XD-MAY 314-A
ISN = 5097 4

SECOND EXTERNAL EVALUATION:

SOUTHERN PERIMETER ROAD PROJECT
(698-0076)

Kingdom of Lesotho

November 29, 1985

L-22

L

made, if appropriate.

(h) Assistance in road maintenance capability will be welcome but it must be properly defined.

2.2 Transport Economics

(a) This sub-section deserves one general comment. It refers to institutional development some of which is in hand such as road Inventory Compilation, traffic counts, etc. These issues are being addressed in the developmental process of the Roads Branch. Most of the data referred to under item (iv) is being collected by other Government Departments and used by Roads Branch. Therefore, there will be no need for duplication of effort in such cases.

(b) Residents isolated by the cut-off section of the road are being taken care of since the Old Access road continues to form a part of the road network under Ministry of Works.

(c) Government continues to make efforts to maintain the roads in reasonable condition for the prevailing traffic conditions.

(d) Employment of an Economist in base line Studies is a reasonable advice.

(e) It is agreed that it is necessary to address a traffic institutional management capacity. As mentioned earlier this issue is being attended to even though limited resources restrain its completeness.

(f) Updating of previous studies, in case of long term time lag in the implementation of projects, have always been done. However, in this case the relevance of the statement is not appreciated. This is not a staged construction project.

2.3 Social

Feeder roads to the project will be constructed as appropriate and depending on availability of resources.

Thanking you in advance for your kind cooperation in this matter.

Yours sincerely,

M.P. SELANAMANE.
Director of Planning.

LIST OF PERSONS CONTACTED

NAME	TITLE	REPRESENTING	LOCATION
E. Boorady	Director	USAID	Maseru
D. Bernius	Program Officer	USAID	Maseru
C. Fortunato	Chief Engineer	USAID	Maseru
P. Layne	Education Officer	USAID	Maseru
A. Moustafa	Ass Agr Development Officer	USAID	Maseru
M. Yohannes	Engineer	USAID	Maseru
M. Chobokoane	Eng Training & Statistics	MOW	Maseru
P. Datta	Dept Chief Roads Engineer	MOW	Maseru
E. Kim	Engineer (Proj Coordinator)	MOW	Maseru
M. Marumo	Chief Roads Engineer	MOW	Maseru
Mr. Mputsoe	Principal Tech Officer	MOW	Qacha's Nek
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Mr. Sekake	Site Clerk-Stores Officer	MOW	Qacha's Nek
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NAME	TITLE	REPRESENTING	LOCATION
M. Maluleka	Vaccinator	CRS	Mt. Moorosi
J. Moji	Food Coordinator	CRS	Mt. Moorosi
A. Moloingoni	Child Weigher	CRS	Mt. Moorosi
P. Tsesane	Chart Keeper	CRS	Mt. Moorosi
M.P. Mahone	Head, Dept Sociology	U of L	Roma
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A. Jones	Manager	Mitchell Bros	Mt. Moorosi
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C.S. Chobokoane	Director	Food & Nutr Office	Maseru
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V. Motemi	Wool & Mohair Recorder	Wool Shed	Ha Ntsie
M. Seitlhelu	Principal	Koali Primary School	Mt. Moorosi

PAA	Project Authorization Amendment
PAX	Passenger
PGA	Project Grant Agreement
PID	Project Implementation Document
PIO/T	Project Implementation Order/Technical Services
PP	Project Paper
PRCH	PRC Harris Inc
PU	Pick-up
RDS	Road Design Standard
RE	Resident Engineer
REDSO	Regional Economic Development Services Office
RSA	Republic of South Africa
SPR	Southern Perimeter Road
SPRP	Soutnern Perimeter Road Project
SPRPA	Soutnern Perimeter Road Project Authority
TA	Technical Assistance
TDY	Temporary Duty
T/L	Truck Load
TRRL	Transport Road Research Laboratory
UN	United Nations
USAID	United States Agency for International Development
VOC	Vehicle Operating Costs
W	With
W/O	Without

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I EXECUTIVE SUMMARY

A. This is the second external evaluation of the Southern Perimeter Road Project (690-0076).

B. The Southern Perimeter Road Project was undertaken in response to a United Nations sponsored emergency appeal for donor-assistance to help the Government of Lesotho (GOL) face the economic repercussions stemming from the GOL's refusal to recognize the "independence" of the South African homeland, Transkei. That situation has imposed severe restrictions on GOL efforts to develop the relatively high agricultural potential of the south-eastern region since the only practical access to Qacha's Nek from the capital, Maseru, was through the Transkei homeland. The Project consists of the design of a gravel surface road from Mohale's Hoek to Qacha's Nek and part of its construction from Quthing to Qacha's Nek, in the south-eastern region of Lesotho.

C. The purpose of the evaluation is to determine if, when viewed in the light of technical, operational, programmatic, economic and social implications, the project is making satisfactory progress towards its stated objectives. The evaluation is also intended to identify and evaluate any problem areas or constraints which may be inhibiting satisfactory progress; to recommend solutions to overcome such problems and/or constraints; and to address the overall economic and social development impact of the project.

D. The evaluation methodology included a review of the project's history as disclosed in such relevant documents and reports as:

1. The Project Feasibility Study, dated 15 April, 1978
2. The Project Paper, dated 19 June, 1978
3. The Project Grant Agreement, dated 30 June, 1978
4. The Project Authorization Amendment, dated 19 September, 1980
5. Various Project Implementation Letters
6. The first External Evaluation Report, dated 3 June, 1983
7. The Project Evaluation Summary, dated 14 February, 1984
8. A Socio-economic Baseline And Preliminary Impact Analysis, dated July, 1985
9. A GOL commission Financial Audit, dated 20 August, 1985
10. Additional letters, agreements, monthly progress reports, and GOL Specifications which pertain to the current status of the project

The evaluation methodology also included interviews with members of USAID; the Ministry of Works; the Southern Perimeter Road Project Authority Technical Assistance Team and their associated personnel: the Ministry of Agriculture; the Ministry of Education; the Ministry of Health; the Ministry of Planning; the Catholic Relief Services; the L. Berger International, Inc; and many users and beneficiaries of the road project.

The evaluation team members viewed the project area between Quthing and Qacha's Nek observing completed construction areas, areas currently under construction, and areas scheduled for future construction. They also viewed the conditions in the surrounding area and the team's sociolcgist concucted many interviews with local authorities, entrepreneurs, and residents along the project route and in adjacent areas.

E. The lessons learned include:

1. Feasibility Studies must be updated if the project implementation is delayed or when staged-construction is planned;

2. Major highways require a significant investment in the determination of their need, in the investigation of the standards to which they shall be designed; and in the exact location in which they will be built;

3. Financial compromises do not necessarily save money in the long term;

4. Mistakes are innerent to the learning process and can be compounded by time and financial constraints; and

5. The capability for maintaining a newly constructed road should be thoroughly addressed when the plans for constructing the road are being developed.

Recommendations include:

1. The development of more comprehensive geometric criteria and construction specifications;
2. The re-evaluation of some erosion control practices;
3. The continued use of Technical Assistance to augment the current brigade;
4. The continuation of the search for Basotho counterparts to the TA team;
5. The inclusion of a field construction superintendent in any TA team;
6. The use of more conventional surveying methods for construction control;
7. The increased awareness of the maintenance implications inherent to the expansion of a road network;
8. The immediate consideration of expanding the local maintenance capability to protect the investment in this project; and
9. The improvement of data collection and more comprehensive use of data to better justify and monitor highway investments.

II. INTRODUCTION

A. Evaluation Team Members

Lloyd R. Crowther, P.E., Team Leader, Consultant

Michael Misaelidis, Transport Economist, Consultant

Joan M. Campbell, Ph.D., Anthropologist, Consultant

J.M. Peete, Senior Roads Engineer, GOL, MOH/Roads Branch

Mr. J.M. Peete acted as the representative of the Government of Lesotho, Ministry of Works on the evaluation. As the GOL's representative his views were considered and reflected in the drafting of the report. However, Mr. Peete did not, due to other pressing duties, participate in the actual drafing and writing of the evaluation report.

B. Evaluation Plan

1. General

Requirements, purpose and objectives for the evaluation of the Lesotho Southern Perimeter Road Project were subjects of telephone conversations, meetings and TDY briefings between AID/W Engineering office and team members. The Terms of Reference are outlined in the team's "Scope of Work".

All members of the evaluation team arrived in Maseru, Lesotho on Sunday, November 3, 1985 and reported to USAID/Lesotho on Monday, November 4, 1985.

2. Data Acquisition

Requirements for the highway project history and background feasibility study, design, construction and encountered problems were subjects of discussions; interviews; and various meetings conducted during the period November 4, 1985 to November 22, 1985. A field trip by all team members was made to the project area between November 11-15, 1985.

3. Scope of Work

The team reviewed relevant documents and reports, undertook site visits, conducted interviews, examined equipment, evaluated past and proposed construction and maintainance. Relevant documents reviewed included:

a. The Project Paper, dated June 19, 1978;

b. Project Authorization Amendment, dated September 19, 1980;

c. Socio-economic Baseline Study and Preliminary Impact Analysis, dated July, 1985;

d. Project files which included the following:

(i) Project Grant Agreement,

(ii) Project Implementation Letters,

(iii) Project Evaluation Summaries of previous evaluations,

(iv) The first External Evaluation Reports, and

(v) L. Berger International, Feasibility Study, 1978.

e. A GOL commissioned Financial Audit, dated August 20, 1985

A list of major publications and documents reviewed is included as Annex 1.

4. Evaluation Process

Data and documentations acquired were analyzed continuously to:

- clarify the detailed nature of the project;

- determine the performance of the Technical Assistance Team and the Ministry of Works/Roads;

- determine the past, current and anticipated roles of each party concerned with the project;

- define current and anticipated problems;

- determine capabilities of the Force Account Unit of the Southern Perimeter Road Project Authority in terms of its ability to strengthen the institutional capacity of the Government of Lesotho in developing and managing a roadway construction force;

- identify and recommend solutions to overcome problems or constraints;

- evaluate the progress toward attainment of project objectives;

- identify and evaluate problem areas or constraints which may inhibit such attainment;

progress achieved to date in relation to the revised work plan;

determine the need to continue involvement of expatriates in relation to the Basotho counterparts - with strong emphasis on those positions scheduled for transition at the end of December, 1985;

evaluate adequacy of fiscal and financial control procedures adopted by the SPRPA acting through the TA Team relative to staffing, financial management and accounting systems;

determine and analyze the effects that the project goals achieved to date, and possible scenarios projected in the future;

determine the ability of the GOL to meet recurrent costs;

evaluate the current pace of progress of the work being performed by FA Unit relative to its human and mechanical resources;

determine an assessment of how much work can be accomplished with the remaining funds; and

evaluate the overall economic and social development impact of the project.

5. Preliminary Draft Report

The preliminary draft report, presenting the results of the project evaluation efforts, was prepared in Lesotho in accordance with the Terms of Reference of the Second External Evaluation of the Southern Perimeter Road Project (Project No. 690-0076, PIO/T No. 690-0076-3-80695, Approp No. 72-11M1006, Contract No. CO-632-0076-S-00-6006-00). It was presented to USAID and GOL representatives on November 22, 1985.

6. Review and Final Report

The preliminary draft evaluation report was reviewed with appropriate members of AID/L and GOL. After such reviews and comments were received, the final evaluation report was submitted to USAID/Lesotho on November 29, 1985 in accordance with the Terms of Reference.

Genesis of the Project

The genesis of the SPR Project stems from Lesotho's refusal to recognize the independence of the South African homeland, Transkei. In 1977, the RSA established the area adjacent to Lesotho's eastern border as an independent homeland. Lesotho, along with most of the world's nations, refused to recognize Transkei as an independent nation. This refusal created a political climate which could lead to economic repercussions against Lesotho. The economic viability of southeastern and southern Lesotho is highly dependent upon access to markets in

South Africa. At present, Transkei controls three border gates leading to these markets and could cut off access to them at any time. A special United Nations mission to Southern Africa studied the economic impact of Transkei independence on Lesotho and recommended upgrading the Southern Perimeter road as a means of protecting residents against economic dependence on Transkei border posts and the South Africa network. Also, an upgraded road would have development impact by integrating southern and southeastern Lesotho more fully into the national economy. In response to the UN report and the GOL request, US agreed to provide assistance in upgrading the road.

D. Chronological History

1. Project Paper

The Project Authorization which is part of the Project Paper, was signed by the Deputy Administrator, A.I.D., on June 29, 1978. The document states: "The project will consist of the design and construction of the Southern Perimeter Road from Qacha's Nek in southeastern Lesotho to Quthing in the western lowlands (approximately 155.1 kilometers), and the design only of that portion of the road north from Quthing to Mohale's Hoek (approximately 50.3 kilometers). Approximately 101 kilometers of the road to be constructed under this project will be built to two-lane gravel standards and approximately 54 kilometers will be built to paved standards.".

The cost of the total project was estimated at $31,450,300 of which AID provided $26 million and the GOL $5.5 million of which approximately $500,000 was in-kind.

The Environmental Assessment (EA) as called for in the document addresses in detail the enviromental effects of the proposed road construction. The paper recommends measures to insure that the environmental factors and values are safeguarded. The recommended construction standards to mitigate negative environmental impact are:

- aprons of concrete or rock to be placed on the downstream of culverts;

- the ditches with steep slopes will be lined with rubble, masonry, or concrete;

- where soil is exposed along cuts, hydro-seeding will be used after adding top soil as necessary;

- borrow areas will be selected carefully to minimize erosion;

- existing erosion gullies along the road will be treated to protect the ecology and the road;

- various forms of stabilizing structures such as slope walls and retaining walls will be constructed predominantly from locally available rubble stones; and
- paving of the road in urban areas.

2. Project Authorization Amendment

The Project Authorization Amendment was signed by the Acting Administrator of AID on September 25, 1980. The amendment authorized an increase of funds amounting to $8.0 M for the project. A detailed engineering design was completed on December 1979. On the basis of the design work, the total completion cost of the project was estimated at $121 million, an increase of $90 million which AID could not seriously consider. Design standards for the road were revised downward in order to permit the successful accomplishment of project objectives at substantially lower costs to both the GOL and AID. The $8 million grant increase by AID to the project was to achieve original project objectives of providing an all-weather road in southern Lesotho, allowing southern and southeastern Lesotho to be opened to accelerated development programs and integrating those regions more fully with the national economy of Lesotho.

3. Socio-economic Baseline Data and Preliminary Impact Analysis

The socio-economic baseline study of the partially completed Southern Perimeter Road between Quthing and Qacha's Nek was submitted in July, 1985. Its purpose was to establish benchmark information as a basis for measurement of the economic and social benefits of the project. In addition, it was to establish hypotheses concerning effects which the road may have on the population in the road's zone of influence, and to make suggestions for an impact evaluation study to be undertaken after project completion.

The tentative impact analysis is based on information from people who were interviewed, observations made by the research team, traffic counts and comparisons between baseline data from road sections which had been completed and those where construction work had not been started. Certain social and limited economic benefits were assessed. A specific elaboration of this analysis is made in the economics portion of this report.

4. Documentation in the Project Files

a. Project Agreement

Project Grant Agreement No. 78-632-22 was signed on June 30, 1978. Appropriation No. 72-1181000, Allotment No. 850-52-090-79-81. Amendment No. 1 dated November 10, 1980 contains a detailed implementation plan for the project.

b. Project Implementation Document

Lesotho Roads Assessment Project 690-0076 was approved by the Acting Regional Development Officer, OSARAC on March 24, 1977. The amount shown in the Project Review Paper Facesheet is for $20,140,000 Grant. The project purpose is stated as "To develop within the Government of Lesotho's Ministry of Works the institutional capacity to be involved effectively in Lesotho's road construction and maintenance as part of overall national development." The PID clearly states that the project is to be institutional building. It states: "To assure that road maintenance does not become a future problem the next stage of project documentation will examine road maintenance in detail and develop a course of action which addresses any identified problems." The document further identifies the need for a full time direct hire engineer to serve as project officer and monitor implementation during the life of the project. The workshop at Mohale's Hoek was planned to support (repair and maintain) equipment operating on the segment of the road from Mohale's Hoek to Quthing area. This workshop will eventually support road maintenance operations for the general area.

The PID states: "the greatest and most important long range effect of this project will come from the trained Basotho it finances and guides on-the-job training and supervision. It is exceptionally important that this part of

the project be designed carefully and realistically so as to produce the most effective possible results for the government and the people of Lesotho."

c. Feasibility Study

The study was prepared by Louis Berger International, Inc., 100 Halsted Street, East Orange, N.J., 07019 and submitted to REDSO/EA on April 15, 1978. The consultants began work on this project on January 9, 1978, and the final report was submitted on April 15, 1978. Louis Berger presented detailed construction costs for various construction strategies as shown:

TABLE II - 1
COST ESTIMATE SUMMARY
(1000's of 1978 Constant U.S. Dollars)

	US Contr W/O Waiver	US Contr W/Waiver	Int. Contr.	Force Account	
Total with DBST on 10%	28128	22838	22422	23848	Gravel = Total
Total with DBST	37851	31990	31368	32901	Paved = Total

As noted, the highest total cost of the project as estimated amounted to $37,851 million for a paved road and $28,128 million for a gravel road.

Standard economic analyses procedures were used for determining the economic return of the project. Project costs were calculated based on the cost of final engineering design, engineering supervision, road construction at the road design

standards recommended for the project, and road maintenance over a 20-year period. Quantifiable economic benefits had been limited to user cost savings accumulated through lesser vehicle operating costs (VOC) over improved surface conditions and shorter and higher quality alignment, and road maintenance savings where maintenance costs with the project are less than maintenance costs without the project. Agriculture and tourism were considered in this feasibility study while, due to time constraints and paucity of data availability, the consultants did not quantify other benefits or related investment costs that might be expected to accrue in the zone of influence. The economic evaluation include Benefit Cost Ratio (B/C), Internal Rate of Return (IRR) and a sensitivity analsis of ± 20% on costs and benefits.

d. Contracts and Amendments

The following contracts have been executed:

Contract between USAID REDSO/EA and Louis Berger International, Inc., signed on November 4, 1978 (LBII) and November 10, 1978 (AID). Not available at USAID.

e. Title I

Contract between the Government of Lesotho and Frederic R. Harris, Inc. for Consulting Services in Connection with: Design, Construction Supervision, and Inspection/ Monitoring of the Southern Perimeter Road and the Seaka Bridge, dated April 5, 1979.

Contract Amendment No. 1 between the Government of Lesotho, Ministry of Works and PRC harris for Consulting Services in Connection with: Construction Supervision (Title II) and Management of Construction by Force Account (Title III). Contract No. 690-0076-1HCC, January 1, 1981.

Agreement between Government of Lesotho, Ministry of Works and Nello L. Teer Company for the Construction of Lesotho Southern Perimeter Road - Mount Moorosi to Mphaki Cut-Off, dated June 29, 1981. Contract 690-0076-03HCC.

Contract between the Government of Lesotho, Ministry of Works and Nello L. Teer Company for Management Consulting Services in Connection with the Construction by Project Authority Title III. Contract No. 690-0076-2HCC, dated December 10, 1982.

f. Title I

Relationships between the A&E execution of Title I (design) Contract requirements and subsequent activities under Title II and III are defined in Appendix II of PRC Harris, Inc. Contract Amendment No. 1 of January 1, 1981.

g. Title II

The PRCH Contract services/responsibilities are defined for both Title I and II in the original April 5, 1979 contract; those for Title II, however, were redefined in Amendment No. 1 dated January 1, 1981 to include Construction Supervision of the Cut-off Construction.

h. Title III

The A&E contract services/responsibilities are defined in Amendment No. 1 to the PRCH contract of January 1, 1981.

5. GOL Financial Audit Report

A GOL commissioned financial audit, dated August 20, 1985, covered SPRA's financial activities. The report provided the audit firms comments on the following major operational functions:

- Systems Audit;
- Audit of Accounts;
- Financial Review;
- Internal Control System;
- Accounts Presentation;
- Financial Year Transactions;
- Losses, irregularities, unecessary expenses; and
- Legal and statutory matters.

E. Project Scope, Goal and Purpose

The primary scope of the original project is:

- design of an all-weather, two lane road from Mohale's Hoek south to Quthing in southeastern Lesotho for construction with other donor financing;

- rehabilitation of the existing bridge over the Seaka river on the road from Mohale's Hoek to Quthing;

- upgrading the existing road from Quthing east to Qacha's Nek to all-weatner two lane standards excepted; and

- construction of an all-weatner, two lane cut-off road through virgin territory between Mt. Moorosi and Mphaki which will substantially shorten the Quthing-Qacha's Nek road.

The project goal is to facilitate economic development and national integration through an all weather road network. The project purpose is to upgrade the basic transportation link between Qacha's Nek and the western lowlands of Lesotho.

III TECHNICAL ANALYSIS

A. Physical Characteristics

The area from Quthing to Mt. Moorosi is in the Senqu Valley. Lithosol soils on sedimentary rocks predominate with some areas of better soils, particularly where dykes have occured. The dolerite gravel used on Title III, section 1 was mined from these dykes.

The mountain soils found from Mt. Moorosi to Sekake are lithosols on lava. The basalt gravel used on Title III, section 2 is common in this area.

The section from Sekake to Qacha's Nek has soils similar to the area between Quthing and Mt. Moorosi. Dolerite gravel should be available in this area.

The climatic zones and their characteristics for the middle section of tne project, centered on Mphaki and covering about 46% of the project length, are reproduced as Table III-1. The transferability of this data to the rest of the project area may be questionable. The location of the area is outlined on Map III-1, Isonyetal map of mean annual rainfall. This data was photocopied from a document being prepared by the Mphaki Livestock Development Program.

