loading

3.1 Introduction

The design of pavement rehabilitation measures is based on the knowledge of the cumulative number of standard (8200 kg) axles to be carried during the road design life. Estimates for cumulative number of standard axles have been made for three values of design life, 10 years, 15 years and 20 years. Based on economic criteria (IRR), a 10 year design life was selected.

The estimates are based on the 12 - hour traffic counts carried out at four locations, converted to a 24 hour value by applying a factor 1.25 calculated by CarlBro/Kampsax from their traffic studies. The traffic counts provided by the Roads Department enabled calculation of daily variation factors to arrive at an average daily flow. However it should be noted that when these factors were applied to he supplementary counts the average daily flows calculated gave a higher traffic volume at km 10.00 than at km 7.00. This inconsistency could have been expected as the Roads Department counts were undertaken on different days leading to a different set of daily variation factors. Thus, these factors were not applied to the supplementary traffic counts, but only used with the Roads Department traffic figures. Seasonal variation factors were not available, but are not likely to be significant.

The equivalent factors (number of standard axles/commercial vehicle) applied to each vehicle group were taken from the results of axle load surveys carried out by Kampsax/CarlBro (Ref 3). The study conducted by Kampsax/Carl Bro indicated that approximately 10% of the truck traffic was overloaded. This "overloaded" factor was given a factor 1.25.

The estimation of the number of standard axles/12 - hour day is summarized in Table 7. The traffic forecasts for three values of design life are presented in Table 6A. The forecasts are based on the relationship:

$$S = 365 \times So \times \frac{(1+r)n - 1}{r}$$

Where S = Cumulative no standard axles over design life
So= No. standard axles/24hr day in opening year
n = design life (years)
r = annual growth rate

For annual growth rate of 2.5% (r = 0.025), this reduces to:

For design life n = 10 years, S = 4090 So
n = 15 years, S = 6545 So
n = 20 years, S = 9324 So

3.2 Total Number of Vehicles in Design Year

The selection of the appropriate road cross-section (i.e., carriageway and shoulder widths) is based on the daily total number of vehicles using the road in the design year. Estimates of the daily flow (2 - way, 24 hrs) after 10, 15 and 20 years have been made at four locations on the study road (Table

6B). The estimates have been calculated using the 12 hour traffic counts carried out in 1989 at km 1.0, km 7.0 and m 53.0, and in 1988 at km 41.0 and adjusted with daily variation factors derived from the Roads Department seven day counts and in the case of the traffic figure at km 41.0 escalated by 2.5% to take into account growth from 1983 to 1989.

$$\text{Av. daily flow} = \frac{\text{Daily flow for specific day}}{\text{Variation factor for same day}}$$

Variation factor calculated from Roads Department seven day counts = Specific day flow divided by Average daily flow.

A factor of 0.828 is used on the 12 hour count conducted at km 1.0 on Monday and a factor of 0.69 is used on the counted figure at km 7.0 to take into account the fact that the count at this location was carried out on a Tuesday. Seasonal variation factors which are normally incorporated into this calculation, were not available and have not been used.

The estimates are based on the relationship

$$Fn = Fo\ (1+r)^{n}$$

Where
Fn = daily 2-way flow in n th year
Fo = daily 2-way flow in n opening year
n = design life
r = annual growth rate

For an annual growth rate of 2.5% (r=0.025) this reduces to:
For design life n = 10 years, Fn = 1.280 Fo
n = 15 years, Fn = 1.448 Fo
n = 20 years, Fn = 1.638 Fo

3.3 Peak hour flow in design year

Estimates of the peak hour flow in the design year have been made for the most heavily trafficked sections (km 0.0 - 15.1) of the project road. The estimates are based on the 12 hour traffic counts carried out in May 1989, and incorporate a growth rate of 2.5 percent per year. Details are shown below.

Km	Section km km	Peak hour flow (May 1989) (Table 4.2, Ref.1) North Bound	South Bound	Max peak hour flow (1 - way) after 10 yrs	15 yrs	20 yrs
1.0	0 -3.9	912	1003	1280	1450	1640
7.0	3.9-15.1	267	281	360	410	460

Estimation of peak one hour flow in the design year.

4. Roughness Survey

A roughness survey was conducted on the project road by Kampsax/CarlBro Study (Ref 3). The results of the roughness surveys are given in Table 8. which shows the values obtained in each direction of travel between Lusaka and the Kafue Bridge. The average road roughness on the Lusaka-Kafue Road ranges from 1500mm/km to over 3000mm/km. For the level of traffic on this road, a roughness order of 1500 mm/km should be achieved. It should be noted that, as the road roughness (Bl value) increase so does the operating cost of a vehicle. It is the aim of all rehabilitation and maintenance projects to reduce road roughness.

The apparent roughness value was obtained using the relationship:

$$Bl = 17.28 \times (25.4 \times Bl_V)^{0.67}$$

Where Bl is the apparent roughness in mm/km.
Bl_V is the value measured by the Vehicle Mounted Bump Integrator (VMBI) in inches/km

5. Drainage Design

5.1 Introduction

An extremely important aspect which must be taken into consideration when designing a road is the provision made for protecting the road from surface water or ground water. If water is allowed to enter the structure of the road then the pavement will be weakened and it will be much more susceptible to damage by traffic. Water can enter the road as a result of rain penetrating the surface or as a result of the infiltration of ground water. The surface must be constructed with a camber so that the rain water on the road surface can be shed, and the road formation must be raised above the level of the local water table to prevent it from absorbing ground water.

Other harmful effects can also be caused by water on shoulders, slopes, ditches and other features. High water velocities can cause erosion which, when severe can lead to the road link being severed. Alternatively, low velocities in drainage facilities can lead to silt being deposited which, in turn, can lead to a blockage which will result in further erosion .

5.2 Drainage of Pavement Layers

The road cross section is designed either to shed water completely or alternatively permit the egress of any water which may enter the cross section. When impermeable base materials are used drainage of the base is not necessary. If permeable base materials are used, then special attention must be given to the drainage of the base layers and shoulders and to the details of the side drains.

5.3 Purpose of Drains

The main functions of drains are described as follows:

- to provide a reasonable capacity to accommodate surface water run-off;
- to dispose the collected water to a natural draining channel or onto the surrounding ground;
- to minimize the hazard to pedestrians and vehicle traffic; and,
- to ensure that the inflow and outflow of the drain causes minimal erosion.

There are various types of drainage control which can be used, however the most common ones are: side and mitre drains, embankments, box culverts and sub-soil drains.

5.4 Design Criteria

The design flood used for calculating the size of box and pipe culverts was 10 years. A design life of greater than 10 years would be uneconomical. The estimation of the design storm water drainage structure is not an exact scenario, however satisfactory methods exist in assisting in the design for the proper drainage structures. The method used was the Rational Method which is discussed in more detail in Section 9.2 and Appendix E (Ref 1).6.

6. Availability of Construction Material

6.1 Crushed Stone

The construction of the project road will require various materials in large quantities. Base and sub-base quality gravels, crushed stone for base course, overlay layer and surfacing, bitumen for overlays and surfacing, cement for stabilization, drainage works and bridge widening, sand for concrete works and water for construction and maintenance of deviations. The timely availability of the required materials at an economic cost is very critical to the implementation of the project.

Base and sub-base quality gravels are obtained wherever possible from borrow pits along the alignment of the road. Opening borrow pits, will incur costs associated with bush clearing, stripping of topsoil and overburden and reinstating the pits at the end of the project. The cost should be compared with the cost associated with hauling the material to the position where it is required on the road.

Taking an ideal case, if suitable material is available adjacent to the road throughout the road alignment, numerous borrow pits could be opened and the material haul distances would be very small. Depending on the depth of overburden and the thickness of the gravel layer the balance distance between borrow pits can be estimated. From experience, this economic spacing is in the order of 10 km. Therefore the feasibility of establishing borrow pits at this spacing has been examined.

The following existing borrow pits were visually examined and found to have suitable material.

- At km 5 + 000 approximately 1.5 km from the left hand side of the road; large borrow pits.

- At km 8 + 000 on the right hand side of the road a large borrow pit adjacent to the road on land belonging to the Lusaka City Council.

  At km 15 + 000 on the right hand side of the road approximately 1 km from the road.

- At km 20 + 000 on the left hand side of the road very close to the road corridor.

- At km 27 + 800 on the right hand side of the road.

- Between km 35 + 000 and 45 + 000 there is sufficient visual evidence to suggest suitable gravels are available.

- At km 51 + 800 within half a km of the road on the left hand side.

- At km 54 + 300 just past the Kafue River Bridge on the left hand side of the road.

From the above it would appear that sufficient quantity of sub-base and base quality gravels will be available at an economic hauling distance throughout the road alignment.

Crushed stone will be required for the base layers of sections which are to be reconstructed, for overlays of sections which are to be sealed and for surfacing of the road throughout. The cost of the establishment required to quarry rock and crush the rock to produce stone of the required size is such that only one crushing site can be economically justified for a road project of this length. It would be more economic to haul stone for 50 km than establish, dismantle and re-establish large scale crushing plants at several locations. The availability of a single good source of stone has been preliminarily determined as follows.

At km 38 + 000 the Roads Department owns and operates a quarry which provides crushed stone for their periodic and routine maintenance operations. This quarry also supplied the stone requirements of the Kafue-Chirundu Road Rehabilitation Project (690-0209). It would appear that there is a sufficient quantity of rock available at this site and the crusher has sufficient capacity to produce adequate quantities of stone to supply the Kafue-Lusaka Road Rehabilitation Project in addition to meeting the Roads Department periodic and routine maintenance requirements.

However, it should be noted that the current layout of the quarry itself will grossly limit the amount of rock that can be taken out to crush. The current layout and method of working is in effect digging a progressively smaller and deeper hole on the side of a hill. The area available to work on at any given time limits the amount of rock that can be blasted and transported out. If the present production capacity is to be increased, which will have to be done if this quarry is to supply the stone requirements of the Kafue-Lusaka Road Rehabilitation Project, then the quarry layout and methods of working must be improved. The overburden on the upper part of the hill must be removed and a large working layer must be exposed and benched.

The Roads Department have expressed their reluctance to supply stone to the contractor for this project. One of the leading arguments is that this in effect makes them a subcontractor in addition to being the client and such a contractually conflicting situation is not desirable. One alternative that was briefly discussed and discarded due to numerous institutional problems would involve the Contractor taking over the quarry for the duration of the road rehabilitation project and selling stone to the Roads Department at a pre-agreed price to meet the department's periodic and routine maintenance requirements. One of the significant problems associated with this approach would be the legal implications of the temporary use of machinery and equipment belonging to the Government, and another would be the reluctance on the contractors part to use the staff currently employed by the Roads Department at this quarry.

In the event that the Roads Department is not prepared to supply stone an alternative would be for the Contractor to establish a new working at a different face of this hill or indeed at the adjacent hill. The contractor will then have to set up his own crushing plant at this site. If the Contractor is to crush his own stone, it may be feasible for the Contractor to establish the crusher at the site of the old Chilanga Cement Quarry on the right hand side of the road at km 26 + 000. It would mean that rock blasted at km 38 + 000 will have to be hauled to km 26 + 000 for crushing. The significant advantage of the site at km 26 + 000 is that three phase power is readily available with the step down transformer facility to hook up to a crusher. The power for crushing at km 38 + 000 will have to be supplied by diesel generators. Another potential source of stone that is worth investigating further is an old disused quarry approximately 3.5 km from the road on the right hand side at km 27 + 800. The quality and quantity will need to be established but this location would be ideal, as it is closer to the above crusher site and is approximately at the middle of the Lusaka-Kafue Road Project, i.e., the longest crushed stone haul distance would be in the order of 27 km from this site.

6.2 Bitumen, Cement and Sand

Bitumen is produced at the oil refinery in Ndola as a by-product of the oil refinery process. However the capacity of the refinery is limited and if a few major road projects are underway simultaneously in Zambia the supply from this source will not be adequate. In estimating the foreign currency requirement for this project the eventuality of having to import bitumen has

been allowed for. Cement is produced at a plant with an annual capacity of 200,000 tons operated by Chilanga Cement at Chilanga which is at km 15 + 000 on the Kafue-Lusaka Road. No problems are envisaged with adequate supply of cement, nor are problems envisaged regarding the availability of adequate quantities of sand from existing sand quarries at Lusaka and Kafue.

6.3 Water

Large quantities of water will be required for construction works. In addition even larger quantities will be required to control the dust on the detours and deviations. It is anticipated that a fleet of three 10,000 l capacity tankers will carry on average 10 loads a day resulting in a total water demand of 300,000 l/day or 300 cu.m per day. The following watering points have been identified from a preliminary investigation.

- At km 3 + 000 water can be pumped out of the quarry operated by Crushed Stone Sales.
- At km 7 + 000 a 6000 gallon/hour borehole supply is available.
- At km 15 + 000 a large quantity of water is available at the old Chilanga Cement quarry at the present Chilanga Golf Course.
- At km 27 + 000 a very large quantity of water is available from the small lake formed by the disused Chilanga Cement Quarry.
- At km 31 + 000 there is water available on the proposed deviations from a fast flowing stream.
- At km 36 + 000 on the proposed deviation water can be drawn from a stream.
- From km 40 + 000 to km 50 + 000 water can be abstracted from small streams or with approval from the Lusaka Urban District Council from hydrants off the Kafue-Lusaka bulk water pipeline.
- At km 53 + 300 water can be abstracted from the Kafue River.

7. Cost Estimate (Based on Construction occuring 1992 and 1993

The estimated cost of rehabilitating the project road (excluding the Lusaka-Makeni section) is estimated to be US$ 20,500,000.

The cost estimate is broken down by work items as shown: (Refer to Tables 9 and 10)

		A.I.D. Contribution (U.S. $)
1.	Preliminaries	2,893,950
2.	Accommodation of Traffic	1,191,050
3.	Borrow Pits	384,800
4.	Site Clearance and Topsoil Stripping	583,000
5.	Earthworks	1,091,800
6.	Shoulders to Existing Pavement	406,000
7.	Existing Pavement Preparation	404,900
8.	Sub-base and base	2,936,200
9.	Dense Bituminous Macadam Base	2,382,900
10.	Surface Treatment/Crack Sealing	2,155,000
11.	Pavement Repair Work	206,700
12.	Drainage Improvement	1,256,400
13.	Miscellaneous Items	373,100
(A)	Subtotal	16,265,800
(B)	Detailed design	350,000
(C)	Construction supervision	1,100,000
	Total (A)+(B)+(C)	17,715,800
	Contingency 15% of U.S.D	2,657,400
	Total Construction Cost	20,373,200
	Rounded to	20,500,000

*Note: The consultant (Ref 1) had included a 10% contingency in the cost estimate based on a survey of which several firms provided illustrative rates for bill of quantity items. However, after review of the tenders, current actual bill of quantity rates confirmed in documents for a NORAD financed road project (Kafue-Monze), the contingency was adjusted to 15% to retract a slight underestimation in rates used by John Burrow. Based on construction occuring during 1992 and 1993, all line items shown above were increased by 6% to take into account the 1 year delay in construction (Refer to table 10). The detailed design/construction supervision shown in cost estimate (1) was broken down to separate line items in the cost estimate. Since the $1,600,000 included a 10% contingency in estimate (1), this amount was readjusted to $1,450,000 (less 10% for contingency) in cost estimate (2) shown in table 9.

For description of work items see description below.

1. Preliminaries - provides for all Contractor's preliminary and general expenses, cost of providing surety and third party insurance, provision and maintenance for the contract period of offices, a laboratory, and residential facilities for the supervisory Engineer and his staff, provision and maintenance of vehicles and telephone communication for the Resident Engineer's staff and provision to pay compensation to any land owners or settlers whose developments or properties may be affected by this project.

2. Accommodation of Traffic - (Refer to Section B in Ref 1), the traffic currently using the road should be provided for throughout the construction period. A network of detours and diversions will be provided and maintained

during the construction period. The bill items provide for the improvement of existing detours or construction of new deviations to an acceptable standard, provision of 150 mm layer of gravel wearing course and the maintenance of these detours and deviations for an average seven month period when they will be required.

3. Borrow Pits - For pavement and shoulder widening, for sections where the road level needs to be raised, for sections where the road is to be reconstructed and for gravel wearing course for (detours) and deviations, lateritic gravels to varying standards will be required. In this Bill provision is made to clear vegetation, topsoil and overburden at approximately five suitable borrow pit sites and reinstate the pits at the end of construction.

4. Site Clearance and Topsoil Stripping - Virtually throughout the whole of the alignment the carriageway and the shoulders have to be widened. In this bill the work items related to clearing the strip of land either side of the existing roadway and stripping topsoil has been allowed for.

5. Earthworks - Which comprises earthworks to raise the level of the road where required for drainage purposes and to build up widened shoulders.

6. Shoulders to Existing Pavement - On sections of the road where the existing pavement is only to be overlaid, or patched and sealed, the existing shoulders have to be widened. The proposed method of widening is to saw through the existing surfacing and base on the edge of the carriageway, remove the existing shoulder material and build up new shoulder to the full width from the lower layers. In this bill, these work items up to road bed level have been allowed for.

7. Existing Pavement Preparation - In the case where the road is to be reconstructed it is recommended that the existing bituminous material be removed and disposed of and the existing base course be scarified and recompacted prior to placing any reconstruction layers.

8. Subbase and base - For widening shoulders and reconstructed pavements the sub-base and base shoulder material, stabilization of sub-base gravel material, and crushed stone base for new construction have been allowed for. This bill also includes all overhaul of material. In the case of lateritic gravel materials it has been assumed that borrow pits will be established at five locations along the alignment. In the case of crushed stone for new construction, carriageway and shoulder base, it has been assumed that the existing quarry at approximately km 36 + 500 will be the source.

9. Dense Bituminous Macadams Base and Regulating Course - This bill allows for the bituminous overlays and regulating course which will be used in sections of the road where the existing pavement is to be strengthened.

10. Surface Treatment and Surface Dressing Crack Sealing Layer - The whole length of the road is to be provided with a surface dressed seal layer. In addition the shoulders are to be sand sealed throughout. In the case of sections of the pavement which are to be overlaid the existing pavement must be sealed prior to placing the overlay. Items of work relating to these tasks are included in this bill.

11. Pavement Repair Work - Even where the existing pavement is to be overlaid or patched and sealed the pavement must be repaired prior to the placing of the next layer. All existing poor quality patchwork must be removed and redone and where pot-holes exist them must be repaired.

12. Drainage Improvement and Rehabilitation - As discussed, the most important aspect of road design is the provision of adequate drainage works to protect the road from surface and ground water. In this Bill, all items relating to the repair or replacement of existing culverts, provision of new culverts, as required, provision of mitre drains, catchment drains, subsoil drains and protection of drainage works has been allowed for.

13. Miscellaneous Items - Road furniture, signage, road markings and such items as guard rails and curbing has been included. In addition a lump sum has been provided for constructing walkways on either side of the existing road-over-road bridge at Chilanga.

The style and format of the Bills are similar to that used for other Road Construction and Rehabilitation works in Zambia and are in general use with international standard conditions of contract. The method of measurement is also that used on similar contracts.

8. Final Design/Construction Supervision

The Roads Department has no staff available for either the final design or construction supervision. A consultant will be hired to perform this work.

Final design will include; preparation of final design drawings, specifications and tender documents. Construction supervision consultant will act as Roads Department Engineer's Representative to ensure that design drawings and specifications are being adhered to by the contractor.

Definitions

1. Sub Grade - The term given to the ground below the pavement layers. It is sometimes referred to as the Road Bed.

2. Base - Sub-base - The term given to the pavement layers. The layers are numbered consecutively the uppermost layer being referred to as Base 1. Alternately the uppermost layer is referred to as base and the layer below is referred to as sub-base.

3. Falling Weight Deflectometer - A tool used to measure the deflection characteristics of the road under a load.

4. Dynamic Cone Penetrometer (DCP) - A standard rod with a cone tip driven into the pavement layers and the road bed. The resistance as measured by the number of blows is used to derive the strength of the various layers.

5. Benkelman Beam - A tool used to measure the deflection characteristics of the road when subjected to a load.

6. Compactive Effort - Defined as the density of the material after the application of the compactive effort. This is specified as a percentage Mod. AASHTO.

7. In Situ Moisture Content (mc) - Field moisture content at time of sampling. This will vary from season to season.

8. AASHTO Classifications - System of soil classification which divides soils into seven groups designated A - 1 to A - 7 depending on physical properties (particle size distribution, liquid limit and plasticity index). The lower the classification number, the better the material is from a highway stability point of view.

9. Design CBR (CBR) - The California Bearing Ratio Value assigned to a subgrade and used to determine the required pavement thickness. It is the CBR of a sample compacted at Standard AASHTO optimum moisture content and soaked for minimum of four days.

10. Design Life - A period of years, e.g., 10, 15, or 20, selected by the designer, for which he expects a pavement to remain serviceable before requiring strengthening or reconstruction.

11. Design Traffic - The estimated number of equivalent 8200 kN single axles which will be carried by the lane during the design life of the pavement.

12. Equivalent 8200 kN Axle - The 'standard axle load' to which all heavy vehicle axles are equated in order to estimate design traffic.

13. Heavy Vehicle - This is defined as any vehicle with a net mass exceeding 2300 Kg. Such vehicle are required by law to carry reflective rear chevron markings and have been analyzed to determine axle equivalences for design purposes.

References

- 1. John Burrow & Partners Zambia, Kafue-Lusaka Road Project Feasibility Study/Cost Analysis Final Report, August 1989.

- 2. Kennedy, C.K. and Lister, N.W., "Prediction of Pavement Performance and the Design of Overlays," TRRL Laboratory Report 833, Crowthorne, 1978.

- 3. (a) Kampsax/CarlBro, "Rehabilitation of Trunk Roads", Final Design Report, January 1988.

  (b) Kampsax/CarlBro, "Investigations and documentation study for initiating rehabilitation of four major roads in Zambia", Final Economic Report, November 1988.

  (c) Appendix A: Pavement Strength and Condition

  (d) Appendix B - 1 : Traffic Surveys
  Appendix B - 2 : Population
  Appendix B - 3 : The Zambian Economy
  Appendix B - 4 : Unit Construction and Maintenance Costs
  Appendix B - 5 : The HDM III Model

  (e) Appendix C : Summary of Economic Evaluation

- 4. Lusaka Kafue Road Project (Lusaka-Chilanga Section), Pavement Data Collection Study - Final Report, John Burrow & Partners Zambia, June 1989.

- 5. McMullen, D., Snaith, M.S. and Burrow, J.C., "Back analysis techniques for pavement condition", Proc. International Conference on Bearing Capacity of Roads and Airfields, Plymouth 1986.

- 6. Powell, W.D., Potter, J.F., Mayhew, H.C. and Nunn, M.E., "The structural design of bituminous roads," TRRL Laboratory Report 1132, Crowthorne, 1984.

- 7. Heukelom, W. and Klamp, A.J.G., "Dynamic testing as a means of controlling pavements during and after construction," Proc. International Conference on the Structural Design of Asphalt Pavements, Ann Arbor, Michigan, 1962.

- 8. "A guide to the Structural design of bitumen-surfaced roads in tropical and sub-tropical countries," Road Note 31, Third Edition, HMSO 1977.

- 9. "Structural Design of Interurban and Rural Road Pavements," Draft TRH4, NITRR, 1980.

145

Table 4

Kafue-Lusaka Road Rehabilitation Program (Phase I)

		Total Length (km)
0.0 km - 3.9 km	Reconstruct	*
3.9 km - 5.8 km	Reconstruct	1.9
5.8 km - 6.7 km	Overlay and Seal	.9
6.7 km - 7.1 km	Reconstruct	.4
7.1 km - 7.5 km	Overlay and Seal	.4
7.5 km - 7.8 km	Reconstruct	.3
7.8 km - 8.8 km	Overlay and Seal	1.0
8.8 km - 9.1 km	Reconstruct	.3
9.1 km - 10.1 km	Overlay and Seal	1.0
10.1 km - 10.8 km	Reconstruct	.7
10.8 km - 12.1 km	Overlay and Seal	1.3
12.1 km - 12.7 km	Reconstruct	.6
12.7 km - 13.3 km	Overlay and Seal	.6
13.3 km - 13.6 km	Reconstruct	.3
13.6 km - 14.6 km	Overlay and Seal	1.0
14.6 km - 14.8 km	Reconstruct	.2
14.8 km - 15.1 km	Overlay and Seal	.3
15.1 km - 15.2 km	Reconstruct	.1
15.2 km - 15.3 km	Overlay and Seal	.1
15.3 km - 15.5 km	Reconstruct	.2
15.5 km - 16.8 km	Overlay and Seal	1.3
16.8 km - 17.3 km	Reconstruct	.5
17.3 km - 18.1 km	Overlay and Seal	.8
18.1 km - 18.5 km	Reconstruct	.4
18.5 km - 21.5 km	Overlay and Seal	3.0
21.5 km - 22.1 km	Reconstruct	.6
22.1 km - 22.3 km	Overlay and Seal	.2
22.3 km - 22.5 km	Reconstruct	.2
22.5 km - 24.8 km	Overlay and Seal	2.3
24.8 km - 25.0 km	Reconstruct	.2
25.0 km - 25.3 km	Overlay and Seal	.3
25.3 km - 25.5 km	Reconstruct	.2
25.5 km - 26.5 km	Overlay and Seal	1.0
26.5 km - 27.0 km	Reconstruct	.5
27.0 km - 31.7 km	Overlay and Seal	4.7
31.7 km - 32.3 km	Reconstruct	.6
32.3 km - 35.45km	Patch and Seal	3.15
35.45km - 35.65km	Reconstruct	.2
35.65km - 39.4 km	Patch and Seal	3.75
39.4 km - 39.6 km	Reconstruct	.2
39.6 km - 42.4 km	Patch and Seal	2.8
42.4 km - 42.6 km	Reconstruct	.2
42.6 km - 44.05km	Overlay and Seal	1.45
44.05km - 44.5 km	Reconstruct	.45
44.5 km - 49.5 km	Overlay and Seal	5.0
49.5 km - 49.7 km	Reconstruct	.2
49.7 km - 50.0 km	Overlay and Seal	.3
50.0 km - 50.2 km	Reconstruct	.2
50.2 km - 51.95km	Overlay and Seal	1.75
51.95km - 52.15km	Reconstruct	.2
52.15km - 53.3 km	Overlay and Seal	1.15

Total (Reconstruct) = 9.85
Total (Overlay and Seal) =29.85
Total (Patch and Seal) = 9.7
49.4

* Not part of the project

Table 1(A)

Lusaka-Kafue Road - Condition of Drainage

CHAINAGE	DIAMETER OR SIZE	TYPE	HEAD WALLS L	HEAD WALLS R	WING WALLS L	WING WALLS R	TO BE REPLACED	SCOUR PROTECTION REQUIRED	COMMENTS
1.32	1 x 300	CONCRETE PIPE	BRICK	BRICK	NIL	NIL	NO	SMALL	LIMITED COVER BUT APPARENTLY IN REASONABLE CONDITION
2.4	1 x 600	CONCRETE PIPE	BRICK	BRICK	BRICK	BRICK	NO	NO	CONCRETE CHANNEL AT INLET AND OUTLET
4.55	1 x 800	STEEL PIPE	NIL	NIL	NIL	NIL	NO	YES	SOFFIT AT ROAD LEVEL
4.75	1 x 900	STEEL PIPE	NIL	BRICK	NIL	NIL	NO	YES	SOFFIT ABOUT 150MM BELOW ROAD LEVEL
5.45	600 x 600	CONCRETE BASE	CONCRETE	CONCRETE	NIL	NIL	YES	YES	CULVERT EQUALISING AND ALMOST SILTED UP
10.3	3 x 600	CONCRETE PIPES	CONCRETE	CONCRETE	NIL	NIL	NO	YES	OUTLET BLOCKED BY TRACTOR TRAFFIC CAUSING SWAMP AREA ON BOTH SIDES
12.5	3 x 900	CONCRETE PIPE	BRICK	BRICK	NIL	NIL	YES	YES	CULVERT TO BE LIFTED, ROAD TO BE RAISED OR MOVED
12.52	3 x 600	CONCRETE PIPE	CONCRETE	CONCRETE	NIL	NIL	NO	YES	APPEAR TO BE SUBSTITUTED BY 12.50
13.46	1 x 600	CONCRETE PIPE	MASONRY	MASONRY	NIL	NIL	YES	YES	ROAD TO BE RAISED
13.5	1 x 600	CONCRETE PIPE	MASONRY	MASONRY	NIL	NIL	YES	YES	ROAD TO BE RAISED
13.89	1 x 600	CONCRETE PIPE	CONCRETE	NIL	NIL	NIL	YES	YES	TO BE ABANDONED
13.9	1 x 600	CONCRETE PIPE	NIL	CONCRETE	NIL	NIL	YES	YES	ABOUT 60% SILTED
14.7	1 x 600	CONCRETE PIPE	CONCRETE	CONCRETE	NIL	NIL	YES	YES	CULVERT NEEDS TO BE RAISED BY 600 MM
15.09	2.7mx4.3m	CONCRETE BRIDGE	CONCRETE	CONCRETE	YES	YES	NO	NO	ROAD BRIDGE
15.4	1 x 600	CONCRETE PIPE	MASONRY	MASONRY	NIL	NIL	YES	YES	RAISE CULVERT BY 500MM

Source: Reference 1

Table 1(B)

Lusaka-Kafue Road - Condition of Existing Drainage

15.9	2 x 1.8m	CONCRETE ARCH	CONCRETE	CONCRETE	CONCRETE	CONCRETE	NO	YES	MASS CONCRETE ARCH 1.8M DIA ON 750 UP STAND
16.2	1 x 450	CONCRETE PIPE	CONCRETE	CONCRETE	NIL	NIL	YES	YES	TO BE LOWERED BY 300MM
16.5	1 x 450	CONCRETE PIPE	CONCRETE	CONCRETE	NIL	NIL	YES	YES	50 MM FRESH WATER PIPE PASSES DIRECT
17.2	2 x 1900	AMCO CONCRETE	CONCRETE	CONCRETE	YES	YES	YES	YES	WING WALLS NOT LONG ENOUGH. CULVERT NEEDS RAISING
17.6	1 x 600	CONCRETE PIPE	CONCRETE	CONCRETE	NIL	NIL	NO	NO	INTAKE PIPE 900MM DIA 3M DEEP PROVIDED ON LEFT SIDE
17.9	1 x 600	CONCRETE	CONC	CONC	NIL	NIL	NO	YES	SILTED SLIGHTLY @ RHS - SCOUR PROTECTION
18.2	1 x 1100	AMCO CONCRETE	CONCRETE	CONCRETE	NIL	NIL	NO	YES	ADEQUATE
18.7	1 x 600	CONCRETE PIPE	MASONRY	MASONRY	NIL	NIL	NO	YES	DRAIN TO BE SCOUR PROTECTED ON LHS
19.1	1 x 600	CONCRETE PIPE	MASONRE	MASONRY	NIL	NIL	NO	YES	RAISED ADEQUATELY
19.2	1 x 450	CONCRETE PIPE	MASONRY	MASONRY	NIL	NIL	NO	YES	DRAINS INTO PROPER FURROW
19.45	2 x 600	CONCRETE PIPE	MASONRY	MASONRY	YES	NIL	NO	YES	NEEDS WING WALL ON RIGHT SIDE
20.1	1x1.7mx1.7m	CONCRETE ARCH	CONCRETE	CONCRETE	YES	YES	NO	YES	DRAINS FROM PROPER LINED CHANNEL ON RIGHT - SCOURED ON LEFT
20.3	1. x 600	CONCRETE PIPE	MASONRY	MASONRY	NIL	NIL	NO	YES	TO BE PROTECTED AGAINST SCOUR ON LEFT SIDE
20.32	1 x 600	CONCRETE PIPE	MASONRY	MASONRY	NIL	NIL	NO	YES	PROTECTION REQUIRED BOTH SIDES
20.41	1 x 600	CONCRETE PIPE	MASONRY	MASONRY	NIL	NIL	YES	YES	SILTED SLIGHTLY
20.51	1 x 1.7 x 1.7	CONCRETE ARCH	CONC	CONC	NIL	NIL	NO	YES	PROTECTION ON LHS

Source: Reference 1

Table 1(C)

Lusaka-Kafue Road - Condition of Existing Drainage

21.4	1 x 600	CONCRETE PIPE	NIL	NIL	NIL	NIL	YES	YES	PIPE EXPOSED AT ENDS NO CONCRETE
21.6	1 x 600	CONCRETE PIPE	MASON RY.	MASON RY	NIL	NIL	YES	YES	SILTED RIGHT AND LEFT ROAD TO BE RAISED
21.99	1 x 600	CONCRETE PIPE	MASON RY	MASON RY	NIL	NIL	YES	YES	SILTED RIGHT AND LEFT RAISE ROAD-NO OVER BURDEN
22.4	1 x 600	CONCRETE PIPE	MASON RY	MASON RY	NIL	NIL	YES	YES	SILTED LEFT AND RIGHT RAISE ROAD
22.6	1 x 600	CONCRETE PIPE	MASON RY	MASON RY	NIL	NIL	NO	YES	DRAINS PROPERLY
23.2	1 x 600	CONCRETE PIPE	MASON RY	MASON RY	NIL	NIL	YES	YES	SILTED RUNS OBLIQUE APPROX. 25M LONG
23.45	2 x 600	CONCRETE PIPE	MASON RY	MASON RY	NIL	NIL	NO	YES	SILTED ON RIGHT SIDE
23.7	2 x 600	CONCRETE PIPE	MASON RY	MASON RY	NIL	NIL	NO	YES	SILTED ON RIGHT SIDE
23.98	1 x 450	CONCRETE PIPE	MASON RY	MASON RY	NIL	NIL	YES	YES	SILTED ON RIGHT SIDE
24.5	1 x 600	CONCRETE PIPE	MASON RY	MASON RY	NIL	NIL	YES	YES	SILTED ON RIGHT SIDE
24.6	1 x 600	CONCRETE PIPE	MASON RY	MASON RY	NO		YES	NO	DRAINS WELL
24.9	2 x 600	CONCRETE PIPE	MASON RY	MASON RY	NIL	NIL	YES	NO	REQUIRES RAISING BY 250 MM ROAD IS LOW
25.4	1 x 600	CONCRETE PIPE	MASON RY	MASON RY	NIL	NIL	YES	NO	HEAVILY SILTED NEEDS RAISING - ROAD VERY LOW
26.4	1 x 450	CONCRETE PIPE	MASON RY	NIL	NIL	NIL	NO	NO	DRAINS PROPERLY
26.8	1 x 1700	CONCRETE ARCH	NIL	NIL	NIL	NIL	NO	NO	SILTATION ON RIGHT SIDE
28.2	1 x 600	CONCRETE PIPE	MASON RY	MASON RY	NIL	NIL	NO	YES	SILTATION ON RIGHT SIDE
28.75	1 x 600	CONCRETE PIPE	MASON RY	MASON RY	NIL	NIL	YES	YES	SILTED ON RIGHT SIDE

Source: Reference 1

Table 1(D)

Lusaka-Kafue Road - Condition of Existing Drainage

28.9	1 x 600	CONCRETE PIPE	MASONRY	MASONRY	NIL	NIL	YES	NO	SILTED ON RIGHT SIDE
29.85	1 x 600	CONCRETE PIPE	MASONRY	MASONRY	NIL	NIL	NO	NO	SILTED ON RIGHT SIDE
31.8	3 x 600	CONCRETE PIPE	NIL	MASONRY	NIL	NIL	YES	NO	BOTH SIDES SILTED ROAD LOW - LIFT ROAD
32.4	1 x 450	CONCRETE PIPE	MASONRY	MASONRY	NIL	NIL	YES	YES	BLOCKED COMPLETELY ON HILL
32.7	1 x 2.5m x 7.5m	CONCRETE BRIDGE	CONCRETE	CONCRETE	YES	YES	YES	YES	BRIDGE SILTED BOTTOM
34.7	1 x 2.5m x 1.75m	CONCRETE BRIDGE	CONCRETE	CONCRETE	YES	YES	NO	YES	FAIR CONDITION
35.25	1 x 1200	CONCRETE ARCH	NIL	NIL	NIL	NIL	YES	NO	SILTED ON BOTTOM
35.55	1 x 600	CONCRETE PIPE	MASONRY	MASONRY	NIL	NIL	YES	YES	FULLY SILTED CULVERT CAN BE RAISED BY 250MM
36.2	1 x 700	CONCRETE PIPE	CONCRETE	CONCRETE	NIL	NIL	NO	NO	RUNS OBLIQUE SILTED ON LEFT SIDE
36.55	1 x 3200	CONCRETE AMCO	CONCRETE	CONCRETE	NIL	NIL	NO	YES	UPSTREAM WING WALL NECESSARY, SILTED ON RIGHT SIDE
37	1 x 100	CONCRETE	CONCRETE	CONCRETE	NIL	NIL	YES	NO	HEAVILY SILTED
38.4	2 x 600	CONCRETE PIPE	MASONRY	MASONRY	NIL	NIL	YES	NO	SILTED, TO BE RAISED BY 300 MM
38.55	1 x 600	CONCRETE PIPE	MASONRY	MASONRY	NIL	NIL	YES	NO	FULLY SILTED
39.5	1 x 600	CONCRETE PIPE	MASONRY	CONCRETE	MASONRY	NIL	NO	YES	SILTED 300 M BELOW ROAD LEVEL - AREA LOW-LYING, LIFT ROAD
39.7	1 x 600	CONCRETE PIPE	CONCRETE	CONCRETE	NIL	NIL	YES	NO	SILTED BOTH SIDES
39.8	1 x 3500	CONCRETE ARMCO	MASONRY	NIL	MASONRY	MASONRY	NO	YES	WING WALLS TO BE IMPROVED

