Chapter 7

Preliminary Design

Chapter 7 Preliminary Design

7.1 Routes Subject to Preliminary Design

The High Priority Roads, which consist of three sections, were selected as described in Chapter 6 under "Selection of High Priority Roads", and a preliminary design for the high priority roads was undertaken in the course of the feasibility study.

7.2 Geometric Design

(1) Design Standard

The Road Design Manual of Kenya (RDM) stipulates the following geometric design standards for the topographic features.

Table 7.2.1 Design Standard

Terrain	Design Speed (Km/h)	Min. Radius (Meters)	Max Gradient (%)	Max. Superelevation (%)
Level	90-100	450-600	3.5-3.0	6.0
Rolling	60-90	160-450	6.0-4.5	-
Mountainous	40-60	60-160	10.0-8.0	6.0

Source: Kenya Design Manual

(2) Revised Design Standard

1) Asphalt Concrete Pavement in Mountainous Areas

The Study Team recommended the adoption of asphalt concrete pavement for roads such as the C20 traversing mountainous areas due to the following reasons.

a) When the longitudinal climbing gradient is over 8 %, the pavement structure is susceptible to rutting and wearing down as a result of heavy loaded vehicles.

b) The surface is also likely to be damaged resulting in increased maintenance costs.

c) Vehicles can safely pass even in the rainy season, if the asphalt pavement is laid correctly.

