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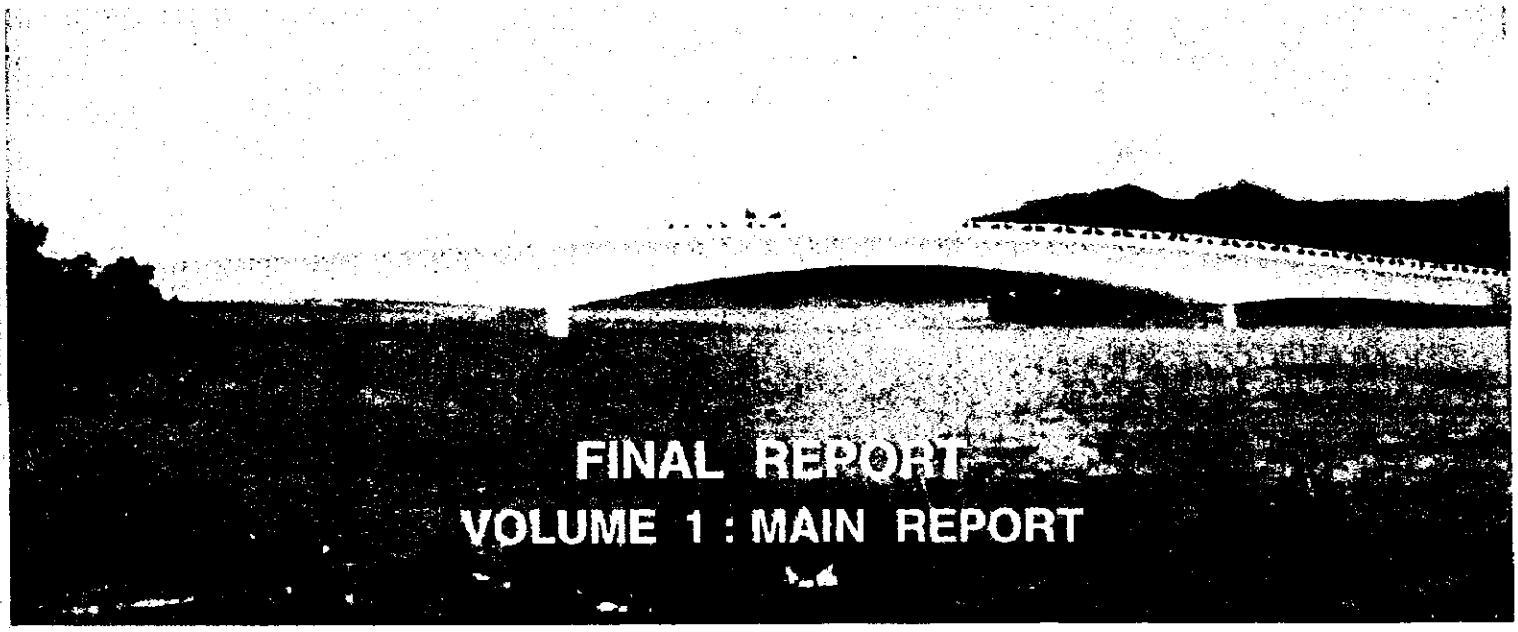
No. 2

MINISTRY OF WORKS AND SUPPLIES
THE REPUBLIC OF MALAWI

THE FEASIBILITY STUDY ON THE RECONSTRUCTION OF MANGOCHI ROAD BRIDGE IN THE REPUBLIC OF MALAWI



FINAL REPORT
VOLUME 1 : MAIN REPORT

AUGUST 1998

JAPAN INTERNATIONAL COOPERATION AGENCY

NIPPON KOEI CO., LTD.
CHODAI CO., LTD.

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NOTE

Following exchange rates are applied in this report
End of March, 1998

US$1.00 = Yen128.7
US$1.00 = MK 25.0

PREFACE

In response to a request from the Government of the Republic of Malawi, the Government of Japan decided to conduct a Feasibility Study on the Reconstruction of Mangochi Road Bridge and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent a study team to Malawi in 1998, headed by Mr. Kazumasa TADA, Nippon Koei Co., Ltd., and composed of the members of Nippon Koei Co., Ltd. and Chodai Co., Ltd. The study team was sent twice between February and July 1998.

The team held discussions with the officials concerned of the Government of Malawi , and conducted field surveys in the study area. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Malawi for their close cooperation extended to the team.

August, 1998

Kimio Fujita
President
Japan International Cooperation Agency

August, 1998

Mr. Kimio Fujita
President
Japan International Cooperation Agency
Tokyo, Japan

Letter of Transmittal

We are pleased to submit to you the final report on the Feasibility Study on the Reconstruction of Mangochi Road Bridge in the Republic of Malawi.

This study was conducted by Nippon Koei Co,. Ltd & Chodai Co,. Ltd, under a contract with JICA, during the period from February 4, 1998 to August 17, 1998. In this study, we examined the feasibility and rationale of the project with due consideration to the present situation of Malawi.

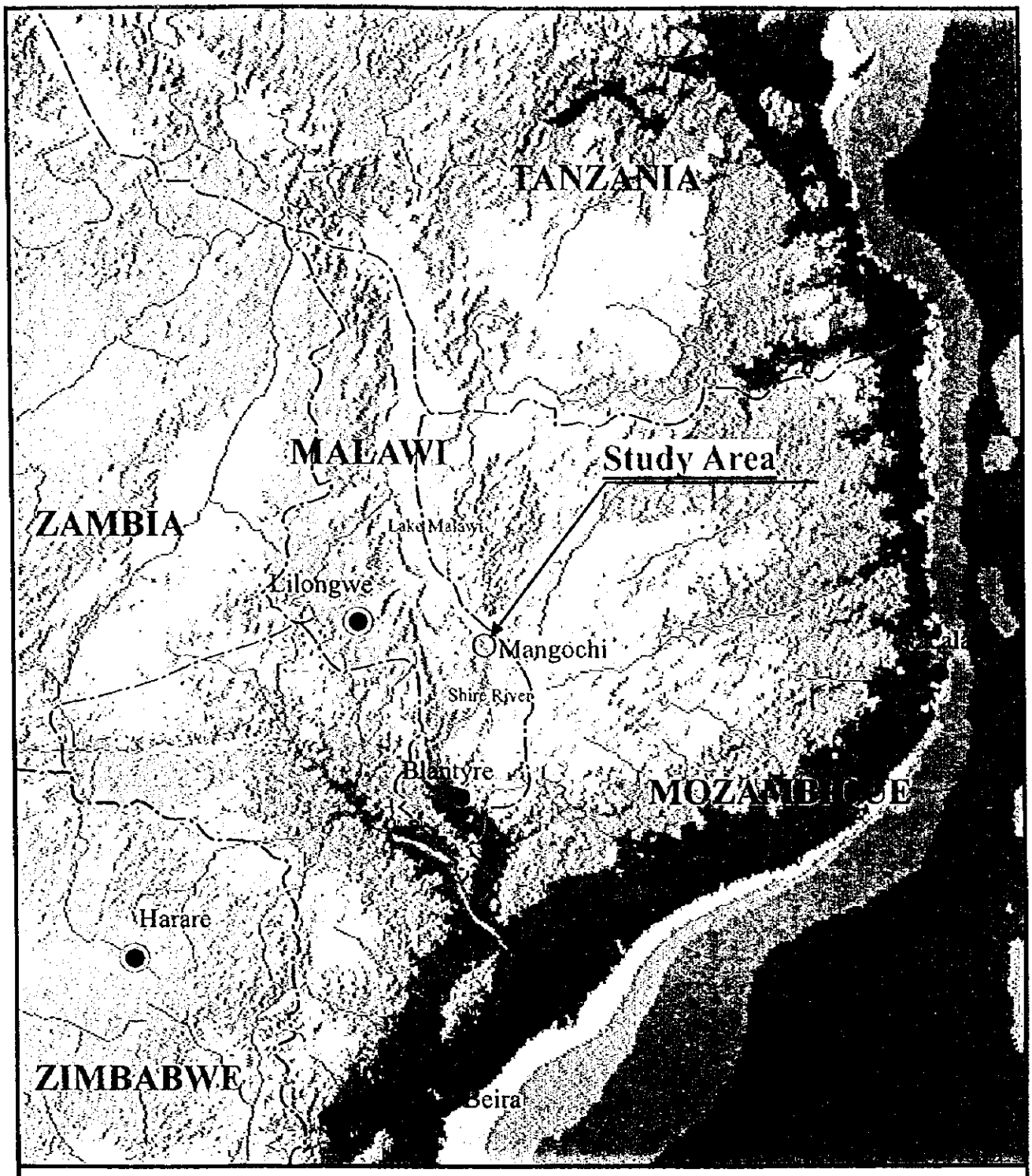
We wish to take this opportunity to express our sincere gratitude to the officials concerned of JICA, the Ministry of Foreign Affairs, the Ministry of Construction, and the Honshu-Shikoku Bridge Authority. We also would like to express our gratitude to the officials concerned of the Ministry of Works and Supplies in the Republic of Malawi for their cooperation and assistance throughout our field survey.

Finally we hope this report will contribute to the realization of the project.

Very truly yours.

多田一正

Kazumasa TADA
Team Leader
The Feasibility Study on
the Reconstruction of the Mangochi Road Bridge
Nippon Koei Co,. Ltd.
Chodai Co,. Ltd.



The Feasibility Study on The Reconstruciton of Mangochi Road Bridge in The Republic of Malawi	Location Map

ABBREVIATIONS

AADT	Average Annual Daily Traffic
ADD	Agricultural Development Division
ADMARC	Agricultural Development and Marketing Corporation
ADT	Average Daily Traffic
B/C	Benefit-Cost
BOD	Biological Oxygen Demand
CHAM	Christian Hospital Association of Malawi
COD	Chemical Oxygen Demand
CRE	Chief Resident Engineer
DCs	District Commissioners
DDCs	District Development Committees
DDF	District Development Fund
DEA	Director of Environmental Affairs
DNEP	Department of National Road and Bridges in Mozambique Government
DO	Dissolved Oxygen
DRIMP	District Roads Improvement and Maintenance Programme
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rates of Return
EM	Environmental Monitor
EMA	Environmental Management Act
EMP	Environmental Management Plan
EPA	Extension Planning Area
ESCOM	Electricity Supply Commission of Malawi
FAO	Food and Agricultural Organization
GDP	Gross Domestic Product
HB	Heavy Bus
HDM	Highway Design and Maintenance Standards Model
HGV	Heavy Goods Vehicle
HT	Heavy Truck
IDA	International Development Association
IEC	Information,Education,and Community
IEE	Initial Environmental Evaluation
IGA	Income Generating Activities
JICA	Japan International Cooperation Agency

JRA	Japan Road Association
LB	Mini Bus
LGV	Light Goods Vehicle
LT	Light Truck
MASAF	Malawi Social Action Fund
MHC	Malawi Housing Corporation
MOAL	Ministry of Agriculture and Livestock
MOFNR	Ministry of Forestry and Natural Resources
MOIWD	Ministry of Irrigation and Water Development
MOLGRD	Ministry of Local Government and Rural Development
MOREA	Ministry of Research and Environmental Affairs
MOWD	Ministry of Water Development
MOWS	Ministry of Works and Supplies
MPU	Micro Project Unit
MT	Medium Truck
MTEF	Medium-term Expenditure Framework
NPV	Net Present Value
NTC	Northern Transport Corridor
OD	Origin-destination
ODA	Official Development Assistance
PC	Passenger Car/Sedan
PFP	Policy Framework Paper
PM	Project Manager
PSIP	Public Sector Investment Programme
PU	Pickup Truck
RDP	Rural Development Project
REO	Resident Engineer's Organization
SADC	Southern African Development Community
SCDP	Secondary Centres Development Programme
SCF	Standard Conversion Factor
SRMP	Shire River Management Project
SS	Suspended Solid
TA	Traditional Authority
THA	Traditional Housing Area
UNDP	United Nations Development Programme
USAID	US Agency for International Development

UTHA	Unplanned Traditional Housing Area
VARBAU	Village Access Road and Bridges Programme III
VHT	Articulated Truck
VOC	Vehicle Operating Cost

Synopsis

Malawi imports and exports have depended upon a northern transportation corridor via the port of Dar es Salaam in Tanzania and a southern corridor via the port of Durban in South Africa. This is because transportation from the port of Nacala has severely deteriorated due to the political turmoil and subsequent civil war in Mozambique.

The Government of Malawi however has put a high priority on the Nacala corridor since the recent cessation of the civil war in Mozambique. Also the existing Mangochi Bridge over the Shire River as a bridge component of the Nacala corridor is deteriorating as it has been nearly 30 years since the existing bridge was constructed.

For the Nacala corridor in Mozambique, the Government of Japan is implementing the rehabilitation of three bridges with a grant aid and the World Bank has a plan of urgent road rehabilitation. Within the section of this corridor in Malawi, the feasibility study and detailed design between the Mangochi Bridge and the border of Mozambique has been completed by the Kuwait Fund except for the bridge itself.

With this background the rehabilitation of the Mangochi Bridge is expected to establish an efficient international transportation link along the Nacala corridor and consequently, the Government of Malawi has requested the assistance of the Government of Japan to carry out a feasibility study for the reconstruction of the Mangochi Bridge.

Since Malawi's economy is heavily dependent on foreign trade, the availability of dependable external transport links at a reasonable cost is crucial. The international routes are by road or rail from Blantyre through Mozambique to the port of Nacala, by road and/or rail to the ports of Beira and Durban, and by rail, lake, and/or road to the port of Dar-es-Salaam.

Prior to the disruption of international traffic through Mozambique due to that country's civil war, the Nacala and Beira ports handled over 90% of Malawi's international traffic.

Presently the total number of motor vehicles crossing the Mangochi Bridge is 398 per day, (not including motorcycles.)

And it was determined that the traffic on the Mangochi Bridge has been consistently increasing at an overall traffic growth rate of 11.0% per annum from 1989 to 1998.

Traffic assignment results are shown bellow:

Traffic Assignment Results for the Mangochi Bridge, Vehicles per Day

Description	Without New Bridge				With New Bridge			
	2002	2005	2012	2022	2002	2005	2012	2022
Normal & Develop. Traffic	765	931	1,485	2,500	799	972	1,556	2,888
Induced Traffic	0	0	0	0	46	54	90	172
Total Traffic	765	931	1,485	2,500	845	1,026	1,646	3,060

Note: Diverted traffic due to a shift in routes (not modes) is included in normal and development traffic.

Source: JICA Study Team.

Outline of the design of study is as follows.

Proposed Bridge Route

The optimum bridge route was selected based on the evaluation of economic, engineering and environmental aspects and the route, which follows the same alignment on national highway M3 and is almost parallel and located 30 m downstream of the existing bridge is recommended as the best alternative route.

Project facility

(1) Bridge

Location	:	30 m downstream of the existing bridge
Bridge width	:	Total width 9.7m
Carriageway	:	7.3m
Sidewalk	:	1.3m
Bridge length	:	220m
Span arrangement	:	Main span 100m Side span 60 m
Bridge Type	:	Three span continuous prestressed concrete box girder
Foundation type	:	Open caisson for pier and cast in situ pile for abutment

(2) Approach Road

Road width	:	10.5 m
Carriageway	:	7.3 m
Side walk	:	1.6m
Shoulder	:	1.5m
Total Length	:	325 m (Mangochi side 125 m, Ntagaluka side 200 m)
Pavement	:	DBST for carriageway

The EIA for this Project conform to Malawian, World Bank and JICA methodologies and standards. The Project was assessed against a standard checklist of possible environmental effects with both the construction and operational stages being assessed.

Three ministries have the responsibility for environmental protection in Malawi. The ministries mainly involved with this Project are the Ministry of Works and Supplies (MOWS), Ministry of Water Development (MOWD) and the Ministry of Research and Environmental Affairs (MOREA). MOREA is a statutory authority for all EIA studies.

The Project site is located in the middle of the Upper Shire River that connects Lakes Malawi and Malombe. This river is a migratory path for chambo fish and an important place for local chambo fisheries. Around the Project site, there is a large embankment on the east bank that provides a bottle-necked shape to the river. Due to this topographic feature, the effect of the scouring around the existing bridge piers is significant. There are historical monuments (Queen Victoria clock tower and a gun from HMS Guendolin) on the west bank while a police check point exists on the east bank.

Based on the knowledge of the local environment surrounding the study area, the initial environmental evaluation (IEE) was carried out, being mainly concerned with the environmental impacts on the water resources, erosion and/or sedimentation, fishery, historical monuments, and the resettlement issues. Throughout this IEE, Route A was selected as the preferred option, and a full EIA was undertaken for this option.

The quality testing of the Shire River water was conducted in order to obtain the baseline data for the Project. The water quality testing was carried out with respect to 12 parameters such as pH, conductivity, dissolved oxygen, biological oxygen demand etc. From the testing, it was found that the present water quality of the Shire River is relatively clean, and impacts caused by any accidents such as oil spillage would be significant and cause severe damage to the local environment.

A Socio-cultural opinion survey was carried out at Mangochi Township (150 interviewees),

and opinions and comments about the relationship between the new bridge construction Project and the surrounding local environment were collected. From this survey, it was found that people show great concern about the bridge Project and recognize the importance that the new bridge will provide, safer, easier and faster transport for the local community. These benefits will be increased considerably once the rehabilitation of the entire Nacala corridor between Mangochi and Chiponde is finished. Deforestation is the biggest environmental concern for the local residents with fish conservation also important. Most of interviewees considered that the new bridge Project would not have a strong influence on the surrounding environment. Relocation of historical monuments caused by the new bridge Project was agreed to by most of interviewees. However, special care must be taken concerning the relocation of the historical monuments located at the bridge site as well as considering other major issues such as water resources conservation.

