No.

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

MINISTRY OF ROADS AND PUBLIC WORKS
MINISTRY OF LOCAL GOVERNMENT
THE REPUBLIC OF KENYA

THE STUDY
ON
MASTER PLAN
FOR
URBAN TRANSPORT
IN
THE NAIROBI METROPOLITAN AREA
IN
THE REPUBLIC OF KENYA

FINAL REPORT

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PREFACE

In response to a request from the Government of the Republic of Kenya, the Government of Japan decided to conduct "The Study on Master Plan for Urban Transport in the Nairobi Metropolitan Area" and entrusted the Study to Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Tsuneo BEKKI of Katahira & Engineers International in association with RECS International Inc. four times between July 2004 and September 2005. In addition, JICA set up an Advisory Committee headed by Dr. Tetsuro HYODO, Associate Professor, Tokyo University of Marine Science and Technology to advise the Study from specialist and technical points of view.

The team held discussions with the engineers of Ministry of Roads and Public Works and Ministry of Local Government as well as other officials concerned of the Government of Kenya and conducted field surveys, data analysis, Master Plan formulation and Pre-Feasibility Study. Upon returning to Japan, the team prepared this final report to summarize the result of the study.

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

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Kenya for their close cooperation extended to the Study.

March 2006

Kazuhisa MATSUOKA
Vice President
Japan International Cooperation Agency

March 2005

Mr. Kazuhisa MATSUOKA
Vice President
Japan International Cooperation Agency

Dear Sir,

LETTER OF TRANSMITTAL

We are pleased to submit herewith the Final Report of "The Study on Master Plan for Urban Transport in the Nairobi Metropolitan Area in the Republic of Kenya". The report includes the advices and suggestions of the authorities concerned of the Government of Japan and your Agency as well as the comments made by the Ministry of Roads and Public Works and other authorities concerned of the Government of Kenya.

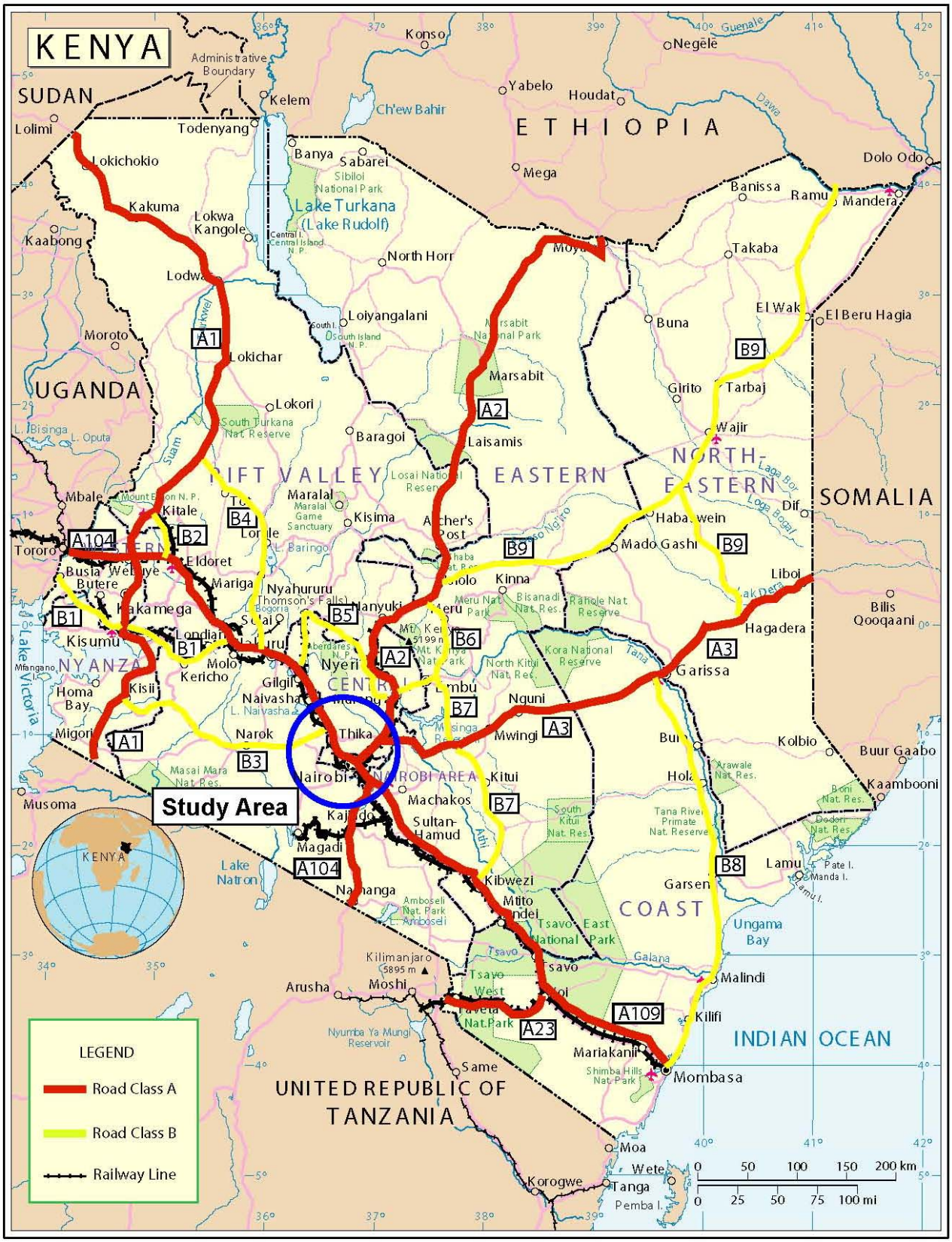
This report analyses the present and future conditions and demand of urban transport in the Nairobi Metropolitan Area. It comprehensively covers the issues of transport including road, public transport, traffic management, institution, legislation, financing and urban environment. The report established an integrated transport Master Plan to the year 2025, including a Short-Term Plan for urgent projects to be implemented in the years 2006 - 2010. The outcome of the Study concludes that the established plans are technically, economically, environmentally and socially feasible and will contribute to the development of the Nairobi Metropolitan Area.

In view of the urgency of development of transport facilities in the Nairobi Metropolitan Area and socio-economic development of the Republic of Kenya, we recommend that the Government of Kenya implement the Projects with high priority.

We wish to take this opportunity to express our sincere gratitude to your Agency, the Ministry of Foreign Affairs and the Ministry of Land, Infrastructure and Transport. We also wish to express our deep gratitude to the Ministry of Roads and Public Works, the Ministry of Local Governments and other authorities concerned of the Government of Kenya for the close cooperation and assistance extended to us during the course of the Study.

Very Truly Yours,

Tsuneo BEKKI
Team Leader
The Study on Master Plan for Urban Transport in the Nairobi Metropolitan Area



Location Map

THE STUDY ON MASTER PLAN FOR URBAN TRANSPORT IN THE NAIROBI METROPOLITAN AREA

FINAL REPORT

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LIST OF ABBREVIATIONS

AADT	Annual Average Daily Traffic
AAK	Automobile Association of Kenya
ADT	Average Daily Traffic
APRP	Annual Public Road Program
ASSHTO	American Association of State Highway and Transportation Officials
B/C	Benefit-Cost Ratio
BOT	Built, Operate and Transfer
BVOC	Basic Vehicle Operating Cost
CBD	Central Business District
CBS	Central Bureau of Statistics
CCN	City Council of Nairobi
CED	City Engineer's Department
CIDA	Canadian International Development Agency
CO	Carbon Monoxide
COMESA	Common Market for Eastern and Southern Africa
COTU	Central Organization of Trade Union
DFID	Department for International Development
DLAI	Department of Local Authorities Inspectorate
DRC	District Roads Committee
DWO	District Works Offices
EAENP	East African Road network Project
EE	External to External
EI	External to Internal
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EMCA	Environmental Management and Coordination Act
EPZ	Export Processing Zone
EU	European Union
F/S	Feasibility Study
FD	Forest Department
GDP	Gross Domestic Product
GFCF	Gross Fixed Capital Information
GIS	Geographic Information System
GNP	Gross National Product
GOJ	Government of Japan
GOK	Government of Kenya
GRDP	Gross Regional Domestic Product

HC	Hydrocarbons
HCM	Highway Capacity Manual
IE	Internal to External
IEE	Initial Environmental Examination
ILO	International Labor Organization
IT	Information Technology
ITC	Information Technology and Communication
ITCZ	Inter-tropical Convergence Zone
ITDG-EA	Intermediate Technology Development Group, East Africa
JICA	Japan International Cooperation Agency
KAA	Kenya Airports Authority
KBS	Kenya Bus Services
KCAA	Kenya Civil Aviation Authority
KFW	Kreditanstalt für Wiederaufbau
KR	Kenya Railway
KRB	Kenya Road Board
Ksh	Kenyan Shilling
KUTIP	Kenya Urban Transport Infrastructure Project
KWS	Kenya Wildlife Services
LAN	Local Area Network
LATF	Local Authorities Transfer Fund
LOS	Level of Service
LRT	Light Rail Transit
MAK	Matatu Association of Kenya
MENR	Ministry of Environment and Natural Resources
MIA	Mode Interchange Area
MOF	Ministry of Finance
MOFA	Ministry of Foreign Affairs
MOLG	Ministry of Local Government
MOLH	Ministry of Land and Housing
MOT	Ministry of Transport
MOT	Maintain Operate and Transfer
MOTC	Ministry of Transport and Communication
MP	Master Plan
MRPW	Ministry of Road and Public Works
MVOA	Matatu Vehicle Owners Association
NDP	National Development Plan
NEMA	National Environmental Management Authority
NGO	National Governmental Organization
NMA	Nairobi Metropolitan Area

NMDA	Nairobi Metropolitan Development Authority
NMIMT	Non-Motorized and Intermediate Means of Transport
NMT	Non-Motorized Transport
NOx	Oxides of Nitrogen
NPEP	National Poverty Eradication Plan
NPV	Net Present Value
NRSC	National Road Safety Council
NUTRANS	Nairobi Urban Transport Study
OD	Origin-Destination
PAP	Project Affected Persons
PAWS	Protected Areas and Wildlife Service
PCU	Passenger Car Unit
PPP	Public-Private Partnership
PSE	Principal Superintending Engineer
PSO	Public Service Obligation
PWO	Provincial Works Offices
R/C	Radial-Circumferential
RAP	Resettlement Action Plan
RD	Road Department
RDUG	Road Design Guidelines for Urban Roads
RMLF	Road Maintenance Levy Fund
ROW	Right of Way
SDP	Social Development Department
SEA	Strategic Environmental Assessment
SME	Small and Medium Enterprise
SN	Structural Number
SSATP	Sub-Saharan Africa Transport Program
TAZ	Traffic Analysis Zone
TLB	Transport Licensing Board
TOR	Terms of Reference
TRANSCAD	Transportation Computer Aided Design
TTC	Travel Time Cost
TU	Transport Unit of CCN
UDD	Urban Development Department
USD	United States Dollar
V/C	Volume Capacity Ratio
VOC	Vehicle Operating Cost
VRC	Vehicle Running Cost
WAN	Wide Area Network
WB	World Bank

PART I

PRESENT CONDITION

CHAPTER 1

INTRODUCTION

CHAPTER 1 INTRODUCTION

1.1 BACKGROUND

There are four major modes of transportation in Kenya for passengers and bulk freight: rail, road, maritime, and air. Of these, the most important in terms of volume is road transport, amongst which the route between Nairobi and Mombasa and the corridor that runs from Nairobi to the west of the country towards Uganda and into the interior of Africa. An efficient transport system is a pre-requisite for the rapid economic development of the country and for improving the quality of life of the people.

However, the transport system of the country is far from satisfactory characterized by low operating speeds, delays, accidents and high operating costs due largely to the poor condition of the road and rail infrastructures coupled with inadequate capacity of the transport system. Over the past decade, sectorial development policy of the Government of Kenya has been legislated to implement proper maintenance for its existing road infrastructure. Despite this, the network has deteriorated rapidly during the same period due to lack of sufficient funds and management capacity. On the other hand, traffic demand has been increasing rapidly during the past decade culminating in the shortage of road capacity to meet the drastic rising demand.

This shortage is particularly experienced in the Nairobi Metropolitan Area. The need to therefore increase the transport supply in this city is obviously not a debatable issue. Inadequacy in the road capacity, road structure and traffic management has led to heavy traffic congestion and traffic accidents. Accordingly, in order to improve this situation, construction of missing links and improvement of road structures/facilities and traffic management capacity are absolutely necessary. The Government of Kenya decided that in order to solve the transport problems, a comprehensive master plan covering the areas of road network improvement, public transport and traffic management should be developed by the year 2025.

In response to the request of the Government of the Republic of Kenya (hereinafter referred to as “GOK”), the Government of Japan (hereinafter referred to as “GOJ”) has decided to conduct the Study on Master Plan for Urban Transport in the Nairobi Metropolitan Area in the Republic of Kenya (hereinafter referred to as “the Study”) in accordance with the relevant laws and regulations in force in Japan. Accordingly, the Japan International Cooperation Agency (hereinafter referred to as “JICA”), the official agency responsible for the

implementation of the technical cooperation programs of the GOJ, undertook the Study in close cooperation with the authorities concerned of the GOK.

JICA organized and dispatched a Study Team consisting of experts of Katahira & Engineers International and RECS International Inc. (hereinafter referred to as "the Study Team") to Kenya to commence the Study in July 2004. The Study was conducted for a total of about 21 months both in Kenya and in Japan. The Draft Final Report (DF/R) was submitted to GOK in January, 2006. After being revised by comments on the DF/R, the Final Report was submitted in March 2006.

1.2 STUDY OBJECTIVES

The objectives of the Study are:

1. To formulate a master plan for urban transport in the Nairobi Metropolitan Area for the target year 2025,
2. To conduct a Pre-feasibility study on the priority projects under the master plan, and
3. To carry out relevant and appropriate technology transfer to Kenyan counterpart personnel in the course of the Study.