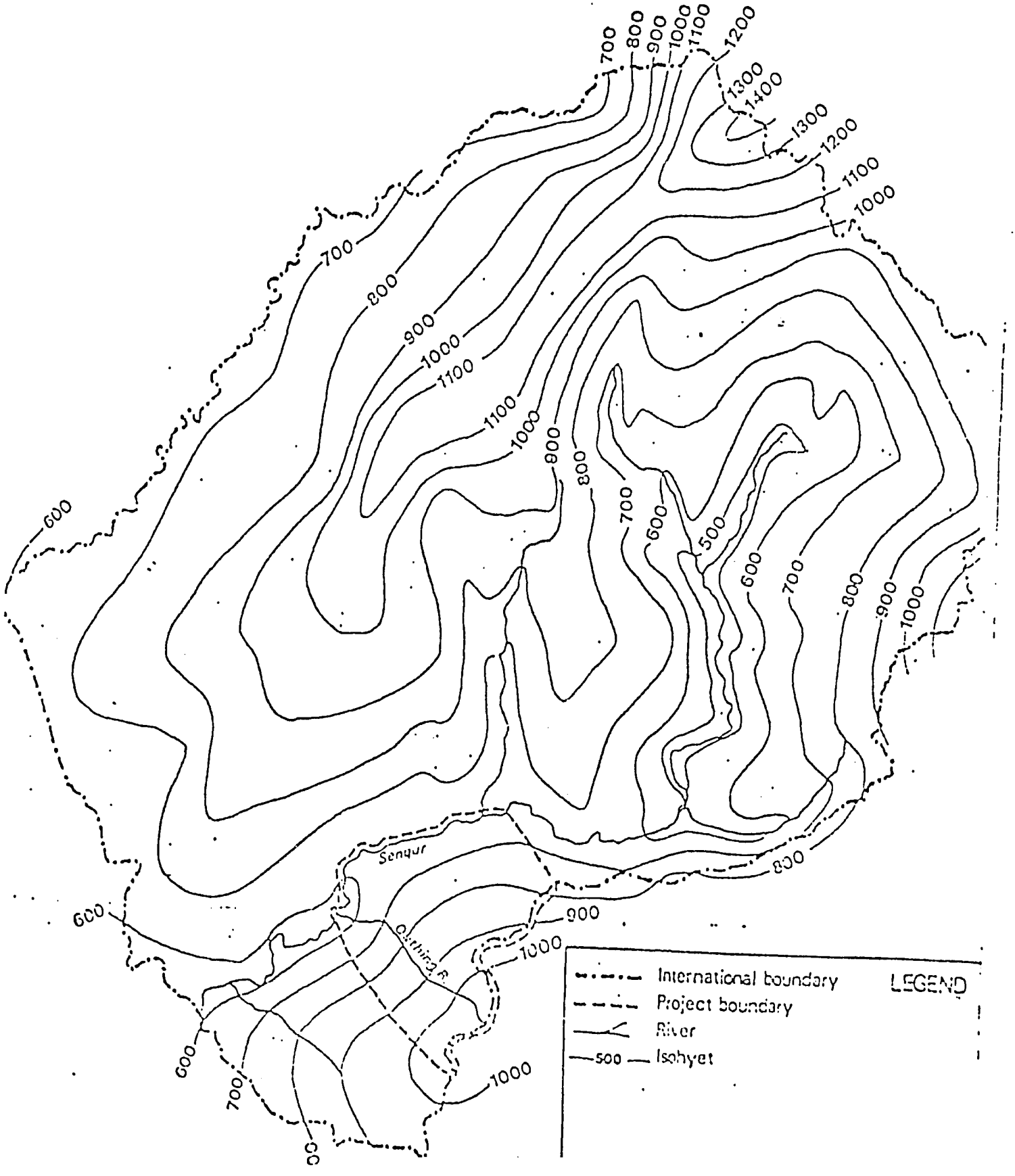
TABLE III-1

CLIMATIC ZONES OF THE MPHAKI PROJECT AREA

ALTITUDE		Below 2000	2000-2500	Above 2500
SUMMER	350mm	80	> 80	> 80
RAINFALL	400mm	60-80	> 80	> 80
(Oct-Mar)	450mm	60-80	> 80	> 80
PROBABILITY OF	500mm	40-60	60-80	> 80
EXCEEDING				
WINTER	100mm	50-80	> 80	> 80
RAINFALL	150mm	25-50	> 50	> 50
(Apr-Sept)				
PROBABILITY OF	200mm	25	25-50	25-50
EXCEEDING				
SUMMER	Mean-Max	23 to 25	19 to 23	15 to 19
TEMPERATURE	Mean-Min	10 to 11	7 to 10	4 to 7
(Oct-Mar)	$\frac{\text{Max+Min}}{2}$	16 to 18	13 to 16	10 to 13
°C				
WINTER	Mean-Max	16 to 20	13 to 16	10 to 13
TEMPERATURE	Mean-Min	2 to 5	-1 to 2	-3 to -1
(Apr-Sept)	$\frac{\text{Max +Min}}{2}$	9 to 10	6 to 9	3 to 6
°C				
GROWING	70%Frost	170-190	140-180	50-140
PERIOD	Fee			
(Days)	90%Frost	140-160	100-150	40-100
	Free			

Isohyetal map of mean annual rainfall (mm)
Map no. III - 1

LESOTHO



This technical evaluation is based on the problems inherent to the physical characteristics described above and the project's success in designing and constructing a road in such a setting. The concept used to make the physical portion of this evaluation is based on environmental equilibrium considerations. Environmental equilibrium can be described as a state of balance. Before a road is built the terrain and its native soils have reacned some sort of equilibrium with the natural environmental forces represented by climatic conditions such as rain and snow, temperature variations and extremes, winds, and seasonal characteristics with their impact on native vegetation. Once man has disrupted an area's environmental equilibrium, nature will exert strong forces to try to reach a new equilibrium condition. Therefore, the design and construction of a road involves two factors: (a) servicing the user, represented by vehicle operating cost reduction, and (b) maintaining or reachieving environmental equilibrium, represented by construction and maintenance costs. To be economically viable, a road construction or upgrading project must produce a greater total savings in users' benefits than the total of its construction and maintenance costs over its design lifetime.

B. Description of Existing Road

This description encompasses the route as it now exists. The first 41 km between Quthing and Mt. Moorosi is referred to as Title III, section 1. It was built by the current Force Account brigade and is considered as "substantially completed" although a major stream crossing at the beginning of the section is currently being constructed by the brigade at the direction of the Roads Department. The brigade is still responsible for the maintenance of these 41 km.

The next 36 km between Mt. Moorosi and Mphaki is referred to as the Cut-off, its current official designation is Title II. It was constructed by a US contractor, Nello L. Teer Company, under the supervision of PRC Harris, a US consulting engineering firm. This section is also considered as "completed" although some slide areas and drainage problems remain to be corrected. Extensive work in this section has already been carried out by the current Force Account brigade. The Cut-off is so named because it is a new alignment designed to reduce the travel distance between Mohale's Hoek and Qacha's Nek, the original project boundaries. The Cut-off construction began before the Title III work and its maintenance is currently the brigade's responsibility.

The remaining 102 km from Mphaki to Qacha's Nek is currently referred to as Title III, section 2. It is being constructed by the same Force Account brigade that built (or is completing) Title III, section 1. Currently the pavement construction is complete to Km 7+000, drainage structures have been installed to Km 11+300, and blasting and embankment

work is underway through Km 11+900. The design is complete to the near abutment of an existing 20 meter long bridge at Km 12+630, and additional design is underway for a new 890 m alignment beyond the bridge. That new alignment will meet the existing roadway alignment at its far end. The survey for further road design is approximately 1100 meters ahead of the end of this new alignment. The brigade is currently responsible for the maintenance of both the new and the yet unimproved existing road up to Km 32 of Title III, section 2.

It is anticipated that the current funding will permit the brigade to complete the new roadway to Km 22.7 or there about. The ending point will of course not be Km 22.7 on the new alignment. Each new individual realignment changes the projected length of road, for example, the selected 890 m alignment beyond the bridge mentioned in the last paragraph reduces the overall road distance to Qacha's Nek by 300 meters.

To summarize - the original project included the design of a route between Mohale's Hoek and Qacha's Nek which was eventually labelled Title I. This activity has been addressed in the previous external evaluation (1983) and is not to be included in the current evaluation. Title II, the Cut-off has also been addressed previously (1983) and no investigation into its past history is to be conducted by this evaluation team. Title III, which is being administered by the Southern Perimeter Road Project Authroity (SPRPA) composed of representatives from several GOL Ministries is to be evaluated in depth as it now stands. However, section 1, Quthing to Mount Moorosi has been substantially reviewed

previously so the major focus of this evaluation is to be concentrated on section 2 of Title III. The technical assistance (TA) portion of the evaluation is to be concentrated on the current TA team from the Nello L. Teer Company (the contractor who built Title II, the Cut-off) rather than the previous TA team from PRC Harris (the consultant engineer who originally designed the project, supervised the construction of the Cut-off, and began the Title III, section 1 force account construction activity).

C. The Current Design Practices

The major design features evaluated included drainage design, horizontal and vertical alignment, and pavement geometric and structural design.

1. Drainage - The drainage design uses the rationale formula as its basis. All the mechanical steps for using this formula are correctly applied and the counterpart engineer seems to have a firm grasp of the subject. The drainage design, i.e., culvert sizing is somewhat hampered by the following factors: (a) the drainage areas are taken from a large scale topographical map, i.e., they are very small areas on the map; (b) the rationale formula is applied to much larger areas than is normally considered acceptable; (c) the rainfall intensity is derived from annual rainfall amounts which are factored to find intensity, however, they do not appear to account for short intense cloud bursts; and (d) a single run off coefficient is used for each terrain classification, the typical rationale formula application allows the designer more latitude in such evaluations.

None of these defects indicates that the drainage design is not being done correctly. Drainage design is at best an approximation of an actual event that may or may not occur in the future.

When viewing the culverts in the field a possible drainage design problem was noted. Culverts are normally laid on the same slope as the natural stream bed. There are several reasons for this. One is environmental equilibrium, the velocity of natural flow in the stream has already eroded the stream line. By affecting the natural velocity as little as possible, equilibrium is maintained. However, a few culverts were observed that were very flat in comparison to the streams being intercepted. The stream bed at the outlet end of the culvert at Sector 2, Km 7+100 ± for example had been filled in to the level of the culvert's invert. This raises the distinct possibility that the fill will eventually erode back to the culvert exit. This technique also inevitably leads to siltation at the culvert entrance. While no erosion was observed in the immediate vicinity of any culvert exit on section 2, some erosion was evident at the outer edges of at least one such fill. Siltation at the entrances was very evident and will continue to be a major maintenance problem and expense. The usual purpose for installing culverts in this manner is to reduce the cost of culvert pipe and/or the culvert exit headwall. The evaluation team recommends further investigation of the need for additional erosion control measures where culverts have altered natural channel slopes.

2. Horizontal Alignment - The horizontal alignment has long since been compromised for financial reasons so the presence of broken back curves and the lack of the usual criteria of reducing curve radii in succeeding curves by a maximum of 50% came as no shock. Surprisingly, the compound curve concept had not been applied since compound curves may offer further savings. As long as the traffic volumes remain low the alignment will provide better, albeit somewhat risky, access to Qacha's Nek. The use of compound curves is not recommended unless they are incorporated within a formal geometric criteria which standardizes the horizontal alignment procedures.

3. Vertical Alignment - The vertical alignment follows the appropriate criteria for the design speed used. However, the relationship between the ends of vertical curves and horizontal curves has apparently been ignored. Several locations were observed between Quthing and the end of the current construction where sharp horizontal curves came as a complete surprise. However, given the financial constraints imposed, little can be done to improve such design situations except to include appropriate signs. Perhaps such occurances can be reduced in the future.

4. Pavement Geometric Design - The cross slope requirement and width is not stated in the 8/82 "Standard Specification for Southern Perimeter Road (Title III)". However, the 10/83 "Summary of Road Design Standards" of Lesotho calls for a cross slope of 3% on gravel road surfaces. It was reported that 4% was being used but the cross slopes seem to be non-existant in several areas. No cross slope control was evident in the work area other than side stakes at 40 m intervals. One normally sees a foreman with a grade board or a pair of surveyors with a tape, rod and handlevel when surfacing is underway, but these activities were not evident during our observation period. Flat cross slopes eventually lead to pothole formation. In a few areas potholes were already forming. Under a more relaxed maintenance effort and larger traffic volumes more potholes will probably appear. The most common cross slope in use for gravel (and earth) surfaces is 5%. Research has shown a definite reduction in potholing when that cross slope exists because water does not remain on the road surface. Potholes only occur when water and traffic are present at the same time. The good compaction practices followed by the brigade is currently somewhat offsetting the flat cross section.

5. Pavement Structural Design - The pavement thickness is a structural determination. It is the basis for determining total equivalent axle loadings the pavement can withstand and is also used by highway engineers to determine how long a pavement will last before periodic maintenance (those maintenance activities that occur only once in several years, such as regravelling) need occur.

Usually the thickness of a gravel pavement surface is a viable indicator of the time frame of the need to regravel because each country normally keeps a record of gravel losses compared to total traffic volume. While pavement thickness design is a function of total equivalent axle loadings, gravel loss and regrading frequency are usually equated to a less reliable indicator, the number of vehicles that pass over the surface. Lacking statistical data for pavement made of specific gravels in specific countries, the highway engineer is able to project the regravelling requirements using broad rules-of-thumb. These rules all assume a gravel surface meets certain structural standards (See Annex 2).

Verbal evidence indicates that the decision to eliminate crusher run gravel on the Title III portion of this project was based purely on financial rather than engineering or economic considerations. Sufficient money was not available so the activities were considered a stage construction project with the base course and DBST surface deferred to a later time. A letter dated 21/10/83 from the then Project Manager (SPRPA) to the Chief Roads Engineer, Roads Department, evaluated the financial implications of pavement design alternatives using four alternatives for unpaved gravel surface and three alternatives for paved surface roads. This letter says "Note: Experience to date has indicated that the cost per kilometer of sub-base material and natural gravel wearing course is the same. Both require the same amount of field processing and the transportation costs for both are the same".

SPRPA, therefore, was asked to choose between four gravel surface alternatives: (a) a natural gravel surface of 150 mm and a sub-base of 100 mm, (b) a natural gravel wearing course of 100 mm and a sub-base of 100 mm, (c) only 150 mm of sub-base, and (d) only 100 mm of sub-base. SPRPA chose item (c), thereby reducing the thickness of the pavement from 250 mm of material to 150 mm of material. If, in fact, both materials were the same, SPRPA's decision meant that future funds would have to be available sooner either to pave or regravel the road.

Regravelling time is normally projected in terms of a gravel loss from a known type of gravel, regravelling occurs when the loss is equal to 1/2 of the applied layer. Since 150/250 = 0.6, regravelling would be required for the chosen alternative in 60% of the time regravelling would be required for the design layers. Since the gravel loss per year has yet to be determined and the trafficability qualities of the sub-base material are unknown, only the relative times can be evaluated; if the original thickness would last 5 years the chosen thickness would last 3 years before regravelling is required; if the original lasted 10 years the chosen would last 6 years; and if the original lasted 20 years, the chosen would last 12 years. Six to ten years is considered a normal regravelling cycle. Apparently no consideration was given to the fact that in a 20 year design life, more regravelling might be required. Fewer regravellings are preferable because of both economy of scale benefits and the time value of money.

Neither GOL nor USAID questioned the assumption that surface and sub-base was the same material, the record shows only a hand-written concurrence on the letter of transmittal of this proposal to USAID. The actions of both groups, the Roads Department and USAID, indicate they agreed that sub-base could be substituted for engineered base course (or engineered surface course) and that surface course material could be found in a natural state. But both parties were merely confirming a decision made earlier accepting the same premise for the Title II construction. The record of this original decision making process was not traced since this team is evaluating Title III construction.

A review of the GOL specifications would have indicated that natural occuring sub-base and manufactured gravel material were not the same. The strength indicator requirement, California Bearing Ratio (CBR), for sub-base states that a minimum CBR at 95% mod. AASHTO compaction shall be 25% (preferable 35%) soaked. The gravel base course described in the 10/83 Summary of Road Design Standards of Lesotho (RDS) indicates a CBR requirement for crusher run base course gravels equal or greater than 80%. Since GOL did not have a specific gravel surface specification in the RDS, either the above base course specifications could have been used or new specifications could have been written for a crusher run or naturally occuring surface course gravel with the same minimum 80% CBR. The Double Bituminous Surface Treaatment (DBST) surfacing adds no strength to the base course so if the decision makers felt that

100 mm of material could be eliminated, a better choice would have been to eliminate the sub-base even if DBST was not to be included. Assuming a natural wearing course material could be found, an envelope grading criteria and the 80% CBR criteria should have been applied to it, otnerwise the Project Manager (SPRPA) was not making a proper comparison.

What are the implications of using a sub-base for a road surface? First, there is no uniformity throughout the road surfacing. If the sub-base surface fails structurally, one can assume the weakest section will fail first, and under the same traffic volume the stronger material will last longer. Table III-2 shows the CBR values for the sub-base materials used on Title III, section 1. They vary from 30% to 70%. Table III-3 shows the CBR values for the sub-base materials used on Title III, section 2. They vary from 53% to 73%.

Second, the possibility exists that the traffic will never reach a high enough volume to cause structural failure. In this case, a regravelling schedule should be determined. For soils that meet a grading envelope requirement, a gravel loss ratio to traffic volume can be developed through experience for use as a regravelling indicator. With materials of unknown characteristics, traffic and erosion impacts are not predictable. Any size gradation difficiencies, i.e., differences in the filler portion of the surface materials, will probably increase the rate of loss because the traffic will pullout (ravel) the larger stones and the

TABLE III-2 SECTION 1 - DOLERITE MATERIAL

Test No.	Source	Soil Name	C.B.R. @ % Compaction		
			90%	93%	95%
1	25 + 900	Dolerite gravel; sandy	13	22	32
2	36 + 740 O.R.H.S.	Dolerite gravel; well graded	25	37	55
3	31 + 200 O.R.H.S.	Dolerite gravel; sandy	15	25	35
4	36 + 880 O.R.H.S.	Dolerite gravel; sandy	12	25	33
5	24 + 460 O.R.H.S.	Dolerite gravel; sandy	14	20	30
6	Km 42	Dolerite gravel; sandy	13	22	30
7	26 + 520	Dolerite gravel; sandy	30	45	70
8	9 + 440 O.R.H.S.	Dolerite gravel; sandy	18	35	52
9	17 + 840 O.R.H.S.	Dolerite gravel; sandy	23	40	60
10	Km 3	Dolerite gravel; sandy	23	40	52
11	32 + 580 O.R.H.S.	Dolerite gravel; sandy	32	56	68

TABLE III-3 SECTION 2 - BASALTIC MATERIAL

Test No.	Source	Soil Name	C.B.R. @ % Compaction		
			90%	93%	95%
12	0 + 560 O.R.H.S.	Basaltic sand; gravelly	30	45	60
13	3 + 700 - 3 + 840	Basaltic sand; gravelly	29	44	58
14	2 + 990 O.R.H.S.	Basaltic gravel; well graded	34	55	73
15	4 + 680	Basaltic sand; gravelly	27	40	53
16	1 + 100 - 1 + 060 O.R.H.S.	Basaltic sand; gravelly	29	44	59
17	6 + 760 O.R.H.S.	Basaltic sand; gravelly	27	41	55
18	5 + 460 - 5 + 720	Basaltic gravel; sandy	35	52	70

small materials will disappear more rapidly as dust. On this project, different areas of the surface will require regravelling in different unpredictable time frames because different materials (from different pits) were used.

The acceptance of the SPRPA Project Manager's proposal also eliminated the requirement for DBST surfacing on grades over 10%, a requirement that was in force on the Title II Cut-Off. Tables III-4 and III-5 show the locations that would have required both a crushed gravel base and a DBST surface on Title III, sections 1 and 2 respectively had that requirement not been waived. The surfacing requirement for 10% or greater gradients is intended to prevent surface longitudinal erosion and excess ravelling from climbing or braking vehicles.

TABLE III-4 SECTION 1, STEEP GRADE LOCATIONS

Location	Grade	Length
0 + 600 - 0 + 960	11.99%	360 m
4 + 080 - 4 + 160	12.00%	80 m
4 + 560 - 4 + 720	12.00%	160 m
4 + 800 - 5 + 200	10.01%	400 m
12 + 280 - 12 + 560	12.00%	280 m
12 + 580 - 12 + 660	10.72%	80 m
14 + 680 - 14 + 760	11.91%	80 m
16 + 520 - 16 + 600	10.11%	80 m
29 + 480 - 29 + 560	12.00%	80 m
30 + 320 - 30 + 400	11.69%	80 m
31 + 200 - 31 + 320	10.45%	120 m
33 + 520 - 33 + 600	11.38%	80 m
34 + 000 - 34 + 040	12.00%	40 m
34 + 200 - 34 + 320	10.60%	120 m
34 + 480 - 34 + 640	12.25%	160 m
38 + 220 - 38 + 500	10.66%	280 m
Sub-total		2480 m

TABLE III-5 SECTION 2, STEEP GRADE LOCATIONS

Location	Grade	Length
0 + 280 - 0 + 720	10.00%	440 m
2 + 920 - 3 + 320	11.95%	400 m
3 + 340 - 3 + 640	10.27%	300 m
3 + 820 - 4 + 000	11.15%	180 m
9 + 360 - 9 + 520	10.00%	160 m
10 + 120 - 10 + 240	10.00%	120 m
12 + 460 - 12 + 620	10.12%	160 m
Sub-total		1760 m
TOTAL		4240 m

The 10% slope is not a magic number, however, it is a commonly accepted criteria. This default was probably good because the DBST surfacing on the Cut-off looks to be older than it is, i.e., it may be rather short-lived, and has serious bleeding problems. Mr. A.L. Botha, Manager, Lesotho Road Binders wrote a letter to the Nello Teer Co. on 25/1/85 addressing the bleeding problem.

To summarize - the project gravel surface is an unknown quantity. No intelligent predictions can be made of its future life or condition. However, based on the traffic type and quantity observed on the completed project road, a good 6" (150 mm) gravel surface over a 4" (100 mm) gravel base will probably lose 5" (125 mm) in 10 years (an average of 1/2" or 12.5 mm per year but in fact less in the early years and more as traffic increases). At the end of 10 years an additional 6" (150 mm) regravelling would be required. Reducing the overall thickness to 6" (150 mm) would require a 4" (100 mm) regravelling in 6 years. As a wild guess, assuming structural failure does not occur, some section/s of the 150 mm sub-base surface will perhaps require regravelling in three years. This, however, is strictly a guess, as would be that some section/s will require regravelling in 2 to 4 years. It is almost certain, however, that all sections will not last six years. The same range seems likely for some section/s of the DBST surfacing but for different reasons. The surfacing is already beginning to ravel in some areas, and while the total surface structure under the DBSt is stronger, the ravelled areas will retain water and begin to potnole quite rapidly unless proper maintenance practices are instituted.

D. Assessment of Technical Assistance

The TA team consists of five expatriates provided by Nello L. Teer Company, Durham, N.C., USA.

Name	Position	Currently Scheduled Arr. Date	Dep. Date
Sam T. Koff	Project Manager	1 May 1984	31 Jan 1986
W.J. Curtis	Project Engineer	10 Feb 1983	31 Dec 1985
W.H. Bachschmidt	Equipment Superintendent	1 Jan 1983	31 Dec 1985
E.C. Lorenzo	Financial Controller	1 Jan 1983	31 Dec 1985
H.M. Fernandez	Master Mechanic	10 Mar 1985	31 Dec 1985

The evaluation team accepts the competency of the members of the TA group. Indeed the record keeping and cost orientated approach to operations were exceptional. Our recommendation is to retain the present TA team as long as the project continues. The construction expertise of the brigade personnel reflect the capabilities of the TA team.

The following are comments about specific items concerning the TA operation:

(a) The monthly progress reporting includes financial unit costs for various items, e.g., common excavation in M^3, culverts in LM. These costs are cumulatively averaged but they do not include the amortization of the equipment involved, therefore, they cannot be compared to any item unit bid costs by contractors.

(b) The fact that a computer printout is included in the monthly report should not imply that all of the figures are correct. For example, the evaluation team picked a piece of equipment at random for a close inspection of condition, e.g., tires, filters, operating gauges, visible signs of wear, etc. It was selected solely on the basis that it was not working so the inspection process would not hold up production. The TA Financial Controller was asked if he had a record of this machine, its costs, down time, etc. He indicated that such evaluations were the responsibility of the TA Equipment Superintendent and that any investigation of fuel theft, diversion of spare parts, etc. would have to be originated by the Equipment Superintendent.

The records of all the equipment for the month of October were then reviewed in the Equipment Superintendent's office with particular attention to the machine previously inspected. The handwritten documentation, i.e., the stock control sheets and job sheets for that piece of equipment did not agree with the computer printout. The machine was a 645B front end loader, number 10-01, and the hand recorded labor cost for repairs was less than that shown on the October 1985 Heavy Equipment Status Report. This example is presented only to suggest that the record keeping needs to be improved, not to imply any wrong doing or incompetancy.

(c) All brigade operations worldwide are subject to one criticism, their inefficiencies can be hidden in the fixed costs and they are not motivated to operate efficiently. This TA team attempts to overcome this criticism by reporting unit prices, and, subject to comment (a) they are to be congratulated for their open information policy. However, there is a gap in this TA activity that somewhat dampens the results of the planning and engineering activities. In this evaluation team's opinion, the TA team should have an expatriate construction superintendent. Many of the comments about the brigade operations in the next section reflect an ineffective means of communicating the intent of the TA team members to the 355 man brigade. This is normally the function of a field construction superintendent.

E. Assessment of the Brigade Operation

This brigade is by far the best equipped brigade the evaluation team's highway engineer has either seen or read about. Its equipment is well maintained. However, the equipment balance is somewhat unusual. During the evaluation much of the equipment was not being effectively utilized.

As the evaluation proceeded more and more of the brigade personnel were observed actually at work rather than participating only as observers. This was taken as an additional indication of the need for a field construction superintendent.

The foremen interviewed appeared to underestand what they were trying to do, but were utilizing only a portion of the mechanical resources on hand. Dump trucks carrying concrete sand were travelling in platoons instead of departing as soon as they were loaded.