The EIA for the Mangochi Bridge reconstruction Project has demonstrated several negative impacts as well as major positive ones. Any predicted negative impacts are of minor significance and can be further reduced or avoided by the recommended mitigation measures. No more environmental studies are required.

Cost estimation was carried out under the following assumptions:

Cost estimation was made at price levels as at the end of March 1998.

The foreign currency exchange rate was assumed to be; US$1.0=Yen 128.70

Malawi Kwach=Yen5.27

Materials and equipment, which cannot be procured in Malawi, are basically imported from South Africa and Japan.

The total Project cost is estimated at US $ 14,668,959 (US $ 9,604,681 for the foreign portion and US $ 5,064,278 for the local portion) and is summarized bellow.

No	Work Item	Foreign (US$)	Local (US$)	Total (US$)
1)	Construction Cost			
A)	Preparation Works	43,966	698,160	742,126
B)	Temporary Works	349,425	94,220	443,645
C)	Bridge	5,072,424	2,446,138	7,518,562
D)	Approach Road	106,936	497,570	604,506
	Total(1)	5,572,751	3,736,088	9,308,839
2)	Engineering Fee	1,312,209	68,243	1,380,452
3)	Non-Eligible Cost			
3.1	Demolition of the Existing Bridge		28,000	28,000
3.2	Relocation of Power Line		6,000	6,000
3.3	Taxes and Duties	1,807,199	736,712	2,543,911
3.4	MOWS's Administration Cost	39,366	2,047	41,413
3.5	Environmental Program	0	26,800	26,800
	Total 3)	1,846,565	799,599	2,646,125
4)	Contingencies	873,153	460,389	1,333,542
5)	Project Cost (1+2+3+4)	9,604,681	5,064,278	14,668,959

The direct economic benefits of the Project (i.e., savings in vehicle operating costs calculated in section 3) vary by year, increasing from an initial US$135,385 in 2002 to US$174,231 in 2005 and US$1,450,375 in 2022. The total economic Project cost was determined to be US$11,153,199. The resultant EIRR of the project is 7.0%.

The indirect benefits of the Project are substantial, and it is the consultant's opinion that these factors remove any doubt concerning the economic viability of the Project. The recommendation of the study is that the Project should be implemented immediately. The new Mangochi Bridge will be an important asset to the Malawian economy which will safeguard the confidence and security needed to continue the current strong regional and national economic growth.

Conclusions of the Study are summarized bellow:

The total quantity of commodities to and from Malawi dealt with at Nacala port in Mozambique has dominated recently other external ports due to the settlement of Mozambique's civil war, the Nacala corridor has a significant road network in Malawi fulfilling an important international transport route as well as railway between Nacala and Blantyre. While the current daily traffic volume counts 398 vehicles in terms of motorized vehicles, 931 and 1,026 vehicles are estimated respectively in the years 2005 and 2022 in the case of "without new bridge"scenario and 2,500 and 3,060 vehicles has been assessed in case of "with new bridge" scenario on the assumption that the adjacent road rehabilitation Project is carried out. In consideration of the future increasing traffic volume and the increase in the weight of vehicles, the existing Mangochi Bridge on the Nacala corridor will not stand the future traffic conditions due to insufficient load carrying and one lane capacities.

On the other hand, road rehabilitation works at both sides of the Mangochi Bridge are scheduled to be implemented. In this regard, the necessity of the rehabilitation of the Mangochi Bridge is required in conjunction with the rehabilitation scheme of the road network.

The direct economic benefit of the Project is composed of savings in distance and time-related vehicle operating costs. These economic benefits vary annually, increasing from an initial US $ 135,385 in 2002 to US $ 174,231 in 2005 and US $ 1,450,375 in 2022.

Indirect benefits can be identified in two categories: transportation effects and regional development effects.

(1) Transportation Effects can be summarized as follows:

- Improvement of traffic safety and reduction of risk and uncertainty
- Strengthening of Malawi's international road network
- Strengthening of Mozambique's international and domestic traffic through Malawi
- Improvement of accessibility to remote area

- Reduced transport tariffs and increased tax revenue

(2) Regional Development Effects

- Promotion of a market-oriented economy
- Upgrading of living standards in rural area
- Modernization of agriculture
- Promotion of agro-industries and fish-processing industries
- Promotion of resource development
- Tourism development
- Balanced development in the region
- Technology transfer

Based on results of the bridge design study, a pre-stressed concrete bridge, 220m in length has been adopted for the new Mangochi Bridge and has been located just downstream of the existing bridge.

The total Project cost is estimated to be US$14,688,959 in which the foreign currency and local currency are US $ 9,604,681 and US $ 5,064,278 respectively. The total construction period is estimated at 26 months.

The surroundings near the Project site in the Shire River are regarded as the migratory path of the chambo fish and also a historical monument of Queen Victoria clock tower exists. Any predicated negative impacts are of minor significance with the construction of a new bridge and can be reduced or avoided by utilization of the recommended mitigation measures.

EIRR is estimated to be 7.0%. As the indirect benefits of the Project are substantial, the Study Team regards that these indirect factors remove any doubt concerning the economic viability of the Project.

The following works are expected to be undertaken by the Government of Malawi when the Project is implemented:

1) Adjustment of plans between this Project and the adjoining road Project
2) Relocation of power lines and other necessary facilities such as water intakes etc.
3) Demolition of the existing bridge
4) Land acquisition and compensation
5) Environmental Impact Assessment and monitoring

In conclusion the Study Team considers that construction of the new Mangochi Bridge is

technically and economically feasible under proper financing and accordingly recommends that it be immediately implemented.

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CHAPTER 1 INTRODUCTION

1.1 Background

The Republic of Malawi is surrounded by Zambia, Tanzania and Mozambique, and has no direct access to the sea. The country is approximately 900km long and between 80km and 150km wide, with an area of approximately 120,000sq km. The Great Rift Valley passes through Malawi, and Lake Malawi lies in a trough formed by this valley. The lake is the third largest lake in Africa, covering almost a fifth of Malawi's total area. Malawi has three other lakes of which Lake Malombe is located less than 10km south of Lake Malawi. Malawi's main river is the Shire; it flows out of the southern end of Lake Malawi, into and out of Lake Malombe and then southward (as the plateau gives way to low ground) to flow into the Zambezi River in Mozambique.

The Export and Import of Malawi have previously depended upon the northern transportation corridor via the port of Dar es Salaam in Tanzania and a southern corridor via the port of Durban in South Africa as transportation from the port of Nacala deteriorated severely due to the political turmoil and the following civil war in Mozambique.

However, the Government of Malawi is putting a high priority on the Nacala corridor as a result of the recent termination of the civil war in Mozambique. The existing Mangochi Bridge over the Shire River as a bridge componebt of the Nacala corridor is deteriorating as it has been 30 years since the existing bridge was constructed.

For the Nacala corridor in Mozambique, the Government of Japan is implementing the rehabilitation of three bridges with grant aid and the World Bank has a plan of urgent road rehabilitation. Within the section of this corridor in Malawi, the feasibility study and detailed design between the Mangochi bridge and the border of Mozambique has been completed by the Kuwait Fund for the bridge itself.

With this background the rehabilitation of the Mangochi bridge is expected to establish an efficient international transportation link along the Nacala corridor and consequently the Government of Malawi has requested the assistance of the Government of Japan to carry out a feasibility study for the reconstruction of the Mangochi road bridge.

In response to this request, the Government of Japan decided to carry out the study

and entrusted its execution to the Japan International Cooperation Agency (hereinafter referred to as "JICA"); the official agency responsible for the implementation of technical cooperation programs carried out by the Government of Japan.

JICA dispatched a preparatory study team to establish an approach on technical cooperation. Based on the agreed approach, JICA organized an advisory committee (hereinafter referred to as "the Advisory Committee") and recruited a Study Team (hereinafter referred to as "the Study Team").

1.2 Objectives of the Study

The major objectives of the Study were:

1) To execute the feasibility study on the reconstruction of the Mangochi road bridge targeting 2005.

2) To promote knowledge and technology transfer through the execution of this feasibility study.

1.3 Scope of the Study

The Study started from the beginning of February 1998 and will come to an end in July 1998. An overall work flow illustrating the inter-relationship of each activity in the Study is presented in Figure 1.1.

The main items studied in each stage of the work are summarized as below:

1) 1st Works in Malawi (Feb. 1998 – Mar. 1998)

To conduct the field survey and to analyze the following:

- collection and review of relevant information and survey datums
- natural conditions survey (topographic survey, geotechnical investigation and hydrological investigation)
- traffic survey
- initial environmental evaluation
- traffic demand forecast
- analysis of bridge plan alternatives
- discussion and confirmation of the undertaking of the Government of Malawi
- preliminary evaluation of socio-economics

- selection of bridge plans
- explanation of interim report

2) 1st Works in Japan (April, 1998 – June, 1998)

- determination of the bridge plan
- design works and the construction plan
- environmental impact assessment
- suggestion of the maintenance management plan
- cost estimates
- implementation plan
- evaluation of socio-economics
- evaluation and conclusion
- preparation of the draft final report

3) 2nd works in Malawi (June 1998)

- submission and presentation of the draft final report

4) 2nd Works in Japan (July 1998)

- preparation and submission of the final report

1.4 Progress of the Study and Outline of the Report

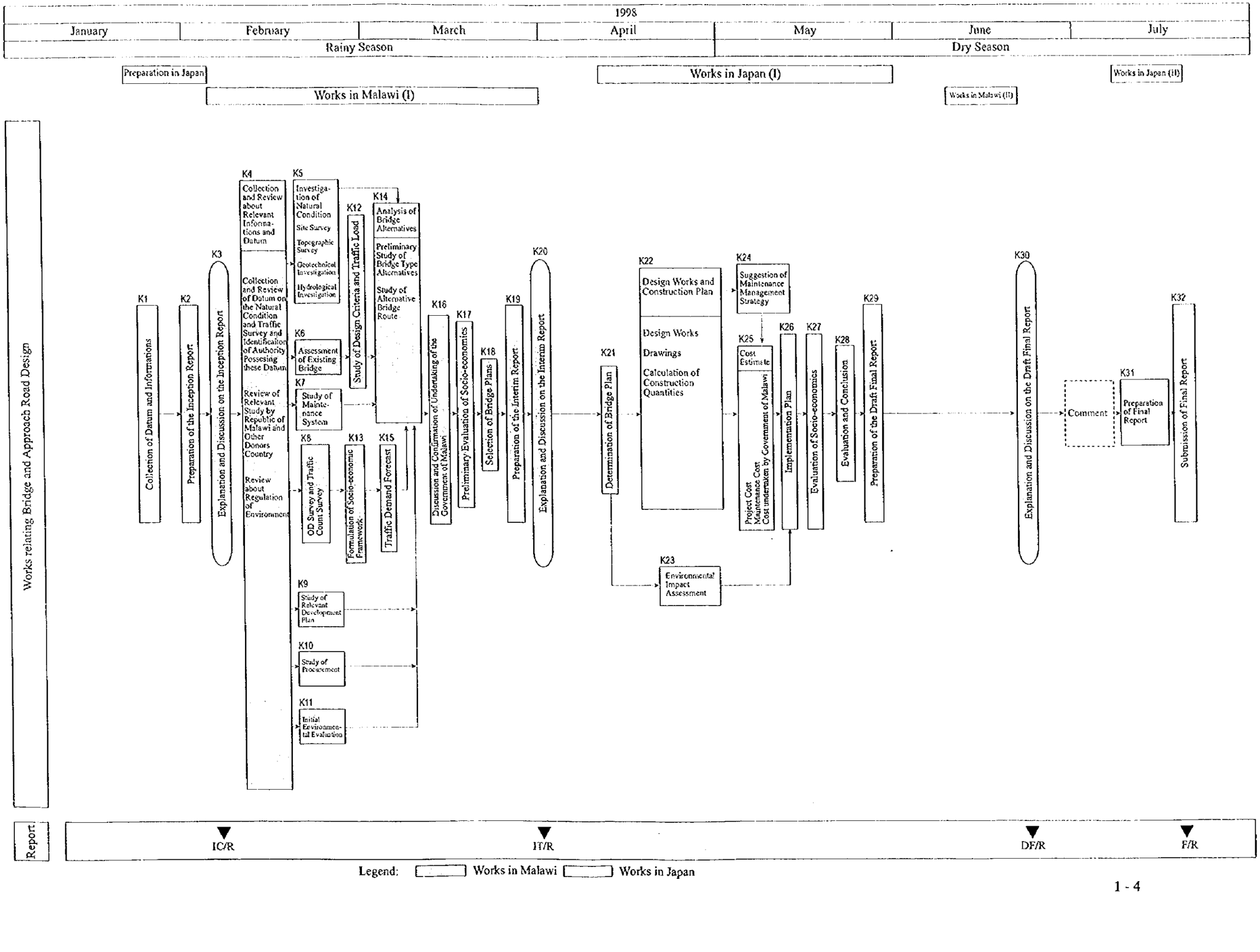
Inception Report

The Inception Report was submitted to the Government of Malawi prior to the Steering Committee Meeting held on 20th February 1998. The contents and schedules were explained by the Study Team in the presence of representatives of the JICA Malawi office. The Inception Report was composed of the following contents:

Chapter 1 The Study

1.1 Background of the Study
1.2 Objectives of the Study
1.3 Study Area
1.4 Work Schedule of the Study
1.5 Organization and Assignment of the Study Team
1.6 Reporting

Figure 1.1 Work Flow Diagram



Chapter 2 Methodology

Chapter 3 Undertaking of the Government of Malawi

Interim Report

The Interim Report was submitted to the Government of Malawi on the 1st May 1998, and was explained on the next day to the members of the Steering Committee in the presence of the Advisory Committee, coordinator of JICA headquarters and representatives of the JICA Malawi office. The Interim Report was composed of the following contents:

Chapter 1 Site Survey and Investigation

1.1 Topographic Surveys
1.2 Geotechnical Investigation
1.3 Hydrological Investigation

Chapter 2 Socio-economic and Traffic Studies

2.1 The Study Area
2.2 Implication of Future Development
2.3 Traffic Surveys and Future Traffic Demand
2.4 Preliminary Evaluation of the Proposed Bridge Reconstruction Project

Chapter 3 Preliminary Engineering

3.1 Condition of the Existing Mangochi Bridge
3.2 Design Standard and Criteria
3.3 Alternative Route
3.4 Preparatory Preliminary Design of the Bridge

Chapter 4 Environmental Impact Assessment

4.1 Description of Environment
4.2 Engineering Baseline and Proposed Project

Chapter 5 Construction Plan and Estimation

5.1 Draft Final Report

The Draft Final Report was prepared based on the results of the studies for each stage, and will be submitted for discussion with the Malawi Counterparts.

1.5 Organization of the Study Team

The Study was carried out by the Study Team under the guidance of the Advisory Committee, which was organized by JICA.

Ministry of Works and Supplies (hereinafter referred to as MOWS), of the Government of Malawi was the counterpart agency to the Study team.

The Government of Malawi established a Steering Committee consisting of the representatives of relevant organizations.

In carrying out the Study, the Study Team worked with the counterpart personnel assigned by the counterpart agency.

The organization chart is presented in Figure 1.2.

1.6 Major Meetings Held

During the study period, the following meetings were held in Malawi and the minutes of each meeting is attached in Appendix 1.