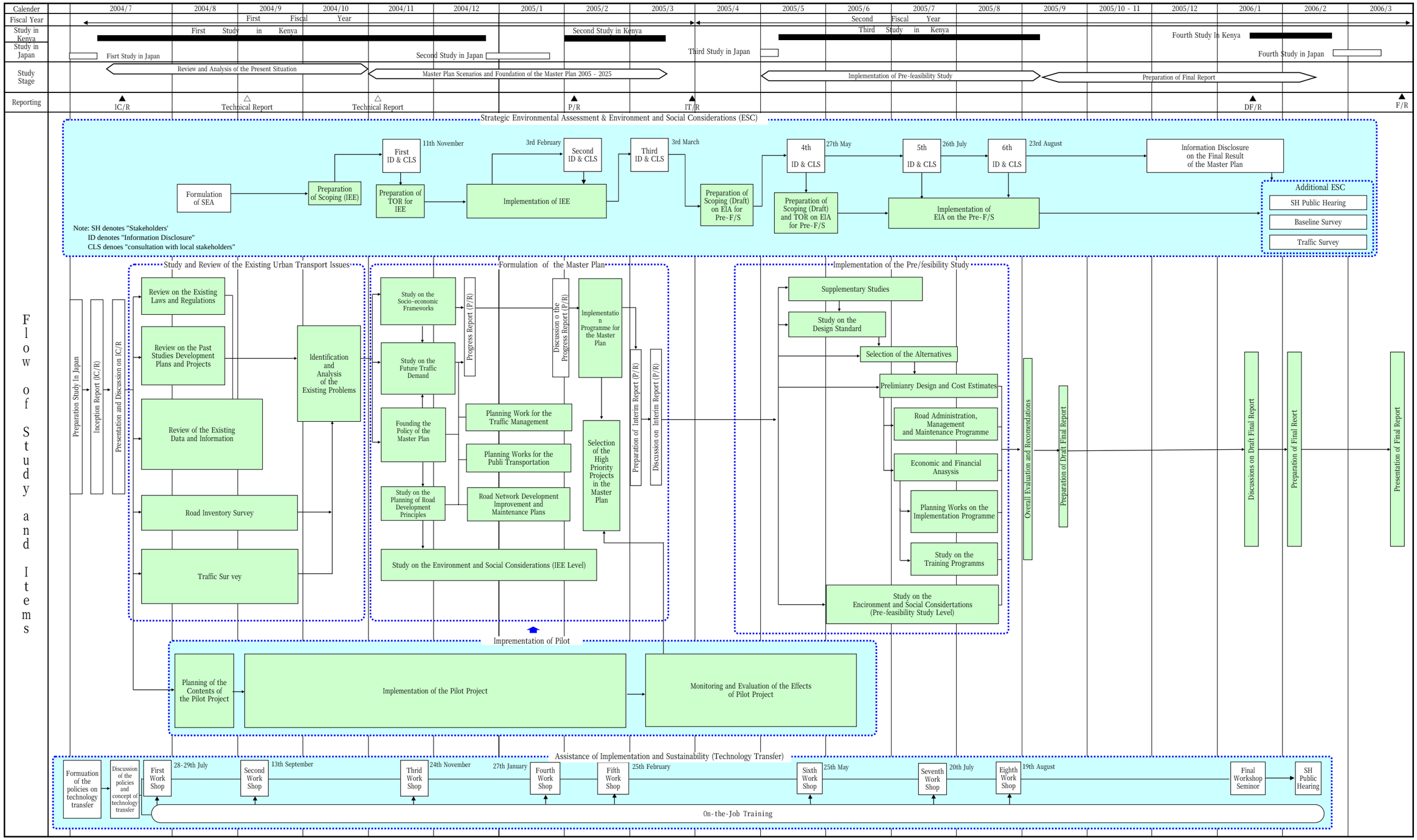
1.3 STUDY AREA

The study shall cover the city of Nairobi and its surrounding areas.

1.4 STUDY SCHEDULE

The Study was carried out within a nineteen (19) month-period, commenced in July 2004 and completed in January, 2006. The Study was composed of three (3) main phases. The first phase was to carry out the review and analysis of the existing situation to identify the present transport problems. The second phase was to formulate a master plan for the target year 2025 based on the identified problems and future traffic demand. The third phase was to implement a Pre- feasibility Study on the priority projects under the Master Plan. In addition to the third phase, an additional environment and social consideration survey was carried out in February and March 2006. Figure 1.4-1 shows the framework and flow of the Study.

FIGURE 1.4-1 STUDY SCHEDULE



1.5 STUDY ORGANIZATION

The organization chart of the study, which clarifies the interrelationship between different agencies, committees and teams involved in the Study, is presented in Figure 1.5-1.

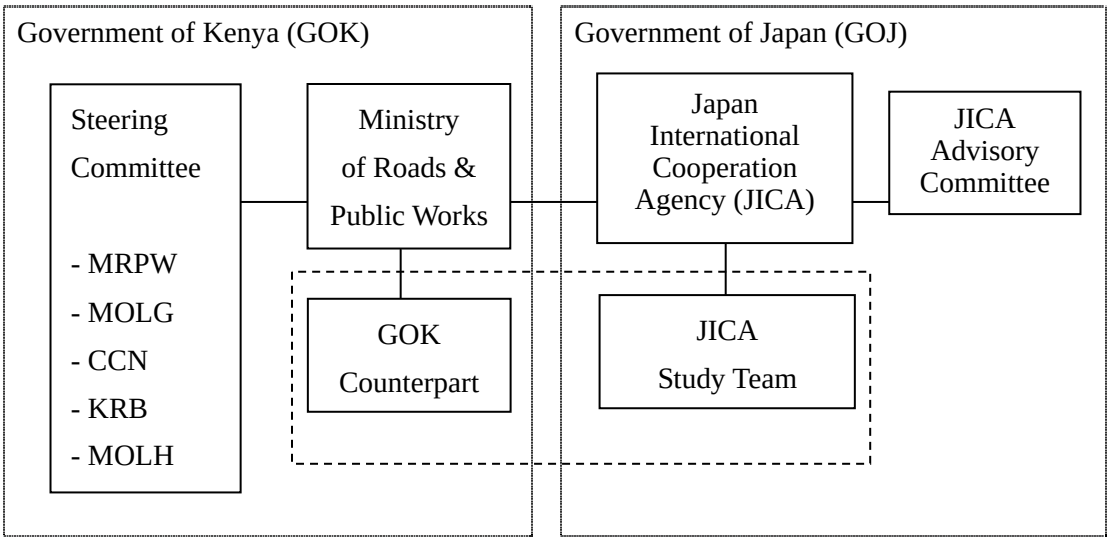


FIGURE 1.5-1 ORGANIZATION CHART

(1) Study Team

The Study was carried out by the Study Team organized by JICA, which was composed by the following experts:

Mr. Tsuneo BEKKI	Team Leader/Urban Transport Policy
Mr. Akio NAKAMURA	Urban Transport Plan/Land Use Plan
Mr. Guang Qian CHEN	Organization and Institution/Management Plan (for Master Plan)
Mr. Takayasu OTAKE	- ditto – (for Pre-F/S)
Mr. Toshinori TODA	Deputy Team Leader/Road Development Plan/Social Environment Consideration
Mr. Masato KOTO	Public Transport Plan/Traffic Management Plan
Mr. Kenji ISOMOTO	Facility Design/Construction/Cost Estimate/Baseline Survey
Mr. Masazumi ONO	Traffic Demand Forecast
Mr. Ryuichi UENO	Traffic Survey and Analysis
Mr. Toshio KIMURA	Economic and Financial Analysis
Mr. Takenobu SUZUKI	Natural Conditions and Environment Considerations
Dr. Tsuyoshi HASHIMOTO	Social Environment Consideration (1)/SEA
Mr. Shusuke MINATO	- ditto – (2)/Participation
Mr. Shuichi Yashiro	Traffic Survey and Analysis (2)

Note: SEA, Strategic Environmental Assessment

(2) JICA Advisory Committee

Guidance for the Study was realized through JICA Advisory Committee consisting of the following Japanese Government Officials:

Dr. Tetsuro HYODO	Tokyo University of Marine Science and Technology
Dr. Susumu TAKAMIYA	Ministry of Land Infrastructure and Transport

(3) JICA Officers

The study was conducted under the supervision of JICA Headquarters and Kenya Office.

Social Development Department, JICA Headquarter

Mr. Akira NAKAMURA	Group Director, Group III (Transportation), Social Development Department (SDP)
Mr. Yodo KAKUZEN	Team Leader, Transportation Team II Group III (Transportation), SDP (July to December 2004)
Mr. Yuichi SUGANO	- ditto - (January 2005 to end)
Mr. Nobuhiro KAWATANI	Staff, Transportation Team II, Group III, SDP

Kenya Office

Mr. Yoshiaki KANO	Resident Representative
Mr. Tomoki NITTA	Deputy Resident Representative (till September 2004)
Mr. Jiro INAMURA	Deputy Resident Representative (from October 2004 to end)
Mr. Masaru ISHIZUKA	Assistant Resident Representative (till May 2005)
Mr. Tomoki KANENAWA	-ditto- (June 2005 to end)
Mr. Godfrey WALUSE	Programme Officer (Economic Infrastructure) (till October 2004)
Mr. Felix MMBOYI	- ditto (till September 2005)

(4) Steering Committee

The Government of Kenya organized a Steering Committee consisting of the following members to discuss major policies on the Study.

1.	Mr. Kiriinya MUKIIRA	Chairman. PS. MRPW (till September 2005)
2.	Eng. Mohamed MUHAMUD	PS. – ditto – (from October 2005 to end)
3.	Mr. Z.O. OGONGO	PS. Ministry of Local Government (MOLG)
4.	Mr. Joseph KINYUA	PS. Ministry of Finance (MOF)

5.	Eng. E.K. MWONGERA	PS. Ministry of Lands & Housing (MOLH)
6.	Mrs. Rachel ARUNGA	PS. MENR
7.	Eng. I.K.W. MUTONYI	Executive Director, Kenya Road Board (KRB) (till December 2004)
8.	Dr. F.N. NYANGAGA	- ditto – (from January 2005 to end)
9.	Prof. Ratemo MICHIEKA	Director General, NEMA
10.	Mr. F.R. MAGANJU	Town Clerk. City Council of Nairobi (CCN)

(5) Counterpart Team

For the smooth implementation of the Study and certainty of optimum technology transfer, the Government of Kenya assigned a Counterpart Team consisting of the following members:

MRPW	Eng. P.P. ILOVI	Chief Engineer (Road) (July to October 2004)
	Eng. F.G. NGACHU	-ditto- (November 2004 to end)
	Eng. S.M. NGARE	Principal Superintendent Engineer (Design)
	Mr. P.N. AMIANI	Engineer (Design)
	Ms. E.MIBEY	Environmentalist
	Ms. Regina OMBAM	Economist (till August 2005)
MOLG	Eng.B.G. ARIGA	Director (Urban Development Department: UDD)
	Eng. N.N. NYARIKI	Assistant Director
	Eng. J.W. THEURI	Ag. Chief Superintending Engineer
CCN	Eng. C.M. CHIURI	City Engineer
	Eng. S.K. MBURU	Deputy City Engineer (till January 2005)
	Eng. E.H. M.KAGAMBA	(from January 2005 to end)
	Mr. NDEREVA	Director (City Planning)
	Mr. P.S. ADOLWA	- ditto - (July 2004 to end)
	Eng. J.K. MWANGI	Assistant City Engineer
	Eng. C.A. OGUT	- ditto -
	Eng. S.M. MUTHAMA	- ditto -
MOLH	Mr. T.G. NDORONGO	Assistant Director (Physical Planning)
KRB	Dr. F.N. NYANGAGA	General Manager
	Eng. S.K. KAMAU	Manager
	Commissioner of Police	

(6) Observer (JICA Expert)

Mr. Masahiko TAKEUCHI	Road Maintenance Unit, MRPW
Mr. Junichi KANEKO	Kenya Institute of Survey & Mapping, Survey Dept, MOLH

1.6 MAJOR ACTIVITIES AND TECHNOLOGY TRANSFER

(1) Technical Workshop

The following technical workshops were held to discuss the technical issues and outputs of the Study, as part of technology transfer.

Master Plan Stage

No.	Date	Main Topics
1.	28, 29 July 2004	• Inception report • Strategic Environmental Assessment (SEA)
2.	13 September 2004	• Land Use • Traffic Survey and Results • Present condition on Road, Public Transport and Management
3.	24 November 2004	• Socio-economic Framework and Future Traffic Plan • Master Plan Policy and Road Development Principles • Scope of IEE
4.	27 January 2005	• Progress Report • Master Plan Scenario • Progress of IEE
5.	25 February 2005	• Proposed Overall Implementation Plan • Sectorial Transport Plan • Results of IEE • High Priority Projects for Pre F/S

Pre Feasibility Stage - Technical Workshop

No.	Date	Main Topics
6.	21 May 2005	• Outline of Selected Studies
7.	21 July 2005	• Progress of Project and the Preliminary Design of Missing Links • Traffic Circulation Improvement in the CBD • Bus/Matatu system restructuring
8.	19 August 2005	• Progress of the Project • Preliminary Design of Missing Links No.3, 6 and 7 • Traffic Circulation Improvement in the CBD • Bus/Matatu system restructuring • Pre-EIA • Institution and Finance

(2) Steering Committee

No.	Date	Main Topics
1.	27 July 2004	• Inception Report

1.7 DIALOGUE AND STAKEHOLDER MEETING

(1) Stakeholder Meeting

No.	Date	Main Topics
1.	11 November 2004	• Discussion of Transport Progress • Proposals on Problem Solutions • Social Considerations in Project Implementation
2.	3 February 2005	• Master Plan Scenario • Proposed Projects(Road, Bus, Matatu, Rail, Management) • Anticipated Social Impact
3.	3 March 2005	• Overall Implementation Plan • High Priority Projects • Result of IEE • Effects of Pilot Projects

Pre Feasibility Stage – Stakeholder Meetings

4.	27 May 2005	• Outline of Selected Studies
5.	26 July 2005	• Improvement of traffic circulation in the CBD • Bus/matatu system restructuring • Anticipated problems in project implementation
6.	23 August 2005	• Recommended mitigation measures in project implementation.

(2) Seminar

No.	Date	Main Topics
1.	20 January 2006	• Presentation of Draft Final Report

(3) Public Hearing

No.	Date	Main Topics
1.	11 February 2006	• Missing Link Construction (No.3, No.6, No.7)

1.8 REPORTS

The following reports were prepared in the course of the Study:

- Inception Report (July 2004)
- Progress Report (December 2004)
- Interim Report (March 2005)
- Draft Final Report (January 2006)
- Final Report (March 2006)

The Final Report is organized with the following:

- Executive Summary
- Main Text Volume 1
- Appendix I Volume 2-1
- Appendix II Volume 2-2 (Additional Environment and Social Consideration Survey)
- Drawings Volume 3