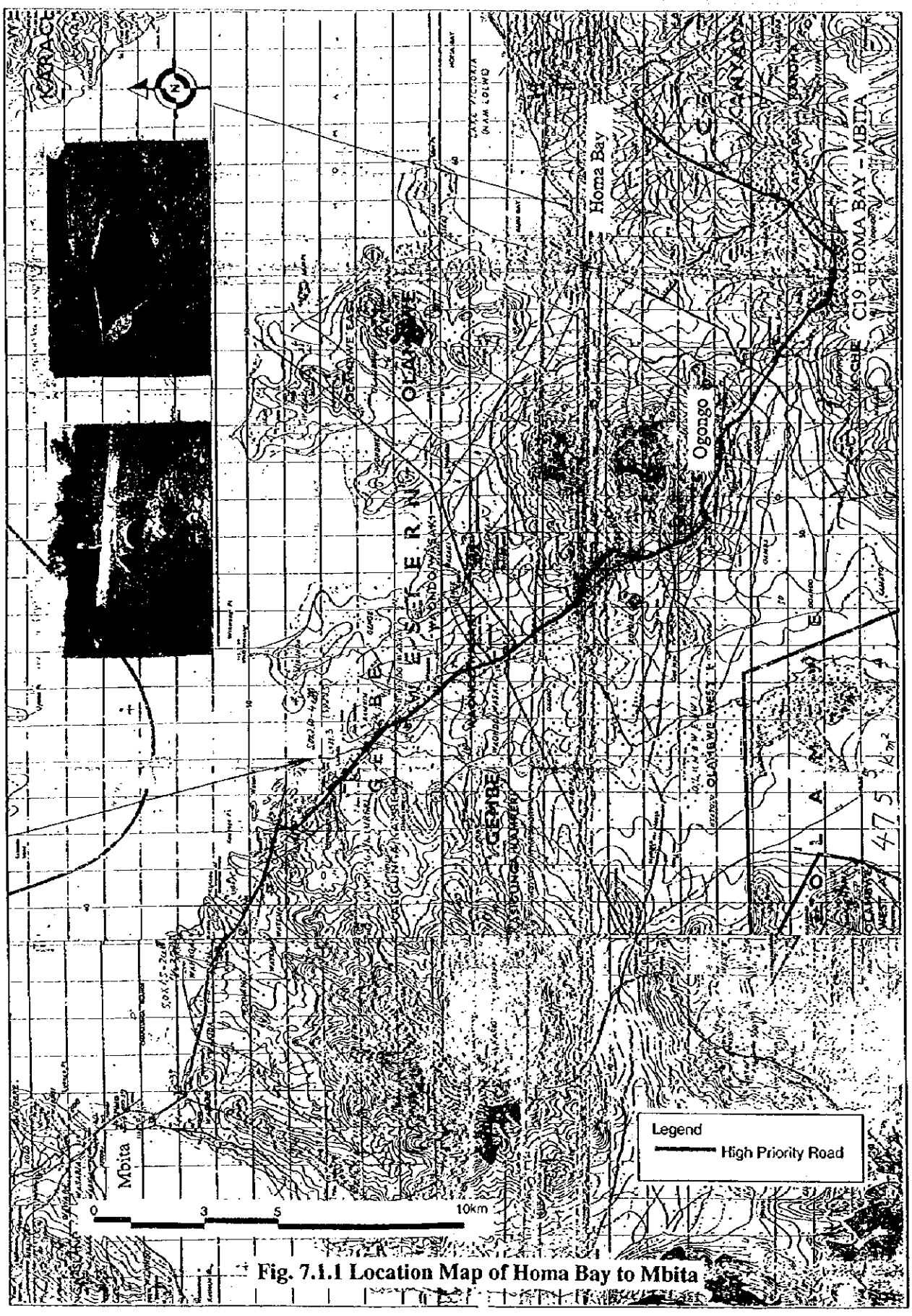


Fig. 7.1.1 Location Map of Homa Bay to Mbita

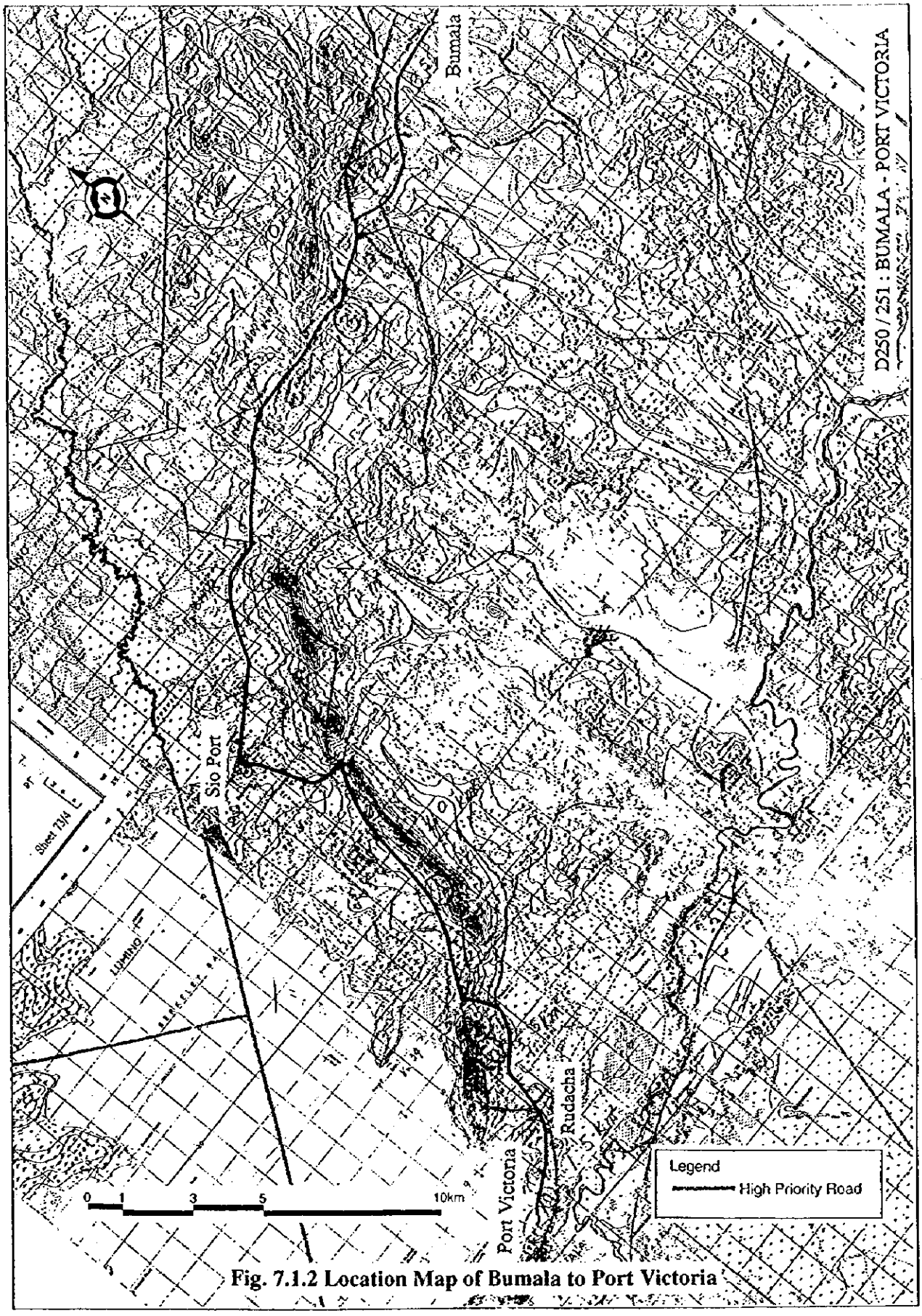


Fig. 7.1.2 Location Map of Bumala to Port Victoria

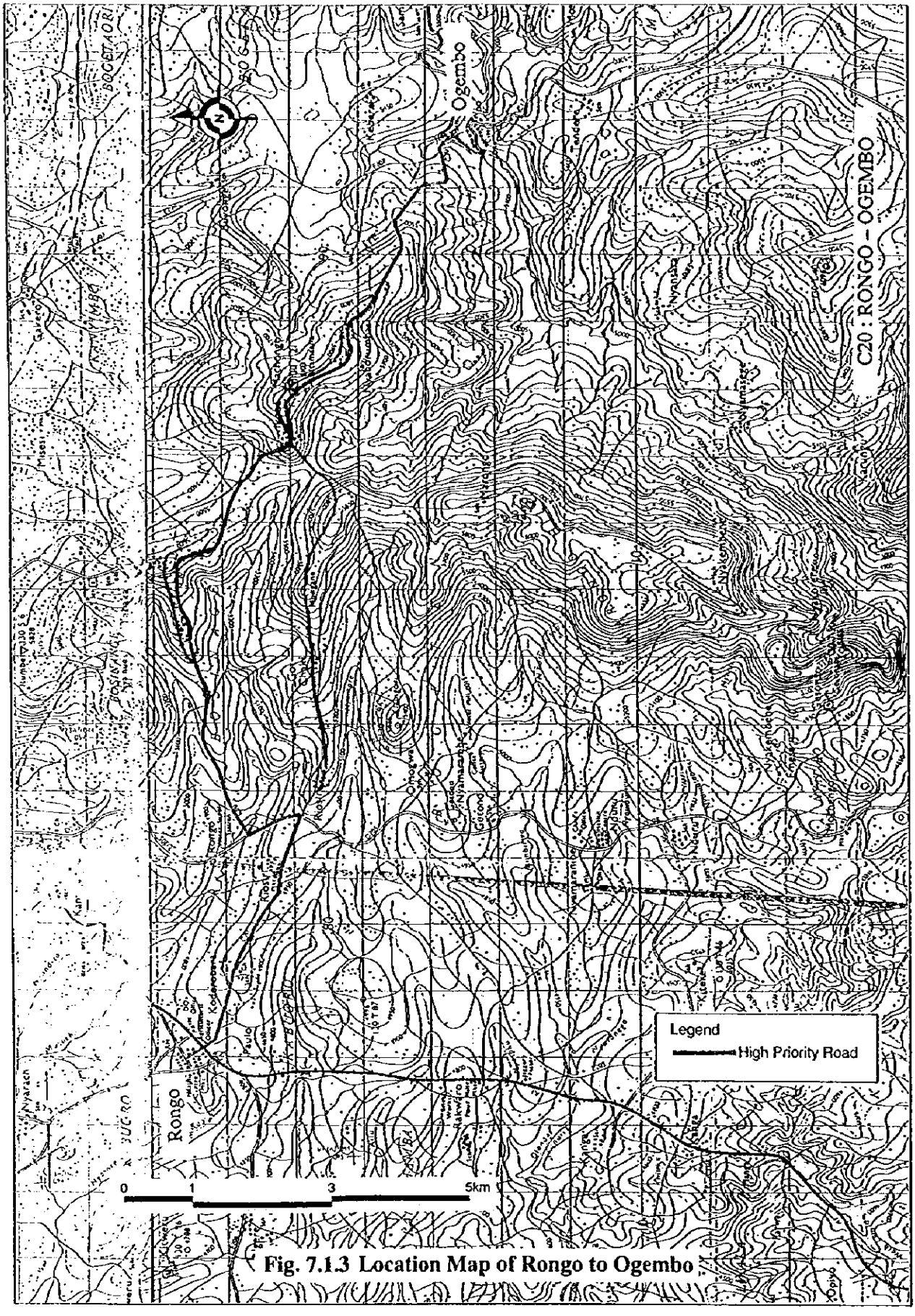


Fig. 7.1.3 Location Map of Rongo to Ogembo

2) More moderate horizontal and vertical alignment was introduced for easy driving in the rainy season (re-alignment was considered in necessary places).

3) Climbing Lane

In cases, in which the road gradient can not meet the design manual's standards in light of improvement costs and land acquisition, an additional climbing lane was provided.

4) Standard Cross Section

a) The dimensions of the standard cross-section was decided on the basis of traffic conditions including consideration of the existence of many pedestrians and bicycle-riders along the selected High Priority Roads within the Study Area:

Carriageway	6.5 m
Shoulder	1.5 m

b) The shoulder width was widened from 1.5m to 2.0m in sections adjacent to villages, since many pedestrians and bicycle-riders use the shoulders. The wider shoulder can provide safe and smooth traffic flow for vehicle traffic, pedestrians, as well as bicycle-riders.

Based on the incorporation of such wider shoulders, the typical cross section would be as illustrated in Fig. 7.2.1.

5) Countermeasures for Environmental Preservation

a) Single surface dressing is provided to cover the shoulders in order to prevent soil erosion.

b) Vegetation should be provided on slopes on the embankment in order to prevent erosion.

c) If the longitudinal slope is over 8%, grouted stone pitching is to be provided along side the ditch in order to prevent erosion.

6) Drainage system

The slope into the ditch should be designed as indicated or flatter.

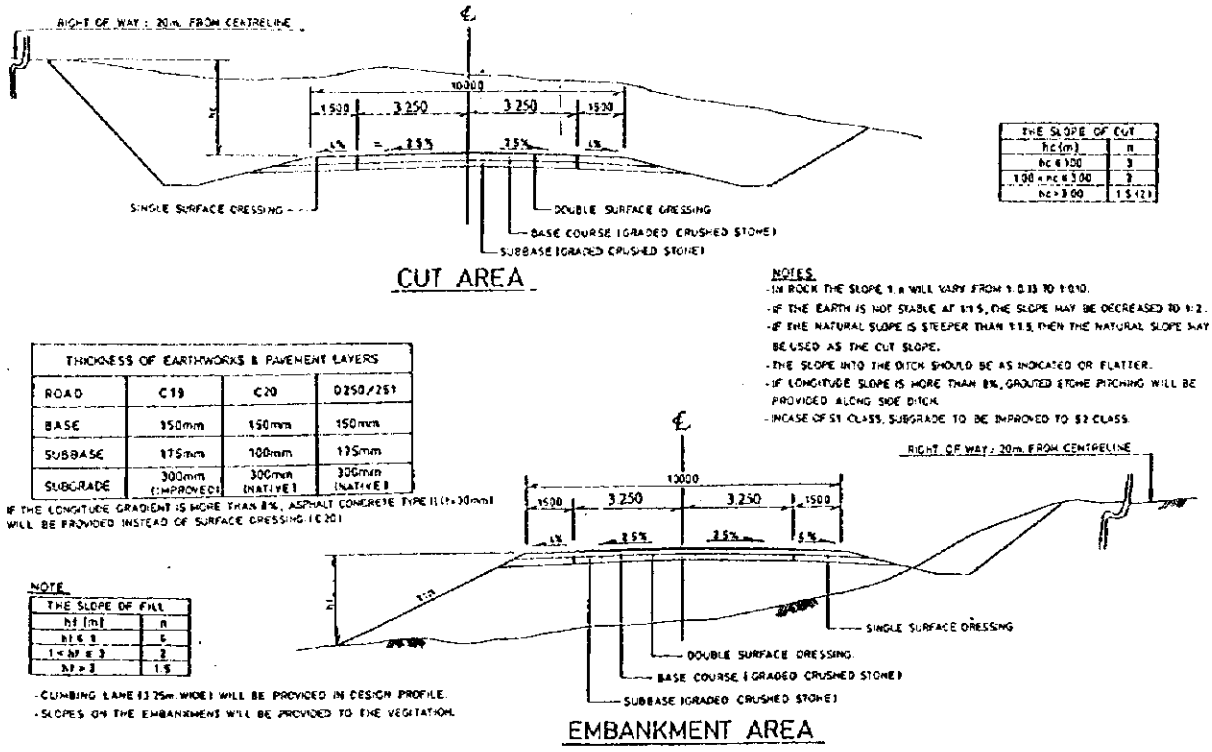


Fig. 7.2.1 Applied Cross Section

7.3 Hydraulic Design

(1) Culvert Design

1) General

Where a required waterway opening is less than about 15m^2 and in particular, where a road crosses a stream on a relatively high embankment, it is usually cheaper to provide a culvert in place of a bridge.

Like bridges, culverts are designed to be large enough to let the designated flood pass without damage to the embankment or surrounding land. In practice this usually means limiting the height of the flood on the upstream side. The required size of the culvert is found by calculating the area required to permit a flow that will maintain the upstream head of water below the critical level. The head downstream is taken to be either the designated flood level before the embankment is built or the top of the culvert, depending on whichever is higher.

2) Culvert Design for the Study Area

Return periods (storm frequencies) used for highway culvert designs are available in the American Association of State Highway and Transportation Officials, Ins., which are presented in Table 7.3.1.