Meeting	Data	Main Subjects
First Steering Committee	February 10, 1998	Inception Report
Second Steering Committee	April 2, 1998	Interim Report
Third Steering Committee	July 1, 1998	Draft Final Report

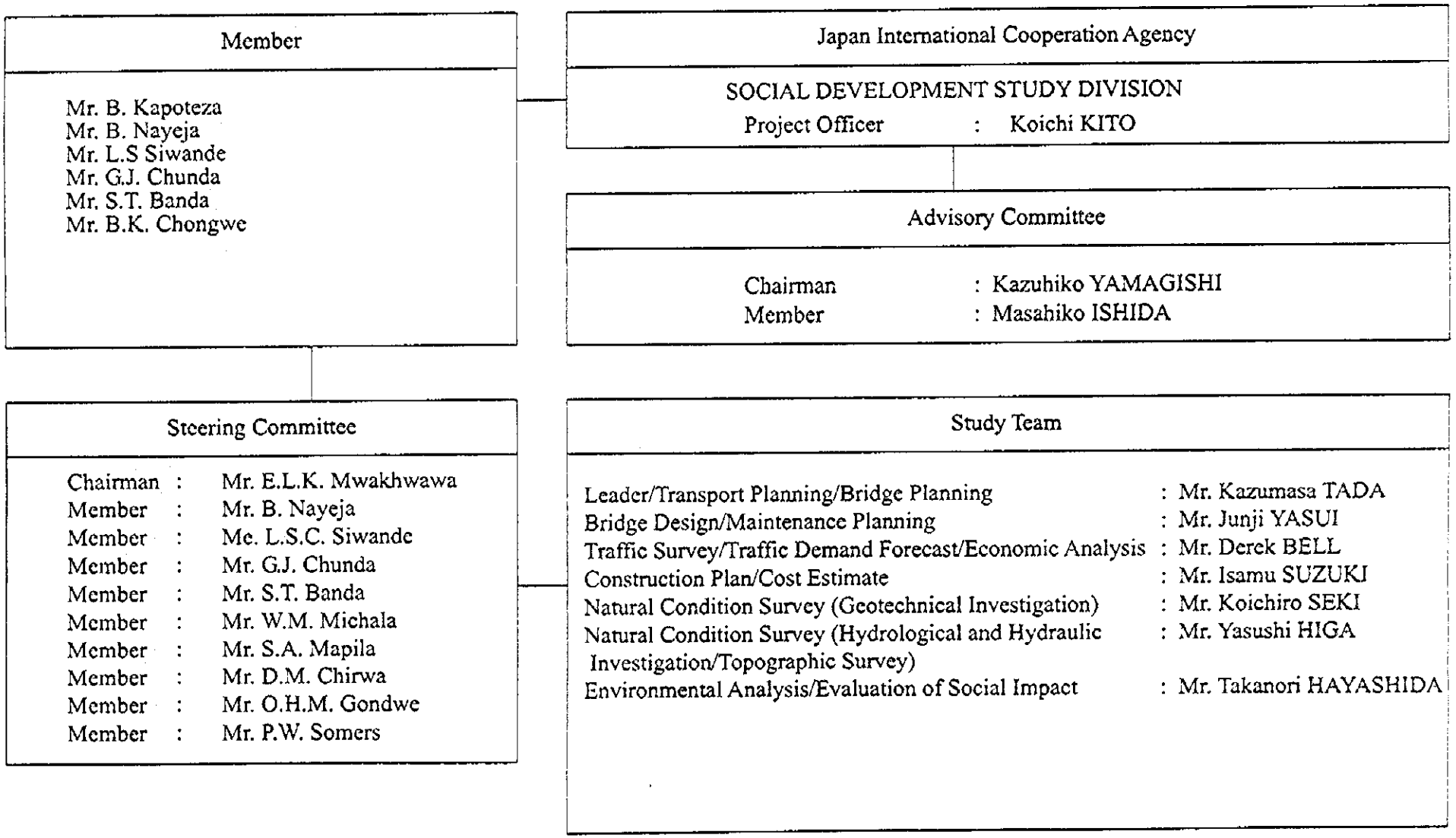


Figure 1.2 Organiztion Chart

CHAPTER 2 SITE SURVEY AND INVESTIGATION

The site surveys and investigations for the Feasibility Study on the Reconstruction of the Mangochi Road Bridge in the Republic of Malawi were conducted by the Study Team.

The surveys and investigations consisted of Topographic Surveys, Geological Investigations, and Hydrological Investigations which included Meteorological Surveys.

2.1 Topographic Surveys

2.1.1 General

The Topographic Survey for the Project was conducted to obtain the basic data and information for the design of the new bridge. The Survey was carried out in the vicinity of the existing Mangochi Bridge. The survey areas are shown in Figure 2.1.

The work was subcontracted to a local consultant, Surveys (Malawi) Ltd., under the supervision of the Study Team.

2.1.2 Scope of Work

The work comprised the following;

(1) Centre line Survey

A centre line survey was conducted along three proposed alignments crossing the Shire River such as Route-A (adjacent to the existing bridge), Route-B (250m upstream of the existing bridge) and Route-C (250m downstream of the existing bridge). These are shown in Figure 2.1.

The total length of the survey was about 1.5km (500 m × 3 lines). Survey stations were established at 20 metre intervals along the proposed routes.

(2) Cross section survey

A cross section survey was conducted on each of the three proposed centre lines with the width of the survey area being 25m on each side of the road centre line.

(3) Cross section of the Shire River

A cross-sections of the river survey were carried out at the designated proposed alignment areas of the river (refer to Figure 2.1).

Measurement of the river bed elevation at 10m intervals along the river were carried out using an echo sounder.

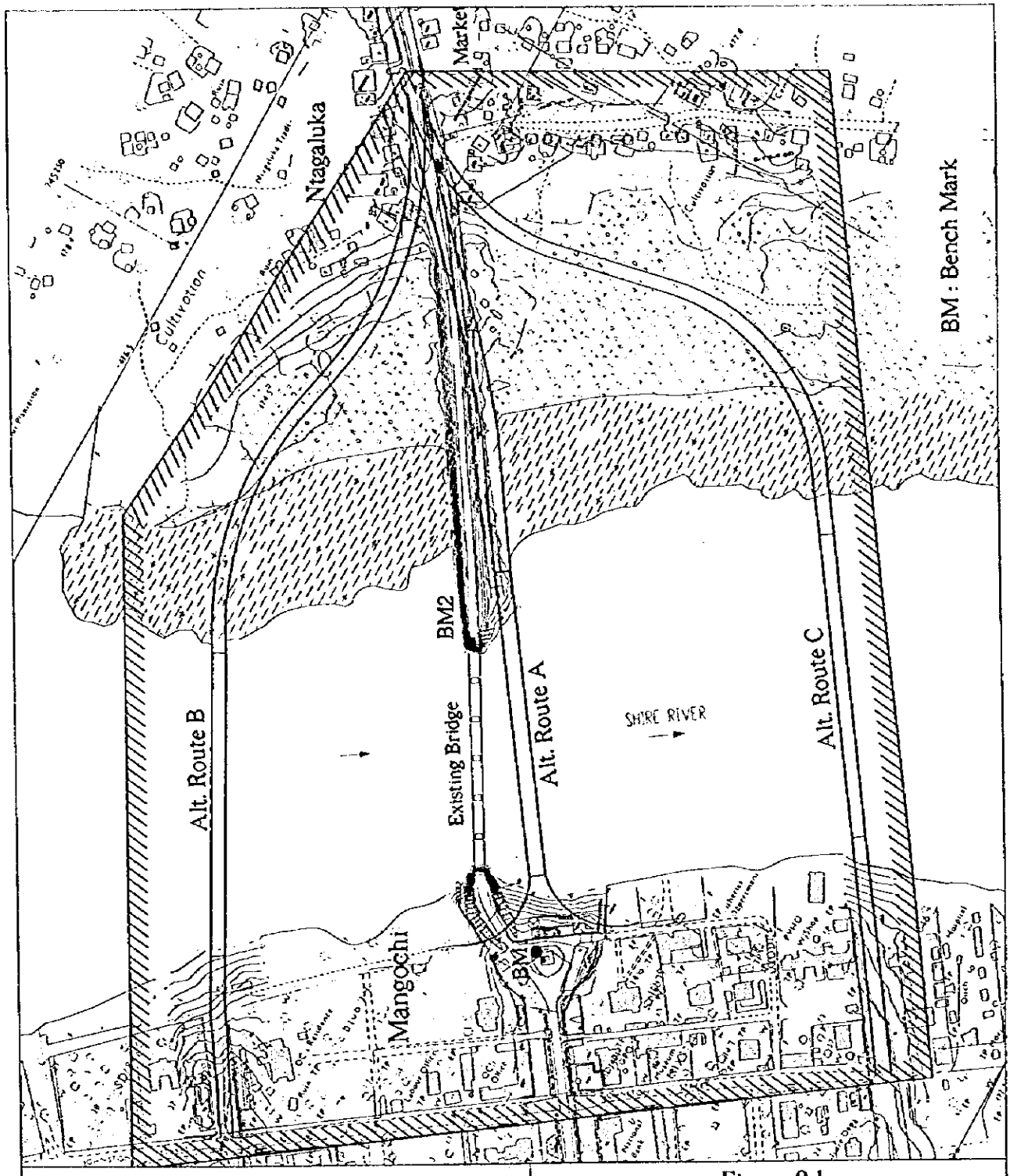
The elevation of the existing bridge structure was measured during the field survey.

The Bench-Marks made of concrete plinths were established on both sides of the existing Mangochi Bridge (refer to Figure 2.1). The coordinates of the Bench Marks are shown in Table 2.1.

Table 2.1 Coordinates of Bench Marks

Bench Mark	East	North	Elevation
BM1	744932.10	8398432.83	479.63
BM2	745100.07	8398585.43	478.79

The Topographic survey maps and DXF files were produced based on the results of this work (refer to Figure 2.1).



The Feasibilty Study on
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in the Republic of Malawi

Figure 2.1
Location Map of the Survey Area

2.2 Geotechnical Investigation

2.2.1 General

This survey was done to obtain the basic data for the preliminary design. The subsurface exploration including drilling, sampling and laboratory testing were conducted at the alternative proposed Route A. For the other two alternative routes (Route B and C) the boring data was collected from MOWS.

The work was subcontracted to a local consultant, and carried out under the supervision of the Study Team.

The proposed site was dominated by quaternary alluvial deposits, which were mainly composed of dense to very dense medium sandy clay. The North-East bank was marshy whereas the South-West bank has a gentle sloping beach. Within the confines of the bridge there were no traces of any cohesive soils or underlying rock.

2.2.2 Soil Investigation at the Bridge Site

(1) Field Work

The field work including boring, sampling and standard penetration tests were carried out at Route A. The work was conducted near the abutment and pier of the proposed bridges as shown in Figure 2.2 (BH 1, 2, 3).

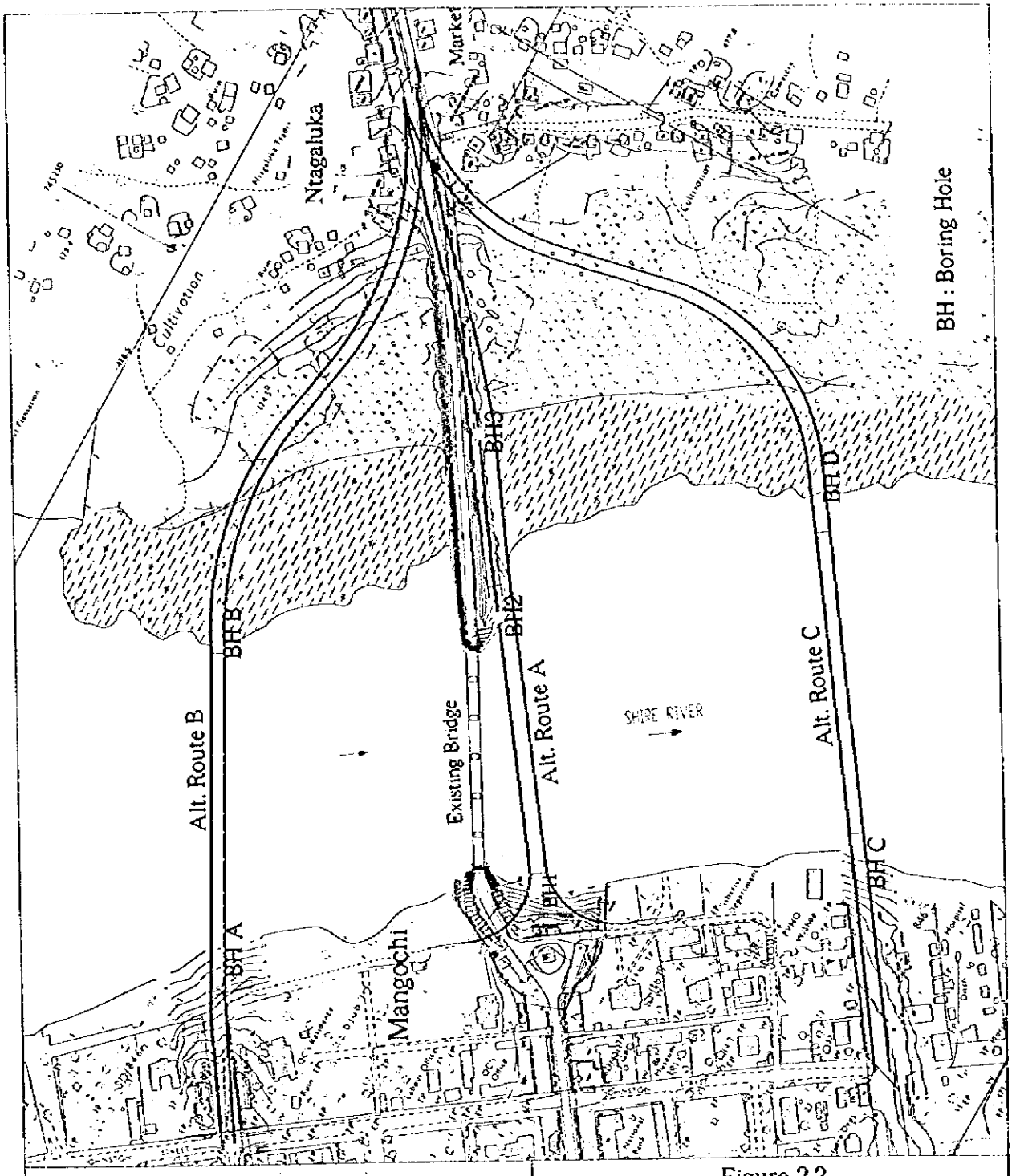
Standard penetration tests were conducted at an interval of 1m depth so as to estimate the bearing capacity of the stratum to be used for the determination of the bridge foundations.

The results of the standard penetration tests are shown in Figure 2.3

(2) Laboratory Tests

The following laboratory tests were carried out.

- Specific gravity
- Water content
- Grain size analysis
- Unconfined compression test
- Liquid limit



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the Reconstruction of Mangochi Road Bridge
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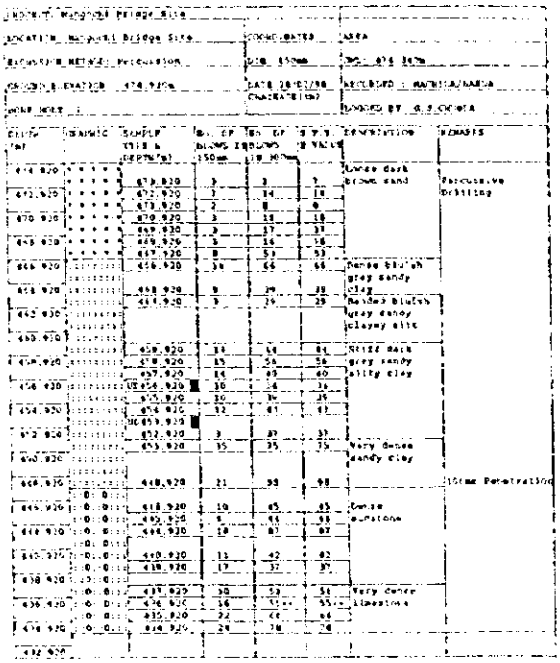
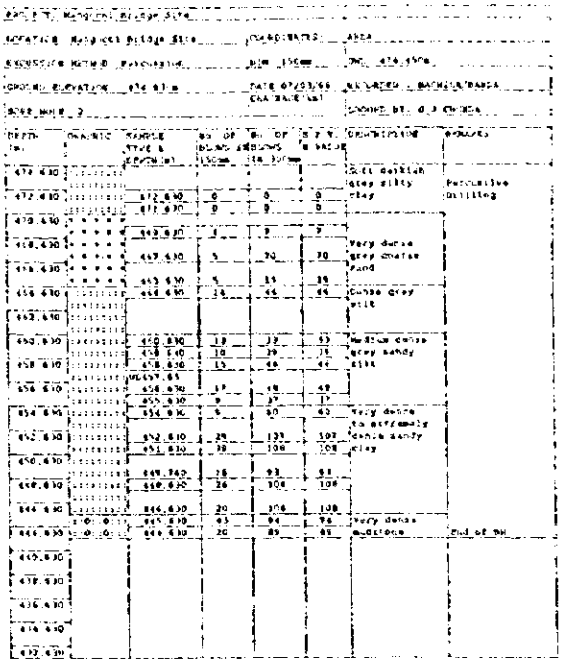
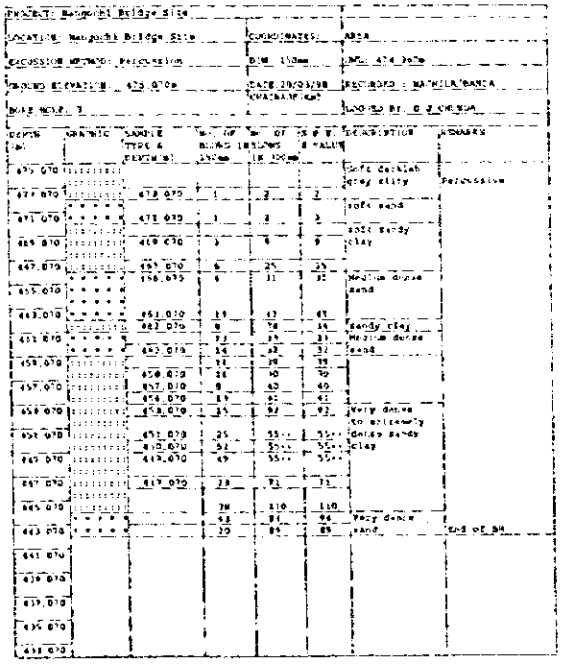
Figure 2.2
Location Map of the Boring Points



BH1



BH2



BH3

The Feasibility Study on the Reconstruction of Mangochi Road Bridge in Republic of Malawi	Figure 2.3 Result of Bore Hole 1-3

(3) General Characteristic of Soils

As observed from the three bore holes drilled at both banks of the Shire River, no rock was encountered. In all bore hole locations dense sandy silty clay or sandy clay was encountered at about 10 metres depth below the ground level. This soil type confined down to a depth of 30 metres with increasing SPT values. The behaviour of the soil strata would indicate the necessity for a deep foundation design. The existing silty clay was very stiff and hard to cut through with a clay cutter.

The Geological Profile is shown in Figure 2.4.

