

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)  
THE MINISTRY OF ROADS AND PUBLIC WORKS  
THE GOVERNMENT OF THE REPUBLIC OF KENYA

**THE STUDY  
ON  
RURAL ROADS IMPROVEMENT  
IN  
WESTERN KENYA**

**FINAL REPORT  
SUMMARY**

DECEMBER, 1999

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**PACIFIC CONSULTANTS INTERNATIONAL  
CONSTRUCTION PROJECT CONSULTANTS, INC.**

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**The following foreign exchange rate is applied in the study:**

**US\$ 1.00 = 72.2 Ksh = 3.61 K£ (as of July 1999)**

## PREFACE

*In response to a request from the Government of the Republic of the Kenya, the Government of Japan decided to conduct the Study on Rural Roads Improvement in Western Kenya and entrusted the study to Japan International Cooperation Agency (JICA).*

*JICA selected and dispatched a study team headed by Mr. Kiyoshi Yasukawa, and which consists of Pacific Consultants International and Construction Project Consultants, Inc. to Kenya three times between March to October, 1999. In addition, JICA set up an advisory committee headed by Mr. Motoo Fujii, the Ministry of Construction, which examined the study from specialist and technical points of view.*

*The team held discussions with the officials concerned of the Government of the Republic of Kenya and conducted the field surveys at the study area. Upon returning to Japan, the study team conducted further studies and prepared this final report.*

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

*Finally, I wish to express sincere appreciation to the officials concerned of the Government of the Republic of Kenya for their close co-operation extended to the study team.*



---

*Kimio Fujita*

*President*

*Japan International Cooperation Agency*

December 1999

Mr. Kimio Fujita  
President  
Japan International Cooperation Agency  
Tokyo Japan

Dear Mr. Fujita,

Letter of Transmittal

We are pleased to formally submit herewith the final report of "the Study on Rural Roads Improvement in Western Kenya".


This report complies rural roads improvement and maintenance plan in western Kenya including a feasibility study on the high priority roads as long as 100 km.

We owed a lot to many people for the accomplishment of the Study. First, we would like to express our sincere gratitude and appreciation to all those their kind assistance and co-operation to the Study Team, in particular, relevant officials of the Ministry of Roads and Public Works, the counterpart agency.

We also acknowledge all the officials of your agency, the JICA Advisory Committee, Embassy of Japan in Kenya and Ministry of Foreign Affairs.

We wish the report would be able to contribute really to appropriate policies and measures for the improvement of rural roads in western Kenya.

Very truly yours,



Kiyoshi Yasukawa

Team Leader

JICA Study Team



## **Abbreviation**

<b>AC:</b>	<b>Asphalt Concrete</b>
<b>BOD:</b>	<b>Biochemical Oxygen Demand</b>
<b>CO:</b>	<b>Carbon Monoxide</b>
<b>dB:</b>	<b>Decibel(s)</b>
<b>DBST:</b>	<b>Double Bituminous Surface Treatment</b>
<b>DWO:</b>	<b>District Works Office</b>
<b>EIA:</b>	<b>Environmental Impact Assessment</b>
<b>HDM:</b>	<b>Highway Design Maintenance Model</b>
<b>IEE:</b>	<b>Initial Environmental Examination</b>
<b>ILO:</b>	<b>International Labour Organisation</b>
<b>IRI:</b>	<b>International Roughness Index</b>
<b>JICA:</b>	<b>Japan International Cooperation Agency</b>
<b>KIHBT:</b>	<b>Kenya Institute of Highway and Building Technology</b>
<b>LBM:</b>	<b>Labour Based Method</b>
<b>MOR&amp;PW:</b>	<b>Ministry of Roads and Public Works</b>
<b>MTD:</b>	<b>Mechanical and Transport Department</b>
<b>MW:</b>	<b>Mechanical Workshop</b>
<b>NOx:</b>	<b>Nitrogen Oxide(s)</b>
<b>pH:</b>	<b>Potential of Hydrogen</b>
<b>PWO:</b>	<b>Provincial Works Office</b>
<b>REC:</b>	<b>Regional Equipment Centre</b>
<b>SBST:</b>	<b>Single Bituminous Surface Treatment</b>
<b>SOx:</b>	<b>Sulphur Oxide(s)</b>
<b>SPM:</b>	<b>Suspended Particle Matter(s)</b>
<b>SS:</b>	<b>Suspended Solids</b>

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## Executive Summary

### 1 Background

Kenya's Nyanza and Western Provinces are densely populated. Both Provinces have abundant fish and agricultural resources. The poor conditions of the roads, however, have been one of the major obstacles to development, and people's standard of living in these provinces remains low. Considering these conditions, the Government of Kenya requested the Government of Japan to conduct a development study in these provinces on the improvement of rural roads with a view to promote balanced growth of the region.

#### (1) Study Objectives

The objectives of the Study are to formulate an improvement plan for rural roads (C, D and E classified roads) in western Kenya, to conduct a feasibility study for selected high priority roads and to strengthen institutional capacity of the Kenyan counterpart organisation in rural roads improvement and maintenance.

#### (2) Study Area

The Study Area comprises Nyanza Province and Teso and Busia Districts in the Western Province ("the Study Area").

### 2 Identification of Problems

Around four million people are living in the Study Area. Many people are forced to walk on earth and gravel roads, which account for around 90% of the rural roads, for over one hour in order to do their shopping and / or visits to hospitals. These earth and gravel roads become sometimes impassable in the rainy season due to lack of proper road maintenance. This threatens the subsistence of the residents.

In addition, fish industry and tea-leaves are in the Study Area's major products. The region's fish products account for more than 95% of Kenya's total. However, these products are spoiled or become rotten due to lack of proper transportation to local markets or to processing factories. This causes economic loss to the region.

As for road maintenance, the following are the major problems.

- The road maintenance budget is insufficient.
- The road inventory lacks basic information such as kilometre post and the record of maintenance works.

- The simple Labour Based Methods do not meet the increase in maintenance works.
- The necessary maintenance equipment is distributed to every province and district, but a number of equipment is in not-workable condition and over aged.
- Private contractors lack enough maintenance equipment.

### **3 Road Network Development and Maintenance Improvement Plan**

#### **(1) Road Network Development**

Roads such as D246 (Siaya to Bondo), D210 (C13 to Karunga), E118 (C19 to D 210), D246 (Siaya to C28), D256 (C30 to C31), D250/251/C30 (Port Victoria to Bumala) should be upgraded and incorporated into the primary road network, which consists of Class C road, in order to meet the requirements for local economic enhancement and improvement of accessibility to support the daily lives of the residents.

#### **(2) Road Maintenance Plan**

Taking advantage of current structural reform within MOR&PW, the following countermeasures should be taken, in order to improve maintenance works:

- Participation of the public as Roads Board members, in order to reflect public opinion on budgetary aspects of road maintenance;
- Establishment of a road inventory system with a minimum of necessary information;
- Strengthening the maintenance management capacity of MOR&PW so that it can cope with the increase in out-house contract work and also provide MOR&PW staff with the opportunity to acquire practical experience in road maintenance works;
- Further introducing the equipment-based approach and promoting the establishment of regional equipment centres at major District Work Offices;
- Establishment of an equipment-lease market by taking optimum advantage of the privatisation of the Mechanical Transport Department; and
- Promoting the development of the construction industry so that it can cope with the increase in maintenance works.

### **4 Selection of High Priority Roads**

The following three roads with a total length of 100 km were selected as high priority roads:

- a. Homa Bay – Mbita (C19, L= 42.4km.),
- b. Port Victoria - Bumala (D250/ D251/C30, L= 42.99 Km.), and
- c. Rongo – Ogembo (C20, L= 19.0 km.).

Port Victoria and Mbita have dominant fish products in the Study Area. Remarkable volume, however, has been spoiled due to lack of transportation to major inland markets during the rainy season. As for Mbita, there are no other access roads for the residents to go to Homa Bay, which is a major town in the region. The Kisii area, where the Rongo – Ogembo road is located, is a highly populated and many residents are affected adversely by the bad conditions of the earth and gravel roads in mountainous terrain. The Rongo – Ogembo road was selected with a view to support residential daily trips to go to shopping and to visit to the hospitals.

## 5 Feasibility Study

### (1) Preliminary Design

The preliminary design was undertaken by applying the Study's design criteria such as asphalt concrete pavement in mountainous areas, provision of climbing lanes in more than 8% of the longitudinal gradient sections, wider shoulders of 2.0m width in areas adjacent to villages and longer return periods of 50 years for hydraulic design. In addition, necessary countermeasures such as vegetation on slopes and single surface dressing to cover shoulders are recommended in order to protect against soil erosion.

### (2) Cost Estimates

The project costs were estimated as tabulated in Table 5.1 in accordance with the preliminary design for the high priority roads.

**Table 5.1 Project Cost**

Unit: 1000US\$

Section	Road Code.	Project Cost
Homa Bay - Mbita	C19	13,068
Bumala - Port Victoria	D250/D251/C30	10,688
Rongo - Ogembo	C20	5,009
Total		28,765

### (3) Environmental Impact Assessment

Any serious adverse environmental impacts are unlikely to be caused by the implementation of the project. However, certain countermeasures will have to be adopted, such as measures against soil erosion and compensation payments

for the owners of the private land, in order to preserve the current environmental conditions alongside the three road project areas.

**(4) Economic Evaluation**

The Economic Internal Rate of Return (EIRR) was used to analyse the economic viability of the three road projects. The results of the analysis are shown in Table 5.2.

**Table 5.2 Result of Economic Analysis**

Name of Project	Economic Internal Rate of Return
Homa Bay - Mbita	8.27%
Port Victoria - Bumala	7.07%
Rongo - Ogembo	7.88%

The EIRRs of the projects are somewhat at the lower end. However, there are many intangible benefits such as an increase in the school attendance rate and regional integration with neighbouring areas. Considering these intangible benefits, implementation of the three road projects is justified.

**6 Analysis of Budget Resources**

The total length of the classified roads in the Study Area accounts for 12% of Kenya's total length of the classified roads. If 5 % out of the Kenya's total road maintenance budget would be allocated for the Study Area, such an amount would ensure a reasonable road maintenance level.

**7 Conclusions**

Road maintenance in Kenya has suffered for a long time from lack of budget. However, it is expected that revenues generated by the Road Maintenance Fuel Levy Fund, the proceeds of which are earmarked for road maintenance, will increase. It is also anticipated that the Road Board will ensure responsibility for the proper allocation of the proceeds from the Levy Fund.

It is suggested that, given such circumstances, the conventional road maintenance approach should be adjusted accordingly with a view to (a) strengthen the out-house contract system, and (b) strengthen the in-house experience in practical maintenance works.

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# **Chapter 1**

## **Outline of the Study**



## Chapter 1 Outline of the Study

### (1) Background

The Nyanza and Western Provinces in the western part of Kenya are densely populated. Both Provinces have abundant fish and agricultural resources. However, the poor conditions of the roads has been one of the major obstacles to regional development and people's standard of living in these provinces remains low. The Government of Kenya requested the Government of Japan to conduct a development study in these provinces on the improvement of rural roads with a view to promote balanced growth of the region.

### (2) Study Objectives

The objectives of the Study are:

- to formulate a rural roads (C, D and E classified roads) improvement plan for western Kenya,
- to implement a feasibility study for selected high priority roads, and
- to strengthen the institutional capacity of the Kenya counterpart organisation.

### (3) Study Area

The Study Area comprises Nyanza Province and Teso and Busia Districts in the Western Province (hereafter referred to as "the Study Area") (see Fig. 1.1.1).

### (4) Study Schedule

The Study was launched in the end of February 1999 and it was completed in the end of November 1999. The rough work schedule is shown in Fig. 1.1.2.

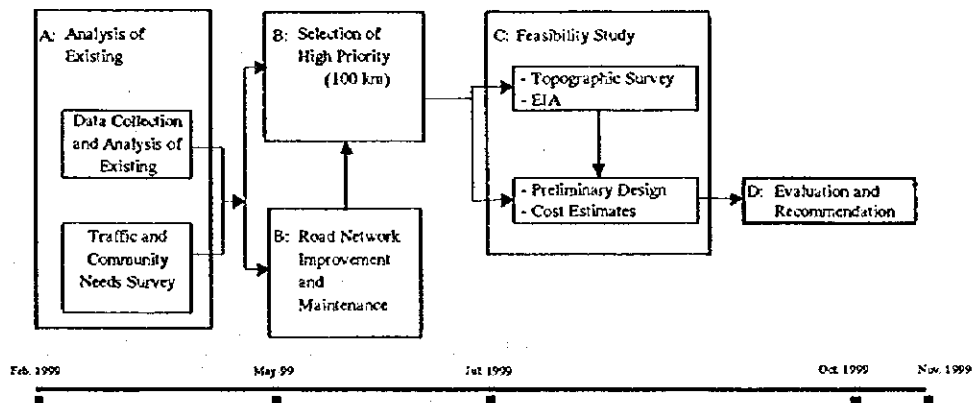


Fig. 1.1.2 Work Schedule



# **Chapter 2**

## **Existing Conditions**



## Chapter 2 Existing Conditions

### 2.1 Socio-economic Conditions

#### (1) Population

The population size of the Study Area is around four (4) million people accumulating for 18% of Kenya's population size. Fig. 2.1.1 shows the population density by district. Kisumu, which is a pivotal town in the Study Area has the highest population density with over 1,251 persons per square kilometre and Kisii and its peripheral areas with a population density of 500 to 1,250 persons per square kilometre.

#### (2) Agricultural Characteristics

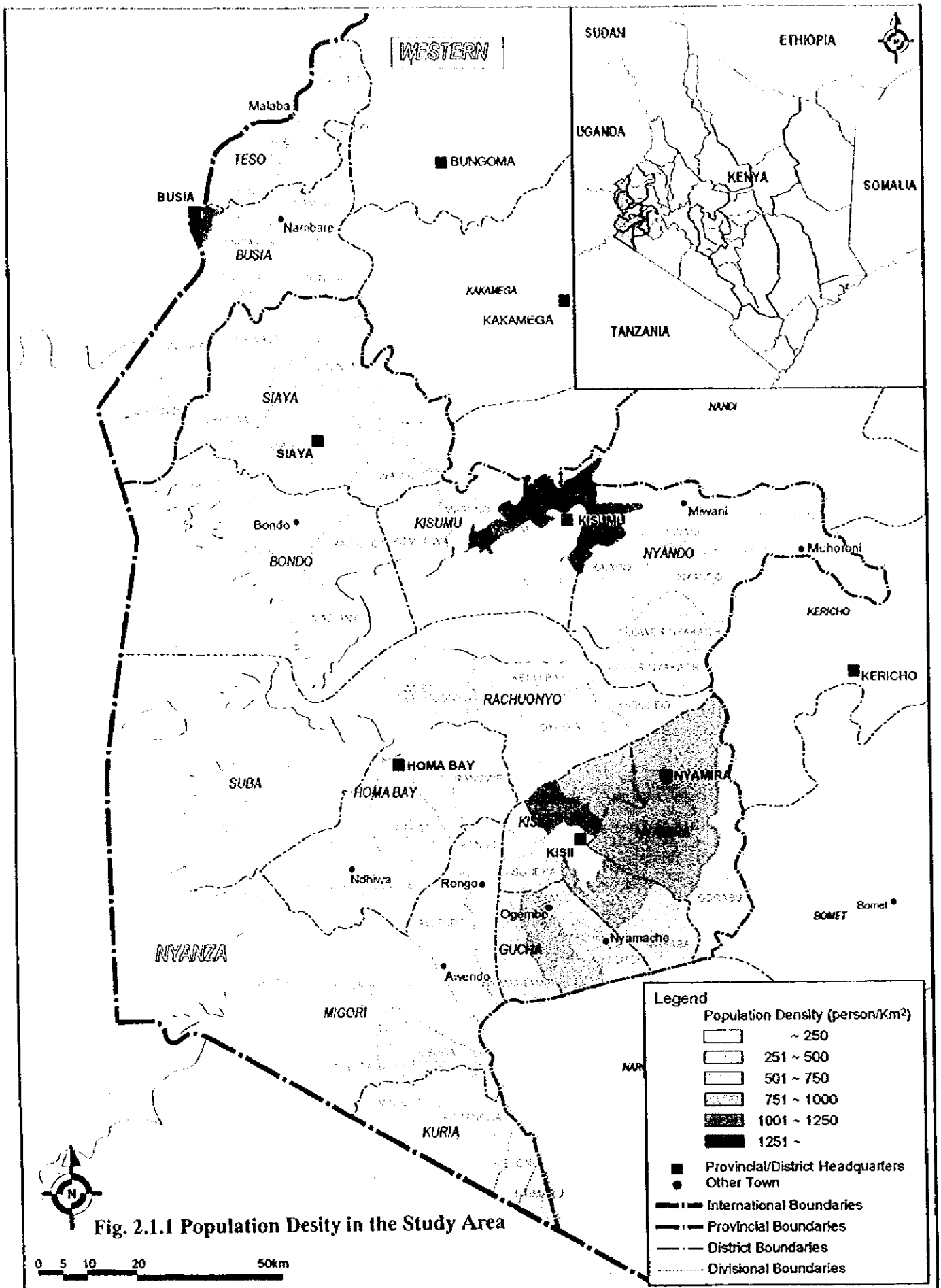
The high potential land for agriculture use in the Study Area accounts for around 20% of Kenya's total, though the land area of the whole Study Area accounts for only 3% of Kenya's total land area. Agriculture related activities are the leading economic activities in the Study Area.

The hilly and mountainous areas grow tea and coffee products under moderate rainfall condition. Maize, cotton, sugar can, wheat, sorghum, cassava and potatoes are the main products cultivated in the plain areas. Alongside the lake area, the fishing industry is one of the major economic activities in this region.