The evaluation team followed three such trucks to see where they were going, only to sit with other traffic when the first truck stopped in a constricted area where other construction was taking place. After a lengthy discussion between the truck driver and other personnel, the driver continued on to his destination at the site where concrete was being prepared for culvert headwalls. An interview with an expatriate area resident concerning his reaction to the new road and the construction activity elicited the comment that the brigade truck drivers intimidated the road users, citing the lubrication truck driver as a prime example.

Many such observations left the overall impression that the efficiency and public relations of the brigade could be improved considerably under the watchful eye of an experienced expatriate construction superintendent. Individual brigade members showed the ability to work well, indicating they have in the past, whether on this project or elsewhere, received competent instruction, but the brigade as a whole seemed somewhat disorganized and inefficient. The evaluation team recommends the inclusion of a TA expatriate field construction superintendent in any future brigade TA teams.

F. Assessment of Institutional Aspects

This project is developing a cadre of experienced personnel at the working level which will benefit the Roads Department in the future. The members of the TA team have a total of some 130 years of practical experience, their counterparts have a total of 32 years of practical experience. Given the fact that all TA personnel do not even have counterparts yet, it would seem unlikely that the brigade will be able to function without some TA in the near future. Therefore, the objective of developing upper management personnel for the Roads Department is somewhat in jepordy.

When the brigade itself is viewed as an institutional entity, certain discomforting facts emerge. Obviously if the project manager was incapacitated, the brigade would flounder until a replacement arrived and became acclimated to the brigade operations. Since there is no counterpart to bridge this time span, the disruption would be quite severe. The accomodation to a new management technique would also take more time because there is no counterpart to provide continuity. The evaluation team urges the GOL to redouble their efforts to find a counterpart for the TA project manager.

The engineering concept of "design-as-you-go" places the TA engineer in a vital position also. While his counterpart seems very competent, both engineers are stretched to their limit today and they are less than a kilometer ahead of the construction crews. Until they can

get five or six km ahead there will not be an adequate cushion if the TA engineer is unable to function. A replacement engineer would be especially hard put to step in because there are no formal design criteria being followed at this time. In the evaluation team's opinion, the design criteria for this project should be more clearly defined to prepare for such an eventuality. The current design approach can result in excessive construction costs because the normal checks and balances practiced in highway engineering to assure finding the most economical route meeting an accepted standard for a realistic traffic projection, are not being applied.

While the majority of the equipment on the project has been used for less than one-half of its assumed productive life, mountain road building is especially hard on road equipment. As the project continues the repair costs will escalate rapidly. It is to the credit of the TA equipment superintendent and master mechanic that the equipment has stood up as well as it has. Past international brigade data indicates the equipment specialists are the last TA members to leave a maturing brigade operation. Therefore, if either of these men were to be unable to continue on the project, the brigade's viability would be threatened.

Anotner person wnose loss would have a substantial impact on the brigade's continuing operation is the chief surveyor. So far a local chief surveyor has not been trained. The survey technology used on this project makes it unlikely that such training will be completed in the

near future. The electronic surveying operation in use is more suitable for route location work than construction control. It should be possible to train a dozen local surveyors to operate a regular transit, measure with a steel tape, and use a construction spirit level and rod in the same time it will take one person to learn the niceties of operating a state of the art electronic survey station. A more primitive surveying method would probably be more useful in the day by day operations of the Roads Department on other projects. This project should employ both survey methods, not only to produce more surveyors for later use, but also to backstop loss of the current chief surveyor.

Yet another key person whose loss would have a substantial impact on the project itself is the grader operator who does the fine grading for construction. Two of the three grader operators listed in the September 1985 monthly progress report are classified as maintenance grader operators. The evaluation team was told that construction grader operators are very difficult to find in Lesotho. This was borne out by visual observation before this comment was made. The fine grader operator currently working on the pavement construction is at best an average operator by standards of other African countries where the evaluation team's highway engineer has observed gravel road construction.

While the loss of this grader operator to the project would not impact the brigade itself, the quality of their finished product will be reduced if a suitable replacement is not available.

The previous examples are presented to indicate that the brigade is not only not a replicable institution in Lesotho but it is within itself a fragile institutional entity.

G. Assessment of Maintenance

The current maintenance resources were reported in the South Maintenance Region.

TABLE III-6 MAINTENANCE FORCES

	AREA			
	MAFETING	MOHALE'S HOEK	QUTHING[1]	QACHA'S NEK[1]
Engineers	-	1	-	-
Supervisors	2	2	-	1
Clerical	2	5	2	2
Operators & Drivers	2	4	-	2
Laborers	62	57	73	78
Dozers	1	-	1	-
Graders	1	-	1	1
Tippers	2	2	1	3
Fuel Trucks	1	*	1	1
Supv. Vehicles	1	3	1	1

1] Maintenance of the project road will become the responsibility of these two areas

Fuel Truck and Premix Machine located in Motseruoa.

Two conclusions can be readily drawn from Table III-6: (a) current maintenance activities are labor-based, and (b) there are currently not enough operators and drivers to run all the available maintenance equipment at the same time.

The evaluation team did not have time to review the future plans for the upgrading of the South Maintenance region. Given the reported lack of qualified grader operators in Lesotho and the lack of graders currently available for the area's present maintenance force, one can conclude that the Roads Department will have to embark on a very ambitious maintenance upgrading program to have any hope of maintaining the project road in the future. One by-product of this project is to eliminate a road that has been maintained by labor and to replace it by a road that will require extensive surface maintenance by equipment.

The project route beyond the construction brigades maintenance limits (Km 32 of Title III, section 2) was in surprising good condition for a labor intensive maintenance operation. This is in part due to the environmental equilibrium of the existing road. Once the blasting operations begin along the proposed route next to the Orange River, several years may be required for that area to establish a new environmental equilibrium. During that period, random rockfalls could possibly close the road for substantial periods of time unless heavy equipment is readily available. The wider the new road, the more material will have to be removed from any possible slides. Detour locations appear to be non-existent.

If the new road surface deteriorates at anywhere near the evaluation team's predicted rate, the maintenance activity will require a full time regravelling crew to keep the road in a condition that will do credit to the Roads Department. To prepare for that event, the Roads Department should be preparing now for an increased administrative and equipment maintenance staff and facilities capability. While further construction can be stopped at any time, the maintenance activities for the road already built must continue indefinitely and will involve a substantial recurring cost to the GOL.

Conversion from a labor-based to an equipment-based maintenance program is more difficult than expanding on an existing equipment-based maintenance operation. The evaluation team urges USAID to encourage and assist GOL to institute an expansion in equipment intensive maintenance capabilities in the project area.

H. Possible Future Scenarios

The future of the project can follow at least five different scenarios:

1. Complete a new sub-base surfaced road from Km 7, the point at which the sub-base surface is now completed, to the bridge abutment at Km 12 + 630, the minimum that can be done because the earthworks has already been started to that location;

2. Complete a new sub-base surfaced road from Km 7 to Km 13.5, the length currently under design;

3. Complete a new sub-base surfaced road to Km 22.7, the length that it is assumed can be finished with no additional funding;

4. Complete a new sub-base surfaced road from Km 7 to Qacha's Nek; or

5. Complete a new sub-base surfaced road from Km 7 to Qahca's Nek using an expanded brigade from Km 22.7 onward.

The basis for estimating the cost and time for any of these scenarios is contained in Annex 3. This annex was prepared by the TA staff at the request of the evaluation team's highway engineer who accepts full responsibility for any errors in approach to the estimating process and for the factors applied. It is understood by both the TA staff and the evaluation team that this is an order of magnitude estimate.

Annex 3 includes Scenario 5 above, the sub-division of a beefed up single brigade into two units to save time, TA costs, and overhead. The evaluation team rejects this concept on the ground that in their opinion the TA team does not have the capability or engineering manpower to effectively operate two units.

Annex 3 does not include TA costs at the request of the evaluation team so that no one can construe that annex as an offer by the Neelo L. Teer Company to provide a TA team to complete any given scenario for a specific sum of money.

Annex 3 includes the maintenance of Title III, section 1, Title II and Title III, section 2 until the project is completed as a sub-base surfaced road. These costs can be further projected by GOL to determine the costs for future maintenance of a sub-base surfaced road until later staged construction is undertaken. The term "light maintenance costs" refers to routine maintenance, while the term "heavy maintenance costs" refers to periodic maintenance, or more specifically regravelling or replenishing the sub-base surface. The timing of this operation was developed independently of the opinion expressed in the summarization of section C of this Technical Analysis.

All scenarios assume that there are currently sufficient funds to finish the road to Km 22.7 including the cost of the TA team extension and that the operation will reach Km 22.7 by December 31, 1986. The costing of additional work is in local currency at current exchange rates. The estimates further assume it will take 48 more months to complete the road described as Scenario 4, the GOL's current intention.

The following estimate is for Scenario 4 since the first three scenarios require no additional funding. It is assumed the total length will be:

Title III, section 1	= 41 Km
Title II	= 36 Km
Title III, completed	= 22.7 Km
Title III, to be done	= 79 Km
SAY	179 Km

The following figures have been taken from Annex 3:

Cost of construction	M 41,791,000
Cost of maintenance	M 1,963,000
subtotal	M 43,754,000

The following figures were estimated by the evaluation team's engineer based on the current TA billing:

Cost of technical assistance	M 6,954,000
subtotal	M 50,708,000
Cost of a construction superintendent	M 1,215,000
TOTAL Scenario 4	M 52,923,000

(US$ 20,770,000 at M/0.40 US$ exchange)

This represents a construction investment of M529,000 per km or a total cost of $263,000 per km for 79 more Km of non-standardized sub-grade alignment covered with 150 mm of sub-base material.

A further cost approximation can be developed from Annex 3. If the work was finished to Km 12.6, the bridge, the total length of completed road would be 41 + 36 + 12.6 = 89.6 Km. Of this approximately 15 km is DBST pavement leaving 75 Km of exposed sub-base. A gravel base for this length of road would require 75 Km x 975 M^3 x 1.96 ton = 143,325 tons of crushed material. This would require 143,325/(8 x 49) = 370 days of crusher activity. The crusher would need to be set up at three locations requiring 12 weeks extra for a total of 1 year and 9 months. 42 Km can be placed in the first year with the remaining 33 Km the second year.

Assuming the present equipment is sufficient and only the necessary employees are retained, the gravelling operation would cost:

42 Km @ 53,095	= M 2,230,000
33 Km @ 61,060	= M 2,015,000
	M 4,245,000
plus start up	M 333,000
subtotal	M 4,578,000

The TA team could replace the engineer with a construction superintendent so the TA cost would be:

1987	= M 557,000
1988	= M 480,500 (9 months)
subtotal	= M 1,037,500

and the cost of placing a 150 mm crushed gravel surface over the existing sub-grade would be M4,578,00 + M 1,037,500 = M 5,616,000 or US $ 2,246,000 which is about $ 30,000 per Km. The maintenance costs would not be borne by the brigade under this scenario. The evaluation team does not recommend that the existing sub-base be gravelled at this time. Efforts should instead be directed at meeting the additional maintenance capability that will be required to keep the present surface in usable condition until GOL is prepared to go to the next construction stage, be it the application of a properly designed gravel surface or a gravel base with a DBST surface.

I. Recommendations

1. Additional geometric and material specifications for the rest of the route should be developed. They should specify not only the normal minimum curvature, maximum grade, etc, but should also indicate that the methodology used to apply these criteria should follow some standard approach, for example, an approach based on the American Association of State Transport and Highway Officials (AASTHO) guides or those of some other agency.

2. The GOL and USAID should increase their dialogue on improving road maintenance resources.

3. The GOL and USAID should discuss alternatives to the continued construction of this route at this time. The major travel time savings are already provided by the cut-off. The evaluation team urges both parties to evaluate the option of concentrating the expenditure of remaining project funds on maintaining what has been completed instead of continuing construction beyond the bridge at Km 12.6, section 2.

J. Lessons Learned

1. Major roads require a significant investment in the determination of their need, in the investigation of the standards to which they shall be designed, and in their exact location.

2. Financial compromises do not necessarily save money in the long term. Cheap construction results in expensive maintenance. Acceptance of compromise for a short term solution only makes the long term solution more expensive.

3. Mistakes are part of the learning process. This evaluation team is aware of previous problems on this project. These problems also must contribute to the lessons learned, but this evaluation team found competent people trying to do their best. Any mistakes pointed out in this evaluation were mostly honest mistakes which were compounded by time and financial constraints.

IV TRANSPORT ECONOMICS EVALUATION

A. Project Economic Profile

This section discusses traffic generating sources in the project road area; i.e. population, agriculture, tourism, storage facilities, commerce and trade, local services, industry and manufacturing, and motor vehicle fleet development.

1. Population

The zone of influence of the project has been defined as the administrative districts of Quthing and Qacha's Nek. The latest statistical population information available is the 1970 Agricultural Census and the preliminary reports from the 1976 National Census. A National Census will be conducted in 1986. Based on all available data the following tabulation is presented:

DISTRICT	POPULATION	% OF LESOTHO	DENSITY PER SQ KM[1]	
			TOTAL LAND	ARABLE LAND
QUTHING	88,500	7.3	28.3	462.1
QACHA'S NEK	76,500	6.3	17.7	691.1
TOTAL	165,000	13.6		

1] Based on the 1979 population estimates of the 1980 Annual Statistical Bulletin.

Assuming that the 1979 estimates are accurate, it is evident that there is a shortage of arable land in relation to population in the two districts.

The population in both districts is concentrated along the Senqu River Valley paralleled by the SPRP as far as Qacha's Nek. The Southern half of Quthing District is sparsely populated. Most of the population is concentrated around the Mphaki area and in the rich agricultural area near the border with the Qacha's Nek district.

In the Qacha's Nek district the population is also concentrated along the Tsoeline river valley and east to Sehlabathebe and Qacha's Nek itself. The area south of the main project road between Sekake and Whitehall is sparsely populated because it is very mountainous with cliffs dropping down to the road and river.

2. Agriculture

Lesotho is basically an agricultural country. The agricultural sector contributes over half of the total GDP (Gross Domestic Product). Over 90% of the population lives in rural households. This section briefly discusses the various agricultural components that affect the project area; i.e. the Qutning and Qacha's Nek districts. The information presented is based mainly on the Lesotho Agricultural Situation Report, 1973/74 to 1981/82, published by the Agricultural Planning/ MOA and the Bureau of Statistics, 1984. However, certain pertinent agricultural data presented were obtained from the Mphaki Livestock Development Project.

a. Arable Land

Land under cultivation in Lesotho exhibited an average of 22.8% decline between 1970 and 1980. Most of this decline was felt in the Quthing and Qacha's Nek districts where land under cultivation dropped by 1.0% and 51.4% respectively. This is evidenced in Table IV-1 that follows.

TABLE IV-1 LAND UNDER CULTIVATION, HA

DISTRICT	TOTAL AREA, HA	Year		
		1970	1977/78	1980
QUTHING	291,600	21,100	11,900	20,900
QACHA'S NEK	234,900	18,100	10,000	8,800
LESOTHO	3035,500	386,200	289,200	298,100

This substantial drop in cultivated arable land is evidence of the lack of motivation among farmers. The majority of men are said to be absent from their farms because they are employed elsewnere. Whilst sufficient income is available from such employment to purchase the shortfall in food production, little incentive remains to raise agricltural productivity. To raise productivity in the project area only to a subsistence level reportedly requires a four-fold increase in yields. This demands a greater commitment by the family to cropping. This commitment is not apparent.

The return from labor in Lesotho agriculture is so low that the men prefer to work in the mines and elsewhere. There is no doubt that there is little economic incentive to raise productivity. Raising prices of commodities to a level that

makes farming attrative requires sufficient land to produce a surplus over and above family requirements. This could compensate for the loss of income from other sources. However, the 400% increase is required in the project area to reach self-sufficiency would not provide the family with a cash income. Cash generation must rely on sales of wool, mohair and cattle. It is doubtful whether this would satisfy the needs of the family for schooling, clothes and similar items.

b. Crops

Cropland in the project area is about 30,000 Ha. Most of the agricultural activity is noticeable in the Quthing district. Main crops produced are maize, sorghum, wheat, beans and peas. Table IV-2 indicates the cropping pattern, tonnage, yield and crop intensity for the period 1976/77 to 1981/82. The dramatic drop of crop production is apparent in Table IV-2, this is substantiated by the fact that the project area is deficient in the already subsistence level of agricultural production. The current drought conditions have undoubtedly affected production during this period.

The exercise of annual truck loadings shown in Table IV-2 is merely presented on a hypothetical basis. A ten ton loading capacity truck would never traverse the farming areas of the road project because to do so would be highly uneconomic. It is believed that most likely either pickups or animals will carry any commercially exportable agricultural production.

TABLE IV-2 CROPPING PATTERNS, TONNAGE, YIELD AND CROP INTENSITY, 1976/77 TO 1981/82

CROP	DISTRICT	TONNAGE[1]	YIELD[2]	CROP INTENSITY	ANNUAL[3] T/LS
Maize	Q	4856/5033	966/574		485/503
	Qa	3029/3024	564/627		303/302
Sorghum	Q	4227/2397	1220/437		423/240
	Qa	1295/1374	681/629		130/137
Wheat	Q	4605/2081	961/587		460/208
	Qa	1935/1267	973/859		193/127
Beans	Q	989/306	1390/285		99/31
	Qa	774/217	1579/513		77/22
Peas	Q	556/353	620/530		56/35
	Qa	332/189	481/807		33/19
	Q = Qutning			0.82/0.94	
	Qa = Qacna's Nek			0.81/0.85	

1] First figure applies to the 1976/77 period and the second figure applies to the 1981/82 period.

2] Kilograms/hectare planted.

3] On the basis of 100% distribution of fully loaded 2 axle trucks, loading capacity 10t. T/L depicts truck loads.

The agricultural production in the two districts will generate insignificant amounts of traffic based on the existing levels of production.

Grain crop yields appear to be variable but generally very low indeed. Almost all farm produce is consumed by the producing households and most families need to purchase substantial quantities of grain flour to feed themselves. Given the existing low levels of production in both the livestock and the cropping sectors, it is clear that many families rely heavily on other sources of income. Wage employment, particularly in the mines of RSA, is a major source in this respect.

Yields of all crops are extremely low. It is, however, difficult to estimate yields as the farmers store their product in differing sized containers and no scales are available for measuring.

The major constraints are summarized as follows:

- poor, erratic rainfall;
- frost, which can occur throughout the year;
- lack of suitable seed varieties;
- inherently low fertility of sandstone soils;
- insufficient draught energy; and
- lack of motivation amongst farmers.

First impressions in both districts suggest that farmers are already cultivating all land with any potential for cropping, and that there are no reserves of unused land with

potential for crop production. Therefore, increased production is difficult. Crop diversification (cash crops) or yield improvement is a possible but a lengthy process.

c. Marketing

(i) Cattle Sales

Cattle sales are a method of reducing the pressure on grazing and not primarily a means of providing cash for the farmer. There is every evidence that the range is over-stocked. However, as the farmers are part of the "cattle complex" associated with traditional cattle people in Africa, it is difficult, if not impossible, to discuss destocking in any meaningful way. Many farmers say they are changing their attitudes and are willing to sell for cash but there is minimal hard evidence of this. They see their cattle as security; an establishment of their place in society; a provision for 'bride wealth' (Bohali), and, above all, as draught power for cultivating the land. The majority have small herds which can only just support a ploughing team of four adult head.. The only animals available for sale are the old and the useless, unable to pull or breed any longer. Therefore, the number available for sale is very low. This should not discourage attempts to encourage the farmer to sell. There should be animals surplus to any acceptable energy requirement. Despite the farmers' feelings, sufficient pasture is not available to support the present herd size.

If the farmer is to be encouraged to sell he must be certain his animals are being sold openly and fairly. If he has the slightest suspicion of being cheated, he will not support the marketing organization. The GOL is aware of this and has built a series of auction salesyards throughout the country. To date, these have been poorly supported by farmers. In Mpnaki, during the past twelve months, this reluctance to sell has been apparent. As a result, efforts have been made to encourage them by various means, mainly advertising, using posters, pamphlets and radio. Despite tnis, little enthusiasm has been shown. It is realized that a major drawback is the failure, on the part of the Chiefs, to issue the necessary permit (Bewys) to the farmers enabling them to move the cattle to the market. Until tne Bewys situation is resolved, all efforts to hold cattle sales will be thwarted.

From February to May 1985, a total of 108 head of cattle were sold at an average price of M303. The highest amount was M565 and the lowest M290. The last sale during this period, in May, was held on a "Show and Sale" basis, with prizes offered for tne top three best meat beasts. This appeared to be popular at the time.

The feedlot staff arranged an 'ad hoc' sale in June, buying by direct negotiation with the farmer. This not only proved an unpopular method, but caused considerable dissatisfaction and possibly harmed the currently devised approach to the marketing system.

As no records of livestock in the area have ever been kept, it is impossible to estimate the present position.

(ii) Wool and Mohair Sales

Wool and mohair sales contribute more cash income to the farm households than any other agricultural commodity. The present upward trend in prices should further enhance this income.

Data presented in table IV-3 pertain to a section of the Quthing district only, the major producing area of the project.

The total weight of wool is 98 tons while that of the mohair is 11 tons. The total figure of wool and mohair represents only 11 vehicles of ten ton loading capacity.

3. Tourism

It is believed that the project area provides a great opportunity for the development of tourism. The most important characteristics to lure the traveller are mountain scenery; climate; archeological and palonetological sites. The major constraints are the absence of communications and little investment in tourism infrastructure, especially accomodation.

There is a tourism development potential in the project area but it requires adequate infrastructure. At present, this sector is not developed adequately. In the project area, no tourism activity was noticed other than visitors coming from RSA in the

TABLE IV-3 WOOL & MOHAIR PRODUCTION, 1984/85

NAME OF WOOLSHED WOOL	NO. OF SHEEP	TOTAL WT. KGS	AVG. WT. OF WOOL PER SHEEP KGS	NO. OF OWNERS	AVG. NO OF SHEEP PER OWNER	MOHAIR	NO. OF GOATS	TOTAL WT. KGS	AVG. WT. OF MOHAIR PER GOAT KGS	NO. OF OWNERS	AVG. NO OF GOATS PER OWNER
Ha Peete	14,117	36,953	2.6	214	66	Ha Peete	7,029	5,044	0.72	243	28
Ha Ntsie	16,285	41,533	2.5	387	42	Ha Ntsie	7,721	5,845	0.76	310	25
Ha Mapheele	8,677	19,532	2.3	148	59	TOTAL	14,750	10,889	0.74	553	26
TOTAL	39,079	98,018	2.5	749	56						

Source: Mphaki Project, Quthing District

Qacha's Nek hotel (15 room accomodation), mainly for business purposes. The available bus services provide transport mainly for the local population.

4. Storage Facilities

A storage distribution system along the project route (Quthing to Qacha's Nek) is not available. There are several woolshed facilities and two warehouses in the vicinity of Whitehill and Qacha's Nek that accomodate merchandize arriving from RSA. There are future long-range plans for the provision of storage facilities for agricultural produce and cold storage facilities are being considered. These long-range plans, if executed, definitely will generate traffic along the route.

5. Trade

Lesotho follows a general trade system in recording imports and exports of merchandise. The general trade system uses the national boundary as a statistical frontier. Unfortunately, recorded trade data are in terms of value and not in terms of tonnage. Thus, it is not possible to assess any traffic information from this source.

General imports consist of:

- imports for home consumption or use.
- imports transferred from RSA ports to customs bonded warehouses in Lesotho.

General exports consist of:

- exports of national produce. Imported goods that have undergone transformation are considered to be national produce.
- nationalized exports. These are goods re-exported in essentially the same physical condition as when they were imported.

6. Local Services

Each of the major towns along the entire route has several cafes, an inn, a beverage shop, a clinic, an animal auction salesyard, and at least two to five general stores.

Buses serve Mohale's Hoek and Qutning from Maseru and between the two district towns. Buses also connect Quthing with Mt. Moorosi and Qacha's Nek. Frequencies, normally twice per day, are adequate and mini-buses or combis of 16 passengers and large buses of 46 passengers were observed on the road.

