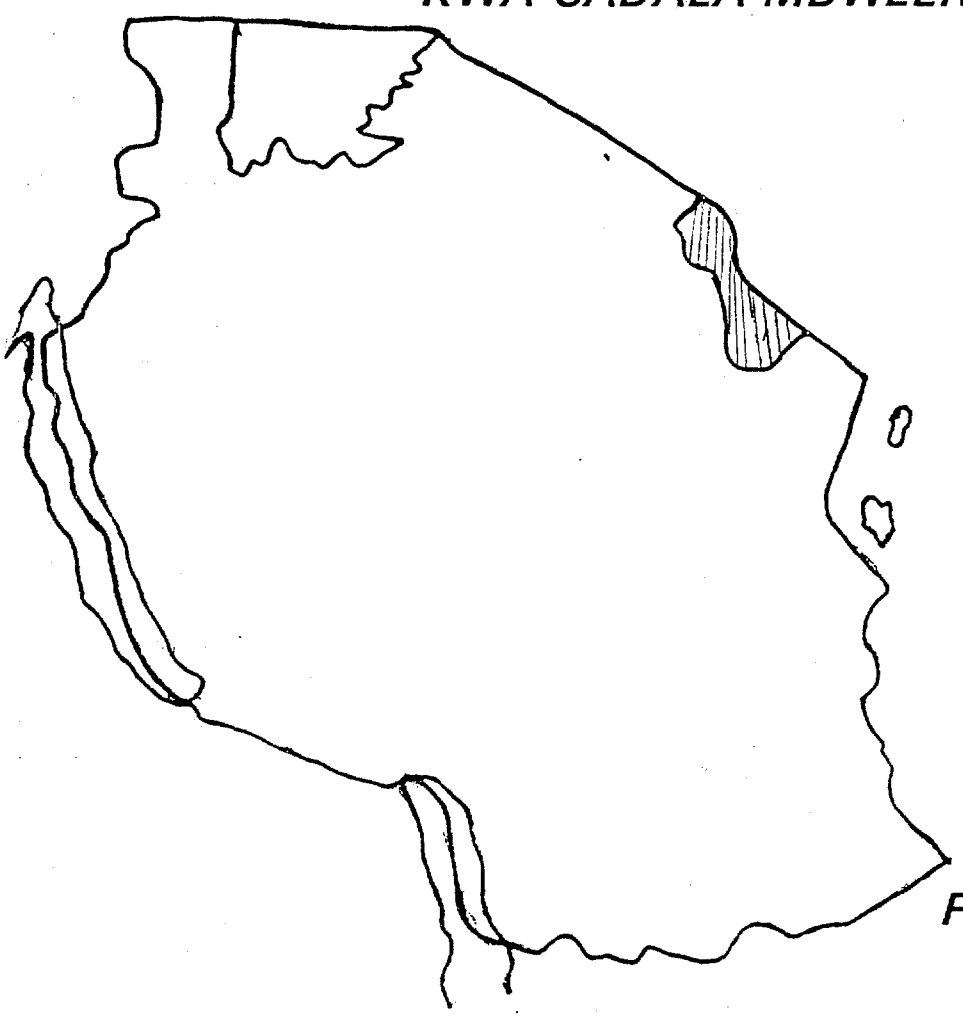
PN-ACA-310
93430

UNITED REPUBLIC OF TANZANIA
MINISTRY OF WORKS
FINANCED BY
UNITED STATES AGENCY FOR
INTERNATIONAL DEVELOPMENT

ECONOMIC EVALUATION AND SOCIAL IMPACT ASSESSMENT OF THE KWA SADALA-MBWEERA ROAD



PREPARED BY
F.S.SHIRIMA
I. MACHA
G. MWAKILUFI
E. MASAMU
Assisted by
C. KALEBE
J. MKIBA
M. MWELA
With advice from
J.O. HAULE
J. STRAUSS

FEBRUARY 1993

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PART I

GENERAL

P R E F A C E

The Economic Evaluation and Social Impact Assessment of the Kwa Sadala-Mbweera Road was carried out in December 1992. In an effort to meet the Agricultural Transport Assistance Program (ATAP) target of institutionalizing road monitoring and evaluation within a local organization, it was decided by USAID and Ministry of Works that the Ministry of Works Planning Division would evaluate the Kwa Sadala-Mbweera road as a "pilot project". The study team consisted of Mr. F.S. Shirima, Team Leader and Economist; Mr. C. Kalebe and Mr. I. Macha, Highway Engineers; Mrs. G. Mwakilufi, a Planner with Rural Roads Division, Mrs. E. Masamu, Sociologist in the Ministry of Health; Mr. J. Mkiba and Mr. M. Mwela, the Statistical Enumerators. The USAID commissioned a local consultant, Mr. J. O. Haule, a Lecturer in Transport Economics at the National Institute of Transport to act as Chief Advisor to the team. The team was also privileged to have the experience of Mr. Joel Strauss, USAID Rural Economy Advisor at their disposal who untiringly offered guidance and encouragement to the team. The views expressed in this report are those of the authors.

EXECUTIVE SUMMARY

During the 30 years of its independence, Tanzania with the assistance of the donor community, has made substantial investments in the road sector. According to a 1987 Transport Sector Recovery report, only 30% of the trunk road network was in good condition while the rural road network (72,000 km) was in a very poor condition. This frustrates increased production in agriculture and industry, for whereas in some areas farmers had responded positively to the government efforts to increase production, the crops could not reach the markets. Likewise, industrial output could not easily reach the users and when it did the price was exorbitant due to high transport costs.

The government therefore prepared a programme for the recovery of the transport sector known as the Integrated Roads Project (IRP) whose major objective is to rehabilitate trunk and rural roads in order to remove bottlenecks to the expansion of exports, farm production, and business mobility while putting in place policies that would facilitate regular maintenance.

USAID assistance has been the backbone of the rural roads component of the IRP through the African Economic Policy Reform Program (AEPRP) and Agricultural Transport Assistance Program (ATAP), whereby a total of Tshs. 3.7 billion ($16.2 million)[1] of local currency funds have been made available for rehabilitating a total of 650km in Shinyanga, Mwanza and Kilimanjaro regions. The purpose of this study is to examine the ATAP by analyzing the cost, benefits and social impact of the Kwa Sadala-Mbweera road in Kilimanjaro region. The analysis was done after carrying out

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[1]Exchange rates used throughout this report are as follows:
1989 1 US$ = Tshs. 140
1990 1 US$ = Tshs. 190
1991 1 US$ = Tshs. 230
1992 1 US$ = Tshs. 330
Source: Bank of Tanzania, Foreign Exchange Rates Directives; various issues.

three surveys namely, Engineering, Economic and Social Impact Surveys.

Results of the Engineering Survey indicate that the road is in poor condition due to the fact that specifications were not strictly adhered to. Gravel loss and rut formation on the road indicate that compaction of subsequent layers was poorly done, a fact which subsequent tests by materials laboratory established. Furthermore, most of new culverts lack adequate cover while some have no cover at all. At some points, the culverts were perched-up well above the level of side drains or in a drain alignment making it difficult for the culverts to transfer water.

Traffic volumes moving over the road were determined from traffic counts and origin/destination surveys (O/D). The counts indicated average total volumes in both directions of 274 vehicles per day. Factoring these survey counts to an Annual Average Daily Traffic (ADDT) indicates 334 vehicles per day with a possible maximum of 342 and minimum of 242. The O-D survey revealed that pick-ups and other light goods vehicles are the main mode of transport for cargo and passengers. On average they carry 1304 passengers a day whose origins and destinations are located in 14 villages, 6 divisions, 4 districts and 5 regional centers.

Results of the economic analysis indicate that the Kwa Sadala-Mbweera road rehabilitation is economically viable. Using a real economic rate of return of 12% p.a without and with generated traffic over a 15-year planning horizon, the net present values (NPVS) were Tshs. 330 million and Tshs. 640 million, respectively. The internal rates of return (IRR) were 32.7% and 41.4%. Sensitivity analysis conducted by reducing the benefit flow by 15% or increasing cost by 15% still provided positive NPVs at a 12% discount rate indicating strong viability of the project.

Impact surveys were conducted at schools, health centers, shops and in village households in the area of influence. The assessment indicates that there has been some positive changes in conditions since 1990, especially regarding such matters as availability of agricultural inputs, equipment and tools, access to market facilities, transport facilities for people and goods, access to consumer goods, household food supply, family health, access to health facilities, access to education facilities, quality of education, access to fuel (diesel and petrol) and a decrease in road accidents. Conditions which remain the same include access to water sources and the incidence of disease. Conditions which have worsened include ability to purchase goods, availability of animal feeds and availability of land. The greatest impact thus far has been on evacuation of crops, particularly grain and green beans, transport and travel and commerce.

INTRODUCTION

Tanzania has an area covering 945,000 square kilometers and has a population of about 25.6 millions. It is a sparsely populated country with a density of about 27 persons per square kilometer. Tanzania lies south of the equator between latitude 1-12 and has a varied climate, influenced mainly by relief and prevailing continental winds.

The economy of Tanzania is based on agriculture which accounts for about 60% of the GDP, 90% of employment and about 85% of the total foreign exchange earnings. In Tanzania, the rural population is about 80% of the total population amounting to about 21 million inhabitants. The average household size in rural areas is 5.5 persons,just slightly higher than 5.3 for the urban areas.

The total road network consists of about 82,000 kilometers out of which 10,000 kilometers are designated as trunk roads, 20,000 kilometers are regional roads and 52,000 kilometers district and feeder roads. The road density for the Tanzania mainland is about 92m/ square km suggesting that a majority of the population in the rural areas live far from a road.

Rural transport is a crucial component in the economy of Tanzania which is agricultural based, in marketing, processing and distribution of food and cash crops, apart from personal movements. Further, rural transport is the key to attracting investment to rural areas for agricultural and non-agricultural activities which in turn increases demand for transport as the level of economic activity increases.

According to a 1987 Transport Sector Recovery report, only 30% of the trunk road network was in good condition while the rural road network (72,000 km) was in a very poor condition.

a

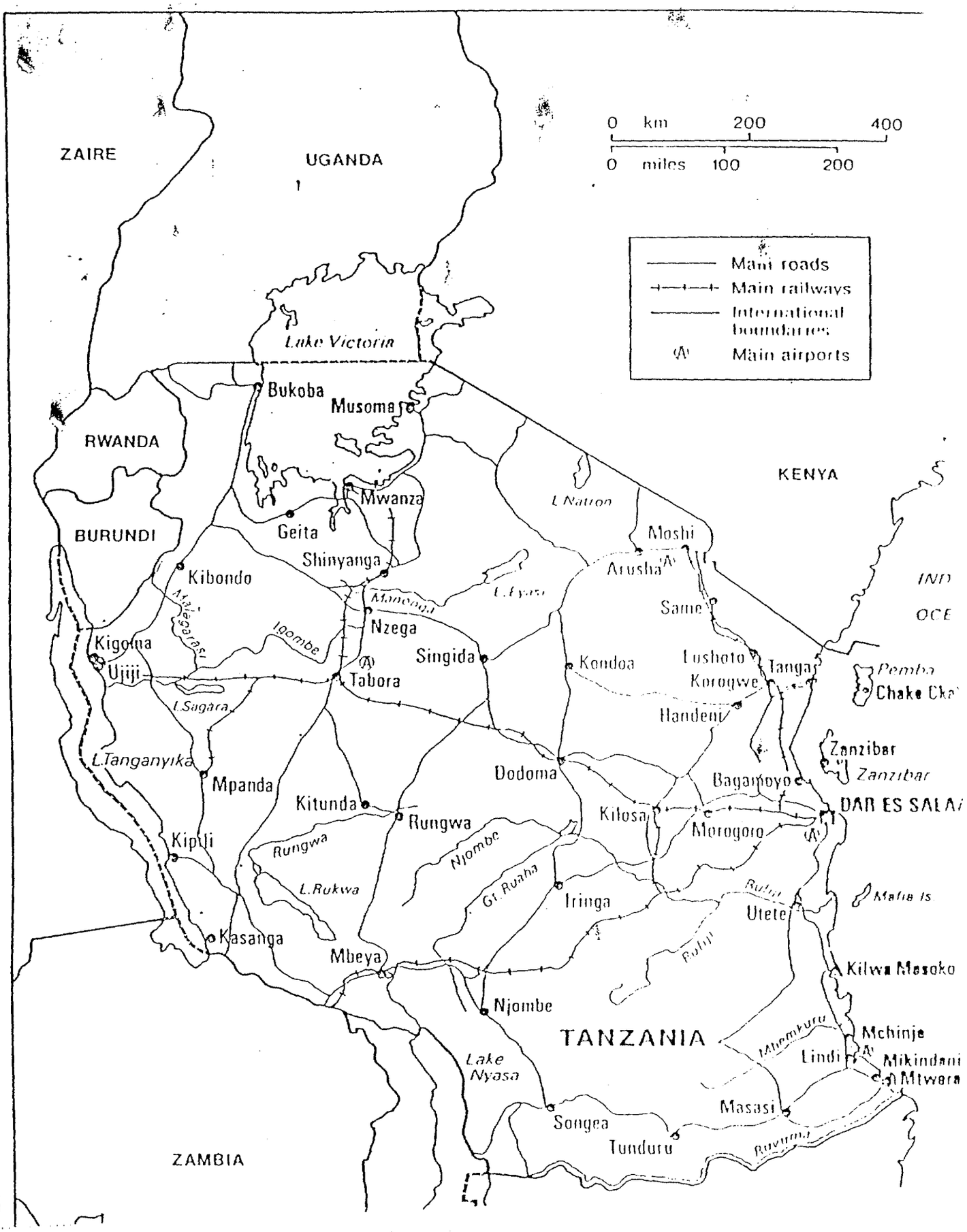
Further, the report points out that in the past, efforts to improve the rural road network have been diffused and not coordinated to ensure proper maintenance and administration, thereby paralysing agricultural and other productive activities. To rectify the situation, a strategy was mapped out under the government's Structural Adjustment Program and the Integrated Road Projects (IRP) to (among other things) rehabilitate and improve the priority trunk and rural roads that are essential for evacuation of agricultural products.

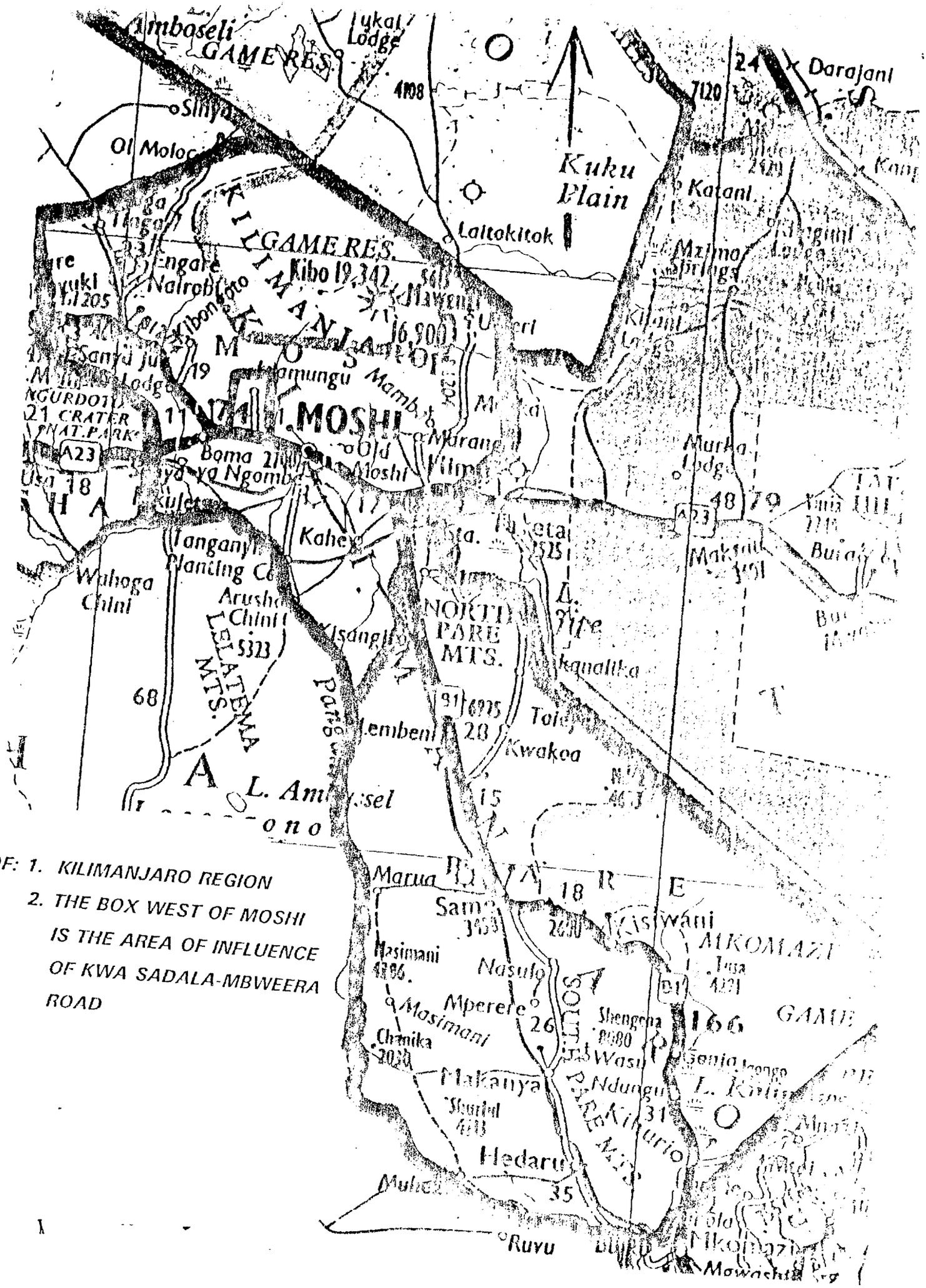
The USAID initiated the African Economic Policy Reform Program (AEPRP) to assist the Government of Tanzania in implementing the Economic Recovery Program (ERP) by supporting policy changes in the transport sector to eliminate bottlenecks in the agricultural sector, particularly production and marketing of export crops, thereby increasing Tanzania's foreign exchange earnings. USAID followed up AEPRP with the Agricultural Transport Assistance Program (ATAP) in 1988. ATAP receives its money from the Development Fund for Africa (DFA) which emphasizes "people-level impact," the goal of which was expanded to include increased incomes and social welfare for the rural population. Under the AEPRP/ATAP, USAID provides dollar grant to the Bank of Tanzania which can be drawn down by Tanzanians in local shillings to import vehicles and spare parts and road construction equipment. The shilling proceeds from this dollar grant are used by the Government of Tanzania to award contracts for road rehabilitation and maintenance. The contracts are mainly being carried out by local private contractors.

The major purpose of AEPRP/ATAP is to improve the Government of Tanzania's capacity to plan, contract, supervise and monitor road works and its capacity to fund improvement works from its own resources. Once the roads have been improved, the rural population will benefit in terms of increased incomes and social welfare.

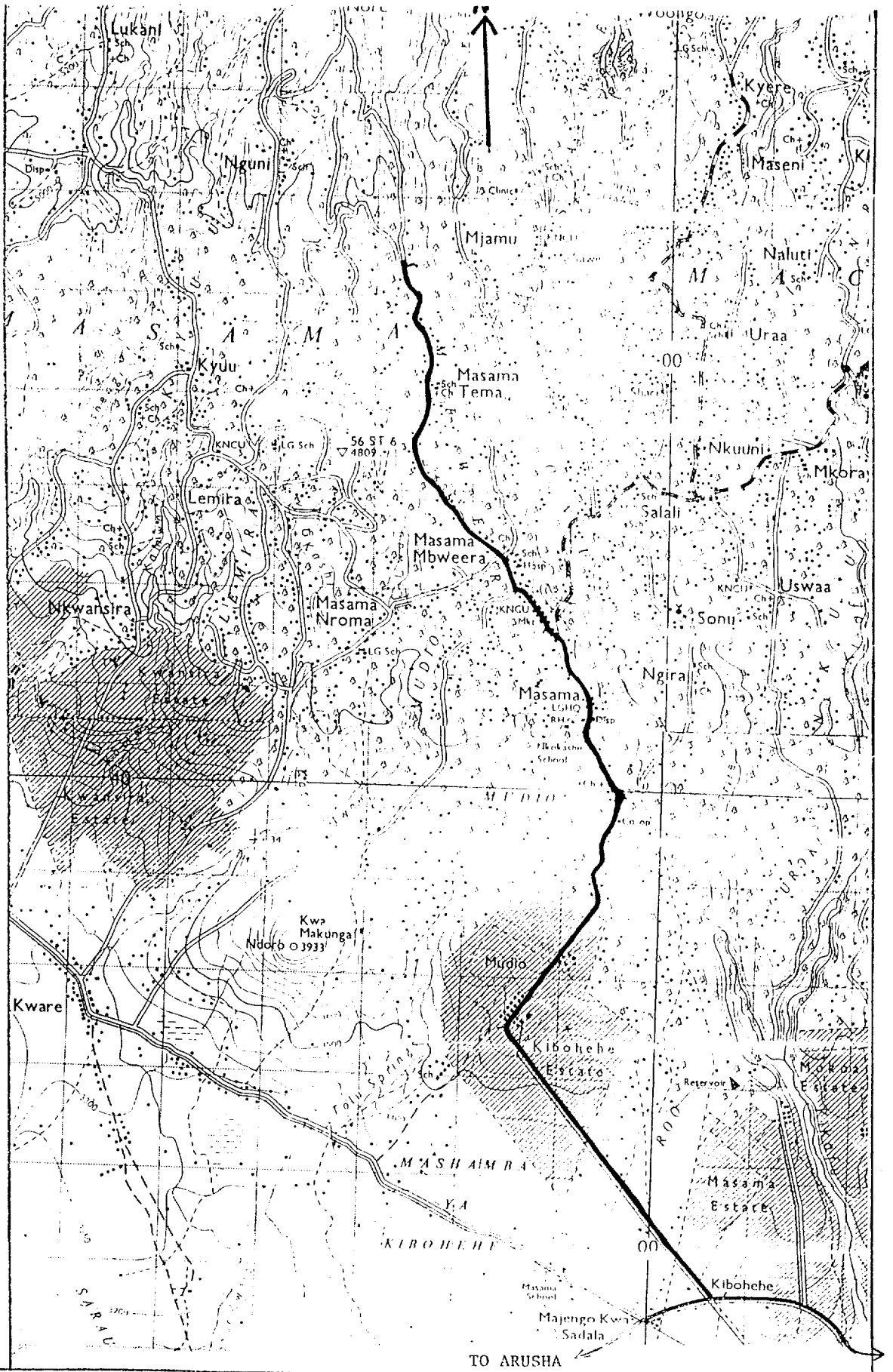
This study analyses the costs and benefits of improving the Kwa Sadala-Mbweera road and assesses the people level impact (socio-economic).

Tanzania


0 km 200 400
0 miles 100 200
Main roads
Main railways
International boundaries
Main airports
ZAIRE
UGANDA
RWANDA
BURUNDI
KENYA
ZAMBIA
TANZANIA
Lake Victoria
Lake Nyasa
L. Natron
L. Eyasi
L. Sagara
L. Tanganyika
L. Rukwa
Bukoba
Musoma
Mwanza
Geita
Shinyanga
Kibondo
Kigoma
Ujiji
Nzega
Tabora
Singida
Kondoa
Moshi
Arusha
Same
Lushoto
Korogwe
Tanga
Handeni
Zanzibar
Pemba
Chake Chake
Dodoma
Bagamoyo
DAR ES SALAAM
Kilosa
Morogoro
Mpanda
Kitunda
Rungwa
Kipili
Iringa
Utete
Mafia Is
Kasanga
Mbeya
Njombe
Kilwa Masoko
Mchinje
Lindi
Mikindani
Mtwara
Masasi
Songea
Tunduru
Ruvuma
Rufiji
Mbemkuru
Kagera
Malagarasi
Igombe
Manonga
Njombe
Gt. Ruaha



MAP OF: 1. KILIMANJARO REGION
2. THE BOX WEST OF MOSHI IS THE AREA OF INFLUENCE OF KWA SADALA-MBWEERA ROAD



AGRICULTURAL FEEDER ROAD STUDY
REGION: KILIMANJARO
DISTRICT: HAI

ROAD LOCATION MAP AT 1:50,000
ROAD NO. HA4
FROM: KM 0.0 TO KM 12.4

KILIMANJARO REGION AND THE KWA SADALA-MBWEERA ROAD

Kilimanjaro region with a population of 1.2 million people (about 4.8% of the nation) is situated in the north of Tanzania. The average household size in Kilimanjaro region is 5.4 while the population growth is 2.1% per annum.

The total land area of the region is 13309 square kilometers and receives about 1000mm to 1500mm of rainfall per annum. The region is the main coffee growing area in the country accounting for almost 1/3 of the total national production. Other marketed crops include bananas, beans, green beans and millet.

The region's road network has a total length of 3437 kilometers with a road density of about 258.3m/square kilometer, among the highest in Tanzania.

The haulage of agricultural produce, farm inputs and consumer goods in the region is done mainly by vehicles owned by private operators, except for coffee which is hauled by vehicles owned or hired by Kilimanjaro Native Cooperative Union (KNCU).

The Kwa Sadala-Mbweera road runs through Masama West and Masama East wards of Hai district. It covers a distance of 12.4 kilometers and has an area of influence encompassing eleven villages with 33642 people in 5937 households or 5.7 persons per household. The road passes through an area of high agricultural potential. The fertility is moderate and there is good response to fertilizer application. Rainfall is adequate for agricultural production with annual average above 1000mm. The main rains fall between March and May.

From Kwa Sadala the road passes through maize farms intercropped with beans as the major food crop produced in the area. As the road rises from Kibo Estates onwards, coffee/banana intercrop dominate. The area served by the road is intensively

cultivated such that livestock is zero grazed. In recent ye s fresh green beans have been cultivated as a cash crop and fc ign exchange earner. Between July and December 1992 exports of esh green beans fetched about 1 million US dollars.

The main center along the Kwa Sadala-Mbweera road is Mbweera (Masama Mula). It has a population of 7025 with 1003 households or 7.0 persons per household. Mbweera or Masama Mula has a post office and a bank, 4 primary schools, one dispensary, 55 vehicles (29% of the vehicles in the area of influence) and a total of 87 businesses. Mbweera has also a large market which operates twice a week. The other market which also operates twice a week under the same system, is situated at Kwa Sadala. In both markets, items being sold include food crops, consumer goods, and locally made crafts. At Kwa Sadala there are 8 grain traders who buy grain from farmers and sell them to buyers who come from Arusha, Moshi, Tanga and even as far as Dar es Salaam. A lodging is going to be built in the near future to cater for the needs of such buyers who at the moment are forced to stay in Moshi town.