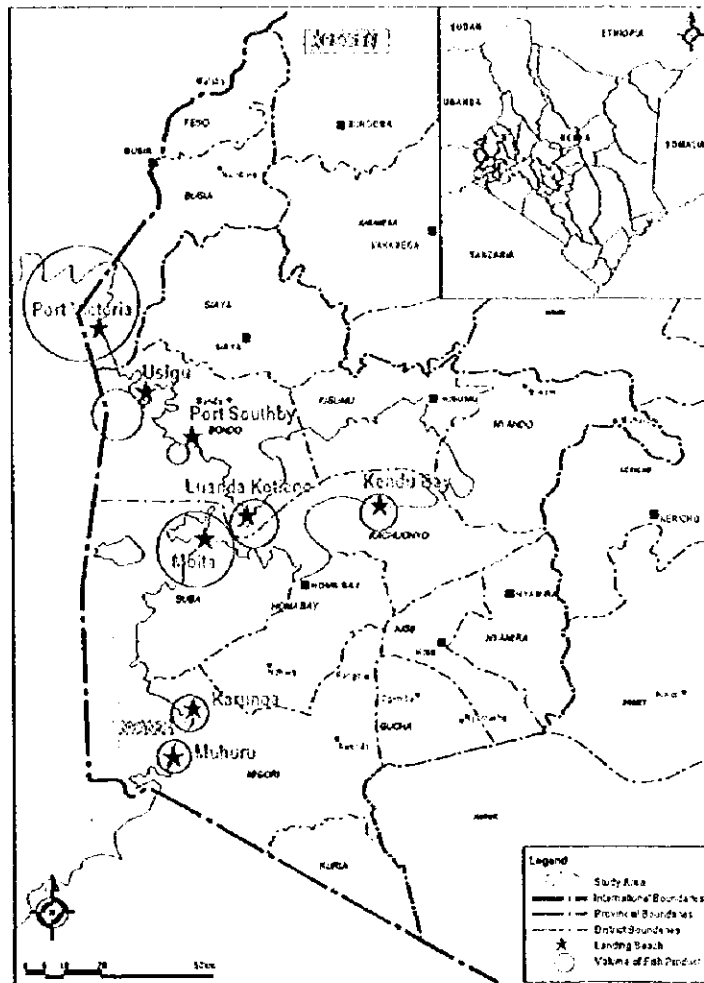
#### (3) Fishery Industry

The fishery industry alongside the shores of Lake Victoria is one of the most remarkable economic activities in the Study Area. The fresh water fish volume caught in the Study Area (Lake Victoria) accounts for around 98% of Kenya's total. Nileperch, Tilapia and Omena (small fish) are the popular catches. Even in terms of landed fish quantity including marine fish, the share of the Study Area reaches around 95% of Kenya' total.

Each district has many landing beaches where the fish products are unloaded from fish boats. Although a precise statistics about all fish products by landing beach do not exist, rough unloading volume can be estimated as shown in Fig. 2.1.2. Port Victoria assumed a dominant position followed by Mbita according to the unloading volume.







**Fig. 2.1.2 Fish Product by Landing Beach**

**(4) Mining and Manufacturing**

There is soapstone mining and there are tea, coffee, tobacco and grain mill factories in the Study Area. However, their economic size is very small. The share of wage employment generated by the manufacturing sector in the Study Area is very small with 4% in comparison with that generated by agriculture and other sectors. In addition, the manufacturing industry is concentrated not in rural areas but in cities and towns.

## 2.2 Geographic and Environmental Conditions

### (1) Topography

The Study Area is classified into the lake area, plain area, and hilly area. The lake area is located at the north-eastern edge of Lake Victoria. This area is quite flat, characterised by swamps and small lakes. The plain area is adjacent to the lake area. The densely populated areas, such as Kisumu and Homa Bay Towns, are located in this area. The hilly area is located mainly in Kisii District in the eastern part of the Study Area. The altitude of each area is approximately 1,150 ~ 1,300 m in the lake area, approximately 1,300 ~ 1,500 m in the plain area, and approximately 1,500 ~ 1,900 m in the hilly area.

### (2) Geology and Soil

Geologically, Kenya varies from the Precambrian to quaternary rocks, recent volcanics, and sediments. The oldest Precambrian rocks belong to the Nyazian and Kavirondan Groups, the outcrops of which are exposed around the Lake Victoria area. The young Precambrian rocks are represented by the Bukoban and the Basement complex, the latter of which is widespread in the peripheral eastern and western marginal areas of the Rift Valley, while the former occurs to the south east of Lake Victoria. A thick black cotton layer radiates around the routes C30, D250, D251 (Bumala – Port Victoria), and around the starting and ending points of C19 (Homa Bay – Mbita).

### (3) Climate

The annual mean temperature is approximately 22 ~ 26 degrees C in the lake and plain areas, and approximately 19 degrees C in the hilly area. The annual mean rainfall is approximately 800 ~ 1,800 mm in the lake and plain areas, and approximately 1,400 ~ 2,700 mm in the hilly area.

### (4) Flora and Fauna

The Savannah type vegetation, such as wooded grassland, bushed grassland, and bush-land, is dominant in most part of the Study Area, while forest occupies very few areas. In addition, wetlands are found in the lake area. There are some endemic species, especially of forest-dependent animals, as well as fresh-water fishes in Lake Victoria.

### (5) Environmental Protection System

#### 1) General

There is no general and integrated environmental law in Kenya. The government has, however, recently considered enacting such an integrated law. Kenya has 77 individual statutes related to the environment, such as Public Health Act; Factories Act; Food, Drugs and Chemical Substances Act; Forest Act; Wildlife Conservation and Management Act; Fish Industry Act; Agriculture Act and Land Planning Act. However, the statutes themselves are incomplete and not well enforced. The Ministry of Environment and Natural Resources has prepared a "National Environmental Action Plan" in order to prevent residents and natural resources from the degrading environmental conditions through various development projects, prior to the establishment of an integrated and comprehensive environmental law.

## 2) Responsible Authorities

There are several authorities, such as the Ministry of Environment and Natural Resources, the Ministry of Tourism and the Wildlife, Ministry of Land Reclamation, Regional and Water Development, the Ministry of Health and Ministry of Culture and Social Service, which are concerned with environmental conservation and management in Kenya. Among these authorities, the Ministry of Environment and Natural Resources has the main responsibility for the conservation and management of the natural environment and resources.

## 3) Environmental Impact Assessment (EIA) System

As environmental conditions have degraded as a result of large scale development projects and due to the lack of comprehensive environmental law and environmental impact assessment system, the Government of Kenya has issued a "Draft Report: Environmental Impact Assessment (EIA) (Guidelines and Administrative Procedures), Ministry of Environment and Natural Resources, 1996", in order to take necessary countermeasures for mitigating negative impacts caused by the projects.

## 4) Conservation Areas

The national parks, reserves, sanctuaries and local sanctuaries are regarded as conservation areas by Kenya Wildlife Service (KWS) under the Ministry of Tourism and Wildlife. There are two national parks in the Study Area, Ndere Island National Park and Ruma National Park.

## 2.3 Road Conditions

### (1) Road Network

The principal modes of Kenya's inland transport are the roads and railway modes. However, the roads play a significantly dominant role in both passenger and freight transport. The total length of the classified road network is estimated at 63,290.7 km, while that of the Study Area is around 8,000 km. The road network in the Study Area is presented in Fig. 2.3.1.

The classified road network consists of Class A, B, C, D and E+Special Purpose Roads. Table 2.3.1 shows the total length of the roads in the Study Area in comparison to Kenya's total classified road network.

### (2) Surface Conditions in the Study Area

The surface type of roads can be categorised into three types; namely bitumen standard, gravel surface and earth surface. The earth and gravel surface types of roads account for around 90% of the total classified roads in the Study Area. The surface of many earth and gravel roads becomes rutted after the rainy season.

The share of bitumen standard roads of the total road network in the Study Area is only around 10%. However, all roads classified as "A" or "B" category have a bitumen surface standard, and 46% of all "C" category roads have also a bitumen surface standard.

The bitumen road network, which comprises major trunk and primary roads, is well distributed as some sort of a basic frame of the road network in the Study Area. However, surface conditions of many parts of the bitumen standard roads have deteriorated due to lack of maintenance, and many potholes can be observed.

Fig. 2.3.2 shows the bitumen road network in the Study Area.

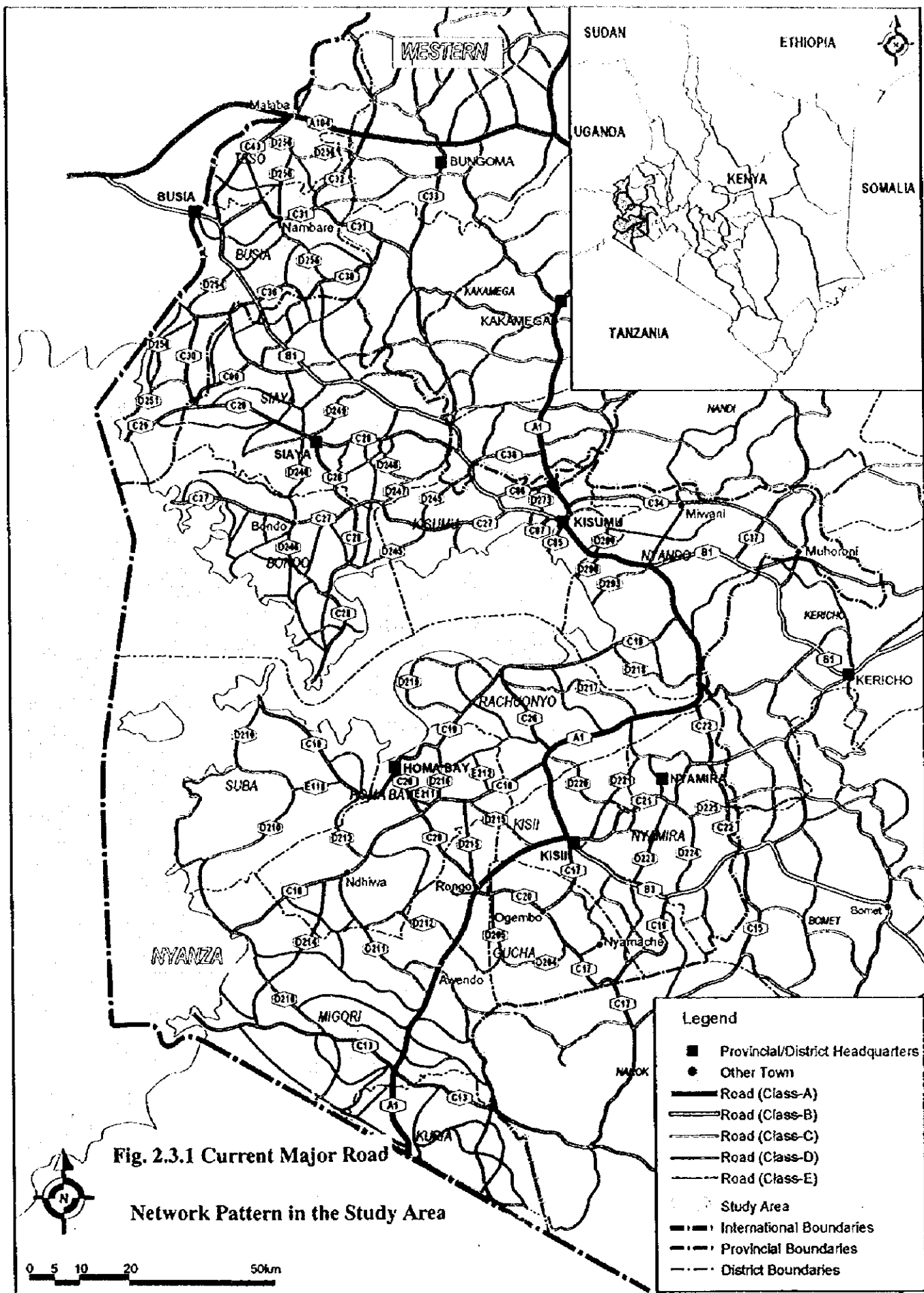
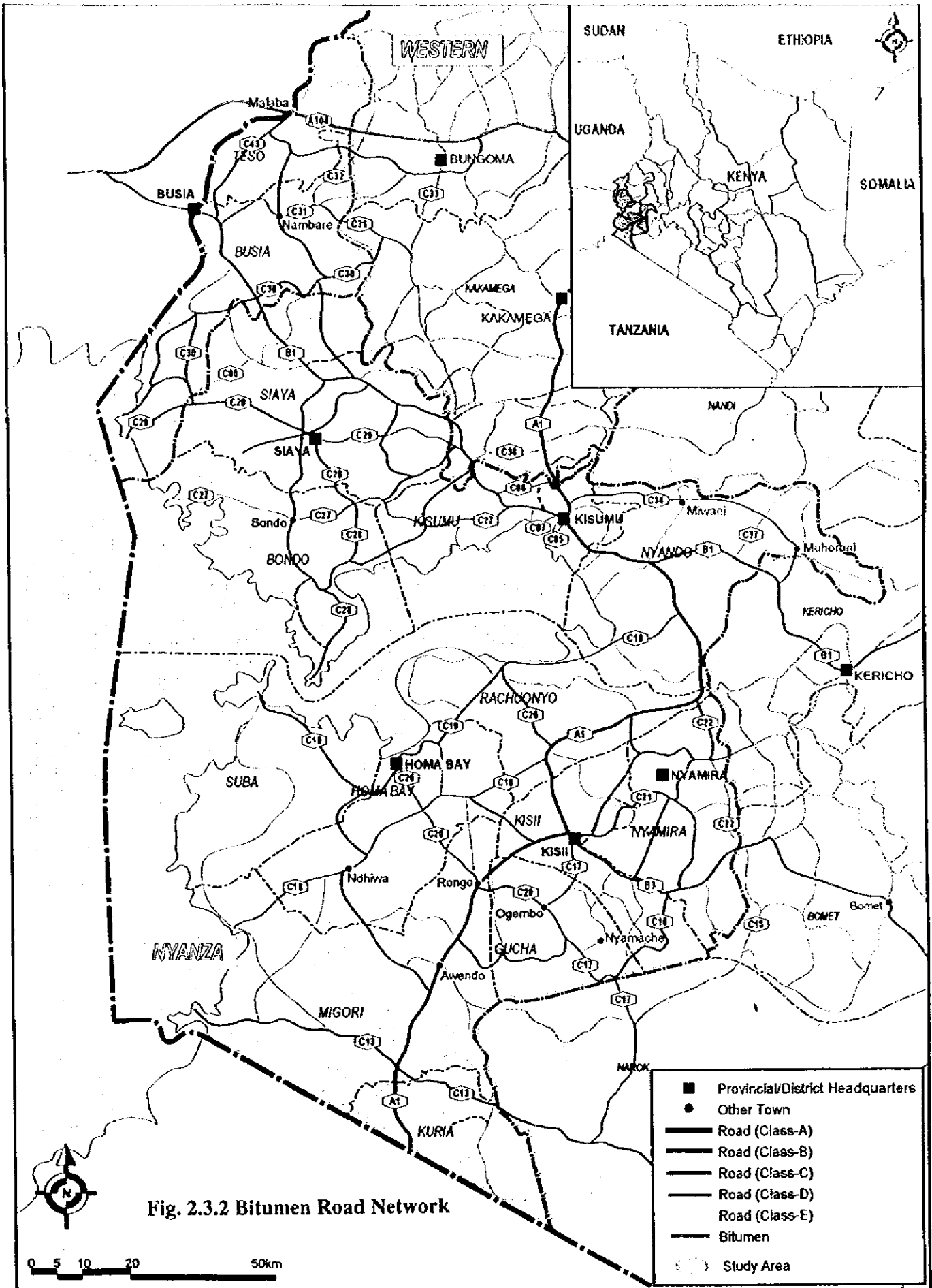


Table 2.3.1 Road Length by Classification and Surface Type

Area	Item	Class	Road Length (km)				Ratio of Class (%)	Ratio of Bitumen (%)	Ratio of Gravel (%)	Ratio of Earth (%)
			Bitumen	Gravel	Earth	Total				
Nation	International Trunk Rds	A	2,653	717	241	3,611	5.6	73.5	19.9	6.7
	National Trunk Rds	B	1,304	842	524	2,671	4.2	48.8	31.5	19.6
	Primary Rds	C	2,562	3,634	1,835	8,031	12.6	31.9	45.2	22.9
	Secondary Rds	D	1,184	6,570	3,585	11,339	17.7	10.4	57.9	31.6
	Minor Rds	E	749	7,651	18,670	27,071	42.3	2.8	28.3	69.0
	Special purpose road		220	8,487	2,513	11,220	17.5	2.0	75.6	22.4
	Sub Total			8,672	27,902	27,369	63,942	100.0	13.6	43.6
Nyanza Prov.	International Trunk Rds	A	210	0	0	210	2.9	100.0	0.0	0.0
	National Trunk Rds	B	153	0	0	153	2.1	100.0	0.0	0.0
	Primary Rds	C	382	478	14	875	12.0	43.7	54.7	1.6
	Secondary Rds	D	17	776	278	1,071	14.7	1.6	72.5	26.0
	Minor Rds	E	3	1,113	1,575	2,691	37.0	0.1	41.3	58.5
	Special purpose road		14	988	1,281	2,283	31.3	0.6	43.3	56.1
	Sub Total			779	3,354	3,148	7,282	100.0	10.7	46.1
Busia and Teso Districts	International Trunk Rds	A	15	0	0	15	1.9	100.0	0.0	0.0
	National Trunk Rds	B	27	0	0	27	3.4	100.0	0.0	0.0
	Primary Rds	C	0	165	0	165	20.8	0.0	100.0	0.0
	Secondary Rds	D	0	83	59	142	17.9	0.0	58.3	41.7
	Minor Rds	E	0	130	93	223	28.1	0.0	58.3	41.7
	Special purpose road		0	222	1	223	28.0	0.0	99.6	0.4
	Sub Total			42	601	153	796	100.0	5.3	75.5
Study Area	International Trunk Rds	A	225	0	0	225	2.8	100.0	0.0	0.0
	National Trunk Rds	B	180	0	0	180	2.2	100.0	0.0	0.0
	Primary Rds	C	382	644	14	1,040	12.9	36.7	61.9	1.4
	Secondary Rds	D	17	859	337	1,213	15.0	1.4	70.8	27.8
	Minor Rds	E	3	1,243	1,668	2,914	36.1	0.1	42.6	57.2
	Special purpose road		14	1,210	1,282	2,506	31.0	0.6	48.3	51.1
	Sub Total			821	3,955	3,301	8,078	100.0	10.2	49.0

Source 1) Schedule of Classified Road in 1996  
 Note 1) 14.8km of C31 is added in bitumen roads.