Gasoline stations exist almost in all major towns and there seems to be no problem in obtaining fuel.

Trucks are operated by private owners. Rates vary depending upon the demand and destination. Rates are discussed in part 9 of this report along with the traffic analyses.

7. Industry

This section of the economy, although still small, appears to offer the best hope for achieving considerable growth for helping to effect optimum efficiency in several sectors, contributing to national income, creating domestic employment, and helping tc reduce dependence on migrant labor.

Industry is in an early stage of development. Industrialization has proceeded at a slower rate than planned, much of tne development taking place in the public sector, while the private sector has been less active than hoped for. Exports are increasing at 2% to 3% per annum in constant prices, while the comparative figure for imports is 23% per annum. The correction of the import-export imbalance must rely heavily on industrial development to increase exports and reduce imports by import substitution. Government itself invests in industrial and commercial ventures and promotes private investment through two parastatals, tne Lesotho National Development Corporation (LNDC) and the Basotho Enterprises Development Corporation (BEDCO).

The first organization (LNDC) is actively engaged in manufacturing enterprises producing foodstuffs, textiles, furniture, chemicals and other non-metalic products. The second organization (BEDCO) encourages and assists Basotho entrepreneurs by providing training, management and skills and credit schemes.

Manuafacturing and handicraft activities are recorded in value and not volume.

8. Motor Vehicle Fleet Development

The motor vehicle fleet registrations and renewals was evaluated for the districts of Quthing and Qacha's Nek and for the whole country. Table IV-4 shows the 1982 new registrations by vehicle type. Table IV-5 indicates the summary of new and old registrations by vehicle type for Quthing and Qacha's Nek for the year 1982. Table IV-6 shows the summary of all vehicles in the country by vehicle type for the period 1973 to 1982 as well as the annual average percentage growth rates for the periods 1973/82, 1975/80 and 1978/82.

It must be emphasized that the registrations do not show scrapping rates. A substantial number of vehicles still having number plates on were junked or abandoned along the Quthing-Qacha's Nek route.

Finally, we must bear in mind that the motor vehicle registration growth rate does not represent the actual traffic on the roads, nor the vehicle utilization.

TABLE IV-4 MOTOR VEHICLE NEW REGISTRATIONS BY TYPE AND DISTRICT, 1982

VEHICLE TYPE	QUTHING	QACHA'S NEK	TOTAL COUNTRY
Motor Car	14	9	1356
Bus/Combi	16	1	583
Truck/Van[1]	27	17	1808
Tractor	4	-	494
Trailer	1	2	187
M/C	-	3	147
Other	1	-	75
TOTAL	63	32	4650

M/C = Motor Cycles

1] includes pickups and landrovers

Source: Transport and Traffic Dept., Maseru

TABLE IV-5 NEW REGISTRATIONS AND RENEWALS BY TYPE AND DISTRICT, 1982

VEHICLE TYPE	QUTHING	QACHA'S NEK	TOTAL COUNTRY
Motor Car	49	34	5129
Bus/Combi	49	7	3310
Truck/Van	282	107	8652
Tractor	23	3	2054
Trailer	8	5	720
M/C	2	4	628
Other	1	-	511
TOTAL	414	160	21004

Source: Transport and Traffic Dept., Maseru

TABLE IV-6 MOTOR VEHICLE REGISTRATION AND RENEWALS BY VEHICLE TYPE FOR THE COUNTRY, 1973/82

YEAR	MOTORCAR	BUS	TRUCK	TRACTOR	TRAILER	M/C	OTHER	TOTAL
1972	1786	366	2425	733	296	82	-	5698
1974	1387	495	2444	600	590	184	-	5700
1975	3464	538	3778	662	639	240	-	9321
1976	2666	994	4395	1143	687	268	-	10163
1977	2996	1122	5065	1303	721	302	-	11509
1978	3441	1374	5579	1427	853	352	-	13026
1979	3254	1187	5555	1346	874	354	259	12829
1980	4301	1475	7002	1535	1012	427	313	16005
1981	5501	2423	7681	2322	1697	798	524	20941
1982	5129	3310	8652	2054	720	628	511	21004
ANNUAL AVG. % GROWTH RATE:								
1973/82	23.8	82.0	22.8	42.7	98.0	314.3	-	18.7
1975/80	12.1	64.0	19.3	55.1	99.7	122.2	-	19.9
1978/82	17.8	40.1	16.1	27.6	31.4	88.1	-	14.5

Source: Transport and Traffic Dept., Maseru.

9. Commercial Freight Rates

Table IV-7 presents the latest freight rates (ton/km) and passenger tariffs (passenger/km) which are applicable to the Quthing - Qacha's Nek route. These data were collected during the field trip and can be used in any future impact analysis.

TABLE IV-7 COMMERCIAL & PASS RATES, ton/km, 1985

TRUCK CAPACITY	LOWLANDS, M.	HIGHLANDS, M.
Loading Capacity of:		
7 ton	2.30	4.00
10 ton	2.30	-
12 ton	3.40	-
19 ton	4.50	-
22 ton	5.70	-

LOCAL RATES

4-HOURS CHARGE

8 ton	40 Km free	M 70.00
7 ton, 4X4	40 Km free	M 30.00
12 ton	40 Km free	M 100.00
17 ton	40 km free	M 136.00
22 ton	40 Km free	M 170.00

FULL DAY CHARGE - 8 hrs

8 ton	80 Km free	M 140.00
7 ton	80 Km free	M 160.00
12 ton	80 Km free	M 200.00
17 ton	80 Km free	M 172.00
22 ton	80 Km free	M 340.00

BUS/COMBIS PAX/KM RATE, M., 1985

SURFACE TYPE	BUS	COMBIS
Paved	0.038	0.041
Gravel	0.057	0.063
Earth	0.076	0.083
Truck	--	0.103

Note: The minimum fare was increased from M 0.20 to M 0.25.

10. Traffic Volumes

a. General

The importance of traffic characteristics (volume and classification count, axle loads and traffic accidents) in a road transport study should not be underestimated. Its use and application include traffic planning, design, operation and research.

While counting the number of vehicles passing a specific location during a given period of time may appear simple, the attainment of reasonable accurate data requires care and exercise; otherwise errors committed can be magnified in the analysis and projection stages of the study.

Traffic volume and classification count information varies with the usage to be made of the data. Some of the major uses are as follows:

- measuring and establishing trends in traffic volume;
- determining need for and priority of improvement;
- determining need for a new road;
- selecting pavement type and design;
- determining capacity of peak volumes;
- calculating accident rates;
- counterchecking accuracy of O & D (Origin and Destination) studies; and
- estimating road users' benefits.

Other uses of traffic volume information are related to geometric design, functional classification of roads, etc. When converted into a common unit, AADT (Annual Average Daily Traffic), traffic volumes can be plotted on maps to produce "traffic desire lines" or "traffic demand patterns" which are proportional to the traffic volumes.

b. SPRP Traffic Volumes

(i) MOW/R

The available traffic volumes of the SPRP derive from MOW/R, Berger Study and SPRPA. The evaluation team does not consider the 12 hr, two day traffic counts presented in the Socio-economic Baseline Study and Preliminary Impact Analysis of July 1985 because: (a) tney are limited and freight is based on visual observation; (b) they are not- and cannot be-expanded to reflect a 24 hr count; (c) no daily factor is developed; and (d) in general they are unadjusted figures. Therefore, they do not serve any purpose of evaluation other than giving a 12 hr count on a specific day of the year.

As a general comment, all available counts are unadjusted and do not reflect AADTs. Furthermore, it seems apparent that recorded traffic on certain locations is excessive - indicating either:

- double counting of local traffic due to the location of the station;
- recording of construction vehicles; or
- arithmetical error.

Table IV-8 presents classification counts obtained by MOW/R for the years 1983 to 1985 in the SPRP area. Annexes 4, 5, and 6 present MOW/R sample forms, all pertaining to a 12 hour classification on a seven day basis.

In analyzing the presented Table IV-8, it is found that:

- there are gaps in the series of counting periods; thus, it is not easy to forecast traffic or notice any change in traffic volumes.
- there are some traffic increases with high percentages of change. The possibility of local or construction traffic could support tnese phenomena.

However, in referring to Annex 4, one can easily notice (a) the inconsistencies of taking counts, and (b) the dramatic traffic volume increases or decreases which range from a traffic increase of 236.67% to a decrease of 69.19%.

The transport economist concludes that the available MOW/R traffic volume data is inconsistent; unadjusted; and, therefore, meaningless for any use for projection purposes; trend analysis or establishment of traffic patterns in various routes.

TABLE IV-8 TRAFFIC COUNTS DATA
JANUARY AND JUNE, 1983 TO 1985[1]

LOCATION	1983		1984		1985		% CHANGE
	JAN[1]	JUN	JAN	JUN	JAN	JUN[2]	1984 - 1985[3]
Moyeni	-	157	-	525	595	-	-
Mt. Moorosi	-	-	295	281	311	-	+ 5.42
Mphaki	-	30	53	41	101	-	+ 90.57
Whitehill	-	118	57	58	62	-	+ 8.77
Mphiti	-	71	99	-	133	-	+ 34.34
Waterfall	-	48	38	55	54	-	+ 42.11

Source: MOW/Roads, Maseru

1] Classification counts; on a 12 hr basis; 7 day/week; Jan to June and pertains to daily averages of unadjusted traffic volumes

2] Data not yet compiled

3] January 1983 to January 1984

The 1985 (January) vehicle mix percentage, according to MOW/Roads classification counts, is presented in the tabulation that follows:

LOCATION	LV	MV	BUS	HV-2	HV-3	TOTAL %
Moyeni	14	71	5	9	1	100
Mt. Moorosi	11	61	11	16	1	100
Mphaki	51	21	4	22	2	100
Whitenill	65	13	2	18	2	100
Mphiti	64	17	3	15	1	100
Waterfall[1]	12	61	6	20	-	100

Source: Compiled from MOW/R data

Note: LV = Light Venicle, includes passenger car and landrover

MV = Medium Vehicle, includes pickup and van

Bus = includes combis

HV-2 = Heavy Vehicle, 2 axle trucks

HV-3 = Heavy Vehicle, 3 or more axle trucks

1] Pertains to May 1984 mix since the 1985 data for this station was not available.

(ii) Other Sources of Traffic

It is felt that it is not of any use to anyone to present the Louis Berger feasibility study counts or any other data and to compare with the available data obtained by MOW/R. The feasibility's traffic counts have been analyzed and commended in other evaluations.

(iii) SPRPA Traffic Counts

For the purpose of traffic analysis, it is preferable to analyze the SPRPA classification counts rather than those shown in the Socio-economic Baseline Impact Study of July 1985. This is because the SPRPA counts cover a wider variety of venicles by type of ownership and were taken on a six day basis; thus presenting a more realistic picture of the area.

The SPRPA undertook some traffic counts between February 14, 1985 and February 20, 1985 at the request of MOW/R. The traffic survey was conducted between Km 0 + 000 at Quthing and Km 42 + 000 at Mt. Moorosi. The time of the survey was 0700 hrs to 1630 hrs, 6 days excluding Sunday. Station locations were:

- Quthing Junction
- Fort Hartley
- Cutting Camp
- Mt. Moorosi village
- Km 42

All vehicles were counted in both directions at each location and were categorized as follows:

- cars
- pickups and light vehicles
- single axle trucks
- double axle trucks
- horse and trailer (wagon)
- truck and trailers
- buses
- taxis
- other equipment

Each category was divided into private, government and SPRPA vehicles. The average daily traffic in both directions; horse and trailer, government and SPRPA vehicles excluded, appears in the tabulation that follows. The traffic is unadjusted for any seasoned variations.

AVERAGE DAILY TRAFFIC

LOCATION	CARS	P/U	BUS	TAXI	TRUCKS	TOTAL
Km 0 + 000	7	30	3	4	7	51
Ft. Hartley	5	24	4	15	9	57
Cutt. Camp	5	22	5	10	9	51
Mt. Moorosi	6	27	5	15	14	67
Km 42 + 000	8	31	5	16	13	73

Source: SPRPA, Mt. Moorosi

The overall vehicle mix percentage distribution is as follows:

Km 0 + 000	Light Vehicles:	80%	Heavy Vehicles:	20%
Ft. Hartley	Light Vehicles:	77%	Heavy Vehicles:	23%
Cutt. Camp	Light Vehicles:	73%	Heavy Vehicles:	27%
Mt. Moorosi	Light Vehilces:	72%	Heavy Vehicles:	28%
Km 42 + 000	Light Vehicles	75%	Heavy Vehicles:	25%

It appears that the light to heavy vehicle ratio is 3 to 1.

(iv) Personal Traffic Observations

The Transport Economist had the opportunity between November 11 to 15, 1985 to travel in the project area and to also observe traffic patterns along the segment between Quthing and Qacha's Nek.

Observed overall average operating speeds on the road are as follows:

Passenger car:	75 - 85 Km/hr
Pickup & Van:	55 - 65 Km/hr
Combi:	40 - 50 Km/hr
Bus:	40 - 45 Km/hr
Truck:	45 - 55 Km/hr

The majority of the traffic consists of pickups, taxis and vans followed by the two and three axle trucks in the ratio of

3 to 1 in favor of the light vehicle. About 30-35 percent of the heavy vehicles and about 15-20 percent of the light vehicles bear RSA license plates. Loading factor was observed to be poor and it is believed that there is a one way full load destination with an empty return trip; i.e., load factor of 50 percent. The road surface type and condition is adequate for all vehicle types. Actually, with the available amount of traffic, any higher standard of road is not warranted. Heavier traffic is noticed around the towns and marketing centers. Apart from these, limited long distance traffic exists and is dominated by foreign licensed vehicles. Traffic is somehow polarized between Qacha's Nek and Quthing.

Finally, one of the reasons that the MOW/R classification counts appear higher is because they trap construction and government (military) vehicles and local traffic as well. This type of traffic should be excluded from any counting system because it is occasional or temporal.

11. Findings

a. Road Inventory

In 1983 an inventory effort was started in MOW. Since then, a total of only 60 kms of road south and 100 km north of Maseru were inventoried. Any other road inventory which exists has been recorded by individual consulting firms.

b. Vehicular Characteristics

Very limited or incomplete information on the regional and local level exist. Data of the project area incorporated in the SPR Socio-economic Baseline and Preliminary Analysis of 1985 are limited and based on a two day count.

c. Vehicle Operating Costs/DLs

At present, there is no realistic VOC development in Lesotho. Several studies performed have used the method of extrapolating previous VOC data assuming a 10 or 15 percent growth rate factor per annum. This procedure is not correct because it underestimates or overestimates any resulting users benefits. Consequently, any economic evaluation criteria presented, such as IRR, is questionable. In Lesotho, VOC has never been developed to reflect running and overall cost/speed relationships by venicle type and category on various road surface, type and condition.

d. Value of Time for Vehicles

This parameter has not been assessed within the recent years, and rightfully so, because inputs mainly derive from the VOC development.

e. Value of Travel Time

The value of travel time on an hourly and kilometerage cost basis by vehicle type and category for various surface types and conditions has not been developed in Lesotho within recent years.

f. Traffic Volumes

Presently, no systematic traffic counting is performed in Lesotho. Although counts, both classification and automatic, are taken by the MOW/R twice a year (May and September on a two day and a seven day basis) the collected data are not properly expanded to reflect:

- seasonal fluctuations
- conversion of coverage count from 12 hrs to 24 hrs
- computation of hourly and daily factors
- translation of all ADT figures to AADT
- dissaggregation of local and long distance traffic
- expansion to reflect AADTs
- disaggregation of military and construction vehicles

g. The Old Road Situation

People on the old road from Mt. Moorosi to Mphaki, which has been bypassed are estimated to be in the number of 12,000 to 15,000, seriously lack transport and feel isolated. They were already established in their locality and at present they are on their own. Unfortunately, the transport economist, due

to time constraints, did not have the chance to visit that area. However, several interviews made in the Mphaki area, confirm the aforementioned.

The advantages of the bypass in terms of travel time savings and construction cost increase due to the terrain are understandable. However, there are social issues that have to be considered. Normally, these are evaluated by the process of comparing costs/benefits over a period of 20 years - taking into consideration the economic potential; induced and diverted traffic; social aspects; etc. Any evaluation, if made on a simple cost savings basis, possibly might create an adverse situation in the long run.

h. Political Considerations

Dependency upon goods and services coming in from RSA to Lesotho via the Qacha's Nek border continues and perhaps it will continue in the future. There is also the possibility that the border will close to commercial traffic. In either case, a road will be required and there is one. It is noteworthy to mention, that if the border closes, traffic most likely will be reduced by 15 to 20% since this represents RSA license plates. However, this percentage will be automatically substituted by Lesotho vehicles in order to meet the demand.

12. Recommendations

a. Road Inventory

Appropriate action should be taken to gather complete information for the project area network.

b. Vehicle Characteristics

The usefulness of these type of data required for VOC development, projections, etc, is significant. It is suggested that MOW/R coordinate activity with the Traffic Dept., to gather more useful statistical data and MOW/R carry out several surveys to determine L/F (load factor); ownership patterns; kilometers travelled per annum; tire life; operating speeds, etc.

c. VOC/DLs

High priority should be given to the development of the financial and economic VOC for all types of vehicles utilized in Lesotho with cost/speed relationships on all types of road surfaces and conditions. The VOC should be developed to also represent regional costs. Concerning the DL factors for sub-standard surface conditions, development of those that apply to the project road conditions is recommended.

d. Value of Time for Vehicles and Passengers and Travel Time Costs

It is recommended that these parameters be developed after the VOC development.

e. Traffic Counts

It is suggested that the guidelines of the 1983 BCEOM be followed methodogically and on a consistent basis with efforts to trap seasonal variations of traffic throughout the country. The traffic data should be expanded to represent adjusted AADT.

Over the past decade, the importance of traffic management has significantly increased as it has been recognized that many transport problems can be resolved without large-scale investment in transport infrastructure. The approach to planning transport improvements which has evolved is management-intensive rather than capital-intensive, with one of the principal objectives being to reduce inefficiencies in the transport system. Traffic management achieves this through the planning, design, implementation, maintenance and monitoring of physical and policy measures which promote the efficient and safe flow of passengers and goods.

Finally, in addition to traffic volume data collection, traffic generating data: such as demographic characteristics, GDP (Gross Domestic Product), income and income distribution,

passenger and freight costs and similar information on other competing modes of transport should be gathered. This is essential for the purpose of projections and planning, both in the project area and countrywide.

f. Old Road Situation

Measures should be taken to support the population served by the old road by maintaining it to the same standard as it was maintained before the Cut-off was built. The population along the old road should be included in any future integrated development program in the project area.

g. Future Development

The evaluation team suggests that upgrading or improving an existing road does not necessarily mean that economic development will occur. Road rehabilitation or improvement is a prerequisite for development but a further investment is required to generate economic and social activity and prosperity.

h. Political Considerations

The evaluation team believes that the existing road will be sufficient to accomodate traffic demands provided it is well maintained in its current condition. Further upgrading of the various project road segments should be undertaken only when traffic volumes increase on those segments.

13. Lessons Learned

Any feasibility study must be updated before project implementation by repeating the same methodology and evaluation criteria. Specifically the 1978 feasibility study should have been updated before the project was finally implemented. This updating procedure can be done by establishing homogenous link sections and, for each of these sections, comparing the feasibility of rehabilitating the existing gravel road link to an improved gravel condition versus the realignment of that section. Such a study update is also warranted when budget considerations indicate the need to develop a time-staged solution.

B. Transport Investment and Impact Analysis

1. General

We all know that statistical information is moderately reliable at best, frequently unreliable and often unavailable. Population estimates for countries have been known to be inaccurate by as much as 50 percent, and estimates for local areas are generally less accurate than for countries. Data on freight rates, costs of transport and the profitability of agriculture are often poor or even unkown.

Statistical limitations raise two problems. The first is how to remedy them and obtain better statistical data and the second is how to adapt the study undertaken to take account of the statistical limitation.

Fundamentally for the impact studies, the following three profiles need to be established:

- economic
- social
- traffic

Baseline data to be collected before and after project completion should be identical; this is required for comparison purposes. Annex 7 presents suggested guidelines for impact studies' quantifiable benefits; with an assessment on time value for vehicles and passengers.

What is actually needed is a limited Agricultural and Traffic survey to be carried out in the area of influence and along the road vicinity - in addition to the collection of the required socio-economic statistic. These could be performed on a sampling method provided the "universe" is known.

2. Baseline Study and Preliminary Impact Analysis, 1985

The Socio-Economic Baseline Study and Preliminary Impact Analysis on the SPR is of dubious value from the transportation economics point of view as far as the quantifiable benefits are concerned. The quantifiable benefits are not assessed in monetary terms; i.e. travel time savings; trip cost; freight and passenger rates, etc. Comparisons are made of an improved link with another segment of the road where no improvements have started. Each road segment has different traffic, economic, development and social characteristics; it is misleading to make comparisons on

eterogenous links having different characteristics. The following comments can be made about the traffic volumes in the Baseline Study:

(i) Traffic analysis is insufficient and some vital important transport quantifiable benefits are assessed on the sole basis of visual boservation; i.e., vehicle load capacities, passengers carried, and cargo type. A two day, 12 hr unadjusted traffic count does not represent the actual picture of traffic in the area.

(ii) Traffic volumes include project construction vehicles that should be excluded from the survey. Such road building equipment are on the road only for a specific reason and time. SPRPA vehicles do not represent any generated economic activity in the area.

(iii) It is misleading to compare traffic volumes recorded during the two day, 12 hr survey with those of 1973 and 1977 conducted by MOW/R because in the earlier period there were no SPRPA vehicles.

3. Premature Appraisal Overview

A transport infrastructure is usually a prerequisite - though by no means a guarantee - of economic growth. In evaluating the impact of transport investment associated with development, there is a serious problem in distinguishing benefits attributable to other inputs or the normal growth that would occur without any road improvement.

The fact that more traffic was recorded in the Baseline Study in 1973 or 1977, with or without the SPRPA construction vehicles or a change noticed in lifestyle, does not necessarily mean that such an increase or change is solely attributable to the road improvement itself. A normal growth takes place everywhere irrespective of an all weather road or a paved road. Therefore, no conclusions can be made unless complete data are gathered and evaluated; a survey performed; and benefits attributable to normal growth are disaggregated from those attributable directly to road improvement. At present, the beneficiaries of the road in monetary terms are primarily the operators and commuters.

4. Recommendations

a. Baseline Survey

(i) A systematic socio-economic survey should be conducted and substantiated with a limited traffic and agricultural survey to include all parameters required with specific emphasis on the quantifiable transport benefits. The baseline survey team should include an economist besides the sociologist or anthropologist. The disciplines differ; thus results will obviously differ.

(ii) All quantitative transport related benefits (travel time savings; trip cost; freight rates, etc) should be quantified.

(iii) Comparison of improved links should be made only on the basis of the "before" and "now-improved" case and most importantly on the same link.

(iv) Traffic volumes should be analyzed over an extended period of time. This might be possible using MOW provided automatic counters. Furthermore, USAID should explore the possibility of building the MOW/Road traffic institution mangement; an essential parameter for short and long term transport investment planning. While this is expensive, in the end it will be more expensive if it is not done.

(v) Decide on a methodological approach to be followed by first performing pilot surveys in the road area.

(vi) Annex 7 presents suggested guidelines for assessment of passenger trip cost and value of time for botn vehicles and passengers.

C. Economic Evaluation Parameters

Main baseline sectoral data consist of road inventory; vehicle operating cost and DLs; vehicluar characteristics; time value costs for passengers and vehicles; trip costs and traffic volumes. Development and availability of these parameters will contribute to the economic assessment of a feasibility study; feeder road study; road improvement and upgrading and will be an input to impact analysis studies.

V. SOCIAL ASPECTS AND SOCIAL IMPACT

A. Introduction

As stated, earlier in this report, the original motivation for USAID to undertake the SPRP was in response to GOL stated socio-political needs of the country and its southern region.