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PART II

ENGINEERING INVESTIGATIONS

2.0 ENGINEERING INVESTIGATIONS

2.1 BACKGROUND

The Kwa Sadala-Mbweera road branches off the Moshi-Arusha trunk road at Km.22.00 from Moshi town. The road was commissioned for rehabilitation to engineering standard in July 1992 to a carriageway width of 5.0m together with 0.5m shoulders and was completed in September 1992, by Messrs BECCO of Dar es Salaam. Prior to this rehabilitation the road was maintained by the local authorities to gravel standard on a self help basis, which made it passable in the rainy season. M/S BECCO, supervised by the consultant Messrs MAKCONSULT, formed the subgrade and a 150mm thick subbase of selected gravel material. Further drainage structures were installed or replaced as needed.

2.2 INTRODUCTION

The terms of reference for this study required an engineering evaluation of the road alignment and surface condition; an inventory of drainage and bridge structures, traffic surveys involving volumetric count and origin - destination (O-D).

These investigations were intended to lead to a suitable maintenance policy. In evaluating the road, it was considered as one section because over most of the length, the condition of the carriageway and the volumes of traffic were similar.

2.3 PROJECT ROAD

2.3.1 ROUTE DESCRIPTION

The start chainage for the route is at its junction with Moshi-Arusha highway, 22 kms from Moshi town. This junction point is referred to as chainage 0+000km. It begins at an

altitude of 1015m above sea level rising steadily through rolling country to 1470m above sea level at chainage 12+000km, a rise of 455m over 12km. Most of the road has steep grades and sharp bends with short sight lines.

2.3.2 CARRIAGEWAY

2.3.2.1 WIDTH

The design specification for rural roads is a width of carriageway of 5.0m with 0.5m shoulders.The existing carriageway width including shoulders varies randomly between 6.0m down to 3.5m.

2.3.2.2 ROUGHNESS

The surface condition was assessed visually, noting areas of potholes, rutting, corrugation and subgrade failure. The roughness was assessed against the criteria set out in Table 2.1.

Table 2-1: VEHICLE SPEEDS/ROUGHNESS VALUE TABLE

GRADE	TYPICAL VEHICLE SPEED (KPH)	CARRIAGEWAY REMARKS	CONCLUSION	EQUIVALENT ROUGHNESS VALUE (MM/KM)
1	80 (Gravel) 100 (Bitumen)	Very good	- Minor potholes/corrugations - Sufficient gravel and - Generally smooth	1000
2	65	Good	- Rough with some potholes - Poor shape - Sufficient gravel	13500
3	50	Fair	- Very rough, fairly potholed - Rutted - Bad shape - Sufficient gravel	25000
4	35	Bad	- Very rough, badly potholed - Some depressions - Deep ruts - Bad shape and - Insufficient gravel	35000
5	20	Very bad	- Major depressions - Road abandoned - Alternative route alignment/track adopted.	40000

Note: Equivalent roughness factor in mm per km as related to reasonably comfortable driving speeds in a 4WD vehicle and observed road conditions.

Comfortable driving speeds ranged between 35KPH - 50KPH, though on some short stretches (ch.7+000- ch.11+800) speeds were up to 60 kph.

The speeds were used to estimate roughness value for the road which ranged between 35000 - 25000 mm/km. The RTIM2

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programme accepts roughness value of 20000 mm/km (termed default value), this means the road is rough.

2.3.3 DRAINAGE WORKS

The drainage system of the project road consist four types of drainage systems:

(1) Cross carriageway drains (culverts).
(2) Side ditches.
(3) Catch ditches.
(4) Mitre ditches.

These systems work together to drain off rain water falling directly on the carriageway and to prevent water which falls on surrounding areas from reaching the roadway. The contract provides for replacement of all drainage facilities by the contractor.

2.3.3.1 CROSS CARRIAGEWAY DRAINS

The sizes of culvert cross drains ranged from 300mm diameter for a drum to between 600mm and 900mm in concrete pipes and armco culverts. These culverts were a mix of new and old. Most of the new ones (presumably placed during rehabilitation) lacked adequate cover and some had no cover at all. Some culverts were located well above the level of side ditches.

2.3.3.2 SIDE/CATCH MITRE/ WATER DRAINS

These are either poorly made or in places missing, allowing rain water to create streams across the carriageway. The existing catch water ditches were damaged in the course of road construction and not replaced causing erosion to sides of cuttings on the uphill side.

At certain places catch drains perform a dual role of checking water movement from high ground as well as transferring it to farm fields and homes for agricultural and other purposes respectively. A detailed description of drainage structures is set out in Appendix A.

2.4 MATERIALS FOR GRAVEL CONSTRUCTION

2.4.1 EXISTING BORROW PIT

The gravel used for the subbase of the road comes from Kware borrowpit, situated some 4.0km along Sanya Juu road from the junction with Moshi-Arusha road.

The pit material is volcanic, which can give a low level of gravel loss compared to other gravel material. Tests made by the materials laboratory in the Kilimanjaro Regional Engineers office confirms its suitability as a subbase material for gravel roads. Gravel from Kware borrow pit has been used by local authorities to maintain its roads before rehabilitation was done. A quick evaluation of remaining deposits indicates that there are enough reserves for future maintenance of the road.

2.4.2 MATERIALS TESTING OF THE CARRIAGEWAY CONSTRUCTION.

Despite the intrinsic good quality of the Kware gravel, the road has suffered deterioration which suggests either heavy traffic loading or a weakly constructed subgrade. Laboratory test on field samples confirms poor compaction of the subgrade. See Appendix A for details.

2.5 TRAFFIC SURVEY

A volumetric count and an origin-destination (O-D) survey were taken at a station located at ch. 3+000km. This point, which is different from that chosen by Agriconsult at ch.1+000km for the baseline study in 1990, was prompted by existence of a

diversion route between ch. 2+000km and ch.3+000km. However O-D survey results established that the diversion route carries on average, only 3 vehicles per day (v.p.d.).

2.5.1 VOLUMETRIC COUNT

Twelve (12) categories of traffic movement were recorded. These included pedestrians, animal drawn carts, tractors, cycles and all other types of vehicles. Counts were conducted for three consecutive days, (10/12/92 - 12/12/92) for 12 hours from 6am to 6pm. Over the three days, the average two-way flow was 274 v.p.d. with a maximum of 342 v.p.d. and a minimum of 242 v.p.d. When factored, the Annual Average Daily Traffic (AADT) was calculated to be 334 vehicles. See Table 2-2.

The base line study finding by M/S Agriconsult in 1990 established an average traffic of 59 v.p.d. The rate of growth per annum in a 2 year period (1990-1992) is therefore in excess of 100% per annum (in fact it is 116%p.a.). This increase in traffic is considerable, but local factors can result in large increases in traffic flows which can be well in excess of traffic growth on the network in a wider geographical context.

2.5.2 ORIGIN-DESTINATION SURVEY

The O/D survey was conducted at the same location as for the volumetric count. The O-D survey was conducted for four days, after the volumetric count, from 6am to 6pm between 13/12/1992 and 16/12/1992.

Because of the high volume of traffic observed in the volumetric counts, the sample rate for interview was fixed at every alternate vehicle (50%). The survey established that pick-ups and other light goods vehicles (LGV) are the main modes of haulage for both cargo and passengers. On average, this category alone carries 1304 people a day in both directions and for the

Table 2–2

VOLUMETRIC TRAFFIC COUNT

C/P NO	ROAD NO	ROAD SUBSECTION	LOCATION	ADJ SOURCE NO	DAY	DATE	HOURS	CARS	P/UP L/R	TRUCKS >(5T)	TRUCKS <(5T)	FULL TRAILER	SEMI TRAILER	BUSES >25P	BUSES <25P	OTHER	Count	AADT
KL-	C--	KWA SADALA-	KIBO ESTATES	35 CONS	THU	10/12/92	12	2	179	4	19	0	0	17	1	12	242	292
		MBWEERA			FRI	11/12/92	12	15	173	4	18	0	2	3	2	21	238	289
					SAT	12/12/92	12	23	246	19	32	1	2	0	1	18	342	419
					AVERAGE COUNT			19	196	9	23	0	1	10	1	14	274	334
					CLASSIFICATION %			7.1	71.7	3.3	8.4	0.0	0.5	3.5	0.4	5.2		

Note:

Nine categories of traffic have been indicated instead of twelve: the "OTHER" category includes tractors, animal drawn carts etc. which do not have established conversion factors as vehicles; also the amount of distress caused to road by the "OTHER" class is not significant.

BEST AVAILABLE DOCUMENT

50% of counted vehicles. When compared to the 1990 baseline study findings of 66 passengers a day it indicates that there is a high influx of passenger movement along the road. The cause of this is discussed more fully in the economic evaluation section.

The origin-destination survey established 29 main O-D locations of which 14 are villages, 6 divisions, 4 districts and 5 regional centers. Table 2-3 shows a summary matrix for origin and destination of trips between the different locations. Some unexpected trips, e.g. Moshi to Sanya Juu and Machame to Arusha, both not linked directly through the project road were observed. The former route may result from trade activities along the project road, and the condition of the route through to Sanya Juu. The Machame to Arusha route is also a shorter link to Arusha, and the villages around the borders of Machame.

A majority of trips arise between Mbweera and Kwa Sadala villages, which each have two market days a week. Also trip volumes to Boma Ng'ombe, Moshi and Arusha centres are high. The trip generation shown in matrix, most of which is business oriented, confirms the growth of trade between centres along project road and neighbouring metropolitan centres. The trade within the project area and other social phenomenon that account for movements along the route and its area of influence is covered in detail in the economic and social impact parts of the report.

2.5.3 TRAFFIC FORECASTS

For purposes of the analysis, the nine classes of vehicle types observed during the census were reduced to 5 classes:

1. Cars
2. Light Goods Vehicle (LGV): Pickups and trucks under 5 tonne (5T).
3. Trucks: Trucks over 5T and semi-trailers;
4. Buses: both for under and over 25 pax.

Table 2 – 3

ORIGIN–DESTINATION SUMMARY MATRIX

S/NO	ORIGIN	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
	DESTINATION																													
1	MBWEERA																2					1	4							
2	MUDIO									69							25	1	2			2	50		2	16		1		1
3	ISUKI																						1							
4	NGUNI																						1							
5	SONU																1													
6	ULOKI									1																				
7	NGIRA (SAWE)																													
8	ROO		3							2							3		1											
9	KWA SADALA	2	72																											
10	MBWASHINI																						1							
11	KIELI																						1			1				
12	MBORENI																						1							
13	MAFETO																						1							
A 14	SHARI																	1												
15	RUNDIGA		3																											
16	BOMA NG'OMBE	2	18		1			1	1												2									
17	MAILI SITA		1																											
18	KIA																													
19	SANYA JUU	1																												
B 20	MACHAME		3							1																				
21	HAI		1																											
22	MOSHI	1	56		1															1										
23	MWANGA		1																											
C 24	ROMBO		2																											
25	ARUSHA		28						2			2																		
26	TANGA		1																											
27	DAR ES SALAAM		1																											
28	SHINYANGA		1																											
D 29	MWANZA		1																											

KEY: Up to A: Village origin–destination
Up to B: Division origin–destination
Up to C: District origin–destination
Up to D: Regional origin–destination

* Serial/No. indicates locality names

Table 2-4 TRIP PURPOSE INFORMATION MATRIX - 4 DAY TOTAL

TRIP PURPOSE: No. of V.P.D.

O/D	1. Home	2. Work	3. Business	4. Mar-ket	5. Med.	6. Educ.	7. Religious	8. Other
1. Home	0	25	113	3	1	1		2
2. Work	17	0	3	2	1	1		2
3. Business	51	29	112*					
4. Market				0	1			
5. Medical					0			
6. Education	4					0	3	
7. Religious	4						0	
8. Other								0

* Shuttle buses between related business activities.

CARGO/ITEMS HAULAGE:

			LORRY				BUS				
Cargo/Vehicle type	Car	P/up	<5t	>5t	F/T	S/T	<25p	>25p	Cart	Tra-ctor	Other
1. Agricultural (unprocessed)	1	38	2	8						1	
2. Processed food/drinks		30	1	3							
3. Building materials		9								2	
4. Oil products		2								2	
5. Passengers (no.)	29	5165	39	296			60	650		16	
6. Other		36		2							

LOAD FACTOR:

			LORRY				BUS				
	Car	P/up	<5t	>5t	F/T	S/T	<25p	>25p	Cart	Tractor	Other
Empty	12	36	2	9						3	
1-50%	9	115	3	16			1	4		6	
50-99%		87	4	13				6		3	
FULL	2	82	4	9				5		2	

VEHICLE AGE SPECTRUM:

Veh/Reg.Year	'60-64	'65-69	'70-74	'75-79	'80-84	'85-89	'90-94
Car		2	3	8	3	4	3
Pick/up	2	40	29	27	30	104	88
Lorry <5t						7	6
Lorry >5t	1	1	3	3	11	9	19
F/Trailer							
S/Trailer							
Bus <25p			1				
Bus >25p				2		1	12
Carts							
Tractors			1	1		8	2
Others							

OWNERSHIP:

			Lorry				Bus				
	Car	P/up	<5t	>5t	F/T	S/T	<25p	>25p	Cart	Tractor	Other
Private	20	293	12	30			1	15		11	
Government	3	27	1	17	51					1	

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5. Other: Tractors, Ox-drawn carts etc.

Similar loading and number of vehicles within some classes has prompted a merger, e.g. Pick-ups and trucks under 5T were merged on the basis of body size loading capacity.

2.5.3.1 TRAFFIC GROWTH RATE

Traffic growth rate generally is assumed to shadow the national economic growth rate (GDP) which is estimated to be 4% per annum.

2.5.3.2 NORMAL TRAFFIC

Normal traffic is that which operates on the project road even if the rehabilitation does not take place. Normal traffic may therefore be estimated as the 1990 Agriconsult counts factored by 4% per year to 1992. See Table 2-5.

Table 2-5: Normal traffic

S/NO	VEHICLE TYPE	AADT - 1990	AADT - 1992
1	Car	9	10
2	LGV	39	42
3	Truck	8	9
4	Bus	3	3

2.5.3.3 GENERATED TRAFFIC

Traffic counts conducted in 1992 by the project team, Table 2-2, show much higher volumes than in Table 2-5. This additional traffic has been generated over the two year period, probably because of the road rehabilitation, see Table 2.6.

The economic analysis of the road has been done using the RTIM2 evaluation model. The traffic is grouped into four classifications. The short length of the road coupled with active market and trade activities make vehicle trips frequency high, the effect is high traffic volume. The large increase in traffic levels cannot be expected to continue in future years and it is assumed that it will settle down to about 4% per annum, the growth rate of the GDP, sometime during 1993.

Table 2-6: Generated Traffic

S/NO	Vehicle type	Traffic Count AADT-1992	Normal Traffic AADT-1992	Generated Traffic AADT-1992
1.	Car	24	10	14
2.	LGV	250	42	208
3.	Truck	30	9	21
4.	Bus	13	3	10

2.6. MAINTENANCE WORKS

Ministry of Works maintenance policy for gravel roads, irrespective of traffic volume and subsequent deterioration levels, provides grading twice a year, once in the dry and once in the wet season, as part of routine and recurrent maintenance. Further, regravelling works should be done every 5-8 years as part of periodic maintenance.

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For the project road however, regravelling may be carried out every four years because the rate of gravel loss and or layer wearing seems to be as high as 30mm per annum, possibly because of the weakness of the subgrade and subbase leading to weakening at the bonding in the gravel wearing course caused by poor compaction, thus in 4 years, 120mm will be worn-out which calls for additional gravel. The remaining 30mm minimum thickness is just enough to safeguard the subgrade and provide required traction before regravelling works commence.

This maintenance policy has been adopted in assessing the project costs with RTIM2 computer model. The RTIM2 print outs, in Appendix A, show four maintenance policies. Grading for the first three years as policy 1 followed by regravelling and grading at consecutive 4-year intervals as policies 2 to 4.

In the RTIM2 analysis model, maintenance costs in the "do nothing" scenario have been stated as actual allocations rather than the amounts budgetted. On average actual allocations are only 70% of budgetted amounts for maintenance. By subtracting "do-nothing" maintenance costs from "do-something" costs, net maintenance costs used in computing the NPV are increased, thereby reducing net benefits. This is the most realistic approach to use.

2.7 ENVIRONMENTAL SURVEY

The road closely follows the existing terrain and therefore blends into the land form. The width is substandard over substantial lengths randomly varying between 3.5m and 6.0m. Widening will be required in many places. Also with the increasing volumes of traffic it will be necessary to ease curves to improve sight lines to avert accidents. Drainage ditches will also have to be relocated and cut. Inevitably this will mean limited clearance of adjacent vegetation. Increased traffic flows are evident along the route with the attendant noise and

pollution. However these are expected to stabilize and are a reflection of enhancement in the local economic well being of people living along the route.

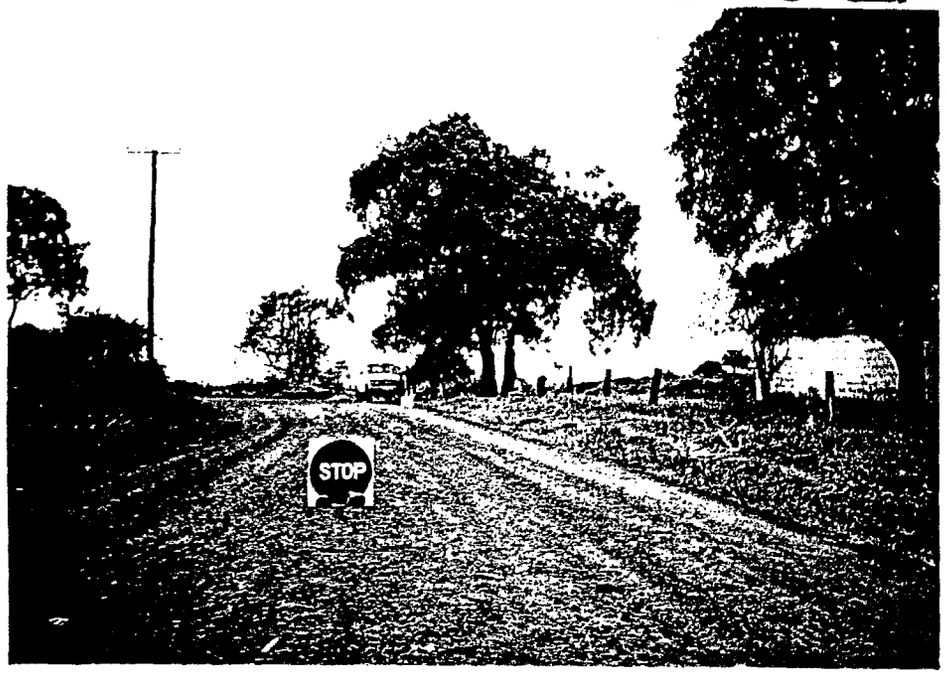
2.8 CONCLUSION AND RECOMMENDATION

The reconstruction of the existing road has been inadequate in terms of the quality of pavement construction and drainage provision. Furthermore, the horizontal and vertical geometrics of the road are no longer suitable for the volumes of traffic now using it. Improvements, both in the standards of geometry and construction, are recommended. The contractor will need professional advice and supervision for the works generally and for the selection and working of gravel pits in particular.

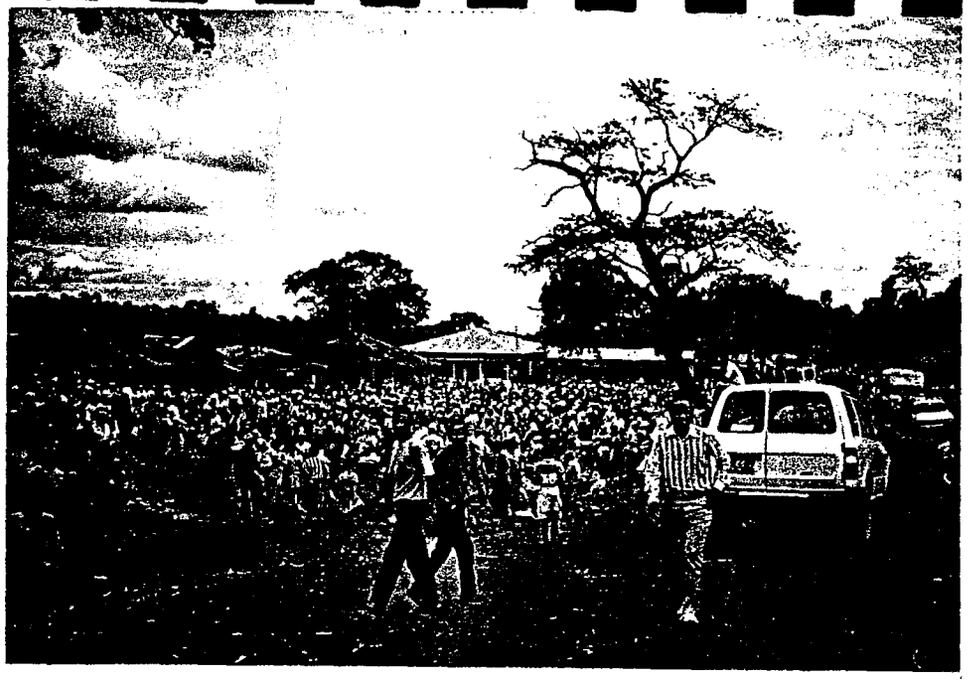
The economic analysis (based on the RTIM2 programme) shows internal Rates of Return on the cost of work required of 41.4%. It may be concluded therefore that the project works has proved to be feasible.

Achievement of this economic return in practice depends on the real implementation of the maintenance policies assumed in the analysis. Failure will result in the collapse of the road structure.

[redacted]UNT[redacted]ATI[redacted] - [redacted]D E[redacted]TE [redacted]



[redacted]RKET [redacted]AY [redacted]BWE[redacted]A



PAX - VAN

WATER PONDS DUE TO LACK OF SIDE DITCHES

BLOCKED CULVERT - NOT REPLACED

RUSTED PIPE/DRUM CULVERT

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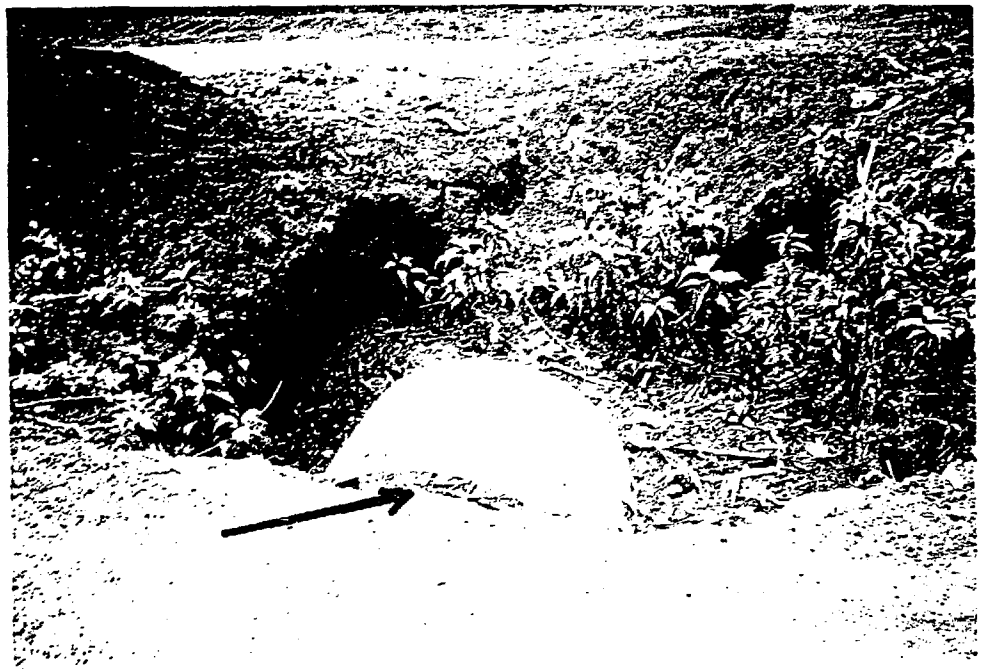
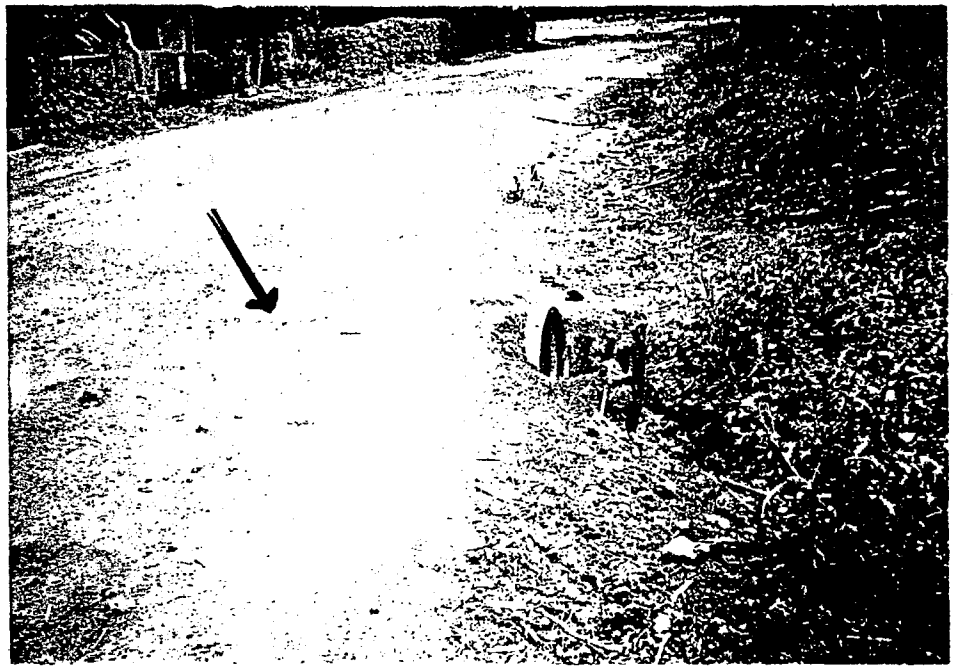
FAIR DRAIN - FALLING PROTECTION