## 2.4 Traffic Characteristics

### (1) Traffic Volume

MOR&PW conducts a traffic count survey every two years over 8,000 stations covering major classified roads. One such survey excluding bicycles and pedestrians was undertaken in 1997. The traffic volume counted by MOR&PW on the rural roads in the Study Area is with a range of 100 to 2000 vehicles per day.

The Study Team therefore, taking the traffic survey stations established by MOR&PW into consideration and in order to determine the characteristics of the traffic on rural roads (see Table 2.4.1), carried out a supplementary traffic count survey, which also included the counting of the number of bicycles and pedestrians.

**Table 2.4.1 Traffic Volume Counts by the Study Team in 1999**

Unit: cars or persons

Station No.		1	2	3	4	5	Sub Total	6	7	8	9
		Car/Jeep /Wagon	Motor Cycles	Small Trucks	Medium & Large Trucks	Matatu/ Buses		Bicycles	Pedestrian	Animal/ Hand drawn	Others
1	D221	8	0	6	9	37	60	43	1209	0	9
2	D221	0	1	8	6	4	19	44	1110	6	0
3	C21	18	8	37	41	190	294	116	1439	1	34
4	C16	14	4	6	13	103	140	83	2730	0	50
5	D206	2	7	5	19	13	46	41	1779	19	0
6	C20	22	16	23	26	59	146	25	1453	8	68
7	C13	29	10	25	45	14	123	552	350	0	0
8	C19	22	5	13	41	42	123	113	263	2	0
9	C19	51	10	36	83	138	318	272	415	0	10
10	D254	52	6	28	8	2	96	1076	1534	3	9
11	D247	2	0	6	3	8	19	789	2230	16	5
12	D248	21	8	13	17	34	93	626	638	14	22
13	D249	41	21	33	36	6	137	3367	2100	10	8
14	C28	11	3	5	14	6	39	349	358	3	1
15	C28	10	1	1	18	27	57	460	1245	12	0
16	C90	11	6	6	13	22	58	718	714	60	0
17	C30	30	8	15	19	52	124	1518	328	0	4
18	D250	18	31	11	13	36	109	2006	1539	0	7
19	C43	42	11	54	26	7	140	524	324	4	0

Source: JICA Study Team

Note: Traffic count from 7 a.m. to 7 p.m.

Matatu is a passenger carrying vehicle with a seating capacity of more than 5 passengers but less than 25 passengers.



It is remarkable that according to the traffic count survey by the Study Team, a large number of pedestrians and bicycle-riders use the rural roads, while the volume of vehicle traffic is relatively small.

Fig. 2.4.1 shows a traffic volume diagram incorporating both the results obtained by MOR&PW and the JICA Study Team. According to the diagram, A1, B1 and B3 have large traffic volume since they serve as trunk roads. As for the rural roads, the C20 (Homa Bay -- Rongo) shows significant traffic volume.

## (2) Features of Trips

Through the analysis mentioned above, the following features on trips in the Study Area can be observed:

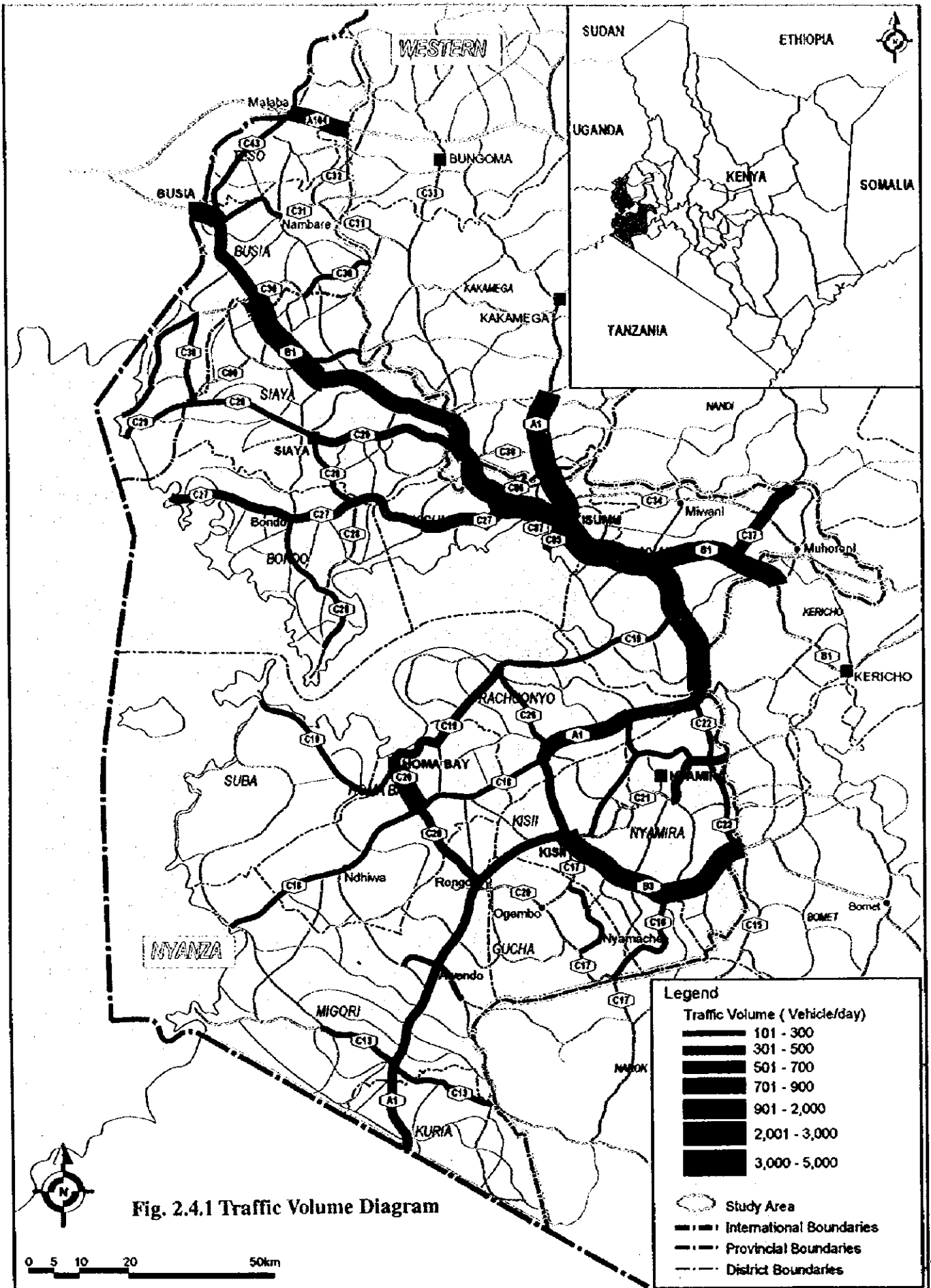
### 1) Regional Trips

Traffic volume on the rural roads reflects mainly through traffic. Matatu, bicycle and walking constitute important means of transport for daily lives of the residents, who live alongside the rural roads. In addition, most residents walk periodically for as long as one hour or more, for example to markets and hospitals, to draw water and / or to other places, in order to sustain their daily lives.

### 2) Transportation of Commodities

Most raw materials for the use of industrial products are acquired locally. On the other hand, commodities, such as processed tealeaves, coffee, cotton, sugar and raw fish, are often transported to major cities, such as Nairobi and Mombasa. It takes more than 6-8 hours to reach Nairobi and more than 12 hours to 1 days to reach Mombasa.

This indicates that in essence the establishment of a functional and diversified whole road network becomes imperative for ensuring smooth accessibility from the rural roads to the arterial trunk road network. Such system configuration plays a crucial role in the transportation of industrial products as well as raw materials within local areas.



## 2.5 Community Needs Survey

### (1) Survey Location

The "Community Needs Survey" was conducted at eight towns as shown in Table 2.5.1 and Fig. 2.5.1 for following purposes:

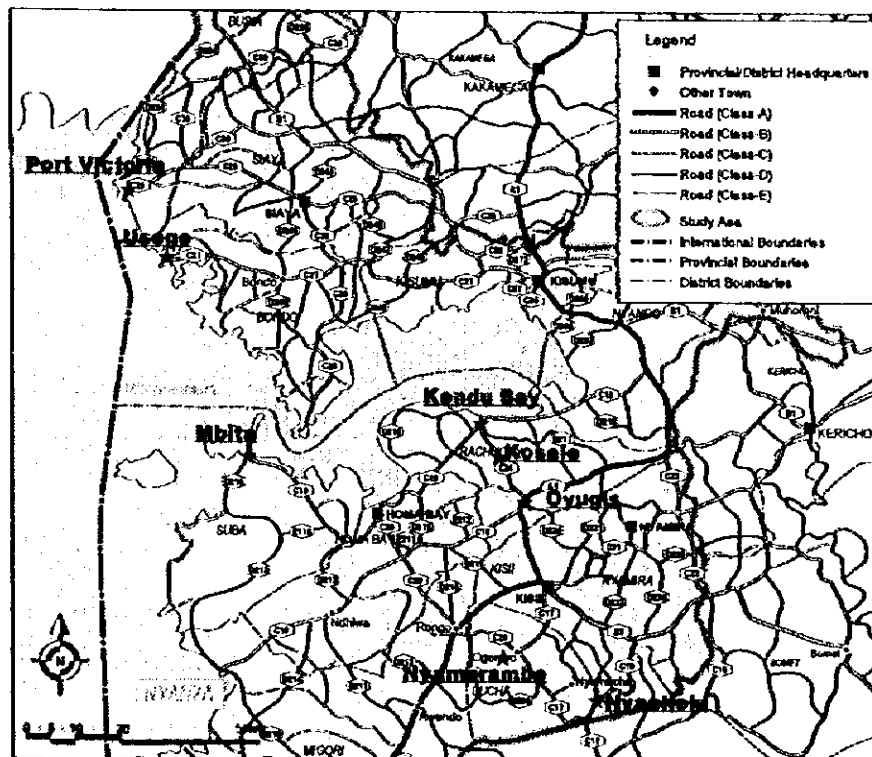
- to investigate the community profile of the Study Area in terms of ethnic background, demographic information, major economic activities and economic relationships to other regions, and so on (as for the detailed regional profiles of the eight towns, please refer to the main report);
- to survey the daily trip activities related to road transport in the Study Area;
- to investigate possibilities of local participation in road maintenance; and
- to survey the needs for roads improvement.

**Table 2.5.1 Eight Towns for Community Needs Survey**

	Good road condition	Poor road condition
Farming zone	Nyacheiki town (Gucha District)	Nyamarambe town (Gucha District)
	Oyugis town (Rachuonyo District)	Kosele town (Rachuonyo District)
Fishery zone	Kendu Bay (Rachuonyo District)	Mbita town (Suba District)
	Port Victoria (Busia District)	Usigu town (Siaya District)

### (2) Survey Method

The community needs survey was conducted through focus group discussions with local community members, interviews with local administrators, and market surveys.



**Fig. 2.5.1 Eight Towns Covered by the Community Needs Surveys**

**(3) Road Conditions and Availability of Goods**

The towns, where road condition are relatively better, are supplied with better commodities, both in terms of the variety of goods available, and their quantity of supply and prices. Many kinds of essential commodities like medical drugs are hard to obtain in areas, where roads towards major market centres are poor. Table 2.5.2 shows some examples for average prices of commodities in the towns in the survey area with good and poor road conditions. Average prices are higher by 3 – 10 % in town connected with poor condition roads.

**Table 2.5.2 Average Price of Essential Commodities**

	Good road condition	Poor road condition
Whole sale price of sugar (50 kg)	Ksh.1,923	Ksh.1,972
Maize flour (2 kg)	Ksh.49.7	Ksh.54.6
A pair of painkiller tablets ("Action")	Ksh.7.2	Ksh.6.8

Source: Community Needs Survey

In addition, there is a difference in the supply of food crops especially cereals between the farming zone and the fishery zone. While people in the farming zone face few problems in the supply of cereals, this is not the case in the fishery zone because local production alone cannot meet local demand in this zone, especially where the road condition to major markets is poor.

**(4) Access to Hospitals**

The improvement of classified roads will have positive effects on the accessibility to referral hospitals such as the district hospitals of each District. Many participants in focal group discussions held in the towns conducted with poor road condition complained about the amount of money and time they needed to spend to reach these hospitals, especially during the rainy season. In fact, it takes 90 minutes and Ksh. 100 for people of Mbita town to go to District Hospital in Homa Bay; 60 minutes and Ksh. 70 for residents of Port Victoria to visit the Nangia Mission Hospital.

**(5) Community Needs for Road Improvement****1) Needs for the Improvement of Classified Roads**

Local communities consider poor road conditions to be a constraint to both their access to goods and hospitals, and for the development of the local economy. Actually, the means of transportation is difficult and expensive to procure and vehicles get often stuck during the rainy season.

Communities in both the farming and fishery zones acknowledge the needs and the demand for improvement of classified roads in order to alleviate the following problems:

- i. Lack of variety of commodities, especially drugs that are not available locally;
- ii. Some foods disappear from local market during the rainy season;
- iii. Medical institutions, especially referral hospitals are hard to visit;
- iv. Bringing commodities to market needs additional time and costs;
- v. Few outside agents come to buy the local commodities; and
- vi. Farming/fishing inputs are hard to obtain.

## 2) Needs for the Improvement of Feeder Roads

The Survey found, however, that merely improving classified roads is not enough. This is especially important because the majority of people in the rural areas both in the farming and in the fishing zones, live far from towns or classified roads.

## (6) Community Participation in Roads Maintenance

The management of community participation in road maintenance is essential. Based on the results of the Survey, there are several experiences in the Study Area gained with local people's participation in the maintenance of roads. However, there are some crucial conditions that should be taken into account for successful community management in classified road maintenance.

### 1) Financial Support and Technical Expertise

Local community members lack the financial as well as technical resources necessary for maintaining the roads by their own. External support will be needed, as otherwise effective and appropriate maintenance will hardly be attained.

### 2) Feeling Stakeholders

People may fail to contribute to the maintenance efforts even though they know that they will benefit from doing so, since the classified roads are used by a large number of users.

Unless local people feel that they are stakeholders of the roads and that responsibility of management falls at least partially on them, community participation will hardly materialise without huge payments. One way to

cultivate the sense of stakeholders in local people is to integrate them in the improvement work of the roads so that people 'feel' that they are part of the process of the making of roads.

## 2.6 Road Improvement and Maintenance System

### (1) Roads 2000 Maintenance Programme

The Roads 2000 Maintenance Programme started the full-scale implementation of the policies and strategies on road network maintenance by MOR&PW as a national basis in co-operation with the World Bank and other donors.

### (2) Ministerial Reform Policy and Privatisation

The Government of Kenya has launched several reform initiatives aiming at improving the performance of ministries and departments in order to enhance their capacity in executing government policies. These initiatives are based on the Economic Reform and Structural Adjustment Programme (ERSAP), which has been undertaken in the Republic of Kenya. The ministerial reform policy is to separate ministerial functions that would be suitable for the private sector and hence, reduce the number of staff. All departments are reviewed to minimise their tasks and to introduce commercial mechanism. MOR&PW are requested to reduce the staff from 15,778 staff current in-post to an optimal level of 8,073, a reduction of 7,705 which is equivalent to 48% of the total current staff.

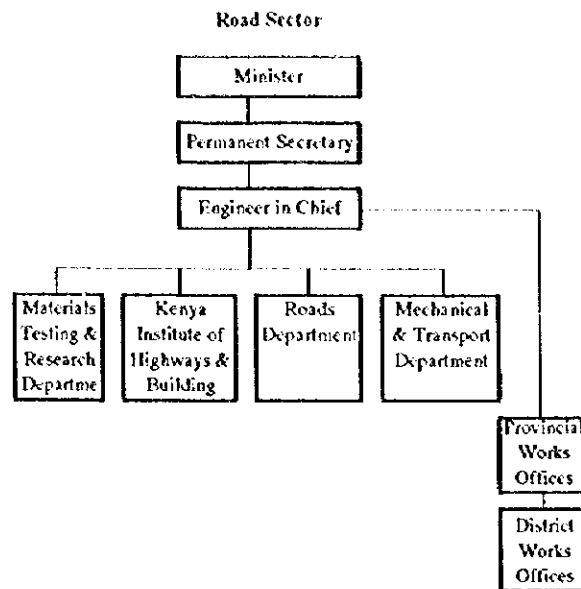
Another target in MOR&PW is to commercialise the Mechanical and Transport Department into a lease company of construction equipment.

### (3) Organisation of MOR&PW

MOR&PW has four departments in its road sector. The name of the departments and the responsibility are shown in Table 2.6.1. Each department has a Chief Engineer or a Principal Engineer. Their organisation structure is shown in Fig. 2.6.1.

**Table 2.6.1 Department and Responsibility of MOR&PW**

Department	Responsibility
Road Department	Road maintenance management, design and construction and maintenance planning
Materials Testing and Research Department	Testing of engineering and non-engineering materials for building and road construction
Mechanical and Transport Department	Serving, maintaining and rehabilitating construction equipment, plant and vehicles
Kenya Institute of Highway & Building	Staff training



**Fig. 2.6.1 Organisation of MOR&PW**

**(4) Provincial Works Office**

MOR&PW is responsible for the classified roads and local government is in charge of non-classified roads. MOR&PW has as a branch office Provincial Works Offices (PWO) and District Works Offices (DWO) in every Province and District. In the Study Area, there are two Provincial Works Offices, one each in Nyanza and Western Provinces, with the Nyanza PWO having 12 District Works Offices and the Western PWO having two District Works Offices.

Provincial Works Offices are in charge of bitumen standard roads and inter-district earth and gravel roads, and District Works Offices are in charge of earth and gravel roads in their districts.

Provincial Works Offices and District Works Offices have a Roads Department, Mechanical Department, and a Building Department supported by administration staff.

The Provincial Mechanical Department has a Provincial Workshop, which maintains and repairs road maintenance equipment and supervises vehicles.

Each Provincial Work Office has a Provincial Work Officer, Provincial Road Engineer and Mechanical Engineer. The total number of staff is 10 for Western PWO and 15 for Nyanza PWO.