Source: Reference 1

Lusaka-Kafue Road - Condition of Existing Drainage

39.9	2 x 600	CONCRETE PIPES	CONCRETE	CONCRETE	NIL	NIL	YES	NO	FULLY SILTED - AREA FLAT
40.1	2 x 600	CONCRETE PIPE	CONCRETE	CONCRETE	NIL	NIL	YES	NO	FULLY SILTED 100 MM AC PIPES FOR SIGNAL CABLES LEVEL CROSSING
41.11	2 x 600	CONCRETE PIPE	CONCRETE	CONCRETE	NIL	NIL	YES	NO	FULLY SILTED - LEVEL CROSSING
40.12	2 x 600	CONCRETE PIPE	CONCRETE	CONCRETE	NIL	NIL	YES	NO	FULLY SILTED
40.8	1100 x 700	BOX CULVERT	CONCRETE	CONCRETE	YES	YES	NO	NO	IN GOOD CONDITION
41.1	1 x 600	CONCRETE PIPE	MASONRY	MASONRY	NIL	NIL	NO	NO	PARTLY SILTED
42.5	2 x 600	CONCRETE PIPE	BRICK	BRICK	NIL	NIL	YES	NO	FULLY SILTED, RAISE CULVERT - LIFT ROAD
42.9	2 x 600	CONCRETE PIPE	BRICK	BRICK	NIL	NIL	NO	NO	PARTLY SILTED
43.1	2 x 600	CONCRETE PIPE	CONC BLOCK	CONC BLOCK	NIL	NIL	NO	NO	PARTLY SILTED LEFT SIDE HEAD WALL BROKEN
43.12	1 x 600	CONCRETE PIPE	CONC	CONC	YES	YES	YES	NO	NEEDS RAISING SLIGHTLY
43.305	2 x 600	CONCRETE PIPE	CONC	CONC	NIL	NIL	YES	NO	SILTED - AREA LOW-LYING
43.31	2 x 600	CONCRETE PIPE	CONC	CONC	NIL	NIL	YES	NO	PARTLY SILTED
43.7	1 x 600	CONCRETE PIPE	CONC	CONC	NIL	NIL	NO	NO	PARTLY SILTED RIGHT WING WALL BROKEN
44.15	2 x 1.5 x 1	BOX CULVERTS	CONC	CONC	YES	YES	YES	NO	ONE COMPARTMENT FULLY SILTED OTHER PARTLY LIFT ROAD
44.25	2 x 600	CONCRETE PIPE	CONC	CONC	NIL	NIL	YES	NO	SILTED PARTLY - ROAD LOW LIFT ROAD
44.4	2 x 450	CONCRETE PIPE	CONC	CONC	NIL	NIL	YES	NO	FULLY SILTED NEEDS RAISING - LIFT ROAD

Source: Reference 1

Table 1(F)

Lusaka-Kafue Road - Condition of Existing Drainage

46.1	2 x 5.4 x 2	BOX CULVERT	CONC	CONC	YES	YES	NO	YES	WING WALL TO BE EXTENDED
47.98	2 x 600	CONCRETE PIPE	CONC	CONC	NIL	NIL	NO	YES	DRAINS PROPERLY - STONE PITCHED APRONS
48.4	1 x 2.5 x 2	BOX CULVERT	CONC	CONC	YES	YES	NO	YES	DRAINS PROPERLY - LARGE ENOUGH
48.9	2 x 600	CONCRETE PIPE	CONC	CONC	NIL	NIL	NO	YES	DRAINS PROPERLY
49.6	2 x 600	CONCRETE PIPE	CONC	CONC	NIL	NIL	YES	NO	FULLY SILTED - LIFT ROAD
49.8	1 x 600	CONCRETE	CONC	CONC	NIL	NIL	NO	NO	GOOD WORKING ORDER
50.12	2 x 600	CONCRETE	CONC	CONC	NIL	NIL	NO	YES	SCOUR PROTECTION ON RIGHT SIDE
50.4	2 x 600	CONCRETE	CONC	CONC	NIL	NIL	NO	YES	JUST REQUIRES CLEANING
50.88	1 x 600	CONCRETE	CONC	CONC	NIL	NIL	YES	YES	SILTED - LIFT ROAD
51.5	3.0m x 2.5m	BOX CULVERT	CONC	CONC	YES	YES	NO	NO	
52.05	1 x 600	CONCRETE	CONC	CONC	NIL	NIL	YES	YES	FULLY SILTED - LOW LIFT ROAD

Source: Reference 1

Table 2

Km	Cumulative standard axles to 1989	Sound		Critical		Failed	
		Mean	SD	Mean	SD	Mean	SD
0 - 3.9	27.4	39	8.4	50	9.6	38	3.5
3.9 - 15.1	14.8	69	24	63	18	62	22

Note: SD = Standard Deviation (Ref to section 10.4)
Mean = Mean Deflection

Cumulative traffic up to 1989

Condition	Cracking Index m/sq.m
Sound	0
Critical	1 2
Failed	3 4 5

Classification of pavement condition

	MODEL A			MODEL B			MODEL C		
	H (mm)	Mr (MN/m2)	V	H (mm)	Mr (MN/m2)	V	H (mm)	Mr (MN/m2)	V
Road base	155	varies	0.35	150	varies	0.35	110	varies	0.35
Sub-base	110	120	0.35	150	160	0.35	160	240	0.35
Subgrade	-	60	0.35	-	80	0.35	-	120	0.35
Subgrade CBR	8%			12%			20%		

Loading details: Contact pressure 590 kN/m2) Wheel load 31 kN
Radius of loaded area 130 mm)

Note: H = Layer thickness Mr = Resilient Modules V = Poisons Ratio

Details of Analytical Pavement Models

Source: Reference 1

Table 3

Derivation of Overlay Design Chart 8

	Layer		H (mm)	M (MN/m²)	U
Overlay		1	Varies	2500	0.35
Existing	Roadbase	2	150	Mr_2	0.35
	Sub-base	3	150	160	0.35
	Subgrade	4	-	80	0.35

Loading details $p = 590$ kN/m² $a = 130$ mm Wheel load 31 kN

$d_o = 60$ mm/100
$Mr_2 = 945$ MN/m²

Overlay (mm)	40	70	100	140
d_1 (mm/100)	51	44	39	33
N (msa)	6.7	9.9	13.8	21.6

$d_o = 80$ mm/100
$Mr_2 = 402$ MN/m²

Overlay (mm)	40	70	100	140
d_1 (mm/100)	65	54	46	38
N (msa)	3.5	5.7	8.8	14.8

$d_o = 100$ mm/100
$Mr_2 = 207$ MN/m²

Overlay (mm)	40	70	100	140
d_1 (mm/100)	80	64	53	43
N (msa)	2.0	3.6	6.0	10.6

$d_o = 120$ mm/100
$Mr_2 = 121$ MN/m²

Overlay (mm)	40	70	100	140
d_1 (mm/100)	97	73	59	46
N (msa)	1.2	2.5	4.5	8.8

d_o = deflection before overlay H = LAYER THICKNESS

d_1 = deflection after overlay M = RESILIENT MODULUS

Mr_2 = Resilient Modulus of Roadbase layer, deduced by Back Analysis V = POISSONS RATIO

Source: Reference 1

Table 4

Predicted overlay requirements based on 1989 deflection levels

km	1989 Design Deflection (mm/100)	Design CBR %	Overlay (mm)		
			10 yrs	15 yrs	20 yrs
5.8 - 6.7	83	20	80	110	130
7.1 - 7.5	93	8	110	150	180
7.8 - 8.8	90	8	110	150	180
9.1 - 10.1	61	12	40	80	120
10.8 - 12.1	70	12	60	100	130
12.7 - 13.3	94	20	90	120	140
13.6 - 14.1	104	20	100	130	150
14.1 - 14.6	91	20	100	130	160
14.8 - 15.1	91	20	100	130	160
15.2 - 15.3	113	20	90	110	130
15.5 - 16.8	113	20	90	110	130
17.3 - 18.1	122	20	100	120	140
18.5 - 21.5	124	20	100	120	140
22.1 - 22.3	132	8	120	150	170
22.5 - 23.6	132	8	120	150	170
23.6 - 24.8	83	8	60	100	130
25.0 - 25.3	83	8	60	100	130
25.5 - 26.5	83	8	60	100	130
27.0 - 27.6	165	8	R	R	R
27.6 - 28.2	101	8	90	120	150
28.2 - 31.7	83	8	60	100	130
32.3 - 35.45	54	20	P+S	P+S	40
35.65- 39.4	54	20	P+S	P+S	40
39.6 - 42.4	54	20	P+S	P+S	40
42.6 - 44.05	87	20	70	100	120
44.5 - 49.5	110	20	70	90	110
49.7 - 50.0	110	20	70	90	110
50.2 - 51.95	110	20	70	90	110
52.15- 53.3	110	20	70	90	110

Design traffic (10 years / 15 years /20 years)

km 0 - 3.9	:	12.3/19.7/28.0 msa
3.9 - 15.1	:	06.6/10.6/15.1 msa
15.1 - 43.9	:	04.1/06.6/09.3 msa
43.9 - 53.3	:	03.3/05.3/07.6 msa

Note: R = Reconstruct P+S = Patch and Seal

Source: Reference 1

Table 5

Predicted overlay requirements based on 1991 deflection levels
(used for project road)

km	1991 Design Deflection (mm/100)	Design CBR %	Overlays (mm) 10 yrs
5.8 - 6.7	95	20	90
7.1 - 7.5	106	8	R
7.8 - 8.8	103	8	R
9.1 10.1	70	12	70
10.8 12.1	80	12	80
12.7 13.3	107	20	R
13.6 14.1	119	20	R
14.1 - 14.6	104	20	100
14.8 - 15.1	104	20	100
15.2 - 15.3	129	20	100
15.5 16.8	129	20	100
17.3 18.1	139	20	R
18.5 21.5	141	20	R
22.1 - 22.3	150	8	R
22.5 23.6	150	8	R
23.6 24.8	100	8	90
25.0 25.3	100	8	90
25.5 26.5	100	8	90
27.0 - 27.6	200	8	R
27.6 - 28.2	122	8	110
28.2 - 31.7	100	8	90
32.3 - 35.45	59	20	P+S
35.65- 39.4	59	20	P+S
39.6 - 42.4	59	20	P+S
42.6 - 44.05	95	20	70
44.5 - 49.5	176	20	R
49.7 - 50.0	176	20	R
50.2 51.95	176	20	R
52.15 53.3	176	20	R

Design traffic (10 years)

km 0 - 3.9	:	12.3 msa
3.9 - 15.1	:	6.6 msa
15.1 - 43.9	:	4.1 msa
43.9 - 53.3	:	3.3 msa

Note: R = Reconstruct when overlay exceeds 120 mm
P+S = Patch and Seal

Source: Reference 1

Table 6

Estimation of Cumulative Standard Axles (Lusaka Bound)

km	Section km - km	No. Standard axles 1989		cumulative million standard axles after		
		12 hr day	24 hr day	10 yrs	15 yrs	20 yrs
1.0	0 - 3.9	2402	3003	12.3	19.7	28.0
7.0	3.9 - 15.1	1298	1623	6.6	10.6	15.1
41.0	15.1 - 43.9	802	1002	4.1	6.6	9.3
53.0	43.9 - 53.3	650	813	3.3	5.3	7.6

Note: 24 hr day = 12 hr day x 1.25 (Standard axle count)

Estimation of the total daily flow in the design year

km	Section km - km	All vehicles (2-way flow, 1989)					
		12 hour counted	12 hour average daily calculated	24 hour Average daily	24 hr flow after		
					10 yrs	15 yrs	20 yrs
1.0	0 - 3.9	14486	13228	16535	21200	24000	27100
7.0	3.9 - 15.1	4297	3852	4815	6200	7000	7900
41.0	15.3 - 43.9	-	1524	1905	2440	2760	3120
53.0	43.9 - 53.3	-	911	1139	1460	1650	1870

Note: 12 hour average calculated as discussed in section 4.5.2 in service indicated below.

Source: Reference 1

Table 7

Estimation of the number of standard axles (SA)/12 hr day
(one way towards Lusaka)

Location (Date)	Traffic Group	No of Commercial Vehicles in average 12 hr day	Standard Axles per Vehicle	SA/12 hr day	Total SA/12 hr day
km 1.0 Mon 29-5-89	2-3 Axle Rigid	662	1.5	993	
	2-3 Axle + Trailer	115	7.0	805	
	Articulated	44	8.5	374	
	Buses	191	1.2	230	2402
km 7.0 Tue 30-4-89	2-3 Axle Rigid	228	1.5	342	
	2-3 Axle + Trailer	26	7.0	182	
	Articulated	82	8.5	697	1298
	Buses	64	1.2	77	
km 10.0 Wed 31-5-89	2-3 Axle Rigid	250	1.5	375	
	2-3 Axle + Trailer	28	7.0	196	
	Articulated	66	8.5	561	1197
	Buses	54	1.2	65	
km 41.0 (Dec 1988)	Single Unit	123	1.5	185	782 (1988)
	Trailer/Semi trailer	71	7.8	554	802 (1989)
	Buses	36	1.2	43	
km 53,0 (April 1989)	Single unit	87	1.5	131	
	Trailer/Semi-trailer	65	7.8	507	650
	Buses	10	1.2	12	

Source: Reference 1

Table 8

Roughness Survey Results

km	Southbound BIv inches/km	Southbound BI mm/km	Northbound BIv inches/km	Northbound BI mm/km	Average BI mm/km
0-1	52	2131	56	2239	2185
1-2	53	2158	60	2345	2252
2-3	61	2371	59	2319	2345
3-4	63	2423	69	2575	2499
4-5	55	2212	60	2345	2279
5-6	38	1727	62	2397	2075
6-7	28	1407	38	1727	1571
7-8	34	1603	37	1696	1650
8-9	21	1161	46	1963	1587
9-10	25	1304	37	1696	1507
10-11	44	1905	59	2319	2117
11-12	24	1269	30	1474	1373
12-13	39	1757	49	2047	1905
13-14	25	1304	57	2266	1817
14-15	82	2891	99	3280	3088
15-16	34	1603	38	1727	1665
16-17	41	1817	40	1787	1802
17-18	87	3008	77	2772	2891
18-19	106	3434	111	3541	3488
19-20	36	1665	75	2723	2226
20-21	43	1876	72	2650	2279
21-22	66	2500	88	3031	2772
22-23	60	2345	82	2891	2625
23-24	44	1905	65	2474	2199
24-25	45	1934	64	2449	2199
25-26	36	1665	62	2397	2047
26-27	55	2212	71	2625	2423
27-28	58	2292	78	2796	2550
28-29	47	1991	57	2266	2131
29-30	55	2212	87	3008	2625
30-31	53	2158	67	2525	2345
31-32	59	2319	75	2723	2525
32-33	53	2158	69	2575	2371
33-34	42	1847	47	1991	1919
34-35	48	2019	50	2075	2047
35-36	50	2075	51	2103	2089
36-37	44	1905	57	2266	2089
37-38	42	1817	56	2239	2047
38-39	47	1991	51	2103	2047
39-40	41	1817	32	1539	1681
40-41	71	2625	79	2820	2723
41-42	44	1905	50	2075	1991
42-43	60	2345	62	2397	2371
43-44	58	2292	69	2575	2436
44-45	50	2075	60	2345	2212
45-46	38	1727	37	1696	1712
46-47	43	1876	53	2158	2019
47-48	41	1817	54	2185	2005
48-49	64	2449	71	2625	2538
49-50	78	2796	76	2747	2772
50-51	71	2625	66	2500	2563
51-52	47	1991	55	2212	2103
52-53	57	2266	52	2131	2199
53-53.3	67	2525	83	2915	2723

Source: Reference 1

Table 9

Project Cost Estimate (2)*

1.	Preliminaries	2,893,950
2.	Accommodation of traffic	1,191,050
3.	Borrow pits	384,800
4.	Site Clearance	583,000
5.	Earthworks	1,091,800
6.	Shoulders to Existing Pavement	406,000
7.	Existing Pavement Preparation	404,900
8.	Sub-base and base	2,936,200
9.	Dense Bituminous Macadam Base	2,382,900
10.	Surface Treatment/Crack Sealing	2,155,000
11.	Pavement Repair Work	206,700
12.	Drainage Improvement	1,256,400
13.	Miscellaneous Items	373,100
	(A) Subtotal	16,265,800
	(B) Detailed Design	350,000
	(C) Construction Supervision	1,100,000
	(D) Total (A)+(B)+(C)	17,715,800
	Contingency 15% of (D)	2,657,400
	Total Construction Cost	20,373,200
	Rounded to	20,500,000

*Note: Based on construction occuring during 1992 and 1993, all line items shown on Project Cost Estimate (1) were increased by 6% to take into account the 1 year delay in construction. The detailed design/construction supervision shown in Cost Estimate (1) was broken down to separate line items in the Cost Estimate. Since the $1,600,000 included a 10% contingency in Estimate (1), this amount was readjusted to $1,450,000 (less 10% for contingency) in Cost Estimate (2).

ECONOMIC ANALYSIS

1. Introduction

1.1 General Background and Priority Context

Because a number of routes to the main SADCC ports are not fully operational, SADCC has, through its transport sector planning institution, SATCC, started the task of preparing a comprehensive development plan for all the region's Port Transport System corridors. The Kafue-Lusaka Road is an integral part of the road section included in the Beira Port Transport System 10-Year Development Plan and has been a priority project in the SATCC program since 1981. It is used for imports and exports of Zaire, Zambia, Zimbabwe and Malawi.

The SATCC Program of Action is premised on SADCC's objectives of reducing economic dependence of member states, enhancing genuine equitable regional integration, and ensuring consistency with national development objectives. This has necessitated the requirement that all identified transport projects have a regional characteristic to be endorsed by SATCC. In keeping with the objectives of SADCC, AID has formulated a program that focuses on this crucial sector of transport. The strategic objective as enunciated in the RDSS is to "install capacity and improve efficiency in infrastructure that serves regional cooperation, provides access to regional and external markets and fosters economic growth."

SATCC has specifically identified the Harare-Lusaka corridor as an essential surface transportation link between Zimbabwe and Zambia that would facilitate the exchange of food and commercial consumer goods between the two nations and with other countries both inside and outside the region. So far, AID has financed (i) reconstruction, resealing and reshouldering of the 62 kilometers on the Zimbabwe side (Makuti-Chirundu), through a US$4.2 million concessional loan to the Government of Zimbabwe, and (ii) rehabilitation of 82 kilometers on the Zambia side (Chirundu-Kafue) through a US$13.1 million loan and US$990,000 grant to the Government of Zambia. The Kafue-Lusaka Road is the final link on the Harare-Chirundu-Kafue-Lusaka Road Corridor.

Of the six options considered in the Kafue-Lusaka Road Project Feasibility Study, the 10-year design life rehabilitation option was favored on the basis of both cost and returns on investment criteria. The project inputs include an A.I.D. grant of US$22.84 million and a host government contribution of ZK122.56 million. The 10-year design option chosen covers widening of the road to class 1A and 1B standard (as appropriate) and strengthening to accommodate the 10-year design traffic with 90 mm overlays for the Makeni-Chilanga section and 80 mm overlays for the Chilanga-Kafue section.

2. Project Context

2.1 Transport Constraint to the Import and Export Sector

As shown below, the project route contributes significantly to the alleviation of the transport constraint on the import and export sector, in terms of availability, distance and cost.

2.1.1 Route Availability

i) Rail

- Dar-es-Salaam Route: From Lusaka and the Copperbelt to Kapiri Mposhi by Zambia Railways, then via Mpika, Kasama and Tunduma to Dar-es-Salaam in Tanzania by TAZARA. (Although this route is the most important route for Zambia to the sea, Zambia does not totally rely on this route because of inefficient port operations at Dar-es-Salaam and capacity problems on the TAZARA railway line.)

- Southern Route: From Lusaka to Livingstone, thence Beira and Maputo in Mozambique and South African ports via Botswana or via Beit Bridge. (The Maputo route is currently not fully operational because of insurgency problems.)

- Western Route: From Lusaka via Ndola to Lubumbashi (Zaire) and then through the Benguela railway (in Angola) to the port of Lobito. (Access to Lobito has been closed since 1975).

ii) Road

- Dar-es-Salaam Route: From Lusaka to Dar-es-Salaam via TANZAM Highway, which for most of the way runs parallel with TAZARA. (This road is tarred throughout but is in need of rehabilitation).

- Eastern Route: From Lusaka to Katete, thence either via Chipata to Mchinji and Malawi Railways to Nacala (Mozambique), or via Moatize (Mozambique) and the railway line to Beira. (The link to Nacala is only occasionally open for up to one train per week. The link to Beira is currently inaccessible because of insurgency problems.)

- Southern Route: From Lusaka to Livingstone, thence to Victoria Falls and on to Mozambique and South Africa, or to Kazungula Ferry and South Africa. (This route, which the project road is part of, is fully operational).

- South Eastern Route: From Lusaka to Harare or the railhead at Lion's Den Northwest of Harare for Beira, and South African ports. (This route, which the project road is part of, and which caters to substantial levels of import and export traffic between Zambia and Zimbabwe, is fully operational.)

2.1.2 Route Distances.

As shown by Table 1 below, the Kafue-Lusaka road is the shortest route to a port from Lusaka:

TABLE 1 : Distances to Ports (Km)

	Lusaka
Rail to Dar-es-Salaam	2,045
Road to Dar-es-Salaam	2,020
Road to Mchingi, thence rail to Nacala	1,705
Rail to Maputo	2,020
Rail to Beira	2,020
Road to Lion's Den, thence rail to Beira	1,115*
Rail to Durban via Botswana	2,751
Rail to Lobito	2,715

Source: Zambia Dry Port Study, 1989.

* Shortest route incorporating the project road.

2.1.3 Cost

A 1983 SATCC study compared user charges of various routes for some major commodities (see Table 2 below). This can be assumed to offer a valid comparative picture despite the change of tariffs and devaluation of the Kwacha since then.

TABLE 2: User Charges per ton to or from Ports
(Zambia Kwacha at 1982 prices)

	Dar-es-Salaam		Nacala	Maputo	Beira*		Durban
	Rail	Road	Rail + Road	Rail	Road	Rail/Road	Rail
Exports							
Copper (Kitwe)	75**	130	210	130	130	125	145
Lead (Kabwe)	60**	115	125	90	105	90	130
Mixed General Cargo							
Container 15t (Lusaka)	205	270	275	185	185	180**	310
General Cargo (Lusaka)	195**	290	325	240	240	210	310
Imports							
Wheat (Lusaka)	105	145	160	85	90	70**	120
Fertilizer (Kafue)	105	160	155	90	90	70**	125
Machinery (Kitwe)	340**	405	510	410	420	395	520
Mixed General Cargo:							
Container 15t (Lusaka)	380	480	450	365	360	440	485

Source: SATCC Technical Unit, July 1983

* Project road forms part of both the road and rail/road links on the Beira corridor.

** Lowest cost alternative

The Dar-es-Salaam and Beira rail/road corridors are the cheapest routes, with the Beira rail/road corridor providing the lowest cost alternative for containerized general cargo exports and wheat and fertilizer imports.

2.2 Investment Scope

2.2.1 Conceptual Framework for Project Analysis

The Kafue-Chirundu road project goal was to enhance the economic development of southern Africa by facilitating the movement of key commodities (food grains and commercial goods) between Zambia and Zimbabwe, and with neighboring countries. As shown in Table 1 the road is on a least cost alternative corridor for containerized general cargo exports and wheat and fertilizer imports. In this (Kafue-Lusaka road), the goal and purpose of the Kafue-Chirundu road project are retained i.e. "to support the development of a stronger economic foundation for growth in Southern Africa", by strengthening and expanding the capacity and operational efficiency of the road system between Lusaka (Zambia) and Harare (Zimbabwe).

The implication for project analysis is that the benefit stream accruing to proposed project activities is inextricably bound to those previous rehabilitation projects, since this 49 km segment forms the final road link connecting Lusaka with import, export and transit corridors to the south. In addition, the project economic analysis for Kafue-Chirundu, in which internal rates of return ranged from 13% to 24% (reflecting measurable direct benefits of vehicle operating costs and road maintenance cost savings), assumed that work would proceed on the Kafue-Lusaka leg. There are indications that, since the earlier project IRR was calculated, the benefits have not decreased. However, the Kafue-Lusaka road portion has already come to the end of its economic life and if allowed to deteriorate any further, the cost of restoration would be so high that it would inevitably eliminate anticipated benefits from the previous investment on the Kafue-Chirundu road. This is, in effect, tantamount to disinvestment, as a result of the fact that since the project road lies on the same stretch as the Kafue-Chirundu road, vehicle operating cost savings estimated on the Kafue-Chirundu road project would inevitably be reduced because traffic projected in the economic analysis of the Kafue-Chirundu project paper would not materialize.

In order to determine the optimal road standard for the section between Kafue and Chilanga, the consultants did the economic analysis in two phases. First, six options were compared on the basis of net present value of total system cost applicable to each option (see section 3.3 for description of options). For purposes of the comparative analysis, total system cost includes road construction, maintenance and vehicle operating costs. (The original consultants' project cost estimates did not include Technical Assistance, Evaluation and Project Management - these were later included in an updated economic analysis done by USAID.) On the basis of identified least cost options, the question of rehabilitation versus periodic maintenance was analyzed in terms of cost savings and budgeting implications. Second, a comparison was made of each of the three rehabilitation options with the "do minimum" (minimal maintenance) option, in order to identify the preferred rehabilitation option.

2.2.2 Demand Analysis

(a) Regional Demand Setting

In June 1989, Coopers and Lybrand Associates were commissioned by USAID/Zambia to undertake an analysis of cross-border traffic movements at Chirundu, Kazungula and Victoria Falls for the year 1988. This was intended inter alia to provide insights on the regional usage of the Kafue-Lusaka road. Analysis was based on a sample count of approximately 30% of representative months' Bills of Entry; (see Attachment 1-3 to this Annex for detailed analysis). In 1988, about 350,000 tons of regional traffic used the three border posts, through the project road. The distribution of the cargo traffic using the project route was roughly 15% exports, 35% imports and 50% transit. Exports, 80% of which went through Chirundu included copper and industrial goods and were mostly destined for overseas (copper), Zimbabwe, R.S.A. and Botswana. Chirundu also handles over 50% of imports comprising agricultural inputs, industrial goods and cereals, and were mostly from Zimbabwe, R.S.A., Swaziland, Botswana and overseas. Transit traffic (mainly petroleum products and industrial goods) mainly originated or was destined to Zimbabwe, Zaire, Mozambique and Malawi.

From the analysis of the regional trade flows, the road plays a major role in promoting intra-regional trade, since it connects with all major international road and rail links leading into and out of the country.

(b) Existing Traffic on Project Road

Base 1989 traffic flows used in the John Burrow consultants report were based on Roads Department traffic surveys and supplementary consultants' counts. The base 1989 traffic flows were then established as follows:

Km Peg	Road Section	Unadjusted 2-Way 12-Hour Average Daily Traffic	Adjusted 2-Way 24-Hour Average Daily Traffic
3.9 -15.1	Makeni - Chilanga	3852	4815
15.1-43.9	Chilanga-Kafue Town	1524	1905
43.9-53.3	Kafue Town-Kafue Bridge	911	1139

* The 12-hour counts were adjusted to 24-hour counts, using a factor of 1.25 from the Carlbro/Kampsax study of Zambian roads.

Vehicle composition is estimated in the counts as follows:

Light vehicles	55%
4-wheel drive and minibus	14%
Medium truck	16%
Heavy truck	2%
Articulated trucks	8%
Buses	5%
	100%

(c) Traffic Growth Trend

Partly due to the poor performance of the Zambian economy, the political problems in Zimbabwe and diversion of traffic to TAZARA, traffic on the project road, has remained static. (See Table 3 below.)

TABLE 3 : UNADJUSTED 2-WAY 12-HOUR TRAFFIC GROWTH AT TRAFFIC COUNT STATION ON KAFUE TOWN-KAFUE BRIDGE SECTION (1983-1989)

Year	Light Vehicles	Buses	Single Trucks*	Articulated Trucks	Total
1983	554	27	295	57	933
1984	756	28	279	59	1122
1985	595	23	276	66	960
1986	635	38	282	60	1015
1987	507	29	159	100	795
1988	796	13	243	161	1203
1989**	632	19	173	129	911

Source: Roads Department

* Assumed to include all commercial vehicles other than single unit trucks and buses

**Not assessed as part of the annual traffic census.

As shown in the table 4 below, while total truck traffic as a percentage of total traffic has remained static, articulated truck traffic has increased at the expense of single unit truck traffic. This has been attributed to the modernization of the country's truck fleet, mostly biased on articulated trucks. In addition, the reopening of the Beira corridor and the diversion of goods traffic from the congested TAZARA line has meant that goods are increasingly being carried on the road by articulated trucks.

TABLE 4 : TRUCK TRAFFIC AS A PERCENTAGE OF TOTAL TRAFFIC AT KAFUE WEIGHBRIDGE (1983-1989)

Year	Single Unit Truck Traffic as % of Total Traffic	Articulated Truck Traffic as % of Total Traffic	Total Truck Traffic as % of Total Traffic
1983	31.6	6.1	37.7
1984	24.9	5.3	30.2
1985	28.8	6.9	35.7
1986	27.8	5.9	33.7
1987	20.0	12.7	32.7
1988	20.2	13.4	33.6
1989	19.0	14.2	33.2

Source: Roads Department

d) Future traffic growth on project road

Articulated truck traffic, with the highest pavement damaging factor, has been increasing over the five years (1983-1989) by about 15% (see Table 3). This traffic was therefore used by the consultant as the basis of determining future growth rate for all traffic on the project road, as follows:

Annual Traffic Growth Rate = a x b x 100
Where a = Percentage of articulated truck traffic as a component of the whole traffic (0.142)
Where b = The growth rate of this component of traffic (0.15)

Although this yields a traffic growth rate of 2.1% (0.142 x 0.15), the figure was rounded up by the consultant to 2.5% to accommodate potential increase of corridor usage due to the local growth impact (e.g., Kafue developing as a national fertilizer distribution center) and regional economic and political developments (e.g., congestion of the Dar-es-Salaam corridor and political stability in Mozambique). This 2.5% growth factor has been used on the current traffic levels determined by traffic counts and data from the Roads Department. This in turn was used by HDM III to enable selection between pavement construction alternatives. (See Project Analysis below.)

3. Project Analysis

3.1 Evaluation Model - The World Bank HDM III

The World Bank Highway Design and Maintenance Standards Model (HDM III) is a multiple link-alternative model which is capable of analyzing several road links in one run - a link being a length of road carrying uniform traffic loading. The model reflects empirical research on statistically validated physical and economic relationships underlying road deterioration.

While the model is ideally suitable for analyzing transport costs for a network of roads, its prime function as an investment appraisal model is to calculate the components of the transport costs in each year of an analysis period and conduct an economic comparison of different construction alternatives. These costs are then discounted at determined rates for the whole economic life to enable calculation of net present value and IRR.

3.2 Model Inputs and Assumptions

On the basis of existing road surveys and data obtained from Roads Department and Suppliers in Lusaka, the HDM III output was based on the following consultants' assumptions:

(i) Traffic
Traffic would increase by 2.5% due to normal local economic growth and regional economic and political developments, but there would be no additional traffic arising from improvements to the road.

(ii) Financial Costs
In the original HMD III calculations the official exchange rate of US$1 = K10 was used as it was the applicable rate at the time of the study. Since the least cost analysis was undertaken in Kwacha, the absolute value of the total costs would obviously be affected by fluctuations in the exchange rate. Fortunately, this does not invalidate the comparative base of determining the least cost option.

(iii) Economic Costs (shadow pricing)
Given a parallel market rate of about US$1 = K60 at the time of the consultants' analysis, and project components reflecting an estimated cost composition ratio of 80% foreign and 20% local, a weighted shadow exchange rate of US$1 = K50 (0.20 x 10 + 0.80 + 60) was considered reasonable though conservative. The economic costings exclude tax and duty elements but no adjustments were made for opportunity cost of labor or the effect of government subsidies other than through exchange rate valuation.

The average shadow rate used in the evaluation is not significantly affected by the devaluation of the kwacha to US$1 = K40 which occured in March 1990, because the parallel market rate did not change. It still stands at US$ 1 = K60. Since the local cost element in the total cost is only 20% of total cost, the devaluation has only a marginal effect on the weighted shadow rate of US$1 = K50. Therefore, the economic analysis on the Kafue-Lusaka road performed prior to the devaluation is still valid.

3.3 Evaluation Parameters

The two sections Kafue-Chilanga and Chilanga-Kafue were evaluated separately on the basis of two one-kilometer sample homogeneous lengths representing conditions before and after improvements. The following six options were considered for the analysis:

Option 1: Minimum-intervention - existing road and existing condition plus routine maintenance plus 100% pothole patching.

Option 2: Periodic Maintenance Option A - existing road and existing condition plus routine maintenance plus 100% pothole patching plus surface dressing whenever wide cracking exceeds 15% of pavement area.

Option 3: Periodic Maintenance B - existing road and existing condition plus routine maintenance plus 100% pothole patching plus surface dressing whenever wide cracking exceeds 15% of pavement area plus 50 mm overlay whenever roughness exceeds 2500 mm/km.

Option 4: 10 Year Design Option - road widened to class 1A and 1B standard (as appropriate) and strengthened to accommodate the 10-year design traffic with 90 mm overlays for the Makeni-Chilanga section and 80 mm overlays for the Chilanga-Kafue section and 50 mm thick overlays at 10 year intervals thereafter.

165

Option 5: 15 Year Design Option - as above but strengthened to accommodate the 15 year design traffic with 120 mm overlays for the Makeni-Chilanga sections and 110 mm overlays for the Chilanga-Kafue section and 50 mm thick overlays at 15 year intervals thereafter.

Option 6: 20 Year Design Option - as above but strengthened to accommodate the 20 year design traffic with 150 mm overlays for the Makeni-Chilanga section and 135 mm overlays for the Chilanga-Kafue section and 50 mm thick overlays at 20 year intervals thereafter.

3.4 Economic Evaluation

The above options were examined, using a 30 year economic analysis period, as below:

Table 5 : Average Annual Economic Road Costs (Million Zambia Kwacha) Per Year Per Kilometer for the Two Sections of Road

Option	Section A (Makeni - Chilanga) per Km	Section B (Chilanga - Kafue) per Km	Whole Road per Km
	Cost	Cost	Cost
1 (do minimum)	10.117	3.823	5.250
2 (periodic maintenance)	9.283	3.437	4.772*
3 (periodic maintenance)	8.557	3.060	4.316*
4 (rehabilitation 10 year design life)	8.783	3.287	4.543*
5 (rehabilitation 15 year design life)	8.840	3.327	4.587*
6 (rehabilitation 20 year design life)	8.893	3.370	4.632*

* Whole road economic costs, include technical assistance, project supervision and evaluation costs (see Tables 6, 7 and 8) estimated at ZK100 million (economic costs) for the whole road length (49.4 km).

Source: Kafue-Lusaka Project Feasibility Study/Cost Analysis, John Burrow & Partners, 1989

In the above analysis, the consultants, John Burrow & Partners, used Kwacha throughout their analysis. The economic analysis is therefore presented in terms of Kwacha rather than the more appropriate US$ monetary unit. Without using HDM III, it is not possible to convert the aggregate costs derived by the consultants from Kwacha to US$. Using Kwacha rather than US$ has the disadvantage that it is difficult to accurately assess the impact of changes in the shadow rate of foreign exchange. But since the Kwacha component of the project is small, depreciation of the Kwacha has not had a significant impact. Moreover, if the exchange rate is raised to US$1 = K120, based on current inflation rates and economic restructuring, the local component of the project will become cheaper, thereby increasing the economic feasibility of the project. Therefore, on balance, conducting the economic analysis in local currency will not significantly distort the economic ranking of the options.

As shown in Table 5, Option 3 is lowest cost, followed very closely by Option 4, 5 and 6. Cost is defined as the discounted cost of total annual system cost defined as the sum of construction cost, maintenance cost and vehicle operating cost, and other costs introduced later by USAID such as technical assistance and contingencies. The discounted cost is calculated by discounting the annual costs at 12 per cent discount rate over the thirty years analysis period.

Though Option 3 is the lowest cost option, the consultant notes that the option is very maintenance intensive. And, though this project takes great pains to assure adequate maintenance of a rehabilitated road, implementing the required level of maintenance in the absence of rehabilitation would be very difficult for the Government, and would likely be delayed. In that case the vehicle operating costs would rise sharply, and the total system cost for option 3 would undoubtedly exceed that of Option 4.

The consultant therefore recommends Option 4 since, with its thicker pavement and higher level of design, it is not as sensitive to lapses in maintenance as Option 3. USAID concurs with this judgement.

USAID carried the analysis a step further by testing the economic feasibility of all rehabilitation Options (4, 5 and 6) by calculating the internal rates of return. The minimum maintenance alternative (Option 1) was considered to represent the "without-project" case. That is, the analysis assumes that the Government of Zambia will carry out the expenditures contained in the minimum alternative, even in the absence of the project. The IRRs for rehabilitation Options 4, 5 and 6 were calculated from the output of HDM III data but adjusted to include TA costs, etc (see Tables 6, 7 and 8, pages 12-14) and therefore assume planned maintenance and no overloading. The IRRs were determined as follows:

Rehabilitation Option	IRR
	%
4	25.8
5	23.8
6	22.0

On the basis of returns on investment criteria, rehabilitation Option 4 is most attractive. No sensitivity test was carried out since it would take unrealistic changes to bring the IRR to below 12%, the point at which the project's viability may be questioned.

Options 5 and 6 are also high (see Table 6, 7 and 8) but the IRR for Option 4 is highest, and is therefore the preferred option. Viewed in terms of incremental IRR, the incremental IRR of Option 5 versus 4 is negative, indicating that the additional benefits of investing in Option 5 are not large enough to justify the additional investment. The same is true for Option 6.

It should be pointed out that, though the difference in total system cost between Options 4, 5 and 6 is very small (less than 1%), the difference in construction cost is substantial. On the basis of HDM III data on financial road capital costs, it would cost an extra 15% for the Makeni-Chilanga section and 18% for the Chilanga-Kafue section to move from Option 4 to Option 5; it would cost 31% and 36% more, respectively, to move from Option 4 to Option 6.

It should also be noted that the 15 and 20 year design lives (Options 5 and 6) yield a longer "structural" road life, however these longer design lives do not lessen the periodic maintenance required. Resealing will still have to be done at 7 year intervals.