- BH1

  Drilling was carried out to about 38 metres below the ground level. Three different soil strata were encountered. The top 7 metres layer was composed of a loose darkish brown sand which was very dense at 7 metres depth with a Standard Penetration Test (SPT) value of 53. Just below this depth there was a thin band of very dense bluish grey sandy clay with SPT value of 66. Next was a 6 metres thick band of Bluish grey sandy clayey silt with an average SPT value of 34. Below this band there was another 7 metres of stiff darkish grey sandy silty clay with an average SPT value of 42. This band became very dense as the depth increased from 8 to 10 metres and changed into another band of dense mudstone which looked almost weathered. This layer was about 11 metres thick. The mean SPT value was again 42. The last band to be encountered was that of a very dense weathered limestone which was drilled into about 3 metres when the boring was stopped. Generally this bore hole had interchanging dense and very dense strata. The very dense bands gave a lot of resistance to both drilling and the taking SPT measurements.

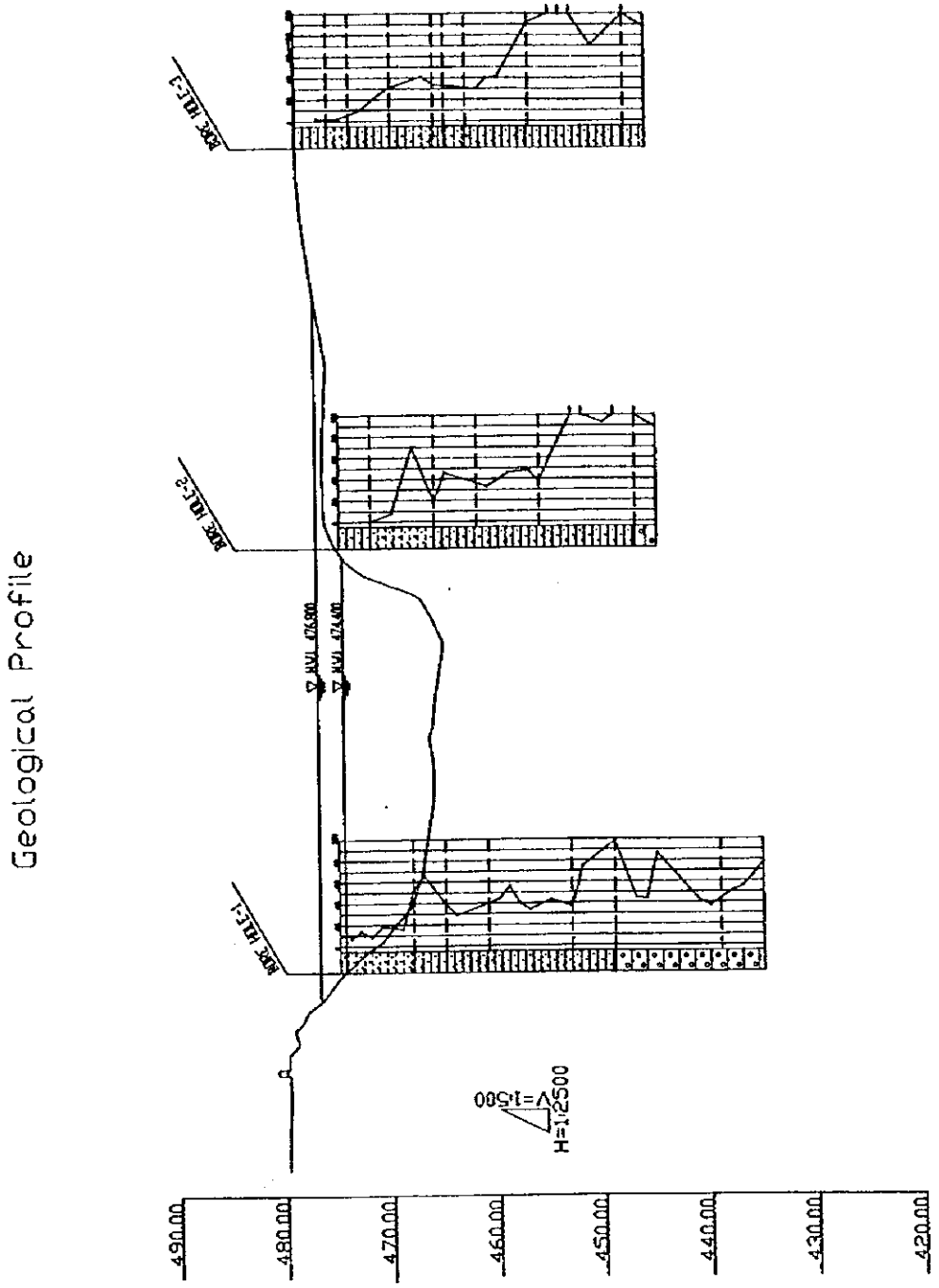
- BH2

  The drilling was carried out through different seams of four types of soil strata. The top three metres were composed of very soft darkish grey silty clay which had no resistance at all. Drilling then passed through very soft to very dense grey coarse sand and then went into medium dense sand. The very dense coarse sand had an SPT value of 70, and the medium sand had SPT value of 19. This combined sand band was

about 6 metres thick. The third band was composed of dense grey silt which was 10 metres thick with an average SPT value of 42. Next encountered was a very dense to extremely dense heavy sandy clay which was about 9 metres thick with an average SPT value of 97. The last layer consisted of a very dense mudstone with an average SPT value of 92. In the last stratum drilling was stopped at a thickness of 2 metres.

- BH3

The top 3.42 metres consisted of very soft darkish brown silty sandy clay. The SPT value at 1.69 metre depth was 2. There was a thin band of very loose brown medium coarse quartz sand which had a SPT value of 2. From 4.85 metres to 8.75 there was again a very soft layer of sandy clay with a SPT value of 9 at 5.45 metre which increased to 25 at 7.6 metres, abd increased to 31at 8.65 metres. At 8.2 metres a dense grey clayey sand was encountered. This layer went down to 11.2 metres. At 11.4 metres a SPT value of 41 was reached. Here dense grey clayey silt was encountered and SPT dropped down to 31 before going to 41 at 13.85 metres. At 13.40 metres another band of dense grey clayey silty sand was encountered. This band continued down to 14.87 metres where a hard grey silty sandy clay was met. This stratum was about 6.55 metres thickness. At 15.45 metres the SPT value was 39 but dropped down to 30 at 16.52 metres and picked up again at 17.45 metres and at 19.55 metres with SPT readings of 40 and 41 respectively. At 21.84 metres a very hard sandy clay was encountered with a SPT value of 92. A very dense whitish grey silty sand was encountered at 22 metres with SPT values well over 55 within 150mm penetration of the spoon sampler. This very dense sand layer went down to 30 metres below the ground level. This bore hole was different from the other two bore holes which had sandy silty clay at around 20 metres and below.



The Feasibility Study on the Reconstruction of Mangochi Road Bridge in Republic of Malawi	Figure 2.4 Geological Profile

2.3 Hydrological Investigation

2.3.1 General Features of Lake Malawi and the Shire River.

(1) General

The main objective of the hydrological investigation was to collect and study the hydrological conditions of Lake Malawi and the Shire River. The hydrological data and information was used for evaluating the maximum flood water level to prepare the bridge design.

(2) Review of Hydrological Data

The water level of Lake Malawi and the Shire River depends on the operation of the Liwonde barrage which was constructed in 1965. The Liwonde barrage is located approximately 80 km downstream from Lake Malawi. The water level of Lake Malawi during the wet season was found to be between 470 m and 472 m above sea level before completion of the barrage. The barrage has regulated the flow of the Shire River for 23 years. Therefore, the water level of Lake Malawi has been maintained at about 476 m in the wet season, with the highest lake level recorded at 477.23 m in 1979. The yearly fluctuations of Lake Malawi for 100 years is shown in Figure 2.5. One (1) meter difference in the water elevation of Lake Malawi requires about 4 years and involves on enormous amount of 28 billion cubic metres of storage.

The observation record at Lake Malawi shows that the yearly fluctuation in the water level between the dry and wet seasons is merely 1 m. The water level is therefore very stable. The seasonal fluctuation of Lake Malawi is shown in Figure 2.6.

Information obtained from the gauging station at the Liwonde barrage located about 60 km downstream from Mangochi indicates that the high water level is measured at 475.74m and that the river gradient between the barrage and Mangochi is 1/33,000 (refer to Figure 2.7).

Based on the high water level of Lake Malawi (477.23 m) and the Liwonde barrage (475.74 m) recorded at each gauge station, the Study Team has estimated the high water level at Mangochi to be 476.8 m by simple calculation (refer to Figure 2.7). The highest water level of the Shire River at Mangochi was recorded at 476.74m in 1980 (refer to Table 2.2).

The mean water level at Mangochi is 474.4m based on the water surface elevation of the current from Topographic Survey and the mean water level of Shire River recorded at above mentioned two gouge station.(refer to Table 2.2)

The peak flood discharge at Mangochi and Liwonde barrage was 1,050m^3/sec (refer to Table 2.2) and 979m^3/sec (refer to Table 2.3) respectively. The annual average discharge of the Shire River at Liwonde barrage is 395m3/sec (refer to Table 2.4).

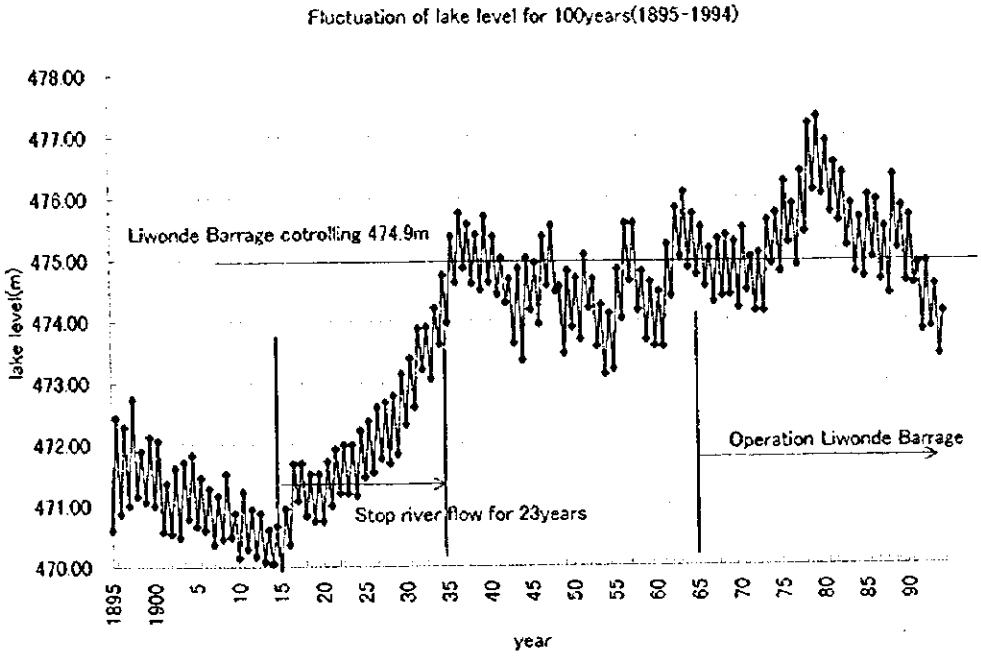


Figure 2.5 Yearly Fluctuation of Lake Malawi Water Level

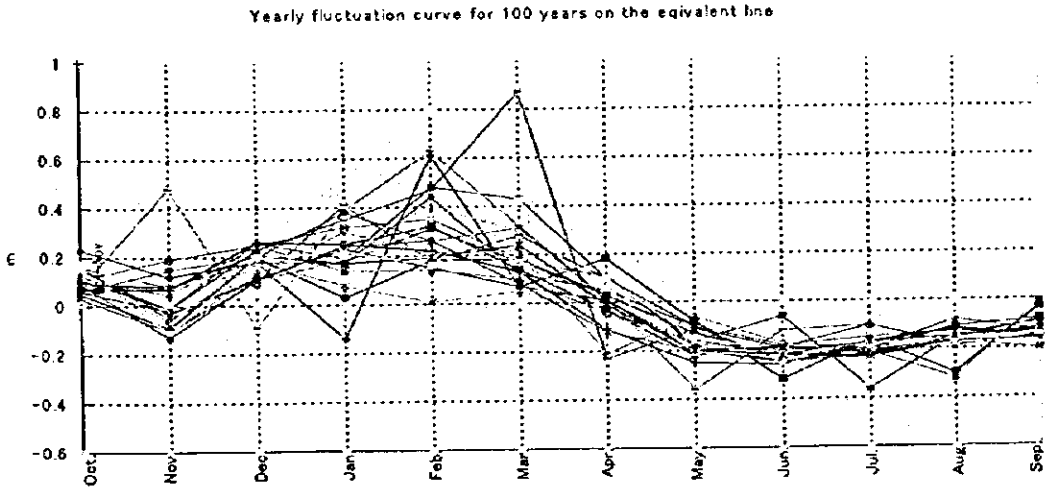


Figure 2.6 Seasonal Fluctuation of Lake Malawi Water Level

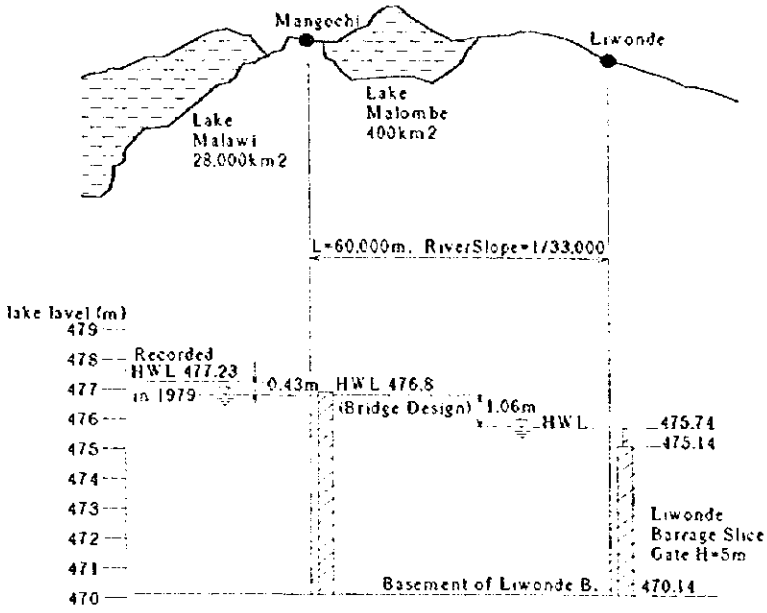


Figure 2.7 The Water Level of Lake Malawi and the Liwonde Barrage

Table 2.2 Gauging and Rating Data for the Shire River at Mangochi

water year	date	gauge hgt. max (m)	gauge hgt. min (m)	mean above sea level	flow
1947/48	1 June	7.849		475.499	-
1948/49	19 Feb	6.934		474.584	-
	26 Oct		5.969	473.619	-
1949/50	25 Apr	7.239		474.889	-
	8 Dec		5.766	473.416	-
1950/51	30 Apr	7.087		474.737	-
	28 Dec		6.172	473.822	-
1951/52	10 May	7.468		475.121	-
	30 Nov		5.944	473.597	-
1952/53	1 Jul	7.188		474.841	-
	19 Dec		6.514	474.167	-
1953/54	1 Jul	6.645		474.298	-
	24 Nov		5.791	473.444	-
1954/55	29 Apr	6.398		474.048	-
	3 Dec		5.377	473.027	-
1955/56	19 May	7.132		474.782	-
	5 Dec		5.456	473.106	-
1956/57	5 May	7.907		475.557	-
	17 Dec		6.111	473.761	-
1957/58	2 Jun	7.69		475.34	-

water year	date	gauge hgt. max (m)	gauge hgt. min (m)	mean above sea level	flow
	13 Dec		6.846	474.505	-
1958/59	8 Apr	7.081		474.74	-
	29 Oct		5.989	473.648	-
1959/60	25 Apr	6.928		474.587	-
	5 Jan		5.87	473.529	-
1960/61	17 May	6.767		474.426	-
	13 Dec		5.819	473.478	-
1961/62	27 Apr	7.495		475.154	-
	13 Nov		5.791	473.45	-
1962/63	15 May	8.147		475.806	-
	29 Nov		6.55	474.209	-
1963/64	30 Mar	8.419		476.078	-
	7 Nov		7.209	474.868	-
1964/65	25 Apr	8.025		475.684	-
	28 Dec		7.077	474.736	-
1965/66	16 Apr	7.897		475.556	-
	23 Oct		6.864	474.523	-
1966/67	2 May	7.495		475.154	-
	30 Oct		6.584	474.243	-
1967/68	2 May	7.647		475.306	-
	24 Nov		6.55	474.209	-
1968/69	6 May	7.775		475.434	-
	20 Nov		6.614	474.273	-
1969/70	13 Apr	7.583		475.242	-
	27 Oct		6.517	474.176	-
1970/71	27 Apr	7.858		475.517	-
	26 Nov		6.407	474.066	-
1971/72	3 May	7.382		475.041	-
	31 Oct		6.37	474.029	-
1972/73	3 May	7.434		475.093	-
	9 Nov		6.346	474.005	-
1973/74	25 May	7.967		475.617	-
	17 Dec		6.325	473.975	-
1974/75	9 May	8.083		475.743	-
	3 Dec		7.148	474.798	-
1975/76	6 May	8.487		476.147	773.029
	10 Jan		7.186	474.846	367.894
1976/77	5 May	8.172		475.832	654.002
	31 Oct		7.225	474.885	376.999
1977/78	23 May	8.57		476.23	806.903
	30 Nov		7.199	474.859	370.911
1978/79	5 May	9.062		476.709	1030.683
	1 Nov		6.783	474.443	283.083
1979/80	23 May	9.096		476.737	1047.878
	12 Nov		8.225	475.866	673.004
*1980/81	23 May	9.102		*476.743	*1050.902