Table 2.6.2 shows road responsibility by the Provincial Works Offices and District Works Offices in the Study Area.

Table 2.6.2 Maintenance Responsible Roads by PWOs and DWOs.

Province	District	Town	Road Class					Unit : Km		
			A	B	C	D	E	SPR	Total	%
Naynza	Kisumu									
Bond	Bond		0	0	104.2	24.3	289.7	97.2	515.4	6.4%
Gucha	Ogenbo		0	0	60.8	87.0	175.8	183.7	507.3	6.3%
Homa Bay	Homa Bay		0	0	104.5	91	190.6	109.8	495.9	6.1%
Kisii	Kisii		31.0	30.2	24.2	70.2	207.1	195.5	558.2	6.9%
Kisumu	Kisumu		68.1	55.2	170.6	148.1	404.1	808.0	1,654.1	20.5%
Nyando	Nyando	(included in Kisumu)							0.0	0.0%
Kuria	Kebancha		16.0	0	20.0	29.5	140.0	75.1	280.6	3.5%
Migori	Rongo		53.0	0	68.6	128.4	404.3	347.8	1,002.1	12.4%
Nyamira	Nyamira		0	18.0	88.7	143.8	214.5	174.9	639.9	7.9%
Rachounyo	Rachono		42	0	65.4	103.2	76.1	184.3	471.0	5.8%
Siaya	Siaya		0	49.5	124.5	181.5	343.4	106.2	805.1	10.0%
Suba	Mbita		0.0	0.0	43.0	64.0	245.0	0.0	352.0	4.4%
Western	Kakamega									
Busia	Busia		0	27	123.3	86.5	161.9	142.1	540.8	6.7%
Teso	Teso		15.1	0	42.1	55.7	61.5	81.1	255.5	3.2%
<b>Total</b>			<b>225.2</b>	<b>179.9</b>	<b>1,039.9</b>	<b>1,213.2</b>	<b>2,914.0</b>	<b>2,505.7</b>	<b>8,071.9</b>	<b>100%</b>

Source: MOR&amp;PW

## (5) Staffing

The total number of all Districts' Staffs is approximately 440 persons. A District Road Department has a number of 40 to 50 persons in the well-established District Work Officers (DWOs). The District Mechanical Department has a number of 20 to 40 persons in the well-established DWOs.

Provincial Works Officers and District Works Officers are well qualified in terms of educational background (college graduate level) and practical road maintenance operation including contract-out management. However, other staff in the Provincial Offices and District Offices is less qualified and less experienced in both fields.

The detailed number of staff is tabulated in Table 2.6.3.



Table 2.6.3 Number of District Staff

District	DWO	Road Department	Mechanical Department	Building Department	Total
Bond	1	0	0	0	1
Gucha	1	28	7	18	54
Homa Bay	1	15	2	0	18
Kisli	1	59	45	1	106
Kisumu	1	50	0	0	51
Kuria	1	18	8	0	27
Migori	1	40	0	0	41
Nyamira	1	0	15	0	16
Nyando	1	23	5	0	29
Rachuonyo	1	12	0	0	13
Siaya	1	49	26	0	76
Suba	1	2	2	3	8
Busia	1	45	9	0	55
Teso	1	21	19	10	51
Total	12	296	110	22	440
Average	1	25	9	2	37
Max.	1	59	45	18	106
Min.	1	0	0	0	1
Percentage	3%	67%	25%	5%	100

Source: Interview with DWOs (as of April 1999)

## (6) Equipment

### 1) Provincial Mechanical Workshop

The Provincial Mechanical Workshop undertakes heavy type of repair and maintenance of the equipment. There are two Mechanical Workshops in Kisumu in Nyanza Province and in Kakamega in Western Province.

### 2) District Mechanical Workshop

The District Mechanical Workshops (DMW) assume responsibility for the maintenance and minor repair of equipment and supervising of vehicles. Most of DMW have no sufficient facilities and tools in order to meet the requirements. The lack of spar parts and a slow procurement system reduce the efficiency of operating machines.

The total number of equipment for road maintenance in the District Works Offices in the Study Area reaches approximately 100. The number of workable equipment is, however, only 36 equipment, which represents 36% of the total number. Most of equipment is aged and some are exceeding the life of equipment.

A total number of 24 units of motor graders are used for gravel and earth road maintenance. Out of this, only eight units are reported as workable.

(7) Maintenance Work

1) Road Inventory

A systematic road inventory has not yet been assembled. DWO prepares once per year a road inventory for budget preparation and road patrols, in case in emergency was reported, decided the scope of the maintenance works. Due to a lack of budget, the current road inventory shows only the road classification, road distance, surface type and traffic volume on major sections. No detailed map, milestone and past maintenance record exist.

2) Maintenance Activities

a) Past and Current Maintenance Activities

The Minor Road Programme was introduced in Kenya in the 1980s in order to maintain rural roads based on a labour intensive approach under which roads were maintained by labour work only. In the 1990s, the Road Maintenance Initiative was introduced. Emphasis was placed not on new road projects but on maintenance of roads. The Labour Based Methods approach was introduced in co-operation with many relevant donors by using simple equipment and local labour on a project basis.

Following the Road Maintenance Initiative, all road maintenance strategies were integrated into the Roads 2000 Maintenance Programme, which is shifting away from project oriented road maintenance toward network based planning and implementation, using Labour Based Methods in the cases, in which it is economically feasible. The Roads 2000 Maintenance Programme was drafted jointly by donors and MOR&PW and it has authorised in 1997 as a road maintenance strategy by the Government of Kenya. The key programme elements are as follows:

- Improved funding arrangement,
- Introducing Labour Based Methods,
- Developing an appropriate road maintenance management system, and
- Enhancing the use of the private sector in road maintenance.

b) Labour Based Methods

Initially, a labour intensive approach, which used labour only in road maintenance works, had been introduced due to lack of construction equipment.

The labour intensive approach was developed to LBM using minimum equipment and local labour for routine and periodic maintenance on earth and gravel roads.

LBM is operations characterised by the extensive use of casual or contract labourers recruited to work on roads in their own locality. For the bituminous standard roads, LBM is used only for off-carriageway maintenance.

c) Recurrent Maintenance

i) Routine Maintenance

The major activities of routine maintenance consist of cyclic work type and reactive work type: the former is vegetation control, and clearing side drains and culverts, the latter is crack sealing, patching, and edge repair.

ii) Periodic maintenance

The main work tasks of periodic maintenance consist of overlay of bituminous pavement (resealing), rehabilitation and spot improvement. Overlay of bituminous pavement and rehabilitation are usually contracted out to contractors. In terms of spot improvement, the Roads 2000 Maintenance Programme has introduced this maintenance work, which is defined as "the work is principally to be carried out using the labour based methods". Small regravelling on the spot, installation or re-installation of small pipe culverts, minor rehabilitation of structure, and minor reconstruction of gravel shoulder are in practice partly by force account of MOR&PW and partly by contract-out.

(8) Road Improvement

Upgrading of pavement from gravel to bituminous standard, widening, realignment, new section construction fall under development and improvement in the definitions. They are defined not as maintenance but as improvement and are carried out so far through external assistance.

(9) Construction Industry

The construction firms are categorised into four contractors by their sizes, i.e., large-scale contractors, medium-scale contractors, small-scale contractors, and

labour based contractors. There are one large-scale, three medium-scale, and around 10 small-scale contractors in the Study Area. The large-scale contractor has construction equipment and asphalt materials for the road construction and maintenance works. However, most of the medium and small-scale contractors have not enough equipment and their financial status is very weak. In terms of labour based contractors, they have no equipment but co-ordination function of labour for road maintenance.

(10) Training

There is no systematic training programme for Provincial Work Officers, District Work Officers and other local officers of MOR&PW except on the Labour Based Methods, for which the Kenya Institute Highway and Building Technology (KIHBT) offers a course. Some ad-hoc seminars and training courses have been organised by donors for particular objectives. Only on-the-job is so far the main training form for local staff of MOR&PW.

(11) Budget

Table 2.6.4 shows the maintenance budgets of DWOs in terms of recurrent expenditures, while Table 2.6.5 shows the development budget used for road improvement. Both budgets are reported as insufficient to meet the requirements of proper road maintenance and improvement.

**Table 2.6.4 Road Maintenance Budgets of DWOs**

Unit: 1,000Ksh.

District	1996/97	1997/98	1998/99	1999/00
Teso	0	1,026	1,851	10,097
Busia	20,085	14,433	1,650	13,197
Homa Bay	0	0	2,000	11,061
Suba	0	6,223	2,670	8,966
Siaya	38,128	40,933	2,445	10,593
Gucha	0	0	1,600	11,267
Kuria	13,844	30,120	1,664	8,731
Rachounyo	5,120	2,000	1,255	17,098
Migori	0	0	5,088	14,829
Bond	0	0	0	7,062
Kisii	0	27,084	14,932	14,972
Kisumu	10,300	10,400	20,358	8,361
Nyamira	0	4,692	2,728	5,853
Nyando	0	0	0	9,457
Total	87,477	136,911	58,241	151,544

Source: 1996/97 Interview with DWO  
1989/99, 1999/00 Annual Work Plan (1999/00 is on a request base)

**Table 2.6.5 Recurrent and Development Budgets of DWOs**

Unit: 1,000 K

	1996/97	1997/98	1998/99	1999/00
Recurrent Budget	44,338	74,249	44,727	151,544
Development Budget	43,138	61,636	35,600	19,787
<b>Total</b>	<b>87,476</b>	<b>135,885</b>	<b>80,327</b>	<b>171,331</b>

Source: 1996/97 Interview with DWO  
1989/99, 1999/00 Annual Work Plan (1999/90 is on a request base)

**(12) Support by Donors**

All past road maintenance activities are incorporated into the Roads 2000 Maintenance Programme at present. Many donors are expressing the support for the Roads 2000 Maintenance Programme and Table 2.6.6 shows the current status of donors' assistance for road maintenance under the Roads 2000 Maintenance Programme in Kenya.

**Table 2.6.6 Support by Donors**

Donors	Budget	Status	Period	Main Districts
Sida	Ksh. 270 mill.	Ongoing	1997-2000	Nyeri and others
EC	Ksh. 700 mill.	Ongoing	1998-2001	Meru and others
KFW	Ksh. 550 mill.	Procurement of consultancy	1999-2004	Nakuru and others
Danida	Ksh. 776 mill.	Agreement signed	1999-2004	Kilifi and others
World Bank	US\$ 30 mill.	Pre-appraisal	1999-2004	Nyandarua and others
ADB	US\$ 14 mill.	Pre-appraisal	1999-2003	Kajiado and others
USAID	US\$ 13.3 mill.	Procurement of consultancy	1999-2003	Kiambu and others

Source: MOR&PW

**Chapter 3**  
**Identification**  
**of**  
**Problems and Development Directions**

## Chapter 3 Identification of Problems and Development Directions

### 3.1 Economic and Social Aspects

#### 3.1.1 Current Problems

##### (1) Population Distribution

Although there are several major cities and towns, not ribbon-typed development along side the roads, but widely spread out area-development is observed in the Study Area. This population distribution generates traffic demand even on minor and feeder roads.

##### (2) Daily Trips

Many people due to low vehicle ownership in this region, walk to their destinations for more than one hour for shopping and other purposes in daily lives whereas the Matatu is the only means of public transport for distant trips. These trips, walking and even Matatu, suffer during the rainy season from muddy condition of the earth and gravel roads.

##### (3) Agriculture

One of the problems in the agricultural sector within the Study Area is uniformity of agricultural products. Although the Study Area can be divided into three zones according to geographic and climate conditions, similar major agricultural products such as maize, sugar cane and cotton are grown in the plain agricultural area. These products can be observed almost everywhere in Kenya as common agricultural products so that the competitiveness in markets is weak.

Tea and coffee, on the other hand, are the special products in the Study Area. Nevertheless, a lot of tealeaves become rotten in the rainy seasons due to lack of transportation to processing factories, which are located in large cities.

##### (4) Fishery Industry

The fishery industry is one characterised by significant economic activities in the Study Area. Around 95 % of the fish products including marine fish in Kenya is landed in the Study Area. Some of the raw Nileperch and Tilapia are transported to Nairobi and Mombasa under iced conditions. Freshness is an important factor when transporting fish to distant markets. Hence, a prompt and stable transport system is the key to the success of such business. Sometimes, part of the fish products become rotten in the rainy season due to

lack of transportation to inland local markets. This has caused much economic loss to the region.

(5) Manufacturing

There are small manufacturing factories such as can-food processing and grain mill factories in the Study Area. The portion of wage employee is as small as 4% and the manufacturing industry is not particularly active so far. As manufacturing factories are located in the cities and towns such as Kisumu, they are initially built at well accessible locations near trunk roads.

(6) Matatu Service

Matatu plays a very important role as a means of public transportation in this region by connecting villages to major local cities and towns and even to Nairobi and Mombasa, where high quality markets and high-ranking hospitals are located. Usually, Matatu is heavily loaded with passengers and sometimes with cargoes making it at times difficult for them to pass along gravel and earth roads due to the deteriorated surface condition, especially during the rainy season. When it rains for many days, this hinders subsistence of the residents.

(7) Problems from a Community Needs Point of View

The following problems are summarised as a result of community needs survey.

1) Price on Commodities

Prices of commodities in the areas with poor road conditions are higher than in those areas with good road conditions.

2) Long Access to Referral Hospitals

Referral hospitals such as the district ones are usually located far from villages and it takes more than one hour and costs Ksh. 70-100 by Matatu to reach there.

3) Lack of Commodity Supply in Villages

The variety of commodities is limited, since suppliers do not serve enough commodities in areas with poor road conditions.

4) Less Competitiveness in Selling Products

People living in the areas with the poor road conditions are forced to pay additional cost and time in transport to bring agricultural products to markets.



This reduces competitiveness of the products in the markets, so that few outside agents come to buy local commodities as well.

### **3.1.2 Directions in Road Network Development**

Road network itself is well developed in the Study Area with a relatively proper hierarchy structure. However, there are many problems in terms of surface conditions. People suffer from rutted earth and gravel roads, and even bitumen standard roads in their daily trips, particularly in the rainy seasons. This situation brings about serious problems on socio-economic fields.

The development directions in road network needed in order to alleviate the current socio-economic problems are summarised into the following two items:

#### **1) Road Network to Support Local Economic Activities**

Spoilage of fish products and rotten tealeaves often occurs in the rainy season due to lack of well-maintained road network. In this view, it is, therefore, important to develop high priority road sections with a view to connect producing areas with current trunk roads, which are connecting to processing factories and major inland markets. Especially road development for fish transport is imminent, since fish landing beaches are distributed away from towns and they are all located in the areas alongside Lake Victoria, which is served by earth and gravel roads. This also helps the commodity supply in fishery zones where the variety of commodities is sometimes in short.

#### **2) Road Network to Support Daily Lives of Residents**

People, who live in the Study Area have also suffered from inconvenience in their daily life activities caused by poor conditions of the rural roads. As the population is widely distributed in the rural areas, it becomes a key issue to establish road network, which integrates efficiently the trunk roads and rural roads into one system, and which covers widely the residential areas.

In addition, it is also crucial to improve accessibility from villages to major public facilities in order to enhance the daily lives of the residents in the rural area.

### **3.2 Problems and Directions for Road Maintenance**

#### **(1) Maintenance Activities**

##### **1) Current Road Conditions**

Many gravel and earth roads have critical spots and muddy conditions to such an extent that traffic cannot pass for a certain period during the rainy season.

Budget limitations make it impossible to upgrade all rural roads to all-weather standard roads (bitumen roads) over a short time span. Efficient and effective road maintenance work is required.

Even for the bitumen standard roads, there are many potholes and, in the worst case, vehicles have to drive on the off-carriageway, it since provides more stable driving condition.

## 2) Road Inventory

The present road inventory is insufficient due to lack of necessary budget and only records the road numbers, district numbers, road length and traffic volume on each classified road. Given the conditions of the road inventory, even MOR&PW' staff cannot identify the road sections to maintain and the necessary maintenance work items to be carried out. The establishment of a road inventory system, which records current road situations by section is essential on the basis of routine monitoring in order to provide pertinent road maintenance.

## 3) Introduction of Total Maintenance Management

A clear strategy and direction for road maintenance has not been established so far, though the Roads 2000 Maintenance Programme is implemented based on the Labour Based Methods. Consistency with the budget, staff and category of maintenance management criteria for contracting out and the force account is precondition under the privatisation scheme and forthcoming structural reform in order to ensure prompt and proper road maintenance works.

## 4) Equipment-based Approach

The Labour Based Methods have been employed with a minimum of equipment such as small rollers and labour force under the Roads 2000 maintenance Programme; in some cases through community participation. However, this method has limitations to meet the current technology standard. As road maintenance requirements increase, a combination of equipment such as graders and bulldozers and labour force is recommended. Applying such an adjusted approach will decrease the life cycle of structures.

## 5) Appropriate Technology Development

The current road construction and maintenance follow the MOR&PW standards that were established in 1987. The present standards are applied widely and equally to the maintenance work without consideration of specific and local climate, geological conditions, and material resources. There are a lot of problems in the field of very expensive operations and short durable life of road and pavement.

There is a necessity of future research and studies in order to improve the durability and strength of the road. This will extend the life of road and pavement structures and develop cost-saving design and construction methods within a framework that considers local climate, materials and geological conditions.

#### 6) Rearrangement of Workshops for Maintenance Equipment

Each District Offices have maintenance equipment at present. This means that scarce equipment is distributed to every office, and some of the equipment are not available due to lack of proper maintenance and over-age. In extreme cases, some District Work Offices have not available equipment in a "ready-for-use" status.

A higher level of concentration of equipment is, therefore, desirable from a viewpoint of effective use and easy maintenance of the equipment, so that the necessary equipment become commonly available and more effective maintenance of the equipment can materialise.

#### 7) Demarcation of Responsibilities for PWO and DWO

The Provincial Work Offices have responsibility for maintenance of bitumen standard and inter-district classified roads, while the District Work Offices are in charge of earth and gravel roads in the districts. One of the reasons of poor maintenance of bitumen standard roads is lack of the necessary budget resources and another reason is the demarcation of relations mentioned above. The District Work Offices realise the necessity for maintenance, but cannot cope with this matter, since the Provincial Work Offices are responsible. It is effective that the District Work Offices assume responsibility for routine maintenance work such as patching and others even in bitumen standard roads in the districts.