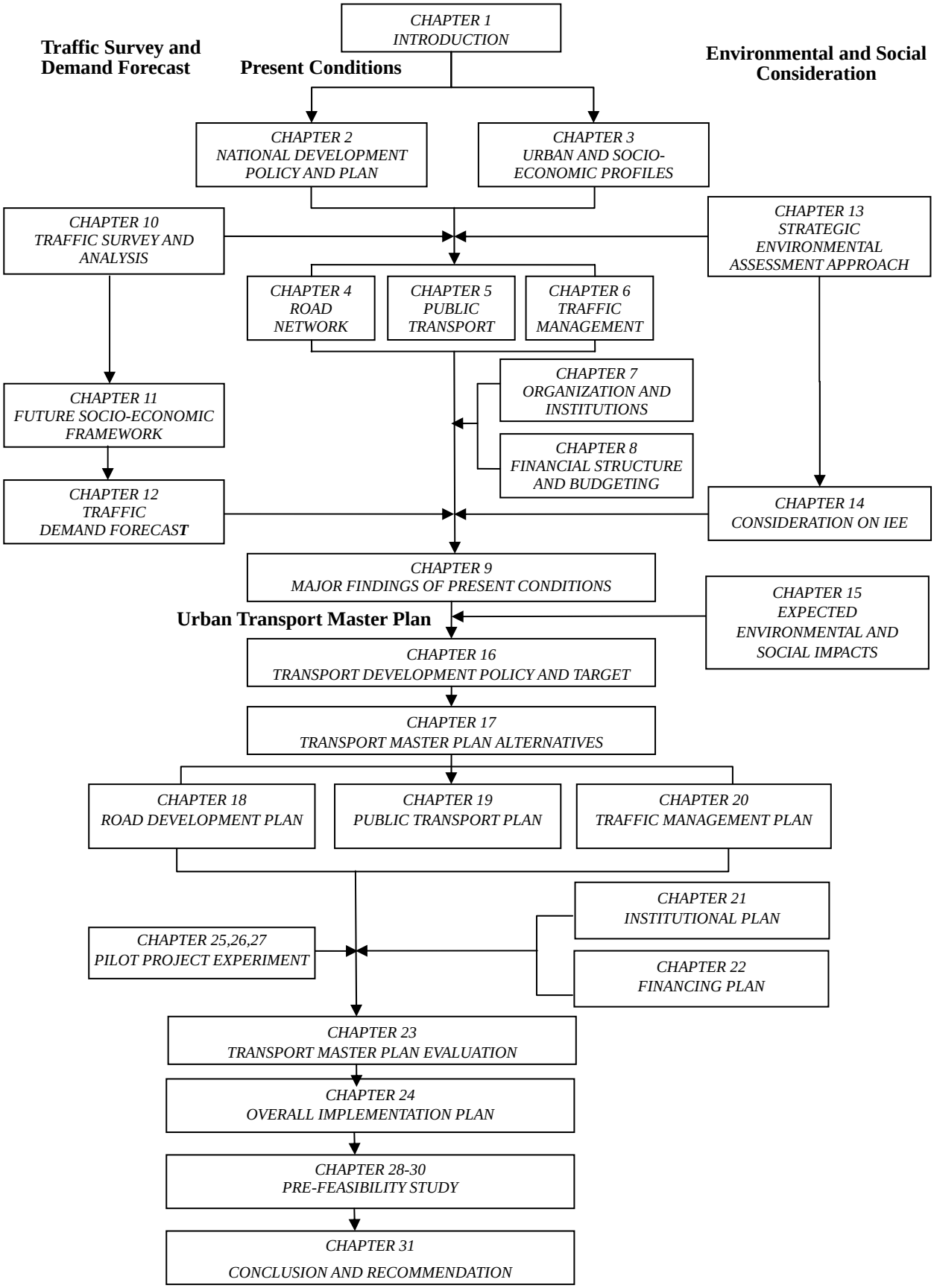


FIGURE 1.8-1 STRUCTURE OF REPORT

CHAPTER 2

NATIONAL DEVELOPMENT POLICY AND PLAN

CHAPTER 2 NATIONAL DEVELOPMENT POLICY AND PLAN

2.1 NATIONAL DEVELOPMENT PLAN

The basic policies of national economic development - poverty reduction and infrastructure development - are stipulated in the "National Development Plan 2002-2008" and the "Economic Recovery Strategy for Wealth and Employment Creation in 2003. Economic development objectives and targets, policy on urbanization and industrial development, and infrastructure development directions announced in these plans will formulate the basic planning framework for this Study.

2.1.1 National Development Plan 2002-2008

(1) Economic Growth Targets

The economy is projected to grow at an annual average of 4 % over the Plan period. To accelerate economic recovery, the Government will take full advantage of the regional cooperation initiatives, preferential market opportunities, while promoting the production and marketing of strategic commodities like beef, horticulture, sugar, coffee, tea and tourism in which the country has comparative advantage.

It is recognized that economic growth of above 6.6 % is required to achieve the poverty eradication targets set out in the "National Poverty Eradication Plan (NPEP),"while growth rates of above 7 % are required to achieve the transformation goals by 2020. Modest targets are set out in consideration of the past economic performance and difficulty in the structural reform. It should be noted that the importance of export-oriented industry and necessity of regional economic cooperation are stressed.

Table 2.1-1, Table 2.1-2 and Table 2.1-3 show sectoral growth targets and shares, projected growth targets (2001-2008), and employment forecast (2002-2008), respectively.

TABLE 2.1-1 SECTORAL GROWTH TARGET AND SHARES

Sector	Average growth rate 1996-2000	Sector share	Projected growth rate 2002-2008	Sector share
Agriculture	1.1	24.0	3.3	22.4
Manufacture	1.3	13.1	3.3	12.2
Finance, real estate	3.6	10.6	5.7	12.1
Government services	1.0	14.6	2.5	13.0
Private household	5.6	0.9	8.1	4.0
Other services	2.3	34.8	4.6	36.3
GDP	2.0	100.0	4.0	100.0

Source: National Development Plan 2002-2008

TABLE 2.1-2 PROJECTED GROWTH TARGETS (2001-2008)

	2000 (Actual)	2001	2002	2003	2008
Real GDP (bill.) (at 1982 constant price)	103.4	105.4	108.7	116.5	138.5
Population (Mil.)	29	30	31	32	35
GDP per capita (USD)	301	300	303	306	341

Source: National Development Plan 2002-2008

TABLE 2.1-3 EMPLOYMENT FORECAST (2002-2008)

	Sector share (2000)	Average growth rate (%) (2002-2008)	Sector share (2008)	Job created (mil.)
Formal agriculture	2.3	0.5	1.9	0.01
Small scale agriculture	57.5	2.8	54.4	1.68
Rural informal	10.8	4.2	11.3	0.49
Urban informal	19.5	5.7	22.4	0.86
Formal non agriculture	9.9	3.6	9.9	0.38
Total	100.0	3.6	100.0	3.42

Source: National Development Plan 2002-2008

(2) Urbanization and Industrial Distribution

Urbanization, if well handled, can provide opportunities for rapid industrialization leading to economic growth and poverty reduction. During this Plan period, urbanization strategies will focus on housing, water and sanitation, solid waste management, and road and transport infrastructure provision through systematic urban planning.

The Importance of urban infrastructure development was again emphasized on the envisaged future rapid urban population increase with statistics indicating this to be from 9.9 million in 1999 to 16 million in 2005. Although allocation of industrial functions is not explicitly stated, promotion of such industries to add value on the produce from primary industry in Kenya and accessibility improvement to international markets is stated.

(3) Development of Physical Infrastructure and Services

The following development directions for road construction and institutional framework for road maintenance are stated in the Plan.

- The institutional framework for road maintenance, restoration of accountability, transparency and professionalism will be strengthened.

- The East African Road Network project under the East African Community, will promote regional trade, as well as facilitate and regulate international road transport services within the member states. Under this project the following roads will be considered for improvement:

  - Mombasa-Nairobi-Malaba
  - Athi River-Namanga
  - Mau Summit, Kericho-Isebania and Isiolo-Moyale
  - Endebes-Suam and Mwatate-Taveta

- The government will consider and explore possibilities of introducing road concessioning projects on major roads and highways. This will be realized under the Roads 2000 Maintenance Strategy.

- The institutional reforms in the road sector of the MRPW will involve the restructuring of the Roads, and the Transport and Mechanical Departments, and privatization of the Axle Load Control function so as to provide the necessary back up to District Roads Committees (DRCs) and the private sector.

- During the Plan period, the government will establish a Kenya Road Safety Authority to oversee safety matters.

- Further measures will be put in place to encourage development of NMT.

In addition, railway transport efficiency and reliability is important for international trade and transit traffic to neighbouring countries apart from supplementing road transport, reducing road damage and road traffic. Efforts will be made to enhance the Rail-Tracker system and install additional modules through COMESA (Common Market for Eastern and Southern Africa) regional programme to facilitate faster and safe transportation of goods. The long-term strategy will involve privatization of the corporation.

2.1.2 Economic Recovery Strategy for Wealth and Employment Creation 2003-2007

(1) Macroeconomic Objectives

Macroeconomic objectives for the period 2003-2007 include:

- Creating 500,000 jobs annually;
- Reducing poverty level by at least 5 % from the current 56.8 % level;
- Achieving a high real growth rate - rising from an estimated 1.1 % in 2002 to 2.3 % in 2003 and 7 % in 2006;
- Containing average annual inflation rate to below 5 %;
- Increasing official foreign exchange reserves from USD 1.1 billion or 2.8 months of import cover in 2002 to USD 1.7 billion or 3.5 months of import cover in 2007;

- Containing the current account deficit in the balance of payments to an average of 6.2 % of GDP; and
- Increasing domestic savings so as to enable higher levels of investment for sustainable development.

Table 2.1-4 shows projected GDP growth rates from 2000 to 2006 while Table 2.1-5 presents the projected growth rates by the sector.

TABLE 2.1-4 PROJECTED GDP GROWTH RATES

(%)

	2000 (act.)	2001 (act.)	2002 (est.)	2003 (est.)	2004 (prj.)	2005 (prj.)	2006 (prj.)
GDP (at constant process)	-0.2	1.2	1.1	2.3	3.7	5.1	6.5

Source: Economic Recovery Strategy

TABLE 2.1-5 PROJECTED GROWTH RATES BY SECTOR

Sector	Annual average growth rates (2003-2007)
Agriculture	3.1%
Industry	8.6%
Construction	16.7%
Tourism	5.4%
IT industry	5%

To achieve the desired growth and employment creation targets, Kenya has to increase ratio of gross fixed capital formation to GDP from 16.8 % in 2002 to about 23 % in 2007. Much of the investment recovery will be financed with domestic savings, which are projected to rise from 10.7 % of GDP in 2002 to 15.8 % in 2007. To finance the remaining resource gap, external resources of at least USD 2.2 billion will be needed by public sector and USD 1.1 billion by the private sector over the next five years.

(2) Urbanization and Industrial Distribution

Although it is not explicitly stated, the following relevant development directions have been identified.

- Identify suitable zones (through Local Authorities) with basic infrastructure which will serve as incubators for SMEs (Small and Medium Enterprises).
- Develop an export development strategy that considers all sectors (goods and services) of export potential and review the existing export development incentives' schemes (such as EPZs and MUBs).
- Review the Sessional Paper No.2 of 1997 on Industrial Transformation to the Year 2020 as a pre-requisite for preparing a comprehensive Industrial Master Plan by the

end of 2004. The Plan will identify the institutional, infrastructural, human resource and incentive regimes necessary to promote industrialization and will be primarily focused on enhancing Kenya's labour intensive export-oriented industries.

It should be noted that with respect to international market, the role of SME in GDP and employment is signified. The development of SME in the region is considered to contribute significantly to the development of the economy, job creation, poverty reduction and stability of migrant population.

As for the re-forestation in terms of urban environment conservation, attainment of the minimum required forest coverage of 10 % by the end of 2007 is stated, that is presumed to be strong fetters for urban development.

(3) Development of Physical Infrastructure and Services

The broad objective in the road sector is to build and maintain durable quality "standard" roads with emphasis on safe and efficient transportation. In this effort, the following measures are envisaged:

- Dualling of the Mombasa-Nairobi-Busia-Malaba Highway;
- Developing of roads under the EARNP (the East African Road Network Project);
- Accelerating the implementation of the Roads 2000 Programme, which involve development of rural access roads, to help the poor by improving their mobility;
- Taking measures to decongest transport in key urban centres through construction of bypasses, mainly the Northern and Southern bypasses in Nairobi and the Mombasa bypasses; and
- Reforming the legal, institutional and regulatory framework with a view to enhancing the proper design of roads, integrity in road contract procurement, enhancing safety and proper and timely maintenance of the road network and allowing for private sector participation.

In order to substantially improve capacity beyond the current performance levels, intervention is required to assist in meeting the immediate requirements for infrastructure development, maintenance, rehabilitation and repair of locomotives, wagons, and equipment. The government strategy for addressing these problems will mainly involve:

- Privatising Kenya Railways by offering a unitary concession to a private operator; and
- Divesting of the Gulf Marine Services on Lake Victoria.

2.2 URBAN DEVELOPMENT AND LAND USE

2.2.1 Nairobi Metropolitan Growth Strategy 1973

(1) History of Urban Planning of Nairobi City

After the construction of a railway base in 1889, population and economy accumulated in Nairobi. It soon developed as the center of transport, government and commerce in Kenya as well as the center of East Africa in terms of scale and functions.

In 1948, "Nairobi Master Plan for a Colonial Capital" as a guideline for the following 20 years was formulated to cope with diverse urban problems resulting from the concentration of population and economy in Nairobi. However, that Plan became rather outdated after independence in 1963 because of the following reasons;

- Expansion of city boundary from 90 sq.km in 1927 to 690 sq.km in 1964;
- Drastic increase in population beyond the targeted one for 1948; and
- Necessity of new development policies different from those adopted during the colonial era.

Figure 2.2-1 shows the changing boundary of Nairobi city from 1900 to 1963.

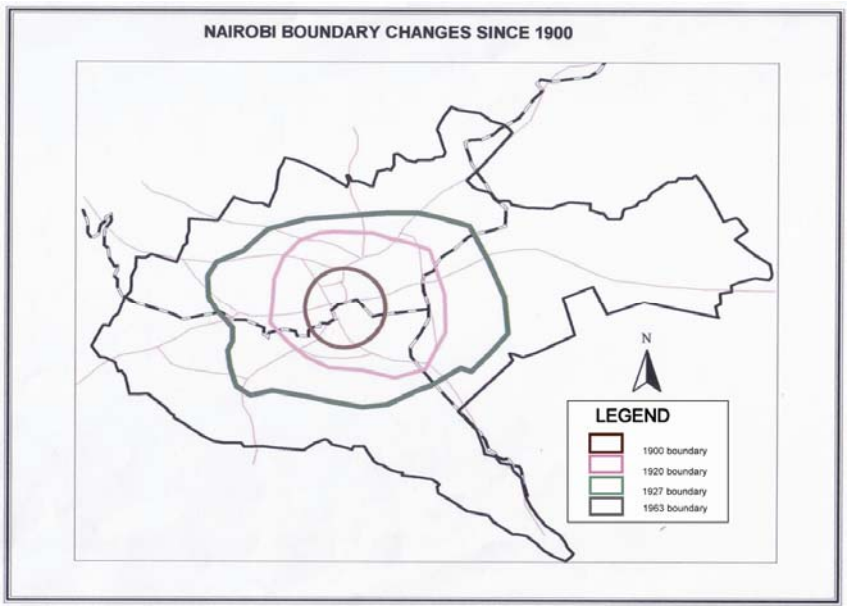


FIGURE 2.2-1 BOUNDARY CHANGE OF NAIROBI CITY FROM 1900 TO 1963

(2) Nairobi Metropolitan Growth Strategy, 1973

After independence, rapid population increase was observed in Nairobi City necessitating crucial requirement for housing development, supply of public services and infrastructure improvement. Consequently, the "Nairobi Metropolitan Growth Strategy" which targeted year 2000 was formulated in 1973.

This Strategy comprises several basic policies addressing urban development and physical planning. The main development aspects are summarized below (see also Section 2.1 of Appendix 2).

Population Forecast

- Population of Nairobi City
  1971 (Census) 585,000
  2000 (Projection) 2,193,000
  2000 (Projection) 3,000,000 (Nairobi and its surrounding areas including Ruiru and Western Shamba)
- Employment in Nairobi City
  2000 (Projection) 750,000（both formal and informal sectors）

However, urban development and physical planning strategy was proposed to be capable of catering for a population of about 4,000,000.

Figure 2.2-2 shows the preferred strategy 2000 in accordance with the Nairobi Metropolitan Growth Strategy.