* highest lake water level

water year	date	gauge hgt. max (m)	gauge hgt. min (m)	mean above sea level	flow
	29 Oct		8.115	475.756	634.014
1981/82	9 May	8.809		476.45	910.615
	31 Oct		7.833	475.474	541.722
1982/83	2 May	8.69		476.32	857.811
	18 Nov		7.7	475.36	501.845
1983/84	13 Apr	8.348		475.818	718.681
	19 Oct		7.15	474.78	359.636
1984/85	8 May	7.79		475.72	528.581
	20 Oct		6.71	474.12	269.434
1985/86	30 Apr	8		475.94	813.317
	9 Nov		6.65	474.59	396.774
1986/87	4 Apr	8.2		475.96	893.81
	16 Nov		6.97	474.91	477.194
1987/88	8 Apr	7.77		475.52	727.199
	26 Oct		6.72	474.48	413.483
1988/89	14 May	8.35		476.1	957.732
	16 Nov		6.59	474.347	382.834
1989/90	2 May	8.12		475.877	860.972
	27 Oct		7	474.75	485.275
1990/91	4 May	7.93		475.687	653.465
	26 Dec		6.81	474.567	389.64
1991/92	1 Apr	7.2		474.957	474.286
	1 Oct		6.26	474.017	283.613
1992/93	5 May	7.26		475.014	487.998
	27 Nov		<6	473.757	<239.007
1993/94	22 Apr	6.91		474.664	410.601
	23 Oct		5.69	473.444	190.522
1994/95	27 Apr	6.44		474.194	316.578
	13 Jan		5	472.754	101.333
1995/96	26 May	6.42		474.169	312.831
	2 Dec		5.2	472.954	124.486
1996/97	25 Apr	6.2		473.949	273.002

Notes : The station was opened in 1940. However, intensive gauge readings started on 1 June, 1948

: The water year in Malawi starts on November, 1 and ends October, 31 the following year

: There are many changes in Zero datum of the gauge of this station

: The station has operated as a water level station until 1976 when discharge measurements were commenced

: Rating equations

(i) 1976-1984 discharge =0.307 (gauge height-1) ^3.89

(ii) 02/11/84-1989 discharge =1.2 (gauge height-1) ^3.35

(iii) Nov.1989-Nov. 1997 discharge =36.14 (gauge height-3.27) ^1.881

Source : Ministry of Water Development

Table 2.3 Annual Flow of the Shire River at the Liwonde Barrage(m3/s)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave
Annual Flow	363	410	440	469	483	458	421	370	349	321	299	316	395

Source : National Water Resources Master Plan, UNDP, 1986

Table 2.4 Maximum Flow at the Liwonde barrage

ANNUAL MAXIMA FOR SHIRE AT LIWONDE	
YEAR	Q(m3 / s)
1949	356
1950	460
1951	541
1952	453
1953	398
1954	285
1955	314
1956	419
1957	377
1958	579
1959	369
1960	362
1961	369
1962	455
1963	562
1964	614
1965	559
1966	559
1967	466
1968	498
1969	486
1970	607
1971	480
1972	392
1973	221
1974	535
1975	683
1976	722
1977	671
1978	779
1979	952
1980	979
1981	954
1982	753
1983	734
1984	736
1985	686

YEAR	Q(m3 / s)
1986	777
1987	772
1988	666
1989	904
1990	829
1991	421
1992	194
1993	223
1994	194
1995	226
1996	170
1997	221

Source: Ministry of Water Development

(3) River condition at the bridge site

The Study Team carried out an investigation of the river bed and the flow condition including water depth at the existing bridge site.

The river bed investigation was conducted by using an echo sounder to make a contour line of the river bed elevation in order to ascertain the scouring condition at the existing piers. The result of the investigation seems to indicate that there is no scouring damage. Scour protection is provided at the existing piers.

The Topographic Survey in this study indicates that the river bed elevation at the existing bridge is from 2 to 4 meters lower than 200m up- and downstream from the existing bridge. This indicates that river bed degradation has occurred around the existing bridge due to the blockage of the river by the embankment at the Ntagaluka side and is also due to the existing piers. The river bed elevations are shown in Figure 2.8.

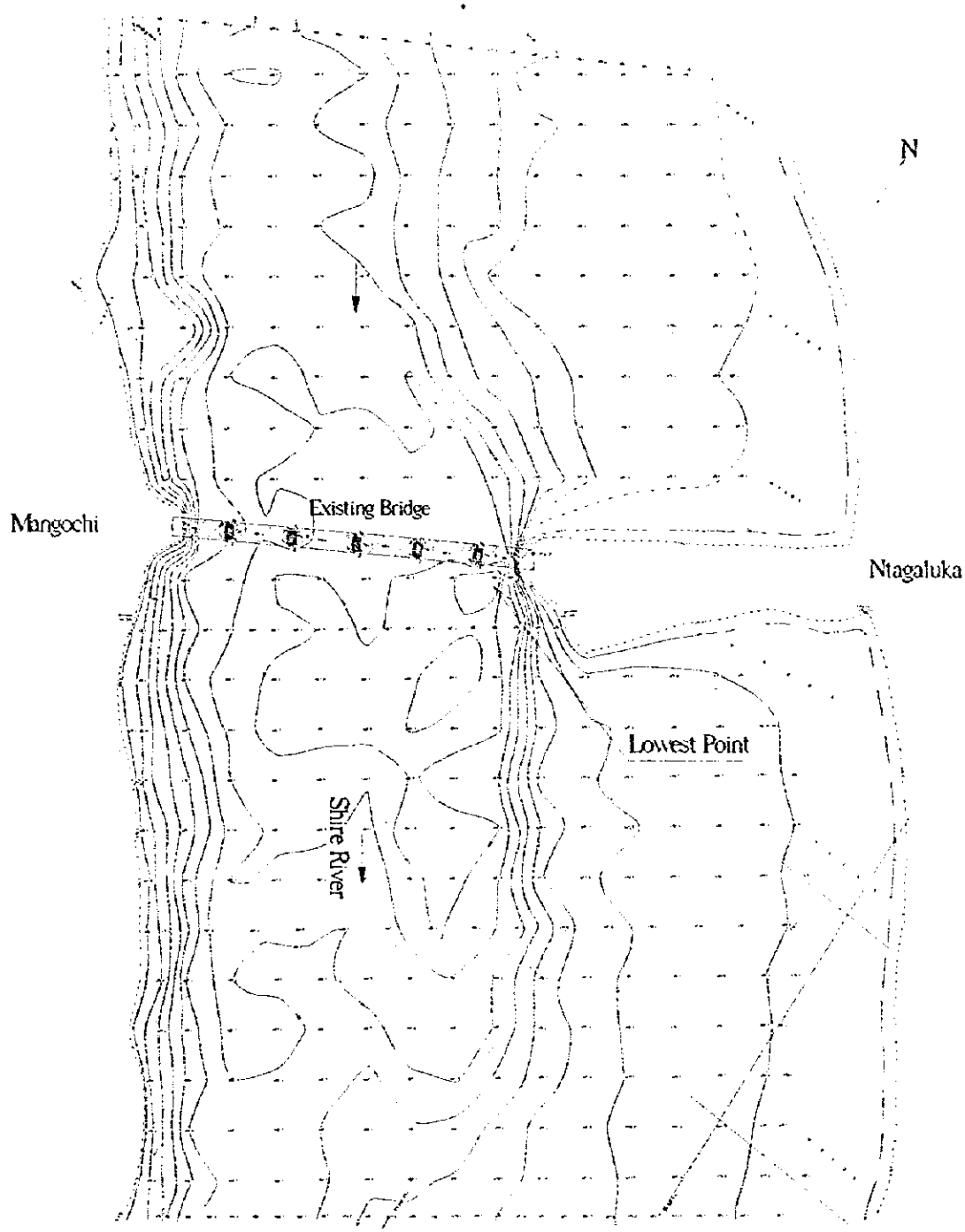


Figure 2.8 River Bed Elevation

The mean flow velocity of the river current at 30m both upstream and downstream from the existing bridge is approximately 0.2m/sec. The maximum flow velocity at mid-span of the existing bridge is about 0.6m/sec(refer to Figure 2.9).

The water depth was in the range between 6 to 10 meters. The water depth at the shallow river area at the Ntagaluka side is 1 to 2 meters.

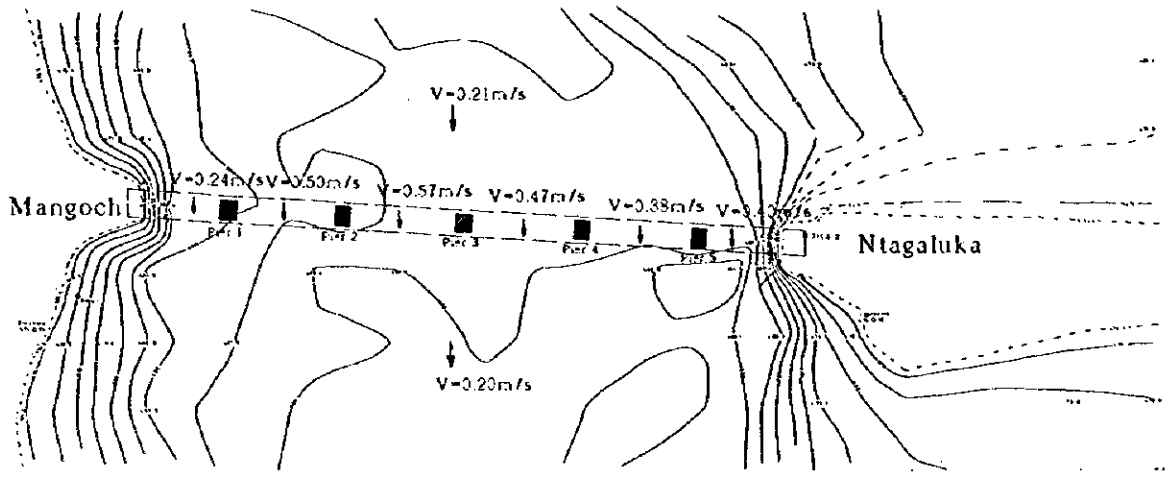


Figure 2.9 Flow Velocity

The recommended hydrological data for the bridge design are shown in Table 2.5.

Table 2.5 Recommended Hydrological Data for the Bridge Design

Items	Unit	
High Water Level	m	476.8
Peak Flood Discharge	m3/sec	1,100
River Gradient		1/33,000

2.3.2 Climate

This section describes the climatic conditions at the Project area. The summary of meteorological data measured at the Mangochi Meteorological Station located at the airstrip just south of the town centre is shown below;

(a) Mean temperature (average over last 25 years): 24℃(Celsius)

Max. monthly mean:	30～34℃ in September ~ December
Max. monthly mean:	14～17℃ in May ~ August

(b) Mean relative humidity (average over last 25 years): 66%

Max. relative humidity:	90～93% in January ~ March, mornings
Max. relative humidity:	32～38% in August ~ October, afternoons

(c) Mean rainfall (average over last 25 years): 824mm/year

1 ~ 5 mm in May ~ September
10 ~ 15 mm in October
40 ~ 60 mm in April and November
150 ~ 220 mm in December ~ March

(d) Wind: wind directions, influenced by the course of the Shire River, are from South and North. The strongest winds occur in mid-year.

January	:	prevailing winds from S, N up to 8 knots
July	:	prevailing winds from S, SE, SW up to 12 knots
October	:	prevailing winds from S, N up to 10 knots

CHAPTER 3 SOCIOECONOMIC AND TRAFFIC STUDIES

3.1 The Study Area

3.1.1 Transport System

(1) Introduction

Since Malawi's economy is heavily dependent on foreign trade, the availability of dependable external transport links at reasonable cost is crucial. Although Malawi is a compact and densely populated country, there are significant imbalances in the levels of economic activity and income within the country. Transport infrastructure plays an important role in the reduction of these imbalances.

It is generally accepted that coordinated development of various sectors of the economy depends crucially on the availability of efficient transport and an integrated network of different modes of transport is vital. This requirement entails expansion of the road system, particularly to rural, urban, and market service centers; modernization of railways; increased air transport coverage; and greater use of inland waterways for transport.

For a landlocked country such as Malawi, the ability to move exports and imports efficiently and economically is key to maintaining consumption levels and to economic growth. Costly and unreliable transit depresses trade. For Malawi, it makes exports less competitive and imports erratic and prohibitively expensive—a serious problem for essentials such as fuel, chemicals, and spare parts.

Malawi depends on its road and rail systems and those of neighboring countries for the transport of exports and imports to seaports. The international routes are by road and/or rail from Blantyre through Mozambique to the port of Nacala, by road and/or rail to the ports of Beira and Durban, and by rail, lake, and/or road to the port of Dar-es-Salaam (Figure 3.1). It is important to note that there is no direct shipping from the Nacala and Beira ports; rather, feeder vessels are required to transfer to Durban. Further, Durban shipping rates are cheaper than Dar-es-Salaam to major markets of Europe.

Figure 3.1
Land Transport Network of the Southern African Development Community (SADC)

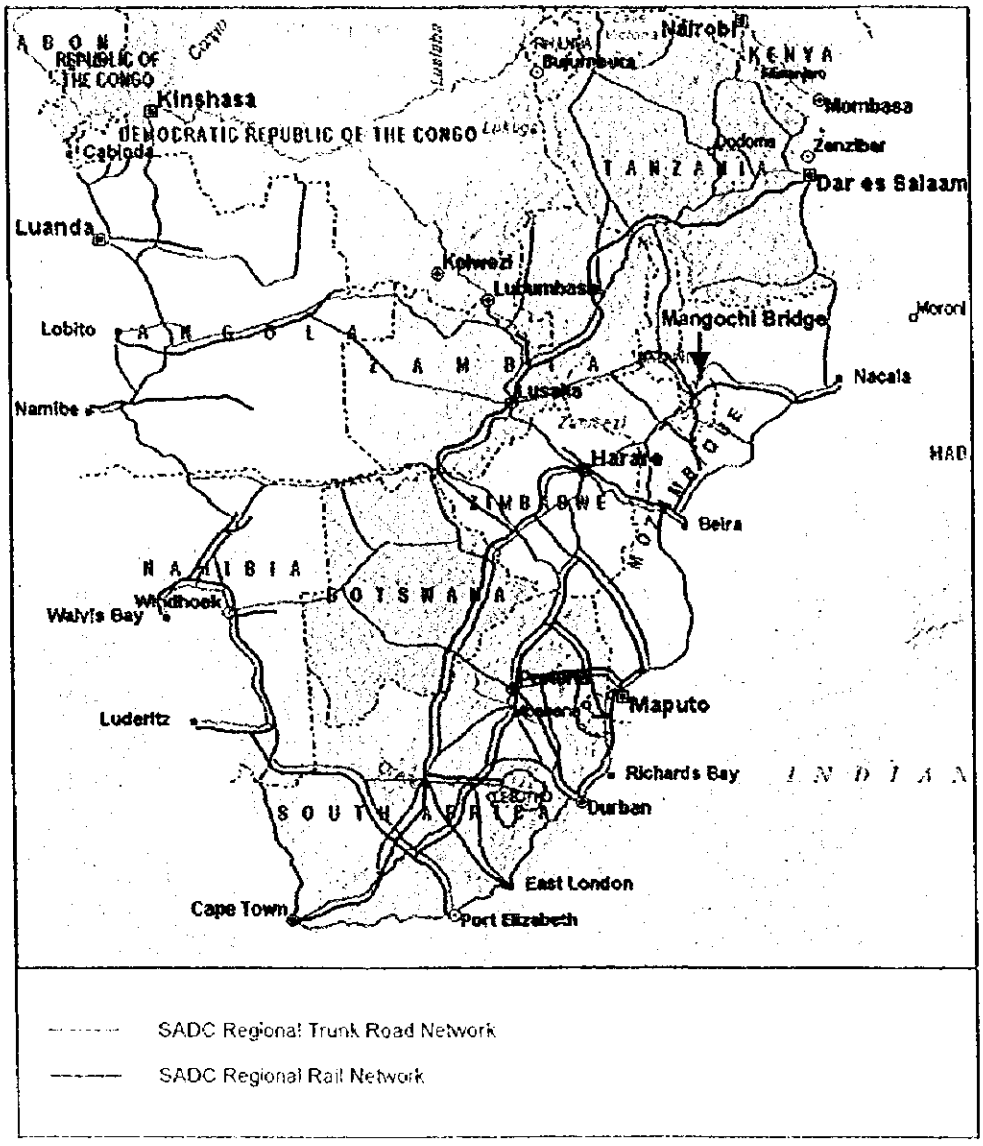


Figure 3.1

Land Transport Network of the Southern African Development Community (SADC)

(2) Transport Infrastructure

a) Roads

i) Road Network in Malawi and Mangochi District

By African standards, Malawi's inter-city road network is well developed and well maintained, while the rural road system is inadequate. In Malawi roads are classified into main, secondary, district, and other roads, the first three categories making up 68% of the total road network. The main and secondary roads constitute the country's primary road network, whereas the district and other roads act as a feeder system to the primary network (Table 3.1).

