

**The Project on Integrated
Urban Development Master Plan
for the City of Nairobi
in the Republic of Kenya**

Final Report

Part I: Current Conditions

December 2014

**Nairobi City County
(NCC)**

**Technical Support From
Japan International Cooperation Agency (JICA)**

**Nippon Koei Co., Ltd.
IDCJ Inc.
EJEC Inc.**

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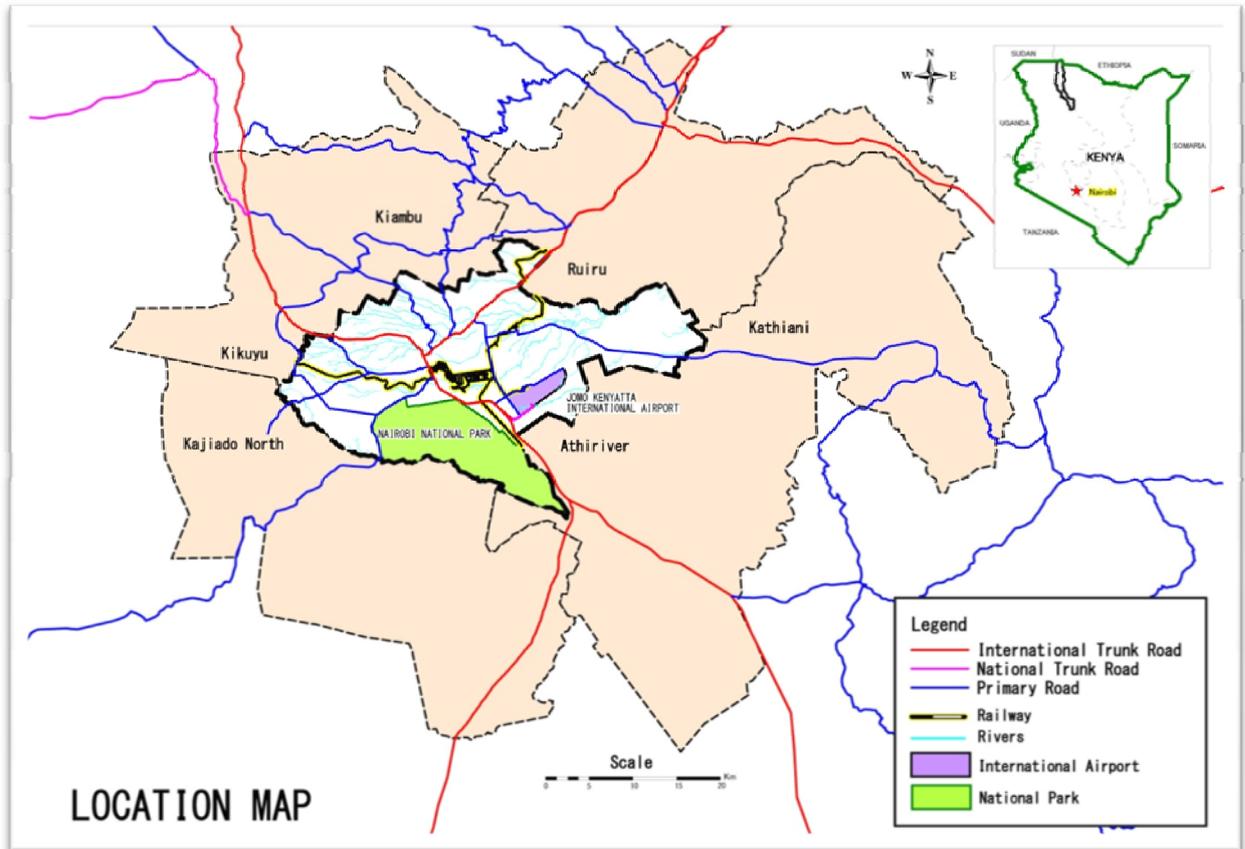
CONVERSION RATE (AT JULY 2014)

1 KES = 1.180 JPY, 1 JPY = 0.847 KES

1 USD = 103.41 JPY, 1 JPY = 0.0967 USD

source : JICA HP

LOCATION MAP



Foreword

Preparation of the Nairobi Integrated Urban Development Master Plan (NIUPLAN) is a major milestone for Nairobi City County (NCC) and the country at large. This is because Nairobi City is not only the capital city of Kenya but also an important commercial and industrial hub for East and Central African Region. The finalization of NIUPLAN marks an important phase for the development of the City and provides us a comprehensive and integrated urban development framework that has been missing since the expiry of the 1973 Nairobi Metropolitan Growth Strategy in year 2000. Ever since, the urban problems such as the chronic traffic congestion, poor housing characterized by the expanding slum areas, environmental degradation, insecurity, unemployment and deterioration of the City's infrastructure-both physical and social have continued to pose great challenges to the City's management and delayed Nairobi City's transition to a truly modern and globally competitive center.

My administration has prioritized the preparation of NIUPLAN as the first step towards resolving the challenges that have stood in the way of achieving a planned and orderly urban environment. The Formulation process has ensured the plan is aligned to global commitments to sustainable development as well as best practices whereas locally, the plan is referenced to Kenya's Vision 2030, Nairobi Metro 2030 (2008), and The Spatial Planning Concept for Nairobi Metropolitan Region (2013). The Constitution of Kenya (2010), The Physical Planning Act, The County Government Act (2012), The Urban Areas and Cities Act (2011) and other applicable statutes form the legislative framework within which NIUPLAN is prepared.

The plan provides an integrated framework based on a comprehensive and holistic view of urban development. This has been achieved through a thoroughly participatory and inclusive process marked by stakeholder participation from inception to validation of the Final report. The development vision contained in the plan "**Nairobi 2030: An Iconic and Globally-attractive City Aimed at Regional Integration and Sustainability**" is anchored on four pillars: i) Economy, ii) Environment, iii) Governance, and iv) Social Culture capturing the views and aspirations of the city residents, and is as a result of numerous grassroots meetings and consultations held in each of the nine sub-counties of the City. NIUPLAN has also been subjected to Strategic Environmental Assessment (SEA) process to identify environmental, social and economic impacts of the plan and elicit related concerns from a broad spectrum of stakeholders thus able to formulate the necessary social and environmental safeguards into the master plan.

The plan has extensive recommendations on measures to tackle the perennial challenges being experienced in the city, such as traffic congestion, unemployment, inadequate housing, and poor infrastructure, among others. Reordering of the city's urban structure through creating multiple sub centers will decentralize employment and service delivery to mwananchi and also reduce the need to come to the CBD for similar functions. NIUPLAN envisages a compact city with multiple core centers and a revitalized Central Business District. The objective is to have an inclusive city, thus ensuring spatial and social equity.

Nairobi City County Government acknowledges with gratitude the support of the Government of Japan through the technical support of Japanese International Cooperation Agency (JICA) and the JICA study Team (JST) for the technical support in preparing NIUPLAN. I want also to extend my appreciation to National Government ministries and line regulatory and implementing agencies for the support in drawing up the plan for Nairobi City. My staff led by the CEC Urban Planning, Lands and Housing Tom Odongo and Chief Officer Urban Planning and Housing, Rose Muema deserve special mention for steering the planning team towards finalization of NIUPLAN. Other stakeholders whose cooperation and technical input is invaluable include International Finance Institutions, UN Agencies, Universities,

Professional Bodies, Resident Associations and the city residents.

I would also like to commend the County Assembly led by the speaker for playing their part during the preparation and approval of this plan. They should be proud for being the first assembly under the new constitution to debate and pass the first Integrated Urban Development Plan in the Country.

My government acknowledges the need for continued stakeholder involvement and collaborative implementation process that requires all of us to work together to achieve this shared vision.

It is my sincere hope that the implementation of the plan will unlock the city's development potential and make Nairobi City a true icon of sustainable urban development.

Dr. Evans Kidero

Governor, Nairobi City County

EXECUTIVE SUMMARY

1 BACKGROUND AND OBJECTIVE

Background

- 1.1 Nairobi is the capital city of Kenya and one of the most important economic centres in East and Central Africa. It accounts for 50% of formal employment in Kenya and generates over 50% of the country's gross domestic product (GDP). Nairobi plays an important role not only as a political centre but also as a model for economic and social development.
- 1.2 The following are some pertinent facts about Nairobi and why a new urban development plan is required:
- Population of Nairobi has grown to over 3.1 million.
 - Urban problems have been left unsolved and are causing negative impacts like perennial traffic congestion, expansion of slum areas, insecurity, poor urban governance, and environment deterioration.
 - In order to accelerate sound and sustainable development, an integrated urban master plan has to be prepared to improve infrastructure such as transport network, water supply, sewerage reticulation energy, etc.
- 1.3 In response to the request of the Government of Kenya, the Government of Japan dispatched a Study Team (hereinafter referred to as JST) for the Integrated Urban Development Master Plan for the City of Nairobi (hereinafter referred by the acronym NIUPLAN or the Project), and signed the Record of Discussion (RD) with the then Ministry of Local Government and City Council of Nairobi for the implementation of the Project.

Outline of the Project

- 1.4 The objective of the Project is to review and develop concepts on sustainable urban development and improvement of living conditions based on an integrated urban development plan for Nairobi City.
- 1.5 The scope of work of the JST include:: to formulate an integrated urban development master plan to 2030; to formulate an implementation and management program; to select priority areas and priority projects; to review and formulate policies, rules and guidelines for local government; and to conduct technical transfer to the counterparts in the course of the Project.
- 1.6 The project area consists of the entire area of the City County of Nairobi (approximately 700 km²).

Organisational Arrangement

- 1.7 Stakeholders of the Project include the various organisations as stipulated in the two RDs, but the key responsible and implementing agencies are as shown in the table below:

List of RDs

Date of Signing of RD	Responsible Agency	Implementing Agency
23 July 2012	MoLG	City Council of Nairobi
24 September 2013	MoLHUD	Nairobi City County

Source: JICA Study Team (JST)

- 1.8 For execution of the master plan formulation, a Joint Coordinating Committee (JCC), Technical Working Group (TWG), and Secretariat were organised

2. SOCIO ECONOMIC AND URBAN CONDITIONS

- 2.1 The city of Nairobi is bounded by Kajiado County to the south and south west, Kiambu County to the north and north-west and Machakos County to the east and south-east. Nairobi is characterised by undulating hilly topography with elevations ranging from 1,460 m to 1,920 m above sea level, rising from the plains in the east to the hills in the west.
- 2.2 Kenya generally experiences two seasonal rainfall peaks in most places. The first peak or “long-rains” from March to May, while the second peak or “short-rains” is observed from October to December.
- 2.3 According to the Kenya Population and Housing Census, the total population of Kenya in 2009 was approximately 38,610,000, and that of Nairobi City was approximately 3,138,000. The average population density, excluding Nairobi National Park, is 5,429 per km². The Central Division and Kamukunji Division have higher population densities than other divisions
- 2.4 The age structure of the population of Kenya in 2009 forms a pyramid while that of Nairobi City has a pair of wings with a large share of the population around the twenties.
- 2.5 The population growth rate of Nairobi City has been higher than that of Kenya. During the 1999–2009 period, the growth rate for the city was 3.9% while the national average was 3.0%. The dominant reason for the difference is judged to be the high in-migration rate to the city.
- 2.6 Nairobi City is positioned higher than the national average in social indicators such as main source of water, main mode of human waste disposal, main type of lighting fuel, and ownership of household assets.
- 2.7 The gross regional domestic product (GRDP) per capita of Nairobi City varies on sources of data, although it is assumed to be three times the national GDP per capita. In 2011, GDP per capita of Kenya is estimated at KSh73,988 at current prices while the GRDP of Nairobi City is estimated at KSh221,965.
- 2.8 Among the wage employment in 2012, the community, social and personal services sector (52.1%), agriculture and forestry sector (24.1%) and wholesale and retail trade, restaurants and hotels sector (7.2%) rank first, second and third, respectively. Commercial and service businesses are more concentrated in the central business district (CBD) while manufacturing businesses are located more in Makadara Division. Informal employments are distributed throughout the city.

- 2.9 The land use composition, as studied by Columbia University's Centre for Sustainable Urban Development (CSUD), shows that open space is 47.8% and comprises the highest land use area, followed by residential use (15.1%), and national park (13.9%).
- 2.10 A lot of land use changes has taken place between 2003 and 2012. Typical land use changes in Nairobi are summarised as: i) soil rich farmland to residential area, ii) grassland to residential area, iii) detached house to apartment or office, and iv) river bank to informal settlements.
- 2.11 For urban services, the current data on the distribution of social services and facilities throughout Nairobi City's nine districts suggests that there are still inequalities between Nairobi East and West emanating from the colonial days.

3. INSTITUTIONS AND REGULATORY CONDITIONS

- 3.1 The Constitution of Kenya (2010), now in force, replaced the 1969 Constitution, that itself had replaced the 1963 Independence Constitution. The acts and policies under the constitutions related with NIUPLAN are the Environmental and Management Coordination Act 1999, National Urban Development Policy (draft), Urban Areas and Cities Act 2011, Physical Planning Act 1996, Building Code 1968 (under revision), National Land Commission Act 2012, County Government Act 2012, and National Government Coordination Act.
- 3.2 Most of the functions and responsibilities for urban development are now under the Ministry of Land, Housing, and Urban Development. Since the national government is still in a transition stage, details on the national government structure are yet to be announced.
- 3.3 Nairobi City is also in a transitional stage from the City Council of Nairobi to Nairobi City County (NCC), through which 17 departments are now restructured to 10 sectors. The City Planning Department of NCC remains responsible for urban development management from forward planning to development control.
- 3.4 The last zoning review was carried out in 2004 and resulted in subdividing 20 zones into smaller zones and prescribed ground coverage ratios (GC) and plot ratios (PR), and defined the minimum plot size for each zone. This revision allowed developers a maximum of four floors for apartments in Westlands, Parklands, Woodley, Kilimani and Kileleshwa. However, it just followed the situation in these areas and the current development activities did not seem to follow much of the revised regulations.
- 3.5 Nairobi Metro 2030 (prepared in 2008) and the Spatial Planning Concept for Nairobi Metropolitan Region (prepared in 2013) are considered umbrella plans for the present NIUPLAN. Some important contents of the Spatial Planning Concept for Nairobi Metropolitan Region such as population framework, settlement pattern (build up area and new town), settlements hierarchy, land use/land cover, and design intervention of Nairobi City County, will be the basis for the NIUPLAN Spatial Planning Concept for Nairobi Metropolitan Region.

- 3.6 For effective management and sustainability of urban development, capacity development is a crucial instrument.. To solve the capacity development issues in Nairobi City County, the basic direction of the capacity development plan was established to include: i) keeping the momentum for capacity development in NCC, ii) identifying target groups for capacity development, iii) encouraging internal training including on-the-job training (OJT), and iv) acquiring fundamental skills of urban development.

4. INFRASTRUCTURE CONDITION AND DONOR ACTIVITIES

Donor Activities

- 4.1 Multi-sector programmes for improvement of infrastructure in operation include the following: i) Kenya Municipal Program (KMP), ii) Kenya Informal Settlements Improvement Project (KISIP), iii) Nairobi Metropolitan Service Improvement Project (NaMSIP), and iv) Kenya Infrastructure Finance/PPP project.
- 4.2 Moreover, various donors, including WB, AfDB, JICA, USAID, UNDP, and UNEP have assisted infrastructure development for sectors such as urban transport, airport, water supply, sewerage and drainage, solid waste, power supply, and telecommunications in Nairobi City. There is need therefore, for improved coordination amongst the donors for effective and efficient urban development.

Road/Public Transport

- 4.3 The importance of the northern corridor as the city's trunk road as well as an international trunk road is emphasised, and traffic flow along the northern corridor is given more priority than other crossing roads. Therefore, the northern corridor becomes a kind of barrier for the local traffic flow in the west-east direction.
- 4.4 As the densely populated area of Nairobi City mainly stretches to the west and east, the traffic demand in the west-east direction is larger than that in the north-south. Therefore, roads in west-east direction across the northern corridor are always congested.
- 4.5 The road length density is 0.98 km/km² over all of Nairobi City, which includes some low population density areas. The Japanese standard density of a trunk road in the urban area is 4.0 km/km², and only the centre of Nairobi City is in this range. The road length density by population for the entire Nairobi City is 0.22 km/1000 people.
- 4.6 Since Kenyan people walk a lot along the arterial roads and in the urban streets, walking occupies a large proportion among the travel modes. Therefore, non-motorised transport (NMT) facilities for safe, comfortable and easy movement are necessary especially in traffic congested areas.
- 4.7 Most of bus and *matatu* (mini-buses used for the citywide transport) terminals are located around the Nairobi railway station, but are not systematically located by direction or destination. Outside the city centre, lay-bys for bus stops are found on the trunk roads, but

along minor roads, *matatus* and buses often stop at roadsides or intersections to pick up passengers, which cause obstacles in the traffic flow of the roads.

Railway

4.8 The main line of the Kenyan Railways Corporation (KRC) is the line from Mombasa to Uganda through Nairobi. Many railway commuters are using this line from the Athi River (south-east direction) to Nairobi, and from Kikuyu, (north-west direction) to Nairobi. Many passengers are also commuting from Ruiru, (north-east direction) to Nairobi, on a branch line towards Thika Town. A short branch line towards Embakashi Village is also used by commuters.

4.9 Due to the increasing severe traffic congestion in the city, the need for mass transit systems is widely recognised. There are two approaches for the development of a rail-based mass transit system in Nairobi: 1) utilisation of the existing KRC facilities and 2) construction of a new light rail transit (LRT) line or mass rapid transit (MRT) line.

Airport

4.10 Nairobi has two civil airports which are the Jomo Kenyatta International Airport (JKIA) and Wilson Airport. JKIA is conveniently located 18 km from the city centre to serve as a domestic hub and international gateway in Kenya. JKIA is the 7th busiest airport in Africa and a major hub in East and Central Africa for tourist and cargo movement. Wilson Airport is located 5 km south of the city and neighbours the Nairobi National Park. Wilson Airport is used mostly for both domestic and international general aviation traffic. This airport lies approximately 18 km west of JKIA.

Water Supply

4.11 The existing water sources for the water supply system to Nairobi City are Sasumua Dam, Thika Dam, Ruiru Dam and Mwagu Intake on the Chania River, Kikuyu Springs and groundwater.

4.12 There are four water supply systems to Nairobi City as per water source, namely the Sasumua system, Ruiru system, Mwagu system and Kikuyu system. Some of the facilities of the systems, such as the raw/treated water transmission pipelines of Sasumua WTP and Ngethu WTP, exist outside of Nairobi City. The distribution network for Nairobi City receives treated water from four reservoirs, namely Kabete, Kyuna, Kiambu and Gigiri reservoirs. The distribution area is segmented into 13 zones based on the reservoir supplying the water to the zone. About the distribution network, pipes are high densely installed in the western area of Nairobi City and low densely installed in the eastern area.

Storm-water Drainage

4.13 In Nairobi City, the existing storm-water drainage system is developed mainly in the central business district (CBD) and part of neighbouring areas. The system is composed of roadside drains along the existing urban roads, storm sewers and canalised trunk drains to collect

storm-water from the catchment areas and discharge the water to the tributaries mentioned above. Because the topography is generally sloping from west to east, the storm-water is drained by gravity. In the suburbs of Nairobi City, it is observed that storm-water is collected and discharged through roadside drains and small natural streams which network are not well-developed as a whole.

- 4.1 The main points of the observations as to causes of inundation are described below:
- i) Roadside drains are not functioning effectively due to improper design and/or construction, structural deterioration, and non-removal of sediment and garbage.
 - ii) The storm-water drainage network is not functioning effectively. Many drainage sections and/or outfalls remain blocked/clogged, due mainly to the difficulty in identifying such locations in densely built-up areas (e.g. informal settlements).
 - iii) In general, there is no systematic identification of problems on the storm-water drainage system, and localised works are done on ad-hoc basis, only to create another problem elsewhere.

Sewerage System

- 4.15 There are 24 existing sewerage treatment plants (STPs) in Nairobi City, but most of them are localised STPs with small capacity of less than 2,000 m³/day. The major STPs are the Dandora STP (capacity 120,000 m³/day) and the Kariobangi STP (32,000 m³/day). A report by the Nairobi City Water and Sewerage Company (NCWSC) indicates that these STPs are not functioning well in terms of actual sewerage treatment volume and water quality of treated outflow.
- 4.16 Majority of existing sewers are the combined sewers, collecting both storm-water and wastewater, and are developed in the CBD and other recent development areas. The total length of existing trunk sewers is about 162 km, collecting wastewaters from the sewerage service areas totalling about 208 km², which accounts for approximately 40% of the total area covered by the water supply service.

Power Supply

- 4.17 The number of power supply customers in Nairobi has increased by more than 100,000 annually from the 2009/10 financial year. Moreover, according to the New Connections Report 2012 to 2013 of Kenya Power, the recorded number of customers in Nairobi totals 1,062,329 in April 2013.
- 4.18 The Nairobi region is one of areas with unreliable electricity. Blackout incidences per 1000 customers as of 29th April 2013 show that, by comparison; Nairobi North and Nairobi West are particularly higher than other regions. For Nairobi South, blackout incidence is also high. In many cases, blackouts occur when a tree comes into contact with a distribution line or falls on the line causing interruption of electricity supply.. In Nairobi City, vandalism of the electricity system such as electricity theft, stealing oil or copper from transformers, and eventually stealing the transformers sometimes happens.

Solid Waste Management

4.19 The Department of Environment (DOE) in NCC collects solid waste by themselves or contracts out the work with a private company. On the other hand, the private company collects the solid waste through contracts with households or public or private enterprises. The collected waste is transported to Dandora dumpsite or other dumping sites. Some of the collected waste is illegally dumped. There are some areas where solid waste cannot be collected by NCC or a private company due to insufficient width of access road or generally poor accessibility. In these areas, community-based organisations collect the waste.

Telecommunications

4.20 In 2011/12, there was a rapid growth of mobile telephone users against a decline in the number of fixed subscribers of 30% from the previous fiscal year. Kenya Broadcasting Corporation (KBC), the government-managed broadcaster, operates FM radio broadcast and middle-wave radio broadcast throughout the nation in English and Kiswahili for 24 hours. Over 100 FM broadcasters, including local broadcasting, are also licensed to broadcast. As of 2012, the Communications Commission of Kenya (CCK) licensed 190 postal/courier operators, an increase of 14 new postal/courier operators compared with the previous year. This was due to a successful public awareness campaign on postal and courier services regulatory requirements.

5. CONSTRAINTS AND PLANNING ISSUES

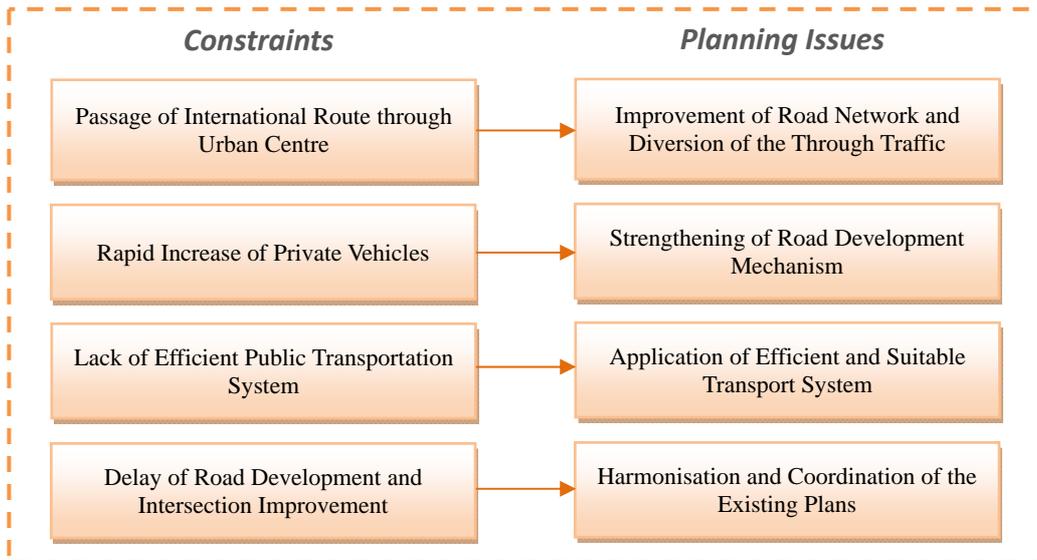
5.1 Figures below illustrate constraints and planning issues for urban planning, urban transport, and the socioeconomy, compiled based on the current conditions.



Source: JICA Study Team (JST)

Constraints and Planning Issues for Urban Planning

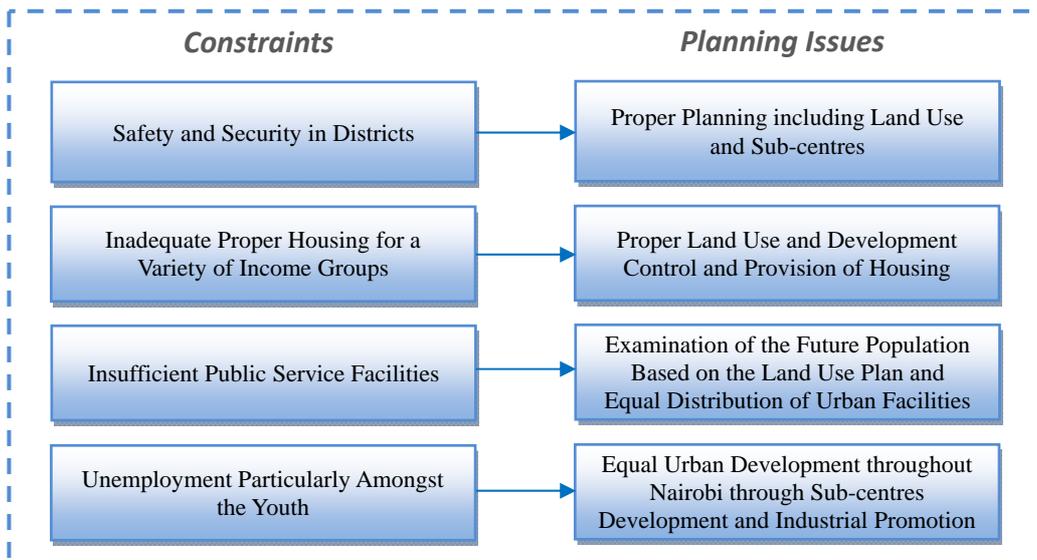
Urban Transport



Source: JICA Study Team (JST)

Constraints and Planning Issues for Urban Transport

Socio-economy



Source: JICA Study Team (JST)

Constraints and Planning Issues for Socio Economy

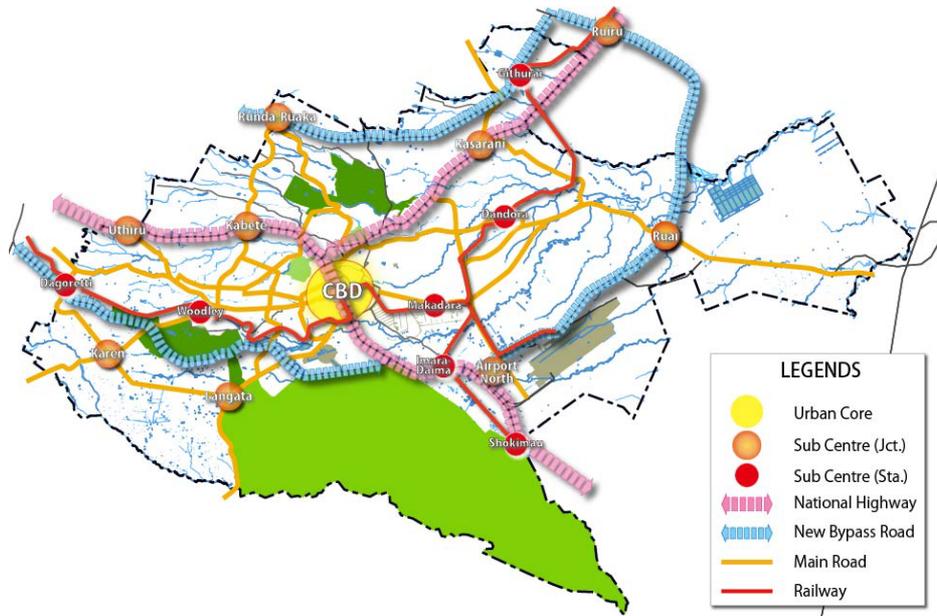
6. DEVELOPMENT VISION AND STRUCTURE PLAN

6.1 The population of Kenya, Nairobi City and its environs are projected for the target year of 2030 as well as the intermediate years of 2013, 2018, and 2023. Three alternatives have been prepared: i) Past Trend Scenario, ii) Rapidly Decelerating Scenario toward a Middle-Income Country, iii) Gradually Decelerating Scenario. Among the alternatives, the “Gradually Decelerating Scenario” was recommended.

6.2 The population growth of Greater Nairobi has been considerably higher than the national

average.. Within Greater Nairobi, Nairobi City was growing faster in the 1990s than the environs, then in the 2000s the environs were conversely growing faster. Considering the past trends and future development ideas of the area, five alternative scenarios including “Containing City Population Scenario” and “Nairobi Metropolitan Development Scenario” are defined.

- 6.3 In conclusion, in view of the basic concept that Nairobi City should contain its population growth while its environs should rapidly develop to function as part of the expanding national capital to be called the Greater Nairobi, the “Nairobi Metropolitan Development Scenario” is adopted. The estimated population of Nairobi City in 2030 is 5,212,500.
- 6.4 The day-time population of Nairobi City is estimated to grow from 3,280,000 in 2009 to 5,468,000 in 2030, by simply adding the net inflow of commuters from outside of the city to the night-time population. It is also equal to the total of the number of jobs, school enrolment and others.
- 6.5 Three sets of cases of future GDP per capita of Kenya and GRDP per capita of Nairobi City are examined assuming that the GRDP per capita will continue to be three times the GDP per capita of Kenya. The “GDP 7% Growth Case” is adopted because it is thought to be a realistic and appropriate target.
- Average GRDP growth rate: 6.8%
 - Average GRDP per capita growth rate: 4.4%
 - GRDP per capita in 2030 at 2011 prices: KSh500,200 (2.3 times the 2011 level)
- 6.6 A technical working group attended by Nairobi City County staff, experts from university, consultants and national government organisations was held to discuss development visions. Based on the discussion at technical working groups and stakeholder meetings, the development vision “Nairobi 2030: An Iconic and Globally-attractive City Aimed at Regional Integration and Sustainability” is proposed. The vision consists of four pillars: i) Economy, ii) Environment, iii) Governance, and iv) Social Culture.
- 6.7 Several prototypes of the structure plan can be conceived for Nairobi City County. For the purpose of discussion, typical prototypes are introduced. Considering the urban development trend and problems that Nairobi is facing, the sub-centre system (bi-polar corridor development), was adopted as the type of structure plan for Nairobi.



Source: JICA Study Team (JST)

Sub-centre System (Bi-polar Corridor Development)

- 6.8 Majority of governmental institutions have their headquarters in the CBD and Upper Hill area. For this reason, the current land use of this area is of mixed use with predominantly institutional and others. Some new office buildings for private companies, however, tend to be located outside the CBD, principally along major roads, which is assumed to change the distribution of institutional use within the city. The Karen-Langata area, located in the south-western part of Nairobi, still keeps low-rise and low density residential profile with ample open space. On the other hand, housing developments in and around Ruai are undertaken by private developers without a clearly defined comprehensive development concept to become high density and low open space area.
- 6.9 Based on the existing regulation entitled “A Guide of Nairobi City Development Ordinances and Zones” and the population densities in each sub-location, JST made an estimate of the population capacity of Nairobi City County. Based on the above conditions, the maximum capacity of population of Nairobi City County is estimated to be approximately five million. This result means that if Nairobi City County needs to accommodate more than five million population, the existing regulation in the development ordinance should be revised to change land use. The revision should convert some of non-residential land use to residential use, and also to increase plot ratio in order to promote higher population density and accommodate the future population.
- 6.10 The number of employment will increase by approximately one million up to 2030. Among the forecast increase, office-employed population in priority industries becomes around 583,900. Approximately 600 ha of land will be necessary for the office demand.

6.11 Public institutions and facilities in Nairobi City County, including KRC and NCC, occupy a large size of lands. Most of these lands are not efficiently utilised. These public lands can be utilised partly for urban development, transportation facilities or public activities by way of redevelopment or agglomeration.

6.12 The following are the principal policies for the Nairobi land use plan 2030.

Principal Policies for Nairobi Land Use Plan 2030

1 Decentralise business, administrative and commerce functions	<ul style="list-style-type: none"> ● Sub-centre system will be adopted with new urban transport network to disperse business functions from the centre. ● Land use regulation for sub-centre areas will be revised to activate its function and to accommodate growing population. ● CBD should be re-developed to revitalise the city centre.
2 Expand and renovate CBD	<ul style="list-style-type: none"> ● KRC's railway yard to be developed as new urban core
3 Preserve and restore green and water environment to create ecological network	<ul style="list-style-type: none"> ● Existing forests and woods should be preserved. ● River and river banks will be restored to open recreational space.
4 Conserve agricultural activities	<ul style="list-style-type: none"> ● Agricultural activities should be conserved for diversification of the land use.
5 Restructure industrial area	<ul style="list-style-type: none"> ● New industrial areas will be allocated in the southern part of the city.. ● Existing industrial area should be re-developed for new urban function.
6 Beautify the city for Kenyan pride	<ul style="list-style-type: none"> ● Urban landscape regulation should be established to keep historical beauty for the citizen.

Source: JICA Study Team (JST)

6.13 As discussed in the Development Vision of Nairobi City County 2030, Nairobi is not only the capital city of Kenya but also one of the leading economic centres of the East Africa Region. The strengthening of the CBD is also critical to support an efficient urban transport system. The current condition of the CBD is not as efficient as it should be, due mainly to a lack of coordination among stakeholders, including the proposed Railway City Development and concentration of transport modes around the Nairobi Station area.

6.14 The current CBD boundary is marked by roads such as Uhuru Highway on the west, University Avenue on the north and Haile Selassie Avenue. Under the influence of the current economic growth, the expanded CBD was proposed as “the Spatial Planning Concept for Nairobi Metropolitan Region” to consider collective development strategy.

6.15 The development visions for the CBD were discussed by members of a Thematic Working Group (Land use and Human settlement). Based on the discussions, the development vision and four pillars of development were formulated. The vision for the CBD is a “Compact urban centre that is innovative, livable, green, efficient, competitive and inclusive.” The four pillars are: i) Economy, ii) Environment, iii) Urban Space, and iv) Transport. The function of the CBD was proposed to include business & commerce, residential, public, transport, art and culture, and academic functions.

6.16 In order to strengthen the CBD function, a comprehensive approach is necessary, including enhancing the road network, possible introduction of a monorail, installation of new urban

facilities, and promoting spatial development. In addition, surrounding areas of the CBD, including Upper Hill and the area along Lusaka road, should be consolidated to the existing CBD to create a greater and stronger area for this comprehensive approach. For this reason, the JST proposed a greater CBD.

6.18 The following components are proposed for the CBD development.

- Road network to strengthen linkage in CBD and in the hierarchy of types of roads;
- New urban transport system (loop monorail line) to reduce traffic to the existing CBD;
- Urban facilities such as bus terminal, Nairobi station square, and open space and green corridor;
- Future land use concept and development ordinance to encourage optimum utilisation of the current development ordinance; and
- Spatial development such as urban development in selected areas, land re-adjustment project, and urban renewal projects.

6.19 The TWG's main recommendations including (1) recognition of development restrictions/constraints and challenges in areas such as Karen, and (2) provision of more nodes for the Eastlands areas. Based on the TWG discussions, development concepts including key issues and proposed urban function structure were formulated for eight sub-centres: Upper Hill South, Karen-Langata, Runda-Ruaka, Dandora, Imara-Daima, Makadara, Kasarani, and Ruai.

7. URBAN TRANSPORT DEVELOPMENT PLAN

Road

7.1 Road development/improvement shall be implemented based on a consistent programme. The implementation schedule is proposed in this study for the efficient and effective solution of the traffic issues, which is the most essential output of the study. Therefore, the establishment of consensus among the stakeholders is expected in the next stage.

7.2 Currently, through traffic of heavy vehicles are passing through international highways, and obstructing the traffic inside the city. After the completion of the Southern Bypass, heavy vehicles should be restricted from entering into the area surrounded by the Eastern Bypass, Northern Bypass, and Southern Bypass.

7.3 At many spots on many roads in Nairobi City, traffic is hampered by deteriorating road conditions. In order to secure smooth traffic flow, maintenance of road surfaces in good condition is crucial.

Public Transport

7.4 At present, relevant organisations are conducting studies individually for the introduction of

new public transport. However, a consistent policy for the development has not been established, such as priority mode, priority corridor, physical standard for each mode and financial method to attract investment. A comprehensive study for the introduction of new public transport is required.

- 7.5 In order for the Mass Rapid Transit System (MRTS) plan to materialise, not only the physical infrastructure but also the institutional framework, especially the setting up of an operator, is the most crucial challenge to be overcome by the relevant authorities.
- 7.6 For the improvement of the transport network, especially the introduction of a Bus Rapid Transit (BRT), obtaining general consensus among the passengers and operators of buses/*matatus* is highly recommended
- 7.7 Since the beneficiaries and the most affected participants by the public transport projects are the citizens of Nairobi City County, a deeper and more committed involvement of NCC to the projects is essential. Moreover, NCC established the land use plan which should harmonise with the transport system. Therefore, NCC should be a prime member of the transport development project team and the opinions from NCC should be reflected into the project.
- 7.8 In order to demonstrate the effectiveness of the introduction of a new system for public transport and to obtain the consensus among the citizens, a pilot experiment is an effective way which was introduced in many countries. For the introduction of the BRT system, a pilot experiment shall be implemented for a certain period, and effects will be evaluated after the implementation.

8. URBAN INFRASTRUCTURE DEVELOPMENT STRATEGY

Water Supply

- 8.1 The development plan of water resources and facilities for intake, raw water transmission, water treatment plant and treated water transmission has been established with five phases already.
- 8.2 Phase I of the well field development in Kiunyu and Ruiru and Phase II of the northern collector and water supply system including Ngorongo WTP have been commenced with funding from WB and AFD. Although the development includes raw water transmission, water treatment plant and treated water transmission, the distribution network to cover the expanded capacity of water supply has not been included in the proposed plan under Feasibility Study and Master Plan for Developing New Water Sources for Nairobi Satellite Town (FSMPNWS). Thus, the development plan of the distribution network needs to be studied separately
- 8.3 Phase III of the S. Mathioya River transfer, Maragua Dam and Ndunyu Chege WTP is under planning stage. Expanding the capacity through the development is necessary to cover the

water demand after 2020. Water resources and facilities are located outside Nairobi City. Thus, an agreement of counties on the development of water supply facilities for Nairobi City is indispensable. Phase IV and Phase V of the northern collector second phase and Ndarugu Dam, Ndarugu WTP, three pump stations and pipelines are planned on the basis of the demand projection by WB for 2030 and 2035, respectively. Phases IV and V could be postponed after 2035 subject to the improvement/decrease of water loss. The projected demand with 20% of the water loss will be below the total capacity of Phases I, II, and III. Depending on the improvement level of the water loss decrease, the revised master development plan needs to be studied further.

Storm-water Drainage

8.4 The storm-water drainage in Nairobi City should be developed in such a manner that ensures integration of the river and localised drainage networks. Within the catchment area of the river, the development and maintenance of the river should be planned and implemented to ensure the required hydraulic capacity for storm-water drainage as well as the riparian reserves maintain better water environment. Local drainage networks should be developed under the conditions, provided for in the plan for development and maintenance of the rivers.

Sewerage

8.5 Sewerage development is implemented currently to expand the capacity of treatment. Besides, the sewerage system in Nairobi City needs to improve its performance in terms of the effluent quality from the STWs and sewerage collection/conveyance.

8.6 The comprehensive framework for the water environment management in Nairobi City was elaborated by the former Nairobi River Basin Program (NRBP) supported by UNEP in the last decade. Under the said framework, the development of storm-water drainage and sewerage should be recognised as part of the subsequent activities being taken by the Nairobi Rivers Basin Rehabilitation and Restoration Program. At present, the activities relevant to the water environment management in Nairobi City are taken by the initiatives of the government organisations in charge. For further enhancement of the activities, the Nairobi City County should increase its involvement with such activities through its capacity development.

Power Supply

8.7 The recommendation to the power sector is to review the demand projection with the setting of the GDP growth rate and the future population forecast. It may be important to ensure adequate power equipment, but excess forecast may lead to an excess construction of power equipment and, as a result, increase in electricity cost. From the demand and gap analysis, two points are set as the development policy for the power sector: appropriate planning for

energy sector and development based on the concept of sub-centres.

- 8.8 Appropriate Planning for Energy Sector: This is the policy for effective and appropriate planning, that is, not to plan with excess design. From the previous section, there seems to be excessive capacity in planning and designing. For example, according to the analysis of demand forecast, the existing demand forecast is substantially higher than the Project Demand Forecast (PDF). As another example, wayleaves and minimum clearance of overhead line are higher than in other countries
- 8.9 Development based on the Concept of Sub-centres: The main overall objective of the NIUPLAN is to implement sustainable urban development and the improvement of living conditions for Nairobi city. Hence, the energy sector needs to achieve part of the objective. For example, as already mentioned, Dandora's development can be revised through the power sector by review of the current generous provision for power line way leaves.. Dandora area is set to become a sub centre under this plan and it's recommended that effective use of the lands now used for the power line be considered.

Solid Waste Management

- 8.10 The development policy for the solid waste management sector is set as follows:
- 1) Application of feasible methods of waste management in terms of environmental, social, economic and technical aspects to keep a clean and safe environment for the people;
 - 2) Development of the system to manage various stakeholders including private contractors, licensed private company, waste dischargers, and waste pickers; and
 - 3) Implementation of capacity development in a suitable manner for target organisations and staff.
- 8.11 One of the priority projects for solid waste management is the new sanitary landfill in Ruai. However, Kenya Airport Authority (KAA) and Kenya Civil Aviation Authority (KCAA) were opposed to the proposed Ruai site, as it is on the flight path of the Jomo Kenyatta International Airport.
- 8.12 JST suggested the importance of the methods of soil cover during landfill operation for the sanitary landfill site to protect the disposed waste from birds. Additionally, JST recommended the introduction of semi-aerobic landfill method such as leachate collection and treatment system, and lining system at the bottom of the site by using black cotton soil, gas collection system, and dividing the landfill areas into six sections.
- 8.13 There are various methods to prevent birds in landfill sites. JST suggested that a pilot project for sanitary landfill operation should be implemented by NCC with relevant stakeholders, including NEMA, KAA and KCAA, as well as the preparation of site visit to the best practices in other areas and holding workshops with relevant stakeholders related to sanitary landfill and airport operation.

Telecommunications

- 8.14 Based on the study of the current conditions, JST set up the five development policies for the telecommunications sector in NCC to achieve Kenya Vision 2030 and the National Broadband Strategy: i) high speed and reliable communications network and its connectivity, ii) collaboration among governmental players and operators, iii) policy, regulation and institution development, iv) promotion of e-government, and v) protecting citizens from disasters and emergencies.

9. CROSS CUTTING ISSUES

- 9.1 The basic policies for institutional strengthening include strengthening development control, implementing urban (spatial) development projects and enhancing infrastructure development management. Conducting community awareness and carrying out private sector promotion are also two of the basic policies.
- 9.2 Strategies for institutional strengthening are as follows: i) Strengthening of development control: formulation of a comprehensive development control mechanism, ii) Facilitation of urban development schemes, iii) Infrastructure development management mechanism, iv) Private sector promotion scheme, v) Development of an information dissemination mechanism, and vi) strengthening of organisations for urban management.
- 9.3 The Working Group members have formulated the capacity development plan. The core target group for capacity development are officials of the City Planning Department of NCC. The goal of capacity development is for the officials “to be able to implement urban development and management consistent with the NIUPLAN.” This is to be achieved through the six approaches: i) to fully understand the NIUPLAN, ii) to acquire fundamental skills in urban development and management, iii) to adapt ICT skills to urban development and management, iv) to encourage internal training programs including on-the-job training, v) to apply participatory methods to trainings, and vi) to strengthen monitoring and evaluation for capacity development.

10. SOCIAL AND ENVIRONMENTAL CONSIDERATIONS

- 10.1 The environmental and social considerations related with the implementation of NIUPLAN are achieved through a series of intensive participatory and information disclosure processes based on the Constitution of Kenya (2010), County Government Act (hereinafter referred to as CGA) No. 12 of 2012, Urban Areas and Cities Act No. 13 of 2011, NEMA’s SEA Guideline (2012), the JICA Guidelines for Environmental and Social Considerations (2010), and other enabling legislation on civic education.
- 10.2 The Environmental (Impact Assessment and Audit) Regulations, 2003 provides that lead agencies should subject all public policies, plans and programs (PPP) to SEA. During the

SEA process, the likely significant effects of a PPP on the environment shall be identified, described, evaluated, and reported. The full range of potential effects and impacts including cumulative, synergistic, and/or temporary impacts, are covered.

- 10.3 In order to conduct the evaluation of five proposed development structure alternative strategies as shown in table below, compound and "risk and opportunity" matrices were developed. The evaluation results support the adoption of the "sub-centre system (bi-polar corridor development)" as mentioned in Item 6.7.

Five Proposed Development Structure Alternatives

Structure Plan	Characteristics
STR-1: CBD one core system (mono core) (present trend)	Regarded as "No Action" plan. Only one strong nuclei which develops and there is no existence or important function of other centres
STR-2: Sub-centre system (poly nucleated development)	There is no dominating single settlement; all nodes of the polycentric network have the same relevance of "spatial participation"
STR-3: Sub-centre system (bi-polar corridor development)	Development of minor settlements along the transport corridor connecting two strong nodes
STR-4: Sub-centre system (corridor cum ring development)	Development of settlements along the corridor and ring
STR-5: Diffused development system	Development of two level of corridor (within Nairobi city county and Greater Nairobi)

Source: JICA Study Team (JST)

- 10.4 Specific negative risks, associated with the implementation of each development structure alternative, are identified for the above four sub-categories from STR-2 to STR-5. No positive impact can be recognised for STR-1 scenario, because the current city traffic congestion and its resultant roadside environmental conditions such as the air quality and noise are getting worse. By implementing either of STR-2 to STR-5, certain amounts of alleviation of traffic congestions and the improvement of related roadside environment are expected.
- 10.5 Each development structure alternative has its own advantages and disadvantages in its implementation, and preparation of the relevant environmental and social management plan or program would be essential to implement environmentally and socially sound options. In STR-1, current countywide issues such as disorganised land use conditions, traffic congestion, illegal settlement, improper waste treatment system, and deforestation will not be changed (most likely to be worsened).
- 10.6 Potential advantages to lessen the difficulties for implementation of urban development and/or improvement programs in the future would be significant. Besides, it can be expected that the chronic shortage of basic infrastructure facilities such as waste disposal sites would be solved by the implementation of the NIUPLAN. It is noted that temporary environmental degradations would be inevitable during construction activities due to its implementation. It would be beneficial to prepare medium-term or long-term comprehensive regional management plans or strategies for the implementation of future urban development program,

based on any development structure alternative.

- 10.7 Based on stakeholder meetings held during the SEA study of NIUPLAN, NCC organised 23 public consultations across the city county (equivalent to have one consultation per one constituency) to encourage the citizens to contribute and share their desired aspirations in the development of the city. It is noted that the findings and remarks, as mentioned above, are incorporated into NIUPLAN.

11. PRIORITY PROJECTS

- 11.1 Priority programs are proposed as a first step of implementation of the Master Plan which is expected to be implemented (start) in the short term (~2018). Instead of implementing individual projects, projects are compiled as a “program” to clarify objectives and promote efficient implementation. Five programs are proposed to be implemented in the short run: (i) urban development program, (ii) urban transport development program, (iii) urban infrastructure development program, (iv) environment improvement program, and (v) urban development management strengthening program.
- 11.2 JST proposed 37 priority projects to be carried out by 2030 to solve the gaps between the current supply and demand forecast. From these projects, 16 high priority projects are selected as shown in the table below, in consideration of “readiness of the program”, “NCC’s involvement” and “range of beneficiaries of the projects”.

List of High Priority Projects

Program	Project Title	Possible Fund Source
Urban Development Program		
CBD Development Program	Railway City Development	ODA (Loan, Technical Cooperation)
Sub-centre Development Program (priority area)	Dandora Sub-centre Development	ODA (Technical Cooperation)
	Eastlands Urban Renewal Project	ODA (Technical Cooperation)
Urban Transport Development Program		
Road Network Development Program	Flyover in CBD for Railway City	ODA (Grant Aid / Loan)
	Widening of Enterprise Road	ODA (Grant Aid)
	Construction of Northern Part of Circumferential Road C-2	ODA (Grant Aid)
Public Transport Development Program	Development of New Bus and <i>Matatu</i> Terminal in Railway City	ODA (Grant Aid)
	Vitalisation of Commuter Train Operation	ODA (Technical Cooperation)
	Feasibility Study on Nairobi Loop Line	ODA (Technical Cooperation)
ITS Development Program	Formulation of ITS City Master Plan	ODA (Technical Cooperation)
Infrastructure Development Program		
Water supply	Master Plan of Distribution Network in Nairobi	ODA (Technical Cooperation)
Power	Amendment for Technical Criteria of Overhead Line	ODA (Technical Cooperation)
Telecommunications	Fiber Optic Trunk Communication Network in Nairobi City	ODA (Loan)
Environment Improvement Program		
Stormwater drainage and sewerage	Capacity Development for Stormwater Drainage System in Nairobi City	ODA (Technical Cooperation)
	Capacity Development for Sewerage System in Nairobi City	ODA (Technical Cooperation)
Solid waste management	Development of New Landfill Site	ODA (Loan)
City-wide Air Quality Management Program	City-wide Air Quality Management Program	ODA (Technical Cooperation)
Urban Development Management Strengthening Program		
Urban Development Management Strengthening Program	Urban Development Management Strengthening	ODA (Technical Cooperation)

Source: JICA Study Team (JST)

12. CONCLUSIONS AND RECOMMENDATIONS

12.1 The Integrated Urban Master Plan covers development vision, structure plan, sub-centre development, urban transport development, infrastructure development, and capacity development. Through the process of the master plan formulation, a series of technical working group and stakeholder meetings was conducted. In addition, a GIS database was developed and priority programs are proposed.

12.2 The following are the main points of the NIUPLAN.

Main Points of the NIUPLAN

Item	Contents
1. Vision	● Development vision is proposed for Nairobi City County to become not only the centre of Kenya but also the centre of the East African Region.
2. Sub-centre System	● Sub-centre system (multi core development) is proposed, which includes strengthening of the CBD and development of seven sub-centres.
3. Urban Transport Development	● Urban transport development proposes multi-modal development including road network, public transport network, and traffic management.
4. Infrastructure	● Infrastructure covers water supply, storm-water drainage and sewerage, power supply, solid waste management, and telecommunications in which development policy is proposed.
5. Capacity Development	● Capacity development proposes to strengthen urban development management from planning, control and development.
6. GIS Database	● GIS database covers land use, infrastructure and urban facilities.
7. Priority Programs	● Priority programs are proposed to be implemented in the short term.

Source: JICA Study Team (JST)

12.3 In order to ensure the smooth transition or implementation of the master plan, recommendations were prepared as shown in the table below.

Recommendations	
Recommendation	Necessary Action
Institutional Aspects	
1. Dissemination of the NIUPLAN to NCC	<ul style="list-style-type: none"> ● NCC and NCC assembly have to understand the contents of NIUPLAN in order to secure consistency of the master plan and other related plans. ● The City Planning Department of NCC should take the initiative in disseminating the NIUPLAN to NCC staff and assembly.
2. Organisational strengthening for the NIUPLAN implementation	<ul style="list-style-type: none"> ● Technical aspect covering land use control, urban development, and infrastructure development should be strengthened. ● Coordinating aspect should be strengthened. It covers coordination within NCC, coordination between NCC and the national government, and coordination among county governments.
4. Capacity Development	<ul style="list-style-type: none"> ● To fully understand the master plan. ● To acquire fundamental skills of urban development and management. ● To adapt ICT skills to urban development and management. ● To put in place capacity development methods including OJT, participatory method, monitoring and evaluation.
5. Sustainable stakeholder involvement for the NIUPLAN implementation	<ul style="list-style-type: none"> ● NCC has to encourage changes in the public pattern and adherence to rules such as obtaining building permits and development permits.
Technical Aspects	
1. Development of CBD and Sub-centres	<ul style="list-style-type: none"> ● Establish urban development mechanism including roles and responsibilities between the public sector and private sector. ● Conduct detailed survey for implementation, including traffic volume and land ownership in the target area. ● Prepare detail plan for CBD and for selected sub-centres as a part of urban development implementation. ● Develop urban development implementation scheme such as land re-adjustment and urban re-development that matches the conditions in Nairobi.
2. Implement urban transport in accordance with development plan proposed as short term measures	<ul style="list-style-type: none"> ● System signal control for the radial trunk road in the city and system signal control in the whole city. ● Introduction of bus-exclusive lane which is effective even before introduction of BRT. ● Staggered working hours to ease morning peak hour. ● Streamline fleet carriers to decrease vehicle trips in the business area. ● Relocation of bus terminal in sub-centres.
3. Infrastructure development to form Nairobi urban structure and support urban development	<ul style="list-style-type: none"> ● Establish coordination mechanism among concerned agencies. Infrastructure development is the responsibility of national government. NCC should be able to coordinate concerned agencies for efficient infrastructure development. ● Conduct survey or study (feasibility study, detailed design) for implementation.

Source: JICA Study Team (JST)

The Project on Integrated Urban Development Master Plan for the City of Nairobi in the Republic of Kenya

Final Report

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ABBREVIATIONS

AAK	Architectural Association of Kenya
ADC	Austrian Development Corporation
AFD	Agence Francaise Developpement (French development agency)
AfDB	African Development Bank
AMRF	Africa Medical and Research Foundation
APL	Adaptable Program Lending
ASAL	Arid and Semi-Arid Land
ASCAS	Accumulated Savings and Credit Associations
AWSB	Athi Water Services Board
BADEA	Arab Bank for Economic Development in Africa
BOD	Biochemical Oxygen Demand
BPO	Business Process Outsourcing
BPO	Business Process Off-shoring
BRT	Bus Rapid Transit
C/R	Circumferential/Radial
CAA	Civil Aviation Authority
CBD	Central Business District
CCK	Communications Commission of Kenya
CCN	City Council of Nairobi
CFAs	Community Forest Associations
CGA	County Government Act
CMA	Capital Market Authority
COD	Chemical Oxygen Demand
COK	Constitution of Kenya
CPD	City Planning Department
CSUD	Centre of Sustainable Urban Development
CWSB	Coast Water Services Board
DANIDA	Danish International Development Agency
DC	Development Control
DCG	Donor Coordination Group
DESTW	Dandora Estate STW
DfID	UK Department of International Development
DFIs	Development Finance Institutions
DGIS	Netherlands Ministry of Foreign Affairs (of Netherland)
DID	Department of International Development (of UK)
DMU	Diesel Multiple-Units
DOE	Department of Environment
DRSRS	Department of Resource Surveys and Remote Sensing
DSL	Digital Subscriber Line
EA	Environmental Audit
EAC	East African Community
EC	European Commission
ECM	Executive Committee Member
EEPCO	Ethiopia Electric Power Corporation
EIA	Environmental Impact Assessment
EMCA	Environment Management Coordination Act
EOI	Expressions of Interest
EPZA	Export Processing Zones Authority
ERC	Energy Regulation Commission
ERSWEC	Economic Recovery Strategy for Wealth and Employment Creation
EU	European Union
FAO	Food and Agriculture Organization
FSMPNWS	Feasibility Study and Master Plan for Developing New Water Sources for Nairobi and Satellite Towns
GC	Gross Coverage Ratio

GCCN	Government Common Core Network
GDC	Geothermal Development Company
GDP	Gross National Product
GIS	Geographical Information System
GNI	Gross National Income
GOK	Government of Kenya
GRDP	Gross Regional Domestic Product
HAC	Harmonization Alignment and Coordination
ICB	International Competitive Bidding
ICT	Information Communication Technology
IDA	International Development Association
IPP	Independent Power Producers
ITCZ	Inter Tropical Convergence Zone
ITS	Intelligent Transport System
JCC	Joint Coordinating Committee
JDA	Joint Development Agreement
JICA	Japan International Corporation Agency
JKIA	Jomo Kenyatta International Airport
JKUAT	Jomo Kenyatta University of Agriculture and Technology
JST	JICA Study Team
CAA	Kenya Airport Authority
KAM	Kenya Association of Manufacturers
KBC	Kenya Broadcasting Corporation
KCAA	Kenya Civil Aviation Authority
KDN	Kenya Data Network
KDN	Kenya Data Network
KEBS	Kenya Bureau of Standards
Ken Gen	Kenya Power Generating Company
KeNHA	Kenya National Highways Authority
KENIC	Kenya Network Information Center
KENSUP	Kenya Slum Upgrading Program
KEPSA	Kenya Private Sector Alliance
KETRACO	Kenya Electricity Transmission Company
KFS	Kenya Forest Service
KfW	Kreditanstalt für Wiederaufbau (German government-owned development bank)
KIA	Kenya Investment Authority
KIE	Kenya Industrial Estate Ltd
KIP	Kenya Institute of Planners
KIPI	Kenya Industrial Property Institute
KIPPRA	Kenya Institute of Public Policy Research an Analysis
KIRDI	Kenya Industrial Research and Development Institute
KISIP	Kenya Informal Settlements Improvement Project
KMP	Kenya Municipal Program
KNBS	Kenya National Bureau of Statistics
KNCC&I	Kenya National Chamber of Commerce and Industry
KPC	Kenya Pipeline Corporation
KPDA	Kenya Property Developers Association
KPLC	Kenya Power and Lighting Company
KPPRA	Kenya Institute of Public Policy Research an Analysis
KPTC	Kenya Post and Telecommunication Company's
KRC	Kenya Railways Corporation
KTB	Kenya Tourist Board
KTDC	Kenya Tourist Development Corporation
KURA	Kenya Urban Roads Authority
KWS	Kenya Wildlife Service
LCPDP	Least Cost Power Development Plan
LPDP	Local Physical Development Plan

LRT	Light Rail Transit
MAF	Mission Aviation Fellowship
MEMR	Ministry of Environment and Mineral Resources
MEWNR	Ministry of Environment, Water and Natural Resources
MFI	Microfinance Institutions
MLH&UD	Ministry of Lands, housing and Urban Development
MNPDV2030	Ministry of National Planning and Vision 2030
MODP	Ministry of Development and Planning
MOE	Ministry of Energy
MOE&P	Ministry of Energy and Petroleum
MOH	Ministry of Health
MOIC	Ministry of Information and Communication
MOICT	Ministry of ICT
MOL	Ministry of Land
MOLG	Ministry of Local Government
MOLHUD	Ministry Of Lands, Housing And Urban Development
MONMD	Ministry of Nairobi Metropolitan Development
MOPHS	Ministry of Public Health and Sanitation
MOR	Ministry of Roads
MORPW	Ministry of Roads and Public Works
MOTI	Ministry of Transport and Infrastructure
MOW&I	Ministry of Water and Irrigation
MRF	Material Recovery Facility
MRTS	Mass Rapid Transit System
MSD	Medium Speed Diesel
MSEA	Micro and Small Enterprises Authority
MSMEs	Micro Small and Medium Enterprises
MSL	Mean Sea Level
MWI	Ministry of Water and Irrigation
NaMSIP	Nairobi Metropolitan Service Improvement Project
NaRSIP	Nairobi Rivers Rehabilitation and Restoration Program: Sewerage Improvement Project
NASP	National Airports System Plan
NBS	National Broad Band Strategy
NCBA	Nairobi County Business Association
NCBDA	Nairobi Central Business District Association
NCC	Nairobi City County
NCWSC	Nairobi City Water and Sewerage Company
NEMA	National Environment Management Authority
NES	National Environment Secretariat
NESC	Nairobi City Water and Sewerage Company
NHC	National Housing Corporation
NIUPLAN	Nairobi Integrated Urban Development Master Plan
NMR	Nairobi Metropolitan Region
NMT	Non-Motorized Transport
NOFBI	National Optic Fiber Backbone Infrastructure
NRS	Nairobi Rail Station
NSSF	National Social Security Fund
NTSA	National Transport and Safety Authority
NUTRANS	The Study on Master Plan for Urban Transport in the Nairobi Metropolitan Area in the Republic of Kenya, March 2006
NUTRIP	National Urban Transport Improvement Project
O&M	Operation and Maintenance
OD	Origin Destination
OJT	On-the-Job Training
OPM	Office of the Prime Minister
PCU	Passenger Car Unit
PDF	Project Demand Forecast

PDP	Project Development Plan
PHPDT	Peak Hour Peak Direction Traffic
PID	Project Information Document
PIDG	Private Infrastructure Development Group Trust
PIS	Policy Implementation Section
PMU	Project Management Unit
PPCSCA	Permanent Presidential Commission on Soil Conservation and Afforestation
PPP	Public-Private Partnership
PR	Plot Ratio
PS	Permanent Secretary
PSP	Private Service Provider
PT	Person Trip
PVSs	Public Service Vehicles
QCBS	Quality- and Cost-Based Selection
RD	Record of Discussion
REA	Rural Electricity Authority
RFC	Regional Financial Centre
ROSCAs	Rotating Savings and Credit Associations
ROW	Right of Way
RTA	Research Triangle Africa
RVR	Rift Valley Railways
SACCOs	Savings and Credit Cooperative Societies
SEA	Strategic Environmental Assessment
SECE	Swiss State Secretariat for Foreign Affairs
SHM	Stakeholder Meetings
SIDA	Swedish International Development Cooperation
SMEs	Small and Medium Enterprises
SOK	Survey of Kenya
SSL	Salary Scale Level
STI	Science, technology and innovation
STP	Sewerage Treatment Plant
STRADA	System for Traffic Demand Analysis
STW	Sewerage Treatment Work
SWM	Solid Waste Management
SWPC	Solid Waste Public Corporation
TOD	Transit Oriented Development
TSS	Total Suspended Solids
TWG	Technical Working Group
UfW	Unaccounted for Water
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UN-HABITAT	United Nations Human Settlements Programme
UNHCR	Office of the United Nations High Commissioner for Refugees
UON	University of Nairobi
USAID	United States Agency for International Development
VCR	Vehicle Capacity Ratio
VRC	Volume Capacity Ratio
WASP	Wien Automatic Simulation Package
WaSSIP	Water and Sanitation Service Improvement Project
WATSAN	Kibera Integrated Water, Sanitation and Waste Management Project
WB	World Bank
WRMA	Water Resources Management Authority
WSB	Water Service Board
WSP	Water Service Providers
WSRB	Water Service Regulatory Board
WTP	Water Treatment Plant
WVK	World Vision Kenya

CHAPTER1 BACKGROUND AND OBJECTIVE

1.1 Background

Nairobi is the capital city and the largest city of Kenya, as well as, one of the most important economic centres in the East and Central African Regions. Nairobi City accounts for 50% of formal employment in Kenya and generates over 50% of the gross domestic product (GDP). The Vision 2030, which shows the long-term national development strategy of Kenya, aims at becoming a middle income country by 2030 and provides the baseline of the economic, social, and political frameworks. It also shows the actions to be taken to achieve the development goals such as the millennium development goals (MDGs). Nairobi City plays an important role not only as a political centre but also as a model for economic and social development. The urban development plan of Nairobi City, on the other hand, has not been updated since 1973 and its direction is not clearly defined.