Table 7.3.1 Return Period for Highway Culvert Design

Type of Highway Facility	Return Period (Storm Frequency) in Year
Interstate highways	50
Limited access freeways and arterial roads	25
Collectors	10
Locals	10
City streets	10

Source: Principles of Highway Engineering and Traffic Analysis

On the other hand, the El Nino disaster was experienced in Kenya in 1961 and 1998. According to the Meteorological Department, the El Nino phenomenon has occurred periodically at an interval of 6-7 years. The Study Team estimated that the probability of flooding in 1998 was around 25 years. It was revealed by the Study Team through the interview survey that all existing box culverts and bridges were submerged by the 1998 El Nino disaster. Referring to Table 7.3.1 and the damage by the El Nino disaster, the following return period was decided in light of endurance of the culvert and maintenance of the pavement.

Highway Facility	Return period
Bridge	50years
Culvert	50years

The expected flow is estimated using the following formula:

$$Q = 0.278\ C \times I \times A$$

Where: Q is the expected flow (m^3/s)
C is the run-off coefficient
I is the intensity of rainfall (mm/h)
A is the Catchment area (km2)

7.4 Pavement Design

(1) Thickness of Earthworks and Pavement Layers

The thickness of earthworks and pavement layers should be adopted in accordance with the standards of the Road Design Manual of Kenya. Alignment soils are expected to be used as sub-grade material while material sites are to be used as burrow pits for both sub-base and base material sources in accordance with the laboratory tests. However, in case the burrow pit material does not meet the requirements stipulated in the RDM Part III, material obtained from quarry sites, as indicated hereafter, shall be adopted.

Asphalt concrete type II (t = 30mm) should be provided on the C20 instead of surface dressing as the wearing course.

(2) Black Cotton Treatment

The Study Team has not considered the necessity of providing special treatment for black cotton soils regarding the embankments of height exceeding 3m. Only stone pitching will be provided in this area to allow the rainwater to permeate the ground. With regard to less than 3m height of the embankment, the soil exhibiting expansive tendencies and low California Bearing Ratio (CBR) values could be improved by treating it with lime or other materials as may be appropriate.

The engineer will decide the location of rock spreading to prevent heaving for the dynamic loading.

The material for improved sub-grade may be obtained from designated material sites after these are extended. More material sites will have to be identified and investigated during the next stage.

Chapter 8

Maintenance for High Priority Roads

Chapter 8 Maintenance for High Priority Roads

(1) Roads to be Maintained

1) Roads for Maintenance

The High Priority Roads were selected for upgrading from gravel to bituminous standard. Maintenance activities are for bituminous standard roads. The roads are shown below.

Table 8.1.1 High Priority Roads

Section	Province	District	Length
a. HomaBay – Mbita	Nyanza	Homabay/Suba	42.41km.
b. Port Victoria - Bumala	Western	Busia	42.99km.
c. Rongo – Ogembo	Nyanza	Migori/ Gucha	19.02km.

2) Maintenance Responsibility

Maintenance of all bituminous roads falls at present under the responsibility of the PWOs. However, the following maintenance system is recommended based on the proposal mentioned in Section 5.3 "Institutional Improvement"(see Table 5.3.1).

Table 8.1.2 Maintenance Responsibility

Section	Routine maintenauce	Periodic Maintenance
a. Port Victoria - Bumala roads	DWO Busia	PWO Western (Kakamega)
b. Homa Bay – Mbita roads	DWO Suba, Homa Bay	PWO Nyanza (Kisumu)
c. Rongo – Ogenbo roads	DWO Gucha, Migori	PWO Nyanza (Kisumu)

Note: Special work is done by both PWO and DWO.

(2) Maintenance Activities and Costs for High Priority Roads

1) Unit Rates of Maintenance Activities

Summaries for bituminous road maintenance are shown as follows:

a) Routine Maintenance

i) Carriageway repair: 70,324 Ksh./km/year

Major activities: potholes and local crack sealing

ii) Off-carriageway repair: 9,155 Ksh./km/year

Major activities: vegetation and drainage clearance by LBM

b) Periodic Maintenance

i) Carriageway Sealing 1,206,884 Ksh./km/year

Maintenance activities: resealing by contractor

c) Total Maintenance Cost Estimate

Average maintenance costs of High Priority Roads are as follows:

2) Maintenance Cost for High Priority Roads

Annual maintenance cost for the High Priority Roads is as follows:

Table 8.1.3 Annual Maintenance Cost for High Priority Roads

Homa Bay - Mbita Road (C19)				
Length=	42 km			
	Off Carriageway	Carriageway	Resealing	Total
	9,155	*70,324*	*1,206,884*	
First Year	384,510	2,953,608	0	3,338,118
5th Year	384,510	2,953,608	50,689,128	54,027,246
Bumala-Port Victoria				
Length=	44 km			
	LBM	Carriageway	Resealing	Total
	9,155	*70,324*	*1,206,884*	
First Year	402,820	3,094,256	0	3,497,076
5th Year	402,820	3,094,256	53,102,896	56,599,972
Rongo-Ogenbo				
Length=	20 km			
	LBM	Carriageway	Resealing	Total
	9,155	*70,324*	*1,206,884*	
First Year	183,100	1,406,480	0	1,589,580
5th Year	183,100	1,406,480	24,137,680	25,727,260
Total Maintenance Cost				
First Year	970,430	7,454,344	0	**8,424,774**
5th Year	970,430	7,454,344	127,929,704	**136,354,478**

Note: Carriageway maintenance cost is increased by increase of traffic of 7.5% per year.
Resealing will be carried out at 5-year interval.
Off carriageway and carriageway is by routine maintenance, resealing is by periodic.
Source: JICA Study Team

(3) Maintenance for Affiliated and Feeder Roads

Affiliated classified roads located around the High Priority Roads have to be maintained together with the High Priority Roads in order to maximise the improvement impacts of the High Priority Roads.

In addition, road maintenance of feeder roads of the High Priority Roads including unclassified roads also becomes an important component to take advantage of the improvement of the High Priority Roads.

Table 8.1.4 shows comprehensive classified rural road network maintenance including affiliated roads.

Table 8.1.4 Comprehensive Classified Road Network Maintenance

Code	High Priority and Affliated Roads	Road Section	Province	District	Length (km)	Classification	Surface
I	**A. High Priority Rds**	**Bumala - Port Victoria**	**Western**	**Busia**	**44**	**D250/D251/C30**	**Unpaved**
I-1	Affiliated Rds	Mundere - Busome-Siaya		Busia/Siaya	38	D251/C30/C29	Unpaved
I-2		Siaya - Bondo		Siaya/Bondo	21	D246	Unpaved
I-3		Lwero - Malaba		Busia/Teso	28	C43	Unpaved
	sub-total				87		
II	**B.High PriorityRds**	**Homa Bay - Mbita**	**Nyanza**	**Homa Bay /Suba**	**42**	**C19**	**Unpaved**
	C. High Priority Rds	**Rongo - Ogembo**		**Migori /Gucha**	**20**	**C20**	**Unpaved**
	sub-total				**62**		
II-1	Affiliated Rds	Kendu Bay - Homa Bay		Rachuonyo/Homabay	30	C19	Unpaved
II-2		Homa Bay - Rongo		Homabay/Migori	29	C20	Paved
II-3		Kendu Bay - Oyugis		Rachonyo	18	C26	Unpaved
	sub-total				201		
Total	**High Priority Rds**				**106**		
Total	Affiliated Rds				288		
	Total				***394***		

Note: Round number is used for the length of the High Priority Roads.
High Priority Roads B and C should be maintained as the same component for work efficiency
Source: JICA Study Team

Chapter 9

Construction plan and Cost Estimates

Chapter 9 Construction Plan and Cost Estimates

9.1 Construction Plan

The construction plan and schedule for the priority project are formulated based on the work quantities derived from the preliminary design, topographic, geological and meteorological conditions of the project site, as well as from minimising adverse environmental effects.

(1) Construction Plan

The priority project is divided into five construction segments. The segments were determined in due consideration of each location, segment length and work volume, difficulty of the construction, and location of towns. These segments are shown in Table 9.1.1.

Table 9.1.1 Construction Section

Route No.	Segments	Location		Length (km)
		STA	Place	
C 19	I-1	0+000 - 20+000	Homa Bay - Obanda	20.00
	I-2	20+000 - 42+060	Obanda - Mbita	22.06
	(I-3)*	41+700 - 42+050	Mbita causeway	0.35
D 250/	II-1	0+000 - 20+000	Bumala - Sio Port	20.00
D 251/C30	II-2	20+000 - 42+992	Sio Port - Port Victoria	22.99
C 20	III	0+000 - 19+020	Rongo - Ogembo	19.02

Note: This cost is appropriated by El Nino disaster rehabilitation budget.

(2) Construction Schedule

In the construction schedule, the construction period of the main work items is firstly analysed based on the assumed workable days, unit progress rate and the estimated quantities, and subsequently, the construction schedule of the project is established applying the period analysed.

The construction periods of the major and critical work items are estimated considering the unit progress rate and the estimated total work quantity of major work items. The total quantity and corresponding construction periods of each major work item are shown in Table 9.1.2.

(3) Implementation of the Projects

The MOR&PW is in charge of three road improvement projects and the projects will be constructed by contractors through international competitive bidding.