#### (2) Strengthening the Construction Industry

There is only one large-scale construction contractor. Medium and small-scale contractors are dominant in the Study Area. The current medium and small-scale contractors have not enough construction equipment due to lack of own funds. In addition, payment to contractors by the Government is sometimes delayed due to budget constraints. These conditions prevent contractors from participation in tenders for road maintenance.

However, it becomes crucial for these contractors to cater for future road maintenance in Kenya, especially for the rural roads, which extend all over the country. Contracting-out of major road maintenance works is expected, though some are still on a trial basis.

Moreover, after the institutional reform of MOR&PW, many employees will have to leave their jobs, and medium and small-scale contractors are one of possible job opportunities.

It is necessary to strengthen and foster the construction industry with a view to meet the road maintenance requirements and also to promote the local economy. In this context, the following direction is of importance:

- creation of equipment leasing or rental market for the medium and small-scale contractors, and
- creation of basic conditions such as credit facilities for improving cash flow, and provision of a guarantee facility for tender and performance bonds for the medium and small-scale contractors so that they can easily participate in tenders for road maintenance works.

**(3) Community Participation**

Although a combination of the equipment and labour Based Method approaches is recommended, the Labour Based Methods will still be effective for rural road maintenance for the time being, since enough equipment will not be provided soon. Community participation alongside the rural roads through the Labour Based Methods for routine road maintenance is necessary with the support by MOR &PW.

**(4) Transparency on Budgetary Allocation for Road Maintenance**

One of the objectives of the Roads Board is the management of the Maintenance Fuel Levy Fund. After the establishment of Roads Board, transparency in the use of and allocation of road budget for road maintenance is expected. It is

necessary to involve some representatives of the public in order to make the most use of this system. This will contribute to increase the level of accountability to the nation with respect to the budget for road maintenance.

(5) Human Resource Development

1) Training for Government Staff

Reductions in the member of staff of MOR&PW and privatisation are a basic feature of the institutional reform, which is currently planned. Senior staff has to quit the job in MOR&PW due to early retirement, and matured engineers and administrators have also to leave their positions. In addition, further introduction of the contracting-out system in road maintenance will deprive middle and young age staff of the opportunity of practical road maintenance works.

These may accelerate the situations of lack of management capability and experienced staff.

Training for maintenance management and actual operational work becomes inevitable in this context.

2) Training for Private Contractors

As previously mentioned, strengthening of private contractors becomes important to meet the road maintenance needs. Training objectives and target-groups must be extended to include the private contractors as well.

## **Chapter 4**

# **Road Network Improvement Plan**

## **Chapter 4 Road Network Improvement Plan**

### **4.1 Roles and Functions of Rural Roads**

Two main aspects represent the roles and functions of the rural roads: local economy enhancement and the enhancement of the quality of life of residents through supporting their daily activities.

#### **(1) Local Economy Enhancement**

The roles and functions of the rural roads from a viewpoint of local economy enhancement are summarised as follows:

- to maintain accessibility to the existing arterial trunk roads such as A1, B1 and B3, which connect to Nairobi and Mombasa, and
- to keep accessibility to the local major towns and centres where relevant factories and other related facilities are currently located.

#### **(2) Enhancement of Quality of Life**

Trips can be divided into two categories; namely daily trips and non-daily trips. In terms of daily trips, most trips consist of walking or bicycle riding in case which destinations are not so far though walking time sometimes exceeds more than 60 minutes. Matatu is the major means of transport to more distant destination.

Taking these facts into consideration, the following may be summarised as the roles and functions of the rural roads:

- to provide facilities for stable and safe walking trips even on earth and gravel road,
- to provide routes for means of public transport such as Matatu, and
- to maintain accessibility to major public facilities (higher rank facilities) such as large markets, high ranking hospitals and administrative centres, which are usually located around local major cities.

### **4.2 Design Standard**

#### **(1) Geometric Conditions**

##### **1) Cross Section**

Most of the Class C roads seem to have kept the necessary pertinent right of way and carriageways, though narrow carriageways can be partly observed. The widths of carriageways of Class D and E roads vary from place to place depending on the surrounding conditions, since no improvement to meet design criteria has been undertaken for a long time.

## 2) Horizontal Alignment

Generally speaking, most of the rural roads have comparatively good horizontal alignment except for some sections, where the roads cross small rivers in mountainous areas.

## 3) Longitudinal Alignment

Longitudinal gradients of more than 8% can be observed at some road sections in mountainous areas. In other areas, the condition seems to be satisfactory in terms of longitudinal alignment.

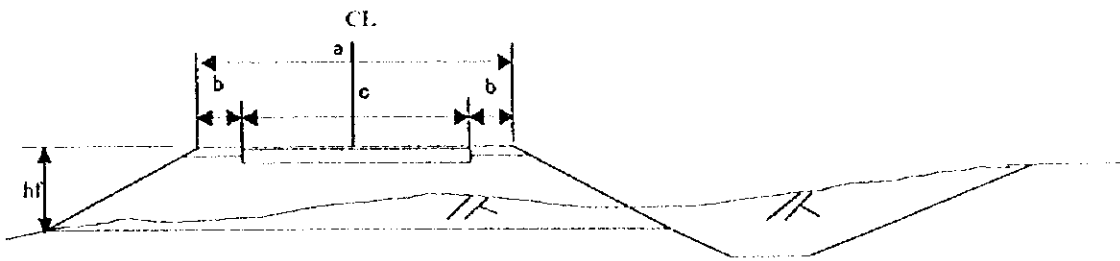
## (2) Design Standard of Cross Section

The geometric road design manual was prepared in 1979. The number and width of carriageways and shoulders, therefore, appear to be rigidly set without given proper consideration to the level of service and technical or economic road capacity criteria for assessing road service quality for justifying an appropriate widening. The following are the major points needing revision and standardisation in future in order to meet national and users' needs:

- the current design speed of Class C Roads (90-100 km/h) on flat area is considered unnecessarily high,
- suitable shoulders width should be standardised in order to cater to pedestrian and the volume of bicycle traffic.
- Guideline on a more detailed and diversified drainage system should be included into the manual for mountainous areas in order to cope with intensive rainfall and also to furnish cost effective drainage systems.

The current standard cross-sections are shown in Figure 4.2.1.





Note: The slope of fill :  
 1:1 where  $hf \leq 1m$   
 1:2 where  $1m < hf \leq 3m$   
 1:1.5 where  $hf > 3m$

Cross Section			Dimensions in Metres			Normal Cross Fall in %
Type	Lanes	Surfacing	a	b	c	s
II	2	Bitumen	11.0	2.0	7.0	2.5
III	2	Bitumen	9.5	1.5	6.5	2.5
IV	2	Bitumen	8.0	1.0	6.0	2.5
V	1	Bitumen	7.0	1.5	4.0	2.5
VI	1	Bitumen	5.0	0.5	4.0	2.5
VII	2	Gravel	8.0			4.0
VIII	1	Earth/Gravel	6.0			5.0

Note: Type V and VIII are only interim solutions (stage construction)

Fig. 4.2.1 Typical Cross Section

### (3) Drainage

One of the most important elements of road design, operation and maintenance is to provide adequate and functional drainage. Roads need good drainage to operate safely and undertake adequately necessary maintenance throughout their useful life-cycle.

As a whole, the current drainage structure in the Study Area appears to be poor. Most of the embanked roads do not have drainage, and non-embanked roads have simple side ditches.

The design scales of the drainage structures used are as shown below:

#### Drainage structure Return period

Bridge 50 years

Culvert 50 years

As the drainage system will be designed according to the natural conditions, the construction of stone masonry or concrete drainage is recommendable in order to prevent soil erosion for roads with more than 8% of longitudinal grade.

The return period for bridges and culverts is not described in the current design manual. This should be specified in the manual, since the drainage system is one of the important components in road maintenance.

### **4.3 Development Criteria for Rural Roads**

#### **4.3.1 Local Industrial Development**

##### **(1) General**

Agriculture is one of the major economic activities and the farms are extensively distributed and almost same products are growing in the Study Area except tealaves and coffee beans. This makes it difficult to specify rural roads to be improved to enhance the agricultural activities. Development of comprehensive road network to cover the agricultural areas becomes necessary.

As for manufacturing industry, there are soapstone mining and manufacturing factories for tea, coffee, tobacco and grain mill processing in the Study Area. However, their sizes are small and activities are not appreciable. In addition, most of the factories are located in adjacent to the major towns where road network is comparatively well developed.

##### **(2) Fish Industry Enhancement**

The fish products in the Study Area occupy a dominant position in Kenya and spoilage of the products occurs during the rainy season due to lack of transportation. In addition, the results of the community needs survey revealed that fishery zones experienced some difficulties in the supply of agricultural food in comparison with farm zones. Road improvement from landing beaches to the existing trunk roads is, therefore, a focal point in order to enhance the fish industry in the Study Area.

The following six routes can be identified as candidate routes from a fishery industry enhancement perspective taking into account the current road condition, the number of landing beaches and the latest fish product statistics. Some candidate roads have also possible alternative routes (see Table 4.3.1).

**Table 4.3.1 Candidate Roads to be Improved for Fishery Industry Enhancement**

Possible Alternative		Distance	Remarks
1	From Port Victoria to inland	(Km)	
A	D251-D250-D254	43.2	Gravel/Earth
B	C29-C90-B1	29.9	Gravel/Earth
C	C27-B1	75.8	Gravel/Earth/Bondo/Bitumen
2	Usigu to Bondo		
	C27	45.0	Gravel/Earth
3	Luanda Kotieno to Siaya		
A	C28-D246-Siaya-C29-B1	58.7	GF/GF/Siaya/Bitumen
B	C28-D245-B1	67.7	GF/GF/Bitumen (C27)
4	Mbita to Homa Bay		
	C19-Homa Bay	40.7	Gravel/Earth
5	Karungu to Homa Bay		
	C18 to C20	35.9	Gravel/Earth/Bitumen (C20)
6	Muhuru to A1		
	C13-A1	47.7	Gravel/Earth

Note: As for the location of the routes, refer to Fig. 2.3.1.

### (3) Transport of Tealeaf

The production of tealeaves is one of the dominant economic activities in the Study Area. Prompt transport from a tea firm to a tealeaf processing factory which is usually located alongside the trunk road is the focal point in order to prevent tealeaves from rotteness, especially in the rainy season. In addition, processed tealeaves are transported to Nairobi and Mombasa by truck.

Feeder road development to connect to the existing trunk roads is, in this context, of importance. However, it is difficult to specify the feeder roads to be improved, as the tea firms are widely spread in the mountainous area. The realisation of bitumen standard road network, which covers the mountainous area in Nyamira and Gucha Districts, is expected to contribute to the promotion of transportation of tealeaf product.

#### 4.3.2 Accessibility Index

##### (1) Major Public Facilities

Administrative centres, major market centres and health centres were examined to analyse accessibility to these facilities from villages. The spatial distribution of the facilities is shown in Fig. 4.3.1.

##### (2) Accessibility Analysis

###### 1) Road Network Condition

Accessibility is presently restrained by the road network condition, which is defined by mainly two components, the road network itself comprising classified roads and the surface condition. Both components are closely interactive in determining the average speed of vehicles.

## 2) Accessibility Index

Accessibility from villages in each territory to the pivotal major facilities of each territory was analysed in the next stage. The concept of an Accessibility Index was used for this purpose. The Accessibility Index indicates the number of access routes from villages to pivotal centres in each territory based on the links of road. The higher the number of routes a road has, the higher improvement priority it shows. A rough schematic explanation is shown in Fig. 4.3.2.

## (3) Territory and Major Centres

### 1) Cluster Tree

Cluster tree analysis was applied to analyse the accessibility to the major public facilities.

### 2) Territory and Location of Pivotal Major Facilities

An integrated territory coupling with administrative and market centres was used for the analysis.

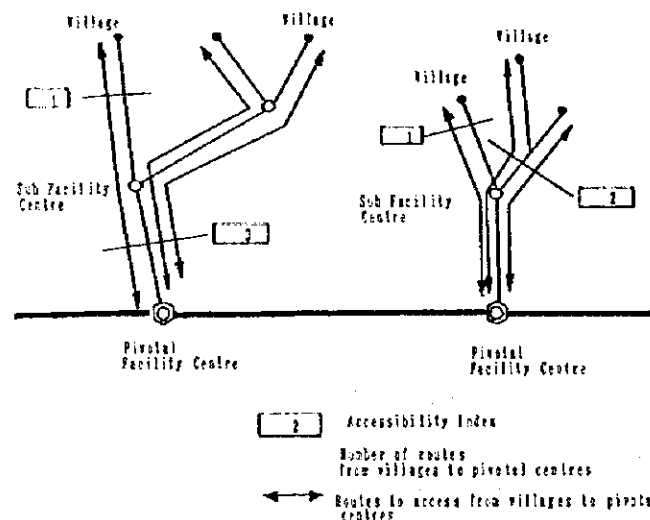


Fig 4.3.2 Explanation of Accessibility Index

Based on this concept, Fig. 4.3.3 illustrates the Accessibility Index of the roads in the Study Area indicating their importance from an accessibility viewpoint relevant to the resident's daily activities.

Considering the order of up to Accessibility Index 8, Class C roads are dominant in this order except for the following road sections:

- D246 (Siaya to Bond)
- D210 (C13 to Charring)
- E 118 (C19 to D210)
- D246 (Siam to C28)
- D256 (C30 to C31)

(Refer to Fig. 2.3.1 for the location of the road sections)

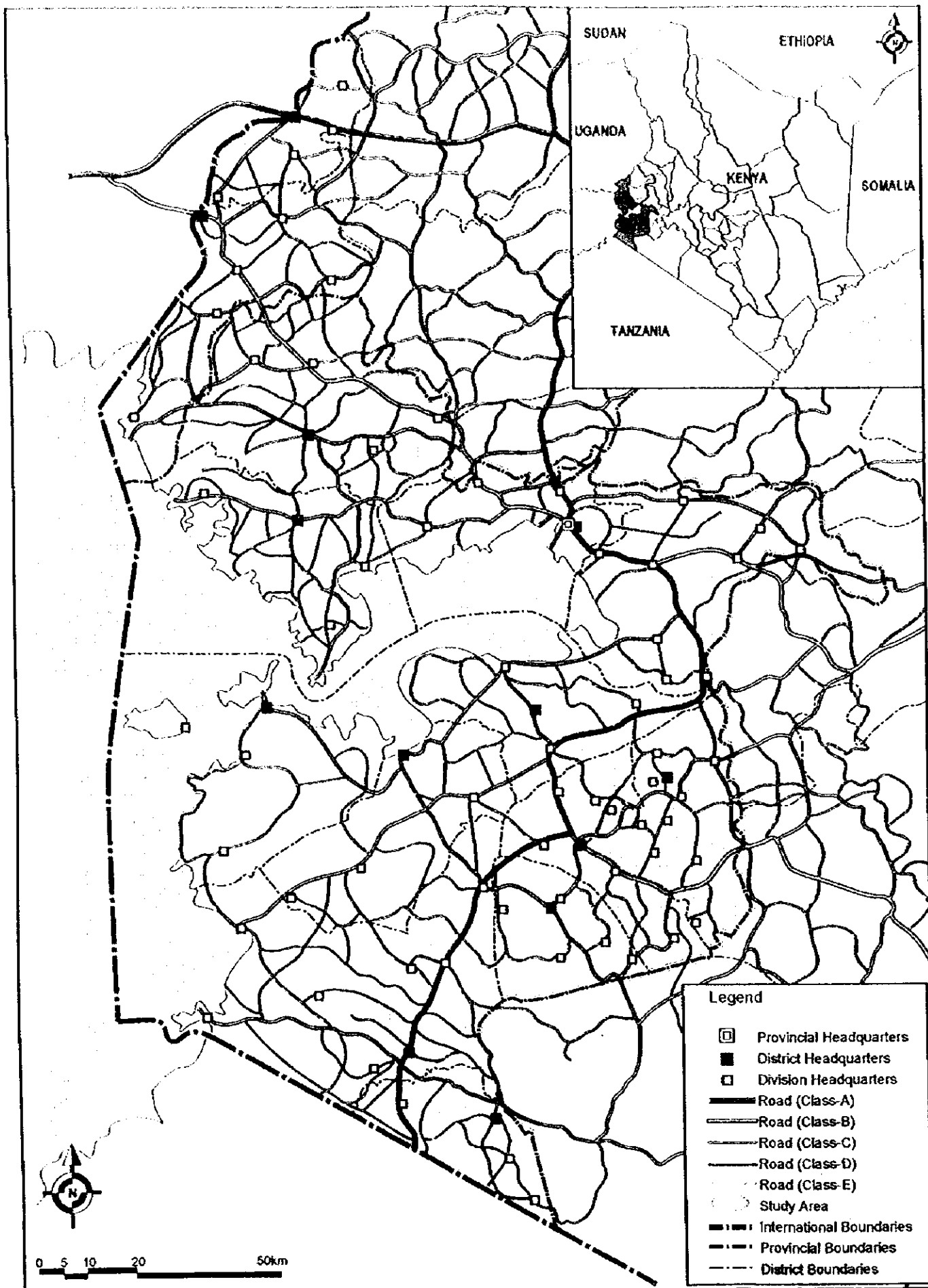
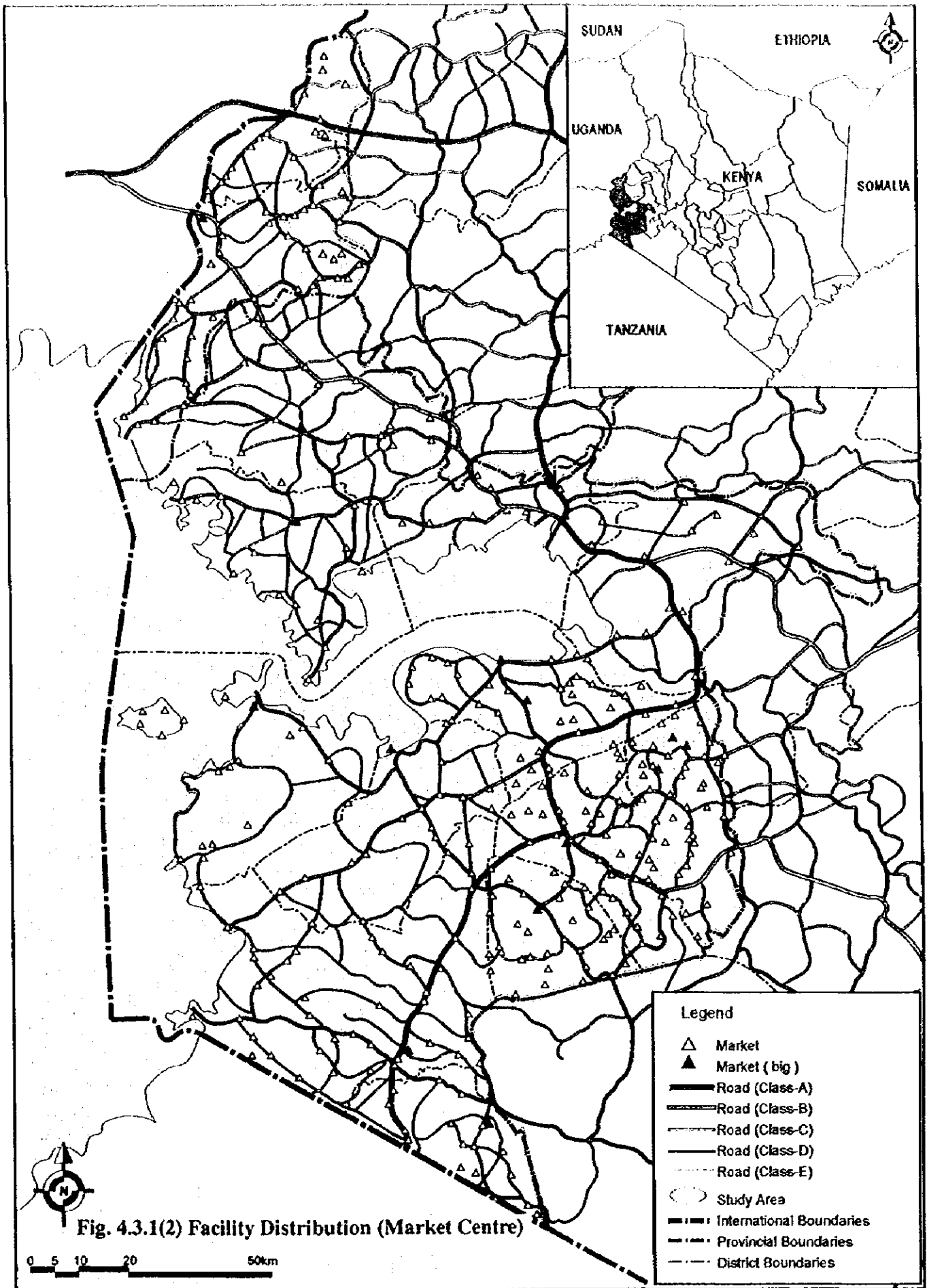