The population of Nairobi City was 800,000 in 1980. Due mainly to population migration from rural area, its population has grown to 3.1 million in 2009 and is expected to grow further. In addition, urban problems such as perennial traffic congestion, expansion of slum area, and environment deterioration have been left unsolved for a long time and are already causing negative impact on the economic activities and daily lives of the people in Nairobi City. In order to accelerate sound and sustainable development, an integrated urban master plan has to be prepared, and thus, transport network, water supply and sewerage, solid waste management, and living environment have to be improved.

In response to the request of the Government of Kenya, the Government of Japan has dispatched a Study Team for “the Integrated Urban Development Master Plan for the City of Nairobi” (hereafter referred to as the Project) in July 2012 and signed the Record of Discussion with the Ministry of Local Government (MOLG) and City Council of Nairobi for the implementation of the Project. (City Council of Nairobi has since been changed to Nairobi City County (NCC) because of organizational restructuring occasioned by passing of the Constitution of Kenya in 2010 and general elections of March, 2012)

1.2 Outline of the Project

(1) Objective of the Project (Overall Goals)

The objective of the Project is to review and develop concepts on sustainable urban development and improvement of living condition based on the integrated urban development plan for Nairobi City.

(2) Expected Outputs

- (i) To formulate an integrated urban development master plan for 2030;
- (ii) To formulate an implementation and management program;
- (iii) To select priority areas and priority projects;
- (iv) To review and formulate policies, rules, and guidelines for local government; and

(v) To conduct technical transfer to the counterparts in the course of the Project.

(3) Concerned Agency

(i) Responsible Agency: MOLG

(ii) Implementing Agency: NCC

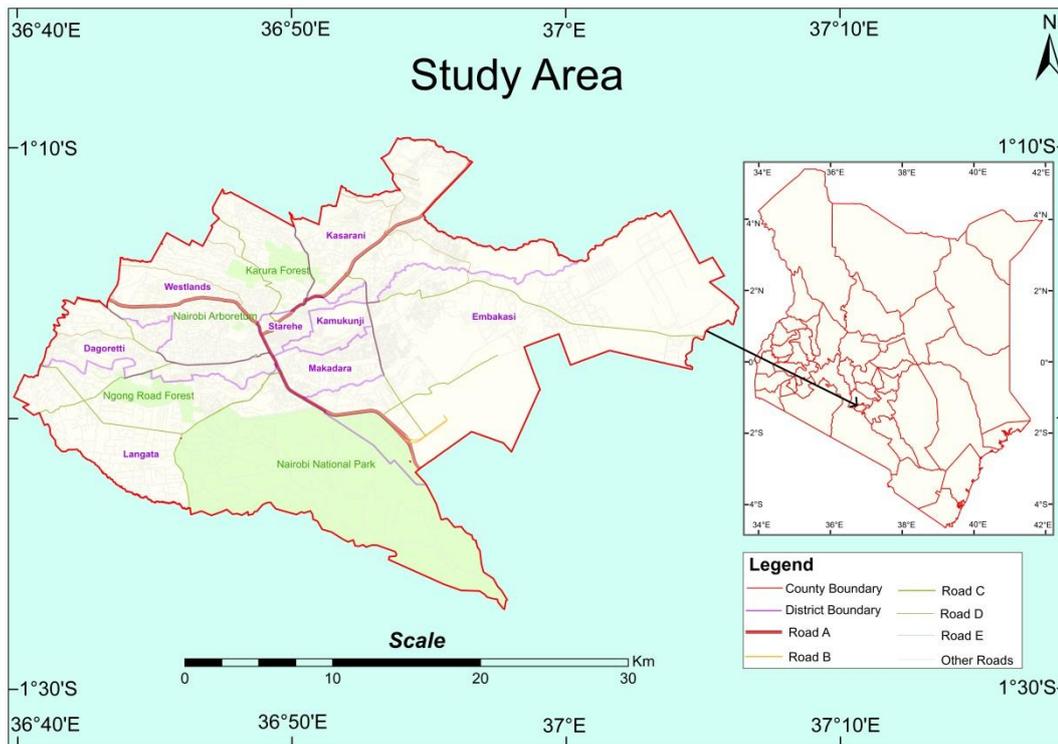
(4) Acronym of the Project

The acronym of the Project on Integrated Urban Development Master Plan for the City of Nairobi in the Republic of Kenya is NIUPLAN.

1.3 Project Area

(1) Nairobi City

The Project area is the entire area of the City County of Nairobi (approximately 700 km²) with a population of 3.1 million (2009 Kenya Population and Housing Census).

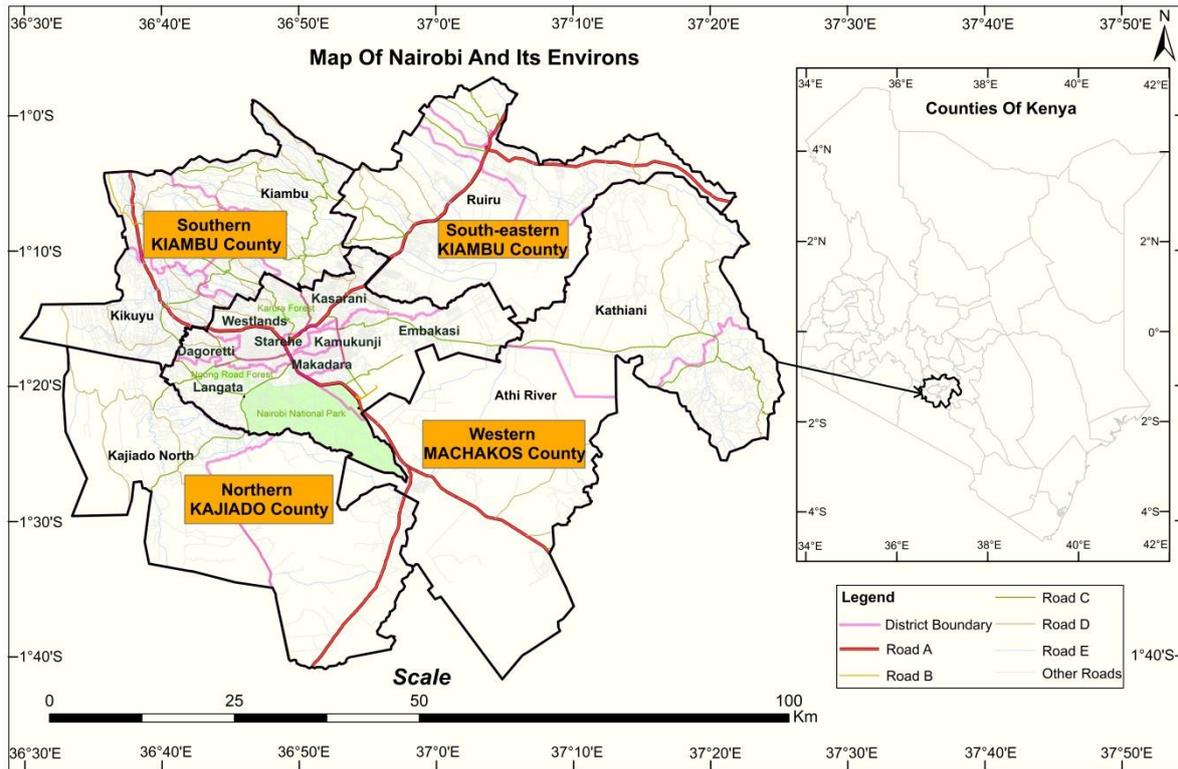


Source: JICA Study Team (JST)

Figure 1.3.1 Location Map

(2) The Greater Nairobi Area

Since urbanisation of NCC is expanding outside the city boundary and the condition of the surrounding area has to be considered, Greater Nairobi is set at about 20 km from the City of Nairobi, which is based on “The Master Plan and Feasibility Study to Alleviate Traffic Congestion and Improve Traffic Safety in the Nairobi Metropolitan Area” prepared by JICA in 2006 and recent urbanisation trend, and census data in 2009. Traffic survey and population analysis have been conducted based on Greater Nairobi. The following Figure 1.3.2 and Table 1.3.1 show the coverage of the Greater Nairobi area.



Source: JICA Study Team (JST)

Figure 1.3.2 Greater Nairobi Boundary

Table 1.3.1 Greater Nairobi (Division List)

	Division	Area(km ²)	Division	Area (km ²)
City of Nairobi	(i) Central	695.1	South-eastern Kiambu County	801.5
	(ii) Makadara		Southern Kiambu County	706.6
	(iii) Kasarani		Northern Kajiado County	1,050.9
	(iv) Embakasi		Western Machakos County	1,598.0
	(v) Pumwani			
	(vi) Westlands			
	(vii) Dagoretti			
	(viii) Kibera			

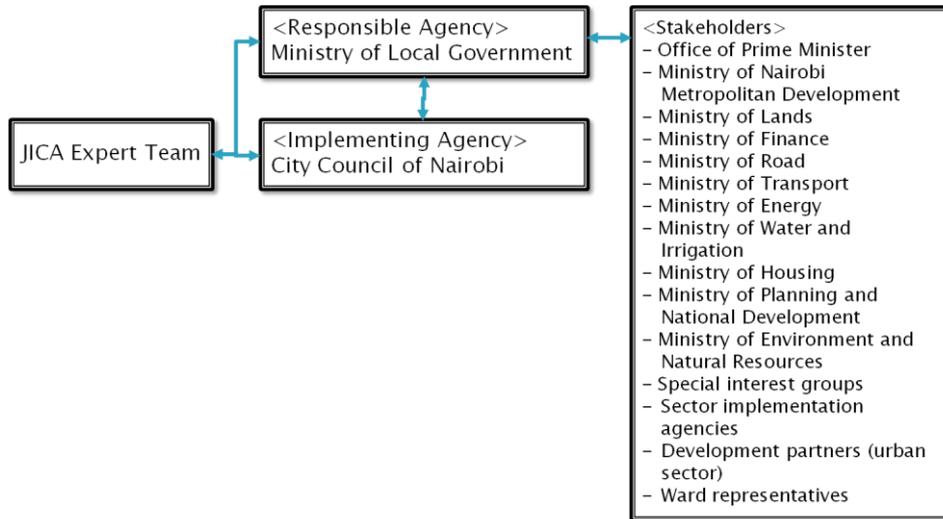
Source: JICA Study Team (JST)

1.4 Organisational Arrangements

For the implementation of the Project, the following organisational setting is established.

1.4.1 Overall Organisational Arrangements

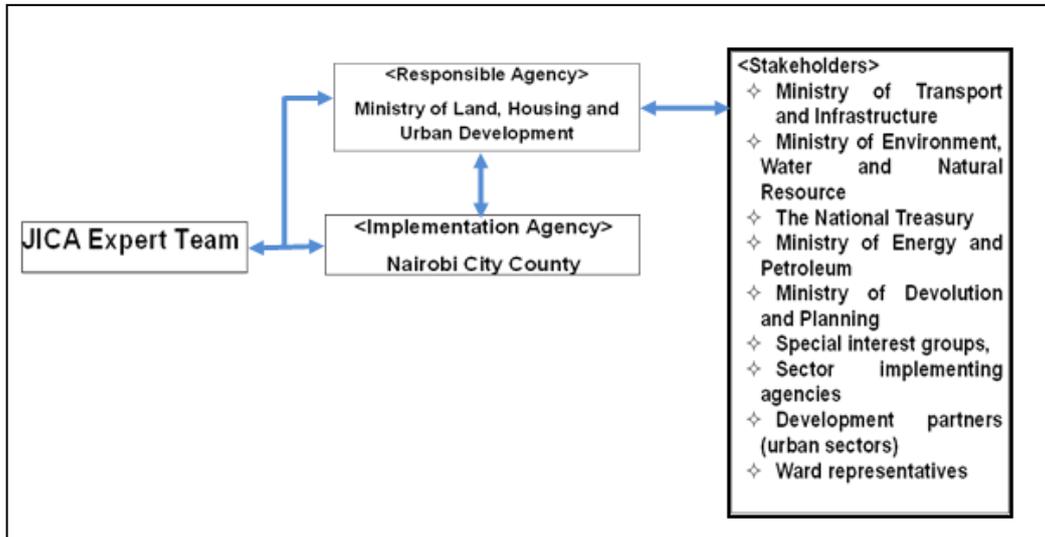
The Project is composed of a number of stakeholders coming from the JICA Study Team, MOLG as Responsible Agency, Nairobi City County as Implementing Agency, and stakeholders from the central government and concerned agencies. Figure 1.4.1 shows the Project organisational chart according to the Record of Discussion (RD) signed in July 2012.



Source: Record of Discussion (RD) signed by MOLG and the City Council of Nairobi and Japan International Cooperation Agency on 23 July 2013

Figure 1.4.1 Project Organisational Chart Based on 1st RD

Due to changes in the ministerial structure in the early part of 2013, the Joint Coordinating Committee (JCC) and working group have been realigned, and the revision of RD is in progress. The new organisational chart is shown in Figure 1.4.2 as per the revised RD signed in September 2013.

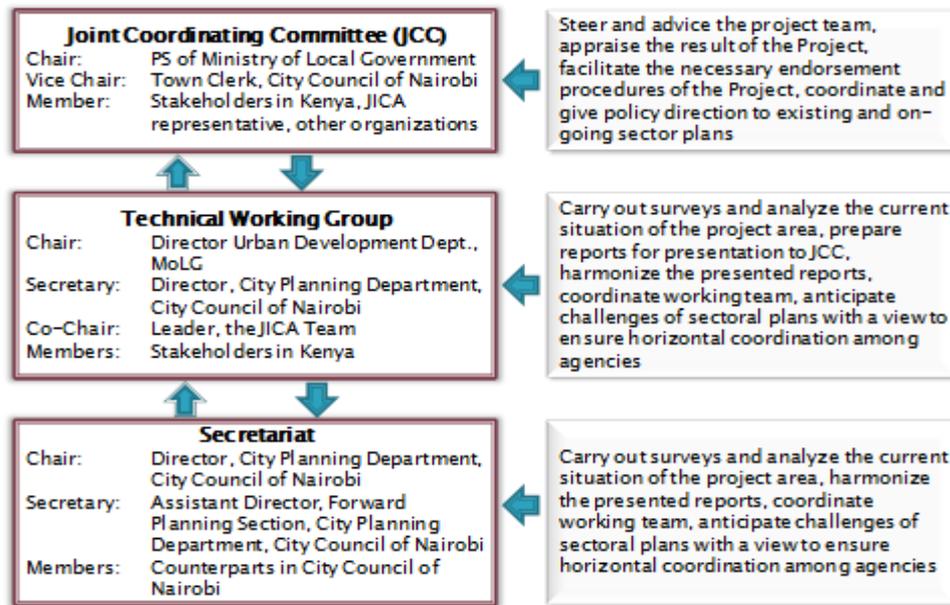


Source: Record of Discussion signed by the Ministry of Lands, Housing and Urban Development, Nairobi City County, Ministry of Devolution and Planning, and Japan International Cooperation Agency on 24 September 2013

Figure 1.4.2 Project Organisation Chart based on the Revised RD

1.4.2 Individual Organisational Arrangements

For the execution of the master plan formulation, the JCC, Technical Working Group, and Secretariat Meeting were organised. The following chart shows the outline of the organisational arrangements.



Source: JICA Study Team (JST)

Figure 1.4.3 Tiers of Discussion Structure

(1) Joint Coordinating Committee (JCC)

JCC is a high level decision-making body composed of the national government agencies represented by the Permanent Secretary Level. The functions of JCC are shown below:

- To steer and advice the project team;
- To appraise the results of the Project;
- To facilitate the necessary endorsement procedure of the Project outputs; and
- To coordinate and give policy direction to existing and ongoing sector plans.

The first JCC was held on 11 December 2012 to discuss the Inception Report. The contents of the Inception Report were approved by the JCC.

Table 1.4.1 JCC Meeting Record

Date	Discussion Topic	Participants
11 December 2012	Topics: Inception report discussion • Remarks from the MOLG, Ministry of Nairobi Metropolitan Development, Town Clerk of NCC, JICA Kenya Office. • Briefing on integrated urban development master plan (NCC) • Explanation of inception report • Discussion	<ul style="list-style-type: none"> • NCC (Town Clerk, Directors, and staff) • MOLG (PS, Director of Urban Planning) • Ministry of Health (MOH) • Ministry of National Planning and Vision 2030 (MNPDV2030) • Ministry of Nairobi Metropolitan Development (MONMD) • Ministry of Water and Irrigation (MOW&I) • Office of the Prime Minister (OPM) • Ministry of Finance • Ministry of Environment and Mineral Resources (MEMR) • JICA Kenya Office • JICA Study Team

Source: JICA Study Team (JST)

Because of the organisational restructure both in the national government and NCC levels, structure of JCC will be changed to represent the new government structure. The new JCC structure will be proposed at the next JCC for approval.

(2) Technical Working Group

The Technical Working Group is organised as:

- To carry out surveys and analyse the current situation of the project area;
- To prepare reports for presentation to the JCC;
- To harmonise the presented reports;
- To coordinate the working team; and
- To anticipate challenges of sectoral plans with a view to ensure horizontal coordination among agencies.

Six thematic technical working groups were proposed in the first Technical Working Group in January 2013 for sector discussion. Six groups are shown in Table 1.4.2 below:

Table 1.4.2 Thematic Working Group

Thematic Working Group	
(i)	Land use and human settlements
(ii)	Governance and institution
(iii)	Population and social system/urban economy
(iv)	Urban transport (road, railway, airport)
(v)	Environment
(vi)	Infrastructure (water supply, wastewater, power, solid waste and disaster prevention, Information Communication Technology (ICT) and telecommunication)

Source: JICA Study Team (JST)

A list of Technical Working Group meetings conducted until March 2014 is shown in Table 1.4.3 below:

Table 1.4.3 Technical Working Group Meeting Record

Date	Discussion Topic	Participants
January 30, 2013	<p>Topics: Introduction of the Project and group discussion</p> <ul style="list-style-type: none"> • Briefing on the preparation of the Integrated Urban Development Plan (Ms. Rose K. Muema, Director of City Planning, Secretary of Technical Working Group) • Presentation of the inception report for the Integrated Urban Development Master Plan (JICA Study Team) • Formation of Thematic Working Group (Mr. Adolwa, Deputy Director, Urban Development Department (Chairman of the Technical Working Group)), JICA Project Team • Thematic group discussion on activity and presentation. 	<ul style="list-style-type: none"> • NCC (concerned departments) • Ministry of Agriculture • MOLG • National Environment Management Authority (NEMA) • Kenya Railways Corporation (KRC) • National Housing Corporation (NHC) • Kenya Urban Roads Authority (KURA) • Kenya Institute of Public Policy Research and Analysis (KIPPRA) • Kenya National Bureau of Statistics • National Economic and Social Council (NESC) • Athi Water Services Board • Nairobi City Water and Sewerage Company (NCWSC) • Communications Commission of Kenya (CCK) • Research Triangle Africa (RTA) • University of Nairobi (UON) • Kenya Institute of Planners (KIP) • Architectural Association of Kenya (AAK) • Urban Designer Consultant • World Bank • United Nations Environment Programme (UNEP) • UN-HABITAT

Date	Discussion Topic	Participants
		<ul style="list-style-type: none"> • Ministry of Public Health and Sanitation (MOPHS) • Jomo Kenyatta University of Agriculture and Technology (JKUAT) • Kenya Electricity Transmission Company Ltd. (KETRACO)
April 24, 2013	Thematic Technical Working Group: <ul style="list-style-type: none"> • Urban transport (road, railway, and airport) • Infrastructure (water supply, waste water, and drainage) • Population and social system/urban economy • Environment 	<ul style="list-style-type: none"> • Ministry of Health (MoH) • NEMA • Athi Water Services Board (AWSB) • KURA • KETRACO • KIP • GIBB (Consultant) • NCC
April 30, 2013	Thematic Technical Working Group: <ul style="list-style-type: none"> • Land use and human settlements (development vision, structure plan) • Governance and institution • Infrastructure (solid waste management) 	<ul style="list-style-type: none"> • RTA • JICA Study Team (JST) • NCC • AAK • UON
May 6, 2013	Thematic Technical Working Group: <ul style="list-style-type: none"> • Infrastructure (telecommunication, power) 	<ul style="list-style-type: none"> • NCC • KETRACO
May 8, 2013	Thematic Technical Working Group: <ul style="list-style-type: none"> • Land use and human settlements (development vision, structure plan, Central Business District (CBD)) • Land use and human settlements (GIS database: confirmation of boundary, data required, and issues) 	<ul style="list-style-type: none"> • KRC • JST • NCC • Ministry of Nairobi Metropolitan Development (MONMD) • Ministry of Lands, Department of Physical Planning (MOL) • GODOWN Arts Centre • Survey of Kenya, Ministry of Lands (SOK) • UON
May 16, 2013	Thematic Technical Working Group: <ul style="list-style-type: none"> • Infrastructure (power) 	<ul style="list-style-type: none"> • Ministry of Energy • MOLG • KETRACO • Geothermal Development Company (GDC) • NCWSC • Kenya Association of Manufacturers (KAM) • Kenya Power and Lighting Company (KPLC) • NCC • JST
May 21, 2013	Thematic Technical Working Group: <ul style="list-style-type: none"> • Infrastructure (solid waste management) 	<ul style="list-style-type: none"> • NEMA • Kenya Civil Aviation Authority (KCAA) • World Bank • REDI International • UON • GIBB Africa Ltd. • NCC • JST
May 28, 2013	Thematic Technical Working Group: <ul style="list-style-type: none"> • Land use and human settlements (Vision) 	<ul style="list-style-type: none"> • MOL • Ministry of Roads • MOLG • Ministry of Agriculture • Kenya National Highways Authority (KeNHA) • KRC

Date	Discussion Topic	Participants
		<ul style="list-style-type: none"> • National Museums of Kenya (NMK) • Kenya Roads Board (KRB) • UN-HABITAT • Urban Design Consultant • Townscape Consultants Planners Ltd. • NCC • JST
June 7, 2013	Thematic Technical Working Group: <ul style="list-style-type: none"> • Governance and institution (capacity development plan and technology transfer) 	<ul style="list-style-type: none"> • NCC • JST
June 19, 2013	Thematic Technical Working Group: <ul style="list-style-type: none"> • Governance and institution (capacity development plan and technology transfer) 	<ul style="list-style-type: none"> • Planning Systems • Safer Nairobi Initiative (SNI) • RTA • Triscope • NCC • JST
June 20, 2013	Thematic Technical Working Group: <ul style="list-style-type: none"> • Land use and human settlements (District Plan for CBD and Land Use Plan for NCC, and GIS data requirements) 	<ul style="list-style-type: none"> • MOL • KRC • NMK • UON • Institute Surveyors of Kenya (ISK) • AAK • KIP • ESRI Eastern Africa • Geomaps • Triscope • Planning Systems • Dakar Services • Kenya Property Developers Association (KPDA) • Renaissance Planning • NCC • JST
July 4, 2013	Thematic Technical Working Group: <ul style="list-style-type: none"> • Land use and human settlements (Development Vision for CBD) 	<ul style="list-style-type: none"> • KIPPR • KRC • NCWSC • UON • KPDA • Triscope • ESRI Eastern Africa • GIBB Africa Ltd. • Urban Design Consultant • NCC • JST
July 25, 2013	Thematic Technical Working Group: <ul style="list-style-type: none"> • Land use and human settlements (land demand forecast, structure plan, discussion on sub-centres. 	<ul style="list-style-type: none"> • UN-HABITAT • Jomo Kenyatta University of Technology (JKUAT) • KURA • AAK • UON • Spatial Collective • Muungano Support Trust/Slum Dwellers International • Townscope Consulting Planners • NCC • JST

Date	Discussion Topic	Participants
July 26, 2013	Thematic Technical Working Group: <ul style="list-style-type: none"> Urban transport (road, railway, and airport) 	<ul style="list-style-type: none"> Ministry of Lands, Housing and Urban Development (MLH&UD) Ministry of Transport and Infrastructure (MOTI) KRC KURA UN-HABITAT NCC JST
August 16, 2013	Thematic Technical Working Group: <ul style="list-style-type: none"> Governance and institutions 	<ul style="list-style-type: none"> RTA NCC JST
August 20, 2013	ITR presentation	<ul style="list-style-type: none"> MLH&UD KeNHA KURA KETRACO NCWSC NEMA KRC World Bank UON Architectural Association of Kenya (AAK/NEOPOLITANS) Godown Arts Centre RTA Planning Systems GIBB Africa Ltd. Townscape Consultants Ochieng Abuodha Consulting Engineers Oakas Services Ltd. NCC JST
August 23, 2013	Thematic Technical Working Group: <ul style="list-style-type: none"> Environment (air pollution and SEA progress) 	<ul style="list-style-type: none"> UNEP NCC JST
August 27, 2013	Thematic Technical Working Group: <ul style="list-style-type: none"> Land use and human settlements (Sub-centres and GIS data update) 	<ul style="list-style-type: none"> KIPPRA UON Renaissance Planning UN-HABITAT KRB Muongano Support Trust KRC NCC JST
September 5, 2013	Thematic Technical Working Group: <ul style="list-style-type: none"> Land Use and human settlement 	<ul style="list-style-type: none"> MLH&UD KURA KeNHA KRC UON World Bank ESRI EA AAK/NEOPOLITANS RTA Planning Systems Mwacharo and Associate Architects

Date	Discussion Topic	Participants
September 5-7, 2013	Thematic Technical Working Group: (Retreat in Nyeri Outspan Hotel) <ul style="list-style-type: none"> • Urban transport • Infrastructure • Environment • Population, urban economy and socio-cultural issues • Governance and institutions • Land use and human settlements 	<ul style="list-style-type: none"> • MLH&UD • Ministry of Devolution and Planning (MOD&P) • Ministry of ICT (MOICT) • Ministry of Energy (MOE) • Ministry of Environment, Water and Natural Resources (MEW&NR) • NEMA • SOK • Kenya Airports Authority (KAA) • CCK • KRC • KURA • NCSWC • KPLC • KIPPRA • World Vision Kenya (WVK) • National Youth Council (NYC) • RTA • KIP • AAK • ITEC Engineering Company • Mwacharo and Associate Architects • Townscope Consultants • NCC • JST
September 11, 2013	Thematic Technical Working Group: <ul style="list-style-type: none"> • Environment (solid waste management) 	<ul style="list-style-type: none"> • NEMA • Kenya Forest Service (KFS) • RTA • NCC • JST
September 18, 2013	Thematic Technical Working Group: <ul style="list-style-type: none"> • Land use and human settlements (building survey result and district plan) • Transportation (railway) 	<ul style="list-style-type: none"> • MLH&UD • KURA • KIPPRA • UN-HABITAT • Kenya Property Developers Association (KPDA) • University of Tsukuba • Mwacharo and Associate Architects • NCC • JST
September 20, 2013	Thematic Technical Working Group: <ul style="list-style-type: none"> • Infrastructure (water sector-water supply, sewerage, and drainage) 	<ul style="list-style-type: none"> • MEW&NR • Water Resource Management Authority (WRMA) • NCWSC • NCC • JST
September 23, 2013	Thematic Technical Working Group: <ul style="list-style-type: none"> • Infrastructure (power)-Power forecast and recommendations 	<ul style="list-style-type: none"> • Ministry of Energy and Petroleum (MOE&P) • NCWSC • Kenya Power and Lighting Company (KPLC) (Kenya Power) • NCC • JST
September 26, 2013	Thematic Technical Working Group: <ul style="list-style-type: none"> • Infrastructure (telecommunication)- Current condition of telecommunication sector and draft master plan 	<ul style="list-style-type: none"> • CCK • Jamii Telcoms • Wananchi Group • Iway Africa • Frontier optical Networks • Telkom Kenya Ltd.

Date	Discussion Topic	Participants
		<ul style="list-style-type: none"> • Virtual City • MTN Business • Simbanet • Access Kenya • JST • NCC
October 31, 2013	Thematic Working Group <ul style="list-style-type: none"> • Joint infrastructure (solid waste management) and Land Use and Human Settlements Technical Working Group (cross-cutting issue on location of new sanitary landfill site discussions) 	<ul style="list-style-type: none"> • KAA • KCAA • GIBB Africa Ltd. • NEMA • ITEC Engineering • MLH&UD • Kenya Roads Board • Survey of Kenya • UON • Kenya Railways Corporation • Kenya Property Developers Association • Townscape Consultants • REDI • Pleng Ltd. • Renaissance Planners • RTA • Real Plan Consultants • UN-HABITAT • Kenya Forest Services • JST • NCC
November 13, 2013	Thematic Technical Working Group: <ul style="list-style-type: none"> • Urban transport (road). Contents of the presentation include: <ul style="list-style-type: none"> ✓ Progress of the study ✓ Future transport network plan ✓ Transport demand forecast result ✓ Analysis and evaluation of traffic demand forecast ✓ Preliminary ideas or staging plan 	<ul style="list-style-type: none"> • MLH&UD • MOTI • UON • KRC • KeNHA • UN-HABITAT • JST • NCC
December 3, 2013	Stakeholders' Workshop: Presentation and review of the progress report	<ul style="list-style-type: none"> • KAA • AAK • NCWSC • MOE&P • MOD&P • MLH&UD • KURA • KIPPRA • KRC • JST • NCC
March 25- 28, 2014	Thematic Technical Working Group: (Retreat in Naivasha Great Rift Valley Hotel)- Review of the draft final report and feedback from public consultations) <ul style="list-style-type: none"> • Urban transport • Infrastructure • Environment • Population, urban economy and socio-cultural issues 	<ul style="list-style-type: none"> • MLH&UD • MOICT • MEWNR • MOE&P • NEMA • SOK • KAA • CCK

Date	Discussion Topic	Participants
	<ul style="list-style-type: none"> Governance and institutions Land use and human settlements 	<ul style="list-style-type: none"> KRC NCSWC UON KIPPRA UN HABITAT WVK NYC RTA Godown Arts Centre KIP AAK ITEC Engineering Company Townscope Consultants NCC JST
April 2, 2014	Thematic Technical Working Group: <ul style="list-style-type: none"> Land use and human settlements (Urban Structure Plan and Draft SEA Report) 	<ul style="list-style-type: none"> SOK UON GIBB Africa Ltd. AAK NCC

Source: JICA Study Team (JST)

(3) Secretariat Meeting

In addition to JCC and the Technical Working Group agreed in the RD, a Secretariat Meeting was organised in NCC for the purpose of coordinating relevant departments, carrying out daily activities with the JICA Study Team, and coordination with agencies outside NCC. The Secretariat Meeting is conducted prior to the Technical Working Group. Confirmed participants from NCC and the JICA Study Team can share views to have mutual understanding of the Nairobi urban development. After the organisation and works of the Technical Working Groups have become routinary and counterpart staff becomes familiar of each task, the Secretariat Meeting was routinely conducted instead of ad hoc basis.

Table 1.4.4 Secretariat Meeting Record

Date	Discussion Topic	Participants
January 21, 2013	Topics: Introduction of the Project <ul style="list-style-type: none"> Introduction of the members Update on master plan (Director, City Planning Department) Outline of the study and activity until March 	<ul style="list-style-type: none"> NCC NEMA KAA NCWSC JICA Study Team
February 6, 2013	Topics: Follow up the Technical Working Group <ul style="list-style-type: none"> Confirmation of activity and data needed Thematic working group activity discussion 	<ul style="list-style-type: none"> NCC NCWSC JICA Study Team
April 18, 2013	Topic: Confirmation of activity until May and working group schedule <ul style="list-style-type: none"> Explanation of activity (land use, urban transport infrastructure, environment) Confirmation of thematic working group topics and schedule 	<ul style="list-style-type: none"> NCC NCWSC NCC (ICT) GIBB (Consultant)

Source: JICA Study Team (JST)

1.4.3 List of Members for JCC, Thematic Working Group, and Secretariat

The list of members for JCC, Thematic Working Group, and Secretariat is summarised in the following tables. When there is a modification in JCC, a working group will be modified as mentioned in Subsection 1.4.1, likewise with its memberships.

Table 1.4.5 JCC Members

JCC	Organisation	
1st (Old) JCC (Refer to 1st RD)	1	Permanent Secretary (PS), MOLG
	2	PS, MONMD
	3	SLAA MOLG
	4	Town Clerk, City Council of Nairobi
	5	Ministry of Health
	6	Ministry of National Development & Vision 2030
	7	D/ Director, UDD, MOLG
	8	Director, CPD
	9	AMP&E, MONMD
	10	D/Director W&S
	11	Secretary Infrastructure, OPM
	12	Deputy Director, CPD
	13	Chief Economist, MOLG
	14	Deputy AS, Pacif, Treasury
	15	JST, Deputy Team Leader
	16	JST
	17	JICA Representative
	18	Planner, CPD
	19	Infrastructure Expert
	20	SPSE, (M)
	21	Senior Rep., JICA
	22	MEMR
New JCC (Refer to Revised RD) Members	23	Chair: Governor, NCC
	24	Co-chair : MLH&UD
	25	MLH&UD
	26	MOD&P
	27	MOTI
	28	MOE&P
	29	MEWNR
	30	Chair of the Technical Working Group
	31	Chair of the Secretariat
	32	JICA
	33	Other organisations can participate in JCC, if necessary

Source: JICA Study Team (JST)

Table 1.4.6 NIUPLAN Secretariat

Organisation	Position	
NCC	1	Director, CPD
	2	Deputy Director, CPD
	3	Assistant Director, DC/CPD
	4	Assistant Director FP/CPD
	5	Planner, CPD
	6	Planner, CPD
	7	Planner, CPD
	8	Planner, CPD
	9	Planner, CPD
	10	Planner, CPD
	11	Planner/ CPD
	12	Assistant Director UDD/ CPD
	13	Deputy City Engineer
	14	City Engineers
	15	City Engineers
	16	City Engineers
	17	Social Services
	18	Assistant Director PIS/CPD
	19	Environment
JICA Study Team (JST)	20	Team Leader, Land Use Expert
	21	Deputy Team Leader, Urban Planning Expert
	22	Urban Transport Expert
	23	Traffic Survey Expert
	24	Environment Expert

Organisation	Position	
	25	Urban Planning Expert
	26	Industrial Promotion/ Socioeconomic Expert
	27	Capacity Development Expert
	28	Water Supply Planning
	29	Solid Waste Management
	30	District Planning Expert
	31	Traffic Demand Projection Expert
	32	Sewerage/ Drainage System Expert
	33	GIS/ Traffic Condition Survey (DBM) Expert
	34	Telecommunication Planning Expert
	35	Power Planning Expert
	36	Railway Planning Expert
	37	Airport Planning Expert
	38	Planner
	39	Planner
	40	GIS Analyst

Source: JICA Study Team (JST)

Table 1.4.7 Technical Working Group Members

TWG	DESIGNATION/ORGANISATION		
Overall Joint Chairmen	1	MLH&UD	
	2	NCC Executive Committee Member (L,PP & H)	
	3	Deputy Team Leader JST	
Land Use and Human Settlements	4	UON	
	5	JST Expert	
	6	JST Expert	
	7	Kenya Railways Corporation	
	8	MLH&UD	
	9	MLH&UD	
	10	MLH&UD	
	11	ESRI East Africa	
	12	Muungano Support Trust	
	13	Pleng Ltd.	
	14	Real Plan Consultants	
	15	The Godown Arts Centre	
	16	The Godown Arts Centre	
	17	Kenya Railways	
	18	Planning Systems	
	19	Oakas Services Ltd.	
	20	World Bank	
	21	JST	
	22	JST	
	23	Townscape Consultants	
	Socioeconomic	24	UON
		25	JST - Industrial Promotion/Socioeconomic Expert
		26	NCC – Social Services
27		NCC – City Education	
Urban Transport	28	UON	
	29	NCC - CPD	
	30	NCC - CPD	
	31	NCC - City Engineers	
	32	NCC - City Engineers	
	33	NCC- City Engineers	
	34	NCC - City Engineers	
	35	NCC - City Engineers	
	36	KeNHA	
	37	KRC	
	38	KRC	
	39	KURA	
	40	MOTI	
	41	KRC	

TWG	DESIGNATION/ORGANISATION	
	42	JST
	43	JST
	44	JST
	45	JST
	46	UN-HABITAT - SUSTRAN
Capacity Development	47	Capacity Development Expert
	48	RTA
	49	JST
	50	NCC – Human Resources
	51	NCC - CPD
	52	World Vision
	53	Sewerage/Drainage System Expert
Infrastructure	54	Water Supply Planning
	55	NCC - CPD
	56	NCC - CPD
	57	NCC - CPD
	58	NCC - CPD
	59	JST
	60	I-Way Africa
	61	Telkom Kenya
	62	CCK
	63	NCC - ICT
	64	JST
	65	Safaricom Ltd.
	66	IWAY Africa
	67	Safaricom Ltd.
	68	Wananchi/ Zuku
	69	Media Council of Kenya
	70	Jamii Telcom
	71	MTN Business
	72	MTN Business
	73	MTN Business
	74	Safaricom Ltd.
	75	Telkom Kenya
	76	Access Kenya
	77	Solid Waste Management
	78	Nairobi Water
Environment	79	Environment Expert
	80	Planner
	81	NEMA
	82	NCC
	83	UN-HABITAT
	84	UON, Geography
	85	KCAA
	86	JST
	87	NCC
	88	NCC - Environment
	89	UNEP

Source: JICA Study Team (JST)



Gabriel Kamau, Mbagathi Road Primary School (Rank 3 of Class 6)

CHAPTER2 SOCIO-ECONOMIC AND URBAN CONDITIONS

2.1 Review of Current Natural and Socioeconomic Conditions

2.1.1 Current Natural Conditions

(1) Geography

The Republic of Kenya is located in the east coast of Africa, with the equator running almost straight through the middle part of the country, and borders with the countries of Somalia, Ethiopia, and South Sudan in the north, Uganda in the west, Tanzania in the south, and the Indian Ocean in the east.

The total area of the country is 610,000 km² comprising land areas of approximately 590,000 km² and water surface areas of 20,000 km². A major part of the inland water surface areas is covered by portions of Lake Victoria and Lake Turkana. Of the land areas, approximately 510,000 km² (more than 85% of the land area) is classified as arid and semi-arid land (ASAL). The remaining area of about 80,000 km² is classified as non-arid and arable lands, sustaining a substantial portion of the Kenyan economy and providing shelter to the human population.

Nairobi City with its administrative area of approximately 700 km² is the capital of the Republic of Kenya and also the centre of administration, politics, economy, and culture. The city is bounded by Kajiado County in the south and south west, Kiambu County in the north and north west and Machakos County in the east and south east. Such adjacent areas are now absorbing increasing population and economic activities.

(2) Topography

The territory of Kenya is characterised by a wide topographical diversity, ranging from glaciated mountains to the deserts. The elevation varies from the sea level of the Indian Ocean to 5,199 m of the Batian Peak of Mount Kenya.

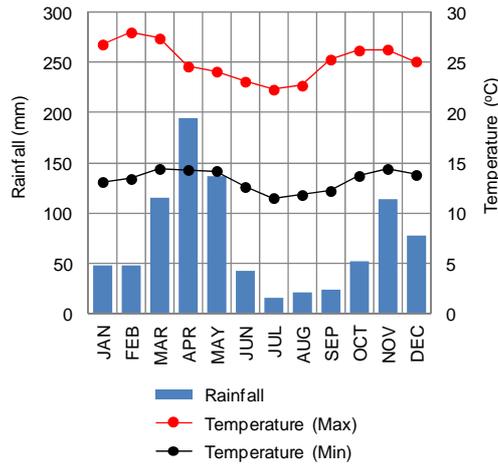
The Nairobi City is characterised by undulating hilly topography with an elevation ranging from 1,460 m to 1,920 m. Lowest elevation occurs in the Athi River at the eastern boundary of the city while its highest is at the western rim of the city. It is unique that it has the Nairobi National Park with an area of 117 km² within its administrative area, extending along the western boundary and attracting a large number of international and domestic tourists annually.

(3) Climate

The climate in Kenya is primarily influenced by the movement of the Intertropical Convergence Zone (ITCZ) and by a topographic relief, especially at various elevations. The rainfall in Kenya is affected by large bodies of water like Lake Victoria, complex topography with the Great Rift Valley, and high mountains, which include Mt. Kenya and Mt. Elgon. A relatively wet but narrow tropical belt lies along the Indian Ocean Coast. Behind the coastline stretches large areas of semi-arid and arid lands. Mean annual rainfall over the country is 680 mm and varies from about 200 mm in the ASAL zone to about 1,800 mm in a humid zone.

Kenya generally experiences two seasonal rainfall peaks in most places. The first peak or a season termed as the “long-rains” in the East African Region occurs from March to May, while the second peak or a season termed as the “short-rains” is observed from October to December.

The climate in Nairobi City is usually dry and cool between July and August but hot and dry between January and February. The average annual rainfall in Nairobi City is about 900 mm. The first peak of monthly rainfall occurs in April and the second peak takes place in November. The mean daily maximum temperature by month ranges from 28 °C to 22 °C and the minimum ranges from 14 °C to 12 °C.



Source: KMD

Figure 2.1.1 Rainfall and Temperature in Nairobi City

2.1.2 Population and Demography

(1) Night-time Population

According to the Kenya Population and Housing Census conducted in 2009, the total population of Kenya was approximately 38,610,000, and that of Nairobi City was approximately 3,138,000, accounting for 8.1% of the national population.

The average population density excluding Nairobi National Park, which occupies 117 km² or 16.8% of the city’s total area, is 5,429 per km². The Central Division and Kamukunji Division located at the centre have a much higher density than the others in excess of 20,000 per km².

Table 2.1.1 Population, Area, and Density of Nairobi City and its Environs in 2009

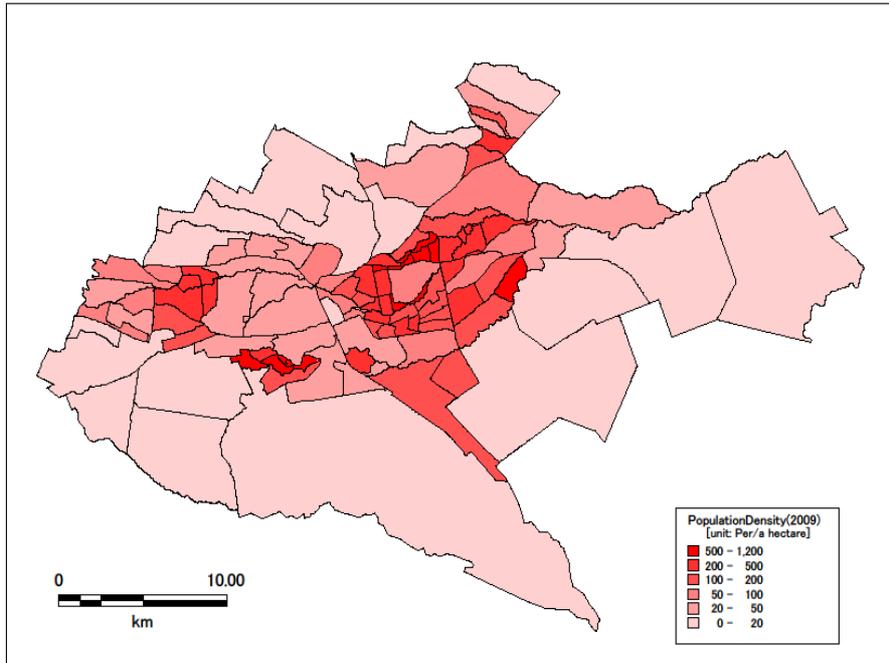
Division	Population	Area in km ²	Density per km ²
Nairobi City excluding Nairobi National Park (117 km²)			
Central/Starehe	274,607	11	25,640
Kamukunji/Pumwani	261,855	12	21,623
Makadara	218,641	23	9,481
Dagoretti	329,577	39	8,532
Kasarani	525,624	86	6,081
Embakasi including Njiru	925,775	204	4,546
Langata/Kibera	355,188	106	3,346
Westlands	247,102	97	2,538
Nairobi City	3,138,369	578	5,429
Outside Nairobi City	1,877,652	4,206	446
Greater Nairobi	5,016,021	4,784	1,049
Kenya	38,610,097	581,313	66

Source: 2009 Census

The population growth rate of Greater Nairobi has been considerably higher than that of Kenya. The average annual growth rate of Greater Nairobi was 4.2% based from the 1989 Census to the 1999 Census and 4.0% based from the 1999 Census to the 2009 Census, while that of Kenya was 3.0% in both periods.

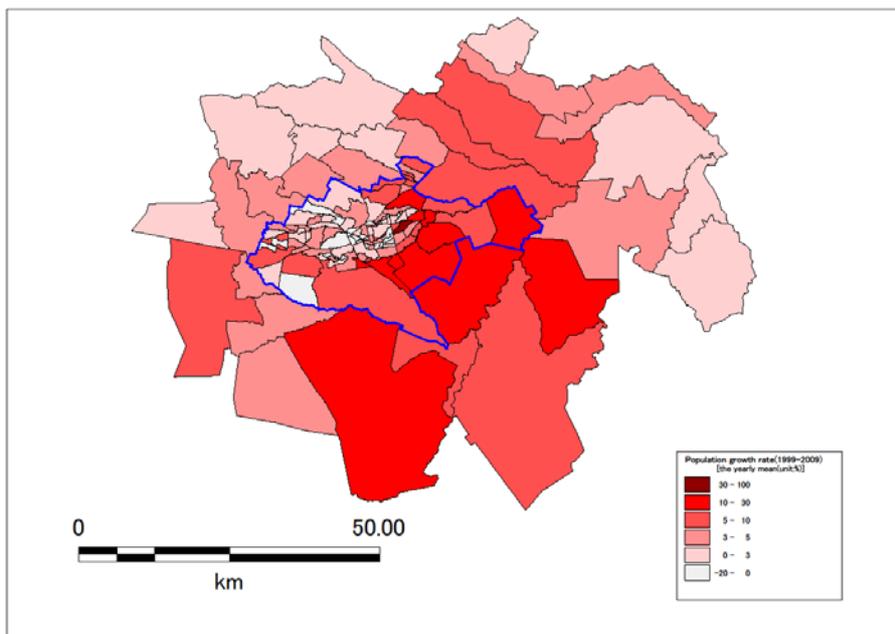
In the Greater Nairobi, Nairobi City had grown faster from 1989 to 1999, when the city grew at 4.9% while the environs outside the city at 3.0%. But from 1999 to 2009, the environs grew faster as it grew at 4.1% while the city at 3.9% as detailed in Chapter 3.3. The change seems to be a signal of Nairobi City’s urban expansion.

Within the city, Embakasi Division has the highest growth rate, while out of the city in Greater Nairobi, Ruiru area to the north of the city and Mavoko and Kitengela areas to the south are the fastest growing municipalities.



Source: 2009 Census

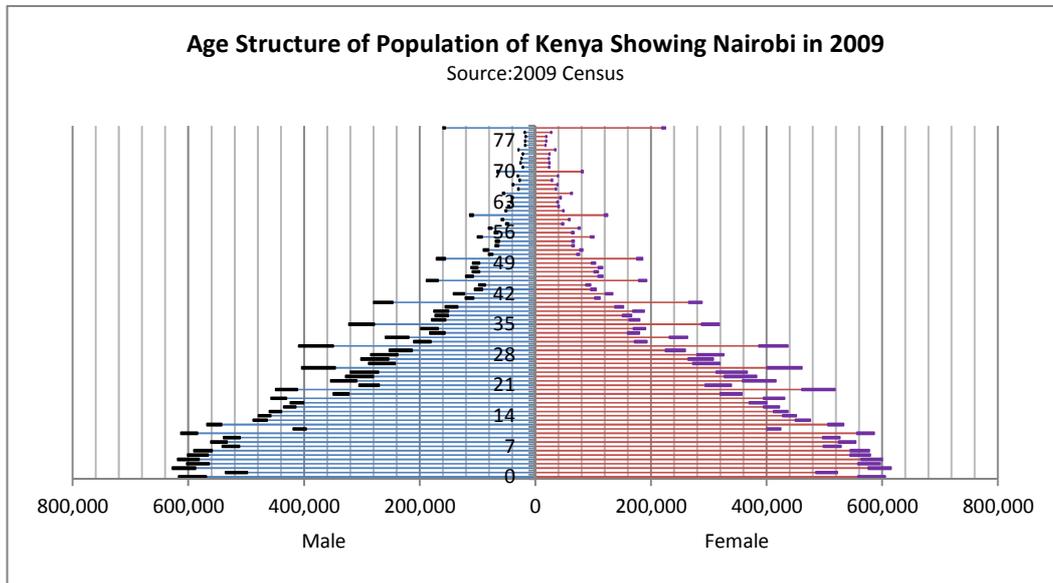
Figure 2.1.2 Population Density per Hectare of Nairobi City in 2009



Sources: 1999 Census and 2009 Census

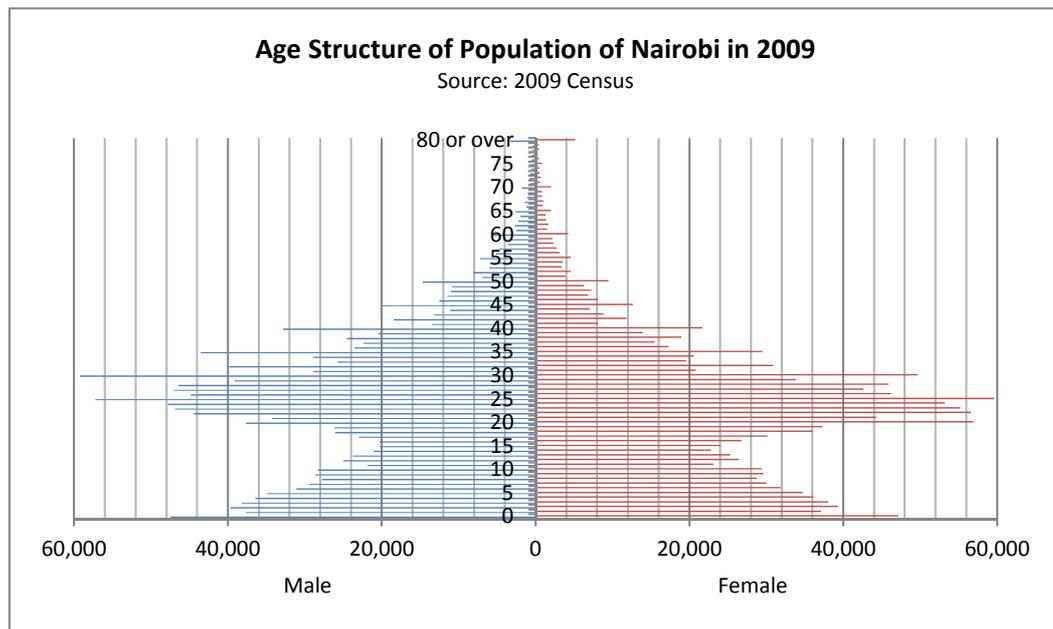
Figure 2.1.3 Average Annual Population Growth Rate of Nairobi City and its Environs in Greater Nairobi from 1999 to 2009 (%)

The age structure of the population of Kenya in 2009 formed a shape of a pyramid while that of Nairobi City showed a pair of wings with large share of population consisting of people around their twenties. It is noted in the figures that the apparent larger population at every five years of age indicates a limited precision of responses to the census questionnaire.



Note: Thick parts of lines represent Nairobi City's population.
Source: 2009 Census

Figure 2.1.4 Age Structure of the Population of Kenya Showing Nairobi in 2009



Source: 2009 Census

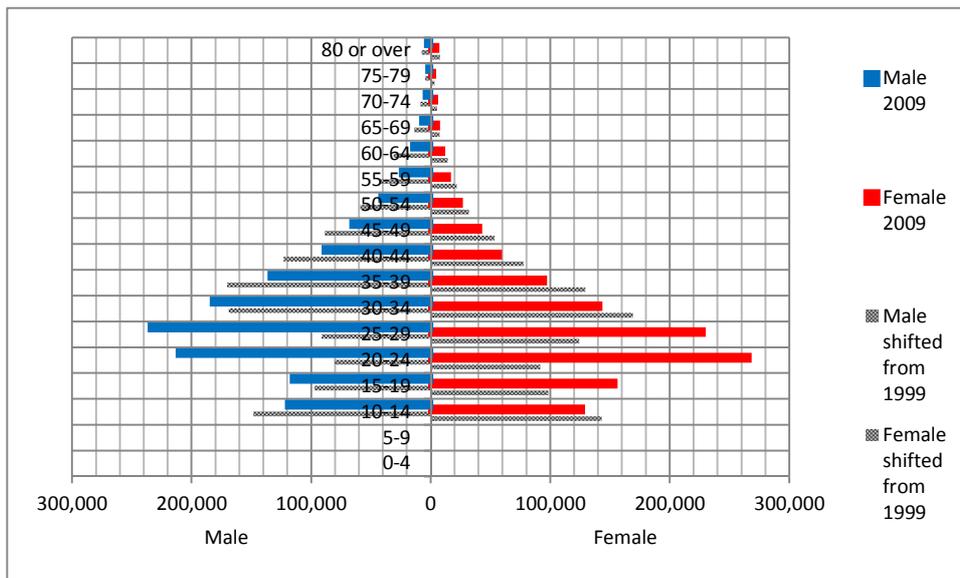
Figure 2.1.5 Age Structure of the Population of Nairobi in 2009

Population growth of an area depends on the births, deaths, in-migration, and out-migration. The population growth rate can be expressed as follows:

$$\begin{aligned} &\text{Population Growth Rate} \\ &= \text{Natural Growth Rate} + \text{Social Growth Rate} \\ &= (\text{Birth Rate} - \text{Death Rate}) + (\text{In-migration Rate} - \text{Out-migration Rate}) \end{aligned}$$

The population growth rate of Nairobi City has been higher than that of Kenya. For example, during the 1999–2009 period, the growth rate of the city was 3.9% while that of Kenya was 3.0%. The dominant reason for the difference is thought to be the high in-migration rate of the city.

In Figure 2.1.6, the age structure of the population of Nairobi City in the 1999 Census is shifted upwards by ten years and overlaid with the population over ten years of age in the 2009 Census. The shifted 1999 data shows the maximum possible population without migration in each sex and age group in 2009, because no death is assumed. If the actual 2009 population is greater than the shifted 1999 data, the difference is the minimum possible net in-migration of the group. The in-migration between 15 years old and 30 years old as of 2009 is remarkably large. This means that between 1999 and 2009 the net in-migration of an age cohort between five years old, the age of the people in 1999 who are 15 years old in 2009, and 30 years old is large. At least some 700,000 people in this age group migrated to the city during the decade.



Sources: Kenya Censuses in 1999 and 2009, and the JICA Study Team (JST)

Figure 2.1.6 Nairobi City's Age Structure Shifted by Ten Years from 1999 and Corresponding Actual Population in 2009

(2) Day-time Population

The number of pupils and students at schools and the number of workers at work places are studied as follows:

1) School Enrolment

According to the 2009 Census, the number of children attending pre-primary schools was 155,936, which was 71.4% (gross enrolment rate) of the 3 to 5 age cohort population. Similarly, that of primary schools was 490,314 or 111.3% of the 6 to 13 age cohort population, while that of secondary schools was 176,837, or 93.8% of the 14 to 17 age cohort population.

On the other hand, according to the 2011 data of the Education Department of the Nairobi City County (NCC) and Ministry of Education, the total enrolment of pre-primary schools was 72,165 indicating the gross enrolment rate was less than 33.0% because of the population increase since 2009. While that of the primary schools was 336,723 with a rate of less than 76.5%, and that of secondary schools was 69,314 with a rate of less than 36.8%.

The gaps between the home-based data and school-based data can be interpreted as follows:

- i) The census data of children attending schools may be overestimated, as the respondents tend to think that actual situation may appear to be inappropriate to disclose.
- ii) The school data of enrolment may be underestimated, as some schools do not reply properly or some private schools present understated figures because they think that the enrolment is linked to taxation.
- iii) Some children are studying in boarding secondary schools situated out of Nairobi City. In this case, these children lived outside the city during their school periods may be enumerated in Nairobi City.

Therefore, it is assumed that the enrolment rates were 50% for the pre-primary schools, 90% for the primary schools, and 65% for the secondary schools in 2009. Then the total number of pupils and students including the tertiary education data of the 2009 census is estimated at 780,000. Although a number of pupils and students schooling across the city boundaries are observed, they are neglected, for the net movement is thought to be marginal compared to the total enrolment.

Table 2.1.2 Distribution of Enrolment of Primary Schools, Pre-Schools, Special Units, and Secondary Schools in Nairobi City by Division in 2012 (Preliminary)

Division	Primary, etc	Secondary	Total
1 Dagoretti	46,181	10,507	56,688
2 Embakasi including Njiru	104,566	13,236	117,802
3 Kamukunji/Pumwani	18,825	4,905	23,730
4 Kasarani	87,791	6,337	94,128
5 Langata/Kibera	38,050	8,037	46,087
6 Makadara	26,489	7,898	34,387
7 Central/Starehe	44,685	9,220	53,905
8 Westlands	42,301	9,174	51,475
Total	408,888	69,314	478,202

Note: As of July 2013, the total enrolment of pre-primary and primary schools is 442,074, instead of 408,888. However, its breakdown into divisions is not fully available.

Sources: City Education Department, -, Nairobi City County

Unit: Number of pupils and students

2) Work Places

Based on the business registration data of NCC in 2013, the total number of formal workers was estimated at approximately one million. On the other hand, based on the 2009 census, the number of active employees who lived in the city was estimated at 1,648,000 in 2013. By assuming a net in-flow of 165,000 commuters from outside the city based on the cordon line survey, the total number of jobs in the city was estimated at 1,813,000 and the number of informal workers was estimated at 813,000.

The basic definitions of the formal workers and the non-formal workers are as follows:

Formal workers are those working at businesses registered as formal in NCC and wage workers in agriculture and forestry, electricity and water, and in the public sector.

Non-formal workers are those working at businesses registered as informal in NCC and unregistered workers except the wage workers mentioned above.

3) Day-time Population

Assuming the above mentioned commuters from outside the city boundary, the day population of Nairobi City was estimated approximately at 3,280,000 in 2009 and 3,766,000 in 2013. It is noted that much higher day population than night population of the city's central areas is largely attributed to the commuters from the suburban areas inside the city boundary.