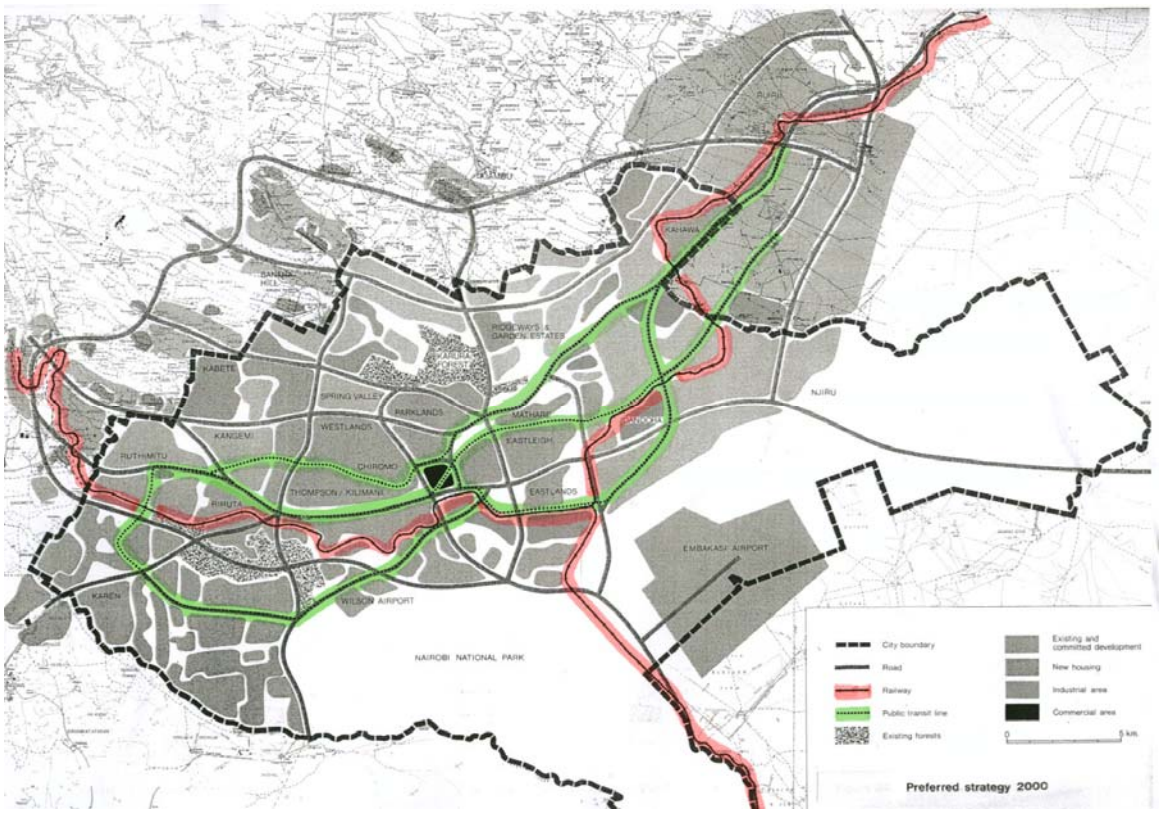


FIGURE 2.2-2 PREFERRED STRATEGY 2000 FROM 'NAIROBI METROPOLITAN GROWTH STRATEGY'

Transportation

- Various constraints will be applied to both the ownership and use of private vehicles, combined with a much improved public transport system.
- Comprehensive transport corridors will be formed to comprise roads, railway and trunk bus routes focusing on Waiyaki Way and Thika Road from west to northeast.
- Conventional bus services will operate over the greater part of the network, and a system comprising some form of high capacity route for the exclusive use of buses is proposed.
- The roads in the city will be in the form of modified grid pattern.
- Careful attention shall be paid to the detailed design of future residential areas and their relationship to employment areas, to ensure that segregated footways, perhaps combined with cycle ways, can be provided as part of the development.

2.2.2 Land Use Plan of Nairobi City

Since the target year of "Nairobi Metropolitan Growth Strategy" prepared in 1973 was year 2000, currently there exists no authorized comprehensive master plan to rely on. Lack of the comprehensive master plan that will give clear directions for development, aggravates the abuse of land.

Land use regulation in relation to land use zoning, plot ratios/ coverages and plot size was prepared in 1979, which, in reality, is a constraint for private sector development.

2.3 NATIONAL TRANSPORT POLICY

2.3.1 Recommendations on Integrated National Transport Policy Moving a Working Nation, February, 2004, Ministry of Transport and Communications

The report was formulated in line with the envisaged economic reconstruction and subsequent sustained growth shown in the "Economic Recovery Strategy for Wealth and Employment Creation 2003-2007" by the National Transport Policy Committee. The main contents of the report are summarized below (see also Section 2.2 of Appendix 2).

(1) Challenges besetting the Transport Sector

- Poor quality of transport services
- Inappropriate modal split
- Unexploited regional role of the transport system
- Transport system not fully integrated
- Urban environmental pollution
- Lack of an urban transport policy
- Institutional deficiencies
- Lack of a vision for the transport sector

(2) Foundations for Comprehensive Transport Sector Reform

Vision for the Integrated National Transport Policy

- A world-class transport system that is integrated and responsive to the needs of people and industry.

The Mission

- To develop, operate and maintain an efficient, cost effective, reliable, safe, secure and integrated transport system and link transport policy with other sectoral policies, in order to achieve national and regional development aspirations in a socially and environmentally sustainable manner.

Policy Principles

- Clarification of the roles of the central and local governments, statutory bodies, non-governmental bodies, and the private sector in the delivery and management of transport infrastructure and services
- User pays and polluter pays principles to facilitate economic efficiency, generation of sufficient revenues to support development, operation and maintenance of transport infrastructure and services, eliminate distortions of user choice of transport modes, eliminate to the extent possible externalities in production and consumption e.g. pollution and congestion
- Stakeholder consultation in setting of tariffs and other prices
- Financing of social and strategic infrastructure through subsidization on a declining basis over time
- Institutionalization of Regulatory Impact Analysis to enable assessment of regulatory proposals
- Establishment of Industry Codes of Conducts and Client Service Charters to enhance service delivery in the transport sector

(3) New Framework for Transport Sector Management

- Establishment of the Department of Transport
- Consolidation of Transport Functions under one Ministry, and separation of Policy Making, Regulatory and Service Provision Functions
- Enhancing the Role of the Private Sector in Transport Infrastructure Development and Management
- Integration of Non-Motorized and Intermediate Means of Transport into the Transport Systems
- Consolidation of Urban Public Transport

(4) Implementation of the Policy

Key to achieving the vision and mission setout in this paper, is the setting up of an “Interim Implementation Team”, comprised of public and private sectors to guide the initial stages of implementing the policy.

2.3.2 Road Development Plans

The relevant studies and plans of Road Development and Improvement are summarized in Table 2.3-1 while the outlines of the structures and plans are presented in Section 2.3 of Appendix 2.

TABLE 2.3-1 RELEVANT ROAD DEVELOPMENT STUDIES AND PLANS

No.	Title	Agencies/Donors	Year	Purposes	Relevant to the Study
1.	Nairobi Metropolitan Growth Strategy	Nairobi Urban Study Group/ City Council of Nairobi/United Nation	1973	Master plan for land use and transport for 2000	Present land use
2.1	The Nairobi Bypass Construction Project Feasibility Study	Ministry of Transport and Communications / JICA	February 1988	Feasibility study of Southern Bypass to divert through traffic on the A104 and traffic on the other roads to the Bypass and then to solve the traffic congestion in the main streets of Nairobi	Southern Bypass
2.2	The Nairobi Bypass Project, Detailed Design Study	Ministry of Transport and Communications/ JICA	September 1992		
3.	Actions Towards a Better Nairobi, Report And Recommendations of the Nairobi City Convention	Nairobi City Convention/ The Friedrich Naumann Foundation	1993	Plan of all sectors in Nairobi City for improvement	Missing Links etc.
4.	A Road Network Development Master Plan Study	MOPW&H/JICA	May 1995	Master plan for development of road network in Kenya in 2013	Southern Bypass
5.1	Kenya Urban Transport Infrastructure Project (KUTIP) (The project was suspended by World Bank.)	World Bank/ Ministry of Local Government	July 1996	[Staff Appraisal Report] Increase economic efficiency of the urban road network and build sustainable road maintenance capacity for Nairobi and 25 urban centres and 22 secondary towns. Study for a long-term land use and traffic demand for Nairobi	NMT
5.2	KUTIP Nairobi: Long Term Transport Study, Stage I	World Bank/ MOLG	January 1999	Master plan for urban transport in Nairobi under KUTIP (uncompleted)	
5.3.	KUTIP Final Engineering Report for Non-Motorized Transport (NMT) Works in Nairobi (under KUTIP)	MOLG/WB	November 2001	NMT study in Nairobi	
6.	Strategic Review; Kenya Road Sector	DFID/EU/KfW/SIDA/ WB	May 2002	Strategic review for road sector institution with KRB	Organisation
7.	Urban Mobility In Three Cities-Scoping Study: Addis Ababa, Dar es Salaam and Nairobi	World Bank	October 2002	[SSATP Woking Paper No.70] Comparing study for urban transport in three cities	Public Transport
8.	Assessment of the Non-Motorized Transport Program, Kenya and Tanzania	World Bank	Nov 2002	[SSATP Woking Paper No.71] Assessment of pilot projects of NMT undertaken in 1995 to 99 in Kenya and Tanzania	NMT
9.	Kenya Transport Sector Memorandum	World Bank, DFID, EU, KfW, SIDA	January 2003	Review of present transport sector for appropriate infrastructure strategy and policy direction	Organisation
10.	Road Sector Review and Stock Take Conference	Kenya Road Board	May 2003	Workshop report	Organisation
11.	Kenya Road Concession Framework	MRPW/World Bank BSK Group	November 2003	Concession study for northern corridor road construction including Southern Bypass	Southern Bypass
12.	Recommendations on Integrated National Transport Policy, Moving a Working Nation	The National Transport Policy Committee, Ministry of Transport and Communications	February 2004	Transport policy	Transport Development Policy
13.	Kenya Transportation Policy and Roads Sub-Sector Policy and Strategy	KRB/ EDF, Scott Wilson	March 2004	Coordinating policy papers for GOK and donors To advance the process of policy and strategy formation and implementation for the road sub-sector in Kenya To summarise the core issues, describe the rationales behind the policies, the main requirements for implementation, and the assumptions	Transport Development Policy
14.	Northern Corridor Road Transport Improvement Project	Road Department MORPW&H/Ministry of Transport and Communications	April 2004	[Staff Appraisal Report] Increase efficiency of road sections in the Northern Corridor, Roadside amenities and HIV/AIDS Mitigation, Private sector participation in road management and maintenance, road safety improvement, institutional strengthening in the road sectors and TA	Southern Bypass

2.3.3 Public Transport Development Plan

Recommendations

- That movement by road is accommodated on a system of new and upgraded existing roads in the form of a modified grid with a clearly defined hierarchy of importance.
- That the whole movement system be based on a policy of minimizing the need for capital investment, by locating workers' housing near employment centres, by restricting the growth of car ownership and by the development of a cheap and efficient public transport service based on an increase in bus service and the establishment of special bus ways. Specific measures recommended include:
  - Immediate steps to ensure the provision of segregated bus ways on recommended routes.
  - Systematic reduction of bus fares.
  - Substantial increase in import and purchase tax on cars, and in the Road Fund License.
  - Substantial increase in fuel taxes to be applied to private motorists between 1973 and 1978, with a system of rebates to licensed public transport and commercial operators.
- Those employment hours in the Central Area are staggered; and that a traffic and parking policy be established for the area. Specific measures recommended include:
  - Development of additional car parks.
  - The end of free parking and increase in parking fees.
  - Improve traffic controls, including provision for pedestrian safety and pedestrian walks.

Public Transport System

- Various forms of public mass transit were investigated, and the final series of tests concentrated on a comparison between a rail system and a bus system operating on own right-of-way. There was little to choose from between the two systems in terms of cost, although the bus way system seemed to have a margin of advantage. Moreover, the bus way system would have the added advantage of using skills and technology that are already available in Kenya, whereas no such experience of commuter rail system exists.

(2) Action Towards a Better Nairobi, the Nairobi City Convention, 1993

This is a comprehensive urban transport improvement plan in the Nairobi city center towards a better Nairobi. Improvement of existing railway system and half ring bus priority roads, excluding southern urbanized area and connecting area, was planned as a public transport system (refer to Figure 2.3-1). Figure 2.3-1 shows the routes of the different modes under the said plan.

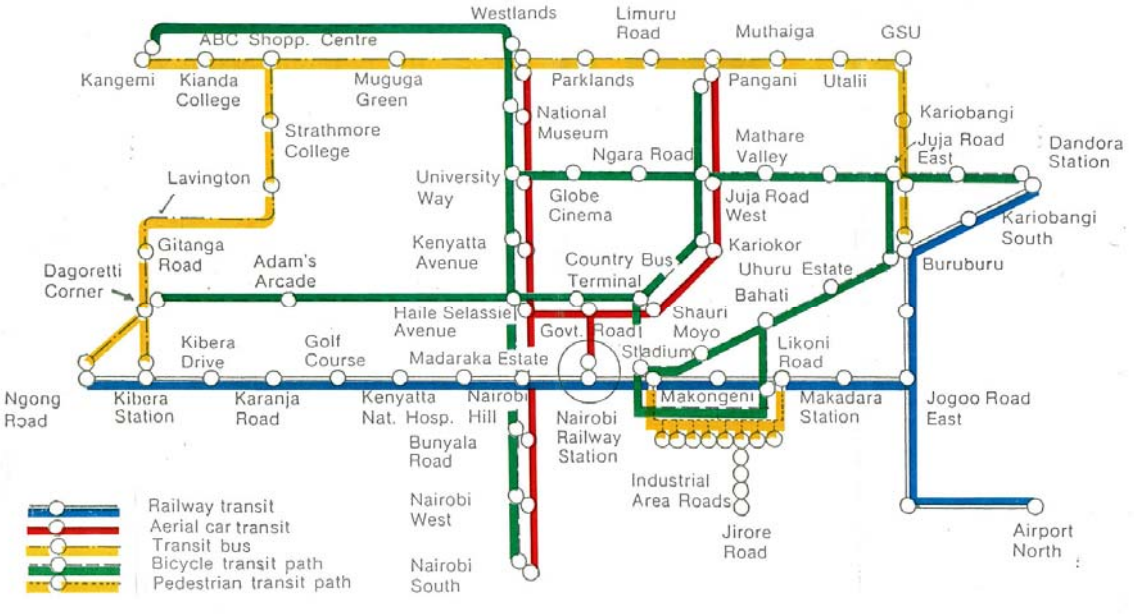


FIGURE 2.3-1 NAIROBI TRANSIT FROM 'ACTION TOWARDS A BETTER NAIROBI'

(3) Nairobi Long Term Transport Study, Stage-1 Report, World Bank, 1999

- The following are the major existing problems in terms of transport:
  - Traffic congestion
  - Poor road pavement
  - Lack of mobility

- This Project would turn out to be one of Nairobi's major projects such as elevated highway along Uhuru Highway and the construction of the Southern bypass.
- Planning of bus system and non-motorized vehicles has more priority in this study.
- The bus priority measures along some model routes are proposed as pilot projects.
- The multi-core urban development is proposed as the urban development strategy.
- The traffic circulation plan is proposed for the traffic management improvement plan in the Nairobi city center.

Figure 2.3-2 shows the public transport proposals from Nairobi Long Term Transport Study.