COLLAPSING PROTECTION - ROAD SIDE ERODED

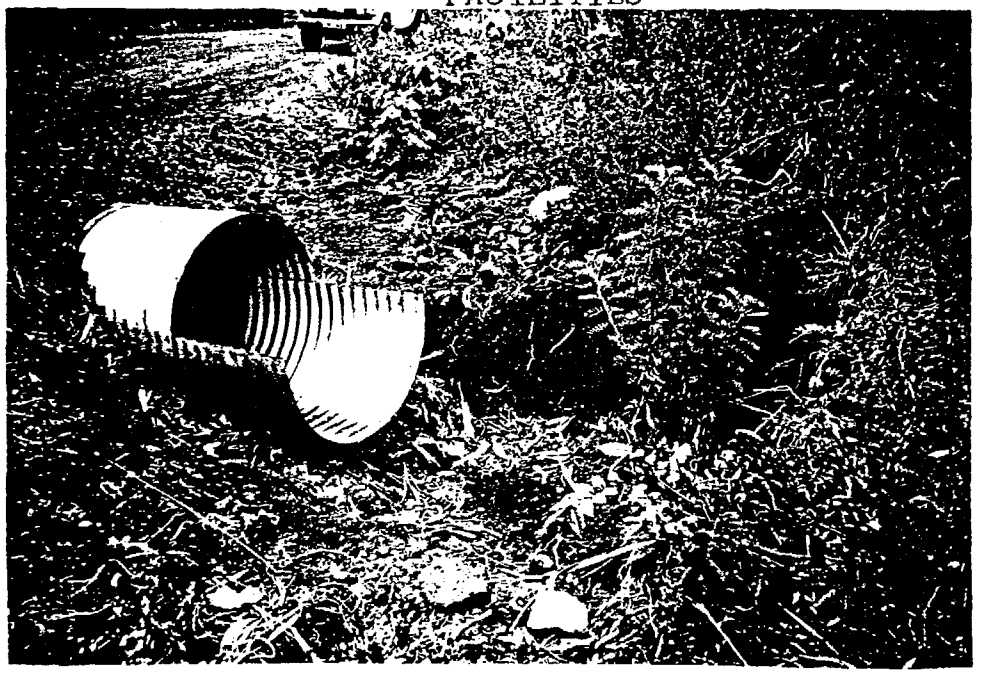
LOOSE CULVERT SECTION



LACK OF COVER/OVERGROWN CHANNEL



WELL PLACED CULVERT LACKS ADEQUATE INLET/OUTLET FACILITIES



NEW CULVERT INLET LEVEL ABOVE SIDE DITCHES

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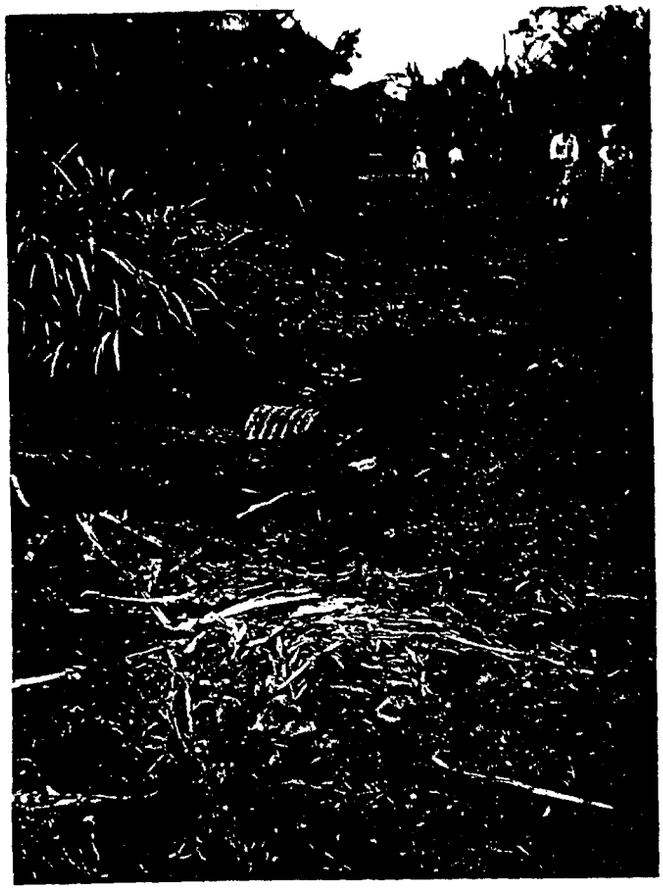
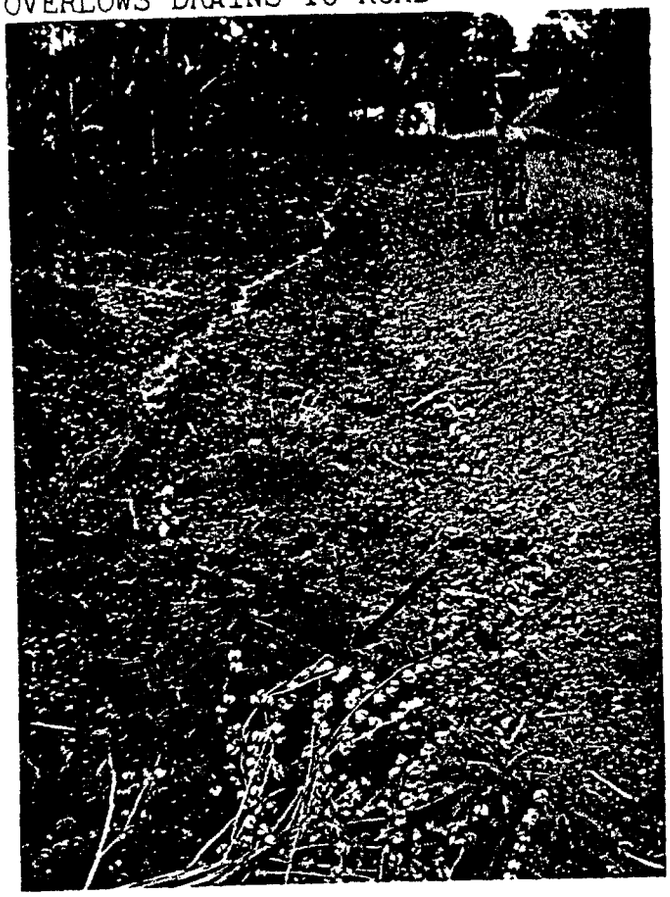
LACK OF SIDE DITCHES

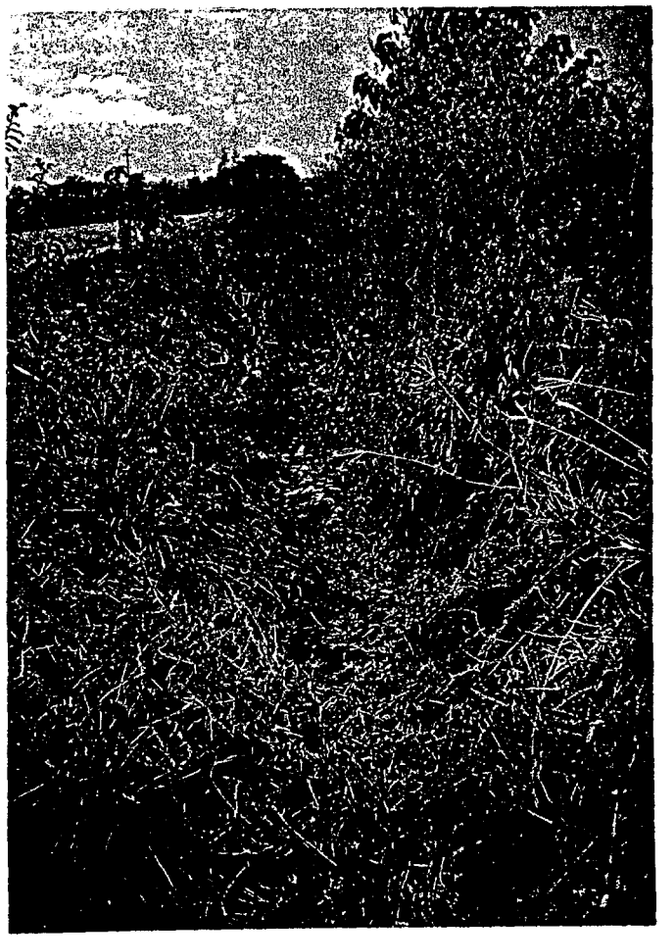


UNREPLACED IRRIGATION DITCHES/
OVERLOWS DRAINS TO ROAD



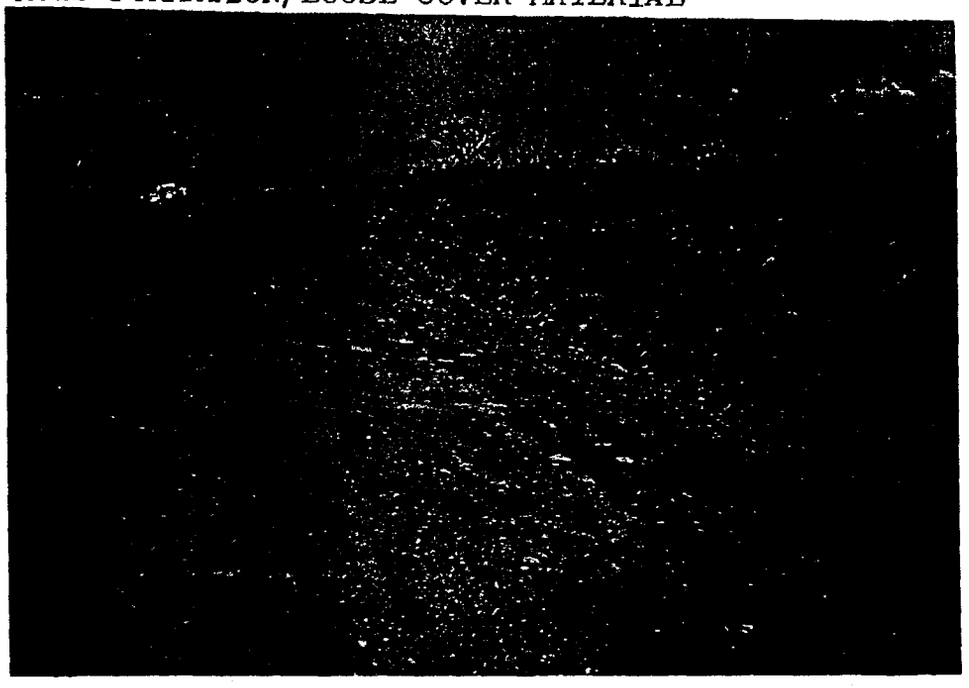
GOOD CULVERT - LACKS OUTLET
PROTECTION

UNRESTORED IRRIGATION DITCHES



LACK OF FEEDER SIDE DITCHES/UNPROTECTED CHAMBER

RUTS FORMATION/LOOSE COVER MATERIAL

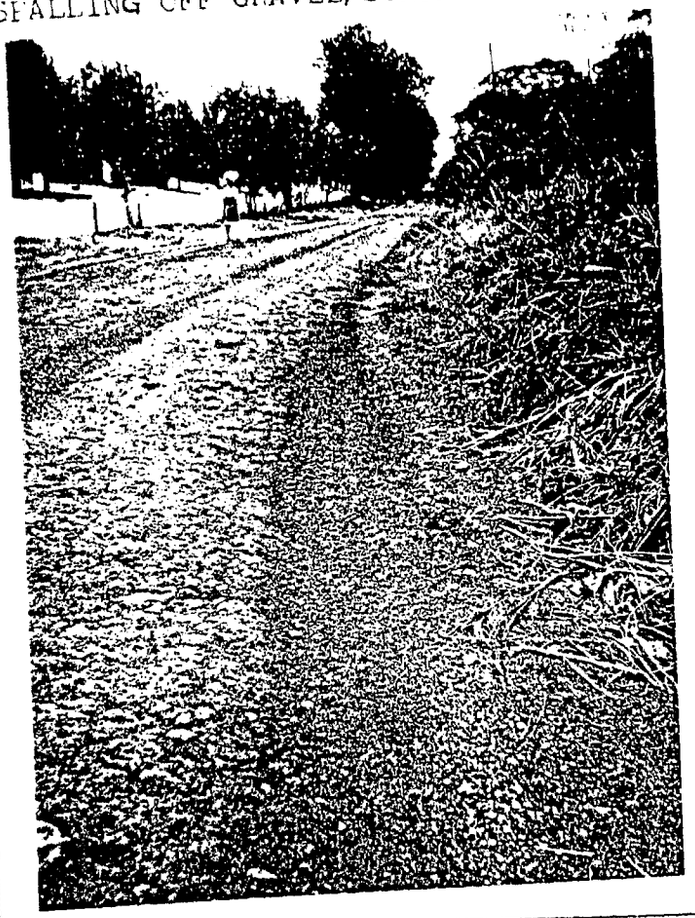


DEQUATE WIDTH/LOSS OF COVER MATERIAL - ROUGH SECTION

NARROW/INADEQUATE WIDTH

INTERVIEW SESSION

SPALLING OFF GRAVEL/SURFACE CRACKING



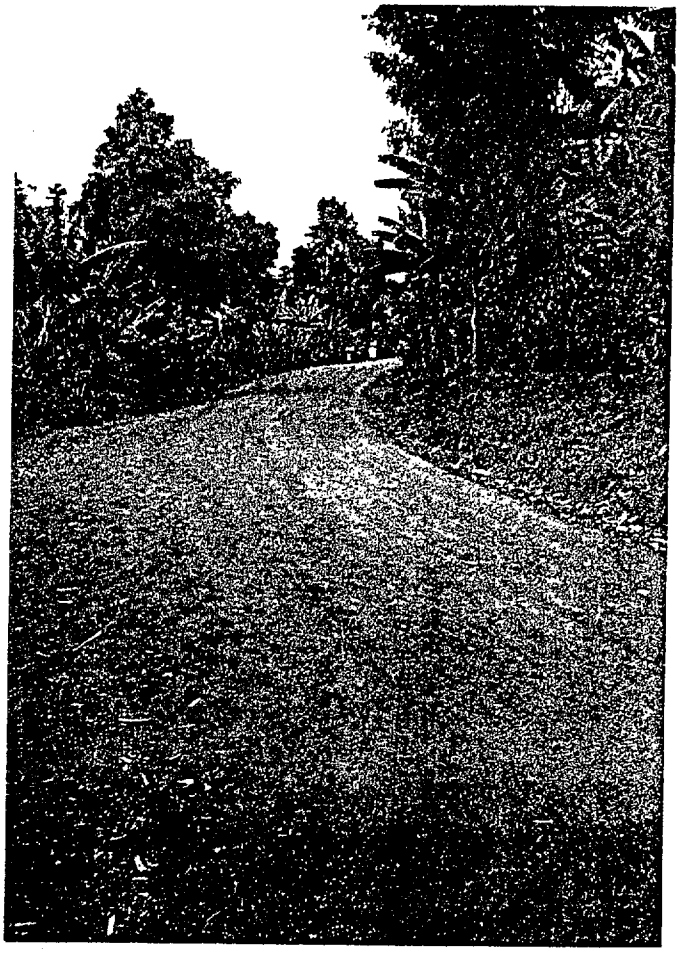
LOADING CHARACTERISTICS FOR LGV

SHARP CORNER/BEND

BORROW MATERIAL FROM KWARE PIT

CARGO TRUCK FOR COFFEE HAULAGE

SHARP BENDS/NARROW STRIP



PART III
ECONOMIC EVALUATION

3.1 INTRODUCTION

This economic evaluation of the Kwa Sadala-Mbweera road is a follow-up of the Socio-Economic Baseline Survey conducted by Agri-Consult in August, 1990.

The study by Agriconsult revealed that:

- The area of influence under Kwa Sadala-Mbweera road has a high agricultural potential both in terms of cash crops (i.e coffee) and food crops.

- The number and types of vehicles using the road was small i.e about 59 vehicles per day.

- Vehicle operating costs were generally high for most types of vehicles, ranging from Tshs. 36 per km for trucks about 5 tons to Tshs. 155 per km for trucks above 10 tons.

- The total number of passengers per day was 66, while cost of travel was Tshs. 15 per km.

- Quality of life - adequacy and quality of medical facilities, water supply, education - was generally low.

- The total number of businesses in the area was low (123 businesses only).

This economic evaluation examines the benefits of improving the Kwa Sadala-Mbweera road to farmers, transporters and consumers as a self-contained project. The evaluation is done using the Road Investment Model (RTIM2) developed by the road research laboratory. The social impact of the road is assessed under Part IV of this report.

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3.2 FORECASTING INCREASED PRODUCTION

Forecasting the increased agricultural production induced by the improvement of the Kwa Sadala-Mbweera road involved:

- Calculation of agricultural and livestock production, after road rehabilitation, i.e. 1992/93.

- Forecasting the likely increase in land utilization and crop yields in response to the improvement of road;

- Calculation of the forecasted increase in marketable production; and

- Calculation of the base year volume of trade after the construction of the road.

Agricultural production is disposed of in three ways: subsistence for consumption by the household, sale for cash, and losses due to poor storage facilities, weather, etc.

In calculating marketable production of food crops, it was assumed that 75% of total food crop production will be used for subsistence consumption including brewing of local beer, and 25% is marketable surplus. The assumption is based on a variety of reports and interviews with village and ward agricultural officers. In the area of influence there has been no significant increase in livestock production (about 1% only) because of unavailability of land for expansion and livestock drugs. However, the volume of trade has increased significantly between 1990 and 1992, about 140% in terms of daily retail sales in typical shops. Social services have also increased as explained below under the section on social impact.

3.3 SOURCES OF INCREASED AGRICULTURAL PRODUCTION

This study was guided by the hypothesis that improvement of

the Kwa Sadala-Mbweera road will lead to increased production of marketable agricultural produce. The main sources of increased production are:

- Intensive cultivation due to more reliable supply of inputs such as fertilizers, pesticides, improved seeds and other farm inputs.

- Expansion of production of crops for sale due to a more reliable evacuation system particularly for fresh green beans, tomatoes, and other vegetables.

- Expansion in volume of trade due to an increase in number of vehicles and a decrease in transport costs.

Estimates for the long-term expansion of production were prepared on the basis of crop production, sales data and projections of the likely expansion due to intensive cultivation and expansion in land utilization (in crops mentioned above) for all eleven villages in the area of influence including the Kibo Estates company. The estimates have been based on a wide variety of reports and material obtained from the District Agriculture Office, Ministry of Agriculture and Livestock, KILIMANJARO NATIVE COOPERATIVE UNION (KNCU) Headquarters and Hai Branch, supplemented by interviews with village and ward agricultural officers together with observations during the field study in December, 1992.

3.4 ESTIMATION OF INDUCED BENEFITS

Induced Benefits are estimated as the value of additional livestock output, agricultural output and volume of trade together with road user savings which are expected to be generated by the improvement of the road less the cost of this increased output. The estimates were made on the basis of data collected from the eleven villages and the Kibo Estates company

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which comprise the Kwa Sadala-Mbweera area of influence. This data is presented in detail in Appendix B and summarized in Table 3.1. Forecasts were made independently for each crop taking into account likely increases in production due to intensive cultivation, use of chemical inputs, improved seeds and expansion in land utilization in some crops, particularly fresh green beans, tomatoes, and other vegetables. Valuation of the estimated quantitative increase in agricultural output was done for cash crops as well as for food crops. The same was done for livestock production and volume of trade.

The net benefits were compared against the cost of the improvement of the road by calculating the economic Net Present Value (NPV) through the RTIM2 Model.

3.5 VEHICLE OPERATING COSTS (VOC)

In the vehicle operating costs survey, 21 type of vehicles were included and categorized into five groups namely passenger car (PC), light goods vehicles (LGV) medium goods vehicle (MGV), buses and tractors as detailed in Appendix B. The light good vehicles (pickups) formed the largest vehicle group system as revealed in the OD survey and traffic counts (see Appendix A). About 72 per cent of the vehicles using the Kwa Sadala-Mbweera road are pickups and are mainly used for both cargo and passengers.

Vehicle operating costs are summarized in Table 3.2 and costs are averaged on a kilometer basis. The most important costs groups are standing costs and running costs. Table 3.2 indicates that the medium goods vehicles recorded the highest average cost per kilometer (Tshs. 136.6) while the passenger car recorded the lowest cost per kilometer (Tshs. 77.7). The big variations in the vehicle operating costs observed are mainly due to the loading capacity, the nature of the work, journey frequency, the number of crew, types of fuel and age of the

Table 3.1

INDUCED BENEFITS OF KWA SADALA–MBWEERA ROAD PROGRAM

	AVERAGE YEARLY MARKETABLE PRODUCTION (1989/90–1992/93)	WITHOUT PROJECT AVERAGE YEARLY MARKETABLE PRODUCTION (NORMAL GROWTH)		WITH RPOJECT AVERAGE YEARLY MARKETABLE PRODUCTION		INDUCED BENEFITS AVERAGE PER YEAR
	TSHS'000	TSHS'000	% GROWTH	TSHS'000	% GROWTH	TSHS'000
COFFEE	200,049.3	204,050.2	2.0	210,171.7	9.0	8,406.9
GREEN BEANS	110,595.9	114,466.8	3.5	122,479.5	20.0	15,401.9
BANANA	163,098.7	166,360.7	2.0	171,351.5	3.0	4,990.8
MAIZE	460,515.6	474,331.1	3.0	502,883.0	10.0	35,201.8
BEANS	95,205.6	98,061.8	3.0	103,964.5	10.0	7,277.5
TOMATO	7,943.5	8,102.4	2.0	8,345.5	5.0	405.1
VEGETABLES	723.9	731.1	1.0	745.7	5.0	36.6
MILLET	1,365.5	1,392.8	2.0	1,434.6	7.0	99.4
TOTAL	1,039,498.0	1,067,496.9		1,121,376.0		71,820.0

Table 3.2

KWA SADALA-MBWEERA ROAD
AVERAGE VEHICLE OPERATING COST (VOC)
(NET OF TAXES)
GRAVEL ROAD

December 1992

VEHICLE OPERATING COST (VOC)	PASSENGER CAR (PV)	LIGHT GOODS VEHICLE (LGV)	MEDIUM GOODS VEHICLE (MGV)	BUS	TRACTOR
SPECIFICATION:					
Annual Vehicle Utilization (km)	23,800	35,447	36,000	99,800	21,167
Annual Passengers (P)/Tons(T)	-	32,333 (T)	79,880 (T)	18,276(P)	971 (T)
Capital Cost	600,000	1,129,638	2,700,000	19,500,000	756,667
New Replacement Cost	5,692,000	7,744,000	21,326,000	22,095,000	10,614,000
Residual Value	949,000	968,000	2,133,000	2,210,000	1,061,000
Interest	-	31%	31%	31%	31%
Life time	6	8	10	10	10
STANDING COSTS:					
Depreciation	791,000	847,000	1,919,300	1,998,500	955,300
Insurance	21,000	39,778	75,110	85,000	-
Salaries, wages & allowances	-	300,889	300,889	1,268,120	100,747
Total standing costs	**812,000**	**1,187,667**	**2,294,810**	**3,341,620**	**1,056,047**
RUNNING COSTS:					
Fuel (Petrol/diesel)	615,000	1,181,067	1,935,080	3,220,000	874,700
Lubricants	40,000	48,233	72,800	86,500	81,767
Spare parts	225,000	232,542	321,600	500,000	383,837
Maintenance (including labor)	42,500	53,778	66,000	150,000	83,333
Tyres and tubes replacement	72,500	208,847	189,683	938,000	242,500
Overheads	20,000	26,667	35,960	49,000	11,667
Total Running Costs	**1,015,000**	**1,751,134**	**2,621,123**	**4,943,500**	**1,677,804**
Total VOC	**1,827,000**	**2,938,801**	**4,915,933**	**8,285,120**	**2,733,851**
VOC per kilometer (Tshs)., 1992	77.7	80.9	136.6	83.0	104.5
VOC per kilometer at constant 1990 Tshs	47.7	46.6	78.6	47.8	60.2
Baseline VOC per km (Tshs.), 1990	-	76.0	128.0	-	88.0
VOC per km (US $), 1992	0.24	0.25	0.41	0.25	0.32
VOC per km (US $), 1990	-	0.40	0.67	-	0.46

BEST AVAILABLE DOCUMENT

vehicle. The biggest vehicles observed here were the ten-tonne trucks and buses. It is significant that the vehicle fleet in Kilimanjaro region is very old. Some vehicles were purchased in 1950s and consequently it is very difficult to establish their original capital costs. Capital costs were therefore based on replacement values and depreciation based on estimated vehicle life.

3.6 ESTIMATION OF VEHICLE OPERATING SAVINGS

Vehicle operator savings are based on vehicle operating costs analysis in Table 3.2. Without the project the average VOC per kilometer was computed by Agriconsult Ltd who carried out the baseline study in 1990 to be Tshs. 97.3 or US $ 0.51 at Tshs. 190.0 per dollar. With the rehabilitation of the road in 1992 the average VOC per km is estimated at Tshs. 107.3 or US $ 0.35 at Tshs. 330.0 per dollar in 1992, an increase in absolute terms of 10% or a decline of 31% in real terms.

The road user savings due to lower vehicle operating costs in real terms is translated over 15 years in Road and Transport Investment Model 2 (RTIM2) applicable to the Tanzanian road environment. The savings with the project are about Tshs 2,109 million including induced benefits or US.$ 6.4 million with generated traffic, and Tshs 1,195 million or US $ 3.6 million in case of normal traffic. See Table 3.3.

We have included the generated traffic specifically because during the baseline survey in 1990 only 59 vehicles were operating daily along the road. After the rehabilitation of the road and with lower operating costs, the traffic volume jumped to 274 daily which is an increase of 364 percent. This volumetric increase justifies the Internal Rate of Return (IRR) of 41.4% with the project. For example before the rehabilitation there were no buses using the road; with the project there are now 10 buses operating over Kwa Sadala-Mbweera road.

3.7 DESIGN, INITIAL REHABILITATION AND SUPERVISION

Actual costs for design, rehabilitation and supervision were used in the evaluation of Kwa Sadala-Mbweera road. The design cost for the 12 km road was Tshs. 3 million (US$ 9091). Rehabilitation costs were Tshs. 144 million (US$ 436,364) and supervision costs was Tshs. 3 million (US$9091). According to Ministry of Works policy design costs should be equal to the supervision costs.

3.8 REGULAR AND PERIODIC MAINTENANCE

The routine and periodic maintenance were derived from the existing Ministry of Works (MOW) budgets. Through analysis conducted by MOW road engineers, routine maintenance would cost Tshs. 396,000 (US $ 1,200) per kilometer per year. Periodic maintenance would be carried out after every three years. The periodic maintenance will cost about Tshs. 5,197,000 (US$ 15,748) per kilometer. All the prices over the 15 year analysis period are in constant prices.

3.9 PROJECT BENEFIT AGGREGATION

The present value of benefits of the Kwa Sadala-Mbweera road is the discounted sum of the annual benefits (vehicle operator savings and induced benefits) from 1993 to 2007. A discount rate of 12% was chosen as reflecting the opportunity cost of capital investment. This rate is recommended by MOW for use in road project evaluation and is the most generally used rate by the World Bank and IDA for road projects. This project was evaluated using 12% and 20% rate of discount. The 20% discount rate was taken because the rate of inflation is about 20 percent.

The growth rates of the vehicle operator savings and induced benefits was assumed to be the same as the GDP growth rate or

about 4% per year.

3.10 ECONOMIC ANALYSIS

Table 3.3 shows cash flow. Economic Net Present Value (NPV) and Internal Rate of Return (IRR) are computed for 12% percent and 20% per annum opportunity cost of capital. The results using domestic prices indicate that Kwa Sadala-Mbweera Road rehabilitation is justified by both methods and economic criteria. At domestic prices, the NPV at 12 percent with normal traffic is Tshs 330 million (US$ 1 million) while with generated traffic the NPV is Tshs. 640 million (US$ 1.9 million). The IRR with normal traffic is 32.7% and with generated traffic is 41.4%. These results clearly indicate that the benefits to the road users (farmers, vehicle operators, consumers) justify the cost of rehabilitation of the Kwa Sadala-Mbweera road. Evaluation of the project using a 20% opportunity cost of capital investment revealed that the road rehabilitation would remain justified.