2.1.3 Socioeconomy

(1) Nairobi City's Position in Kenya

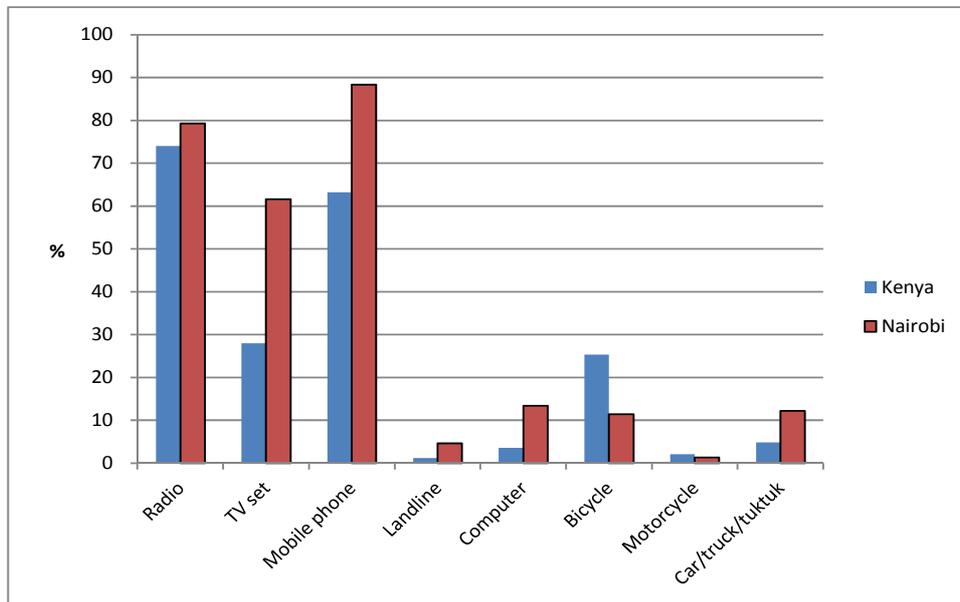
1) Social Indicators

In most social indicators, Nairobi City is positioned higher than the average of Kenya.

Table 2.1.3 Position of Nairobi City in Comparison with Kenya

Social Indicators	Kenya	Nairobi City
Main Source of Water	Share of spring/well/borehole is the highest (35.4%).	Share of piped water is the highest (52.3%).
Main Mode of Human Waste Disposal	Share of pit latrine (covered/ uncovered) is the highest (69.6%).	Share of main sewer is the highest (47.7%).
Main Type of Lighting Fuel	Share of tin lamp is the highest (38.5%).	Share of electricity is the highest (72.4%).
Ownership of Household Assets	Kenya has higher ownership in bicycle and motorcycle.	Nairobi City has higher ownership in radio, TV set, mobile phone, landline, computer, and car/truck/tuk tuk.

Source: 2009 Census



Source: 2009 Census

Figure 2.1.7 Percentage of Households of Ownership by Household Assets

2) Gross Regional Domestic Product (GRDP) per Capita

Although estimated GRDP per capita of Nairobi City varies on sources of data, it is assumed to be triple the national Gross Domestic Product (GDP) per capita, because it is the average of the collected estimates excluding an exceptionally high figure. The assumption made for 2009 is that the GDP share of Nairobi is 24.4% of Kenya.

In 2011, GDP per capita of Kenya was estimated at KSh73,988 at current prices of 2011 and GRDP of Nairobi City is estimated at KSh221,965.

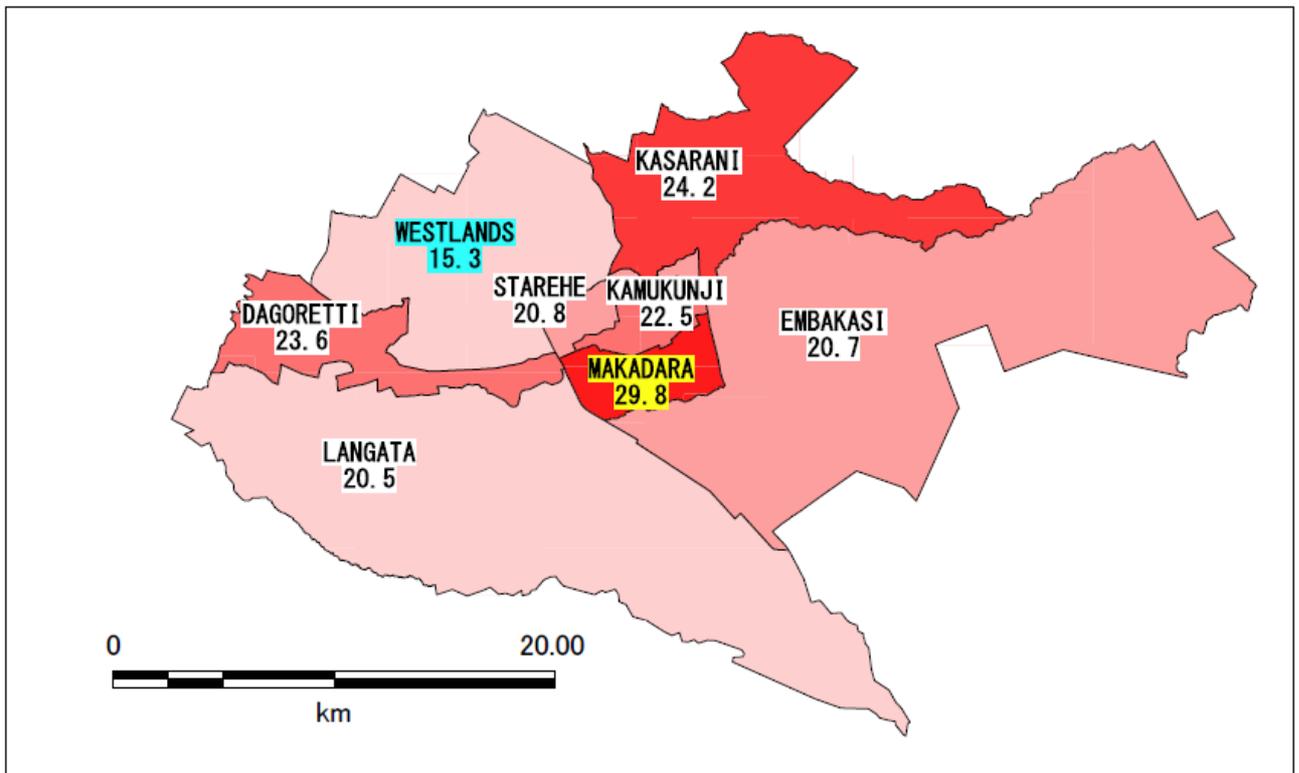
Table 2.1.4 References and their Implications

Reference	Implications
Labour Force Analytical Report based on the Kenya Integrated Household Budget Survey 2005/06	In the mean monthly household expenditure per capita, Nairobi City's level is 3.1 times of Kenya's level.
Basic Report on Well-being in Kenya based on the Kenya Integrated Household Budget Survey 2005/06	In the mean monthly food and non-food consumption per capita, Nairobi City's level is 2.5 times of Kenya's level.
Statistical Abstract 2012	In the earnings per capita, Nairobi City's level is 3.7 times of Kenya's level.
Global City GDP Rankings 2008-2025 Pricewaterhouse Coopers	In GDP at PPP per capita, Nairobi City's level is 2.5 times of Kenya's level.
Appraisal Document of Kenya Municipal Program, World Bank, April 2010	In GDP/GRDP per capita, Nairobi City's level is more than 6.2 times of Kenya's level.

Source: JICA Study Team (JST)

(2) Socioeconomic Conditions in Nairobi City

The Kenya Integrated Household Budget Survey 2005-2006 estimated the poverty line at KSh2,913 per person per month for urban households. According to the survey, the share of individuals below the poverty line was the highest at 29.8% in Makadara Division and lowest at 15.3% in Westlands Division. As a very broad trend, a larger number of relatively high income households are found in the west of the Central Business District (CBD) than in the east, although there are a number of low income informal settlement areas in the western areas such Kibera and Kawangware.



Source: Kenya Integrated Household Budget Survey 2005-2006

Figure 2.1.8 Share of Individuals below Poverty Line

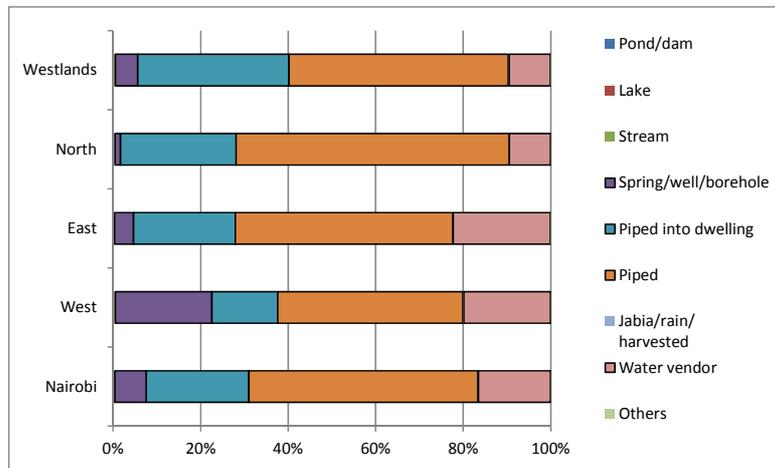
Socioeconomic characteristics of households in the four districts of Nairobi City can be compared based on the 2009 Census Volume 2 “Population and Household Distribution by Socioeconomic Characteristics”.

Table 2.1.5 Definitions of the Four Districts in Nairobi City According to 2009 Census

District	Division	Remarks
Nairobi West	Dagoretti, Langata/Kibera	Kibera here means a division, not a location.
Nairobi East	Embakasi including Njiru, Makadara	
Nairobi North	Central/Starehe, Kasarani, Kamukunji/Pumwani	
Westlands	Westlands	Westlands here is a district and also a division.

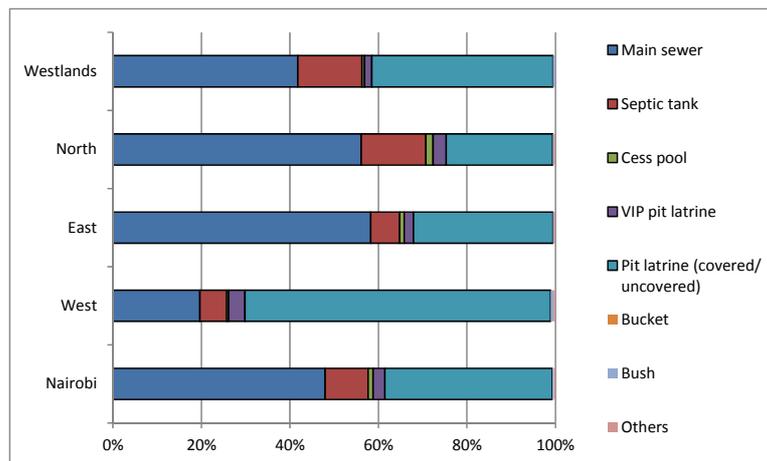
Sources: 2009 Census and the JICA Study Team (JST)

Regarding water supply, the piped water supply system is the most common source in all the districts. Westland has the highest rate (34.5%) of the system of piped into dwelling, while Nairobi East and Nairobi West have the highest rates (22.2% and 19.8%) of water from vendors. Regarding human waste disposal, Nairobi East and Nairobi North have the highest rates (58.0% and 55.7%) of the main sewer system, while Nairobi West has the highest rate (68.6%) of the pit latrine system. Regarding main type of lighting fuel, Westlands has the highest rate (79.0%) of electricity, while Nairobi West has the highest rate (18.3%) of tin lamp. In Nairobi City, mobile phones, radios, and TV sets are common in this order. The ownership of computer, car/truck/*tuk tuk* and bicycle is 13.4%, 12.2%, and 11.4%, respectively. The ownership of landline and motorcycle is less than 5%. In all cases, the shares of Westlands are the highest.



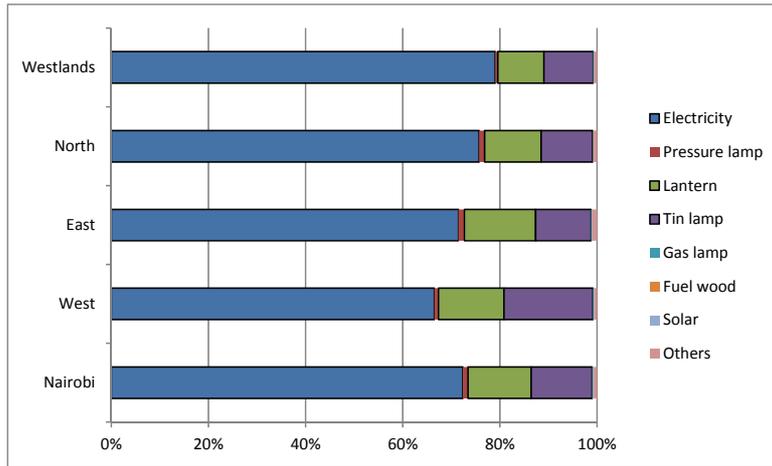
Source: 2009 Census

Figure 2.1.9 Households by Main Source of Water and District



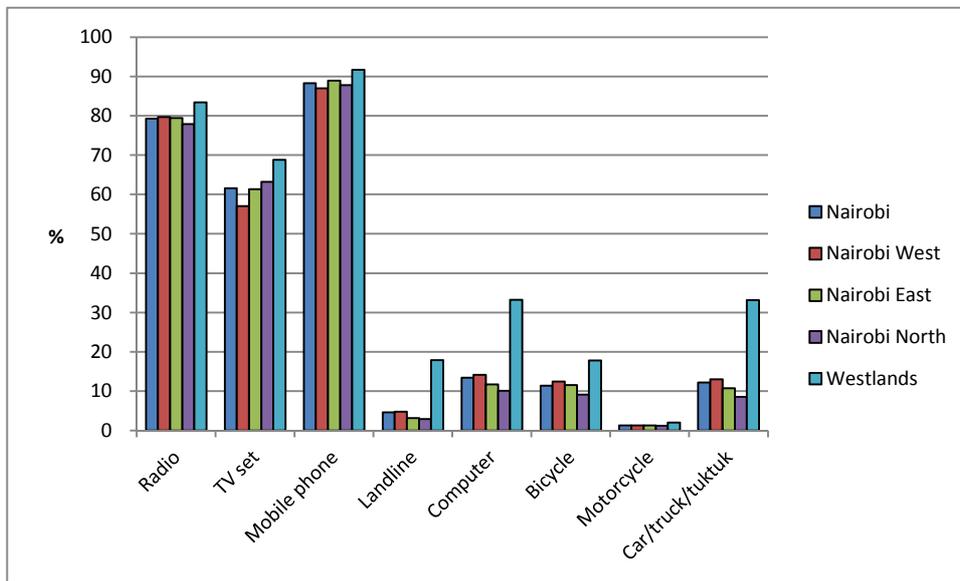
Source: 2009 Census

Figure 2.1.10 Households by Main Mode of Human Waste Disposal and District



Source: 2009 Census

Figure 2.1.11 Households by Main Type of Lighting Fuel and District



Source: 2009 Census

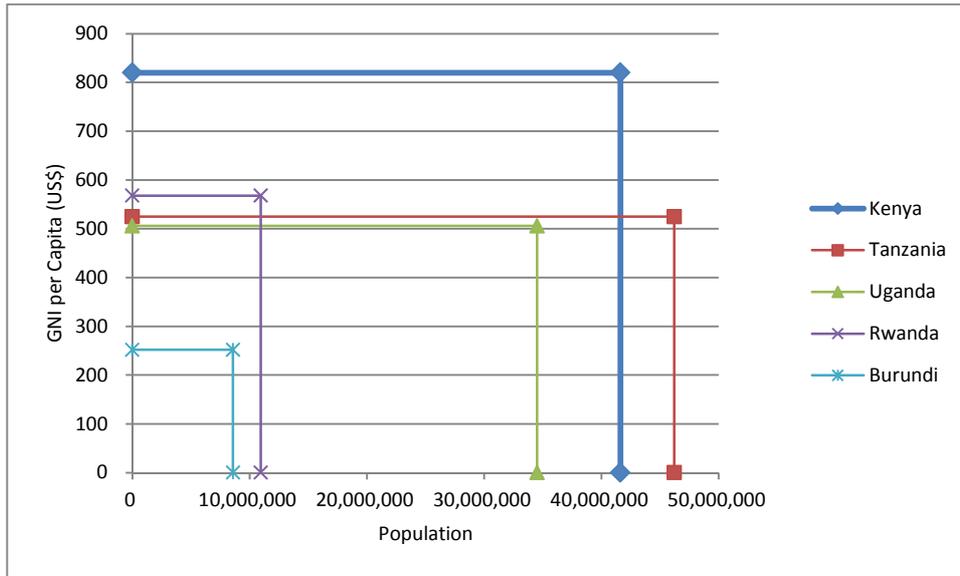
Figure 2.1.12 Percentage of Households by Ownership of Household Assets and District

Safety and security issue has been raised as priority social concern during stakeholder meetings. Various socioeconomic factors can be attributed to the increasing insecurity in NCC. Such factors including increasing population leading to congestion in some residential areas, unemployment, poverty, poor living standards, lack of education, and civic responsibility have overtime made safety and security a key issue of concern. Poor planning, design, and management are some of the numerous factors that give rise to crime and violence in the cities.

(3) Position of Nairobi City's Industries

In the East African Community (EAC), Kenya's Gross National Income (GNI) was the largest accounting for 40.5% while the second largest Tanzania's share at 28.8% in 2011. Kenya's GNI per capita is also the highest at US\$820 in the same year as shown in Figure 2.1.13, although it is still below the threshold of the lower middle income countries of US\$1,026 at 2011 prices.

GRDP per capita of Nairobi City is estimated 3 times of Kenya's average GDP per capita, and its GRDP is estimated at 24.4% of Kenya's GDP. The GRDP is larger than Rwanda's GDP.



Source: World Development Indicators website (2013)

Figure 2.1.13 Population and GNI per Capita in 2011

The EAC started a common market system in 2010 and moving toward further integration, while issues remain in harmonisation of domestic systems to the EAC rules, elimination of non-tariff barriers, and relations with other international communities. Integration of the EAC member countries provides Kenya with an opportunity for expansion of its industries although it requires their competitiveness.

(4) Outline of Kenya's Industries

As shown in Tables 2.1.6-2.1.9, agriculture and forestry has the largest share at 24.0% in GDP, followed by wholesale and retail (10.6%), transportation and communications (9.7%), and manufacturing (9.4%) in 2011. In terms of growth rate, financial business is fastest growing at 7.8% per annum followed by wholesale and retail (7.3%) and mining and quarrying (7.1%) in the same year. The top two export earners are tea (21.2% of the total export value) and horticultural produce including cut flowers (17.3%). The fastest growing export commodities are tobacco and tobacco products (76.4% per annum), leather products (71.9%), and soda ash (70.3%) but the share of each of them is less than 4%.

Table 2.1.6 GDP Shares in 2011 (Provisional)

Rank	Sector	Share (%)
1	Agriculture and forestry	24.0
2	Wholesale and retail	10.6
3	Transportation and communications	9.7
4	Manufacturing	9.4
5	Financial business	6.4
6	Education	5.8

Source: Economic Survey 2012

Table 2.1.7 Real GDP Growth Rates in 2011 (Provisional)

Rank	Sector	Growth Rate (%)
1	Financial business	7.8
2	Wholesale and retail	7.3
3	Mining and quarrying	7.1
4	Hotels and restaurants	5.0
5	Education	4.9
6	Transportation and communications	4.5

Source: Economic Survey 2012

Table 2.1.8 Shares in Export in 2011 (Provisional)

Rank	Sector	Share (%)
1	Tea	21.2
2	Flowers	17.3
3	Garments and accessories	4.6
4	Coffee	4.0
5	Tobacco and tobacco products	3.9
6	Steel	3.8

Source: Economic Survey 2012

Table 2.1.9 Growth Rates in Export in 2011 (Provisional)

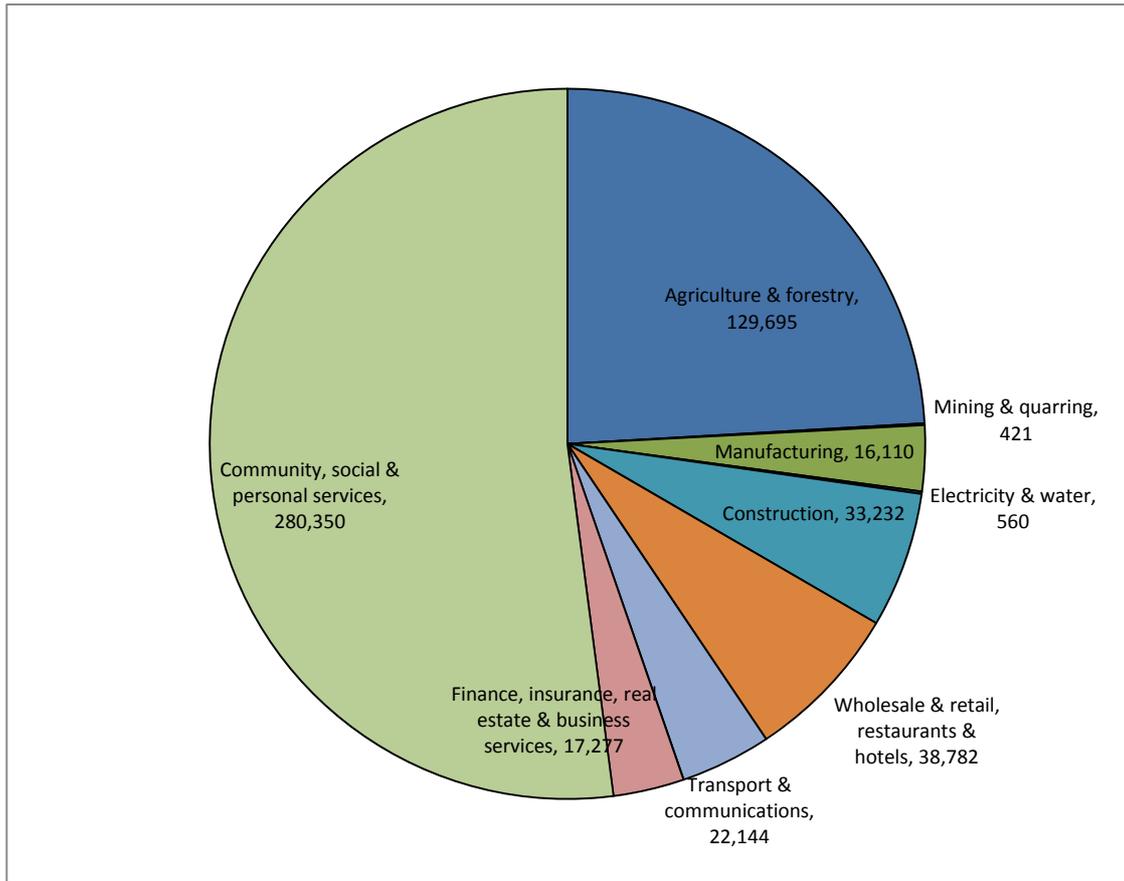
Rank	Sector	Growth Rate (%)
1	Tobacco and tobacco products	76.4
2	Leather products	71.9
3	Soda ash	70.3
4	Steel	49.8
5	Essential oil	43.6
6	Organic oil	43.2

Source: Economic Survey 2012

(5) Overall Situation and General Issues of the Industries of Nairobi City

1) Overall Situation of Industries

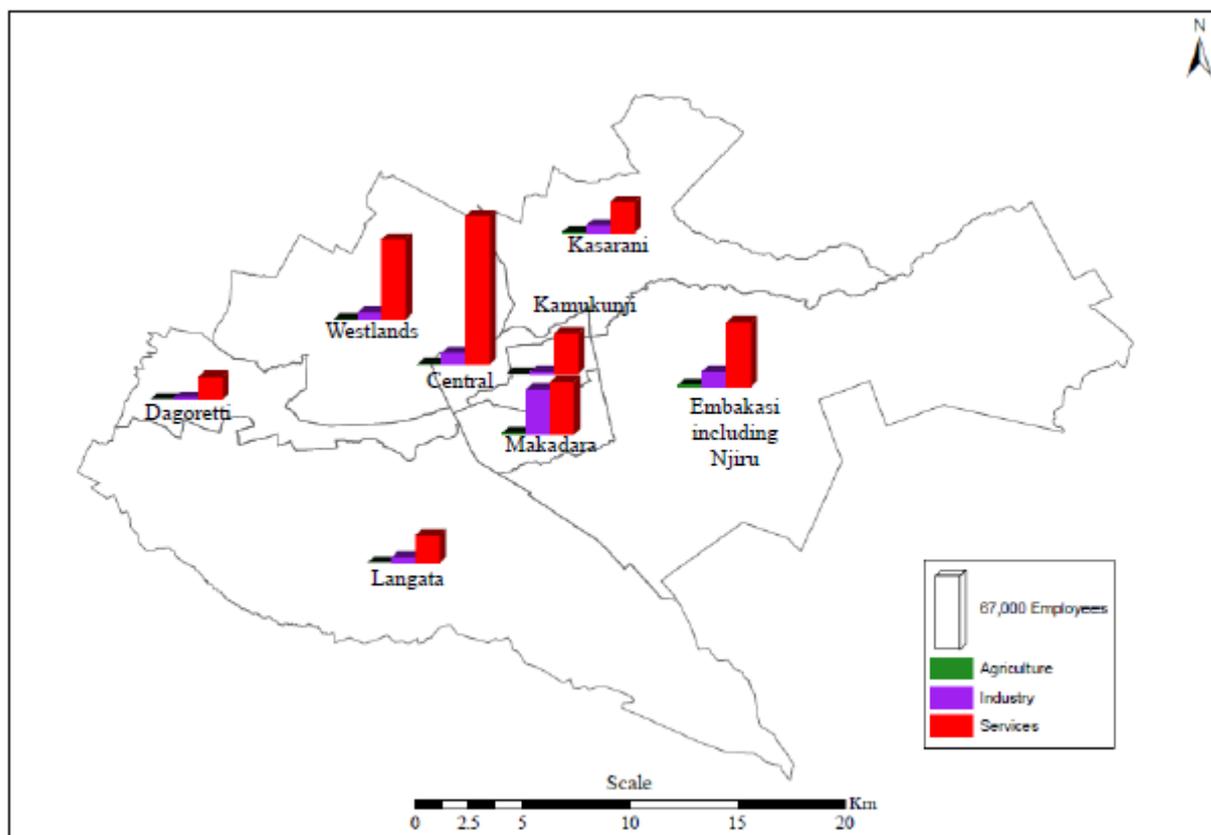
Among the wage employment in 2012, the community, social, and personal services sector has the highest share (52.1%), the agriculture and forestry sector has the second share (24.1%), while the wholesale and retail trade, restaurants and hotels sector has the third share (7.2%) according to the Statistical Abstract 2012. The manufacturing sector accounts for only 3.0%. It seems that the total wage employment of 538,571 is too small, and the share of agriculture and forestry is too large, while that of manufacturing is too small. However the apparent incompatibility of the data may be due to the definition of the wage employment. (Figure 2.1.14)



Source: Statistical Abstract 2012, Kenya National Bureau of Statistics (KNBS)

Figure 2.1.14 Wage Employment by Industry in 2011 (Provisional)

The estimated distribution of employees of business establishments registered in NCC reflects the concentration of commercial and service businesses in the relatively small area of CBD and that of manufacturing businesses in Makadara Division, as well as an overall dominance of the services sector (Figure 2.1.15). In addition, the informal employments are thought to be partly distributed according to formal employment and to the population distribution.



Note: "Agriculture" includes forestry and fishing, "industry" comprises mining, manufacturing, construction, electricity and water, and "services" means the rest, as in the World Development Report. Businesses not registered in NCC are not included.

Source: Business Registration Data of NCC

Figure 2.1.15 Estimated Distribution of Employees of Business Establishments Registered in NCC

2) General Issues and Directions for Improvement of Industries

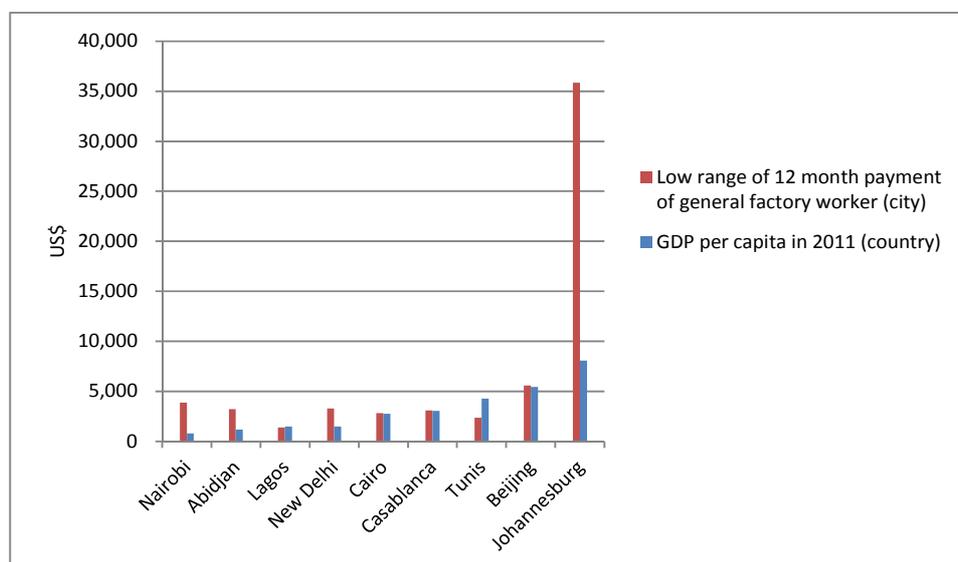
General issues and directions for improvement of industries in Nairobi City are summarised in Table 2.1.10.

Table 2.1.10 General Issues and Directions for Improvement of Industries in Nairobi City

General Issues		Directions for Improvement
(i) Industrial structure		
Lack of competitive skills	Skill levels vary a lot. The informal light manufacturing (Jua Kali) is yet to improve its product quality; otherwise they cannot maintain the market share.	Nairobi City needs a larger number of highly skilled and specialised small enterprises. Improve the skills mainly through business linkages and by responding to market needs.
High cost structure	Extra costs are incurred due to costly power supply, traffic congestion, and insecurity in addition to not-so-low labour costs. (Figure 2.1.16)	Improve efficiency of the economic system including efficiency of labour, infrastructure, and utilities.
Lack of linkages	Due to mismatch of quality, costs, etc., inter-business linkages are weak. Figure 2.1.17 shows gaps between large, medium, small, and micro/individual businesses. It also shows general supporting organisations and their major targets. Line agencies and NCC should support directly or indirectly businesses in various sizes.	Deepen inter-business linkages as well as linkages with major buyers such as government organisations and supermarkets.
Weak competitiveness	Freer importation including in-flow of counterfeits is dominating the market and destroying local businesses.	Overall efforts to strengthen competitiveness and to find areas with relative advantages, so that protectionism is not necessary.

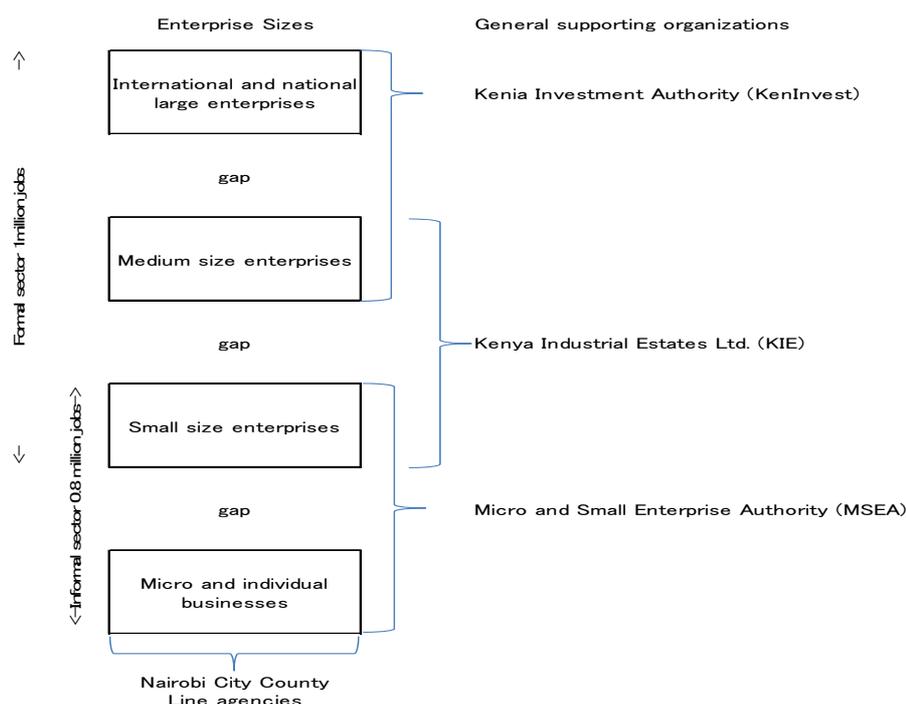
General Issues		Directions for Improvement
(ii) Basic and socioeconomic conditions		
Lack of available land	Given the current land use and transportation conditions, the land of Nairobi City appears to be mostly saturated, although a lot of spaces are underutilised.	Efficient land use at selected locations and relocation of space-intensive functions to the environs. Open up new spaces for various business activities by such means as vertical mixed use.
Lack of public safety	Lack of safety and its reputation are destroying Kenya's tourism potential. It also incurs extra costs and impedes many business activities.	A full set of measures ranging from immediate countermeasures to longer-term socioeconomic bottom-up strategies. (Table 2.1.11)
(iii) Infrastructure		
Traffic congestion	Traffic congestion wastes a huge amount of time cost and fuel cost, deteriorating Kenya's business climate.	A full set of measures ranging from immediate countermeasures including traffic management by ICT to longer-term structural measures such as shift to multi-centric urban structure.
Unreliable and costly power supply	Unreliable power supply necessitates generators of each business incurring additional investment and operation costs.	Power development can be regarded as a private business opportunity as PPP. Develop new large and small energy sources and optimise energy operation.
Insufficient waste management service	Coupled with lack of public safety, wastes have invaded many potentially attractive streets.	Clean Nairobi City campaign linked with safe tourism development.
(iv) Institutional system		
Lack of finance	Small enterprises in need of financial support such as ICT entrepreneurs have difficulties in obtaining loans with concern about unpredictable outcome.	Open up various financial channels at various levels ranging from integration of loan provision and consulting services for micro, small, and medium enterprises (MSMEs) to PPP schemes for larger enterprises.
Inefficient administrative procedure	"An Investment Guide to Kenya" (2012) points out that investors may face delays on refunds of VAT, withholding taxes, and customs clearance. Doing Business Rank of Kenya in 2013 placed at 121, out of the 185 economies.	Improve the doing business rank by efficient administrative, tax, and custom procedures, and also smooth inter-agency collaboration to support businesses. NCC can play expanded roles in an efficient way.

Source: JICA Study Team (JST)



Sources: World Development Indicators website (2013) and Japan External Trade Organisation (JETRO) website (2013)

Figure 2.1.16 Comparison of GDP per Capita and Typical Labour Cost



Note: MSEA under the Ministry of Industrialisation and Enterprise Development is the former Department of Micro and Small Enterprise Development (DMSED) of the Ministry of Labour.
Source: JICA Study Team (JST)

Figure 2.1.17 Gap Structure of Industries of Nairobi City

Table 2.1.11 Some Causes for Lack of Public Safety and Candidate Measures

Causes	Candidate Measures	Remarks
Lack of safety services and equipment - Insufficient police service and police posts. - Lack of street lights. - Lack of CCTV. - Public facilities without safety considerations. - High fences of parks.	- Enhance police activities, police posts, and community policing. - Increase street lights. - Enhance CCTV system. - Equip public toilets with safety measures, e.g., CCTV and siren. - Establish safe public transport system. - Lower fences of parks.	
Exclusion of people from public facilities, amenities, and services - Worsened access to public facilities, amenities and services, e.g., social/community halls, open spaces and parks, etc.	- Improve public facilities, amenities, and services; and its access including temporary pedestrian or play zones. - Involve the youth and the community in improving and sustaining them.	
Socioeconomic conditions - Unemployment, underemployment, working poverty. - Gap between rich and poor (privileged and underprivileged). - Incidence of corruption. - Lack of hope. - Lack of family care and education at home, schools and communities.	- Generate employment. - Seek inclusive and bottom-up development (as well as top-up). - Strengthen anti-corruption measures. - Shift from vested interest to meritocracy. - Enhance community care and safety campaigns.	Kenya ranks at 107 out of 134 countries in Gini index that shows inequality in income or expenditure within each country (Table 2.1.12).
External conditions - Domestic and international in-migration of underprivileged people.	- Balance support measures and enforcement of rules to address such migration.	

Note: Accidents, pollution, disasters, and terrorism are not explicitly considered here.

Source: JICA Study Team (JST) based on interviews with the Nairobi County Business Association (NCBA) (2013) and Mr. Elijah Agevi (2013)

Table 2.1.12 Gini Index of Selected Countries

Rank	Country	2000-	Rank	Country	2000-
1	Sweden	25.0	68	Israel	39.2
2	Norway	25.8	69	Guinea	39.4
3	Finland	26.9	70	Kyrgyz Republic	39.5
4	Afghanistan	27.8	71	Burkina Faso	39.6
5	Belarus	27.9	72	Chad	39.8
6	Bulgaria	28.2	73	Djibouti	40.0
7	Ukraine	28.2	74	Sri Lanka	40.3
8	Germany	28.3	75	Nicaragua	40.5
9	Croatia	29.0	76	United States	40.8
10	Austria	29.2	77	Morocco	40.9
11	Ethiopia	29.8	78	Georgia	41.1
12	Slovak Republic	29.8	79	Qatar	41.1
13	Hungary	30.0	80	Mauritania	41.3
14	Montenegro	30.1	81	Tunisia	41.4
15	Kazakhstan	30.8	82	Gabon	41.5
16	Luxembourg	30.8	83	Cote d'Ivoire	41.5
17	Iraq	30.9	84	Cambodia	41.9
18	Slovenia	31.2	85	Thailand	42.4
19	Pakistan	31.2	86	China	42.5
20	Romania	31.6	87	Sierra Leone	42.5
21	Egypt, Arab Rep.	32.1	88	Turkey	42.6
22	Canada	32.6	89	Uganda	42.6
23	Belgium	33.0	90	Angola	42.7
24	Albania	33.0	91	Ghana	42.8
25	Bangladesh	33.2	92	Nigeria	42.9
26	Burundi	33.3	93	Central African Republic	43.6
27	India	33.4	94	Nepal	43.8
28	Serbia	33.4	95	Niger	43.9
29	Tajikistan	33.6	96	Philippines	44.0
30	Switzerland	33.7	97	Congo, Dem. Rep.	44.4
31	Azerbaijan	33.7	98	Jamaica	45.5
32	Indonesia	34.0	99	South Sudan	45.5
33	Greece	34.3	100	Uruguay	45.9
34	Ireland	34.3	101	Fiji	46.8
35	Togo	34.4	102	Mozambique	47.1
36	Spain	34.7	103	Madagascar	47.2
37	Poland	34.9	104	Gambia, The	47.3
38	Sudan	35.3	105	Congo, Rep.	47.3
39	Guinea-Bissau	35.5	106	Costa Rica	47.6
40	Latvia	35.7	107 Kenya	47.7	
41	Vietnam	35.8	108	Argentina	49.3
42	Bosnia and Herzegovina	35.8	109	Venezuela, RB	49.5
43	Syrian Arab Republic	35.8	110	El Salvador	50.3
44	Lithuania	35.8	111	Cape Verde	50.5
45	Estonia	36.0	112	Swaziland	50.7
46	Italy	36.0	113	Sao Tome and Principe	50.8
47	Armenia	36.2	114	Dominican Republic	51.1
48	Moldova	36.3	115	Peru	51.1
49	Mongolia	36.5	116	Mexico	51.2
50	Uzbekistan	36.7	117	Chile	51.8
51	Lao PDR	36.7	118	Paraguay	52.5
52	Maldives	37.4	119	Lesotho	52.5
53	Russian Federation	37.5	120	Rwanda	53.1
54	Tanzania	37.6	121	Panama	54.0
55	Yemen, Rep.	37.7	122	Ecuador	54.1
56	Jordan	37.7	123	Zambia	54.6
57	Malaysia	37.9	124	Guatemala	55.9
58	Bhutan	38.1	125	Colombia	56.1
59	Liberia	38.2	126	Brazil	57.4
60	Iran, Islamic Rep.	38.3	127	Bolivia	57.8
61	Benin	38.6	128	Haiti	59.2
62	West Bank and Gaza	38.7	129	Honduras	59.7
63	Cameroon	38.9	130	Micronesia, Fed. Sts.	61.1
64	Mali	39.0	131	Namibia	63.9
65	Malawi	39.0	132	Comoros	64.3
66	Macedonia, FYR	39.1	133	Seychelles	65.8
67	Senegal	39.2	134	South Africa	67.4

Note: Gini index in 2005 or in the 2000s.

Gini index measures inequality of income or consumption expenditure among individuals or households within an economy. A Gini index of 0 represents perfect equality, while an index of 100 implies perfect inequality

Source: World Development Indicators website (2013)

(6) Current Situation of Industries in the Environs

Based on the District Development Plans (2008-2012), industries of the surrounding districts of Nairobi City can be outlined as follows. It is noted that the description of each district is for the whole district and not limited to the parts within the Greater Nairobi.

1) Thika District (Gatanga Division, Githurai Division, Kakuzi Division, Ruiru Division, Thika Municipality)

Outline	Around the urban centre of Thika and Ruiru along Thika Highway, a number of factories are located as well as the Jomo Kenyatta University of Agriculture and Technology (JKUAT). Historically, Thika District is one of the leading industrial districts in Kenya besides undertaking agricultural activities on both large and small scales. Its proximity to Nairobi City provides a ready market to the agricultural produce.
Primary industry	The main cash crops are coffee, tea, pineapple, and macadamia while the main food crops are maize, beans, Irish potatoes, and pigeon peas. Most of the farming areas in the district are rainfed except for large-scale pineapple production by the multinationals and coffee estates. Besides crop farming, livestock farming is undertaken in the district. The main livestock are dairy cattle, dairy goat, meat goat, poultry, and beekeeping. The cooperative sector is central in marketing of agricultural produce and products. It also assists in provision of credit and farm inputs.
Secondary and tertiary industries	There are small-, medium-, and large-scale businesses including 16 chemical and 15 engineering industries.

2) Kiambu East District (Githunguri Division, Kiambu Municipality, Kiambaa Division)

Outline	Due to close proximity to Nairobi City and jobs at coffee and tea estates among others, the district is well populated and the land has been fragmented into small and inefficient pieces.
Primary industry	The main food crops grown are maize, beans, Irish potatoes, and vegetables whereas the major cash crops are coffee, tea, and horticultural crops. Due to the emphasis on cash crops, the district is importing food from neighbouring districts. Several agro-processing factories can be accessed and so production of livestock and livestock products has been increasing.
Secondary and tertiary industries	The industries are mostly operated by the informal sector. The district's tourist attractions include the house of the first president Jomo Kenyatta.

3) Kiambu West District (Limuru Division, Kikuyu Division, Lari Division, Ndeiya Division)

Outline	The growing population working in the district or commuting to Nairobi City is leading to the reduction of arable land.
Primary industry	The district has been predominantly agricultural. The main food crops are maize, beans, Irish potatoes, and vegetables, whereas the major cash crops are coffee, tea, pyrethrum, horticultural products, and flowers. Several agro-processing factories can be accessed and so production of livestock and livestock products has been increasing.
Secondary and tertiary industries	The district has agro-industries such as milk processing firms and large tea factories.

4) Kajjado District (Ngong Division, Central Division, Magadi Division, Isinya Division, Namanga Division, Mashuru Division, Ewaso Kendong Division)

Outline	With the change from group ranches to the individual land tenure system and owing to either agricultural potential or proximity to Nairobi City, immigration has increased to some locations such as Ngong and Kitengela.
Primary industry	Kajjado is an arid and semi-arid lands (ASAL) district and livestock keeping has been the dominant economic activity although there has been a reduction in livestock population due to droughts.
Secondary and tertiary industries	The vast mineral deposit around Lake Magadi is a main source of soda ash. The largest deposits at Mile 46 and Loodikalani area can be exploited for commercial purposes. Proximity to Athi River Export Processing Zone is an advantage.

5) Machakos District (Athi River/Mavoko Division, Central Division, Kalama Division, Kathiani Division)

Outline	The district has relatively high population density along the hills in Kathiani Division, in the Athi River, along Mombasa Road and in Machakos Town due to fertile soils and high rainfall for agriculture. Low plains where ranching and dairy farming are carried out are sparsely populated.
Primary industry	Agriculture contributes majority of household income. Livestock rearing is generally practiced in small scale.
Secondary and tertiary industries	Athi River Export Processing Zone was established in 1990. Besides that, the sector is not well developed due partly to over reliance on rainfed agriculture.

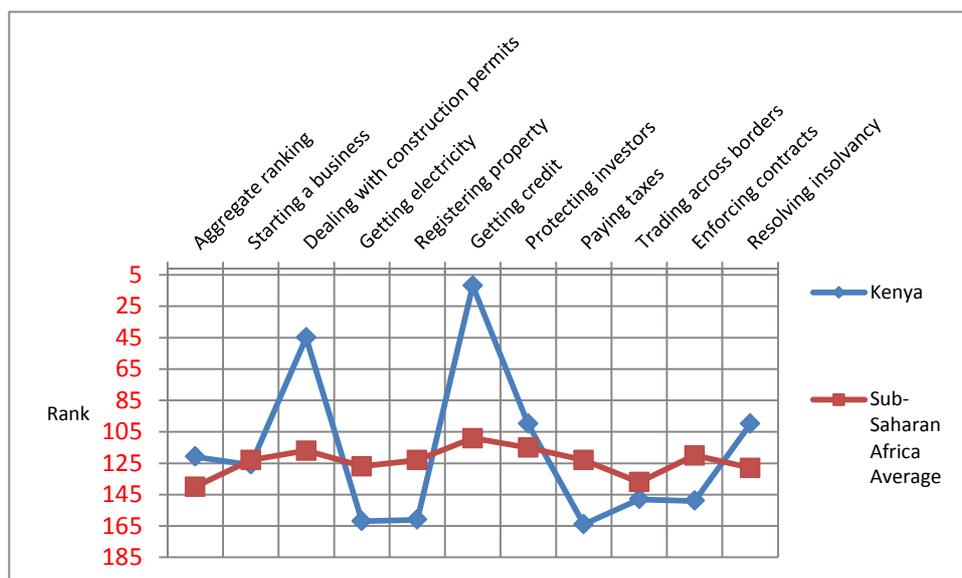
6) Kangundo District (Matungulu Division, Kangundo Division)

Outline	Agriculture, livestock production, and informal sector businesses are major economic activities.
Primary industry	The production of main crops in the district, including maize, has been fluctuating over the years due to low, unpredictable, erratic, and inadequate rainfall. This has created food insecurity among the general population. Other key issues affecting farmers in the district include declining soil fertility and high percentage of post harvest crop losses. All these factors have been influenced by the use of poor quality seeds, inadequate farm inputs, frequent droughts, and poor storage as well as lack of market, transportation, and processing. The major cash crops grown in the district are coffee and horticultural products in some parts. Of the forests areas, the district has a total of 7,420 ha of gazetted forests. The major threat is the forest destruction for timber and firewood. The revitalisation of Kenya Meat Commission (KMC) has provided a ready market for livestock.
Secondary and tertiary industries	Most retail and wholesale traders are small scale and in the informal sector. Ndonyo Sambuk National Park has tourism development potential.

(7) Doing Business Procedures

According to "Doing Business 2013" International Finance Corporation 2013, Kenya's aggregate ranking on the ease of doing business is 121 out of 185 countries. Kenya ranks high at 12 in "getting credit" for strong legal rights and deep credit information, while low at 164 in paying taxes mainly for time taken for the procedure (Figure 2.1.18).

NCC is related to starting a business, dealing with construction permits, getting electricity, registering property, and paying taxes. It is required to raise the aggregate ranking by concerted efforts of the responsible agencies (Table 2.1.13).



Source: "Doing Business 2013" International Finance Corporation 2013

Figure 2.1.18 Doing Business Ranks of Kenya in 185 Economies in 2013

Table 2.1.13 Doing Business Ranks of Kenya in 185 Economies in 2013

Topic	Kenya	Sub-Saharan Africa Average	Tasks of CCN	Department of NCC in charge	Major factors of low ranking
Aggregate ranking in 185 economies in 2013	121	140			
1 Starting a business	126	123	Issuing business permits	Business licensing Department	
2 Dealing with construction permits	45	117	Approval of architectural plans	Technical Committee	
			Approval of structural plans and final building permits	City Planning Department (Development Control Section) and City Engineer Department (Structural Section)	
			Inspection after construction	City Planning Department (Enforcement Section)	
			Occupancy certificates	City Planning Department (Enforcement Section)	
			Water and sewerage connection	Nairobi City Water and Sewerage Company	
3 Getting electricity	162	127	Excavation permits	City Engineer Department	Typical total time taken is 146 days.
4 Registering property	161	123	Issuing rates clearance certificates	Ministry of Lands (National Land Commission) is in charge but Nairobi City County (Department of Legal Affairs) facilitates the procedure.	Typical total time taken is 73 days.
5 Getting credit	12	109			
6 Protecting investors	100	115			
7 Paying taxes	164	123	Property tax/Rents	Privately-owned land : Ground rates annually paid to Nairobi City County (City Treasury) Ground rents annually paid to Ministry of Lands (National Land Commission) NCC-owned land : Rents monthly paid to Nairobi City County (Department of Social Services and Housing)	Typical time taken per year is 340 hours.
8 Trading across borders	148	137			Time and cost for trade are burdens.
9 Enforcing contracts	149	120			Typical number of procedures is 44.
10 Resolving insolvency	100	128			

Source: "Doing Business 2013" International Finance Corporation 2013

2.1.4 Current Environmental Status of Nairobi City

(1) Baseline Descriptions of Current Nairobi City

Nairobi City, located at 1,600 m to 1,850 m above sea level, covers an area of about 700 km² in the south-eastern end of Kenya's agricultural heartland, and has tolerable climate throughout the year. The western part of the city is the highest, with a mountainous topography, while the eastern side is lower and generally flat terrain. The Nairobi, Ngong, and Mathare rivers run through the city area, and most of household and industrial effluents are directly discharged into those rivers without any proper treatments. Minor earthquakes and tremors occasionally shake the city since Nairobi City exists next to the Rift Valley, which is active due to the tectonic movement therein.

In 1901, there were only 8,000 people living in Nairobi City. By 1948, the population number had grown to 118,000 and reached 343,500 inhabitants by 1962. Currently, that number is projected to be 3.8 million by 2015.

Much of Nairobi City's urban area is classified as unplanned settlement, driven by the rapid population growth, and urban poverty. Sprawling informal settlements hamper the spread of city's baseline social services and eventually leading to deterioration of quality of life therein. In the early 1990s, it was reported that over half of the city's population lived in those unplanned settlements. Recently, this large and rapid growing population of Nairobi City has begun to trigger environmental degradation and cause some negative impacts on human health and the economy.

(2) Major Environmental Issues

The following table is a summary of the recent environmental issues raised for the entire city [NCC, 2007]:

Table 2.1.14 Environmental Issues of Nairobi City

<p>1. Rapid Urbanisation</p> <p>Nairobi City's physical expansion has come at the expense of natural environment. Urban sprawl and construction of roads and other city infrastructure have led to the loss of forests and other natural areas. As a result, forest coverage has receded and replaced by coffee plantations. Later, demand for food of the growing population led to the transformation of the city's outskirts to other agricultural uses, which in turn were threatened by further urban growth.</p>
<p>2. Protected Ecosystem or Green Spaces</p> <p>Nairobi City has managed to retain a number of green spaces within and close to the city, which provide its residents with shady recreation areas and visitors with a glimpse of Kenya's wildlife and vegetation. They also help in maintaining the biodiversity, filter pollutants from air, and act as minor water catchments within and outskirt of the city. Although these green spaces have been protected, much of the natural vegetation surrounding the City was lost as Nairobi City's boundaries were extended numerous times to accommodate the growing population and other associated need for more land. As city expanded after its founding, much of the new settlements are unplanned.</p>
<p>3. Informal Settlement</p> <p>Nairobi City's rapid growth increased the demand for land and led to inappropriate land allocation, forcing poor people to settle in fragile and unsavoury areas where they face hardships due to lack of proper housing and public services and where they are vulnerable to environmental change. Urban poverty, lack of employment opportunities, and inadequate urban planning also conspired in gradual growth of informal settlements in Nairobi City since its founding.</p> <p>People living in Nairobi City's informal settlements, particularly slums, usually find themselves in city's most fragile areas, such as flood plains, steep slopes, river valleys, or adjacent to sewers or dump sites. The Dandora Municipal Dumping site, which receives most of city's solid waste, is only about 8 kilometers from Nairobi City's centre and is surrounded by low-income residential area. This situation exposes slum residents to floods, landslides, and health risks from contaminants. In addition, they lived in overcrowded conditions with poor sanitation, inadequate and unsafe water, make-shift shelters, and unstable social networks. They also face high degree of tenure insecurity since most of these settlements are illegal, exposing them to constant threat of harassment and eviction.</p>
<p>4. Air Pollution</p> <p>Main sources of atmospheric pollution are vehicles, industries, emissions from use of charcoal and firewood, and other municipal sources such as open burning of waste. Increasing number of cars in the city intensifies traffic and pollution problems. Vehicles emit significant levels of air pollutants, including greenhouse gases and precursors of smog. Charcoal burning, which is the very prevalent energy source in the city, emits methane (CH₄) and carbon monoxide (CO) and sends tiny particulates into the air.</p> <p>Air pollution adversely affects human health and environment. Particulates are associated with respiratory and eye diseases such as asthma, lung cancer, and conjunctivitis, especially in young and elderly who are more vulnerable. Air pollution is also major contributor to create such effects like acid rain, which has been responsible for much damage to soil, fish resources, and vegetation, often very far from the emission sources.</p>
<p>5. Water Pollution</p> <p>The city's wastewater management has not kept up with the increasing demands of the growing population and is inadequate to treat the amount of industrial and municipal effluent entering the Nairobi River and other surface waters. Nairobi City has changed from a "place of cool waters" to one in which the water is no longer potable or fit for many other useful purposes. A number of factories in Nairobi City's industrial area discharge waste directly into the Ngong River, making it the most polluted river in Kenya. Industrial waste effluents include petrochemicals and metals from micro-enterprises and "Jua-kali", as well as, oil and</p>

grease from busy roads which run off into adjacent waters.

The Nairobi River also receives improperly treated effluents from Dandora Sewage Treatment Plant and several drainage channels that gather stormwater from Nairobi City. Domestic garbage from informal settlements that have no public waste collection services also finds itself into the river similarly does sewage from pit latrines and other on-site sewerage-disposal methods. Sanitation facilities are very basic in many informal settlements, consisting of earth drains, communal water points, pit latrines shared by many people, and no systematic solid-waste disposal.

Improperly treated sewerage and uncollected garbage have contributed to the vicious cycle of water pollution, water-borne diseases, poverty, and environmental degradation. Water pollution carries environmental and health risks to communities within Nairobi City, especially the poor who may use untreated water in their homes and irrigate their gardens. Farmers along the Nairobi River and its tributaries commonly use polluted waters and raw sewage for irrigation, exposing both farm workers and customers who consume the food crops to potential health problems. Almost half of the vegetables consumed within Nairobi City are grown on the banks of polluted rivers. All these impacts affect human health and productivity and challenge Kenya's ability to reach the targets under the Millennium Development Goals (MDG).

6. Sanitation

Nairobi City faces enormous challenges in providing adequate public sanitation facilities and sewage disposal, and refuse collection; these problems are compounded as the population increases. Improperly treated sewerage and uncollected garbage have contributed to vicious cycle of water pollution, water-borne diseases, poverty, and environmental degradation.

7. Solid Waste Management

Waste management is a growing problem in Nairobi City. Increasing urbanisation, rural-urban migration, rising standards of living, and rapid development associated with population growth have resulted in increased solid waste generation by industrial, domestic, and other activities. This increase has not been accompanied by equivalent growth in capacity to address the problem. Proper management of waste has thus become one of most pressing and challenging environmental problems in the city.

Among them, listed in above table, Issues 1 (rapid urbanisation), 3 (informal settlement), 5 (water pollution), 6 (sanitation), and 7 (solid waste management) are addressed by other sections of this study report. So, the main focal points are addressed to Issues 2 (protected ecosystem/or green spaces) and 4 (air quality) within the environmental sector of this proposed MP study, and the specific issues to be addressed for the selection of the priority project within the environmental sector are summarised in Chapter 5 of this proposed MP study.

(3) Recent Air Quality Degradation of Nairobi City

Currently, some parts of Nairobi City, with heavy traffic volumes, are facing severe urban air quality degradation, and current reports and/or available data indicate that the local air quality along several major roads has rapidly deteriorated. These are mainly the results of human activities in the transport as well as energy and industrial sectors. The situation is getting worse with the increasing population and relevant growth in vehicle number, growing industrial area, deforestation on the city's fringes, and increased construction works.

The impacts of air pollution range from the ecological to the socioeconomic one. These include loss of the biodiversity, damages to vegetation, buildings and animal health due to acid rain; and eventually lead to climate change in the long term. It also affects not only the human health but also the visibility which may result in increased traffic accidents or create unpleasant living environments. The growing incidence of pollution is thus creating new challenges for the environmental integrity.

(4) On-Site Urban Air Quality Survey

In the past, several on-site roadside air quality studies were conducted around the CBD of Nairobi City. The following are the major results of these studies:

Air Quality Survey 1 (Odhiambo et. al, 2010).							
Survey Period: February-April 2003							
Survey Results							
Lead (0.051 - 1.106 $\mu\text{g}/\text{m}^3$)	<table border="1"> <tr> <th colspan="2">WHO Air Quality Guideline</th> </tr> <tr> <td>PM10: 20 $\mu\text{g}/\text{m}^3$</td> <td>Annual mean</td> </tr> <tr> <td>50 $\mu\text{g}/\text{m}^3$</td> <td>24-hour mean</td> </tr> </table>	WHO Air Quality Guideline		PM10: 20 $\mu\text{g}/\text{m}^3$	Annual mean	50 $\mu\text{g}/\text{m}^3$	24-hour mean
WHO Air Quality Guideline							
PM10: 20 $\mu\text{g}/\text{m}^3$		Annual mean					
50 $\mu\text{g}/\text{m}^3$		24-hour mean					
NO ₂ (0.011-0.976 ppm)							
NO (0.001-0.2628 ppm)							
PM10 (66.66 - 444.45 $\mu\text{g}/\text{m}^3$)							
Remarks							
Study results showed strong correlation between fine (0.4 μm) particulates, NO _x , and motor vehicle density, indicating urban traffic as major source for both fine particulates and NO _x air quality. It is noted that specific description of this survey program was not provided; therefore, direct comparison with WHO Guideline values is not possible but comparable for this preliminary evaluation.							

Air Quality Survey 2 (Kinney et.al., 2012)							
PM2.5 is a concern							
Survey Period: July 2009							
Survey Results							
Measured values ranging between 128.7 and 18.7 $\mu\text{g}/\text{m}^3$ were observed at 100 m downwind of major intersections in Nairobi City.							
<table border="1"> <tr> <th colspan="2">WHO Air Quality Guideline</th> </tr> <tr> <td>PM2.5: 10 $\mu\text{g}/\text{m}^3$</td> <td>Annual mean</td> </tr> <tr> <td>25 $\mu\text{g}/\text{m}^3$</td> <td>24-hour mean</td> </tr> </table>		WHO Air Quality Guideline		PM2.5: 10 $\mu\text{g}/\text{m}^3$	Annual mean	25 $\mu\text{g}/\text{m}^3$	24-hour mean
WHO Air Quality Guideline							
PM2.5: 10 $\mu\text{g}/\text{m}^3$	Annual mean						
25 $\mu\text{g}/\text{m}^3$	24-hour mean						
Remarks							
Vertical dispersion experiment revealed a decrease from 119.5 $\mu\text{g}/\text{m}^3$ on the street level to 42.8 $\mu\text{g}/\text{m}^3$ on a 3rd-floor rooftop in CBD. It is noted that specific description of this survey program was not provided, so that direct comparison with WHO Guideline values is not possible but comparable for this preliminary evaluation.							

It is noted that no long-term continuous air quality survey and/or monitoring work has been conducted across the Nairobi City yet. However, the total number of vehicles circulating inside the city has been increasing continuously, and the entire traffic condition such as the local traffic jams, is getting worse without any significant improvement in the city's infrastructure. So, it is most likely that

current city-wide air quality condition has deteriorated further from the time when those two air quality studies were conducted.

Currently, the Ministry of Land, Housing, and Urban Development (MLH&UD) (former Ministry of Nairobi Metropolitan Development) is preparing for the study report in collaboration with the University of Nairobi (UON).

(5) Vehicle Inspection and Maintenance (I/M) System

1) Current Vehicle I/M Framework

In Kenya, the vehicle inspection and maintenance is administrated by the National Transport and Safety Authority (NTSA), the Ministry of Transport and Infrastructure (MOTI) after October 2013 (Note: it was previously organised by the Motor Vehicle Inspection Unit of Kenya Police). According to the Traffic Act, Chapter 403 Law of Kenya, owners of public service vehicles (PVSS) and/or commercial vehicles have to take their vehicles for inspection every year for renewal of their registrations. However, the legal enforcement of this law does not seem to be appropriate and most PVSSs and commercial vehicles circulating across the city are ill-conditioned, and emitting black smokes frequently. It is noted that there is no specific regulation yet for I/M for passenger cars.