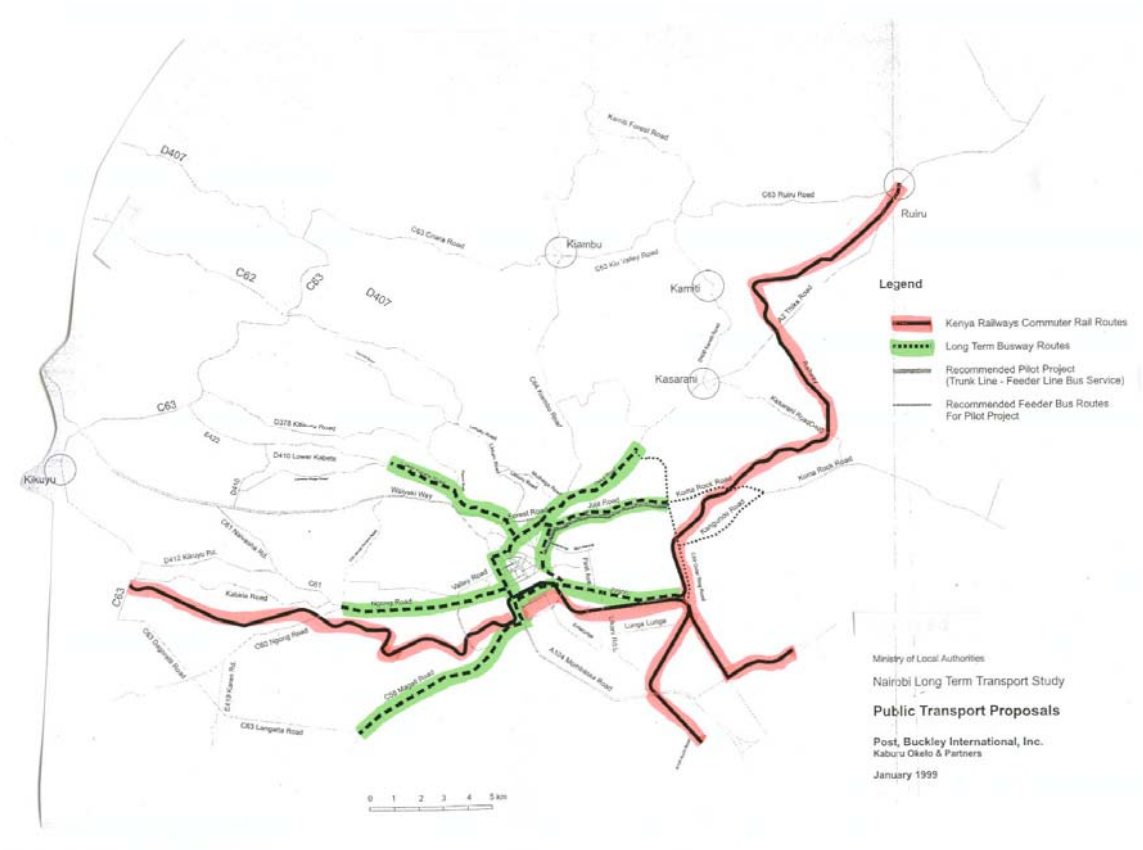


FIGURE 2.3-2 PUBLIC TRANSPORT PROPOSALS FROM 'NAIROBI LONG TERM TRANSPORT STUDY'

CHAPTER 3

URBAN AND SOCIO-ECONOMIC PROFILES

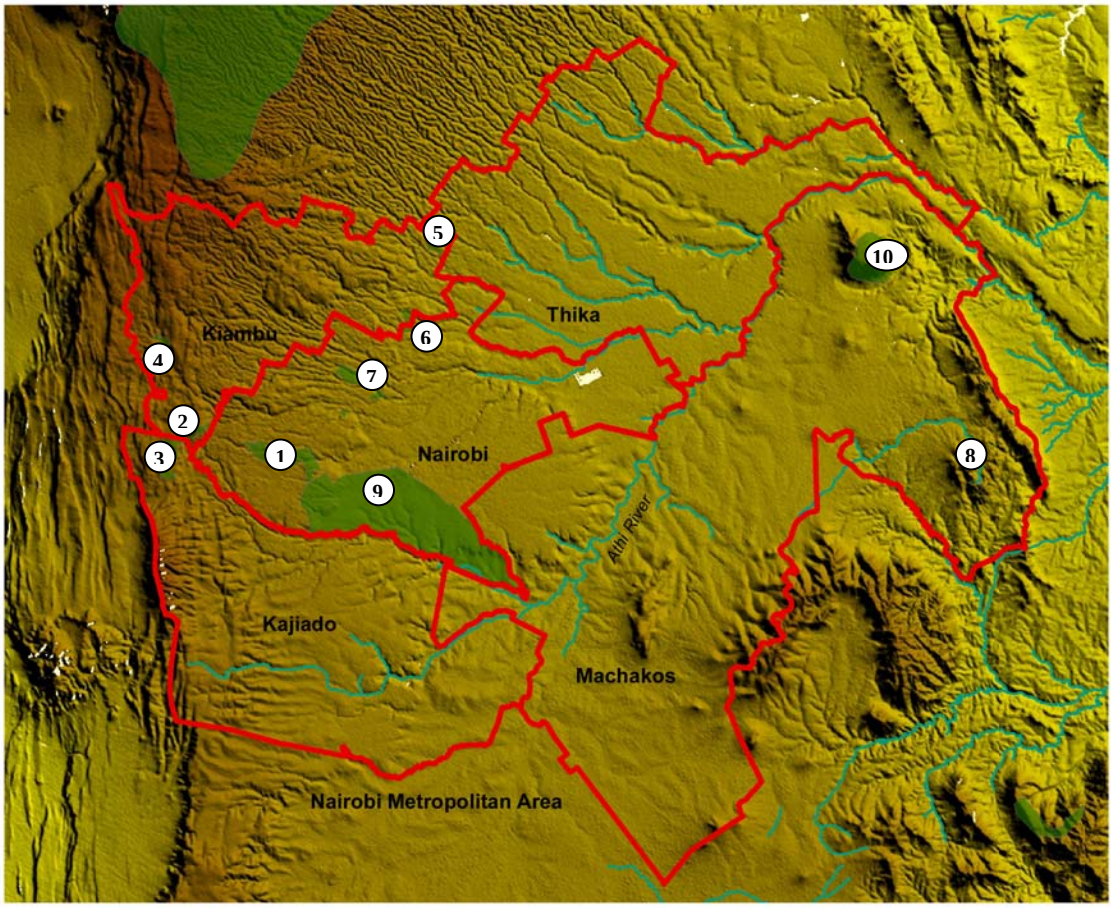
CHAPTER 3 URBAN AND SOCIO-ECONOMIC PROFILES

3.1 URBAN PROFILE OF THE NAIROBI METROPOLITAN AREA (NMA)

3.1.1 Natural Conditions

(1) Topography

The land of the NMA extends from the eastern edge of the Rift Valley at an elevation of 2,300m, gradually sloping down towards the east and the south to an altitude of 1,400m. The western part above the 1,700m altitude has rugged topography, while the eastern part slopes gently to flat land. The topographic features and drainage patterns are shown in Figure 3.1-1.



Note : Forest Area : ①Ngong Road, ②Dagoretti, ③Embakasi, ④Muguga, ⑤Kamiti, ⑥Kiambu, ⑦Karura, ⑧Mateteni, Kithatani and Ngulini, ⑨Nairobi National Park, ⑩The Oldonyo Sabuk National Park

FIGURE 3.1-1 TOPOGRAPHIC FEATURE OF NAIROBI METROPOLITAN AREA

(2) Natural Drainage

The NMA falls largely in the drainage basin of the Athi River and its tributaries. The Nairobi River, a major tributary, flows generally from the southwest to the northeast through Nairobi City,

and is joined by the Kamiti, Thiririka and Nalaruru Rivers in the eastern part of the NMA before it drain in the Athi River. The Ruiru River, another major tributary, originates from mountainous areas to the northwest of the NMA, and drains in most part of Thika District. The main stream of the Athi River itself flows generally from the southwest to the northeast in the eastern part of the NMA.

(3) Geology

The land of the NMA is composed of volcanic rocks in the west and metamorphic rocks (e.g. mica, marble, quartzite, gneisses and schist) in the east. The rocks in the Nairobi area mainly comprise a succession of lavas and pyroclastics of cenozoic age, overlying the foundation of folded Precambrian schists and gneisses of the Mozambique belt. The crystalline rocks are rarely exposed, but occasionally fragments are found as agglomerates derived from former Ngong volcano. See Section 14.1 of Appendix 14 for details.

(4) Soil

Soil in the NMA is composed mainly of shallow red-brown sandy loam in the east, fertile highland clay loams in the north, and fertile low-lying black clays in the central area. The soils of the Nairobi area are mostly products of weathering of mainly volcanic rocks. Weathering has produced red soils more than 15m thick. A number of soil subdivisions are recognized in the Nairobi area according to drainage, climatic regions and slopes. The principal soil overlying the trachytic rocks of the northwestern part of the NMA includes strong brown to yellow–red friable clays and dark red friable clays (latosolic soils) with a high humus layer overlying clay. These are developed from lava, volcanic tuff and ash in humid region with rainfall of more than 1,000 mm per year. In the area to the south and the southeast, red friable clays (latosolic soil) are developed over similar rock types in areas where the annual rainfall is 760-1,000 mm. (See Appendix 14)

(5) Climate

The climate of Kenya is affected by the movement of inter-tropical convergence zone (ITCZ), which creates distinct rainy seasons of March-May and October-December. Altitude exerts the great influence on temperatures in Kenya as a whole. There is a wide variance between maximum and minimum temperatures from below the freezing point on the snow-capped Mount Kenya to over 40^{o}C in some of the north and north-eastern parts of the Country. Due to the high altitude ranging in 1,400-2,300m above the sea level, the NMA enjoyed temperate climate throughout a year with basically the same precipitation pattern but much larger total precipitation than the west of the Country. (See Figure 14.1-2 of Appendix 14 for daily temperature)

(6) Conservation Areas

There are various conservation areas in the NMA including two national parks, forest areas, and city parks. The locations of these areas are shown in Section 14.1 of Appendix 14.

Forest Areas

Forest areas existing in the NMA are summarized in Table 3.1 and the locations are shown in Figure 3.1-1.

TABLE 3.1-1 FOREST AREAS WITHIN THE STUDY AREA

Forest Area	Location	Area (ha)	Considerations for the Master Plan
Ngong Road	Western part of Nairobi City	1,189.5	It may be partly affected by the Southern Bypass Project.
Dagoretti	Just outside of Nairobi City	764	It may be partly affected by the Southern Bypass Project
Embakasi	Immediately southwest of Dagoretti Forest	573	
Muguga	Western end of the NMA	225.3	
Kamiti	Northern part of the NMA	169.6	
Kiambu	Northern part of the NMA	79.3	
Karura	Northern part of Nairobi City	956.1	The headquarters of the Forest Department is located in the forest are.
Mateteni, Kithatani and Ngulini	Machakos District	N.A.	These are district forests known as trust land.
Nairobi National Park (see below)	Southern Part of Nairobi City	117,000	
Oldonyo Sabuk National Park	Machakos District	18,500	

National Parks

The Nairobi National Park in the south of Nairobi City is the largest conservation area within the NMA with a land area of 117km^2. The Oldonyo Sabuk National Park is in the east of the NMA, and has a land area of 18.5km^2.

Nairobi City's Parks and Conservation Areas

The Nairobi Arboretum is located to the north of the State House. Two city parks, namely Uhuru and Central, front the west side of the Uhuru Highway. Depending on the mode of design of selected projects, a part of these parks may be directly affected. The Nairobi City Park is in the north of Nairobi City between the Forest Road to the south and the Limuru Road to the northwest. This is the Nairobi residents' most popular park for weekend outing. The Jeevanjee Park faces the Moi Avenue. It is the smallest city park in the middle of the congested downtown business district.

3.1.2 Social Conditions

(1) Settlement Patterns

In 1993, there were about 110 informal settlements with a total population of approximately 0.75 million. They occupied 5.84% of the land area used for residential purposes, but housed 55% of the City's population. Some of Nairobi's informal settlements and their associated population are as follows: Kibera (251,040), Dagoretti (186,250), Kasarani (158,120), Makadara (102,480), Embakasi (31,890), Pumwani (11,890) and Parklands (7,330).

The Dagoretti, Embakasi and Kasarani settlements are most remotely located in the range of 12-18km from the main employment and service center of the CBD and the Industrial Area. The smaller and older settlements, Parklands and Pumwani, are closer to the center in the range of 4-6km. Kibera is exceptional in the sense that it is large and close, at about 5km from the CBD. For all settlements, the weighed average distance from the centre is 11km.

(2) Housing

Housing characteristics in Nairobi reflect socio-economic characteristics of the population. More permanent houses are found in high and middle income areas with tiled roofs and stone walls and often with large gardens. They are detached houses concentrating in the areas to the west of the Uhuru highway and the north of the Waiyaki Way/ Forest Road, including the area beyond the Ngong Road Forest. Middle income households can afford well established apartment buildings, which are scattered among the detached houses.

(3) Drainage and Waste Management

Sewer mains in Nairobi City are laid along the Nairobi River, the Natari and Ruiruaka River, and the Ngong River. Nearly 20 sewage treatment plants are operational, large-scale ones being at Dandora and Kariobangi. The sewerage system does not cover the whole of Nairobi City, and septic tanks and latrines are used in some areas. The storm water drainage system is inadequate even within Nairobi City, often causing inundation and traffic disruption. Dumping of solid wastes in drainage channels makes the situation worse.

(4) Other Social Characteristics

Gender and Household Headship

Male headed and female headed households are almost equally distributed. The number of household members ranges from 3-6 persons for both male and female headed households. Males and females rent their living places almost equally, but their cooking fuel consumption distinctly differs. Male headed households spend more paraffin and charcoal than female headed households. This indicates that female headed households are generally poorer in terms of household expenditure.

Public Health

Respiratory symptoms and malaria are the top two major causes of mortality in recent years, followed by accidents.

Education

The young population not attending schools has increased in recent years. However, attendance of primary school and secondary school is on the steady increase as a whole.

3.2 URBAN GROWTH OF THE NAIROBI METROPOLITAN AREA

The city area of Nairobi has not been changed since 1973, when the Nairobi Metropolitan Growth Strategy was prepared. The land area of Nairobi City is 696km^2. The city population increased from 0.83 million in 1979 to 1.32 million in 1989 and 2.14 million in 1999. Inter-census population growth indicates that the urbanization of Nairobi City accelerated only slightly with the average annual population growth registering 4.81% during 1979-89 to 4.93% during 1989-99.