3.11 SENSITIVITY ANALYSIS FOR THE ECONOMIC EVALUATION

Three tests were made to find out the sensitivity of our assumptions to the results obtained and viability of Kwa Sadala-Mbweera road.

(a) All costs increased by 15%;
(b) Both vehicle operator savings and induced benefits reduced by 15%;
(c) All costs increased by 15% combined with a reduction of all benefits by 15%.

The sensitivity analysis is presented in Table 3.4. At domestic prices and using a discount rate of 12% an increase in all costs by 15% reduces the NPV for the normal traffic option to Tshs. 294 million (US$ 890,909) and with generated traffic to Tshs. 605 million (US$ 1,833,000). The IRRs are 28.8% and 37.6%

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Table 3.3

ECONOMIC EVALUATION OF THE BENEFITS – KWA SADALA–MBWEERA ROAD AT DOMESTIC PRICES ALL COSTS AND BENEFITS IN TSHS. (000)

YEAR	DESIGN COST	CONSTRU-CTION COST	SUPERVI-SION COST	MAINTEN-NANCE COST	VOC SAVINGS		OTHER BENEFITS (INDUCED)	NET ECONOMIC BENEFITS	
					NORMAL TRAFFIC	GENERATED TRAFFIC		NORMAL+ INDUCED	NORMAL+ GENERATED+ INDUCED
1992	(3,000)	(144,000)	(3,000)	0	0	0	0	(150,000.00)	(150,000.00)
1993	0	0	0	(1,425.6)	(2,886.68)	(5,705.7)	35805	31,492.72	25,787.02
1994	0	0	0	(1,425.6)	(3,068.17)	(6,064.43)	39165	34,671.23	28,606.80
1995	0	0	0	(1,425.6)	(3,295.76)	(6,514.27)	42805	38,083.64	31,569.37
1996	0	0	0	(59,025.6)	(3,607.96)	(7,131.37)	46795	(15,838.56)	(22,969.93)
1997	0	0	0	(1,425.6)	45,148.26	89,238.35	51135	94,857.66	184,096.01
1998	0	0	0	(1,425.6)	45,799.82	90,526.21	55895	100,269.22	190,795.43
1999	0	0	0	(1,425.6)	46,154.95	91,228.15	61110	105,839.35	197,067.5
2000	0	0	0	(59,025.6)	46,231.43	91,379.33	66780	53,985.83	145,365.16
2001	0	0	0	(1,425.6)	45,989.50	90,901.13	72975	117,538.9	208,440.03
2002	0	0	0	(1,425.6)	45,381.31	89,699.01	79800	123,755.71	213,454.72
2003	0	0	0	(1,425.6)	44,361.13	87,682.55	87150	130,085.53	217,768.08
2004	0	0	0	(59,025.6)	42,832.78	84,661.67	95305	79,112.18	163,773.85
2005	0	0	0	(1,425.6)	40,724.36	80,494.26	104230	143,528.76	224,023.02
2006	0	0	0	(1,425.6)	37,969.46	75,049.02	113890	150,433.86	225,482.88
2007	0	0	0	(1,425.6)	34,615.25	68,419.21	124460	157,649.65	226,068.86
TOTAL	(3,000)	(144,000)	(3,000)	(194,184)	462,349.68	913,863.12	1,077,300.00	1,195,465.68	2,109,328.80
					12% discount rate		NPV	329,515.47	639,992.294
							IRR%	32.7	41.4

Note: Benefits as obtained in the 'RTIM2–Model' runs in the do–something scenario

respectively for normal and generated traffic. Similarly, reducing all benefits by 15% leads to a NPV of Tshs. 245 million (US$ 742,424) and Tshs. 509 million (US$ 1,542,000) respectively for normal and generated traffic; and the IRRs are 28.2% and 37.0% respectively. Further reducing all the benefits by 15% combined with 15% increase in all costs results in an NPV of - Tshs. 210 million (US$ 636,364) and Tshs. 474 million (US$ 1,436,000) for normal and generated traffic respectively. The IRRs are 24.2% and 33.4 respectively. These results indicate a strong viability of the project.

As a result of the above, it is concluded that there is a high degree of certainty that the rehabilitation of the Kwa Sadala-Mbweera road is economically viable.

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Table 3.4

SENSITIVITY ANALYSIS FOR ECONOMIC EVALUATION
OF KWA SADALA–MBWEERA ROAD

	NORMAL TRAFFIC + INDUCED BENEFITS			GENERATED TRAFFIC + INDUCED BENEFITS		
	NPV at 12% (TSHS.000)	NPV at 20% (TSHS.000)	IRR %	NPV at 12% (TSHS.000)	NPV at 20% (TSHS.000)	IRR %
(1) Base Case	329,515	133,028	32.7	639,992	300,955	41.4
(2) All costs of Rehabilitation, design supervision and maintenance increased by 15%	294,361	102,383	28.8	604,838	270,310	37.6
(3) Both road user savings and induced benefits reduced by 15%	244,934	84,429	28.2	508,839	225,167	37.0
(4) All costs increased by 15% and all benefits reduced by 15%	209,779	51,784	24.7	473,684	194,522	33.4

PART IV
SOCIAL IMPACT ASSESSMENT

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SOCIAL IMPACT ASSESSMENT

4.1 INTRODUCTION

Evaluation of Kwa Sadala-Mbweera road included a survey of the households in the area to assess community life. Thus information on social factors has been an important aspect of the whole exercise.

Data has been organized and analysis carried out and presented in tables. Results have shown that the impact of the road on people's living conditions was not directly felt by them; although they admitted that most living conditions have been improving. Except for a few respondents who have been able to relate road improvement with improved living conditions, most could not explain the reasons behind the improved conditions.

Notwithstanding the answers received from respondents reflecting no road impact, the household surveyors formed the opinion that the road has contributed to the improvement of people's lives in many facets.

4.2 Methodology

A household survey was conducted in December, 1992 in the Kwa Sadala-Mbweera area. The aim of the survey was to assess the impact of the road on the people living around and within the area. The assessment covered such matters as health, education, business activities, population issues, transportation, agriculture/livestock production and other village based activities/services.

The area of influence of the road was first identified. It comprised eleven villages which were found to be benefitting from this road. Of these, four villages were picked as sample villages. The basis of the choice was mainly the distance from

the road. Two villages were situated along the road while the other two were selected from the interior about 3 kms on either side of the road. Ten households in each of the four villages were selected for a face to face interview totalling 40 households interviewed. Of the 40 interviewees, 22 were male and 18 female. Ages of the interviewees ranged from 25 to 90 years. The sample selection included a mixture of high, medium and low income groups. Village authorities were left to undertake this selection.

Although only 4 villages out of 11 making up the area of influence were taken as a sample, general data was collected also from all the 11 villages. The types of data collected include: number of households in the village, population, housing conditions, education facilities, health services available and number and type of vehicles. All this data was provided by the respective village authorities. A health survey was conducted in 3 health units to collect data. One of them was a government health center and 2 dispensaries out of 5 run by the church. A business census was also conducted on the types of businesses along the road from Kwa Sadala to Mbweera. They totalled 147. Twenty of them were interviewed.

Respondents were asked questions comparing conditions in 1990 (without the project) to the present (with the project). The questions and responses resulting from the interviews have been summarized in tables at the end of this section and attached as Appendix C and will be referred to throughout the narrative.

As regards to data reliability, it would be misleading to treat all data as reliable because in some cases, some data have been found to be contradictory; in others some data were not made available. Such cases will be pinpointed in the text.

During the interviews, none of the enumerators mentioned a road to the respondents. Discussions about the road were only

made when that topic was brought up by the respondent during the interview. Except for respondents in Mroma village, none from the other villages mentioned a road. This is an observation which enumerators couldn't ignore and had to look deeper into. It was later found that most respondents representing the residents of Mroma village preferred to use a road passing through Lemira Kati and Kware to Boma la Ng'ombe which, according to them, serves them more than the Kwa Sadala-Mbweera road. However in fact, most of the other services are received from Mbweera; such as health services, markets etc. This issue made enumerators doubt the reliability of this information.

4.3 Assessment of Impact

In general, most respondents indicated that there has been some positive changes in conditions since 1990. It was quite difficult to get a direct explanation as to why conditions had changed since the road project had started. Some reasons given by respondents didn't touch on the road. Most people thought that the conducive environment created by the government through policies like trade liberalization, open border with Kenya, rising production capacity of the country's factories, increased efforts by the people in production, availability of more vehicles now, availability of different types of goods in shops, and several others, had made conditions better. Of course such reasons have a relationship with the road in one way or another and it leads us to comment so.

On comparing the conditions in 1990 with present, responses were positive (better) on such matters as availability of agricultural inputs, availability of agricultural equipment and tools, access to market facilities, transport facilities for people and goods, access to consumer goods, household food supply, family health, access to health facilities, access to education facilities, quality of education, access to fuel (not fuel wood) and decrease in road accidents. The conditions

remained the same for access to water sources and incidence of disease, while they worsened in as far as the ability to purchase goods, availability of animal feeds and availability of land.

Although most conditions have improved, few attributed improvement to the road except such matters as availability of transport facilities for people and goods where 29 and 28 respondents respectively felt there has been impact. Also 28 respondents felt road impact on reducing accidents. They stated that the number of road accidents has significantly decreased since the road was rehabilitated. No impact has been felt on the rest of the items. It should be noted that some conditions had been improving even before the road was rehabilitated. About 10 different questions received no answer by various respondents.

4.3.1 Transportation

According to the baseline study of the road conducted in 1990, there was an average of 59 vehicles a day passing on the road. But the 1992 survey revealed an annual average daily traffic of 334 vehicles. Many of the vehicles have their origin and destination within Masama division and Hai district. Some go out of the district and region.

According to the traffic survey conducted, 50% of the traffic along Kwa Sadala-Mbweera road is ferrying passengers from the villages to the towns and back and/or carrying agricultural crops and other consumer commodities for sale, especially during market days. Some also carry grass for livestock.

In the area of influence, there were 193 vehicles at the time the survey was conducted. Of the 40 households surveyed, 8 respondents owned vehicles; 3 of the vehicle owners had more than 1 vehicle, and 5 people owned bicycles.

The impact of the road on transportation services for people

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and goods is shown in table 4.5, where 29 respondents stated that impact of the road is felt on transport of people and 28 others felt an impact of road on transportation of goods. This is equivalent to 72% and 70% respectively. This was borne out by other surveys. Passenger fares have dropped from Tshs. 15 per km in 1990 to Tshs. 10 per km in 1992. Cargo rates between 1991 and 1992 have either remained stable or risen less than the rate of inflation. As stated earlier on 28 respondents felt an impact of the road on reducing road accidents. It is possible that distance from the road has an influence on the people in as far as impact is concerned. For example, of the 15 people who noted much impact of the road on transport of people (Table 4.8), 6 were in Roo and 7 in Mbweera which are both located on the road, while only 2 in Ngira and none in Mroma noted impact. The last two villages are not on the road, but within its area of influence.

4.3.2 Agriculture

The most common problem households face is the acute shortage of land, particularly for agriculture. This has made it almost impossible to expand the area under cultivation. All 40 respondents pinpointed land shortage as their main problem and it becomes worse over time because of the system of land ownership (Kihamba) where a man is required to distribute the same piece of land to his sons and sons to the grandsons. As a result, a piece of land owned by one person becomes smaller and smaller.

Some people have managed to rent some land for farming. The area which is usually rented is more than 15 kms away to the south of the Moshi - Arusha road where only annual crops, particularly maize and beans, are intercropped. The distance makes it difficult to reach the farms without transport facility. It is usually the high income group who are able to rent such areas and have to travel all the way to the farms and back.

The main crops grown on the homestead plot are coffee and bananas. Like maize and beans these are also intercropped. Coffee is the main cash crop for big farmers. The survey has revealed that for small farmers banana is the main cash crop and in fact it earns people more than coffee does. (see Table C.11 in Appendix C).

There are a few households which also grow perishables such as tomatoes and green beans for cash. Although maize, beans and bananas are considered food crops, surplus can be sold to meet some household expenses. Irrigation by small furrows is carried out in every village except Kwa Sadala. Water from rivers or springs is diverted through the furrows to coffee and banana farms near the homesteads where tomatoes and green beans are grown and irrigated. Thus, except for maize and beans, the rest of the crops grown in the area of influence do not depend on rainfall.

Apart from agricultural production, livestock keeping is another important activity of all households in the area of influence. Cattle are usually kept using the zero-grazing system where food is brought to the animal in its shed. The same applies to goats and sheep. For those who keep large numbers of livestock, these are left to feed on grass in an open grazing area south of the Arusha-Moshi road near Kwa Sadala. Of the livestock, poultry seem to be attacked more by diseases, thus frustrating poultry keeping.

Agricultural inputs, agricultural equipment and tools are more available now than they were in 1990 as evidenced by responses from interviewees where 33 out of 40, equivalent to 82.5% responded positively to better conditions on availability of agricultural inputs, while 37 out of 40 or 92.5% of them reacted positively to conditions on availability of equipment and tools. A major concern of many has been the rising prices of these commodities.

Another problem which has been singled out by many has been the availability of pesticides and livestock drugs which, it is argued, are either not available or unaffordable.

As regards to animal feed, the scarcity of land has contributed also to another problem of the availability of natural animal feed, particularly grass. One has to walk long distances in search of grass. Responses from respondents show that the condition of natural animal feed has worsened. Twenty-three respondents, representing 57.5%, stated this is a problem. Ready-made feeds are available in animal feed shops although many complain that they are expensive. The supply of ready-made animal feed, they say, has improved since 1990.

Although to the villagers conditions regarding agriculture and livestock issues have improved, when asked about the reason as to why these conditions have improved, 95% gave reasons which have no relationship with the road. Only 2 respondents stated that animal feeds are made available because they are brought from town by vehicles passing on the road, thus reflecting a road impact. Twenty-eight respondents said household food supply is better now with no reasons as to what contributed to this state of affairs.

All in all, many benefits are reflected within the agricultural sector. Some of them are presented in Section 3 - Economic Evaluation. The assessment of such production indicates the impact of the road on agricultural and livestock production.

4.3.3 Commerce

Since the baseline survey of 1990, the total number of businesses in Kwa Sadala, Roo, Mudio and Mbweera has doubled from 123 to 249. For the entire area of influence the total is 456 businesses which does <u>not</u> include informal sector activities nor market traders at Kwa Sadala and Mbweera. The business survey

indicated that 40% of the enterprises had begun since 1990. Most of the businesses in the area are privately owned. Only three out of 20 surveyed were coops.

Shopkeepers' transport costs in 1991 and 1992 have either remained constant (a decline in real terms of 43.5%) or increased in absolute terms only 25% which is half the inflation rate. (See Table 4.9). Price comparisons between 1990 and 1992 show a range from a 10% decline to an increase of 50% in absolute terms. However, in real terms, prices have either remained constant or gone down by as much as 48%. The observation of 37 individuals out of 40 surveyed that the availability of basic goods has increased was reinforced by the business survey. Of the 18 items listed, all 20 shops had at least 12, some had all items and all items could be obtained within a short distance. The variety of businesses operating along the road (See Annex C) gives a good indication of services provided from the common general stores, tea shops and bars to the rather unusual pharmacy, radio-watch repair shop and cement wholesaler.

The average volume of trade has risen from Tshs. 6000 daily sales in 1990 to Tshs. 13,250 in 1992, an increase of 120% in nominal terms but only 27% using constant 1990 shillings. In fact most shopkeepers grossly understate their sales and a very conservative estimate would put the real volume of trade at closer to Tshs. 25,000.

In discussing road impact, merchant comments run the gamut from very positive to very negative. Some mentioned the road in connection with the steady cost of transporting goods from Moshi over the last two years. Some mentioned the road as a reason for increased business. Others noted that the improved road has hurt business because of increased competition, especially from the twice-weekly markets. (However what may be negative for the shopkeeper may be positive for the consumer). Increases in business services provided and volume of trade in the area cannot

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be solely attributed to the improved road. However increased vehicle and passenger traffic and decreased transport costs have obviously had a beneficial impact on both businesses and the communities they serve.

4.3.4 Health

The road has had significant impact on health services particularly in the two health units out of the three health units which were visited. Those units were built 3 km away from the road. The medical assistants reported that the rehabilitation of the road had helped them to transfer their patients to bigger hospitals without much difficulties. The road also improved delivery of their hospital supplies. There have been no serious road accidents or epidemics, particularly those caused by water borne organisms due to poor drainage, since the rehabilitation of the road. Two dispensaries out of the 3 health units reported an increase of patients during the period 1990-92. None of the respondents connected the increase of patients with the rehabilitation of the road. All health units visited reported an increase of staff due to the increase of patients.

Drug supply in the two church dispensaries was adequate while in the government health center the supply was inadequate. The commonest diseases in both health centers were malaria, intestinal worms, upper respiratory infections, pneumonia and diarrhoeal diseases. Diseases in both dispensaries and in the health center are increasing every year. None of the respondents interviewed linked the increase of drugs with the rehabilitation of the road, but rather with the economic recovery. Diseases have increased with people's movement from one area to another, particularly business men/women, and may be related to some extent with road rehabilitation.

Two out of the three surveyed health units ran Maternal and Children Health Service (MCH). They also distribute condoms to

the community members through community health workers to prevent the transmission of HIV virus. The government health center distributes about 90 boxes containing 150 condoms each per month and the church dispensary distributes 3 boxes per month.[2]

The majority of families interviewed about the health situation since 1990 reported that there was an improvement of health conditions in their families. Twenty-seven out of 40 respondents (68%) reported better health, while 8 (20%) didn't notice any changes and 5 (12%) reported family health was becoming worse. Those who reported family health was better said it was because of the better access to health services. They cite particularly improved health education and availability of drugs, especially in church dispensaries and in private medical stores although they are expensive. None of the respondents connected access to health services with the rehabilitation of the road. Those who reported family health declining said it was because of lack of hospital facilities and drugs, particularly in the government health center, and the increase of costs in the private health services.

4.3.5 Education

Access to education facilities and the quality of education since 1990-92 didn't show a significant impact from the rehabilitation of the road. The majority of the respondents said that the education facilities increased and the quality of education has improved since 1990, but none of them connected the increase of education facilities or the improvement of the quality of education with the rehabilitation of the road. Twenty-seven interviewed families (68%) reported the increase of education facilities, while 11 (28%) didn't notice any change since 1990. One out 40 reported that the condition was becoming

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[2]The third unit did not distribute condoms because it had no MCH center

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worse. One couldn't tell whether education facilities were better, the same or worse. For those respondents noting an increase in education materials and supplies, they said it was because of the increase of different shops in the area where they can easily get them. None of the respondents linked the access to education supplies with the rehabilitation of the road. Twenty-two out of 40 respondents (55%) reported an improvement of the quality of education since 1990. Seven (18%) didn't notice any change and 9 (22%) out of 40 respondents said that the quality of education was becoming poorer and poorer. One couldn't tell whether the quality of education was better, same or worse. For those who reported that there was an improvement in the quality of education, they said it was because school authorities agreed to reduce some of the self reliance activities which took up too much of the students' time. None of them noticed an impact of the road on the quality of education.

Those respondents who reported poor quality of education said it was because of too many self-reliance activities, laziness of some teachers, irresponsibility of some teachers and poor supervision from the higher authorities.

4.3.6 Gender

Out of the 40 interviews, 18 were with females. In the interviews there was no significant variation in responses given by men and women concerning their socio-economic activities. Out of the 40 household interviewed, 35 were male headed and 5 were female headed households - 3 of these were widows, 1 unmarried and another whose husband had run away. In comparing the standards of living of the male headed and female headed households, the female headed households were poorer than most male headed households. This may be attributed to the system of property ownership, in particular land, especially for the unmarried and the widowed, whereby they are forced to surrender whatever land they have acquired (or have been using for

cultivation), by virtue of their being married or being part of the family, to the male members of the family thus leaving them without land.

Regarding the household chores, they are mostly done by women; except when a woman has given birth, she is supposed to have complete rest of about 2 - 3 months. In such a case, the husband or the husband's relatives take care of almost all the domestic work.

Ownership of other family property such as agricultural equipment, and tools, vehicles, house, livestock, kitchen utensils etc. is communal in the sense that such possessions are a property of all members of the household and will be used by members of that household, with guidance from the head of the household.

Other activities such as farming, pruning coffee trees, weeding, spraying, harvesting, marketing are done together by both men and women, while cutting grass for zero-grazing cattle is mostly done by women in early hours of the day.

When it comes to the distribution of household income, men have more say than women because it is mostly men who handle financial matters in male headed household. However, the fact that women could as well tell on how income is used makes us believe that even women are involved in financial matters. Most of the earnings, the survey has shown, goes to educating the children. The survey has shown that all the people in the area of influence value education. A good portion of the income is used to buy food while the rest of the income goes to house building, farming and to meet other household expenditures.

4.3.7 Household Income

As stated earlier in item 4.3.2, most people within

the area of influence earn their living from agricultural production. According to data collected from an agricultural expert in Isuki village, 83% of people's income in Masama division stems from agricultural produce, 4% of the income comes from sales of either livestock directly or indirectly through the sales of livestock products such as milk or meat, and 13% of the people's income is estimated to come from other sources which may include wage employment, trading, handicrafts, brewing, etc.

The survey shows that people earn more income from the sale of bananas than they earn from other crops. This is substantiated by data on household income for 1992. Two years back, i.e. 1990, coffee was the major cash crop which earned people more money than any other crop, as indicated in Table C. 10 in Annex C on household income for 1990. As of 1992, income from coffee in the 4 surveyed villages had dropped. This may be attributed to fall in the price of coffee from Tshs. 255/= per kg in 1990 to Tshs. 155/= per kg. in 1992. In addition, production costs of coffee have risen tremendously from Tshs. 39.80 per kg. of coffee produced in 1990 to Tshs. 140 per kg of coffee produced in 1992. On the other hand, the price of bananas has been going up without a proportional rise in the cost of production.

The prices of maize and beans have been going up in a somewhat proportionate manner with the cost of production hence no major changes in the value of crops.

Comparing the household income of villagers in 1990 to their income in 1992 as calculated from data collected from the survey in December, 1992, there has been an increase in household income in absolute terms. Tables 4.1 below indicates that there has been an increase in average household income in all the 4 villages.

Table 4.1 Average Household income for 1990 and 1992

VILLAGE	AVERAGE HOUSEHOLD INCOME		% INCREASE	% in constant 1990 Tshs.
	1990	1992		
MROMA	36,455	98,452	170	55.5
NGIRA	144,388	273,973	89.7	9.2
ROO	64,045	114,360	78.6	2.8
MBWEERA	441,360	605,769	37.3	-20.9
	171,562	273,138	59.2	-8.3

Source: Baseline & Household Survey

Table 4.2 provides information on income groups. The income groups have been categorized into 3: the upper, middle and lower. For the purpose of this survey income groups have been described in the table below.

The income groups are based on 1992 earnings from crop sales and estimates of livestock/livestock products sales, plus outside income. Each village was grouped separately as follows:

Table 4.2 Income groups by villages

VILLAGE	UPPER	MIDDLE	LOWER
MROMA	+130,000	60,000-130,000	60,000 and below
NGIRA	+200,000	100,000-200,000	100,000 and below
ROO	+130,000	80,000-130,000	80,000 and below
MBWEERA	+200,000	100,000-200,000	100,000 and below
TOTAL	11	14	15

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There has been quite a variation between income group in answering the questions as shown in Table 4.7 when asked to compare conditions in 1990 with conditions 2 years later. There are some respondents who have not been affected by some issues asked. In this case they could not provide an answer. Most respondents belonging to the middle and low income groups believed that conditions including the availability of agricultural inputs and equipment, access to market facilities, transport facilities, access to consumer goods and access to health facilities have improved. Reaction of the upper income group on the conditions just mentioned has not been felt so much, probably because, being better off than the rest of the groups, they have been able to travel by personal transport or hire a vehicle to town to purchase whatever they needed.

Most of the upper income group respondents cited availability of agricultural equipment, access to market facilities, access to consumer goods and reduction of road accidents as conditions which have improved now when compared to the condition in 1990.

All income groups regard ability to purchase goods as worse in 1992. On the other hand, 37 respondents, 11 from upper income group, 14 from middle and 12 from low income group said that availability of consumer goods have improved. Commodities have become expensive though. They believe that the amount of money they are earning now buys less than what it used to buy in 1990. However, if we compare increases in incomes between 1990 and 1992 averaging 59% as shown in Table 4.1 and increases in prices of some basic goods averaging 33% as shown in Table 4.9 (E), we note that this may not be the case, and that incomes are rising faster than prices.

Household food supply is better for most of the upper income group and middle income group, but is worse for almost half the

number of low income group. As indicated by Table 4.3, there is a large income discrepancy between the poorest person with Tshs. 4200 a year and the richest in the area of influence with Tshs. 4,094,800 a year.

Table 4.3 RANGE OF 1992 HOUSEHOLD INCOMES (IN TSHS.)

INCOME INTERVALS	FREQUENCY
1,000,000 and above	3
500,000-1,000,000	0
200,000-500,000	6
100,000-200,000	11
70,000-100,000	4
40,000-70,000	5
10,000-40,000	9
Below 10,000	2

MEDIAN Tshs. 99,800
RANGE Tshs. 4,200 - 4,090,600

On availability of animal feed, conditions are worse for all respondents of the middle income group while some few people in the upper income group and low income group said conditions are better, a few others said the conditions are worse. An explanation for this can be that the respondents in upper income group can hire a vehicle to go and collect grass or they can use money to buy ready-made animal feed from the shops. The low income people, having few or no livestock, don't require much to feed them. The problem is felt more by the middle income group because most own some livestock, but can't afford to buy feed from shops or hire vehicles which could help them collect grass from distant areas.

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The survey revealed that the population per square kilometer in the area of influence of the road was very high when compared to the national average population of 27 persons per square kilometer. For entire area of influence, the population density is 280 people per sq. km., while the area north of Roo is around 400 people per sq. km. That shows how overcrowded the area is.

The surveys, interviews and observation of people's movement revealed the impact of the rehabilitation of the road on the people regarding transportation of agricultural goods to and from their farms, to the town (Moshi) e.g. coffee for processing and exportation, transportation of market goods, commercial goods and so forth. The improved road has helped people move from one place to another without great difficulty as it was before road rehabilitation. The majority of the inhabitants work far from their homes, yet they prefer living at home. In this regard the road enhances family relations and social-economic activities.

4.3.8 Other Impacts

Ten out of 40 respondents reported improvement of water sources since 1990. None of respondents connected the improvement of water sources with the rehabilitation of the road because these people received tap water before the rehabilitation of the road. Fifteen (38%) didn't notice a difference in access to water since 1990 because they had plenty of water before 1990. Fifteen (38%) reported having poor water sources, either for irrigation or for household use. In general the area has plenty of water on Mount Kilimanjaro. Their main problem is clean water for household use.

Every respondent said that land availability was worse. They related the availability of land to rapid growth of population. Others couldn't tell exactly the cause of poor availability of land. Some said that the problem of land was there long long ago even during their grandparents time.