TABLE 6: CALCULATION OF INTERNAL RATE OF RETURN BASED ON AVERAGE AND TOTAL ROAD ECONOMIC COSTS (Zambian Hundred Million Kwacha)*

YEAR	TOTAL BASE CASE COSTS (Option 1)			TOTAL WITH PROJECT COSTS (Option 4)			TOTAL ROAD COSTS DIFFERENCE			TOTAL PROJECT COSTS INCLUDING ALL PROJECT RELATED COSTS**
	Nakeni-Chilanga (1.0 km)	Chilanga-Kafue (1.0 km)	Kafue-Lusaka (49.4 km)	Nakeni-Chilanga (1.0 km)	Chilanga-Kafue (1.0 km)	Nakeni-Kafue (49.4 km)	Nakeni-Chilanga (1.0 km)	Chilanga-Kafue (1.0 km)	Nakeni-Kafue (49.4 km)	(49.4 km)
1	0.24	0.098	6.4316	0.23	0.085	5.823	0.01	0.013	0.6086	0.6085
2	0.246	0.098	6.4988	0.297	0.133	8.6362	-0.051	-0.041	-2.1374	-2.6374
3	0.249	0.098	6.5324	0.312	0.144	8.9952	-0.063	-0.046	-2.4628	-2.9628
4	0.264	0.097	6.6622	0.243	0.084	5.9304	0.021	0.013	0.7318	0.7318
5	0.27	0.105	7.035	0.251	0.087	6.1346	0.019	0.018	0.9004	0.9004
6	0.285	0.105	7.203	0.258	0.09	6.3276	0.027	0.015	0.8754	0.8754
7	0.293	0.113	7.5982	0.265	0.092	6.4824	0.028	0.021	1.1158	1.1158
8	0.306	0.115	7.8202	0.273	0.095	6.6866	0.033	0.02	1.1336	1.1336
9	0.324	0.12	8.2128	0.28	0.098	6.8796	0.044	0.022	1.3332	1.3332
10	0.335	0.13	8.718	0.288	0.101	7.0838	0.047	0.029	1.6342	1.6342
11	0.352	0.133	9.023	0.297	0.104	7.2892	0.055	0.029	1.7238	1.7238
12	0.375	0.139	9.5098	0.305	0.107	7.5034	0.07	0.032	2.0064	2.0064
13	0.389	0.152	10.1632	0.338	0.132	8.828	0.051	0.02	1.3352	1.3352
14	0.415	0.155	10.569	0.313	0.109	7.6694	0.102	0.046	2.8936	2.8936
15	0.435	0.168	11.2896	0.322	0.112	7.8848	0.113	0.056	3.4048	3.4048
16	0.462	0.174	11.8212	0.331	0.115	8.1002	0.131	0.059	3.721	3.721
17	0.498	0.185	12.6446	0.34	0.118	8.3156	0.158	0.067	4.329	4.329
18	0.526	0.198	13.4548	0.35	0.122	8.5804	0.176	0.076	4.8744	4.8744
19	0.559	0.2	13.9008	0.36	0.125	8.807	0.199	0.075	5.0938	5.0938
20	0.587	0.205	14.4054	0.37	0.129	9.0718	0.217	0.076	5.3336	5.3336
21	0.596	0.214	14.85	0.381	0.133	9.3478	0.215	0.081	5.5022	5.5022
22	0.615	0.215	15.101	0.392	0.137	9.6238	0.223	0.078	5.4772	5.4772
23	0.626	0.224	15.568	0.427	0.162	10.9708	0.199	0.062	4.5972	4.5972
24	0.643	0.226	15.8348	0.401	0.139	9.801	0.242	0.087	6.0338	6.0338
25	0.663	0.232	16.288	0.412	0.143	10.077	0.251	0.089	6.211	6.211
26	0.674	0.241	16.755	0.424	0.147	10.3642	0.25	0.094	6.3908	6.3908
27	0.695	0.243	17.0666	0.435	0.151	10.6402	0.26	0.092	6.4264	6.4264
28	0.708	0.252	17.556	0.448	0.156	10.9768	0.26	0.096	6.5792	6.5792
29	0.727	0.255	17.8834	0.46	0.16	11.264	0.267	0.095	6.6194	6.6194
30	0.748	0.262	18.386	0.462	0.155	11.0854	0.286	0.107	7.2906	7.2906
INTERNAL RATE OF RETURN							0.322709	0.287278	0.299535	0.256450

*Costs include road construction, maintenance and vehicle operating costs.

**At time of PP design additional US$4.35m was added to the consultants' estimated project financial cost for the whole project road, to cover Technical Assistance, Evaluation and Project Administration.

ECONIRRa.wk1

SOURCE: Economic road costs obtained from the HDMIII outputs (Kafue- Lusaka Road Project Feasibility Study/Cost Analysis, 1989)

TABLE 7: CALCULATION OF INTERNAL RATE OF RETURN BASED ON AVERAGE AND TOTAL ROAD ECONOMIC COSTS (Zambian Hundred Million Kwacha)*

YEAR	TOTAL BASE CASE COSTS (Option 1)			TOTAL WITH PROJECT COSTS (Option 1)			TOTAL ROAD COSTS DIFFERENCE			TOTAL ROAD COSTS INCLUDING ALL PROJECT-RELATED COSTS**
	Makeni-Chilanga (1.0 km)	Chilanga-Kafue (1.0 km)	Kafue-Lusaka (49.4 km)	Makeni-Chilanga (1.0 km)	Chilanga-Kafue (1.0 km)	Makeni-Kafue (49.4 km)	Makeni-Chilanga (1.0 km)	Chilanga-Kafue (1.0 km)	Makeni-Kafue (49.4 km)	(49.4 km)
1	0.24	0.098	6.4316	0.023	0.085	5.823	0.01	0.013	0.6086	0.6086
2	0.246	0.098	6.4988	0.306	0.147	9.0426	-0.06	-0.049	-2.5438	-3.0428
3	0.249	0.098	6.5324	0.321	0.152	9.4016	-0.072	-0.054	-2.8692	-3.3692
4	0.264	0.097	6.6622	0.243	0.024	5.9304	0.021	0.013	0.7318	0.7318
5	0.27	0.105	7.035	0.25	0.087	6.1234	0.02	0.018	0.9116	0.9116
6	0.285	0.105	7.203	0.257	0.089	6.2782	0.028	0.016	0.9248	0.9248
7	0.293	0.113	7.5982	0.265	0.092	6.4824	0.028	0.021	1.1158	1.1158
8	0.306	0.115	7.8202	0.272	0.095	6.6754	0.034	0.02	1.1448	1.1448
9	0.324	0.12	8.2128	0.28	0.097	6.8414	0.044	0.023	1.3714	1.3714
10	0.335	0.13	8.718	0.288	0.1	7.0456	0.047	0.03	1.6724	1.6724
11	0.352	0.133	9.023	0.296	0.103	7.2498	0.056	0.03	1.7732	1.7732
12	0.375	0.139	9.5098	0.304	0.106	7.454	0.071	0.033	2.0558	2.0558
13	0.389	0.152	10.1632	0.313	0.109	7.6694	0.076	0.043	2.4938	2.4938
14	0.415	0.155	10.569	0.322	0.112	7.8848	0.093	0.043	2.6842	2.6842
15	0.435	0.168	11.2896	0.331	0.116	8.1384	0.104	0.052	3.1512	3.1512
16	0.462	0.174	11.8212	0.341	0.119	8.365	0.121	0.055	3.4562	3.4562
17	0.498	0.185	12.6446	0.351	0.123	8.6298	0.147	0.062	4.0148	4.0148
18	0.526	0.198	13.4548	0.365	0.148	9.9656	0.141	0.05	3.4892	3.4892
19	0.559	0.2	13.9808	0.354	0.123	8.6634	0.205	0.077	5.2374	5.2374
20	0.587	0.205	14.4054	0.364	0.127	8.9282	0.223	0.078	5.4772	5.4772
21	0.596	0.214	14.85	0.374	0.13	9.1548	0.222	0.084	5.6952	5.6952
22	0.615	0.215	15.101	0.385	0.134	9.4308	0.23	0.081	5.6702	5.6702
23	0.626	0.224	15.568	0.396	0.138	9.7068	0.23	0.086	5.8612	5.8612
24	0.643	0.226	15.8348	0.407	0.142	9.9828	0.236	0.084	5.852	5.852
25	0.663	0.232	16.288	0.418	0.146	10.2588	0.245	0.086	6.0292	6.0292
26	0.674	0.241	16.755	0.43	0.15	10.546	0.244	0.091	6.209	6.209
27	0.695	0.243	17.0666	0.442	0.154	10.8332	0.253	0.089	6.2334	6.2334
28	0.708	0.252	17.556	0.455	0.159	11.1698	0.253	0.093	6.3862	6.3862
29	0.727	0.255	17.8834	0.468	0.163	11.4682	0.259	0.092	6.4152	6.4152
30	0.748	0.262	18.386	0.459	0.157	11.2502	0.279	0.105	7.1358	7.1358
INTERNAL RATE OF RETURN							0.295539	0.254005	0.267954	0.237327

*Costs include road construction, maintenance and vehicle operating costs.

**At the time of PP design, additional US$4.35m was added to the consultants' estimated project financial cost for the whole project road, to cover Technical Assistance, Evaluation and Project Administration.

ECONIRR3.wk1

SOURCE: Economic road costs obtained from the HDMIII outputs (Kafue- Lusaka Road Project Feasibility Study/Cost Analysis, 1989)

TABLE 8: CALCULATION OF INTERNAL RATE OF RETURN BASED ON AVERAGE AND TOTAL ROAD ECONOMIC COSTS (Zambian Hundred Million Kwacha)*

YEAR	TOTAL BASE CASE COSTS (Option 1)			TOTAL WITH PROJECT COSTS (Option 6)			TOTAL ROAD COSTS DIFFERENCE			TOTAL PROJECT COSTS INCLUDING ALL FIXED RELATED COSTS**
	Makeni-Chilanga (1.0 km)	Chilanga-Kafue (1.0 km)	Kafue-Lusaka (49.4 km)	Makeni-Chilanga (1.0 km)	Chilanga-Kafue (1.0 km)	Makeni-Kafue (49.4 km)	Makeni-Chilanga (1.0 km)	Chilanga-Kafue (1.0 km)	Makeni-Kafue (49.4 km)	(49.4 km)
1	0.24	0.098	6.4316	0.25	0.085	5.823	0.01	0.013	0.6086	0.6086
2	0.246	0.098	6.4388	0.314	0.154	9.3996	-0.068	-0.056	-2.9008	-3.4608
3	0.249	0.098	6.5324	0.329	0.159	9.7586	-0.08	-0.061	-3.2262	-3.7162
4	0.264	0.097	6.6622	0.243	0.084	5.9304	0.021	0.013	0.7318	0.7318
5	0.27	0.105	7.035	.25	0.	6.1234	0.02	0.018	0.9116	0.9116
6	0.285	0.105	7.203	0.257	0.[illegible]	6.2782	0.028	0.016	0.9248	0.9248
7	0.293	0.115	7.5982	0.264	0.[illegible]	6.4712	0.029	0.021	1.127	1.127
8	0.306	0.115	7.8202	0.272	0.0[illegible]	6.6754	0.034	0.02	1.1448	1.1448
9	0.324	0.12	8.2128	0.279	0.0[illegible]	6.8302	0.045	0.023	1.3826	1.3826
10	0.335	0.13	8.718	0.287	0.1	7.0344	0.048	0.03	1.6836	1.6836
11	0.352	0.133	9.023	0.295	0.103	7.2386	0.057	0.03	1.7844	1.7844
12	0.375	0.139	9.5098	0.304	0.106	7.454	0.071	0.033	2.0558	2.0558
13	0.389	0.152	10.1632	0.312	0.109	7.6582	0.077	0.043	2.505	2.505
14	0.415	0.155	10.569	0.321	0.112	7.8736	0.094	0.043	2.6954	2.6954
15	0.435	0.168	11.2896	0.331	0.115	8.1002	0.104	0.053	3.1894	3.1294
16	0.462	0.174	11.8212	0.34	0.119	8.3538	0.122	0.055	3.4674	3.4674
17	0.498	0.185	12.6446	0.35	0.122	8.5804	0.148	0.063	4.0642	4.0642
18	0.526	0.198	13.4548	0.36	0.126	8.8452	0.166	0.072	4.6096	4.6096
19	0.559	0.2	13.9008	0.371	0.13	9.1212	0.188	0.07	4.7796	4.7796
20	0.587	0.205	14.4054	0.381	0.134	9.386	0.206	0.071	5.0194	5.0194
21	0.596	0.214	14.85	0.393	0.138	9.6732	0.203	0.076	5.1768	5.1768
22	0.615	0.215	15.101	0.404	0.142	9.9492	0.211	0.073	5.1518	5.1518
23	0.626	0.224	15.558	0.44	0.168	11.3456	0.186	0.056	4.2224	4.2224
24	0.643	0.226	15.8348	0.401	0.139	9.801	0.242	0.087	6.0338	6.0338
25	0.663	0.232	16.288	0.412	0.143	10.077	0.251	0.089	6.211	6.211
26	0.674	0.241	16.755	0.424	0.147	10.3642	0.25	0.094	6.3908	6.3908
27	0.695	0.243	17.0666	0.435	0.151	10.6402	0.26	0.092	6.4264	6.4264
28	0.708	0.252	17.556	0.448	0.156	10.9768	0.26	0.096	6.5792	6.5792
29	0.727	0.255	17.8834	0.46	0.16	11.264	0.267	0.095	6.6194	6.6194
30	0.748	0.262	13.386	0.459	0.152	10.9472	0.289	0.11	7.4388	7.4388
INTERNAL RATE OF RETURN							0.275772	0.230067	0.245223	0.220647

*Costs include road construction, maintenance and vehicle operating costs.

**At the time of PP design additional US4.35m was added to the consultants' estimated project financial cost for the whole project road, to cover Technical Assistance, Evaluation and Project Administration.

ECONIPRc.wk1

SOURCE: Economic road costs obtained from the HDM III outputs (Kafue- Lusaka Road Project Feasibility Study/Cost Analysis, 1989)

ORIGIN AND DESTINATION ANALYSIS OF TRANSIT CARGO TRAFFIC

ATTACHMENT 1A

EXPORTS

NAME: CHIRUNDU BORDER POST

Year: 1988

COMMODITY TYPE	Origin	DESTINATION (TONS) Overseas	Zimbabwe	Mozambique	RSA	Botswana	Lesotho	Swaziland	Other	Total
COPPER	Kafue									
	Lusaka									
	Other	24172								
	S/total	24172								24172
										24172
OTHER MINERALS	Kafue									
	Lusaka									
	Other									
	S/total									
PETROLEUM PRODUCTS	Kafue									
	Lusaka									
	Other		3405							
	S/total		3405							3405
										3405
OTHER INDUSTRIAL GOODS	Kafue									
	Lusaka									
	Other									
	S/total									
CEREALS/ OTHER AGRIC PRODUCTS	Kafue									
	Lusaka		1702							1702
	Other									
	S/total		1702							
										1702
AGRIC INPUTS	Kafue									
	Lusaka									
	Other									
	S/total									
OTHER CONSUMPTION GOODS	Kafue									
	Lusaka		3300		1200	266				4766
	Other									
	S/total		3300		1200	266				4766
PERSONAL EFFECTS	Kafue									
	Lusaka									
	Other									
	S/total									
TOTAL		24172	8407		1200	266				34045

NOTE:

Origin 'other' - Kitwe for Copper and Ndola for Petroleum Products, Kabwe, Livingstone, etc.

ATTACHMENT 1B

ORIGIN AND DESTINATION ANALYSIS OF CARGO TRAFFIC

(IMPORTS) NAME: CHIRUNDU BORDER POST Year: 1988

COMMODITY TYPE	Destination	ORIGIN: Overseas	Zimbabwe	Mozambique	RSA	Botswana	Lesotho	Swaziland	Other	Total
COPPER	Kafue									
	Lusaka									
	Other									
	S/total									
OTHER MINERALS	Kafue									
	Lusaka									
	Other									
	S/total									
PETROLEUM PRODUCTS	Kafue									
	Lusaka									
	Other					171				171
	S/total					171				171
OTHER INDUSTRIAL GOODS	Kafue		13		9					22
	Lusaka	79	10094		10919	383		1179		22654
	Other	19	14812		12505	567		1910		29813
	S/total	98	24919		23433	950		3089		52489
CEREALS/ OTHER AGRIC PRODUCTS	Kafue									
	Lusaka									
	Other									
	S/total									
AGRIC INPUTS	Kafue									
	Lusaka	23	4395		224					4642
	Other									
	S/total	23	4395		224					4642
OTHER CONSUMPTION GOODS	Kafue									
	Lusaka		1952		8091	664				10707
	Other									
	S/total		1952		8091	664				10707
PERSONAL EFFECTS	Kafue									
	Lusaka		17		82					99
	Other									
	S/total		17		82					99
TOTAL		121	31283		31830	1785		3089		68108

NOTE: Destination 'other' - Kitwe, Ndola, Kabwe, etc.

DESTINATION ANALYSIS OF TRANSIT CARGO TRAFFIC

ATTACHMENT 1C

TRANSIT

NAME: CHIRUNDU CUSTOMS POST

YEAR: 1988

COMMODITY TYPE	DESTINATION OF TRANSIT TRAFFIC														
	NORTHBOUND							SOUTHBOUND							
	Over-seas	Tanzania	Zaire	Malawi	Kenya	Uganda	Other	Over-seas	Zimbabwe	Mozambique	RSA	Botswana	Lesotho	Swaziland	Other
COPPER															
OTHER MINERALS															
PETROLEUM PRODUCTS			4564	32787											
OTHER INDUSTRIAL GOODS		51	11954	2049	3154	308	6333		1027						
CEREALS & AGRICUL GOODS			6278	41418	221		1201	6691	401		765				
AGRICULTURAL INPUTS			3933	8930	51										
OTHER CONSUMPTION GOODS			5680	517			928		254						
PERSONAL EFFECTS				868				120			40				
TOTAL		51	32409	86569	3426	308	8462	6811	1082		805				

NOTE

* NORTH BOUND
Destination 'other' - Burundi and Rwanda.

ATTACHMENT 1D

ORIGIN ANALYSIS OF TRANSIT CARGO TRAFFIC

YEAR 1988

NAME: CHIRUNDU CUSTOMS POST

TRANSIT

COMMODITY TYPE	ORIGIN OF TRANSIT TRAFFIC (IN TONS)													
	SOUTHBOUND							NORTHBOUND						
	Over-seas	Tanza-nia	Zaire	Malawi	Kenya	Uganda	Other	Over-seas	Zimbabwe	Mozamb-que	RSA	Botswa-na	Lesotho	Swazi-land	Other
COPPER															
PETROLEUM PRODUCTS									34691	1835	825				
OTHER INDUSTRIAL GOODS	410	206			411			428	13773		7930			1718	
CEREALS & AGRIC GOODS				7857					49015		103				
AGRICUL-TURAL INPUTS									8526		4388				
OTHER CONSUMP-TION GOODS	102	52			100				6198		927				
PERSONAL EFFECTS				160					868						
TOTAL	512	258		8017	511			428	113071	1835	14173			1718	

ATTACHMENT 1E

VALUE TO WEIGHT CALCULATION OF TOTAL

CROSS BORDER CARGO TRAFFIC

YEAR: 1988

NAME: CHIRUNDU CUSTOMS POST

COMMODITY TYPE	CALCULATION OF WEIGHT TO VALUE RELATIONSHIP					
	NORTHBOUND			SOUTHBOUND		
	Total Tonnage	Total Value (US. Dollars in '000)	Value per Ton (US. Dollars in '000)	Total Tonnage	Total Value (US. Dollars in '000)	Value per Ton (US. Dollars in '000)
COPPER				24172	33670	1.39
OTHER MINERALS						
PETROLEUM PRODUCTS	37522	9641	0.257	3405	328	0.1
OTHER INDUSTRIAL GOODS	76338	80594	1.056	1027	534	0.52
CEREALS AGRIC	49118	8401	0.171	9559	17423	1.82
AGRICULTURAL INPUTS	17556	5214	0.297			
OTHER CONSUMPTION GOODS	17832	13739	0.770	5020	3263	0.65
PERSONAL EFFECTS	967	2578	2.666	160	386	2.41
TOTAL	199333	120167	0.603	43343	55604	1.28

Note: ZK8 = US$1

ATTACHMENT 2A

ORIGIN AND DESTINATION ANALYSIS OF CARGO TRAFFIC

EXPORTS

NAME: VICTORIA FALLS BORDER POST

Year: 1988

COMMODITY TYPE	Origin	DESTINATION (TONS) Overseas	Zimbabwe	Mozambique	RSA	Botswana	Lesotho	Swaziland	Other	Total
COPPER	Kafue									
	Lusaka									
	Other									
	S/total									
OTHER MINERALS	Kafue									
	Lusaka									
	Other		16							16
	S/total		26							26
			42							42
PETROLEUM PRODUCTS	Kafue									
	Lusaka									
	Other									
	S/total									
OTHER INDUSTRIAL GOODS	Kafue									
	Lusaka									
	Other		20		2	90				112
	S/total				137	20				157
			20		139	110				269
CEREALS/ OTHER AGRIC PRODUCTS	Kafue									
	Lusaka									
	Other									
	S/total									
AGRIC INPUTS	Kafue									
	Lusaka									
	Other									
	S/total									
OTHER CONSUMPTION GOODS	Kafue									
	Lusaka									
	Other					7				7
	S/total					7				7
PERSONAL EFFECTS	Kafue									
	Lusaka									
	Other		1							1
	S/total		4							4
			5							5
TOTAL			67		139	117				323

NOTE: Origin 'other' - Kitwe, Ndola, Livingstone, Choma, Mazabuka, Mansa, etc.

ATTACHMENT 2B

ORIGIN AND DESTINATION ANALYSIS OF CARGO TRAFFIC

(TONS)

(IMPORTS)

NAME: VICTORIA FALLS BORDER POST

COMMODITY TYPE	Destination	ORIGIN: Overseas	Zimbabwe	Mozambique	RSA	Botswana	Lesotho	Swaziland	Other	Total
COPPER	Kafue									
	Lusaka									
	Other									
	S/total									
OTHER MINERALS	Kafue									
	Lusaka									
	Other									
	S/total									
PETROLEUM PRODUCTS	Kafue									
	Lusaka									
	Other									
	S/total									
OTHER INDUSTRIAL GOODS	Kafue		10		7					
	Lusaka		205		88	7				17
	Other	1	215		288					300
	S/total	1	430		383	7				504
										821
CEREALS/ OTHER AGRIC PRODUCTS	Kafue									
	Lusaka					2				
	Other									2
	S/total					2				
										2
AGRIC INPUTS	Kafue		1							1
	Lusaka		16							16
	Other		18							18
	S/total		35							35
OTHER CONSUMPTION GOODS	Kafue		1							1
	Lusaka		1		25	8				34
	Other		9		3					12
	S/total		11		28	8				47
PERSONAL EFFECTS	Kafue									
	Lusaka		1							1
	Other		5		1					6
	S/total		6		1					7
TOTAL		1	482		412	17				912

NOTE: Destination 'other' - Kitwe, Ndola, Livingstone, Choma, Kalomo, Mongu, etc.

ATTACHMENT 2C

DESTINATION ANALYSIS OF TRANSIT CARGO TRAFFIC

YEAR: 1988

NAME: VICTORIA FALLS CUSTOMS POST

TRANSIT

COMMODITY TYPE	DESTINATION OF TRANSIT TRAFFIC (IN TONS)														
	NORTHBOUND							SOUTHBOUND							
	Over-seas	Tanza-nia	Zaire	Malawi	Kenya	Uganda	Other	Over-seas	Zimbabwe	Mozambi-que	RSA	Botswa-na	Lesotho	Swazi-land	Other
COPPER															
OTHER MINERALS															
PETROLEUM PRODUCTS			8												
OTHER INDUST-TRIAL GOODS			1260	411			10								
CEREALS															
AGRICUL-TURAL INPUTS			27	48											
OTHER CONSUMP-TION GOODS			132	60			21								
PERSONAL EFFECTS				41											
TOTAL			1427	560			31								

ORIGIN ANALYSIS OF TRANSIT CARGO TRAFFIC

ATTACHMENT 2D

YEAR: 1988

TRANSIT NAME: VICTORIA FALLS CUSTOMS POST

ORIGIN OF TRANSIT TRAFFIC (IN TONS)

COMMODITY TYPE	SOUTHBOUND							NORTHBOUND						
	Over-seas	Tanza-nia	Zaire	Malawi	Kenya	Uganda	Other	Over-seas	Zimbabwe	Mozambi-que	RSA	Botswa-na	Lesotho	Swazi-land	Other
COPPER															
OTHER MINERALS															
PETROLEUM PRODUCTS											8				
OTHER INDUST-TRIAL GOODS								30	514		1102		35		
CEREALS															
AGRICUL-TURAL INPUTS									25		50				
OTHER CONSUMP-TION GOODS									113		84	16			
PERSONAL EFFECTS															
TOTAL									22		19				
								30	674		1263	16	35		

NOTE:

* NORTH BOUND
Destination 'other' - Burundi

ATTACHMENT 2E

VALUE TO WEIGHT CALCULATION OF TOTAL

CROSS BORDER CARGO TRAFFIC

YEAR: 1988

NAME: VICTORIA FALLS CUSTOMS POST

COMMODITY TYPE	CALCULATION OF WEIGHT TO VALUE RELATIONSHIP					
	NORTHBOUND			SOUTHBOUND		
	Total Tonnage	Total Value (US. Dollars in '000)	Value per ton (US. Dollars in '000)	Total Tonnage	Total Value (US. Dollars in '000)	Value per Ton (US. Dollars in '000)
COPPER						
OTHER MINERALS				42	55.65	1.325
PETROLEUM PRODUCTS	8	7.552	0.944			
OTHER INDUST-TRIAL GOODS	2502	2507.504	1.002	269	72.63	0.27
CEREALS	2	1.1	0.55			
AGRICUL-TURAL INPUTS	110	95.48	0.868			
OTHER CONSUMP-TION GOODS	260	234.78	0.903	7	52.829	7.547
PERSONAL EFFECTS	48	34.272	0.714	5	0.7	0.14
TOTAL	2930	2880.688	0.983	323	181.809	9.282

ZK 8 = US$1

156

ATTACHMENT 3A

ORIGIN AND DESTINATION ANALYSIS OF CARGO TRAFFIC

EXPORTS

NAME: KAZUNGULA BORDER POST

COMMODITY TYPE	Origin	DESTINATION (TONS) Overseas	Zimbabwe	Mozambi	RSA	Botswana	Lesotho	Swazi-	Other	Total
COPPER	Kafue									
	Lusaka				110					110
	Other									
	S/total				110					110
OTHER MINERALS	Kafue									
	Lusaka									
	Other									
	S/total									
PETROLEUM PRODUCTS	Kafue									
	Lusaka									
	Other									
	S/total									
OTHER INDUSTRIAL GOODS	Kafue									
	Lusaka									
	Other									
	S/total									
CEREALS/ OTHER AGRIC PRODUCTS	Kafue									
	Lusaka									
	Other									
	S/total									
AGRIC INPUTS	Kafue									
	Lusaka									
	Other									
	S/total									
OTHER CONSUMPTION GOODS	Kafue									
	Lusaka		210			7500				7710
	Other					228				228
	S/total		210			7728				7938
PERSONAL EFFECTS	Kafue									
	Lusaka									
	Other									
	S/total									
TOTAL			210		110	7728				8048

NOTE: * Origin 'other': - Kitwe, Ndola, Kabwe, Kalomo, Livingstone, etc.

ATTACHMENT 3B

ORIGIN AND DESTINATION ANALYSIS OF CARGO TRAFFIC

(IMPORTS) NAME: KAZUNGULA BORDER POST YEAR 1988

COMMODITY TYPE	Destination	ORIGIN: Overseas	Zimbabwe	Mozambi	RSA	Botswana	Lesotho	Swazi-	Other	Total
COPPER	Kafue									
	Lusaka									
	Other									
	S/total									
OTHER MINERALS	Kafue									
	Lusaka									
	Other									
	S/total									
PETROLEUM PRODUCTS	Kafue									
	Lusaka									
	Other									
	S/total									
OTHER INDUSTRIAL GOODS	Kafue	2			316	28				346
	Lusaka	68			17750	1344		20		19182
	Other	39			10413	779		12		11243
	S/total	109			28479	2151		32		30771
CEREALS/ OTHER AGRIC PRODUCTS	Kafue									
	Lusaka									
	Other									
	S/total									
AGRIC INPUTS	Kafue									
	Lusaka				580	51				631
	Other									
	S/total				580	51				631
OTHER CONSUMPTION GOODS	Kafue									
	Lusaka	55			3482	1161				4698
	Other									
	S/total	55			3482	1161				4698
PERSONAL EFFECTS	Kafue									
	Lusaka									
	Other									
	S/total									
TOTALS	Kafue	2			316	28				346
	Lusaka	123			21812	2556		20		24511
	Other	39			10413	779		12		11243
	TOTAL	164			32541	3363		32	-	36100

NOTE: * Destination 'other': Kitwe, Ndola, Kabwe, Livingstone, Kalomo, Mazabuka, etc.

DESTINATION ANALYSIS OF TRANSIT CARGO TRAFFIC

ATTACHMENT 3C

YEAR: 1988

NAME: KAZUNGULA CUSTOMS POST

TRANSIT

COMMODITY TYPE	DESTINATION OF TRANSIT TRAFFIC														
	NORTHBOUND							SOUTHBOUND							
	Over-seas	Tanza-nia	Zaire	Malawi	Kenya	Uganda	Other	Over-seas	Zimbabwe	Mozambi-que	RSA	Botswa-na	Lesotho	Swazi-land	Other
COPPER															
OTHER MINERALS															
PETROLEUM PRODUCTS				2952											
OTHER INDUST-TRIAL GOODS			12177	8367											
CEREALS				103				17146			3026				
AGRICUL-TURAL INPUTS			824	7080											
OTHER CONSUMP-TION GOODS			8179	3177											
PERSONAL EFFECTS				1751											
TOTAL			21180	23430				17146			3026				

ORIGIN ANALYSIS OF TRANSIT CARGO TRAFFIC

ATTACHMENT 3D

NAME: KAZUNGULA CUSTOMS POST

YEAR: 1988

TRANSIT

COMMODITY TYPE	ORIGIN OF TRANSIT TRAFFIC (IN TONS)														
	SOUTHBOUND							NORTHBOUND							
	Over-seas	Tanza-nia	Zaire	Malawi	Kenya	Uganda	Other	Over-seas	Zimbabwe	Mozambi-que	RSA	Botswa-na	Lesotho	Swazi-land	Other
COPPER															
PETROLEUM PRODUCTS											2952				
OTHER INDUSTRIAL GOODS								658			19521			365	
CEREALS				20172							103				
AGRICUL-TURAL INPUTS											7904				
OTHER CONSUMP-TION GOODS								2511			8845				
PERSONAL EFFECTS											1751				
TOTAL				20172				3169			41076			365	

ATTACHMENT 3E

VALUE TO WEIGHT CALCULATION OF TOTAL
CROSS BORDER CARGO TRAFFIC

YEAR: 1988

NAME: KAZUNGULA CUSTOMS POST

COMMODITY TYPE	CALCULATION OF WEIGHT TO VALUE RELATIONSHIP					
	NORTHBOUND			SOUTHBOUND		
	Total Tonnage	Total Value (US. Dollars in '000)	Value per ton (US. Dollars in '000)	Total Tonnage	Total Value (US. Dollars in '000)	Value per Kg (US. Dollars in '000)
COPPER				110	205	1.86
OTHER MINERALS						
PETROLEUM PRODUCTS	2952	1057	0.358			
OTHER INDUSTRIAL GOODS	51336	87442	1.703			
CEREALS & AGRIC PRODS	103	45	0.437	20172	41418	2.06
AGRICULTURAL INPUTS	8535	5062	0.593			
OTHER CONSUMPTION GOODS	16054	12216	0.761	7938	5500	0.69
PERSONAL EFFECTS	1751	1544	0.882			
TOTAL	80731	107366	1.33	28220	47323	1.67

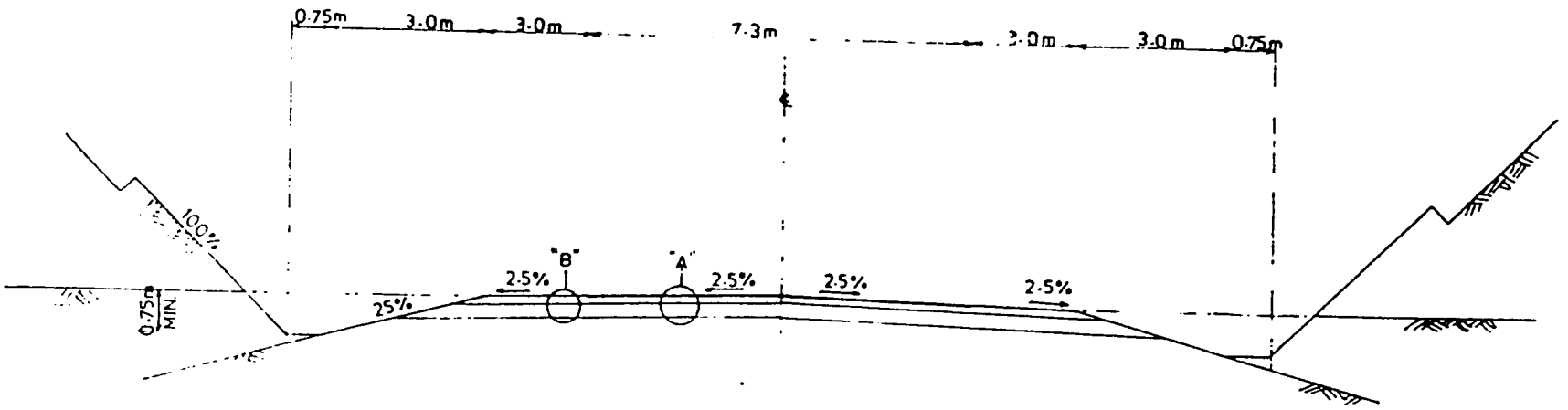
ZK 8 = US$1

Table 10

Project Cost Estimate (1)*

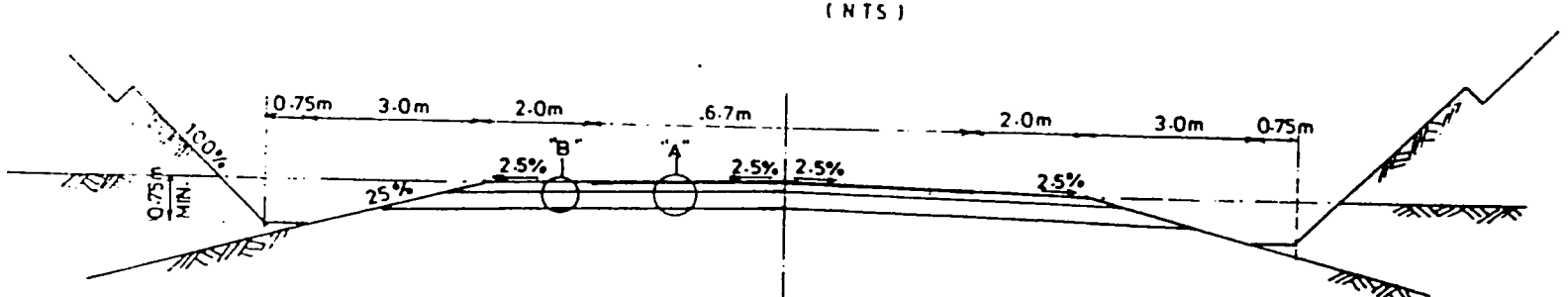
1.	Preliminaries	2,730,150
2.	Accommodation of traffic	1,123,650
3.	Borrow pits	363,000
4.	Site Clearance	550,000
5.	Earthworks	1,030,000
6.	Shoulders to Existing Pavement	383,000
7.	Existing Pavement Preparation	382,000
8.	Sub-base and base	2,770,000
9.	Dense Bituminous Macadam Base	2,248,000
10.	Surface Treatment/Crack Sealing	2,033,000
11.	Pavement Repair Work	195,000
12.	Drainage Improvement	1,185,250
13.	Miscellaneous Items	352,000
	(A) Subtotal	15,345,050
	(B) Contingency (10% of (A))	1,534,500
	Total (A)+(B)	16,879,550
	Detailed Design/Construction Supervision	1,600,000
	Total Construction Cost	18,479,550

*Note: Based on construction occuring during 1991 and 1992, all line items were taken from the John Burrow's study (Section 14) except for items 1,2,3, 13 and 14 which had to be readjusted downward($\frac{3,028,000}{19,435,000} \times 100\% = 15.58\%$)to take into account the adjustment needed to offset the dual carriageway section which was included in the Burrow's study, however was deleted in the A.I.D project.



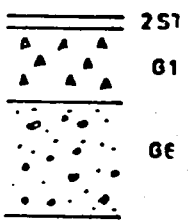
TYPICAL CROSS SECTION CLASS IA (RECONSTRUCTION)

(NTS)



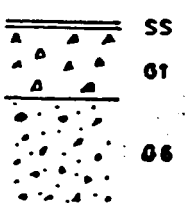
TYPICAL CROSS SECTION CLASS IB (RECONSTRUCTION)

(NTS)



DETAIL A

(N T S)



DETAIL B

(N T S)

John Burrow & Partners
CONSULTING ENGINEERS

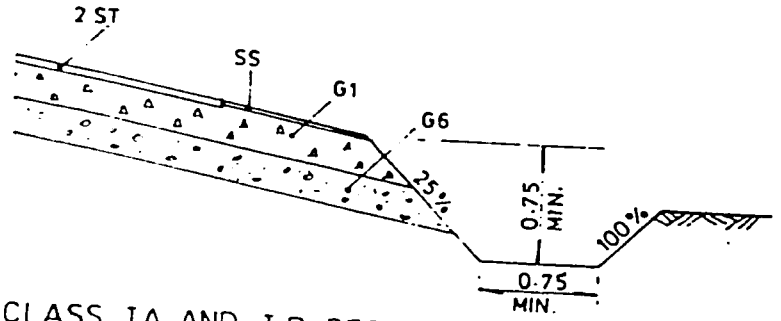
KAFUE LUSAKA ROAD
FEASIBILITY STUDY/COST ANALYSIS

RECONSTRUCTION DETAILS
SINGLE CARRIAGEWAY (Class IA and IB)

Fig. 1

Source: Reference 1

Source: Reference 1



CLASS IA AND I B SECTION (RECONSTRUCTION)

TYPICAL CROSS SECTION (NTS)

2ST - Double bituminous surface treatment
First seal 80/100 pen bitumen @ 1.5 l/m2 19mm chipping @ 70 m2/m3
Second seal 80/100 pen bitumen @ 1.3 l/m2 13.2mm chipping @ 80m2/m3

SS - Sand seal surface on shoulders
Seal 80/100 pen bitumen @ 1.0 l/m2
Crusher dust @ 120 m2/m3

G1 Crushed stone road base and shoulder material PI>6 CBR<80

G6 Selected gravel sub-base PI>12 CBR<25

Notes

1. Design based on 10 (Class IA) and 5(Class IB) m.s.a.

2 Prime coat (where required) to be MC30 cutback @ 1.0 l/m2

3 Tack coat (where required) to be K1-40 emulsion @ 0.6 l/m2

4 Cross section widths according to design standard.

5 Existing base course material (after removal of bituminous surfacing may be incorporated into the sub-base layer where required to match levels.