Table 9.1.2 Construction Schedule

Section	Work Item	Construction Year 1	2	3	4
I-1	Tender preparation				
	Earth Work				
	Pavement Work				
	Culvert & Drainage				
	Road Furniture				
	Black Cotton Soil Treatment				
	Land Acquisition				
I-2	Tender preparation				
	Earth Work				
	Pavement Work				
	Culvert & Drainage				
	Road Furniture				
	Black Cotton Soil Treatment				
	Land Acquisition				
I-3	Tender preparation				
	Earth Work				
	Pavement Work				
	Road Furniture				
II-1	Tender preparation				
	Earth Work				
	Pavement Work				
	Culvert & Drainage				
	Road Furniture				
II-2	Tender preparation				
	Earth Work				
	Pavement Work				
	Culvert & Drainage				
	Road Furniture				
	Land Acquisition				
III	Tender preparation				
	Earth Work				
	Pavement Work				
	Culvert & Drainage				
	Road Furniture				

9.2 Cost Estimates

The project cost estimates started with a data collection exercise at several construction sites and interview surveys with MOR&PW and related agencies in order to ensure that the unit price analysis and results are firmly based on the realities in Kenya. The project cost estimates are carried out on the basis of the preliminary design and the construction plan and schedule, assuming that project implementation will be realised by an international contractor.

(1) Basic Condition

The following assumptions and conditions are applied in the project cost estimates.

a) Price level of labour, material and equipment is based on the cost in July 1999.

b) The exchange rate applied to convert the US dollar to Kenya shilling is US$1.00=72.2 Kenya shillings (Daily Nation, July 9,1999).

c) The costs are divided into foreign currency (indicated in US$) and local currency (indicated in US$) portions. The foreign and local currency components of each unit price are computed based on the following classification of basic cost elements.

The foreign currency component includes the costs of:

- Imported equipment, material and supplies,
- Imported materials in the local market,
- Wages of expatriate personnel,

The local currency component includes the costs of:

- Domestic materials and supplies,
- Wages of local personnel,
- Duties and tax.

Indirect construction costs, engineering services and physical contingency are calculated at both the local currency portion and the foreign currency portion, reflecting the likelihood of an international joint venture.

d) Major material items included in the unit costs are bitumen cut back, chipping, crushed stone, gravel, cement, galvanised gabion wire, reinforcement bars and fuel.

e) Imported equipment and materials are assumed to be exempted from tax and duty by the Government of Kenya.

f) To estimate the rate of each work item, "Analysis of Contract Rates-1998 "issued by MOR&PW, Roads Department, Design branch, is provided for reference.

g) Production rates to analyse the costs of main work items are based on standard production rates in Japan after some modification were made with due consideration to Kenya local conditions.

h) Except for the direct construction costs, other costs such as indirect construction costs, engineering services, physical and escalation contingency are computed using multiplier factors.

(2) Quantity Estimates

Construction work items of the projects consist of earthwork, pavement, culvert and drainage, road furniture, land acquisition and house compensation. Each work consists of the quantity items to estimate the direct construction costs.

(3) Total Project Costs

The project costs on the priority roads selected for the feasibility study are estimated on the basis of the quantities estimated in the preliminary design and the unit price analysis for each work item. The project costs on the priority roads are estimated at US$ 13.1 million, US$ 10.7 million and US$ 5.0 million for Section I, II and III, respectively as shown in Table 9.2.1. and 9.2.2.

Table 9.2.1 Project Costs by Component

Unit: in US$1,000

Cost Component	Work Item	C19				D250/D251/C30			C20	Grand total
		I-1	I-2	I-3	Sub-total	II-1	II-2	Sub-total	III	
Direct Construction Cost	1 Site clearance	24	30	0	54	23	26	49	28	131
	2 Earth work	655	633	14	1,302	637	1,362	1,999	1,027	4,328
	3 Pavement	2,586	3,105	33	5,724	1,897	2,172	4,069	1,623	11,416
	4 Culvert/drainage	139	313	15	467	175	74	249	219	935
	5 Others	118	54	1	173	16	25	41	106	320
	Sub-total	3,522	4,135	63	7,720	2,748	3,659	6,407	3,003	17,130
Indirect Construction Cost		1,233	1,446	22	2,701	962	1,280	2,242	1,051	5,994
Engineering Services		352	414	6	772	275	366	641	300	1,713
Others		909	952	14	1,875	597	801	1,399	656	3,930
Total		6,016	6,947	105	13,068	4,582	6,106	10,688	5,010	28,766

Note: land acquisition and compensation costs are included in the above project cost
The cost of Mbita causeway (US$101,251) is appropriated by El Nino disaster rehabilitation budget

Table 9.2.2 Project Cost by Year

Unit: in US$1,000

Route	Year	1			2			3			Total		
	Segment	Currency			Currency			Currency			Currency		
		Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total
C19	I-1	1,580	2,342	3,922	875	1,219	2,094	0	0	0	2,455	3,561	6,016
	I-2	533	105	638	2,022	2,816	4,838	615	856	1,471	3,170	3,777	6,947
	I-3	0	0	0	0	0	0	43	60	103	44	61	105
	Sub-total	2,113	2,447	4,560	2,897	4,035	6,932	658	916	1,574	5,669	7,399	13,068
D250/ D251/ C30	II-1	1,375	1,915	3,290	540	752	1,292	0	0	0	1,915	2,667	4,582
	II-2	31	49	80	1,865	2,597	4,462	653	910	1,563	2,550	3,556	6,106
	Sub-total	1,406	1,963	3,369	2,405	3,349	5,754	653	910	1,563	4,465	6,223	10,688
C20	III	0	0	0	579	806	1,385	1,515	2,110	3,625	2,094	2,916	5,010
Grand total		3,519	4,411	7,930	5,881	8,191	14,072	2,826	3,936	6,762	12,228	16,538	28,766

Note: land acquisition and compensation costs are included in the above project cost
The cost of Mbita causeway (US$101,251) is appropriated by El Nino disaster rehabilitation budget

Chapter 10

Environmental Impact Accessment

Chapter 10 Environmental Impact Assessment

10.1 Initial Environmental Examination for the Proposed Projects

The initial environmental examination (IEE) process was applied to the three selected projects. The IEE examines a series of environmental items, on which project implementation may have an adverse impact not only on the project sites but also on surrounding areas, which may be directly or indirectly affected during the construction and operational stages. The screening and scoping of such environmental items was completed, and 13 items were selected for inclusion in the IEE process (Table 10.1.1).

Table 10.1.1 Screening and Scoping for the Proposed Projects

Major Facilities / Activities		Roads / Roadside Facilities / Construction Roads				
		Construction Stage		After Construction Stage		
Activities which may cause impacts		Trespassing on Land *1	Operation of Construction Equipment *2	Land Acquisition *3	Traffic *4	Concentration of People and Goods *5
Social Environment						
1	Resettlement	○		○		
2	Economic Activities			○		
3	Traffic and Public Facilities				○	
4	Split of Communities			○		
5	Cultural Property	○				
6	Water Rights/ Rights of Common	○				
7	Public Health Condition					
8	Waste					
9	Hazards (Risk)					
Natural Environment						
10	Topography and Geology					
11	Soil Erosion	○				
12	Groundwater					
13	Hydrological Situation	○				
14	Coastal Zone					
15	Flora and Fauna	○				
16	Meteorology					
17	Landscape			○		
Pollution						
18	Air Pollution		○		○	
19	Water Pollution	○			○	
20	Soil Contamination					
21	Noise and Vibration		○		○	

22	Land Subsidence					
23	Offensive Odor					

Note 1 : O: The environmental items which may have a significant impact depending on the scale of the project and site conditions

*1: Activities trespassing on land for preparation work of road construction.

*2: Activities which may cause impacts by construction equipment under construction.

*3: Situations which may cause impacts by permanent use of land after construction.

*4: Activities which may cause impacts by traffic on the project roads after construction.

*5: Situations which may cause impacts by concentration of people and goods at public facilities such as administrative facilities, hospitals, schools, and markets after construction.

Source: this table was modified from Environmental Guidelines for Infrastructural Project III Roads. September 1992, JICA.

10.2 Environmental Impact Assessment for the Proposed Projects

The environmental impact assessment (EIA) for the proposed projects was carried out for the items, which were selected at the IEE stage. The results of the EIA are as elaborated on below:

10.2.1 Existing Environmental Conditions

(1) Homa Bay - Mbita Road (C19)

1) Social Environment Conditions

The population density is moderately high at present around the C19 road. The largest town in the region is Homa bay, the population of which is around 53,000 people in 1999. The town is located around 40 km away from Mbita. Much of the income along the C19 road is derived from fishing, agriculture and livestock. Wage earnings of employees in the urban area ranges from Ksh. 900 to 2000 per month. Especially, fishing is an important activity along most of the C19 road, and pursued at the lake, rivers and in ponds. The total volume of landing fish at Mbita was around 8,000 tonnes in 1998.

Homa Bay and Kisumu are major marketplaces for the residents, who go to the Homa Bay District Hospital in serious cases. It takes about 1.5 hours for Homa Bay by Matatu. There are around 17 services per day to Homa Bay by Matatu.

There are some public facilities around the C19 road, such as dispensaries, education facilities, small local markets and administrative centres.

2) Natural Environmental Conditions

The C19 road descends into generally flat low-lying terrain, and there are several perennial and seasonal rivers. Various types of soils are found along the C19 road, which are of high fertility in general.