According to their values, norms and customs, parents had to give land to their sons after they got married. Therefore if a parent had 4 or 6 sons, he had to divide his land into 4 or 6 parts for his sons. Eventually as days were passing by, it came to a point where parents found that they had too small an area of land to divide it for their sons or sons themselves learnt that the remaining portion was too small for them to survive. That was where the problem started. The interviewees said that some children decided to go away from their parents' area and went to other regions looking for land for cultivation and grazing. Thus today people originally from Kilimanjaro are found in different parts of the country. Some respondents said that sometimes they had to go outside their homes 10-30 miles looking for land for cultivation and for grazing.

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Table 4.4

SUMMARY SHEET
VILLAGE SURVEY
KWA SADALA - MBWEERA ROAD
DECEMBER 1992

VILLAGES SURVEYED: ROO (10) NGIRA (10) MBWEERA (10) MROMA (10)
TOTAL INTERVIEWED: 40
GENDER: MALE 22 FEMALES 18
AGE RANGE: 25 - 90
AREA CULTIVATED
TOTAL 276.5 ACRES
RANGE 0.1-87
AVERAGE 6.9

CROPS	CULTIVATORS/40	RANGE (ACRES)	AVERAGE (ACRES)
MAIZE	38	0 - 42.5	2.92
BEANS	38	0 - 42.5	2.97
COFFEE	39	0 - 10	1.12
BANANA	39	0 - 10	1.12

NOTE: Usually, beans are intercropped with maize and banana with coffee.

LIVESTOCK:	TOTAL	OWNERS/40	RANGE (OWNERS ONLY)	AVERAGE (OWNERS)
CATTLE	95	28	1 - 15	3
GOATS	74	23	1 - 7	3
POULTRY	238	28	1 - 45	9

POSSESSIONS:	OWNERS/40
IRON ROOF	32
RADIO	26
BICYCLE	5
MOTORCYCLE	1
VEHICLE	6
TRACTOR	1
MILLING MACHINE	1

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Table 4.5

COMPARISON OF CONDITIONS IN 1990 WITH PRESENT

(Sample of 40 Interviewed)

ITEM	BETTER	SAME	WORSE	N/A*
1. Ability to Purchase Goods	13	5	22	
2. Ag. Inputs	33	2	5	
3. Ag. Equipment	37	2	1	
4. Access to Mkts.	37	3	-	3
5. Availability of Animal Feeds	8	6	23	1
6. Transport (People)	29	5	5	1
7. Transport (Goods)	28	4	7	1
8. Access to Consumer Goods	37	2	-	1
9. Household Food Supply	28	4	8	-
10. Family Health	27	8	5	-
11. Access to Health Facility	21	10	9	-
12. Access to Education	27	11	1	1
13. Quality of Education	22	7	9	2
14. Access to Water	10	15	15	-
15. Access to Fuel	21	8	11	-
16. Availability of Land	-	-	40	-
17. Road Accidents Reduced	28	11	-	1
18. Disease Reduced	1	30	9	-

* N/A = No answer

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Table 4.6

RESPONSES DISAGGREGATED BY GENDER

ITEM	BETTER M	BETTER F	SAME M	SAME F	WORSE M	WORSE F	N/A*
1. Ability to Purchase Goods	6	7	2	3	14	8	
2. AG. Inputs	18	15	1	1	3	2	
3. AG. Equipment	21	16	1	1	-	1	
4. Access to Mkts.	20	17	2	1	-	-	
5. Availability of Animal Feeds	3	5	2	4	16	7	3
6. Transport (People)	17	12	2	3	3	2	1
7. Transport (Goods)	17	11	2	2	3	4	1
8. Access to Consumer Goods	21	16	1	1	-	-	1
9. Household Food Supply	17	11	2	2	3	5	
10. Family Health	14	13	4	4	4	1	
11. Access to Health Facility	12	9	4	6	6	3	
12. Access to Education	16	11	4	7	1	-	1
13. Quality of Education	13	9	1	6	7	2	2
14. Access to Water	6	4	7	6	9	8	
15. Access to Fuel	12	9	5	3	5	6	
16. Availability of Land	-	-	-	-	22	18	
17. Road Accidents Reduced	16	12	5	6	-	-	1
18. Disease Reduced	2	7	19	12	-	-	

* N/A = No answer

Table 4.7

RESPONSES DISAGGREGATED BY INCOME GROUPS

ITEM	BETTER			SAME			WORSE			
	UPPER	MIDDLE	LOW	HIGH	MIDDLE	LOW	HIGH	MIDDLE	LOW	N/A
1. Ability to purchase goods	3	6	4	3	1	1	5	7	10	
2. Availability of Agricultural imputs	8	14	11	–	–	2	3	–	2	
3. Availability of Agricultural equipment	11	14	12	–	–	2	–	–	1	
4. Access to markets	10	13	14	1	1	1	–	–	–	
5. Availability of Animal feed	4	–	4	1	–	5	6	14	4	3
6. Transport facilities (people)	9	10	10	2	–	3	–	4	1	1
7. Transport facilities (goods)	8	10	10	1	–	3	2	4	1	1
8. Access to consumer goods	11	14	12	–	–	2	–	–	–	1
9. Household food supply	9	12	7	2	–	2	–	2	6	1
10. Family Health	8	10	10	2	1	4	1	3	1	
11. Access to health facilities	3	11	7	4	1	5	4	2	3	
12. Access to education	8	10	9	3	4	4	–	–	1	1
13. Quality of education	7	6	10	1	3	3	3	5	1	1
14. Access to water	3	4	3	5	–	7	3	10	5	
15. Access to fuel	2	10	8	5	2	2	4	2	5	
16. Availability of land	–	–	–	–	–	–	11	14	15	
17. Road accidents (reduction)	10	8	11	1	6	3	–	–	–	
18. Disease (reduced)	5	1	3	6	13	12	–	–	–	

Table 4.8

IMPACT OF ROAD ON CONDITIONS

ITEM	MUCH	SOME	NONE	N/A
1. Ability to Purchase Goods	0	0	39	1
2. AG. Inputs	0	0	39	1
3. AG. Equipment	0	0	39	1
4. Access to Mkts.	0	0	40	
5. Availability of Animal Feeds	2	0	37	1
6. Transport (People)	15	8	16	1
7. Transport (Goods)	14	9	16	1
8. Access to Consumer Goods	0	0	39	1
9. Household Food supply	0	0	40	0
10. Family Health	0	0	40	0
11. Access to Health Facility	0	0	40	0
12. Access to Education	0	0	39	1
13. Quality of Education	0	0	39	1
14. Access to Water	0	0	40	0
15. Access to Fuel	0	0	40	0
16. Availability of Land	0	0	40	0
17. Road Accidents Reduced	22	3	14	1
18. Disease Reduced	1	0	39	0

Table 4.9

KWA SADALA - MBWEERA ROAD
BUSINESS SURVEY

A. GENERAL INFORMATION:

Shops surveyed: 20 of which 17 private, 2 coops, 1 village
Location: Ng'uni-2, Mbweera-10, Mudio-1, Roo-3, Kwa Sadala-4
Gender of Owners: Male-16, Female-1
Average number of employees: 2
Number established since 1990: 8 (40%)

B. TRANSPORT COSTS: (Tshs.) 1 bag of rice (50kg) from Moshi to -

LOCATION	1992	1991
Ng'uni	200	200
Mbweera	200	150
Kwa Sadala	100	100

C. AVERAGE DAILY SALES 1992 (Tshs.)

Maximum-40,000, Minimum-5,000 Average-13,250

D. AVAILABILITY OF BASIC CONSUMER GOODS IN 20 SHOPS

1.	Sugar	20
2.	Cooking oil	20
3.	Salt	20
4.	Tea	20
5.	Soap	20
6.	Toothpaste	20
7.	Matches	20
8.	Batteries	20
9.	Exercise books	20
10.	Bowls	8
11.	Spoons	9
12.	Buckets	6
13.	Lamps	13
14.	Clothes	10
15.	Khanga	5
16.	Shoes	19
17.	Vaseline	20
18.	Tablets	20

Table 4.10

E. PRICE COMPARISONS (Tshs.)

	1990		1991		1992		1990-92 INCREASE	
ITEM	RANGE	AV	RANGE	AV	RANGE	AV	ABSOLUTE	REAL
Sugar (kg)	180-300	220	140-240	240	180-220	200	-10%	-48%
Cooking Oil (lt)	160-500	360	180-600	450	240-800	540	+50%	-14%
Salt (kg)	30- 80	60	40-100	60	60- 150	80	+33%	-25%
Soap (pc)	30- 60	50	50- 65	50	65- 70	70	+40%	-24%
Matches (box)	10	10	10	10	15	15	+50%	0
Battery (pc)	60-100	90	70-120	100	90- 150	120	+33%	-19%

Table 4.10

KWA SADALA - MBWEERA ROAD
HEALTH SURVEY

LOCATION:	MUDIO	MBWEERA	LEMIRA
TYPE:	GOVT	CHURCH	CHURCH
CLASS:	HEALTH CENTER	DISPENSARY "A"	DISPENSARY "A"
DAILY ATTENDANCE: INCREASE SINCE '90'	230 SOME	55 YES	95 YES
STAFF INCREASE SINCE '90	36 YES	11 YES	11 YES
DRUG SUPPLY INCREASE SINCE '90	INADEQUATE NO	ADEQUATE YES	ADEQUATE YES
COMMON DISEASES INCREASE SINCE '90	MALARIA INTESTINAL WORMS U.R.T. Infection Pneumonia Diarrhoeal diseases YES	MALARIA INTESTINAL WORMS U.R.T Infection Pneumonia Diarrhoeal Diseases YES	MALARIA INTESTINAL WORMS URT Infection Pneumonia Diarrhoeal deceases YES
FAMILY PLANNING SERVICES	YES	YES	NO
CONDOMS DIST/MO	90 boxes	3 boxes	NO
IMPACT OF ROAD	SIGNIFICANT - Easy to get transport to refer their patients to other big hospitals. - Easy to transport hospital supplies	SIGNIFICANT - Easy to get transport to refer their patients to other big hospitals. - Easy to transport hospital supplies	SIGNIFICANT - They seldom use Kware to Lemira Road.

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PART V

CONCLUSIONS AND RECOMMENDATIONS

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5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

5.1.1 The economic evaluation and social impact assessment of the Kwa Sadala-Mbweera Road was carried out in part as a pilot project to guide the development of a general methodology for rural road evaluation.

It is considered that the methodology developed provides an appropriate framework for evaluation and further similar studies should be carried out.

5.1.2 Conclusions drawn from the study are discussed below in three parts; these being Engineering, Economic Evaluation and Social Impact Assessment.

5.2 ENGINEERING INVESTIGATIONS:

5.2.1 The engineering studies suggest that the rehabilitation works carried out were sub-standard. This conclusion refers essentially to pavement and drainage structures. Review of the original traffic studies carried out in 1990 which provided the basis for the rehabilitation works suggests that the traffic counts were under-estimated. Since the pavement design reflected this under-estimation, the surface proved inadequate to handle the actual flows with consequent rapid deterioration. Even allowing for the fact that traffic volumes were under-estimated, it is considered that the standard of work carried out in the rehabilitation was inadequate. As a result the surface has badly deteriorated over a period of a few months whereas a gravel surface would normally be expected to last for a period of about 4 years.

The failure of this road therefore can be attributed to three possible causes:

- Under-estimate of the traffic volume and loading;

- Consequent under design of the pavement;

- Possible substandard workmanship by the contractor.

5.2.2 Since the works were carried out by local contractors and since it is government policy to promote the Tanzanian construction industry, it is recommended that the Ministry of Works introduce programs to strengthen contract management and project quality control.

5.2.3 In order to ensure reliable road communication for rural communities, it is essential that funds are available for routine and periodic maintenance works. Where possible maintenance works should be carried out by local contractors, and routine maintenance should emphasize the role of the local community in undertaking the labour intensive works required.

5.3 ECONOMIC EVALUATION

Economic benefits to local communities generated by road improvement schemes fall into 2 broad groups; these are:

- Direct benefits;
- Induced benefits.

5.3.1 DIRECT BENEFITS

Direct benefits are the cost savings to road users generated by the reduction in vehicle operating costs which arise with improvement of road surfaces. These vehicle cost reductions include fuel, maintenance, tyre wear and, in the case of commercial vehicles, crew costs. Related to these cost savings are increased vehicle speeds, vehicle utilization and improved reliability in trip times. Further direct benefit arising from

road improvements is the generation of additional trips which would otherwise be suppressed. These generated trips provide an immediate economic benefit. The economic evaluation carried out during the study indicates direct benefits of Tshs. 462.4 million excluding benefits derived from generated traffic and Tshs. 1375 million including generated trips.

5.3.2 INDUCED BENEFITS

Induced benefits refer to benefits generated to the entire community and are measured by the overall increase in agricultural output over the period from 1990 - 1992, that is before and after completion of the improvement works.

The analysis indicates that value of production has increased almost 20% between 1990 and 1992, of which about 8% has been attributed to improved road conditions. This has resulted from the improvement in accessibility, reduction in transport costs, and a more reliable supply of agricultural inputs such as fertilizer, pesticides, seeds etc.

The improvement in road access and therefore reliability of transport has been an important factor in the introduction of more perishable but higher value cash crops such as green beans and tomatoes. Green beans now fetch about US$ 30,000 per tonne on overseas markets.

Induced benefits represent 44% of total benefits.

5.4 SOCIAL IMPACT ASSESSMENT

Surveys were carried out to determine the socio-economic impact of the road improvement on villages located both on the alignment and within the road's areas of influence (approximately 3-5 km either side of the road). The surveys revealed the following:

- Passenger traffic has increased from 66 persons per day in 1990 to over 1300 in 1992. Over this same period fares have fallen from Tshs. 15 per km. to Tshs. 10 per km.

- Freight rates have generally remained constant over the period 1990 to 1992. In those cases where rates have been increased, they have been less than the rate of inflation.

- Residents claim a reduction in road accidents although this cannot be verified since accident data was not collected for the period prior to the rehabilitation.

- Volume of trade as measured by daily sales has risen from an average of Tshs. 6,000 in 1990 to Tshs. 13,250 in 1992. Of 20 retail shops surveyed 8 have been established since 1990.

- Most residents noted an increase in the availability of goods. Average household incomes have risen by 59% between 1990 and 1992 while prices of consumer goods have risen by only about 33%.

- The major impact of road rehabilitation on health has been in transferring patients to bigger hospitals and delivery of medical supplies. There has been no measurable impact on the provision of educational services.

- The road improvement works seem not to have had any impact on the relative position of women in the local economy. However it is concluded that increased participation of women in commercial activity and in the accumulation of property will be achieved only with general economic development and an essential feature of development is the provision of improved road communication.

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APPENDIX A

ENGINEERING DATA

TABLE A.1


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*****************************
*                           *
* TRRL ROAD INVESTMENT MODEL *
*  FOR DEVELOPING COUNTRIES  *
*          (RTIM2)          *
*                           *
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A N A L Y S I S P E R I O D

BASE YEAR OF STUDY	FIRST YEAR OF TRAFFICKING	YEARS OF TRAFFIC
1992	1993	15

GEOMETRIC DESIGN DATA

ALIGNMENT LENGTH = 12.00 KM

CARRIAGEWAY WIDTH = 5.00 METRES

SHOULDER WIDTH = 1.00 METRES

AVERAGE DEGREE OF HORIZONTAL CURVATURE = 46 DEGREES PER KILOMETRE

R I S E A N D F A L L D A T A - LENGTH OF ROAD (KMS)

PER CENT GRADIENT UP TO

	FLAT	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5
RISE	1.000	0.000	1.750	1.050	0.950	1.250	2.150	0.900	0.400	0.700	0.000	0.900	0.000	0.000
FALL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PER CENT GRADIENT UP TO

	7.0	7.5	8.0	8.5	9.0	9.5	10.0	10.5	11.0	11.5	12.0	12.5	13.0	13.5
RISE	0.000	0.000	0.800	0.000	0.000	0.000	0.000	0.150	0.000	0.000	0.000	0.000	0.000	0.000
FALL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PER CENT GRADIENT UP TO

	14.0	14.5	15.0	15.5	16.0	16.5	17.0	17.5	18.0	18.5	19.0	19.5	20.0	20 +
RISE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
FALL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

AVERAGE PERCENTAGE GRADIENT = 2.97

PAVEMENT AND SHOULDER DETAILS

PAVEMENT CODE	SHOULDER CODE	GRAVEL THICKNESS - MM
14 (GRAVEL)	14 (GRAVEL)	150

CONSTRUCTION COSTS

	CAPITAL COST	FOREIGN EXCHANGE (0 PER CENT)
1992 100 PER CENT =	150000.00	0.00
TOTAL CONSTRUCTION COST =	150000.00	0.00

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ROAD CONDITION DATA

AT FIRST YEAR OF TRAFFICKING IN THE STUDY

ROUGHNESS (MM/KM)
20000

CLIMATIC DATA

AVERAGE ANNUAL RAINFALL (MM)	NUMBER OF WET MONTHS
1000	6

TRAFFIC INPUT DATA

YEAR	TRAFFIC	* NORMAL TRAFFIC DATA FOR EACH VEHICLE TYPE							GENERATED TRAFFIC DATA FOR EACH VEHICLE TYPE						
		1	2	3	4	5	6	7	1	2	3	4	5	6	7
1993	A D T	10	42	9	3	0	0	0	14	208	21	10	0	0	0
1994	PERCENTAGE	4	4	4	4	0	0	0	4	4	4	4	0	0	0

TRAFFIC A.D.T FOR EACH YEAR

YEAR	NORMAL TRAFFIC DATA FOR EACH VEHICLE TYPE								GENERATED TRAFFIC DATA FOR EACH VEHICLE TYPE							
	1	2	3	4	5	6	7	TOTAL	1	2	3	4	5	6	7	TOTAL
1993	10	42	9	3	0	0	0	64	14	208	21	10	0	0	0	253
1994	10	44	9	3	0	0	0	67	15	216	22	10	0	0	0	263
1995	11	45	10	3	0	0	0	69	15	225	23	11	0	0	0	274
1996	11	47	10	3	0	0	0	72	16	234	24	11	0	0	0	285
1997	12	49	11	4	0	0	0	75	16	243	25	12	0	0	0	296
1998	12	51	11	4	0	0	0	78	17	253	26	12	0	0	0	308
1999	13	53	11	4	0	0	0	81	18	263	27	13	0	0	0	320
2000	13	55	12	4	0	0	0	84	18	274	28	13	0	0	0	333
2001	14	57	12	4	0	0	0	88	19	285	29	14	0	0	0	346
2002	14	60	13	4	0	0	0	91	20	296	30	14	0	0	0	360
2003	15	62	13	4	0	0	0	95	21	308	31	15	0	0	0	375
2004	15	65	14	5	0	0	0	99	22	320	32	15	0	0	0	389
2005	16	67	14	5	0	0	0	102	22	333	34	16	0	0	0	405
2006	17	70	15	5	0	0	0	107	23	346	35	17	0	0	0	421
2007	17	73	16	5	0	0	0	111	24	360	36	17	0	0	0	438

* VEHICLE TYPES

1 = Car

2 = LT. Goods

3 = Trucks

4 = Bus

VEHICLE INPUT DATA

P R I C E S

PETROL PER LITRE	DIESEL PER LITRE	LUBRICANTS PER LITRE	MAINTENANCE LABOUR PER HOUR
0.20 (80)	0.13 (80)	1.00 (80)	1.20

VEHICLE TYPE	CLASS	FUEL	ENVRMT SPEED (KM/H)	AVERAGE ANNUAL KM	ANNUAL VEHICLE HOURS	NEW VEHICLE PRICE	TYRE PRICE	CREW WAGES PER HR	OVERHEADS FIXED COST PER YEAR	OVERHEADS PER CENT COST	TIME VALUE PER HR
1	CAR	PETROL	60	23500.	1500	5692.00(80)	9.61(80)	0.08	0.00(0)	20.00(50)	0.08
2	LT GOODS	PETROL	50	35447.	2400	7744.00(80)	20.84(80)	0.18	0.00(0)	30.00(50)	0.08
3	TRUCK	DIESEL	45	36000.	2700	21326.00(75)	59.48(80)	0.35	0.00(0)	35.00(50)	0.10
4	BUS	DIESEL	45	99800.	2700	22095.00(75)	76.21(80)	0.50	0.00(0)	35.00(50)	1.00

VEHICLE TYPE	CLASS	BRAKE HORSE POWER	UNLADEN WEIGHT (TONNES)	OUTWARD LOAD (OUTWARD)	INWARD LOAD (INWARD)	EQUIVALENCE FACTOR (OUTWARD)	EQUIVALENCE FACTOR (INWARD)	POWER/WEIGHT RATIO	POWER/WEIGHT RATIO
2	LT GOODS	95	1.7	0.6	0.6	0.0	0.0	41.3	41.3
3	TRUCK	150	8.2	8.5	8.5	0.8	0.8	9.0	9.0
4	BUS	195	9.9	8.0	8.0	1.3	1.3	10.9	10.9

VEHICLE TYPE	CLASS	PERCENTAGE VEHICLES OF EACH AGE												
		NEW	1 YR	2 YRS	3 YRS	4 YRS	5 YRS	6 YRS	7 YRS	8 YRS	9 YRS	10 YRS	11 YRS	12 YRS
1	CAR	18.18	16.36	14.55	12.73	10.91	9.09	7.27	5.45	3.64	1.82	0.00	0.00	0.00
2	LT GOODS	18.18	16.36	14.55	12.73	10.91	9.09	7.27	5.45	3.64	1.82	0.00	0.00	0.00
3	TRUCK	15.38	14.10	12.82	11.54	10.26	8.97	7.69	6.41	5.13	3.85	2.56	1.28	0.00
4	BUS	15.38	14.10	12.82	11.54	10.26	8.97	7.69	6.41	5.13	3.85	2.56	1.28	0.00

VEHICLE WASTAGE - AGE SPECTRUM WILL CHANGE DEPENDING ON TRAFFIC GROWTH AND STANDARD WASTAGE EQUATIONS

MAINTENANCE INPUT DATA

MAINTENANCE POLICY 1

ROUTINE AND RECURRENT MAINTENANCE

	GRADING		OVERHEADS	
	NUMBER OF GRADINGS	COST PER KM	FIXED COST	PER CENT COST
WET SEASON	1	165.00 (0)	0.00 (0)	20.00 (0)
DRY SEASON	1	165.00 (0)		

MAINTENANCE POLICY 2

PERIODIC MAINTENANCE (RESURFACING)

REGRAVELLING TO BE CARRIED OUT WHEN EITHER OF THE FOLLOWING VALUES IS REACHED

NUMBER OF YEARS SINCE CONSTRUCTION OR REGRAVELLING	RESIDUAL GRAVEL THICKNESS (MM)
4	

ROUGHNESS AFTER REGRAVELLING (MM/KM)
5000

PAVEMENT DATA

LAYER THICKNESS (MM)	MATERIAL TYPE	STRENGTH	DESCRIPTION	UNIT COST PER SQ M	UNIT COST PER CU M
120	14	0.00	subbase	0.96(0)	0.00(0)

SHOULDER DATA

LAYER THICKNESS (MM)	MATERIAL TYPE	STRENGTH	DESCRIPTION	UNIT COST PER SQ M	UNIT COST PER CU M

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O V E R H E A D S

FIXED COST	PER CENT COST
0.00 (0)	0.00 (0)

ROUTINE AND RECURRENT MAINTENANCE

G R A D I N G — O V E R H E A D S

	NUMBER OF GRADINGS	COST PER KM	FIXED COST	PER CENT COST
WET SEASON	1	165.00 (0)	0.00 (0)	20.00 (0)
DRY SEASON	1	165.00 (0)		

MAINTENANCE POLICY 3

PERIODIC MAINTENANCE (RESURFACING)

REGRAVELLING TO BE CARRIED OUT WHEN EITHER OF THE FOLLOWING VALUES IS REACHED

NUMBER OF YEARS SINCE CONSTRUCTION OR REGRAVELLING	RESIDUAL GRAVEL THICKNESS (MM)
4	

ROUGHNESS AFTER REGRAVELLING (MM/KM)
5000

P A V E M E N T D A T A

LAYER THICKNESS (MM)	MATERIAL TYPE	STRENGTH	DESCRIPTION	UNIT COST PER SQ M	UNIT COST PER CU M
120	14	0.00	subbase	0.96(0)	0.00(0)

S H O U L D E R D A T A

LAYER THICKNESS (MM)	MATERIAL TYPE	STRENGTH	DESCRIPTION	UNIT COST PER SQ M	UNIT COST PER CU M

O V E R H E A D S

FIXED COST	PER CENT COST
0.00 (0)	0.00 (0)

ROUTINE AND RECURRENT MAINTENANCE

	GRADING		OVERHEADS	
	NUMBER OF GRADINGS	COST PER KM	FIXED COST	PER CENT COST
WET SEASON	1	165.00 (0)	0.00 (0)	20.00 (0)
DRY SEASON	1	165.00 (0)		

MAINTENANCE POLICY 4

PERIODIC MAINTENANCE (RESURFACING)

REGRAVELLING TO BE CARRIED OUT WHEN EITHER OF THE FOLLOWING VALUES IS REACHED

NUMBER OF YEARS SINCE CONSTRUCTION OR REGRAVELLING	RESIDUAL GRAVEL THICKNESS (MM)
4	

ROUGHNESS AFTER REGRAVELLING (MM/KM)
5000

PAVEMENT DATA

LAYER THICKNESS (MM)	MATERIAL TYPE	STRENGTH	DESCRIPTION	UNIT COST PER SQ M	UNIT COST PER CU M
120	14	0.00	subbase	0.96(0)	0.00(0)

SHOULDER DATA

LAYER THICKNESS (MM)	MATERIAL TYPE	STRENGTH	DESCRIPTION	UNIT COST PER SQ M	UNIT COST PER CU M

OVERHEADS

FIXED COST	PER CENT COST
0.00 (0)	0.00 (0)

ROUTINE AND RECURRENT MAINTENANCE

	GRADING		OVERHEADS	
	NUMBER OF GRADINGS	COST PER KM	FIXED COST	PER CENT COST
WET SEASON	1	165.00 (0)	0.00 (0)	20.00 (0)
DRY SEASON	1	165.00 (0)		

MAINTENANCE POLICY 5

PERIODIC MAINTENANCE (RESURFACING)

NO PERIODIC MAINTENANCE TO BE CARRIED OUT

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*                       *
* YEAR-BY-YEAR ANALYSIS *
*                       *
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PERIODIC MAINTENANCE TO BE CARRIED OUT IN YEAR 1996

PERIODIC MAINTENANCE TO BE CARRIED OUT IN YEAR 2000

PERIODIC MAINTENANCE TO BE CARRIED OUT IN YEAR 2004

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*                  *
* SUMMARY OF COSTS *
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FOREIGN EXCHANGE

1992	0.00
1993	318655.37
1994	339782.28
1995	358988.58
1996	377681.09
1997	224336.36
1998	237613.48
1999	251848.89
2000	267418.68
2001	284669.98
2002	303975.52
2003	325873.47
2004	350393.06
2005	377867.55
2006	408542.05
2007	443443.66
	4871090.05