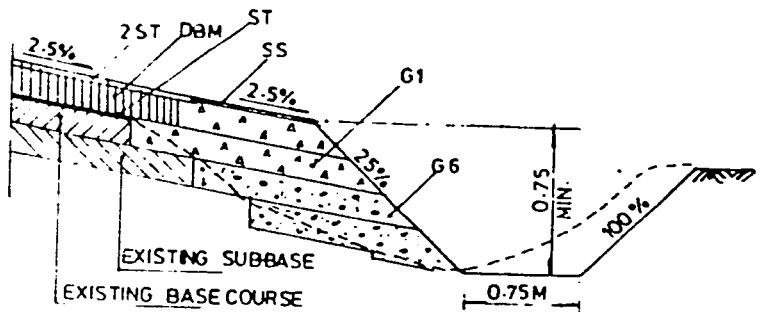
John Burrow & Partners
CONSULTING ENGINEERS

KAFUE LUSAKA ROAD
FEASIBILITY STUDY/COST ANALYSIS

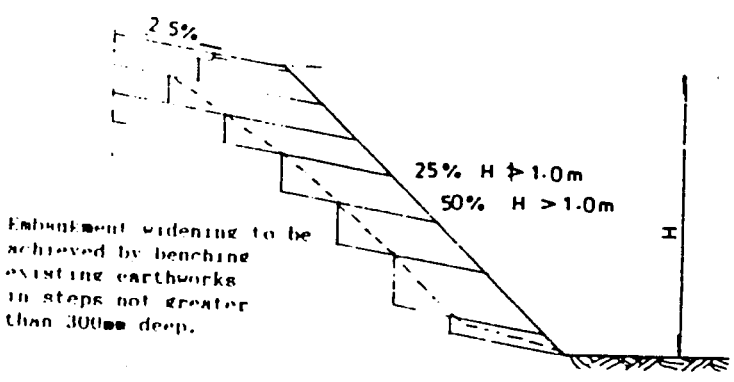
RECONSTRUCTION DETAILS
SINGLE CARRIAGEWAY (Class IA and IB)

Fig. 2:

Source: Reference 1



CLASS IA AND IB SECTIONS (OVERLAYING WITH OR WITHOUT WIDENING)
(NTS)



CLASS IA AND IB SECTIONS (EMBANKMENT WIDENING)
(NTS)

2ST - Double bituminous surface treatment
First seal 80/100 pen bitumen @ 1.5 l/m2 19mm chipping @ 70m2/m3
Second seal 80/100 pen bitumen @ 1.31/m2 13.2mm chipping @ 80m2/m3

DBM - Dense bitumen macadam overlay in 2 layers Recipe mix (nom. size depending on thickness) to base course quality (approximately 4.4% binder content) using 80/100 pen bitumen.

ST Existing surface patched and prepared by sealing cracks and applying a single bitumious surface treatment comprising 80/100 pen bitumen @ 1.3 l/m2 13 mm chipping @ 80m2/m3

SS Sand seal surface on shoulders.
Seal 80/100 pen bitumen @ 1.0 l/m2
Crusher dust @ 120m2/m3

G1 Crushed stone road base and shoulder material PI≯6 CBR≮80

G6 Selected gravel material PI≯12 CBR≮25

Notes

1 Design based on 10 (Class IA) and 5 (Class IB) m.a.a

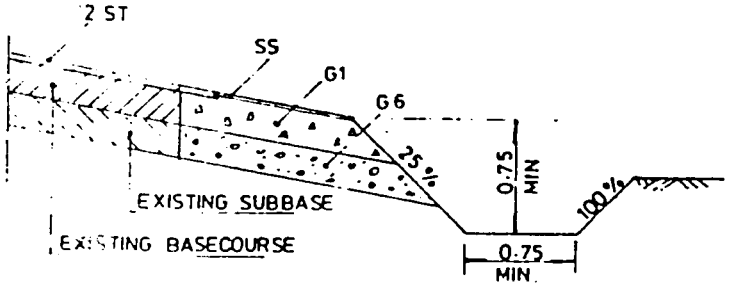
2 Prime coat (where required) to be MC30 cutback @ 1.0 l/m2

3 Tack coat (where required) to be K1-40 emulsion @ 0.6 l/m2

4 Cross section widths according to design standard.

db John Burrow & Partners	KAFUE LUSAKA ROAD FEASIBILITY STUDY/COST ANALYSIS	OVERLAY DETAILS / WIDENING DETAILS	Fig. 3

Source: Reference 1



CLASS IA AND IB SECTION (PATCH & RESEAL WITH OR WITHOUT WIDENING)

TYPICAL CROSS SECTION (NTS)

[illegible] Existing surf[illegible] patched and prepared by sealing cracks and applying a double bituminous surface treatment comprising: first seal 80/100 pen bitumen @ 1.5 l/m2 19mm chipping @ 70m2/m3 Second seal 80/100 pen bitumen @ 1.3 l/m2 13mm chipping @ 80m2/m3

SS - Sand seal on shoulders. Seal 80/100 pen bitumen @ 1.0 l/m2. Crusher dust @ 120m2/m3

G1 - Crushed stone road base and shoulder material PI $\geq$ 6 CBR $\geq$ 80

G6 - Selected gravel material PI $\geq$ 12 CBR $\geq$ 25

Notes

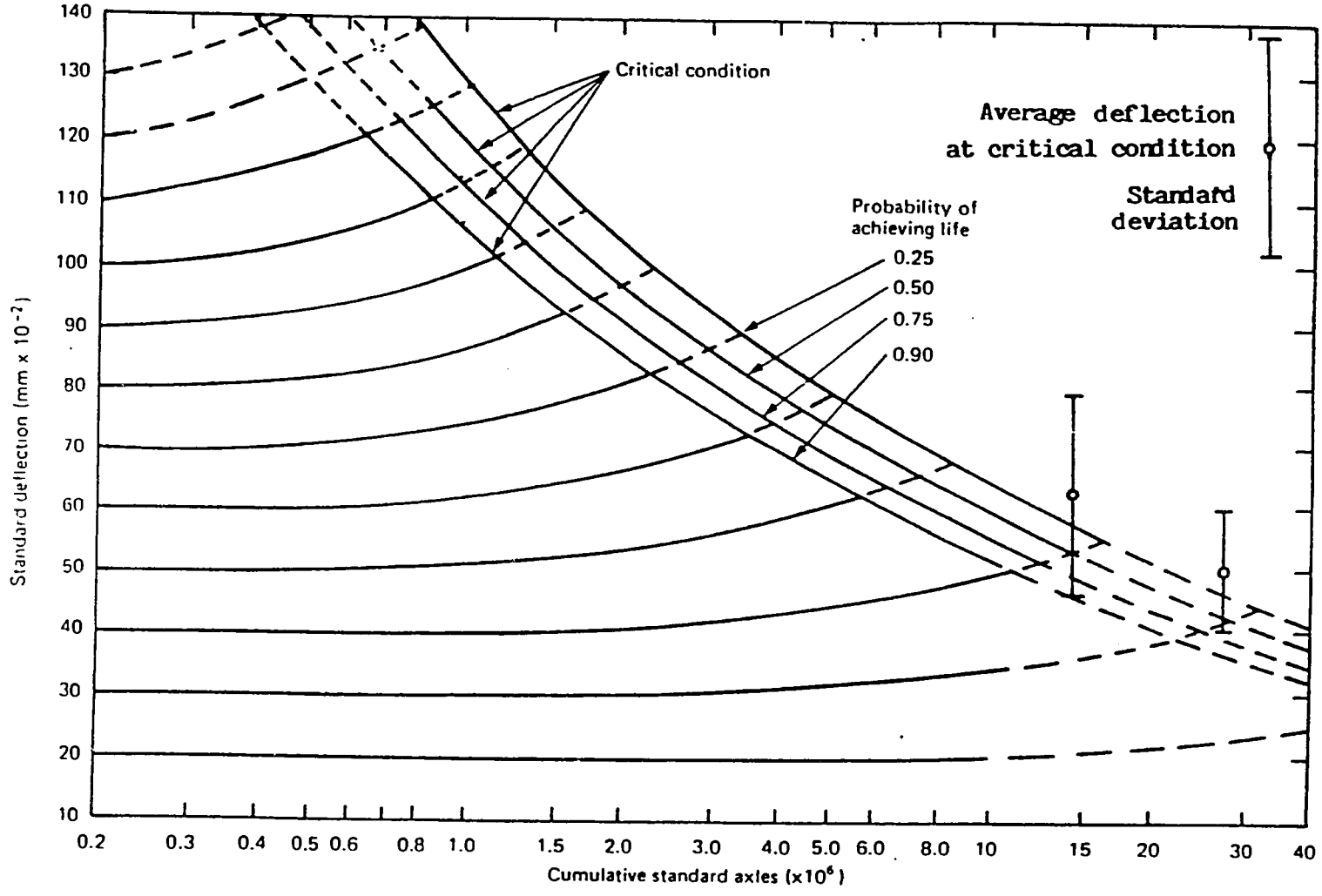
1 Only to be used where remaining life exceeds 5 (Class IA) and 2.5 (Class IB) m.s.a

2 Prime coat (where required) to be MC30 cutback @ 1.0 l/m2

3 Tack coat (where required) to be K1.40 emulsion @ 0.6l/m3

4 Cross section widths according to design standard

db John Burrow & Partners	KAFUE LUSAKA ROAD FEASIBILITY STUDY/COST ANALYSIS	PREPARATION OF EXISTING SURFACE	Fig. 4



RELATION BETWEEN STANDARD DEFLECTION AND LIFE FOR PAVEMENTS WITH NON-CEMENTING GRANULAR ROAD BASES

Figure 5 Typical TRRL Deflection - Performance Chart.

Source: Reference 1

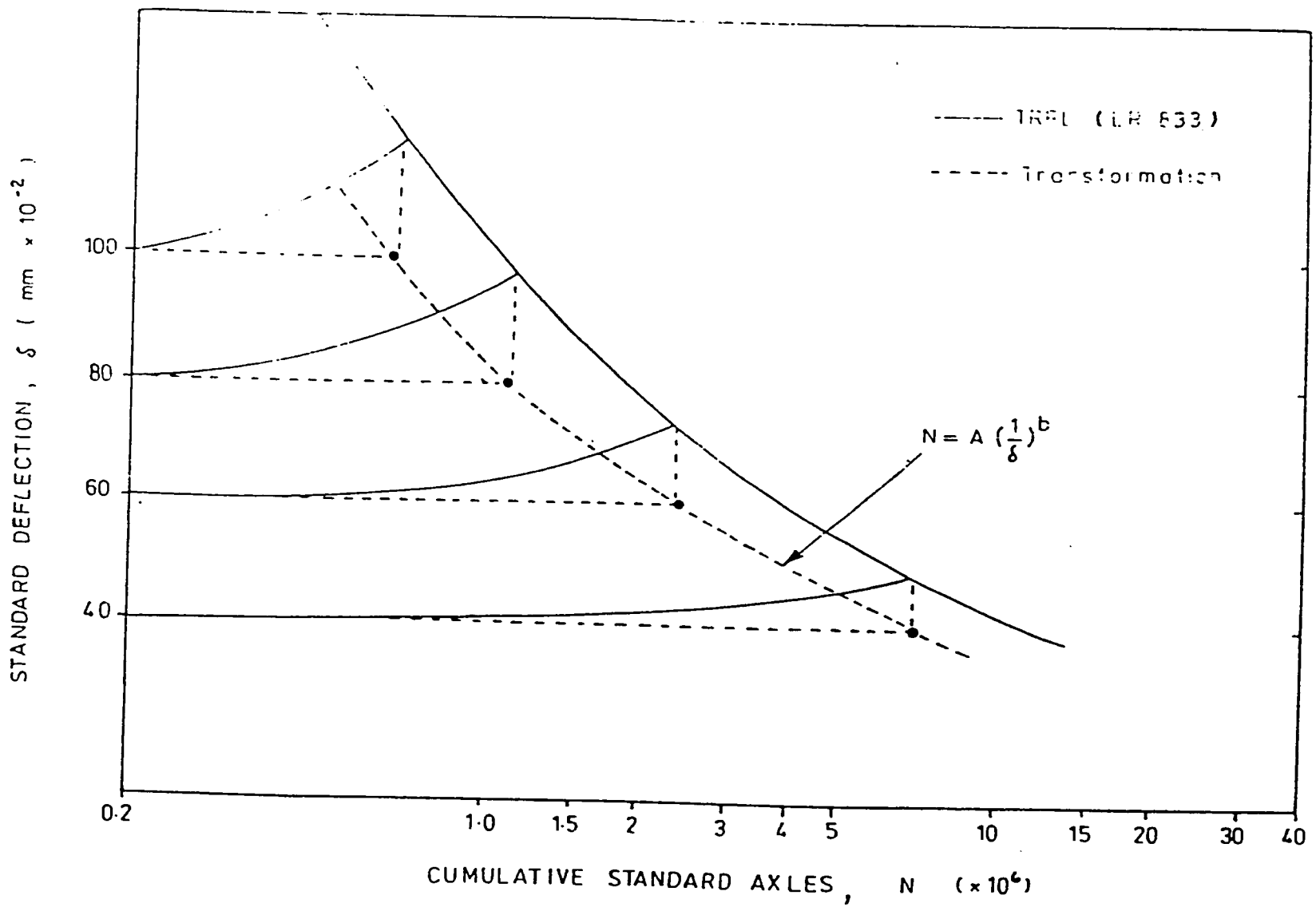


Figure 6 Transformation to give Deflection - Life Relationship

Source: Reference 1

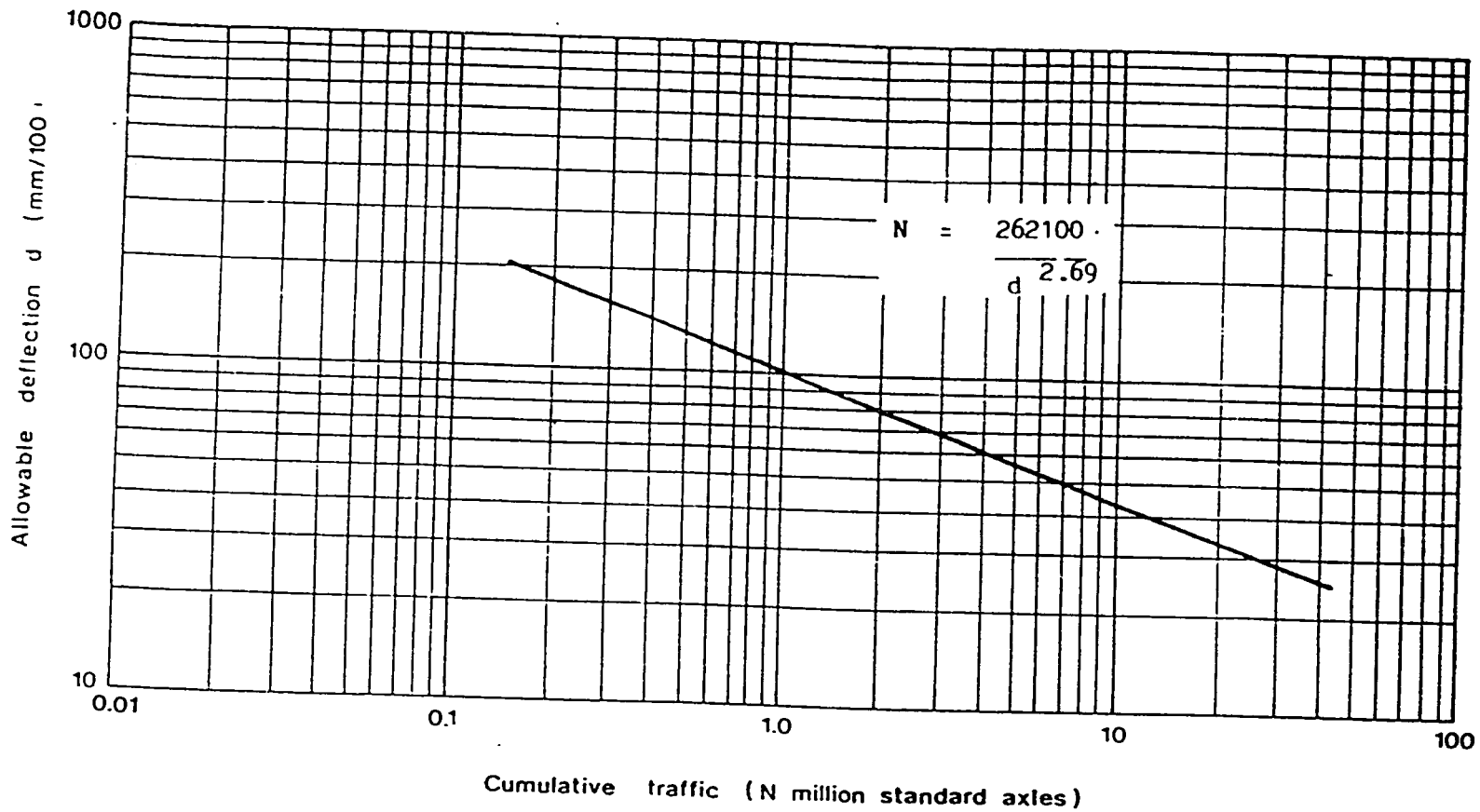
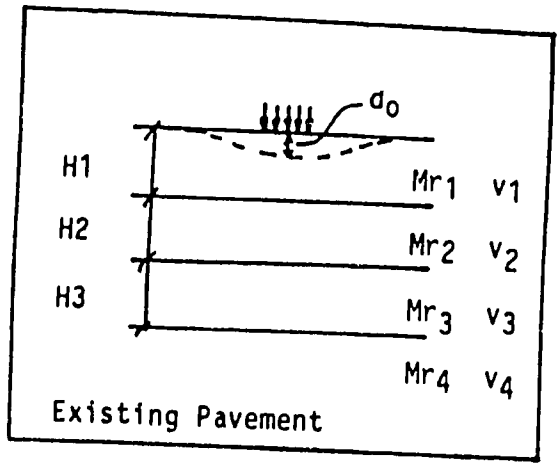


Figure 7 Deflection - Life Relationship

Source: Reference 1

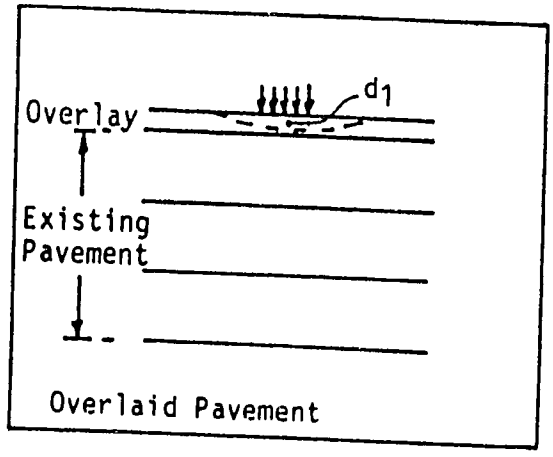
Define Pavement Model

Back Analyse to obtain Mr_1 based on deflection before overlaying (d_o)

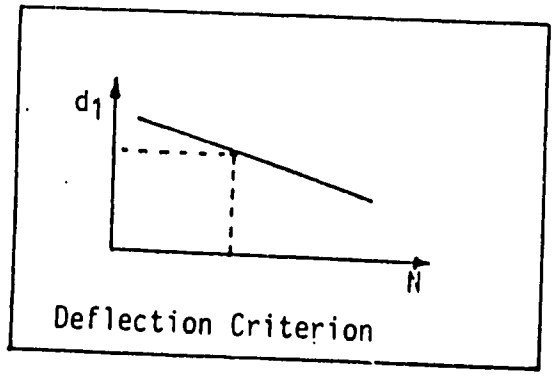


Apply overlay thickness as extra layer.

Analyse to obtain d_1 (new early life deflection) for different overlay thicknesses.



Predict Design Life N for different overlay thicknesses using deflection criterion.



Iterate for various values of d_o

Plot Overlay Thickness vs Design Life.

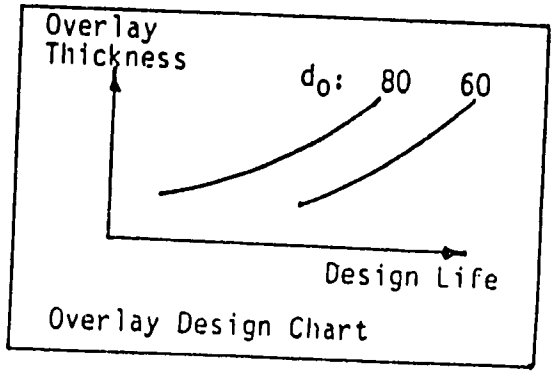
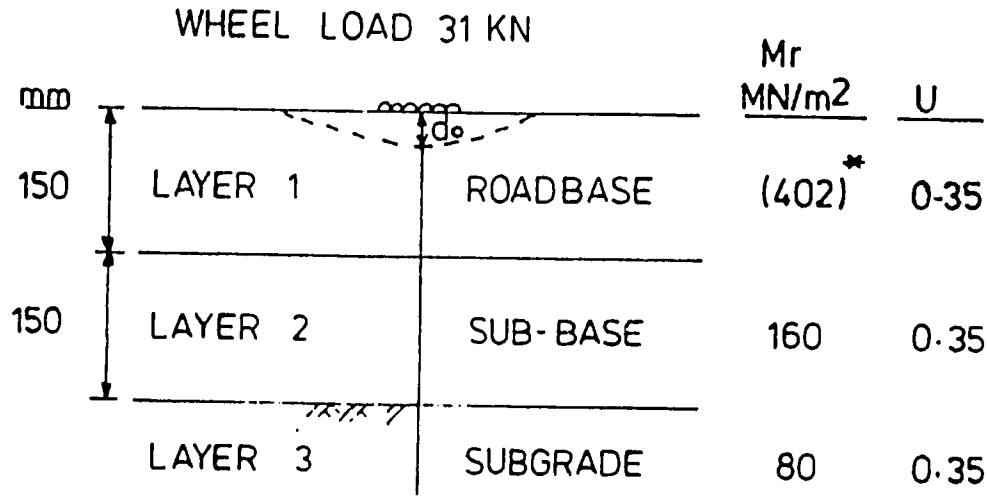


Figure 8 Design Methodology for Overlays

Source: Reference 1



* d_o = 80 mm/100

FIGURE 9 EXISTING PAVEMENT CONSTRUCTION-MODEL B

Source: Reference 1

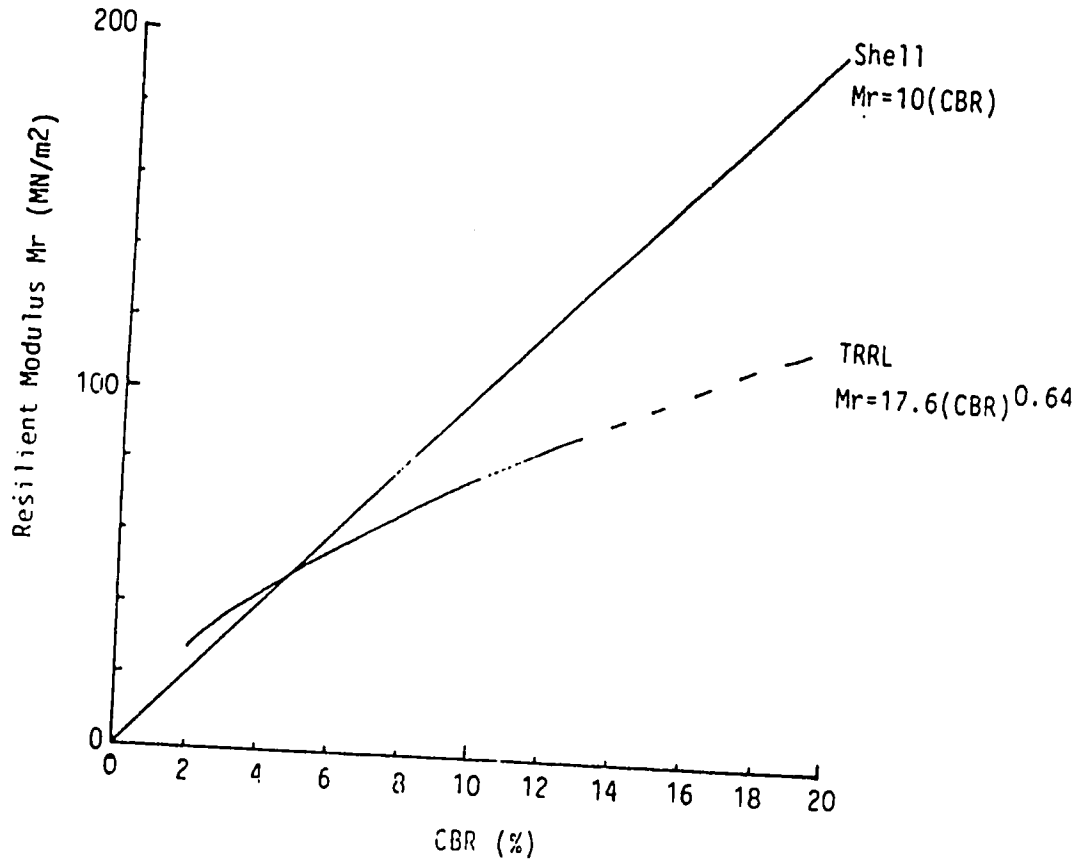


Figure 10 Resilient Modulus - CBR Relationships

Source: Reference 1

Source: Reference 1

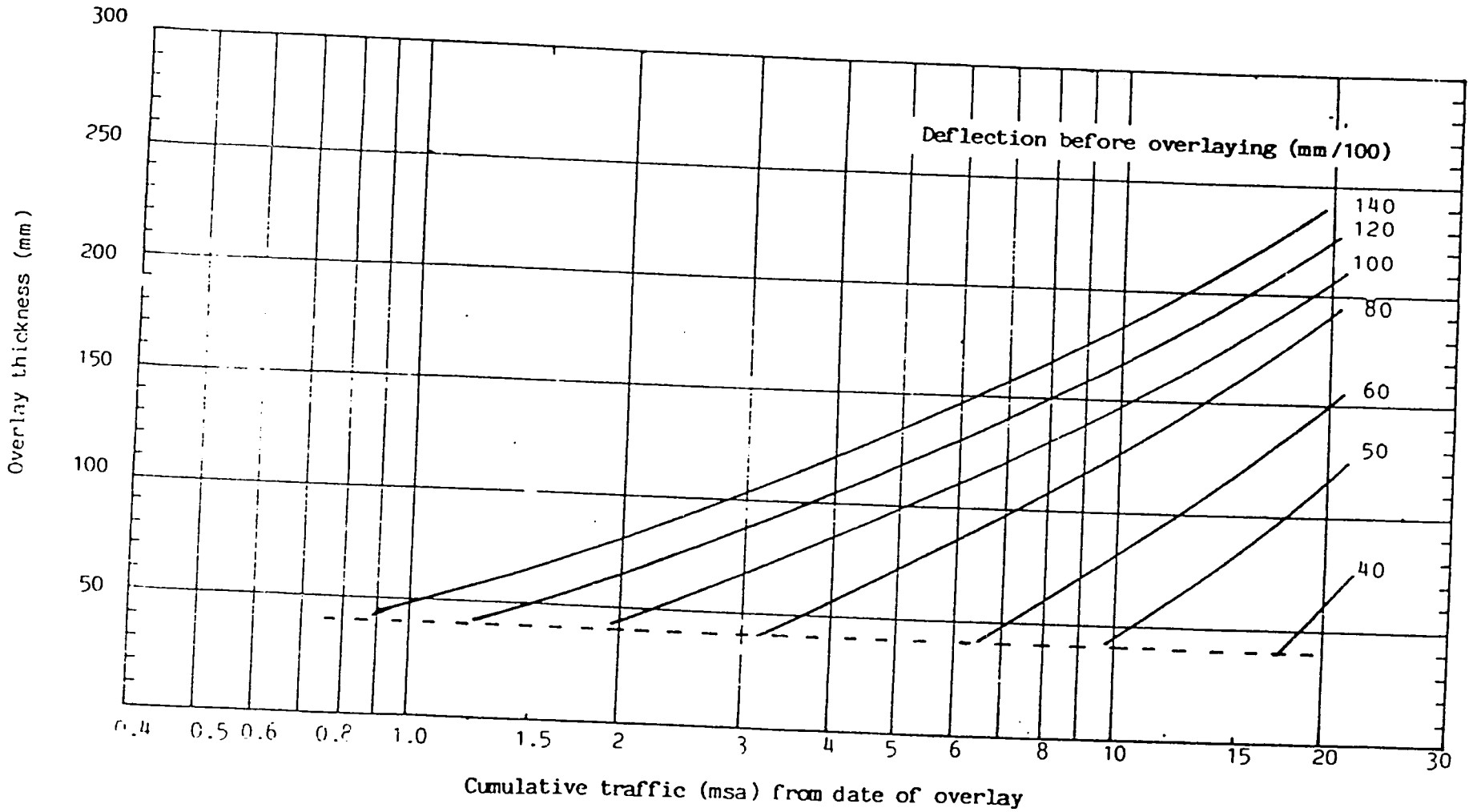


Fig 11 Overlay Design Chart A (Subgrade CBR 8%)

Source: Reference 1

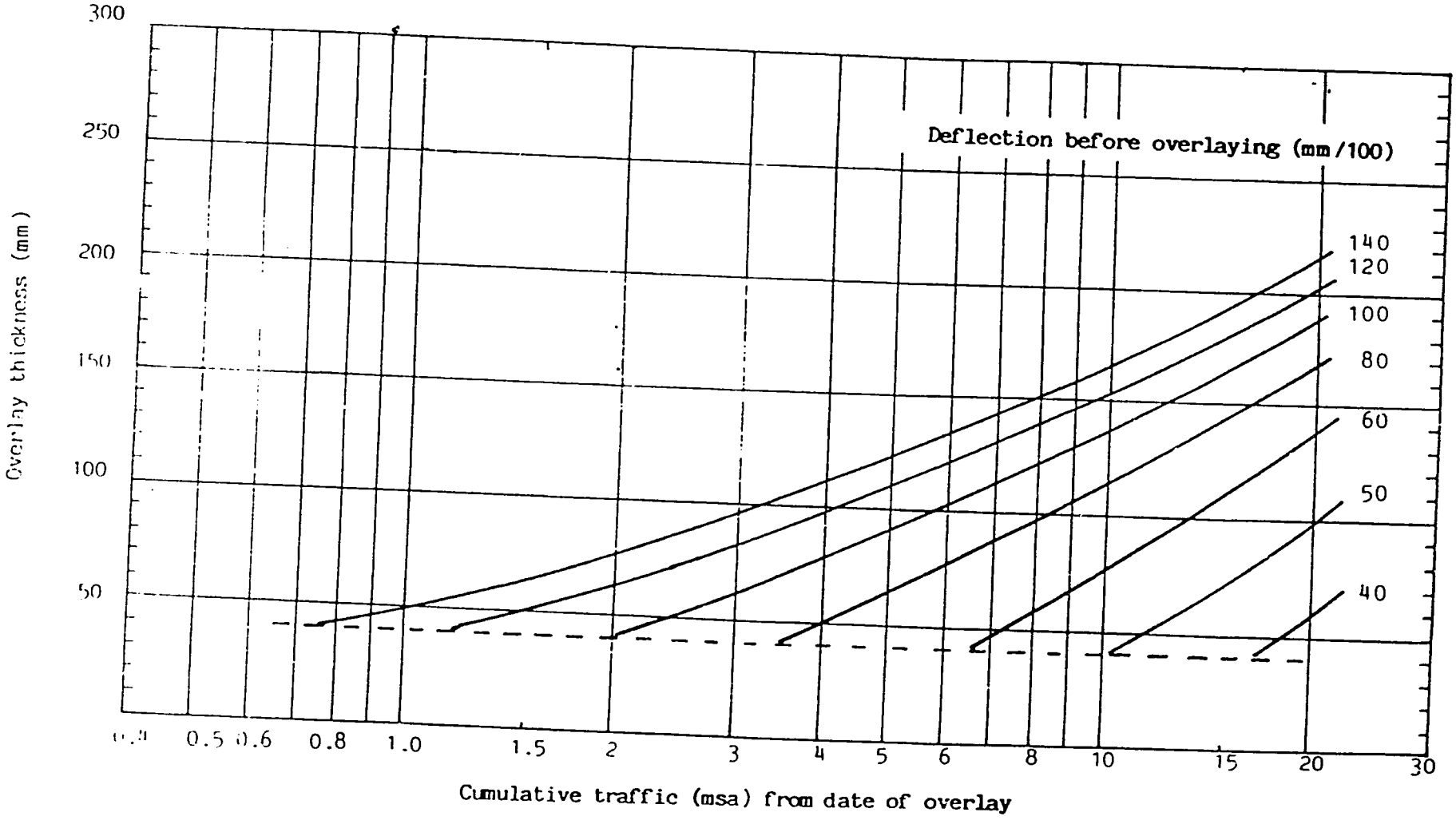


Fig 12 Overlay Design Chart B (Subgrade CBR 12%)

Source: Reference 1

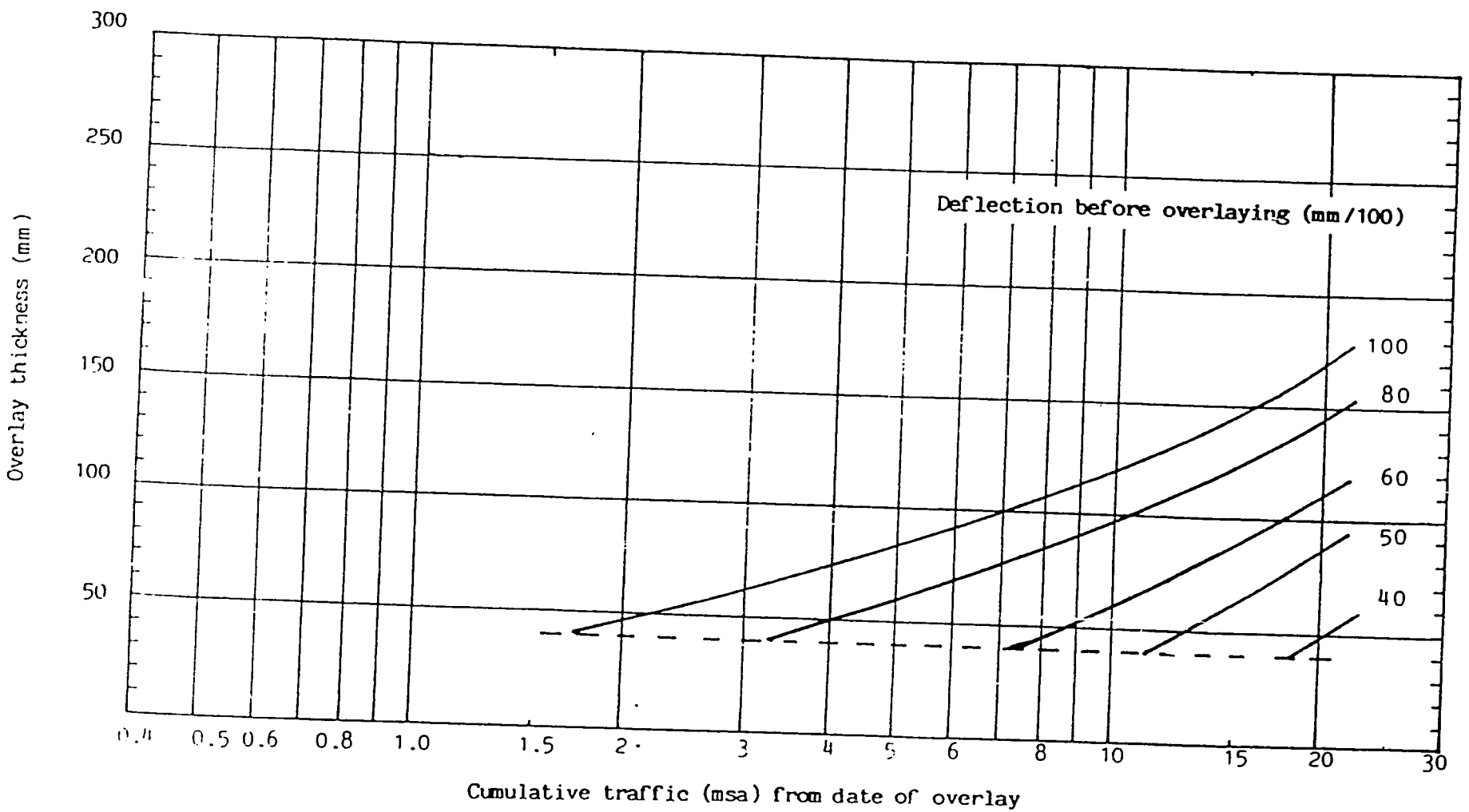
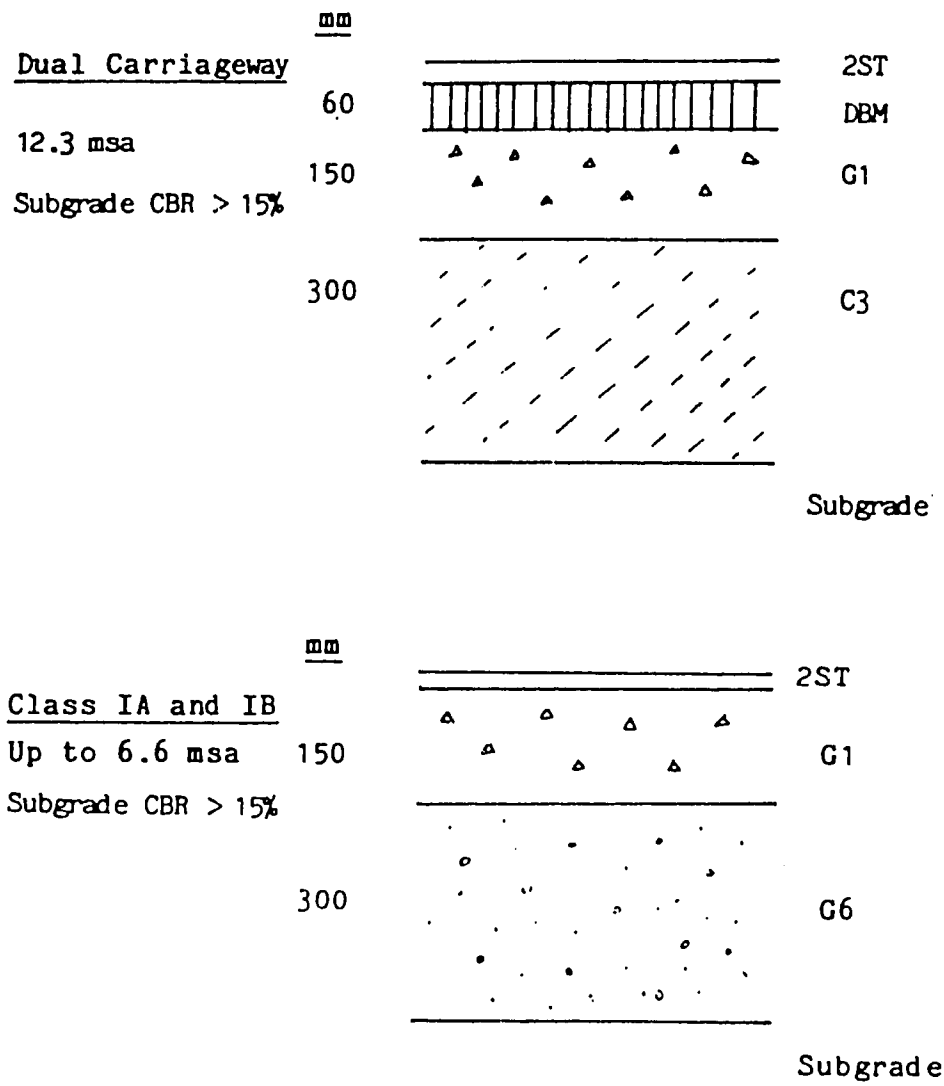


Fig 13 Overlay Design Chart C (Subgrade CBR 20%)



Legend

2 ST	Double Surface Treatment
DBM	Dense Bitumen Macadam
C3	Cemented Natural Gravel
G1	Graded Crushed Stone
G6	Natural Gravel

Figure 14 New Pavement Construction

Source: Reference 1

SOCIAL SOUNDNESS ANALYSIS

I. Sociocultural and Socioeconomic Context

A. Intraregional Context of the Road

1. User Countries

The Kafue-Lusaka road directly contributes to the intraregional flow of commodities in southern Africa. This is especially true for Zimbabwe, Zambia, Malawi, Botswana and eastern Zaire which utilize the road for imports and exports. While most of the commodities originate from and are destined for countries within the region, a small proportion of the traffic consists of international trade outside the region. The road also facilitates the movement of passengers from one country to the next.