In responding to the need for the SPR, USAID stated in the logframe of the SPR project paper two social goals of the SPR:

1. facilitation of economic development, and
2. national economic integration.

The first External Evaluation* states that "social benefits are the primary raison d'etre of road construction" and that these social benefits "cannot be assured by contract but instead depend upon responses of the general society and economy". It suggests therefore, that "evaluations must focus upon original assumptions, provision for goal realization, and procedures for measuring changes that occur in response to new or improved roads", (p. 67).

While the current study concurs with the above analysis of the justification for roads and the non contractual nature of the relation of

* External Evaluation; Southern Perimeter Road Project, 1983.

social benefits to road construction, it must take issue with the last commandment as to the need for "procedures for measuring changes that occur in response to new or improved roads".

Roads take a long time to build; as of this date the new SPR, begun in May of 1981, is approximately 85 km long and it is projected that completion of the road to its originally planned goal would not take place before 1990.

It is simplistic to assume that in such periods of time no other factors will exert a stimulus to social change in the area, either reinforcing, or counteracting the influence of the road. In a scientific experiment, it is customary when stating conclusions, to add the caution: "other things being equal" - meaning, other conditions remaining constant. The problem with trying to analyze social experiments (and the introduction of a means of improved transport is surely a social experiment) as though they were scientific ones, is that the one thing that is certain in a situation involving groups of people is that "other things" are not going to remain constant. In the area of the SPR, for example, the entire construction period was coincident with a period of severe drought in Lesotho. It was also a time of decreasing opportunity for young men to work in the mines of RSA, a major source of income in Lesotho and in the SPR area (See table V-1 p. 108). It has also been a time of proliferation of young landless families. (Indeed, it has been a time and a cause of creating new landless families, since now, when land for new allocation is practically non-existent, the road is forcing

Specific methodology for data collection depended heavily (during the four days of field work) on "observations, experience, and interviews along the road", a method which Gay reports was her "most obvious source of evidence for the impact of the Southern Perimeter Road" (p. 40).

Additionally, interviews were held in Maseru with GOL personnel and others directly concerned with development of the SPR area and/or social development in general, and literature related to the SPR project and to the social situation and socio-economic development in Lesotho was examined (see list of persons contacted, and Annex 1 for bibliography).

B. Socio-Economic Development in its Setting

1. Changing Settlement Pattern

The area of the SPR is one of rugged mountain terrain, and limited arable land. Accomodating to these conditions the traditional settlement pattern is of villages built on hill tops, or steep mountain slopes. The villages of today are made of clusters of houses which include mixtures of variations of the traditional rondavel or square one room houses with mud/dung walls and thatched roofs and more modern rectangular buildings with galvanized metal roofs and walls of cement blocks, bricks, or stones. One or more kraals (for stock of different types) may be included in any house cluster.

While most villages along the SPR are still of this type, some few new settlements may now be seen lining the road.

Farm lands, now largely uncultivated as years of drought have discouraged their cultivation - include the relatively flatter areas and gentler slopes around the villages. They were customarily reached either by foot or, in this century, by horse. Although the SPR was designed for motorized transport, it is noticeable that one use of the road is to facilitate travel by foot and on horseback. It is also used as the path for occasional pack carrying donkeys.

Cattle can be seen grazing anywhere on the hillsides, along the road, and between the houses - although we are informed that the major part of the national herd is grazing in the mountains at this time of year (late spring). The few cows kept near the homes should be those used to provide the family with daily milk.

Flocks of sheep and goats can be seen anywhere - herded usually by pairs of boys or sometimes by old men. Indeed, for the shepherds, life is transhumant, in accordance with the needs of their animals. Summers are spent in the mountains and winters near the family village.

In traditional society boys passed through the stages of life with a groups of agemates, and although the systems of age grades has died out, retention of the herding role for boys must have some effect on their preparation for manhood. One, of course, is the emphasis on life being with mates rather than with families. In the modern setting this has probably made it easier for them to accept life as migrant mine workers in the company of men and away from families.

An unfortunate consequence - a constraint on development, both for individual and nation - is the extent to which herd boys have been cut off from formal schooling, thus hurting their chances at skilled jobs in the modern sector. But they must be skilled with animals - something that could be put to use by incorporating them into grazing schemes.

A potential harmful effect of the new road relates to the 12-15 thousand people served by the old road between Mt. Moorosi and Mpnaki. The new road bypasses the old one and should the old road not be maintained a great number of people could become more isolated than ever.

2. Social Organization

a. The State

A factor often cited both as justification for the political goal of the SPR (national unity) and as a positive trait for development is that the Basotho are one people. Although originally moulded from many tribes, the current Basotho people have been a single tribe since the common threat of Zulu and/or White settler conquest brought them together organized into a kingdom through a series of chiefs and subchiefs. This is still the political structure of the nation. Everyone is part of the nation as his/her maximally extended family, and as the head of the nation the King derives his rightful authority as the head of this great family.

b. The Family

In the tradition of herding peoples, the Basotho are patrilineal, patrilocal and partiarchal. For rural families, at least, it is still true that at marriage a girl enters her husband's family, and indeed the new couple do not usually start life in their own home. Today, this period of life in her husband's family's home may be extended for a bride as her husband goes off to work in the mines of RSA. One such young wife, interviewed at the home of her mother, whom she was visiting after her monthly trip to the child health clinic, described how she worked on the farm of her husband's father, that she thought the family's only income came from remittances from her husband and that she hadn't seen her husband since the baby she held, and who appeared to be about six months old, had been born. She also said she hoped he would continue to work in the mines, so she could still get his remittance. A second young mother, interviewed at her husband's father's home, reported that her present poverty was due to her husband having been excluded from mine work because he had overstayed his leave when on a visit home he discovered his two children to be sick. She looked forward to his returning to the mines after his long period of seclusion would end.

It is reported that working in the mines has suited the Basotho traditional "natural" family planning pattern very well. A Masoto man is supposed to refrain from intercourse with a pregnant or lactating wife - and the two year contract

in the mines, often timed to begin after the birth of a child - allowed for easy compliance with the rules of abstinance. It can be anticipated that one social impact of a road which enables men to return home at much shorter intervals than previously, may be to contribute to increase in family size- or at least in number of children per woman. (Number of children per woman is responsible for total population, if not, in the case of polygyny families, total family size.) Since in its Third Five Year Development Plan 1980-1985 the GOL states its committment to population management, (p. 334) it might want to prepare for this possible road influenced change.

Although polygyny is still allowed and practiced under customary law, it is dying out* and this puts pressure on a couple to resume sexual relations much sooner after the birth of a child.

Although working in the mines gives a man money that could be invested in development it does not necessarily give him the necessary skills. His wife is more likely to have education than he, but his much higher earnings probably reinforces his authority in the family, whether at home or abroad. This conflict between education and authority may act as a general constraint on development in Lesotho and

*Probably at least partly influenced by the near impossibility of getting new farm plots allocated for a second wife.

emphasizes the need to increase education of boys, as well as economic opportunities for women.

The table reprinted on p. 108 shows various sources of income for families in the SPR project area. Retail trade, the highest earner, is engaged in by both women and men, but high earning shopkeepers tend to be men and small scale food sellers tend to be women.

3. Agriculture

Agricultural production, technology and inputs are discussed in the economic section of this report. Many other factors related to agriculture and its development remain to be discussed, as for example land tenure.

a. Land Tenure

Traditional Basotho land tenure was based on the premise that all land in the country belonged to the people of the Basotho nation through their chiefs. Married men could apply for land to their local chief - first for homesteads and, as family size justified, for food production. Land thus allocated usually three fields, one for each major crop (sorghum, maize, wheat) - was tenurable by a man as long as he cultivated it. In effect, he could count on security of tenure and - during the cultivating season - exclusitivity of tenure. After the annual crop was harvested, however, all land was opened to communal grazing by stock returning from summer pasture in the mountains. (In winter, frozen soil

prohibits grazing in the mountains). This practice of turning cropland to communal grazing deprives the soil of nutrition since the stock grazes on the crop residue were the cattle dung left to fertilize the field it should compensate for loss of stover, but dung is collected for use in house building, floor polisning and fuel. With the increase of modern houses and paraffin stoves that seems to follow road improvement, there may be less need for dung in the home.

As population in Lesotho increased, less land was available for new allocations, leading to an ever increasing population of landless people in the rural areas. For landholders, fields had become increasingly smaller and more fragmented. At the same time, men began to leave home to work in the mines of South Africa, leaving allocated land in the care of a wife who perhaps could not work it fully alone. At this time the traditional system of share partnership (sealelo) - which had developed as men with oxen were invited to work the land of men with none for a half share of the crop - was adapted to meet the requirement that land must not be left unused. This share partnership became a way for the landless members of a community to engage in farming. Or perhaps a man with oxen, even though he had not land of his own, would be enabled to increase his area of land use by share cropping the land of one, or several farmers who had no oxen.

Today men with tractors use this method of seahlolo for greatly increasing the amount of land they cultivate, thus, by extensive share cropping, manipulating the traditional egalitarian land tenure system to acquire rights to land, and consequent wealth.

Recently a GOL Land Act (1979) gave permanent tenure, - but not the right to sell to landholders. Land may only be taken from landholders if it is needed for national development, such as road building. This Land Act was designed to decrease fragmentation and, by securing tenure, to encourage investment in agriculture.

b. Cattle Complex

Paralleling share partnership of fields is the traditional practice of cattle lending (matisa). A man with many animals may "lend" some to another who has none or few. The borrower cares for them in return for their milk, dung and work. The owner thus can build up his/her herd*, and therefore his prestige, beyond his own capacity to graze and care for his stock.

Among cattle complex cultures, prestige comes from numbers, not quality, of cattle.

This tradition, of course, increases the overgrazing said to be responsible for much of the extreme erosion of Lesotho, including the area of the SPR. The practice of matisa also defeats destocking schemes since a member of such a scheme may "lend" his extra cattle to a partner in an area not subject to destocking rules, rather than to reduce the size of his herd by sale of cows, as is the intent of destocking schemes.

It is said that historically one source of cattle ownership was the income earned by migrants to South Africa. It is to be hoped that excess income brought to the SPR area by increased economic opportunity afforded by the road will not further increase the numbers of inferior cattle.

It is reported that farmers in the area have been even more reluctant to sell horses than cows. This is possibly related to the fact that horse ownership seems to convey even higher prestige than does ownership of the more traditional cattle. (In bride price payments - now more often paid in cash than cows - one horse has the value of two cows.) It is also notable in the SPR area that people tend their horses more carefully than they do their cows. Despite this, we have been told that, whereas earlier attempts to get horse owners to sell excess horses had failed, they have begun to respond to efforts to sell aminals to the abattoir for horse meat, and of course, the good road to Maseru facilitates this.

The Berger report expressed the thought that with a good road, vehicles might replace cattle as prestige possessions. According to Gay, "investment in retail trade has come to replace investment in cattle for many people" (p. 90).

If this is true it signifies a grand scale culture change - that of prestige coming from money rather than animals, (Gay's table of income sources in the SPR area reprinted here on p. 108 shows that by far the greatest income earner is retail trade, an average of M367/month as compared to the second highest earnings from truck, taxi, etc M154.25 and the third - but by far the most numerous - wages of migrant men M113.54.)

For sheep and goats the major industry in the SPR area is the selling of wool and mohair and the extent of these sales is indicated by the number of roadside woolsheds, some seemingly new, and opened in relation to the new road.

Resistance to reducing herd size by large herd owners is due to their prestige value cited in an earlier discussion of the "cattle complex". Information concerning the persistence of the cattle complex in Lesotho is contradictory.

It must be noted that one very busy woolshed visited by our team sociologist located near the old road was in danger of being cut off when the new road's planned bypass reached the area. At the time of our visit the shed's record keeper expressed to us her fear that the shed's long history of successful operation (from 1966) would end should no provision be made for a branch road from the bypass to the shed. As of this date, project management has made the decision to incorporate such an access road in their plans.

That the sale of wool and mohair is important in the area served by the SPR is attested to in the following table which shows it to be the third most common source of family income, after only migrant men's wages and sale of beer.

c. Agricultural Development

According to interviews with government personnel, the GOL has demonstrated its eagerness to use the SPR to increase services to farmers. As the road extends, extension agents are provided to new areas. The reasoning has been that the main constraint to agricultural development in the SPR has been the difficulty of getting marketable produce from inaccessible farms to markets. Now that farmers can see that this constraint has been overcome by the road, the government anticipates that they will be motivated to return to farming, and the extension agents should be there to instruct such farmers in the use of new technologies, improved seeds, etc.

TABLE V-1 REPORTED MONTHLY INCOME BY SOURCE:
MEAN PER HOUSEHOLD AND PERCENT OF HOUSEHOLDS REPORTING EACH SOURCE
(in Maloti)

Source of Income	Mean computed for all households interviewed	Number of households reporting this source	Mean computed for those reporting this source
wages of migrant men	62.16	369	113.54
wages of migrant women	1.90	19	67.95
wages of men working Lesotho	11.13	68	110.56
wages or women working Lesotho	7.06	52	91.25
earnings from house building	2.43	28	58.57
earnings from truck, taxi etc	.91	4	154.25
piece jobs	2.16	45	32.58
earnings from ox team	.03	3	7.33
sale of livestock	2.84	61	31.61
sale of wool or mohair	3.04	114	18.02
sale of chickens,eggs	1.84	50	24.98
sale of crops	1.78	56	21.52
earnings from own cafe or shop	22.19	41	367.00
re-sale of fruit, vegetables	.71	71	28.18
sale of beer	8.44	236	24.19
sale of handicrafts	5.74	46	84.57
food-for-work projects	.62	64	6.56
pension or insurance	2.60	20	87.90
"help" from friends	1.28	51	16.98
other sources	1.83	28	44.25
MEAN FOR ALL SOURCES	141.85	659	---

Source: Gay, Judith. Southern Perimeter Road, 1985, Table 2.14, p. 73.

At the same time, Co-op Lesotho Ltd. has opened branches as demand in an area suggests that a new branch would be cost effective. Previously there were many areas in the southern region not served by the SPR that the Co-op would not serve, since cost to maintain its delivery vehicles serving that area, due to the bad road, proved to be more than any profits earned. Today there are fifteen branches in the area of the

road - a good proportion of the 56 country-wide. Co-op Lesotho Ltd. is a parastatal organization in which the GOL invests and it is expected to make a profit.

The GOL has been using the Co-op as a channel for helping individual farmers - for example the Fund Self Sufficiency Program through which the government assists individual farmers to acquire such inputs as fertilizers and seeds, but also building materials and foodstuffs. The GOL has also given grants in the SPR area for developing warehouses and transport facilities.

There is evicence, by change in Co-op membership - still predominantly women, but with a steadily increasing number of men - that with the road induced improvement in income potential, agriculture in the SPR area is absorbing men who can no longer (or do not desire to) emigrate to the RSA.

Although the Co-op is a farmer-membership organization, it serves non-members as well, at a slightly higher price, and it is likely that a researcher, wanting to find how farmers spend their money could use the records of the Co-op stores as one reliable source of information. As of now, the indications are that they buy machinery to replace animals for work, wheelbarrows rather than donkeys for cartage of supplies to the field and of crops to the purchase point, for example.

A Co-op service that seems designed to encourage large scale farming is the dispatching, at no cost to producers, of a suitably sized truck to pick up produce whenever there is enough produce at one place to fill the truck.

And it seems where there is a way, there is a will. Our team sociologist was able to visit two large private irrigated vegetable farms near Mt. Moorosi, initiated by private entrepreneurs. Of particular interest was one started as a co-op by a pair of partners - Mr. Joseph Ranthiane and Mr. S. Albert Nzeku of Ha Koali village - with six interested neighboring farmers whose lands adjoined their own. The group, having borrowed money from the Agricultural Development Bank, and with the aid of thirteen permanent field hands (all men) and the occasional services of 30 casual laborers (all women), were cultivating 12 1/2 hectares of mixed vegetables and grains with overhead irrigation equipment purchased in Bloemfontein, RSA, and water pumped from the bordering Orange River. Although the first harvest is still awaited, it is clear to any observer that the vegetables, particularly cabbages, are flourishing. Enough adjoining farmers to increase the co-op area to forty-one hectares are waiting to join. The present members are equally eager to extend the irrigated area, the only constraint being the refusal of the Agricultural Development Bank to extend further loans while one is outstanding.

The bank estimates that the loan can be paid with the income from four successive harvests, counting on three harvest of vegetables in a year. It is interesting to note that teff, a food grain in Ethopia, is grown on this farm as a fodder crop.

In three other situations we heard of people waiting for loans from the ADB - one a professional in the Ministry of Agriculture, who, despite his salary and expertise (he had studied dryland farming overseas), has not been able to meet the Bank's requirements. He has family land, but in Lesotho land cannot be used as security for a loan. Nor can commercial banks make loans for agriculture. This difficulty in financing would appear to be a constraint on private agricultural development. There is, however, at least one other GOL source of capital for would be intensive vegetable and fruit growers. The Masoto Canners, a parastatal company, will extend credit to farmers who agree to grow produce for the cannery. Currently they are looking for groups of farmers who will plant fruit trees. USAID provides credit to farmers through its support of two projects - the Long Distance Teaching Center and the Lesotho Cooperative Credit Union League.

d. Recommendations

It is recommended that credit be made available for farmers who can demonstrate their ability for intensive cash crop production.

One way to attain such production is through irrigation. It is recommended that various types of irrigation other than pumping water from the area be tried in appropriate circumstances. For example:

1. Mountain springs could provide water to successive fields down-hill from the spring (possibly a series of terraces) using only the energy of gravity and simple pipes or furrows. (An ideal, cost free, pipe can be made from bamboo. Perhaps a project to see whether bamboo could grow in the SPRP area would be feasible.)

2. Fruit trees grow well with drip irrigation.

3. Perhaps in the cold climate of the mountain regions, the near desert conditions dew irrigation could be used to grow fruit trees.

4. Consumption and Consumer Goods

Table 2 (p. 113) lists consumer goods by frequency of sale, available in shops in various areas related to the SPR and compares their prices in these locations with the prices in Maseru. This list consists of small items of what might be termed - exclusive of the last 4 - items of day-to-day necessity.

Two obviously frequent consumer goods are not mentioned in the charts. One is beer, widely consumed, whether modern or traditional; (as indicated by Gay's information about numbers of women engaged in the sale of each (Table V-1, p. 108) and the other is soft drinks - as indicated in the enormous number of discarded cans visible throughout the area.

In addition to the items mentioned in the tables reproduced above, in all areas visited in the course of our field work, team members noted that most of the population was well dressed in new

TABLE V-2 AVERAGE PRICES FOR COMMON CONSUMER GOODS BY ROAD ZONE
In Maloti

No of Shops Selling Item	Item	Unit Size	SPRPA Q - Mpnaki 8 Shops	Quthing old+fedr 13 Shops	Middle Section 13 Shops	Qacha's Nek 8 shops	Maseru 5 shops
			M	M	M	M	M
47	Sugar	1 kg	1.19	1.16	1.25	1.19	1.00
47	Milk Longlife	.5 lt	1.17	1.20	1.32	1.27	1.00
47	Powdered Soap	150 gms	1.08	1.07	1.23	1.20	1.00
47	Candles	pkt of 6	1.16	1.13	1.24	1.07	1.00
46	Maide Meal	25 kg	1.17	1.13	1.24	1.17	1.00
46	Salt	500 gms	.89	.89	1.11	1.12	1.00
46	Fat/oil	125 gms	1.16	1.23	1.36	1.31	1.00
46	Tinned fish	155 gms	1.09	1.12	1.26	1.17	1.00
46	Sunlight Soap	125 gms	1.01	.84	.90	.89	1.00
45	Coffee	62.5gms	1.13	1.22	1.11	1.33	1.00
45	Paraffin	1 litre	1.13	1.14	1.04	1.09	1.00
45	Cigarets	pk of 20	1.13	1.16	1.19	1.15	1.00
43	Wheat meal	25 kg	1.11	1.19	1.24	1.26	1.00
42	Vaseline	50 gms	1.24	1.20	1.16	1.22	1.00
41	Bread, brown	loaf	1.25	1.34	1.37	1.20	1.00
37	Dawn handlotion	200 ml	1.25	1.37	1.48	1.36	1.00
23	Babymilk	250 gms	1.26	1.16	1.27	1.18	1.00
20	Blanket	adult size	1.07	1.06	1.24	1.17	1.00
12	Primus	1	1.28	1.17	1.39	1.13	1.00
11	Cement	50 kg pocket	1.37	1.26	1.59	1.53	1.00
10	Roof zinc	12 ft length	1.00	.85	1.01	.99	1.00

looking clothes, some with the addition of traditionally worn blankets.

Out team would like to note that, judging by the number and quality of consumer goods evident in the SPR area, it is hard - in comparison to otner countries in Africa with which it members are familiar - to consider the population of the area, or of Lesotho in general as being very poor.

5. Health/Nutrition

a. Facilities

There are three levels of institutions for health care in the SPR area: the full service hospital (as at Quthing); the outpatient or short stay clinic (there is one at Mt. Moorosi); and several child health clinics which provide vaccinations and growth/nutrition monitoring of infants up to the age of three.

There are also private doctors who, according to reports, will visit patients for a fee of 5M cents, and these home visits are facilitated by the new road.

Some new health facilities have been opened in the area since improvement of the road, including a nurses' training school attached to the Quthing Hospital. At the same time, the Ministry of Health has been able to greatly reduce the dependence on its Flying Doctor Service in the area, thereby saving a great deal of money.

Travelling along the road, one sees a series of child health centers and they appear to be well attended. It is difficult to judge whether mothers primarily bring children for vaccinations and regular weighings or - in the case of CRS child clinics - for the food gifts (bulgar wheat, oil and powdered skim milk).

At the St. Mathew's child health center in Mt. Moorosi visited by the evaluation team's sociologist, it was reported that about 40% of local mothers now bring babies on a regular basis. For the 60% of mothers who do not attend the clinic, several services are provided. The vaccinator goes out to service children throughout the area - up to the border of the area of the next clinic. Clinic personnel travel throughout their area to give nutrition demonstrations. The clinic personnel also directs mothers from each community who do attend clinic to select a mother to be the community health worker. This mother is given training in child health monitoring to assist the mothers who do not attend clinic.

St. Mathew's clinic had been opened in 1971 - ten years before the road improvement. At that time, according to clinic personnel, few mothers attended, especially during the rains when the clinic was virtully unreachable.

All mothers coming to the clinic on a given day come from the same area. On the day of our visit they had come from Lefikeng. No one knew Lefikeng's distance from the clinic, but walkers reported that the journey regularly took them 2

hours each way. Of the forty mothers attending the clinic, thirty had walked. Of those who had come by bus or taxi, four gave as their reason that they could not walk with two children; three that they had started late; two that they were carrying maize to the mill; and one that she was sick.

Of those who walked, the principal reason given for not riding was lack of money. One walker planned to take a bus home since she was buying food that would be too heavy to carry.

Later, visiting in a village near Mphaki, the team's sociologist found young mothers and their children who regularly stop off to visit their mothers as they return from the clinic. There was a bus stop on the road immediately down hill from this village and these mothers said that use of the bus enables them to add this social dimension to their clinic visiting day. Such a chance for a family visit probably encourages mothers to take children to the clinic and, in any case, is especially valued in a society where daughters regularly move away from their own home area on marriage to live with their husband's family, even though the husband may be absent.

b. Other Services

To the sociologist's eye, nutritional status, in the SPR area, particularly of young children, seemed quite good, but the director of the Food and Nutrition Coordination Office

(FNCO) reports that the mountainous region as a whole, and particularly the areas of Quthing, Qacha's Nek and Mohoto are the most nutritionally vulnerable in the country.

According to the director, the SPR has been instrumental in maintaining such good status in that it has enabled the government to reach the area with food aid, thereby considerably mitigating the potentially disasterous nutritional impact of the drought.

The road has also enabled the FNCO to increase the frequency of its nutrition workshops in the area from once every three to six months, to once every month. These multisectoral worksnops prepare not only nutrition and health workers, but teachers, policemen, rural development and various other extension workers to offer nutrition education with the aid of an FNCO designed nutrition education kit which is provided by UNICEF.