Table 3.1 Growth of the Road Network in Malawi, 1964-1995 (Km)

Road Type	Year						
	1964	1970	1975	1980	1985	1990	1995
Bitumen							
Main	431	438	1,120	1,671	1,776	2,123	2,564
Secondary	-	10	121	233	285	285	285
SUBTOTAL	431	448	1,241	1,904	2,061	2,408	2,849
Earth/Gravel							
Main	2,441	2,506	1,911	1,074	895	1,093	1,956
Secondary	2,113	2,259	2,324	2,504	2,495	2,161	2,483
District	4,928	5,279	5,023	5,060	5,356	5,465	6,789
Other	211	211	201	220	244	244	517
SUBTOTAL	9,693	10,255	9,459	8,858	8,990	8,963	11,745
TOTAL	10,124	10,703	10,700	10,762	11,051	11,371	14,594

Source: Ministry of Works and Supplies.

As part of the Rural Motorized Transport Survey conducted by the Ministry of Economic Planning and Development, some 631 km of roads were surveyed in Mangochi District (Table 3.2), of which 506 km or 80% were considered passable by motorized vehicle. Of these passable roads, only sections of Routes M3 and M10 are being serviced by pickups, minibuses, and standard buses. Route M3, which contains the Mangochi Bridge and is passable in all seasons, is probably the route served by the largest number and variety of vehicles. A detailed description of the existing conditions of Route M3 from Mangochi to Chiponde and Route S131 from Chiponde to Naminga follows.

Table 3.2 Road Situation in Mangochi District

Route No./Section	Length (km)	Surface Type	No. of Bridges	No. of Culverts	Drifts	New Structures
M3/Mpalo-Chiponde	91.2	Bitumen/Gravel	13	NA	NA	0
M10/MH-Kapiri	96.7	Bitumen/Gravel	4	NA	NA	0
S129/Chigo-Makanjila	98.9	Earth	60	2	4	4
S131/Chiponde-Nyenyesi	36.8	Gravel	7	0	0	0
T377/Makanjila-Ft Maguire	31.7	Earth	6	0	0	0
T379/Nankhwali-Malembo	23	Earth	(all drifts washed away)			
T381/Chipungu-Kapiri	62	Earth	5	1	5	0
T382/Nankumba-Ntcheu	19	Earth	3	0	0	2
T385/MH-Chiripa	64.4	Earth	4	2	0	0
T386/Idrusi-Kwisimba	41	Earth	4	0	0	1
T387/Namwera-Ituchi	45	Gravel/Earth	6	0	0	1
T388/Mbalula-Masanja	NA	Earth	(all 15 bridges washed away)			
T389/Masuku-Nkwepele	22	Earth	2	0	0	0
Total	631.7		114	5	9	8

Source: *Rural Motorized Transport Survey Report Covering District of Mangochi*, Ministry of Economic Planning and Development, Monitoring and Evaluation of Transport Projects, 1997.

ii) Existing Conditions of Route M3: Mangochi to Chiponde (51.7 km)

Route M3 actually starts near Blantyre and runs through Zomba, Liwonde, and Mangochi to Chiponde at the border with Mozambique. Traveling eastward from Mangochi, Route M3 intersects with Route M10 which continues north toward Monkey Bay. After Mangochi, Route M3 traverses the Shire River by the existing Mangochi Bridge, an old Bailey bridge with a length of 160 m and a carriageway width of 3.5 m. The existing bridge consists of six spans with a steel and wooden deck and, as demonstrated in this report, needs to be replaced. From the bridge onward, the road continues toward M'Baluku with a surfaced carriageway of 6 m with 1-m unsurfaced shoulders. The alignment of this section of the road is acceptable, but the surface is damaged with extensive potholes, which force vehicles to leave the carriageway and travel inside ditches that are eroded.

After traveling 1 km from M'Baluku the road starts to climb an escarpment for a distance of about 5.5 km. This stretch of road, which is about 4 m wide, was constructed some 100 years ago by Greek tobacco farmers. Therefore, the road was placed at the steep side of the mountain with steep cut slopes at the right hand side and

the natural terrain sloping very steeply to the bottom of the mountain at the left hand side. Due to the difficult topography, the horizontal alignment of the road is poor with very sharp and short bends, not allowing for speeds higher than 30 kph. In addition the vertical alignment is very steep. In general, this section is probably not able to accommodate significant volumes of international traffic in its present condition.

After Km 6.5 the topography becomes more gentle and the alignment is fairly acceptable. At Km 7.3 the 6-m carriageway is surfaced up to Km 12.0 with 1-m unsurfaced shoulders. In general, the rideability is fair except for some stretches where the road surface has completely disappeared or is full of potholes.

From this point onward, the road continues to Namwera, which contains a village market and health center. Namwera is also well known for tobacco plantation. The side ditches in this stretch are eroded due to their steep slopes and require protection. From Namwera, the road continues to Chiponde, at which there is a border post leading to the village of Mandimba in Niassa Province of Mozambique.

iii) Existing Conditions of Route S131: Chiponde to Liwonde (116.1km)

This road section extends from Chiponde toward the south where it joins with the already paved section of the same road (i.e., Route S131) at Naminga and then runs to Liwonde. After Chiponde and at a distance of about 4 km, the road crosses Mandimba River by a bridge with a length of 41 m. This bridge is constructed of steel beams and a concrete deck, and it is reportedly subject to flooding during the rainy season.

Thereafter the road passes through Masuku village, Masuku trading center, Mkumba trading center and health unit, Nselema trading center, Ntaja trading center, Nsanama or Malasi shopping center, and Naminga tobacco estate, and ends at Liwonde.

The topography changes from hilly to fairly flat terrain toward the end of the road. In general, the alignment of the road is acceptable except in some locations where several reverse curves in succession

should be realigned and replaced with a more direct alignment. The rideability is fair due to the corrugation in the surface of the gravel layer. In some areas, the lack of side drains or poor maintenance of such drains results in water flowing on the surface of the road, which has led to longitudinal erosion of the surface. The cross sectional width of the road varies from a total width of 5-6 m up to Mkumba village where it widens to 7-9 m to the end of the section.

The 25.5-km section of S131 from Naminga to Liwonde was paved in 1982-83. Major problems with this section have been noted regarding the bridge and drainage structures along the road. In fact, many of the bridge structures are at various stages of cracking and are considered unstable.

b) Railways

The present route length of rail in Malawi is 763 km with a gauge of 1,067 mm. A single-track line runs from Mchinji near the Zambian border through Lilongwe and Blantyre to the southern border with Mozambique. This line connects with the Mozambican port of Beira. A line from Nkaya to Nayuchi on the eastern border with Mozambique connects with the port of Nacala.

When civil war broke out in Mozambique in the 1980s both rail routes to the ports of Nacala and Beira were closed. The railway line from the Malawian border to Beira was destroyed by banditry actions, while the Nacala line was spared any serious damage. This situation was devastating for Malawi. Exports and imports were moved by road via Zambia and Zimbabwe to the South African port of Durban. Due to high transport costs, Malawi exports became uncompetitive in the world market, and the prices of all goods increased dramatically. The Government, therefore, began looking for an alternative route to the sea via the Tanzanian port of Dar-es-Salaam. These studies led to the so-called Northern Transport Corridor (NTC) Project.

The NTC Project comprised of moving goods from Blantyre by rail to Chipoka on Lake Malawi, and from Chipoka the goods would be moved by lake to the northern lake port of Chilumba in Karonga District. From there, a shuttle service would carry the goods by road to the Tanzanian town of Mbeya, from where the goods would be moved on the Chinese-

built Tazara Railways to the port of Dar-es-Salaam. Alternatively, the goods could be taken all the way from Blantyre to Dar-es-Salaam by road, which would save the numerous multi-modal transfers (and the associated transshipment costs) and was still shorter than carrying the goods by road from Blantyre to the port of Durban.

The NTC was a massive US$140 million project that required multi-donor funding and agreements with the Tanzanian Government. With the support of many donors (i.e., IDA, EDF, KfW, ODA, USAID, Netherlands, and GOM), the project was implemented consisting of eight major components: (i) 308 km of road reconstruction and rehabilitation; (ii) construction of transshipment facilities in Tanzania for handling containerized traffic and break-bulk cargo, construction of cargo facilities in Dar-es-Salaam and Mbeya as storage points for goods to/from Malawi, and infrastructure improvements at a new site in Dar-es-Salaam for resettlement of people; (iii) construction of transshipment facilities in Tanzania for fuel handling; (iv) procurement of fuel-hauling vehicles; (v) improvements of port facilities on Lake Malawi and acquisition of equipment for Lake Services; (vi) construction of a border post and weigh bridge in Songwe at the Karonga-Ibanda border crossing between Malawi and Tanzania; (vii) consultancy services, technical assistance, detailed engineering and design, and project supervision; and (viii) training of Malawi transport sector personnel.

The Northern Transport Corridor is now fully operational and is managed by Malawi Cargo Center Ltd., a privately owned company. This route carried 15% of Malawi's trade in 1996 but its importance is expected to diminish as the ports of Nacala and Beira return to regular service due to peace in Mozambique. In fact, the share of Malawian tobacco exports shipped through Dar-es-Salaam has already fallen from a high of 32% in 1992 to zero today. However, because fuel storage and distribution facilities are now in place along the Northern Corridor, Dar-es-Salaam will probably continue to serve as a route for imported fuel to Malawi.

As pointed out recently by USAID, proper risk analysis of the NTC project during the initial feasibility study might have suggested that the complexity of the multi-modal system, possible implementation delays, an earlier than expected reopening of the Mozambican trade routes, the possibility of falling Lake Malawi water levels, and the redundancy of the

water route could have combined to some degree to make many of the investments, especially those concerning lake cargo, doubtful starters.

At present, Malawian freight headed for the port of Beira is first hauled by road through Malawi's Mwanza border post, along the Tete corridor, and either continues by road or is loaded onto Mozambican Railways near Chimoio for the 150-km journey to Beira. The rail line from Malawi to the port of Nacala is operational and is expected to receive additional traffic as the Beira port becomes more congested.

A major restructuring of Malawi Railways was carried out in 1995 under the auspices of the World Bank, and in 1996 the Government invited consultants to provide advice on strategies for possible privatization. During 1997, a consulting firm was undertaking a study of the feasibility for privatization. This process is still ongoing.

The current locomotive fleet comprises 13 main-line diesel-electrics (all now refurbished under a USAID program), 1 diesel-hydraulic unit for light traffic, and 4 diesel-hydraulic shunters. The 5 diesel hydraulics were supplied in 1993 by Cockerill Mechanical Industries of Belgium. The rolling stock fleet consists of 400 freight wagons, 47 engineering service wagons, 29 passenger coaches and 1 special coach, and 10 diesel railcars.

c) Lake

Malawi is dominated by its enormous lake, Lake Malawi. This stretch of water measures 570 km in length by 16-80 km in width. In size, Lake Malawi is the world's 12th and Africa's 3rd largest lake. Its waters lie some 450 m above sea level and occupy the greater proportion of the deep Rift Valley that cuts through Malawi from north to south.

From 1935 to 1994, Malawi Railway Ltd. operated a lake service on Lake Malawi. However, the railway was restructured in 1995, and passenger and freight services on Lake Malawi are now run by a separate company, Malawi Lake Services Ltd. This new company is responsible for running the former Malawi Railway vessels on Lake Malawi, and also for running the maintenance dock at Monkey Bay. The ports, which were previously ran as part of the Lake Service, became a company wholly owned by the Government called Malawi Port Services Ltd., under the

Marine Department of the Ministry of Transport and Civil Aviation. The lake transport services connect with the rail system at Chipoka at the south end of the water.

Improved freight transport performance in 1996 was partly attributable to the resumed services of M.V. Ufulu. This lake vessel was not operational in 1994 and 1995 due to low water levels on Lake Malawi which led to docking problems at the ports of Chilumba and Chipoka.

International services operate between Malawi and Tanzania. The M.V. Ilala calls on Tanzanian ports while Tanzanian ships call on some Malawian ports.

(d) Air

The Department of Civil Aviation in the Ministry of Transport and Civil Aviation is responsible for air travel regulations in Malawi, and also runs the airports in the country. Only five airports, Lilongwe International, Chileka (Blantyre), Mzuzu, Karonga, and Kasungu Airports, can be used all year round. The remaining airports, including Mangochi Airport, are only open during the dry season.

(3) Transport Pattern

a) Modal Share

As shown in Table 3.3, road and rail transport comprise the majority of domestic freight traffic in Malawi. Both modes have suffered sharp declines in terms of total tonnage hauled since the early 1990s; however, road transport has been increasing rapidly since its low point in 1994. Unfortunately, freight traffic by road was not captured in 1997.

Table 3.3 Domestic Freight Traffic Distribution by Transport Mode, 1991-1997

(Thousand Tons)

Mode	Year						
	1991	1992	1993	1994	1995	1996	1997
Road	379	267	424	83	137	174	-
Rail	264	237	303	368	226	132	152
Lake	19	17	13	4	6	13	10
Air	1	1	3	2	2	2	1
Total	663	522	743	457	371	321	-

Note: Freight traffic by road was not captured in 1997.
Source: Ministry of Economic Planning and Development.

With respect to passenger traffic, road transport by bus has consistently dominated all other modes with a mode share greater than 96% since 1991 (Table 3.4). Passenger transport by rail has fallen quite dramatically due to poor service and eliminated routes. Both lake and domestic air transport have remained relatively constant.

Table 3.4 Passenger Traffic Distribution by Transport Mode, 1991-1997

(Thousand Passengers)

Mode	Year						
	1991	1992	1993	1994	1995	1996	1997
Road*	52,307	50,734	52,757	53,314	50,012	43,146	34,146
Rail	1,469	901	734	444	431	339	391
Lake	169	199	115	162	169	191	133
Air (Domestic)	62	71	59	74	65	64	57
Total	54,007	51,905	53,665	53,994	50,677	43,740	34,727

Note: * Stagecoach (bus only) total.

Source: Ministry of Economic Planning and Development.

(b) Transport Pattern

Prior to the disruption of international traffic through Mozambique due to that country's civil war, the Nacala and Beira ports handled over 90% of Malawi's international traffic. Today, the situation is quite different with the Mwanza Border Post handling over 70% of Malawi's total international traffic followed by the Nacala, Kaporo, and Mchinji Border Posts, each with 9-10% shares (Table 3.5).

While the Nacala Border Post refers to rail traffic from Malawi to the Mozambican port of Nacala, the Mwanza, Kaporo, and Mchinji Border Posts are for road traffic. The Mwanza Border Post leads to western Mozambique (and Beira port), Zimbabwe, Botswana, and South Africa (and Durban port). The Kaporo Border Post leads to Tanzania, and the Mchinji Border Post to Zambia. The remaining border posts in Malawi, such as Chiponde, Muloza, and Marka (all of which connect Malawi to Mozambique), presently represent a very small proportion of total international traffic. Further, only the four-listed border posts in Table 3.5 have weighing stations.

Table 3.5 External Trade Traffic Movement by Border Post (Thousand Tons)

Border Post	Exports		Imports		Total	
	1995	1996	1995	1996	1995	1996
Mwanza	224.21	201.79	642.57	661.85	866.78	863.64
Kaporo	130.95	72.02	29.30	38.09	160.25	110.11
Nacala	35.17	32.00	77.47	88.00	112.64	120.00
Mchinji	89.98	53.99	52.34	53.39	142.32	107.37
Total	480.31	359.80	801.68	841.33	1,281.99	1,201.12

Source: Ministry of Economic Planning and Development.

Growth in rail transport between Malawi and the Mozambican port of Nacala is shown in Table 3.6. As shown, rail transport export volumes through Nacala peaked in 1995 and have declined slightly since. Import volumes peaked in 1996 and decreased by 2% the following year. In year 1995, the import volume of 77,470 tons represented 87% of the total tonnage of international goods that embarked at Nacala Port; the export volume of 35,170 tons represented 14% of the total tonnage of international goods that disembarked from Nacala Port.

Table 3.6 Import and Export Volumes through Nacala by Rail, 1990-1997

(Thousand Tons)

Year	Exports	Imports	Total
1990	9.47	21.65	31.12
1991	14.08	26.34	40.42
1992	13.59	56.01	69.60
1993	16.93	81.30	98.23
1994	31.06	71.83	102.89
1995	35.17	77.47	112.64
1996	32.00	88.00	120.00
1997	31.00	86.00	117.00

Source: Ministry of Transport and Civil Aviation.

Detailed truck movements at the Mwanza Border Post for 1997 and 1998 are shown in Table 3.7. The sharp drop in truck traffic since January 1997 can be attributed to the recent devaluation of the Malawian Kwacha and the consequent short-term decrease in purchasing power. Regardless, the figures from Table 3.5 above indicate that the freight tonnage transported by truck across the Mwanza Border Post in the first half of 1997 exceeded that in the first half of 1996 by 4%.

Table 3.7 Monthly Trade Traffic at the Mwanza Border Post, 1997-1998

(Number of Trucks per Month)

Month	In	Out	Transit
1997			
Jan.	20,548	15,655	65
Feb.	1,792	1,870	71
Mar.	1,308	850	74
Apr.	3,934	2,988	151
May	4,349	3,889	254
Jun.	5,226	4,366	142
Jul.	3,020	3,594	174
Aug.	3,886	4,689	170
Sep.	5,989	7,349	230
Oct.	6,384	7,956	174
Nov.	4,986	3,925	132
Dec.	3,584	2,196	140
Total	65,006	59,327	1,777
1998			
Jan.	2,596	2,010	112
Feb.	2,335	2,029	178

Source: Mwanza Customs and Excise Office, Mwanza Border Post.