2) Vehicle I/M for Imported Used Vehicles

In Nairobi City, certain number of vehicles circulating are imported used vehicles. Those imported used vehicles are inspected before the shipping from designated countries such as Japan, UAE, UK, Singapore, and South Africa under the Kenya Bureau of Standards (KEBS) Regulation (Legal Notice 78 of 15/07/2005). KEBS has signed contracts with several overseas inspection organisations such as Auto Terminal Japan Ltd. (ATJ), Japan Export Vehicle Inspection Center Co. Ltd. (JEVIC), and Quality Inspection Services Inc. Japan (QISJ) for pre-export verifications of the conformity to standards for used vehicles. Basically, those international inspection companies are paying respect to KEBS rules, therefore, most of the imported used vehicles are relatively well-conditioned in the beginning, but tend to be in ill-conditioned after a long run usage with improper vehicle inspection and maintenance [Toyotsu, Personal Communication, 2013] due to the weak legal enforcement of the current Vehicle Inspection Law.

(6) Air Pollution and Human Health

Good health is a basic component of a sound human society and a necessity for earning a livelihood. The main health issues in Nairobi City include access to health facilities, child and maternal mortality, and incidences of certain diseases such as HIV/AIDS, tuberculosis and malaria, and others, and most of these diseases are closely related to the state of the natural and social environment.

Recent data shows that the leading cause of mortality is due to respiratory ailments. In 2000, respiratory diseases and malaria accounted for over 50% of all deaths in the city. The five most important causes of mortality in children under five years old include the acute respiratory infection (ARI), diarrhea, measles, malaria, malnutrition, and anemia (see Table 2.1.15). All these are closely related to the living environment.

Table 2.1.15 Top Ten Major Causes of Mortality in Nairobi City (1998- 2000)

	1998	1999	2000
Respiratory diseases	37.0	27.0	35.5
Malaria	23.1	18.8	14.7
Accident	-	14.2	10.0
Skin disease	14.4	6.6	7.7

	1998	1999	2000
Diarrhea	9.3	8.3	9.5
Urinary tract infection	4.6	Not indicated	6.0
Intestinal worms	4.1	Not indicated	Not indicated
Disease of puerperium and child birth	3.9	7.3	Not indicated
Eye infections	3.2	7.9	6.7
Ear infections	-	9.4	0.8

Source: City of Nairobi Outlook, 2007

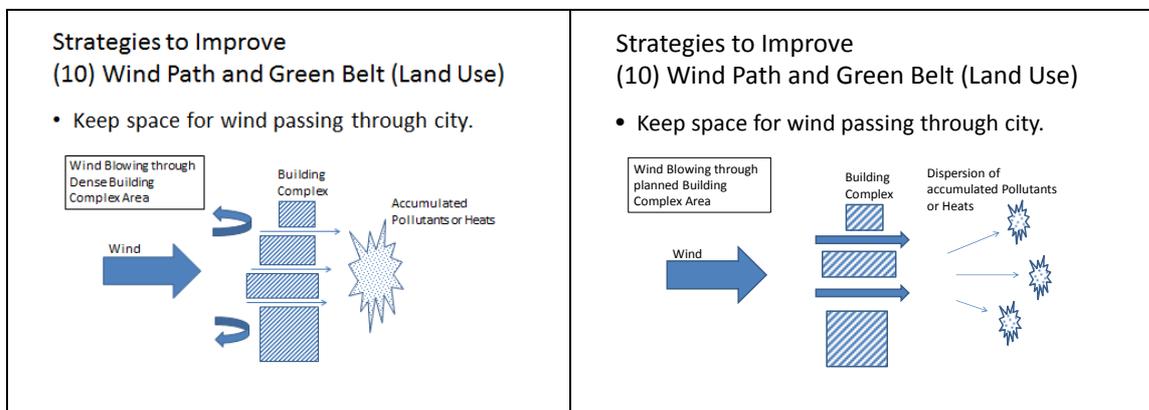
(7) Heat Island and Green Space

Importance of the conservation of several ecosystems such as forest reserves and the national park is already mentioned in several prominent study reports [e.g., UNEP, 2009], so the interaction between the urban infrastructure and the green spaces/or green belt are mainly focused in order to achieve a sound urban environment in this section.

The urban geometry is one of the important factors leading to the modification of local urban climate. Specifically, the urban land use pattern and its building/or housing complex geometry that relates to the urban canopy layer (UCL) influences aspects like increased substrate heat storage due to greater thermal admittance of the surface materials and decreased latent heat fluxes arising from the replacement of the soil and vegetated surfaces such as the green spaces with impervious materials. It also leads to increase in the solar radiation absorption due to lower albedo of urban materials and reduced wind speeds caused by the aerodynamically rougher urban fabric. There is also the release of human activity-related heat from domestic, commercial, industrial, and transport energy sources and increased atmospheric radiation absorption from greenhouse gases.

According to the current report [Makokha and Shisanya, 2010], it is reported that the thermal behavior of the several urban landscapes showed noticeable differences in their cooling and warming rates over the four different climatic periods of Nairobi City. The largest cooling and warming rates were generally found during the hot-dry period while the lowest during the cool-dry period. Except for the cool-dry period, all the remaining three periods had the urban canyon and the urban park and green space sites recorded lower cooling rates than the suburban site. Also, it is reported that the highest cooling rates were recorded at the suburban site while the lowest at the urban site. The reduced cooling rates at the urban site were attributed to the increased heat absorption by urban fabric.

Generally, urban park sites and/or green spaces show relatively moderate cooling and warming rates, due to the moderating effects of these vegetations. Therefore, to reduce excessive nocturnal heat loads and increase nocturnal cooling, the urban landscape shall have adequate open and green spaces, which will enhance air circulation and less radiation absorption during the day. Furthermore, it would be beneficial to establish a wind path through an appropriate location of urban green spaces leading to the establishment of a smooth citywide air circulation that would sweep away the accumulated pollutants inside of CBD, as mentioned in the previous section (Figure 2.1.19).



Source: JICA Study Team (JST)

Figure 2.1.19 Creation of Urban Wind Path through Design of Sustainable Urban Land Use Pattern

(8) Summary

From this review, it can be said that the current environmental and social issues that Nairobi City is facing are regarded as a compound one, therefore, these issues shall be addressed through a comprehensive and integrated approach addressing not only environmental factors but also other relevant aspects such as city-wide land use, transport policy, energy, the social system, governance, and enforcement.

2.2 Review of Urban Conditions

2.2.1 Analysis of Present Land Use

(1) Land hold and land tenure

A land hold (land ownership) and a land tenure are distinguished clearly in Kenya. About 80% of the lands in Nairobi City are owned by the government, but those lands are held by several types of users. About 41% of government lands (33% of total land) are alienated to private and other parties.

Table 2.2.1 Land Use by Land Hold in Nairobi City

Category	Subcategory	Area(sq.km)	%
Government land	1) Forest reserve	21	3.1
	2) Other government reserve	77	11.3
	3) Township	93	13.6
	4) Alienated land	225	32.9
	5) Un-alienated land	16	2.3
	6) National parks	117	17.1
	7) Open water	-	-
	Subtotal	549	80.3
Freehold land	8) Smallholder schemes	-	-
	9) Other	135	19.7
	Subtotal	135	19.7
Grand Total		684	100.0

Source: Statistics Abstract 2005

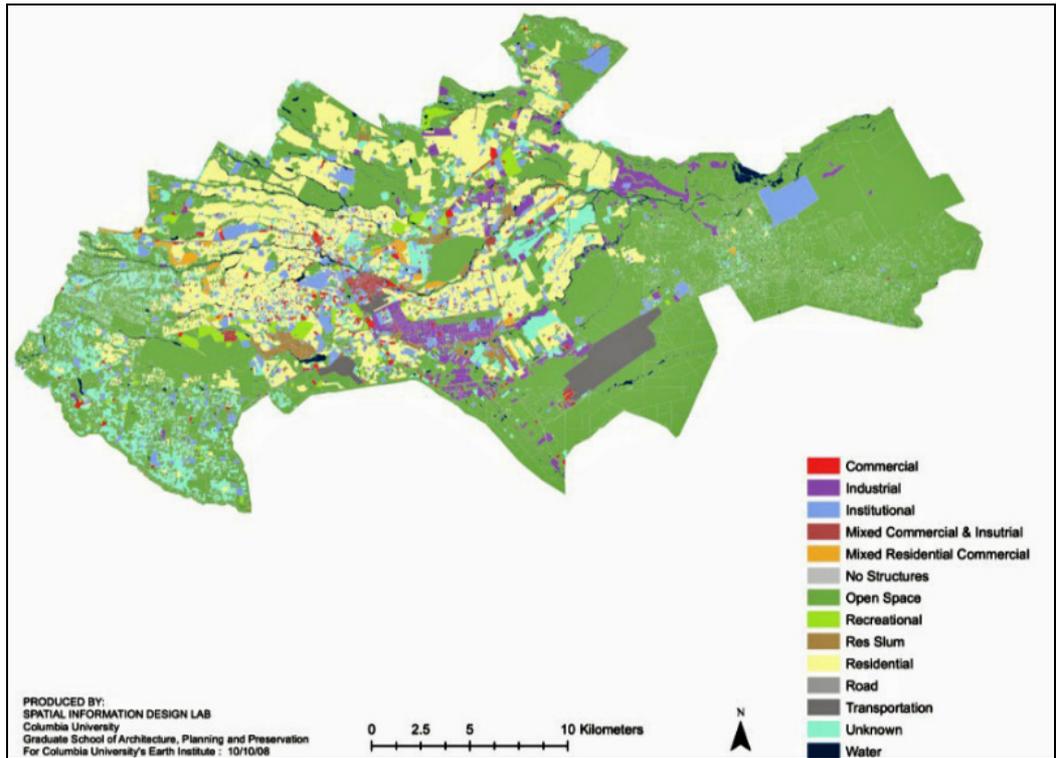
(2) Land use

Land use surveys for the whole area of Nairobi City were conducted by the Centre of Sustainable Urban Development (CSUD) of Colombia University in collaboration with Nairobi University in 2005 and 2010. The land use map was developed from a combination of analysis of satellite images and ground surveys. The composition of land use is summarised as shown below.

Table 2.2.2 Land Use Composition

Land Use	Area (sq. km)	
Residential	105.2	15.1%
Commercial	5.9	0.8%
Industrial	22.2	3.2%
Mixed commercial and industry	3.6	0.5%
Mixed residential and commercial	4.2	0.6%
Institutional	39.8	5.7%
No structures	0.3	0.0%
Open space	332.0	47.8%
Recreational	8.7	1.3%
Res slum	7.8	1.1%
Transportation	15.5	2.2%
Unknown	42.3	6.1%
Water	10.9	1.6%
Total	598.2	86.1%
National Park	96.9	13.9%
Grand Total	695.1	100.0%

Source: JICA Study Team (JST)



Source: JICA Study Team (JST)

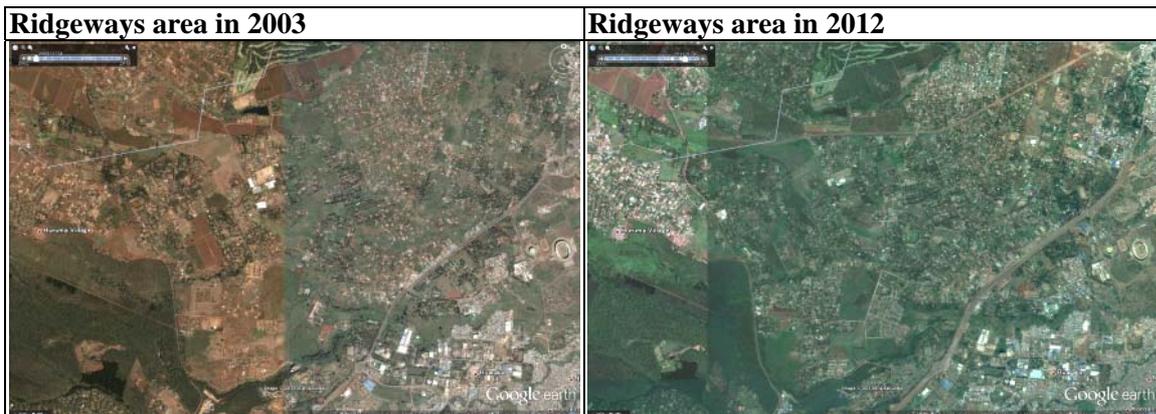
Figure 2.2.1 Land Use Map Done by Columbia University and Nairobi University

The JICA Study Team obtained the satellite images of Nairobi City in 2012, and updated the land use map of Colombia University.

(3) Land use change during the last decade

A lot of changes have taken place between 2003 and 2012. Typical land use change in Nairobi City is summarised as shown below.

1) Soil rich farmland to residential area

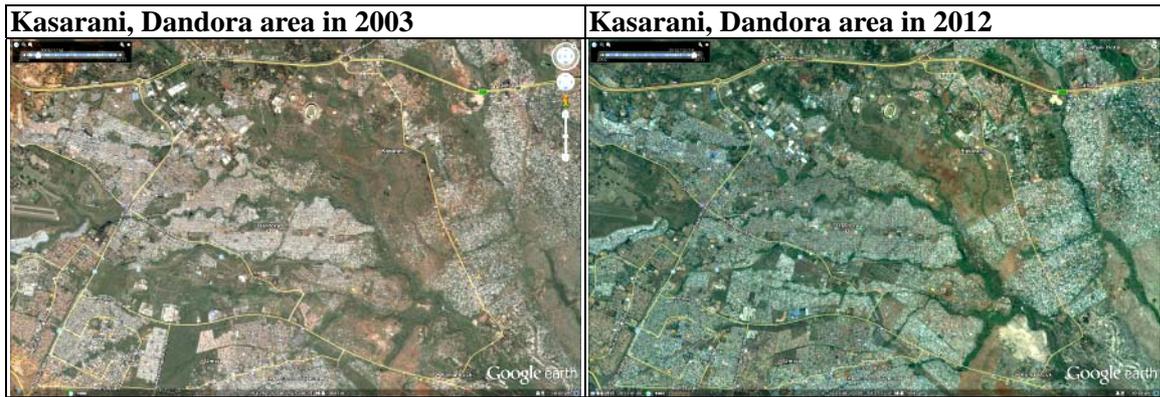


Source: Google Earth

Figure 2.2.2 Satellite Image of Ridgeways Area

The northern and eastern parts of Nairobi City have rich red soil being utilised for tea/coffee plantation or other agricultural activities. These plantations have been recently developed into residential areas.

2) Grassland to residential area

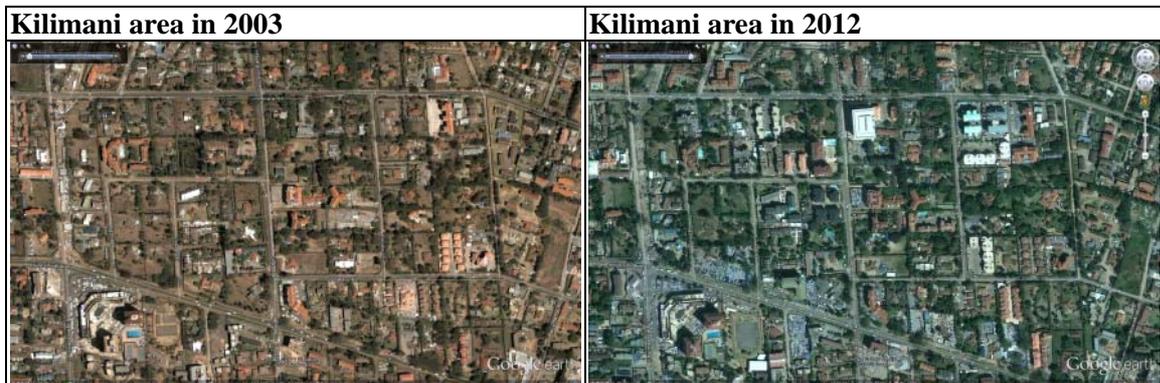


Source: Google Earth

Figure 2.2.3 Satellite Image of Kasarani, Dandora Area

The eastern part of Nairobi City is mainly lower grassland and is also changed into residential areas.

3) Detached house to apartment or office



Source: Google Earth

Figure 2.2.4 Satellite Image of Kilimani Area

Highlands in the western area of Nairobi City were developed as estates for European settlers before the independence. Recently, low-rise detached houses for single families are converting into high-rise apartments or offices.

4) River bank to informal settlements



Source: Google Earth

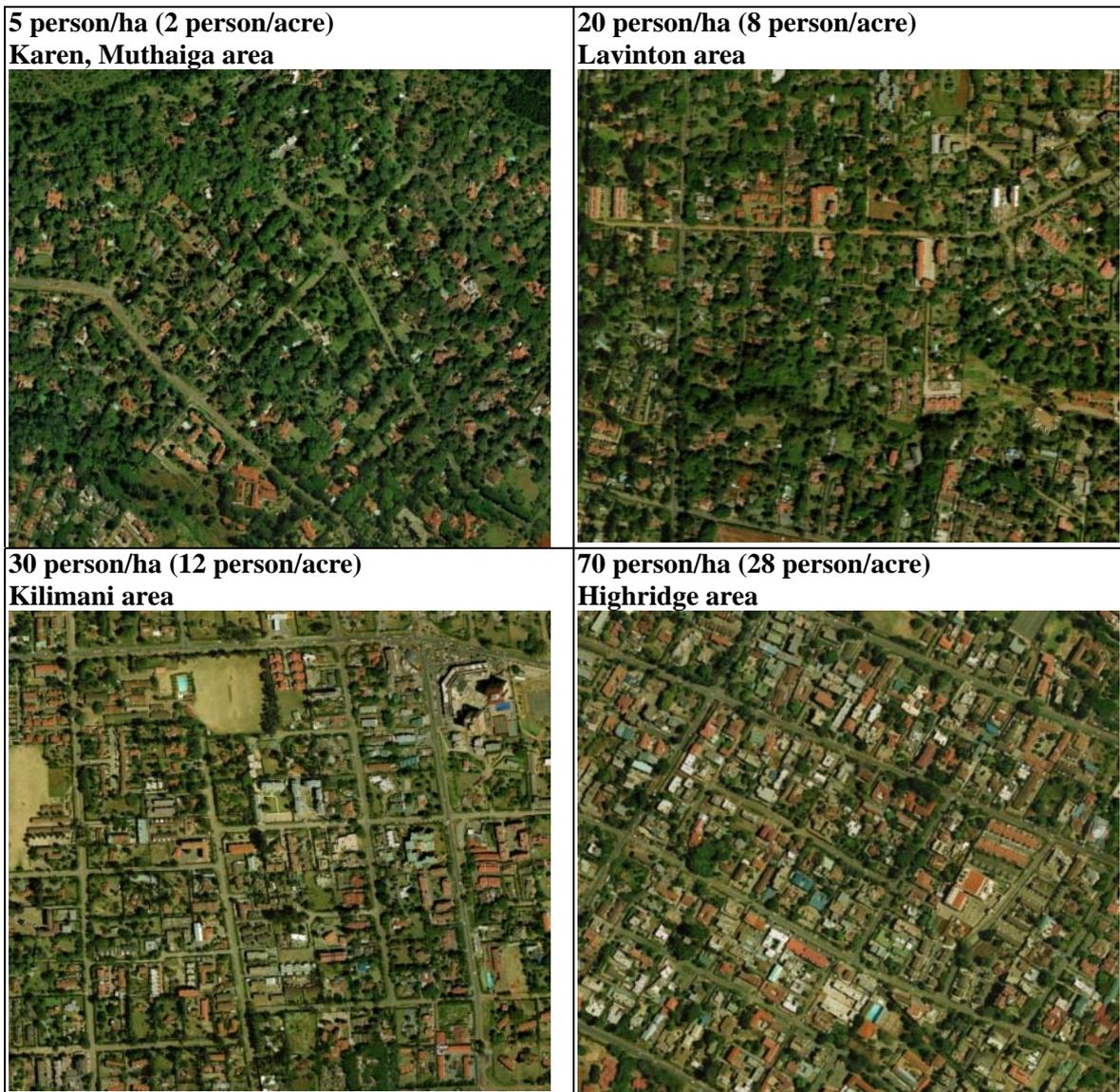
Figure 2.2.5 Satellite Image of Eastleigh South to Uhuru Estate

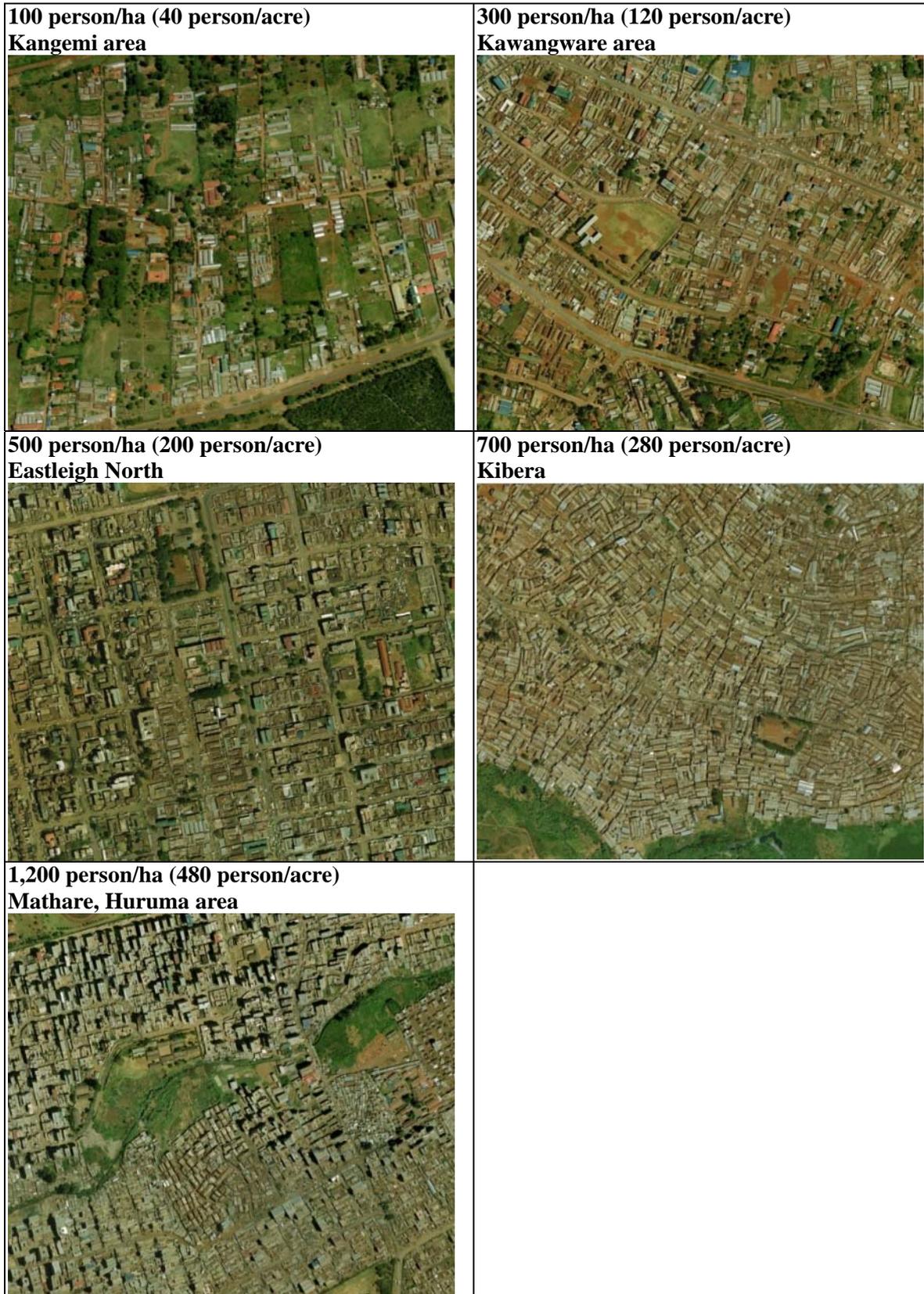
Informal settlements on the river banks are still spreading rapidly. A research paper indicated that half of increased population during the last decade settled in so-called slum areas.

(4) Typical development pattern and population density

These satellite images below show the relationship between typical development patterns at different population densities in Nairobi City. Karen, Muthaiga area showed lowest density in Nairobi City of 5 persons/ha, Lavinton and Kilimani areas showed about 20 persons/ha and 30 persons/ha, respectively. Mathare, Huruma area showed the highest density over 1,000 persons/ha.

European average population density is from 50 to 100 person/ha while the United States average is around 10 to 20 persons/ha. The Nairobi Metropolitan Growth Strategy 1973 recommended an average density of 15 persons per acre (equivalent to 37.5 person/ha).





Source: JICA Study Team

Figure 2.2.6 Typical Development Pattern

2.2.2 Urban Services

(1) Educational Services

According to the NCC Department of Education, the total number of enrolled primary schools students in 2011 was 336,723 compared to 408,888 in 2012, underscoring either a sharp increase in primary school attendance or inconsistency in the data.

Among public primary schools in Nairobi City, the Embakasi-Njiru District has the largest number of schools while Langata and Kamukunji districts have the fewest. Districts such as Starehe and Westlands have almost as many number of schools as Embakasi and Njiru, a district with almost 2.5 times more primary school students. In addition, there are almost as many non-formal schools as public schools in Nairobi City, especially in the Embakasi District and in Kasarani, where there are more non-formal schools than public. Embakasi also covers 35% of the total land area of Nairobi City and has the highest rate of growth among all districts.

The data suggests evidence of a general discrepancy between the school capacity in Nairobi East and Nairobi West, and an indication of possible overpopulation in Eastland schools. Future planning of educational facilities should concentrate on increasing the number of schools in Nairobi East, in order to minimise overpopulation and align with population growth trends.

Table 2.2.3 Number of Schools and Students in Primary Schools in Nairobi City, 2012

	District	Students in the Primary School	No. of Schools
1	Dagoretti	46,181	25
2	Embakasi and Njiru	104,566	39
3	Kamukunji	18,825	16
4	Kasarani	87,791	25
5	Lang'ata	38,050	15
6	Makadara	26,489	30
7	Starehe	44,685	36
8	Westlands	42,301	30
	Total	408,888	216

Source: City Education Department, -, Nairobi City County (NCC)

Table 2.2.4 Percentage of Type of Schools by District in Nairobi City, 2012

	District	Public	Private	Non-formal	Total
1	Dagoretti	5.6	2.0	3.8	11.3
2	Embakasi and Njiru	11.1	3.4	11.0	25.6
3	Kamukunji	3.7	0.7	0.2	4.6
4	Kasarani	7.4	2.6	11.5	21.5
5	Lang'ata	3.6	1.5	4.2	9.3
6	Makadara	5.0	0.7	0.8	6.5
7	Starehe	6.3	0.5	4.1	10.9
8	Westlands	5.5	2.8	2.0	10.3
	Total	48.2	14.2	37.6	100.0

Source: City Education Department, Nairobi City County (NCC)

(2) Health Services

Among the sick population of Nairobi City, approximately 47% preferred private health care providers, including private dispensary hospitals and private clinics. Only 8% preferred major public facilities such as public health care centres and district hospitals, though 13% preferred public dispensaries. This infers that private health care facilities may be more appealing for sick, perhaps for reasons of reliability, quality, or accessibility or others.

Kamukunji and Embakasi have the highest number of major health facilities. Similar to schools, there are almost as many health facilities in Embakasi as in Kasarani and Westlands, though the population of Embakasi is more than both combined districts.

Table 2.2.5 Type of Health Care Providers Preferred by Sick Population in Nairobi City

Health Care Provider	Percentage (%)
Private Dispensary Hospital	23.8
Private Clinic	22.8
Pharmacy/Chemist	14.1
Public Dispensary	13
Missionary Hospital /Dispensary	8.4
Referral Hospital	7.9
Public Health Centre	5.1
District Provincial Hospital	3.3
Other	0.8
Kiosk	0.8
Traditional Healer/Herbalist	N/A

Source: Kenya National Bureau of Statistics (KNBS)

Table 2.2.6 Number of Major Health Facilities by District

Type of Facility	Kamukunji	Makadara	Dagoretti	Langata	Starehe	West.	Kasarani	Embakasi
Medical Clinic	25	37	12	46	54	63	63	101
Dispensary	13	17	31	24	22	17	41	11
Health Centre	7	2	17	7	2	10	16	24
VCT Centre	2	3	9	4	11	2	11	7
Other Hospital	2	3	2	6	4	8	10	5
Nat. Referral Hospital	0	0	1	0	0	1	0	0
District Hospital	0	0	1	0	1	0	0	2
Medical Centre	1	0	0	0	0	2	0	0
Total Facilities	50	62	73	87	94	103	141	150

Source: E-Health Kenya Facilities

According to the World Bank, the Kenyan national average of beds/1,000 people from 2003-2007 was 1.4. However, there is no global target for the number of beds per country, since impatient services vary by several factors, including burden of disease and demographics.

Density of beds per population may not be as accurate at assessing adequate health services as health care affordability. Calculations showed that the average number of beds per 1,000 people in Nairobi City is 0.74, a significant decrease from the estimated Kenyan national average of 1.4. However, as the capital city is expected to have more health facilities than its surrounding cities, there may be some inconsistencies in the data. Similar to schools and major health facilities, Embakasi has many beds per 1,000 people as Dagoretti, which has one-third of the population of the Eastlands District.

Table 2.2.7 Beds/1,000 People for All Health Facilities by District

District	Total No. of Beds	Total Population	Beds/1,000 people
Westlands	1,093	247,102	0.23
Starehe	848	274,607	0.32
Makadara	332	218,641	0.66
Langata	748	355,188	0.47
Kasarani	350	525,624	1.50
Kamukunji	1,061	261,855	0.25
Embakasi	737	925,775	1.26
Dagoretti	1,845	329,577	1.26
Average No. of Beds/1,000 People			0.74

Source: E-Health Kenya Facilities

(3) Community Facilities

Community facilities can be conduits for social activity such as recreational parks, channels for social services such as fire stations or children's homes, and can also have positive economic benefits for an area, including stadiums and markets. There are 45 markets in Nairobi City owned by NCC and 26 community halls.

1) Temporary Community Facilities

It is also important to recognise temporary community facilities, predominantly those that utilise open air parking lots for recreational areas and markets. In the Central Business District, these include skating facilities in Aga Khan Walk and Masaa Market located in the parking lot of Kenya's Supreme Court Building. Their uses are approved by the NCC, however, due to their temporary nature, they may be overlooked among other recreational facilities or more permanent markets. These cultural and recreational areas can serve to provide mixed and changeable uses which stimulate the local economy and social activity within the city.

Table 2.2.8 Stadiums and Sport Facilities

Name of Facility	Location	Division	Seating Capacity
City Stadium	Jogoo Road	Kaloeleni	15, 000
Moi Stadium	Thika Highway	Kasarani	60, 000
Nyayo Stadium	Uhuru Highway	Nairobi West	35, 000
Joseph Kangethe Mini Stadium	Woodley	Kibera	~10, 000
Kamukunji	Kamukunji	Kamukunji	~10, 000
Jericho Lumumba	Jericho	Makadara	~10,000
Desert	California		~1,000

Source: Nairobi City County (NCC)

2) Stadiums and Playgrounds

There are seven stadiums in Nairobi City, which capacity ranges from less than 1,000 spectators at Desert Stadium to 60,000 spectators at Moi Stadium. There are only 18 registered public playgrounds throughout the city, which indicates a severe undersupply of recreational and open spaces for more than 400,000 primary school age children in the city.

Table 2.2.9 Public Playgrounds

	Name of Playground	Location
1.	Hamza	Makadara Jogoo Road
2.	Uhuru	Makadara
3.	Shauri Moyo	Kamukunji
4.	Bahati	Kamukunji
5.	Kaloleni	Nxt to Kaloleni Social Hall
6.	Buruburu Flats (BBF)	Buruburu opp. Police Station
7.	Umeme	Ziwani
8.	Huruma	Huruma
9.	Ngong Road	City Inspectorate Grounds
10.	Canon Apollo	Mbotela
11.	Kariobangi	Next to Kariobangi Social Hall
12.	Kawangware	Dagoretti behind BP
13.	Kinyago	Biafra Slums, Kamukunji
14.	Soweto	Kahawa West, Kasarani
15.	Bomas	Next to Bomas of Kenya
16.	Kibera DO	Next to DO Office, Kibera
17.	Soweto	High Ridge College Ground
18.	Lungalunga	Star of Hope Primary School, Lungalunga Slums

Source: Nairobi City County (NCC)

Table 2.2.10 Community Centres by District and Capacity

	Name of Community Hall	District	Capacity
1	Mbotela Community Centre	Makadara	200
2	Jericho Community Centre	Makadara	1,200
3	Lumumba Community Centre	Makadara	100
4	Bahati Community Centre	Kamukunji	200
5	Shauri Moyo Community Centre	Kamukunji	100
6	Mathare North	Kasarani	700
7	Kariokor Community Centre	Starehe	1,200

	Name of Community Hall	District	Capacity
8	Pumwani Community Centre and Hall	Kamukunji	1,600
9	Muthurwa Community Centre	Kamukunji	1,100
10	Kaloleni Community Centre	Makadara	1,600
11	Kariobangi Community Centre	Kasarani	150
12	Dandora Sports Complex	Embakasi	30
13	Dandora I	Embakasi	100
14	Dandora II Community Centre	Embakasi	100
15	Kayole I Community Centre	Embakasi	700
16	Kayole II Community Centre	Embakasi	700
17	Embakasi Community Centre	Embakasi	130
18	Soweto Community Centre	Embakasi	250
19	Ruai Community Centre	Embakasi	120
20	Kariobangi South Community Centre	Kasarani	(under construction)
21	Karen Community Centre	Langata	110
22	Ngong Road Community Centre	Dagoretti	70
23	Waithaka Community Centre	Dagoretti	130
24	Kangemi Community Centre	Westlands	90
25	Joseph Kangethe Community Centre	Dagoretti	90
26	Ziwani Sports Centre	Starehe	600

Source: Nairobi City County (NCC)

3) Markets

The population of market traders are mostly low income earners, who venture into micro-enterprises activities. This economic sector plays an important role in the city economy in terms of employment generation and delivery of urban services, accounting for about 60% of working population and 20% of GDP. The markets also serve as alternative trading spaces for hawkers, offering a wide variety of choices of goods effectively by lowering the prices of common goods, and are often more conveniently located to traders and buyers than formal stores.

However, a number of the NCC markets were constructed during the colonial era and the market conditions have deteriorated over time. Further, the number of traders and buyers has increased considerably, putting pressure on the infrastructure and capacity of existing facilities. These facilities require upgrading and expansion to remain viable.

Table 2.2.11 Types and Capacity of City Council Markets by Ward

Type of Market	Name	No. of Stalls	Owner	Location/Ward
A. Wholesale Markets	Wakulima Market	8	CCN	Kamukunji
B. Hawkers Markets	Muthurwa Hawkers Market	10,000 (traders)	NCC	Kamukunji
C. Rental Markets	Landhies Road	72	NCC	Kamukunji
	Shauri Moyo	308	NCC	Shauri Moyo
	Jogoo Road	450	NCC	Maringo
	Umoja I	320	NCC	Umoja
	Westlands	109	NCC	High Ridge
	Westland Curio	300	NCC	High Ridge
	Quarry Road	274	NCC	Pumwani/Bondeni
	Ngara	319	NCC	Ngara
	Karen	83	NCC	Karen
	Githurai	298	NCC	Githurai
	New Pumwani	44	NCC	Eastleigh South
	Dandora A-F	392	NCC	Dandora
	Kariokor	206	NCC	Ziwani
City Market	143	NCC	Central	
D. Development Tenant Purchase Markets	Kenyatta	608	NCC	Kenyatta Golf Course
	Kayole	159	NCC	Kayole
	Kahawa West	335	NCC	Kahawa
	Mathare North	53	NCC	Mathare A
	Umoja II (A & B)	72	NCC	Umoja

Type of Market	Name	No. of Stalls	Owner	Location/Ward
E. Self-constructed Markets	Kibera	678	NCC	Kibera
	Jericho	476	NCC	Hamza Lumumba
	Kariobangi North	696	NCC	Kariobangi North
	Kariobangi South	156	NCC	Kariobangi South
F. Open Air Markets	New Ngara	Open air	NCC	Ngara
	Kiamaiko (Goats)	Open air	NCC	Mathare
	Maasai	Open air	NCC	Central
	Sunken (High Court)	Open air	NCC	Central
	Yaya	Open air	NCC	Kibera
	City Stadium	Open air	NCC	Kaloleni
	Maziwa	Open air	NCC	Shaurimoyo
	Jericho	Open air	NCC	Uhuru
	Kahawa	Open air	NCC	Kahawa
	Mutindwa	Open air	NCC	Harambee
	City Park	Open air	NCC	Parklands
	Toi	Open air	NCC	Kibera
	Kangemi	Open air	NCC	Kangemi
	Kawangware	Open air	NCC	Kawangware
	Korogocho	Open air	NCC	Korogocho
	Gikomba	Open air	NCC	Pumwani
	Kayole Soweto	Open air	NCC	Kayole
	Westgate	Open air	NCC	Westlands
	Woodley	Open air	NCC	Woodley
Dandora Terminus	Open air	NCC	Dandora	

Source: Nairobi City County (NCC)

(4) Planning Implications

A main feature of the 1927 Master Plan for Nairobi City is the segregation of racial classes into various zones throughout the city. Particularly, Nairobi East was restricted to African residents, while the Western regions, for European settlers. The current data on the distribution of social services and facilities throughout Nairobi City's nine districts suggests that inequalities in the facilities between Nairobi East and Western regions may be reflective of the disproportionality of resources caused during the earlier period.

Although the Embakasi District constitutes 35% of the county's total land area and has the highest growing population of all the districts, it has many schools, major health facilities, and hospital beds as a district with one half to one third of its population, including Starehe, Westlands, Dagoretti, and Kasarani, respectively. The Embakasi District is also home to Nairobi City's largest informal settlement areas, including Mathare and Mukuru slums. The rising population growth trends in the informal settlements and in the Eastlands area exacerbates the inadequacy of sufficient social services.

It is also important to consider the role of community facilities as a generator of employment and activity and in creating nodes and destinations within the city. Markets, which play a large role in supplying low cost goods to a multitude of residents and employment for a majority of workers, require upgrading and infrastructure improvements while recreational facilities such as playgrounds, stadiums and others must be strategically planned within the urban fabric.

In considering the benefits of socioeconomic and cultural assets to urban development, the Nairobi Integrated Urban Development Master Plan (NIUPLAN) will strategically distribute necessary social services according to the current and anticipated population growth areas, specifically in Nairobi East and plan for social, recreational, and commercial facilities which promote activity, employment, and destinations within the city.

CHAPTER3 INSTITUTION AND REGULATORY CONDITIONS

3.1 Review of Related Laws and Regulations

3.1.1 Urban Planning

(1) 2010 Constitution of Kenya

The 2010 Constitution of Kenya is the current constitution of the Republic of Kenya, which is now in force, replacing the 1969 Constitution, that itself was amendments of the 1963 Independence Constitution. The constitution was presented to the Attorney General of Kenya in April 2010, officially published in May 2010, and was subjected to a referendum in August 2010. The constitution provides that there shall be a county government for each county, consisting of a county assembly and a county executive.

With regard to land, the constitution provides that land in Kenya shall be held, used, and managed in a manner that is equitable, efficient, productive, and sustainable, and in accordance with the following principles:

- (i) Equitable access to land;
- (ii) Security of land rights;
- (iii) Sustainable and productive management of land resources;
- (iv) Transparent and cost effective administration of land;
- (v) Sound conservation and protection of ecologically sensitive areas;
- (vi) Elimination of gender discrimination in law, customs, and practices related to land and property in land; and
- (vii) Encouragement of communities to settle land disputes through recognised local community initiatives consistent with this constitution.

(2) Outline of the laws and regulations for urban planning

After the issuance of the 2010 Constitution of Kenya, laws and regulations have been revised to adjust to the new constitution. Laws related to urban development can be classified into: (i) laws concerning government management, (ii) laws concerning urban and physical development, and (iii) laws concerning environment.

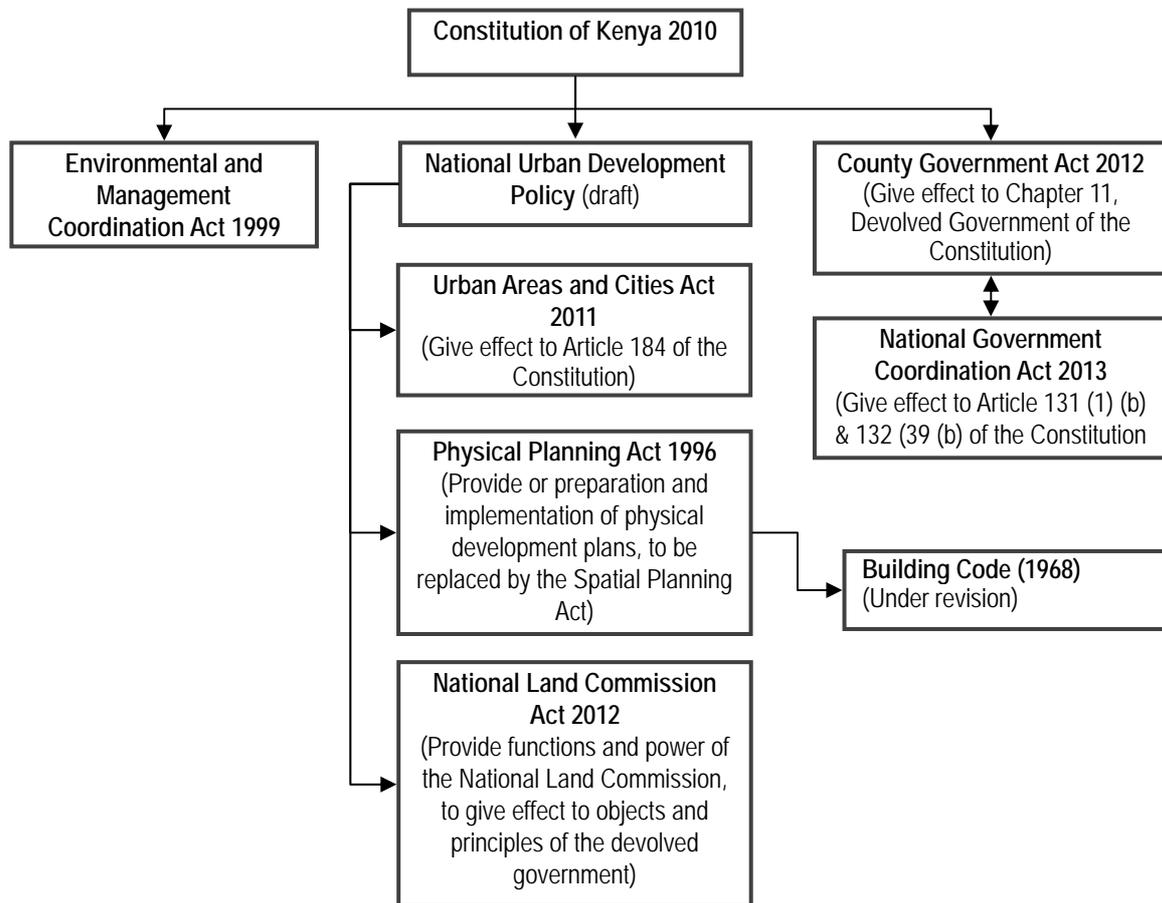
The County Government Act 2012 and National Government Coordination Act 2013 define the role and function of the county government and coordinating function of the national government, respectively.

The National Urban Development Policy (draft), which is considered as an “umbrella policy”, aims at strengthening development planning, urban governance, and management, and promotion of urban investment and delivery of social and physical infrastructure in urban areas throughout the country. The Urban Areas and Cities Act 2011 states the definition and management of urban areas and cities. The Physical Planning Act 1996 defines the urban development management. The National Land Commission Act 2012 describes the functions of the National Land Commission and the objects and principles of devolved government in land management and administration. While the Building Code, which specifies the condition of building construction, supplements the development control mentioned in the Physical Planning Act in technical aspects.

The Environment Management Coordination Act (EMCA) provides for the establishment of an appropriate legal and institutional framework for the management of the environment (This act is also described in Section 2.2.2 Environment).

The Integrated Urban Development Master Plan for Nairobi City (NIUPLAN) will be prepared chiefly under the framework of the County Government Act with specification of the Urban Areas and Cities Act, because the entire area of Nairobi City County (NCC) is an urban area.

The following figure shows the relationship of laws.



Source: JICA Study Team (JST)

Figure 3.1.1 Structure of Concerned Laws and Plans

The following table shows the laws and regulations related to urban development management and their characteristics.

Table 3.1.1 Management of Urban Development

Policy, Act	Coverage	Relation with Urban Planning
County Government Act 2012	County	<ul style="list-style-type: none"> ● Part XI County Planning: ● Governance
National Government Coordination Act 2013	National government and county government responsibilities	<ul style="list-style-type: none"> ● To establish an administrative and institutional framework for the coordination of national government functions at the national and county level of governance. ● Chapter IV: Collaboration and dispute resolution between the national and county governments on issues of apparent concurrent mandate
National Urban Development Policy	Urban area management	<ul style="list-style-type: none"> ● Chapter 5: County urban planning ● Governance
Urban Areas and Cities Act 2011	Urban areas and cities management	<p><u>Planning</u></p> <ul style="list-style-type: none"> ● Part V Integrated development planning <p><u>Controlling</u></p> <ul style="list-style-type: none"> ● Integrated development plan will be a basis for development control (36, (1), (g))
Physical Planning Act 1996	Physical development for the selected area and selected purpose for the concerned administrative unit	<p><u>Planning</u></p> <ul style="list-style-type: none"> ● Part IV Physical development plans <p><u>Controlling</u></p> <ul style="list-style-type: none"> ● Part V Control of development: physical development: building construction control, development control (change of users, extension of user, subdivision)
National Land Commission Act 2012	Land management mechanism	<ul style="list-style-type: none"> ● Land management by the National Land Commission and devolved government in land management and administration
Building Code 1968	Building construction control	<ul style="list-style-type: none"> ● Supplement the control of development stated in the Physical Planning Act 1996
Environmental Management and Coordination Act 1999	Environmental management	<ul style="list-style-type: none"> ● Describes the legal and institutional framework of environmental management.

Source: JICA Study Team (JST)

1) County Government Act 2012 (former Local Government Act Cap 265)

The County Government Act 2012, which essentially defines the roles and management of “a county government”, was newly stipulated to replace the former Local Government Act Cap 265. The act aims at giving effect to Chapter 11 (Devolution) of the 2010 Constitution of Kenya (COK), and more specifically to provide for the county government powers, functions, and responsibilities in the delivery of services and for connected purposes. After the county government is in place, the administration of Kenya has two pillars, namely, “National Government” and “County Government” at the local level.

The County Government Act 2012 is composed of fifteen parts, and states the management of county government from assembly, executive, public service, citizen participation, to county planning. amongst them, Parts VIII and IX provide the fundamental principles regarding the citizen participations and public communication and access to information, respectively. Also, Part X mentions the importance of civic education. Contents of the act are summarised below.

Contents	
Part I	Preliminary
Part II	County governments
Part III	County assembly
Part IV	Electoral wards
Part V	County executive
Part IV	Decentralised units
Part VII	County public service
Part VIII	Citizen participation
Part IX	Public communication and access to information
Part X	Civic education
Part XI	County planning

Contents	
Part XII	Delivery of county public services
Part XIII	Procedure for suspension of county government
Part XIV	Miscellaneous
Part XV	Transitional provision

Some key elements of the County Government Act 2012 in regard to urban management are summarised below.

104.(1) A county government shall plan for the county and no public funds shall be appropriated outside a planning framework developed by the county executive committee and approved by the county assembly.

This means that the county government must have a master plan to receive funds from the national government for project implementation.

107.(1) To guide, harmonise, and facilitate development within each county, there shall be the following plans:
(a) County integrated development plan;
(b) County sectoral plans;
(c) County spatial plan; and
(d) Cities and urban areas plans as provided for under the Urban Areas and Cities Act.

The NIUPLAN is considered as “cities and urban areas plans”.

2) National Government Coordination Act 2013

This act establishes an administrative and institutional framework of governance for the coordination of government functions at the national and county levels.

The objectives of this act are as follows:

- (i) Facilitate the exercise of executive authority pursuant to Articles 131 (1) (b) (Authority of the President) and 132 (3) (b) and (c) (direct and coordinate the function of ministries and government departments, decision published in the Gazette) of the Constitution;
- (ii) Provide for the effective coordination and administration of the national government functions prescribed in the constitution, this act or any other written law; and
- (iii) Provide for the establishment of an administrative and institutional framework at the national, county, and decentralised units to ensure access to national government services in all parts of the Republic.

Contents of the act are summarised below.

Contents	
Part I	Preliminary
Part II	National government coordination framework
Part III	Appointment, roles, and responsibilities of the national government administrative officers
Part IV	Collaboration and dispute resolution between the national and county governments on issues of apparent concurrent mandates
Part V	General provision

3) Urban Areas and Cities Act 2011

The Urban Areas and Cities Act 2011 is effective for urban areas and cities. The objective and purpose of the act is to establish a legislative framework for the following:

- (i) Classification of areas as urban areas or cities;
- (ii) Governance and management of urban areas and cities;
- (iii) Participation by the residents in the governance of the urban areas and cities; and
- (iv) Other matters for the attainment of the objectives.

Contents	
Part I	Preliminary
Part II	Classification and establishment of urban areas and cities
Part III	Governance and management of urban areas and cities
Part IV	Delivery of services
Part V	Integrated development planning
Part IV	Financial provisions
Part V	Integrated development planning
Part VI	Financial provisions
Part VII	Miscellaneous provisions
Part VIII	Transitional provisions

Since NCC is categorised as an urban area, formulation of NIUPLAN has to follow this act, which specifies that the integrated development planning shall be the basis for:

- (i) The preparation of environmental management plans;
- (ii) The preparation of valuation rolls for property taxation;
- (iii) Provision of physical and social infrastructure and transportation;
- (iv) Preparation of annual strategic plans for a city or municipality;
- (v) Disaster preparedness and response;
- (vi) Overall delivery of service including provision of water, electricity, health, telecommunications, and solid waste management; and
- (vii) Preparation of a geographic information system for a city and municipality.

4) Physical Planning Act Cap 286, 1996 (Revised in 2010)

The Physical Planning Act Cap 286, 1996 (revised in 2010) provides for preparation and implementation of physical development plans and for connected purposes. In regard to urban development management this act is a base for physical planning and development control (building construction permit and land development permit).

Since Physical Planning Act was in effect before the new constitution was in effect, a new law, namely, "Spatial Planning Act" is under preparation. Physical Planning Act is expected to be repealed after the Spatial Planning Act comes to effect.

Contents of the act are summarised below.

Contents	
Part I	Preliminary
Part II	Administration
Part III	Establishment and Composition of Physical Planning and Liaison Committee
Part IV	Physical Development Plans
Part V	Control of Development
Part VI	Miscellaneous

Some key elements of the Physical Planning Act 1996 in regard to urban management are summarised below.

Two types of plans are specified in the act as shown below. The regional physical development plan is prepared for the administrative unit within local authority. While the local physical development plan is prepared for a functional purpose such a plan includes zoning policy for 20 zones in Nairobi City or redevelopment of the railway city.

Regional Physical Development Plan: A regional physical development plan may be prepared by the director with reference to any government land, trust land, or private land within the area of authority of a county council for the purpose of improving the land and providing for the proper physical development of such land, and securing suitable provision for transportation, public purposes, utilities and services, commercial, industrial, residential, and recreational areas, including parks, open spaces, and reserves and also the making of suitable provision for the use of land for building or other purposes.

Local Physical Development Plan: Land, trust land, or private land within the area of authority of a city, municipal, town, or urban council or with reference to any trading or marketing centre, are included in a local physical development plan. A local physical development plan may be a long-term or short-term physical development or for a renewal or redevelopment.

The “Part V Control of Development” shows the powers of local authorities in development permission including application and approval of development. In addition, forms for development application and for approval (P.P.A.1, P.P.A.2) are attached.

Permission will be required for the following four cases of land development:

- (i) Change of use: change in the use of land.
- (ii) Extension of use: adding other use to the land (20% of the total land).
- (iii) Amalgamation: combination of the plot or use of land.
- (iv) Subdivision: separating the use of the land.

Building construction control is also based on the Physical Planning Act but execution of building construction permit is done mainly based on the Building Code.

5) National Land Commission Act, 2012

This act makes provision as to the functions and power of the National Land Commission, qualification and procedures for appointments to the Commission, and gives effect to the objects and principles of devolved government in land management and administration,.

The object and purpose of this act is to provide:

- (i) For the management and administration of land in accordance with the principles of land policy set out in Article 60 of the Constitution and the national land policy;
- (ii) For the operations, powers, responsibilities and additional functions of the Commission pursuant to Article 67 (3) of the Constitution;
- (iii) A legal framework for the identification and appointment of the chairperson, members, and secretary of the Commission pursuant to Article 250 (2) and (12) (a) of the Constitution; and
- (iv) For a linkage between the Commission, county governments, and other institutions dealing with land and land related resources.

The contents of the act are summarised below.

Contents	
Part I	Preliminary
Part II	Functions and powers
Part III	Composition and administration
Part IV	Financial provisions
Part V	Transitional provision
Part IV	Miscellaneous provision

6) Environment Management and Coordination Act 1999

This act describes the legal and institutional framework of environment management. General principles of the act are that every person in Kenya is entitled to a clean and healthy environment and has the duty to safeguard and enhance the environment. The entitlement to a clean and healthy environment includes access by any person in Kenya to various public elements or segments of the environment for recreational, educational, health, spiritual, and cultural purposes.

The contents of the act are summarised below.

Contents	
Part I	Preliminary
Part II	General principles
Part III	Administration
Part IV	Environmental planning
Part V	Protection and conservation of environment
Part IV	Environmental Impact Assessment
Part VII	Environmental audit and monitoring
Part VIII	Environmental quality standards
Part IX	Environmental restoration orders, environmental conservation, and environmental easements
Part X	Inspection, analysis and records
Part XI	International treaties, conventions, and agreements
Part XII	National environment tribunal
Part XIII	Environmental offices

(3) Policies, Rules, and Regulations

1) National Land Use Policy (Concept Paper)

In March 2011, the Ministry of Lands issued a concept paper for the National Land Use Policy. This concept paper is said to prove a roadmap for a National Land Use Policy in Kenya, as the importance of the land use in the social and economic activities makes it imperative that such a policy is formulated to effectively provide guidelines for managing land as a valuable resource.

To address the issues of optimal utilisation of land-relate resources, the concept paper says that the policy should be guided by objects that includes, amongst others;

- (i) Provide guidelines for land-use planning, resource allocation, and resource management;
- (ii) Provide principles to promote optimal utilisation of land resources to meet governance, social-economic, political, and cultural obligations of the people of Kenya;
- (iii) Develop and strengthen coordinated institutional linkage; and
- (iv) Provide framework for the preparation of a national spatial plan and review of various land use plans.

The concept paper states that a national land use policy will be delivered by mid-2011. The status of the policy needs to be confirmed.

2) National Urban Development Policy (Concept Paper)

In December 2008, the Office of the Deputy Prime Minister and the Ministry of Local Government jointly issued a concept paper for a National Urban Development Policy. The Department of Urban Development is in charge of the preparation of the paper. The concept paper that marks a starting point for this process laid out for developing a robust roadmap to guide and encourage meaningful participation and ownership of the whole process and the outcome from therein by all key stakeholders in the sector.

The paper says that a clear, comprehensive, well-articulated, and coherent urban development policy will be developed within the stipulated time frame and based on a predictable and structured engagement framework for all the various stakeholders. The process will be guided by amongst others, the following:

- (i) Stakeholder-centeredness and driven and sensitive to gender, youth, and people with disabilities and equality of stakeholders;
- (ii) Meaningful consultation, participation, and networking;
- (iii) Long-term perspective, comprehensiveness, and sustainability;
- (iv) Public-private partnerships; and
- (v) Focus on value addition: Process will pay special attention on value for the common good or intended beneficiaries.

The concept paper states that they have set in motion a process that will yield a National Urban Development Policy by June 2009.

3) National Urban Development Policy (Draft)

The National Urban Development Policy, which is under discussion at the Parliament, is the basic policy of urban development in Kenya, which provides a framework under which cities, towns, and metropolitan regions will play a critical role in national socio-economic development.

The policy aims at strengthening development planning, urban governance and management, promote urban investment, and delivery of social and physical infrastructure in urban area under a devolved system of governance.

The key themes addressed by this policy are: urban economy, urban finance, urban governance and management, national and county urban planning, land, environment and climate change, social infrastructure and services, physical infrastructure and services, urban housing, urban safety and disaster risk management, marginalised and vulnerable groups, cross cutting issues, and implementation framework.

The contents of the policy are summarised as shown below.

Vision

Kenya’s vision is to have **secure, well governed, competitive, and sustainable cities and urban areas** that contribute to the achievement of the broader national development goals articulated in the Constitution and *Vision 2030*.

Mission

NUDP’s mission is to facilitate sustainable urbanisation through good governance and delivery of accessible and efficient infrastructure and services.

Principles

NUDP’s guiding principles are:

- a. Participatory urban planning, development, and governance;
- b. Equity in access to resources and opportunities;
- c. Efficiency in resource use and service provision;
- d. Social, economic, and environmental sustainability;
- e. Inclusivity: cities and urban areas that cater for all segments of urban residents including marginalised and vulnerable groups;
- f. Good governance;
- g. Connectivity: Urban areas that have synergy between national and county urban areas and their hinterlands and global urban systems; and
- h. Livability: Cities and urban areas that have adequate quality services and infrastructure, and are secure, clean and green.

Overall Objective

The overall objective of the policy is to provide a framework for sustainable urban development in Kenya.

Specific Objectives

The specific objectives are to:

- a. Mainstream good governance, gender, environment, and HIV/AIDS in all aspects of urban development;
- b. Foster timely and adequate delivery/management of land for urban development;
- c. Promote integrated environmental planning and management;
- d. Promote technological innovation leading to more effective mitigation and adaptation to climate change;
- e. Facilitate accessibility to the full range of social services that improve the health, education, skills development, and recreational needs of citizens in urban areas;
- f. Foster safe, secure, and liveable urban areas; and
- g. Ensure adequate housing for all urban income groups.

(4) Building Code, 1968

In addition to the Physical Planning Act, “Building Code 1968” is used for development permission of building construction. The contents are shown below.

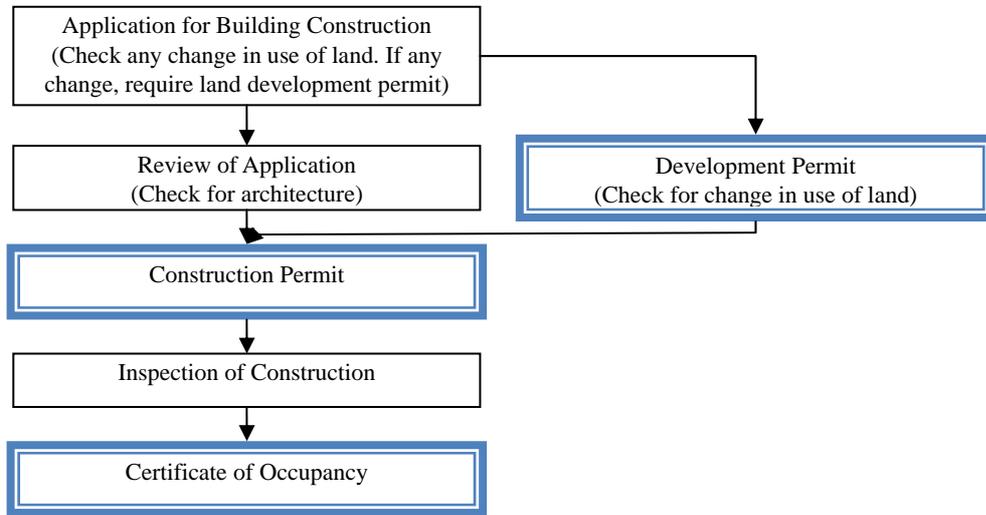
Contents	
Part I	Introductory
Part II	Site and space about buildings
Part III	Building materials
Part IV	Advertisement
Part V	General

Since the existing building code is outdated, a new building code is under preparation. A new building code, namely, “Planning and Building Regulations”, is under preparation and to be approved by the Ministry of Lands, Housing and Urban Development and plan to be finalised by the end of 2013. The main change in the building code is to include the aspects of “outdoor advertisement”, “painting”, and “urban design”.

(5) Development Permit

Regarding development control, there are mainly three types of permits: construction permit, certificate of occupancy, and development permit, all of which are executed under the Physical Planning Act. Development permit is required for the land development which requires change in use of land, which is the responsibility of the Policy Implementation Section of NCC. Construction permit

is for building construction for which the Development Control Section of NCC is responsible. Certificate of occupancy is issued when the building construction is completed and is ready for use, which is under the responsibility of the Enforcement Section of NCC. These permits are conducted separately but there is a plan to combine them under NIUPLAN.



Source: JICA Study Team (JST)

Figure 3.1.2 Land Control Scheme

1) Development Permit

The Policy Implementation Section (PIS) is responsible for land development permit. Permission is required for four cases of land development.

- Change of use: change in the use of land
- Extension of use: adding other use to the land (20% of the total land)
- Amalgamation: combination of the plot or use of land
- Subdivision: separating the use of the land

A development application is reviewed from the point of view of zoning plan, types of facility, and minimum plot size required in the zoning policy although it is outdated. The process is the same for the construction permit process, all applications have to go through the Technical Committee to receive an approval.