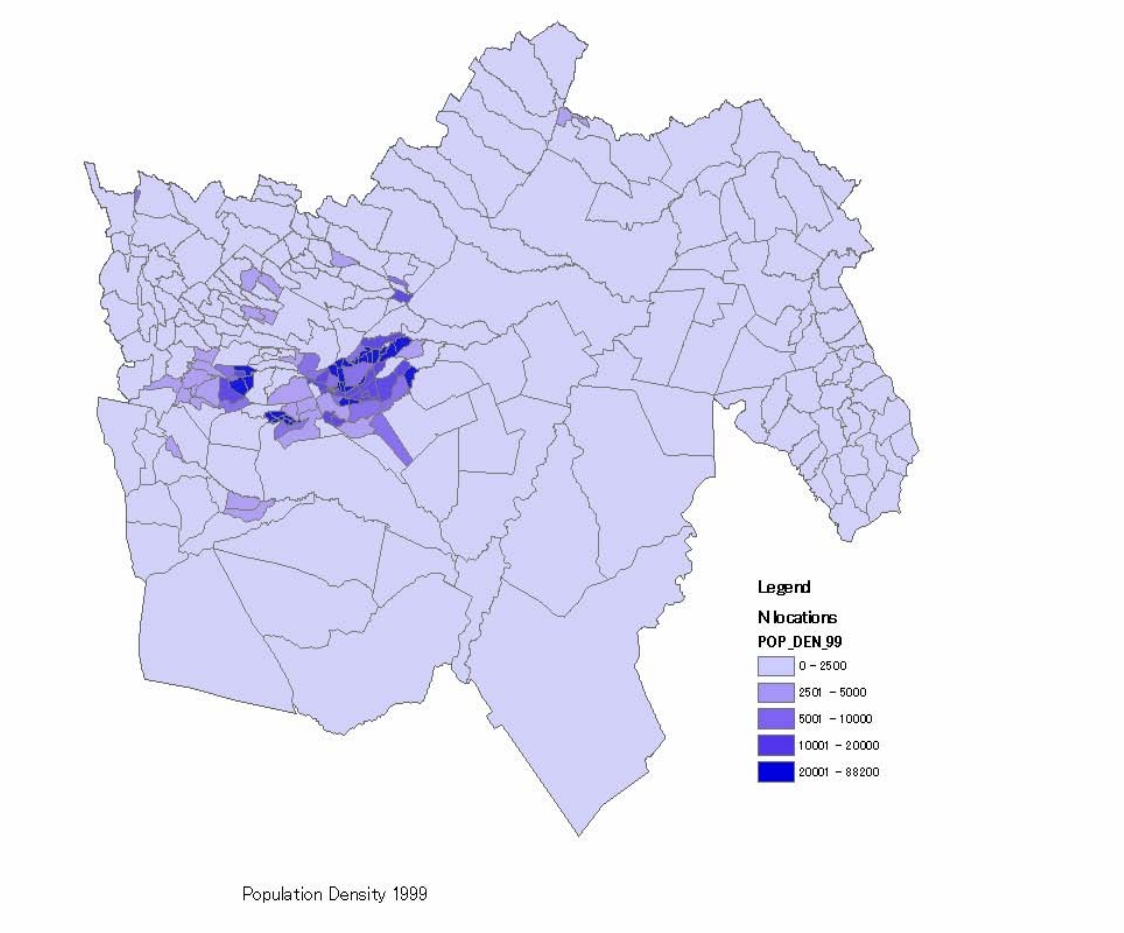


FIGURE 3.2-1 POPULATION DENSITY BY SUB-LOCATION 1999

The Urbanization in the Nairobi Metropolitan Area (NMA) proceeded beyond the city boundary. The total population of the NMA increased from 1.36 million in 1979 to 2.06 million in 1989 and 3.23 million in 1999. In particular, the urban population of the NMA increased at the average rate of 5.20% per annum during 1979-89, and 7.23% per annum during 1989-99. Accordingly, the urbanization ratio increased from 66.0% in 1979 to 72.2% in 1989 and 92.7% in 1999. The population share of the NMA to the total population in Kenya increased consistently from 8.9% in 1979 to 9.6% in 1989 and 11.3% in 1999.

Within the NMA, rapid population increase is observed in the central area of Nairobi, Embakasi, Tala/ Kangundo along C98 (Kangundo Road), Ruiru along Thika Road, and Kikuyu along A104. The average population density in 1999 was 3,079 per km^2 in Nairobi City and 721 per km^2 in the NMA. Most areas outside Nairobi City, however, had a population density lower than 2,500 per km^2 except for a few areas along the city boundary (Figure 3.2-1). This indicates that urbanization in the NMA is characterized by low density urban sprawl, and it is not simply a ribbon-type development along the major radial roads but spreads more widely spatially.

3.3 POSITION OF THE NAIROBI METROPOLITAN AREA IN THE KENYAN ECONOMY

3.3.1 Recent Performance of the Kenyan Economy

Due to the change in the macroeconomic policy in the mid 1980's and generally favorable weather conditions; the GDP of Kenya attained an average annual growth of 5% during 1986-90. After this period, the Kenyan economy experienced a continuous decline throughout 1990s, caused partly by bad weather precipitated by the 1992 drought, but more importantly by the poor economic management and the resultant decrease in donor support. The annual average GDP growth decreased to 2.5% during 1990-95 and further to 2.0% during 1996-2000.

The population growth in Kenya decreased from the annual average of 3.4% during 1979-89, but still averaged 2.9% during 1989-99. Consequently, the per capita GDP decreased consistently throughout the 1990's. After even lower GDP growth in the 2000's, the Kenyan economy started to recover under the new administration, which took office in December 2002.

3.3.2 Position of the Nairobi Metropolitan Area

(1) Economy

Statistical data of the Gross Regional Domestic Product (GRDP) is not available for any region, province or district. Data on wage earnings by province and district indicate that the contribution of Nairobi City to the national economy decreased from some 40% during the 1990's to slightly over 30% after 2000. The total contribution of the NMA including the neighboring districts of Thika, Kiambu, Limuru and Athi River to the national economy, in terms of earnings, was 32.0% in 2002. Considering this area in relation to the GDP, the GRDP of the NMA is estimated to have been Ksh 271.6 billion in 2002. The per capita GRDP of the NMA was calculated at Ksh 73,520 in 2002, 2.72 times per capita GDP of Kenya of Ksh. 27,000 in 2002.

(2) Employment

The NMA had wage employment of 457,547 in 2002, accounting for 26.9% of the total wage employment in Kenya (1,699,600 in 2002), while the population share of the NMA was 11.3% in 1999. Nairobi City had urban informal sector employment of 1,343,100 in 2003, which accounts for 70.7% of the total urban informal sector employment in Kenya (1,898,900 in 2003). This corresponds to 24.2% of the total informal sector employment in Kenya (5,545,200 in 2003).

Thus, the NMA is dominant in employment generation in Kenya for both the informal and the formal sectors. Of the working population, about three-quarters are in the informal sector in both the NMA and Kenya.

3.4 URBAN STRUCTURE

3.4.1 Artery Transport Network

Three regional arterial roads pass through the NMA: the Uhuru Highway leading to Athi River and Mombasa, the Limuru Road to Kisumu, and the Thika Road to Murang'a, Nanyuki, Embu, and Meru. The roads constitute a radial network centering on the central area of Nairobi. Parallel to these arterial roads, railway lines exist leading to Mombasa, Eldoret, Kitale and Nanyuki. Road A104, another radial road, branches off from the Mombasa Road to Namanga passing through Athi River Town. Arterial roads and railway lines carry not only domestic passengers and freight but also accommodate international passengers and freight transport.

The Jomo Kenyatta International Airport is located in the southeast of Nairobi City, while the Wilson Airport lies in the southwest direction adjacent to Nairobi National Park, the two of which form a hub for international and regional air transport respectively. The above transport facilities form the primary structure of the artery transport network for the NMA.

3.4.2 Distribution of Urban Functions

(1) Economic Activities

The NMA is a center of population and business in Kenya functioning also as the lifeline of transport and communications, administration and politics in Kenya. The concentric urban structure has been dominant for long time where most working people in the secondary and the tertiary sectors commute to the Central Business District (CBD) and adjoining Industrial Areas.

From the 1990's, however, urban functions are being distributed along trunk roads and major transport nodal points as summarized below.

- A belt type industrial development is taking place along the Mombasa Road.
- EPZs as the strategic industrial footholds based on the national economic development policy have been established along trunk roads and in the east of Nairobi City. Out of those EPZs, Athi River Town EPZ was developed on a large scale in combination with housing area development.
- SMEs have also been located sporadically in the surrounding districts in the NMA. Especially food processing industries based on agricultural produce are located in the areas with high agricultural potential in Thika and Kiambu.
- Commercial cores have developed at nodal points of road transport outside the CBD of Nairobi City.

(2) Residential Areas

The distribution of residential areas in Nairobi City still reflects the designation of residence by ethnicity in 1948 based on residential areas formed during the colonial era. While local people have become the majority in most areas, the basic pattern of residence reflects income class

distribution. In the western and the northern hilly areas, low density residential areas are located for high income class, and the northern areas adjacent to the central area of Nairobi are mainly for middle income class. Residential areas for low income class are found generally to the south and the east of the industrial area in the central area of Nairobi.

The pressure of large population influx and the increase of the urban poor in recent years, however, have changed the distribution of residential areas as follow.

- Middle-income residential areas are formed along the Thika Road, the Mombasa Road and the Kangundo Road (C98). Intensive residential area development on a large scale has taken place in those towns of Thika, Ruiru, and Athi River.
- Slum areas and informal settlements are expanding and burgeoning in the areas where land is available regardless of righteousness, especially swampy areas and publicly reserved lands. Accordingly newly emerging slums and informal settlements tend to locate remote from the central area of Nairobi, not only within Nairobi City but also in adjacent districts.
- Land subdivision is proceeding by private developers, most of whom are large land owners. The subdivision is commonly observed along the Thika and Kangundo Roads, and in Embakasi, where basic infrastructure is not sufficiently provided. To make matters worse, areas are remained without housing construction after the subdivision and land transfer are expanding.
- Land subdivision has also taken place in the formerly residential areas for high-income class.

3.4.3 Distribution of Land Use

(1) Overview of Existing Land Use

The distribution of land use in the NMA reflects generally the topographic and the climatic condition of the Area. The northwestern part of the NMA has topography raging from 1,400m to 1,600m above the sea level, and the precipitation is high. The annual precipitation is 750mm or higher in the area extending from Kikuyu to Kiambu and Thika, where large scale tea and coffee plantations are located. Small scale farming is dominant in areas immediately to the north and the west of the NMA. The eastern and the southern parts of the NMA are relatively flat and generally classified as dry and hot savanna areas, where the land is used for cattle ranging and extensive plantations.

The Nairobi National Park, gazetted in 1949 as Kenya's first national park, is located in the southern part of Nairobi City. The Park borders on the Wilson airport to the north, the Mombasa road to the east, the Langata road to the west, and the Kitengela conservation area to the south. Forest areas are located to the southwest, the northwest and the north of Nairobi City.

The Eastleigh air force base with almost the same tract of land as the central area of Nairobi City

spreads over the eastern area of the old city. Largely neglected sisal plantations occupy a large area in the east. The present land use is shown in Figure 3.4-1.

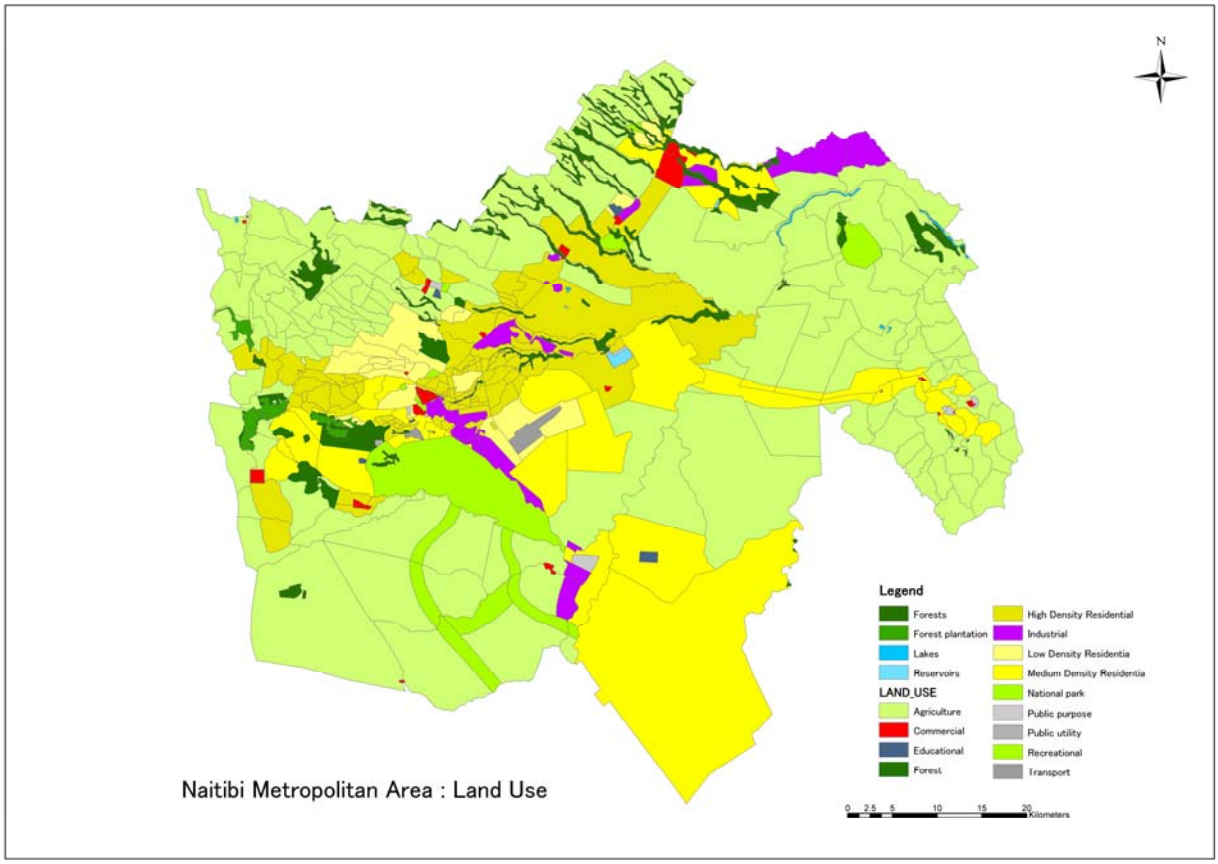


FIGURE 3.4-1 LAND USE IN NAIROBI CITY

(2) Functional Definition of Zones

For the purpose of identifying transport problems in the different parts of NMA, the land of the NMA is subdivided into four zones.

Central Business District (CBD) defined as the area surrounded by the Uhuru Highway, the Moi Avenue, the University Way and the railway, where business and commercial functions are concentrated.

Central area of Nairobi City, containing the Old Town, surrounded by the Lusaka, the Mabagathi and the Nagara Roads.

Urbanized area, outside of the central area, surrounded by the Karura forest to the north, the Outer Ring Road to the east, and the Kingara Road to the west.

Suburban area defined as the outer part of the urbanized area, including district towns and municipalities.

3.5 URBANIZATION TREND

The urbanization in the NMA has proceeded toward the northeast along the Thika Road, the southeast along the Mombasa Road, and the east along the Kangundo Road, resulting in a radial urbanization pattern. A large population increase can be observed in the eastern area as opposed to the Nairobi Metropolitan Growth Strategy, while the Karen-Langata area has not absorbed much of the population increase (Figure 3.5-1). The population density in the Old Town has increased also as opposed to the Growth Strategy. On the other hand, the complex and multiple corridor development as proposed in the Growth Strategy has not been realized accordingly.

Formation of district cores

In the National Metropolitan Growth Strategy, formation of local centers of public services and local industries were proposed at Kiambu, Kikuyu, Limuru, Machakos, Athi River, and Thika. Out of these municipalities and townships, only the Athi River town and the Thika municipality have grown as local centers with accumulation of local industries and considerable work places.

Distribution of industrial functions

Influx of population into most parts of the proposed small scale industrial areas within the city has taken place, resulting in a formation of land use different from the one initially proposed in the Nairobi Metropolitan Growth Strategy. Factories and firms sited along the Mombasa Road in the past 30 years and EPZs scattered within the NMA are characteristic of this feature. Evidence of industrial area formation for the informal sector can be seen along some intra-regional trunk roads.