Zimbabwe is connected with the Kafue-Lusaka road through three border crossings: Chirundu, Kariba and Victoria Falls. Botswana is linked to the road through the border post of Kazangula. From Lusaka a road leads to Malawi through Chipata. The main route proceeding north from Lusaka branches approximately 150 km. from the city, with a road going northwesternly through the Copperbelt that links with the Zairean town of Lubumbashi. The second branch proceeds northeast and again branches to either to Mpulungu on Lake Tanganyika from which cargo is sent by ship to Rwanda and Burundi or Nakonde on the border with Tanzania and onward to Dar es Salaam.

Information on traffic crossing the Chirundu, Kazungula and Victoria Falls border posts indicates the importance of the Kafue - Lusaka road in intraregional trade. Out of a total of 354,859 tons of cargo which passed through the three posts in 1988, 58 percent was transit cargo, that is not from or for Zambia. Most of the transit cargo (86%) was northbound. The main transit user was Malawi and secondarily Zaire. Together they accounted for 93 percent of the northbound cargo tonnage and 86 percent of the southbound tonnage. Kenya, Swaziland, Rwanda, Burundi and Mozambique traffic accounts for a very small proportion of the total tonnage.

The extent to which a particular country uses a route which includes the Kafue - Lusaka road section relates to factors influencing the viability of alternative routes and extraordinary circumstances in that country. For example, landlocked Malawi which normally produces enough maize for its population, experienced a maize scarcity in 1988 due to refugees, floods and drought, and therefore, had to import a large amount of maize. Maize was hauled from Zimbabwe via the project road.

Use of alternative routes is influenced by factors internal and external to their operations. This is particularly significant since charges are less for transporting heavy, bulk items by rail rather than road. The railroads, however, are unable to meet the demand and tend to be a more inefficient means of transport (due to several reasons which are currently being addressed

through SATCC). Also, political unrest hinders use of specific routes. For example, insurgents in Mozambique have caused stoppage of the rail traffic to Nacala, thus cutting Malawi off from its nearest seaport.

The major importance of all SADCC transport routes is to lessen the countries' dependency on routes through the Republic of South Africa (RSA) and to strengthen trade between the SADCC nations.

2. Sociocultural and Demographic Patterns

The population in the four SADCC countries and eastern Zaire which depends on the Kafue - Lusaka road totals some 30 million. There are significant similarities among the countries in terms of patterns of development and differences in indicators of general welfare. As indicated in Table 1, all the countries except Malawi have a relatively high rate of urbanization and most have a significant industrial and manufacturing base which is mainly centered on mining activities. However, indicators of general welfare, i.e. infant mortality rates and GNP per capita, show a wide range of difference. Malawi has the highest mortality rate and together with Zaire the lowest GNP per capita, while Botswana has the lowest mortality rate and highest GNP per capita.

Table 1: Socioeconomic and Demographic Indicators*

	Zambia	Zimbabwe	Malawi	Botswana	Zaire
Population (millions 85)	6.7	8.4	7	1.1	30.6
Urbanization %pop 1985	48	27	..	20	39
Infant mortality rate 1985	84	77	156	71	102
GNP per cap US$ 1985	390	680	170	840	170
%GNP Industry & Manuf 1985	61	72	19	57	35

* 1985 statistics have been used since they are the only ones accessible on all of the countries and use of the same base year permits a more accurate analysis of similarities and differences.

Source: World Development Report 1987, World Bank.

The five countries specifically affected by the Kafue - Lusaka road exhibit sociocultural differences in terms of ethnicity and languages. However, there is one overreaching unifying force among the people in the four SADCC countries: that is their common problematic history and experience vis a vis the RSA apartheid system. Recognition of this common problem takes precedence over sociocultural differences among the four SADCC countries.

B. Kafue - Lusaka Area and The National Context

1. The Immediate Impact Zone

The immediate impact zone is from the Lusaka suburb of Makeni to the Kafue river bridge, approximately 50 kms. Kafue was developed in the 1960s as a model industrial complex and is located 41 kms. from Lusaka. Kafue town currently has a population of some 21,000 people. The largest employers are Kafue Textiles and Nitrogen Chemicals of Zambia. The town also contains the Bata Tannery, Zambia Concrete, a brewery of chibuku (maize based) beer, boat builders, a company manufacturing nets, twines and ropes, and a bakery. There are several medium to large size wholesale and retail shops, service stations with repair facilities, retail and open air markets, and various social service facilities.

Chilanga, 14 km. from Lusaka, is the only town between Kafue and Lusaka. It is the site of Chilanga Cement Ltd, an agricultural research station, a botanic garden, arboretum, zoo, shops and normal social facilities.

Several businesses are adjacent to the road for about 8 kms. south of the Kafue roundabout in Lusaka. These include a soybean oil processing plant, a stone quarry, engineering firms of various types and medium size manufacturers. In addition, there are a couple of low income housing areas. In regard to microenterprise activities, some 15 sellers of crushed stone line the road in front of the quarry and a few people sell handicraft items and food.

Lusaka town contains some 600,000 people, with a slightly higher proportion of males to females. About 55 percent of the labor force living in the greater Lusaka area are economically active in the formal and informal sectors. (The labor force is defined as those 12 years of old that are either employed or unemployed or looking for work and are available for work.) According to the Lusaka Urban Labor Force Survey of 1985 which included informal sector activities, 73 percent of the men were active on the labor market compared to 36 percent of the women. Sales work is the most common job for women (48%), whereas among the men almost half (45%) work as transport and equipment operators and laborers.

2. National Context

Kafue - Lusaka is part of the major road route which connects southern and northern Zambia. This section of road will effectively be an extension of the recently completed Regional Transport and Storage Development Project - Phase II (the Kafue-Chirundu road rehabilitation) and will complete an unbroken stretch of high standard trunk road between Lusaka and Harare. It plays a role in imports and exports as well as domestic traffic.

Road traffic accounted for 13 percent of the total volume of Zambia's external trade in 1987, while rail accounted for 86 percent. Two main road routes for Zambia are to Tanzania and to Zimbabwe via Chirundu. In absolute terms the volume carried by road to Zimbabwe decreased between 1983 and 1987 because formerly more imports and exports went through the RSA. However, in

early 1988 Zambia lessened its restrictions on trade with and through the RSA so the overall proportion of road traffic may have increased since then. Furthermore, the increased focus on promotion of trade within SADCC and the PTA is expected to result in an increase of road traffic on the project road.

An Analysis of Cross Border Traffic Movements at Chirundu, Kazungula and Victoria Falls for the Year 1988 reveals that 147,536 tons of Zambia's external trade passed through the three border posts. Sixty-one percent of the volume of imports were destined for locations other than Kafue or Lusaka and 66 percent of the export tonnage originated in locations other than Lusaka an Kafue. Most of the other imports were destined for the Copperbelt and a significantly large proportion of the other exports originated in this area. Virtually all of the traffic used the project road.

Beside this traffic, some Zambia northbound exports traverse the project road. In particular, cement from Chilanga is exported to Malawi, Rwanda and Burundi and sugar from Nakambala (located on the road from Livingstone which connects with the project road) is exported to Zaire, Rwanda and Burundi. The commodities destined for Rwanda and Burundi are taken by road to Mpulungu from where they are forwarded by ship.

In addition to the external trade traffic on the road, the Kafue - Lusaka road also plays a major role in domestic marketing of agricultural commodities. Commercial farmers in Southern Province and the sections of Central Province within the road catchment area produce cash crops and rely on commercial agricultural inputs such as fertilizer.

Commercial farmers are classified into three categories: large scale, small scale and emergent. A significant proportion of each category lives within Southern Province and within Central Province, which includes the road catchment area. About 40 percent of the large scale commercial farmers reside in Southern Province and most of the rest live in Central Province. These farmers market hybrid maize, tobacco, sunflower seed, cotton, soybeans, wheat, horticultural products, beef cattle, hogs, poultry and dairy products. Also some Commercial Farmers in the project catchment area produce seed maize, seed potatoes and seed wheat which is delivered to the Zambia Seed Company in Lusaka.

In comparison the small scale and emergent commercial farmers primarily market hybrid and traditional maize, sunflower seed, cotton, beans and horticultural products. Forty-three percent of the 19,300 small scale commercial farmers and 57 percent of the 101,700 emergent commercial farmers reside in Southern Province.

Factors related to the efficiency of the marketing system are particularly critical since nearly 50 percent of Zambia's population is urban based, and hence purchasers of food. Overwhelmingly the main crop marketed in Zambia is maize, which normally accounts for some 80 percent of all the crops marketed. Seed cotton and wheat have vied closely for second position over the past 3 to 4 years and soya beans is becoming a healthy fourth. Zambia produces enough oil seeds to meet about half of its edible oil requirements.

Almost all commercial farmers use fertilizer. Currently 65 to 75 percent of the fertilizer use occurs in Southern, Central and Eastern Provinces, which reflects the distribution of commercial farms.

II. Beneficiaries

A. Direct

1. Road Construction Workers and Supervisors

An estimated 500 jobs will be created to implement the project. Some 95 percent of the positions will be for general laborers and 5 percent for tradesmen (e.g. carpenters, steel fixers, and mechanics) and supervisors of work teams. In addition to the basic pay which is the set government rate, the workers will have the opportunity to earn overtime pay for more than 45 hours of work a week. The construction firm may also use a bonus system as did the second construction contractor on the Chirundu road, whereby extra income can be earned when a set task is completed within a given time frame. Besides earning income, the tradesmen are expected to benefit from on the job training which will upgrade their skill level.

Twenty percent of the new jobs created by the road work financed by USAID will be targeted for women. The construction firm will be required to hire women to work on the road and in the camps. This has been determined to be feasible, as explained in part IV A.

Many of the locally registered construction firms do not use Zambians or other Africans as foremen, and hire expatriates. If this occurs then the project construction firm will be expected to provide on the job training for two to three Zambians in positions as assistants to the foremen. It is anticipated that these people will already be on the firm's staff.

2. Commercial Transporters

Commercial transporters involved in intraregional and domestic trade will benefit from rehabilitation of the Kafue - Lusaka road. The benefits should be in terms of a) fewer accidents due to improvements, b) a reduction in hauling time due to the elimination of potholes, expansion of road shoulders, improved laybys, and better flow of traffic, and c) a reduction in operating costs. The commercial transporters are registered companies which are individually or jointly owned. Ownership is primarily if not completely by men.

An analysis of vehicles crossing the three southern border posts reveals that 47 percent of the vehicles are registered in Zambia (Table 2). However, Table 2 needs to be interpreted with care since trucks with Zambian license plates are not necessarily Zambian owned. A study of the trucking sector in Zambia carried out in late 1983 showed that a significant proportion of the trucks registered by the private sector were owned by resident non-Zambian firms and by firms from neighboring countries. It does not appear that the composition of the private sector trucking fleet in Zambian has changed much since 1983.

TABLE 2: Origin Profile of Crossborder Truck Traffic
Chirundu, Kazungula and Victoria Falls 1988

Vehicle Type	Origin and Number of Vehicles				
	Zambia	Zimbabwe	Republic SA	Botswana	Other
Trucks	11,517	4,536	7,116	600	692
% of Total	47	19	29	2	3
			(GRAND TOTAL	24,461)	

Source: Derived from Tables 13, Coopers & Lybrand Associates, An Analysis of Cross Border Traffic Movements at Chirundu, Kazungula and Victoria Falls for the Year 1988, June 1989.

The 1983 study, by P. Moeller on behalf of the National Commission for Development Planning and IBRD and published March 1984, found that there were 140 private sector trucking firms in Zambia with an average of 10 trucks. Fifty-three percent of the firms were owned by Zambians. Almost half of the firms were located in Lusaka and another 20 percent were located in either Kitwe or Ndola. About 27 percent of the total number of trucking firms were owned by resident non-Zambian firms, and comprised eleven nationalities, but with Yugoslavian, Italian and Zimbabwean firms accounting for half of these. Twenty-eight percent of the firms were registered foreign private firms operating from outside of Zambia. This consisted of Zimbabwean (11), Botswanan (9) and South African (8) firms.

No information was available on the age of the private sector fleet in 1983. Most likely the average number of vehicles owned by the three categories of firms has changed. Availability of spare parts and new vehicles as well as their cost have hindered growth of the commercial transport fleet. Moreover, the initial cost of procuring equipment has barred entry by newcomers. Currently a commercial truck costs an equivalent of over U.S. $60,000 and tires cost over $500 each.

The Zambian public sector commercial transport fleet is under Contract Haulage Limited (CHL) which has a fleet of 220 vehicles of which about 170 are operational at any given time. It provides service for general and liquid cargo throughout Zambia, the SADCC and PTA countries. The largest volume of cargo is carried on behalf of parastatal organizations like Zambia Consolidated Copper Mines, Chilanga Cement, Indeco Milling and farming cooperatives.

The Zambia trucking fleet that handles intraregional cargo also plays a significant role in domestic cargo. CHL for example hauls more domestic than international traffic in terms of tonnage. And, although precise statistics are not available on the private sector trucking fleet, it is estimated that some 60 percent of their cargo is domestic traffic. In fact because of the relatively small size of the fleet in relation to demand, it is common for the GRZ to declare the borders closed to Zambian transporters during the agricultural season to haul fertilizer and maize domestically.

3. Other Commercial Users

Besides the commercial transporters, numerous other types of companies use the Kafue - Lusaka road with their own vehicles. This traffic is domestic rather than intraregional and involves commercial farmers, wholesale traders, and manufacturers. For example, a number of the commercial farmers along the Kafue - Lusaka route produce vegetables, fruits and flowers for the export market; these commodities are transported by road to the Lusaka airport.

For those who use the road on a daily or near daily basis, there should be a significant reduction in operating costs. Because of other economic factors, however, it is extremely doubtful if the savings will be passed on to consumers. The users are also expected to benefit in terms of fewer accidents and increased convenience.

4. Passengers

There are three types of passengers: those in private passenger cars, those on buses and those having obtained a ride in trucks. The latter primarily involves domestic travelers. Both domestic and intraregional passengers will benefit from the road improvements. People living within the immediate impact area shall benefit from better bus stops. All passengers shall benefit from an improved flow of traffic due to better road surface and improved shoulders and laybys which should lessen the amount of travel time.

There is a daily bus service between Lusaka and Kafue, beginning at 4 am in the morning and with at least 7 trips a day. Also, there is a regular bus service between Lusaka and Siavonga, and between Livingstone and Lusaka.

At least a hundred people commute daily between Kafue and Lusaka in their personal cars. Other frequent users are residents and visitors to the Entomology Center of the National Council for Scientific Research and the Mt. Makulu Agricultural Research Station, and staff and trainees of the Zambian Industrial and Mining Corporation Limited (ZIMCO) Institute of Management, located near the project road between Chilanga and Lusaka.

In regard to intraregional passengers, there is a bus departing Lusaka and one departing Harare virtually every day. In 1988 there were an average of 65 people on each of the 681 buses that passed through Chirundu. Only 40 buses, presumably tourist buses, passed through Victoria Falls in 1988 and they averaged 40 people. Since January 1989 a regular bus service operates between Francistown in Botswana, and Lusaka via Kazungula.

The analysis of cross border traffic combines passenger cars with other light vehicles such as vans. The number of light vehicles passing Chirundu and Victoria Falls did not vary significantly, (12,712 and 12,212 respectively), whereas Kazungula had much less traffic (6,709). The light vehicles passing Chirundu in 1988 averaged 3.5 passengers. In contrast, the average number of passengers in the light vehicles going through Victoria Falls and Kazungula was 2.5 and 2 respectively.

An analysis of light vehicle and bus passengers reveals that the former carried two-thirds of the passenger traffic. While no information exists on the purpose of these trips it may be assumed that most of the passengers in light vehicles were traveling in regards to tourism or holidays, and the second most common purpose was probably business. Except for tourist buses, bus passengers were probably traveling on business and to visit relatives or friends and of a lower socioeconomic class than were those riding in light vehicles.

While no statistics are available, observations of passenger traffic reveal that at least two-thirds of the passengers in light vehicles are male and about 50 to 60 percent of the bus passengers are male.

5. Pedestrians

No statistics exist on the pedestrian traffic along the project road. However, it appears that some 60 percent of the pedestrians are male.

Currently the road shoulder is often less than a meter wide. Under the project the shoulder shall be two meters wide, except for a stretch of some 7 kms in the Chilanga area which will be three meters wide. The extension of the shoulders will make walking along this major highway much safer for pedestrians.

Accidents occur in front of the Chilanga Primary School which has an enrollment of 2,000 students. The school lies adjacent to the road which curves downwards at this site. The official speed limit in town is 50 km. and there are warning signs on the approach to the school. However, neither of these factors result in most of the traffic slowing down; it is common for the vehicles to be moving at over 80 km per hour around the school. Because this is an international highway, ways of controlling the speed of vehicular traffic is limited by law. The project engineers will investigate technical options for slowing the traffic at this point.

B. Indirect Beneficiaries

1. Malawi, Zaire and Zimbabwe

Of the total volume of transit cargo passing through the three southern border posts in 1988, 96 percent of the southbound cargo was from Malawi and 62 percent of the northbound cargo was destined for Malawi. The northbound cargo consisted mainly of cereals and other agricultural goods (48%) and petroleum products (38%). Fifteen percent of the tonnes were agricultural inputs, predominately fertilizer. The southbound cargo consisted almost exclusively of agricultural products, in particular tobacco, sugar, tea and groundnuts.

Thus it can be surmised that all socioeconomic classes in Malawi will indirectly benefit from the rehabilitated road facilitating external trade. The poor shall benefit when food is imported such as in 1988 and from the availability of kerosene for lighting. Owners of medium and large scale

farming operations will acquire imported fertilizer and should be able to export their cash crops more efficiently. Vehicles owners may have better access to petrol and diesel fuel.

The inhabitants of eastern Zaire, especially those living in Lubumbashi, depend on receiving commodities imported over the road. In 1988 31 percent of the volume of all transit imports were destined for Zaire. Of the total volume passing into Zaire, 46 percent were industrial products such as steel bars and rods, chemicals, machines and spare parts. Cereals and agricultural products accounted for 11 percent of the volume imported and other consumption goods comprised 25 percent.

Only a small volume of Zairean exports are transported over the project road and this consists mainly of industrial products such as copper sheets, cobalt and zinc slabs.

Information on the type of cargo carried indicates that owners of Lubumbashi industries and people in medium and high level positions will be the main indirect beneficiaries in Zaire.

Zimbabwe will be another indirect beneficiary, largely by the project enabling greater efficiency in transportation of exports. From the 1988 traffic data it is difficult to know precisely if the cargo stated as originating in Zimbabwe had its origin elsewhere but Zimbabwe is either the source or transit point. However, certain types of commodities unquestionably originated in Zimbabwe.

In 1988 113,071 tons of the traffic passing through the three southern border posts and transiting Zambia are listed as having originated in Zimbabwe. Virtually all of this cargo passed through Chirundu and over the project road. Cereal products and petroleum products accounted for almost three-fourths of the total volume. In addition 31,765 tons of traffic originating in Zimbabwe were i ported to Zambia. Most of this cargo (80%) consisted of industrial goods, such as steel bars and rods, chemicals, machinery and spare parts. Agricultural inputs, especially seed maize and irrigation equipment, accounted for 14 percent of the cargo.

Zambian exports to Zimbabwe are primarily of an industrial nature, such as copper rods and billets, zinc sheets, bitumen, and telephone cables. It also sells molasses to Zimbabwe.

2. Zambian Companies

The main Zambian company utilizing the project road is Zambia Consolidated Copper Mines Ltd. (ZCCM), located in the Copperbelt. The Government of Zambia through Zambia Industrial and Mining Corporation Ltd. (ZIMCO) owns 60 percent of the shares. ZCI Holdings, a subsidiary of Anglo-American, owns 27 percent of the shares and 7 percent is held by RST International, which is part of the Sardanis group of companies. Five percent of the ordinary shares are held by the public and of these shares 76 percent are held by a company on behalf of Morgan Guaranty Trust Company of New York, the depositary of American Depositary Receipts.

Besides its direct operations, ZCCM also has subsidiaries which largely provide supplies and services to it. ZCCM employees some 54,130 people, of whom 2 percent are expatriates. An additional 7,861 people are employed by its subsidiaries in Zambia. Given that total formal sector employment in 1987 was some 356,500, ZCCM and its subsidiaries account for some 17 percent of employment in the formal sector. In addition, it has forward and backward linkages with other industries and hence affects employment and production in various realms.

While ZCCM relies mainly on the port of Dar es Salaam for its exports, some pass on the Kafue - Lusaka road to Zimbabwe, Botswana and the Republic of South Africa. Moreover, a large proportion of the imports transported on the project road are directly or indirectly for ZCCM and its subsidiaries.

Practically all of Zambia's exports and hence foreign exchange are attributable to ZCCM. Thus, the amount of foreign exchange earned, the amount of taxes collected and the earnings per share accrued by ZIMCO all relate to the economic well-being of ZCCM.

Many of the other Zambian indirect users of the project road are principal subsidiaries and associate companies of ZIMCO, the main GRZ parastatal. ZIMCO principal subsidiaries consist of 94 companies, most of which are in mining and industry including ZCCM and its subsidiaries. ZIMCO percentage of equity ranges from 51 to 100 percent. In regard to the 7 associate companies the percentage of equity ranges from 23 to 50 percent.

As of March 1988 employment in ZIMCO companies totalled 140,408 including those discussed above under ZCCM. Thus ZIMCO accounts for some 38 percent of formal sector employment.

3. Zambian Consumers

Virtually thousands of rural and urban consumers may indirectly benefit from the project through improved efficiency in marketing. These are people who purchase goods transported on the road. For example, virtually every Zambian household purchases sugar on a regular basis and a significant proportion of the country's sugar output in transported over the project road. In addition, as mentioned in part I B, if the plans for reorganization of the fertilizer marketing system are implemented thousands of commercial farmers who purchase fertilizer will indirectly benefit from the project.

The other types of consumer products transported over the road are too numerous to detail. However, the previous sections provide the reader with a notion of these.

4. Republic of South Africa

While the project does not intend that RSA be a beneficiary, it is inevitable. The RSA sells and purchases commodities which are transported on the Kafue - Lusaka road. Industrial products especially steel and chemicals, vehicles and associated spare parts, and consumer goods such as food and

fridges are exported. And it receives primarily metal products from the SADCC countries.

III. Participation

SATCC has classified the Harare to Lusaka road route as a priority. Kafue to Lusaka is the only portion of the Harare to Lusaka route which has not been rehabilitated to a first class standard. The GRZ also considers the proposed road work as a priority and has been involved in making decisions about the contents and design of the project. The GRZ has already financed a local engineering firm to provide engineering surveys for use in the design of this project.

Road users have not and will not participate directly in the decision making process for project design or implementation. However, numerous road users were consulted during the design of the project. These users were very pleased with the objective of the project.

IV. Sociocultural Feasibility

A. Female Road Workers

A target of 20 percent has been set for employment of women on the road work. This has been deemed feasible based on conversations with a representative of the second construction firm on the Chirundu road project, and rural men and women along the road.

Zambian women have seldom been employed on road construction work. The second USAID construction contractor on the Kafue-Chirundu road, however, did seek out women workers during the last few m months when the men were not doing a specific task properly. He found that they were quite good and reliable workers. In this case, it appears that wives or other family members of the men already employed were brought onto the labor crews.

Between Lusaka and Kafue there are numerous single female parents and unmarried women without children. Conversations with some of them and with fathers did not reveal any prejudices against women doing road work. Married women usually require the permission of their husbands to work. Since almost all of the work will be done during the dry season, the jobs should not conflict with the main agricultural tasks with which women are normally engaged.

Recent assessments of females working on labor intensive road maintenance and construction in Kenya reveal the following. First, information dissemination about job opportunities often occurs through channels which do not reach women and unless those responsible for recruitment specify that women are to be employed then it is assumed that the jobs are only available to men. Second, although men often claim that women cannot do the heavy tasks, women were found carrying out virtually all types of work. However, it varied greatly by site depending on the attitude of the men involved in recruitment and assignment of work. Third, male supervisors often reported that the women were more reliable and better workers than the men. Fourth, in some cases it appeared that the immediate male supervisor and male workers exploited women's ability and earnestness about their work.

Because construction firms normally use their own staff or experienced people as "boss boys" or leaders of work teams, it is not expected that women will be hired for this position. Furthermore, it is questionable at this stage if women would be able to obtain the respect and approval needed from male workers to successfully carry out the job responsibilities.

The extent to which the recruitment and employment of women will succeed on the Lusaka - Kafue road will be influenced by the attitude and behavior of the project construction firm. The construction industry is dominated by men, most of whom either do not believe in sexual equality or cannot be bothered with addressing equity issues when carrying out their job responsibilities. Unless the supervisor and foremen support the effort and recognize the economic payoff to their work, the effort is unlikely to succeed.

2. Other Issues

The following sections on disruption and displacement include discussions on compensation for loss of building structures It should be noted that men are normally considered the head of household and hence representatives of construction firms negotiate with them. However, if money is not used for the purpose for which it was intended then other family members suffer. Because of this it is recommended that the loss of building structures be compensated by in-kind payments to the extent possible, for example, providing poles, mud bricks and a builder.

In the few cases where land will be acquired the person handling the negotiations should be aware of intrahousehold dynamics and make the amount of payment known to male and female adult members. This information will permit them to seek compensation from the recipient.

B. Disruption and Displacement

1. Introduction

Major work on an international highway such as the project road can cause disruption and physical displacement of people in the following ways. First, deviation routes have to be identified: either existing adjacent low volume roads or creation of temporary roads. In the former the increased volume of traffic may be hazardous to those living near the road. If paths are created they may be within the road access corridor, ie. 60 metres, but cause a safety risk to those who dwell immediately adjacent to the path. In most cases the engineers try to avoid having to negotiate to obtain private land on which to build the deviation road because of the time involved.

Second, people who are living, cropping or trading within the road access corridor are displaced. Third, an office and a road camp are usually constructed along the route, with access to water an important factor. Land is normally obtained from the government or by payment to the legal owner.

2. Those in the Road Corridor

The Lusaka - Kafue road corridor is legally 60 meters wide. Any structures (e.g. houses, graneries, trading stalls, and walls), crops being grown or fruit trees planted in this corridor are not protected by law.

Between Lusaka and the Kafue bridge there are some 12 trading stalls of semi-permanent and permanent materials, most of which are selling fruits and vegetables to people in passing vehicles, which are in the road corridor. About 7 fruit stands made of unpressed clay bricks with tin roofs are located at Chimamanga (km. 30). The traders have paid for the building materials and erection of these. Here women sell fruit and vegetables which they have purchased from the large commercial Fresh Fruit Farm and to a lesser extent local producers. Except for some five isolated stands (three of permanent materials) this is the main road side produce marketing spot along the project road.

In addition there are approximately 30 family compounds, with houses, graneries and other buildings within the corridor. These are found primarily between Chilanga and Kafue town (between kms. 35-41). Many are located between the railway line and road in front of a GRZ quarry. The people here sometimes work as casual laborers at the quarry but are otherwise involved with trade, hence the reason they settled close to the road. Here the men make crude wooden frame chairs woven with raffia, wood animal carvings, pestals and morters (for pounding maize). The families have been living here for over five years and a couple houses show a substantial amount of investment.

Closer to Kafue, between the old Kafue road leading to Chilanga and the current main road, numerous families have settled with permission of the Kafue Urban Council. Families here include carpenters, metal workers, shoe makers and wood carvers. It appears that only some five structures are on or over the boundary of the road corridor. In addition there are a few farming compounds scattered along the road with the houses probably within the road corridor.

Legally these people with houses and other structures within the road corridor do not have to be compensated and can be ordered to depart. However, construction contractors have found that this approach can be very costly because of delays and disputes which halt work on the road. Hence, many negoiate with those who are within the road corridor, offering to compensate the people for the structures which have to be abandoned and sometimes offering casual employment for a family member. Since the total cost of compensation is estimated to be under $20,000 payable in kwacha, the GRZ is expected to support this approach and provide the funds.

In some locations people are growing maize within the road corridor. This is particularly evident between the road and the commercial farms. Laborers on the farms are usually the people who have planted the crops. The project contractor will make public announcements in newspapers and on radio stating when road work will begin and warning growers that their crop will be in jeopardy if not harvested immediately after the rains. (The practice is to

allow the maize to dry in the field.) It might be assumed that after work has been completed on the road, the former growers will recommence planting of maize and will not have lost any land to the improved road since no maize is now being grown within 3 meters of the road.

3. Those Effected by Diversion of Traffic

Between Chilanga and Kafue town the possible options for diversion of traffic include use of the Chilanga quarry road, the pipeline road and old Kafue road. From Kafue town to Kafue bridge and from Chilanga to Lusaka city a path may be made parallel to the existing road and within the road corridor. Especially in these cases, the construction engineers will need to be aware of the disruption and risk imposed on households with compounds are near the diversion road. In particular there are about seven sites where the deviation road could readily pose a threat to the inhabitants. These are in a township immediately within the border of Lusaka Urban Area (around km 11), in Chilanga and Kafue towns, and a few rural sites.

The publicity and uproar over a serious collision of vehicles or child being hit by a vehicle on a deviation road could hinder work on the road and provide negative publicity on USAID and the construction firm. Hence, the selection of the deviation road will include attention to the number of families which might be at risk. Furthermore, when residential buildings are within some 25 meters of the deviation road, the families will be compensated to build houses further from the flow of traffic.

4. Those Effected by Road Realignments

Two realignments will occur near Lusaka to eliminate dangerous blind spots. The realignments will involve securing land lying on the inside of the now dangerous curves in the road. In one case land will be obtained from the owner of a large commercial farm. The second realignment cuts through the fields of three to four smallscale farmers. Particularly in this case the construction supervisor will be made aware of intrahousehold dynamics and make the amount of compensation known to all adult family members, not just the male head.

INSTITUTIONAL ANALYSIS

1.0 Overview of Roads Department

The Roads Department of the Ministry of Works and Supply (MOWS) is responsible for the construction and maintenance of primary and secondary roads which comprise approximately 21,000 km or 54% of the roads gazetted in Zambia. These responsibilities entail administering all roads designated as International Main (T) and Main (M), which form a major portion of the primary system linking provincial capitals with one another and other SADCC countries. In addition, the Roads Department has administrative responsibilities for secondary District (D) roads which link the primary network with district headquarters and economic centers. The Roads Department is responsible for implementing policy, budgeting and administering the nine provincial organizations in the country. The Department is comprised of a Headquarters in Lusaka, responsible for coordination, planning and centralized provision of services, and nine provincial divisions which carry out the organization's primary task of road maintenance.

2.0 Organization of the Roads Department

2.1 Headquarters

The headquarters in Lusaka is comprised of the Offices of the Director and Deputy Director, four functional sections, the Mumbwa Workshop, the Materials Laboratory, and a Training School. Each of these units is headed by a Senior Executive or Executive Engineer (see organizational chart in Annex IID). The four functional sections are Planning and Design, Maintenance, Administration and Contracts.

The Planning and Design Section is subdivided into the Survey and Drawing Office and the Planning and Design Office. The Survey and Drawing Office has very limited capabilities because 60% of the personnel slots are vacant. However, their services will not be required for this project because a complete Schedule of Cross Section Data has been compiled by John Burrow & Partners as part of the Feasibility Study/Cost Analysis provided as input to the project design. It will therefore be a relatively easy task for the Final Design contractor to complete longitudinal (horizontal and vertical) and cross sectional drawings, drainage structure and miscellaneous drawings, and perform soil analysis testings.

Also located at the headquarters is the Traffic Statistics Office which supports both the Planning and Design Office and the Maintenance Section. The Traffic Statistics Office is responsible for data collection and traffic analysis and maintains detailed records of traffic counts taken over a period of years at various locations throughout the country. Although the Statistics Office does a creditable job in carrying out its mandate to collect data on country-wide traffic flows, it is not envisaged that they will be the primary data collection unit for project evaluations. Under Local Currency Counterpart Funds Project No. 2.68, Kafue-Lusaka Road Rehabilitation Administrative Support, kwacha has been earmarked for data collection services procured through A.I.D. Direct Contacts (i.e. purchase orders) from local

consulting firms. The contract method of data collection has proven to be reasonably economical, flexible and easiest to tailor to the exact needs of project evaluations.

The Administration Section has primary responsibilities for personnel management functions such as hiring, firing, creation of new staff positions, salaries, administration of leave time, and other tasks related to staffing. Since the project cannot address the primary personnel issue related to pay structures and a sufficiently attractive benefit package to hire and retain management personnel, no further analysis will be made of this section. Problems emanating from the salary/benefits package offered by the section will be discussed below under staffing.

The Maintenance Section, administered by a Senior Engineer provided by NORAD, has a central role in policy making and the identification, prioritization, coordination and monitoring of maintenance activities carried out by the Provincial Road Engineers. This section also plays a central role in the allocation of funding to the provinces. Maintenance will be further discussed below under the Operations heading in the Analysis of Institutional and Management Capability.

The Contracts Department will play a critical role in the success of the project at two stages of implementation. First, the Executive Engineer for Contracts will have the primary GRZ responsibility for the development of advertisements, host country solicitation/contract documents, the review of bids/recommendation of awards, follow-on contract administration, and coordination with A.I.D. to ensure that all documents and Departmental procedures conform to HB 11 rules. Due to his previous experience with A.I.D. regulations on the Kafue-Chirundu Road Project, it is anticipated that the Executive Engineer will not encounter any significant problems with preparation of documents, contract award and administration, and securing required A.I.D. approvals. The staff of the Roads Department has a good working relationship with USAID/Zambia, so close coordination will be easy to achieve. The second important function of Contracts will be the review and certification of invoices for payment. Invoices from the construction contractor will first be reviewed by the construction supervision contractor and then re-checked by the Executive Engineer who will pass them to the Director of Roads for certification. Invoices of the construction supervision contractor will be be verified for accuracy by the Executive Engineer and passed to the Director of Roads for certification. All dollar payments will subsequently be made by A.I.D. and kwacha payments will be made by the accounts section of the MOWS. Payment problems are not anticipated because USAID/Zambia did not experience problems with either the timeliness or the accuracy of the Department's payment approval process under the Kafue-Chirundu Project. Further, a July 1989 RIG audit report found that financial controls over disbursements were adequate for the recently completed Kafue-Chirundu Project.

The Mumbwa Workshop is located approximately 20 km west of Lusaka on the Old Mumbwa Road and provides maintenance/overhaul services for engines, plant and vehicles owned by the Department and serves the provincial organizations as a central spares distribution facility. The workshop, established under the World Bank Third Highway Project, was originally administered for Roads by the Mechanical Services Department (MSD) but is now administered by an Egyptian expatriate hired under a local contract. While the workshop provides

a centralized service to all provinces in theory, the facility has never fully achieved this objective due to insufficient funding and a lack of staff with sufficient mechanical expertise. While the facility is well stocked with spares, there have been bureaucratic delays in transferring responsibilities for distribution of spares from the MSD to Roads.

The materials lab has the capability to do basic soils testing. However, it is not anticipated that their services will be required to any great extent for this project. During the Feasibility Study/Cost Analysis completed prior to project design, John Burrow and Partners implemented a thorough program of testing which has been fully documented in their report to A.I.D. Since this report will be available for the engineering firm contracted to complete the final design, it is not anticipated that any significant additional testing will be needed prior to the commencement of construction. If any additional testing is required it will be performed by the engineering consultant responsible for the design/construction supervision. Lab equipment required by the construction supervision contractor to monitor the quality of construction will be procured as a provisional sum item under the construction contract and be set up in an on-site facility at the construction camp.

The Training School, established in 1985, provides both theoretical and practical training for road foremen termed "gangers". To date, only 60 gangers have received training in labor intensive road maintenance techniques due to initial problems in hiring an adequate staff. However, this problem has now been solved and the Training School is an ongoing and integral part of operations. The training program consists of a sequence of 6 months theory, 6 months on-the-job and 6 months theory. An additional 30 gangers will graduate in September 1989, making a total of 90 trained maintenance crew supervisors available for duty in the provinces. This program appears to have been effective in improving the level of performance among road maintenance crews due to increased knowledge of techniques and effectiveness of supervision by road gangers. It is conceivable that the effectiveness of the program may be largely attributed to the relatively low level of turnover at the technician level of the Department (approximately 5 % annually). If Roads continues to retain technicians at current levels, it is probable that this training will continue to produce positive results as the number of graduates grows over time.

There is a definite training void in the area equipment maintenance. This problem has arisen because of a GRZ reorganization of the MSD. Formerly, the MSD had Government wide responsibilities for the maintenance of equipment and vehicles, and thus, the Department was mandated to use their maintenance services for all plant and equipment. The MSD has recently been reorganized under a profit-making parastatal charter so the Department has the flexibility to shop around for the most advantageous contract maintenance service, or alternatively, develop its own capability. The project will address this opportunity to strengthen the Roads Department's capability to maintain equipment by providing short term training in equipment maintenance. Details of this program are included in the Training Plan.

2.2 Provincial Organization

Each provincial organization is headed by a Provincial Roads Engineer (PRE) who is responsible for the maintenance of the class T, M and D roads within the province. Each provincial organization, with headquarters in the

provincial capital, is divided into maintenance zones. Each of the zones, which total 127 country wide, has offices and living facilities for the workforce and their families. Road Foremen (gangers) and the workforce are usually provided with transport and basic equipment. Each zone has been provided with a tractor, trailer and mower. A water tanker and tipper truck are generally provided for every 4 or 5 zones. The zone establishment carries out routine and recurrent maintenance work such as pot hole patching, grading, drainage, clearing, grass cutting, painting of center lines, and other routine tasks.

A number of District Offices are located throughout the country. Each district, comprised of several zones, is headed by a Road Superintendent. Responsibilities of the District Office are more extensive than those of the zones, and include extensive work to repair failures on paved roads and replacement of damaged culverts in addition to activities carried out at the zone level.