There are several constraints to obtain a development permit:

- An application is checked with archive data of each land plot record and changes are made manually. The data are still in hard copy, which has a risk of losing documents and takes longer time to process because the data is stored in the other section and will have to find it from a pile of documents.
- Zoning policy is outdated so there is often mismatch of demand and regulation. Because of high demand for land development, the zoning policy has to be reviewed to accommodate the growing demand.
- In order to improve the process, E-permit is expected to be installed as Phase 3 of International Finance Corporation (IFC) support. Utilising the E-permit and GIS database to clarify the zoning policy makes the process more efficient.
- Organisation capacity in terms of the number and skills of the staff are weak. Permit process requires checking application documents and field surveys to examine the conditions at the sites. The number of field surveyors, in particular, is not enough to follow up the process, which can also be applied to construction permit. Monitoring of construction has not been executed due mainly to lack of field surveyors.

2) Construction Permit

The Development Control Section of the City Planning Department is executing construction permits. Even though the building construction permit is required for all building constructions, most buildings are constructed without permits. It is said that 70% (or more) of constructions are without permits in the eastern part of the city where houses for low income households are dominant. The rate is lower (40%~50%) in the Upper Hills area where houses for high income household exist.

The causes of illegal construction can be summarised as follows:

- Slow permit process: Between 2004 and 2006, since permit process was slow (2 to 3 months), the number of applications was also low. After the process was improved, the number of applications has increased.
- Residents and some architects do not know the rule or requirement: Residents and some architects are not even aware that a permit is required for construction.
- Incentive to cut the cost of construction: In order to receive a permit, buildings have to meet the building codes in terms of materials and safety, which imposes additional cost to the developer. In order to reduce the cost of construction, developers have an incentive not to apply for a permit.
- Outdated land use policy: Since urban master plan has not been updated, land use and zoning policy is also outdated and not matching the development needs. Many areas where urbanisation and commercialisation are progressing are still designated as low-rise residential areas. This encourages the developer to avoid obtaining a permit. As a result, many residential areas are converted to commercial use without permits.

In order to reduce the number of illegal construction, Nairobi City has been trying to improve the permit system including change in the evaluation process by establishing the Technical Committees and re-organising the office for efficient process since 2006. A Technical Committee, composed of the departments in Nairobi City and professionals (Architect Association of Kenya, Kenya Institute of Planning, Nairobi City Water Supply Company, etc.), is now holding a meeting every two weeks to discuss and approve the applications. The office was also renovated to improve the working environment. These efforts enable the process duration to be less than 30 days. Before, on average it took 2~3 months, sometimes even more than six months.

Nairobi City is receiving the support from the IFC of the World Bank Group to install an E-Permit system, which is composed of three phases:

- Phase 1: E-permit. Electric building permit system (Development Control Section)
- Phase 2: Inspection (Monitoring and certificate of occupancy) (Enforcement Section)
- Phase 3: Development permit (Policy Implementation Section)

Implementation of the system for Phase 1 has started in 2012. Along with continuous system improvement, introduction of the E-permit system has increased the number of applications drastically. Before the improvement, the number of applications was 400 to 600 per year. After the improvement, the number of applications has jumped to more than 3,000 a year.

3) Certificate of Occupancy

The “Certificate of Occupancy (Certificate of Compliance)” is required after the completion of construction, issuance of which is under the responsibility of the Enforcement Section. The main task of the Enforcement Section is the monitoring and inspection of construction by

checking the construction following the instructions in the construction permit. The developer is also responsible to report the progress of construction to the city but this hardly happens for the same reasons as for the construction permit. The monitoring and inspection part of the process is considered weak and needs improvement.

Nairobi City has a right to demolish illegal buildings but demolition hardly happens because of a financial and security reason. For some cases, developers may organise demonstration to protest the demolition.

IFC is planning to install the E-permit system for monitoring and inspection (Phase 2 of the assistance).

3.1.2 Environment

The Environment Management and Co-ordination Act (EMCA) of 1999, and the Environment Impact Assessment (EIA) and Audit Regulations that followed in 2003, are the core environmental frameworks in Kenya. Based on these laws and regulations, relevant rules such as a series of environmental criteria were developed. Besides, the County Government Act of 2012 plays an important role for public participation and information disclosure regarding any activities of county planning processes. Outlines of major environmental laws and regulations are described as follows:

(1) Environment Management and Coordination Act (EMCA), No. 8 of 1999

This act consists of 13 parts. The importance of a nationwide environmental planning is described in Part IV and the methods of protection and conservation of the environment are specified in Part V. The enactment of EMCA in 1999 was a milestone in promoting the sustainable environmental management in Kenya. This act provides for the harmonisation of about 77 sectoral statutes. EMCA provides an institutional framework and procedures for the environmental management, including provisions for conflict resolution.

(2) Environmental Impact Assessment and Audit Regulations (EIA/EA), No.121 of 2003

An EIA is a critical examination of potential effects to be caused by a project which is to be implemented on the environment. The goal of an EIA is to ensure that decisions on proposed projects and its relevant activities should be environmentally sustainable with proper environmental management program. An EIA is conducted in order to identify potential impacts of a project on the environment, predict likely changes on the environment as a result of the development, evaluate the impacts of various alternatives on the project and propose mitigation measures for significant negative impacts of the project on the environment.

An Environmental Audit (EA) is a systematic documentation and a periodic and objective evaluation of activities and processes of an ongoing project. The goal of an EA is to establish whether proponents are complying with environmental requirements and enforcing legislation. The purpose of an EA is to determine the extent to which the activities and programs conform to the approved environmental management plan. A comprehensive EA ensures safe and healthy environment at all stages of project operations until decommissioning.

Regulation 42 of this EIA/EA Regulations vests the responsibility for carrying out Strategic Environmental Assessment (SEA), and the lead agencies shall work closely with National Environment Management Authority (NEMA) for SEA implementation. Regulation 42 (3) commits the government and all lead agencies to incorporate the principles of SEA in the development of sector or national or regional policy and/or master plan. The objective of SEA is to systematically integrate environmental considerations into policy, planning, and decision-making processes, such that environmental information derived from the examination of proposed policies, plans, programs, or projects are used to support the decision.

According to the series of preliminary discussions with NEMA, conducted in January 2013, it is likely that the proposed urban development master plan needs to conduct the SEA study, based on the SEA Guideline, to be described later in Section 4.3.

- (3) Noise: Environment Management and Co-ordination (Noise and Excessive Vibration Pollution Control) Regulations, No. 61 of 2009)

Table 3.1.2 summarises the noise standard, specified within the Environment Management and Coordination (Noise and Excessive vibration Pollution Control) Regulation of 2009 in Kenya.

Table 3.1.2 Maximum Permissible Noise Levels (Leq)

	Day	Night
A. Silent Zone	40	35
B. Places of worship	40	35
C. Residential : Indoor	45	35
Outdoor	50	35
D. Mixed residential (with some commercial and places of entertainment)	55	35
E. Commercial	60	35

Note: Day: 6:01 a.m. – 8:00 p.m., Night: 8:01 p.m. – 6:00 a.m.

Source: Environment Management and Co-ordination (Noise and Excessive Vibration Pollution Control) Regulations, No. 61 of 2009

- (4) Water Quality: Environment Management and Co-ordination (Water Quality) Regulations, No. 120 of 2006)

The objective of this regulation is to protect human health and the aquatic environment. The effective enforcement of the water quality regulations will lead to a marked reduction of water-borne diseases and hence, a reduction in the health budget. This water quality regulation applies to water used for domestic, industrial, agricultural, and recreational purposes; water used for fisheries and wildlife purposes, and water used for any other purposes. Different standards apply to different modes of usage. These regulations provide for the protection of lakes, rivers, streams, springs, wells, and other water sources.

This regulation also provides guidelines and standards for the discharge of poisons, toxins, noxious, radioactive waste, or other pollutants into the aquatic environment in line with the Third Schedule of the regulation. This regulation has standards for discharge of the effluent into the sewerage and the aquatic environment. While it is the responsibility of the sewerage service providers to regulate discharges into sewerage lines based on the given specifications, NEMA regulates the discharge of all effluent into the aquatic environment.

Also, it is specified that any development activities to be planned at the riverbanks of tributaries running through Nairobi City need an environmental permit by conducting EIA from NEMA for the water quality protection. Basically, 6 m to 30 m from the highest water level (flood event) are defined as the protected river bank. Exact configuration of this protected area depends on development natures, surrounding land use, environmental importance, and others.

- (5) Waste Management: Environment Management and Co-ordination (Waste Management) Regulations, No. 69 of 2006)

The Waste Management Regulations are meant to streamline the handling, transportation, and disposal of various types of waste. The aim of this Waste Management Regulation is to protect human health and the environment. Currently, various types of wastes are dumped haphazardly, posing serious environmental and health concerns. This regulation places emphasis on the wastes minimisation, cleaner production, and segregation of waste at source.

(6) Wet Land, Lake, and Sea: Environmental Management and Co-ordination (Wetlands, River Banks, Lake Shores and Sea Shore Management) Regulations, No. 19 of 2009

This regulation, consisting of three parts, specifies that any wetland adjacent to the rivers, lakes as well as riverbanks, and lake shores shall be protected. If some development works are planned to be conducted inside such a wetland, a special permit shall be obtained from the Water Resources Management Authority (WRMA) by conducting an appropriate study such as EIA, which will be described later.

(7) Forest Act of 2005

The Forests Act 2005, enacted in 2007, provides for the establishment, development, and sustainable management, including conservation and rational utilisation, of forest resources for the socio-economic development of the country. This act recognises the importance of forests for the benefits of soil conservation, groundwater regulation, and agriculture, and provide for their role in absorbing greenhouse gases. The key elements of the Forests Act are: 1) the inclusion of management of all types of forests; 2) involvement of adjacent forest communities and other stakeholders in forest conservation and management; 3) an ecosystems approach to forest management planning; 4) provision of appropriate incentives to promote sustainable use and management of forest resources; 5) development of a framework for a forest legislation; and 6) establishment of the Kenya Forest Service (KFS). This act also recognises the Community Forest Associations (CFAs), who shall participate in forest conservation and management under KFS. This act has specific provisions related to access rights and benefit sharing arrangements which provide a role for communities in the utilisation of forest resources and protection of forests. This act has four priority areas related to the management of forests, including: 1) reducing pressure to clear forests for agriculture and other uses, 2) promoting the sustainable utilisation of forests, 3) improving governance in the forest sector, and 4) enhancing carbon stocks and reforestation of degraded lands.

(8) Wildlife Conservation and Management Act of 1989

This act, consisting of nine parts, is to strengthen the wildlife conservation and management policy and support relevant activities in Kenya. The legislation of nature conservation began to develop in 1945 in Kenya with the National Park Ordinance. This legislation and the Wild Animal Protection Ordinance of 1953 were not very effective. In 1976, the Wildlife Conservation and Management Act replaced the former ordinances, which brought about some changes in the conservation policies. The 1976 Act was also unable to fully achieve efficient conservation measures. Reforms were made mostly in policies and legislation but there were no major impact on the real world. Credit to the act was that wildlife and natural resources were mentioned to have relevant economical potential. In 1989, when the weakness of existing legislation was finally realised, the Kenya Wildlife Service (KWS) was established by a new act. KWS replaced all the former conservation-aimed organizations and it was secured to have a more independent position on its own field.

3.1.3 Economy and Investment

(1) Companies Act

The Companies Act (Chapter 486, Laws of Kenya) commenced in 1962, is based on the United Kingdom's Companies Act 1948.

The act aimed to regulate all aspects of companies including the following:

- Incorporation of companies
- Share capital
- Registration
- Management and administration

- Winding up
- Companies incorporated outside Kenya
- General provisions as to registration
- Insurance companies, societies, partnerships, etc.

Due to the need to reform the act according to the government's policy objectives such as Vision 2030, the Companies Bill 2010 was proposed as a follow-up of the Companies Bill 2008. The Bill 2010 repealing the act aims to modernise Kenya's business sector by easing investment of domestic and foreign companies in Kenya toward a competitive economy in the East African Community and in the globalizing world. The bill has gone through parliamentary reading stages.

(2) Employment Act

The Employment Act published in 2007 defines the fundamental rights of employees in order to provide basic conditions of employment of employees, to regulate employment of children, and to provide for matters connected with the following:

- Employment relationship
- Protection of wages
- Rights and duties in employment
- Termination and dismissal
- Protection of children
- Insolvency of employer
- Employment records
- Employment management
- Foreign contracts of service
- Disputes settlement procedure

Enforcement of the act is supervised by the Ministry of Labour, Social Security and Services, which also maintains industrial peace, industrial training, and promote safety and health of employees.

(3) Public Private Partnerships Act

The Public Private Partnerships Act 2013 was published in January 2013. It is to provide for the participation of the private sector in the financing, construction, development, operation, or maintenance of infrastructure or development projects of the government through concession or other contractual arrangements; the establishment of the institutions to regulate, monitor, and supervise the implementation of project agreements on infrastructure or development projects and for connected purposes.

The act was in line with the Vision 2030, which is a vision to transform Kenya into a middle income country by 2030. To this end, a number of key projects are required. However, they cannot be funded and implemented by the government alone. Therefore, this act has been proposed to involve the private sector in such projects. The act includes the detailed procedure of projects in public-private partnerships and the following institutional arrangement:

- (i) Establishment of the public-private partnership committee for ensuring that each project agreement is consistent with the provisions of this act, formulating policy guidelines on public-private partnerships, and ensure that all projects are consistent with the national priorities, etc.
- (ii) Establishment of the public-private partnerships units for serving as the secretariat and technical arm of the committee, and for providing technical, financial, and legal expertise to the committee and any node established under this act.
- (iii) Establishment of public-private partnership nodes for identifying, screening and prioritising projects based on guidelines issued by the committee, preparing and appraising each project

agreement to ensure its legal, regulatory, social, economic, and commercial viability, ensuring that the parties to a project agreement comply with the provisions of this act, and undertaking the tendering process in accordance with this act, etc.

(4) Tourism Act

The Tourism Act is to develop, manage, market, and regulate sustainable tourism and tourism-related activities and services by changing the management and structure of related institutions. The act that passed the Parliament in 2011 includes a total of 124 clauses including establishment of various organisations together with formulation of the national tourism strategy as follows:

- Establishment of Authority
- Establishment of the Tourism Protection Service
- Establishment of the Kenya Tourism Board
- Establishment of Kenyatta International Convention Centre
- Establishment of Tourism Research Institute
- Establishment of Tourism Fund
- Establishment of Corporation

(5) Banking Act

The Banking Act revised in 2010 is for regulating the business of banking and for protecting the industry in Kenya.

The banking act covers a wide area in the banking business, as follows:

- Licensing of institutions
- Prohibited business
- Reserves and dividends
- Accounts and audit
- Information and reporting requirements
- Inspection and control of institutions
- The deposit protection fund
- Representative offices of foreign institutions

Based on the act, the Central Bank of Kenya stipulates guidelines, which include:

- Governance and risk management,
- Financial reporting requirements,
- Business continuity management,
- Bank services, and
- Bank data reporting.

3.1.4 Infrastructure

(1) Kenya Roads Act No. 2 of 2007

The Kenya Roads Act No. 2 of 2007 is an act of the Parliament to provide for the establishment of the Kenya National Highways Authority (KeNHA), the Kenya Urban Roads Authority (KURA), and the Kenya Rural Roads Authority, to provide for the powers and functions of the authorities and for connected purposes.

Sections 3, 4, and 5 of the Kenya Roads Act (2007) provide for the establishment and functions of KeNHA, which is responsible for the management, development, rehabilitation, and maintenance of national roads. Functions of KeNHA are discussed in Section 3.2.4.

Sections 9, 10, 11, and 12 of the Roads Act provide for the establishment, functions, and composition of KURA, which is the body corporate in charge of management, development, rehabilitation, and maintenance of all public roads in the cities and municipalities in Kenya except where those roads are national roads. The role of KURA is discussed in Section 3.2.4.

(2) Public Roads and Roads of Access Act Cap 399

This is an Act of Parliament to provide roads of public travel and access to public roads. According to Section 8 (1) of this act, whenever it is made to appear to the Minister that requirements exist for the establishment, alteration, or cancellation of a line of public travel or for the conversion of a road of access into a line of public travel, the Minister may, by order published in the Gazette, dedicate, alter, or cancel such line of public travel or convert such road of access into a line of public travel. For the purposes of the act, Article 8 (3) provides that where an order under this section dedicates a line of public travel or converts a road of access into a line of public travel, such line of public travel shall be absolutely dedicated to the public as a public road within the meaning of any law now or hereafter in force relating to public roads.

However, this act also provides for the procedure for construction of private roads of access. Section 9 (1) provides that where any owner or occupier of land is in respect of his land so situated in relation to a public road which is passable to vehicular traffic, or to a railway station or halt, that he has no reasonable access to the same, he may make an application to the board of the district in which such land is situated for leave to construct a road or roads (hereinafter called a road of access) over any lands lying between his land and such public road or railway station or halt.

Section 13 provides for the right of way, responsibilities of the owner, including direct orders in Section 13 (5) on responsibility of the owner to keep the road in good state of repair at all times to the satisfaction of the board responsible (District Roads Board in this case or any other body as the case may be in the new constitutional dispensation/ order).

(3) Wayleaves Act Cap 292

In Kenya, the Wayleaves Act Cap 292 allows for a right of way (ROW) of transmission lines. The Wayleaves Act provides that a wayleave as ROW over any lands whatsoever but may not in so doing interfere with any existing buildings. In this act, "private land" does not include any land sold or leased under any act dealing with government lands.

Kenya Electricity Transmission Company (KETRACO) defines a wayleave as ROW over the land of another. This ROW is for carrying sewer, drain, power line, or pipeline into, although over or under any lands but in so doing may interfere with the existing buildings. (www.ketraco.co.ke). This is contrary to the Wayleaves Act Cap 292 which consider utilisation of all land for any such functions as outlined above.

The Wayleaves Act Cap 242 in general provides for the power to carry sewers, drains, and pipelines through land, guidelines for legal notification on the intention to use any land, and on the procedures as to lodge objections by owners or occupiers of private land that may be used for ROW. Further, the act provides Section 7 of the Wayleaves Act, which provides in whole that any person in the service of the government and any contractor executing any work for the government, together with his agents and servants, may at any time enter upon any land for the purpose of surveying, setting out, and marking the line of any intended sewer, drain or pipeline, or for the purpose of inspecting, repairing, removing, re-laying or cleansing any sewer, drain or pipeline the property of the government, or for any other purpose under this act. Article 9 lays the penalty for unauthorized building over sewers, drains, or pipelines.

Wayleaves are important in regard to location of the various trunk utilities. For the purposes of NIUPLAN:

- (i) There are various areas of trunk utilities to be considered in NIUPLAN whose location should be secured, including, but not limited to power lines (both overhead and underground), sewerage reticulation networks, stormwater drains, water-mains, telephone lines, fibre-optic cables, railway wayleaves, road reserves, etc.;
- (ii) Currently, the use of wayleaves is not properly regulated as different utilities companies, some serving competing interests digging up road reserves, posing dangers to human and the quality of the roads, and other existing infrastructure;
- (iii) There is a need to open up additional wayleaves for newly proposed trunk utilities, adding to the existing lines and opening new lines in new areas;
- (iv) There is a need to limit and restrict the use of the wayleaves to optimise the use of the existing and future wayleaves. Case in hand is through proposed utilities tunnel to be shared by all trunk utilities to limit destruction of roads and existing utilities; and
- (v) There is a need to propose the use of some of the secured wayleaves for other allowable urban uses in some of the larger wayleaves.

1) Gaps in the Wayleaves Act

The various gaps in the Wayleaves Act that may constrain the implementation of NIUPLAN include, that the Wayleaves Act:

- (i) Is mostly outdated and needs to be extensively reviewed to cater for modern development scenarios;
- (ii) Is less detailed on the definition of wayleaves, especially in regard to the types of trunk utilities, users, and actors (sectoral bodies that have/use/need wayleaves);
- (iii) Is silent on most types of infrastructure that require wayleaves, but is particular on power, drains, and pipelines;
- (iv) The act is silent on the use, management, and protection of the existing wayleaves;
- (v) Does not recognise the role of private actors in the use of the wayleaves, which leads the private sector actors to destroy the amenity of the wayleaves as well as the quality of roads;
- (vi) Lays a small penalty on contravention of the Wayleaves Act, seeing as to the importance of the wayleaves for the development of the city as well as the value of public good/public interest they carry/possess;
- (vii) Does not provide inter-sectoral linkages on the use of wayleaves, including the competing interests of roads, power, telecommunication, water, municipal, and other such sectoral interests for the purposes of harmonisation of functions;
- (viii) Does not give the actual measurements of the wayleaves, and the relationship with adjacent land users;
- (ix) Does not stipulate allowable temporary users (if any) of the wayleaves; and
- (x) Recommendations for Wayleaves Act.

The main recommendation on the Wayleaves Act includes that the act should be overhauled and drafted afresh to take into account current glaring omissions including:

- (i) Definition of wayleaves;
- (ii) Examples of wayleaves;

- (iii) Examples of the land in which the wayleaves operate;
- (iv) Inter-sectoral relationships on the use of wayleaves;
- (v) Dimensions of wayleaves;
- (vi) Use of wayleaves/allowable users of the wayleaves;
- (vii) Non-allowable users of wayleaves;
- (viii) Mixed use of wayleaves, including allowable temporary users;
- (ix) Management plan of wayleaves; and
- (x) Optimisation of the use of wayleaves, amongst others.

(4) Energy Act No. 12 of 2006

The Energy Act is an act of the Parliament to amend and consolidate the law relating to energy, to provide for the establishment, powers, and functions of the Energy Regulatory Commission and the Rural Electrification Authority, and for connected purposes. The provisions of this act shall apply to every person or body of persons importing, exporting, generating, transmitting, distributing, supplying, or using electrical energy; importing, exporting, transporting, refining, storing, and selling petroleum or petroleum products; producing, transporting, distributing, and supplying of any other form of energy, and to all works or apparatus for any or all of these purposes.

The Energy Act stipulates conditions for granting licenses for generation, importation, exportation, transmission, or distribution of electrical energy, including certain provisions that are particular to the well-being of the environment.

Sections 46, 47, 48, 49, 50, 51, 52, 53, and 54 provide for procedures for acquisition (whether through willing surrender or compulsorily) of and the use of wayleaves. Specifically, Section 53 (1) provides that for the purpose of the conveyance, transmission, or supply of electrical energy, a licensee may erect, fix, install or lay any poles, wires, electric supply lines, power, or other apparatus in, upon, under, over, or across any public streets, road, railways, tramways, rivers, canals, harbours, or government property, in the manner and on the conditions as provided in this act.

Section 53 (2) stipulates that notwithstanding the provisions of any other written law, but subject to the provisions of this section, a licensee may break up any street within his area of supply, and may erect posts and lay or construct power lines or electric supply lines along, under or over any such street, and may, from time to time, repair, alter, or remove any posts or lines so erected, laid, or constructed:

Provided that the person having the control of such street shall have a prior right to break up and repair such street with reasonable despatch upon payment to him of a reasonable charge by the licensee.

Having completed works on the wayleaves, an operator is obligated under Section 53 (5) to comply with the by-laws, if any, of the local authority concerned and shall complete that work with reasonable despatch and reinstate the street that was broken up and remove any debris or rubbish occasioned thereby and shall, while the street is broken up or obstructed, cause the works to be, at all times, fenced and guarded, and during the night, adequately lit.

The Energy Act also provides for siting of petroleum installations. Section 90 provides that any person intending to construct a pipeline, refinery, bulk storage facility, or retail dispensing site shall, before commencing such construction, apply in writing to the Energy Regulation Commission (ERC) for a permit to do so. Such applications must be accompanied by an EIA report.

Section 98 provides for a compliance with environmental, safety, and health standards for any person engaged in petroleum business. Section 98 (2) stipulates that in the event of a fire, explosion, oil spill, injury, or fatality occurring in the course of operating a petroleum facility or transportation of

petroleum, either by accident or through negligence, the operator or person transporting petroleum shall forthwith clean up the polluted or damaged environment, at his own expense, to the satisfaction of the Commission and other relevant authorities:

Provided that any person engaged in the transportation of petroleum and petroleum products shall have an oil clean-up plan in compliance with the national oil policy.

Important to note for NIUPLAN is the provision of Section 99 which provides that a local authority shall designate a place or places exclusively reserved for parking of petroleum tanker vehicles.

Section 99 (2) provides that a local authority that contravenes Subsection (1) commits an offence and shall be liable, on conviction, to pay a fine of Ksh50,000 for each day or part thereof that the offence continues.

Amongst the conditions highlighted for the granting of permits are compliance to relevant government policies (which the NIUPLAN will be one of), as well compliance with the demands of EMCA (1999).

Part V of the Energy Act provides for use of renewable energy, energy efficiency, and conservation. Section 103, provides, inter alia promotion of the development and use of renewable energy, including, but not limited to:

- (i) Research in renewable energy;
- (ii) Efficient and sustainable energy;
- (iii) Use of municipal waste for energy production;
- (iv) Development of appropriate capacity for manufacture, installation, maintenance, and operation of such technologies as bio-digesters and solar systems; and
- (v) International cooperation programmes focussing in renewable energy.

1) Application of the Energy Act to NIUPLAN

For purposes of the NIUPLAN, the ERC mandates and responsibilities touch on the various aspects of Nairobi City in the following manner:

- (i) Energy is an important component of urban life and a city's wellbeing, tied closely to matters of security and safety, urban transport, economic development (including to a very major extent, industrialisation), power sector, telecommunications sector, utilities, and services availability;
- (ii) Energy components are a major consumer of urban space and land, including:
 - a. Power wayleaves;
 - b. Pipeline wayleaves;
 - c. Petrol/service stations
 - d. Petroleum storage/bulk storage facilities;
 - e. Road transport of petroleum products; and
 - f. Petroleum pipeline, etc.;
- (iii) Energy wayleaves are important contributor of the amount and quality of open spaces within the urban landscape;
- (iv) Security, safety, and health concerns with respect to energy installations in an urban settings are important considerations in planning;
- (v) The Energy Act is one of the two acts that clearly stipulate the protection, use, and management of wayleaves;

- (vi) The Master Plan provides for various land use guidelines and approval standards, which calls for the implementation of various guidelines and enforcement thereof, including, but not limited to granting of approvals, insistence of environmental impact assessments, and NEMA licenses for approvals, with the intention of ensuring environmental friendliness of activities/developments related to energy;
- (vii) Most proposals in the NIUPLAN are directly and indirectly tied to energy availability and tariffs, including on the cost of doing business, cost of transport, cost of setting up industries, location of major business districts, etc;
- (viii) In compliance with Section 99, NIUPLAN needs to come with a place(s) exclusively dedicated for parking of petroleum tanker vehicles; and
- (ix) Need for the NIUPLAN to suggest strategies of integration of renewable energy into the energy plan of the city with the suggestion of ensuring energy sufficiency and efficiency, including the use of municipal waste for energy production.

2) Weakness of the Energy Act to the NIUPLAN

The promotion, installation, and use of solar water heating systems by the act is a positive move towards renewable energy use in Kenya. However, provisions of Energy (Solar Water Heating) Regulations, 2012 may be deemed too harsh considering the provisions of Sections 3(3) and 11(1) amongst others. Premises may fail to install solar water heating mechanisms because of the incapability of the owners/occupiers, and that should not be a weakness for which to send people to prison. Rather than use threats to encourage people to use renewable energy, the Energy Act Regulations should instead use actual incentives, for example zero-rating of taxes on solar water-heating equipment and other such hardware that will entice people to use the technology.

(5) The National Land Commission Act No. 5 of 2012

This is an act of the Parliament to make further provision as to the functions and powers of the National Land Commission, qualifications and procedures for appointments to the commission; to give effect to the objects and principles of devolved government in land management and administration, and for connected purposes.

In relation to the NIUPLAN, this act provides for the:

- (i) For the management and administration of land in accordance with the principles of Land Policy set out in Article 60 of the Constitution and the National Land Policy;
- (ii) A linkage between the National Land Commission, county governments, and other institutions dealing with land and land related resources.

Section 18 provides for the establishment of the County Land Management Boards in consultation and cooperation with the national and county governments to establish county land management boards for purposes of managing public land. Section 19 (1) provides that the commission shall, subject to the physical planning and survey requirements, process applications for allocation of land, change and extension of user, subdivision of public land, and renewal of leases. This statute is important in all infrastructure located on the land. Sometimes infrastructure and utilities are located on contested land, or land in which acquisition of wayleaves may be done through compulsory acquisition. This may require the role of the National Land Commission.

(6) Survey Act Cap 299

This act provides for the establishment of the Director of Surveys and such other officers as may be deemed necessary for the purposes of this act. The act provides for the sole role of the surveying works by the Director of Surveys and his agents, and the sole power to authenticate survey plans prepared by any private registered surveyor. This overreaching mandate spans to issues like aerial photography. In terms of infrastructure provision, the survey act is important to help in the production of reliable spatial data, now and in the future. Maps may be prepared by various sectoral bodies in conjunction with the Survey of Kenya but validation needs to be done by the Survey of Kenya.

For purposes of the NIUPLAN, there is a need for cooperation between the Director of Survey with the NIUPLAN team for production of accurate maps and plans for the purposes of planning. The Director of Surveys also has the power to furnish the team with an up-to-date aerial images for preparation of maps. The Director of Surveys will help in authenticating maps, accuracy of maps produced for the reference and use by the NIUPLAN team.

(7) Urban Areas and Cities Act Number 3 of 2011

Urban Areas and Cities Act is an act of Parliament to give effect to Article 184 of the Constitution; to provide for the, classification, governance, and management of urban areas and cities; to provide for the criteria of establishing urban areas, to provide for the principle of governance and participation of residents and for connected purposes.

Subject to Subsection 3 of this act, an urban area may be classified as a city under this act if the urban area satisfies the following criteria—

- (i) Has a population of at least 500,000 residents according to the final gazetted results of the last population census carried out by an institution authorised under any written law, preceding the application for grant of city status;
- (ii) Has an integrated urban area or city development plan in accordance with this act;
- (iii) Has demonstrable capacity to generate sufficient revenue to sustain its operation;
- (iv) Has demonstrable good system and records of prudent management;
- (v) Has the capacity to effectively and efficiently deliver essential services to its residents as provided in the First Schedule;
- (vi) Has institutionalised active participation by its residents in the management of its affairs;
- (vii) Has infrastructural facilities, including but not limited to roads, street lighting, markets, and fire stations, and an adequate capacity for disaster management; and
- (viii) Has a capacity for functional and effective waste disposal.

Section 6 provides for the establishment of Nairobi City as the capital city of Kenya, and its roles and responsibilities. Following stipulations of Section 5 (1) (b), Nairobi City is in the process of preparing an integrated urban plan called the NIUPLAN, which, amongst others, will provide for the functions outlined in Subsection 3, including improvement of the efficiency of the transport network as well as promotion of commerce and industry.

Part III provides for the governance and administration of cities. Some of the principles outlined for governance and management include institutionalisation of active participation by its residents in the management of the urban area and city affairs, efficient and effective service delivery, and clear assignment of functions which the NIUPLAN is to provide for. Part V provides for Integrated Development Planning. Section 36 stipulates the objectives of the plans which include formation of basis for preparation of environmental management plans, valuation rolls, provision of physical and social infrastructure, preparation of annual strategic plans for the city as well as overall delivery of services and infrastructure. Such an integrated urban plan shall also be the basis for development

control. It further highlights the contents, adoption, approval, and provides for annual reviews for development.

(8) Companies Act Cap 486

Several Kenyan State Corporations are established generally by the Companies Act Cap 486. Some of these institutions with relation to the NIUPLAN including the Kenya Pipeline Corporation (KPC), the Kenya Power and Lighting Company (KPLC), and the KETRACO in Nairobi City which are important infrastructure providers of petroleum, pipeline, and electricity, respectively.

(9) Kenya Railways Corporation Act Cap 397

This is an act of the Parliament for the establishment of the Kenya Railways Corporation, simply called Kenya Railways. The act provides for the Powers of Kenya Railways Corporation being generally, without prejudice, to construct railways, development of roads to access the railways, development of parking, provision of train services, and determination of tariffs and train fares. The other roles include responsibilities to buy and sell property, provision of housing to its employees, and all such related services.

(10) Intergovernmental Relations Act

The Intergovernmental Relations Act of Parliament to establish a framework for consultation and cooperation between the national and county governments and amongst county governments; to establish mechanisms for the resolution of intergovernmental disputes pursuant to Articles 6 and 189 of the Constitution, and for connected purposes.

The objects and purposes of this act are to—

- (i) Provide a framework for consultation and cooperation between the national and county governments;
- (ii) Provide a framework for consultation and cooperation amongst county governments;
- (iii) Establish institutional structures and mechanisms for intergovernmental relations;
- (iv) Provide a framework for the inclusive consideration of any matter that affects relations between the two levels of government and amongst county governments;
- (v) Give effect to Articles 187 and 200 of the Constitution, in respect of the transfer of functions and powers by one level of government to another, including the transfer of legislative powers from the national government to the county governments; and
- (vi) Provide mechanisms for the resolution of intergovernmental disputes where they arise.

It is to be noted that some of the disputes may be in the area of infrastructure provision, including cross-boundary utility mains like roads, petroleum pipelines, railway lines, water pipelines, etc.

(11) The Water Act Cap 372 No 8 of 2002

The Water Act No 8 of 2002 is an act of the Parliament to provide for the management, conservation, use, and control of water resources and for the acquisition and regulation of rights to use water; to provide for the regulation and management of water supply and sewerage services; to repeal the Water Act (Cap. 372) and certain provisions of the Local Government Act; and for related purposes. Being important inter-county resources and important for life, every water resource is hereby vested in the State, subject to any rights of user granted by or under this act or any other written law.

Section 7 establishes the Water Resources Management Authority. Powers and functions of the authority are outlined in Section 8, and included in the regulation of allocation of water resources,

monitoring and assessment of the national water resources management strategy, determination of applications for permits for water use, protection of water resources from adverse use, management of water catchments, amongst other water resource management needs/ strategies.

Section 51 provides for the establishment of Water Services Boards. The roles of these boards include planning for the improvement in provision of water supply and sewerage services, appointment and contracting water service providers as well as being asset holder of central government facilities. The Athi Water is one of the eight water boards under the Ministry of Environment, Water, and Natural Resources created to bring about efficiency, economy, and sustainability in the provision of water and sewerage services in Kenya. Athi Water is created under Section 51 of the Water Act 2002 serving a population of over 4.5million in Nairobi City and its environs.

3.2 Roles and Tasks of Related Organisations

3.2.1 Urban Planning

The Government of Kenya, including national government and local government, is in the transitional stage based on the Constitution 2010 and subordinate legal framework such as the Local Government Act 2012, as well as the new President's policy. The number of ministries will be reduced from 24 in the previous government to reportedly 18 in the new government. The President has been nominating the cabinet members since April and the job description of each ministry will be announced later.

Local government structure has shifted from a variety of status (city, municipality, town) to a county government. NCC is also under transition based on the County Government Act and the policy of the new governor.

(1) National Government

The main ministries related to Nairobi City urban development in the old structure were the Ministry of the Local Government, the Ministry of Lands, and the Ministry of Nairobi Metropolitan Development. Functions of each ministry are summarised in the following table.

Table 3.2.1 Ministries Related to Urban Planning (Old Structure)

Organisations	Functions
Ministry of Local Government (Urban Development Department)	<ul style="list-style-type: none"> ● Responsible for managing local government matters (policy, assist local authority for planning) ● Urban Development Department is responsible for urban development (main organisation for preparing National Urban Development Policy)
Ministry of Lands (Physical Planning Department)	<ul style="list-style-type: none"> ● Responsible for land management ● Physical Planning Department is responsible for physical planning and implementation ● Approval of urban master plan
Ministry of Nairobi Metropolitan Development (Metropolitan Planning and Environment)	<ul style="list-style-type: none"> ● Responsible for providing technical support and resources in areas of planning and implementation of projects (based on the Local Government Act (Cap 265 which was repealed in 2012). ● Prepared Metro Strategy 2030 and Spatial Plan for 2030.

Source: Thematic Working Group

The new government structure has been compiled based on the government announcement and input from Thematic Working Group. Most of the functions and responsibilities for urban development have been put together in the Ministry of Land, Housing, and Urban Development. Since the national government is still in a transition stage, detail of the national government structure is yet to be announced, so some of the information in the table is still tentative.

Table 3.2.2 Ministries Related to Urban Planning (New Structure)

Old Government	New Government
Ministry of Local Government	<ul style="list-style-type: none"> ● Mostly shift to the Ministry of Devolution

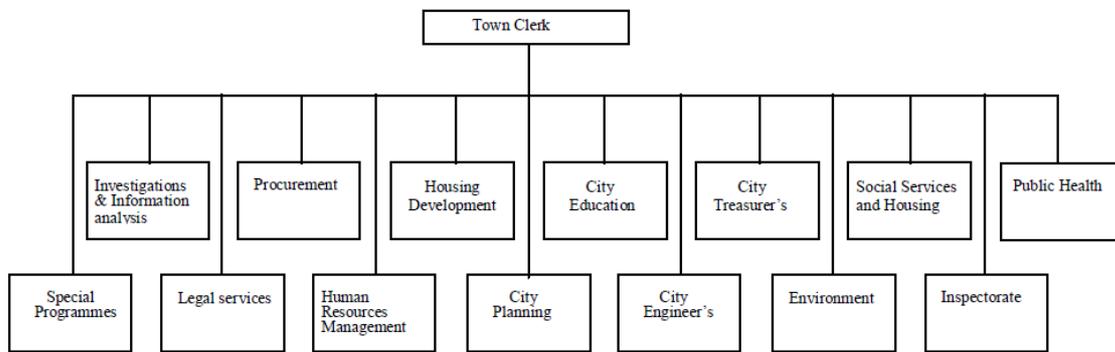
(Urban Development Department)	<ul style="list-style-type: none"> ● Urban Development Department shifts to the Ministry of Lands, Housing, and Urban Development
Ministry of Lands (Physical Planning Department)	<ul style="list-style-type: none"> ● Ministry of Lands, Housing, Urban Development ● Combining Ministry of Lands, Ministry of Housing, and Urban Development sections of other ministries ● Integrated urban development section of the Ministry of Local Government and the Ministry of Nairobi Metropolitan Development
Ministry of Nairobi Metropolitan Development (Metropolitan Planning and Environment)	<ul style="list-style-type: none"> ● Dissolved ● Integrated into the Ministry of Lands, Housing and Urban Development

Source: Government announcement, Thematic Working Group

(2) CCN (City Council of Nairobi)

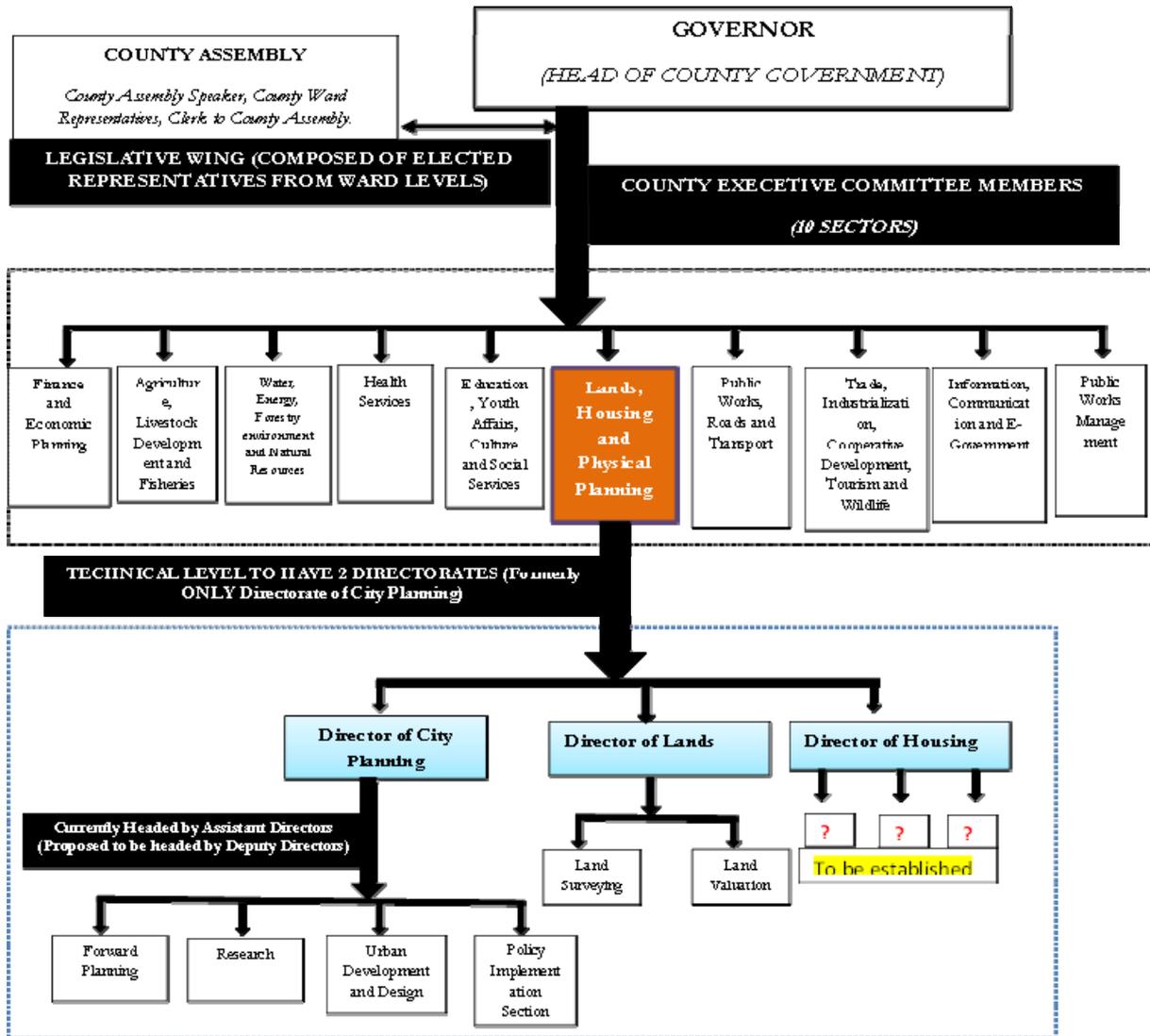
Nairobi City is changed from the City Council of Nairobi to Nairobi City County (NCC), through which seventeen departments were restructured to ten departments.

The City Planning Department of NCC became the Department of Planning and Development, which is an integration of the City Planning Department, City Engineer's, and Housing Development.



Source: JICA Study Team (JST)

Figure 3.2.1 Organisation Chart of NCC (Old System)



Source: JICA Study Team (JST)

Figure 3.2.2 NCC Land, Housing, and Physical Planning Sector Organogram (tentative)

The City Planning Department is composed of eight sections. The following table shows the tasks of each section in the City Planning Department.

Table 3.2.3 Tasks of Sections in the City Planning Department

	Section	Job Description
(1)	Forward Planning Section	Responsible for policy formulation and supporting permit process.
(2)	Research Section	Responsible for supporting section by conducting survey and provide information regarding urban condition, housing, and infrastructure, renew land lease, register private schools, designating street names, and designating physical address.
(3)	Central Administration	Responsible for administrative matter, including staff evaluation, organisation restructure, and other supporting matters.
(4)	Development Control Section	Responsible for building construction permit management
(5)	Policy Implementation Section (PIS)	Responsible for land development permit management. Permit is required for change in land use, division of land plot, and extension (adding) of new and use.
(6)	Urban Design Development Section	Responsible for development of landscape (greenery, bench, bus shelter) and management of advertisement.
(7)	Enforcement Section	Responsible for inspection and monitoring of development approved by the Development Control Section and Policy Implementation Section.
(8)	Land Survey Section	Responsible for conducting land survey that belongs to Nairobi City and develop GIS database.

Source: Official organisational chart, interviews with the assistant directors.

3.2.2 Environment

(1) Ministry of Environment and Mineral Resources (MEMR)

The MEMR (currently, the Ministry of Environment, Water, and Natural Resources (MEWNR) since April 2013) is the environmental administrative body of Kenya. Main vision of MEWNR is to promote, monitor, conserve, protect, and sustainably manage the environment and mineral resources across the nation for national development. MEMR has several departments and state corporations, and the National Environmental Management Authority (NEMA) is one of MEMR's departments. In April 2013, the restructuring plan of the central government was released, and this ministry will become the Ministry of Environment, Water, and Natural Resources.

(2) National Environmental Management Authority (NEMA)

The NEMA is established under EMCA, No. 8 of 1999, as the principal instrument of the government in the implementation of all policies related to the environment. This authority became operational on 1 July 2002 following the merger of three government departments, namely: the National Environment Secretariat (NES), the Permanent Presidential Commission on Soil Conservation and Afforestation (PPCSCA), and the Department of Resource Surveys and Remote Sensing (DRSRS). However, following government restructuring, conducted in March 2003, DRSRS reverted to its departmental status under MEMR.

Kenya is divided into eight main administrative provinces, i.e., (i) Central, (ii) Coast, (iii) Eastern, (iv) North Eastern, (v) Nyanza, (vi) Rift Valley, (vii) Western, and (viii) Nairobi, which is also the capital city. Concerning environmental management, each of these provinces has an office of NEMA. The Kenya's environmental administration and its legal framework are described in the following sections.

(3) Department of Environment (DOE), City Council of Nairobi/NCC

The DOE of the City Council of Nairobi was established in 1996 and still exists under NCC. Main mission of this department is to conduct a sustainable environmental management across Nairobi City, aiming at creating a healthy, clean, and aesthetically pleasant environment to its residents and to formulate and implement suitable policies and tools for the effective management of the environment. This department comprises the following four sections: (i) Cleansing Section, (ii) Parks Section, (iii) Environmental Management and Planning Section, and (iv) Administration Section. Its key responsibilities include:

- (i) Garbage collection, transportation, and disposal;
- (ii) Street/road sweeping, litter picking and drains clearing;
- (iii) Grass cutting and bushes clearing in public parks, open spaces, and road reserves;
- (iv) Urban reforestation and beautification;
- (v) Management of parks and open spaces;
- (vi) Management of solid waste disposal sites;
- (vii) Formulation and implementation of effective environmental management policies;
- (viii) Creation of public awareness on environmental issues; and
- (ix) Establishment of public/private partnership in environment management.

(4) Kenya Forest Service (KFS)

The KFS is a state corporation, established in February 2007 under the Forest Act of 2005. Its main mission is to conserve, develop, and sustainably manage forest resources for Kenya's social-economic development. The KFS management structure comprises ten conservancies that are ecologically demarcated, 76 zonal forest offices, 150 forest stations. About 250 divisional forest extension offices

are working across the country and play critical roles in the forest management and relevant surveillance. To make the forest management more effective, forest adjacent communities have formed registered forest management bodies with assistance from KFS. Those registered groups are currently working with KFS to sustainably manage forest resources. In total, there are 325 community forest associations.

In Nairobi City, there are several forest reserves such as (i) Karura Forest Reserve (1,063 ha) and (ii) Ngong Forest Reserve (638.4 ha), supervised by KWS. Besides, the Nairobi Arboretum (25.0 ha) is also under KFS's supervision.

(5) Kenya Wildlife Service (KWS)

The KWS conserves and manages Kenya's wildlife for the Kenyan people and the world. It is a state corporation established by an Act of Parliament Cap 376 with the mandate to conserve and manage wildlife in Kenya, and to enforce related laws and regulations. KWS undertakes the conservation and the management of wildlife resources outside protected areas in collaboration with stakeholders. The community wildlife program of KWS in collaboration with others encourages communities, located near and/or within important wildlife conservation areas, such as wildlife corridors and dispersal lands outside parks and reserves for the biodiversity conservation. KWS manages about 8% of the total landmass of the country. Kenya has 22 national parks, 28 national reserves and five national sanctuaries. Also under KWS management are four marine national parks and six marine national reserves on the coast. In addition, KWS manages 125 field stations outside the protected areas. The Nairobi National Park (11,640 ha), located within Nairobi City, some 7 km away from the city centre, is conserved and supervised by KWS.

(6) Water Resources Management Authority (WRMA)

The WRMA is a state corporation under the Ministry of Water and Irrigation (now under MEWNR), established under the Water Act 2002. WRMA is the lead agency in nationwide water resources management. Wetlands located along the tributaries running through Nairobi City are protected. If some development works are planned to be conducted inside of those wetlands, a special permit shall be obtained from this organisation.

3.2.3 Economy and Investment

(1) New Ministries

The Ministry of Commerce and Tourism and the Ministry of Industrialisation and Enterprise Development are particularly related to the economic activities and investment promotion in Nairobi City. In addition, the Ministry of Mining may have relevance in the quarrying businesses in the city and the Ministry of Agriculture, Livestock, and Fisheries may play certain roles for the farms in the suburban areas in the city.

(2) Other Public and Private Organisations

The following are the organisations and their major roles, particularly, relevant to businesses.

1) Investment Promotion, Industrial Infrastructure Provision, and Business Promotion

i) Kenya Investment Authority (*KenInvest or KIA*)

Pre-Investment Services

- Assistance in obtaining any necessary licenses and permits;
- Assisting in obtaining incentives or exemptions under the Income Tax Act, the Customs

- and Excise Act, the Value Added Tax Act, or other legislation;
- Providing information to investors on the business climate, operating rules, investment opportunities and sources of capital; and
- Liaison with other government agencies for the issuance of additional licenses and approvals not directly handled by the authority.

Post – Investment Services

- Issuance of Investment Certificate that facilitates the immediate start of a business, and
- Provision of after care services.

ii) Export Processing Zones Authority (EPZA)

The EPZA operates export processing zones (EPZs) in the Athi River and Mombasa.

It is noted that the development of a new strategic plan became necessary to enable the authority transform the areas to special economic zone (SEZ) environment.

iii) Kenya Industrial Estate Ltd (KIE)

The KIE was established in 1967 to provide for the development of industrial estates/sheds, financial support, and entrepreneurship development. It became an independent state corporation in 1978, with the government as the sole shareholder.

KIE's products and services are as follows:

- Industrial estates development and incubation services
 - Industrial shed rehabilitation
- Financial support services
 - Credit facilities
 - Special credit facilities for marginalised areas
 - Top up loan facilities
 - Bid bond facility
 - Performance bond facility
 - Jitahidi group loans (group guarantee scheme)
 - Agency banking
- Business advisory services
 - Facilitating inter-firm linkages
- Special government projects

iv) Micro and Small Enterprise Authority (MSEA)

The MSEA is a newly established authority under the Ministry of Industrialisation and Enterprise Development in order to upgrade micro and small enterprises (MSE) to small and medium enterprises (SME). MSEA coordinates and harmonises all activities for MSE development.

MSEA's specific tasks are as follows: a) financing, b) training, c) infrastructure development, and d) policy development.

MSEA is a successor to the Department of Micro and Small Enterprise Development (DMSED) of the Ministry of Labour. DMSED was responsible for the formulation of policies and coordination of implementation strategies for the development of the MSE sector.

2) Multi-sectoral Private Sector Groups

i) Kenya Private Sector Alliance (KEPSA)

The KEPSA seeks private sector development through advocacy, projects, and partnerships for both local and international, as well as through policy formulation and implementation.

ii) *Kenya National Chamber of Commerce and Industry (KNCC&I)*

The KNCC&I is an umbrella organisation of businessmen and industrialists in Kenya.

iii) *Nairobi County Business Association (NCBA)*

The NCBA is a rebranded successor of Nairobi Central Business District Association (NCBDA). Its target area is the whole Nairobi City and no longer limited to the Central Business District (CBD). Its mandate is to be an intermediary between the government and the private sector. It is an umbrella of many private sector organisations. Its core functions are (1) improvement of security of businesses, (2) improvement of environment and beautification, and (3) request and proposals for improvement of the transportation system. Such functions are fulfilled by project implementation, advocacy, and campaigns in collaboration with government organisations, particularly with NCC.

One of the active members of NCBA is the United Business Association (UBA). It supports all types of SMEs.

3) Manufacturing

i) *Kenya Industrial Property Institute (KIPI)*

The KIPI is a parastatal with the following functions:

- Administer industrial property rights;
- Provision of technological information to the public;
- Promotion of inventiveness in Kenya; and
- Provision of training on industrial property.

ii) *Kenya Industrial Research and Development Institute (KIRDI)*

The KIRDI was established to promote industrialisation in Kenya by undertaking industrial research, development, and disseminating findings that have a positive impact on national development.

iii) *Kenya Association of Manufacturers (KAM)*

The KAM is a representative organisation of the manufacturing sector with a wide range of services in advocacy, business services, and communication.

4) Tourism

i) *Kenya Tourist Development Corporation (KTDC)*

The KTDC is facilitating and providing affordable development funding and advisory services for long-term investment in Kenya's tourism industry.

ii) *Kenya Tourist Board (KTB)*

To market the country, KTB sensitises the industry players and monitors the standards of the accommodation facilities of tourists in Kenya.

5) Information and Communications Technology (ICT)

i) *Kenya ICT Board*

- Marketing (positioning and promoting Kenya as an ICT destination (locally and internationally), especially promoting business process outsourcing (BPO) and offshoring);
- Advisory (advise the government on all relevant matters pertaining to the development and promotion of ICT industries in Kenya);
- Capacity building (providing government and other stakeholders with skills, capacity and funding for anchor implementation of ICT projects for development); and
- Project management (coordinating, directing, and implementing anchor ICT projects in development).

6) Financial

i) *Capital Market Authority (CMA)*

The CMA functions are as follows:

- Licensing and supervising all the capital market intermediaries;
- Ensuring proper conduct of all licensed persons and market institutions;
- Regulating the issuance of the capital market products (bonds, shares, etc.);
- Promoting market development through research on new products and institution;.
- Promoting investor education and public awareness; and
- Protecting investors' interest.

3.2.4 Infrastructure

This section presents an analysis of the key institutions that relate to the infrastructure provision. These institutions are established by the acts of the Parliament which provides for their functions, roles, and operation. The analysis also highlights how the NIUPLAN will help the specific institutions in meeting and executing their specific mandates and vice-versa.

(1) Kenya National Highways Authority (KeNHA)

Sections 3, 4, and 5 of the Kenya Roads Act (2007) provide for the establishment and functions of the Kenya National Highways Authority (KeNHA) which is responsible for the management, development, rehabilitation, and maintenance of the national roads. Functions of KeNHA are as follows:

- (i) Constructing, upgrading, rehabilitating, and maintaining roads under its control;
- (ii) Controlling national roads and road reserves and access to roadside development;
- (iii) Implementing road policies in relation to national roads;
- (iv) Ensuring adherence to the rules and guidelines on axle load control prescribed under the Traffic Act (Cap. 403) and under any regulations under this act;
- (v) Ensuring that the quality of road works is in accordance with such standards as may be prescribed by the minister;
- (vi) In collaboration with the ministry responsible for transport and the Police Department, overseeing the management of traffic and road safety on national roads;
- (vii) Collecting and collating all such data related to the use of national roads as may be necessary for efficient forward planning under this act;

- (viii) Monitoring and evaluating the use of national roads;
- (ix) Planning the development and maintenance of national roads;
- (x) Advising the minister on all issues relating to national roads;
- (xi) Preparing the road works programmes for all national roads;
- (xii) Liaising and coordinating with other road authorities in planning and on operations in respect of roads; and
- (xiii) Performing such other functions related to the implementation of this act as may be directed by the minister.

There needs to evolve a clear framework for cooperation between KeNHA and the NIUPLAN team for the formulation of the Urban Transport Plan since the two main highways (Thika Superhighway and Mombasa Highway) that pass through the heart of Nairobi City are under the care of KeNHA. The two roads contain large volumes of traffic passing through Nairobi City, and the major problem associated with them is that they both carry local and through traffic. It is indeed worth noting that key urban transport strategies have to take into consideration the two highway corridors.

(2) Kenya Urban Roads Authority (KURA)

Sections 9, 10, 11 and 12 of the Roads Act provide for the establishment, functions, and composition of KURA which is the body corporate in charge of management, development, rehabilitation, and maintenance of all public roads in the cities and municipalities in Kenya except if these roads are national roads. KURA has the following powers and duties:

- (i) Constructing, upgrading, rehabilitating, and maintaining roads under its control;
- (ii) Controlling urban road reserves and access to roadside development;
- (iii) Implementing roads policies in relation to urban roads;
- (iv) Ensuring adherence of motorists to the rules and guidelines on axle load control prescribed under the Traffic Act (Cap. 403) and under any regulations under this act;
- (v) Ensuring that the quality of road works is in accordance with such standards as may be defined by the minister;
- (vi) In collaboration with the ministry responsible for transport and the Police Department, overseeing the management of traffic and road safety on urban roads;
- (vii) Monitoring and evaluating the use of urban roads;
- (viii) Planning the development and maintenance of urban roads;
- (ix) Collecting and collating all such data related to the use of urban roads as may be necessary for efficient forward planning under this act;
- (x) Preparing the road works programmes for all urban roads;
- (xi) Liaising and coordinating with other road authorities in planning and on operations in respect of roads;
- (xii) Advising the minister on all issues related to urban roads; and
- (xiii) Performing such other functions related to the implementation of this act as may be directed by the minister.

Urban transport is an important component of any integrated plan for urban development. In the preparation of the NIUPLAN, there needs to be strong collaboration between KURA and the NIUPLAN team. KURA is currently engaged in the development of all urban roads in Nairobi City with involvement of most roads, including the new ones like the by-passes and the missing links.

(3) Energy Regulatory Commission (ERC)

The Energy Act establishes ERC which is an independent body corporate with the objects and functions to:

- (i) Regulate
 - a. Importation, exportation, generation, transmission, distribution, supply, and use of electrical energy;
 - b. Importation, exportation, transportation, refining, storage, and sale of petroleum and petroleum products; and
 - c. Production, distribution, supply, and use of renewable and other forms of energy;
- (ii) Protect the interests of consumer, investor, and other stakeholder interests;
- (iii) Maintain a list of accredited energy auditors as may be prescribed;
- (iv) Monitor, ensure implementation of, and the observance of the principles of fair competition in the energy sector, in coordination with other statutory authorities;
- (v) Provide such information and statistics to the minister as he may from time to time require;
- (vi) Collect and maintain energy data;
- (vii) Prepare indicative national energy plan; and
- (viii) Perform any other function that is incidental or consequential to its functions under this act or any other written law.

The Energy Act stipulates the conditions for ERC in granting licenses for generation, importation, exportation, transmission, or distribution of electrical energy, including certain provisions that are particular to the well-being of the environment, including provisions such as:

- (i) The impact of the undertaking on the social, cultural, or recreational life of the community;
- (ii) The need to protect the environment and to conserve the natural resources in accordance with the Environmental Management and Coordination Act of 1999 (No. 8 of 1990);
- (iii) Land use or the location of the undertaking;
- (iv) Economic and financial benefits to the country or area of supply of the undertaking;
- (v) The economic and energy policies in place from time to time;
- (vi) The cost of the undertaking and financing arrangements;
- (vii) The ability of the applicant to operate in a manner designed to protect the health and safety of users of the service for which the licence or permit is required and other members of the public who would be affected by the undertaking;
- (viii) The technical and financial capacity of the applicant to render the service for which the licence or permit is required;

- (ix) Any representations or objections made under Subsection (4) of Section 28 (which provides for the procedures for making representations and/or objections to applications seeking permits);
- (x) The proposed tariff offered; and
- (xi) Any other matter that the commission may consider likely to have a bearing on the undertaking.

(4) Kenya Pipeline Corporation (KPC)

The KPC is the state corporation in charge of the only pipeline network in Kenya. KPC, alongside with KRC has high controlling stakes in the Nairobi City's wayleaves. One key aspect that needs to be considered is the fact that a large chunk of the KPC wayleaves is occupied other land uses like informal settlements.

KPC needs to contribute to NIUPLAN in order to help in providing information on identification and uses of its facilities, networks, and wayleaves to avert any possible disaster like the Sinai fire tragedy, as well as to improve the efficiency of utilisation of land surrounding them. In the future, management of wayleaves will need to be done in a manner consistent with the Vision of Nairobi City 2030 as it is outlined in the NIUPLAN.

(5) Kenya Power and Lighting Company (KPLC)

The KPLC is the body mandated to supply electricity in Kenya. KPLC buys electric power or energy from Kenya Electricity Generating Company Limited (Kengen) and sells on their behalf.

For purposes of NIUPLAN, KPLC plays a critical role of enhancing connectivity, distribution, and availability of electricity to consumers. Thus, KPLC involvement in the NIUPLAN preparation is an important factor as they control a large chunk of wayleaves in the city, in addition to the reliable role of the electric power plays in national development.

(6) Kenya Electricity Transmission Company (KETRACO)

The KETRACO was incorporated on 2 December 2008 and registered under the Companies Act, Cap 486 pursuant to Sessional Paper No. 4 of 2004 on Energy. KETRACO is 100% government owned and being a state corporation, it is regulated under the State Corporations Act, Cap 446.

The company was established to develop new high voltage electricity transmission infrastructure that will form the backbone of the National Transmission Grid, in line with Kenya Vision 2030.

In relation to the NIUPLAN, KETRACO is an important organisation in laying the infrastructure for electric power. Some of the infrastructure is substandard and needs to be upgraded. For purposes of the NIUPLAN, if the large power wayleaves are properly utilised by KETRACO, especially through construction of high quality towers, the wayleaves could be utilised safely for some significant urban functions that have limited land.