Fig. 4.3.1(1) Facility Distribution (Administrative Centre)



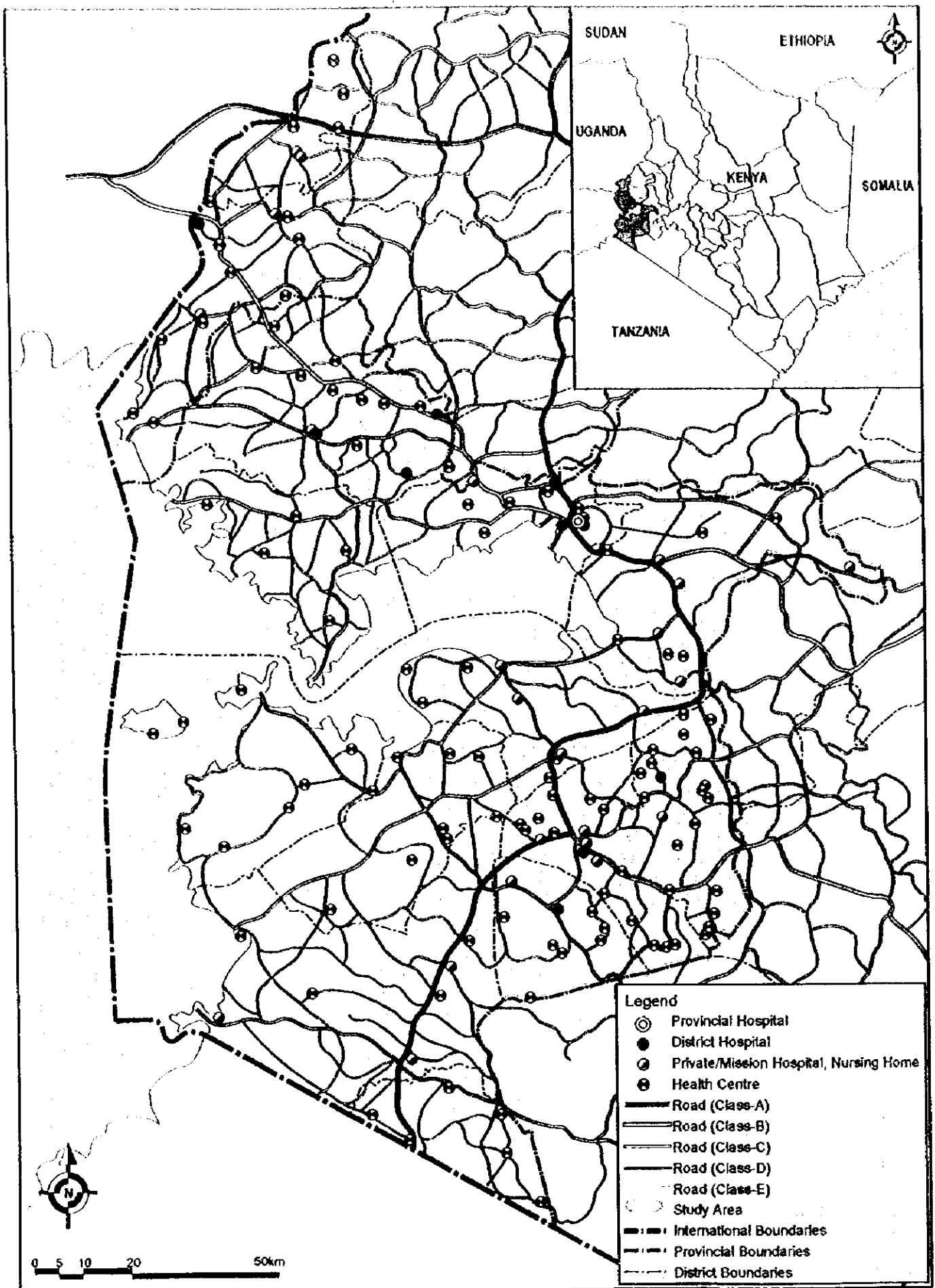


Fig. 4.3.1(3) Facility Distribution (Health Centre)



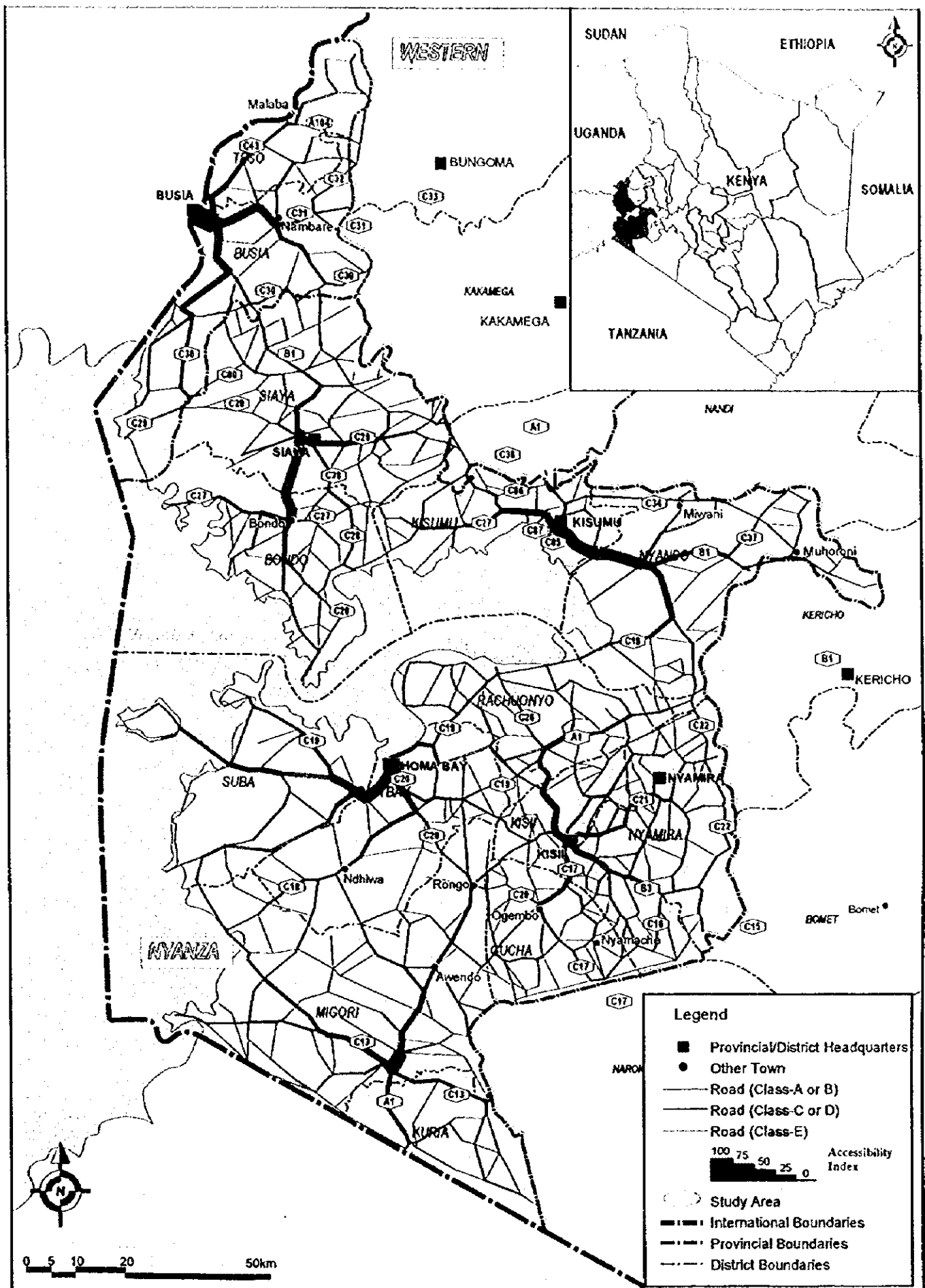


Fig. 4.3.3 Accessibility Index

#### 4.4 Improvement Plan

##### (1) Road Network Density

The Study Area has a high road network density in comparison with those of other countries in terms of classified roads including special purpose roads. (see Fig. 4.4.1)

It is obvious that the road network itself is well developed in the Study Area in relation to population density.

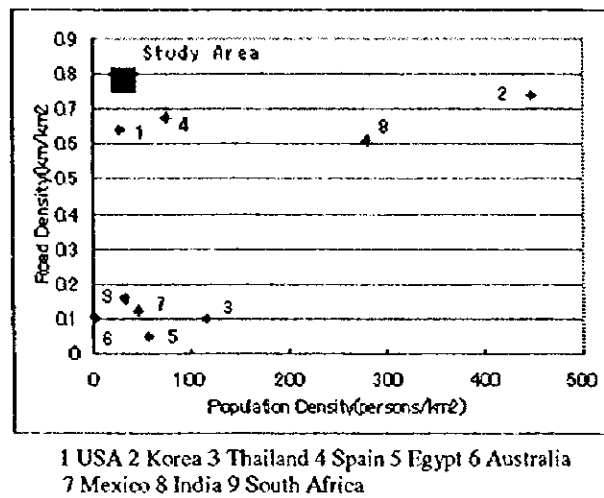


Fig. 4.4.1 Population Density and Road Density

##### (2) Road Network Hierarchy

The categories of the classified roads ranking from A to E are consistent with road network hierarchy from international trunk road to minor road (see Table 2.3.1 for details). According to the accessibility index analysis, the index corresponds with the categories of the classified roads; namely the higher ranking roads, such as class A, B and C, have a higher number of accessibility index.

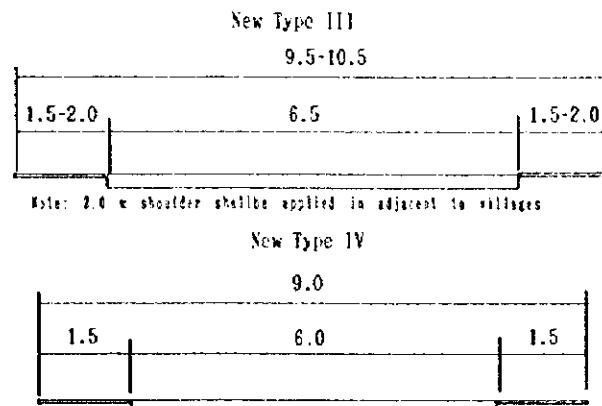
##### (3) Recommended Cross Section

###### 1) Carriageway

The width of carriageways was decided based on the current design criteria, which prescribed those by traffic characteristics including standard axles.

###### 2) Width of Shoulders

As for the width of shoulders, the traffic count survey revealed that many people are walking, and many bicycle-riders could be observed on the rural roads. This is one of the traffic characteristics of the rural road in the Study Area. This phenomenon has brought about serious traffic accidents, since pedestrians and bicycle-riders cross over onto the carriageways due to the narrow shoulders. The shoulder width should have, therefore, a clearance as wide as possible in order to cater for such type of traffic (see Fig. 4.4.2).



**Fig. 4.4.2 Proposed Cross Section for Rural Roads**

### 3) Pavement Structure

It is desirable to provide a higher degree of variety with respect to pavement types to meet local conditions in Kenya. However, a conventional standard currently used in Kenya should be applied at this stage, since it will take a long time to establish a new standard for pavement structure, which is based on a local soil material conditions.

The roads, which need to be provided with wider shoulders are listed in Table 4.4.1.

**Table 4.4.1 Road to be Upgraded**

Rd. No.	Accessibility Index	Section	Remarks
C20	83	Homa Bay - C19	Fish transport
C19	50	C20-D213	
D246	41	C29 (Siaya)-C27(Bondo)	Fish transport
C31	38	B1-D256	
C20	33	C19 - C18	
C29	21	Eastand west Siaya	
C13	20	A1 - D210	Fish transport from A1 to Muhuru
C17	19	B3 -Ogembo	
C43	19	Connecting to D256	
D210	19	C13-Karungu	
E118	19	C19-D210	
C43	16	D256-A1	
C19	14	C20-D216	
D246	14	Siaya-C28	Fish transport
D256	14	C30-C31	
C21	13	Kisii-D222	
C27	13	B1-D243	
C31	12	D256-C32	
C18	11	A1-C20	Fish transport
C27	10	West Bondo	
C13	9	D202-A1	
C18	8	C20-D210	
C19	8	For Mbita from D213	
D250		D251-D 250-C30	Fish transport
D245		C28-D245-B1	Fish transport

Note: E212 and E211 are eliminated due to cutting corners function of routes

## **Chapter 5**

# **Road Maintenance Improvement Plan**



## **Chapter 5 Road Maintenance Improvement Plan**

### **5.1 Principal Policy for the Future Road Maintenance Plan**

The suspension of and/or delay in daily maintenance activities has resulted in the deterioration of the road network, and thereby increasing constraints to road users. Road maintenance work needs sustainability and the importance of sustainability in road maintenance work have been recognised as a key factor in the Road Maintenance Initiative (RMI, refer to Section 2.6), which has been undertaken in the past by the Government, the World Bank, and other donors.

Sustainability in road maintenance is required in the following areas:

1. Financial arrangement for full budget preparation;
2. Institutional capacity building with a view to respond to road maintenance requirements from all stakeholders;
3. Maintenance methods and technology development to meet the above requirements at the maximum effectiveness and efficiency;
4. Human resource development to train the staff, the public and the private sectors;
5. Information system development for road maintenance management; and
6. Policies to support construction industry development.

The above described maintenance sustainability will be considered in terms of external, institutional, and technical factors. The Road Maintenance Fuel Levy is an existing external factor to secure financial sustainability. The Road Board Act, that is now under deliberation, will be a principal institutional policy to review the maintenance organisation and its functions. Under this policy, MOR&PW is expected to be reformed into a Road Agency. These will be a precondition for the road maintenance improvement plan. The on-going Roads 2000 Maintenance Programme will be an actual road maintenance strategy. The Labour Based Methods proposed in the Roads 2000 Maintenance Programme are technical factors and will be developed in the road maintenance improvement plan of the Study taking into account private sector involvement and construction industry development.

In addition, a new policy framework for commercialisation and privatisation is also proposed in the Study in order to achieve maximum effectiveness and

efficiency, which should respond to road users' requirements.

Table 5.1.1 summarises the major planning issues for the road maintenance improvement plan.

**Table 5.1.1 Major Planning Issues for Maintenance Improvement**

Factors Issues	Technical Improvement	Institutional Improvement	External Factors
Current Policies	- Labour Based Methods - Contract Maintenance	- Roads Board & Road Agency	- Maintenance Fuel Levy Fund
Sustainability	- <b>Establishment of road inventory system</b> - <b>Total maintenance management</b> - <b>Appropriate technology development</b>	- New role of MOR&PW - <b>Rearrangement of equipment workshop</b> - <b>New relation between PWO &amp; DWO</b>	- Structural reform
Commercialisation /Privatisation	- <b>Construction industry development</b>	- MTD privatisation	- Structural reform
Accountability/ Transparency	- <b>Community participation</b> - Computerised information system	- <b>Public involvement</b>	- Definite allocation method with clear priority
Human Resource Development	- <b>Private sector training</b> - <b>Total maintenance training</b>	- <b>Contract training</b>	- <b>Planning training</b>

Note: Items in bold letter are proposed by the Study

## 5.2 Improvement of Road Maintenance Works

### (1) New Road Inventory System

The provision of a well-developed road inventory is basic information needed for establishing a road maintenance system. The current road inventory used in MOR&PW is a very simple one lacking needed information such as kilometre posts, grade of current surface condition and the past record of maintenance.