The area along the C19 road has an inland equatorial climate heavily influenced by its proximity to the lake. The vegetation and wildlife along C19 road is no longer untouched nature, as there is considerable agricultural activity in the area.

3) Conditions on Pollution

Air quality, such as NO_x, SO_x, CO, SPM, concentration levels were sampled at just outside Homa Bay. The results show that at present there are no serious air pollution problems along the C19 road.

Water quality, such as pH, DO, BOD, SS, Faecal Coliform, concentration levels were measured at the River Olambwe and the causeway at Mbita. The samples taken at River Olambwe show that water quality in the river is generally acceptable, apart from levels of suspended solids (SS) which exceed by far permissible limits. The river is reportedly always turbid anyway. The samples taken at the causeway at Mbita show that water quality in the lake is generally acceptable.

Traffic noise levels were measured at just outside Homa Bay. The peak levels were within the accepted practical range.

(2) Rongo ~ Ogembo Road (C20)

1) Social Environmental Conditions

The population size of Rongo and Ogembo towns was around 6,400 and 1,800 people respectively in 1999. The population density along the C20 is moderately high at present. Income along the C20 road is mainly generated from agricultural and livestock activities. Sugarcane, tea and coffee are the major agricultural products. Per capita income in the Kisii District is as high as Ksh. 23,000 per month according to the Welfare Monitoring Survey. This income level is far beyond the urban poverty line of Ksh. around 1,000 per month. Another important activity is quarrying for soapstone.

Kisii is a major marketplace for the residents. It takes about 70 minutes by Matatsu and there are around 8-10 services per day by Matatu to Kisii. There are two major hospitals, Tabaka Mission Hospitals and Kisii District Hospiatals. It takes 30 minutes to Tabaka by Matatu.

There are some public facilities, such as health centres, dispensaries, education facilities, local markets, and administrative centres along the C20 road.

2) Natural Environmental Conditions

The entire road is located in fairly hilly terrain with several ridges near Ogembo. Soils around the project road are highly fertile.

The area around the C20 road can be regarded as having a highland equatorial climate (warm temperate). The vegetation and wildlife along the C20 road is no longer untouched nature, as there is considerable agricultural activity in the area.

3) Conditions on Pollution

Traffic noise levels were measured at a distance of 2 km from Rongo town. The peak levels were within the accepted practical range.

There are no data of air/ water quality levels along the C20 road. However, there might be no serious air/ water pollution problems at present along the C20 road according to ocular inspection and information obtained from the residents.

(3) Port Victoria - Bumala Road (D250/D251/C30)

1) Social Environmental Conditions

The population size of the Budalangi Division, in which Port Victoria is located, was around 50,000 people in 1999. The population density along the D250/D251/C30 is moderately high at present. Average per capita income for waged labour ranges between Ksh. 1,500 to 4,000 per month. Most income along the D250/D251/C30 road and in its area of influence is generated from activities such as fisheries, trade and commerce, and to some extent agriculture. Especially, fishing is the most important economic activity along most of the project road, being pursued at the lake, rivers and swamps. The total volume of fish products in Busia District reached 15,000 tonnes in 1998. Almost all of the fish products are landed at Port Victoria, which displays the largest landing volume in the Study Area.

Busia, Kisumu and Bumala are the major marketplaces. It takes three hours, three hours and two hours by Matatu respectively. There is a Mission Hospital in Nangia and a Busia District Hospital about one hour and three hours respectively from Port Victoria by Matatsu. There are around 15 services per day by Matatu between Port Victoria and Bumala.

There are some public facilities, such as local hospitals, dispensaries, education facilities, local markets, and administrative centres along the D250/D251/C30 road.

2) Natural Environmental Conditions

The whole of the D250/D251/C30 road traverses gently undulating terrain. The soils have low natural fertility.

The climate along the D250/D251/C30 road is greatly influenced by the lake. The vegetation and wildlife along the D250/D251/C30 road is no longer untouched nature, as there is considerable agricultural activity in the area.

3) Conditions on Pollution

Air quality, such as NO_x, SO_x, CO, SPM, concentration levels were sampled at Bumala. The results show that there are at present no serious air pollution problems along the D250/D251/C30 road.

Traffic noise levels along the D250/251 were measured at 1.5 km from the junction at Bumala with the Kisumu - Busia Road (B1). The peak levels were within accepted practical range.

There are no data on the water quality along the D250/D251/C30. However, there might be no serious water pollution problems at present along the D250/D251/C30 road according to ocular inspection and information obtained from the residents.

10.2.2 Forecast of Environmental Impacts

(1) Social Environment

1) Forecast of Environmental Impacts on Resettlement

Resettlement may occur caused by land acquisition and by the transfer of rights of residence and land ownership. It may cause impacts such as: 1) the loss of living foundation of inhabitants to be relocated, and the deterioration of living standard after resettlement due to the poor compensation system or the status of illegal occupants. Therefore, compensation for such impacts caused by resettlement will be required.

2) Economic Activities

Economic benefits derived from the project road are obviously noticeable, as it provides the quickest access routes to markets for fish and agricultural produce. Therefore, the impact on economic activities might be positive rather than negative.

However, in some of the settlements/centres along the road, shops and kiosks are located within the road reserve, so that activities in the trading centres and settlements along the project road might be interrupted. The loss of bases of economic activities, such as land and change in the economic structure, might occur by loss of arable land and changes in land use. Therefore compensation for impacts on economic activities will be required.

3) Traffic and Public Facilities

Road projects are associated with numerous sociological and socio-economic benefits, resulting from improved access to schools, health facilities and market centres, which contribute to increased productivity and thus an ultimate improvement in the standards of living. Therefore, the impact on traffic and public facilities might be positive rather than negative.

However, the impacts on schools, hospitals and present traffic conditions, such as increased traffic congestion and accidents, might occur through the replacement of transport means through road traffic emergencies and an increase of vehicular traffic. There will be some danger to pedestrians, cyclists and livestock along the road. Therefore, mitigation measures for road safety and for any impacts on traffic and public facilities will be required.

4) Environmental Impact by Split of Communities

Community-split due to interruption of area traffic might occur through the interruption of the existing route caused by the construction of new roads and the interruption of traffic of inhabitants. However, the traffic volume is not expected to be so large. Therefore, the impact on splitting of communities might not be so severe.

5) Impact on Cultural Property

There are no sites of cultural, historic or traditional value that would be affected by the road improvement works. Therefore, there will be no impact on cultural property.

6) Impact on Water Rights/ Rights of Common

Obstruction of fishing rights in rivers, water rights and land use rights might occur through occupancy of arable land needed road construction, obstruction or alteration of fishing grounds in places where the roads traverse rivers or pass by

lake side areas, and an increase in traffic. Therefore, compensation for such impacts on water rights/ rights of common will be required.

(2) Natural Environment

1) Impacts by Soil Erosion

Topsoil erosion caused by rainfall after land reclamation or vegetation removal might occur as a result of exposure of topsoil caused by land reclamation or removal of vegetation for road construction, and / or rainfall and flood during construction. Earthworks (for road construction and quarries) will have a major impact on soil erosion, which may continue after construction. Therefore, erosion control against such impacts on soil erosion and the monitoring of soil conditions will be required.

2) Hydrological Situation

Changes in river discharges and riverbed conditions due to the inflow of drainage or landfill might occur by the hydrological regime that would be altered by the construction of structures, such as piers, where the route passes over rivers. There will be alterations to the hydrological regime, but these are not considered serious. Most of the seasonal or permanent watercourses in the project area drain across the road. Provision for these river crossings (box and pipe culverts) and for facilitating drainage (side drains, mitre drains) will be designed so that flow is not obstructed. However, the monitoring of the hydrological situation will be required.

3) Flora and Fauna

Clearings of vegetation will be necessary within the road reserve and for deviations and new alignments. The natural vegetation in the project area has been substantially altered, but this vegetation is not regarded as having special conservation significance. Therefore, adverse impact on flora and fauna is not forecasted.

4) Landscape

The proposed projects are mainly rehabilitation ones. Therefore, an adverse impact on landscape at the operational stage is not forecasted. During construction, visual intrusion will be due to construction works (including quarries) and traffic. However the scale of construction and the construction

term is small. Therefore, an adverse impact on the landscape at the construction stage is not forecasted.

(3) Impacts by Pollution

1) Air Pollution

There will be air pollution during construction, but this will be temporary in nature. During operation, air pollution will also affect settlements/households along the road. However, the scale of construction and the construction term is small, and the traffic volume is not expected to be so large. Therefore, an adverse impact on air pollution is not forecasted.

2) Water Pollution

Oil wastes will have a bigger and longer-term impact, particularly when they enter the wetlands or the lake. Sediment loads (building debris) in water courses will increase temporarily due to the construction of culverts, which will replace bridges. During operations, oil waste pollution will also affect settlements/households along the road. Pollution due to sediment loads will not be a problem during operations. Therefore, pollution controls against the impacts of water pollution and monitoring of water quality will be required.

3) Noise and Vibration

Noise and vibration generated by vehicles might occur caused by the operations of construction equipment, vehicles for construction and detonations.