(7) Kenya Railways Corporation

This is an act of the Parliament for the establishment of the Kenya Railways Corporation, simply called Kenya Railways.

The act provides for the powers of Kenya Railways Corporation being generally, without prejudice, to construct railways, develop roads to access the railways, develop parking, provide train services, and determine tariffs and train fares. The other roles include responsibilities to buy and sell property, provide housing to its employees, and all such related services.

Relating to the NIUPLAN, the KRC remains an important player in delivering sustainable urban transport framework for the whole of Nairobi City. The current train system is not fully integrated with Nairobi City, and is not helping the city to develop effectively. However, the various plans have the KRC facilities at the core of their development. The Urban Transport Strategies are themselves built around those studies, in addition to the current primary studies that have been conducted for NIUPLAN urban strategies. Further, the massive land holdings that the KRC holds around the current CBD are important components in the land use planning of the CBD. The proposed Railway City is just one of the components of this NIUPLAN.

(8) Athi Water Services Board

Section 51 provides for the establishment of water services boards. The role of these boards include planning for the improvement of the provision of water supply and sewerage services, appointment and contracting water service providers as well as being asset holder of the central government facilities. The Athi Water is one of the eight water boards under the Ministry of Environment, Water, and Natural Resources created to bring about efficiency, economy, and sustainability in the provision of water and sewerage services in Kenya. The Athi Water is created under Section 51 of the Water Act 2002 serving a population of over 4.5 million in Nairobi City and its environs.

Under the Act, water service providers are licensed by water service boards to retail water in their jurisdictions. Nairobi City Water and Sewerage Company is one such water service provider, which has been appointed by the Athi Water Service Board to provide water and sewerage services to the residents of Nairobi City and its environs. The Nairobi City Water and Sewerage Company is committed to ensure that all stakeholders receive water regularly and efficiently and that the water reaching the customers is of highest quality.

According to www.nairobiwater.co.ke, currently, of the three million residents of Nairobi City, only 50% have direct access to piped water. The rest obtain water from kiosks, vendors, and illegal connections. Of the existing customers, about 40% receives water on a 24-hour basis. This is a weakness that the NIUPLAN needs to solve in order to increase water availability to all the residents of Nairobi City.

3.3 Review of Existing Urban Master Plans

3.3.1 History of Nairobi City

The history of Nairobi City traces back to the last decade of the 19th century, when the British started the Mombasa Uganda Railway. When the railway tracks were started to be laid, a camp for workers and a depot for construction materials and equipment were established in an elevated land, which later became Nairobi. The first plan of Nairobi was made in 1906, and the population reached 11,000 in 1906. In 1919, Nairobi became a municipality, and the population started to grow. In 1927, the second plan of Nairobi for a Settler Capital was prepared by professionals.

In 1948, shortly after the World War II, a new plan for Nairobi as a colonial town was prepared. The population at this time was 119,000. Then, Nairobi grew as a regional economic centre, and when Kenya achieved her independence in 1963, Nairobi became the capital city of the Republic of Kenya. The population of Nairobi City at the time of independence was 342,000.

In 1969, the National Census was started in Kenya. The population of Kenya in 1969 at the time of the 1st Census was 509,000, but the population reached the one million mark in the 3rd Census in 1989, exceeded the two million mark in the subsequent census in 1999, and then the three million mark in the most recent census in 2009.

In terms of population growth, the annual average growth rates of Nairobi City population have been more than 6% since its birth until the first Census in 1969. The annual growth rate has subsided to a

4% per annum since then until 1999, and now it falls below the 4% per annum mark. This means that the population in Nairobi City is going through a process of rapid growth to a stable one recently.

Table 3.3.1 Historical Population Change of Nairobi City

Year	Population (1,000)	Average Annual Growth Rate (%)	Remark
1906	11		1 st Master Plan (1898) 2 nd Plan for Settler Capital (1927)
1948	119	6.84	3 rd Master Plan (1948)
1963	342	7.29	Independence (1963), Capital of Kenya
1969	509	6.85	1 st Census
1979	828	4.99	4 th Master Plan (1973), 2 nd Census
1989	1,325	4.81	3 rd Census
1999	2,143	4.93	4 th Census
2009	3,138	3.89	5 th Census, New Constitution (2010)

Source: Nairobi City County

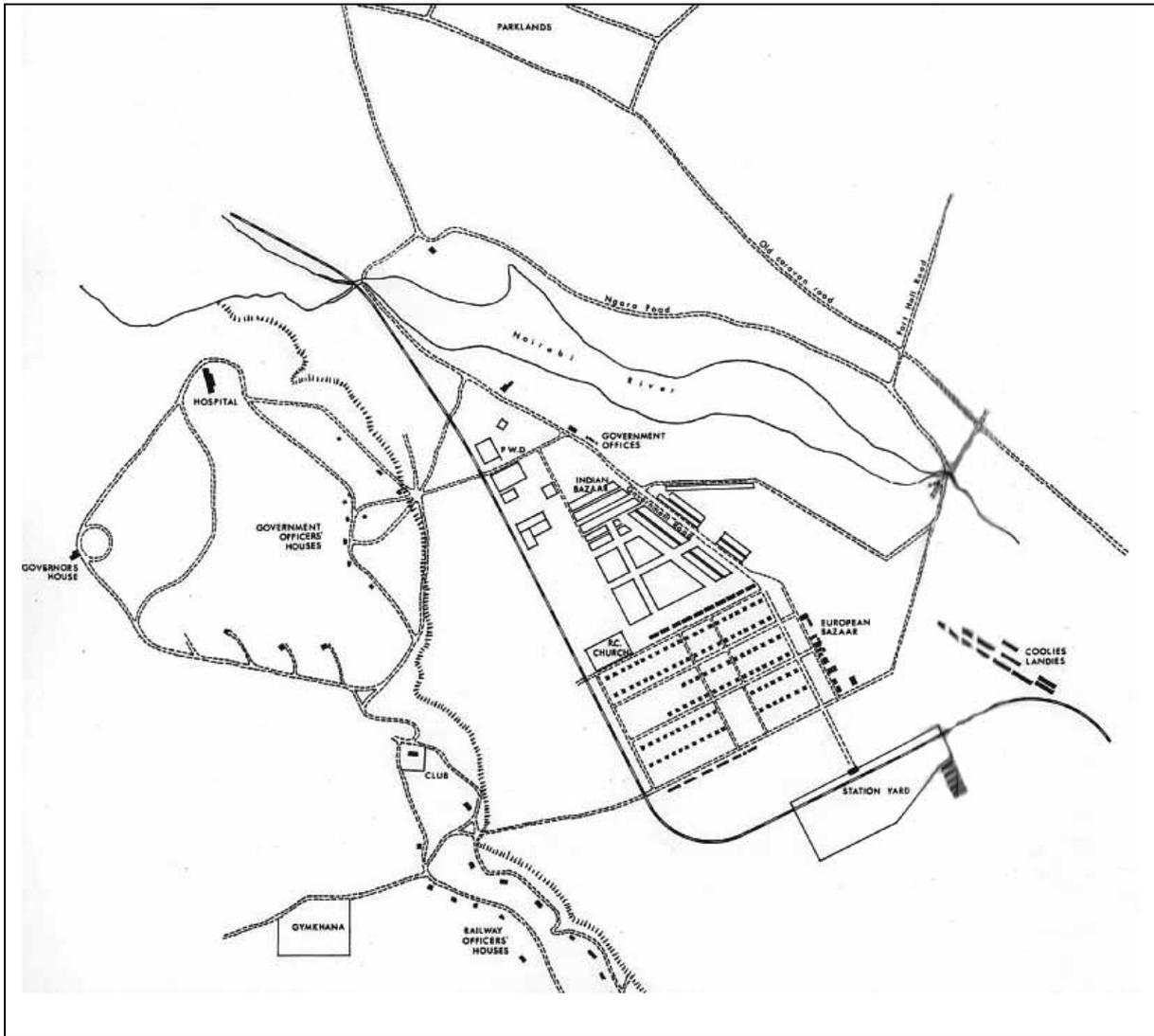
3.3.2 Urban Planning History of Nairobi City

(1) First Plan of Nairobi City in 1898

The first plan of Nairobi City was drawn by a young assistant railway engineer by the name of Arthur Frederick Church in 1898. Church was only 30 years old when he was dispatched to assist Chief Engineer George Whitehouse, and was instructed to prepare a town layout for the railway depot in “Nairobi”.

The church’s plan had the following features:

- (i) The Nairobi Station was just about the same location as it is today, and the railway was laid out at the same location where the Uhuru Highway is today;
- (ii) The main street from the railhead, which was called Station Road (today’s Tom Mboya Street), was laid out to the north of the station, with a design to be wide enough for a three-axled oxcart wagons to turn;
- (iii) Another street parallel to Station Road called Victoria Street (renamed as Government Street in 1901, and today as Moi Avenue) was laid out with the same width as the Station Road, along with 13 commercial plots called European Bazaar;
- (iv) Off Victoria Street were ten streets where the houses for railway workers were built;
- (v) Along the rise that bordered the flat land are a half dozen sites for upper grade houses for senior railway men, which is today the location of the railway golf course, and
- (vi) The Nairobi River was dammed up to create an impounding pond.



Source: S. Mills, Railway to Nowhere - The Building of the Lunatic Line, Nairobi, 2012

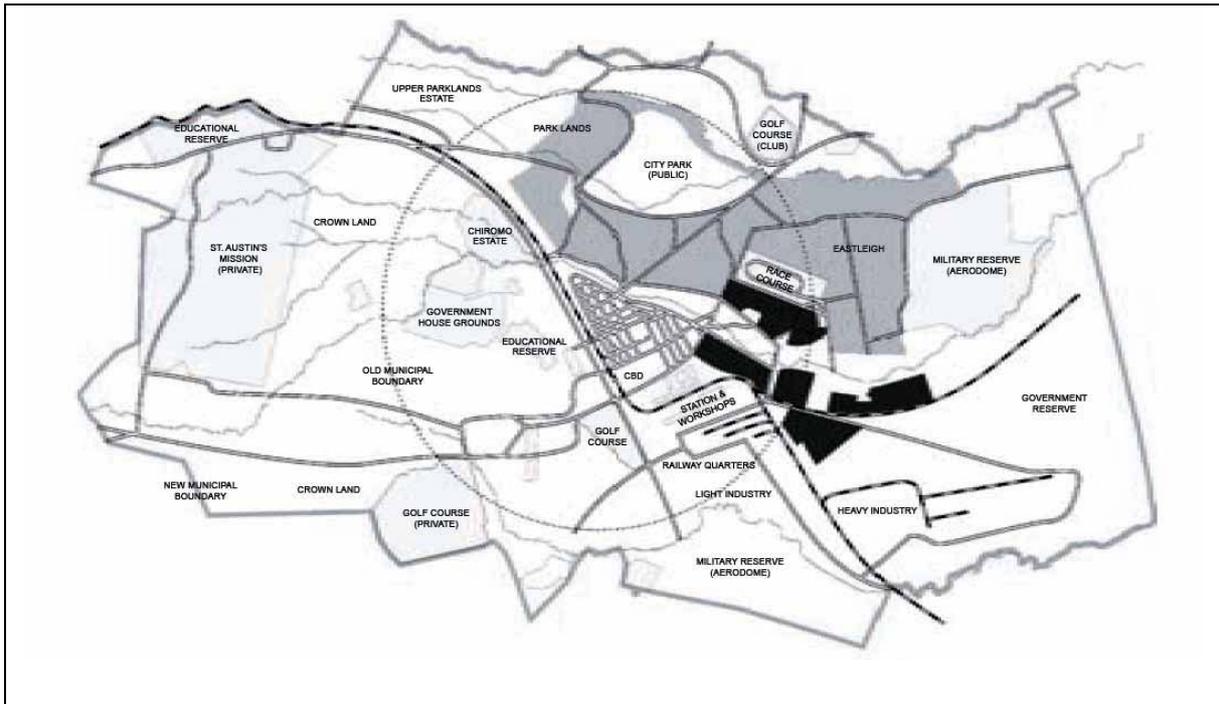
Figure 3.3.1 First Plan of Nairobi City by A. F. Church in 1898

The first town plan was approved by the Chief Engineer Whitehouse on 30 November 1898 and dispatched to London for approval. The spelling of the town was changed by Whitehouse from Nyrobi to Nairobi as is used today before his approval.

The first plan strikingly resembles the town layout of Nairobi City's CBD and its environs today.

(2) Plan for a Settler Capital in 1927

The Plan for a Settler Capital was drawn by F. Walton James and planned by Eric Dutton in 1927 under the British East African rule. The city area was expanded to 77 km² to accommodate the growing population. The plan focused on the improvement of drainage and clearing of swamps and regulating building and density. The plan introduced traffic regulations to reach the expanded land for residence, although the residential area was generally segregated by racial groups.



Source: ETH Studio Basel, History of Urban Planning in Nairobi City, 2008

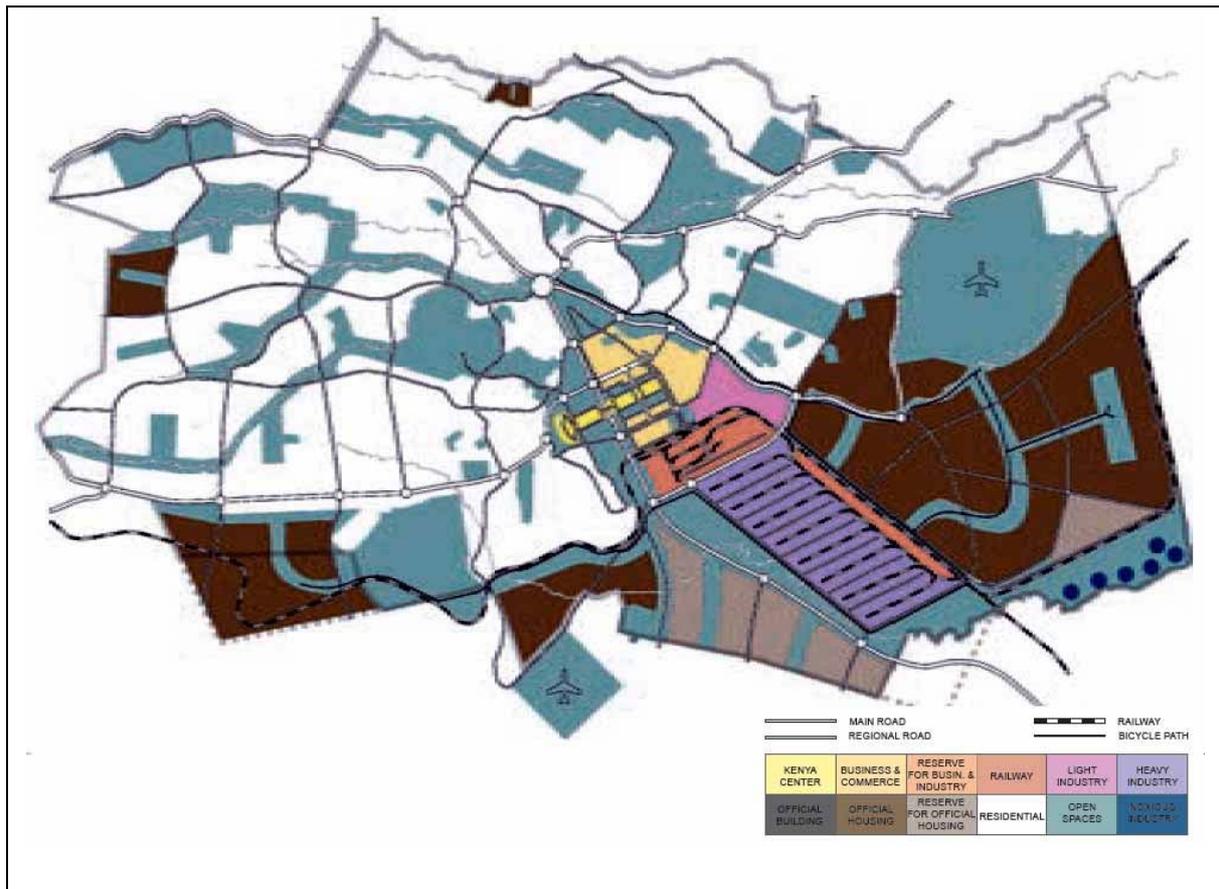
Figure 3.3.2 Plan for Settler Capital in 1927

(3) Master Plan for a Colonial Capital in 1948

The new plan was an experiment in town planning for the colonial Nairobi City, prepared by L. W. T. White, architect and town planner and head of the Department of Architecture, University of Cape Town and others. The master plan was funded by the Municipal Council of Nairobi and the Railway Authorities.

In this plan, a zoning scheme was introduced with zones for official buildings, business and commercial, industry, railway, residential, official housing, open space, forest reserve, and parks. One of the goals of the plan was to establish neighbourhood units for the working class for segregation. Also the plan was expected to make Nairobi more attractive for industrial investments.

It is noteworthy that the alignment of the railway had been changed to the present one along the western part of the town, which gave way for the expansion of the Uhuru Highway today. The area to the south of the railway station was converted to an extensive industrial zone.



Source: ETH Studio Basel, History of Urban Planning in Nairobi City, 2008

Figure 3.3.3 Master Plan for a Colonial Capital in 1948

(4) Nairobi Metropolitan Growth Strategy 1973

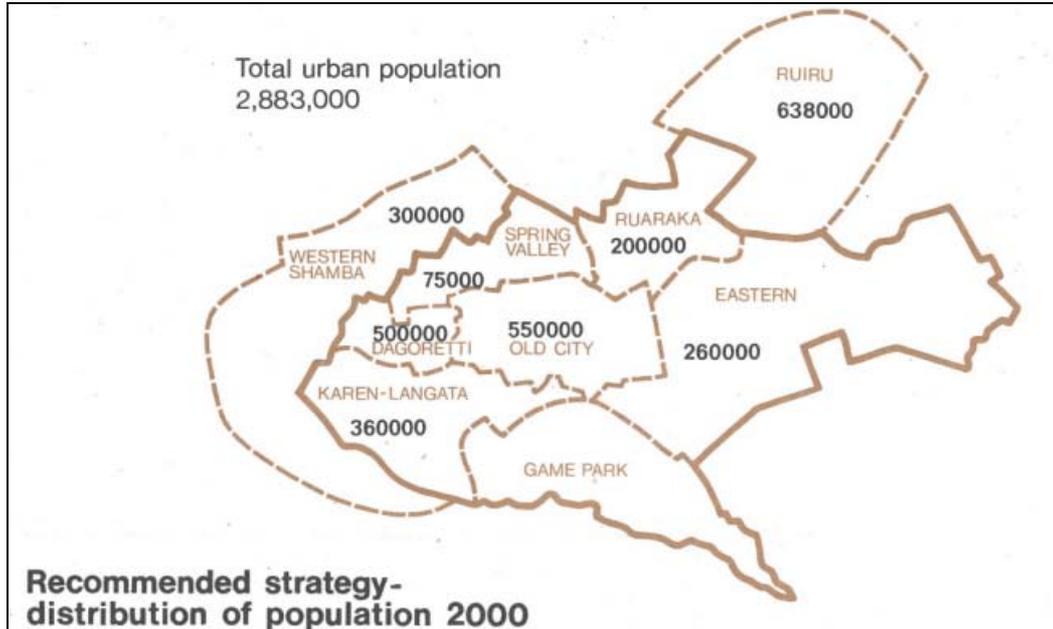
In 1971, the United Nations assisted the formulation of the Metropolitan Growth Strategy in collaboration with the UN experts, urban planners in the City Council of Nairobi, and urban planning consultants to form the Nairobi Urban Study Group. In 1973, Nairobi Metropolitan Growth Strategy was published. The team leader was Charu Gupta (1971-72) and Donald Monson (1972-73).

The Metropolitan Strategy set the ultimate target year of 2000, and an intermediate target of 1985. The population of Nairobi City was about 590,000 in 1971, and projected to be 2.88 million in 2000, which was composed of 1.94 million for NCC and the remaining balance in adjoining areas outside of NCC, including Ruiru and Western Shamba. The actual population of NCC was 2.20 million in 2000, so the target was slightly surpassed.

The recommended strategy of the 1973 Plan contains six parts, as listed below:

- (i) Regional Strategy
- (ii) City Strategy
- (iii) Description of the Strategy by Area
- (iv) Phasing of Development
- (v) Recommended Transport Policy
- (vi) Implementation Resource

In the section of phasing of development, the distribution of the projected population in 2000 is shown below. Estimated population of Nairobi City was 1,945,000 and urban population including Ruiru and Western Shamba was 2,883,000.



Source : Nairobi City County

Figure 3.3.4 Recommended Distribution of Population in 2000

For the 1973 development plan proposals to be realised, the following are required amongst other factors and conditions:

- (i) The 1973 plan was essentially a long-term structure planning policy, recommendation of broad long-term policy directions, strategies, possibilities, and guidelines for the development of Nairobi City. The plan was thus required to be translated into a short-term detailed implementable development programmes and projects, appropriate for each local zone or area of the city.
- (ii) The plan required the availability of financial capability and skilled professional personnel resources within the City Council of Nairobi and the Government of Kenya to facilitate the process of detailed planning and implementation of the planned actions at the local level.
- (iii) It also required a significant strengthening and streamlining of the City Council of Nairobi and the Government of Kenya institutional decision-making and enforcement machinery and instruments for effective implementation and realisation of the goals and objectives of the 1973 Plan.

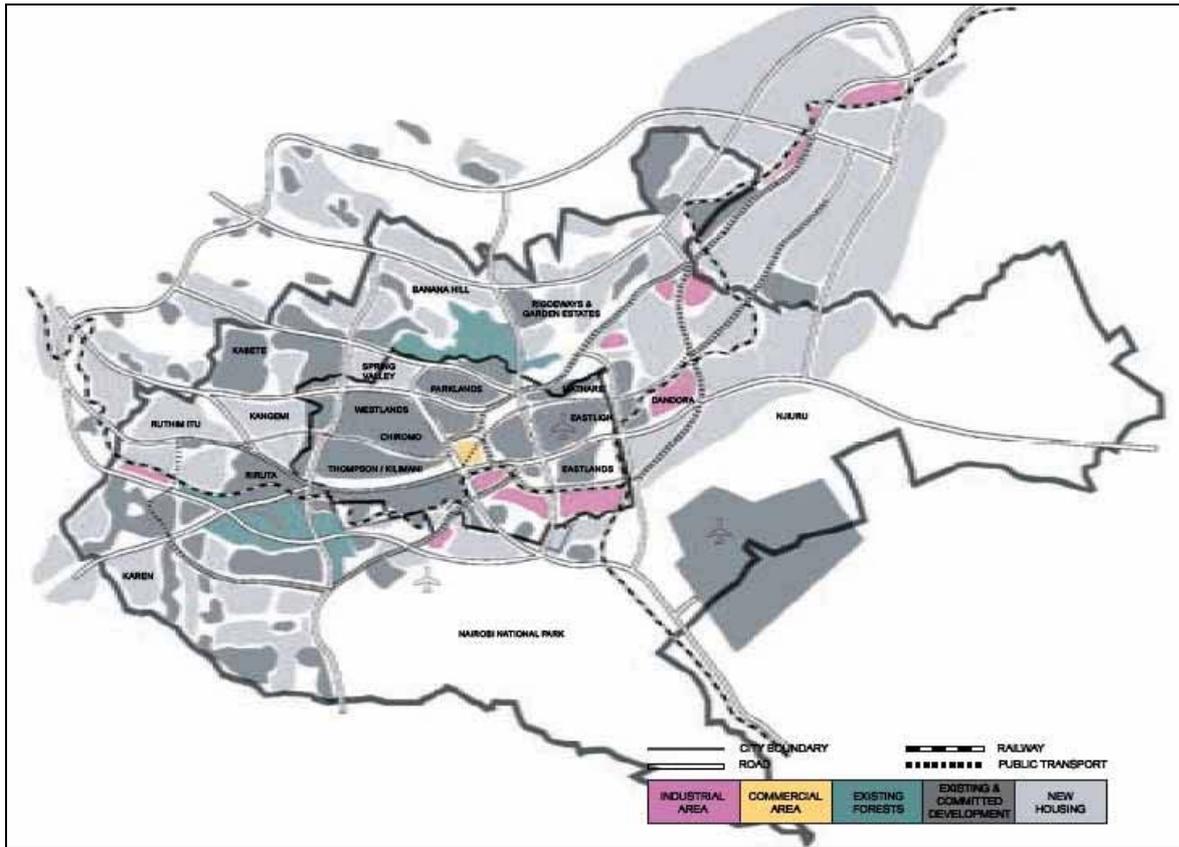
It was observed with regret that the above stated conditions were hardly met in the process of subsequent implementation phase of the 1973 Development Plan for Nairobi City. With direct relevance to the planning area, the results are as follows:

- (i) Development has continued without the guidance of a detailed localised zonal system; i.e., Physical Development Plan.
- (ii) The forces of speculation and private investment that desire to maximise profit have driven the process of development in these areas with minimum control or guidance from the authorities concerned.

- (iii) This development has also taken place without regard to the limitations of the existing infrastructural, transport, and utility facilities to support the increased development in the planning area.
- (iv) The existing extreme shortage of housing generally prevailing in the whole Nairobi City has only helped to fuel the speculative development process.

In the 1973 Strategy, a variety of proposals were made in relation to the urban planning of Nairobi City, major parts of which are listed below:

- (i) The Central Business District (CBD) was already congested, and it was proposed to supplement some of the functions of CBD in some suburban sub-centres to avoid excessive concentration in reference to the experiences of some major metropolitan areas in the world. For Nairobi City, a wide road surrounding CBD was proposed with bus ways to connect residential and industrial areas, and use of private cars was curtailed so that the increasing number of population would shift to public transport.
- (ii) The industrial area close to CBD was providing a large number of employments, but was already heavily concentrated. Excessive concentration should be avoided. When necessary, the expansion may be limited to capital-intensive, urban industry type with limited employments. For other existing industries, expansion of production shall be recommendable in suburban locations.
- (iii) The northern part of the city, which then had mostly been taken in as coffee plantation and estates, was expected to be an urban area by the turn of the century. As some areas are steep-sided hills that are not easy to convert to high to medium density housing area or industrial area, they will be used mainly for low density housing development.
- (iv) The southern part of the city, which includes Kibera and Wilson Airport, was proposed to be used chiefly as residential area for low to medium income population. Wilson Airport was proposed to be relocated to a site outside of Nairobi. The site after relocation may be suitable for industrial area.
- (v) Karen and Langata areas continue to be used for middle to high income population.
- (vi) Dagoretti is an area located in the west of the city, which was expected to have rapid population growth. In order to absorb employments within the zone, provision of industrial area and commercial centres would be necessary.
- (vii) The eastern part of the city continues to serve for low to middle income population except for few high end estates.



Source: ETH Studio Basel, History of Urban Planning in Nairobi, 2008

Figure 3.3.5 Nairobi Metropolitan Growth Strategy 1973

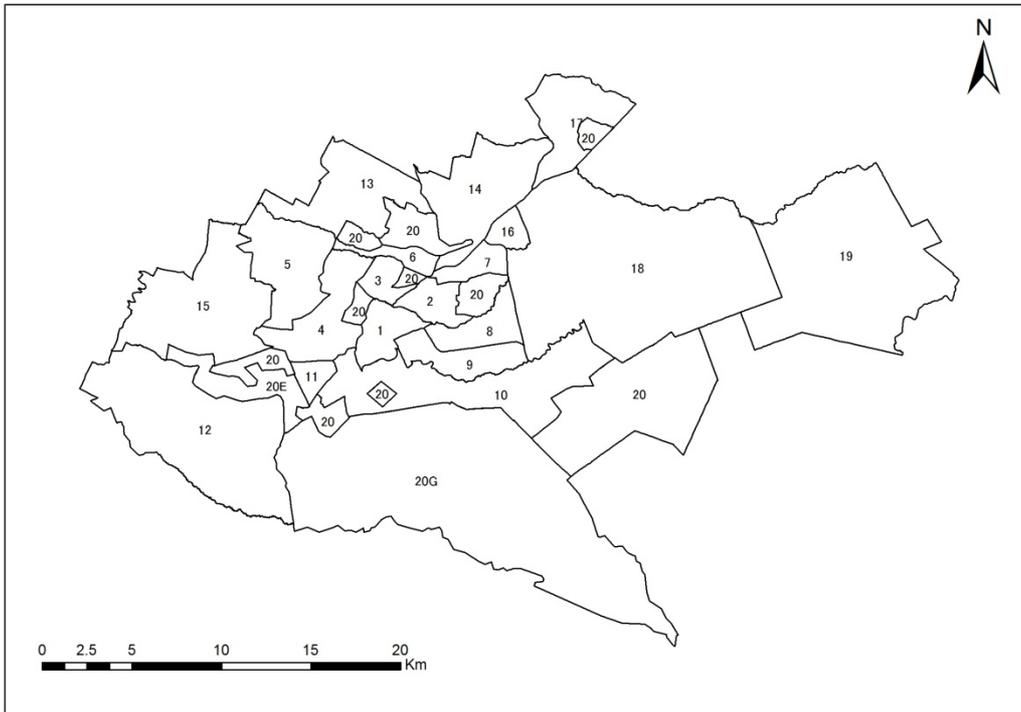
3.3.3 Nairobi City Development Ordinances and Zones

This subsection looks into some of the practices in Nairobi City's regulations on the zoning system, though the system itself is not complete and systematic.

(1) Old Zoning Systems

A preliminary land use zoning was designated for the 1948 master plan in smaller Nairobi boundary in 8,315 km² with 20 zones.

Then a new scheme based on the expanded to the existing Nairobi City boundary was introduced in 1968. This zoning system tried to regulate land use and minimum plot size by zones established as below.



Source: JICA Study Team (JST)

Figure 3.3.6 Zone Map by JST

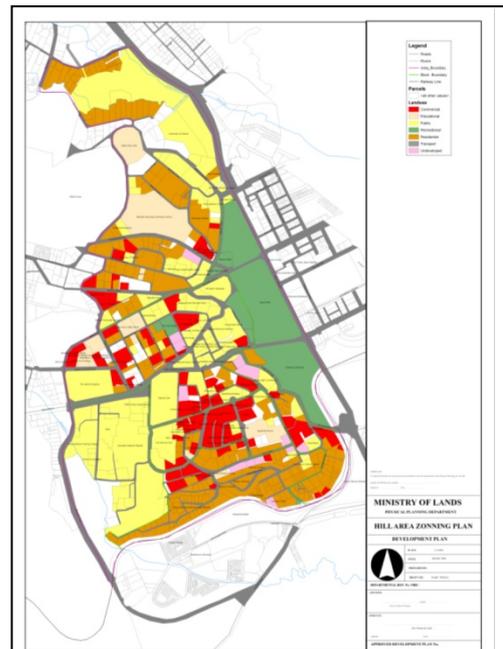
(2) Revision of Zoning for Upper Hill Area in 1993

The City Council of Nairobi in conjunction with the Physical Planning Department of the Ministry of Lands engaged in a joint study and formulated the Upper Hill Rezoning Plan in 1993. This revision was motivated by the rapid development in the area and the infrastructure services remained mostly unmatched particularly for the roads. In the meanwhile, a number of modern office buildings are built in the Upper Hill area.

One of the challenges that was faced by the City Council of Nairobi in the implementation of the revised plan was the level of infrastructure in place vis-a-vis the magnitude of development being realised. Although the 1993 Rezoning Plan provided for widening and expansion of the roads serving the area, this had not been implemented much afterwards.

(3) Nairobi City Development Ordinances and Zones

The last zoning review was carried out in 2004 and resulted in subdividing 20 zones into smaller zones and prescribed ground coverage ratios (GC) and plot ratios (PR), and definition of the minimum plot size for each zone.



Source : Nairobi City County

Figure 3.3.7 Hill Area Zoning Plan

Table 3.3.2 Part of Nairobi City Development Ordinances and Zones

ZONE	AREAS COVERED	GC %	PR %	Dept Ref. Map	TYPE (S) OF DEVELOPMENT ALLOWED	MIN. AREA (Ha.)	REMARKS/POLICY ISSUES
1A	Central Business District (CBD)			CP/EP/XXX	Commercial/Residential/Light Industry	0.05	
	• Core CBD	80	600				
	• Peri-CBD	80	500				
	• West of Tom Mboya St	60	600				
	• East Of Tom Mboya St	80	350				
• Uhuru H/W/ University Way/Kipande Rd	80	500					
1E	Upper Hill Area			CP/EP/XXX	Commercial/Offices/ Residential	0.05	
	• Block 1 - Offices (Community)	60	300				
	• Block 2 - Comm/Off	60	250				
	• Block 3 - Offices	60	300				
	• Block 4 - Residential	35	150				
	• Block 5 - Institutional (KNH)						
• Block 6 - (Mixed: Inst;Htls;Offs)	60	200					
2	Eastleigh			CP/EP/XX	Commercial/Residential (High-rise Flats)	0.05	
	• Eastleigh District Centre	80	250				
	• Eastleigh Comm/Residential	60	240	CP/EP/XXX	Commercial/Residential (High-rise Flats)	0.05	
	Pumwani/California	60	240				
	Ziwani/ Starehe						
• Commercial	80	150					
• Residential	35	75					

Source : Nairobi City County

This revision allowed developers a maximum of four floors for apartments in Westlands, Parklands, Woodley, Kilimani, and Kileleshwa. However, the situation in those areas and the current development activities did not seem to follow the revised regulation much. These can be observed in incidents of high-rise building of more than five floors and land use mixture in residential areas.

Actual regulation may seem to be more ad-hoc than the adopted scheme. Maps indicating the standing regulations were planned for public reference, but have not been realised. Thus, the zoning itself lacks discipline and strength to control the day-to-day development activities appropriately.

(4) Revision of the Existing Zones and Regulations

The NCC conducted two studies on Land Use Study and Policy Plan for Zones 3, 4, and 5 and Zones 6, 13 and 20B in 2012. And also another study was conducted for the Upper Hill area with stakeholder forums in 2008. These revisions are not yet authorised, and still waiting for the outcome of the NIUPLAN.

3.3.4 Strategy and Spatial Planning Concept for Nairobi Metropolitan Region

The Nairobi Metro 2030 (prepared in 2008) and Spatial Planning Concept for Nairobi Metropolitan Region (prepared in 2013) are considered umbrella plans for the present Nairobi Integrated Urban Development Master Plan (NIUPLAN). Some of the recommendations and proposals in the Spatial Planning Concept for Nairobi Metropolitan Region will be integrated in the NIUPLAN. The components related to the formulation of NIUPLAN were reviewed hereafter.

(1) Nairobi Metro2030

Nairobi Metro 2030 is a part of an overall national development agenda for Kenya towards 2030 and aims at optimising the role of Nairobi Metropolitan Region (NMR) in the national development context.

The Nairobi Metro 2030 is composed of: (i) growth and development framework; (ii) Metropolitan Nairobi's strategic challenges; (iii) vision and goals, (iv) growth management structure, the goals, strategies, and actions; and (v) strategic vision to reality: employing class metropolitan governance systems. The outline of the plan is summarised below.

Delineation of the Nairobi Metro Boundary

The NMR is a much larger area than Nairobi City. The population of NMR was 6.64 million (2009 Kenya Population and Housing Census) and the area is 32,000 km², while the population of Nairobi City was 3.1 million and the area is 700 km². The following Table 3.3.3 shows the local authorities included in the NMR. Local authorities included in the NMR are listed in the table below.

Table 3.3.3 Delineation of the Nairobi Metro Boundary

Groups	Local Authorities
Core Nairobi City	City Council of Nairobi
Northern Metro	Municipal Council of Kiambu, Municipal Council of Ruiru, Municipal Council of Karuri, Town Council of Kikuyu, County Council of Kiambu
Southern Metro	Town Council of Kajiado, County Council of Olkejuado
Eastern Metro	Town Council of Tala/Kangundo, Municipal Council of Machakos, Municipal Council of Mavoko, County Council of Masaku

Source : JICA Study Team (JST)

The vision, goals, and strategies set in the Nairobi Metro 2030 are summarised below.

Vision

<p>Metropolitan Vision 2030: To be a world class African metropolis, supportive of the overall national agenda articulated in Kenya Vision 2030</p> <p>Four principals:</p> <ol style="list-style-type: none"> (1) A world class working environment. (2) A world class living environment. (3) A world class business environment. (4) World class metropolitan governance. <p>Key foundation for Metropolitan Vision 2030</p> <ol style="list-style-type: none"> (1) Building an internationally competitive and inclusive economy for prosperity. (2) Deploying world class infrastructure and utilities in the region. (3) Optimising mobility through effective transportation. (4) Enhancing the quality of life and inclusiveness in the region. (5) Delivering a unique image and identity through effective place branding. (6) Ensuring a safe and secure region. (7) Building world class governance system.

Goal, strategies, and actions

Goals	Strategy and Action
Building an internationally competitive and inclusive economy for prosperity.	<ul style="list-style-type: none"> ● Building a regional and global financial services, regional trade and business services hub. ● Regional manufacturing, industrial technology parks initiative. ● Building the Jomo Kenyatta International Airport City. ● Diplomatic initiative. ● Bringing the world to Nairobi Metropolitan Region: a tourism initiative. ● Regional and global research and education hub. ● Enhancing service culture in work organisations.
Deploying world class infrastructure and utilities in the region.	<ul style="list-style-type: none"> ● Service level mapping exercise and benchmark nationally, regionally and globally. ● Energy demand management initiative. ● Water master plan. ● Integrated waste management project. ● A comprehensive stormwater drainage and flood water mitigation plan. ● A metropolitan wide strategic environment assessment. ● Integrated information communication technology infrastructure plan. ● Smart city/villages strategy. ● Develop and integrated metropolitan infrastructure master strategy and plan.

Goals	Strategy and Action
Optimising mobility and accessibility through effective transportation.	<ul style="list-style-type: none"> ● Metropolitan road transport infrastructure measures. ● Metropolitan mass rapid transit program. ● Traffic management strategies. ● Central business district access strategies. ● Demand management. ● Logistics and supply chain management. ● Land use measures. ● Information and communication technology in transport measures. ● Coordination of institutional interventions. ● Metropolitan road safety program.
Enhancing quality of life and inclusiveness in the region.	<ul style="list-style-type: none"> ● Housing and elimination of slum program. ● Environmental management strategy. ● Enhancing access to medical services strategy. ● Enhancing access to and performance of education. ● Enhancing food safety and security. ● Ethnic and race relations. ● Integrated spatial strategy for the Nairobi Metropolitan Region.
Delivering a unique image and identity through effective branding.	<ul style="list-style-type: none"> ● Branding and promoting the Nairobi Metropolitan Region. ● A Nairobi Metropolitan Region heritage and culture strategy. ● An identity building urban design and landscaping strategy.
Ensuring a safe and secure Nairobi Metropolitan Region.	<ul style="list-style-type: none"> ● An effective metropolitan policing strategy. ● Street light program. ● Building an effective metropolitan emergency service. ● Metropolitan street addressing program.

(2) Spatial Planning Concept for Nairobi Metropolitan Region

The “Spatial Planning Concept for Nairobi Metropolitan Region” was prepared by the Ministry of Nairobi Metropolitan Development and approved in March 2013.

According to the staff of the Ministry of Nairobi Metropolitan Development, despite the fact that the Ministry Nairobi Metropolitan Development does not exist in the new government structure, the plan is still valid and the NIUPLAN has to be in line with the Spatial Plan Concept for NMR. Some important contents of the plan, such as population framework, settlement pattern (build up area and new town), settlements hierarchy, land use/land cover, design intervention of NCC, which will be a base for NIUPLAN, are summarised as shown below.

1) Population Framework

The population size of NCC is forecasted under the following assumptions:

- Gradual containment of Nairobi City’s growth to be within acceptable, optimum city density.
- Disincentives for location of activities within Nairobi City such as heavy industries, which require large extent of land, cause major environmental pollution, and generate heavy goods traffic.
- Promotion of activities and investments in other parts of the region through incentives. These policies would include favourable land policies, improved accessibility and connectivity, higher levels of physical and social infrastructure, fiscal incentives, differential pricing of services, etc.

The gross density of NCC, by 2030, is proposed to be limited to 75 persons per ha increasing from 52 persons per ha in 2009. The assigned population size of NCC is 5.21 million and housing demand is forecasted at 1,303,125 in 2030.

Table 3.3.4 Population of NMR

Sr. No.	Spatial Units	2009	2030
1	NMR	6,658,000	15,131,435
	Urban	4,924,286	13,073,459
	Rural	1,733,714	2,057,976
2	Nairobi City	3,138,369	5,212,500
3	ONMR	3,519,631	9,918,935
	Urban	1,785,917	7,860,959
	Rural	1,733,714	2,057,976
4a	Northern Metro	1,786,879	4,971,173
	Urban	991,852	4,187,315
	Rural	795,027	783,859
4b	Eastern Metro	1,045,440	2,962,187
	Urban	511,343	2,376,206
	Rural	534,097	585,981
4c	Southern Metro	687,312	1,985,575
	Urban	282,722	1,297,438
	Rural	404,590	688,137

Source: Spatial Planning Concept for Nairobi Metropolitan Region

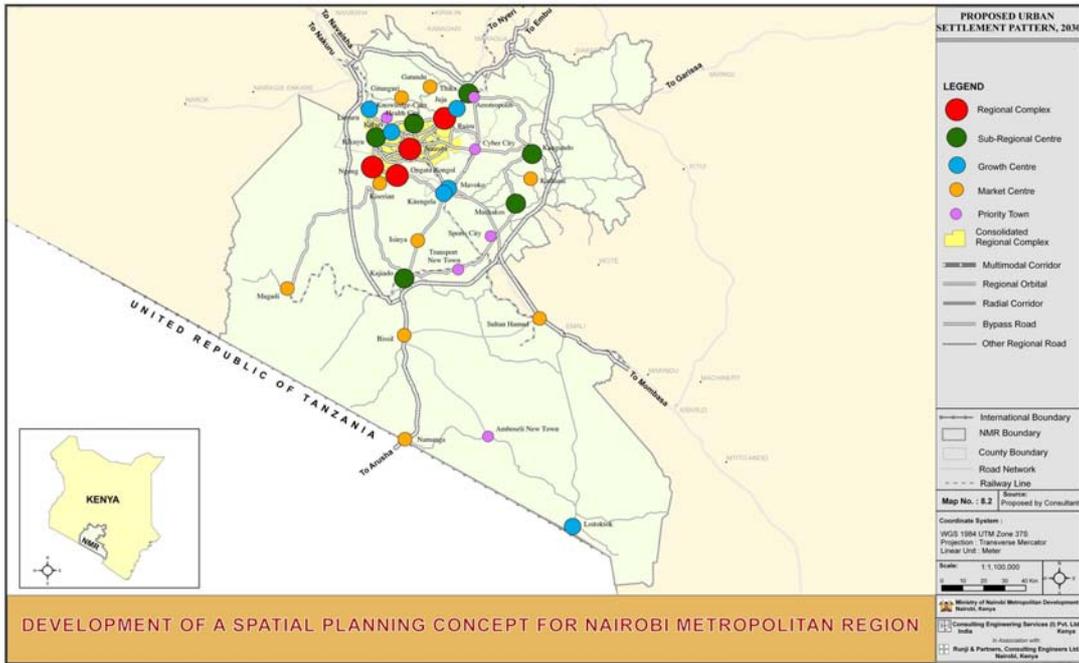
2) Settlements Hierarchy of Settlements

Proposed Settlement Hierarchy for NMR in 2030 is summarised below. NCC is classified in the “Regional Complex”.

Table 3.3.5 Settlement Hierarchy of NMR

Level	Settlement Hierarchy	Settlements	Characteristics
I	Regional Complex	Nairobi City-Ngong-Ongata Rongai-Ruiru Complex	<ul style="list-style-type: none"> ● Highest administrative functions ● Specialised and world class facilities ● Tertiary activities
II	Subregional Centre	Thika, Kikuyu, Kiambu, Machakos, Tala/Kangundo, Kajiado	<ul style="list-style-type: none"> ● Administrative functions/county headquarters ● Higher level infrastructure ● Secondary and tertiary activities ● Strong industrial base
IIA	Priority Town	New Towns	<ul style="list-style-type: none"> ● Planned to decongest Nairobi City and developments in the surrounding regions ● Designed with specialised facilities on the basis of world class norms ● To be planned as special packages and special focus for development
III	Growth Centre	Limuru, Karuri, Juja, Mavoko, Kitengela, Loitoktok	<ul style="list-style-type: none"> ● Intermediary towns ● Important role in promoting rural development and in achieving a balanced distribution of urban population ● Provide functional linkages between the smaller towns and subregional centre
IV	Market Centre	Gatundu, Githunguri, Kathiani, Kiserian, Namanga, Isinya, Bissil, Sultan Hamud Magadi	<ul style="list-style-type: none"> ● Small town having linkages with immediate rural hinterlands. ● Is the higher order village having central location and potential for development within its catchment area, with relatively better services and facilities in terms of education, health, communication, accessibility and has the capacity to serve a group of basic villages.
V	Central Village Centre	To be identified as part of subregional plans	<ul style="list-style-type: none"> ● Would cater to the rural hinterland as agro service centre in the collection and distribution of agricultural goods and services with processing, marketing, warehousing, and storage facilities.
VI	Basic Village	All villages	

Source: Spatial Planning Concept for Nairobi Metropolitan Region

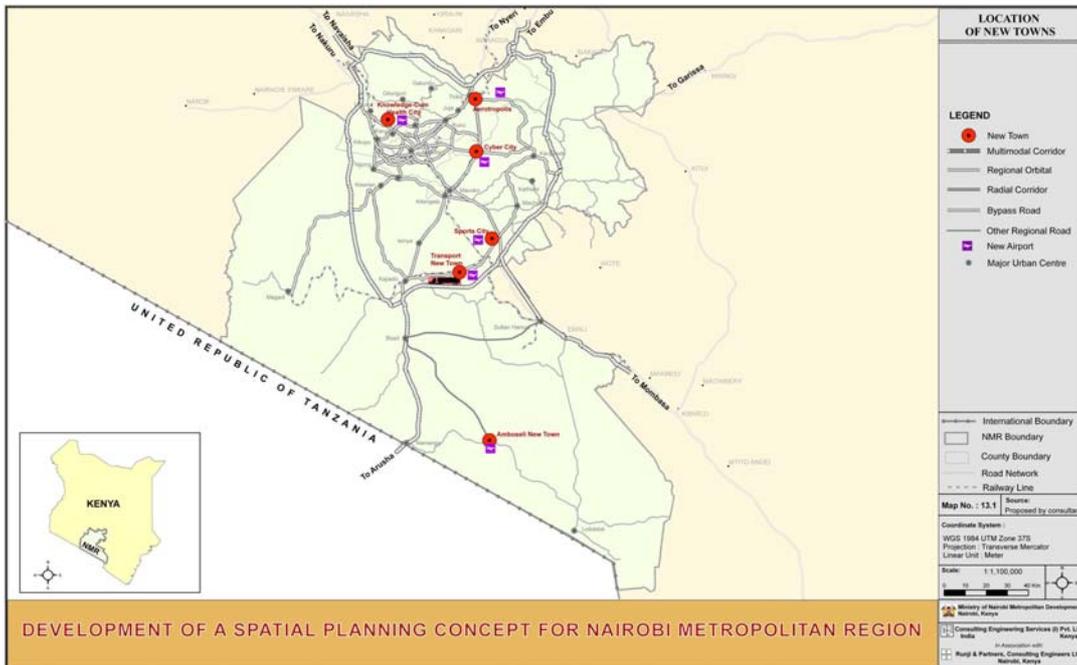


Source: Spatial Planning Concept for Nairobi Metropolitan Region

Figure 3.3.8 Proposed Urban Settlements Pattern

3) New towns

Six new towns are proposed within the NMR such that each county has two new towns. The six proposed new towns are as follows:



Source: Spatial Planning Concept for Nairobi Metropolitan Region

Figure 3.3.9 Location of New Town

Table 3.3.6 List of New Towns Proposed

No	New Towns	Characteristics
1	Aerotropolis	<p>Function The Aerotropolis will comprise aviation-intensive businesses and related enterprises. Aerotropolis typically attracts industries related to time-sensitive manufacturing, e-commerce fulfilment, telecommunications and logistics, hotels, retail outlets, entertainment complexes, and exhibition centres; and offices for business people who travel frequently by air or engage in global commerce. Clusters of business parks, logistics parks, industrial parks, distribution centres, information technology complexes, and wholesale merchandise marts located around the airport and along the transportation corridors radiating from them. An air transport oriented SEZ to be part of the proposed Aerotropolis.</p> <p>Location The Aerotropolis is proposed near Thika Municipality, north of Garissa Road in between the proposed regional orbital and Greater Eastern By-pass extension to Thika at a distance of approximately 40 km from CBD, Nairobi City.</p>
2	Knowledge-cum-Health City (Nairobi City)	<p>Function The Knowledge-cum-Health City would comprise agricultural research centres, technological university, management institutes, agro-based health centres, hospitals, and other institutions.</p> <p>Location The Knowledge-cum-Health City is proposed north of Limuru Road, coffee and tea plantations at a distance of approximately 20 km from CBD, Nairobi City.</p>
3	Cyber City	<p>Function: The Cyber City would comprise service oriented industries in the field of information technology and information technology enabled services (IT/ITeS) for the region.</p> <p>Location: The Cyber City is proposed at the junction of Greater Eastern By-pass and Kangundo Road in Machakos County at a distance of approximately 30 km from CBD, Nairobi City.</p>
4	Transport New Town	<p>Location: The Transport New Town is proposed along the regional orbital near the transport-cum-logistic hub near Kajiado in Kajiado County at a distance of approximately 60 km from CBD, Nairobi City.</p> <p>Population and Density It has been envisaged that by 2030 the Transport New Town will accommodate a population of 100,000 with a population density of 50 ppha</p>
5	Sports City	<p>Function: The Sports City would incorporate world-class sporting venues and sports academies, as well as residential and commercial properties and all related amenities such as hotels, entertainment outlets, schools, medical facilities, and retail opportunities. It is envisaged that the main sports complex will have a multi-purpose outdoor stadium of a capacity of 60,000 seats. The stadium could be used for athletics, cricket, and football. Also a 25,000 seat cricket ground, a 10,000 seat indoor arena, and a 5,000 seat field hockey stadium are proposed apart from sports academies and institutes.</p> <p>Location: The Sports City is proposed on a relatively flat land at the junction of the Mombasa Road and the regional orbital in Machakos County at a distance of approximately 60 km from CBD, Nairobi City.</p>
6	Amboseli New Town	<p>Function: Amboseli New Town will comprise the hospitality industry to boost tourism in the area. It will consist of hotels, resorts, entertainment outlets, gaming arcades, outdoor activities with lush green landscaped gardens.</p> <p>Location: The new town is proposed adjacent to the Amboseli National Park at a distance of approximately 150 km from CBD, Nairobi City.</p>

Source: Spatial Planning Concept for Nairobi Metropolitan Region

4) Land cover/land use

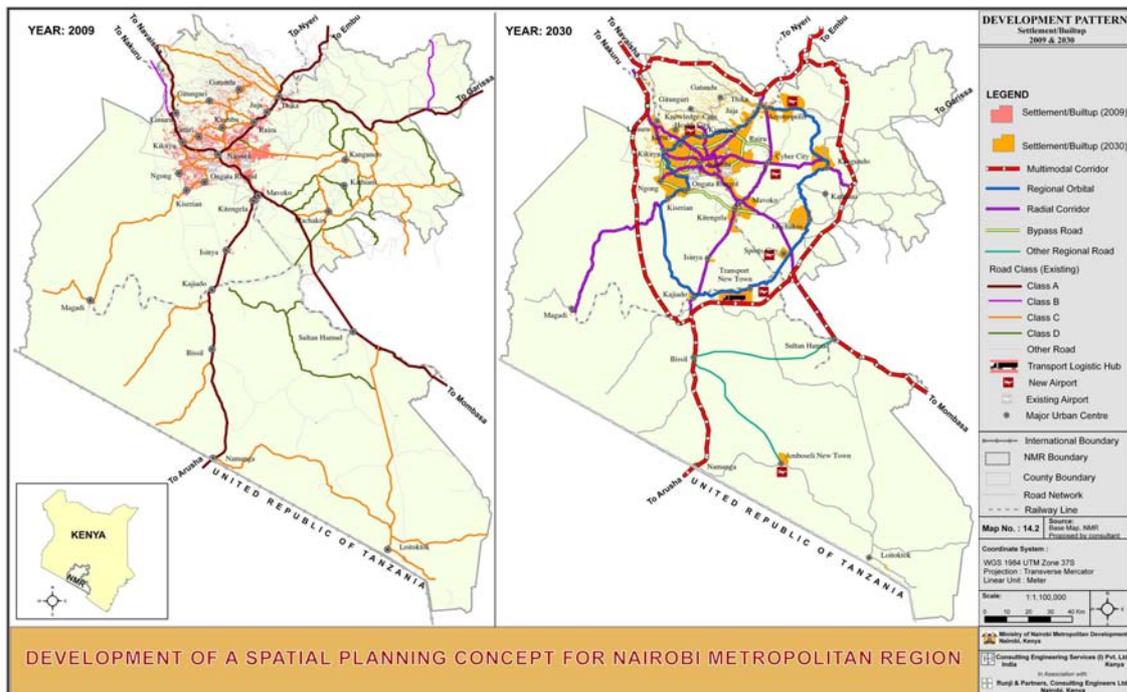
The following land use classification is proposed for NMRs.

Table 3.3.7 Proposed Land Use Classification

No	Land Use Classification	Characteristics
1	Settlement Zone	Settlement zone is the spatial built up area within the region and covers both urban and rural areas.
2	Transport Zone	The transport zone includes road, rail, and airport areas within the region.
3	Forest Zone	It includes all environmentally sensitive areas which are meant to be protected. It includes existing areas under forest, national parks; conservation zone; and open shrubs, plantation, and riverine trees.
4	Water Bodies	The water bodies in the region are divided into three categories: rivers, drainage; swamps and sand; and other water bodies.
5	Agriculture and Rangeland	It includes land used for agriculture and related activities such as grazing, etc.

Source: Spatial Planning Concept for Nairobi Metropolitan Region

Settlement zone is proposed as follows. The entire NCC and six new towns are classified as settlement zones.



Source: Spatial Planning Concept for Nairobi Metropolitan Region

Figure 3.3.10 Development Pattern, Settlement/Build Up 2009 and 2030

Land use classification for urban centres of NMR and distribution for NCC have been proposed as follows:

Table 3.3.8 Proposed Urban Land Use Classification for NMR and Distribution for NCC

No.	Land Use Categories	Area / Activities Included Within the LandUse	Area	
			(ha)	(%)
1	Residential area	- Primary residential - Mixed residential - Unplanned/informal residential	27,800	40
2	Commercial area	- Retails shopping - General business and commercial district/centres - Wholesale, godowns, warehousing/regulated markets	2,780	4
3	Public and semi-public	- Government/semi government/public offices - Government lands - Educational and research - Medical and health - Social, cultural, and religious - Utilities and services - Cremation and burial grounds	5,560	8
4	Industrial area	- Service and light industry - Extensive and heavy industry - Special industrial, hazardous, noxious, and chemical	6,950	10
5	Transport:	- Roads - Railways - Airport - Seaports and dockyards - Bus depots/truck terminals and freight complexes - Transmission and communication	12,510	18
6	Open spaces	-Playground/stadium/sports complex -Parks and gardens-public open spaces -Special recreational - restricted open spaces -Multiple-purpose open spaces	13,900	20
	Total		69,500	100

Source: Spatial Planning Concept for Nairobi Metropolitan Region

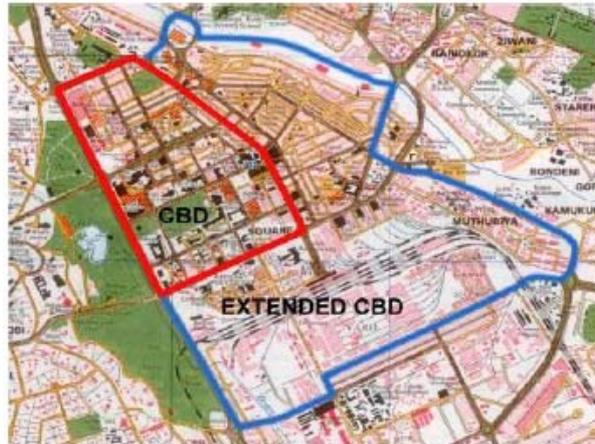
5) Design Interventions for Nairobi City

Urban design and regional landscape is also proposed in the Spatial Planning Concept, particularly in CBD of NCC. The following interventions are recommended in the plan:

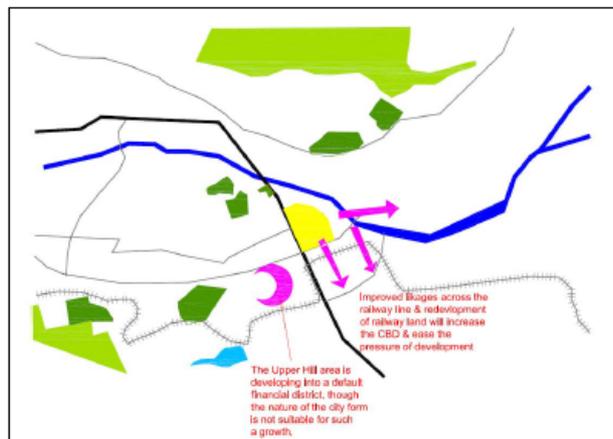
- (i) Establishment CBD as a City Precinct
- (ii) Redevelopment of Moi Avenue
- (iii) New square development in the CBD area
- (iv) Air force station area reorganisation
- (v) Industrial area reorganisation and linkages
- (vi) Capitol complex development
- (vii) Nairobi riverfront development

The figures shown below illustrate one of interventions proposed for urban design and regional landscape for CBD. Figure 3.3.11 illustrates the necessity of delineation of CBD boundary based on collective strategies, for the development of the entire area (intervention (i) establishment CBD as City Precinct). The main objective is proposed to make CBD as a City Precinct in order to “create a vibrant commercial centre”.

Figure 3.3.12 shows the idea for (v) industrial area recognition and linkages and illustrates the importance of land use upgrading of the industrial area, which allows for the CBD peripheral development for commercial and industrial activities.



Source: Spatial Planning Concept for Nairobi Metropolitan Region
Figure 3.3.11 CBD of Nairobi City County



Source: Spatial Planning Concept for Nairobi Metropolitan Region
Figure 3.3.12 CBD and Its Linkage to Railway, Upper Hills

3.4 Human Resources Development

3.4.1 Introduction

(1) Background of Capacity Development

As seen in earlier parts of the report, i) uncontrolled urban development, ii) insufficient infrastructure, iii) poor living condition, iv) lack of social facilities, and v) transport problems have been identified as major urban problems in Nairobi City. These problems are caused by (i) demand side, which is categorised by a large share of low and middle income group and extensive in-migration from the rural area and by (ii) public sector/supply side, which is categorised into lack of updated urban development plans, lack of comprehensive development management system, and insufficient capacity of urban development management. Amongst these causes, insufficient capacity of urban development management is addressed as a human resources management and capacity development issue. For effective management of urban development, capacity development is a crucial instrument for improvement. To sustain the organisation in the long run, it is also very important to address capacity development.

(2) Output of Capacity Development in the Project

The following outputs for capacity development are to be attained in the Project in order to cater for an effective urban management.

- To formulate mid-long term capacity development plan.
- To formulate technology transfer plan during the project.

Technology transfer will be conducted between the Kenyan counterparts and the Japanese experts in the course of the project. Capacity development plan as a management tool for strengthening of urban management will be formulated through discussion with Working Group members during the Project. The capacity development plan is part of the urban master plan, so the capacity development plan covers not only the short-term capacity development scheme during the project but also extends to mid-long term after the project.

It should be noted that the City Council of Nairobi (CCN) is in transition to NCC, and the following basically pertains to the situation under CCN. In the transition, some changes may occur in relation to human resources development and management, which are yet to be observed.

3.4.2 Current Situation of Human Resources Management

The Human Resources Development Department of CCN is in charge of human resources development. For the department level, administration section of each department plays an important role to execute human resources management and capacity development. With the cooperation of the administration section of the City Planning Department, the JST conducted an interview survey and literature survey to grasp the current situation of capacity development.

(1) Interview Survey

JST had interviews with the chiefs of the sections in the City Planning Department of CCN. Table 3.4.1 shows the results of training needs by each section. Most of the sections see GIS as the most important skill to execute the works. GIS is seen to make things work easily and efficiently. ICT is also effective not only in document preparation and data analysis but also in retrieving information from the database. However, the number of computers and software is too small to meet the needs.

Table 3.4.1 Number of Officials and Training Needs

Section	Number of Officials	Necessary Skills
Policy Implementation	11 (Technical 4, Admin. 7)	GIS
Enforcement	18 (Technical 6, Admin. 12)	Building Control
Development Control	40 (Technical 15, Admin. 25)	ICT Auto CAD
Research	18 (Technical 14, Admin. 4)	ICT GIS
Forward Planning	14 (Technical 8, Admin. 6)	GIS
Land and Survey	40 (Technical 15, Admin. 25)	GIS
Urban Design	18 (Technical 6, Admin. 12)	GIS

Source: JICA Study Team based on Interview to City Planning Dept. CCN

The current grading structure in CCN comprises 18 grades altogether, made up of eight management and ten non-management grades. The following table shows the number of staff per grade in the City Planning Department. The share of supporting staff is the largest, which is about 70% of the staff members of the department. Supporting staff include drivers and cleaning staff, who are not engaged in planning works.