A most frequent answer given both by local people and government officials to the question concerning benefits of the road, is that sick people can be transported to the hospital more quickly.

Related to this is more rapid transport of the dead. As reported by Professor Mohame, Head of the Sociology/ Anthropology Department of the University of Lesotho, Lesotho has become a country where "we work for five days and bury our dead for two". This refers to the tremendous importance placed on funerals, which have become a major social occasion

throughout the country. A policeman interviewed in Sekake, in fact, gave "rapid transport of the dead" as his first answer to what benefits he has seen since the road. He explained that Basotho want to hold the body for burial until all the kin might be present. Since some kin are usually working in RSA, there is often quite a delay before burial.

Bodies must be transported to Quthing to the undertaker, the policeman reports, and now that transport time has been greatly reduced, unpleasant post mortem changes are no longer a problem for the deceased's family.

6. Education

a. Formal Education

This is an area where impact of the road cannot be so simply measured. For example, pupil enrollment at Maseribane HS near Mt. Moorosi, which was visited by the evaluation team's sociologist, is now lower than before the road was improved. This is because the GOL has recently decided to restrict class size to a mixmum of forty and the school has had to admit fewer pupils in order to comply with the order.

The principal thinks, however, that when he is able to have more rooms built (actually more buildings - classrooms are two or three to a long rectangular building), the enrollment of his school will build up again, and continue to grow - due to the improved road. He feels that the road is already contributing greatly to education. Not only can

students from remote areas get to school, and supplies get to the school (equipment for its new laboratory - including stools donated by the US Embassy did recently) but teachers have been able to take students on educational field trips. Similar trips taken by the school's football team to play other HS football teams in Lesotho, he feels, are good examples of road facilitated national integration.

Among other often cited benefits to education prompted by the SPRP is the greater willingness of good teachers to work in the area now that they can hope to spend week ends at home in Maseru or other parts of the country.

An area of education which needs improvement in order to prepare the local population to more fully participate in anticipated benefits of the road is the education of herd boys.

The unusual situation prevalent in Lesotho of more literate and more highly educated women than men is related to the "need" for boys to herd the family's animals. A traditional role for boys, their importance as herders was increased as young men began to migrate to RSA and ceased their herding at a younger age. Young boys had to fill the gap and their herding days started earlier. The people of Lesotho have evolved a variety of strategies for sharing work/school arrangements for their herder - sons, usually rotating school attendance and herding duties among their sons. Such boys, however, attending school part time, often fall behind, and, in discouragement, often drop out.

The local elementary school principal mentioned one of the few road related problems this evaluation team has heard in the field. She felt that the road contributed to truancy of boys who were attracted by the excitement of the road more than by the school. These boys, meeting at a bus stop, formed gangs of delinquents which the area did not have before work on the road began.

b. Nonformal Education

Four examples of nonformal education in the SPR area have been mentioned: agricultural extension, nutrition workshops, nutrition demonstrations and the training of village mothers to be local health workers. All of these programs are facilitated by the improvement of the SPR.

The sociologist was also told of church sponsored women's craft classes, such as dressmaking. There are undoubtedly other examples of nonformal education but we did not come across them.

c. Recommendations

1. Practical education courses suitable to the needs and opportunities of the area should be offered to high and middle school students, particularly courses in agriculture.

Improved cultivation of both food crops and animals should be taught. These courses should include management as well as husbandry skills, particularly at the HS level.

Coordinated with these courses, there should be field trips to actual agricultural development and range management projects and the project personnel should be encouraged to instruct student visitors.

If possible, upper level students in such courses should be offered summer internships or apprenticeships on such development schemes. Project personnel might also be invited to give lecture/ demonstrations at the high schools. Such interaction with agricultural experts might lend excitement to the field.

Efforts should be made to persuade their parents to send herd boys to school. Perhaps, convinced of the economic potential of school attendance, these parents might be motivated to hire professional herders, old men who return to herding as their only marketable skill after their mining days are over.

Mobile demonstration units presenting material of benefit to local people should visit SPRP communities in rotation. Demonstrations might deal with agriculture, nutrition, hygiene, etc. Similar units might offer adult education in literacy and many other skills.

Mobile libraries should serve the SPRP area, but not just for high schools as called for on p. 318 of the Third Five Year Development Plan. The community, both adults and children, should be catered to as well, for educational, informative and recreational reading.

7. Recreation

a. What there is

A major source of recreation, funerals, has already been discussed, including the role of the road in increasing attendance at funerals by allowing for faster embalming of the body. Of course, mourners find travel to the funeral to be speeded as well. Inter scholastic games, made possible by the road has also been mentioned. So has beer drinking - which may take place at homesteads in the case of home brewed sorghum beer, or at cafes in the case of tinned beer. There are frequent cafes seen along the road, and occassional discos.

Most homes seem to have radios - batter operated, in the main as electricity is uncommon. In Mt. Moorosi, a local retailer offers television viewing to the community in his cafe every evening and week ends.

The role of the road in enabling women to visit their family homes has been mentioned.

b. Recommendations

For small rural communities, too small to support many recreational establishments, a good road is ideal for bringing recreation to the community:

1. Travelling theater and dance on a flat bed truck. The Institute of extra mural studies of the National University of Lesotho combines recreation with development in its travelling theater for development unit.

2. Mobile library with recreational literature.

3. Mobile movie unit.

C. National Integration

1. Sociopolitical

It is clear from the social point of view that the road is serving well to promote national integration. People can travel now, for whatever purpose, to other parts of the SPR area, to Maseru and elsewhere in Lesotho. They can live more of their lives in their own country and get more satisfaction within its borders.

From the point of view of government, more services can be provided to its citizens in the SPRP area. Those government agents serving the area can extend the range of their activities. New ones are more easily recruited. There can be more agricultural extension, more health workers and health facilities. More teachers, policemen, tax collectors and other government institution agents, services and obligations that make citizens feel and be part of the nation. It is also true that travel within the country can replace travel through the transkei and/or RSA, thus giving security against border closure which was the initial stimulus for the SPRP.

2. Economic

From the economic point of view, where national integration really means economic independence from RSA it seems difficult to believe that the road can make a significant difference in the short run. Earlier in this chapter, it was noted that economic self sufficiency in maize flour does not mean freedom from dependence on RSA, but that, although all the flour needed in Lesotho can now be produced in the country, it is produced largely from maize imported from RSA. Economic independence in agriculture requires that crop production increase.

It is suggested elsewhere in this report that one advantage of the SPR is that it is now feasible to get large supplies of high earning crops out of the area quickly enough to market them at peak prices and that with such produce to offer, a larger international market than RSA might be catered to.

Should this be so, Lesotho might earn enough foreign exchange to purchase necessary inputs from the international markets beyond RSA, or might aim to produce more of these, or more consumer goods itself. In any case, it may be possible that with irrigation, fertilization and skilled farming, food production could actually increase four times.*

As mentioned earlier, food production has decreased considerably in recent years due to the drought.

Certainly, the SPR cannot, by itself, bring such development and independence about, but it can make a great contribution toward achieving that independence by speeding transport of goods, services and people.

D. Recommendations

The road should be considered as functioning now and its exploitation for improving life and the economy in the area should be maximized without waiting for further improvement.

One way to do this is not to cut its potential by creating stumbling blocks such as long wait for credit - to capable and responsible citizens who are eager to take advantage of possibilities opened by the road. Such as intensive cultivation of high priced cash crops.

Another way to do this is to use the road as a way to bring services and even amenities to rural communities which could not otherwise afford them.

A third way is to enlarge the SPRP zone of influence by encouraging the building by people who wish to reach the road through simple feeder roads. This is being done spontaneously in certain areas of the road. In other areas feeder roads and small bridges are being constructed through Food for Work programs.

E. Evaluation of Social Impact of the SPRP

There is no doubt that in many ways the quality of life of people in the SPR area has been enhanced by the opportunity for easier transport of people and things that the improved road offers. There are many ways in which this socially beneficial influence of the road could be maximized with no further money spent on the road.

On the other hand, traffic on the road does not seem unduly heavy, reinforcing the idea that the road as it exists now, could be used to serve the people in many more ways than it currently does.

It is also true that for many people of the are the road has become a symbol of national unity and national pride and this factor should be taken into consideration when decisions are made as to whether to continue the road to its originally planned end.

In sum, the road has assuredly increased socio-political-economic national integration of the people in the area. And the political situation it was designed to protect the area from - the need to insure against economic problems due to border closure - has not gone away.

It is therefore to be expected that both the GOL and the people of the SPRP area will be greatly disappointed if the project is aborted.

F. Lessons Learned

It would seem that much more advantage could be taken of opportunities opened by improvement of the SPR - as far as it goes - than is presently being done.

It has been pointed out in earlier evaluations that no true baseline data collection for the SPRP had been done. It is suggested here that a social possibility study at the planning stage of a road project and at appropriate stages of its implementation - might suggest specific ways in which to maximize social benefits of a road. Such a study might include examination of ways in which other similar roads, world/wide have facilitated socio-politico-economic development of an area.

G. Possible Scenarios Projected to the Future

1. Should the improvement of the road stop at the point it has reached as of now?

It is clear that the approximately half section of the SPR which has already been upgraded has facilitated transport in the southern and southeastern regions of Lesotho considerably. It can be projected that the use of the road for taking people and goods from the region to the rest of Lesotho, and bringing people and goods from the rest of Lesotho will continue and gradually expand as the opportunities afforded by the improved road are taken

advantage of by more people.

As suggested throughout this section of this evaluation report, many more ways of using the road could be taken advantage of - and probably will. The social, economic and political benefits of the road will continue, and grow.

2. Should the road be continued to its original goal, Qacha's Nek?

For the area now served by the road, the scenario will probably not be very different from scenario 1, above, but - just as impact of the road extends beyond its present point - completion to Qacha's Nek should extend its area of benefits far beyond that point.

Continuation of the road to Qacha's Nek would also decrease dependence on RSA, because there is evidence that at Qacha's Nek, much transport is still diverted to RSA through border points convenient to Qacna's Nek. Should the road be improved from Qacha's Nek all the way to its beginning, thereby rendering transport easy all the way to Maseru. It can be anticipated that export from and import to Qacna's Nek would be more frequently by domestic road to and from Maseru than by international road eith to Maseru or RSA. This would reduce dependence on RSA not only of the SPR area, but of Lesotho generally.

VI CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

The recommendations included in each section of this report are restated in abbreviated form in this chapter. They are concerned with three general areas. The technical recommendations are based on the actual road as it is now constructed, and the brigade that is constructing the road. The economic recommendations concern the requirement to gather better data needed for the impact and economic analyses primarily for the highway network in the project area, but the recommendations are valid for the entire Lesotho Highway system. The social recommendations are based on the impact of the project road on the immediate area and how that road can be utilized to provide even more social and institutional benefits.

The evaluation team's major conclusion, based on engineering and economic considerations only, is that the project road will service the needs of the area without the commitment of additional funding at this time. Committed GOL and USAID funds are already available for the 1986 construction season. The team believes that the road can be finished in all respects beginning at Quthing and including 41 Km of Title III, section 1 to Mt. Moorosi; 36 Km of Title II, the cut-off to Mphaki; and 12.6 Km of Title III, section 2 beyond Mphaki using already committed funds. The remaining 89 Km to Qacha's Nek, in the evaluation team's assessment, is suitable for the traffic expected in the near future if adequate maintenance is provided for that portion of the route. Any remaining committed funds not expended in the construction program should be redirected to improve maintenance capabilities.

The evaluation team also concludes that certain institutional issues must be addressed to assure that:

a. this road continues to be maintained to the extent necessary to keep it in its current condition;

b. future construction investments can be properly evaluated and their impacts better identified; and,

c. the social impact of this and future roads be maximized.

A precise assessment of the road and of its impact on its zone of influence is impossible because of the variations in construction materials, verifiable economic evaluation tools, and a proper economic and social baseline study. Many of the institutional issue recommendations included in the next section are directed at preventing such circumstances from occuring in the future.

B. Recommendations

1. Technical Recommendations

a. Erosion control measures should be reinvestigated where culverts have altered natural channel slopes.

b. A comprehensive geometric criteria for this route should be formalized before investing in further construction towards Qacha's Nek.

c. Further development of suitable standards for road gravels and further investigation of the existing standards for DBST surfacing should be undertaken to insure further construction will result in lower maintenance costs.

d. The TA team should be utilized to finish the construction now underway.

e. The GOL should provide counterparts for the TA team as soon as possible.

f. If a TA team is required for the next construction stage, it should include a Field Construction Superintendent.

g. The project's current survey methodology should be implemented with a less demanding surveying methodology for construction control.

h. USAID should encourage and assist GOL to face an expansion in maintenance capabilities, especially with regard to preserving the investment in this project.

2. Transport Economics Recommendations

a. The following evaluation parameters should be generated by the Roads Department:

(i) road inventory;

(ii) vehicle operational characteristics;

(iii) financial and economic vehicle operating costs for all types of vehicles used in Lesotho with cost/speed relationships on all types of road surface and conditions; and

(iv) sufficient traffic counts to properly evaluate seasonal variations and additional traffic generating data such as demographic characteristics, gross domestic product, income and income distribution, passenger and freight costs, and similar information on competing transport modes for use in projections and planning.

b. Measures should be considered to assure access to the residents isolated by the Cut-off and to include them in any future development projects.

c. The project road should be maintained in its current state to encourage furtner development within its zone of influence.

d. USAID and GOL should include an economist in any future baseline socio-economic surveys to assess all quantifiable benefits in monetary terms.

e. USAID should encourage and assist GOL to build their traffic institutional management capability.

f. Previous studies should be updated when there is a time lapse between the study and the project's implementation or before beginning subsequent phases of a staged construction project.

3. Social Recommendations

a. GOL should expand the zone of influence of the project road by building feeder roads to reacn more of the population.

ANNEX NO 1

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ANNEX NO 2

Gravel Surface

A. Generic Gravel Definition

In order to clarify the concepts of gravel surface design for the non-technical reader, and to define the usage of technical terms in this evaluation report for the technical reader, this brief explanation of the concept of gravel surfaces is included as an annex. The theory is somewhat simplified herein for the non-technical reviewers.

For this discussion, soil can be divided into three general classifications: (a) coarse-grained soil; (b) fine-grained soil; and (c) highly organic soil. The third classification is commonly known as peat or muck in the US, is not a suitable road building material, and is not a factor here because it is excluded as a gravel surface component. It will not be furtner addressed.

Soil samples containing more than 50% visible particles excluding large stones, are termed coarse-grained soils. This visible soil division falls between fine sand and silt. Fine sand does not fit down into the crevices of your "finger prints", silt and clay do. Fine sand feels sharp and gritty, while both silt and clay soils, when dry, feel soft and smooth like flour. The difference between sands and silts is important because sands are free draining and stable while smaller sized soil components impede drainage, are unstable, and are difficult to compact.

In a soils evaluation the division between fine sand and silt, or between coarse-grained and fine-grained material can be determined by using a 0.075 mm British Standard (BS) sieve. The Road Design Standards (RDS) of Lesotho include this sieve size in their gravel standards. If more than 50% of the soil sample passes through that sieve size, the soil is classified as a fine-grained material in spite of the classification of the material that is retained on that sieve.

If more than 50% of the sample is retained on the 0.075 mm BS sieve, the soil is called coarse-grained. Coarse-grained material can be further subdivided into sand or gravel. The 5 mm sieve can be used to make this distinction. When more than 50% of the coarse-grained portion of a coarse-grained soil passes through the 5 mm sieve the sample is classified as sand. If more than 50% of the coarse-grained portion of the coarse-grained soil is retained on the 5 mm BS sieve, the entire sample is classified as gravel.

The generic definition of gravel as used in this annex therefore includes any soil containing no organic matter and meeting the following requirements after the large stones are removed: (a) less than 50% passes the 0.075 mm BS sieve; and (b) more than 50% of the material that does not pass the 0.075 mm BS sieve is also retained on the 5 mm BS sieve.

B. Road Gravels

A wide range of material can consequently be termed gravel. Much of it can have characteristics that make it unsuitable for a road surface structure. Therefore, engineers modify these generic gravel parameters to try to specify only road gravels that offer strength in both wet and dry conditions and offer suitable traction in both conditions. Suitable traction is not present if the road surface becomes slippery when wet, i.e., the fine-grained soil characteristics prevail, or when the sand size particles dominate, i.e., the surface is loose in a dry state. When a disproportionate amount of gravel size particles are included, the road surface becomes very rough. The modifications necessary to produce a suitable road gravel under the anticipated conditions become the specifications for an all-weather road gravel material.

These modifications take two major factors into consideration. The first is strength. Putting aside many technical considerations pertaining to the specific types of gravel sources, i.e., the geological history that results in various types of gravels such as basalt or dolerite gravels, strength is developed by designing a road gravel that meets certain gradation and other standards. Coarse-grained material depends on mechanical interlocking for strength and surface durability under traffic. The more particles that are available to interlock, the stronger the layer of road gravel. The ideal road gravel would, therefore, be very dense and include just enough smaller particles to fill in the spaces between the bigger particles, thereby maximizing the interlocking faces. Of course, such ideal road gravel seldom occurs

naturally, nor is it possible to manufacture such ideal road gravel in any quantity.

Engineers instead specify an envelope of gradation requirements for road gravels. This grading envelope specifies some number of decreasing size sieves with an allowable range of the gravel sample permitted to pass each suceeding sieve. For example, if 55% to 80% of the material must pass through the 10 mm BS sieve size, any sample in which less than 55% or more than 80% of the material by weight passed through the 10 mm sieve would fall outside of the envelope. This approach permits an approximation of the strength of a given thickness of a layer of road gravel graded witnin the envelope. Knowing the required strength parameters, the engineer can determine the thickness of a road gravel layer that will satisfy the anticipated traffic loadings over the design life of the road surface.

As mentioned earlier, generic gravel can contain up to 49.99% of material that passes the 0.075 mm BS sieve. This material was termed fine-grained material. Fine-grained materials in general rely on cohesion for strength. However, the choesive characteristic is present only in the clay portion of the "fines" as a molecular attraction between dry particles of clay. As a result of this cohesive characteristic, dry clay is very hard but its surface cracks as the volume of the clay decreases during the drying process. When the same clay gets wet, it

swells and looses its cohesive properties, becoming slippery and eventually softening and rutting under traffic as the water content continues to increase.

The presence of a small portion of fines in a road gravel surface helps to retain moisture during dry spells because it retards evaporation, reduces dusting and prevents the smaller sized course-grained materials from being sucked out by passing vehicles or by the wind. Consequently, road gravel surface layers usually include from 5% to 15% or more of material passing the 0.075 mm BS sieve to reduce surface deterioration during the dry season.

Gravel base courses i.e., the layer of gravel under a water proof membrain such as a double bituminous surface treatment, (DBST), do not need these cohesive fines to prevent deterioration during dry periods since the DBST itself prevents evaporation. The DBST layer over a gravel base provides no additional strength, its purpose is to prevent erosion, ravelling and water intrusion thereby reducing maintenance costs and vehicle operating costs. Fines in a base course tend to collect water which cannot evaporate because the gravel is covered by a moisture proof barrier. This water eventually softens the base coarse causing it to weaken and possibly swell. Consequently, even though the grading envelope for gravel surface and gravel base could be exactly the same for the interlocking sizes, the fines portion of the base must be reduced. Recent research indicates that the most current specifications for gravel road base coarse material, the 0.075 mm BS sieve size envelope is 0% to 5%.

C. Lesotho Gravel Standards

The Road Design Standards (RDS) of Lesotho call for many additional requirements in a gravel pavement structure. These are necessary because the local road making materials are low grade (i.e., weathered basalt and dolerite gravels, and sandstone). Lesotho's specifications are far superior to those in many third world countries.

The material on which the bottom layer of a road pavement is placed is called the sub-grade. The RDS pavement specifications require the sub-grade to meet a minimum CBR value (California Bearing Ratio, i.e., a strength indicator), maximum PI and LS values (Plasticity Index and Linear Shrinkage, i.e., fine-grained soils' indicators), and to be compacted to a specified density before the pavement materials are placed.

The RDS require a sub-base when a standard thickness (150 mm) of gravel base course (layer) or surface course is not sufficient to absorb the expected traffic loadings. Sub-base material is less expensive than an equivalent thickness of base course material. Its purpose is to further reduce the anticipated traffic loading transmitted to the sub-grade. Consequently, it must be better material than the subgrade but does not require the engineering characteristics of a road gravel course because it is not subjected to the same loading intensities. The Lesotho RDS therefore, require a higher minimum CBR and a lower PI in a sub-base material than in a sub-grade material. In addition, a minimum GM (Grading Modulus, i.e., an indicator of the coarseness of the sub-base material) is specified. Proper compaction is required but no grading envelope is imposed.

The requirements for the subgrade and sub-base are to insure the proper conditions exist so the engineering properties incorporated in the base or surface road gravel layer will function as anticipated. The Road Design Standards call for 150 mm layer of road gravel with a high CBR requirement, a specific PI range, a low LS maximum and a maximum LL (Liquid Limit, i.e., a fines' characteristics indicator). In addition a grading envelope is specified including a maximum size of coarse-grained material to be allowed. The maximum size limitation helps to control the smoothness of the finished surface. If a natural gravel deposit that meets these requirements can not be found, the RDS requires blending, i.e., mixing materials from different deposits, crushing the gravel to manufacture a material that fits within the grading envelope, or chemical stabilization. This project anticipated use of rock crushers to produce road gravel.

D. A Comparison of Road Gravel Specifications

It would be unwarrented to condemn the current RDS base coarse gravel specification because it contains too much fine-grain material although current technology indicates that the amount of fines in base coarses under DBST surfaces is more critical than previously thought. Instead Table 1 has been prepared to show the trend of Leostho's change in road gravel specifications and to make better comparisons with earlier US specifications for road gravels.

In 1980 the Lesotho standards specified a single gravel requirement for both base and surface road gravel as indicated in Table 1 (column 4). The maximum size particle had to pass the 19 mm (3/4" sieve). Compared to tne US specifications for either base (column 5) or surface (column 6) material with the same maximum particle size, Lesotho's gravel envelope allowed or required a significantly larger portion of fines. It was reported that Lesotho's road gravel was causing concern and was often stablized with cement or lime. It should be noted that the minimum clay content for stabilizing soil with lime is often considered as 10%, the minimum fines content in the RDS gravel. It should also be noted that the US specifications required a minimum of 5% fines and permitted more fines in the base than the surface material. While the US specification tied tne total amount of fines (passing the 0.075 mm sieve) to the amount passing tne number 40 sieve, this fines content of base course material is now considered excessive. Many gravel base course specifications now indicate 0-5% passing the 0.075 mm sieve as ideal but note that 0-10% passing is acceptable because of practical constraints. The same specifications require a minimum of 5% passing for surface gravel even if the fines must be added.

By 1982, the Lesotho RDS for the project road indicated that a larger size of granular material (column 8) was acceptable, 37.5 mm vrs. the previous 19 mm. The gravel was for base course use and the fines content was similar to the US base course requirements (column 10) with the same maximum size limits although Lesotho had switched to British sieve sizes. The US envelope appears to accept a slightly greater amount

of course material and uses an addition 1 inch sieve requirement not included in the Lesotho RDS. It would appear that the newer Lesotho specifications were intended to provide a stronger base course using larger stone sizes to gain more mechanical strength.

However, if we compare the larger permissable passing size US specifications in Table 1 with each other, the base (column 10) and surface (column 11) gravel as published in 1961 show significant differences. The US preferred a smaller maximum size for their gravel road surface to improve rideability. However, the envelope segment used to determine plasticity (everything passing the no. 40 sieve) is much higher as is the amount of fines passing the number 200 sieve. Simply put, the surface material has more filler and adhesive than the base material. The Lesotho Roads Department might consider the feasibility of designing a new road gravel surfacing envelope and its auxiliary requirements if they are not fully satisfied with their current gravel surfaces.