ANNUAL COST MATRIX

YEAR	CONSTRUCTION	MAINTENANCE	VEHICLE OPERATING COSTS NORMAL TRAFFIC	VEHICLE OPERATING COSTS GENERATED TRAFFIC	TIME COSTS NORMAL TRAFFIC	TIME COSTS GENERATED TRAFFIC	OTHER BENEFITS
1992	150000.00	0.00	0.00	0.00	0.00	0.00	0.00
1993	0.00	4752.00	93576.04	378885.41	1824.58	6899.50	35805.00
1994	0.00	4752.00	99775.58	404036.34	1918.30	7252.24	39165.00
1995	0.00	4752.00	105362.84	426941.83	2018.03	7627.38	42805.00
1996	0.00	62352.00	110816.90	449206.46	2124.30	8026.89	46795.00
1997	0.00	4752.00	66779.14	265531.20	1431.22	5299.05	51135.00
1998	0.00	4752.00	70687.12	281247.15	1506.20	5575.65	55895.00
1999	0.00	4752.00	74877.20	298106.00	1586.72	5872.64	61110.00
2000	0.00	62352.00	79455.21	316549.01	1673.47	6192.57	66780.00
2001	0.00	4752.00	84519.61	336985.13	1767.28	6538.53	72975.00
2002	0.00	4752.00	90175.72	359853.40	1869.17	6914.24	79800.00
2003	0.00	4752.00	96571.50	385778.90	1980.36	7324.28	87150.00
2004	0.00	62352.00	103728.78	414821.30	2102.40	7774.30	95305.00
2005	0.00	4752.00	111743.26	447380.28	2237.19	8271.41	104230.00
2006	0.00	4752.00	120685.42	483757.07	2387.20	8824.66	113890.00
2007	0.00	4752.00	130868.66	525177.34	2555.57	9445.74	124460.00
	150000.00	244080.00	1439622.99	5774256.82	28982.01	107839.09	1077300.00

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* *
* SUMMARY OF BENEFITS *
* *
****

NET BENEFITS

YEAR	CONSTRUCTION	MAINTENANCE	VEHICLE OPERATING COSTS NORMAL TRAFFIC	VEHICLE OPERATING COSTS GENERATED TRAFFIC	TIME COSTS NORMAL TRAFFIC	TIME COSTS GENERATED TRAFFIC	OTHER BENEFITS
1992	-150000.00	0.00	0.00	0.00	0.00	0.00	0.00
1993	0.00	-1425.60	-2886.68	-5705.70	-322.60	-637.64	35805.00
1994	0.00	-1425.60	-3068.17	-6064.43	-353.49	-698.69	39165.00
1995	0.00	-1425.60	-3295.76	-6514.27	-387.64	-766.19	4280%.00
1996	0.00	-59025.60	-3607.96	-7131.37	-425.46	-840.94	46795.00
1997	0.00	-1425.60	45148.26	89238.35	339.10	670.25	51135.00
1998	0.00	-1425.60	45799.82	90526.21	338.75	669.57	55895.00
1999	0.00	-1425.60	46154.95	91228.15	336.19	664.50	61110.00
2000	0.00	-59025.60	46231.43	91379.33	333.23	658.64	66780.00
2001	0.00	-1425.60	45989.50	90901.13	327.79	647.89	72975.00
2002	0.00	-1425.60	45381.31	89699.01	318.54	629.62	79800.00
2003	0.00	-1425.60	44361.13	87682.55	304.50	601.87	87150.00
2004	0.00	-59025.60	42832.78	84661.67	284.39	562.12	95305.00
2005	0.00	-1425.60	40724.36	80494.26	256.57	507.13	104230.00
2006	0.00	-1425.60	37969.46	75049.02	218.89	432.65	113890.00
2007	0.00	-1425.60	34615.25	68419.21	168.50	333.06	124460.00
	-150000.00	-194184.00	462349.67	913863.14	1737.27	3433.83	1077300.00

DISCOUNT RATE
PER CENT

12.0	-150000.00	-84363.57	157079.16	310476.82	50.23	99.29	406799.86
20.0	-150000.00	-54299.27	84958.96	167926.72	-282.95	-559.27	252368.52

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NET PRESENT VALUE

DISCOUNT RATE PER CENT	CONSTRUCTION MAINTENANCE VOC NORMAL TRAFFIC ONLY	PLUS BENEFITS TO GENERATED TRAFFIC	PLUS TIME BENEFITS	
12.0	329515.45	639992.29	640042.54	
20.0	133028.22	300954.93	300671.96	
INTERNAL RATE OF RETURN	32.70	41.36	41.29	(PER CENT)
FIRST YEAR RATE OF RETURN				
1993 DISCOUNT RATE = 16.0	18.10	14.82	14.63	(PER CENT)

Table A.2

DRAINAGE STRUCTURES

S/NO	*CHAINAGE KM*	*DRAIN TYPE*	*DIMENSIONS LXWXH (M)*	*DESCRIPTION*	*REMARKS*
1	*0+020*	*Armco - Culvert*	*11x0.9*	*Skewed to right* *- Inadequate cover (100mm)* *- Debris in barrel* *- Channel poorly made* *- Channel perched higher than outlet* *- No protection to inlet & outlet*	*- Inadequate, need replacement*
2.	*1+300*	*Armco-Culvert*	*11x0.9*	*- Adequate cover (300mm)* *- Debris block side drain* *- No protection to I/O*	*- Good barrel, poor side drains renders culvert ineffective.* *- Re-do side drains*
3.	*1+450*	*Armco-Culvert*	*11x0.9*	*- Adequate cover (500/220)* *- Good placement with regard to side drains and channels.* *- No protection to I/O.* *- Poor connections rendered loosers sections*	*Barrel to fail soon need replacement*
4.	*4+400*	*Armco-Culvert*	*9x0.6*	*- Inadequate cover (100mm)* *- Sagging at location* *- Silted up stream* *- Channel overgrown* *- No feed form* *- Side drains* *- No protection to I/O*	*- Poorly established* *- Re-do placement*
5.	*5+000*	*Armco-Culvert*	*9x0.6*	*- No cover at all* *- Skewed to Right* *- Silted barrer* *- No protection to I/O* *- Inlet and outlet*	*- Poor culvert* *- Need replacement*

qm

6.	5+100	Armco-Culvert	9x0.6	- Inadequate cover 50mm - Barrel silted - Channel overgrown	Poor culvert
7.	5+200	Armco Culvert	9x0.6	- Inadequate cover (200mm) - Poor link to side drains - Loose sections - Silted barrel - Poor channel	Poor culvert
8.	5+300	Drum	9x0.5	- Adequate cover (500mm) - Inlet/outlet silted - Channel/overgrown	- An old drain need replacement
9.	6+300	Concrete Arch	11x1.9x0.6	- Adequate cover 1.2m - Ring walls fair - Apron, side wall good - Channel fair	- Good old drain needs repair to side/retaining wall
10.	6+350	Armco Culvert	11x0.9	- Adequate cover (300mm) - Barrer silted - Partially loose sections - Channel fair	Fair culvert
11.	6+750	Double-Armco Culvert	12x0.6	(1) OLD - Adequate cover (400mm) - Good link with sidedrain (2) NEW - Adequate cover (300mm) - Perched high 250mm from old drain bottom - No link with side drain	- In working order - Inadequately located rendered it useless
12.	6+950	Armco Culvert	12x0.6	- Adequate cover (300mm) - Blocked culvert - Channel fair	- Poor culvert Need replacement

13.	7+1300	Armco Culvert	12x0.6	- Adequate cover (300mm) - Side scouring to inlet/ outlet - Channel overgrown and blocked	- Poor culvert - Need replacement
14.	7+650	Drum	11x0.5	- Adequate cover (350mm) - Channel fairly over-grown - Barrel rusted and worn out	- Need replacement
15.	7+900	Concrete pipe	11x0.6	- Old drain - Good wing walls and Apron - Retaining wall failing - Head wall absent	- Channel adequate - Drain in good condition - Need repairs to retaining wall
16.	8+400	Armco-Culvert	11x0.9	- Inadequate cover (200mm) - Mild silting to barrel - Channels fine. - Scouring to inlet/outlet sides	- Fair drain
17.	8+500	Drum	12x0.5	- Adequate cover (350mm) - No lead link from side drains - Scouring possible - Channel's fine - Old drain	- Fair drain
18.	6+800	(1) Drum (2) box-Culvert	6x0.5 6x0.5x0.4	- Adequate cover (400mm) - Old wingwalls - Aprons'find - Headwalls' fine - Scouring to wing walls sides - Located on a narrow road section	- Fair drain - Need new long section (9900mm) with road section width increased
19.	9+400	Armco-Culvert	12x0.6	- Adequate cover - Scouring to inlet and outlet - Barrel half width silted	- Poor drain - Need replacement

20.	10+300	Armco Culvert	12x0.9	- Adequate cover (450mm) - No side drain - Feeder ditch poorly made - Scour to inlet and outlet - Channel fine	- Side drain required - Lining to feeder required
21.	10+400	Armco-Culvert	12x0.6	- Adequate cover (500mm) - Scour to inlet and outlet - Barrel silted	- Poor drain need replacement
22.	10+900	Armco-Culvert	12x0.6	- Adequate cover (300mm) - Mild silting - Channel's fine - Side drains poor	- Fair drain
23.	11+300	Armco Culvert	12x0.9	- Adequate cover - Loose section - Barrel silted - Poor inlets	- Need retightening - Fair section
24.	0+100-4+200	Miter drains	Variable	- String of drains running on both sides of road	- Poorly connected with side drains making draining work inadequate.

Table A.3

THE UNITED REPUBLIC OF TANZANIA
MINISTRY OF WORKS
ECONOMIC EVALUATION AND SOCIAL IMPACT STUDY OF
KWA SADALA MBWEERA ROAD

ORIGIN-DESTINATION SURVEY FORM

LOCATION..... SHEET NO.....
DATE:.....
DIRECTION FROM:..... SUPERVISOR:.....

1. TYPE OF CAR: | Tick |
2. AXLE CONFIGURATION:.....

CAR	PICK-UP VAN	LORRY		FULL TRAILLER	SEMI TRAILLER	BUS		OX-HORSE DRAWN CART	TRAC-TORS	OTHERS
		<5T	>5T			<25p	>25p			

3. REGISTRATION..... ADDRESS:.....
4. TRIP STARTED AT: Village/Ward.....
5. TRIP ENDS AT: Village Ward..... ....
6. LOAD FACTOR: Empty ☐ 1-30 % ☐ 50-99% ☐ FULL ☐

7. PURPOSE OF TRIP

ORIGIN	DESTINATION
☐ Home	☐ Home
☐ Work	☐ Work
☐ Business	☐ Business
☐ Shop/Market	☐ Shop/Market
☐ Medical	☐ Medical
☐ Education	☐ Education
☐ Religious	☐ Religious
☐ Other	☐ Other

8. TYPE OF CARGO
-Agricultural products, Unprocessed..... ☐
-Processed food/drinks.... ☐
-Building materials..... ☐
-Oil products..... ☐
-Passengers..... ☐
-Other..... ☐

9. How often do you make this journey.....

TABLE A.4 MATERIALS LABORATORY TEST RESULTS

MINISTRY OF WORKS
CENTRAL MATERIALS LABORATORY
FIELD DENSITY SUMMARY SHEET

1

Project GREP NASAMA ROAD
Material SUB-GRADE
Chainage 0+000 TO 1+200
Test method SAND REPLACEMENT

Date 15[illegible]
Max. Dry Density (Kg/m³)
Opt. moist. Content %

TEST NO	LOCATION KM	OFF SET	WET DENSITY Kg/M³	FIELD DENSITY Kg/M³	FIELD M/C %	REL. COMP. %
1	0+000	OL	1919	1735	10.6	95.4
2	0+150	IRS	1858	1637	13.5	89.9
3	0+300	RRS	1947	1737	12.1	95.4
4	0+450	OL	1905	1652	15.3	90.8
5	0+600	IRS	1915	1736	10.3	95.4
6	0+750	RRS	1816	1607	13.0	88.3
7	0+900	OL	1863	1698	9.7	93.3
8	1+050	IRS	1831	1561	17.3	85.8
9	1+200	RRS	1692	1516	11.6	83.3

No of Tests 9

Average .....90.8..... %
Minimum .....83.3..... %
Maximum .....95.4..... %

MATERIALS ENGINEER

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MINISTRY OF WORKS
CENTRAL MATERIALS LABORATORY
FIELD DENSITY SUMMARY SHEET

2

Project MAGAMA ROAD
Material SUB - GRADE
Chainage 2+900 TO 4+100
Test method SAND REPLACEMENT

Date [illegible]
Max. Dry Density (Kg/M[illegible]
Opt. moist. Content [illegible]

TEST NO	LOCATION KM	OFF SET	WET DENSITY Kg/M3	FIELD DRY DENS Kg/M3	FIELD M/C %	REL. COMP %
1	2+900	CL	1944	1716	13.[illegible]	[illegible]
2	3+050	RHS	1952	1674	16.[illegible]	[illegible]
3	3+200	RHS	1930	1693	14.[illegible]	[illegible]
4	3+350	CL	1907	1688	13.[illegible]	9[illegible].7
5	3+500	LHS	1836	1657	10.[illegible]	[illegible]
6	3+650	RHS	1872	1685	11.[illegible]	[illegible]
7	3+800	CL	1845	1713	7.7	[illegible]
8	3+950	LHS	1852	1702	8.8	[illegible]
9	4+100	RHS	1913	1568	22.[illegible]	86.1

No of Tests 9

Average ..... 92.1 ..... %
Minimum ..... 86.1 ..... %
Maximum ..... 94.3 ..... %

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MINISTRY OF [illegible]
CENTRAL MATERIALS LABORATORY
FIELD DENSITY SUMMARY SHEET

3

Project [illegible]
Material ~~SUB GRADE~~
Chainage 4+250 to 5+300
Test method

Date [illegible]
18[illegible]0 Kg/[illegible] Max. Dry Density [illegible]
17.[illegible] Opt. moist. Content

TEST NO	LOCATION KM	OFF SET	WET DENSITY Kg/M^3	FIELD [illegible] Kg/M^3	FIELD M/C %	REL. [illegible] %
10	4+250	C.LINE	1853	1663	[illegible].4	[illegible]
11	4+400	LHS	1851	1649	[illegible].2	[illegible].6
12	4+550	RHS	1854	1659	11.7	91.2
13	4+700	C.LINE	1824	1652	10.4	[illegible].8
14	4+850	LHS	1839	1636	[illegible].4	[illegible].0
15	5+00	RHS	1706	1482	[illegible].1	81.4
16	5+150	C.LINE	1975	1829	8.0	[illegible].5
17	5+300	LHS	2070	1862	11.2	[illegible].3

No of Tests 8

Average ..... 92.3 %
Minimum ..... 81.4 %
Maximum ..... 102.3 %

Nayamuya
[illegible]

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MINISTRY OF WORKS
CENTRAL MATERIALS LABORATORY
FIELD DENSITY SUMMARY SHEET

4

Project [illegible]
Material SUB GRADE
Chainage 5+450 TO 6+050
Test method SAND REPLACEMENT

Date [illegible]
Max. Dry Density (Kg/M³) [illegible]
Opt. moisture Content [illegible]

TEST NO	LOCATION KM	OFF SET	WET DENSITY Kg/M³	FIELD DRY DENS Kg/M³	FIELD M/C %	REL. COMP %
1	5+450	RHS	1925	1760	9.4	96.7
2	5+600	CL	1878	1710	9.8	94.0
3	5+750	LHS	1839	1669	10.2	91.7
4	5+900	RHS	1704	1563	9.0	85.9
5	6+050	CL	1868	1683	11.0	92.5

No of Tests 5

Average ..... 92.2 ..... %
Minimum ..... 85.9 ..... %
Maximum ..... 96.7 ..... %

[illegible]

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MINISTRY OF WORKS
CENTRAL MATERIALS LABORATORY
FIELD DENSITY SUMMARY SHEET

5

Project ~~GRRP Ka4 MAJANA ROAD~~
Material ~~SUB GRADE~~
Chainage ~~6+200TO 6+800~~
Test method ~~SAND REPLACEMENT~~

Date ~~[illegible]~~
1740 Max. Dry Density (Kg/M³)
19.0 Opt. moist. Content %

TEST NO	LOCATION KM	OFF SET	WET DENSITY Kg/M³	FIELD DRY DENS Kg/M³	FIELD M/C %	REL. COMP %
~~23~~	~~6+200~~	~~LHS~~	~~1908~~	1731	10.2	97.[illegible]
24	6+350	RHS	1860	1688	10.2	97.[illegible]
[illegible]	6+500	CL	1864	1654	12.7	95.1
26	6+650	LHS	1918	1702	12.7	97.3
27	6+800	RHS	1813	1619	12.0	93.3

No of Tests 5

Average ..... 96.5 ..... %
Minimum ..... 93.3 ..... %
Maximum ..... 99.5 ..... %

MAMPITATO ENGINEER

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MINISTRY OF WORKS
CENTRAL MATERIALS LABORATORY
FIELD DENSITY SUMMARY SHEET

6

Project MASAKA ROAD (MA4)
Material SUB GRADE
Chainage 6+950 to 7+100
Test method SAND REPLACEMENT

Date 15 - 6 -
1740 Max. Dry Density (Kg/M³)
19.0 Opt. moist. Content %

TEST NO	LOCATION KM	OFF SET	WET DENSITY Kg/M³	FIELD DRY DENS Kg/M³	FIELD M/C %	REL. COMP %
28	6+950	C. LINE	1750	1540	13.6	88.5
29	7+100	LHS	1845	1644	12.2	94.5
30	7+250	RHS	1676	1524	10.0	87.6
31	7+400	C. LINE	1897	1698	11.7	97.6
32	7+550	LHS	1867	1721	8.5	98.9
33	7+700	RHS	1993	1798	10.8	103.3

No of Tests 6

Average ..... 95.07 ..... %
Minimum ..... 87.6 ..... %
Maximum ..... 103.3 ..... %

[illegible]

MINISTRY OF WORKS
CENTRAL MATERIALS LABORATORY
FIELD DENSITY SUMMARY SHEET

7

Project MASAKA ROAD (H14)
Material SUB GRADE
Chainage 7+850 to 8+600
Test method SAND REPLACEMENT

Date 15/6/[illegible]
1740 Max. Dry Density (Kg/[illegible])
19.0 Opt. moist. Content

TEST NO	LOCATION KM	OFF SET	WET DENSITY Kg/M^3	FIELD DRY DENSITY Kg/M^3	FIELD M/C %	REL. COMPACT %
34	7+850	C. LHS	1809	1622	11.[illegible]	[illegible]
35	8+000	LHS	1621	1480	9.5	[illegible]
36	8+150	RHS	1781	1619	10.5	[illegible]
37	8+300	C. LHS	1787	1609	11.0	[illegible]
38	8+450	LHS	1857	1626	14.0	93.[illegible]
39	8+600	RHS	1792	1656	8.2	95.2

No of Tests 6

92.1
Average .....95.1..... %
Minimum .....95.2..... %
Maximum ..... %

MATERIALS ENGINEER

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MINISTRY OF WORKS
CENTRAL MATERIALS LABORATORY
FIELD DENSITY SUMMARY SHEET

8

Project GREP - NAA MASAKA ROAD
Material SUB GRADE
Chainage 9.570 TO 9.800
Test method SAND REPLACEMENT

Date 23/06/1992
1740 Max. Dry Density (Kg/M^3)
19.0 Opt. moist. Content %

TEST NO	LOCATION KM	OFF SET	WET DENSITY Kg/M^3	FIELD DENSITY Kg/M^3	FIELD M/C %	REL. COMP %
1	9.570	RHS	1662	1498	10.9	87.2
2	9.650	RHS	1735	1566	9.5	92.2
3	9.800	CL	1722	1567	9.5	92.4

No of Tests 3

Average ..... 90.1 ..... %
Minimum ..... 87.2 ..... %
Maximum ..... 92.4 ..... %

Nyanunya
RESIDENT ENGINEER

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MINISTRY OF WORKS

CENTRAL MATERIALS LABORATORY

FIELD DENSITY SUMMARY SHEET

9

PROJECT: GRRP - Ha - 04

DATE 9/07/93

MATERIAL: S&B GRADE

MAX. DRY DENSITY (KG/M³)

CHAINAGE: 10+800 to 11+250

OPT. MOISTURE CONTENT

TEST METHOD: SAND REPLACEMENT

TEST NO	LOCATION KM	OFF SET	WET DENSITY KG/M³	FIELD DRY DENS KG/M³	FIELD M/C %	[illegible]
1	10+800	C. LINE	1,819	1,597	13.9	[illegible]
2	10+950	LHS	1,898	1,665	14.1	[illegible]
~~3~~	~~11+100~~	~~RHS~~	~~1,771~~	~~1,591~~	~~11.3~~	[illegible]
4	11+250	C. LINE	1,842	1,572	17.2	90.[illegible]

NO. OF TESTS 4

AVERAGE 92.3 %

MINIMUM 90.3 %

MAXIMUM 95.6 %

MATERIALS ENGINEER

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MINISTRY OF WORKS
GENERAL MATERIALS LABORATORY
FIELD DENSITY SUMMARY SHEET

PROJECT: GRRP - HA-04 DATE 21st July,1992

MATERIAL: SUB GRADE MAX. DRY DENSITY (KG/M^3) 1740

CHAINAGE: 11+800 TO 12+100 OPT. MOIST. CONTENT % 19.0

TEST METHOD: SAND REPLACEMENT

TEST NO	LOCATION KM	OFF SET	WET DENSITY KG/M3	FIELD DRY DENS KG/M	FIELD M/C %	REL.COMP %
1	11+800	CL	2164	1677	29.0	96.4
2	11+950	LHS	2070	1645	25.8	94.5
3	12+100	RHS	1965	1488	32.1	85.5

NO. OF TESTS 3

AVERAGE 92.1 %

MINIMUM 85.5 %

MAXIMUM 96.4 %

MATERIALS ENGINEER

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MINISTRY OF WORKS
CENTRAL MATERIALS LABORATORY
FIELD DENSITY [illegible] ARY [illegible]

11

Project MASAMA ROAD (HA 4)
Material WEARING COURSE
Chainage 0+000 TO 0+450
Test method SAND REPLACEMENT

[illegible] Max. Dry Density [illegible]
[illegible] Opt. moist. Content [illegible]

TEST NO	LOCATION KM	OFF SET	WET DENSITY Kg/M^3	FIELD DRY DENSITY Kg/M^3	FIELD M/C %	REL. COMP %
1	0+000	0. LINE	1845	1690	9.	[illegible]
2	0+150	LHS	1699	1540	11.3	[illegible]
3	0+300	RHS	1771	1535	8.3	[illegible]
4	0+450	0.LINE	1805	1584	7.2	[illegible]

No of Tests 4

Average ..... 89.2 ..... %
Minimum ..... 83.9 ..... %
Maximum ..... 92.1 ..... %

[illegible] ENGINEER

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MINISTRY OF WORKS
CENTRAL MATERIALS LABORATORY
FIELD DENSITY SUMMARY SHEET

12

Project MASAKA ROAD(M14)
Material WEARING COURSE
Chainage 0+600 to 2+400
Test method SAND REPLACEMENT

Date [illegible]
1,835 Max. Dry Density (Kg/M [illegible]
17.0 Opt. moist. Content [illegible]

TEST NO	LOCATION KM	OFF SET	WET DENSITY Kg/M3	FIELD DRY DENS Kg/M3	FIELD M/C %	REL. COMP %
1.	0+600	LHS	1790	1658	7.9	[illegible]
2.	0+750	RHS	1856	1702	7.9	92.8
3.	0+900	C. LINE	1762	1632	7.7	89.2
4.	1+650	LHS	1865	1739	7.2	94.3
5.	1+200	RHS	1921	1785	7.6	97.3
6.	1+350	C. LINE	1923	1771	8.6	96.5
7.	1+500	LHS	1807	1659	8.9	9[illegible].4
8.	1+650	RHS	1681	1551	8.4	84.[illegible]
9.	1+800	C. LINE	1740	1610	8.1	87.7
10.	1+950	LHS	1807	1679	7.6	91.[illegible]
11.	2+100	RHS	1824	1680	8.6	91.6
12.	2+250	C. LINE	1944	1748	11.2	[illegible]
13.	2+400	LHS	1834	1686	8.8	[illegible]

No of Tests 13

Average ..... 91.8 ..... %
Minimum ..... 84.5 ..... %
Maximum ..... 96.5 ..... %

MATERIALS ENGINEER

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MINISTRY OF WORKS
CENTRAL MATERIALS LABORATORY
FIELD DENSITY SUMMARY SHEET

13

Project MASAKA ROAD (H44)
Material WEARING COURSE
Chainage 2+550 TO 3+650
Test method SAND REPLACEMENT

Date [illegible]
1355 Max. Dry Density [illegible]
17.0 Opt. moist. Content [illegible]

TEST NO	LOCATION KM	OFF SET	LAST DENSITY Kg/M^3	FIELD DENSITY Kg/M^3	FIELD M/C %	REL. COMP. %
1	2+550	RHS	1870	1748	[illegible]	[illegible]
2	2+700	CL	1863	1749	[illegible]	[illegible]
3	2+850	LHS	1860	1740	[illegible]	[illegible]
4	2+000	RHS	1761	1655	6.4	[illegible]
5	3+150	CL	1888	1771	[illegible]	[illegible]
6	3+300	LHS	1899	1765	[illegible]	[illegible]
7	3+500	RHS	1855	1737	[illegible]	[illegible]
8	3+650	CL	1758	1654	[illegible]	[illegible]

No of Tests 8

Average ..... 94.7 %
Minimum ..... 90.1 %
Maximum ..... 96.5 %

[illegible]

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MINISTRY OF WORKS
CENTRAL MATERIALS LABORATORY
FIELD DENSITY SUMMARY SHEET

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Project ~~GREF – EL – 4 MASAKA~~ ROAD
Material ~~WEARING COURSE~~
Chainage ~~3+800 TO 4+250~~
Test method ~~SAND REPLACEMENT~~

Date ~~25/06/1982~~
Max. Dry Density (Kg/M³) 1835
Opt. moist. Content 17.0

TEST NO	LOCATION KM	OFF SET	WET DENSITY Kg/M³	FIELD DRY DENSITY Kg/M³	FIELD M/C %	REL. COMP. %
~~26~~	~~3+800~~	~~RHS~~	~~1727~~	~~1610~~	~~7.3~~	~~87.7~~
~~27~~	~~3+850~~	~~RHS~~	~~1891~~	~~1761~~	~~7.4~~	~~96.0~~
~~28~~	~~4+100~~	~~CL~~	~~1790~~	~~1685~~	~~6.2~~	~~9.8~~
~~29~~	~~4+250~~	~~LHS~~	~~1788~~	~~1660~~	~~7.7~~	~~90.5~~

No of Tests 4

Average .....91.5..... %
Minimum .....87.7..... %
Maximum .....96.5..... %

MATERIALS ENGINEER

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MINISTRY OF WORKS
CENTRAL MATERIALS LABORATORY
FIELD DENSITY SUMMARY SHEET