During construction there will be a noise problem, but this will be temporary in nature. During operations, the noise problem will affect settlements/households along the road. However, the traffic volume is not expected to be so large. Therefore, the impact by noise and vibration is not forecasted.

10.2.3 Mitigation Measures Against Environmental Impacts

(1) Compensation

Loss of land, crops and housing will be mitigated through compensation. The Commissioner for Lands in the Ministry of Lands and Settlement (Ardhi) assesses the amount of land required for deviations, road reserves and realignments, depth and area of quarries, the market value of the land itself, value of crops lost, value of buildings on the land that may be affected,

environmental and social implications, and so on. The Commissioner for Lands then determines the amount of compensation to be paid for private land.

Compensation to landowners, who must submit their land for the project road must be fair and paid promptly. It should cover crops, all structures and land. It is recommended that a detailed compensation plan is prepared during the detailed design stage of the project to address the above-mentioned issues satisfactorily.

(2) Erosion Control

Earthworks should be controlled during construction, so that land that is not required for deviations, realignments or quarries is not disturbed. The earthworks should be carried out during the dry season to prevent soil from being washed away by the rain. The embankments should be planted with shrubs and grasses to reduce erosion of the road embankments. Unnecessary clearing of vegetation should be avoided to preclude additional erosion.

Changes to the hydrological regime will be taken into account on the road design through the construction of box and pipe culverts so that the flow in the rivers is not disturbed, and by having side drains and mitre drains to direct road runoff away from the road.

(3) Water Pollution Control

Contamination of soil and/or water sources resulting from oil in stormwater drains can be controlled through installing oil sumps at truck parking bays and at the point where stormwater drains meet the lake. Sediment loads in the rivers and streams can be reduced by installing culverts, wherever possible, during the dry season. Information from the residents around Mbita indicates that fish die around the causeway, because of water pollution after construction of the causeway. However, this was assumed to be caused by oil inflow into the lake alongside the causeway by vehicles passing through the causeway. Provision of oil sumps will prevent the lake water from the contamination by oil inflow.

(4) Road Safety

The danger posed to pedestrians and cyclists due to increased traffic volumes and higher speeds can be mitigated by installing clear and frequent road signs and markings (both directional and warning). Signs are also necessary near

health centres and schools. The provision of shoulders will also contribute to making the roads safer, in that they can be used as foot and cycle paths.

(5) Environmental Monitoring

The establishment of EIA system and environmental monitoring system is most important item. In terms of EIA system, it is under consideration by the Kenyan Government through Ministry of Environment, and is expected to be effective in the near future. For environmental monitoring system, the environmental units should be established it as soon as possible. Table 10.2.1 shows the environmental monitoring plan, for which MOR&PW assume the responsibility, for sample.

Table 10.2.1 Environmental Monitoring Programs

Environmental/ Social parameter	Frequency of monitoring
Unimpeded drainage/efficiency of drainage structures	3 - 4 times a year
Erosion of road embankment and roadside erosion	3 - 4 times a year
Quarry rehabilitation	Twice a year for seasonal variations
Establishment of replanted areas	Twice a year for seasonal variations
Social assessment of people from whom land was acquired	Once a year
Sanitation at workmen's camp	Once a month
Impact on public health	Once a year
Air/water/noise quality	Every 2 - 3 years
Impact on wetlands	Every 2 - 3 years
Impact on road safety (number of accidents)	Once a year
Impact on economic development in project area	Every 5 years

10.2.4 Evaluation of Environmental Impacts

The impacts on resettlement, traffic and public facilities, water rights/ rights of common, by soil erosion, and by water pollution, were forecast through the implementation of the projects. Therefore, the mitigation measures including compensation, erosion control, water pollution control, and road safety are proposed. When these mitigation measures and maintenance work are implemented adequately, these impacts can be solved. The implementation of the projects is expected to bring about positive impacts on social environment such as benefits to agricultural and fishing activities, improvement of traffic accessibility to public facilities by the residents.

10.2.5 Recommendations for Environmental Impacts

The recommendations for the prevention and mitigation of adverse impacts are as follows:

- Establishment of project design, a construction plan, and a detailed mitigation measures plan with careful attention for the environment at the detailed design stage
- Implementation of construction in accordance with the project design, the construction plan, and the detailed mitigation measures plan
- Establishment of a environmental monitoring plan and implementation of environmental monitoring

Capacity building is recommended for the management of road construction / operations and the implementation of environmental monitoring. The MOR&PW and Public Works has recently established an environmental unit under its Planning Branch, the responsibility of which is to oversee environmental compliance in all road related activities. However, the environmental unit does not function yet. Therefore, capacity building, such as the establishment of a staff training scheme and an environmental laboratory, the preparation of a budget, and related rules, is recommended.

Chapter 11

Economic Evaluation and Budget Resources Analysis

Chapter 11 Economic Evaluation and Budget Resources Analysis

11.1 Economic Evaluation

11.1.1 Project Cost and Traffic Forecast

(1) Project Cost (Financial Cost)

The project cost is estimated on the basis of 1999 prices. 15% physical contingency, including price escalation, is included in both construction and engineering costs. An exchange rate of 72.2 Ksh. to 1 US$ as of the study year is used in the analysis. One Kenya pound is equivalent to 20 Kenya shillings.

(2) Estimation of Economic Cost

Financial project cost is converted into economic cost under the following assumptions.

a. Composition of foreign and local portion:
   - Construction cost: foreign portion 30%, local portion 70%
   - Engineering cost: foreign portion 60%, local portion 40%
   - Land cost: local portion 100%

b. Tax: accounting for 20% of the financial cost is eliminated for economic cost estimate

c. Opportunity cost of unskilled labour: 20% of financial cost is estimated as economic cost.

d. Productivity of land: assumed 80% of market price as economic cost.

Table 11.1.1 shows the financial and economic cost of the project.

Table 11.1.1 Comparison between Financial Cost and Economic Cost

Unit: 1000 Ksh.

	Cost in Financial Price	Cost in Economic Price	Conversion Ratio
Homa Bay – Mbita	943,523	634,520	67.3%
Bumala – Port Victoria	771,681	517,554	67.1%
Rongo - Ogembo	361,686	242,553	67.1%

Source: JICA Study Team

(3) Traffic Growth

Traffic volume is estimated for the 25 years beginning in the year of project completion. The rate of increase in traffic is estimated at 7.5% per year for all

vehicle types. It should be noted that the results of the past traffic count surveys undertaken by MOR&PW has shown the growth rate in some stations to be over 7.5%. However, a moderate growth rate was used for the economic analysis due to low vehicle ownership in the rural areas.

11.1.2 Project Benefits

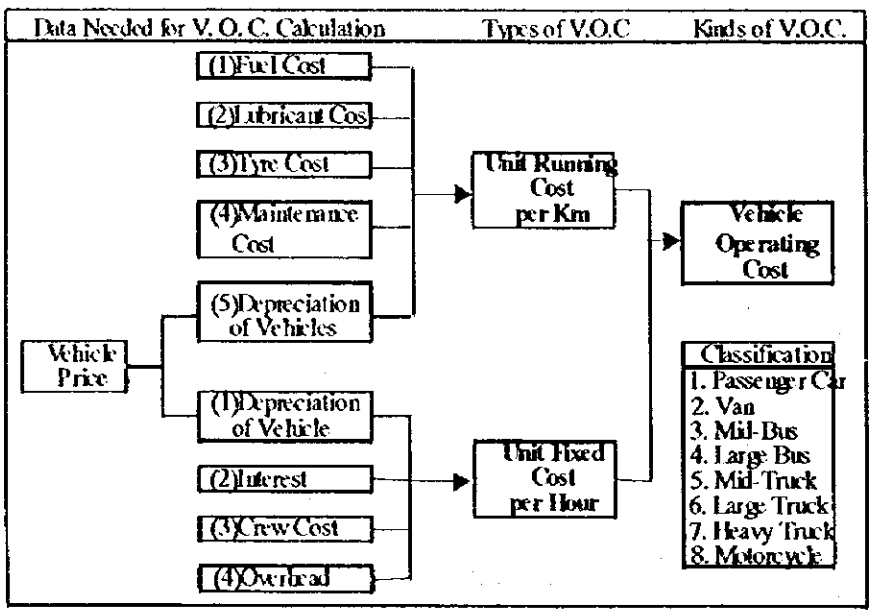
Tangible benefits from the project consist of the following items:

a) Vehicles: Vehicle operating cost saving benefit,
b) Roads: Road maintenance saving benefit,
c) Passengers: Passenger time cost saving benefit,
d) Fish transport: Fish spoilage cost saving benefit, and
e) Induced traffic: Induced benefit.

(1) Vehicle Operating Cost Saving Benefit

1) Estimation of Unit Vehicle Operating Cost

Unit vehicle operating cost is estimated according to the methodology as shown in Fig. 11.1.1.



Source: JICA Study Team

Fig. 11.1.1 Diagram Depicting Vehicle Operating Cost Estimation Procedure

2) Estimation of Vehicle Operating Cost Saving Benefit

The benefit is calculated according to following formula:

Benefit = VOC by speed x traffic volume x average travelling distance x 365.

Benefits are estimated for 25 years. The estimation of benefits is based on the following assumptions.