TABLE 1 GRAVEL ENVELOPES (Percentage Passing)

U.S. Sieves	mm Equivalent	Lesotho Sieves	1980 Lesotho[1]	1961 US Base "E-1"	1961 US Surface "C"[2]	Cut-off	Title III 8/82[3]	Lesotho Specs 10/83[4]	1961 US Base "C-1"	1961 US Surface "E"
1 1/2"	38.1									
		37.5							100	
1"	25.0					100	100	100		
		20.0							70-100	100
3/4"	19.0	19.0	100	100	100	80-100	80-100	80-100		
		10.0							60-90	85-100
3/8"	9.5		80-100	---	---	55-80	55-80	55-80		
		5.0							45-75	65-100
No 4	4.75	4.75	60-85	45-80	45-80	40-60	40-60	40-60		
		2.36	45-70						30-60	55-85
No 10	2.00	2.00		30-60	25-60	30-50	---	30-50		
		0.60							20-50	40-70
No 40	0.425	0.425	25-45	20-35	---	15-30	15-30	15-30		
No 200	0.075	0.075	10-25	5-15[5]	5-12	5-15	5-15	5-15	10-30	25-45
P.I.									5-15[5]	10-25
L.L.							4-10	6-9	≤ 6	4-9
L.S.								≤ 25%	≤ 25%	≤ 35%
								≤ 4%		

1] Base and Wearing (Surface) Course

2] U.S. no longer publishes gradation envelopes for surface courses

3] Two alternatives presented, this alternative accepted before base course eliminated

4] General specifications, but specifically mentions Quthing - Qacha's Nek

5] Fraction passing No 200 shall be less than 2/3 of fraction passing No 40

ANNEX NO 3

Cost Evaluation - Km 22.7 to Qacha's Nek

Data Prepared by Technical Assistance Team 18/11/85

Table of Contents

I. SUMMARY OF SCHEME "A":

Refer to Calculation Sheets A-17 - A-26. Construction of approximately 79 km of road from Km 22.7 to Quacha's Nek using the existing fleet. New equipment is to be purchased on an as needed basis to maintain current production should any of the existing fleet become scrap. Note that the cost of the Technical Assistance Contract has not been addressed in this estimate.

Summary of Costs:

A.	Operational Costs 4 years	= 27,800,000	p A-22
B.	One new DL9 Dozer to augment existing earthwork fleet	= 1,190,000	p A-22
C.	New main camp in vicinity of White Hill	= 1,250,000	p A-23
D.	Drainage pipe	= 3,193,000	p A-24
	Subtotal	= M33,433,000	
E.	Add 25% contingency to account for uncertainty of earthwork and drainage schedule and Rand/US$ exchange rate	= 8,358,250	
	Total Cost	M 41,791,250	
F.	The average cost per Km using 79 Km	= 529,003.16	
	Say	M 530,000/Km	
G.	From Page A-26, the cost of maintenance from Qutning to Quacha's Nek is projected to be	= M 1,963,000	

II. SUMMARY OF SCHEME "B":

Refer to Calculation Sheets A-27 - A-31. Construction of 79 Km of road from Km 22.7 to Qacha's Nek is to be done by augmenting the existing equipment so that two equipment spreads can be used to complete construction in approximately 2 1/2 years. As per Scheme "A", the TA contract has not been included in the estimate.

Summary of Costs:

		MALOTI
A.	Operational costs 2 1/2 years	= 21,820,000
B.	New equipment	= 10,372,000
C.	New Main Camp in area of White Hill	= 1,309,000
D.	Drainage Pipe	= 3,193,000
	Subtotal	= 36,694,000
E.	Add contingency of 25%	= 9,173,500
	Total Cost	= M 45,867,500
F.	The average cost per Km using 79 Km	= M 580,601/Km
	Say	M 581,000/Km
G.	From Page A-31, the cost of maintenance from Quthing to Qacha's Nek is projected to be	= M 1,260,000

III. SUMMARY OF GRAVEL & DBST COSTS:

YEAR	GRAVEL BASE M/KM	DBST M/KM
1986	46,170	16,085
1987	53,095	18,500
1988	61,060	21,270
1989	70,220	24,460
1990	80,750	28,130

M = MALOTI

Scheme "A" - Estimate the costs of constructing the road from Km 22.7 to Quacna's Nek using the existing equipment and only augmenting with new equipment as required to maintain the current rate of production. Estimated construction time is 4 years starting 1 January 1987.

a) From the financial reports

		MALOTI
Expenditures	30 Sept. '85	= 7,686,817.90
"	31 Dec. '84	= 5,049,324.87
	Difference	= 2,637,493.03
Ave cost/mo (9 mos.)		= M 293.055

b) Compare the cost per month in 1984 to 1985

Expenditures	31 Dec. 1984	= 5,049,324.87
"	31 Dec. 1983	= 2,260,494.38
		2,788,830.49
Average cost/mo (12 mos)		= M 232,402.54

c) Determine the inflation factor for future work

$$\text{Current Cost Factor} = \text{Average Monthly Expenditure} \quad \frac{1985}{1984}$$

$$= 1.26$$

Considering a) the increased rate of overtime where the earth work crews work on Sunday allow 5% increase in costs over 1984 and b) a 30% increase in labour costs effective January 1985 as mandated by G.O.L. which may not occur again in the life of the project.

c) Determine the inflation factor for future work life of project use an inflation factor of 15%.

d) Estimate the average monthly costs for future work:

YEAR	Estimated Average Monthly Operating Cost - Maloti
1986	337,013
1987	387,565
1988	445,700
1989	512,555
1990	589,438

Note: The above values based upon 1985 costs to date and an inflation factor of 15% compounded annually.

The above monthly costs were determined assuming the operational procedures and equipment fleet currently being used is not augmented except as required to maintain the current rates of production.

e) Estimate the additional equipment's expenses required to maintain the current rate of production using the existing fleet during the period from 1 Janauary 1987 through 31 December 1990. Based on our past experience with equipment having the number of usage hours the current fleet has, a 50% increase in spare part costs and a 25% increase in repair labour costs will be required.

From the financial report, the cost of spare parts from Janauary - September 1985 is as follows:

January	39,122.83
February	12,553.06
March	86,885.50
April	41,747.44
May	31,438.85
June	56,211.57
July	49,195.47
August	66,185.35
September	53,101.53
TOTAL	= 436,441.60

Average Monthly Cost = M48,493.51/Month

Since Barlows has advised a 32% increase in spare parts effective November 1985, assume all vendors will follow suit and increase the current cost of parts by 32%. Then, add an additional 50% to account for the age of the equipment starting 1987.

Therefore, the average monthly equipment parts ADD ON cost would be:

Add on Cost = (48,493.51 x 1.32 x 1.5 - 48,493.51) = M47,523.64

Using an inflation rate of 15% the average monthly cost increase is:

YEAR	EQUIPMENT PARTS COST "ADD ON"
1986	--
1987	62,850
1988	72,277
1989	83,119
1990	95,587

Determine the increased cost of repair labour costs:

Total hourly cost of mechanics, welders and foremen = $^{M}40.69/_{hour}$

Using 195 hours/month, the monthly cost = $^{M}7,934/_{month}$.

With a 25% increase in labour, the "ADD ON" cost is:

Add on Cost = [0.25 (7934)] = $^{M}1983/month$

The average monthly cost increase is:

YEAR	COST/MONTH LABOUR
1986	-
1987	2,623
1988	3,017
1989	3,469
1990	3,990

f) To augment production which will result from the increased frequency of down time, 1 - D9L will be required in early 1987.

The purchase price will be an immediate outlay of cash. Therefore with a mid 1985 price of $US 360,000 a Rand/US$ rate of 0.4 M/US$ and an inflation rate of 15% the 1987 price estimate = $360,000 \times 2.5 \times (1.15)^2$

= M1,190,250

Estimate the operating costs for the D9L assuming the costs are comparable to the Komatsu 355A currently on site:

a) Average hourly cost POL, part & repair labour = M53.22/hours

b) Assume 80% operating time

c) 195 hours per month

Therefore, cost per month 1985 = M8,302.32/M with inflation at 15%:

YEAR	COST/MONTH
1986	-
1987	10,980
1988	12,627
1989	14,521
1990	16,699

Note: Machine does not go on line until Janauary 1987.

g) Summary of operational costs to construct road from Km 22.7 to Qacha's Nek. Using current standard 01 Jan. 1987 - 31. Dec 1990.

YEAR	PROJECTED COSTS: CURRENT COSTS M/MONTH	SPARE PARTS M/MONTHLY	REPAIR LABOUR M/MONTHLY	D A L OPERATIONAL COST M/MONTHLY	TOTAL MONTHLY OPERATIONAL COST MALOTI	NO. MONTHS	ANNUAL OPERATIONAL COST MALOTI
1987	387,565	62,850	2,623	10,980	464,018	12	5,568,216
1988	445,700	72,277	3,017	12,627	533,621	12	6,403,452
1989	512,555	83,119	3,469	14,521	613,664	12	7,363,968
1990	589,438	95,587	3,990	16,699	705,714	12	8,468,568

Total Operating cost = M27,804,204

h) Estimate the cost of additional equipment.

a) Assume the Fiat-Allis 645B loaders are replaced in 1968. Therefore, these costs are not included.

b) Add 1 - D9L with ripper and blade to augment the increased down time for the D-8 dozeres.

c) Purchase, rather than rent, the air track currently on site (rent 172800/mo). Therefore, the purchase cost is already incorporated into the operational costs:

Therefore, total cost of additional equipment = M1,190,250.

i) Estimate the cost of a new base camp located in the area of White Hill. Assume accommodations for expatriate and senior staff is in trailer and prefab units. The tin huts currently being used will accommodate the operators:

a) Senior staff = 24

Use 6 - 4 man port-a-camp units
@ 35,000 each = M210,000

c) Junior staff "40 x 2,500" = M100,000

d) Expatriate staff & family

Use 5 families
Assume accommodations similar to Teer Title II Camp
C M52,500 each = M262,500

c) Site preparation = 200,000

d) Sanitary facilities = 50,000

e) Warehouse & shop w/machine shop = 250,000

f) Radio system = 100,000

g) Electrical system = 50,000

Total = 1,222,000

Say M1,250,000

j) Drainage Pipe

Based upon a materials cost of M550,000 for the first 22.7 Km of section assume similar conditions for the next segment toward Qacha's Nek. Add 500,000 for two large structures in the area of White Hill.

Therefore 1985 cost =

$$\frac{79}{22.7} \times 550{,}000 + 500{,}000 = M2{,}414{,}000$$

Assume purchase in 1987

@ 15% per year = 1.32 x 2,414,000 = 3,192,500

Say M3,193,000

k) Evaluate the maintenance costs:

From September Progress Report, Current Costs Section 1 = M99211 for 9 months. During this time, approximately 8 Km of road was heavily regraded at a cost of approximately M40,000 = M5000/Km.

Therefore, the cost of light regrading and drainage maintenance projected over a 12 month period is
(99211 - 40,000)(12/9)/42K = M1,880/Km.

On the cutoff, the cost of maintenance is significantly different. The gravel section has been regraded 2 times in the past year with drainage clean out as required at an annual cost of M18697/21Km = M890/Km.

Since the sub-base surface and ditchline conditions were in good condition at the time of take over it is anticipated that the annual maintenance cost will escalate by about 50% in 1986. Say M1350/Km.

The DBST maintenance costs are currently M22864/15 = M1525/Km. This is primarily drainage maintenance in those areas where stone ditchlining was subsequently installed and removal of rock slides. Since the stone ditchlining has just recenly been installed and the rock slopes will season, the cost of maintenance on the DBST section should decrease.

Based on existing conditions the anticipated annual maintenance cost is M500/Km of DBST surface. This does not include patching or repair of the DBST surface. As a contingency for the DBST, assume an annual repair cost equal to the current costs say M1000/Km.

To project maintenance costs, use the following criteria:

a) For Section 1, the complete portion of Section 2 and the graveled portion of the Cut-off, use a maintenance cost of : M1500/Km/year (1985)

b) For the DBST Sections of the Cut-off use: M1000/Km/year (1985)

c) Use an inflation rate of 15% to develop the maintenance costs through 1990.

d) Estimate the maintenance costs for each segment fo the road using the average Light Maintenance Cost given on P A-24

PROJECT LIGHT MAINTENANCE COSTS

YEAR	ANNUAL COST PER KM		DBST CUT-OFF	GRAVEL ROAD			ANNUAL COST MAINTENANCE	
	GRAVEL M/KM	DBST M/KM	KM	SECTION 1 KM	CUT-OFF KM	SECTION 2 KM	DBST MALOTI	GRAVEL MALOTI
1987	1984	1323	15	42	21	22.7	19,845	170,029
1988	2281	1521	15	42	21	42	22,815	239,505
1989	2624	1749	15	42	21	62	26,235	328,000
1990	3017	2011	15	42	21	82	30,165	437,465
			TOTAL COSTS			=	M99,060	M1,174,999

e) Estimate the cost of heavy maintenance i.e., ripping, recompacting, adding additional material and regrading the road.

Note: This operation should only be done on an as needed basis. For estimating assume every $2^{1}/2$ - 3 years, use an inflation factor of 15% per year and a 1985 cost of M5000/Km.

PROJECTED HEAVY MAINTENANCE COSTS

YEAR	ANNUAL COST M/KM	SECTION 1		CUT-OFF		SECTION 2		ANNUAL COST
		KM	COST	KM	COST	KM	COST	
1987	6,613	--	-----	--	-----	--	-----	- 0 -
1988	7,604	42	319,368	21	159,684	--	-----	479,052
1989	8,745	--	-----	--	-----	12.5	109,313	109,313
1990	10,057	--	-----	--	-----	10.0	100,057	100,570
					TOTAL COST		=	M688,935

From P A-24 - A-25, the total estimated cost of maintenance from Qutning to Qacha's Nek for the period from 01 January 1987 to 31 December 1990 is as follows:

1 Gravel
Light Maintenance = M1,174,999

Heavy Maintenance = M 688,935

2 DBST = M 99,060

Total Cost = M1,962,994

Say = M1,963,000

2. Scheme "B" - Estimate the cost of construction the road from Km 22.7 to Qacha's Nek using essentially two equipment spreads. The spreads would be developed from the equipment currently on site and the additional equipment listed in S.T. Koff's memo to Lloyd Crowther dated 14 November 1985. The basic operation envisioned is to construct the Base Camp near White Hill and start construction from the Base Camp toward Qacha's Nek and back toward Km 22.7. For reference, White Hill is approximately mid way between Km 22.7 and Qacha's Nek.

Based upon a review of the total equipment that would be available under the above conditions and considering the original estimate of time required to complete the operation using Scheme "A", it is our opinion that it would take approximately $2\frac{1}{2}$ years to complete the road to current standards (sub-base only) starting on 01 January 1987. Therefore, the time frame of this scheme is from 01 January 1987 to 31 June 1989. The methodology used to develop costs for this scheme will be similar to those used for Scheme "A".

a) Develop the operational costs:

Since the two equipment spreads will both be approximately the same size as the current fleet assume that the direct cost for operations will be two times the current level and that overhead will remain the same. However, the assumed increases for the costs of spare parts and repairs would only be valid for the old equipment. Therefore, the operational costs would be as follows (refer to p A-22 of calcs. Use same inflation rate).

At this time the overhead factor is approximatley two based upon the site costing system used on site. Therefore, the cost of overhead and the direct operational cost are equal, to (0.5)(293,055) which is M146,527.50. As a result, the projected 1985 base cost of Scheme "B" follows:

Base = 2 x direct + overhead

= 293,055 + 146,527.50

= M439,582.50/month which is 1.5 times the projected current costs shown on p A-22 of these calcs.

The operational costs for Scheme "B" are as follows based upon a fleet factor of .5:

YEAR	PROJECTED COSTS: CURRENT COSTS M/MONTH	FLEET FACTOR	ADJUSTED CURRENT COSTS M/MONTH	SPARE PARTS M/MONTH	REPAIR LABOUR	TOTAL MONTHLY OPERATIONAL COSTS	NO. MOS	ANNUAL OPERATIONAL COSTS M
1987	387,565	1.5	581,348	62,850	2623	646,820	12	7,761,846
1988	445,700	1.5	668,550	72,277	3017	743,844	12	8,926,128
1989	512,555	1.5	768,833	83,119	3990	855,942	6	5,135,652

Total operating cost = M21,823,626

b) Estimated cost of additional equipment:

Based upon data received from various vendors the total cost of the equipment listed in S.T. Koff's memo to L. Crowtner is M7,842,700 = F.O.B. RSA

(See page A-29)

The costs would be compared with prices from United States vendors including transportation changes to the work site.

Considering a 15% inflation factor, the FOB Bloemfontein prices are projected to be M10,372,00 by 01 January 1987.

Equipment required to implement Scheme "B" per telex & telephone conversations with various vindors in RSA: October 1985 prices:

ITEM NO.	DESCRIPTION	UNITS REQ'D	UNIT COST MALOTI	TOTAL COST MALOTI
1.	DL9 Dozer (CAT)	2	900,000	1,800,000
2.	966-D Front end loader (DAT)	1	350,000	350,000
3.	950-B Front end loader (Wright)	2	162,500	325,000
4.	14-G Grader (CAT)	2	391,000	782,000
5.	215 Back hoe (CAT)	1	195,000	195,000
6.	815 Compactor (CAT)	1	312,500*	312,500
7.	CP-22 Pneumatic roller (Dynopac)	1	200,000*	200,000
8.	CM-350 Air track (IR)	2	79,300	158,600
9.	750 CFM Compressor (IR)	2	80,800	161,600
10.	Rock-dump trucks 10 -16 M^3	3	440,000**	1,320,000
11.	GP-dump 10 - 12 M^3	8	275,000	2,200,000
12.	Pick-ups 4x4	4	9,500 -	38,000
			E =	7,842,700

* Assumed prices

** The CAT D25C articulated truck which is too large has a cost of 17,505,400. Assume smaller truck at = 15% less cost.

c) Drainage pipe

Same as Scheme "A" (see pg A-24) = M_3,193,000

d) Estimate the cost of the Base Camp:

Since the Senior Staff will be augmented with four (4) additional foremen to supervise the second equipment spread and approximately 25 operators, one additional port-a-camp and 12 tin huts will be required.

The estimated additional cost is

a)	1 port-a-camp	= M 35,000
b)	12 tin huts @ 2000	= 24,000
	Subtotal	= 59,000
c)	Scheme "A" cost	= 1,250,000
		M1,309,000

e) Maintenance costs Scheme "B":

Since Scheme"B" construction will be completed by 17.0 1989. The cost of maintenance will be as follows:

PROJECTED LIGHT MAINTENANCE

YEAR	ANNUAL COST PER KM		D B S T CUT-OFF KM	GRAVEL ROAD SECTION 1 KM	CUT-OFF KM	SECTION 2 KM	ANNUAL COST MAINTENANCE	
	GRAVEL M/KM	DBST M/KM					DBST	GRAVEL
1987	1984	1323	15	42	21	22.7	19,845	170,029
1988	2281	1521	15	42	21	55	22,815	269,158
1989	1312	875	15	42	21	72	13,125	177,120
					Total cost	=	55,785	616,307

The heavy maintenance shown on P A-26 for Scheme "A" through 1989 is valid for Scheme "B". Therefore, the estimate cost of heavy maintenance is M688,422 less the 1990 costs:

Therefore, heavy maintenance = M588,365

The total estimated cost of maintenance from Quthing to Qacha's Nek for Scheme "B" is as follows:

1. Gravel Sections:

Light maintenance	=	M616,307
Heavy maintenance	=	M588,365
2. DBST	=	55,785
Total cost	=	M1,260,457

3. Estimate the costs of placing crushed gravel base and DBST. Use the report developed by E. King Engr., (SPR) as a base:

a) Gravel base course costs:

The estimated cost of crushed gravel base (Aug. 1983 = $M32.68/M^3$

Therefore, volume per Km:

Average width = 6.5^M

Deptn = 0.15^M

Therefore, 1983 cost = $(32.68\ ^M/_M3)(975M^3) = {}^M31,863/Km$

This price includes the quarry operation, crushing and a median haul distance of approximately 13 Km.

Assuming a 26% increase between August 1983 and October 1985 and a projected inflation factor of 15% the projected costs per Km are as follows:

YEAR	COST/KM
1986	46,170
1987	53,095
1988	61,060
1989	70,218
1990	80,751

Costs are in Maloti

The costs per Km do not include start up costs and approximately 5 relocations which will cost approximately $M550,000. Equipment to operate the quarry and crusher would be scheduled out of the expanded fleet outlined in Scheme "B".

b) DBST costs:

The August 1983 estimated cost of DBST per King report is as follows:

ITEM	COST/M^2
Prime	0.40
Bitumen, 2 seals	0.45
Chips	1.00
Total =	M 1.85/M^2

Therefore, with a 6 meter wide carriage way, the estimated cost in August 1983 was

$$\text{Cost/Km} = 6(1000)(1.85)$$

$$= M11,100/\text{Km}$$

Using the same cost projection assumptions given for gravel base, the project cost/Km for DBST are as follows:

YEAR	COST/KM (MALOTI)
1986	16,084
1987	18,496
1988	21,271
1989	24,462
1990	28,131

Gravel required = 165,000 M^3

19 mm = 20,000 M^3

7 mm = 7,000 M^3

Total = 192,000 M^3

Say 200,000 M^3

WT = 1.96 ton/M^3 (200,000) = 392,000 tons

Estimated production time:

Crusher capacity = 70 T/hr maximum

Assume 74% capacity

Therefore, at (8hrs/day)(49 tons/hr)

Total time = 1000 days/245 days/yr = 4 years single shift

Six set-ups at 4 weeks each = 24 weeks - Say 6 months.

Preliminary Information WJC 19/11/85

ANNEX NO 4

REGION (SOUTH)

TRAFFIC COUNT FIGURES

STATION NAMES	1983		1984		1985		1986	
	Count 1	Count 2	Count 1	Count 2	Count 1	Count 2	Count 1	Count 2
MOTSEKUOA Daily Averages			234	237	243			
MAFETENG MARKET		314	508	530	536			
TSA-LITLAMA			552	584	581			
HA LEBENTLELE			558	534	597			
HA QABA		198	50	54	61			
SEPHAPO'S GATE		71	67	68	66			
MOHARANE		65	109		93			
HA TSEPO		134	186		186			
HA POTSANE			798	721				
MAKHALENG BRIDGE		173	154					
MESITSANENG		265	100					
VILLA MARIA		289	542	417	665			
HA NTHO		143						
MOYENI		157		525	595			
TELE BRIDGE		129	117	165	148			
MT. MOOROSI			295	281	311			
MPHAKI		30	53	41	101			
WHITE HILL		118	57	58	62			

REGION (SOUTH) CONT.