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Project MAGAMA ROAD NA4
Material WEARING COURSE
Chainage 4+000 TO 5+450
Test method SAND REPLACEMENT

Date [illegible]
1835 Max. Dry Density (Kg/[illegible])
17.0 Opt. moist. Content [illegible]

TEST NO	LOCATION KM	OFF SET	WET DENSITY Kg/M^3	FIELD DRY DENSITY Kg/M^3	FIELD M/C %	REL. COMP %
1	4+700	LHS	1835	1717	6.[illegible]	93.[illegible]
2	4+850	RHS	1878	1745	7.6	95.1
3	4+000	CL	1850	1738	6.5	95.6
4	5+150	LHS	1905	1774	7.4	96.7
5	5+300	RHS	1834	1732	5.9	94.4
6	5 + 450	CL	1849	1723	7.3	93.9

No of Tests 6

Average ..... 94.6 ..... %
Minimum ..... 93.6 ..... %
Maximum ..... 96.7 ..... %

MATERIALS ENGINEER

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MINISTRY OF WORKS
CENTRAL MATERIALS LABORATORY
FIELD DENSITY SUMMARY SHEET

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PROJECT: MASAKA ROAD - NA 04 DATE
MATERIAL: WB CLAY SURGE MAX. DRY DENSITY (KG/M³) 1756
CHAINAGE: 6+200 TO 7+400 OPT. MOISTURE CONTENT % 14.7
TEST METHOD: SAND REPLACEMENT

TEST NO	LOCATION KM	OFF SET	WET DENSITY KG/M³	FIELD DRY DENS KG/M	FIELD M/C %	REL. COMP
1	6+200	RHS	1907	1726	10.5	98.4
2	6+350	CL	2032	1805	12.6	97.8
3	6+500	LHS	1843	1671	10.3	95.2
4	6+650	RHS	1830	1688	8.4	96.1
5	6+800	CL	1896	1757	7.9	94.7
6	6+950	LHS	2004	1804	11.1	97.2
7	7+100	RHS	1842	1687	9.2	96.9
8	7+250	CL	1916	1750	9.5	94.3
9	7+400	LHS	1865	1741	7.1	99.6

NO. OF TESTS 9

AVERAGE 93.6 %
MINIMUM 90.0 %
MAXIMUM 97.5 %

MATERIALS ENGINEER

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MINISTRY OF WORKS
GENERAL MATERIALS LABORATORY
FIELD DENSITY [illegible]

PROJECT: GRRP-RA 04 DATE [illegible]

MATERIAL: WEARING COURSE MAX. [illegible]

CHAINAGE: 8+450 TO 9+850 PT. [illegible]

TEST METHOD: SAND REPLACEMENT

TEST NO	LOCATION KM	OFF SET	WET DENSITY KG/M3	FIELD [illegible] KG/[illegible]	[illegible]	FIELD [illegible]
1	8+450	RHS	1934	172[illegible]		[illegible].1
2	8+600	CL	1920	1714		12.0
3	8+750	LHS	1969	1838		[illegible].1
4	8+900	RHS	1926	1711		14.9
5	9+050	CL	1738	1581		15.7
6	9+200	LHS	1881	1656		[illegible]
7	9+350	RHS	1916	1697		12.9
8	9+500	CL	1864	1648		13.2
9	9+650	LHS	2136	187[illegible]		[illegible]
10	9+850	RHS	1918	1693		13.5

NO. OF TESTS 10

AVERAGE [illegible]

MINIMUM 85.[illegible]

MAXIMUM 100.9

MATERIALS ENGINEER

MINISTRY OF [illegible]
CENTRAL MATERIALS [illegible]
FIELD DENSITY [illegible]

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PROJECT: ~~GRRP-H1-04~~ DATE: [illegible]

MATERIAL: ~~WEARING COURSE~~

CHAINAGE: [illegible]

TEST METHOD: ~~SAND REPLACEMENT~~

TEST NO	LOCATION KM	FF [illegible]	WET DENSITY KG/M³	FIELD [illegible]	[illegible]	[illegible]
~~1~~	~~9+950~~	~~RHS~~	~~1882~~	~~1699~~	[illegible]	[illegible]
~~2~~	~~10+050~~	~~LHS~~	~~2087~~	~~1818~~	[illegible]	[illegible]
~~3~~	~~10+200~~	~~RHS~~	~~1976~~	~~1711~~	[illegible]	[illegible]
~~4~~	~~10+350~~	~~CL~~	~~1834~~	1595	[illegible]	[illegible]
~~5~~	~~10+500~~	~~LHS~~	~~1703~~	~~1483~~	[illegible]	[illegible]
~~6~~	~~10+650~~	~~RHS~~	~~1989~~	~~1756~~	[illegible]	[illegible]
~~7~~	~~10+800~~	~~RHS~~	~~1961~~	~~1716~~	[illegible]	[illegible]
~~8~~	~~10+950~~	~~LHS~~	~~1954~~	~~1639~~	[illegible]	[illegible]
~~9~~	~~11+100~~	~~RHS~~	~~1863~~	~~1610~~	[illegible]	[illegible]
10	11+250	CL	2221	1876	[illegible]	101.1
11	11+400	LHS	2015	1748	[illegible]	[illegible]

NO. OF TESTS 11

[illegible] 91.4 %

[illegible] 80.0 %

[illegible] 101.1 %

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MATERIALS ENGINEER

MINISTRY OF WORKS
CENTRAL MATERIALS LABORATORY
~~SAND REPLACEMENT METHOD~~

PROJECT: ~~MAGAMA ROAD PH - 04~~ DATE 7/8/92

MATERIAL: ~~WEARING COURSE~~ MAX. DRY DENSITY (KG/M^3) 1856

CHAINAGE: ~~11+550 TO 12+050~~ PT. MOULD. CONTENT % ~~14.7~~

TEST METHOD: ~~SAND REPLACEMENT~~

TEST NO	LOCATION KM	OFF SET	WET DENSITY KG/M^3	FIELD DRY DENS KG/M^3	FIELD M/C %	REL.COMP %
1	11+550	C.LINE	[illegible]	1683	13.7	90.7
2	11+700	LHS	1893	1716	10.3	92.6
3	11+850	RHS	2260	1972	14.6	106.3
4	12+050	C.LINE	1820	1664	9.4	89.7

NO. OF TESTS 4

AVERAGE 94.8 %

MINIMUM 89.7 %

MAXIMUM 106.3 %

Add water to low compaction sections then re-compact.

MATERIALS ENGINEER

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MINISTRY OF COMMUNICATIONS AND WORKS

MATERIALS LABORATORY

SUMMARY OF TEST RESULTS

P.O. Box 9452
DAR ES SALAAM

PROJECT: SANYA JUU BORROW PIT **ORIGINATOR:** MINISTRY OF WORKS

LABORATORY No.		8372								
LOCATION										
SAMPLE No	A	B	C							
DEPTH										
COLOUR										
GRADATION										
% passing (76mm) 3 in.										
(38mm) 1½ in.										
(19mm) ¾ in.										
(9.5mm) $\frac{3}{8}$ in.										
(4.76) $\frac{3}{16}$ in.										
B.S. Sieve No. 7										
14										
25										
36										
52										
72										
100										
200										
ATTERBERG LIMITS										
L.L.										
P.L.										
P.I.										
CLASSIFICATION PRA/UNIFIED/FAA										
COMPACTION (Std/Mod.) M.D.D. kg/m³	1306	1650	1476							
O.M.C.	21.6	24.0	14.0							
F.D.D. kg/m³										
F.M.C.										
Field Compaction (%)										
C.B.R. At 95/100% M.D.D. Std/Mod. kg/m³ Unsoaked										
1 day soaked										
4 days soaked	11	75	66							
Swell (%)	..									
TRIAXIAL Cohesion kn/m²										
Friction										
U.C.C. Max Strengh										
Strain at failure (%)										

Date

For [illegible] ENGINEER,
CENTR[illegible] LABORATORY
MATERIALS ENGINEER
P.O. Box 9452
DAR ES SALAAM

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APPENDIX B

ECONOMIC EVALUATION DATA

Table B.1

ESTIMATED CROP PRODUCTION AND VALUE IN KWA SADALA–MBWEERA AREA OF INFLUENCE

CROPS	1989			1990			1991			1992			AVERAGE		
	TONS	TSHS.000	US$000	TONS	TSHS.000	US$000	TONS	TSHS.000	US$000	TONS	TSHS.000	US$000	TONS	TSHS.000	US$000
COFFEE	1325.2	166,856.0	1191.8	1394.5	235853.2	1241.3	635.7	152,242.8	661.9	1582.2	245,245.3	743.2	1234.4	200049.3	959.6
GREEN BEANS	–	–	–	–	–	–	174.3	81,517.0	354.4	538.6	360,866.7	1093.5	356.5	110595.9	724
BANANA	28,181.0	1,097,403.5	7838.6	28220	395,080.0	2079.4	27,246.0	435,936.0	1,895.4	34058	681,160.0	2064.1	29426.3	652394.9	3469.4
MAIZE	6,624.0	188,538.8	1346.7	27256	953,960.0	5020.8	39,515.0	1,975,750.0	8,590.2	85000	4,250,000.0	12878.8	39598.8	1842062.	6959.1
BEANS	5,280.0	110,500.0	789.3	5791	463,280.0	2438.3	4,180.0	376,200.0	1,635.7	6370	573,309.0	1737.3	5405.3	380822.3	1650.2
TOMATO	562.0	16,360.0	116.9	573	34,380.0	181.0	398.0	19,056.0	82.9	1146	57,300.0	173.6	669.8	31774	138.6
VEGETABLES	152.0	2,140.0	15.3	152	4,560.0	24.0	257.0	1,794.0	7.8	386	3,088.8	914	236.8	2895.5	14.1
MILLET	95.0	4,812.5	34.4	111	5,550.0	29.2	67.0	3,685.0	16.0	130	7,800.0	23.6	100.8	5461.9	25.8
Total	42,219.2	1,586,610.8	11,332.9	63,497.5	2,092,663.2	11,014.0	72,473.0	3,046,180.8	13,244.3	129,210.8	6,178,770	18,723.6	76791.5	3,226,056.0	13,578.7

SOURCE: Village Agricultural Officers Hai District

NOTE: 1989/90 Exchange Rate = $ 1 Tshs. 140.0
1990/91 Exchange Rate = $ 1 Tshs. 190.0
1991/92 Exchange Rate = $ 1 Tshs. 230.0
1992/93 Exchange Rate = $ 1 Tshs. 330.0

Table B.2

NUMBER OF LIVESTOCK AND VALUES FOR THE YEAR 1991

VILLAGE	CATTLE		GOATS		SHEEP		PIGS		POULTRY		TOTALS		
	TOTAL	VALUE	TOTAL	VALUE	TOTAL	VALUE	TOTAL	VALUE	TOTAL	VALUE	ANIMALS	TSHS.	US$
Masamamula	2167	54,175,000	337	1,516,500	751	3,379,500	194	1,940,000	2,878	1,439,000	6,327	62,450,000	271,521.7
Mbweera													
Mudio	976	24,400,000	557	2,596,500	963	4,333,500	160	1,600,000	3,327	1,663,500	6,003	34,593,500	150,406.5
Roo	313	7,825,000	324	1,458,000	246	1,107,000	75	750,000	2,471	12,355,500	3,429	12,375,500	53,806.5
Ngira	517	12,925,000	227	1,021,500	298	1,341,000	61	610,000	1,380	690,000	2,483	16,587,500	72,119.6
Sonu	706	17,650,000	127	571,500	388	1,746,000	188	1,880,000	1,858	929,000	3,267	22,776,500	99,028.3
Same	2500	62,500,000	556	2,502,000	510	2,295,000	155	1,550,000	708	354,000	4,429	69,201,000	300,873.9
Nguni	1126	28,150,000	293	1,318,500	838	3,771,000	140	1,400,000	2,502	1,251,000	4,899	35,890,500	156,045.9
Isuki	932	23,300,000	1,254	5,643,000	610	2,745,000	230	2,300,000	2,300	1,150,000	5,326	35,138,000	152,773.9
Lemira Kati	890	24,500,000	165	742,500	270	1,215,000	200	2,000,000	820	410,000	2,345	28,867,500	125,510.9
Mroma	907	22,675,000	177	796,500	268	1,206,000	235	2,350,000	818	409,000	2,405	27,436,500	119,289.1
Kwa Sadala	131	3,275,000	400	1,800,000	100	450,000	0	0	800	400,000	1,431	5,925,000	25,760.9
TOTAL	11165	281,375,000	4,437	19,966,500	5,242	23,589,000	1,638	16,380,000	19,862	9,931,000	42,344	351,241,500	1,527,136.9

SOURCE: District Livestock Officer

NB: Exchange rate: 1 US$ = Tshs. 230

Table B.3

GREEN BEANS EXPORT PRODUCTION AND VALUES

NAME OF COMPANY	1991			1992		
	KGS	VALUE IN TSHS.	VALUE IN US $	KGS	VALUE IN TSHS.	VALUE IN US $
SUNRIPE KILIMANJARO LTD. (SKL)	80,833	3,783,180	161,666	214,105	141,309,300	428,210
EQUATORIAL PROGRESSIVE COMPANY LTD (EPCL)	93,423	42,974,580	186,846	324,502	214,171,320	649,004
TOTAL	174,256	80,157,760	348,512	538,607	355,480,620	1,077,214

SOURCE: 1. Sunripe Kilimanjaro Ltd, Moshi office
2. Equatorial Progressive Company Ltd., Moshi office

NB: Exchange rate: 1 US$ = Tshs. 230 for 1991
1 US$ = Tshs. 330, for 1992

Table B.4

COFFEE PRODUCTION AND VALUE (KGS)

VILLAGE	1989			1990			1991			1992		
	KGS	VALUE IN TSHS.	VALUE IN US $	KGS	VALUE IN TSHS.	VALUE IN US $	KGS	VALUE IN TSHS.	VALUE IN US $	KGS	VALUE IN TSHS.	VALUE IN US $
Masamamula	209,919	26,374,686	188,390.6	207,331	34,704,837	182,657.0	171,392	40,502,994	176,600.0	269,598	41,787,690	126,629.4
Mudio	269,333	33,935,958	242,399.7	234,687	38,816,582	204,297.8	56,718	13,634,057	59,278.5	325,174	50,401,970	152,733.2
Roo	134,108	16,897,608	120,697.2	99,973	17,099,595	89,997.9	31,003	7,672,865	33,360.3	166,009	25,731,395	77,973.9
Ngira	58,358	7,353,108	52,522.2	55,477	9,619,555	50,629.2	26,210	6,422,800	280,121.7	89,336	13,847,080	41,960.8
Sonu	111,673	14,070,798	100,505.7	77,443	13,333,785	70,177.8	48,565	11,888,125	51,687.5	66,406	10,292,930	31,190.7
Sawe	45,928	5,786,928	41,335.2	103,105	17,651,895	92,904.7	76,311	17,995,905	78,243.1	40,453	6,270,215	19,000.7
Nguni	99,122	12,478,640	89,133.1	205,213	35,683,735	187,809.0	92,701	22,219,855	96,608.1	77,050	11,942,750	36,190.2
Isuki	132,158	16,648,911	118,920.8	206,558	34,967,761	184,040.8	78,346	18,888,368	82,123.3	131,516	20,384,980	61,772.7
Lemira Kati	34,075	4,263,450	30,453.2	55,024	9,549,540	50,260.7	11,225	2,834,450	123,231.6	166,686	25,836,330	78,291.9
Mroma	76,924	9,692,424	69,231.6	65,679	11,405,905	60,031.1	10,256	2,593,405	11,225.7	–	–	–
Kwa Sadala	–	–	–	–	–	–	–	–	–	–	–	–
Kibo Estate	153,600	19,353,600	138,240.0	84,000	13,020,000	68,526.3	33000	7590000	3,300.0	250000.00	38,750,000	1,174,242.4
Total	1,325,198	166,856,111	1,191,829.3	1,394,490	2,358,531,190	12,413,321.0	635,727	152,242,824	661,925.3	1,582,228	245,245,340	743,167.7

SOURCE: KNCU HAI BRANCH, December, 1992

NOTE: Exchange rate for 1989 = Tshs. 140.0
Exchange rate for 1990 = Tshs. 190.0
Exchange rate for 1991 = Tshs. 230.0
Exchange rate for 1992 = Tshs. 330.0

Table B.5

ESTIMATED FOOD CROP PRODUCTION AND VALUES 1989

VILLAGE	BANANA			MAIZE			BEANS			TOMATO			VEGETABLES			MILLET			TOTALS		
	TONS	TSHS.	US$	TONS	TSHS.	US$	TONS	TSHS.	US$	TONS	TSHS.	US$	TONS	TSHS.	US$	TONS	TSHS.	US$	TONS	TSHS.	US$
Masama mula	2,600	84,000,000	60,000,000.0	220	4,840,000	34,571.4	15	750000	5,357.1	1	30000	214.3	1	20,000	142.9				3,051	89,640,000	640,285.7
Mudio	545	16,380,000	117,000.0	759	16,684,800	119,177.1	368	18,400,000	131,428.6	33	990000	7,071.4	5	100,000	714.3				1,711	52,554,800	375,391.4
Roo	2,697	79,738,938	569,563.6	1,630	35,860,000	256,142.9	53	2,650,000	18,928.6	417	12510000	89,357.1	50	100,000	7,143.0				4,847	130,858,934	934,706.6
Ngira	191	5,644,600	41,747.1	2	44,000	314.3	1	50,000	357.1	10	300000	2,142.9	15	300,000	2,142.9				219	6,538,600	46,704.3
Sonu	4,761	63,480,000	453,428.6	7	210,000	1,500.0	2	100,000	714.3	15	450000	3,214.3	20	400,000	2,857.1				4,805	64,640,000	461,714.3
Sawe	540	16,200,000	115,714.3	400	12,000,000	85,714.3	21	1,050,000	7,500.0	7	210000	1,500.0	4	80,000	571.4				972	29,540,000	211,000.0
Nguni	30	900,000	6,428.6	10	220,000	1,571.4	6	300,000	2,142.9	1	30000	214.3	2	40,000	285.7				49	1,490,000	10,642.9
Isuki	9,282	464,160,000	3,315,428.5	1,300	65,000,000	464,285.7	1,300	65,000,000	464,285.7	25	750,000	5,357.1	20	400,000	2,857.1	30	750,000	5,357.1	11,957	596,060,000	4,257,571.4
Lamira Kati	3,500	175,000,000	125,000.0	10	500,000	3,571.4	8	400000	2,857.1	1	30,000	214.3	5	100,000	714.3				3,524	176,030,000	1,257,357.1
Mrome	3,834	191,700,000	1,369,285.7	8	400,000	2,857.1	6	300000	2,142.9	2	60,000	428.6	10	200,000	1,428.6				3,860	192,660,000	1,376,142.8
Kwa Sadala	–	–	–	2,000	50,000,000	357,142.9	3,200	20,000,000	142,857.1	50	1,000,000	7,142.9	20	400,000	2,857.1	65	4062500	29,017.9	5,335	75,462,500	539,017.9
Kibo Estate	–	–	–	278	2,780,000	19,857.1	300	1,500,000	10,714.3	–	–	–	–	–	–	–	–	–	578	4,280,000	30,571.4
Total	28,181	1,097,403,538	66,113,596.6	6,624	188,538,800	1,346,705.6	5,280	110,500,000	789,285.7	562	16,360,000	116,857.2	152	2,140,000	21,714.4	95	4,812,500	34,375.0	40,908	1,419,754,834	10,141,115.6

SOURCE: Village Agricultural Officers, Hai District

NOTE: 1989 Exchange rate = 1 US$ = Tshs. 140.000

Table B.6

ESTIMATED FOOD CROP PRODUCTION AND VALUES 1990

VILLAGE	BANANA			MAIZE			BEANS			TOMATO			VEGETABLES			MILLET			TOTALS		
	TONS	TSHS.	US$	TONS	TSHS.	US$	TONS	TSHS.	US$	TONS	TSHS.	US$	TONS	TSHS.	US$	TONS	TSHS.	US$	TONS	TSHS.	US$
Masama mula	2,996	41,944,000	220,757.9	231	8,085,000	42,552.6	17	1360000	7,157.9	1	60000	315.8	1	30,000	157.9				3,246	51,479,000	270,942.1
Mudio	584	8,176,000	43,031.6	797	27,895,000	146,815.8	405	32,400,000	170,526.3	33	1980000	10,421.1	5	150,000	789.5				1,824	70,601,000	371,584.2
Roo	2,886	40,404,000	212,652.6	1,712	59,920,000	315,368.4	58	4,640,000	24,421.1	420	25200000	132,631.6	20	1,500,000	7,894.7				5,126	131,664,000	692,968.4
Ngira	204	2,856,000	15,031.6	3	105,000	552.6	2	160,000	842.1	10	600000	3,157.9	15	450,000	2,368.4				234	4,171,000	21,952.6
Sonu	5,094	71,316,000	375,347.4	8	280,000	1,473.7	3	240,000	1,263.2	20	1200000	6,315.8	20	600,000	3,157.9				5,145	73,636,000	387,557.9
Sawe	577	8,078,000	42,515.8	420	14,700,000	77,368.4	23	1,840,000	9,684.2	10	600000	3,157.9	4	120,000	631.6				1,034	25,338,000	133,357.9
Nguni	32	448,000	2,357.9	11	385,000	2,026.3	7	560,000	2,947.4	1	60000	315.8	2	60,000	315.8				53	1,513,000	7,963.2
Isuki	8,000	112,000,000	589,473.7	1,365	47,775,000	251,447.4	1,430	114,400,000	602,105.2	25	1500000	7,894.7	20	600,000	3,157.9	30	1,500,000	7,894.7	10,870	277,775,000	1,461,973.6
Lemira Kati	3,745	52,430,000	275,947.4	11	385,000	2,026.3	9	720000	3,789.5	1	60,000	315.8	5	150,000	789.5				3,771	53,745,000	282,868.4
Mroma	4,102	57,428,000	302,252.6	9	315,000	1,657.9	7	560000	2,947.4	2	120,000	631.6	10	300,000	1,579.0				4,130	58,723,000	309,068.4
Kwa Sadala	–	–		22,200	777,000,000	4,089,473.6	3,500	280,000,000	147,368.4	50	3,000,000	15,789.5	20	600,000	3,157.9	81	4050000	21,315.8	25,851	1,064,650,000	5,603,431.0
Kibo Estate	–	–		489	17,115,000	90,079.0	330	26,400,000	138,947.4	–	–	–	–	–	–				819	43,515,000	229,026.3
Total	28,220	395,080,000	2,079,368.5	27,256	953,960,000	841,289.4	5,791	463280000	1,112,000.1	573	34,380,000	180,947.5	152	4,560,000	24,000.1	111	5,550,000	29,210.5	62,103	1,856,810,000	9,772,694.0

SOURCE: Village and Ward Agricultural Officers, December, 1992
Exchange Rate: 1 US $ 1 = Tshs. 190.0

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Table B.7

ESTIMATED FOOD CROP PRODUCTION AND VALUES 1991

VILLAGE	BANANA			MAIZE			BEANS			TOMATO			VEGETABLES			MILLET			TOTALS		
	TONS	TSHS.	US$	TONS	TSHS.	US$	TONS	TSHS.	US$	TONS	TSHS.	US$	TONS	TSHS.	US$	TONS	TSHS.	US$	TONS	TSHS.	US$
Masama mula	3,570	248,347.8	248,347.8	250	12,500,000	54,347.8	250	22500000	417.4	2	96,000	410.4	1	42,000	182.6				4,073	92,258,000	401,121.7
Mudio	607	42,226.1	42,226.1	1,896	94,800,000	412,173.9	500	45,000,000	10,434.8	50	2,400,000	10,260.8	8	336,000	1,460.9				3,061	152,248,000	661,947.8
Roo	3,000	208,695.7	208,695.7	1,630	81,500,000	354,347.8	1,102	99,180,000	43,408.7	208	9,984,000	42,684.9	83	3,486,000	15,156.5				6,023	242,150,000	1,052,826.0
Ngira	191	13,287.0	13,287.0	125	6,250,000	27,173.9	90	8,100,000	4,591.3	22	1,056,000	4,514.8	55	2,130,000	9,260.9				483	20,772,000	90,313.0
Sonu	2,645	184,000.0	184,000.0	350	17,500,000	76,087.0	90	8,100,000	4,173.9	20	960,000	4,104.3	50	2,100,000	9,130.4				3,155	70,980,000	308,608.7
Sawe	101	7,026.1	7,026.1	450	22,500,000	97,826.1	27	2,430,000	2,295.7	117	528,000	2,257.4	7	294,000	1,278.3				596	27,368,000	118,991.3
Nguni	32	2,226.1	2,226.1	12	600,000	2,608.7	7	630,000	208.7	1	48,000	205.2	3	126,000	547.8				55	1,916,000	8,330.4
Isuki	8,840	614,956.5	614,956.5	1,300	65,000,000	282,608.7	1,300	117,000,000	6,260.9	30	1,440,000	6,156.5	25	1,050,000	4,565.2	30	1,650,000	7,173.9	11,525	327,580,000	1,424,260.8
Lemira Kati	4,000	278,260.9	278,260.9	9	450,000	1,956.5	8	720,000	417.4	2	96,000	410.4	5	2,100,000	9,130.4				4,024	65,476,000	284,678.3
Mroma	4,260	296,347.8	296,347.8	8	400,000	1,739.1	6	5,400,000	208.7	1	48,000	205.2	8	336,000	1,460.9				4,283	74,344,000	323,234.8
Kwa Sadala	–	–	–	33,250	1,662,500,000	7,228,260.8	450	40,500,000	10,434.8	50	2,400,000	10,260.8	12	504,000	2,191.3	37	2,035,000	8,847.8	33,799	1,707,939,000	7,425,821.7
Kibo Estate	–	–	–	235	11,750,000	51,087.0	350	31,500,000		–	–	–	–	–	–	–	–	–	585	14,900,000	64,782.6
Total	27,246	1,895,374.0	1,895,374.0	39,515	1,975,750,000	8,590,217.3	4,180	376,200,000	82,852.3	398	19,056,000	81,470.8	257	1,794,000	54,365.2	67	3,685,000	16,021.7	71,662	2,797,931,000	12,164,917.1

SOURCE: Village and Ward Agriculture Officers, December, 1992
Exchange Rate: 1 US $ = Tshs. 230.0