Average vehicle travelling speed in 1999 without project:

1) Passenger car:35km/h, average speed decreases by 2km/h every 2 years
2) Bus and truck: 30km/h, average speed decreases by 2km/h every 2 years
3) Motorcycle: 25km/h, average speed decreases by 2km/h every 2 years
4) Bicycle: 6km/h, average speed decreases by 1km/h after 10 years

Average vehicle travelling speed with project does not change for project life:

1) Passenger car:70km/h Bus and truck: 60km/h
2) Motorcycle: 45km/h Bicycle: 10km/h

Average travelling distance:

1) Homa Bay-Mbita: 42.41km x 80% = 33.9km
2) Bumala-Port Victoria: 42.99km x 70% = 30.1km
3) Rongo-Ogembo: 19.02km x 80% = 15.2km

(2) Road Maintenance Cost Saving Benefit

The existing earth road, without implementation of the project, requires regular road maintenance works. On the other hand, bituminous road, with project implementation, also needs road maintenance works. The difference between the maintenance costs consists of benefit and all costs are converted from financial costs to economic costs.

(3) Passenger Travel Time Cost Savings Benefit

1) Estimation of Unit Time Cost of Passenger

Benefit of the time cost saving is calculated from the difference of running speed between the existing road and the project road. Beneficiaries of time cost saving are users of passenger cars, buses and motorcycles. Time saving benefit of vehicles is not included here because it is calculated in running cost benefit as a fixed cost item.

2) Benefit of Time Cost Savings

The time cost saving benefit of 3 road projects are calculated based on the following 5 items: a) average running distance, b) average running speed, c) time value, d) traffic volume and e) vehicle types.

(4) Benefit of Fish Transport with Project

The kinds of fish found in this area are mainly Nileperch, Tilapia and Omena (small fish). There are 33 fish loading beaches around Mbita in the Suba District and 17 around Port Victoria in the Busia District. Without project, the fish products lose their freshness and sometimes spoil during truck transport due to delay of arrival and interruption of transport in the rainy season.

The amount of tonnage of spoiled fish is estimated based on the following assumptions:

a. At Mbita of Suba District, 80% of the fish products is assumed to be handled.

b. At Port Victoria of Busia District, 85% of the fish products is assumed to be handled.

c. The ratio of transport of fresh fish to dried fish is assumed to be 30%: 70%.

d. The fish spoilage ratio is assumed to be 20% in the rainy season.

The total rainy season is considered to be 4 months, that is 2 months, in February and March, and another 2 months from August to November on average (half of a month is not regarded as a rainy season because it does not rain heavily) in the Homa Bay area. There are 5months of rainy season, that is 3 months from March to May, 2 months from August to November (half of a month is not regarded as a rainy season for the same reason as above) in the Busia area.

The total value of loss by fish spoilage amounts to 11, 239,00 Ksh. per year in Homa Bay-Mbita and 22,434,000 Ksh per year in Bumala Port Victoria road improvement project areas.

(5) Induced Benefit

The improvement of road conditions and the increase of convenience for road users along the road will accelerate their movement and their economic activities.

a. Traffic using existing road: Normal traffic, which increases as a result of economic development

b. New traffic induced by project road: Induced traffic, which is estimated through increase of convenience

The traffic volume of induced traffic fluctuates based on the characteristics of the projects. The induced traffic is estimated to be at 15% of the normal traffic based on the "Economic Evaluation of Transport Project, by Hanse A. Adler". In addition, it is expected to prevail only 10 years after the operation of the project. Unit benefit of the induced traffic is calculated as that of the half of normal traffic.

11.1.3 Result of Economic Analysis

(1) Result of Economic Analysis

Table 11.1.2 shows the summary of the result of economic analysis.

Table 11.1.2 Summary of the Result of the Economic Analysis

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

Source: JICA Study Team

(2) Sensitivity Analysis

With a 10% increase of traffic, or with 10% decrease of construction cost, the economic internal rate of return is found to be less than the capital opportunity cost of 12%. Table 11.1.3 shows the result of sensitivity analysis.

Table 11.1.3 Sensitivity Analysis of Economic Indicators

Project Name	Base Case	Traffic 10% Increase	Construction Cost 20% Decrease	Maintenance Cost Decrease	Investment 1 Year Postponed
Homa Bay-Mbita	8.27%	8.97%	10.07%	8.90%	
Bumala-Port Victoria	7.07%	7.58%	8.93%	8.49%	
Rongo-Ogembo	7.88%	8.70%	9.50%	9.62%	8.44%

11.1.4 Intangible Benefits

Intangible benefits are not included in the investment feasibility analysis. As rural road improvement projects have not only tangible benefits but also many intangible benefits, a comprehensive analysis including both benefits is necessary in order to evaluate the rural road improvement projects.

Although a part of benefits was included in the savings of the vehicle operating costs and passenger time costs, the major intangible benefits are as follows:

i) Benefit from getting rid of muddy road condition during the rainy season

ii) Benefit of dustless air on road side

iii) Benefit from increased school attendance rates

iv) Benefit of increased bus (Matatu) service frequency.

v) Benefit by increased accessibility to hospitals and medical health facilities.

vi) Benefit of regional integration to neighbouring villages and local centres

vii) Benefit of increased production by strong impacts to fishery zones and tea producing areas

In conclusion, if all the intangible benefits along with the tangible benefits are taken into consideration, the three projects, Homa Bay-Mbita, Port Victoria-Bumala and Rong-Ogembo projects, should be implemented despite a moderate EIRR.

11.2 Budget Resources Analysis

(1) Budgeting Scale of the Central Government

1) Government Revenues

The general revenue of 1995/96, 7,171 million K£ has increased by 1.3 times to 9,673 million K£ in 1998/99. Ordinary major revenue sources are income duty, value-added tax, custom duty, excise duty and non-tax revenue. The fuel levy tax, which is earmarked for road maintenance is included in the excise duty.

On the other hand, the development account of 1995/96, 287 million K£ has decrease to less than half of that 121 million K£ in 1998/99.

(Note: 1 K£=20Ksh.)

2) Government Expenditures

Recurrent expenditures consist mainly of wages and salaries, maintenance and operation cost, and domestic and foreign interest.

Development expenditures are financed through ODA sources from foreign mainly composing loans and grants, though a small portion is appropriated from domestic budget resources. The ratio of recurrent to development expenditures is roughly 80 to 20.

(2) Break Down of the Road Related Budget

1) Road Expenditure vs. National Budget

Road expenditures are also divided into recurrent and development expenditures. Recurrent expenditures are for ordinary light routine maintenance works, and the development expenditures are for new road construction and periodic maintenance works.

Road related expenditure amounts to 25% or 30% of the expenditures in Economic Service category.

2) Road Recurrent Expenditure

Recurrent expenditures have increased from 190 million K£ in 1995/96 to 260 million K£ in 1998/99. 20% of the expenditure is used for routine maintenance of trunk roads, while 31% is used for routine maintenance of the rural roads.

3) Road Development Expenditure

Table 11.2.1 shows a breakdown of road development expenditures. 86% of the total expenditure accounts for construction of 34 new roads and for Northern Corridor Rehabilitation Project. For the development budget, major funds depend on loans and grants provided through Official Development Assistance (ODA), and around 10% is funded from the domestic budget.

Besides the above, the total financial budget of MOR&PW includes 16 million K£ for building and works, and 5 million K£ for building a research centre, planning and research, and for other results.

Table 11.2.1 Road Development Expenditure Required in 1999/2000

Unit: Million K£

Title	Appropriations in Aid	Net Expenditure	Total
Major roads (15 sections)	116	36	152
Other roads (19 sections)	59	7	66
Road markings and signs	0	0	0
Planning and design	0	0	0
Northern corridor rehabilitation	40	0	40
Miscellaneous	29	13	42
Total Expenditure	244	56	300

Source: 1999/2000 Estimates of Development Expenditure by Government of Kenya
Note: 1 K£ is equivalent to 20 Ksh

(3) Resources of the Road Budget

1) Recurrent Budget

Table 11.2.2 provides a breakdown of financial sources for road maintenance. Financial sources for road recurrent expenditures comprise the following three items:

a. fuel levy fund,

b transit toll, and

c. other funds from recurrent budget.

Table 11.2.2 Road Source for Recurrent Expenditure

Unit: Million K£

	1994/95	1996/97	1998/99	1999/00
Fuel Levy	69	-	-	-
Transit Toll	6	-	-	-
Sub total	75	159	265	314
Other Funds	52	85	13	29
G. Total	127	243	277	343

Source: Central Bureau Statistics, 1999
Note: - Portion is not announced from 1996/97 to 1999/00.
1 K£ is equivalent to 20 Ksh.

a) Road Users Levy Fund

The road maintenance budget depends totally on the Road Maintenance Levy Fund. The Road Maintenance Levy Fund was established in 1994 with the following particulars:

Gasoline tax:	1.5 Ksh. / Liter,
Diesel oil tax:	1.0 Ksh. / Liter, and
Lubricant oil tax:	1.0 Ksh. / Liter.

b) Transit toll

In 1994, the government introduced the Common Market for Eastern and South Africa (COMESA) and it harmonized the road transit charge at the following rates:

a. Heavy goods vehicle with up to 3 axles: US$ 3 / 100km,
b. Heavy goods vehicle with more than 3 axles: US$ 8 / 100km, and
c. All articulate vehicles: US$ 8 / 100km,

2) Development Expenditures

The ratio of the budget shares of the total recurrent budget and the development budget is about 80 to 20.