In addition, taking the current scarce budget and staff in the road sector into account, it is realistic to phase-in the establishment of a proper road inventory.

The following steps are recommended in this context:

- a. Phase I: Kilometre posts installation and upgrading of the inventory capacity by identifying the types of damage through a road and pavement condition survey.
- b. Phase II: Evaluation for specifying the repair jobs needed and prioritisation of the repair works.



- c. Phase III: Examining future rehabilitation needs using the road conditions survey.
- d. Phase IV: Establishing a preventive maintenance and road security system against disaster.

(2) Total Maintenance Management

MOR&PW is to enhance its role to the Road Agency, and it is to reduce its staff to meet effectiveness and efficiency of road maintenance. It is, therefore, important to comprehensively manage the whole road maintenance works through the combination of contracting-out and use of the force account according to types of maintenance work.

Taking advantage of the contracting-out system to the extent possible is inevitable for periodical road maintenance to implement efficiently maintenance works, since maintenance work will increase in future to meet road user's requirements and support local economic development.

In terms of special works including emergency work, it is recommended that MOR& PW implements such works by use of the force account taking into account the urgency of the works.

(3) Combination of Labour Based Methods and Proper Equipment

The Labour Based Methods have been applied in Kenya for a long time due to lack of equipment to meet the road maintenance requirements, and promotion of community participation in order to create job opportunities in the rural areas has also been introduced. However, this method faces a turning point, since minimum labour wages are rising to 135Ksh./hour, which results in an increase of road maintenance costs by the Labour Based Methods. According to the Roads 2000 Maintenance Programme, the Labour Based Methods are recommended in combination with the use of a minimum of equipment such as small rollers but only in the case in which it is economically viable. However, even the Labour Based Methods recommended by the Road 2000 Maintenance Programme face still problems: it takes too long time to complete the necessary maintenance work, and the quality of works sometimes does not meet the required standard.

A combination of not minimum but proper equipment, such as bulldozers and graders, in combination with the Labour Based Methods should be, therefore,

taken into account in order to effectively and economically meet the road maintenance requirements and also in order to keep the engineering quality of the maintenance works as a stable level.

(4) Establishment of Regional Equipment Centres

Although contracting out of maintenance works will be encouraged in order to cope with the structural reform of MOR&PW, special works by force account will still remain even in the future. Necessary construction equipment has to be kept in the Mechanical Transport Department, which is expected to become a lease and rental firm under the privatisation scheme.

It is proposed, in order to progress in the privatisation of MTD, that all PWO and DWO equipment be integrated into the Regional Equipment Centres (RECs) such as at Busia, Siaya, Kisumu, Homa Bay, Migori, and Kisii districts. This integration is expected to facilitate the repair and maintenance of the equipment, and to efficiently expedite the availability of equipment. The RECs will provide necessary equipment to both the private contractors and the DWO and PWO on a rental base, so the PWO and DWO can use vehicles and equipment for their in-house routine patrol, supervision, and special maintenance works such as emergency repairs and training.

(5) Measures to Facilitate Easy Equipment Maintenance

1) Unification of Equipment for Easy Maintenance

Various donors provide construction equipment without taking into full account standardisation for maintenance equipment. This creates difficulties with respect to availability of spare parts for the machines. Most of the temporal local dealers have no capacity to keep stocks corresponding to the various kinds of spare parts. MOR&PW capacity is also limited to maintain and repair the various kinds of machines, the makers of which differ. For efficient use of it, it is recommended that the equipment and machines, of which dealers should have full ability for back-up services. In addition, unification of kinds of equipment is desirable for easy maintenance.

2) Importance of Back-up Service

It has become virtually impossible to repair equipment at MOR&PW and local workshops properly because of technological advances. Modern equipment has adapted computerised engines, hydraulic systems, and transmissions.

Machine makers train their mechanics at the dealers when equipment modification is introduced. This progress is now too fast for MOR&PW mechanics to catch up with. The role of local dealers has become more important. A credible back-up service system through dealers in the local market must be guaranteed, when new machines are provided.

(6) Research and Development

A simple and uniform standard has been applied to pavement design due to lack of basic data. This, in turn, is one of the reasons for increases in construction and maintenance costs and it has shortened the life-cycle of roads. It is vitally important in terms of construction and maintenance cost savings and life cycle extension as well to research and develop appropriate road beds and pavement structures for both heavy loaded trunk highways and for less traffic rural roads.

In this view, it is necessary to address long-term monitoring on pavement behaviour in co-operation with public-academic-private consortium. It is proposed that the Material Testing and Research Department (MTRD) assumes the responsibility for these subjects. One of the major tasks to be addressed is to review the current pavement design standard, which has been applied in Kenya, in order to provide more various types of standard to meet local conditions.

(7) Prioritisation of Maintenance Work

There are two aspects from a viewpoint of prioritisation; which roads have priority for maintenance, and how should maintenance works be prioritised? As for the former subject, MOR&PW Headquarters in Nairobi is introducing a cost-benefit analysis approach to decide on maintenance priorities for the national trunk road network.

In terms of rural roads, this cost-benefit analysis approach for prioritisation of maintenance works is inadequate, since the traffic volume on rural roads is as small as 200 vehicles per day on average. A more simplified method, such as accessibility index and the routes contributing to local economy enhancement, is available to decide on road maintenance priorities in place of cost-benefit analysis approach (refer to section 4.3).

As for the latter subject, priority should be placed on the following types of maintenance works with a view to secure smooth traffic with minimum maintenance costs:

- Emergency work (emergency repairs on blocked and impassable roads),
- Cyclic drainage work (roads are seriously and easily deteriorated by damaged drainage system),
- Reactive work on pavement (patching and local sealing),
- Periodic preventive and resurfacing work (rescaling),
- Other cyclic and reactive work, and
- Periodic overlay.

### **5.3 Institutional Improvement**

#### **(1) Roles between Roads Board and Road Agency**

The establishment of the Roads Board is under deliberation in the Parliament and enactment is expected soon. One of the most important functions of the Roads Board is to decide on appropriate use of the Roads Maintenance Fuel Levy Fund, which is tax earmarked for road maintenance, and to monitor the road maintenance activities by this fund. Proper and transparent road maintenance budget allocation can also be expected after the establishment of the Roads Board. In this regard, public involvement as board members of the Road Board is significant.

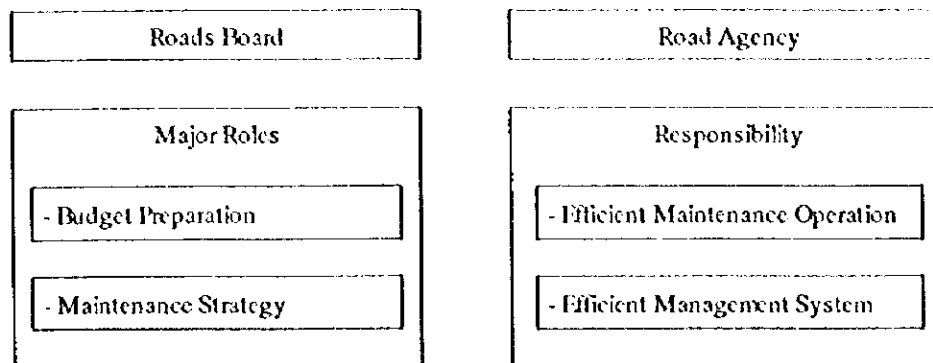
When establishing the Roads Board, major parts of the Road Department, Material Testing and Research Department, and Kenya Institute of Highway and Building Department of Ministry of Roads and Public Works (MOR&PW) will be converted into Road Agency. The Mechanical and Transport Department will be privatised as a lease firm of construction equipment.

The Road Agency is to concentrate on road maintenance of the classified roads in order to effectively and promptly carry out the actual road maintenance works to meet national requirements that provide well developed basic infrastructural facilities in the whole of Kenya.

Taking advantage of this system, the following relationship between the Roads Board and Road Agency is proposed:

- The Roads Board requests the Road Agency to maintain the classified roads according to a road maintenance plan, which will be established by the Roads Board based on the necessary budgetary allocation.

- The Roads Agency implements the required road maintenance efficiently and effectively.



**Fig 5.3.1 Relationship of the Roads Board and the Road Agency**

(2) Provincial Works Office Structure

At present, there is no clear goal of institutional improvement established for the Provincial Works Office (PWO). PWO has no planning and programming section so far. Maintenance work is expected to increase in future, and a quick response will be required to keep the level of service of the roads for users. In addition, prioritisation of maintenance works will be required as well.

It is proposed that PWO add the function of planning and programming in order to cope with road maintenance and upgrading requirements. Bituminous road maintenance is under the responsibility of PWO according to the current demarcation. However, the current maintenance process is not able to completely meet effective maintenance works. District Works Offices (DWO) have much local information on the current conditions of roads including bitumen standard. They inform about the necessity for repairs of the bituminous roads to PWO but the response is often delayed and the timing is inadequate.

Table 5.3.1 shows an immediate proposal for the demarcation between PWO and DWO on bituminous road maintenance. The major points of the proposal are as follows:

- DWO has responsibility for patching work in routine maintenance works;
- PWO has responsibility for surfacing in periodic and special maintenance works; and

- Special work is done in co-operation by both PWO and DWO.

**Table 5.3.1 Bituminous Road Maintenance**

	<i>Present</i>			<i>Proposed</i>	
	PWO	DWO		PWO	DWO
Routine	⊙	X	Patching	X	⊙
Periodic	⊙	X	Surfacing	⊙	X
Special	⊙	X	Special	⊙	○

← - <report>  
 ← - <request>  
 ↔ <coordinate>

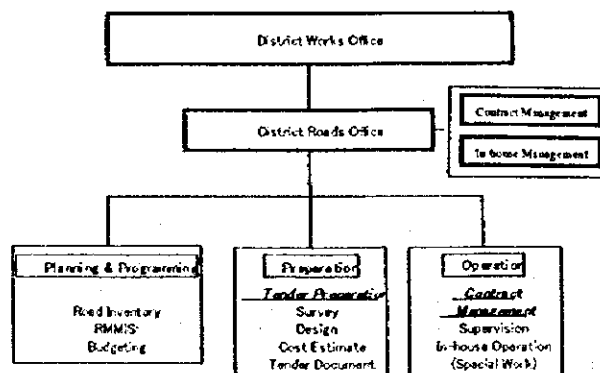
(3) District Works Office Structure

District Works Offices (DWO) directly undertake road maintenance. Improvement of the organisational efficiency of DWOs is one of the most important tasks.

The proposal for District Works Offices in the Roads 2000 Maintenance Programme has no institutionally clear function for programming, planning, or preparation of maintenance system. In addition, there is no consideration for preparing emergency maintenance and the training function. These functions become more important in maintenance management system under the prospective Roads Board Act. Furthermore, there are not clear demarcation between contract management and in-house operations.

A new concept of the District Works Offices proposed by the Study is shown in Fig. 5.3.2. The major points of the proposal are as follows:

- DWO has two sections, contract management and in-house management, since contract-out maintenance work and force account work (in-house) follow different procedures.
- DWO has a planning and programming section to make the most use of local information on maintenance work.



**Fig. 5.3.2 Proposed DWO Structure**

## 5.4 Construction Industry Development

### (1) Supporting Institutional Arrangement

It is recommended to introduce supporting an institutional arrangement in order to ease financial constraints and to enhance maintenance capacity as follows:

#### 1) Equipment Rental and Lease Market

The contractors have difficulties in finding equipment for maintenance operations, because there is no equipment rental and lease market in Kenya. This low availability of equipment results in the contractors delay and incomplete contracts. Three alternatives are considered to solve this constraint. The first alternative is enhancement of the force account by MOR&PW. The second alternative is to provide funding system for contractors to purchase necessary equipment. The third alternative is to provide a lease market with equipment. As mentioned before, enhancement of force account is against the prevailing privatisation climate. Although to provide funding system or lease market is considered, attention has to be paid to the privatisation of the Mechanical and Transport Department (MTD), which is one of the department of MOR&PW. Creation of a rental and lease market for road construction and maintenance equipment is, thus, to meet the solution of the current constraints. The present MTD equipment should be one of the resources for the rental market.

#### 2) Credit Facility for Working Capital Fund and Guarantees

Most of the local contractors need easy access to credit facilities such as banks and insurance companies. Generally, they need tender bonds, performance bonds, advance bonds and operating capital in implementation of the contracts. However, the private banks and insurance companies request very high interest rates of over 18% in some case. Many contractors missed opportunities to enter new tenders and sometimes they went bankrupt because of a shortage of operational funds, when their cash flows deteriorated due to the delay of government payments.

Creation of credit corporations and facilities for local small and medium contractors will solve these problems and it will assist to develop the local contractors. This will also create employment opportunities in the rural areas by locally established contractors.

(2) Training Needs

Private contractors have currently no training opportunities except for on-the-job construction and maintenance work. For increasing capacity of private sectors in accordance with progress of privatisation, training by KIHBT is helpful as well as the governmental officers. In Kisumu, KIHBT has trained small-scale contractors in co-operation with the Swiss International Development Agency in order to promote the Labour Based Methods. This experience will be expected to medium-scale contractors, where are local key enterprises in the rural areas. They need basic education and training in the fields of total corporate management, quality control and maintenance engineering.

(3) Market Demarcation and Tender Policy

In the construction industry development, market demarcation is required in accordance of the size of the contractors as follows.

- a. Large Contractor: regional general contractor and export-oriented firms
- b. Medium Contractor: district general contractor and specialised contractor
- c. Small Contractor: specialised artisan
- d. Community Group: Labour Based Methods contractors in the rural community.

Currently, the large contractors occupy periodic and rehabilitation of bituminous standard roads in the regional markets, and they have become suppliers to provide asphalt materials for routine maintenance. Their roles are important. Therefore, regional preference in maintenance tenders is needed.

The middle contractors are district-based firms that carry out mostly regravelling maintenance. However, the contractors from the other districts and provinces come to the district market, which provide a few benefits in the local economy. They need district's tender preference.

(4) Release of Market Information

Market information has to be released to contractors for creating transparency and more competitions and increasing tender opportunities to contractors. Such system is expected to be developed in future, as a computer system for efficient and effective procurement management to be integrated into the Highway Management Information System (HMIS) of MOR&PW.



## 5.5 Human Resource Development

### (1) Training Fields

There are two major fields for human resources development; one is to foster staff who is able to manage comprehensive road maintenance works including contracting-out management, in-house maintenance works, and planning and programme issues. The other is to foster experienced staff in actual maintenance operation works. These two fields are the focal points in order to cope with future prospect of MOR&PW, which faces structural reform with a scaling down of the staff and further introduction of contracting-out system in order to pursue efficient and effective road maintenance works. In addition, the training should be extended to private contractors in order to meet the construction industry development.

### (2) Training Subjects

#### 1) Road Maintenance Management

The required major training subjects are as follows:

- Planning (needs survey, road inventory, traffic survey, road planning, environmental consideration and prioritisation study),
- Maintenance Work (design, cost estimates, construction plan, maintenance plan, schedule management, and equipment plan),
- Contract Management (consultant procurement, contractor procurement, financial aspects, legal problems, and
- Administration (total co-ordination, personnel management, public advertisement and community participation).

#### 2) Maintenance Operation Work

The required major training subjects are as follows:

- Planning (traffic survey, road inventory survey),
- Maintenance Technology (material investigation, laboratory test, design, cost estimates and equipment plan),
- Operation (maintenance work, supervision, quality control, equipment management and construction plan), and
- Monitoring (road condition survey and prediction of deterioration).

**(3) Trainee**

For rural road maintenance, Provincial Work Officers, Provincial Road Engineers, District Work Officers, engineers, planners and administrative officers having more than 10 years experience are the candidates in order to strengthen the current management capability and to foster the next generation.

**(4) Organisation for Training**

The Kenya Institute of Highways & Building Technology (KIHBT) assume responsibility so far training for MOR&PW's staff. It is desirable that KIHBT will assume responsibility for the training mentioned above by taking advantage of the past and current experience and facilities.

**(5) Trainers**

This training is aiming at institutional reform development for rural road maintenance in order to meet the future prospect of new MOR&PW. In this context, the following qualifications are requested for the trainers.

- Advanced engineering experience
- Financial management experience in the private sector
- Rich experience in institutional reform in the public sector

**(6) Improvement of Kenya Institute of Highways & Building Technology**

The Kenya Institute for Highway and Building Technology (KIHBT) has a conventional training scheme, which covers Labour Based Methods in operation of road maintenance. As mentioned above, the new training is expected to be implemented by KIHBT. KIHBT has also to be improved in order to be in a position to meet this new type of requirement.

## **Chapter 6**

### **Selection of High Priority Roads**



## Chapter 6 Selection of High Priority Roads

The candidate routes for the High Priority Roads are selected from the viewpoints of enhancement of the local economy and improvement of accessibility on the basis of the development criteria mentioned in Section 4.3.2.

### 6.1 Enhancement of Local Economy

#### (1) Candidate Routes

The following six routes including alternatives were designated with a view to enhance the local economy as important for fish transport:

- 1 From Port Victoria to B1
  - 1-1 D251-D250-C30
  - 1-2 C29-C90-B1
  - 1-3 C27-B1
- 2 Usigu to Bondo (C27)
- 3 Luanda Kotieno to Siaya
  - 3-1 C28-D246-Siaya-C29-B1
  - 3-2 C28-D254-C27
- 4 Mbita to Homa Bay (C19)
- 5 Karunga to Homa Bay (C18)
- 6 Muhuro to A1 (C13)

#### (2) Criteria to Select the High Priority Roads

The following five evaluation criteria were applied for the selection of the High Priority Roads:

- a. Priority should be given to the routes selected by both Accessibility Index analysis and local economic enhancement (overlapping route),
- b. Earth and gravel roads only (bitumen standard roads are excluded),
- c. Other than the El Nino Disaster Rehabilitation Projects should be selected to avoid double investment,
- d. The High Priority Roads on the District Development Plan (DDP) should be taken into account (see Fig. 4.4.1), and
- e. Routes for fish transport from landing places with high volume of fish products have a high priority.