Table B.8

KWA SADALA – MBWEERA ROAD
SUMMARY SHEET FOR VEHICLE OPERATING COSTS (VOC) – TSHS.
GRAVEL ROAD

DECEMBER, 1992

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
VEHICLE CATEGORY	SOURCE CONSULTED	TYPE OF VEHICLE	VEHICLE UTILIZATION (KM)	ANNUAL PASSENGER/(P) /TONS(T)	VEHICLE CAPITAL COST	DEPRECIATION	INSURANCE	SALARIES WAGES & ALLOWANC	FUEL COST (DIESEL (D) & (PETROL (P)	LUBRIC-ANTS COSTS	SPARE PARTS COSTS	LABOUR MAINTE-NANCE COS'	TYRES TUBES COSTS	OVERHEADS
1. Private Car (pc)	(i) Masama Safaries Ltd.	(a) Toyota Corolla (p)	22,500	–	500,000		27,000	–	680,000	90,000	200,000	85,000	75,000	25,000
	(ii) R.S. Mushi	(b) Peugeot 404 (p)	24,500	–	700,000		15,000	–	550,000	190,000	250,000	100,000	70,000	15,000
Total			47,000	–	1,200,000		42,000	–	1,230,000	280,000	450,000	185,000	145,000	40,000
Average			23,500	–	600,000		21,000	–	615,000	140,000	225,000	92,500	72,500	20,000
2. Light Goods	(i) H.M.H. Msami	(a) Datsun Pickup(	33,000	6,654(T)	300,000	30,000	17,000	154,000	1,584,000	55,000	100,000	15,000	135,000	10,000
		(b) Toyota Dyna(D	26000	54,400(T)	900,000	40,000	27,000	484,000	1,760,000	120,000	360,000	180,000	210,000	20,000
Vehicle (LGV)	(ii) Said Hussein	(c) Toyota Hilux(p)	36,000	32,320(T)	1,000,000	100,000	15,000	297,000	880,000	33,000	165,000	55,000	100,000	10,000
	(iii) Equatorial Progressive Co. Ltd. (EPCL)	(d) Nissan 4x4 Pickup(D)	35,000	87,200(T)	3,176,000	900,000	7,000	600,000	960,000	56,000	576,000	35,000	180,000	25,000
	(iv) Charles Shangali	(e) Toyota Staut(p)	34,500	46,800(T)	2,174,743	217,474	176,000	180,000	1,150,000	46.000	180,000	30,000	334,000	25,000
		(f) Toyota Land Cruiser(D)	47,000	15,000(T)	1,500,000	150,000	65,000	132,000	561,600	9.600	200,000	14,000	380,000	15,000
	(v) Eperfraeli Mushi	(g) Toyota Staut(p)	39,000	3,960(T)	200,000	20,000	15,000	165,000	1,950,000	39,000	264,000	55,000	180,000	20,000
	(vi) Wilfred M. Lema	(h) Toyota Dyna(D	38,000	7,660(T)	16,000	1,600	10,000	528,000	1,000,000	60,000	100,000	50,000	150,000	15,000
	(vii) Raja Kimaro	(i) Toyota Dyna (D	30,500	37,000(T)	900,000	90,000	26,000	168,000	784,000	15,000	150,000	50,000	210,000	10,000
Total			319,000	290993(T)	10,166,743	1,599,074	358,000	2,708,000	10,629,600	433,600	2,095,000	484,000	1,879,000	150,000
Average			35,445	32,333(T)	1,129,638	112,963	39,778	300,889	1,181,067	48,177	232,778	53,778	208,776	16,667
3. Medium Goods	(i) KNCU HQS	(a) Scania 10 Tons (D)	30,500	1,750(T)	3,300,000	330,000	171,550	192,000	893,000	90,000	230,000	72,000	213,415	40,000
Vehicle (MGV)	(ii) Baraka I. Shuma	(b) Bedford 7 Tons (D)	28,800	4,928(T)	1,200,000	120,000	54,000	550,000	960,000	64,000	200,000	50,000	189,000	33,000
	(iii) Daudi S. Kimaro	(c) Isuzu 10 Tons(I	46,000	5,980(T)	3,000,000	300,000	60,000	360,000	822,400	40,000	600,000	44,000	140,000	16,000
	(iv) F. Edward	(d) Isuzu 7 Tons(D	50,700	18,480(T)	4,000,000	400,000	70,000	180,000	1,200,000	80,000	300,000	84,000	260,000	50,000
	(v) Vicent Pendaeli	(e) Bedford 7 Tons	24,000	8,800(T)	2,000,000	200,000	20,000	220,000	1,300,000	90,000	278,000	80,000	146,000	10,000
Total			180,000	39,938	13,500,000	1,350,000	375,550	1,502,000	5,175,400	364,000	1,608,000	330,000	948,415	29,800
Average			36,000	7,988	2,700,000	2,700,000	75,110	300,400	1,035,080	72,800	321,600	66,000	189,683	5,960

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
4. Bus	(i) Masama Safaries Connections Ltd. 65 seats	(a) Scania Luxury(D)	107,000	17,169(p)	21,000,000	2,100,000	1,000,000	1,448,000	2,200,000	80000	600,000	100,000	767,000	20,000
	(ii) Massama Cliff Bus Ltd. (65 seats)	(b) Leyland Daff(D)	92,000	19,391(p)	18,000,000	1,800,000	700,000	1,088,240	2,240,000	93,000	400,000	200,000	610,000	18,000
Total			199,000	36,551	39,000,000	3,900,000	1,700,000	2,536,240	44,440,000	173,000	1,000,000	300,000	1,377,000	38,000
Average			99,800	18,276	19,500,000	1,950,000	850,000	1,268,120	2,220,000	86,500	500,000	150,000	688,500	19,000
5. Tractor	(i) Massama Rural Cooperative Society Ltd.	(a) Kubota (Japane	19,700	1,412(T)		77,000	–	192,200	864,000	50,200	250,900	120,000	201,100	15,000
	(ii) Wilfred M. Lema	(b) Fiat	21,500	–		40,000	–	45,000	485,000	94,600	500,500	50,000	138,400	10,000
	(iii) G. Mushi	(c) Massey Furgeso	22,300	1,500(T)		110,000	–	65,000	675,000	100,500	400,200	95,000	388,900	10,000
Total			63,500	2,912		127,000	–	302,240	2,024,100	245,300	1,151,600	265,000	728,400	35,000
Average			21,167	971		42,333	–	100,747	874,700	81,767	383,837	88,333	242,800	11,667

APPENDIX C

SOCIAL ASSESSMENT DATA

Table C.1

KWA SADALA - MBWEERA ROAD
AREA OF INFLUENCE

VILLAGE	POPULATION	TOTAL HOUSE-HOLDS	AVERAGE
1. KWA SADALA	1596	228	7.0
2. ROO	4175	745	5.6
3. MUDIO	5440	1050	5.2
4. MBWEERA	7025	1003	7.0
5. NG'UNI	2378	440	5.6
6. NGIRA	1763	426	4.1
7. SONU	3569	609	5.8
8. SAAWE	2409	472	5.1
9. ISUKI	2175	346	6.2
10. LEMIRA KATI	1457	311	4.7
11. MROMA	1655	307	5.4
TOTAL	**33642**	**5937**	**5.7**

SOURCE: VILLAGE SECRETARIES, DEC. 1992

Table C.2

KWA SADALA - MBWEERA ROAD
QUALITY OF LIFE

	HOUSING		SCHOOLS			HEALTH		
VILLAGE	TIN ROOFS	THATCH ROOFS	KINDER	PRIM.	SEC	DIS	HC.	HOSP.
KWA SADALA	141	87	-	-	-	-	-	-
ROO	708	37	1	3	-	-	-	-
MUDIO	1034	16	2	4	-	-	1	-
MBWEERA*	968	35	3	4	-	1	-	-
NG'UNI	395	45	2	2	1	1	-	1
NGIRA	334	92	2	2	-	1	-	-
SONU	532	77	1	2	1	-	-	-
SAAWE	449	23	-	2	-	1	1	-
ISUKI	320	26	1	1	-	1	1	-
LEMIRA KATI	274	37	1	1	1	1	-	-
MROMA	199	108	1	2	-	1	-	-

*** MBWEERA: also has a Post Office and Bank**

SOURCE: Village Secretaries, December 1992

Table C.3

KWA SADALA - MBWEERA ROAD
VEHICLES

VILLAGE	PICK-UPS	4X4	SALOON	TRACTORS	-5 TONNERS	5 TONNERS +	BUSES	MOTOR-CYCLES	TOTAL
KWA SADALA	2		1	2	-	-	-	2	7
ROO	8	1	-	-	-	-	-	6	16
MUDIO	12	-	-	4	-	-	-	20	36
MBWEERA	33	1	12	-	2	4	3	-	55
NG'UNI	3	1	1	4	-	-	-	5	14
NGIRA	4		12	2	-	1	-	1	20
SONU	13	1	-	4	-	-	-	-	18
SAAWE	-	-	-	2	-	-	-	2	4
ISUKI	1	-	-	-	-	-	-	7	8
LEMIRA KATI	1	-	-	2	1	-	-	4	8
MROMA	6	-	-	-	-	-	-	1	7
TOTAL	83	4	27	20	3	5	3	48	193

SOURCE: Village Secretaries, December 1992

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Table C.4

KWA SADALA - MBWEERA ROAD
TOTAL BUSINESS IN AREA OF INFLUENCE

BUSINESS*	KWA SADALA	ROO	MUDIO	MBWEERA	NG'UNI	NGIRA	SONU	SAAWE	ISUKI	LEMIRA KATI	MROMA
GEN STORES	8	14	12	28	11	7	7	4	12	6	7
TEA SHOPS	1	2	2	3	-	-	1	1	-	-	-
BARS	4	4	5	6	2	-	2	2	3	-	-
POMBE CLUB	2	8	9	11	2	3	11	7	6	3	4
TAILORS	1	8	6	7	1	3	6	4	5	2	2
CARPENTERS	-	20	7	4	-	6	1	3	10	5	1
BUTCHERIES	-	4	5	6	2	2	2	2	2	2	3
BICYCLE REPAIR	1	7	3	1	-	-	-	1	-	-	-
MECHANICS	-	-	-	-	-	1	-	-	-	-	-
PRV. DISPE-NSARIES	1	1	-	1	-	-	-	-	-	-	-
GRAIN TRADERS	8	-	-	-	-	-	-	-	-	-	-
HIDE TRADERS	1	-	1	1	1	1	-	-	-	-	-
CEMENT TRADERS	-	-	-	1	-	-	-	-	-	-	-
GRAIN MILLS	-	-	3	2	5	2	-	2	3	3	3
SEED STORES	1	-	1	1	-	-	-	-	-	-	-
PETROL STATIONS	1	-	-	2	-	2	-	-	-	-	-
LODGING	1	-	-	-	-	-	-	-	-	-	-
OTHERS	2	4	3	13	10	2	4	5	3	2	1
TOTAL	32	72	58	87	25	29	34	31	44	23	21
GRAND TOTAL									456		

* Does not include informal sector or market traders

Source: Village Secretaries and surveys December 1992

Table C.5

KWA SADALA - MBWEERA ROAD

BUSINESSES ON ROAD ONLY

BUSINESS*	KWA SADALA	ROO	MUDIO	MBWEERA	NG'UNI	TOTAL
GEN STORE	8	8	1	18	4	39
TEA SHOP	1	2	2	3	-	8
BAR	4	-	1	6	-	11
POMBE CLUB	2	2	2	11	2	19
LODGING	1	-	-	-	-	1
PETROL STATION	1	1	-	2	-	4
GRAIN MILL	-	3	-	2	1	6
SEED STORE	1	-	1	1	-	3
GRAIN MERCHANT	8	-	-	-	-	8
HIDES MERCHANT	1	-	1	1	-	3
CEMENT MERCHANT	-	-	-	1	-	1
BUTCHERY	-	5	-	6	1	12
BAKERY	-	-	1	-	-	1
TAILORING	1	-	-	7	1	9
CARPENTRY	-	-	1	4	-	5
BICYCLE REPAIR	1	-	-	1	-	2
MECHANIC	-	-	-	1	-	1
SHOE REPAIR	-	-	-	1	-	1
RADIO/WATCH REPAIR	-	-	-	1	-	1
WELDING SHOP	-	-	-	2	-	2
TIN SMITH	-	-	-	1	-	1
PVT DISPENSARY	1	1	-	1	-	3
PHARMACY	-	-	-	1	-	1
CLOTHES FACTORY	-	-	-	1	-	1
KNCU COOPS	1	1	-	1	1	4
TOTAL	31	23	10	73	10	147

* NOTE: Does not include informal hawkers and vendors, nor does it include twice weekly market traders at Kwa Sadala and Mbweera

Source: Survey December, 1992

Table C.6 (a) **SOCIO-IMPACT ASSESSMENT DATA**

VILLAGE: ROO

NO. INTERVIEWED: 10

GENDER: M - 5 F - 5

AGE RANGE 70 - 25

AGRICULTURE

AREA CULTIVATED ACR. 33 1/2 AV 3.35 RANGE 01/4 - 7 ACRES

CROP	TOTAL ACRES	CULTIVATORS/10	AV	RANGE
COFFEE	10.5	9	1.17	1/4 - 2
BANANAS	10.5	9	1.17	1/4 - 2
MAIZE	21	10	2.1	1/2 - 5
BEANS	23	10	2.3	1/2 - 5

LIVESTOCK	TOTAL	OWNERS/10	AV (OWNERS ONLY)	RANGE (OWNERS)
CATTLE	12	5	2.4	1 - 5
GOATS	17	4	4.25	3 - 5
POULTRY	49	7	7	4 -15
RABBITS				

POSSESSION	OWNER/10
IRON ROOF	9
RADIO	8
BICYCLE	3
MOTORCYCLE	-

Table C.6 (b)

COMPARISON OF CONDITIONS IN 1990 WITH PRESENT

QUESTION	BETTER			SAME			WORSE			N/A
	M	F	T	M	F	T	M	F	T	
1. Ability to Purchase	3		3		2	2	2	3	5	
2. AG. Inputs	5	4	9		1	1				
3. AG Equipment	5	4	9		1	1				
4. ACCESS to MKTS	5	5	10							
5. Availability of Animal Feed	1	1	2		1	1	4	1	5	2
6. Transport (People)	5	4	9		1	1				
7. Transport (Goods)	5	4	9		1	1				
8. Access to Consumer Goods	5	4	9		1	1				
9. Household food Supply	4	4	8		1	1	1		1	
10. Family Health	2	4	6	1	1	2	2		2	
11. Access to Health Facility	3	4	7		1	1	2		2	
12. Access to Education	5	2	7	3	3					
13. Quality of Education	4	2	6		2	2	1	1	2	
14. Access to Water		1	1	3	1	4	2	3	5	
15. Access to Fuel	3	5	8	2		2				
16. Availability of Land			0				5	5	10	
17. Road Accidents	5	4	9		1	1				
18. Increase in Diseases			0	5	5	10				

Table C.7 (a) **SOCIO-IMPACT ASSESSMENT DATA**

VILLAGE NGIRA

NO. INTERVIEWED: 10
GENDER: M 6 F 4
AGE RANGE: 36 TO 75

AGRICULTURE

AREA CULTIVATED T.ACR 77.5 AV. 7.75 RANGE 1.5 TO 38

CROPS	T. ACR.	CULTIVATORS/10	A/V	RANGE
COFFEE }	25.5	10	2.55	0.5-8
BANANAS}				
MAIZE }				
BEANS }	52	10	5.2	0.5-30

LIVESTOCKS	TOTAL	OWNERS/10	AV. (OWNERS ONLY)	RANGE (OWNERS ONLY)
CATTLE	26	8	3.25	2 - 6
GOATS	25	7	3.57	1 - 7
POULTRY	71	8	8.88	1 - 25
RABBITS				

POSSESSION	OWNER/10
IRON SHEETS ROOF	7
RADIO	5
BICYCLE	1
MOTORCYCLE	1
S. CARS	-
LORRIES	-
PICK-UPS	1
TRACTOR	10

Table C.7 (b)

NGIRA

COMPARISON OF CONDITIONS IN 1990 WITH PRESENT

QUESTION	BETTER			SAME			WORSE			N/A
	M	F	T	M	F	T	M	F	T	
1. Ability to Purchase	3	2	5			0	3	2	5	
2. AG. Inputs	5	4	9			0	1	-	1	
3. AG. Equipment	6	4	10			0	-	-	0	
4. Access to Mkts.	5	4	9	1		1	-	-	0	
5. Availability of Animal Feeds	2	1	3		2	2	4	1	5	
6. Transport (People)	6	4	10			0	-	-	0	
7. Transport (Goods)	6	4	10			0	-	-	0	
8. Access to Consumer goods	6	4	10			0	-	-	0	
9. Household Food Supply	6	2	8			0	-	2	2	
10. Family Health	5	4	9	1		1	-	-	0	
11. Access to Health Facility	4	2	6	1		1	1	2	3	
12. Access to Education	4	3	7	2	1	3	-	-	-	
13. Quality of Education	5	3	8		1	1	1	-	1	
14. Access to Water	6	3	9		1	1	-	-	-	
15. Access to Fuel	3	2	5	1	2	3	2	-	2	
16. Availability of Land	-	-	0	-	-	0	6	4	10	
17. Road Accidents	4	2	6	1	3	4	-	-	0	
18. Increase in Diseases	1	-	1	1	5	4	9	-	0	

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Table C.8 (a) **SOCIO-IMPACT ASSESSMENT DATA**

VILLAGE: MBWEERA

NO. INTERVIEWED: 10

GENDER M 6 F4

AGE RANGE 28 TO 75

AGRICULTURE:

AREA

CULTIVATED (1992) TOTAL ACREAGE 147.38 AVER. 14.74 RANGE 1/8 ACRE TO 8.7 ACRES

CROPS	*TOTAL ACR.*	*CULTIVATORS/10*	*A/V*	*RANGE*
COFFEE}				
BANANA}	*31.38*	*10*	*3.14*	*0.125 - 20 acres*
MAIZE}	*116*	*9*	*12.29*	*0.25 - 85 acres*
BEANS}				

LIVESTOCK	*TOTAL*	*OWNERS/10*	*AVER(OWNERS ONLY)*	*RANGE OWNERS ONLY)*
CATTLE	*37*	*8*	*4.63*	*1 - 15*
GOAT/SHEEP	*17*	*7*	*2.43*	*1 - 4*
POULTRY	*85*	*6*	*14.17*	*2 - 45*

POSSESSIONS	*OWNER/10*
IRON ROOF	*8*
RADIO	*7*
BICYCLE	*-*
MOTORCYCLE	*-*
SALOON CAR	*1*
LORRY	*-*
PICK-UP	*2*
BUS	*1*

Table C.8 (b)

COMPARISON OF CONDITIONS IN 1990 WITH PRESENT

MBWEERA

QUESTION	BETTER			SAME			WORSE			N/A
	M	F	T	M	F	T	M	F	T	
1. Ability to Purchase		1	1	1			5	3	8	
2. AG. Inputs	4	2	6	1			1	2	3	
3. AG. Equipment	5	3	8	1				1	1	
4. Access to Mkts.	5	4	9	1					0	
5. Availability of Animal Feeds		3	3	2			4	1	5	
6. Transport (People)	5	3	8	1					0	1
7. Transport (Goods)	5	2	7	1				1	1	1
8. Access to Consumer Goods	5	3	8	1					0	1
9. Household Food Supply	4	2	6	1	1	2	1	1	2	
10. Family Health	4	3	7	2	1	3			0	
11. Access to Health Facility	2	2	4	1	1	2	3	1	4	
12. Access to Education	3	3	6	1	1	2			1	1
13. Quality of Education	2	1	3		1	1	3	1	4	2
14. Access to Water			0	2	3	5	4	1	5	
15. Access to Fuel	4		4	1		1	1	4	5	
16. Availability of Land			0			0	6	4	10	
17. Road Accidents	6	3	9			0			0	1
18. Increase in Diseases			0	6	4	10			0	

Table C.9 (a) **SOCIO-IMPACT ASSESSMENT DATA**

VILLAGE: MROMA

NO. INTERVIEWED: 10

GENDER: M 5 F 5

AGE RANGE: 34 TO 90

AGRICULTURE: (1992)

AREA TOTAL ACREAGE 18.17 AV. 1.82 ACRES RANGE:0.17 TO 3 ACRES

CULTIVATED

CROPS	TOTAL ACR.	CULTIVATORS/10	AV.	RANGE
COFFEE}	8.92	10	0.89	0.167-2 ACRES
BANANA}				
MAIZE}	9.25	9	1.03	0.5-3 ACRES
BEANS}				

LIVESTOCK	TOTAL	OWNERS/10	AVER. (OWNERS ONLY)	RANGE (OWNERS ONLY)
CATTLE	20	7	2.86	1-8
GOAT/SHEEP	15	5	3	2-6
POULTRY	33	7	4.7	1-14

POSSESSION	OWNER/10
IRON ROOF	8
RADIO	6
BICYCLE	1
PICK-UP	1
LORRY	-
SALOON CAR	-
MILLING MACHINE	-
MOTOR CYCLE	-

Table C.9 (b)

MROMA

COMPARISON OF CONDITIONS IN 1990 WITH PRESENT

QUESTION	BETTER			SAME			WORSE			N/A
	M	F	T	M	F	T	M	F	T	
1. Ability to Purchase			0	1	3	4	4	2	6	
2. AG. Inputs	4	5	9			0	1		1	
3. AG. Equipment	5	5	10			0			0	
4. Access to Mkts.	5	4	9		1	1			0	
5. Availability of Animal feeds			0		1	1	4	4	8	1
6. Transport (People)	1	1	2	1	2	3	3	2	5	
7. Transport (Goods)	1	1	2	1	1	2	3	3	6	
8. Access to consumer goods	5	5	10			0			0	
9. Household food supply	3	3	6	1		1	1	2	3	
10. Family Health	3	2	5		2	2	2	1	3	
11. Access to Health Facility	3	1	4	2	4	6			0	
12. Access to Education	4	3	7	1	2	3			0	
13. Quality of Education	2	3	5	1	2	3	2		2	
14. Access to Water			0	2	3	5	3	2	5	
15. Access to Fuel	2	2	4	1	1	2	2	2	4	
16. Availability of Land			0				5	5	10	
17. Road Accidents	1	3	4	4	2	6			0	
18. Increase in Diseases			0	5	5	5			0	

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Table C.10

CALCULATION OF HOUSEHOLD INCOME (AS PER 1990 PRICES)

INCOME FROM AGRICULTURAL PRODUCTION (1990)

CROP	AMOUNT HARVESTED (IN KGS)	VALUE PER UNIT (IN TSHS.)	TOTAL VALUE (TSHS.)	UNIT COST OF PRODUCTION (TSHS.)	TOTAL PRODUCTION COST (TSHS.)	NET INCOME FROM AGRICULTURE
1. MROMA VILLAGE						
MAIZE	5,600	20	112,000	3.20	17,920.00	94,080.00
BEANS	502	18	9,036	8.70	4,367.40	4,668.60
COFFEE	657	255	167,535	39.80	26,148.00	141,386.40
BANANAS	634	100	63,400	1.50	951.00	62,449.00
			351,971		49,387.00	302,584.00
2. NGIRA VILLAGE						
MAIZE	24,600	20	492,000	3.20	78,720.00	413,280.00
BEANS	4,970	18	89,460	8.70	43,239.00	46,221.00
COFFEE	2,512	255	640,560	39.80	99,977.60	540,582.40
BANANAS	1,530	100	153,000	1.50	2,295.00	150,705.00
			1,375,020		224,231.60	1,150,778.40
3. MBWEERA VILLAGE						
MAIZE	7,700	20	154,000	3.20	24,640.00	129,360.00
BEANS	3,240	18	58,320	8.70	28,188.00	30,132.00
COFFEE	1,540	255	392,700	39.80	61,292.00	331,408.00
BANANAS	413	100	41,300	1.50	619.50	40,680.50
			646,320		114,739.50	531,380.50
4. ROO VILLAGE						
MAIZE	46,340	20	926,800	3.20	148,288.00	778,512.00
BEANS	14,290	18	257,220	8.70	12,124,323.00	132,897.00
COFFEE	12,377	255	3,156,135	39.80	492,604.60	2,663,530.40
BANANAS	897	100	89,700	1.50	1,345.50	88,354.50
			4,429,855		766,560.60	3,663,293.90

Table C.11

CALCULATION OF HOUSEHOLD INCOME (AS PER 1992 PRICES)

INCOME FROM AGRICULTURAL PRODUCTION (1992)

CROP	AMOUNT HARVESTED (IN KGS)	VALUE PER UNIT (IN TSHS.)	TOTAL VALUE (TSHS.)	UNIT COST OF PRODUCTION (TSHS.)	TOTAL PRODUCTION COST (TSHS.)	TOTAL NET INCOME FROM AGRIC.
1. MROMA VILLAGE						
MAIZE	4,040	50.00	202,000	16.00	64,640	137,360
BEANS	922	81.80	75,419.60	25.00	23,050	52,369.6
COFFEE	600	155.00	93,000	140.00	84,000	9,000.0
BANANAS	774 BUNCHES	800.00	619,200	1.00	774	618,426.0
			989,619.60		172,464	817,155.60
II. NGIRA VILLAGE						
MAIZE	27,250	50	1,362,500	16.00	436,000	926,500
BEANS	5,443	81.80	445,237.40	25.00	136,075	309,162.4
COFFEE	1,822.5	155	282,487.50	140.00	255,150	27,337.5
BANANAS	1,350 bunches	800	1,080,000	1.00	1,350	1,078,650
			3,170,224.90		828,575	2,341,649.90
III. ROO VILLAGE						
MAIZE	10,950	50	547,500	16.00	175,200	372,300
BEANS	2,950	81.80	241,310	25.00	73,750	167,560
COFFEE	1,260	155	195,300	140.00	176,400	18,900
BANANAS	524 bunches	800	419,200	1.00	524	418,676
			1,403,310		425,874	977,436
IV. MBWEERA VILLAGE						
MAIZE	55,320	50	2,766,000	16.00	885,120	1,880,880
BEANS	40,510	81.80	3,314,123.10	25.00	1,012,750	2,301,373.1
COFFEE	10,581	155	1,640,055	140.00	1,481,340	158,715
BANANAS	1,047	800	837,600	1.00	1,047	836,553
			8,557,778.10		3,380,527	5,177,521.10

Note: Household income constitute the following
- Income from agriculture 83%
- Income from Livestock 4%
- Income from other sources 13%
  e.g wage income, trading, handicrafts, brew etc.

Table C.12

HOUSEHOLD INCOME 1990

VILLAGE	INCOME FROM AGRICULTURAL PRODUCTION	INCOME FROM LIVESTOCK	INCOME FROM OTHER SOURCES	TOTAL	AVERAGE INCOME PER HH.
MROMA	302,584.00	14,582.40	47,392.70	364,559.10	36,455.90
NGIRA	1,150,788.40	112,850.60	180,244.00	1,443,883.00	144,388.30
ROO	531,580.50	25,618.35	83,259.60	640,458.45	64,045.85
MBWEERA	3,663,293.90	176,544.30	573,768.90	4,413,607.10	441,360.70

Table C.13

HOUSEHOLD INCOME 1992

VILLAGE	INCOME FROM AGRICULTURAL PRODUCTION	INCOME FROM LIVESTOCK	INCOME FROM OTHER SOURCES	TOTAL	AVERAGE INCOME PER HH.
MROMA	817,155.60	39,381.00	127,988.25	984,524.85	98,452.50
NGIRA	2,341,649.90	93,666.00	304,414.50	2,739,730.40	273,973.00
ROO	977,436.00	39,097.40	127,066.55	1,143,599.90	114,360.00
MBWEERA	5,177,521.10	207,100.80	673,077.60	6,057,699.5	605,769.95

APPENDIX D

R E F E R E N C E S

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