The road development budget has not increased very much each fiscal year.

Table 11.2.3 Requested Development Budget for Road Projects by Foreign Donor in 1999/2000

Unit: Million K£

Project	Amount	Donors
15 Major projects	153	EEC/EDF(European Development Fund)
		IDA, OPEC,FRG(Germany)
		Saudi Fund, Kuwait
19 Other Project	66	BADEA, ADF(African Development Fund)
		EEC, FRG, China
Others	81	SIDA, DANIDA(Denmark)
		Netherlands, EEC/EDF, FRG
Total	300	

Source: 1999/2000 Estimates of Development Expenditure by Government of Kenya (request base).
Note: 1 K£ is equivalent to 20 Ksh.

(4) Road Investment in the Study Area

1) Cost Required in the Study Area

Table 11.2.4 shows the road expenditure for the Study Area from 1996/97-1999/2000.

Table 11.2.4 Road Expenditure in the Study Area

Unit: million Ksh.

	1996/97	1997/98	1998/99	1999/00
Recurrent Budget	44.3	74.3	44.7	151.5
Development Budget	43.1	61.6	35.6	19.8
Total	87.4	135.9	80.3	171.3

Source: MOR&PW
Note: 1999/00 is request base. Others are actual expenditure.

Table 11.2.5 shows the required road maintenance cost and construction cost in the Study Area. The total maintenance cost amounts to 102 million K£ for 5 years that is from 2000/01 to 2004/05.

Table 11.2.5 Required Road Investment Cost in the Study Area

1) Road Maintenance Cost of Study Area (Recurrent)

Year	2000/01	2001/02	2002/03	2003/04	2004/05	Total
Maintenance cost in million Ksh.	310	326	342	359	695	2,032
(in million US$)	(4.3)	(4.5)	(4.7)	(5.0)	(9.6)	(28.1)
Maintenance cost in million K£	16	16	17	18	35	102

2) Construction Cost of Projects (Development) Unit: Million Ksh.(Million US$)

Project	2000/01	2001/02	2002/03	Total
Homa Bay-Mbita	329	501	114	944
	(4.6)	(6.9)	(1.6)	(13.1)
Port Victoria-Bumala	243	416	113	772
	(3.4)	(5.8)	(1.6)	(10.8)
Rongo-Ogembo	0	100	262	362
	(0)	(1.4)	(3.6)	(5.0)

Source: JICA Study Team
Note: 1 K£ is equivalent to 20 Ksh.

2) Source from Road Maintenance Levy Fund

The road maintenance cost of 102 million K£ of the Study Area for 5 years is to be funded from the Road Maintenance Levy Fund in the recurrent budget.

Comparing the road expenditure with the national budget, the road expenditure in the coming 5 years is estimated under the following assumptions:

i) The ratio of road expenditures to total national budget is kept at around 2%.

ii) The ratio of road expenditures to the economic service budget is kept at around 30%.

iii) Annual increase rate of the road budget is 11% on average.

Table 11.2.6 shows the recurrent budget estimate calculated under the following assumptions:

i) The road recurrent budget will increase at 11% annually.

ii) 85% of the road recurrent budget is expected to be funded from the Road Maintenance Levy Fund.

iii) The 15% shortage of the fund for road recurrent budget will be funded from the general recurrent budget.

Table 11.2.6 Recurrent Budget Estimation for the Whole Country and for the Study Area (2000/01 – 2004/05)

Unit: Million K£.

	2000/01	2001/02	2002/03	2003/04	2004/05	Total	Anoual
Levy Fund	274	304	337	374	415	1,705	341
Ordinary Budget	48	54	60	66	73	301	60
Sub total	322	357	397	440	489	2,005	401
Requested Cost	16	16	17	18	35	102	20.4
Allocation Ratio	5.0%	4.5%	4.3%	4.1%	7.2%	5.1%	5.1%

Source: JICA Study Team
1 K£ is equivalent to 20 Ksh.

The required amount for road maintenance in the Study Area amounts to around 5 % of total revenues obtained from the Road Maintenance Levy Fund and general budget over the period from 2000/01 to 2004/05 as shown in Table 11.2.6.

The road length in the Study Area accounts for around 12.6% of the country's total road length. MOR&PW employs a large number of staff in Nairobi Headquarters. This is one of the reasons why the road maintenance budget

allocations have not fitted the pertinent proportion of the regional road network. After the restructure of MOR&PW, based on the institutional reform, an appropriate road maintenance budgetary allocation is expected, which is accordance with the proportion of road length by region.

Chapter 12

Conclusions

Chapter 12 Conclusions

(1) Significance of the Road Network Improvement Plan

The significance of the road network improvement plan emanates out of the long-term perspective that focuses on establishing a well-developed road network. This is expected to support both the local economy and the daily lives of the residents living in the road network's influence area. Any sufficient development of the road network will inevitably require some time. This is so, since the realisation of the road improvement plan including the construction of new and additional roads will depend on donor assistance for some time to come. The road network improvement plan proposed in this Study will make, notwithstanding this reality, a contribution to the GOK's self-help efforts to establish an integrated and unified road network for future long-term development.

(2) Key Elements for Road Maintenance Improvement

The two key elements for implementing the road maintenance improvement plan will be:

- Realising MOR&PW's institutional and organisational reforms; and
- Ensuring that adequate budgetary resources are allocated for the road sector.

Hence, addressing the following two issues will be essential.

a) Improvement of Management Skills that Match with Privatisation Needs

MOR&PW will be converted into a Road Agency in line with the GOK's structural reform efforts, and the Mechanical and Transport Department is expected to be modified under the privatisation scheme into a private equipment-leasing corporation. All new departments and/or entities under the privatisation scheme will have to be managed in accordance with the new roles defined under said scheme.

It is essential for the smooth realisation of the reform efforts that full use is made of foreign expertise with ample accumulated experience in private sector management skills. Because MOR&PW's personnel does not have enough experience in privatisation schemes and can not match the management requirements. It is anticipated that this issue will be addressed through external assistance, such as dispatching of experts.

b) Adjustments in the Fuel Levy

Insufficient allocations for the road budget in the past have been the most serious obstacle for implementing proper road maintenance. This situation is unlikely to change over the short-term. The Road Maintenance Fuel Levy has played an important role since 1994 in securing a portion of the road sector's budgetary resources. However, a long time may pass by until this levy can cover fully budgetary requirements. It is recommended to revise the fuel ratio level in accordance with the growth performance of the national economy with a view to secure an increasing share from that source for future road maintenance requirements.

Transparency about the actual use of the fuel levy is another significant issue and accountability to the public about the actual road budget use is essential. The Road Maintenance Fuel Levy Fund is to be managed by the Road Board through discussions among Road Board members after the establishment of the Road Board. Hence, disclosure to the public of key information on the actual use of the road budget will increase public awareness about the road budget and road maintenance activities.

(3) Implementation of Recommended High Priority Roads

It is expected that the improvements of the recommended high priority roads, that is C19, D250/D251/C30 and C20, will be implemented through donor funded assistance schemes, since almost all of the road sector's development budget will be supported through external aid schemes for the time being. Enhancement of road maintenance is the single most important factor of success for implementing the projects, since improvement of the recommended high priority roads will be meaningless without sufficient road maintenance activities. The GOK is invited in this context to adopt measures geared at improving the following aspects.

a) Strengthening DWO

PWO and DWO share the responsibility for road maintenance implementation. DWO, in co-ordination with PWO, should be engaged in major works, since DWO has the most up-to-date information on current road conditions. It will be necessary in this context for the DWOs to take the initiative in actual road maintenance works including road maintenance planning, and in-house and out-house subcontract management.

b) Involvement of Local Communities

It is unlikely that sufficient equipment for road maintenance works will be provided soon due to the inadequate road maintenance budget. Some limitations on proper road maintenance in the areas of equipment availability, human and financial resources are likely to remain in force even in the future. It is recommended, under such circumstances, that a broader and more flexible approach ranging from equipment- to labour-based methods be introduced. Such an approach would reduce the limitations imposed on proper road maintenance caused by limited resources. Involvement of the local communities in road maintenance is likely to compensate somewhat for inadequate resources allocated for maintenance works of rural roads. For example, reporting by the local communities to DWOs on prevailing deteriorated road conditions and/or participation by local communities in the labour-based method in actual routine road maintenance work are expected to support smooth and low-cost rural road maintenance.

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Acronym

PCI: Pacific Consultants International
CPC: Construction Project Consultant
HEC: Hokkaido Engineering Consultant
IDeA: International Development Association
MOC: Ministry of Construction
MOR&PW: Ministry of Roads & Public Works
MOH&NHCS: Ministry of Home affairs and National Heritage, Culture & Social services
OOP: Office of the President
MOEC: Ministry of Environment and Conservation
VP, P&N Dep.: VP, Planning & National Development Department
MOR Dev.: Ministry of Rural Division
MONR: Ministry of National Resources