Periodic maintenance (overlaying and sealing) and regravelling is carried out by the Department and by contract, subject to available GRZ funding and the availability of Departmental resources. All major in-house Departmental works are implemented by augmenting existing District Office resources in relation to the size of the given job. For instance, a major maintenance activity could require the movement of several pieces of equipment and reassignment of additional manpower. However, major works are supervised and controlled by the Provincial Roads Engineer even if District level resources are utilized to do the work. In-house works are inevitably constrained by a severe lack of equipment and adequately trained supervisory personnel so major maintenance works must generally be contracted out.

Road construction and major rehabilitation such as the Kafue-Lusaka Road Rehabilitation Project are carried out by contract, awarded and controlled by the Roads Department Headquarters in Lusaka. A consultant is generally engaged to supervise the works.

3.0 Analysis of Institutional and Management Capability

3.1 Staffing

The Roads Department has experienced very serious problems in the hiring and retention of qualified staff, particularly at managerial and professional levels. At the level of Executive or Senior Executive Engineer (i.e., Department Head or Provincial Roads Engineer level) only 10 of 27 existing positions were occupied as of December, 1988. The problem of vacancies continues down through the organizational hierarchy in practically all functional areas, including laboratory staff, mechanical and materials personnel, and on-site line supervisory personnel. For instance, as of December 1988 (see 1988 Staffing Levels in Table 1 below) only 14 of 29 critical Road Superintendent positions were filled. The Superintendent positions also indicated a negative trend in which vacant slots increased from 9 at the beginning of the year to 15 at the end. Obviously, this situation seriously constrains the Department's ability to adequately manage the scarce human, physical and financial resources necessary to maintain the 21,000 km of roads under its charge.

Table 1: Staffing Levels

Designation	Salary Scale	Est 1987	Est 1988	Strength 1988 Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Director of Roads	GPS/3	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Dep. Director of Roads	GPS/5	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Senior Exec. Engineer	GPS/7	7	7	5	5	5	5	5	5	5	5	5	5	4	2
Exec. Engineer	GPS/9	18	18	4	4	4	4	4	4	4	4	4	4	4	6
Exec. Engineer Mechanical	GPS/9	4	4	1	1	1	1	1	1	1	1	1	1	1	1
Senior Exec Officer	S/11/10	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Personnel Officer	S/11/10	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Executive Officer	S/13/12	4	4	4	4	4	4	3	3	3	3	3	3	3	1
Asst. Personnel Officer	S/13/12	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Registry Supervisor	S/13	1	1	-	-	-	-	-	-	-	-	-	-	-	-
Asst. Executive Officer	S/14	2	2	2	2	2	2	1	1	1	1	1	1	1	2
Clerical Officer	S/15	10	10	10	10	10	10	7	9	9	9	9	9	9	9
Tel. Operator Grade 1	S/17	2	1	1	1	1	1	1	1	1	1	1	1	1	1
Asst. Clerical Officer	S/19/17	14	14	13	13	13	13	11	14	14	14	14	14	14	14
Head Orderly	S/19	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Laboratory Assistant	S/19/16	7	7	4	4	4	4	4	4	4	4	4	3	3	3
Computer Operator	S/12/11	1	1	-	-	-	-	-	-	-	-	-	-	-	-
Tel. Operator Grade II	S/19/18	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Senior Orderly	S/19	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Chief Engineering Asst.	TS/2	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Chief Materials Officer	TS/2	1	1	-	-	-	-	-	-	-	-	-	-	-	-
Chief Road Inspector	TS/2	1	1	-	-	-	-	-	-	-	-	-	-	-	-
Chief Mech.Superintendant	TS/3	1	1	-	-	-	-	-	-	-	-	-	-	-	-
Senior Engineering Asst.	TS/3	3	3	1	1	1	1	-	-	-	-	-	-	-	-
Senior Materials Officer	TS/3	4	4	1	1	1	1	1	1	1	1	1	1	1	2
Senior Road Inspector	TS/3	8	8	6	6	6	4	4	3	3	3	3	3	3	3
Road Inspector	TS/4	9	9	9	9	9	9	9	8	8	8	8	8	8	4

22

Table 1: Staffing Levels

esignation	Salary Scale	Est 1987	Est 1988	Strength 1988 Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
oad Superintendant	TS/5	29	29	20	20	20	20	14	16	16	16	16	16	16	14
ech.Engineering Asst.	TS/5/4	4	4	-	-	-	-	-	-	-	-	-	-	-	
raughtsman	TS/6/14	3	3	2	2	2	2	2	2	2	2	2	2	2	2
ngineering Assistant	TS/6/4	16	16	11	11	11	11	10	10	10	10	10	10	10	12
aterials Officer	TS/6/4	4	4	3	3	3	3	4	3	3	3	3	3	3	3
sst. Field Survey Officer	TS/6/5	6	6	1	1	1	1	1	1	1	1	1	1	1	1
echanic	TS/6/5	2	2	-	-	-	-	-	1	1	1	1	1	1	2
oad Foreman & Plant Oper.	TS/6/5	3	3	1	1	1	1	-	1	1	1	1	1	1	1
earner Field Survey Offic.	TS/8/7	1	1	1	1	1	1	1	1	1	1	1	1	1	1
aterials Assistant	TS/8/7	5	5	4	4	4	4	2	2	2	2	2	2	2	2
ub-Road Foreman	TS/8/7	1	2	-	-	-	-	-	-	-	-	-	-	-	-
racer	TS/8/7	5	5	4	4	4	4	5	5	5	5	5	5	5	5
ransport & Mach.Overseer	TS/8/	14	14	9	9	9	9	7	8	8	8	8	8	8	8
earner Technician	TS/9	5	5	-	-	-	-	-	-	-	-	-	-	-	-
tenographer	SS/2	2	2	1	1	1	1	1	1	1	1	1	1	1	2
ypist	SS/4	12	12	12	12	12	12	12	12	12	12	12	12	12	12

The problem of retention of adequate staff is most critical at the management and professional levels where the lack of pay and benefit packages offered by the Department pushes qualified staff into the private/parastatal sector which provides more attractive remuneration. Even if the Department is able to hire qualified engineering/technical graduates from Zambian institutions, it is highly unlikely they will be retained long enough to be developed into senior management (current annual salary is less than $1500). This is evidenced at the provincial level where only 2 of 9 PRE's are native Zambians. Remaining PRE slots are filled by 3 British OSAS managers (2 of which are being terminated by ODA) and 3 expatriates under local contracts. This is further evidenced at the Headquarters where expatriates under foreign assistance programs fill key slots on a long term basis. The Deputy Director and Executive Engineer for contracts have been provided under the British OSAS Program and the Senior Executive Engineer for Maintenance by NORAD. While the use of expatriates may not be optimal from the point of view of utilizing Zambian human resources, it is probably the only way the Department could efficiently operate at the present. Yet, this arrangement for the provision of key management personnel leaves the Department at the mercy of the foreign assistance programs which may or may not be there with needed technical assistance. For instance, the OSAS program provided 6 Executive or Senior Executive engineers at Headquarters in 1985, whereas for reasons outside the control of the Department, only 2 are currently being provided. In 1985, there were 12 OSAS engineers at the Department, a figure which will be reduced to 3 shortly.

FINNIDA is currently providing six engineers on a long-term basis. Three road maintenance engineers are working in the Lusaka Province under a pilot project which is scheduled to run through 1993 and may be expanded to other provinces. Three engineers have also been provided to establish a stone crushing facility at Kafue. Their services are scheduled to end in 1990.

It is because of this seemingly irreversible trend in hiring and retaining Zambian management/professional level staff that the Department has concentrated efforts on a bottom-up personnel development program centered around the training school for road foremen (gangers). Personnel at the technician level have tended to stay with the Department on a long term basis so it has been possible to realize the benefits of in-house training.

In summary, the Roads Department has the same problems with hiring and retaining competent staff which are faced by all GRZ Ministries. Until the Government modifies the salary/benefits package which the Department may offer, competent management/professional personnel will continue to flock to the private and parastatal organizations. In the near future, the Department will have to rely on its own training program for road foremen, and assistance from donors for senior level management staff and appropriate training. Given the turnover pattern experienced by the Department, it may be most effective to direct as much training as possible toward the technician level (such as training for mechanics already on the staff who have shown potential) because artisans and technicians have demonstrated the most longevity and loyalty within the organization.

3.2 Operations

The Department's two main areas of responsibility are construction and maintenance of International Main (T), Main (M) and District (D) Roads. All construction and major maintenance such as rehabilitation are contracted out so Departmental actions in that regard are confined to contract administration and monitoring construction. The primary operations of the Department are therefore focussed on maintenance activities such as patching, cleaning and repairing drainage ditches, and periodic resealing of road surfaces to prolong their useful lives. It is because of the relative importance within the organization and the critical nature of the activity in general that the following discussion focuses on the organizational process of how the Department carries out maintenance.

3.2.1 Goals: Goals are initiated by each Provincial Roads Engineer (PRE), reviewed by the Roads Department Headquarters in Lusaka and forwarded to the Ministry of Finance to be programmed in relation to Government-wide requirements and available funds. For instance relevant information for decision making purposes regarding paved roads would include necessary resealing, vegetation control, ditch digging, drainage structure clean-up and pothole patching. On gravel roads the resealing task would be replaced by regravelling.

3.2.2. Planning vs. Implementation: Both tasks are initiated by the PRE. Levels of implementation are always less than those planned due to funding constraints, and the availability of equipment and labor. At the end of the year the Headquarters in Lusaka does a comparison study on planned vs. actual work implemented and makes appropriate adjustments in requests for funding, deployment of equipment and personnel, and other actions.

3.2.3 Accountability: The responsibility for both financial and technical issues lies with the PRE's. They report to the Director of the Roads Department who reviews technical matters and renders decisions. However, on financial issues the Director must consult with the Ministry of Finance and Ministry of Power, Transport and Communication. On administrative matters only, the PRE's are responsible to the Provincial Permanent Secretaries who coordinate and monitor all government activities within the province.

3.2.4 Level-of-Service Standards: There are three classes of paved roads. They are Class 1A: 7.3 meters-wide carriageway with 3 meter shoulders (only one road of this type exists in Zambia), Class 1B: 6.7 meters-wide carriageway with 2 meter shoulders (only a few of this type of road exist in Zambia; and Class 1C - 6.1 meter wide carriageway (most paved roads in Zambia are of this class). Current Roads Department practice calls for a double seal surface dressing, and for every road to be resealed at least once every seven years. This is defined as periodic maintenance.

3.2.5 Training: Training is an extremely important element to maintain an effective level of service. The Director of Roads stated that his philosophy is to strengthen the base of the organization by concentrating on improving the efficiency of road maintenance crews. As previously described, maintenance repair gang leaders will be for a training course given in

Lusaka. Roads Department feels it is more important to provide short-term training for its road technicians and maintenance gang leaders than it is to provide long-term training for the engineers. The road technicians and maintenance gang leaders tend to remain with the Roads Department long-term versus the engineers who work only for short durations before going to better-paid jobs. Current managerial courses for Road Provincial engineers are of 4 weeks duration.

The Director of Roads believes that more short-term intensive training is needed especially in the area of mechanical services because the Department is taking over responsibilities for equipment maintenance from the Government's Central MSD. Roads is also getting 3 new road maintenance equipment units which will need proper maintenance (one unit is being provided by the current A.I.D.-funded Kafue-Chirundu Road Project).

3.3 Organizational Framework (Maintenance Section):

3.3.1 Decentralization: The Road Maintenance Section is mainly decentralized. The entire Zambian Roads Department consists of 127 Road Maintenance Zones. Each zone has approximately 150 km of primary/secondary paved/gravelled roads. Each PRE is responsible on average for 12 maintenance zones. Each zone crew is comprised of 10-15 people including the road gang leader. General laborers are hired as needed for specific jobs on a casual basis. In each province there are usually Urban City Councils who are responsible for road maintenance of urban roads. Only planning control (i.e., for new capital projects) and budgeting are performed on a centralized basis by the Roads Department Headquarters in Lusaka. As stated above, maintenance plans are initiated by the PRE's.

3.3.2 Organizational Relationships: Provincial Roads Engineers are responsible to the Permanent Secretary of their Province (administratively only). However, for technical and financial support they report to the Director of Roads. The PRE is responsible for the maintenance crews working in each zone.

3.3.3 Personnel and Equipment Distribution: Roads Department Headquarters hires all engineers and road technicians and deploys them wherever services are needed. The PRE is responsible for hiring all maintenance crew personnel (drivers, laborers, gang leaders, etc.) The Roads Department Headquarters procures and distributes equipment.

3.3.4 Equipment Availability and Utilization: This is the responsibility of the PRE, however the task is closely monitored by the Roads Department Headquarters which deploys equipment to provinces based on local requirements.

3.3.5 Road Maintenance Budget and Expenditure: PRE's are responsible for submitting a budget for their province on a quarterly basis to the Roads Department Headquarters. Work preparation for the annual budget is usually started by the PRE's in August. The Roads Department Headquarters authorizes the request, then sends the request (with revisions) to the Ministry of Power, Transport and Communication which in turn submits the request to the Ministry of Finance for final review. In November the Ministry of Finance submits the

request (which has been reviewed by the Cabinet Office) to Parliament for approval. Parliament approves the budget in December for the next fiscal year which starts January 1. Expenditures are analyzed by the Roads Department at the end of the year after the budget has been spent. The Roads Department has flexibility to move funds from one line item to another to implement programs. A supplementary appropriation may be requested by the Roads Department for additional maintenance.

3.3.6 Work Programs or Plans: These actions are initiated by the PRE's and approved by the Roads Department Headquarters. Special capital programs (large new construction projects) are initiated by the Ministry of Works and Supply and approved by the National Commission for Development Planning and the Ministry of Finance.

3.3.7 Private Sector Contracting Capacity and Utilization: There are 5 approved contractors available in the country for construction jobs consisting of a value of K41,000,000.00 ($2,562,500.00) or more. It is believed that only one of these firms is actually Zambian owned, and therefore it will be necessary to solicit bids from other contractors in the SADCC region or the U.S.

4.0 Equipment

Equipment is deployed by the Director of Roads to the provinces on an as needed basis (see Table 2 for a breakdown of the Roads Department Plant/Vehicles/Equipment Inventory). While the Department owns a sizable amount of equipment, the upkeep and ongoing maintenance of these units has been a problem for a number of reasons. Stocking of adequate spares has been a problem which the Department has attempted to resolve by standardizing on certain brands of trucks such as Mercedes and Mitsubishi. Another problem has been attributed to inadequate service from the MSD. However, the Roads Department is no longer mandated to use their services and is attempting to do more repair/maintenance work in-house. In addition to the Mumbwa Workshop, each provincial headquarters has a workshop and a staff of mechanics.

Table 2: Plant/Vehicle/Equipment (Working)

	Lusaka	Central	Copperbelt	Northern	North Western	Luapula	Western	Southern	Eastern	Total	Procurement (Pending)
Truck	2	4	3	3	2	2	2	3	4	25	-
r	12	7	8	8	6	7	5	4	12	69	40
Tanker	3	3	4	3	3	3	3	-	3	25	04
end Loader	2	4	2	3	4	2	1	-	3	21	02
en	2	-	1	-	-	-	-	1	-	4	02
tributor											
r (Tire)	4	2	2	3	2	4	2	3	2	24	02
Dozer	2	1	-	2	1	1	1	2	1	11	04
Grader	4	5	2	5	5	4	1	3	3	32	04
oader	-	1	-	1	1	1	1	-	1	6	-
Breaker	-	-	-	-	-	-	-	-	-	-	02
Shovel	-	-	-	-	-	-	-	-	-	-	02
r (Steel)	2	1	2	1	1	-	-	-	8	8	04
te	5	3	3	4	3	4	1	2	3	28	06
Spreader	2	-	-	-	1	-	-	-	2	5	06
lt Kettle	-	-	-	-	-	-	-	-	-	-	02
er (plant)	1	-	1	-	-	-	-	1	-	3	02
essor	-	1	1	-	1	1	1	-	2	7	02
Tractor	12	6	8	13	10	11	7	9	7	83	-
e Workshop	3	-	-	-	-	-	-	-	-	3	-
r (small)	-	-	-	2	-	-	-	-	2	4	-
en Storage	1	-	-	-	-	-	-	-	1	2	-

June 1989

29

METHODS OF FINANCING

1.0 Responsibilities for Implementation

This project will be obligated under a bilateral grant agreement with the Government of the Republic of Zambia (GRZ). REDSO/ESA/RFMC will be the authorized accounting station for the project and will be responsible for grant disbursements and financial accountability until USAID/Zambia's controller arrives in August 1990. At that time, certain financial management responsibilities will be transferred to USAID/Zambia. Foreign exchange will be disbursed for the provision of international training, the procurement of equipment and spares, design supervision services and construction services, unless a Zambian owned contractor is awarded the construction contract. In this case, the Zambian-owned contractor will be paid in kwacha procured from the Bank of Zambia under local cost financing. To the maximum extent possible, the host government will provide local currencies under a standard counterpart funds agreement signed by USAID/Zambia and the GRZ. The counterpart funds agreement will finance a maintenance sinking fund, land acquisition costs, disruption compensation for displaced persons, training and locally produced maintenance equipment. Accountability for these funds will remain with USAID/Zambia.

Host country contracting was successfully utilized to procure nearly identical goods and services under the recently completed Kafue-Chirundu Road Rehabilitation Project. These include the procurement of design/supervision and construction services, and maintenance equipment/spares required to achieve project objectives. The contracting capability of the GRZ was found to be satisfactory under that activity.

In compliance with State 185082, before host country contracting procedures can be used to implement this project, the Mission Director must certify in writing, on a case by case basis, that the Roads Department, the host country implementing agency, has the capability to undertake the required procurements. This certification, included as Annex I.I to this project paper, has been made by the Director, USAID/Zambia based on: (1) the recent performance of the Roads Department in successfully administering an almost identical set of host country contracts under the Kafue-Chirundu Road Rehabilitation Project and a positive finding on the effectiveness of those procedures by RIG/A/N in Audit Report No. 3-690-89-17, (2) a current review of host country contracting procedures by the Controller, USAID/Zimbabwe and the design team, and (3) in conformance with AID/W guidance, the Mission's plan to monitor and control the required GRZ contracting procedures.

Under the recently completed Kafue-Chirundu Road Rehabilitation Project, the Roads Department demonstrated the capability to effectively administer host country contracts for all of these activities. As was the case under Kafue-Chirundu, all contracts under this project will be in compliance with A.I.D. Handbook 11 procedures. Further, all A.I.D. financial, legal, engineering, contracting and commodity officer approvals will secured, as required, prior to A.I.D. approval of contracts for both services and commodities. Contracts will be administered by the senior engineer in charge of the contracts section of the Department, who successfully administered all host country contracting under previous A.I.D.-financed road rehabilitation projects.

Host Country contracting actions are expected to exceed $100,000 dollars under this project. In compliance with State 185082, A.I.D. approvals of the following interim steps in the contracting process will be carried out:

1. The shortlist of prequalified firms for both the procurement of design/supervision and construction services, and

2. Solicitation documents for the procurement of services and, as required by Handbook 11, road maintenance equipment and spare parts.

Per State 185082, a representative of USAID/Zambia will be included on the Department's evaluation panel for services contracts as an observer to assure that the evaluation is done fairly in accordance with the stated method and criteria in the solicitation process. It is envisaged that commodities will be procured by the design/supervision contractor, acting as an agent of the Department. Although the Department successfully procured equipment in conformance with Handbook 11 procedures in the past, it was determined by the design team that the upcoming commodity procurement should be handled by a procurement agent in order to free the Department to carry out its primary task of administration of the contracts for design/supervision and construction services.

The Department has demonstrated adequate financial control procedures under Kafue-Chirundu in approving payments made by A.I.D. under Direct Letters of Commitment. All disbursements were first certified correct by the Director of Roads, administratively approved by the USAID/Zambia project officer and certified for payment by RFMC. These procedures will be used to implement this project.

Contract administration and financial control procedures of the Roads Department under Kafue-Chirundu were carefully reviewed by RIG/I/N in Audit Report No. 3-690-89-17. The report stated "The audit disclosed that the project objective of facilitating the movement of key commodities was achieved, as construction was substantially complete, the overall quality of construction was excellent, and provisions were made for the future maintenance of the road. In addition, internal controls over $12.1 million of disbursements were adequate to ensure that work was satisfactorilly completed in conformance with applicable contractual requirements and A.I.D. regulations."

All host country procurements and procedures under this project are the same as those successfully implemented under the Kafue-Chirundu Road Project. Based on their recent performance and our current review of their procedures, the USAID/Zimbabwe controller, the design team and USAID/Zambia have determined that the Roads Department has the capability to undertake the host country contracting procedures described herein.

All kwacha disbursements of GRZ-owned counterpart funds will be made from a project working account controlled by the Roads Department. Disbursements of K2,560,000 in local currency, provided by the host government for land acquisition, training and equipment, will be made from the project working account. Additional local currency in the amount of K120 million for the sinking fund will be deposited in a special interest bearing account at a local commercial bank. The deposits of K60 million each must be made prior to January 15, 1991 and November 15, 1991. The appropriate amount of local currency will be transferred periodically from the interest bearing sinking fund account to a separate project working account to meet the annual requirement to top up the maintenance budget for the Lusaka-Kafue-Chirundu Road to adequate levels. These transfers will be in accordance with the annual GRZ budgeting process to fund Roads Department operations. Funds deposited from local currency generations will not be commingled with the GRZ regular budget account. For estimates of revelant costs, see Table 1 and the related discussion in Annex III.F., Maintenance Analysis. The counterpart funds agreement must be signed and the aforementioned accounts established prior to the signing of any host country contracts, or other commitments requiring local currency contributed by the GRZ as part of this project, to minimize delays in making payments. Payments from the working account will be made to the local training institution and to suppliers of locally produced equipment. All kwacha payments to contractors must be authorized and approved by the Director of Roads or his designee in accordance with the USAID/GRZ counterpart fund agreement for the project. Kwacha payments will be effected by the Accounts Department of the Ministry of Works and Supply based upon the Director of Roads approval.

All payments from the USAID grant will be certified by RFMC until financial accountability is transferred to the Controller, USAID/Zambia. Administrative approval will be given in Zambia for dollar payments to the final design/construction supervision contractor, the construction contractors, equipment suppliers and overseas training institutions.

Local cost financing will only be utilized if a Zambian-owned firm is awarded the construction services contract. In this event Zambian construction firms will be paid in local currency and required to exchange kwacha for foreign exchange with the Bank of Zambia at the highest rate of exchange not unlawful in Zambia. If the construction contract is awarded to a non-Zambian firm, all disbursements will be made in dollars in accord with standard A.I.D. disbursement procedures and sound financial management principles. Except for possible payments to a Zambian construction contractor, all kwacha payments under this project will be made from GRZ-owned counterpart funds. (FYI. Design supervision firms have already been prequalified and the short-listed firms are all U.S.-owned or associations of consultants led by U.S. firms that will receive payments.) All counterpart funds will be provided from generations under PL 480 Title I or other A.I.D. program support already obligated, excluding the possibility of generations from any future Food for Progress Programs.

All disbursements of project funds will reflect standard A.I.D. procedures vis-a-vis nationality of services and currency of payment. Exact details of host country contract disbursement procedures will be determined at the time tender documents and contract formats are developed by the Roads Department for review/approval by USAID/Zambia, RLA, and the Regional Engineer from REDSO/ESA.

Host country contracting mechanisms detailed in HB 11 will be utilized to procure services for both final design/construction supervision and construction. Additionally, locally-produced road maintenance equipment and in-country training will be procured under standard GRZ contracting procedures and financed using GRZ-owned counterpart funds from the project working account established and controlled by the Director of Roads. Imported maintenance equipment and spare parts will be purchased in foreign exchange provided under the project using HB 11 procedures.

Evaluations will be carried out primarily by the REDSO/ESA staff. USAID/Zambia will utilize PSCs or IQCs to support REDSO/ESA in areas where direct hires are not available during required time frames. A non-federal audit will also be contracted with a firm under an A.I.D. direct contract if RIG/A/N staff from Nairobi are not available.

2.0 Recurrent Costs Financing

The issue of recurrent costs financing was studied in detail by the engineering firm, John Burrow and Partners, as part of a maintenance study included in the project design. The study is detailed in Annex III.F, Maintenance and Sustainability Analysis. The study estimated maintenance costs for the Kafue-Lusaka as well as the Kafue-Chirundu roads up to the year 2000 (see Table 1 of Annex III.F). The aforementioned sinking fund will be established by the Roads Department with K120 million of GRZ-owned counterpart funds to assure that sufficient financing will be available to top-up the regular Roads Department maintenance budget to adequate levels.

As recommended in the Burrow study, foreign exchange financing of $425,000 will also be provided under the project to supplement funds for maintenance spares expected to be provided by the Bank of Zambia and the donor community. These spares are estimated to cover requirements to assure adequate maintenance of the Lusaka to Chirundu road through the year 2000 and will be procured, on behalf of the Roads Department, by the design/supervision contractor or other procurement agent to be determined. A road resealing maintenance unit comprised of 13 items and spares valued at about $860,000 (including contingency), will also be financed for first priority use to protect A.I.D.'s investments. HB 11 host country procurement procedures will be utilized to complete these purchases. It is envisaged that various Direct Letters of Commitment will be established to provide funding. Short term training in road maintenance management at ESAMI will be provided in Tanzania at a cost of $20,000 and funded by direct A.I.D. payments.

The aforementioned counterpart and foreign exchange support made available to finance recurrent costs is required because of current GRZ policies which do not provide for adequate maintenance budgeting. This situation is primarily the result of GRZ policies over a number of years that guided a public expenditure program emphasizing the subsidization of consumption over maintenance of the infrastructure. Obviously, this unfavorable public expenditure pattern has serious implications as to whether future support for recurrent cost budgeting is an acceptable intervention under this project.

In sum, the design team believes project interventions to support the financing of recurrent road maintenance costs are justified in view of recent GRZ policy reform efforts to provide required budgeting. This new GRZ attitude has been evidenced during the GRZ's current restructuring and budget control efforts, and was most recently supported by statements at the Zambia Consultative Group Meeting held in Paris April 9-11, 1990. As expected a high priority was placed on road maintenance funding by all concerned parties at the CG. For instance, the sinking fund earned the special mention of both the Ministers of Power, Transport and Communication and Finance as a creative effort by A.I.D. to assist the GRZ in assuring adequate road maintenance. Additionally, the Public Investment Program (PIP) proposed by the the World Bank in relation to roads demonstrates the importance and priority of maintenance over capital expenditures. In other words, the Bank has emphasized they will not support any new capital projects to develop roads until the GRZ adequately provides for the maintenance of those already in existence. It is therefore a very positive outcome that the Bank, as a leader in the structural adjustment process, intends to include this important principle in their continuing dialogue with the GRZ. It appears that genuine reforms are possible in the area of maintenance financing given the strong stance taken by the Bank and the commitment to maintenance of the transportation infrastructure expressed by high level GRZ officials.

In particular the PIP includes significant increases in funding for road and equipment maintenance during the period 1990-1993. The main priorities indicated by the Bank also include a comprehensive program for the rehabilitation of roads, provision of spare parts and a thorough evaluation of transport regulations. Project interventions complement each of these areas. The sinking fund and provision of foreign exchange for critical spares provides the necessary breathing space to protect A.I.D.'s investments in road rehabilitation until the necessary reforms in the planning and budgeting process are achieved under the structural adjustment program. As a condition precedent to disbursements under the construction contract, the GRZ has also agreed to carry out a thorough study of the whole system for the limitation of axle loads and enforcement of requlations to safeguard the road network.

Other donors are also actively involved in building institutional maintenance capability at the Department of Roads. FINNIDA, NORAD and British ODA are each contributing technical assistance and budget support to the Department on a long-term basis. Future road rehabilitation projects such as

the AfDB East Road Rehabilitation will include resources dedicated to improving the road maintenance capability of the GRZ. The EC has also indicated their intention to provide budgetary support for the Department of Roads as part of the Lusaka-Copperbelt road rehabilitation project.

3.0. Financing Methods

Financing methods for the various elements of the project are included in the Methods of Financing and Implementation tables below. Table 1 relates to dollar disbursements and Table 2 relates to kwacha disbursements.

Obligations by fiscal year are detailed in Table 3. Accrued expenditures are detailed in Table 4 for dollars and in Table 5 for kwacha. A cost build-up for the PSC engineer is detailed in Table 6.

Table 1: Methods of Financing and Implementation
U.S. $ Financing (000)

Element	Method of Implementation	Method of Financing	Total
Final Design	Host Country Contract, competitively procured in accordance with HB 11, Ch 1 procedures	Direct Letter of Commitment	$350.00
Construction Supervision	Host Country Contract, competitively procured in accordance with HB 11, Ch 1 procedures (same contract as final design	Direct Letter of Commitment	$1,100.00
Construction Services	Host Country Contract, competitively procured in accordance with HB 11, Ch 2 procedures	Direct Letter of Commitment	$16,270.00
Maintenance Equipment	Host Country Contract, competitively procured in accordance with HB 11, Ch 3 procedures	Direct Letters of Commitment	$860.00
Training	Direct Contract or PO with Training Institutions	Direct Payment	$20.00
Spares (procured by agent of Roads Dept)	Host Country Contract, competitively procured in accordance with HB 11, Ch 3 procedures	Direct Letters of Commitment	$425.00
PSC Engineer	Direct Contract with individual	Direct Payment	$735.00
Evaluations, Audits	Direct contract with acctng firm or work order IQC NFA	Direct Payment	$100.00

doc:lotus:harmon:methfin

Table 2: Methods of Financing and Implementation
Kwacha Costs (000)

Element	Method of Implementation	Method of Financing	Total Amount (k)
Sinking Fund (a)	Direct budget support thru funds transfer from interest bearing acct to Roads Dept working acct in accord with MOWS financial mgmt procedures and USAID/GRZ local currency agreement.	Direct payment by Accts Dept of MOWS from working acct at Lusaka commercial bank.	120000.00
Maintenance Equipment (b)	Host Country Contract, in accordance with GRZ procurement procedures and USAID/GRZ counterpart funds agreement.	Direct payment by Accts Dept of MOWS from working acct at Lusaka commercial bank.	450.00
Training (in-country) (c)	Host Country Contract, in accordance with GRZ procurement procedures and USAID/GRZ counterpart funds agreement.	Direct payment by Accts Dept of MOWS from working acct at Lusaka commercial bank.	730.00
Land Acquisition	Land purchases and disruption compensation implemented by Roads Dept in accordance with GRZ procedures and USAID/GRZ local currency agreement.	Direct payment by Accts Dept of MOWS from working acct at Lusaka commercial bank.	100.00

Note:

(a) In addition to K47,675,000 to cover maintenance costs expressed in currently valued kwacha, the sinking fund also includes a contingency amount of K72,325,000 to allow for anticipated inflation over 10 years. Hence, total sinking fund disbursements are estimated to be K120 million.

(b) Kwacha financed equipment is comprised of one bitumen storage tank estimated at K300,000 and one mobile fuel tank estimated at K150,000.

(c) Based on costs provided by the International Training Center in Lusaka. Costs for 1990 are for 10 participants @ 900 K/week X 8 weeks (two 4-week sessions) = K 72,000 plus 400 lunches X K45 =K 18,000. Total 1990 = K 90,000. Applying a cost escalator of 50 % per year, estimated costs over time are: K 135,000 (1991), K 202,500 (1992), and K 303750 (1993).

doc:lotus:harmon:methfink

Table 3: A.I.D. Obligations Schedule
By Fiscal Year
($ 000)

Activity	FY 90	FY 91	FY 92	Total
Final Design	350.00	0.00	0.00	350.00
Construction Supervision	1100.00	0.00	0.00	1100.00
Construction Services	8650.00	5575.00	2045.00	16270.00
PSC Engineer	250.00	250.00	235.00	735.00
Spare Parts (procured by Agent of Roads Dept)	75.00	30.00	320.00	425.00
Training	10.00	0.00	10.00	20.00
Maintenance Equipment	0.00	0.00	860.00	860.00
Evaluations, Audits	0.00	0.00	100.00	100.00
Contingency/Inflation (15 %)	1565.00	880.00	535.00	2980.00
TOTAL	12000.00	6735.00	4105.00	22840.00

doc:lotus:harmon:klobdols

Table 4: A.I.D. Projected Accrued Expenditures
By Fiscal Year
($ 000)

Activity	FY 90	FY 91	FY 92	FY 93	FY 94	Total
Final Design	0.00	350.00	0.00	0.00	0.00	350.00
Construction Supervision	0.00	0.00	500.00	600.00	0.00	1100.00
Construction Services	0.00	0.00	7500.00	8770.00	0.00	16270.00
PSC Engineer	120.00	190.00	190.00	235.00	0.00	735.00
Training	3.00	4.40	5.50	7.10	0.00	20.00
Maintenence Equipment	0.00	0.00	0.00	860.00	0.00	860.00
Spares (procured by agent of Roads Department)	15.00	28.00	30.00	34.00	318.00	425.00
Evaluations, Audits	0.00	0.00	30.00	0.00	70.00	100.00
Contingency/Inflation (15 %)	21.00	86.00	1238.50	1576.00	58.50	2980.00
TOTAL	159.00	658.40	9494.00	12082.10	446.50	22840.00

doc:lotus:kldolex

Table 5: Local Currency Expenditures
By Fiscal Year

(Kwacha 000)

Activity	FY 90	FY 91	FY 92	FY 93	FY 94	FY 95-2000 (a)	Total
Sinking Fund (b)	0.00	2062.80	4129.38	7737.72	7897.82	98172.28	120000.00
Maintenance Equipment	0.00	0.00	0.00	0.00	450.00	0.00	450.00
Training	90.00	135.00	202.00	303.00	0.00	0.00	730.00
Land Acquisition	0.00	100.00	0.00	0.00	0.00	0.00	100.00
Contingency/Inflation (c)	90.00	235.00	202.00	303.00	450.00	0.00	1280.00
TOTAL	180.00	2532.80	4533.38	8343.72	8797.82	98172.28	122560.00

Notes:

(a) Local currency expenditures for road maintenance exceed the PACD.

(b) Includes maintenance costs of K47,675,000 expressed in currently valued kwacha plus a contingency for inflation of K72,325,000.

(c) Contingency equals 100% of costs for maintenance equipment, training and land acquisition costs (including compensation to displaced persons).

doc:lotus:harmon:klkex

Table 6: Estimated Cost For Personal Services Contractor
Engineering Services For Kafue-Lusaka Road Project

Tour of Duty: 3 1/2 yrs
Compensation: $52,000 /yr (a)
Dependents: Spouse and 2 children (assumed)

ALLOWABLE COSTS

A. Personal Compensation	1st Year ($)	2nd Year ($)	3rd Year ($)	4th Year ($)	Total ($)
1. Basic Pay (a)	52,000	53,560	55,167	28,411	189,138
2. Post Differential	7,800	8,034	8,275	4,262	28,371
B. Personal Benefits (5% annaual inflation)					
1. Education Allowance	38,950	40,910	42,970	22,587	145,417
C. Travel and Transportation					
1. International Travel	7,000	0	0	7,875	14,875
2. Excess Baggage	1,000	0	0	1,125	2,125
3. Per Diem (post assign/ return)	800	0	0	900	1,700
4. Unaccompanied Baggage	7,000	0	0	7,875	14,875
5. Household Effects	25,000	0	0	28,125	53,125
6. POV	4,000	0	0	4,500	8,500
7. Storage	4,000	4,200	4,410	4,675	17,285
8. R and R	0	14,000	14,700	0	28,700
9. Emergency Med. Travel	3,500	3,675	3,859	4,050	15,084
10. Medical/ Minbank	500	525	551	579	2,155
11. Vehicle	21,000	0	0	0	21,000
D. Rent & Utilities					
1. Residential Rent	24,000	24,000	24,000	12,000	84,000
2. Utilities	18,000	18,000	18,000	9,000	63,000
3. Furnishings	20,000	0	0	0	20,000
4. Appliances	9,000	0	0	0	9,000
5. Maintenance to Res.	2,400	2,400	2,400	2,400	9,600
E. Other Direct Costs					
1. Physical Exams	375	0	0	375	750
2. Miscellaneous	1,800	1,800	1,800	900	6,300
TOTAL ($)	248,125	171,104	176,132	139,639	735,000
AVERAGE COST/MONTH	$17,500				

Note:
(a) Assumes starting salary of $52,000, with annual increases of 3 %.

jh:lotus:doc:psc1

ROAD MAINTENANCE AND SUSTAINABILITY ANALYSIS

5.6.1 General Constraints

A primary concern of this and most other road rehabilitation projects in developing countries is sustainability, associated with ongoing maintenance. Except for certain rural roads under the auspices of the district councils, maintenance throughout Zambia is carried out by the Roads Department. As identified in the Institutional Analysis, there are a number of general constraints to effective road maintenance throughout the country. These include a lack of funding for recurring Departmental costs and GRZ employment policies that make it difficult to hire and retain qualified professional and managerial staff.

However, the primary constraint to adequate maintenance on a national level, as identified by a recent World Bank mission to Zambia, is inadequate funding. The purpose of the mission was to carry out preliminary analytical work in several sectors in preparation for the proposed structural adjustment program. As a result of their preliminary investigation, the World Bank representative in charge of the road assessment advised he would recommend that the Bank not fund any more Roads Department capital projects until adequate funding for maintenance is provided. A brief analysis of the Department's country-wide budget line item for resealing and regravelling roads will illustrate the World Bank's concern. The estimated levels of adequate funding developed by the roads Department and the Bank are: K398.6 million (1991), K446.6 million (1992), and K446.6 million (1993), as opposed to only K132 million actually budgeted in 1990. The Bank representative believed that new road projects were not justified unless the GRZ provided adequate financing to maintain existing roads and stated he would strongly encourage his organization to take this position in discussions with the Zambian government. It is expected that the Bank will strongly encourage donors involved in road rehabilitation projects to concentrate on financing mechanisms to protect their own investments. The Government of Zambia delegation to the April 1990 Consultative Group meeting in Paris did in fact encourage donors to design their road projects with provisions to assure adequate follow-on maintenance.

It was with these maintenance concerns in mind that the design team investigated alternatives for a project maintenance intervention strategy to protect the A.I.D. investment in road rehabilitation. The basic assumption was that A.I.D. could not effectively address each and every constraint to adequate road maintenance throughout Zambia under an activity to merely rehabilitate a 50 km stretch of road. For instance, A.I.D. does not have enough leverage to effect any significant changes in the salary/benefits package offered to all GRZ civil servants. This type of issue will most likely be addressed by the World Bank in discussions with the GRZ. Furthermore, the project cannot realistically hope to leverage adequate levels of maintenance funding on a national scale or alleviate the shortage of crushed stone to properly maintain roads countrywide.

However, despite the rather awesome problems faced in maintaining roads throughout the country, it appeared to the design team that the Roads Department had fully demonstrated its capability to maintain the past A.I.D. investment in rehabilitating the Kafue-Chirundu road. In fact, prior to the onset of the current rainy season the Department completed approximately one half of the periodic maintenance required to preserve and extend the life of the road rehabilitated under Phase I of the Kafue-Chirundu Road Project. The remainder of the periodic maintenance on Phase I sections is scheduled to be completed once the current rainy season has ended. This periodic resealing is being carried out on schedule by the Lusaka Provincial Roads Engineer (PRE) with funds provided by the Department. The work was assessed to be of good quality by A.I.D. regional engineers working on the project design and the Consultant who reviewed the GRZ maintenance capabilities. While this level of effort seems somewhat inconsistent with the general lack of maintenance throughout the country, it does indicate that the Department can carry out maintenance at a much higher standard than is generally practiced.