As of the CBD area, much difference is not observed between proposed and actual developments. However, some of the business functions have moved from the CBD because of traffic congestion and security problem.

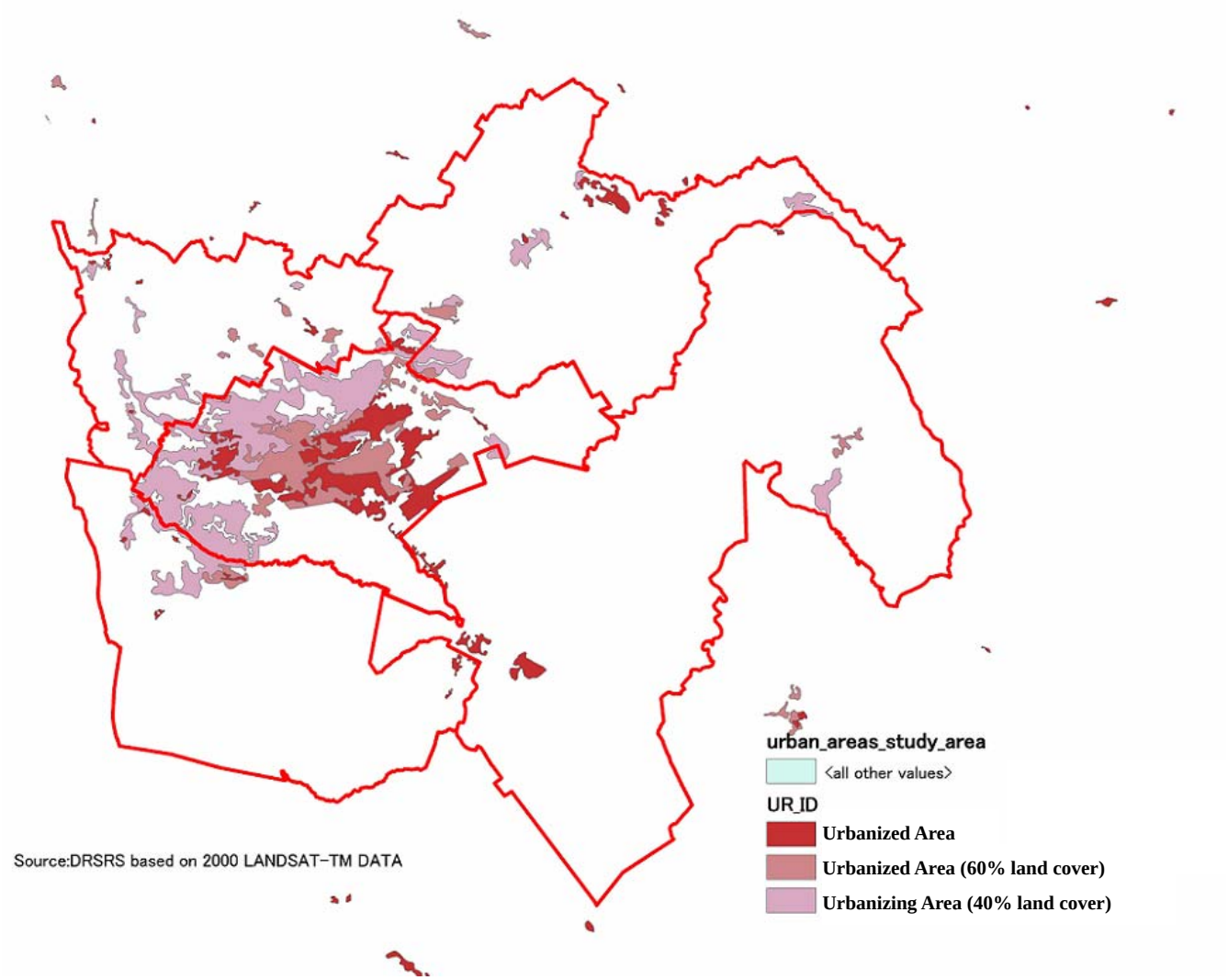


FIGURE 3.5-1 URBANISED AREA

Distribution of housing areas

Housing development by the private sector has evolved without apparent linkages to industrial and/or business areas. Housing development has been taking place based on the affordability of residents without any defined plan mixing low income housing with the residential area for high income groups.

CHAPTER 4

ROAD NETWORK

CHAPTER 4 ROAD NETWORK

4.1 ROAD CONDITION SURVEY

4.1.1 The Surveyed Roads

To investigate the condition of the road network, a road inventory survey is performed from August 2004. The results are summarised in GIS data in October 2004. The area of survey is Nairobi City and its environs (The Study Area) which is approximately 4,200 square kilometers. The results of the road inventory survey are presented in Appendix 4.

The selection of roads to be surveyed in the Study Area is determined as follows:

a. Roads constituting network for this master plan
b. Roads included in a CCN road list
c. Roads related to newly proposed roads plans and projects

The road inventory survey as mentioned is carried out and shown in Table 4.1-1.

TABLE 4.1-1 PLANNED AND ACTUAL SURVEY LENGTH OF ROADS

	Road Class	JICA TOR	Planned Survey Length (km)	Actual Survey Length (km)		Remark
				Inventory Road (MRPW)	Inventory Road (CCN)	
MRPW	A	Data from MRPW	158.8	177.6	-	Field survey
	B		8.3	4.0	-	Field survey
	C		300.9	329.8	-	Field survey
	D	39.5	225.2	300.5	-	Simple Field Survey
	E	13.0	75.1	532.6	-	Simple Field Survey
	SP (G, R)	110.5	110.5	77.6	-	Simple Field Survey
CCN	Classified City Road*	-	921.2	-	962.5 (1165.2)**	Field survey for Major Roads Simple survey for Minor Roads
	Unclassified City Road	1,850 (estimated)	-	-	-	Unclassified road not identified in CCN Road List.
Actual Survey Length of MRPW and CCN				**1,422.1**	**962.5**	
Total of Actual Survey Length				**2,384.6**		
New Road	Missing Links	-	31.5	-	31.5	Field survey
	Bypass	-	168.5	-	-	No survey
	Total	2,013.0	2,000.0	1,422.1	994.0 (1165.2)**	
Grand Total of Inventory Roads				**2,416.1**		

Note: * Classes of city road are: Highway (H) / Primary (P) / Distributor (D)/ Collector (C)/ Local (L)/ Access (A).

** Total classified city roads of CCN is 1,165.2km, which includes 202.7km of MRPW classified roads. Thus actual classified City Roads are 962.5km

4.1.2 Inventory Survey Method

(1) Objectives of Survey

The objectives of the road inventory survey are the following:

(i) To collect data on the present condition of the existing roads and bridges;
(ii) To compile the data collected and prepare Road Inventory of the road network in the Study Area; and
(iii) To assess the road condition in the Study Area.

(2) Data Collection

Data collection task is conducted by compiling the latest road inventory data available in MRPW, CCN, etc. Based on the existing data, field survey forms are prepared by modifying the inventory format previously prepared in Japan.

(3) Field Survey

The field survey is carried out by applying either a detailed field survey or a simple field survey based on road hierarchy in the road network. The detailed field survey is carried out for major roads of class A, B, C, and some D roads under MRPW and class H, P, D under CCN. The simple field survey for the minor roads included D, E, Special Purpose Roads under MRPW, and the minor roads under CCN classification. At the same time the bridge inventory survey is conducted for major bridges by field investigation and update of the bridge inventory data of MRPW.

(4) Data Recording

Since KRB, MRPW, CCN, MOLG uses GIS Data Base, all data collected above are compiled in GIS format. All data that was collected is presented in Appendix 4.

4.2 EXISTING ROAD NETWORK CHARACTERISTICS

4.2.1 Classification of Roads

Road classification in Kenya by the MRPW is shown in Table 4.2-1.

TABLE 4.2-1 ROAD CLASSIFICATION IN KENYA

Road Class	Classification	Definitions
A	International Trunk Road	Roads crossing international boundaries or terminating at ports
B	National Trunk Road	Roads connecting provincial headquarters to each other or to 'A' roads
C	Primary Road	Roads connecting places of national importance to each other or the higher class roads
D	Secondary Road	Roads connecting places of local importance to each other or to higher class of roads
E	Minor Road	Minor roads of local significance
Special Purpose	Government/Rural/Tea/ Sugar etc. area's road	Roads serving specific transport for government access, settlement, rural access, sugar, tea and wheat.
Unclassified	Feeder	Roads connecting communities

Note: Special purpose roads include: G: Government facilities access. R: Rural access.
Unk: Unclassified road. L: Settlement road. S: Sugar road. T: Tea road. W: Wheat road.

The MOLG uses different road classification for urban roads as shown in Table 4.2-2.

TABLE 4.2-2 PROPOSED ROAD CLASSIFICATION FOR URBAN ROAD

Road Class	Classification	Functions
Urban arterial roads	Highway (H)	International trunk road
	Primary Arterials (P)	National Trunk road
Urban collector roads	Distributor (D)	Primary distributor
	Collector (C)	District distributor
Local Road	Local (L)	Local Street
	Access (A)	Residential stand access/ Commercial and industrial stand access/ Shopping street

Source: "Kenya Urban Transport Infrastructure Project. 2nd Draft, Road Design Guidelines for Urban Roads", MOLG, August, 2001, and CCN Road List

4.2.2 Road Network in Kenya

(1) National Road Network in Kenya

The national road network in the Republic of Kenya is summarised in Table 4.2-3 and Figure 4.2-1.

TABLE 4.2-3 NATIONAL ROAD NETWORK IN KENYA

Road Class	Code	Length by Surface Type (km)			Total	Share
		Bitumen	Gravel	Earth		
CLASSIFIED ROAD						
International Trunk Road	A	2,886.0	716.8	152.0	3,754.8	*6%*
National Roads	B	1,432.9	841.6	524.2	2,798.7	*4%*
Primary Roads	C	2,487.2	3,208.7	1,972.3	7,668.2	*12%*
Secondary Roads	D	1,166.8	6,483.7	3,565.4	11,215.9	*18%*
Minor Roads	E	750.5	7,206.2	18,592.4	26,549.1	*42%*
Special Purpose Roads	-	213.5	8,724.3	2,366.2	11,304.0	*18%*
Total		8,936.9	27,181.3	27,172.5	63,290.7	100%
Share of Surface Type		*14%*	*43%*	*43%*		
UNCLASSIFIED ROAD					87,309.3	
Country Roads					150,600.0	

Source: Planning Department of MRPW

(2) International Trunk Roads

The International Roads (A) connecting the neighbouring countries are shown in Figure 4.2-1. The Road (A109) traverses from Mombasa, the International Sea Port and ends at Athi River, connecting A104 that runs from the Tanzanian border. A104 to Uganda diverges from A2 that leads to the north for Ethiopia from Nairobi, which also connects at Thika to the A3 that goes to Somalia. In western Kenya, A1 runs from the Tanzanian border at Migori towards the Sudan border at Lokichogio through Bungoma where A104 connects. These roads carry import-export goods of these countries to the port of Mombasa. Thus Nairobi Metropolitan Area is the mid point of these international roads.

(3) National Roads

There are ten national trunk roads (Class B) linking important major towns and urban centers. Most of Class B roads have a function of linking the international trunk roads (Class A). In the Study Area B10 links A104 to Jomo Kenyatta International Airport and B3 diverges from A104 near the northern border of the Study Area.

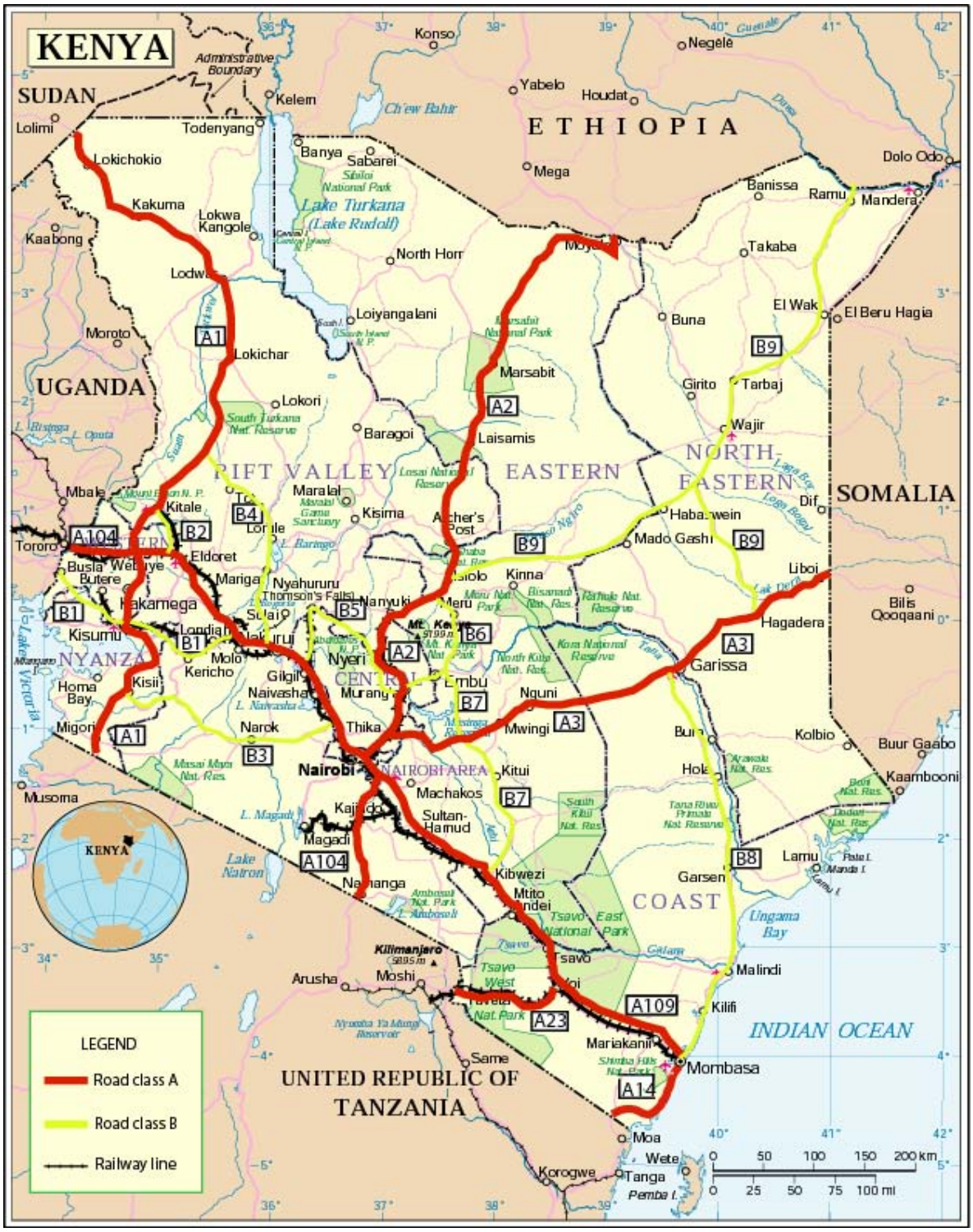


FIGURE 4.2-1 ROAD NETWORK OF KENYA

4.2.3 Road Network in Nairobi Metropolitan Area

(1) Division of the Study Area

Referring to zonings in Section 3.3, the Study Area is divided into divisions in terms of land use in order to undertake as precisely as possible, analysis of the road network characteristics and problems for future planning. The divisions are defined in Table 4.2-4 and schematically presented in Figure 4.2-2.