As indicated in Table 3.7, in February 1998, 178 transit trucks passed through the Mwanza Border Post with both origin and destination outside of Malawi. Of the total, 74 trucks (42%) traveled to/from Chiponde, 73 trucks (41%) traveled to/from Muloza, and the remaining traveled to/from Kaporo (15 trucks), Marka (15 trucks), and Mchinji (1 truck). These data imply that approximately 40% of the transit traffic passing through the Mwanza Border Post also passes through the Chiponde Border Post and therefore may utilize the Mangochi Bridge.

Table 3.8 shows the number of motor vehicles that passed through the Chiponde Border Post in early 1998, the only year for which data were reportedly available. The 74 transit (foreign) trucks that passed through Malawi via the Mwanza Border Post and Chiponde Border Post in February 1998 represent only 18% of the total 402 foreign motor vehicles that passed through the Chiponde Border Post in that month. Although detailed origin-destination data were not provided by the Chiponde Border Post officials, discussions revealed that a large portion of foreign vehicles entering and existing Malawi at this point are South African farmers who recently moved to Niassa Province in Mozambique.

Because Niassa Province is relatively undeveloped, many of these new farmers are required to travel to Mangochi and Blantyre to obtain supplies.

Table 3.8 Vehicular Traffic at the Chiponde Border Post in Early 1998

Period	Malawian Vehicles		Foreign Vehicles		Total	
	In	Out	In	Out	In	Out
Jan. 1-31	71	80	186	171	257	251
Feb. 1-28	73	92	199	203	272	295
Mar. 1-9	13	12	59	68	72	80
Daily Avg.	2.3	2.7	6.5	6.5	8.8	9.2

Source: Chiponde Customs and Excise Office, Chiponde Border Post.

Between Ntcheu and Dedza, there are two additional border posts along Route M1 that, like the Mwanza Border Post, link Malawi with Tete Province in Mozambique. Both border posts lead to the Mozambican town of Vila Ulongwe. According to customs records at the Vila Ulongwe border post near Ntcheu, between 1 January and 11 March 1998 a total of seven Mozambican motor vehicles traveled from this point through Malawi and the Chiponde Border Post to eastern Mozambique, equivalent to one vehicle every 10 days.

At the Vila Ulongwe border post near Dedza, customs records revealed that in 1997 only eight Mozambican motor vehicles traveled from this point through Malawi and the Chiponde Border Post to eastern Mozambique. For the period between 1 January and 11 March 1998, the figure was three Mozambican motor vehicles, equivalent to one vehicle every 23 days.

c) Growth in Number of Motorized Vehicles

The number of vehicle registrations per year since 1994, the year from which such data is considered reliable, is shown in Table 3.9. Interestingly, the annual number of vehicle registrations decreased steadily from 1994 to 1996, but increased sharply in 1997. Because the total number of registered motor vehicles in Malawi as of December 1997 was 98,498, one can estimate that the number of motor vehicles in Malawi increased at an average rate of 9.3% per year during this period.

Table 3.9 Annual Vehicle Registrations, 1994-1997

Year	Motor-cycle	Car	LGV	HGV	Trailer	Bus	Total
1994	819	2,834	1,881	274	157	59	6,024
1995	882	1,488	1,802	315	134	35	4,656
1996	419	951	1,948	332	144	41	3,835
1997	1,090	1,694	4,424	838	340	104	8,490

Note: LGV is light goods vehicle, and HGV is heavy goods vehicle.
Source: Road Traffic Department, Blantyre.

3.1.2 Socioeconomic Situation

(1) Population

The World Bank's population estimate for Malawi is 10.14 million people in 1996, and the Economist Intelligence Unit's estimate for mid-1997 is 10.45 million (Table 3.10). Between 1964, when Malawi gained independence, and 1994 the population increased from 4 million to 10 million, an average annual growth rate of 3.1%.

Table 3.10 Population in Malawi

Year	Population (millions)	Growth Rate (%)
1987	7.99	-
1992	8.82	-
1993	9.13	3.5
1994	9.46	3.6
1995	9.79	3.5
1996	10.14	3.6
1997	10.45	3.1

Sources: Malawi Population and Housing Census 1987, Vol. I, Summary of Final Results, National Statistics Office, July 1991, p. 21; EIU Malawi Country Profile 1997-98, The Economist Intelligence Unit, 1997, p. 13; EIU Malawi Country Report 4th Quarter 1997, The Economist Intelligence Unit, 1997, p. 18.

According to the World Bank, the urban population in 1995 represented about 13% of the total with an average annual growth rate from 1980 to 1995 of 6.0%. The Malawian population is young, with approximately half of the population under 15 years of age. In 1995, the life expectancy at birth was 43 years of age, largely as a result of poverty, chronic malnutrition, and substandard health services. The high incidence of HIV is expected to lower life expectancy over the next ten years.

Malawi's Southern Region is the most populous and most densely populated region and includes the country's largest city, Blantyre, with an estimated

population of 390,000 in 1997. The capital, Lilongwe, with an estimated 1997 population of 280,000, lies in the Central Region. The Northern Region, which is the poorest and least developed, is sparsely populated and its only city, Mzuzu, is much smaller than Blantyre or Lilongwe.

Out of the 24 districts that make up Malawi, Mangochi District is the fifth most populous, with an estimated 1997 population of 680,000, following the districts of Lilongwe, Mulanje, Blantyre, and Machinga (Table 3.11). In 1987, the urban population of Mangochi District represented only 4% of the total.

Table 3.11 Population in Malawi by District

Region/District	Population (thousands)	
	1987	1997
Malawi	7,989	10,450
Northern Region	912	1,193
Chitipa	97	127
Karonga	148	194
Nkhata Bay	138	181
Rumphi	95	124
Mzimba	434	568
Central Region	3,111	4,069
Kasungu	323	422
Nkhotakota	158	207
Ntchisi	121	158
Dowa	322	421
Salima	189	247
Lilongwe	977	1,278
Mchinji	250	327
Dedza	412	539
Ntcheu	359	470
Southern Region	3,966	5,188
Mangochi	497	680
Machinga	515	670
Zomba	442	573
Chiradzulu	211	274
Blantyre	590	766
Mwanza	122	158
Thyolo	431	560
Mulanje	638	830
Chikwawa	317	412
Nsanje	204	265

Sources: *Malawi Population and Housing Census 1987, Vol. I, Summary of Final Results*, National Statistics Office, July 1991, pp. 21-22; *EIU Malawi Country Profile 1997-98*, The Economist Intelligence Unit, 1997, p. 13; *Rural Motorized Transport Survey Report Covering District of Mangochi*, Ministry of Economic Planning and Development, Monitoring and Evaluation of Transport Projects, 1997.

Note: District-level population figures for 1997, other than that for Mangochi, were estimated by applying the average annual national population growth rate to the district-level 1987 census population figures (in 1997 sufficient funds were not available to carry out a national census).

Mangochi District is divided into nine villages or so-called traditional authorities (TAs): Mponda, Chimwala, Nankumba, Jalasi, Nyambi, Chowe, Katuli, Makanjila, and Namabvi. The district also contains Lake Malawi National Park. The highest number of people are in TA Mponda, which encompasses the town of Mangochi, with a population of 113,200 (Table 3.12). The average annual population growth rate of TA Mponda from 1990 to 1997 is also the highest at 3.7%, compared to 3.4% for Mangochi District as a whole. Namwera is located in TA Jalasi, Monkey Bay is located in TA Nankumba, and Chiripa is located in TA Chimwala.

Table 3.12 Population in Mangochi District by Traditional Authority, 1990-1997

Traditional Authority	Population (thousands)							
	1990	1991	1992	1993	1994	1995	1996	1997
Mponda	87.7	91.4	95.8	99.7	103.2	106.7	110.1	113.2
Nankumba	69.5	72.3	75.6	78.5	81.3	83.8	86.3	88.7
Chimwala	78.9	81.7	84.9	88.1	91.1	93.9	96.5	99.1
Jalasi	65.8	68.1	70.8	73.5	76.0	78.3	80.5	82.6
Nyambi	54.5	56.5	58.7	60.9	63.0	64.9	66.7	68.5
Chowe	72.2	74.8	77.7	80.6	83.3	85.9	88.3	90.6
Katuli	50.8	52.6	54.7	56.7	58.6	60.4	62.1	63.8
Makanjila	38.1	39.5	41.1	42.6	44.0	45.4	46.7	47.9
Namabvi	18.9	19.6	20.4	21.1	21.9	22.5	23.2	23.8
Lake Malawi Nat'l Park	1.1	1.1	1.2	1.2	1.2	1.3	1.3	1.4
Total	537.3	557.7	508.9	603.0	623.6	643.1	661.7	679.5

Source: Mangochi DDO Office.

(2) Economic Activities

The Malawian economy is agriculture-based. Depending on climatic conditions, agriculture usually accounts for more than one-third of GDP and over 90% of export earnings. The sector employs nearly half of those in formal employment and directly and indirectly supports an estimated 85% of the population. The country's staple crop is maize, although tobacco is by far Malawi's largest export, followed by tea and sugar (Tables 3.13 and 3.14). Maize and tobacco are grown throughout the country, while sugar and tea production are found mostly in the south. The manufacturing sector is relatively small partly due to the high transport costs to potential export markets. Reduction of these costs would be a huge boost to this sector. Commercial activity is concentrated in Blantyre. Tourism potential is good and as yet mostly under-exploited.

In 1996, Malawi experienced 9.5% growth in real GDP, second in the Southern African Development Community (SADC) only to Lesotho. In 1997, real GDP grew by 5.3%, and EIU forecasts for 1998 and 1999 are 4.8% and 5.8% respectively. Erratic weather patterns in recent months associated with the El Niño oceanic current have raised concerns about the 1997/98 harvest, but real GDP growth in 1998 should not fall below 4.8% due to healthy activity in the industrial sector, which will be helped by progress with the Government's privatization program. The acceleration of growth to 5.8% in 1999 reflects the likely recovery of agricultural production in 1999 due to improved weather conditions. Further, peace in Mozambique and democratic transition in South Africa should provide a stimulus to investment in the region. Real GDP growth rates forecast by the World Bank are slightly lower than those prepared by EIU at 4.0% per year for 1998-2005, and those forecast by the Ministry of Economic Planning and Development for 1998, 1999, and 2000 are 5.6%, 4.3%, and 4.1% respectively.

Table 3.13 Principle Domestic Export Commodities, 1994-1997 (MK million)

Commodity	Year			
	1994	1995	1996	1997
Agriculture Crops				
Tobacco	1,689.0	3,915.2	4,596.2	6,517.0
Tea	261.2	414.4	393.7	694.0
Sugar	224.0	404.8	519.5	328.2
Cotton	15.0	57.7	227.6	108.9
Rice	20.0	22.5	23.6	20.0
Coffee	128.2	238.8	164.6	128.8
Pulses	24.9	112.5	180.4	153.8
Maize	16.8	80.5	-	-
Other Exports	342.7	745.7	1,066.1	1,123.0
TOTAL DOMESTIC EXPORTS	2,721.8	5,992.1	7,171.7	9,073.7
Re-Exports	117.1	197.2	181.3	190.4
TOTAL	2,838.9	6,189.3	7,353.0	9,264.1

Source: *Mid-Year Economic Review 1997-1998*, National Economic Council, 1997, p. 11.

Table 3.14 Domestic Exports by Main Commodities, 1994-1997

(% Share of Total Value)

Commodity	Year			
	1994	1995	1996	1997
Agriculture Crops				
Tobacco	62.1	55.3	64.1	71.8
Tea	9.6	6.9	5.5	7.6
Sugar	8.2	6.8	7.2	3.6
Cotton	0.6	1.0	3.2	1.2
Rice	0.7	0.4	0.3	0.2
Coffee	4.7	4.0	2.3	1.4
Pulses	0.9	1.9	2.5	1.7
Maize	0.6	1.3	-	-
Other Exports	12.6	12.4	14.9	12.4
TOTAL	100.0	100.0	100.0	100.0

Source: *Mid-Year Economic Review 1997-1998,* National Economic Council, 1997, p. 11.

Mangochi District has an area of 6,272 sq. km covering about 5.3% of the country's total area and a population of 680,000 constituting about 6.5% of the country's total population. The largest hecterage of land use falls under water bodies constituting 43.4% (Table 3.15). About 29.2% of the total district area not including water bodies is arable land with estates comprising 7.9%.

The arable land in Mangochi District is used for growing a wide variety of crops, including maize, rice, sorghum, groundnuts, millet, pulses, cotton, tobacco, sesame, cassava, sweet potatoes, sunflower, chilies, paprika, cashew nuts, macadamia nuts, and others. With respect to agricultural administrative division, Mangochi District forms part of the Machinga Agricultural Development Division (ADD), which extends southward to encompass Zomba and westward to include Balaka. The Machinga ADD is further subdivided into five Rural Development Projects (RDPs): Mangochi, Namwera, Kawinga, Zomba, and Balaka. The Mangochi and Namwera RDPs are of interest to this project.

Table 3.15 Land Use Composition in Mangochi District

Land Use Type	Hectares	Percentage	Percentage (Not Including Water Bodies)
Water Bodies	144,097	43.4	-
Forestry Reserves	68,522	20.6	36.4
Arable Land	54,923	16.5	29.2
Marginal Land	43,520	13.1	23.1
Estate Land	14,800	4.5	7.9
Water Shed	6,377	1.9	3.4
Total	332,239	100.0	100.0

Source: Mangochi Rural Development Project (RDP) Office.

During the 1997/98 growing season, the Mangochi and Namwera RDPs are expected to produce over 97,000 tons of maize, 2,400 tons of rice, 1,200 tons of sorghum, 7,000 tons of groundnuts, 9,000 tons of pulses, 1,000 tons of cotton, 3,700 tons of tobacco, 26,000 tons of cassava, and 66,000 tons of sweet potatoes (Tables 3.16 and 3.17). Additionally, Machinga ADD is expected to produce nearly 640 tons of macadamia nuts from estates located primarily in Namwera (a breakdown of macadamia nut production by RDP is not available). Much of this produce ends at various market outlets such as the Agricultural Development and Marketing Corporation (ADMARC) and other local markets. In the case of ADMARC, there are 7 permanent markets, 6 unit markets, and 10 seasonal markets.

In order to move goods from the farmers to the markets, an efficient transport system is required. However, the current transport situation in Mangochi District is so constrained that most people rely on unscheduled pickups and trucks. In fact, during the 1996/97 buying season, 1 unit market and all 10 seasonal markets were unable to operate due to poor roads, thereby reducing prospects for income generation for smallholder farmers.

With respect to commercial activities in Mangochi District, there are 491 retailers and 47 trading centers throughout the district. All of the 30 wholesalers in the district, however, are located at the district headquarters. This situation requires retailers to travel to the district headquarters to purchase various items.

Table 3.16 Smallholder Crop Production Estimates in Mangochi and Namwera RDPs, 1997/98

Crop		Production		
		Cultivated Area (ha)	Avg. Yield (kg/ha)	Total Prod. (MT)
1.0	Maize			
	1.1 Local Maize			
	Mangochi	24,987	824	20,579
	Namwera	29,483	471	13,883
	1.2 Hybrid Maize			
	Mangochi	19,980	2,869	57,064
	Namwera	4,112	1,449	5,958
	1.3 Composite Maize			
	Mangochi	-	-	-
	Namwera	146	986	144
	1.4 All Maize			
	Mangochi	44,967	1,727	77,643
	Namwera	33,741	592	19,985
	Total	78,708	1,240	97,628
2.0	Commercial Rice (Faya)			
	Mangochi	1,330	1,195	1,590
	Namwera	642	1,265	812
	Total	1,972	1,218	2,402
3.0	Sorghum			
	Mangochi	1,026	558	572
	Namwera	943	725	684
	Total	1,969	638	1,256
4.0	Groundnuts			
	4.1 Chalimbana			
	Mangochi	2,325	855	1,988
	Namwera	5,773	881	5,085
	4.2 Chitedzi Groundnut No. 7			
	Mangochi	-	-	-
	Namwera	14	857	12
	4.3 All Groundnuts			
	Mangochi	2,325	855	1,988
	Namwera	5,787	881	5,097
	Total	8,112	873	7,085
5.0	Pearl Millet			
	Mangochi	-	-	-
	Namwera	48	333	16
	Total	48	333	16

Table 3.16 (continued) Smallholder Crop Production Estimates in Mangochi and Namwera RDPs, 1997/98

Crop	Production		
	Cultivated Area (ha)	Avg. Yield (kg/ha)	Total Prod. (MT)
6.0 Pulses			
6.1 Beans			
Mangochi	290	638	184
Namwera	3,146	498	1,568
6.2 Cow Peas			
Mangochi	3,760	619	2,327
Namwera	409	286	117
6.3 Pigeon Peas			
Mangochi	2,589	721	1,867
Namwera	1,703	1,103	1,879
6.4 Dolichus Beans			
Mangochi	625	666	416
Namwera	-	-	-
6.5 Soya Beans			
Mangochi	166	693	115
Namwera	448	674	302
6.6 Ground Beans			
Mangochi	91	516	47
Namwera	399	682	272
6.7 Grams			
Mangochi	25	400	10
Namwera	-	-	-
6.8 Vervet Beans			
Mangochi	-	-	-
Namwera	181	503	91
6.9 All Pulses			
Mangochi	7,546	658	4,966
Namwera	6,286	673	4,229
Total	13,832	665	9,195
7.0 Cotton			
Mangochi	1,151	924	1,063
Namwera	-	-	-
Total	1,151	924	1,063

Table 3.16 (continued) Smallholder Crop Production Estimates inMangochi and Namwera RDPs, 1997/98

Crop	Production		
	Cultivated Area (ha)	Avg. Yield (kg/ha)	Total Prod. (MT)
8.0 Tobacco			
8.1 Southern Dark-Fired			
Mangochi	5	650	3
Namwera	50	547	27
8.2 Burley			
Mangochi	1,406	1,050	1,476
Namwera	2,699	813	2,194
8.3 All Tobacco			
Mangochi	1,411	1,048	1,479
Namwera	2,749	808	2,221
Total	4,160	889	3,700
9.0 Sesame			
Mangochi	5	400	2
Namwera	-	-	-
Total	5	400	2
10.0 Cassava			
Mangochi	2,927	5,555	10,399
Namwera	1,908	5,450	16,260
Total	4,835	5,514	26,659
11.0 Sweet Potatoes			
Mangochi	2,439	11,726	28,599
Namwera	2,834	13,482	38,208
Total	5,273	12,670	66,807
12.0 Sunflower			
Mangochi	12	500	6
Namwera	11	455	5
Total	23	478	11
13.0 Chilies			
Mangochi	78	526	41
Namwera	16	500	8
Total	94	521	49
14.0 Paprika			
Mangochi	-	-	-
Namwera	3	333	1
Total	3	333	1
15.0 Cashew Nuts			
Mangochi	8,585	2	17
Namwera	-	-	-
Total	8,585	2	17

Source: *Machinga Agricultural Development Division Crop Estimates for 1997/98 Season, Round 1*, January 1998.