The hypothesis of the design team was that this better than expected maintenance performance on the Kafue-Chirundu road was due to a number of factors including the strategic importance of the Lusaka-Harare corridor, the resultant high visibility of the A.I.D.-financed road work and the fact that the road is in a maintainable state. The country's limited maintenance funds are being directed to the more important roads.

5.6.2 Assessment of A.I.D.-Financed Road Rehabilitation

A consulting engineering firm, John Burrow and Partners, was hired in January 1990 to carry out an assessment of the maintenance of the previous USAID financed projects and to estimate potential for maintaining the new project. The primary tasks in the scope of work were to: (a) provide a professional critique of the maintenance operation of the Roads Department; (b) assess the maintenance record of the Department on past A.I.D.-financed road rehabilitation, much of which was completed approximately eight years ago under Phase I of the Kafue-Chirundu Road Rehabilitation Project; (c) detail personnel, equipment and funding requirements to provide for adequate maintenance on A.I.D. investments in the out years; and (d) provide realistic recommendations on how the project might best address the issue of maintenance of the A.I.D. investment from Kafue to Lusaka as well as the previous investment from Kafue to Chirundu. An important task was to specifically evaluate the maintenance operation and performance of the Lusaka Provincial Roads Engineer, who is responsible for maintaining the A.I.D. investment. The concept of limiting project interventions to maintain only the A.I.D. investment, if operationally feasible at the Department and advantageous to the project, is consistent with the proposal of the recent World Bank mission to Zambia such that each donor provide for adequate maintenance of the section of road rehabilitated under a given project.

The John Burrow report, attached to this annex, is organized as follows:

Section 1 Background Information
Section 2 Maintenance Operation of the Roads Department
Section 3 Maintenance Record in Lusaka Province (Kafue-Chirundu Road)
Section 4 Maintenance Requirements for the Lusaka-Kafue-Chirundu Road
Section 5 Equipment Requirements
Section 6 Maintenance, Axle Loading and Land Acquisition

Annex 1 Kafue-Chirundu Road Inspection
Annex 2 Details of Maintenance Cost Estimates
Annex 3 Review of Maintenance Capability: Persons Interviewed
Annex 4 Mechanical Equipment Provided by Donors

Section 2 confirms the serious shortage of professional and technical staff identified in the Institutional Analysis, but states that this constraint has been alleviated to some extent by expatriate engineers with executive responsibilities at the Department. In addition the FINNIDA maintenance project in Lusaka Province has provided five engineering advisors who provide training and improved maintenance planning. The report also describes a Departmental plan to have the five best technicians in Lusaka Province appointed as permanent civil servants, therefore making them eligible for training courses in Lusaka and overseas. Furthermore, four engineering technicians have already been sent to the Zambia Institute of Technology for training to graduate as engineering assistants. The report states that this progression of trained staff should assist immensely in upgrading the capability of the Lusaka PRE to carry out adequate maintenance. The report identifies the recent increase of the GRZ subsistence allowances as an encouraging development, however low government wages continue to be a probler

The provision and maintenance of equipment continue to be a problem throughout the country, and according to the report, the Department must continue to rely heavily on donors. Fortunately, Lusaka Province will benefit from equipment and spares valued at over $2 million provided by this and the previous A.I.D. road rehabilitation projects as well as $4.1 million provided by FINNIDA under its current maintenance project. In addition to these units dedicated to the Lusaka Province, maintenance of the A.I.D.-financed road from Lusaka to Chirundu will benefit from sizeable equipment inputs provided by other donors as described in Section 2.3 of the project paper entitled Other Donor Activity. This is in addition to maintenance equipment provided under the project.

The report identifies the the need for adequate funding through the GRZ budgeting process, but cautions it is doubtful that any large increases in the maintenance allocation could be effectively spent unless there are also sufficient vehicles, equipment and trained staff. As described above the Department has already embarked on a bottom-up training program to upgrade the skills of Lusaka PRE's maintenance operations field staff. In conjunction with the current on-the-job training provided under the FINNIDA maintenance project and the training interventions in this project, the report states the Department is providing for an adequately trained staff at the operational level. The equipment provided by A.I.D., FINNIDA and other donors is therefore a very critical link in the successful utilization of increased maintenance funding in the GRZ budget. Required funding is discussed in detail in Section 4 of the Burrow Report.

Section 3 and Annex 1 of the Burrow Report review the Department's performance in maintaining A.I.D.'s past investments in the Kafue-Chirundu Road Rehabilitation Project. The original work was completed by three contractors: Phase I by Nello L. Teer in 1981-82, Phase II by L.J. Whyle in 1983-85, and Phase II by Lendor and Burton in 1987-88.

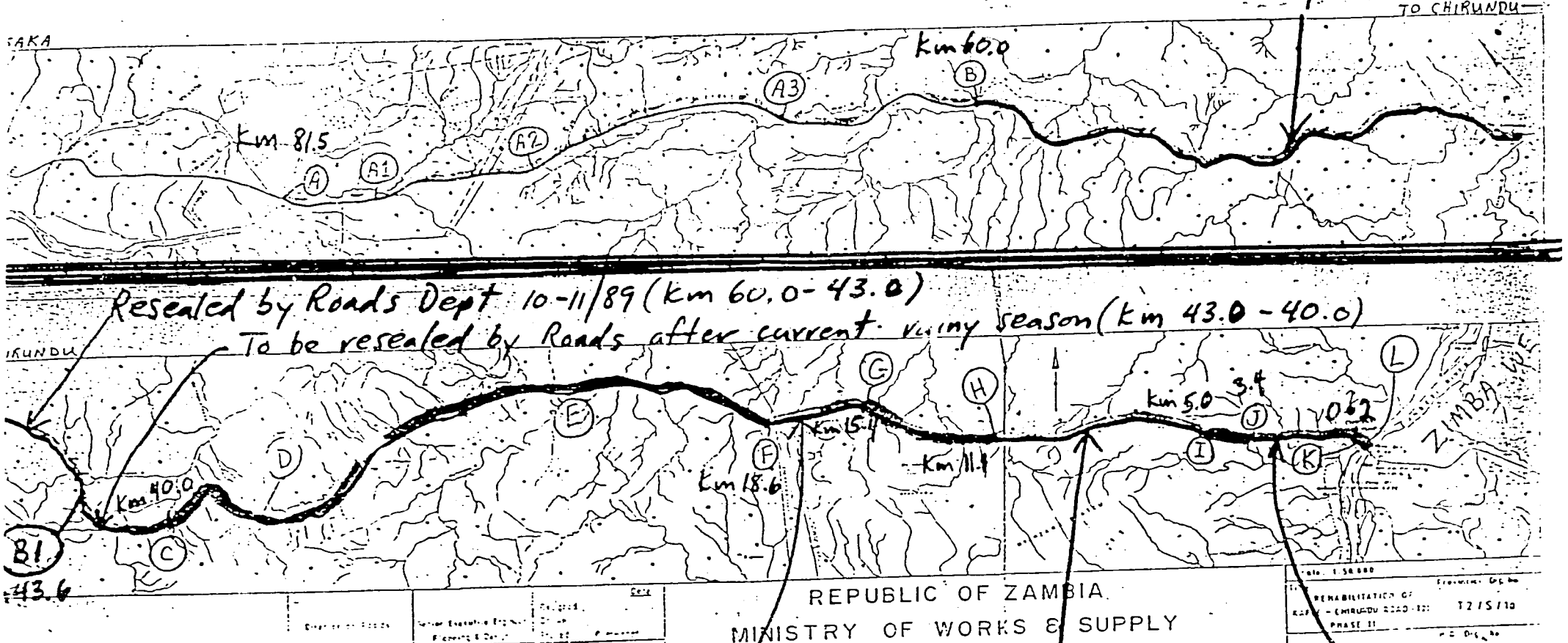
A brief summary of background information is provided to assist with interpreting the Burrow report. Prior to the onset of the current rainy season in December 1989, approximately half of the 33 km of rehabilitation

work completed in 1981-82 under Phase I has been resealed by the Roads Department. The largest portion is a 17 km section running from approximately km 60.0 to km 43 (see Chart 1, section of road from B to B1). A considerable amount of work to widen and prepare for resealing another 3.2 km has already been completed by the Department (Chart 1, section J to K). The remaining 3.2 km of the required widening and resealing of Phase I rehabilitation will be completed once the rains stop in March/April of this year (Chart 1, section F to G). Approximately 6 km reconstructed under Phase I were widened and resealed by a contractor under the second part of Phase II in 1988, and therefore, will not be done currently by the Department. It is important to note that the aforementioned work was completed by the Roads Department under its normal maintenance budget. Furthermore, it has been carried out in accordance with the standard Departmental periodic maintenance schedule of approximately 7 year intervals, under the supervision of the Lusaka PRE's staff and the FINNIDA maintenance project engineers. The widening was an improvement undertaken entirely at the initiative and expense of the GRZ.

With respect to the Phase I work the report states in Paragraph 3.5, "The general impression was of a road that had been well maintained over a period of 7 years so that it continues to give the required level of service for its traffic." Regarding the recent periodic maintenance which was curtailed by the onset of the rainy season, the report states "Most of the resealing inspected seems to have been done satisfactorilly and competently, apart from the lengths affected by the rains. At the onset of the rainy season, there is always this risk, and the choice is between curtailing the resealing program early, or accepting the possible loss of some resealing." In sum the Department will have to rework a small portion of the resealing that was rained on before the bitumen dried. The report further states in Annex 1 that "Although it has not been possible to see the resealing units in operation during this visit, judging from the majority of the Roads Department sealing work that has been seen, and reviewing the equipment available and proposed, it is considered that the Department should have the ability to undertake satisfactory periodic maintenance so far as resealing of paved roads in this area is concerned, providing that sufficient and satisfactory stone can be produced." (A stone crusher is operated by the Department at Kafue, under the guidance of the FINNIDA maintenance project. While this unit experiences certain operational problems, past experience indicates that it is a reliable source of quality stone as it supplied the total requirement used by Lendor and Burton to complete Phase II of the Kafue-Chirundu Road Rehabilitation Project.)

The Burrow assessment found that routine maintenance had been neglected to a certain extent by the foreman and crew responsible for the Kafue-Chirundu road. This situation was attributed to the loss of the tipper truck assigned to the foreman, thus limiting routine maintenance to sections within walking distance of the maintenance camp for three to four weeks prior to the assessment. The report states "The present state of routine maintenance is commensurate with this situation. Grass cutting, side drain and culvert clearing and similar routine operations away from the camp have obviously not been done recently, but there is no sign of long term neglect." Lack of such routine maintenance for short periods is not expected to effect the structural integrity of the road.

- MAP OF KAFUE-CHIRUNDU ROAD



Routine maintenance is a much more labor intensive operation than periodic resealing, but has nevertheless been a traditional problem even though the Department has a large workforce capable of performing the required tasks. While most of the work is not highly technical, it is continual and requires ongoing day-to-day supervision and discipline. This discipline has and will continue to be a problem in the Roads Department. However, the FINNIDA project, envisaged for another four years, addresses the need for continuity, discipline and the absolute necessity for adequate supervision of routine maintenance crews. It appears fortunate that the A.I.D. investment is located where the benefits of the long-term FINNIDA institution building exercise will be realized.

The report indicates that work done by L.J. Whyle in 1984 showed a normal amount of wear for its age and traffic. There was some cracking that was not structurally serious if treated. The Lusaka PRE advised of the scheduled procedure to clean out the cracks and seal with bitumen poured from hand containers, a procedure the Burrow roads engineer felt would be satisfactory. The work completed by Lendor and Burton in 1987-88 was in good condition as expected, except for several kilometers on steep inclines which had experienced considerable bleeding. However, the bleeding is a rehabilitation design issue as opposed to maintenence and an arrangement has been made between the Department and the original construction contractor to remedy the situation.

Section 4 of the report provides estimates of required kwacha and foreign exchange funding to allow the Department to carry out adequate routine and periodic maintenance of both the Kafue-Chirundu and Kafue-Lusaka roads. These estimates, developed by Burrow engineers in conjunction with the Lusaka PRE, cover the period 1990-2000 for Kafue-Chirundu and 1994-2000 for Kafue-Lusaka as it is assumed that the Department will not take over maintenance of the latter section until the one year maintenence period under the construction contract is over. Based on the implementation schedule, the contractor will hand over various sections of the Kafue-Lusaka road during the course of 1994, completing this action by the end of December.

Details of the build up of the estimates and underlying assumptions are contained in Section 4 and Annex 2 of the Burrow report. In sum estimated routine maintenance costs include housing and subsistence allowances, equipment operating and materials costs. Seven percent of the costs are estimated to be in foreign exchange to provide for equipment spares. It is also assumed that current resealing by the Department will continue as planned, and that periodic maintenance will be carried out thereafter at six or seven year intervals. These foreign exchange and kwacha costs are presented in the report in Section 4, Table 1 (Kafue-Chirundu) and Table 2 (Kafue-Lusaka). It is important to note that cost estimates have been developed in current kwacha and dollars and therefore must be inflated to equate to terminal values to accomplish the required work in the out years. This will be further explained in a discussion of a financing strategy below.

Section 5 of the consultant's report reviews equipment requirements to provide for adequate maintenance. The costs developed in Section 4 of the report do not include capital costs of new equipment needed because the consultant determined that a sufficient stock of units to carry out maintenance throughout the country is being provided by donors. However, the equipment being provided does not include a sufficient buffer of equipment to allow for serious breakdowns if the Department is to adequately maintain roads country wide. It is for this reason that the project is providing a resealing unit, with a covenant that the GRZ will dedicate the equipment to maintaining the A.I.D. investments in road rehabilitation on a first priority use basis. This resealing unit, along with a similar one financed under the Kafue-Chirundu Road Rehabilitation Project, will ensure that the Department has sufficient equipment to maintain the road from Lusaka to Kafue to Chirundu. A generous stock of appropriate spares provided with each resealing unit along with a project foreign exchange financing mechanism to purchase additional spares should be sufficient to keep the equipment in continual operation. A listing of resealing and other units in the Roads Department equipment inventory is included as Annex 4 to the Burrow's report.

Section 6 of the Burrow's report deals with maintenance considerations in road rehabilitation design, axle loading and land acquisition needed for the road rehabilitatiom project. The first two points are discussed in detail in Annex III. A, Technical Analysis. Land acquisition requirements, although minimal, have been detailed and costed out by the Department and the Burrow's engineers at an estimated Kwacha 77,600 ($1,940). The GRZ has agreed to provide a contribution of K100,000 ($2,500), included in the project budget, or whatever is necessary to acquire the small parcels of land and compensate the few persons to be displaced. The ProAg will contain a Condition Precedent to disbursements under the construction contract stipulating that the GRZ provide a letter to A.I.D. assuring that all land necessary to complete the project road rehabilitation, has been acquired.

The consultant's report highlighted inadequate funding as the primary constraint to effective routine (continual) and periodic (resealing every 7 or 8 years) maintenance.

5.6.3 Recommendations of Assessment-Maintenance Interventions

The overall conclusion of the Burrow report is that the Roads Department clearly has the capability to properly maintain the T2 Road from Lusaka to Chirundu if sufficient funding is provided. The design team believes this is in contrast to many other areas in the country where a number of constraints to effective maintenence by the Department exist. These constraints, including a lack of trained staff and departmental stone crushing capacity, might make the choice of contract maintenance more attractive in a number of provinces. Yet, the option to use contract maintenance may be inhibited by a number of the same constraints faced by the Department. A number of professional engineers based in Zambia believe the main constraint to contract maintenance in Zambia is a lack of qualified construction contractors, a shortage of crushed stone and an insufficient stock of equipment throughout the country. However, in Lusaka Province where the Kafue-Lusaka road is located, the critical elements of departmental crushing capacity, maintenance management/supervision and major inputs of equipment/spares are being provided by the long-term FINNIDA maintenance project.

The required funding identified by Burrow was primarily local currency needed to pay subsistence allowances for technicians and operational level personnel and to procure petroleum, cement, locally refined bitumen, etc. A glaring need was identified for a minimum amount of foreign exchange funding and a procurement mechanism to purchase spares on a timely basis to keep equipment in continual operation. This situation was highlighted at the site inspection by a lack of routine maintenance beyond walking distance from the maintenance camp which had occurred during a three week period while a truck was out of operation due to the lack of spares.

As discussed above, the consultant worked closely with the Roads Department to develop: (a) required kwacha budget levels to provide for adequate routine and periodic maintenance of the A.I.D. investment until the year 2000, and (b) estimates of required foreign exchange over the next 10 years to top-up amounts expected to be provided by the Bank of Zambia and donors for spare parts. These estimates of required local currency and foreign exchange form the basis of a financing strategy which is the primary maintenance intervention of the project. The financing package, in conjunction with the provision of training and road maintenance equipment, will provide adequate safeguards for the A.I.D. investment in the rehabilitation of the Kafue-Lusaka and the recently completed Kafue-Chirundu roads.

The local currency financing mechanism is based on the concept of a sinking fund. The GRZ agreed to provide K120 million in GRZ-owned counterpart funds to be deposited in an interest-bearing sinking fund account. This sum will ensure adequate funding for routine and periodic maintenance, given a set of realistic assumptions on future rates of inflation, increases in GRZ budgeting and interest paid on the sinking fund. The GRZ will finance the sinking fund through a standard local currency counterpart fund agreement currently used to support a number of A.I.D. projects. The primary sources of counterpart funds will be the FY 1989 and FY 1990 PL 480 Title I programs. No counterpart funds are anticipated to be generated by FY 1991 or other Food For Progress Programs. Further sinking fund details are summarized in Table I below.

Table 1
Kafue-Lusaka Road Rehabilitation Project (690-0254)
Sinking Fund Analysis

ear	Projected Cost of Required Maintenance Costs						Terminal Value of Projected GRZ Maint Bud for Lusaka to Chirundu Rd (without USAID)		Terminal Value of Sinking Fund					
	Valued in CY90 Kwacha		Projected Annual	Terminal Value in Out Year					Starting	Add:	Projected Annual	Add: Annual	Less:	Total Balance
(A)	Kafue-Lusaka (B)	Kafue-Chirundu (C)	Inflation (% / 100) (D)	Kafue-Lusaka (E)	Kafue-Chirundu (F)	Total K-L Plus K-C (G)=(E+F)	Annual Increase (% / 100) (H)	Annual Estimate (I)	Balance (J)	Deposit (K)	Interest %/100 (L)	Interest (M)	Amt Applied to Support Normal Bud (N)=(G-I)	to Date (O)
990	0	2422000	0.80	0	3390800	3390800	0.75	4030200	0	0	0.18	0	0	0
991	0	3465000	0.60	0	8108100	8108100	0.50	6045300	0	60000000	0.21	12600000	2062800	70537200
992	0	3498000	0.50	0	12592800	12592800	0.40	8463420	70537200	60000000	0.21	27412812	4129380	153820632
993	0	3615000	0.40	0	18740160	18740160	0.30	11002446	153820632	0	0.18	27687714	7737714	173770632
994	575000	2617000	0.30	3999240	18201758	22200998	0.30	14303180	173770632	0	0.15	26065595	7897819	191938408
995	1150000	2849000	0.25	10171980	25199975	35371955	0.25	17878975	191938408	0	0.15	28790761	17492980	203236189
996	1150000	3528000	0.25	12714975	39007332	51722307	0.25	22348718	203236189	0	0.15	30485428	29373589	204348029
997	1150000	2536000	0.25	15893719	35049105	50942824	0.25	27935898	204348029	0	0.15	30652204	23006926	211993307
998	1360000	3487000	0.25	23495063	60240649	83735712	0.30	36316667	211993307	0	0.15	31798996	47419044	196373259
999	3580000	3498000	0.25	77309121	75538354	152847475	0.30	47211668	196373259	0	0.14	27492256	105635807	118229709
000	3580000	3615000	0.25	96636401	97581171	194217572	0.30	61375168	118229709	0	0.13	15369862	132842404	757167

Notes to Table 1
Kafue-Lusaka Rehabilitation Project (690-0254) Sinking Fund

Column

(A) Calendar year, which equals GRZ budgeting year.

(B) Taken from Maintenance Study carried out by John Burrow and Partners (Zambia). This assumes that the Roads Dept will take over maintenance of the Kafue-Lusaka Road at the beginning of 1994. This represents a conservative estimate that will probably overstate the maintenance costs since the construction contractor will most likely not turn over all maintenance responsibilities to the Roads Department until the end of CY 1994.

(C) Taken from Maintenance Study carried out by John Burrow and Partners (Zambia). This assumes that the Roads Dept will continue with required maintenance of the Kafue-Chirundu Road from the beginning of 1990.

(D) Projected inflation rates. The 1990 rate is currently being used by an international bank in Zambia for operational purposes. Rates are decreased in out years accordance with the PFP which emphasizes additional monetary and fiscal restraint by the GRZ. Inflation rates in this analysis are conservatively estimated at levels above PFP targets.

(E) Annual estimated required kwacha maintenence costs (valued in current kwacha) are escallated by projected inflation rates to terminal values in out years when the costs will actually be incurred. Terminal costs are calculated by escallating out year costs, denominated in current kwacha, by the full inflation in previous years and one half the inflation in the current year. For example, the 1994 Kafue-Lusaka required maintenance cost equals: K 575,000 x 1.8 x 1.6 x 1.5 x 1.4 x 1.15.

(F) This escallates current kwacha required maintenance costs in the same manner as colunn E.

(G) Total required maintenance costs for Kafue-Chirundu and Kafue-Lusaka, escalated to terminal values as in columns E and F.

(H) Represents conservative annual increase in maintenance budgeting based on observed 40% annual increases in actual maintenance expenditures from 1984-1989 and 75% increase from 1989 to 1990. The figures are based on the total 1990 maintenance budget allocated to the Lusaka Province, as scaled down to be proportionate to the provincial budget devoted to the T2 Road from Lusaka to Chirundu. Roads Dept. advised that the T2 Road from Lusaka to Chirundu receives approximately 20% of the allocation for the Lusaka Province.

(I) 1990 maintenance budget for Lusaka to Chirundu Road escallated by estimated annual increases in column I. Note that this is a conservative estimate of kwacha resources to be devoted to road maintenance in the out years as analysis of the GRZ Budget indicates that actual expenditures generally exceed amounts budgeted.

(J) Starting balance for sinking fund, equals ending balance of previous year.

(K) Amounts added to sinking fund immediately prior to Jan. 1 of stated calendar year, with GRZ contributing counterpart financing through standard A.I.D./GRZ local currency agreement.

(L) Estimated annual interest rate earned in an interest bearing account at local branch of an international bank. Figures are based on current rates paid by the bank, with estimates for 1991-1993 based on current projections of GRZ T-Bill rates. Projections for out years are based on three quarters of projected GRZ T-Bill rates. T-Bill rates in out years are assumed to run approximately 5% below projected inflation starting in approximately 1994, when the economy is assumed to have stabilized somewhat.

(M) Estimated annual interest earned at local branch of an international bank for large accounts.

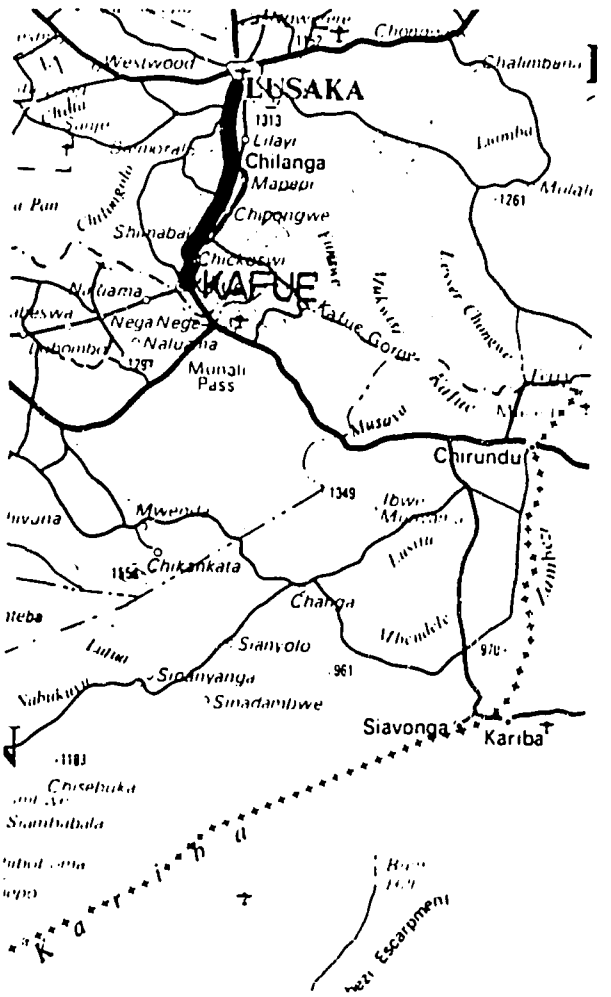
(N) Amount applied from sinking fund to plug the gap between requirements for adequate maintenance and the projected GRZ budgeting, without the sinking fund.

(O) Ending annual balance in sinking fund.

The sinking fund will provide an annual supplement to the funds which would realistically be expected through the regular budgeting process. Estimates of regular funding levels for road maintenance were made by observing trends in the annual GRZ budget. The observed trends indicated an increasing, but as may have been expected, insufficient level of funds to fully cover road maintenance. The sinking fund will provide the required incremental financing through the normal budgeting process, probably through the regular supplementary budget request, utilizing a footnote to indicate that the supplemental line item will be provided from the sinking fund. The fund will be comprised of a GRZ contribution of kwacha 47,485,000 to cover estimated costs and a contingency of kwacha 72,155,000 in anticipation of extraordinarily high inflation that is expected in the out years. As in all activities for which GRZ counterpart contributions are made, USAID will require detailed annual reports on annual drawdowns from the fund. As usual, drawdowns will be closely controlled by both the Ministry of Finance and USAID/Zambia, with signatures of both parties required to transfer kwacha from the sinking fund to the working account under the Director of Roads.

The consultant's report recommends that $326,000 be provided to the Lusaka PRE over the next 10 years to top-up expected foreign exchange inputs and ensure that spares are available to keep equipment in continual operation. Starting in CY 1990, the spares will be procured on behalf of the Department by the design/supervision contractor (or other procurement agent to be determined) on an as needed basis, with the final disbursement made for a bulk purchase prior to the PACD in December 1994. The Lusaka PRE will be accountable for proper inventory control procedures and utilization of these spares. To account for annual inflation the amounts provided by the consultant in current dollars are increased at an assumed 8% rate per annum for years 1990-1994 to represent terminal values when expenditures will be made. The adjusted amount is $425,000. Because most on-hand GRZ equipment is of European origin, geographic code 935 source/origin procurements will be authorized under DFA authority delegated to the Mission Director. Further details are included in Annex I.G, DFA Source/Origin Determinations.

United States of America
Agency for International Development



Kafue -Lusaka Road Project
Maintenance Study
Final Report

John Burrow & Partners Zambia
in Association with
John Burrow & Partners Overseas

254

CONTENTS

1. Background

2. The Maintenance Operational of the Roads Department.

3. The Maintenance Record in Lusaka Province.

4. Maintenance Requirements for Lusaka - Kafue - Chirundu Road.

5. Equipment Requirements.

6. Maintenance Axle Loading and Land Acquisition

Annex 1 Kafue - Chirundu Road Inspection January 10th 1990.

Annex 2 Kafue Lusaka Road Rehabilitation Details of Cost Estimates.

Annex 3 Review of Maintenance Capability Kafue-Lusaka Road.

Annex 4 Mechanical Equipment Provided by Donors to Roads Department.

THE REPUBLIC OF ZAMBIA.

Maintenance Prospects for the Rehabilitated Kafue Lusaka Road.

I. BACKGROUND.

1.1 As part of its Southern Africa Regional Program, the United States Agency for International Development (USAID) intends to provide funds during FY 1990 commencing on October 1st, 1989 to rehabilitate the Kafue Lusaka road from the Kafue River bridge to the Makeni Road turn-off, about 3.9 km South of Lusaka centre. The total length planned for rehabilitation was about 49.4 km.

1.2 To assist project preparation, John Burrow & Partners Zambia, in association with John Burrow & Partners Overseas, (the consultants) were commissioned on April 22nd 1989 to undertake a feasibility study and cost analysis, including preliminary design, for the proposed rehabilitation. When the study commenced, the consultants were requested to include the length between the Makeni turn-off and the Kafue traffic circle, increasing the length to 53.3 km. The consultants submitted their report and recommendations to USAID in August 1989.

1.3 Following their generally favourable review of the report and recommendations, USAID queried the capability of the Roads Department (RD) of the Ministry of Works and Supply (MWS) previously the Ministry of Power, Transport and Communications (MPTC) to maintain the subject road in a satisfactory condition following rehabilitation. The consultants were asked during December, 1989 to review this capability urgently in order not to delay the project. A review was carried out between December 22nd 1989 and January 13th 1990, and forms the subject of this report. The basic questions to be answered are: firstly, whether the Provincial Roads Engineer (PRE), Lusaka Province, is likely to have the necessary resources to maintain the Kafue Lusaka road in good condition once it has been rehabilitated; and secondly, whether he is likely to do so. The background to the first query is reviewed in Section II of this report, and to the second, in Section III.

11. THE MAINTENANCE OPERATION OF THE ROADS DEPARTMENT.

2.1 MWS, through RD, is responsible for the planning, construction and maintenance of primary and secondary roads in the country, using funds provided by central government. Tertiary roads are the responsibility of the Ministry of Decentralisation, operating through District Councils. The network for which RD is responsible country-wide and in Lusaka Province, is reported as follows:

Classification:	Paved (Class I)	Gravel (Class II)	Earth (Class III)	Unclassified	Total
Country Total (km):	5926.2	2277.2	6290.3	6348.9	20842.6
Lusaka Province:	970.3	339.0	731.8	546.4	2587.5

There are different figures quoted for the total RD road network, and due to improvements, the figure for paved Class I roads is now given as 6387.4 km. A mid 1989 survey of road condition over 2376 km of main roads, using measured road roughness, estimated that 34% was in good condition, requiring only continuing maintenance, 25% was in fair condition, where strengthening or resurfacing is due, and 41% was in poor condition, requiring rehabilitation or reconstruction.

The Maintenance Organisation.

2.2 The RD headquarters in Lusaka operates under the Permanent Secretary of MWS, and a Director of Roads, who heads Roads Branch (RB). Road maintenance is controlled by a Road Maintenance Engineer, who is at present an expatriate, supported by the services of a materials and testing laboratory. Under RD headquarters, the road network is administered through nine provincial headquarters, each having a Provincial Road Engineer (PRE) responsible for road maintenance, and for minor construction and improvements. The network is further sub divided into 29 Districts and 127 Zones. Zones are the basic maintenance unit, and operate under a Road Foreman, with a gang of usually about a dozen labourers plus clerks and drivers, basic tools and equipment and transport. Depending on the type of road and its traffic, a Road Foreman has responsibility for the maintenance of between 80 km and 250 km of road. This maintenance comprises routine and recurrent operations, that is, grass cutting,

ditch and culvert cleaning, upkeep of signs and barriers, grading gravel roads, shoulder repairs and repair of pot-holes. Periodic maintenance, such as regravelling or resealing, is undertaken by special units, or by contract, under the Provincial Road Engineer.

2.3 This organisation is illustrated in Figure 1. It is similar to many operating elsewhere in sub Saharan Africa, and is managerially sound. It permits clear lines of responsibility, and duties can be well defined. In practice, this may not be the case, and effective operation depends on the right numbers and calibre of staff, with other resources, being in position.

Road Maintenance Staff.

2.4 There is a serious shortage of professional and technical staff in RD, although there is adequate administrative staff. At December 1989, there were only five Zambian engineers in RD out of an authorised establishment of 31. This shortfall has been alleviated to some extent by the presence within RD of nine expatriate engineers with executive responsibility, who have been supplied under various aid projects. In addition, there is an advisory team of five provided under aid from Finland to plan improved road maintenance, initially in Lusaka Province.

The situation will be further alleviated as the PRE has applied to the Civil Service Board (a statutory requirement) for the five best technicians (at present in temporary status) to be appointed as permanent Civil Servants. They will thus become entitled to become Engineering Technicians and become due for further training courses both in Lusaka and Overseas. These five technicians will then be replaced by trainees from the Lusaka Road Training School. In addition four engineering technicians have been sent to the Zambia Institute of Technology for further training to graduate as engineering assistants. This progression of trained staff should assist imensely in the upgrading of the PRE roads maintenance capabilities.

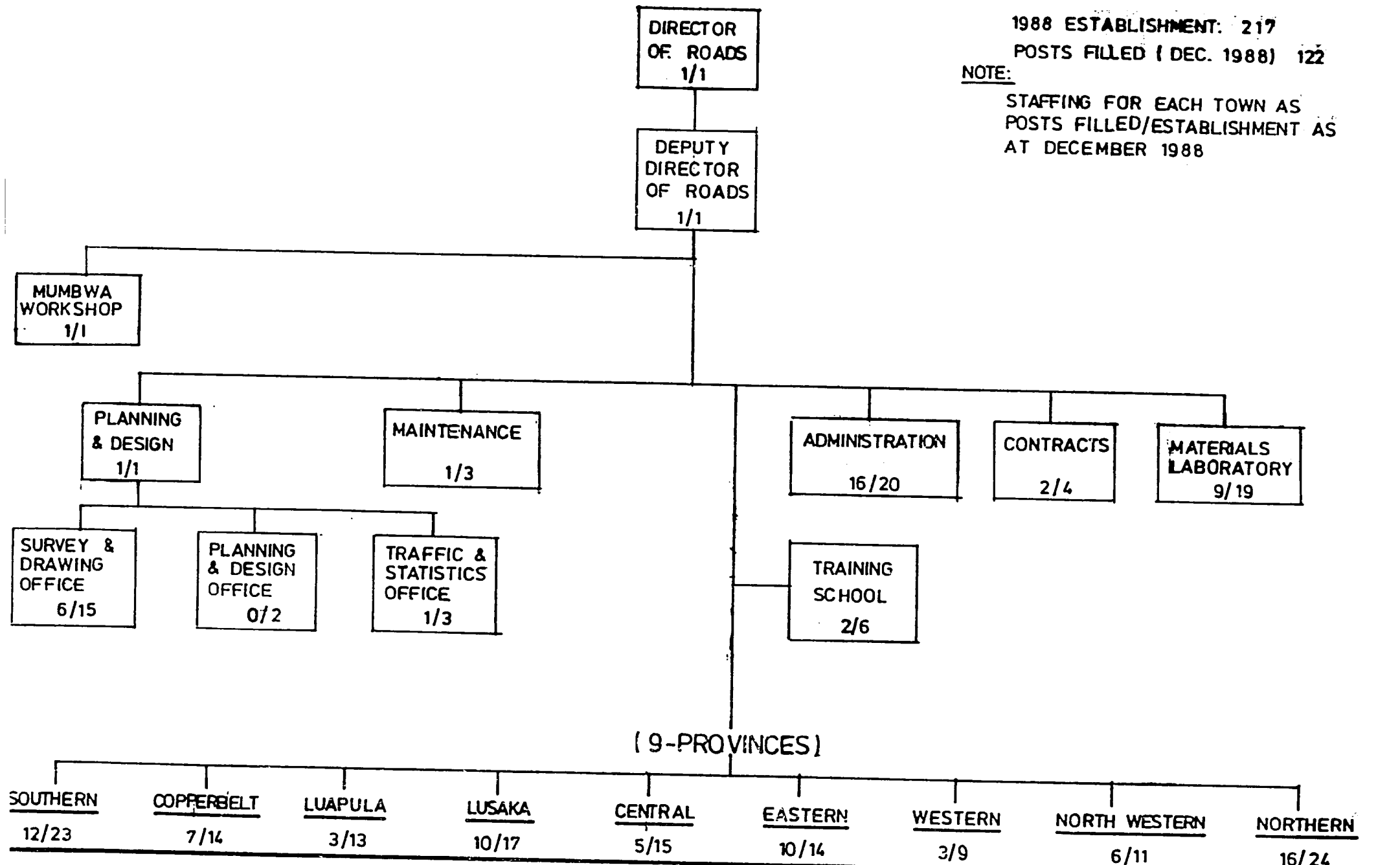
2.5 Shortages in middle level technical management also exist. Of 108 authorised posts such as Engineering Laboratory and Materials Assistants, Road Inspectors and Road Superintendents, only 51 were in place in December 1988, and this number had decreased during

the previous year. At 1988 year end, 122 posts were filled out of an establishment of 217. Casual and daily paid staff had numbered about 4,000 in 1987, but were later reduced to about 2,500, varying according to season and the volume of work in hand. Details of the staff situation are also shown in Figure 1.

2.6 Apart from an absolute shortage of trained and experienced local personnel, RD staff are attracted to the private sector in Zambia or to neighbouring countries by better salaries. High inflation of 100% /year or more has seriously reduced the purchasing power of government salaries, and poor personnel administration means that increments and bonuses are not always paid when they are due. In spite of this, competent and dedicated staff remain with RD at all levels, although their numbers are less than necessary to man all positions. An encouraging development is that payment of substantial subsistence allowances amounting to between K1,000 and K1,4000 per night (depending on grade) were authorised in the 1990 Budget. Although the total amount under this item for FY90 is small (K239,000), if extra funds can be made available, there is now the possibility of increasing the low salaries of permanent and monthly paid staff to a more competitive level by a tax free allowance whenever they spend time away from their base. This device could be used to retain competent key staff who might otherwise be lost to RD.

Equipment.

2.7 Until 1989, RD equipment and vehicles were procured and maintained by the Mechanical Services Department, a part of MPTC. However, a policy decision was then made to transform this department into a parastatal body in order to improve efficiency of operations. In the meantime, RD started to set up their own workshops and they were permitted to make use of the private sector to keep transport and equipment in operation. However, this effort was not a great success, and the backlog of repair work increased. Full information on the equipment fleet is not available at present, but a survey in Eastern Province in mid 1989 showed that out of 126 items, 38 (30%) were in working order. It is reported that this situation is probably representative of the whole RD equipment fleet. However, this situation is being rectified by the acquisition of mobile service vehicles to maintain the field equipment.



THE ROADS BRANCH OF THE MINISTRY OF WORKS AND SUPPLY.