TABLE 4.2-4 DIVISION OF THE STUDY AREA

Division	Definition	Land Use/Road Network
Nairobi Metropolitan Area	Nairobi City, parts of Thika, Machakos, Kajiado, Kiambu districts	Land Use : Containment of urban and suburban areas such as CBD, City Centre, Urbanized Area, Urban Area, and Sub-Urban Area. Road Network : International and national roads concentrating to Nairobi City Centre
CBD	Old Town as Central Business District	Land Use : High administration and commercial centre including shopping malls, CCN, Nairobi Railway Station, an international convention centre and government offices. Road Network : Highly dense regular grid type and limited road space for widening
City Centre	CBD and administration centre (AC)	Land Use : Eastern CBD and western administration areas in hilly area including State House, government offices, embassies, WB, JICA, Nairobi University, Uhuru Park, hotels, and some residential apartments and housing. Road Network : Less development as distorted road network in AC and less connectivity with CBD and AC
Urbanized Area	The area outside the City Centre covering 5 to 7 km radius from CBD and surrounded by ring roads	Land Use : Industrial, commercial, and residential areas. Road Network : Incomplete R/C system and distorted network with missing links.
Urban Area	Nairobi City jurisdiction outside the Urbanized Area	Land Use : Residential sub-division, industrial estates, and commercial centres including air ports and Nairobi National Park Road Network : Radial arterial roads concentrating to CBD
Sub-Urban Area	Outside Urban Area of Nairobi City	Land Use : Agriculture and pasturage, suburban towns, and residential development Road Network : Less developed road network except western area where coffee/tea feeder roads developed on the ridges of mountain.

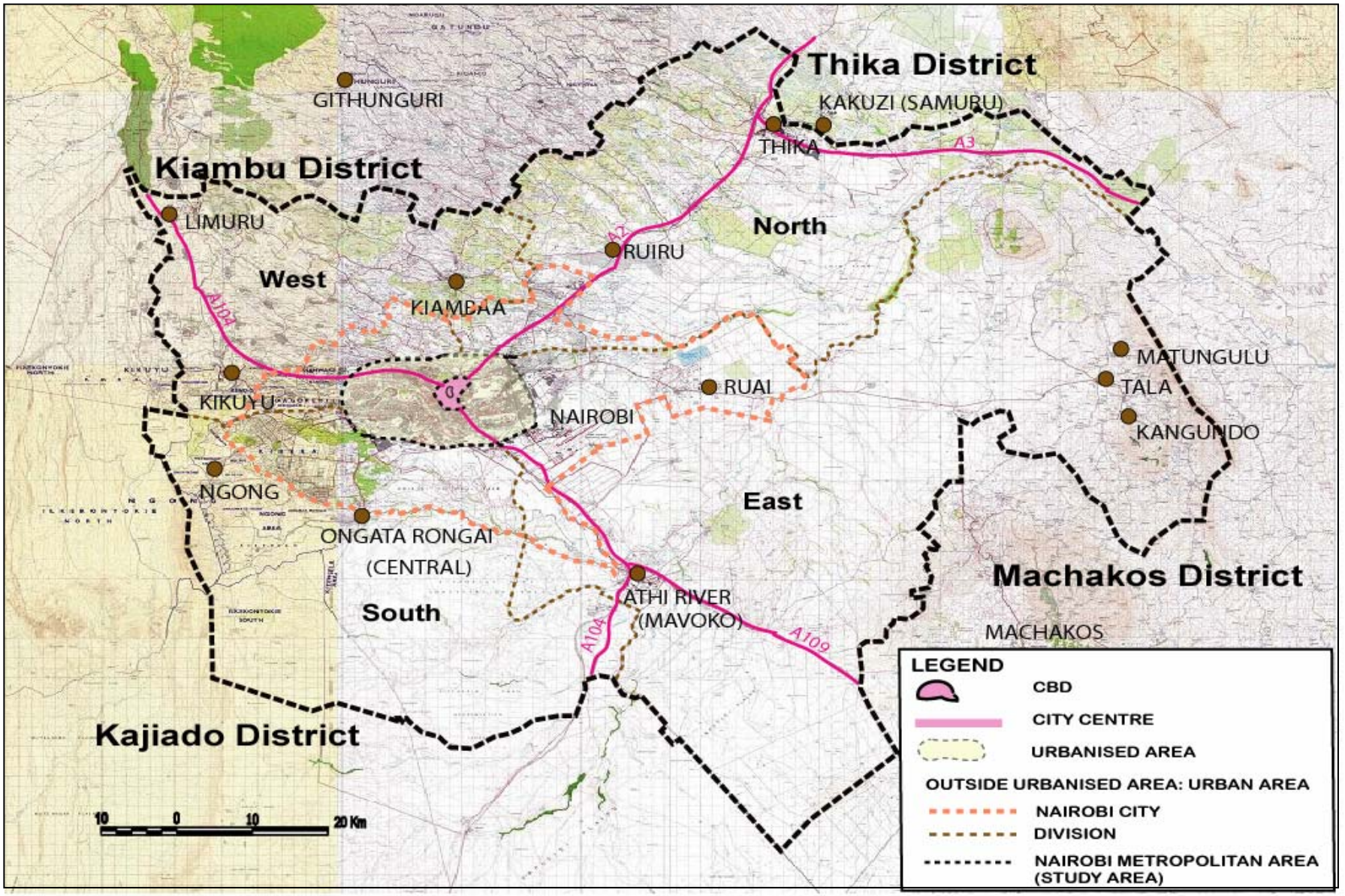


FIGURE 4.2-2 DIVISION OF THE STUDY AREA

(2) Roads under MRPW

A classified MRPW road network in the Study Area is presented in Table 4.2-5 and Figure 4.2-3.

TABLE 4.2-5 ROAD NETWORK IN THE STUDY AREA

(Unit: Km)

Road Class		Length by Surface Type			Total (Km)	Double Counts in MRPWH	Net Total	Share
MRPW		Bitumen	Gravel	Earth				
International Trunk Roads	A	177.6	0.0	0.0	177.6	-	177.6	12.5%
National Roads	B	4.0	0.0	0.0	4.0	-	4.0	0.3%
Primary Roads	C	298.3	28.9	2.6	329.8	-	329.8	23.2%
Secondary Roads	D	108.3	146.9	45.3	300.5	-	300.5	21.1%
Minor Roads	E	58.6	321.8	152.2	532.6	-	532.6	37.4%
Special Purpose Roads		7.3	61.4	8.9	77.6	-	77.6	5.5%
Total		**654.1**	**559.0**	**209.0**	**1,422.1**	**-**	**1,422.1**	**100%**
CCN		Bitumen	Gravel	Earth				
Highway	H	41.5	0.0	0.0	41.5	40.3	1.2	0.2%
Primary Arterials	P	58.8	0.0	0.1	58.9	4.0	55.0	5.8%
Distributor	D	174.1	3.0	6.1	183.3	118.4	64.8	5.8%
Collector	C	162.9	12.3	46.8	222.0	35.9	186.1	12.3%
Local	L	147.7	2.2	5.6	155.5	4.1	151.3	36.8%
Access	A	284.3	11.0	59.2	354.5	0	354.5	23.4%
Not Classified	-	106.7	7.0	35.9	149.6	0	149.6	15.7%
Total		**976.0**	**35.5**	**153.7**	**1,165.2**	**202.7**	**962.5**	**100.0%**
					Actual Survey Length of MRPW and CCN Roads		**2,384.6**	
Missing Links		New Road					31.5	
					Grand Total of Inventory Road		**2,416.1**	

Source: MRPW / CCN

(3) Roads under Nairobi City

The road network in Nairobi City is presented in Figure 4.2-4.

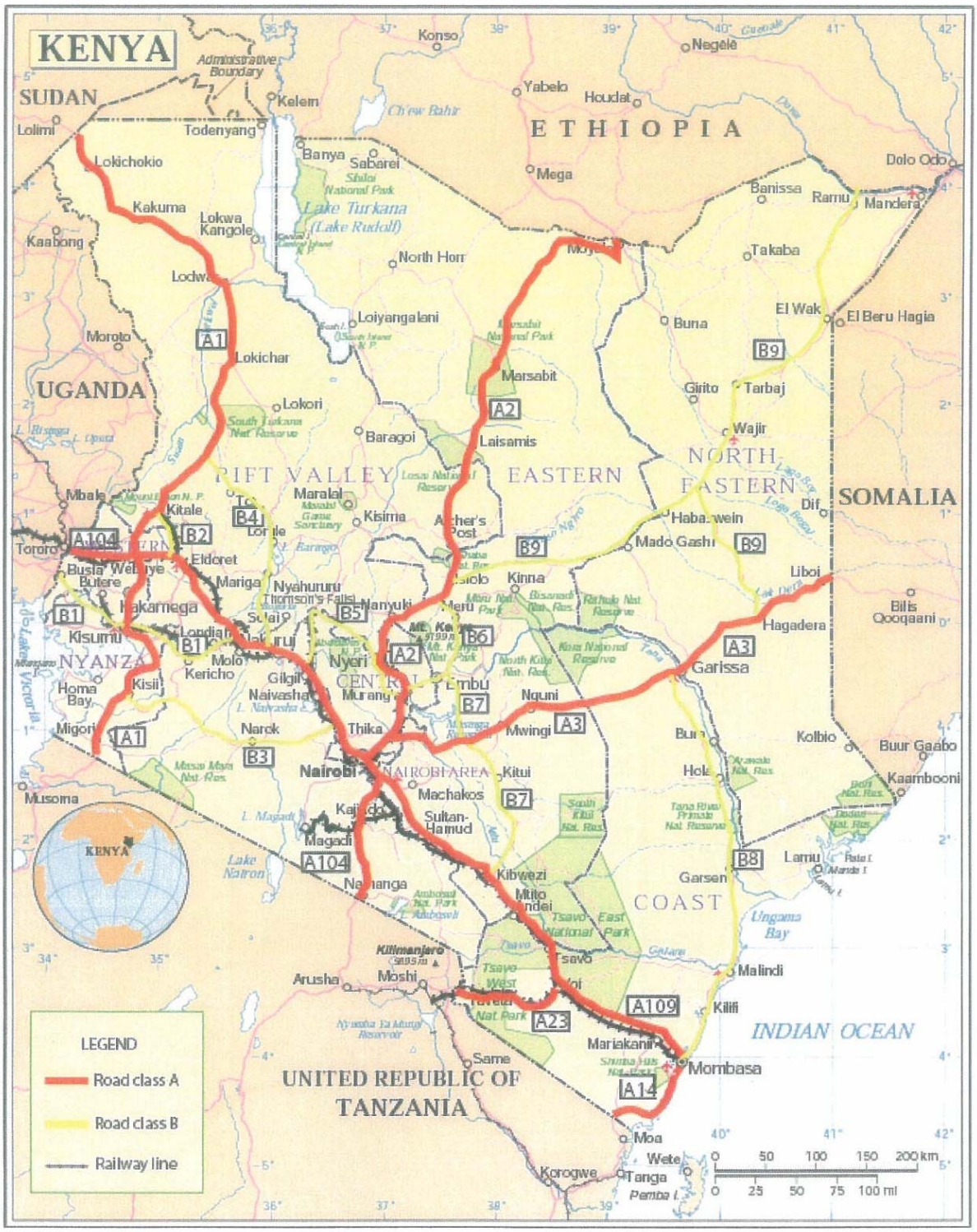


FIGURE 4.2-3 ROAD NETWORK IN THE STUDY AREA

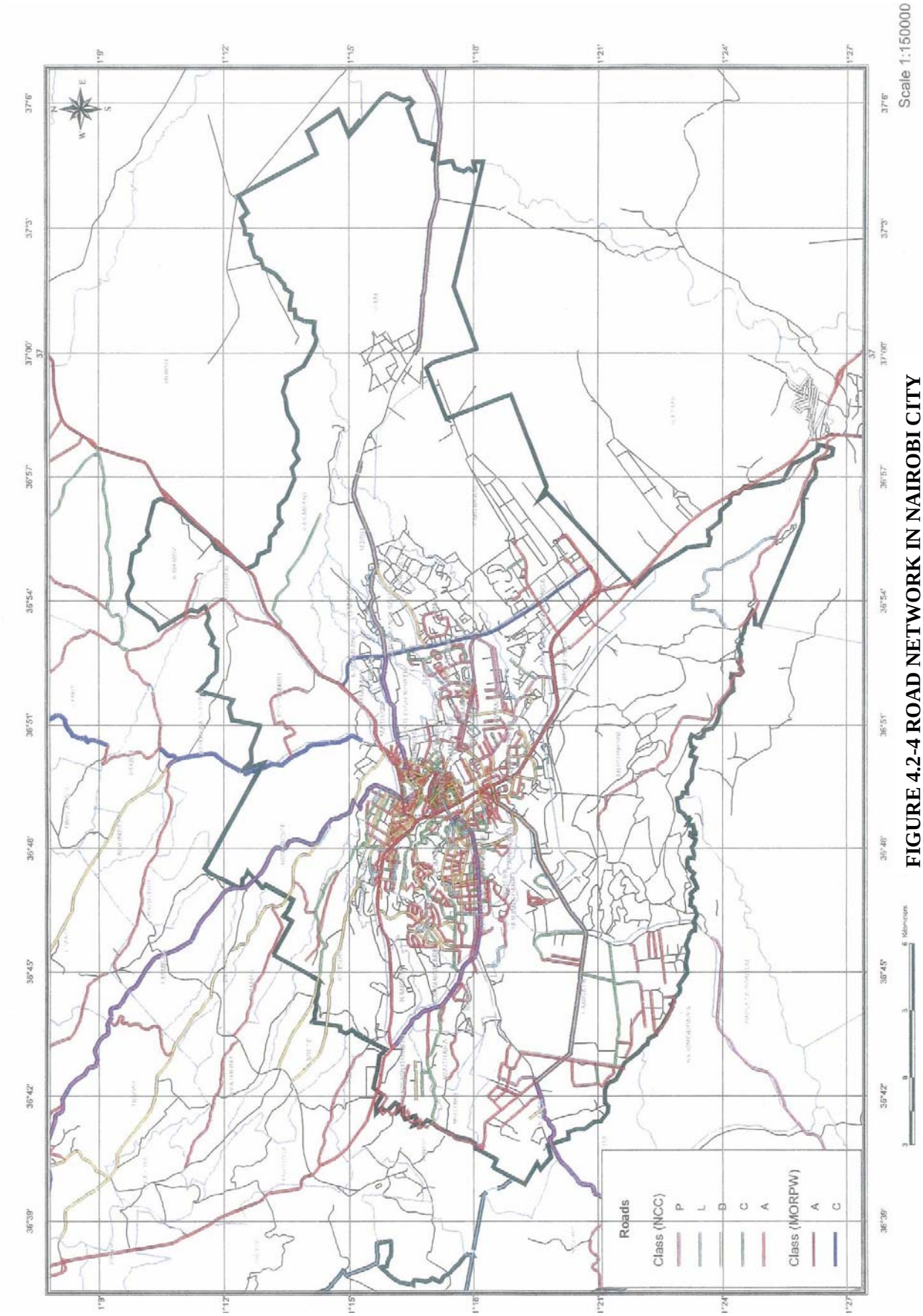


FIGURE 4.2-4 ROAD NETWORK IN NAIROBI CITY