Table 3.17 Horticulture Production Estimates in Mangochi and Namwera RDPs, 1997/98

Crop	Production		
	Number of Trees	Avg. Yield (kg/tree)	Total Prod. (MT)
1.0 Oranges			
Mangochi	4,127	41	169
Namwera	849	44	37
Total	4,976	41	206
2.0 Tangerines			
Mangochi	2,540	38	96
Namwera	—	—	—
Total	2,540	38	96
3.0 Mangoes			
Mangochi	253,810	210	53,300
Namwera	146,731	180	26,412
Total	400,541	199	79,712
4.0 Bananas			
Mangochi	315	24,000	7,510
Namwera	681	28,000	19,068
Total	996	26,685	26,578
5.0 Cabbages			
Mangochi	32	18,000	576
Namwera	42	17,310	727
Total	74	17,608	1,303
6.0 Tomatoes			
Mangochi	1,240	15,500	19,220
Namwera	78	16,000	1,248
Total	1,318	15,530	20,468
7.0 Onions			
Mangochi	85	22,494	1,912
Namwera	65	18,046	1,173
Total	150	20,567	3,085

Source: *Machinga Agricultural Development Division Crop Estimates for 1997/98 Season, Round 1*, January 1998.

Concerning minerals, two areas in Mangochi have been identified as containing kimberlitic rocks, which host diamonds. Some limited drilling to collect fresh samples for various geological studies was recently completed.

Mangochi also serves as one of Malawi's tourism centers. Consider, for example, that the district contains Lake Malawi National Park, the Shire River, Lake Malombe, the Mangochi Forest Reserve (containing the ruins of an old colonial fort), the Namizimu Forest Reserve, Makanjila, and Liwonde National Park—considered to be one of Malawi's top tourist attractions with a large population of elephants, hippos, crocodiles, lions, and exotic bird life, as well as two reintroduced black rhinos from South Africa. Currently, there

are six international class lakeshore resorts in Mangochi District supplying a total of 372 bedrooms, a four-fold increase over the past 10 years.

Clearly, Mangochi is a strategic region for the country's economy. Not only does the district contain Mangochi RDP and Namwera RDP, which produce a wide variety of staple and cash crops, but it also represents one of Malawi's tourism centers. Most importantly, Mangochi District contains one of Malawi's shortest external transport links, i.e., a vital international road corridor connecting Malawi with the Mozambican port of Nacala.

(3) Financial Situation

The Government has continued to pursue its expenditure control and revenue enhancement measures in order to correct budget imbalances. The Government is expected to expand coverage of the Medium-Term Expenditure Framework (MTEF) from four major ministries during 1996/97 to eleven ministries during 1997/98. The MTEF helps to guide in the allocation of available resources among sectors and ensures that higher priority sectors receive sufficient funds. Eventually, MTEF will cover the whole Government.

In the 1995/96 fiscal year, the Government adopted the cash budget system in order to reduce over-expenditures. With this system, public spending is paid on a purely cash basis from accounts held with private banks, so the ministries can only defray expenses when there is income to meet them. The objective of reducing over-expenditures is being achieved as evidenced by the fact that most ministries have kept their expenditures close to their budgeted expenditures. The Government will continue restraining its expenditures and reducing the fiscal deficit. These policies should reduce the level of domestic financing during the 1997/98 fiscal year and increase the volume of credit to the private sector leading to faster economic growth.

With respect to road maintenance, there has been a severe shortage of funds. The recently implemented cash budget system has drastically reduced financial resources made available compared to the previous budget program. This lack of financial resources to meet all of the requirements for road maintenance has forced the Ministry of Works and Supplies to adopt the approach of attending to urgent maintenance only as and when funds are made available. This situation has unfortunately resulted in the road network deteriorating from bad to worse over time, due to increased traffic on some of

the major roads. In addition, heavy rains have worsened the conditions on all roads, including wash-aways in some parts of the country. In order to meet its transport infrastructure needs, the Government relies heavily on donor assistance for road maintenance and construction.

3.2 Implication of Future Development

3.2.1 Economic Policies and Plans

(1) Economic Policies and Plans

a) National Statement of Development Policies

Malawi's development policy is outlined in a document entitled Statement of Development Policies, otherwise known as DEVPOL. Rather than consisting of a detailed economic plan as a basis for executing development policies, it is a framework that sets out in some detail objectives, policies, and Government budget forecasts using quantified economic analysis as an illustration of possible trends as opposed to a framework for control and direction.

The existing published illustration of this approach is for the period 1987-1996. Although certain parts of DEVPOL are undergoing revision as part of the Vision 2020 document now under draft, the main contents and characteristics will remain intact.

DEVPOL was formulated and adopted by the Government as a direct intervention to stimulate and maintain a momentum for development as well as deal with factors of colonial legacy. The objectives of DEVPOL are to help the Government realize economic and social objectives in the development process over an agreed period. In this regard, the objectives relate to sustained economic growth, income distribution, maintenance of self-sufficiency in basic foodstuffs, and improvement in economic security.

While the document outlines sectoral requirements and policy guidelines, it does not attempt to present a detailed and quantified blueprint for action. Rather, it represents an initial path forward on which there is a large measure of understanding and consensus. For this reason, DEVPOL is supplemented by various other sectoral and central policy documents such as the November 1996 Policy Framework Paper and the

October 1995 Policy Framework for Poverty Alleviation Programme. Both documents are discussed below.

b) Policy Framework Paper

The Policy Framework Paper 1996/97-1998/99 outlines the Government's objectives for the medium-term and reflects the understanding reached between the Government and the World Bank and the International Monetary Fund on policy reforms. Key sectoral policies set out in the Policy Framework Paper (PFP) considered to be of relevance to this project include those in the agriculture, industry, and infrastructure sectors.

i) Agriculture

The agriculture sector's potential for growth arises from four different sources: (i) an improvement in yields through more efficient use of inputs and the adoption of high-yielding technology; (ii) the diversification of production into more lucrative cash crops, such as burley tobacco, by smallholders, which creates a virtuous cycle of higher incomes, investment, and demand for off-farm activities; (iii) the better use of underutilized lands, especially in estates; and (iv) an improvement in strategies to cope with periodic droughts that severely reduce agricultural production. The Government seeks to stimulate these sources of growth by policy reforms in four areas: land, output markets, input markets, and in use of better technology and drought preparedness.

Government policies in the medium term will emphasize (i) providing incentives to farmers to take advantage of new opportunities, and ensuring an adequate supply of inputs, credits, and extension services by the public and private sectors and policy reforms to improve land utilization; (ii) promoting small-scale irrigation schemes as appropriate, which would be based on the participation of the benefiting communities, with special focus on improving access by women; and (iii) providing an appropriate policy framework to support private investment in agro-processing and trading, infrastructure, and the development of commercial linkages.

ii) Industry

The Government intends to encourage industrial activity through further trade liberalization (while addressing the anomalies of the tariff structure), export promotion, deregulation, and rectification of the concentrated and interlocking ownership structure that characterizes the trade, distribution, manufacturing, and finance sectors. To this end, the Government is developing plans to restructure or privatize the large corporate sector, such as ADMARC and MDC, as well as enhancing domestic competition. Also, the Government is promoting the participation of foreign investors in Malawi's private sector and the reorientation of production toward export markets. Similarly, it is encouraging the separation of ownership of the financial sector from the non-financial sector to promote competition and efficiency.

iii) Infrastructure

Malawi faces major challenges in the infrastructure sector, especially in the water and transport sectors. An immediate task will be to mitigate the effects of the drop in the water level in Lake Malawi—caused by the droughts of the past years—on the lakeshore economy, power generation, and water supply for Blantyre. With the assistance of the International Development Association (IDA), the Government is monitoring Shire River flows, and is conducting studies to improve demand management of water resources in the river catchment.

With respect to transport, the Government seeks to increase efficiency and competition and lower the high costs in Malawi's transport sector. The opening of the Beira road route, utilization of the Northern Transport Corridor, and the improvements in the rail and road routes to Nacala are envisaged to help lower international transport costs. A comprehensive National Transport Policy, including a revised Road Traffic Act, is expected to be finalized soon with a view to promoting intramodal and intermodal competition and improving safety.

c) Public Sector Investment Programme

The Public Sector Investment Programme (PSIP) is a five-year rolling program which contains all ongoing and approved projects scheduled to start within the five-year time frame. The report is complied by the Ministry of Economic Planning and Development in close consultation with central agencies, executing agencies, and the donor community. The PSIP provides the framework for planning and scheduling of investment projects in line with the long-term development goals and objectives of the Government, as currently stipulated in the Statement of Development Policies (discussed earlier) and also in line with the medium-term macroeconomic objectives as laid out in the Policy Framework Paper (discussed earlier) and the various sectoral strategy documents.

The main policy objective of the PSIP with respect to the transport sector is to build and ensure the efficient utilization of a network of infrastructure and services necessary for developmental requirements of the economy. One of the road improvement projects specifically identified in the document is the Mangochi-Chiponde road on the same alignment as the Mangochi Bridge (i.e., Route M3).

d) National Poverty Alleviation Programme

The Government launched the Poverty Alleviation Programme in August 1994 with a vision centered on a process of economic and social development in which people are directly involved and empowered at the community and national levels to improve their livelihood. The overall strategy of the Poverty Alleviation Programme is characterized by the following elements: (i) promoting the increased participation of poor women, men, and youth in economic, social, and political affairs by the provision of basic services that enable them to take advantage of opportunities; (ii) economic empowerment of the poor by promoting the more productive use of their abundant resource, namely labor, which is underemployed or unemployed; (iii) development of safety net programs to cushion those who are adversely affected by changes in policies and natural disasters; (iv) promoting the spirit of self-determination and reliance by accelerating the decentralization process and encouraging participatory approaches to development; (v) instilling the spirit of poverty consciousness in planners, administrators, politicians, extension

workers, and the general public by intensifying poverty alleviation information, education, and community (IEC), and capacity building—with due recognition of the cultural diversity of the country; (vi) improving the poor's access to credit facilities by deepening and broadening the financial sector to assist the poor to diversify their sources of income; and (vii) introducing a system of poverty monitoring and evaluation to inform the policy formulating process and subsequent planning for poverty alleviation interventions.

The Poverty Alleviation Programme is a broad institutional framework envisaged to incorporate various strands of development initiatives to provide a coherent basis for poverty alleviation in the country. The programming structure is featured in Figure 3.2.

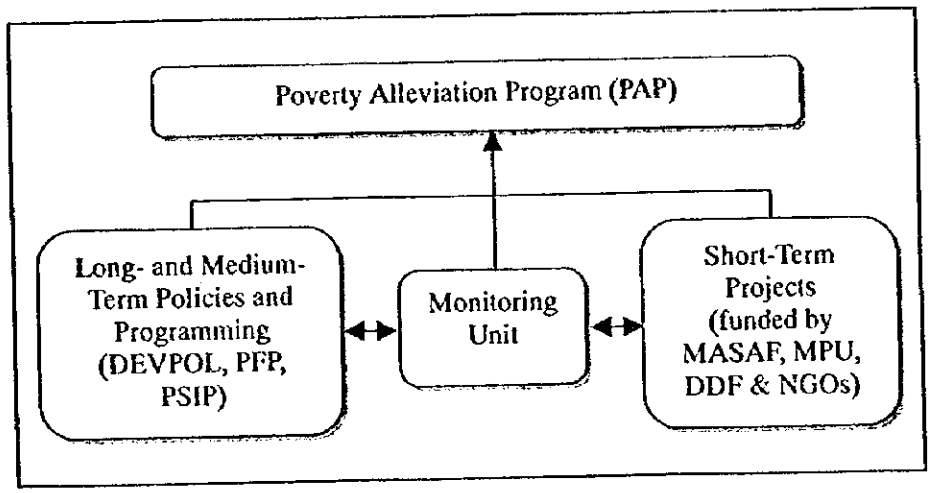


Figure 3.2 Programming Structure of the Poverty Alleviation Program

In this structure, the development of sectoral programs embodied in the Policy Framework Paper (PFP) and Public Sector Investment Programme (PSIP) for medium-term planning and policy reforms on the one hand, and the operations of short-term (community-based) projects funded by the Malawi Social Action Fund (MASAF), Micro Projects Unit (MPU), District Development Fund (DDF), and NGOs on the other hand has to be related to the Policy Framework for Poverty Alleviation Programme. The progress of implementing the PAP is monitored by the Ministry of Economic Planning and Development.

Within the PAP, transport—a service sector whose role is to link producers and consumers of goods and services—is identified as playing

a crucial role in facilitating and promoting economic growth. In this context, groups to be targeted are poor smallholder farmers, women in poverty, estate workers, tenant farmers, ganyu (casual) laborers, youth in poverty, the urban poor, and island and lakeshore communities. The constraints experienced by these target groups have been identified as follows: (i) inadequate supply of all weather access roads especially in rural areas; (ii) poorly maintained roads; (iii) shortage of transport facilities particularly in rural areas; (iv) lack of financial resources and shortage of appropriate transport means as well as supportive policies for opening rural transport networks through the private sector; and (v) high transport costs, which limit market activities in rural areas and affect private sector activity in remote areas.

The stated objective of the transport sector is, therefore, "to improve the mobility and accessibility of households to goods and socioeconomic services by provision of both motorized and non-motorized means of transport including development and improvement of the road network." Clearly, reconstruction of the Mangochi Bridge would be fully in-line with the objectives and strategies of the Poverty Alleviation Programme, as the new bridge would be a substantial improvement in Malawi's domestic and international road network. In combination with road improvement works between Mangochi and Chiponde to be financed by the Kuwait Fund for Arab Economic Development (Kuwait Fund), the Arab Economic Development in Africa (BADEA) Fund, the OPEC Fund for International Development, and the Malawian Government, this bridge would also result in improved mobility and accessibility of households to goods and socioeconomic services.

e) Secondary Centres Development Programme

With funding from the German Development Bank (i.e., KfW or Kreditanstalt für Wiederaufbau), the Secondary Centres Development Programme has been undergoing implementation since the late 1980s. The objective of the program is to develop and strengthen rural centers, and it is administered and executed by the Ministry of Local Government. Mzuzu and Kasungu were the two target cities of Phase I of the program. Luchenza was the subject of Phase II, and Karonga was the target city of Phase III. Currently, Phase IV is being finalized and will include Mangochi, Liwonde, Salima, and Bangula.

The project components for Mangochi will include the following: (i) improvement of the M'Baluku local market located on the eastern side of the Shire River across the existing Mangochi Bridge, (ii) improvement of the central market, (iii) improvement of the central bus station and construction of a bus depot, (iv) development of a number of commercial plots in the town, (v) upgrading several city roads, and (vi) financial strengthening of local authorities. Certainly, reconstruction of the Mangochi Bridge would be fully consistent with the objectives of the Secondary Centres Development Programme, as the new bridge would enable balanced development of Mangochi on both sides of the Shire River.

(2) Economic Growth Prospects

Mangochi District has high agricultural potential to produce more cash crops. Since estimated space for new agricultural land development is restricted, agricultural development should be oriented toward intensification and diversification. The constraints to developing the area's agricultural potential are a lack of sufficient irrigation schemes and poor transport conditions.

The environment in Mangochi District is favorable for intensification and diversification of high value added cash crops, such as burley tobacco, cotton, spices, macadamia nuts, and oil seeds. The main issue for such diversification is marketability, i.e., accessibility to markets and market prospects. Because many farmers are already growing these crops, it can be assumed that intensified cropping will expand in the areas where accessibility to Mangochi, Blantyre, and Lilongwe is adequate.

Urbanization and concentration of agro-industries and commercial and service industries are not well developed in Mangochi District at present. The population of Mangochi town, which is designated as a regional center, is only about 0.1 million inhabitants and much lower populations inhabit Jalasi and Namwera. Urbanization and particularly agro-industrialization should expand, including concentration of population in Mangochi town.