FIG. 1

2.8 Equipment and vehicles have been provided over the past several decades to RD by different national and international aid organisations as part of their projects. Many of these items are now well past their useful economic lives, and keeping them in good repair has been made more difficult by chronic shortages of foreign exchange. All parts of the economy are similarly affected, so that being able to use the private sector has not removed this difficulty (para 2.7). It is unlikely that Zambia would be able to finance equipment replacement from its own resources in the near future, and must therefore continue to rely very much upon donors. Under existing and recent aid projects, significant amounts of transport and equipment suitable for road maintenance have been, or are to be, provided (Annex 4). In view of present road conditions, there is little doubt that extra equipment for resealing, regravelling and shoulder rehabilitation is urgently required. RD's task of operating and maintaining aid equipment would be made very much simpler, and aid would be more effective, if co-ordination between the various donors were closer, and this subject is dealt with more fully in para 2.15.

2.9 Producing good quality, well shaped and well graded stone for resealing is a particular problem (see Annex 1, para 5). Three stone crushing plants are now operated by RD, with a total practicable output of about 15,000 cubic meters of resealing stone a year, compared with a requirement for about 50,000 cubic meters a year to fulfill the normal resealing program of (say) 900 km a year (assuming resealing is done once every 7 years). At present, there is a backlog of about 3,500 km of road in need of resealing, which would require 200,000 cubic meters, apart from the requirement for other stone sizes for rehabilitation work. Here again, effective co-ordination between donors will be necessary to overcome these shortages in the best way. The production at Kafue Quarry in 1989 was

	19 mm	13-16 mm	0-6 mm	6-12 mm	0-8 mm
tonnes	2924	1693	1265	1952	2556

In addition, a further three stone crushing plants will be arriving in Zambia in 1990 from various donors. Finida will establish one of these plants with quarry in the Lusaka Province.

Road Maintenance Funding.

2.10 Until FY89, funds for road maintenance were issued en bloc to RD headquarters, who distributed them among the provinces according to need. In FY90, funds have been allocated directly to provinces, for which provincial permanent secretaries (coming under the office of the Prime Minister) are accountable. There is also a reserve issued to RD headquarters, for which the permanent secretary, MWS, is accountable. Under government accounting procedure, within the main Vote, funds are disbursed under subheads as follows:

Personal Emoluments, which includes salaries, wages, leave pay and housing allowances;

Recurrent Departmental Charges, which includes subsistence allowances, petrol oil and lubricants, spares and costs of regravelling and resealing, and cost of services such as fares, rents, post and telegraph costs and lighting and water charges.

Depreciation and maintenance of premises, salaries of established civil servants, and the capital cost of equipment and vehicles are paid out of votes not controlled by RD. Hence, work costs as recorded by RD do not represent the true costs, and conversely, aid provided to RD on the basis of their (apparent) costs may not proceed as planned because essential funds are not provided to Votes controlled by other Ministries or departments. Until recently, major overhaul costs for vehicles and equipment were not paid by RD, but following the reorganisation of workshops (para 2.7), this cost is now payable by RD out of their Recurrent Departmental Charges Vote.

2.11 Recent allocation of funds for road construction, improvement and maintenance to RD have been as follows:

FY:	1988	1989	1990
	(Millions of Kwacha)		
Personal Emoluments:	17.21	19.12	n.a.
Recurrent Departmental Charges:	32.29	51.50	132.24

These figures indicate that whereas Recurrent Departmental Charges, which include road maintenance, have probably kept up with the cost increases in Kwacha, Personal Emoluments and Capital Expenditure have not, which indicates a commitment on the part of government to the objective of improved road maintenance. Capital expenditure includes rehabilitation and improvement of roads, often under aid projects. In the FY90 total of K 450.87 million, for example, K 290.5 million (59%) has been provided by loans or grants from Italy, United States of America, West Germany, Finland and Norway.

2.12 Using the government system of costing, RD estimate that K370 to K400 million a year is necessary to maintain all the network correctly, assuming that the necessary equipment, materials and staff would be available. This compares with a current allocation of about K50 million (US$2.17 million at US$1.00 = K23.00) for regravelling and resealing, out of K132 million (say US$5.80 million) for all maintenance. The regravelling/resealing allocation represents a little over 30% of estimated average annual requirements, and the total of K132 million would be sufficient for about 40% of the work necessary. However, with the present shortages of equipment and vehicles, it is unlikely that any large increase in the road maintenance allocation could be effectively spent unless RD's resources could be augmented in some way. RD resources which need to be augmented covers personnel, vehicles and road rehabilitation equipment. The personnel resources are being increased by promotion form within higher site allowances and various donor aided training programmes. The vehicles and equipment to allow the trained staff to function will partially be supplied by donor agencies.

In addition appropriate intervention to augment RD resources to ensure the long term maintenance of Lusaka Chirundu road will be discussed in Sections four and five of this report.

The Effect of Aid on Road Maintenance.

2.13 The role of aid donors in the roads subsector has been described in para 2.3 "Other Donor Activity" of a draft USAID project paper for the Kafue-Lusaka Road Rehabilitation 690-0254, dated December 12, 1989. In addition, UK ODA has been funding eight executive staff in RD, but this is now reduced to three of the nine mentioned in para 2.4.

2.14 Many Zambian main roads were built in the 1960's and 1970's for lower traffic loadings than they now carry, and they are well overdue for strengthening and improvement. The aid projects described in 2.13 will help to rehabilitate some 2,000 km of these main roads which are now virtually unmaintainable, and to this extent will ease the maintenance task of RD for some years to come. The Finnish aid team in RD headquarters (para 2.4) has been in place for about a year, and is working closely with the PRE, Lusaka Province, to improve maintenance, with the object of extending improved methods to other provinces in time. Depending on their success, the duration of this aid is seen as extendible beyond its initial two years. The road maintenance equipment provided and planned (Annex 4), goes a long way towards building up a maintenance fleet, but any equipment and vehicles given in aid projects must come with a generous foreign exchange provision for spares, as otherwise they will be ineffective.

2.15 There is the danger that the amount of roads aid and the many donors involved may overload the capabilities of RD headquarters to organize and control operations. Without this control, aid will be less beneficial, and could result in increasing, rather than decreasing, RD's problems. The donors active in Zambia co-ordinate their efforts through the usual aid group meetings and by means of informal meetings in Zambia. The government of Zambia has set up Sectoral Committees and an Infrastructural Committee to co-ordinate aid efforts within sectors. The need for better donor co-ordination in road maintenance has been emphasised in the London Donors' meeting in 1985 and since. The initiative for better donor co-ordination should come from government, and it would be in line with general trends for RD to ensure close co-ordination amongst its donors. There seems now to be a need in RD to have one experienced officer with designated responsibility to ensure that all roads aid projects follow agreed common policies and standards, and that they will combine, rather than conflict. Whether government can provide a suitable person, or whether he is provided under aid, and probably international aid, is a matter for discussion with government. What is certain is that aid will be more effective and some key personnel in RD less overworked if this assistance can be arranged.

III THE MAINTENANCE RECORD IN LUSAKA PROVINCE.

3.1 An inspection of the Kafue-Chirundu road, which immediately adjoins the Kafue-Lusaka road, was done on January 7th and 8th, and a report on the January 8th inspection is attached (Annex 1). The object of these inspections was to assess the standards of maintenance that have been attained on this road with the resources that PRE Lusaka Province has had at his disposal, as an indication of what standard of maintenance can be expected on the Kafue-Lusaka road.

3.2 The Kafue-Chirundu road has been undergoing a program of USAID financed improvements since the early 1980's, and parts of the road rehabilitated by Nello L Teer under Phase I of the Kafue-Chirundu Rehabilitation Project have therefore been maintained by RD for eight years. The road carries more than one hundred multi-axle heavy trucks every day, the average daily traffic passing Kafue Bridge in 1989 was 173 single axle trucks and 129 trailer or semi-trailer trucks, and about a third of its length is through hilly country with maximum gradients. At the time of the inspection, the whole length of the road was in good condition, so that vehicles were able to pass in comfort and at speeds limited only by other traffic and road geometry. About ten kilometres of the road, now being resealed, have had no major repairs since built in 1982, and a further 22 km have had no major repairs since 1984 when rehabilitated by L J Whyle under Phase II of the USAID financed Kafue-Chirundu Project, and are now planned for resealing. These sections of old pavement are still in reasonable condition with no pot holes. They have had a small amount of patching consistent with a regime of correct maintenance over the past six or eight years.

3.3 Routine maintenance such a ditch clearing and grass cutting was in arrears on parts of the road, explained by the fact that the maintenance gang had been without transport for some three weeks following an accident to their truck. Long term, routine maintenance had obviously normally been done as necessary. Periodic maintenance (resealing and shoulder maintenance) is now being done on a 17 km stretch of the road rehabilitated by Teer under Phase I of the USAID Project, together with widening and improvements on another three kilometre length. The earliest sections

constructed by Teer with sealed surfaces in 1982 will all be resealed by mid 1990, and sealed sections built in 1984 are planned for resealing between 1990 and 1992. Resealing at seven or eight year intervals might be considered not sufficient in developed countries, but judging from these road sections, the pavement has not suffered thereby and is still structurally sound.

3.4 In November/December 1989 RD resealed 17 km of the section rehabilitated by Teer in 1982. Most of the 17 km of resealing carried out by RD was well done. Sudden rainstorms had affected about two kilometres on one lane, and this will be redone. Heavy trucks have affected the surface on steep gradients, and there are ways in which this problem could be overcome (Annex J, para 5), although expert advice may be needed for best results. Some sections may warrant resealing because they have become slippery, and not for structural reasons, and testing would show if this is so. The Road Foreman, stationed at a road camp about 15 km South of Kafue Bridge, appeared well experienced, and said that he has no serious problems in getting maintenance materials whenever they are required, but keeping transport and minor equipment in operating condition appears to present problems.

3.5 The general impression was of a road that had been well maintained over a period of seven years so that it continues to give the required level of service for its traffic. Given the presence of the Finnish Aid team in RD (para 2.14) and with assistance to overcome problems associated with foreign exchange for equipment and transport, there seems no good reason why a similar organization could not operate equally well on the complete section the road from Lusaka to Chirundu.

3.6 The Provincial Road Engineer (PRE) for Lusaka Province has the responsibility for the total stretch of the road from Lusaka to Chirundu. A visit was made to the PRE's headquarters in Lusaka where reasonable facilities exist. Normal administrative and financial control over works appeared to be in place, and staff concerned were familiar with the processes involved. Both the PRE and his engineering assistant are competent individuals with sound knowledge of their duties. As always where there are staff shortages, operations depend heavily upon the presence of a few key individuals, and there is little doubt that the

Lusaka PRE's office is no exception. PRE Lusaka is well situated close to RD headquarters to develop a rapport with senior RD management, which he has done.

Being in charge of all RD roads leading into Zambia's capital, he is expected to keep these roads in as good a condition as possible, and in turn is able to obtain resources to do this, which more distant PRE's cannot.

IV. MAINTENANCE REQUIREMENTS FOR THE LUSAKA-KAFUE-CHIRUNDU ROAD.

4.1 The following estimates are made for routine and periodic maintenance of the Kafue-Chirundu road, commencing in 1990, and for the Kafue-Lusaka road after rehabilitation, which is assumed to be complete by 1994. These estimates are at early 1990 prices, and on the basis of RD accounting practices. Capital costs for equipment and vehicles are estimated separately, and where available, unit rates provided by RD have been used. While the present rate of exchange of K23 = US 1.00 has been used throughout, in formulating proposals for future action adequate provision must be made in the estimates for inflation and thus indirectly for devaluation of the exchange rate. Details of the estimates are in Annex 2.

Kafue-Chirundu Road:

i) Routine Maintenance:

4.2 Routine maintenance covers wages, normal overtime and housing allowanes for a gang of 12 labourers, a road foreman, one driver and one operator plus clerical staff, carrying out normal regular daily maintenance. Operating costs for one truck and one item of small mechanical equipment are included, and materials, equipment and transport costs for a normal amount of pavement patching and shoulder repairs. Also included is an element for upset and subsistence allowances (para 2.6), to provide incentive payments for field staff, amounting to an approximate doubling of basic pay. On these assumptions, routine maintenance for the 81.4 km of road amounts to K1,572,000 per year, 7% of which is estimated as foreign exchange in the shape of equipment spares.

ii) Resealing and Shoulder Rehabilitation:

4.3 It is assumed that the present resealing program will continue as planned, and that thereafter, resealing will be done at six or seven year intervals. It is also assumed that lengths of premix constructed by whyle under phase II of that may not otherwise need sealing will be treated to reduce the risk of skidding US$6,250 (say K150,000) per km has been used. This figure is low, reflecting low wages and the fact that

capital costs of mechanical equipment are not included. This cost is estimated to be 19% foreign exchange payable direct by RD giving a total cost of US$1,200 plus K116,000 per km at 1990 prices.

4.4. Shoulder rehabilitation includes carting to site and laying fresh material and replacing (or providing) a sealed surface. It also includes for lining and improving side ditches outfalls where necessary, and is estimated to cost US$600 per km (US$120 plus K11,000), once every five years.

iii) **Total Maintenance Costs, Kafue-Chirundu:**

4.5. On these assumptions, total maintenance costs for the Kafue-Chirundu road to the Year 2,000 are estimated as follows, with details given in Annex 2 and Table 1.

Overall, the foreign exchange component is estimated at 14% on the basis outlined in para 4.2 and 4.3, leaving 86% in local currency. The FY90 level of funding would meet about 39% leaving a shortfall of about 51% of the total required amount in kwacha, plus all the foreign exchange component.

Kafue-Lusaka Road:

i) **Routine Maintenance;**

4.6 On the same basis as for the Kafue-Chirundu road, routine maintenance for the 53.3 km Kafue-Lusaka road is estimated to cost K1,280,000 a year, with 10% foreign exchange, or say US$5,500 plus K1,150,000. This is assumed to commence over half the road in 1994, as parts are handed over by contractors, and over the full road from 1995.

ii) **Resealing and Shoulder Rehabilitation;**

4.7 Costs per km are estimated to be the same as for the Kafue Chirundu road, and resealing is assumed to be necessary over 20km in 1999 and in 2000. Shoulder rehabilitation has been assumed to start for 10 km a year from 1998 through 2000.

iii) **Total Maintenance Costs, Kafue-Lusaka:**

4.8 Total maintenance costs are estimated from the completion of rehabilitation (from 1994) to the Year 2,000 as follows in Table 2.

FY	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Routine ('000)											
Km											
US $	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
ZMK	1469	1469	1469	1469	1469	1469	1469	1469	1469	1469	1469
Resealing ('000)											
Km	7.1	15.5	15.6	16.6	8	10	8.5	7.3	15.5	15.6	16.6
US $	8.8	18.6	18.7	19.9	9.6	12	10.2	8.8	18.6	18.7	19.9
ZMK	847	1798	1809	1926	928	1160	1839	847	1798	1809	1926
Shoulders ('000)											
Km	9.6	18.6	20	20	20	20	20	20	20	20	20
US $	1.2	2.3	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
ZMK	198	198	220	220	220	220	220	220	220	220	220
TOTAL COST ('000)											
US$	14.5	25.4	25.6	26.80	16.50	18.90	17.10	15.7	25.50	25.60	26.80
ZMK	2422	3465	3498	3615	2617	2849	3528	2536	3487	3498	3615

Total Cost to 2000 is US$ 238400 (14%)
ZMK 35.130 000

Table 1

FY	1994	1995	1996	1997	1998	1999	2000
Routine							
Km							
US $	2.8	5.5	5.5	5.5	5.5	5.5	5.5
ZMK	575	1150	1150	1150	1150	1150	1150
Resealing							
Km							
US $						24	24
ZMK						2320	2320
Shoulders							
Km					100	100	100
US $					1.2	1.2	1.2
ZMK					110	110	110
TOTAL COST ('000)							
US$	2.8	5.5	5.5	5.5	6.7	30.7	30.7
ZMK	575	1150	1150	1150	1360	3580	3580

Total Cost US$ 87400 (14%)
ZMK 12.545.000

Overall foreign exchange component for this road, on the same basis as in para 4.5, is about 14% and local component is 86%, leaving a shortfall of about 56% of total maintenance requirements in Kwacha, plus the foreign exchange component, if the FY90 level of funding by government were to continue.

4.9 The minor foreign currency requirement detailed above for maintenance activity could be provided for in a similar way to that for the local funds, i.e. by establishing a fund or by providing a stock of spares as part of the rehabilitation project. In either cases an appropriate office should be established to ensure that the actual spares or the financing provided is used primarily for the intended purpose.

V EQUIPMENT REQUIREMENTS.

5.1 The estimates given in the previous section do not include capital costs of extra equipment needed, and in view of the overall need for more road maintenance equipment (paras 2.8 and 2.9), it would be unwise to expect that adequate equipment will be available whenever needed from the existing fleet. Nine resealing units have been, or are to be, provided (Annex 4), but with average practicable outputs of about 100 km per year each, there is no room for serious breakdowns or inefficient operation if the requirement of about 900 km a year of resealing is to be met. In addition, there is now a very large backlog. It would therefore be an added insurance that the required resealing program between Lusaka and Chirundu will take place as outlined in the previous section if an extra resealing unit were to be provided as part of the project. The cost of such a unit has been estimated at US$ 860 000 and has been provided for in the proposed USAID financed Kafue Lusaka Rehabilitation Project. It would obviously be desirable that all units are similar, so that equipment is interchangeable between units.

5.2 One shoulder rehabilitation unit has been provided with Finnish aid, with an estimated output of 90 km of road per year. Correct repair of shoulders adds considerably to pavement life, and is a real benefit to traffic. Having shoulders paved or sealed also reduces maintenance problems. There is therefore a need for up to 15 or 20 such units in the country as a whole. Cost of a unit is estimated to be about US$1.0 million, and it should be compatible with other similar units, (see Appendix 4).

5.3 The production of good quality roadstone is a real bottleneck, and at present, there are no private sector quarries with one possible exception that could be used. Production at the RD quarry north of Kafue is limited, and it cannot be assumed that it will be able to produce sufficient stone for both the normal resealing program in the vicinity and for rehabilitation of the Kafue-Lusaka road. It will probably therefore be necessary to open up another quarry near this road for the rehabilitation project, and this should be planned so that the same quarry can continue to produce good quality stone for resealing

272

after rehabilitation is completed, that is, after 1995. The cost of suitable equipment and of preparing a good long-term quarry site can be expected to be in the region of US$3.0 million.

5.4 Proper routine maintenance is now often inhibited by shortages of transport. The cost of providing this is small, but the effects are profound. To ensure that routine maintenance will be done on the project roads, transport and small items of plant for repairing local failures would be required, at an estimated cost for both roads of US$500,000.

5.5 In this section of the report we have outlined the total plant requirements for the routine and periodic maintenance of the Lusaka Chirundu road. FINIDA is currently undertaking a pilot road maintenance activity in Lusaka Province, the road network of which will include the whole of the Lusaka Chirundu Road. In addition funding for equipment will be provided through the AFDB funded Lusaka to the Malawi border road rehabilitation project. It is our opinion that care should be taken to co-ordinate all the various donors activity to ensure that effort is not duplicated. World Bank is likely to assume this co-ordination role during 1990. In the meantime we recommend that provision be made in the financing managements on the Lusaka Chirundu Project to include the provision of a resealing unit. In addition we would also recommend that the question of crushed stone supply for road maintenance be the subject of a detailed base line study for a significant policy reform in the way stone is provided for road rehabilitation and maintenance activities.

VI MAINTENANCE, AXLE LOADING AND LAND ACQUISITION

6.1 Maintenance Considerations in Rehabilitation Design.

The maintenance burden during the operating life of a road can be significantly reduced by selection the correct design options during the design and construction phase. For example surface dressing on top of the asphaltic concrete structural overlay, sealing the shoulder, widening the road at sharper horizontal curves and living the drains at steeper gradients all minimised future maintenance cost. It should be noted that all these have been provided in the preliminary design used to derive cost estimates for the Lusaka Kafue rehabilitation project.

6.2 Road maintenance is the activity which reduces the rate of deterioration of the road, maintains a standard of surface which minimises vehicle operating costs and allows the road to be used continuously with minimum or no interruption. The extent and cost of this activity is largely dictated by design features than design life. A road design for life of 10, 15 and 20 years will all require the same level of maintenance activity. The consequence of little or no maintenance action is also the same in the case of a road designed for a life of 10, 15 or 20 years. The main consequence is premature failure followed closely by exponential increase in vehicle operating costs with time. Thus the maintenance issue cannot be used as a criteria for selection of the appropriate design life. Vice Versa selections of a particular design life has little or no bearing in determining the level of maintenance activity required.

6.3 Effect of Axle Load on Pavement life

The structural design of a road pavement is based on the number of passages of a standard axle on the road during the specified life. Each and every vehicle can and was converted in the report to an Equivalent Standard Axle (ESA) with the knowledge of the weight of its axles. If a vehicle is overloaded this will mean that vehicle is represented by a greater number of ESAs than a similar type of vehicle which complies with the Axle load restriction.

6.4 The Investigation and Documentation study for initiating rehabilitation of four major Roads in Zambia by Kampsax/Carl Bro in 1985/86 included Axle load surveys at 14 locations on the trunk road network including one at Kafue River Bridge and another at

Chilanga both on the Lusaka-Chirundu road. during the period 11 April to 27 June 1985. These surveys found that two percent of all rigid trunks and buses weighed. twelve percent of all trucks with draw bars weighed and five percent of all articulated trucks weighed we found to be overloaded. i.e have axle loads which were grater than the permissible 8200 kg. The number of ESA was calculated for every vehicle weighed and aggregated by vehicle type and on average ESA number was calculated for each vehicle type. These same numbers. which allows for the level of over-loading found by Kampsax/Carl Bro study. were used in the rehabilitation design of the Lusaka-Kafue road undertaken in 1989 and are shown below (from page 31 of Final Report.

Year	ESA/Commercial Vehicles
1983	2.40
1984	2.46
1985	2.59
1986	2.43
1987	3.59
1988	3.85
1989	3.93

Source: Consultants Calculation using Kampsax/Carl Bro data.

6.5 LAND ACQUISATION AND DISPLACEMENT OF PEOPLE

6.5.1 Land Acquisation

There are two locations on the Kafue-Lusaka Road between Chilanga and Lusaka at km 7.5 and km 12.5 where the overtaking sight distances will be improved by realignment of the carriageway using the standard 60 m wide road corridor. the area of land acquisation at location 1 (7.5 km) will be 4.1 hectares and at location 2 (12.5 km) is 2.3 hectares.

The area at km 7.5 is part of a very large heavily mechanised commercial farm with no re-location of people small-holders maize patches or fruit trees. However the areas between the new and old road will then be virtually useless from a commercial point of view but could be utilised by local traders.

The area at km 12.5 is not a mechanised farm as such but is used locally. However again there are no habitations near the area and the area does not contain any fruit trees. The areas on both sides of the existing road are planted in maize up to the edges of the road so the loss of area will be that of the road corridor.

6.5.2 Displacement of People

In the area of Kafue Quarry, about km 33 - 35 there are about 12 small clay with grass roof houses within or on the limit of the road reserves and on the left hand side two concrete block with galvanised iron roof houses near enough to be disturbed if traffic diversions are constructed on the left hand side of the road. It is considered that those houses within the road reserve will have to be moved but this is generally not a major problem if financial awards are made and as the land behind the housing is owned by the people of the area.

Using the following figures obtained from the Valuation Department of the Ministry of Decentralisation (Jan 1990) and after brief inspection of housing and farmland.

Commercial Farmland	K 4000 / hectare
Clay and Grass Roof house	K 1000
Block House and galvanised iron roof	K20000
Banana Tree	K 400
Mango Tree	K 2500

6.5.3 Financial Cost of Road Realignment

At km 7.5		
4.1 Hectares at K4000/ha	=	16.400
At km 12.5		
23 Hectares at K4000/ha	=	9.200
At km 33 - 35		
12 No. Clay and grass roof houses		K12.000
2 No. Block House with Galvanised iron roof		K40.000

		K77.600
		=======

ANNEX 1

Kafue-Chirundu Road Inspection on January 8th 1990.

1. On Monday, 8th January 1990, Mr Thriscutt of John Burrow & Partners inspected the Kafue-Chirundu road in company with Mr J.Harmon, USAID representative, Mr J.D.Mwila, Provincial Roads Engineer, Lusaka, and Mr J.Kontsas, Road Maintenance Adviser to the Roads Department. Weather was cloudy with some heavy rainstorms.

2. The 81.5 km road has been widened and improved since 1982 in 15 sections by a number of contractors, and work by Roads Department (RD) continues on a section near Chirundu. Road condition is reported in these 15 sections as follows, commencing at Chirundu Bridge as km 0, and following the lettering adopted in Annex A of report 690-0209.2 of November 1987 "Evaluation of the Transport and Storage Development Project, Kafue-Chirundu Road".

   Section L-K, km 0.0 to 0.2: this section comprises the customs and immigration area close to Chirundu bridge. It was repaired and double sealed by Lendor Burton within the past two years, and is in acceptable condition.

   Section K-J, km 0.2 to 3.4: improved by Teer in 1982, this section is now being widened, strengthened and provided with a double seal surface by RD. Work commenced in October 1989 and it is planned to complete by May 1990. Not surprisingly, there has been some slope erosion on widened embankments during the current rains, but this will not be serious if controlled and repaired.

   Section J-I, km 3.4 to 5.0: repaired and provided with a double seal by Lendor Burton in 1988, this section is in good condition with slight shoulder wear in places. There are already signs of surface wear on uphill lanes in a few places, and a general comment is made on this at the end of this Annex.

   Section I-H, km 5.0 to 11.1: originally improved by Teer, this section was widened and resurfaced by Lendor Burton in 1988. The section is in good condition, but again there are signs of surface wear on uphill lanes. On this section, there is insufficient camber or crossfall for the type of surface and

the construction standards, with the result that water lies in places on the surface in shallow pools. Whether this is due to traffic loading or, whether it was a feature of the standard of construction, is uncertain. There is the same problem on some other sections of the road, and while it does not seriously threaten pavement life so long as the surface is kept in repair, if at any time an overlay is to be provided, the opportunity should be taken to increase cambers and cross-falls. In general, the pooling of water is not so exten-sive as to be a danger to traffic.

Section H-G, km 11.1 to 15.4: reconstructed with a double seal surface in 1988 by Lendor Burton, the section is in good condition, and the fact that about half the width of the shoulders were sealed has kept these also in good condition. The flat cross-section noticed in Section I-H also occurs in this section.

Section G-F, km 15.4 to 18.6: this section was repaired and given a single seal by Teer in 1982, and is still in quite acceptable condition, with shoulders showing only normal signs of wear. It is planned to widen this 6.1m wide section to 7.3m when resealing takes place, probably during 1990.

Section F-E, km 18.6 to 25.0: ending near the (non-functioning) tsetse barrier, this section was repaired or reconstructed and given a double seal surface by Lendor Burton in 1988. The 7.0m wide road with 1.5m shoulders, half width sealed, are all in good general condition.

Section E-D-C, km 25.0 to 40.0: these two sections, total length 15km, were both repaired and given a double seal by Lendor Burton in 1987/8. From km 30 onwards, the terrain becomes hilly and there are some steep gradients, where uphill lanes are showing wear, stripping and/or bleeding, which is discussed at the end of this annex. In a few places there is cracking of the pavement towards the edges, but without deformation. This seems to be due to reflected shrinkage cracking in the cement stabilized base and is not structurally serious so long as the surface is kept sealed to prevent the ingress of water. These sections have a 7m wide roadway with sealed shoulders, and lined side ditches over much of the length. With the exception of the defects noted, condition is good.

Section C-B, km 40.0 to 60.0: repaired and given a single seal by Teer in 1982, this section is now being resealed by RD. Km 43.6 to km 60 was completed during 1989, plus one lane between km 42.5 and km 43.6. The balance of the section is planned for resealing during 1990. Those lengths that have not yet been resealed are in sound and acceptable condition considering their age. Between km 47 and km 53, there is stripping or wear on several uphill lanes (see comment at the end of this annex). Between km 43.6 and km 46, there has been stripping due to heavy rain during or shortly after resealing, and these sections are to be done again. Otherwise the quality of the resealing done by RD appears to be good. The hilly portion of the road, which starts at km 30, ends at about km 55, and over most of this length, there are narrow paved shoulders and fully lined side drains, which makes maintenance easier. Heavy recent rains have caused rock and debris falls into the side ditches in places, and some minor longitudinal scour. These defects would normally be dealt with as a part of routine maintenance, and it may be that the maintenance team's lack of a vehicle following an accident explains why they have not been repaired so far.

Section B-A3, km 60.0 to 66.0: reconstructed with a double seal surface and half-sealed shoulders by Whyle in 1984, this section is in sound condition and is due for resealing in 1991/92.

Section A3-A2, km 66.0 to 73.8: this section was provided with a 5 cm hot premix overlay, plus sealed shoulders, by Whyle in 1984. The premix surface is showing a normal amount of wear for its age and traffic, and exposed aggregate seems to have polished, which would increase the possibility of skidding accidents. There is some cracking within about 50 cm of the pavement edge, which again seems to be due to reflected cracking from a cement stabilized base. This is not structurally serious if treated, and it is planned to clean out and seal these cracks with hot bitumen during the next dry season, which should be a satisfactory remedy. Wear on the shoulders and shoulder seal will require treatment which could be combined with a seal coat over the premix. Although there is no sign of structural failure of the premix surface, resealing may be desirable (See para 4).

Section A2-A1, km 73.8 to 78.4: reconstructed with a double seal surface by Whyle in 1984, this section is structurally sound, but shows signs of shoulder wear up to about 5 cm in places. The section ends adjacent to the weighing station, where all construction work is complete, apart from approach slabs on either side of the weighing unit. Staff and equipment are on site, and final electrical connections have to be made to the equipment house, although the equipment can function on rechargeable batteries. It is planned that the Police checkpoint about 200m to the North will be moved to the weighing station to assist with traffic control, and the station is due to commence operation in February 1990, with approach slabs completed by mid 1990.

Section A1-A, km 78.4 to 81.5 (Kafue Bridge): Whyle provided a hot premix overlay to this section in 1984, and condition is still good, apart from a normal amount of wear and some shoulder wear. There is some silting and scouring of side drains from about km 65 to Kafue Bridge which needs attention, although during heavy rains, this type of damage could occur within a few hours.

General Comments on the Kafue-Chirundu Road.

3. Routine maintenance for this road is provided from a road camp at about km 65, where there is a Road Foreman with 23 years experience plus 13 labourers, hand tools, some stores and (usually) a tipper truck. However, this truck has been out of action for the past three or four weeks following an accident, and routine maintenance can now be done only within walking distance of the camp, say from km 60 to km 70. The present state of routine maintenance is commensurate with this situation. Grass cutting, side drain and culvert clearing and similar routine operations away from the camp have obviously not been done recently, but there is no sign of long term neglect. Road markings are worn but legible, except where they have not been replaced after resealing, and kerbs and barriers are painted. There have been edge repairs in places, and isolated pavement failures have been well repaired by digging out and patching. The amount of these failures is in line with what could be expected on a road of this nature. Road signs and marker posts are frequently missing due to the local population's habit of finding alternative uses for them. On the present showing, it is considered that the road

structure and traffic safety are not threatened by any deficiency in routine maintenance, although especially during the rains, every effort should be made to see that this vital road is permanently provided with a adequate transport for maintenance purposes.

4. Periodic maintenance (resealing) is done by special RD units, which are not operating at present due to the rains. However, most of the resealing inspected seems to have been done satisfactorily and competently, apart from the lengths affected by rain. At the onset of the rainy season, there is always this risk, and the choice is between curtailing the resealing program early, or accepting possible loss of some resealing. The time between reseals of about seven years might be reduced if resources permit, although with the present timing, there is no sign of signifioant failure of the old pavement before resealing is done. If the equipment is available, it would be desirable to check the skidding resistance of premix overlays, which may have reduced under the effects of traffic, and this would indicate that a seal coat is desirable, although structurally the premix may still be quite satisfactory. The same applies to the stripped or bleeding sections of sealed surfaces, especially in the hilly length between km 30 and km 55. Several recent accidents could have been due to skidding, which is more likely when there is bleeding bitumen on the road surface during the rains.

5. Concerning the wear and stripping that is evident on uphill lanes, it should be recognized that the high proportion of heavy trucks in the traffic flow, mostly having only one or two driving axles, put heavy shear loads on the road surface on steep gradients. Hence, very high standards of design and workmanship are necessary to avoid failures over these sections. The principal source of road maintenance stone for resealing is from the RD quarry North of Kafue, and the present output is poorly shaped and contaminated with dust. Before being used on these difficult sections of road, stone should be tested to ensure that is is not at all bituphobic, and shape and cleanliness must be carefully controlled. Grade of bitumen, rates of application, size, grading and rates of spread for stone all need to be carefully considered in design, and well controlled during the resealing itself. Every effort should be made to get maximum

adhesion, which would include careful preparation of the old road surface, strict control of rolling after laying, and possibly drying and pre-coating of stone before use and the use of adhesion additives. It is by no means impossible to attain the high standards necessary on these steep sections so that seal coats will have a satisfactory life, but expert and experienced advice may be required.

6. Although it has not been possible to see the resealing units in operation during this visit, judging from the majority of the RD sealing work that has been seen, and reviewing the equipment available and proposed, together with RD's proposed resealing program on this road, it is considered that RD should have the ability to undertake satisfactory periodic maintenance so far as resealing of paved roads in this area is concerned, providing that sufficient and satisfactory stone can be produced. However, RD's total resealing capacity should be reviewed against the total resealing demands of existing paved roads plus those proposed for construction and rehabilitation by government and various donors.

7. There is at present a shortage of capacity for rehabilitating and maintaining shoulders of paved roads in good condition. Equipment for one unit, provided under Finnish Aid, has arrived in Lusaka, and this will allow rehabilitation and sealing of shoulders over about 90 km of road a year. Again, it would be desirable for the total need for shoulder rehabilitation to be reviewed against RD's capacity to undertake such work before provision of further units is considered. The need for more units would, of course, be affected by any decision to seal shoulders in all paved road rehabilitation and construction.

John Burrow & Partners Zambia
Consulting Engineers

Annex 2.

KAFUE-LUSAKA ROAD REHABILITATION.

Details of Cost Estimates.

Routine Maintenance.

Kafue Chirundu:

Taking average mid-scale wage rates for one foreman twelve labourers. One clerk, one driver and one operator, allowing some overtime and housing allowance of K750 per month. monthly wages are as follows:

Foreman 2850 pm
10 labourers 1800 pm
2 casual labourers 1050 pm
1 clerk 1900 pm
1 driver 2150 pm
1 operator 2150 pm
Say K.350.000 p.a.
1 truck @ 8 litres/hr for 6 hrs per day. 150 days/yr @ K8 per litre + 10% for lubricants + repairs @ 10% p.a. of $30.000
Say K 148.000 p.a.
including foreign exchange for spares of $3000 p.a.

Small plant items @ 50% of above.
K74.000 p.a. including foreign exchange of $1 500

Patch and reseal 2% of surface per year 1.6 km @ K90 per sq m
= 81.5 x 1000 x 7 x 0.002 x 90 = (say) K1.000.000 p.a.

Note. this item contains an element for wages. that are already allowed for. Assuming wages = 30% of total cost. this would allow about K300.000 a year to pay upset allowances.

Total: K 350.000 + 148.000 + 74.000 + 1.000.000
= K 1.572.000 p.a.
@ K23 = US$1.00 for 81.5 km = US$ 836 per km p.a.

Average cost for sub-Saharan Africa is about US$1.000 per km p.a.
Taking cost of spares. (US$4 500) as foreign Cost. total is 7% foreign and 93% local cost.

Kafue-Lusaka:

Assume same labour team, 25% increased plant costs to allow for heavier traffic, but patching reduced pro rata for length.

Wages	K350,000
Equipment	K270,000
Patching	K660,000

Total: K1,280,000, or (US$1,080) per km p.a. with 10% foreign exchange for spares.

Resealing.

Take RD cost (RD accounting) of US$6250 per km (say K150,000), and deduct cost of equipment spares, estimated at 10% p.a on capital cost of equipment in resealing unit (US$800 000) plus 50%of crushing equipment spares for a year to reseal 100 km per year. = US$1200 per km, or 10% of total cost. Cost reseal therefore is US$1200 + K116 000 per km.

Kafue-Chirundu

On Kafue-Chirundu section, requirement for resealing (at approx 7 years between reseals) would be:

	kms	US$ ('000)	ZMK ('000)
1990	7.3	8.8	847
1991	15.5	18.6	1798
1992	15.6	18.7	1809
1993	16.6	19.9	1926
1994	8	9.6	928
1995	10	12	1160
1996	8.5	102	1839
1997	7.3	8.8	847
1998	15.5	18.6	1798
1999	15.6	18.4	1809
2000	15.6	19.9	1926

Kafue-Lusaka

Assuming the road will be complete in 1994 the first reseal is assumed necessary over 20 km in 1999 and on a further 20 kms in 2000, to allow for heavier traffic close to Lusaka

	kms	US$ ('000)	ZMK ('000)
1999	20	24	2320
2000	20	24	2320

Shoulder Rehabilitation:

Cost estimated at $500 per km (made up of US$120 (20%) for spares, and, say, K11 000) for average width and condition of shoulders.

On the Kafue-Chirundu section, 9.6 km require treatment in 1990, and 18.8 km in 1991. Thereafter, regular treatment every 1 years or say 20 km p.a.

On the Kafue-Lusaka section, no treatment is assumed before 1998, and thereafter every 4 years, or say 15 km per year.

Annex 3

Review of Maintenance Capability: Kafue-Lusaka Road.

Persons Interviewed during Mission.

Roads Department Headquarters:

Mr T.Ngoma, Director of Roads
Mr T.Norheim, (NORAD), Maintenance Engineer
Mr P.Kosonen (FINNIDA) Project Manager
Mr J.Kontsas (FINNIDA) Highway Engineer
Mr W.Simusoko, Materials Engineer.

PRE, Lusaka Province:

Mr J.D.Mwila, Provincial Road Engineer
Mr Russel Phiri, Eng Asst, Lusaka Province
Mr A.K.Phiri, " " , Luapula Province
Mr N. Chansa, Accounts Clerk.
Road Foreman, Kafue)Chirundu Road.

Outside Government:

Mr Sarshar Khan, World Bank Resident Representative
Mr A. Burton, Burton Contractors.
Review of Maintenance Capability: Kafue)Lusaka Road.

Annex 4

KAFUE-LUSAKA ROAD REHABILITATION

Mechanical Equipment Provided by Donors to Roads Department.

Date	Equipment Provided	Donor	Destination.
1978	80 Graders	Canada	Whole Country
1987	3 Resealing Units		Lusaka. Luapula & Northern Provinces
1989	1 Resealing Unit	Japan	Eastern Province
1989	1 Resealing Unit	U.S.A.	Lusaka Province
1989	1 Shoulder Rehab. Unit Planned	Finland	Lusaka Province
1990	1 Resealing Unit	Denmark	Western Province
1990	2 Resealing Units	Japan	Northern and Central Province
1990	1 Patching Unit	Finland	Lusaka Province
1990	2 Mobile Crushers	Japan	Eastern and Northern Province

Source: RD Headquarters.