Table 3.4.2 Number of Employee in City Planning Dept. CCN

Salary Scale Level	Staff Level	Number of Employees Within the Grade
Scale 1-4	Senior Management	1 (0.5%)
Scale 5-8	Middle level management	21 (9.7%)
Scale 9-10	Non-management	48 (22.1%)
Scale 11-18	Support	147 (67.7%)
	Total	217 (100%)

Source: City Planning Dept. CCN

The officials have taken training courses in the universities, poly techniques, training schools by the Government of Kenya, or technical colleges. Taking the course is the main method of capacity development in the department. An internal training programme such as lectures by senior staff are not frequently conducted. The cost of taking the course in external organisations is shouldered by CCN, but the officials have to pay the tuition first from their own pockets and submit the completion certificate of the course to CCN after the trainings. CCN reimburses the tuition after checking the certificate. This poses difficulty for officers who could not afford to pay their tuition first in order to take the training courses in external organisations. Also, the risk of non-completion is totally burdened by the staff, which makes it more difficult for the staff to enroll.

(2) Literature Survey

1) Skills and Competency Needs Assessment Baseline Survey

The Human Resources Management Department is conducting the “Skills and Competency Needs Assessment Baseline Survey” by outsourcing to a private consultant every year. CCN sees employee’s trainings as the most important factor to provide better administrative services to the public. The Government Recruitment and Training Policy (2005) which the council uses together with the council’s policy on training requires that all trainings be based on comprehensive training needs assessment. In addition, the performance contract for the year 2011/2012 for the council requires that periodic surveys be conducted to determine the skill level.

This periodical survey should be highly evaluated to grasp the status of capacity development in CCN. However, it should be noted that this is not a survey targeting all employees but a

sample survey. From the target population of 11,433 employees of CCN, a sample of 653 respondents was selected using simple random sampling across all departments of the CCN. In all, 25 out of 653 respondents are the officials belonging to the City Planning Department.

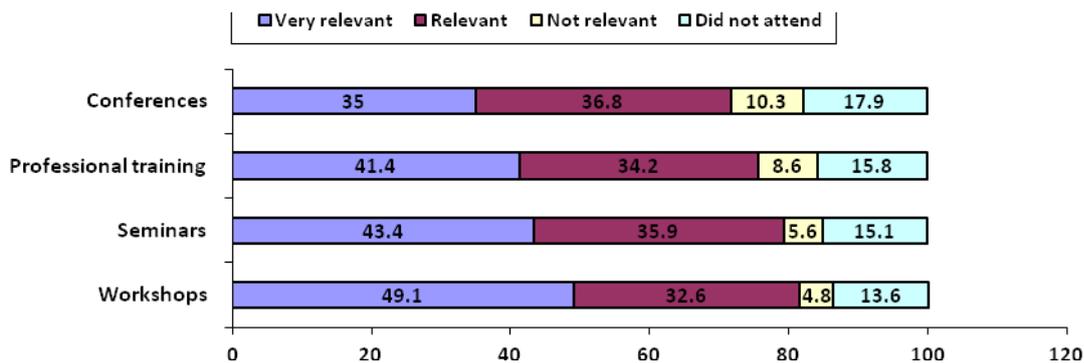
The following skills were assessed as shown in Table 3.4.3. The skills are general and mixed between administrative skills and technical skills.

Table 3.4.3 Critical Skills Identified in Sample Survey

No.	Critical Skill
1	Record keeping/information management
2	Revenue mobilization
3	Financial planning and management
4	Management of public transportation and terminal
5	Urban research/studies/surveys
6	Management and implementation of urban development plans, projects, and programs
7	Computer skills/IT
8	Expenditure, planning, and control
9	Slum upgrading and management
10	Strategic planning
11	Knowledge of government policies
12	Preparation of urban development strategies and guidelines
13	Efficient use of resources
14	Litigation and prosecution
15	Analysing customer feedback and customer care skills
16	Planning and designing for urban housing renewal projects

Source: Skills and Competency Needs Assessment Baseline Survey (2012)

The survey also analysed the style of capacity development. Four functions were listed for rating by the employees, and more than 60% (both very relevant and relevant) had high scores. Workshops had the highest score in terms of relevance from the respondents with a score of 81.8%, followed by seminars at 79.3%, trainings at 75.6%, and conference at 71.8%, as indicated in the graph below. Workshops are worth considering as the effective method of capacity development.



Source: Skills and Competency Needs Assessment Baseline Survey (2012)

Figure 3.4.1 Relevance of Capacity Development Method

2) Human Resources Consultancy Phase 2 City Council Nairobi

Pricewaterhouse Coopers prepared a report of human resources in April 2012. The report is an output of the following activities:

- Review and appraisal of the council's strategic plan,

- Proposal of a new organisation structure,
- Repositioning the council’s human resources plan, and
- Develop a staff rationalisation plan.

The report targets all departments of CCN including City Planning Department.

The report also performed a skills assessment. In the study, academic qualifications were taken as an indicator for acquired skills. The highest academic qualifications of officials in all departments of CCN were analysed with eight levels: i) no qualification, ii) primary, iii) high school, iv) trade test, v) certificate, vi) diploma, vii) higher national diploma, and viii) degree. Academic qualifications were more or less correlated with skills, but having qualifications do not always mean having skills. A direct measurement whether the officials have the required skills in his/her daily works or not should be more valued in capacity assessment.

(3) Capacity Assessment

Capacity of necessary skills for the NIUPLAN from planning to management stage has been assessed in October 2013. The target group of the assessment was the officials of Salary Scale Levels 1 to 12 in the City Planning Department of NCC. The assessment sheet consists of 51 skills divided into five categories: 1) Planning, 2) Implementation, 3) Development, 4) Control, and 5) Management. These categories are consistent with the project cycle of project management.

Amongst the target officials, 50 officials answered the five categories using the scale of one to five for each skill. The highest scale is five (5) representing “Very Well”, followed by four (4) for “Well”, three (3) for “Fair”, and two (2) for “Little”. The lowest scale is one (1) showing “Not at all”.

Table 3.4.4 shows the overview of the capacity assessment results. Amongst the five categories, the average score of “Control” is the highest. The average scores of “Development” and “Management” are the lowest and the second lowest, respectively. NCC officials as a whole are strong in skills for “Control” and weak in skills for both “Development” and “Management”.

The table also shows the strengths and weaknesses for each category. The officials well understand the procedures and processes of planning, EIA, land acquisition, etc., but they are weak in ICT related skills such as GIS, website, database, and funding related knowledge.

Table 3.4.4 Overview of Capacity Assessment Results

Category	Average Score/Scale	Strength	Weakness
1. Planning	3.16	<ul style="list-style-type: none"> • Procedures of plan formulation • Knowledge of necessary information for planning 	<ul style="list-style-type: none"> • Production of GIS maps • Knowledge of possible funding schemes
2. Understanding the Master Plan	3.07	<ul style="list-style-type: none"> • Understanding the Master Plan 	<ul style="list-style-type: none"> • Formulation of civic education program
3. Development	2.94	<ul style="list-style-type: none"> • Knowledge of EIA process • Knowledge of land acquisition 	<ul style="list-style-type: none"> • Fund raising • Conducting of public procurement
4. Control	3.86	<ul style="list-style-type: none"> • Development permission • Respond to applicant 	<ul style="list-style-type: none"> • Control illegal sign/outside advertisement
5. Management	2.95	<ul style="list-style-type: none"> • Project evaluation 	<ul style="list-style-type: none"> • Database management • Update of website

Source: Source: JICA Study Team (JST) based on the Capacity Assessment to City Planning Department of NCC

Table 3.4.5 shows the strong and weak category of skills by section. Seven sections have strength in “Control”. Six sections have weakness in “Management”.

Table 3.4.5 Strong and Weak Category of Skills by Section

	Section	Number of Respondents	Average Score/Scale					Strong (S) and Weak (W) Category
			Planning	Und. Of MP	Development	Control	Management	
(1)	Forward Planning Section	5	3.27	3.70	3.15	3.56	2.89	(S): Und. of MP (W): Management
(2)	Research Section	4	2.25	2.50	1.84	3.09	1.89	(S): Control (W): Development
(3)	Central Administration	1	3.47	4.50	3.38	4.27	3.14	(S): Und. of MP (W): Management
(4)	Development Control Section	5	2.65	2.60	2.59	3.98	2.20	(S): Control (W): Management
(5)	Policy Implementation Section (PIS)	5	3.44	3.50	3.00	4.05	2.91	(S): Control (W): Management
(6)	Urban Design Development Section	10	3.00	2.90	2.98	4.16	2.80	(S): Control (W): Management
(7)	Enforcement Section	6	3.37	3.25	3.18	4.35	3.52	(S): Control (W): Development
(8)	Land Survey Section	11	3.54	2.95	3.19	3.54	3.53	(S): Planning/Control (W): Und. of MP
	Total/Average	47	3.16	3.07	2.94	3.86	2.95	

Source: JICA Study Team (JST) based on the Capacity Assessment to City Planning Department of NCC

Table 3.4.6 shows the strong and weak skills by section. This table shows more specific strong and weak skills than Table 3.4.5. Table 3.4.6 implies fairly strong correlation between strong skills and tasks for each section. For example, the Land Survey Section, responsible for land survey and development of GIS database, has strength in production of GIS thematic maps and updating information with GIS software. On the other hand, most of the sections have common weaknesses in production of GIS thematic maps, fund raising, and understanding of possible funding schemes.

Table 3.4.6 Strong and Weak Skills by Section

	Section	Job Description	Strong Skills	Weak Skills
(1)	Forward Planning Section	Responsible for policy formulation and supporting permit process.	<ul style="list-style-type: none"> • Execution of EIA • Acquaintance to the development permission procedures 	<ul style="list-style-type: none"> • Production of GIS thematic maps • Conducting of public procurement • Project management
(2)	Research Section	Responsible for supporting section by conducting survey and provide information regarding urban condition, housing, and infrastructure, renew land lease, register private schools, designating street names, and designating physical address.	<ul style="list-style-type: none"> • Understanding the planning procedures • Checking the compliance of development/construction at the sites • Responding to land use change application 	<ul style="list-style-type: none"> • Understanding the procedure of availing funds • Fund raising for project implementation • Conducting public procurement
(3)	Central Administration	Responsible for administrative matter, including staff evaluation, organisation re-structure, and other supporting matters.	<ul style="list-style-type: none"> • Explanation of master plans • Coordination amongst related organisations 	<ul style="list-style-type: none"> • Fund raising for project implementation • Web update
(4)	Development Control Section	Responsible for building construction permit management	<ul style="list-style-type: none"> • Acquaintance to the development permission procedures • Responding to land use change application 	<ul style="list-style-type: none"> • Understanding the urban issues • Production of GIS thematic maps • Understanding the possible funding schemes

	Section	Job Description	Strong Skills	Weak Skills
(5)	Policy Implementation Section (PIS)	Responsible for land development permit management. Permit is required for change in land use, division of land plot, extension (adding) of new and use.	<ul style="list-style-type: none"> Understanding the approval process of master plans Acquaintance to the development permission procedures Responding to land use change application 	<ul style="list-style-type: none"> Production of GIS thematic maps Understanding the procedures of availing funds Updating information with GIS software
(6)	Urban Design Development Section	Responsible for development of landscape (greenery, bench, bus shelter) and management of advertisement.	<ul style="list-style-type: none"> Checking the compliance of development/construction at the sites Responding to land use change application Acquaintance to the sign control and outside advertisement 	<ul style="list-style-type: none"> Production of GIS thematic maps Fund raising for project implementation Web update
(7)	Enforcement Section	Responsible for inspection and monitoring of development approved by the Development Control Section and Policy Implementation Section.	<ul style="list-style-type: none"> Acquaintance to the development permission procedures Control illegal development Check compliance of sign control 	<ul style="list-style-type: none"> Understanding the possible funding schemes Coordination amongst related organisations Fund raising for project implementation
(8)	Land Survey Section	Responsible for conducting land survey that belongs to Nairobi City and developing GIS database.	<ul style="list-style-type: none"> Production of GIS thematic maps Execution of land acquisition Updating information with GIS software 	<ul style="list-style-type: none"> Acquaintance in the development permission procedure Fund raising for project implementation Conducting public procurement

Source: JICA Study Team (JST) based on the Capacity Assessment to City Planning Department of NCC

(4) Analysis of Current Situation

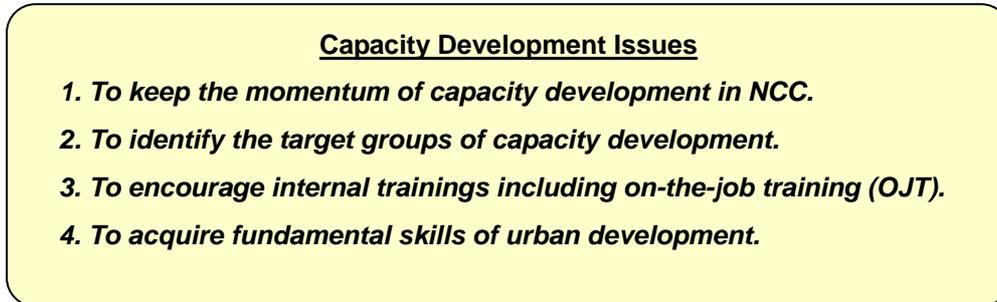
As a result of an interview survey, literature survey, and capacity assessment, the following characteristics in the current capacity development were identified:

- The concerned government officials are keen to capacity development.
- Target groups of capacity development are not clarified.
- Capacity assessment items are fairly general.
- Attending trainings conducted by external organisations such as universities are more encouraged than internal trainings conducted by senior officials.
- The needs for GIS/ICT skills are high in most of the sections.

The strength of the City Planning Department of CCN is that the officials are motivated to develop their capacity. The weakness is that the method of capacity development is not balanced as seen in high share of external trainings, high need to GIS/ICT skills, etc. Thus, this project should enhance the strength and improve weakness to formulate a capacity development plan by solving the following issues:

(5) Issues of Capacity Development

Through analysis of the current situation including strength and weakness in above (3), the issues to be tackled for improving capacity development in NCC are identified as shown in Figure 3.4.2. To solve the issues is the basic direction of capacity development plan.



Source: JICA Study Team (JST)

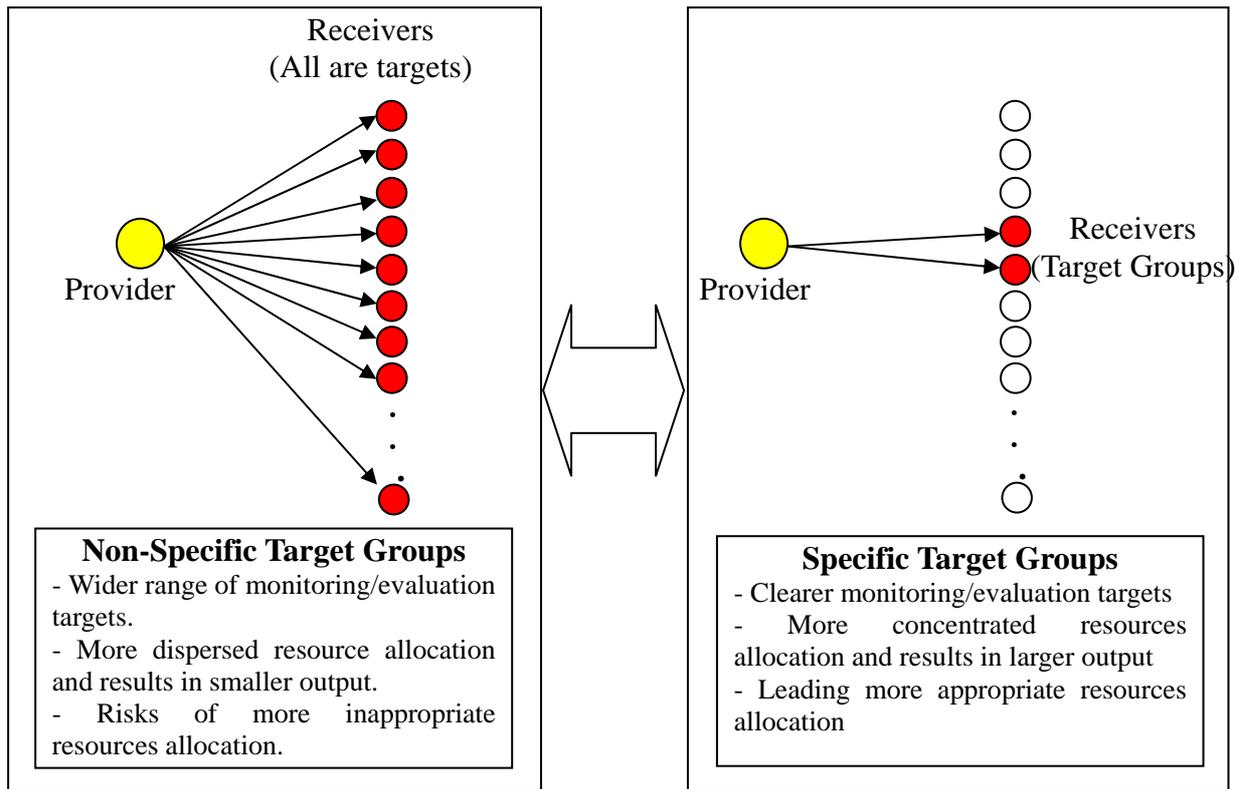
Figure 3.4.2 Capacity Development Issues

1) To keep the momentum of capacity development in NCC

The momentum of capacity development in NCC should be kept in the Capacity Development Plan. NCC sees the capacity development as very important for better urban management. NCC (former CCN) already has had special function for human resources management such as Human Resources Department, as well as the administration section in the City Planning Department. The assessment of the concerned NCC officials has also been conducted periodically. An official of the Human Resources Department was appointed as a Secretariat Meeting member and Working Group member. These existing functions as well as mechanism for the assessment of capacity development should be fully utilised not only in planning but also in the implementation of capacity development.

2) To identify the target groups of capacity development

The merits of setting the target groups are as follows: i) to be able to focus on the activities for important and prioritised stakeholders, ii) to be able to efficiently use available resources and monitor/evaluate activities, and iii) to be able to attain outputs more effectively. Figure 3.4.3 schematically compares non-specific target groups to specific target groups.



Source: JICA Study Team (JST)

Figure 3.4.3 Comparison between Non-Specific Target Groups and Specific Target Groups

3) To encourage internal trainings including On-the-Job Training (OJT)

Internal trainings including on-the-job training (OJT) and lectures by senior officials should be encouraged more. As a result of an interview with the NCC official, the capacity for the concerned government officials has been developed mainly through trainings conducted by outside organisations such as university, technical school, etc.

Under the current system, only limited officials can shoulder the tuition, and thus can take part in trainings outside. It is because NCC is applying a system to reimburse the tuition of the trainings upon submission of the certificates of trainings. This system discourages some officials to take part in the trainings being conducted outside.

4) To acquire fundamental skills of urban development

The target officials should acquire fundamental skills of urban management, including information collection and analysis, planning, implementation of infrastructure development, and inspection and monitoring. The officials are required to develop GIS and ICT skills based on capacity assessment, so that the output produced through GIS and ICT in the context of urban planning and management should be understood better. Knowledge of possible funding schemes and skills of fund raising will also be strengthened. As such, the capacity development should address the development of fundamental skills first. Table 3.4.7 shows the fundamental skills to be acquired by the officials.

Table 3.4.7 Fundamental Skills to be Acquired

	Topics for Capacity Development	Explanation
(i)	Planning skills	<ul style="list-style-type: none"> • Objective of the urban development plan (development oriented plan, control, or conservation oriented plan) • Planning technique: selection of scales, land use category, urban facility allocation (parks, green-open space, schools, hospitals), road network (urban planning road) to be included in urban design. • Possible funding schemes (government budget, aid, loan, private funds, PPP schemes)
(ii)	Development control: land development control, and building control	<ul style="list-style-type: none"> • Objective of the development permit (why permit is necessary, how permit is related to urban development plan). • Relationship between land permit and urban plan.
(iii)	Implementation of urban development project : examination of zone development mechanism, PPP	<ul style="list-style-type: none"> • Zoning development in the urban plan. • Implementation for infrastructure (project approval, fund raising, and implementation organisation)
(iv)	Socialisation and citizen participation	<ul style="list-style-type: none"> • Public awareness to citizens to deepen their understanding on the urban plan, development control, etc. • Collaboration between civil society and government through community participation
(v)	Management	<ul style="list-style-type: none"> • Check consistency between actual development situation and related government policies • Database management

Source: JICA Study Team (JST)



Stella Achieng, Mbagathi Road Primary School (Rank 3 of Class 4)

CHAPTER 4 INFRASTRUCTURE CONDITION AND DONOR ACTIVITIES

4.1 Review of Related Projects by the Development Partners

4.1.1 Multi-Sector Programme

(1) Kenya Municipal Program (KMP)

The Ministry of Local Government (MOLG), which is now under the Ministry of Land, Housing and Urban Development (MOLHUD) is implementing the phase 1 of the KMP with the financial assistance of the World Bank (WB), Agence Française de Développement (AFD), and Swedish International Development Cooperation Agency (SIDA). The development objective of phase 1 is to strengthen local governance and improve service delivery in 15 selected municipalities through a combination of institutional reforms, capacity building, and investment in infrastructure. The phase 1 of the KMP is scheduled to be implemented from 2010 to 2015.

The funding for this project consists of US\$100 million from the World Bank-International Development Association (IDA), US\$45 million from AFD, and US\$10 million each from SIDA and the Government of Kenya (GOK), with a total amount of US\$165 million.

The 15 selected municipalities (major cities and towns) are (1) Nairobi City, (2) Mombasa, (3) Kisumu, (4) Nakuru, (5) Eldoret, (6) Malindi, (7) Naivasha, (8) Kitui, (9) Machakos, (10) Thika, (11) Nyeri, (12) Garissa, (13) Kericho, (14) Kakamega, and (15) Embu.

The project comprises the following four components:

- (i) Component 1: Institutional Strengthening
- (ii) Component 2: Participatory Strategic Urban Development Planning
- (iii) Component 3: Investment in Infrastructure and Service Delivery
- (iv) Component 4: Project Management, Monitoring, and Evaluation

Of the above, Component 3 consists of infrastructure developments, which are considered eligible for financing under the KMP. These include motorised and non-motorised transport facilities (including bus parks, access roads, sidewalks, and paved paths), street lighting, markets, solid waste management, stormwater drainage, disaster management and prevention facilities and equipment, public parks, and green spaces.

The investments for Component 3 are phased into two: (a) year 1–2 investments for implementing the infrastructure developments during 2010-2013 and (b) year 3–5 investments for implementing the infrastructure developments during 2013-2015. The selection of infrastructure developments belonging to year 1–2 or year 3–5 investments is performed based on the criteria established in the process of the project design of the KMP as described in the project appraisal report (World Bank, April 2010).

The procurement plan has been developed for project implementation during the period from July 2012 to June 2013 and was approved by the World Bank in August 2011. This plan includes 33 works projects, 23 goods procurement, and 72 consultancy services. According to the Implementation Status and Result Report in November 2012, there was considerable risk towards meeting the project's development objectives, due primarily to the very slow implementation of the projects. Only one project, which was the Mombasa Stormwater Drain work, was implemented in September 2012.

(2) Kenya Informal Settlements Improvement Project (KISIP)

The Ministry of Housing (MOH) (currently under MOLHUD) is implementing the KISIP with financial assistance from WB. The project development objective is to improve living conditions of informal settlements in 15 selected municipalities in Kenya as shown below. The KISIP is scheduled to be implemented from 2011 to 2016.

The funding for KISIP has the same scheme as for KMP, with the total funding of US\$165 million.

The 15 selected municipalities (major towns and cities) are (1) Nairobi City, (2) Mombasa, (3) Kisumu, (4) Nakuru, (5) Eldoret, (6) Malindi, (7) Naivasha, (8) Kitui, (9) Machakos, (10) Thika, (11) Nyeri, (12) Garissa, (13) Kericho, (14) Kakamega, and (15) Embu.

The KISIP comprises the following four components:

(i) Component 1: Strengthening Institutions and Programme Management

This component will support institutional strengthening and capacity building of the MOH (now under MOLHUD), the MOLG (now partly under MOLHUD and Ministry of Devolution and Planning (MODP)), and the participating municipalities (major towns and cities). It will also support the development of policies, frameworks, systems, and guidelines for slum upgrading.

(ii) Component 2: Enhancing Tenure Security

This component will directly support the implementation of the new national land policy in urban informal settlements through refinement, systematisation, and scale-up of ongoing efforts to strengthen tenure security in the slums.

(iii) Component 3: Investing in Infrastructure and Service Delivery

This component will support investments in settlement infrastructures, and if necessary, extension of trunk infrastructure to settlements.

(iv) Component 4: Planning for Urban Growth

This component will support the planning and development of options that facilitate the delivery of infrastructure services, land, and housing for future population growth. The objective is to provide an alternative to the current chaotic practice of informally establishing settlements on any open land.

Of the above, Component 3 supports investments in settlement infrastructures, and, where necessary, extension of trunk infrastructure to settlements. The infrastructure developments considered eligible for financing under the KISIP are roads, bicycle paths, pedestrian walkways, street and security lighting, vending platforms, solid waste management, storm-water drainage, water and sanitation systems, electrification, public parks, and green spaces. The selection of infrastructure developments is performed based on the criteria established in the process of the project design of the KISIP as described in the project appraisal report (World Bank, February 2011).

(3) Nairobi Metropolitan Service Improvement Project (NaMSIP)

NaMSIP is a five-year project, which was approved by the WB Board in May 2012. The Ministry of Nairobi Metropolitan Development (MONMD) (now under MOLHUD) is the responsible agency to implement the Project with the financial assistance by the WB. The project development objective is to strengthen urban services and infrastructure in the Nairobi Metropolitan Region.

The total funding for this project is US\$330 million (US\$300 million from World Bank-IDA and US\$30 million from the GOK). The level of funding for this programme is US\$28 million for Nairobi City County, which includes projects in planning, transportation, disaster management, GIS development, and security lighting.

The project comprises the following four components:

(i) Component 1: Institutional reform and planning (US\$15 million)

This component will assist existing local authorities within the Nairobi Metropolitan Area, as well as new entities and authorities that will be created once the devolved government aspect of the new constitution takes effect. These new entities possibly include county governments, metropolitan authorities, agencies, and other units of administration. This component will support the capacity enhancement and planning activities of these entities.

(ii) Component 2: Local government infrastructure and services (US\$60 million)

This component will finance on a grant basis the priority urban infrastructure in 13 selected urban areas in the Nairobi Metropolitan Area. The 13 selected urban areas are Nairobi City, Ruiru, Kikuyu, Kangundo/Tala, Thika, Mavoko, Karuri, Ngong, Limuru, Kiambu, Kitengela, Juja, Ongata, and Rongai. The investments to be financed under this component are relatively small-scale local projects. The investments to be selected by the local authorities can include drainage systems, local streets, bicycle and foot paths, street and security lighting, public parks, public markets, solid waste management and street cleaning, and firefighting equipment and facilities.

(iii) Component 3: Metropolitan infrastructure and services (US\$250 million)

This component will assist in providing large-scale metropolitan infrastructure in the areas of solid waste, transport, and sewerage services. In contrast to those financed under Component 2, these investments will be large scale which is crucial for the development and integration of the metropolitan area as a whole.

(iv) Component 4: Project management and monitoring and evaluation (US\$5 million)

This component will finance the management activities associated with project implementation, including establishing and implementing a comprehensive monitoring and evaluation system and training of the implementing agencies in environmental and social management. This component will also provide funds to undertake feasibility studies and prepare designs for implementation of a potential follow-up project in the urban sector in Kenya, and for other studies identified and agreed during implementation.

(4) Kenya Infrastructure Finance/ Public-Private Partnership (PPP) project

The objective of the first phase of this Adaptable Program Lending (APL) initiative is to improve the enabling environment in order to generate a pipeline of bankable PPP projects.

The project comprises the following four components:

(i) Component 1: Technical Support to PPP Institutions for PPP Legal, Regulatory and PPP Financing Environment.

- (ii) Component 2: Support for Preparation of Individual PPPs.
- (iii) Component 3: Improvements on Fiscal Risk Management Framework.
- (iv) Component 4: Support for Programme Management.

4.1.2 Urban Transport

In Kenya, the Roads and Transport Sector Donor Group created the Harmonisation Alignment and Coordination (HAC) initiative consisting of 12 donors (African Development Bank (AfDB), AFD, Arab Bank for Economic Development in Africa (BADEA), China, DANIDA, EC, JICA, KfW, SIDA, USAID, UNDP, and World Bank). Under this framework, transport sector issues are discussed by the donor coordination group regularly. Progress has been made recently towards a new perspective of sector and donor coordination with the Ministry of Roads (currently under Ministry of Transport and Infrastructure (MOTI)) chairing a joint GOK/Donor meeting under its new policy and regulatory role. Review of related projects by other development partners in the urban transport sector is described by the donors.

(1) World Bank

The WB issued two projects on urban transport as shown below.

1) National Urban Transport Improvement Project (NUTRIP, 9 July 2012)

In 2007, the WB and GOK proposed the concept of Nairobi Urban Toll Road Project (NUTRP). This project was to offer a section of the Northern Corridor to the private sector for expansion and tolling through concession. Unfortunately, this offer attracted limited interest from the private sector and circumstances changed significantly, leading the GOK to cancel the project.

In 2011, the Consultancy Services for Feasibility Study and Technical Assistance for Mass Rapid Transit System for the Nairobi Metropolitan Region (MRTS) was issued by MOT (currently MOTI) with assistance by AfDB. Therefore, one aspect of NUTRIP is to enhance the realisation of NMRTS.

The objectives of the project are: (a) improve the efficiency of road transport along the Northern Corridor; (b) improve the institutional capacity and arrangements in the urban transport sub-sector; and (c) promote private sector participation in the operation, financing and management of transport systems. The project has three components, namely: A) support to Kenya National Highways Authority (KeNHA) to upgrade the urban road transport infrastructure; B) support to Kenya Urban Roads Authority (KURA) and Kenya Railways Corporation (KRC) to develop selected mass transit corridors; and C) institutional strengthening and capacity building. The total project cost is estimated to be US\$413.11 million, and amongst the total cost, US\$300.00 million is WB financing through IDA.

Project component A (support to KeNHA to upgrade the urban road transport infrastructure) includes the following projects:

- (i) Expanding and upgrading the Northern Corridor road section through Nairobi City from Jomo Kenyatta International Airport (JKIA) turnoff to Rironi Road, as well as associated service roads and access roads; all through provision of goods, works and services.
- (ii) Constructing the Kisumu Northern Bypass Road.
- (iii) Constructing and rehabilitating non-motorised transport facilities, including foot paths, cycle tracks, pedestrian bridges, and underpasses.

(iv) Strengthening the capacity of KeNHA

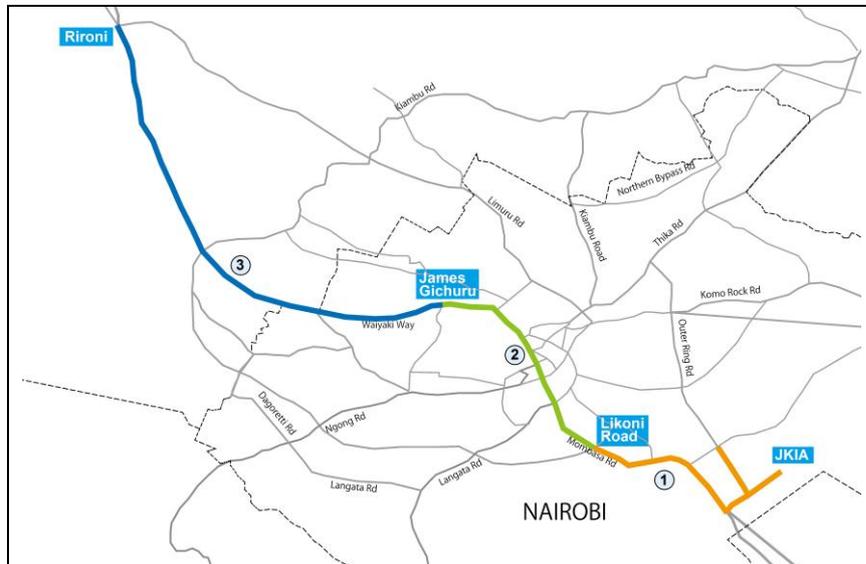
Regarding upgrading of the Northern Corridor (A104), three studies were conducted by KeNHA. Table 4.1.1 shows the name, location, and the length of each study.

Table 4.1.1 Studies Conducted on A104 by KeNHA

No.	Title of the Study	Time of Publication	Section and Length
1	Consultancy Services for Preliminary and Detailed Engineering Design for JKIA Turnoff - Likoni Road (A104) and Link Roads	February 2013	JKIA – Likoni Road Junction (8 km) plus adjoining roads
2	Consultancy Services for Upgrading the A104 from Likoni Road to James Gichuru Road	May 2012	Likoni Road Junction – James Gichuru Road Junction (12 km)
3	Preliminary Design for the Rehabilitation and Capacity Enhancement of A104 from James Gichuru Road Junction to Rironi (A104/ B3 Junction)	November 2012	James Gichuru Road Junction to Rironi (25 km)

Source: Kenya National Highways Authority (KeNHA)

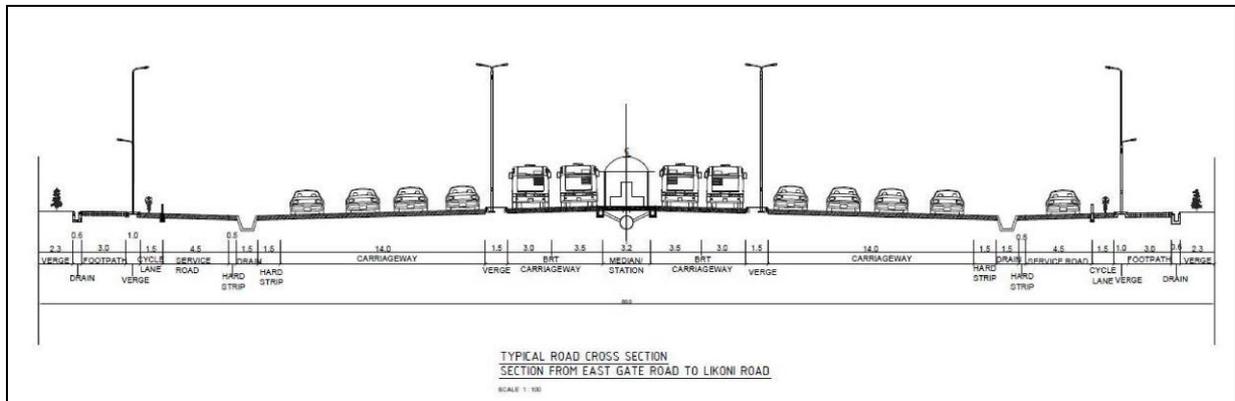
Locations of the study sections are shown in Figure 4.1.1. Numbers shown in the figure correspond to the numbers of the study given in Table 4.1.1.



Source: Kenya National Highways Authority (KeNHA)

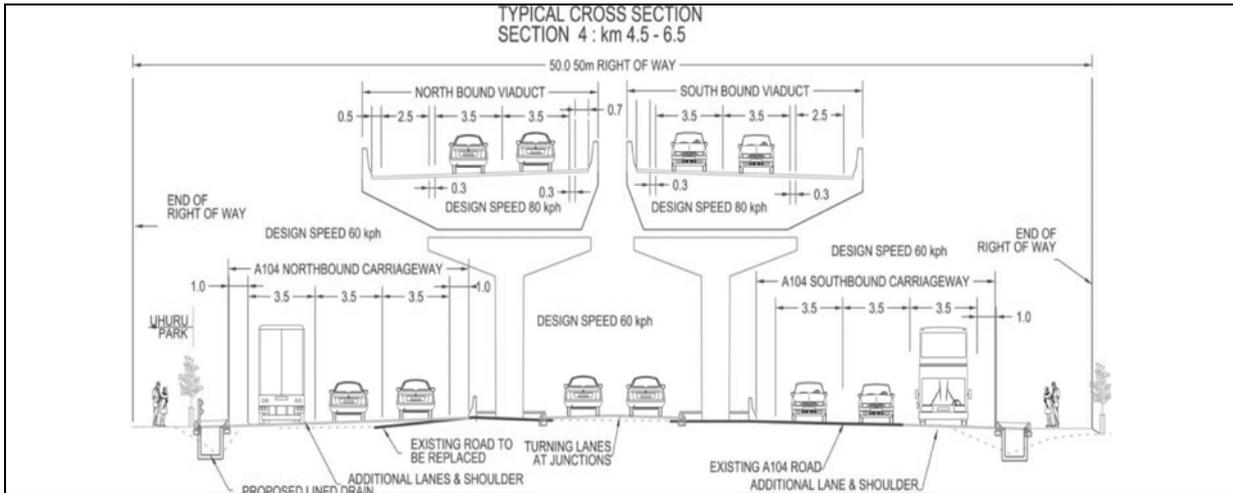
Figure 4.1.1 Location of Study Sections for A104

Figure 4.1.2 - 4.1.4 show the typical cross section of the three studies.



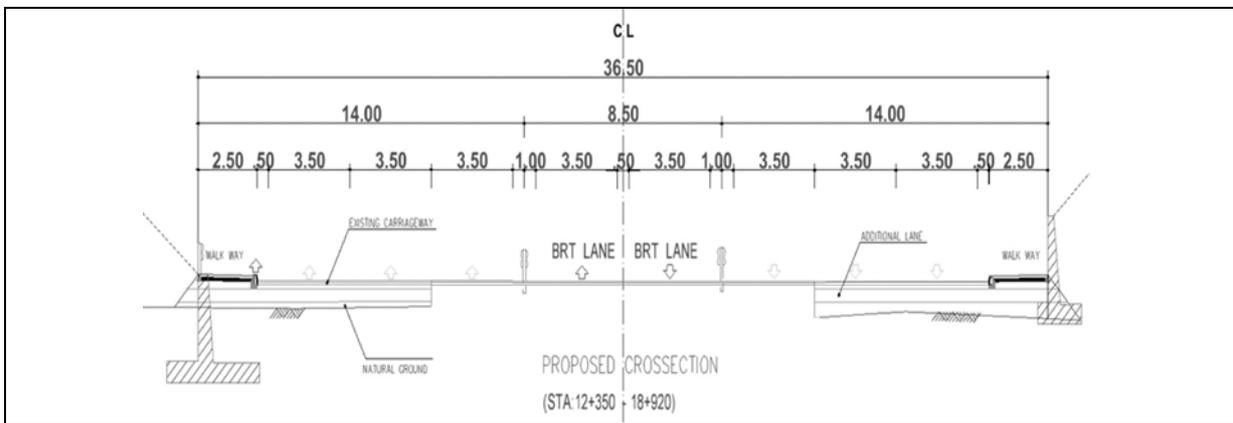
Source: Overview of the Capacity Improvement of JKIA – Rironi Road, KeNHA

Figure 4.1.2 Typical Cross Section JKIA – Haile Selassie Section



Source: Overview of the Capacity Improvement of JKIA – Rironi Road, KeNHA

Figure 4.1.3 Typical Cross Section from Just Before Haile Selassie Junction to Just After the University Way Junction



Source: Overview of the Capacity Improvement of JKIA – Rironi Road, KeNHA

Figure 4.1.4 Typical Cross Section James Gichuru Junction – Uthiru Section and Gitaru - Rironi Section

Component B (supporting KURA and KRC to develop selected mass transit corridors) includes sub-component B1 for Kura and sub-component B2 for KRC. The sub-component B1 includes the following projects:

- (i) Carrying out a range of feasibility studies, including detailed designs, and preparing bidding documents for selected bus rapid transit (BRT) road corridors through provision of technical advisory services.
- (ii) Providing public transport and associated services through provision of technical assistance.

In Annex 2: Detailed Project Description, the following concepts for BRT are shown:

- (i) The MRTS has identified nine BRT corridors which, if developed, will serve the most densely populated and low income parts of the larger Nairobi. The eastern part of Nairobi City is one such area.
- (ii) The Jogoo Road corridor with a length of about 21 km has the most dense traffic and passenger demand in Nairobi City, with a forecast travel demand of 424,680 persons in 2030; It is connected to the Juja Road corridor, Outering, and Thika corridors in Nairobi City.

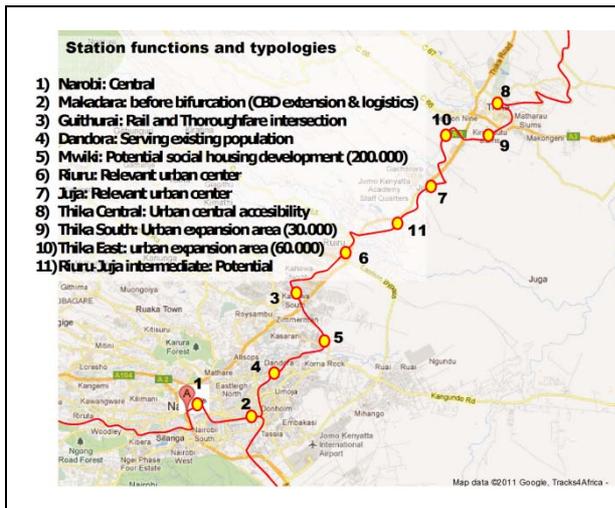
- (iii) The other key corridors include Mombasa Road, which would partly serve JKIA and the southern part of Nairobi City, the key growth pole for greater Nairobi
- (iv) The BRT corridors that will be considered under this project include Juja Road and Mombasa-Uhuru Highway-Waiyaki Way road segment. NUTRIP will support the preparation of the first comprehensive BRT route and will involve carrying out feasibility and detailed (engineering) design and studies.

Source: Project Appraisal Document on a Proposed Credit to the Republic of Kenya for a National Urban Transport Improvement Project, WB and Project Information Document (PID) Concept Stage

Nairobi Metropolitan Services Improvement Project (NaMSIP, 10 May 2012)

NaMSIP, already described in Section 4.1.1 (3) is deeply related to transportation in its Component 3 “Investing in Infrastructure and Service Delivery”.

The document named “Nairobi Metropolitan Leadership” issued at the meeting held by the WB and Nairobi City County (NCC) on 2 July 2013 focuses on the synergy between the commuter train and land development around the stations. Since the document is in its conceptual stage, the detailed method of improvement and operation of the commuter train is not studied, but the number and the location of stations are described. The proposed development/improvement of 12 stations along the NRS-Ruiru section and nine stations along the NRS-Kikuyu section is shown in Figures 4.1.5 and 4.1.6.



Source: NaMSIP, Nairobi Metropolitan Leadership (Presentation document for 2 July 2013 meeting)

Figure 4.1.5 Proposed Stations in NRS-Ruiru Section

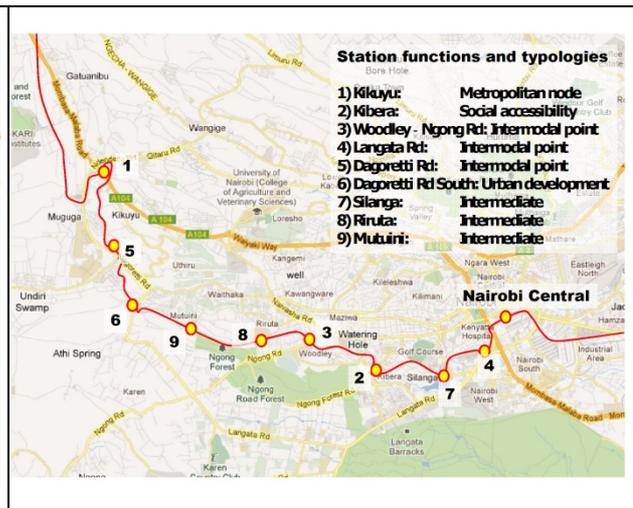


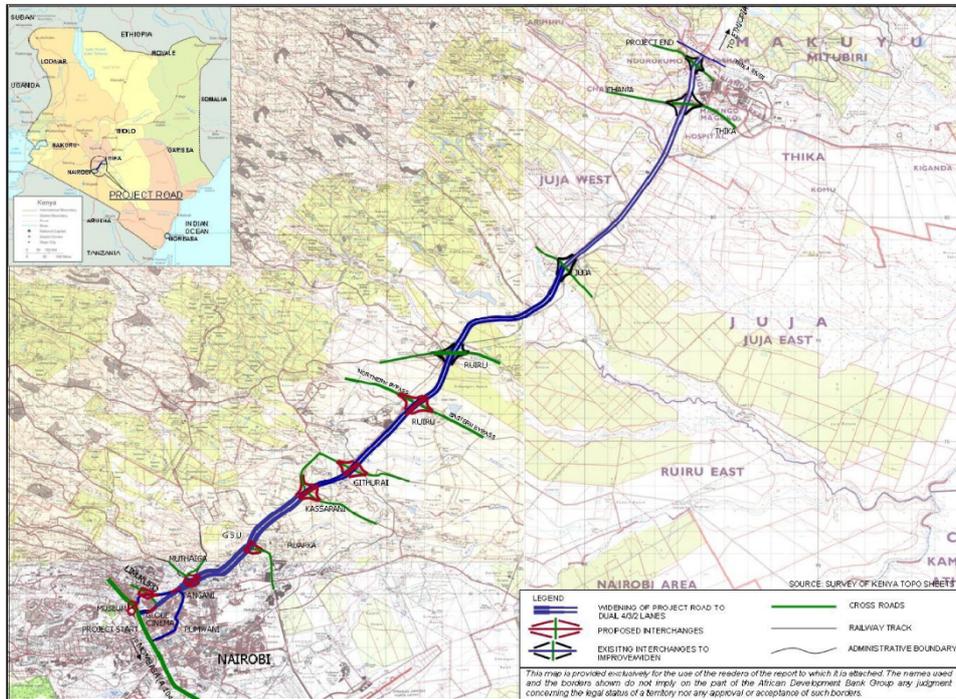
Figure 4.1.6 Proposed Stations in NRS-Kikuyu Section

(2) African Development Bank (AfDB)

1) Nairobi - Thika Highway Improvement Project

The Nairobi-Thika highway is a dual-carriageway road of about 45 km. The road is part of the international trunk road classified as A2 which originates in downtown Nairobi City and extends to Moyale at the Ethiopian border. To accommodate the existing and future traffic, the highway needs substantial improvements to increase its capacity which would entail the construction of additional lanes and the removal of at-grade intersections at several locations to be replaced by interchanges.

The project was implemented by the Roads Department of the Ministry of Roads and Public Works (MORPW) (currently under MOTI). The project started in January 2008, and opened in November 2012.



Source: Appraisal Report, Nairobi-Thika Highway Improvement Project, September 2007, ADF
Figure 4.1.7 Nairobi-Thika Highway Improvement Project Location Map

The construction between downtown Nairobi City and Kenyatta University was financed by AfDB and the Kenyan government for the amount of US\$260 million. AfDB financed the project with a package of US\$180 million through its concessional window, the African Development Fund, including a loan of US\$175 million (civil works and related consultancy services), and a grant worth US\$5 million (feasibility study and detailed design of a mass rapid transit system for the Nairobi Metropolitan Area). The Kenyan government contributed US\$80 million towards the road project. The project still has one major drawback in that, the connectors to the Nairobi City centre and Uhuru Highway (A104) are still congested during the peak hours.

The section from Kenyatta University to Thika Road, which is part of the Nairobi-Thika Highway Improvement Project, is being implemented at a cost of KSh10.6 billion. It involves the construction of extra lanes from Kenyatta University to Thika Town with an intention to improve the traffic flow along the route. The Exim Bank of China financed US\$100 million for the upgrading between Kenyatta University and Thika.

2) Mass Rapid Transit System (MRTS) for the Nairobi Metropolitan Region, June 2011 (Consultancy Services for Feasibility Study and Technical Assistance for the Mass Transit System of the Nairobi Metropolitan Region)

i) Study Area and Study Components

The study area of MRTS corresponds to the area of Nairobi Metro 2030, and the target year is also 2030. The major study components are described as follows:

- (i) Preparation of an integrated multi-modal transport plan for NMR that complements the Nairobi urban transport master plan proposals covering a period of 20 years (2010-2030)
- (ii) Formulation of a comprehensive public transport policy for Nairobi Metropolitan Region (NMR)
- (iii) Recommendation of an appropriate legal, institutional, and regulatory framework for facilitating the implementation of the MRTS in NMR
- (iv) National Road Transport and Safety Authority which has been established to deal with road transport issues and concerns
- (v) Nairobi Metropolitan Transport Authority (to be established) which will be responsible for licensing, regulating public transport, and traffic management in NMR.

ii) MRTS Corridors

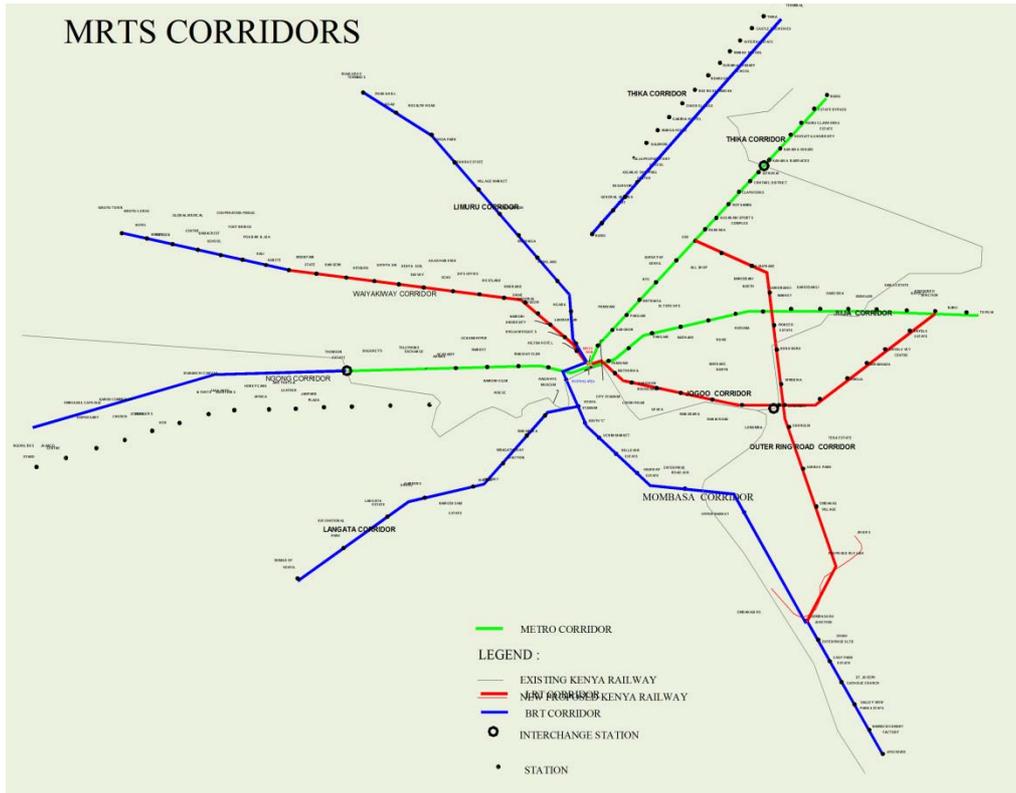
Evaluating existing corridors in Nairobi City, the study considers appropriate mass rapid transport system along the nine corridors leading to the central business district (CBD) of Nairobi City. These corridors are as follows:

- (i) Nairobi Rail Station (NRS)- Ruiru - Thika
- (ii) NRS - Juja Road – Kangundo
- (iii) NRS – Jogoo Road – Komorock
- (iv) NRS - JKIA - Athi River
- (v) NRS - Langata Road - Karen
- (vi) NRS – Upperhill – Ngong
- (vii) NRS – Kabete – Kikuyu
- (viii) NRS – Gigiri – Limuru
- (ix) Outer Ring Road

iii) Selection of Modes

The selection of modes amongst metro, BRT system, light rail transit (LRT) system or monorail depends mainly on the forecasted passenger demand presented in peak hour peak direction traffic (PHPDT). The BRT or monorail have been considered where the PHPDT is in excess of 5,000 passengers. The LRT has been considered where the PHPDT is in excess of 12,000 passengers; and metro rail in corridors where PHPDT is in excess of 30,000 passengers.

The proposed network on nine corridors in Nairobi City is shown in Figure 4.1.8.



Source: Mass Rapid Transit System for the Nairobi Metropolitan Region (MRTS), June 2011, Chapter 8.

Figure 4.1.8 MRTS Corridors

iv) *Economic Viability*

The annual cost and benefit streams for each MRTS corridor were analysed to derive the net cash flow. The EIRR and NPV at the 12% discount rate were determined using the discounted cash flow technique. The results of the economic evaluation are summarised in Table 4.1.2.

Table 4.1.2 Results of Economic Evaluation

Corridor	EIRR (%)	NPV@12% (million KSh)
MRTS 1: Waiyaki Way	11.09%	(-)2,255
MRTS 2: Thika Road	25.52%	97,057
MRTS 3: Juja Road	16.53%	17,598
MRTS 4: Jogoo Road	19.80%	18,654
MRTS 5: Outer Ring Road	20.81%	22,198
MRTS 6: Ngong Road	18.99%	18,431
MRTS 7: Limuru Road	22.31%	8,537
MRTS 8: Langata Road	28.98%	6,775
MRTS 9: Mombasa Road/Athi River	14.23%	2,598
All Corridors Together	19.88%	189,592

Source: Mass Rapid Transit System for the Nairobi Metropolitan Region (MRTS), June 2011, Chapter 10

The results indicate that all the corridors, except Waiyaki Way, are economically viable, as the EIRRs are greater than 12%. BRT corridors have higher EIRRs because of their relatively lower costs compared with LRT costs.

(3) Government of Japan/JICA

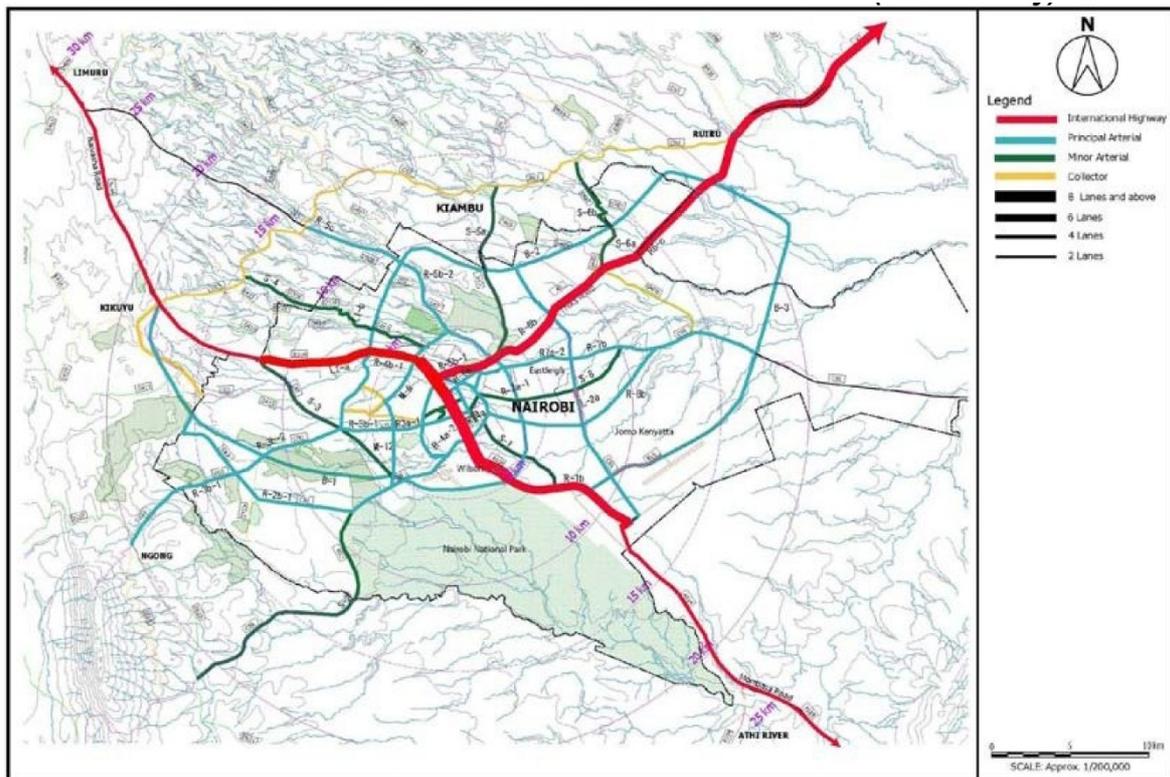
The Study on Master Plan for Urban Transport in the Metropolitan Area in the Republic of Kenya, 2006, JICA

The Study commenced in July 2004 and was completed in January 2006. The objectives of the Study were: 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.

Components of the recommended master plan are as follows:

- (i) Radial and circumferential (R/C) road network (2) including planned projects
- (ii) Bus incentive and priority measures
- (iii) Upgrading of the existing rail to a commuter rail
- (iv) Improvement of Uhuru Highway, stage I as expressway

The road network of the master plan in 2025 is shown in Figure 4.1.9.



Source: The Study on Master Plan for Urban Transport in the Metropolitan Area in the Republic of Kenya, Final Report Executive Summary, March 2006

Figure 4.1.9 Road Network in the Urban Area (Nairobi City) in 2005

Table 4.1.3 Staging Plan Proposed in the Master Plan and its Current Progress

	Short-term (2006-2010)	Medium-term (2011-2015)	Long-term (2016-2025)	Progress
1. Bypass and Link Roads			<ul style="list-style-type: none"> • Bypass roads • Link roads • Link roads extension 	<ul style="list-style-type: none"> • Eastern bypass completed • Northern bypass completed • Western bypass under construction • Western link road under construction
2. Missing Link	<ul style="list-style-type: none"> • Missing links (arterial) 	<ul style="list-style-type: none"> • Missing links (collector) • Missing links (local) 		<ul style="list-style-type: none"> • Missing link 6, 7 under construction • Refer to (4) EU assistance
3. Radial Roads	<ul style="list-style-type: none"> • Radial roads within C-3 	<ul style="list-style-type: none"> • Radial roads outside C-3 (north and east) 	<ul style="list-style-type: none"> • Radial roads outside C-3 (south and west) • New radial roads 	<ul style="list-style-type: none"> • Ngong Road under design • Langata Road under construction
4. Circumferential Arterial Roads		<ul style="list-style-type: none"> • Circumferential arterial roads C-3 	<ul style="list-style-type: none"> • Circumferential roads C-1 and C-2 	
5. Secondary Arterial Roads			<ul style="list-style-type: none"> • Secondary arterial roads (south-west) • Secondary arterial roads (north-east) 	
6. Intersection Improvement	<ul style="list-style-type: none"> • Intersection improvement (stage 1) 	<ul style="list-style-type: none"> • Intersection improvement (stage 2) 	<ul style="list-style-type: none"> • Intersection improvement (stage 3) 	
7. Non-motorised Transport (NMT)	<ul style="list-style-type: none"> • NMT (north and west) 	<ul style="list-style-type: none"> • NMT (south and part of west) 	<ul style="list-style-type: none"> • NMT (south and part of west) 	
8. Uhuru Highway	-	-	-	
9. Traffic Circulation	Traffic circulation (stage 1)	Traffic circulation (stage 2)		

Source: The Study on Master Plan for Urban Transport in the Metropolitan Area in the Republic of Kenya, Final Report, and JICA Study Team

Nairobi Western Roads

Nairobi western roads are referred to as the missing link which connects Kileleshwa Police Station to the Westlands Roundabout, Ole Dume Road, and James Gichuru Road to Ngong Road. The construction of roads was derived from the master plan as the priority roads by the grant aid project from the Government of Japan. Connecting the three missing link roads will create a network in the area, which is currently separated by rivers, and alleviate the congestion as well as contribute to the smooth and safe transport of people and goods between the Westlands and Kilimani areas. The total road length is 8.36 km, and the grant amount is ¥2.54 billion. The construction commenced in June 2011 and was completed in June 2013.

Nairobi Dagoreti Corner Road C60/C61

The Preparatory Survey on the Project for Dualling of Nairobi-Dagoretti Corner Road C60/C61 in the Republic of Kenya was conducted from June 2010 to March 2011. The proposed road improvement section was from Adams Arcade intersection to Ngong Road/Kenyatta Avenue intersection. The improvement measure is to widen the current two lanes into four. The total length is 4.7 km. After the completion of the preparatory survey, the MRTS project by MOT selected Ngong Road as one of the nine corridors for MRTS. The investigation of the cross section for the proposed road was carried out to make space for MRTS. In conclusion, the mode of the MRTS was decided as LRT, and the detailed design will be conducted under this precondition.