#### (3) High Priority Roads for Enhancement of the Local Economy

## 1) Evaluation

Considering the criteria mentioned above, the candidate routes were evaluated as shown in Table 6.1.1.

**Table 6.1.1 Evaluation of the Roads**

Routes with alternatives	Overlapping routes	Earth/Gravel Roads	Other than E/Nino Rehabilitation	High Priority on DDP	Fish Products	Evaluation
<b>1 From Port Victoria</b>						
1-1 D251-D250-C30		○	○	○	○	○
1-2 C29-C90-B1		○	○	○	○	△*1
1-3 C27-B1			○		○	
<b>2 Usigu to Bondo</b>						
<b>3 Luanda Kotieno to Siaya</b>						
3-1 C28-D246-Siaya-C29-B1	○	○	○			
3-2 C28-D254-C27		○	○			
<b>4 Mbita to Homa Bay(C19)</b>						
4 Mbita to Homa Bay(C19)	○	○	○	○	△	○
<b>5 Karunga to Homa Bay(C18)</b>						
5 Karunga to Homa Bay(C18)			○			
<b>6 Muhuru to A1(C13)</b>						
6 Muhuru to A1(C13)			○	○		

Note: \*1) 1-1 and 1-2 are almost the same but 1-2 is a little bit longer in distance.

○ indicates applicable

△ indicates partly applicable

## 2) High Priority Roads

According to the evaluation, the route from Mbita to Homa Bay (C19) was ranked the highest in priority since this route satisfied almost all the basic criteria mentioned above, though the volume of fish products is somewhat lower than at Port Victoria.

As for the routes from Port Victoria to the trunk roads, 1-1 and 1-2 are placed at almost the same priority level. However, the route 1-1 (D251-D250-C30) had a shorter distance than route 1-2 (C29-C90-B1). Consequently, the route 1-1 (D251-D250-C30) and the Mbita to Homa Bay (C19) route were selected as high priority roads based on the enhancement of the local economy perspective.

## 6.2 Improvement of Accessibility for Residents

### (1) Candidate Areas for Road Improvement

Based on the analysis of the Accessibility Index, representative areas were identified, where the roads need to be improved in order to enhance accessibility for residents in matters pertaining to daily lives.

Fig. 6.2.1 shows the location of the roads tabulated in Table 4.4.1 identifying the following five areas, where the roads need to be improved.

- 1 Nambale Area
- 2 Siaya Area
- 3 Homa Bay Area
- 4 Kisii Area
- 5 Migori Area

Consequently, priority has to be determined through comparing the above five areas.

(2) Priority Criteria

The following different criteria were introduced in order to analyse the improvement priority from the accessibility viewpoint.

- a. Establishment of a bitumen road network
- b. Priority from the District Development Plan perspective
- c. Impact on beneficiaries

(3) Priority Area

The Kisii Area was selected through the above comparison, as the high priority area. The major points of evaluation are as follows:

1) Dissolution of Missing Links of Bitumen Road Network

An essential point of the criteria is that the establishment of bitumen road network, without doubt, contributes to comfortable and stable transport for users from the viewpoint of accessibility. In this view, the Nambale Area, Siaya Area and Kisii Area were designated from this perspective having high priority. Specifically, although the Kisii Area has a well-developed bitumen road network, the network does not fully function, since the section between Rongo and Ogembo is missing.

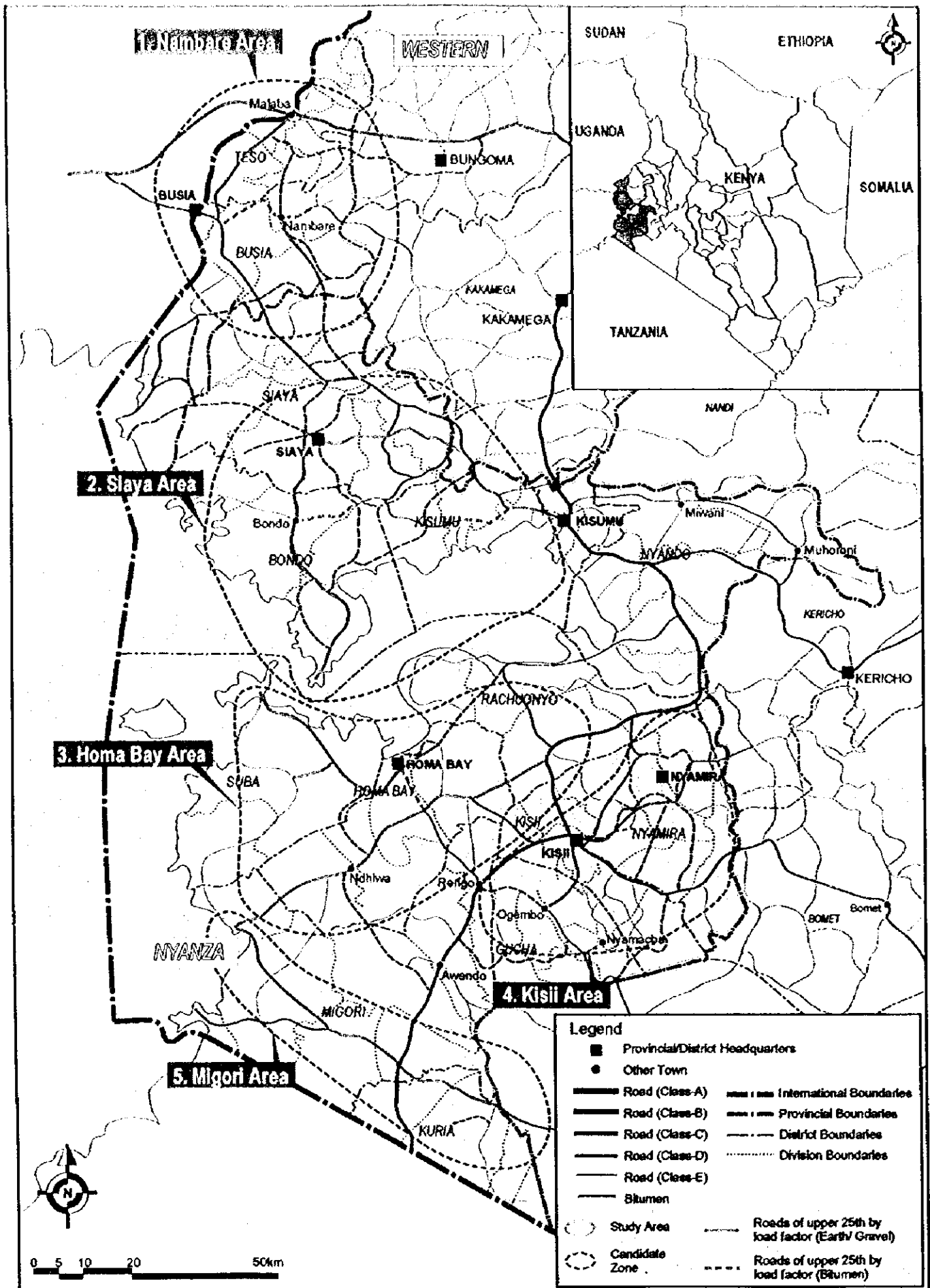


Fig. 6.2.1 The Areas Where Roads are to be Improved



## 2) Priority According to the District Development Plan

Each district has a District Development Plan showing the development priorities of roads (see Fig. 6.2.2). In the plan, the first priority is attached to roads connecting to the major towns and / or the existing trunk roads. The identified first priority roads in the District Development Plans are reasonable and approvable taking into account the effectiveness of the impact generated by road network development.

In the meanwhile, none of the priority roads in the southern part of the Siaya Area have been designated in the District Development Plan.

## 3) Impact on Beneficiaries

As illustrated in Chapter 2 “Existing Conditions”, Kisii and Nyamira Districts have, in comparison with other areas, dominant population densities as high as 750-1000 persons per km<sup>2</sup> on average.

## 4) Priority Area

The Kisii Area is, according to the above facts, evaluated as the highest priority area where the roads need to be improved from the viewpoint of improvement of accessibility.

### (4) Priority Roads in the Kisii Area

The key point to discuss the high priority roads in the Kisii Area is to fill in missing links in the bitumen road network, since this area has comparatively well developed bitumen road network even at present. In addition, this area has a high population density and is comprised of hilly and mountainous terrain, which often makes the roads impassable in the rainy season. The improvement of the road section between Rongo and Ogembo is crucial and this improvement would contribute significantly to the establishment of the regional bitumen road network coupled with serving the daily trips of the residents and tealeaf transport.

## 6.3 Definitive High Priority Roads

The definitive High Priority Roads were, through the above examination, selected as listed below (see Fig. 6.3.1).

- 1) Homa Bay – Mbita Road (C19 between Rusinga Island and Homa Bay from C20 to D213 and from D213 to Rusinga Island: L=42.4 km.)

This route was selected for mainly by two reasons. One is its contribution to the improvement of accessibility in the peripheral region, since all the residents have to use this route to go to Homa Bay, which is the centre of the region for shopping, and other daily trips.

Another reason is that the route is expected to improve the transport of fish, which will enhance the local economy. In terms of volume of fish products, Mbita is placed in the second position in the Study Area following Port Victoria.

A causeway of an approximate length of around 300 meters connecting Rusinga Island and the mainland is included in this section. However, the causeway is expected to be improved under the El Nino disaster rehabilitation scheme.

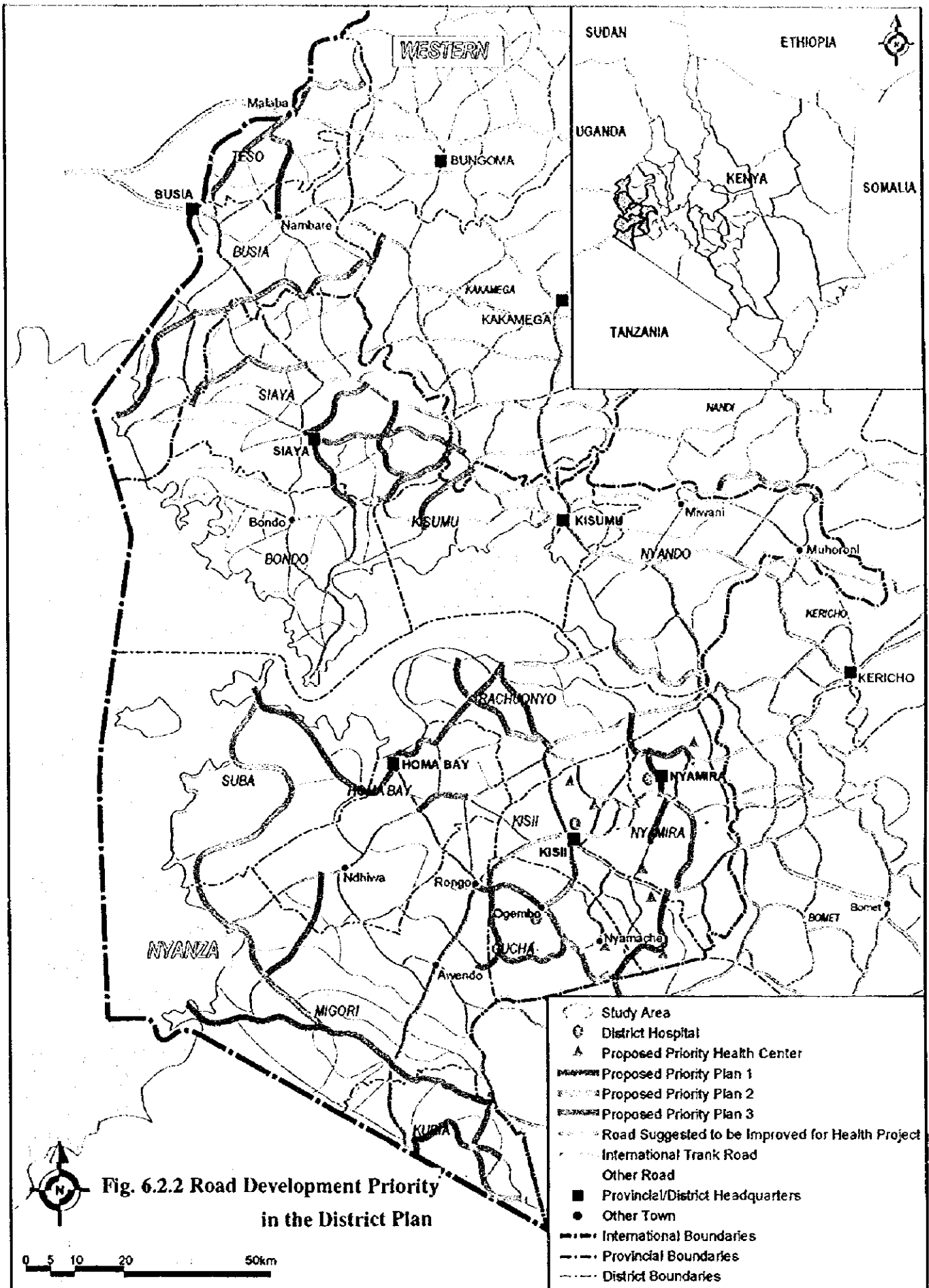
2) From Port Victoria to Bumala (D250/D251/C30 : L=43.0 km.)

Port Victoria shows a dominant position, in terms of volume of fish products, in landing beaches in the Study Area. In the rainy season, many fish products become rotten, since trucks cannot pass through the roads connecting toward inland markets due to muddy condition of the roads. As there are several alternative routes, the priority was given to the establishment of road network coupled with the existing domestic trunk road, B1 in order to ensure prompt accessibility to major inland markets such as in Nairobi and Mombasa.

3) C20 (from Ogembo to Rongo: L=19.0 km.)

The Kisii Area, including Kisii and Nyamira Districts, consists of hilly and mountainous terrain with a high population density. JICA conducted "A Study on Strengthening the District Health System" in this area in 1998. This study revealed a lack of basic health care facilities and insufficient access roads due to its hilly and mountainous topographical condition and few bitumen roads. Especially, this area has higher precipitation in comparison with other regions. Even Matatu cannot provide frequent enough services to meet basic residential demand such as going to referral hospitals due to muddy and rutted conditions in steep longitudinal gradient sections. This condition also makes it difficult for the residents to have access to enough food for their subsistence.

This improvement is expected strongly to support the daily lives of the residents and it will also contribute to filling in the missing link in the bituminous road network in the area.



**Fig. 6.2.2 Road Development Priority in the District Plan**

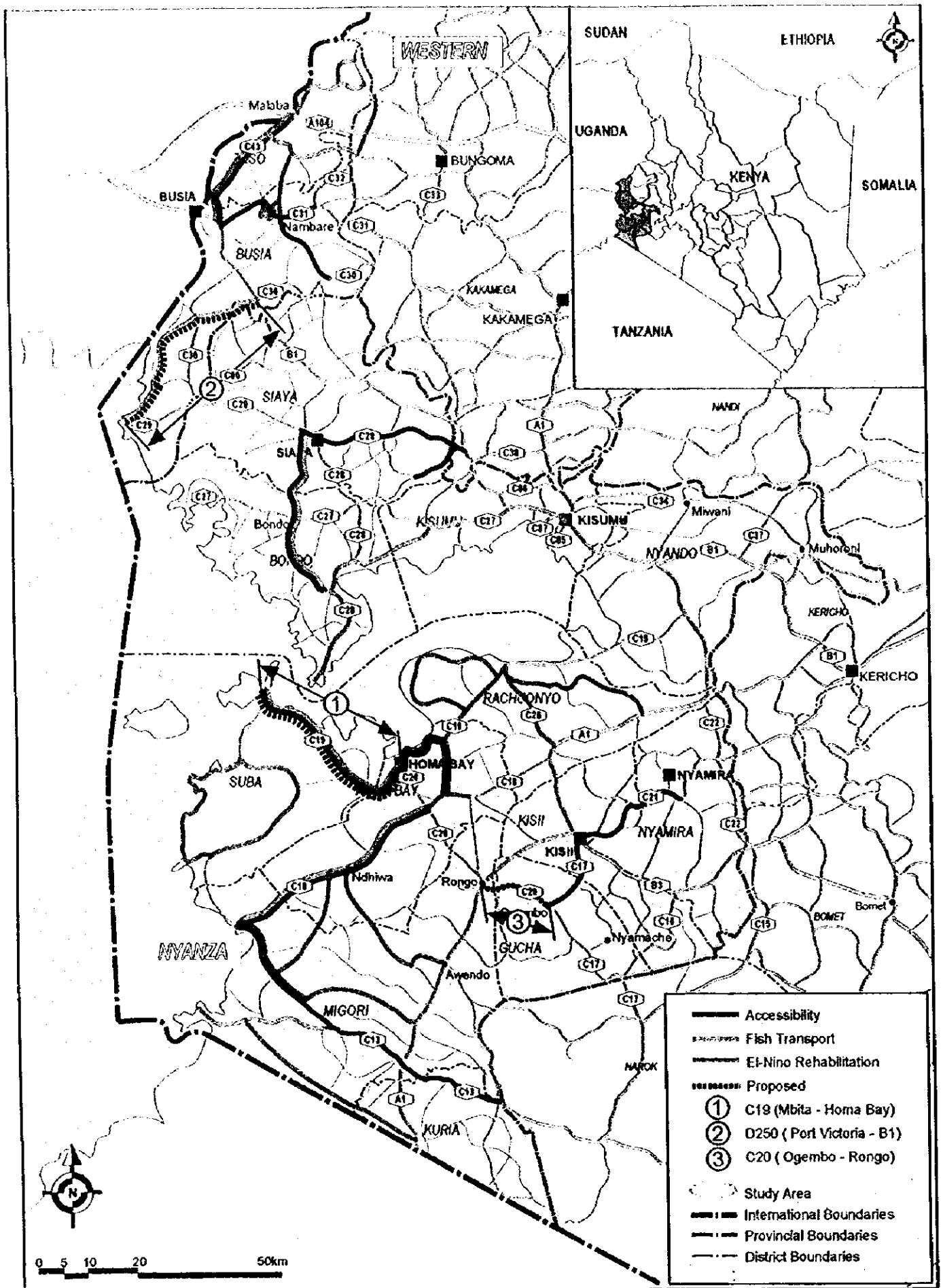


Fig. 6.3.1 Definitive High Priority Roads