TRAFFIC COUNT FIGURES

STATION NAMES	1983		1984		1985		1986	
	Count 1	Count 2	Count 1	Count 2	Count 1	Count 2	Count 1	Count 2
MPITI								
Daily Averages		71	99		133			
WATERFALL		48	38	55	54			
RAMATSELISO'S GATE		23	16	24	27			
SEHLABATHEBE		24	37	42	79			
RAMOKOATSI		698			741			
RAMOHAPI								
QOMOQOMONG			655					

ANNEX NO 5

KINGDOM OF LESOTHO MINISTRY OF WORKS ROADS BRANCH MAINTENANCE MANAGEMENT SYSTEM

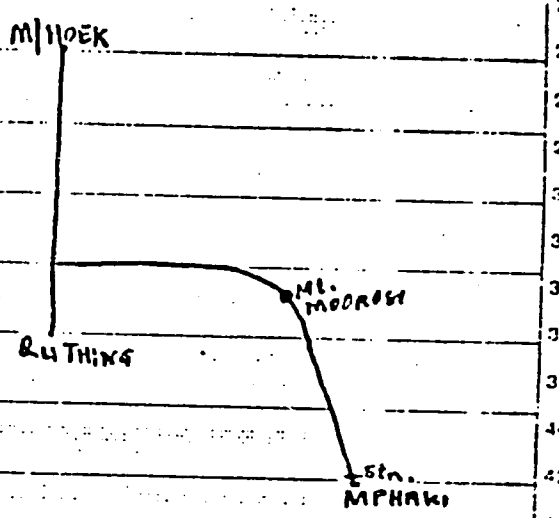
MANUAL TRAFFIC COUNTS

STATION MPHAKI(100415) MAY 1984 7 - 13 MAY 1984

THE NUMBER OF DAYS IN PERIOD: 7

DAILY NUMBER OF VEHICLES

	LV	MV	BS	HT2	HT3	TOT
DAY 1	12	17	0	10	0	39
DAY 2	13	17	1	8	0	39
DAY 3	12	29	1	11	0	53
DAY 4	11	18	1	15	0	45
DAY 5	16	9	3	9	0	37
DAY 6	17	7	3	4	0	31
DAY 7	22	14	2	2	0	40
TOTALS	103	111	11	59	0	284
DAILY AVERAGES	15	16	2	8	0	41
PERCENTAGES	36	39	4	21	0	99



light vehicles:*****,medium vehicles:>>>>>,buses:+++++,two-axle heavy trucks:<<<<<,three-axle heavy trucks:&&&&&

program manugraf/wkl

KINGDOM OF LESOTHO
MINISTRY OF WORKS
ROADS BRANCH

TRAFFIC

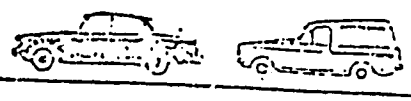
Pavement Management System
Full Name

MANUAL COUNTING FIELD SHEET

REGION		ROAD NUMBER		STATION	Name:	Code:
	South		A4		Mphaki	

Prepared by:	Date:	Direction:	Time period:
	15-21/2/85	ADT	

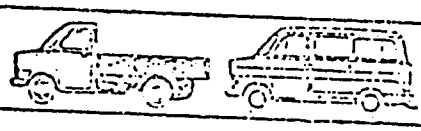
Light Vehicles (A)



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100

53

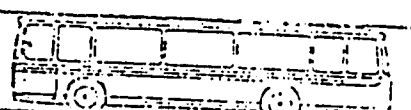
Medium Vehicles (B)



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100

32

Busses (C)



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80

ANNEX NO 7

TRANSPORT INVESTMENT AND IMPACT ANALYSIS

GUIDELINES ON ASSESSMENT OF QUANTIFIABLE BENEFITS

A. General

Although a substantial amount of work has been done in the area of evaluating transportation investment impacts on economic development, relatively little of this work has focused on the contribution of transport investment to meeting basic human needs or the social impact of such investments. The fact that little research has been done by no means shows that transportation has little effect on meeting basic human needs. Rather, it points out the need for systematic project evaluation to identify such impacts.

Practically all of the impact research identified in the past 20 years relates to roads rather than to ports, shipping, rail or air transportation. Subjects range from major highways to feeder roads in rural areas. Some studies address the impacts of roads alone on rural development; others are concerned with integrated rural development projects where roads are one component of a package input.

From 1963 to 1967, USAID sponsored a Transport Research Program at Brookings Institution, focused on the relationship of transport investment to development and social benefits. Many studies were carried out since then, and particularly in Africa, India, South America and Southeast Asia.

Social impact evaluation studies covered the following parameters:.

Changes in Economic Characteristics:

- Transportation and Services
- Production/Prices
- Marketing Practices
- Average Gross Income/Distribution
- Economic Enterprises & Establishments
- Energy
- Employment

Changes in Social Characteristics:

- Population Mobility
- Education Services
- Health Services
- Government Services Availability
- Recreational Facilities
- Communications and media
- Environment

The impact analysis must be based on surveys and "based-line" data collected:

- Before Commencement of the Project
- On the Completion of the Project, and
- At full Development

B. Benefits and Beneficiaries

The benefits considered in the evaluation of the impact studies include: (1) Road User Benefits and (2) Non-user Benefits.

Road user benefits result from improvements to the road of an area represent a gain to the user both in terms of lowering operating cost per kilometer and reducing trip cost and time by means of a shorter road distance (e.g., a reduction in travelled distance), or surface improvement. All these benefits are quantifiable in monetary terms.

The non-user benefits accrue either directly or indirectly as a result of road improvements. Non-user benefits impact the entire community whereas use benefits accrue only to road users. Non-user benefits are less readily perceived and lend themselves to quantitative analysis.

It is generally recognized that non-user benefits impact different segments of society in slight varying ways, and are best understood when treated as:

- Commercial benefits
- Community benefits
- Regional benefits

1. Commercial Benefits are those economic benefits which result either directly or indirectly from road improvement. Direct impacts may be realized in the form of lower freight rates, reduced transit time, or increased transport dependability. Indirectly, commercial benefits often result because a road improvement project expands a market area - more people are within a reasonable driving time of a commercial outlet. Road improvements may also be a catalyst for increased tourism and other social or recreational activities; many businesses could be favorably impacted as a result. Expansion of industry can also be ennanced by road improvements; this could increase employment thereby impacting the commercial sector in a major way.

2. Community Benefits are more aestnetic in nature and very difficult to quantify. They accrue to the community as a whole rather than to individual elements of it, and include improved access, increased mobility and less congestion. These factors generally affect the quality of living in a positive way. Other community benefits which may accrue include an improved tax base, increase in land values, or an increase in the effectiveness with which protective public services can be rendered.

3. Regional Benefits extend beyond the immediate community impact area; they too are difficult to quantify. Road improvements are said to enhance or cause population dispersion; this could be

favorable or not, depending on growth goals and objectives. This phenomenon could in turn decrease congestion, raise land values, and increase employment. Other regional benefits include expansion of recreational activities and more intense utilization of natural resources. The impact on transport operators, shoppers, sellers and commuters is graphically presented in Figures A, B and C.

C. Data Collection and Analysis

It is necessary to develop an economic, social, and transport profile before and after the project completion. The profiles will cover the road area and the zone of influence. The following will be covered in each of the profiles:

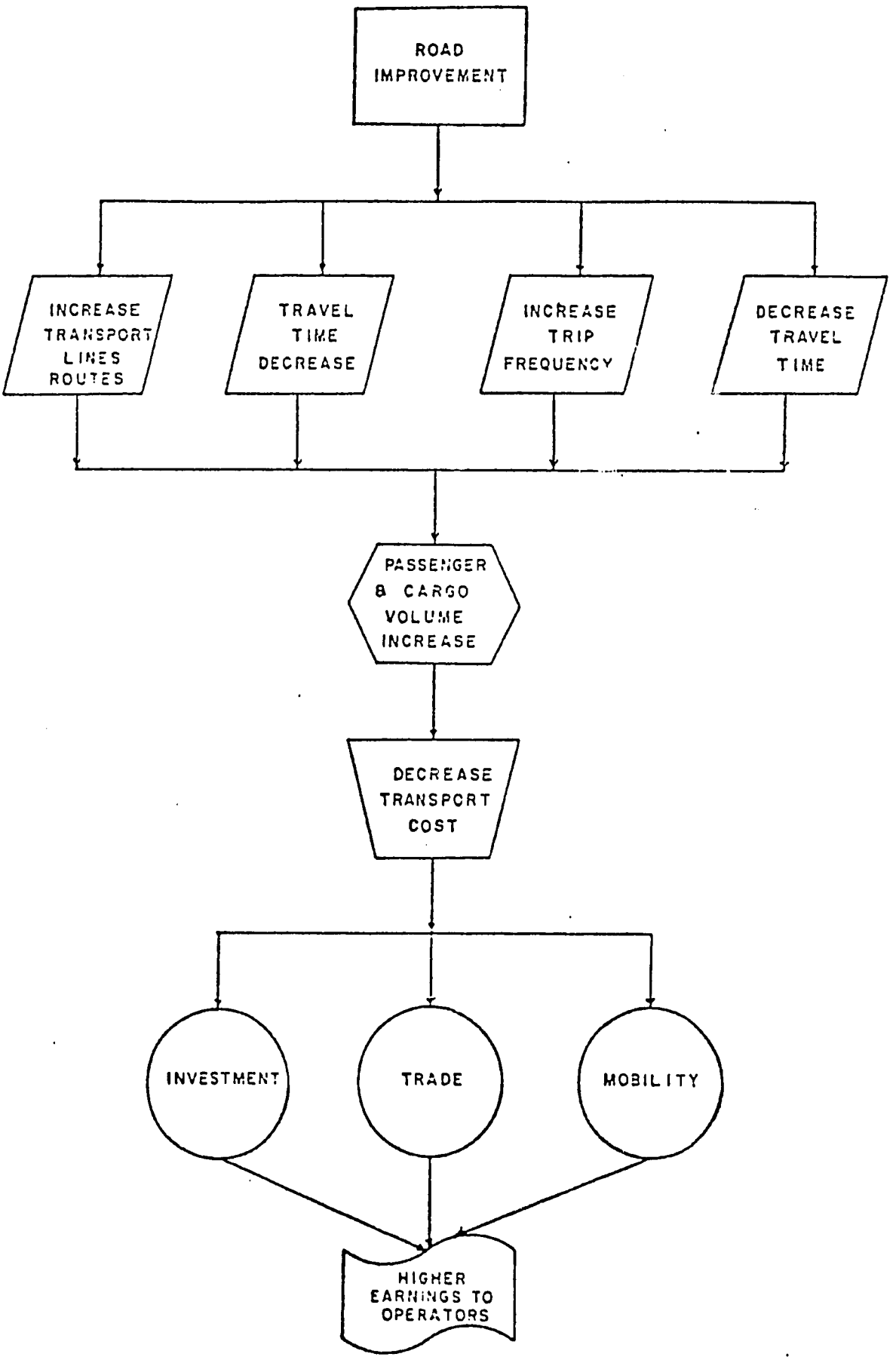
Economic Profile

In the economic profile data collection will include the following:

- Average farm size
- Total amount of arable land and cropped area
- Present crop production and potential surplus or deficit
- Potential growth of rural markets and agriculture processing facilities
- State and potential of agricultural development particularly programs for irrigation, electrification, use of fertilizer, etc.
- Underutilized labor force
- Extent of potentially arable land
- Size of small scale industries

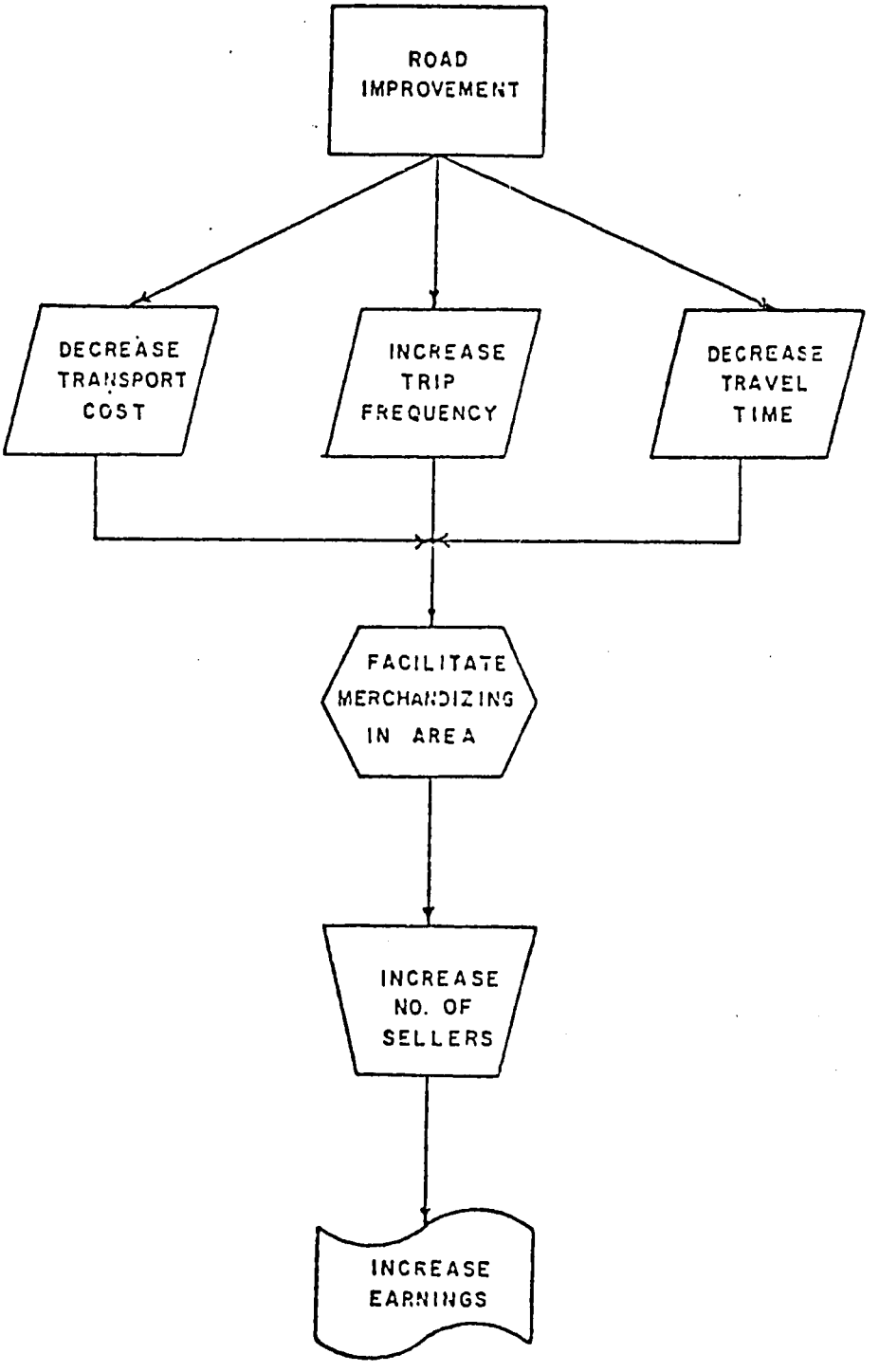
IMPACT ON TRANSPORT OPERATORS

FIGURE A



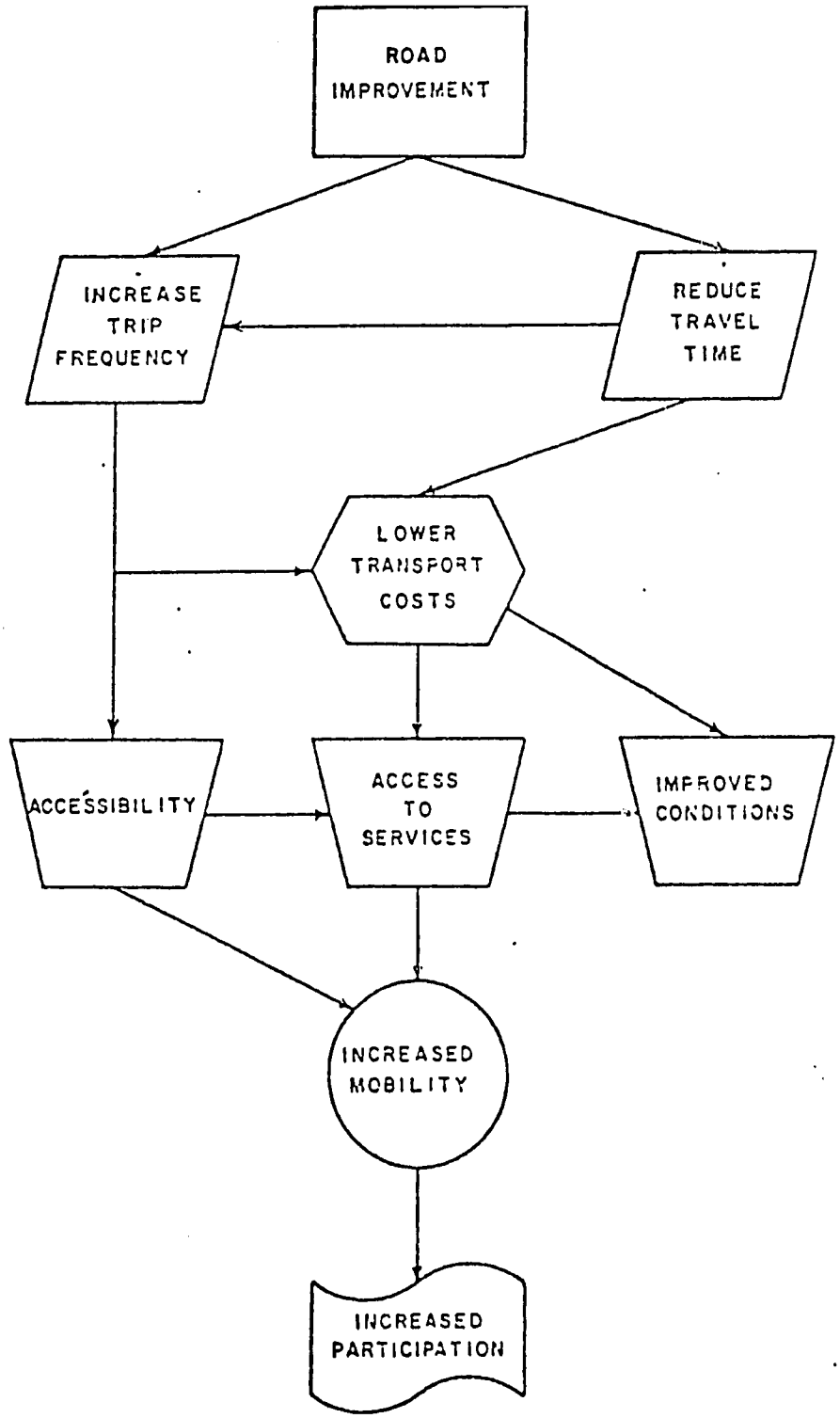
IMPACT ON SHOPPERS AND SELLERS

FIGURE B



IMPACT ON COMMUTERS

FIGURE C



- Repair of manufacturing shops
- Other activities
- Potential development
- Agricultural prices, farm and market

Social Profile

The social profile describes the socio-economic, environmental and cultural activities. This is not covered in this annex.

Transport Profile

The traffic profile will include best estimates and data on:

- Traffic counts
- Traffic by vehicle type and other modes, if applicable
- Origins and Destinations
- Purposed business and other trips
- Number of occupants in both buses and cars
- Type of Commodity carried by type of vehicle
- Tons carried by freight vehicles
- Estimate of annual increase of vehicles by type and category
- Motor fuel consumption patterns
- Freight and passenger rates
- Conditions of the road under consideration; structures, average speeds; length; and geometrics

The quantifiable economic benefits cover the following:

- Transport and Travel Savings-Energy
- Production and Productivity
- Income growth and Distribution

An elaboration of the above quantifiable parameters follows.

1. Transport and Travel Time Savings

VOC Savings

A change in accessibility brings about a number of changes in the perceived costs of transport and travel. First, actual user costs can be expressed as costs per unit of distance, so a reduction in distance travelled brings about a reduction in total cost per trip. Secondly, there is a time cost associated with both transport and travel, so a reduction in time brings about a further reduction in total cost per trip. Thirdly, there is a safety and convenience factor, which, though usually unquantifiable, may be a major factor in travel and transport decision-making. The generalized reduction in perceived transport costs has two effects. First, it affects price of transport and travel to the consumer; and second, it generates additional traffic due to this activity. Induced traffic may also affect the structure of socio-economic impacts by changing the competitiveness of the market in transport services and thereby increasing the probability of a passthrough of cost savings in the form of price reductions to the consumer. In addition to changes in the market price of freight

and passenger transport, a reduction in transport costs provides a benefit to vehicle owners that may induce additional vehicle use. To the extent that vehicles are privately owned and operated for personal use, the benefits of such use accrue as profit to the vehicle owners. Privately owned vehicles that are used to provide public passenger and freight transport services generate user cost savings that may accrue partly to the owners with the rest being passed on through lower transport and travel prices in a desirable economic environment. Time, safety and convenience savings are necessarily benefits to vehicle users.

The following VOC savings formula has to be used in order to quantify savings to transporters:

VOCS = VT x L x VOCD

Where: VOCS = Vehicle operating cost savings

VT = Number of vehicle trips

L = Average length or travel distance

VOCD = VOC differential, or difference in operating costs when a vehicle is made to operate over the same road under two different conditions (see below)

Passenger Trips

The formula used is:

$$PVOCS = PT \times L \times VOCD$$

Where: PVOCS = passengers VOCS

PT = No. of passenger trips annually

L = Average length (distance) of passenger trip

VOCD = VOC differential, which is:

(Operating Costs) minus (Operating Costs)

(B = Before) (A = After)

$$= \left(\frac{F}{S_2} + R \times \frac{(1 + dl \text{ value})}{O} \right) - \left(\frac{F}{S_1} + R \times \frac{(1 + dl \text{ value})}{O} \right)$$

Where: F = fixed costs
S_2 = speed before improvement
O = average occupancy
R = running costs
S_1 = speed after improvement
d_1 = cost differential for surface condition

The road user savings are normally calculated by the DL method. The basic point in this procedure is to express the additional cost of driving on a substandard road in terms of driving additional length (l) on a flat paved tangent roads.

A dl on 0.30 for road with bad surface conditions means that the additional cost from increased fuel and the consumption,etc., of driving 1 km on the substandard road equals the cost of driving 1 km = 300 m on an ideal road.

Passenger Time Value

The value of travel time of passenger vehicles has to be assumed to be equivalent to the economic wage rate of the vehicle occupants (excluding the driver). It must be further assumed that the extra time spent in travelling would have been either used productively or the perceived value of pleasure time saved due to a road improvement would be equal to work time at the average wage rate.

The equations to be used are as follows:

a. $C = W \times O$ (Hourly)

b. $C_1 = \frac{C}{S}$ (Kilometer)

Where: C = Cost per hour passenger time
W = Average wage rate
O = Average vehicle occupancy
C_1 = Cost per kilometer passenger time
S = Average speed

Value of travel time is an important factor in determining the feasibility of new construction. The new facility is economical only when travel time is reduced and so the traveller has an opportunity to earn more income.

Time Value for Vehicles

Beyond saving personal time any decrease in the duration of a trip also saves vehicle operating time. This is proved by the fact that road improvements result in increasing the use of a vehicle within the same length of time. This applies, of course, mainly to

trucks and buses since these aim at increased transportation utilization. This can be accomplished by the possibility of making more trips in the same time.

Components required for assessment of time value for vehicles are: 1) average vehicle life in years; 2) annual hourly operation time, 3) occupancies, excluding the driver; and, 4) vehicle financial and economic price. The equation to be utilized is as follows:

$$T = \frac{FP}{L \times O} \qquad OR \qquad T = \frac{EP}{L \times O}$$

Where: T = Travel time for vehicles
F/E = Financial/Economic
P = Vehicle price
L = Average vehicle life (years)
O = Annual average operating time (Hrs)

Needless to say, an O-D survey is required, in addition to spot speed studies, detailed economic research and in general refined data. The equations and their deriviation is furnished only for the record. Only if more data are collected and made available will it be worth while to assess time values for both passengers and commercial vehicles.

Miscellaneous Benefits

Differences between pre-construction and post construction should be assessed for the following important parameters:

- Traffic
- Income growth
- Marketing practices
- Production and productivity

D. Baseline Data Requirements

Information has to be gathered:

- before the construction period
- after the project completion

The economic benefits - all of which are quantifiable in monetary terms, are as follows:

- vehicle operating cost savings
- passenger trips (assessment)
- passenger time value saving
- time value for vehicle-savings
- income growth
- decrease in transport costs
- price changes
- more profits to operators, producers
- lower transport cost to commuters

All of the above are quantifiable in monetary terms.

The distribution aspect of benefits are considered for two reasons:

a. To evaluate incentives for increased production

b. Evaluate project impact on the distribution of income

b. Relationship of Problems in the Agricultural Sector to the Macroeconomic Situation

i. Agricultural Input Distribution System Inefficiencies and Market Distortions

ii. Lack of an Integrated Livestock Management Policy

3. The Program Proposed to Deal with the Perceived Problems

i. Assistance to Improving the Efficiency of the Agricultural Input Distribution System

ii. Assistance in Development of an Integrated Livestock Management Policy

4. Type of Assistance Proposed

5. Estimated Dollar Amounts Required

6. Special United States Interests

7. Additional Requirements for Preparation of the PAAD