(4) European Union (EU)

EU assists in the road development in Nairobi City through a project named “KENYA/ACP/Regional Economic Integration by means of Transport Infrastructure - Urban Roads”. The project, which is under KURA, comprises technical assistance for MOTI, relevant road authorities, and MOT, and construction of Nairobi City’s missing link roads and non-motorised transport facilities. The construction project consists of 10.5 km of new road links, pedestrian footpaths, and cycle tracks in the Westlands/Parklands area as well as in the industrial area. Design for the Missing Link No. 6 is ready. Tendering for construction of the roads is ongoing. The roads are:

- (i) Accra Road to Ngara Road: 0.7 km (Missing Link No. 1)
- (ii) (Muratina St) General Warungi St to Juja Road: 3.0 km (Missing Link No. 5)
- (iii) (Likoni Road Extension): Enterprise Road to Mombasa: 1.8 km (Missing Link No. 10)
- (iv) Ring Road Parkland (Westlands Roundabout-Limuru Road): 4.0 km (Missing Link No. 15a)
- (v) Ring Road Parkland Extension (Limuru Road to Thika Road): 1.6 km (Missing Link No. 15b)
- (vi) Quarry Road Extension (Ladhies Road to Quarry Road): 2.5 km (Missing Link No. 16)

Source: Showcasing the status of roads in Nairobi City, August, 2012, MOR (Ministry of Roads)

(5) China

China assisted GOK through four large road projects, three of which were completed. The extent of assistance is shown in Table 4.1.4.

Table 4.1.4 Chinese Assistance on Road Development in Nairobi City

	Length	Cost	Financer	Progress
Thika Road (Kenyatta University-Thika)		KSh10.6 billion	Exim Bank of China	Completed in November 2012
Northern Bypass	31 km	KSh8.5 billion	Kenya Gov’t 15% China Gov’t 85%	Completed
Eastern Bypass	39 km	KSh4.2 billion	Kenya Gov’t 15% China Gov’t 85%	Completed
Southern Bypass	28.8 km	KSh16.9 billion	Kenya Gov’t 15% Exim Bank of China 85%	Construction period: three years from March 2012

Source: Megaprojects Kenya Website

4.1.3 Railway

(1) The Nairobi Commuter Railway Project

Kenya Railways Corporation (KRC) has a national railway network, including a network within and around Nairobi City, which is capable of providing reliable commuter services affordably. In order to utilise the existing railway infrastructure, the Government of Kenya authorised KRC to enter into a joint development agreement (JDA) with InfraCo Limited (INFRACO) to develop the new commuter rail system jointly on the basis of a public-private partnership. Kenya Railways Corporation and INFRACO signed the JDA on 15 April 2009.

INFRACO is a company owned by the Private Infrastructure Development Group Trust (PIDG), which is supported by several development partners including the following:

- (i) Swedish International Development Cooperation Agency (SIDA);

- (ii) UK Department of International Development (DfID);
- (iii) Swiss State Secretariat for Foreign Affairs (SECE);
- (iv) Netherlands Ministry of Foreign Affairs (DGIS);
- (v) Austrian Development Corporation (ADC); and
- (vi) World Bank

The project development is to be undertaken in two phases as stipulated in the JDA. The purpose of phase 1 is to create the project development plan (PDP), which includes proposed funding and commercial structure, as follows:

- (i) Detailed market forecast;
- (ii) Engineering designs;
- (iii) Development of bankable project documents;
- (iv) Competitive procurement of contractors, suppliers, and operator(s); and
- (v) Identification and procurement of debt and equity financing through to financial close and start of constructions.

The system has been designed with a capacity to move 43 million passengers per year, which means 172,000 passengers per day compared with the current capacity of 25,000 passengers per day.

KRC is continuing the station improvement project between Syokimau and Nairobi stations, including providing automated ticket gates and high platforms for commuter train operations. The following Figure 4.1.10 shows the Makadara Station improvements.



Figure 4.1.10 Automated Ticket Gate (left) High Platform Construction (right)

INFRACO is now planning to provide a Diesel Multiple Unit (DMU) train set, consisting of five cars, for commuter train operations on this line. An automated fare collection system will be provided at Nairobi, Syokimau, and Makadara stations.

The Kenyan government has agreed with the Chinese government for the finance and construction of a standard gauge track between Mombasa and Nairobi stations. When the standard gauge track is constructed, all the freight trains will be shifted to the new track, and the existing meter gauge track will be dedicated for passenger services. The following Figure 4.1.11 indicates the planned alignment of the standard gauge track from Nairobi to Dagoretti.



Source: Kenya Railways Corporation (KRC)

Figure 4.1.11 Proposed Standard Gauge Railway Corridor from Nairobi to Dagoretti (Blue Line)

4.1.4 Airport

Kenya Airports Authority (KAA) conducted several airport development projects. Some of the projects were implemented through foreign assistance. The recent projects of JKIA and Wilson Airport are shown below.

(1) Jomo Kenyatta International Airport (JKIA)

KAA announced the expansion plan for the terminal area (Terminal 4) including the aircraft apron in October 2005. The expansion project aimed at the improvement of JKIA aviation services such as terminal area and related apron and taxiways. The passenger capacity increased from 25,000 m² to 55,000 m² and the apron space expanded from 200,000 m² to 300,000 m². The project cost was approximately US\$204 million, which is funded by WB and the national budget. The first phase of the project was completed in mid-2008, which consisted of civil works of the terminal building including the aircraft apron, taxiway, and fuel hydrant system. The second phase was the construction of the Terminal 4 building with car parks.

On the other hand, KAA conducted the national airports system plan (NASP) in 2010. This plan consisted of ten airport master plans for JKIA, Wilson, Mombasa International, Eldoret International, Kisumu, Ukunda, Malindi, Lamu, Lokichogio, and Wajir airports.

A huge fire damaged the main airport building of JKIA on 7 August 2013. Investigations have concluded that it was due to an electrical fault that started from the power distribution box where some wires in the box overheated and sparked. This resulted in complete destruction of the terminal building and especially the entire arrivals section of the main airport building, forcing the shutdown of the runway and cancellation of flights. Within days, a huge tent was put up to act as a makeshift terminal which was later replaced (September 2013) by a temporary terminal in what used to be the main parking garage.

KAA is in the process of bringing down the damaged international arrival terminal to pave the way for its reconstruction, alongside the redesign for terminals 1, 2, and 3. Plans are also underway to complete the new terminal 4 to house international arrivals and departures until JKIA expansion plans are fully implemented. The construction of the greenfield terminal, with a handling capacity of 20 million passengers per year has also kicked off.

1) JKIA Expansion Plan

As part of Vision 2030's flagship project, KAA intends to enhance its passenger handling capacity and improve on the efficiency of hub operations at JKIA through construction of a

new passenger terminal complex. The floor area is around 178,000 m² on four levels. The associated facilities of the passenger terminal building are as follows:

- (i) 50 international check in positions
- (ii) 32 contact and eight remote gates
- (iii) Associated apron with 45 aircraft stands and linking taxiways

2) National Airports System Plan (NASP)

In the last ten years, both passenger and goods traffic through Kenya's main airport has increased substantially. In order to handle the growth in its international and domestic air traffic and maintain its status as an important hub in the region, Kenya faces several challenges.

The airport development plans of NASP consist of airside facilities, landside facilities, and public utilities. The facilities development has three phases, namely: phase I for target year 2015, phase II for target year 2020, and phase III for target year 2030. The detailed facilities requirements are shown below.

i) Phase I Development

Airside facilities

- The taxiway is extended to the end of the runway
- Displacement of 572 m of the threshold of Runway 24
- Three new runway exits
- A holding bay near the end of Runway 06
- Isolated parking stand
- Remote parking positions

Landside facilities

- A cell phone parking lot
- A new lane arrival curb

Public utilities

- New electrical equipment to supply the new domestic passenger terminal area
- Expansion of the telephone system
- Complementary equipment in the existing substations

ii) Phase II Development

Airside facilities

- A parallel runway and a full length taxiway
- Taxiway connectors to the new runway system
- Two holding bays
- New airport rescue firefighting (ARFF) facilities
- Integrated landing systems and navigation aids for the new runway

Landside facilities

- New arrival and departure building
- BHS system
- New cargo terminal building

iii) Phase III Development

Airside facilities

- Expansion of the general aviation apron
- Expansion of cargo apron
- Two rapid exit taxiways to the new runway
- Parallel taxiway to Taxiway G

Landside facilities

- Expansion of the primary access roads
- Additional lanes in the arrival curb

Public utilities

- New electrical equipment to supply the new domestic passenger terminal area
- Expansion of the telephone system
- Complementary equipment in the existing substations

(2) Wilson Airport

Wilson Airport is the busiest airport in Kenya and the third busiest in Africa. The daily aircraft frequency recorded is 160 flights in 2012. KAA is currently undertaking airport development based on the NASP of 2010. The development phases are scheduled in the short, medium and long terms by target years 2015, 2020, and 2030, respectively. The airport development plans are shown below.

1) Phase I Development (2015)

Airside facilities

- Full parallel taxiway to Runway 07-25 and a partial 275 m long taxiway to Runway 14
- Additional aircraft position of Aprons 1, 2 and 3
- New engine run-up apron
- A new control tower and ARFF facility

Terminal

- Temporary terminal building

Landside facilities

- Parking lot expansion, 165 spaces

Utilities

- Upgrading the existing generator including mechanical equipment, electrical equipment, and cable network
- IP Telephony

2) Phase II Development (2020)

Airside facilities

- New apron for the new terminal building
- Parallel taxiways for both runways
- New calibration taxiway and pad

Terminal

- New terminal building

Landside facilities

- New access road

Utilities

- New standby generator including mechanical equipment, electrical equipment, and cable network

3) Phase III Development (2030)

Phase III development is considered for the passenger terminal building, if the forecasts are exceeded.

With regard to the relocation of Wilson Airport, each organisation has a different view. NASP includes the Wilson Airport development plan and spatial planning concept for the Nairobi Metropolitan Region proposed redevelopment of the Wilson Airport area to a government office complex. The position of Wilson Airport will be further discussed and confirmed with stakeholders through a working group discussion.

(3) Airport Development in Nairobi City

Both JKIA and Wilson Airport are operated and managed by KAA who are also in the process of implementing the airport's future development plan. The future plan of JKIA was announced by Vision 2030 as an airport city; Wilson Airport has already undergone improvement works under NASP. This could illustrate KAA's reluctance to approve the relocation of both airports at the moment.

However, airports sometimes may have negative impacts when social and environmental factors are considered. Recently, it seems that there is no airport operation-related complaint or impact such as aircraft noise and pollution, even though a number of housing developments are being implemented around the airports. Wilson Airport is particularly affected in this regard.

JKIA will not be able to relocate from its present location where it has been incorporated in the Nairobi development plan. On the other hand, the Wilson Airport area is the most strategic in Nairobi City. Therefore, it must be required to relocate to another area from the standpoint of city planning and the citizens. However, airports in many cities in the world are located in the city centre for general aviation for business executives. Some airport relocation plans have been postponed in other countries. Therefore, it is not easy to promote the relocation of Wilson Airport.

4.1.5 Water Supply

(1) World Bank

The Water and Sanitation Services Improvement Project is ongoing for supporting the Athi Water Service Board (AWSB), Coast Water Service Board (CWSB), Lake Victoria North Water Service Board (LVNWSB), and their water service providers (WSPs) for the improvement of water supply and sanitation systems. The area covered by AWSB and its WSP includes Nairobi City.

Under the project, the Feasibility Study and Master Plan for Developing New Water Sources for Nairobi and Satellite Towns (FSMPNWS) was carried out and co-financed by AFD. Its contents were the projection of population and water demand until 2035, preparation of six scenarios of water resource development, and the preliminary design of water resource development and water supply system.

(2) Agence Francaise Developpement (AFD)

In addition to FSMPNWS, AFD financed two projects for the rehabilitation of water supply facilities including a barrage for Nairobi City and development of the water supply system in informal settlements of Nairobi City. The projects financed by AFD are as follows:

- (i) Nairobi Water and Sewerage Emergency Physical Investment Project, and
- (ii) Complementary Support to the Nairobi and Kisumu Water and Sanitation Project

(3) Japan International Cooperation Agency (JICA)

The development of the National Water Master Plan 2030 in Republic of Kenya (NWMP) was completed. In the project, a comprehensive plan for water resources is discussed for water supply, sanitation, irrigation, hydropower generation, food and drought management, and environmental management. The project carried out the projection of population and water demand, proposal of water allocation plan, development plan of water resources and strategy of water supply system for the Athi Catchment Area including Nairobi City.

(4) African Development Bank (AfDB)

To support the institutional activity of AWSB and the development activity in Kibera, Nairobi City, AfDB financed the Water Service Boards Support Project. The project is ongoing as of April 2013.

(5) European Commission (EC)

EC supported water supply projects for anti-poverty programme. Ongoing projects financed by EC are as follows:

- (i) Nairobi Informal Settlement Water and Sanitation Improvement Programme; and
- (ii) Micro Financing for Community Managed Water Projects.

(6) Other Partners

A few bilateral development partners are active in Nairobi City for the development of the water supply system in informal settlements and reform of the water sector. The following projects are financed by bilateral partners:

- (i) Water Sector Reform Program financed by German Technical Cooperation;
- (ii) Water Supply and Sanitation for the Urban Poor financed by German Technical Cooperation;
- (iii) Water Supply and Sanitation for the Urban Poor Phase II financed by German Technical Cooperation;
- (iv) Support to Water Service Trust Fund financed by Finland; and
- (v) Kenya Water and Sanitation Program financed by SICA.

Besides the above, there are two projects financed by UN-HABITAT, as follows:

- (vi) Kibera Water and Sanitation Project financed by UN- HABITAT; and
- (vii) Kibera Support Programme financed by UN-HABITAT.

4.1.6 Stormwater Drainage and Sewerage

The major ongoing projects relevant to the infrastructure development of the stormwater drainage and sewerage in Nairobi City are listed in Table 4.1.5. Each project covers a wide scale in terms of the objectives and target areas. Brief descriptions of each project and ongoing activities relevant to the infrastructure development of stormwater drainage and sewerage in Nairobi City are identified from the published documents and summarised hereunder in this subsection.

Table 4.1.5 Ongoing Projects Relevant to Infrastructure Development for Stormwater Drainage and Sewerage in Nairobi City

Project	Implementing Agency	Donor
Water and Sanitation Service Improvement Project (WaSSIP)	AWSB, CWSB, LVNWSB	World Bank
Kenya Municipal Program (KMP)	MOLG	World Bank
Kenya Informal Settlement Improvement Project (KISIP)	MOH	World Bank
Nairobi Metropolitan Services Improvement Project (NaMSIP)	MONMD	World Bank
Nairobi Rivers Basin Rehabilitation and Restoration Program: Sewerage Improvement Project (NaRSIP)	AWSB	AfDB

Source: Project Appraisal Documents

(1) Water and Sanitation Service Improvement Project (WaSSIP)

The WaSSIP is financed by the WB and aims at increasing access to reliable, affordable, and sustainable water supply and sanitation services; and improving the water and wastewater services in the areas served by AWSB, CWSB, and LVNWSB. The period of the project implementation was scheduled originally for 2008-2012 and is further extended with additional financing by the WB.

The project comprises the following three components:

- (i) Component 1: Support to the Athi Water Services Board
- (ii) Component 2: Support to the Coast Water Services Board
- (iii) Component 3: Support to the Lake Victoria North Water Services Board

Of the three components, Component 1 comprises the following subcomponents:

- (i) Rehabilitation and Extension of Water Supply Facilities;
- (ii) Rehabilitation and Extension of Wastewater and Sanitation Facilities; and
- (iii) Institutional Strengthening Program.

Of the infrastructure developments for wastewater and sanitation facilities under subcomponent (ii) above, the major works implemented in Nairobi City are listed as shown in Table 4.1.6 below.

Table 4.1.6 Major Infrastructure Developments for Wastewater and Sanitation Facilities in Nairobi City under the WaSSIP

Works	Procurement Information	Description
Construction of Gatharaini Trunk Sewers including Rui-Rwaka, Gatharaini North and Gatharaini South	Contract No. AWSB/WaSSIP/Comp.1/W-6/2009 Contract Signed on 24 March 2010 Construction Period: 24 months	<ul style="list-style-type: none"> ● Construction of approximately 49 km of pre-cast concrete sewers of various sizes ranging from 300 to 1200 mm diameter ● Construction of box culvert (1400 x 1400), manholes, and other auxiliary works ● Construction period: 24 months
Construction of Lavington - Riruta Trunk Sewers Extensions	Contract No. AWSB/WaSSIP/Comp.1/W-7/2009 Contract Signed on 9 June 2009 Construction Period: 12 months	<ul style="list-style-type: none"> ● Extension of approximately 8 km trunk sewers of various sizes ranging from 750 mm diameter nominal (DN) to 225 mm DN spigot and socket concrete pipes covering Lavington, Riruta North, and Riruta South areas, in Nairobi City
Rehabilitation of Dandora Sewerage Treatment Works and Reconstruction of the Ngong River Trunk Sewers	Contract No. AWSB/WaSSIP/Comp.1/W-9/2009 Contract Signed on 20 May 2009 Construction Period: 20 months	<ul style="list-style-type: none"> ● Desludging of existing facultative and maturation pond series 7 and 8 including removal of approximately 550,000 m³ of sludge (at Dandora STP) ● Construction of six anaerobic ponds prior to series 1 and 2 and series 7 and 8, each dimension is 120 m by 90 m by 4.5 m deep including earthworks of approximately 200,000 m³ (at Dandora STP) ● Construction of associated reinforced concrete works of approximately 3,000 m³ and ancillary 3No penstocks 1400 mm by 100 mm and 1 No. 1000 mm by 1000 mm (at Dandora STP) ● Rehabilitation and reconstruction of 24,000 m of Ngong trunk sewers including cleaning, unblocking, repairing and replacement of short sections and manhole covers, and associated works.

Source: Procurement Plan for the WaSSIP (World Bank, January 2010) and the updates shown in the website of the World Bank as of April 2013

In addition, the procurement plan for the WaSSIP from July 2012 to December 2013 indicates the recruitment of consultants to carry out the consulting services for updating the Nairobi City sewerage master plan and preparation of the master plan for selected satellite towns. Based on the procurement plan, the submission and opening of proposals had been planned on 30 October 2012.

(2) Kenya Municipal Program (KMP)

MOLG is implementing phase 1 of KMP with financial assistance from the WB. The development objective of phase 1 is to strengthen local governance and improve service delivery in 15 selected municipalities through a combination of institutional reforms, capacity building, and investment in infrastructure. The phase 1 of the KMP is scheduled to be implemented from 2010 to 2015.

The selected municipalities (major cities and towns) are (1) Nairobi City, (2) Mombasa, (3) Kisumu, (4) Nakuru, (5) Eldoret, (6) Malindi, (7) Naivasha, (8) Kitui, (9) Machakos, (10) Thika, (11) Nyeri, (12) Garissa, (13) Kericho, (14) Kakamega, and (15) Embu.

The project comprises the following four components:

- (i) Component 1: Institutional Strengthening
- (ii) Component 2: Participatory Strategic Urban Development Planning
- (iii) Component 3: Investment in Infrastructure and Service Delivery
- (iv) Component 4: Project Management, Monitoring, and Evaluation

Of the above, Component 3 consists of the infrastructure developments considered as eligible for financing under the KMP; motorised and non-motorised transport facilities (including bus parks, access roads, sidewalks, and paved paths), street lighting, markets, solid waste management,

stormwater drainage, disaster management and prevention facilities and equipment, public parks, and green spaces.

The investments for Component 3 are phased into two: (a) investments for implementing the infrastructure developments during 2010-2013 and (b) investments for implementing the infrastructure developments during 2013-2015. The selection of infrastructure developments is based on either (a) year 3-5 investments, or (b) the criteria established in the process of the project design of the KMP as described in the project appraisal report (World Bank, April 2010).

The investments for Component 3 cover the infrastructure developments for stormwater drainage in the municipalities (major towns and cities) concerned. The procurement plan for phase 1 of the KMP (World Bank, July 2012) shows the scheduled procurements relating to the infrastructure developments for stormwater drainage in Mombasa, Malindi, Nyeri, Naibasha, and Kitui.

Besides, the updated list of the procurement notices (World Bank website, as of April 2013) shows the request for expression of interest (EOI) for the Preparation of a Master Plan, Detailed Designs, Tender Documents and Operations and Maintenance Manuals for Stormwater Drainage Works in the City of Nairobi (Contract No. MOLG/KMP/COMP3/SWD-02C), which was announced by the MOLG on 11 March 2013. The period of the assignment for the consultancy service is expected to be nine months. The request for EOI was closed on 26 March 2013.

(3) Kenya Informal Settlement Improvement Project (KISIP)

The MOH (currently under MOLHUD) is implementing the KISIP with the financial assistance by the WB. The project development objective is to improve living conditions of informal settlements in 15 selected municipalities in Kenya as shown below. The KISIP is scheduled to be implemented from 2011 to 2016.

The selected municipalities (major towns and cities) are (1) Nairobi City, (2) Mombasa, (3) Kisumu, (4) Nakuru, (5) Eldoret, (6) Malindi, (7) Naivasha, (8) Kitui, (9) Machakos, (10) Thika, (11) Nyeri, (12) Garissa, (13) Kericho, (14) Kakamega, and (15) Embu.

The KISIP comprises the following four components:

- (i) Component 1: Strengthening Institutions and Programme Management
- (ii) Component 2: Enhancing Tenure Security
- (iii) Component 3: Investing in Infrastructure and Service Delivery
- (iv) Component 4: Planning for Urban Growth

Of the above, Component 3 supports investments in settlement infrastructure, and when necessary, extension of trunk infrastructure to settlements. The infrastructure developments considered as eligible for financing under the KISIP are roads, bicycle paths, pedestrian walkways, street and security lighting, vending platforms, solid waste management, stormwater drainage, water and sanitation systems, electrification, public parks, and green spaces. The selection of infrastructure developments is performed based on the criteria established in the process of project design of the KISIP as described in the project appraisal report (World Bank, February 2011).

From the procurement plan of the KISIP from December 2012 to December 2013 and the updated list of the procurement notices (World Bank website, as of April 2013), the following procurements relating to the infrastructure developments for stormwater drainage and sewerage in Nairobi City are identified:

- 1) Extension of Services to Informal Settlements in Nairobi City, Lot 4: Kayole Soweto Sewerage

Contract No. AWSB/KISIP/W-1/2013

Bid Submission and Opening (NCB): 14 May 2013

Construction Period: 16 months

Major Components:

- (i) Excavation, laying, jointing, and backfilling of trenches for 4 km of precast concrete sewer pipes of diameter 300 mm to 375 mm;
 - (ii) Excavation laying, jointing, and back filing of trenches for 26 km of PVC Class 41 sewer pipes of diameter 160 mm to 225 mm; and
 - (iii) Construction of 164 manholes and 3,760 inspection chambers.
- 2) Socio-economic surveys, settlement upgrading plans, and bidding documents for infrastructure improvement of informal settlements in Nairobi, Naivasha, and Machakos

Contract No. MH/KISIP/CS/004/2011-2012

Signing Date: 22 August 2012

Period of Consulting Service: August 2012 - October 2013

Key objective: to prepare settlement upgrading plans for selected informal settlements

Major tasks:

- (i) Carrying out a socio-economic survey;
- (ii) Preparing a preliminary settlement upgrading plan, including preliminary designs and feasibility studies for the proposed infrastructure investments; and
- (iii) Preparing a final upgrading plan as well as detailed engineering designs and bid documents for the agreed infrastructure investments.

(4) Nairobi Metropolitan Services Improvement Project (NaMSIP)

The MONMD is the agency responsible for implementing the NaMSIP with financial assistance from the WB. The project development objective is to strengthen urban services and infrastructure in the Nairobi Metropolitan Region.

The project comprises the following four components:

- (i) Component 1: Institutional reform and planning
- (ii) Component 2: Local government infrastructure and services
- (iii) Component 3: Metropolitan infrastructure and services
- (iv) Component 4: Project management, and monitoring and evaluation.

Under Component 3, the project will invest in the development of local infrastructure (roads, markets, street lighting, bicycle and pedestrian pathways, drainage, etc.) as well as solid waste management and sewerage collection/disposal.

The procurement plan of NaMSIP from December 2012 to December 2013 (World Bank, December 2012) describes a series of procurements for the implementation of the NaMSIP. Of these, the following procurements are found to be directly relevant to the infrastructure development for stormwater drainage and sewerage in and around Nairobi City.

1) Construction of Nairobi stormwater drainage works

Procurement Method: International Competitive Bidding (ICB)

Bid Submission and Opening: 1 August 2013 (Planned)

- 2) Preparation of feasibility studies, final designs and bidding documents for stormwater drainage in Nairobi City (Dagoretti, Langata, CBD, and Embakasi), Thika (CBD and west of CBD), Mavoko and Ongata Rongai townships

Contract No.

Procurement Method: Quality- and Cost-Based Selection (QCBS)

RFP Submission and Opening: 23 November 2012 (Actual)

- (5) Nairobi Rivers Basin Rehabilitation and Restoration Program: Sewerage Improvement Project (NaRSIP)

The Nairobi Rivers Basin Rehabilitation and Restoration Program provides the comprehensive framework for the water environment management in Nairobi City. The comprehensive framework was elaborated by the former Nairobi River Basin Program (NRBP, 1999-2008).

The Sewerage Improvement Project is part of the Nairobi Rivers Basin Rehabilitation and Restoration Program. The project has been elaborated in the Nairobi Sewerage Master Plan study (1998), and further detailed in the feasibility study completed in June 2010. The AWSB is the agency responsible for implementing the project with financial assistance by the AfDB.

The project has three main components, as follows:

- (i) Wastewater Infrastructure
- (ii) Sanitation, Hygiene, and Social-environmental Support
- (iii) Institutional Development Support

Of the above, (i) Wastewater Infrastructure consists of the following works as described in the project appraisal report (AfDB, July 2010):

- (i) Rehabilitation of the Kariobangi conventional sewerage treatment plant currently operating at about 30% of its design capacity to the full capacity of 32,000 m³/day;
- (ii) Construction of two additional series of waste stabilisation ponds at Dandora to increase the capacity by 40,000 m³/day from 120,000 to 160,000 m³/day;
- (iii) Rehabilitation and laying of new trunk lines at an overall length of 54 km in addition to 40 km of reticulation lines;
- (iv) Duplication of inlet works at Dandora for the increased wastewater flow; and
- (v) Construction of 100 ablution blocks in various informal settlements where the trunk sewer lines are proposed to go through.

The procurement notices issued by AWSB in relation to the above are listed in the website of the AfDB as shown in Table 4.1.7 below.

Table 4.1.7 Major Ongoing Infrastructure Developments in Nairobi City under the Sewerage Improvement Project

Contract	Description	Procurement Information
Works	Lot 1: Construction of the Kiu River and Dandora Estate Trunk Sewers and Expansion of Dandora Waste Water Treatment Plant.	Contract No. AWSB/NaRSIP/W/01/2012 Bid Submission and Opening 24 May 2012
Works	Lot 2: Construction of Mathare, Nairobi, Ngong Rivers Trunk Sewers and Reticulation Network	Contract No. AWSB/NaRSIP/W/01/2012 Bid Submission and Opening 11 June 2012
Works	Construction of Dandora, Kangundo Road, Kibera, Upper Hill and, Kirichwa Dogo Trunk Sewers	Contract No. AWSB/NaRSIP/W03/2013 Bid Submission and Opening 2 August 2013
Consultancy Services	Design and supervision of works.	Expressions of Interest (EOI) Submission: 3 January 2011
Consultancy Services	Community mobilisation and sensitisation, design and supervision and works coordination for implementation of the ablution blocks	Expressions of Interest (EOI) Submission: 25 May 2012

Source: Relevant documents listed in the website of the AfDB as of September 2013

4.1.7 Power Supply

The power sector in Kenya has many kinds of projects such as distribution, transmission and generation projects, and rural electrification projects. Amongst the projects, the section reviews projects with a focus on Nairobi City. Table 4.1.8 shows the ongoing projects related to the project.

Table 4.1.8 Power Sector Projects

No.	Project	Loan Amount (million)	Status	Implementing Agency	Donor
1	Electricity Expansion Project	US\$330.00	Ongoing (2010-2015)	MOE, Kenya Power, REA KenGen,	WB, IDA
2	Energy Sector Recovery Project Additional Financing	US\$80.00	Ongoing (2009-2013)	MOE, Kenya Power, REA KenGen,	WB, IDA
3	Nairobi Ring	€78.50	Ongoing (2012-)	MOE, KETRACO, Kenya Power	AFD
4	Ethiopia-Kenya Electricity Highway Project	UA760.00	Ongoing (2012-2017)	EEPCO, KETRACO	WB, AfDB, AFD

MOE : Ministry of Energy
KPLC : Kenya Power and Lighting Company Limited,
WB : World Bank
REA : Rural Electrification Authority
KenGen : Kenya Electricity Generating Company Limited
AFD : French Development Agency
AfDB : African Development Fund
IDA : International Development Association
EEPCO : Ethiopia Electric Power Corporation

Source: JICA Study Team

(1) Electricity Expansion Project

The objectives of the WB-assisted Electricity Expansion Project are to increase electricity access in urban, peri-urban, and rural areas as well as to improve the efficiency, reliability, and quality of services to consumers. The project has five components, of which the components of distribution upgrading and infilling project are related to this survey. This component includes upgrading of distribution substations as well as reinforcement and extension of networks in an area including the Nairobi region.

(2) Energy Sector Recovery Project Additional Financing

The World Bank-assisted Energy Sector Recovery Project additional financing enables the original project to meet unanticipated cost overruns and financial shortfalls. The original project had four components, namely: (i) institutional and capacity building component, (ii) studies and engineering

services component, (iii) generation component, and (iv) distribution component. The additional financing project is for (iii) and (iv). The original distribution component (iv) was to provide the upgrading of existing substations, constructing new substations, reinforcing and extending the distribution system, supplying energy meters and upgrading SADA/EMS systems. The additional financing for the distribution component includes expanding the distribution network to un-electrified areas in Nairobi City, Western, Central, and Coast provinces. This activity will cater to 40,000 applicants for connection.

(3) Nairobi Ring Project

The objective of AFD-assisted Nairobi Ring Project is to support the country's economic growth by providing reliable, economical, and low-carbon energy. The objective is divided into the following three sub-objectives:

- (i) Improve the security of supply of Nairobi City as well as encourage social and economic development of the city and of the country.
- (ii) Allow the transmission of energy generated by Olkaria geothermal plants, wind power plant of Lake Turkana, and thermal power plant near Mombasa to Nairobi City.
- (iii) Allow interconnection with Ethiopia and Tanzania under the East African Power Pool.

In order to realise the objective, the project sets the following components:

- (i) Construction of 400 kV transmission lines, approximately 100 km, from Suswa to Isinya;
- (ii) Construction of 220 kV substations in Suswa, Isinya, Thika Road, Koma Rock, the Athi River, and Ngong, as well as switching and monitoring devices at the existing substation and Dandora;
- (iii) A spur line to Ngong Substation and an underground cable between Dandora and Komarock Substation.

(4) Ethiopia-Kenya Electricity Highway Project

The project co-financed by the WB, AfDB, and AFD involves the construction of an electricity highway between Ethiopia and Kenya consisting of about 1,068 km of 500 kV transmission lines and associated substations. The demand for electricity in the East African region has steadily increased. The region has a great variety of natural resources, in particular hydropower, mainly concentrated in Ethiopia. The project seeks to position Ethiopia as the main powerhouse and Kenya as the main hub for power trade in the East African Region. The power sector in Kenya has a plan to import electricity from Ethiopia to Nairobi Region, so the project is important for Nairobi City to avoid electricity shortage.

4.1.8 Solid Waste Management (SWM)

There are some development partners implementing studies, programmes, and projects. The main development partners are UNEP, UN-HABITAT, and WB.

(1) UNEP

UNEP has supported small-scale and medium-sized projects related to solid waste management. These projects are related to waste, sanitation, and poverty reduction sectors. One of the main projects is “Integrated Solid Waste Management Plan for Nairobi City”. The project commenced in March 2009. A national task team was formed and local university teams took hundreds of samples of wastes in 2009 to determine the origins and compositions as well as to estimate the amounts. In the plan, some action plans were proposed.

Several training sessions were run. Stakeholders were consulted on matters of concern in early December 2009, and a strategic approach to the integrated waste management plan was presented by the national task team. In the plan, some action plans such as 1) strategic alignment, 2) recognition of partners, 3) continuous monitoring and research of waste character, quantities, and related solid waste information to aid in future planning, 4) end-of-life levies on problematic wastes, 5) source separation of recyclable and pure organic wastes with incentives, 6) streamlined (weight-based) collection fees, 7) awareness campaigns and education, 8) zoning of waste collection, 9) formalised waste collection contracts, 10) development of material recovery and transfer facilities, 11) derivation of value from the organic waste fraction, 12) strengthening of specific recycling strategies, 13) development of a new engineered landfill site, and 14) rehabilitation of Dandora landfill site.

(2) UN-HABITAT

The Kibera Integrated Water, Sanitation and Waste Management Project (WATSAN) assists in low-cost community-based demonstrations in the Soweto Village of Kibera slums. The project aims at contributing towards improving the livelihoods of the urban poor in Soweto East, by supporting small-scale community-based initiatives in water, sanitation, and waste management. The activities related to solid waste is to implement small-scale door-to-door waste collection and recycling demonstrations. The Kenya Slum Upgrading Program (KENSUP) is also related to solid waste management and the main objective is to improve the livelihood of people living and working in slums and informal settlements in Kenya’s urban areas. The programme started with selected slums within the statutory, regulatory, and legal boundaries of the County Council of Nairobi (CCN), the Kisumu Municipal Council, and the Mavoko Municipal Council.

(3) World Bank

The WB implements the KMP from 2010 to 2015, which includes solid waste management (SWM) through the cooperation of the Ministry of Metro Development. However, the area of the SWM sector of this programme is outside of Nairobi City. The WB currently considers the possibility of assistance for SWM in Nairobi Metropolitan Area.

4.1.9 Telecommunications

The telecommunications projects are as listed below. Projects for the overhaul of the telecommunications infrastructure of Kenya were sponsored by the WB and were implemented in 1979, 1982, and 1985, consecutively.

(1) World Bank Project in 1979

The project in 1979 overhauled the telecommunications services by expanding local services and by providing high quality long-distance circuits, as well as basic telecommunications facilities to rural areas which were poorly served at the time. Major components included the installation of (a) a total of 46,200 additional lines of local automatic exchange equipment with associated cables and subscribers' plant, and a total of 46,000 additional connections; (b) long distance public call centres to

provide services in 200 urban, rural, and market areas without telephone services; (c) eight microwave radio systems, each with a capacity of 960 channels, three UHF radio systems with a total of 540 channels, 190 UHF/VHF channels and multiplex equipment to provide 3,100 additional channels; (d) long distance automatic exchanges with a total of 3,600 terminations and extensions to existing exchanges by 1,800 terminations; and (e) buildings to house equipment.

(2) World Bank Project in 1982

The second WB telecommunications project in 1982 comprised the installation of (a) a total of 80,900 additional lines of local automatic exchange equipment with associated cables and a subscribers' plant to connect 75,000 additional main lines; (b) a total of 7,100 terminations in long distance exchanges; (c) three microwave and radio systems and 1,270 additional channels; (d) rural carrier systems to provide 200 additional channels; (e) two telex systems with a total of 3,000 additional lines and connection of 500 additional subscribers; and (f) buildings to house the equipment. The project also included consulting services and training in association with the above installations.

(3) World Bank Project in 1985

The third telecommunications project in 1985 comprised of (a) expansion of telephone and telex switching facilities, associated cable networks and subscriber plants, and expansion of international and long distance facilities; (b) overhaul of workshops and repair facilities and provision of spare parts; (c) support for the Kenya Post and Telecommunication Company's (KPTC) training programmes and procurement of laboratory equipment; and (d) overhaul of KPTC's management system and consulting services for studies, including a review of the telecommunications tariff structure.

(4) USAID Project in 2011

In 2012, the United States Agency for International Development (USAID) provided technical assistance that covered the development of a national broadband strategy to underpin the deployment of modern broadband infrastructure to meet the needs of businesses, the government, and the entire economy.

4.2 Review of Current Infrastructure Conditions

4.2.1 Urban Transport

(1) Road Network

1) Road Classification and Jurisdiction

Roads in Kenya are classified under the Kenya Road Classification Manual (July 2009, Ministry of Roads). The manual classifies rural roads into eight categories (S-G) and urban roads into seven categories (H-P). The summary of categories is shown in Table 4.2.1.

Table 4.2.1 Summary of Road Classification in Kenya Road Classification Manual

Category	Functional Class	Road Class	Functional Class	Alternative Descriptive Term	Description	Indicative Design Standards	
						Carriageway Width in Meters	Design Speed (kph)
Rural Road	Arterial or Trunk	S	Super Highway	Auto route, Motorway, Expressway	Highways connecting two or more cities and designed to carry safely large volumes of motor vehicle traffic at high speeds	Dual carriageway of min 2 lanes	90-120
		A	Major Arterial	Trunk Road	Roads forming strategic routes and corridors, connecting international boundaries, and international terminals	7-14	70-110
		B	Minor Arterial	Trunk Road	Roads forming important national routes, linking province headquarters or other important centres to the capital, to each other or to class A roads	7 (-14)	70-110
	Collector	C	Major Collector	District	Roads linking district headquarters and other major designated towns to the higher level network or to each other	6.5	60-110
Urban Road	Arterial	H	Major Arterial	Highway	Major arterials provide for through traffic and for relatively long distance movements between widely separated parts of the town or city	3.5 m per lane, 4-6 lanes	70-90
		J	Minor Arterial	Principal Arterial	Minor arterials provide the main means of moving between different zones of the urban area	3.5 m per lane, 2-4 lanes	50-60
	Collector	K	Major Collector	Primary Distributor	Major collectors provide the link between arterials and local roads, distributing traffic to residential and other defined zones	7	30-50
		L	Minor Collector	District Distributor	These perform a similar function to major collectors, but generally serve a smaller area, with lower traffic levels	7	30-50
	Local	M	Major Local	Shopping / Local Street	These roads include the main shopping and business streets in the urban CBD or suburbs of larger towns and cities	5-7	30-50
		N	Minor Local	Non-residential Access	Roads providing direct access to individual or groups of properties, other than residential areas	5	30-50
		P	Local Access	Residential Access	Roads providing direct access to groups of residential properties	3-5	30-50

Source: "Kenya Road Classification Manual" July 2009, Ministry of Roads

Amongst the classified rural roads, class S, A, B, and C are national roads under the jurisdiction of KeNHA. Other rural roads are mainly under the jurisdiction of Kenya Rural Roads Authority (KeRRA). Urban roads are under jurisdiction of KURA and are currently in the process of devolution to the municipality.

Nairobi is the capital city of Kenya and the economic, social, and cultural centre of Kenya. There are two international roads (class A) forming the major arterial road in Nairobi City. One is the Northern Corridor (A109/104) that includes Mombasa Road, Uhuru Highway, Chiromo Road, Waiyaki Way, and Naivasha Road as the trunk road. A104 then extends from Nairobi City centre to the south through Kajiado and Namanga towards the Tanzanian border. Further, A109 extends to the east and connects to Mombasa, the second largest city in Kenya, and to the west border of Uganda, and forms the logistic axis for the inland countries.

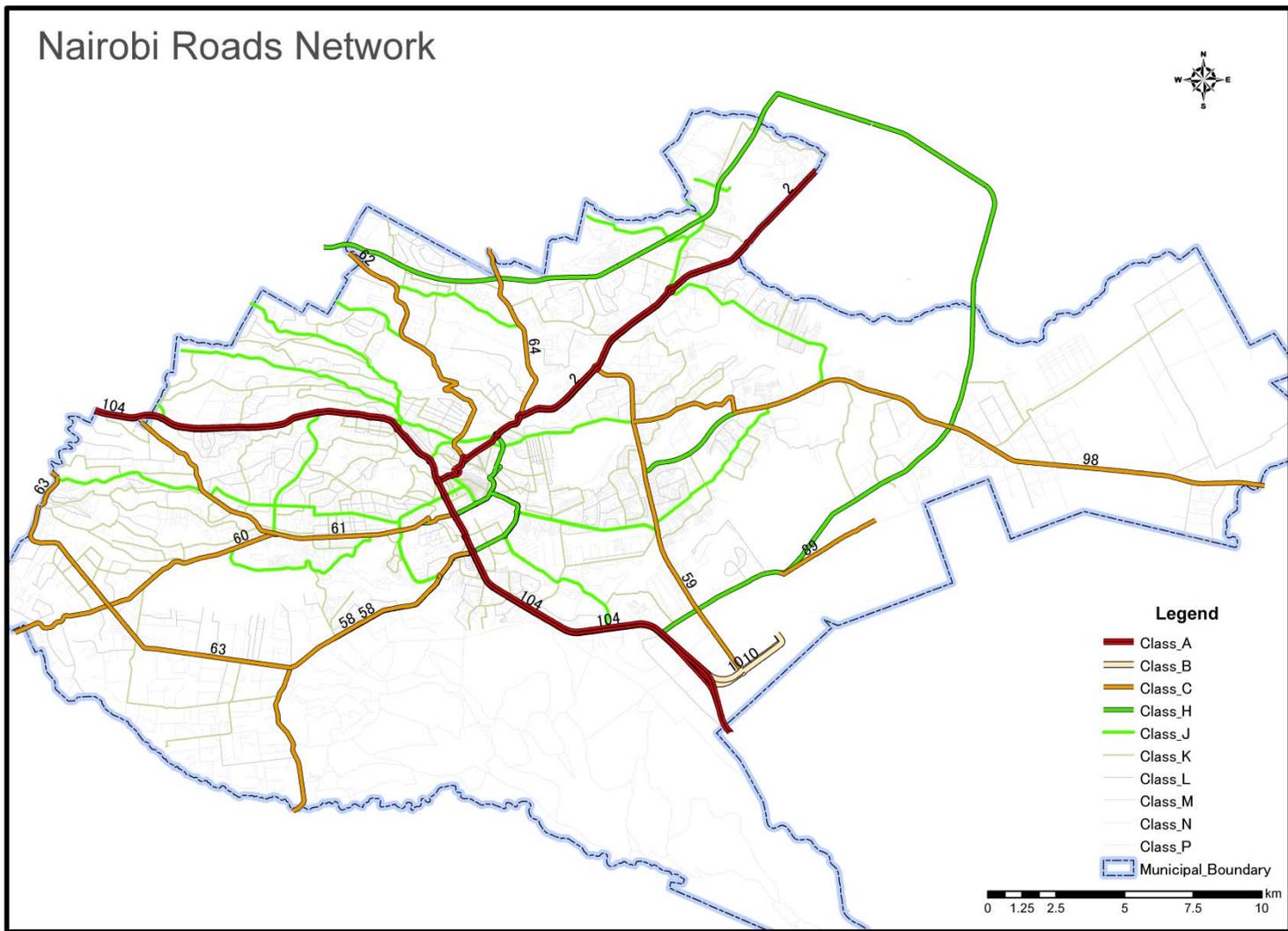
The second international trunk road is Thika Road (A2) that was constructed and improved currently with the assistance of AfDB and China. The road connects in the northeast direction from Nairobi City centre to Thika and to A2, which connects further to Ethiopia.

Figure 4.2.1 shows the road network and road classification in Nairobi City. The functions of major roads of class B, C, and H are described in Table 4.2.2. Recently constructed bypasses such as H6 and H7 are also included in the table.

Table 4.2.2 Classified Roads in Nairobi City and Their Functions

Road Number	Name	Function	Coverage Area
B10	Airport North Road	Principal Arterial	Airport North
C58	Magadi Road	Minor Arterial	Langata, Kajiado
C59	Outer Ring Road	Principal Arterial	Embakasi, Makadara, Kamukunji, and Kasarani
C60	Ngong Road	Principal Arterial	Dagoretti, Langata to Kajiado
C61	Naivasha Road	Minor Arterial	Dagoretti to Langata (partly missing)
C62	Limuru Road	Principal Arterial	Westlands
C63	Langata Road, Dagoretti Road, Kiambu Road and Ruiru Road	Principal Arterial	Langata, Kajiado, Kiambu
C64	Kiambu Road	Minor Arterial	Kasarani, Westlands
C98	Komarock Road	Principal Arterial	Embakasi, Kijiru, Kathiani
H6	Eastern Bypass	Principal Arterial	Embakasi, Njiru
H7	Northern Bypass	Principal Arterial	Kiambu, Kasarani, Westlands

Source: JICA Study Team, Road functions are based on The Study on Master Plan for Urban Transport in the Nairobi Metropolitan Area, JICA 2006



Source: JICA Study Team

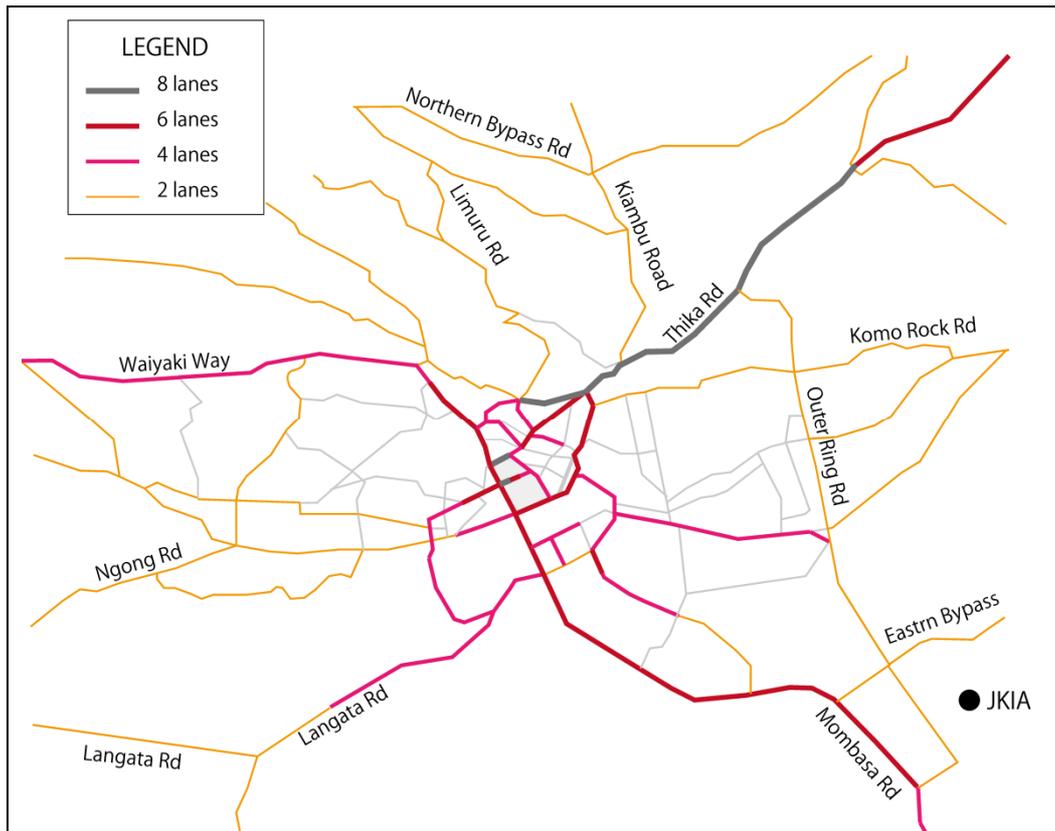
Figure 4.2.1 Road Network in Nairobi City

The structure of the road network in Nairobi City is described as follows:

- (i) The international roads go through Nairobi City and function as the most crucial radial road in the study area.
- (ii) The importance of the Northern Corridor as the city's trunk road as well as an international trunk road is emphasised, and traffic flow of the Northern Corridor is apparently given more priority than other crossing roads. Therefore, the Northern Corridor becomes a kind of barrier for the local traffic flow in the west-east direction.
- (iii) As the densely populated area of Nairobi City mainly stretches to the west and east, the traffic demand of west-east is larger than north-south. Therefore, roads in the west-east direction across the Northern Corridor are always congested.
- (iv) The present land use structure of Nairobi City is centralised around the CBD. Hence, radial roads are predominant in the network system. This network system attracts most of the traffic into the city centre including vehicles that do not have intention of going to the city centre.
- (v) In the suburban area, where housing developments are in progress, not only the access roads and collector roads, but also arterial roads that collect the generating traffic are insufficient.
- (vi) The urban transport master plan by JICA emphasised the forming of radial and circumferential road system, and a staging plan is proposed based on this policy. Although, currently, this road development has not been implemented based on the proposed staging plan.

2) Number of Lanes

The number of lanes of the existing road class A to J and those that have more than four lanes are shown in Figure 4.2.2. The roads with more than four lanes are major trunk roads in the city centre area. Most of the roads in the south-north direction have two lanes. Consequently, traffic demand is concentrated to A104. According to the traffic analysis, traffic in the east-west direction will increase in the future. Roads in the east-west direction also require to be strengthened.



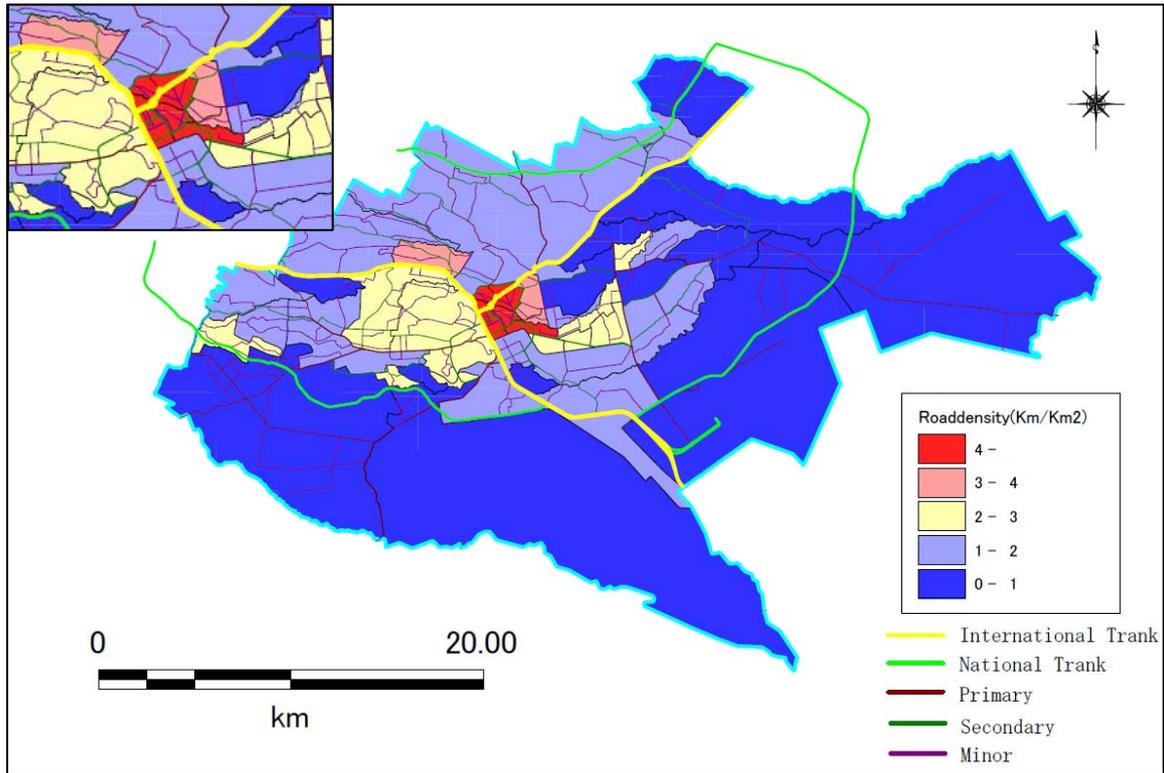
Source: JICA Study Team (JST)

Figure 4.2.2 Number of Lanes of Existing Roads

3) Road Density

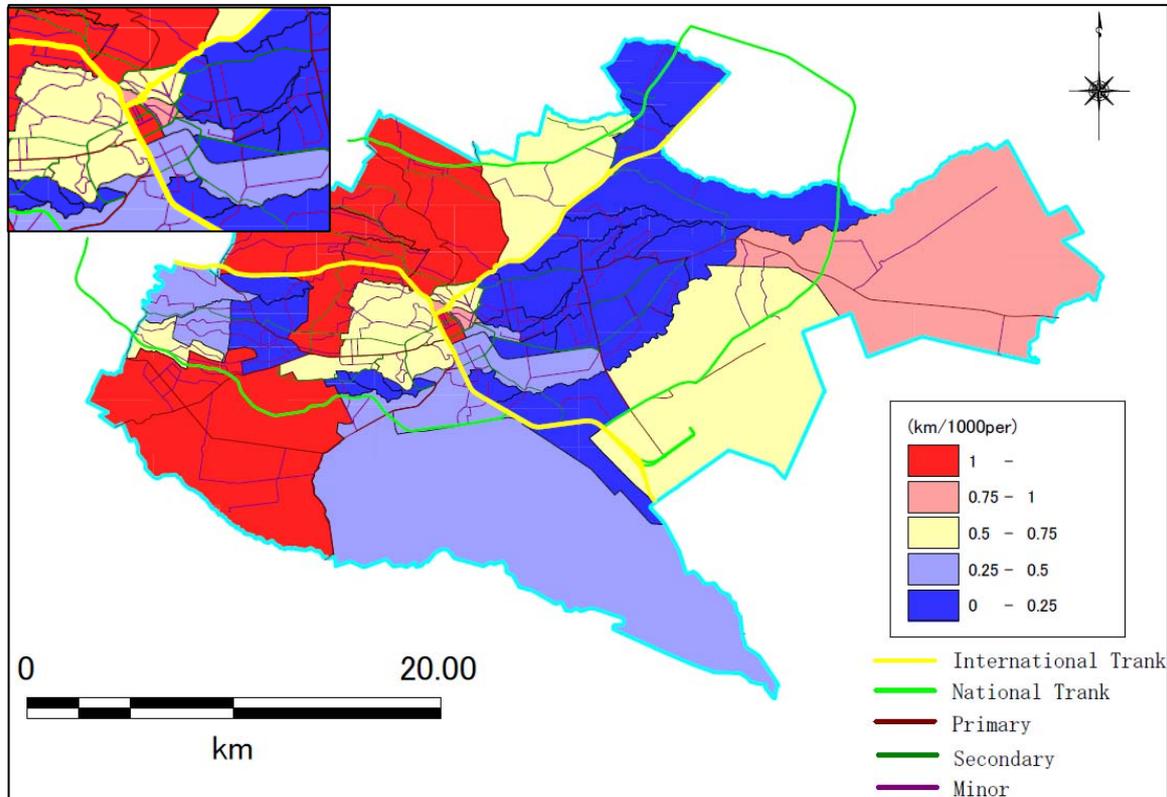
The road length density of the road network is shown in Figure 4.2.3. The road length density is 0.98 km/km² in entire Nairobi City, which includes some low population density areas. The Japanese standard density of the trunk road in the urban area is 4.0 km/km², and only the centre of Nairobi City is in this range. Next, the road length density by population is shown in Figure 4.2.4. The road length density by population of entire Nairobi City is 0.22 km/1000 people. The western part of Nairobi City has a high road length density by population. However, the east side of Thika Road has low road length density; it indicates that there are not enough roads where rapid increase in population is taking place. (Refer to Figure 2.1.3, Average Annual Population Growth Rate of Nairobi City and its Environs)

In general, the development/improvement of roads in Nairobi City is concentrated in the trunk roads, and the development/improvement of small roads in residential areas is left behind.



Source: JICA Study Team (JST)

Figure 4.2.3 Road Length Density by Area of the Target Road Network



Source: JICA Study Team (JST)

Figure 4.2.4 Road Length Density by Population of the Target Road Network

(2) Non-Motorised Transport

Since Kenyan people walk a lot along the arterial roads and in the urban streets, walking occupies a large proportion of the travel modes. Therefore, NMT facilities for safe, comfortable, and easy movement are necessary especially in traffic congested areas. In this viewpoint, the following are pointed out:

- (i) Sideways are narrow.
- (ii) Markings for pedestrian crossings are not sufficient.
- (iii) Pedestrian crossing signals are insufficient, sometimes not working, and are neglected by drivers and passengers.
- (iv) Along some roads, sideways are provided, but there is still no formulated pedestrian network.
- (v) No dedicated lane for bicycles is available in the urban area.

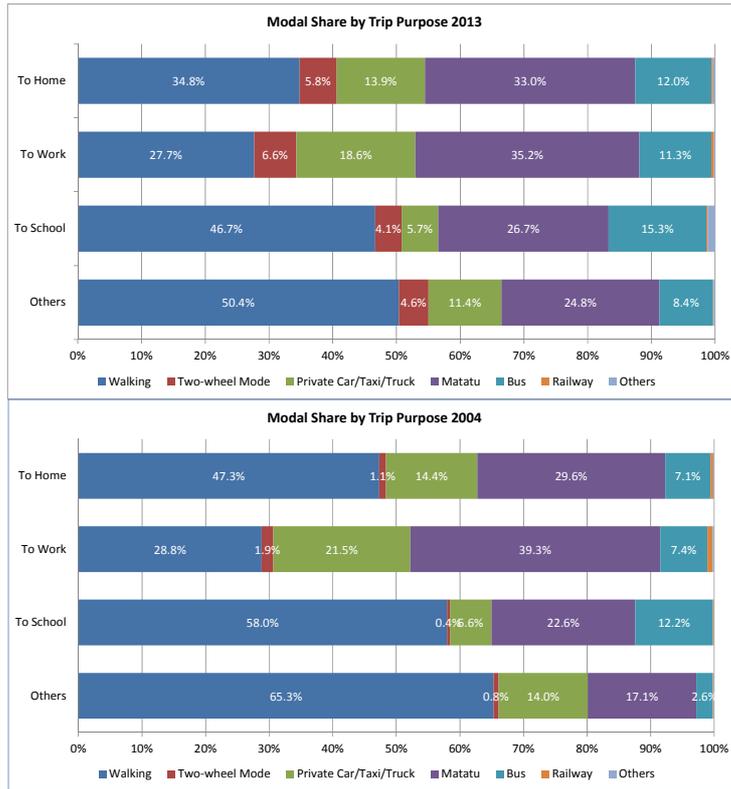
(3) Public Transport

Most bus and *matatu* terminals are located around the Nairobi Railway Station, but are not systematically located according to direction or destination. Outside the city centre, lay-bys for bus stops are prepared on the trunk roads, but along minor roads, *matatus* and buses often stop at roadsides or intersections for picking up passengers, which cause obstacles in the traffic flow of the roads.

According to interviews with public transport passengers, three major requirements of bus/*matatu* passengers were: 1) improvement of bus stop facility/information, 2) improvement of accessibility, and 3) improvement of regularity/punctuality.

As a result of the screen line survey, there were a total of 72,000 *matatus* and 23,000 large buses. Applying the average number of passengers, which is ten per *matatu* and 27 per large bus, the total passengers crossing the screen line are 720,000 by *matatu* and 620,000 by bus.

Figure 4.2.5 also shows that modal shift to public transport was not progressing much. Considering the traffic condition in Nairobi City, the use of public transport should be encouraged more. To this end, conditions and quality of public transport operations shall be improved for higher operation speed, punctuality, better accessibility to terminals, and convenience for passengers.



Source: JICA Study Team (JST)

Figure 4.2.5 Comparison of Travel Mode by Trip Purpose between 2004 Survey and 2013 Survey

4.2.2 Railway

The main line of the KRC is the line from Mombasa to Uganda through Nairobi City. Many railway commuters are using this line from the Athi River (south-east direction) to Nairobi City, and from Kikuyu, (north-west direction) to Nairobi City. Many passengers are also commuting from Ruiru, (north-east direction) to Nairobi City, on a branch line towards Thika Town. A short branch line towards Embakasi Village is also used for commuting purposes.

The existing meter gauge track is composed of 85/90 lb/yard rail with steel sleepers. Rails are welded at some sections; however, mainly fishplate joints are used. The ballast is heavily contaminated with soil. Turnouts are operated manually without any type of signal equipment. Train operation is controlled by telephone between stations. Instead of a tablet, paper sheets are used to confirm the track occupancy.

Except for a few stations, the existing station buildings are small and not well maintained. In general, the access roads to the stations are in poor condition as shown in the photos below.



Figure 4.2.6 Existing Track Condition (left), Existing Ruiru Station (right)

KRC is now planning to strengthen commuter train services by providing new lines as indicated in red on the following Figure 4.2.7. The planned new line from Nairobi to Kikuyu shown on the map is overlapping with the planned LRT line, proposed in the MRTS report in 2011.



Kenya Railways Corporation (KRC)

Figure 4.2.7 KRC Existing and Planned Lines

Due to the increasing severe traffic congestion in the city, the need for mass transit system is widely recognised. There are two approaches for the development of rail-based mass transit system in Nairobi City; namely, 1) the utilisation of the existing KRC facilities, and 2) the construction of new LRT/mass rapid transit (MRT) lines.

(1) Utilisation of Kenya Railways Corporation Facilities

Although the Nairobi Commuter Railway Project, as described in Clause 5.3.2, is ongoing, there is no other specific operation that has been achieved other than the Nairobi-Syokimau commuter service.

The existing commuter train services on the following lines are operated by Rift Valley Railways (RVR), the concessionaire of train operations since 2006.

RVR is now operating commuter train services on the following sections:

(i) Nairobi Railway Station (NRS) – Ruiru Section (32 km)

Operating 22 coach trains, 2 trains/day, total of 6,900 passengers/day in 2010, 7,450 passengers/day in 2011, and 5,350 passengers/day in 2012.

(ii) NRS – Kahawa Section

Operating 16 coach trains, 2 trains/day, total of 6,900 passengers/day in 2010. From 2011, 8 trains/day, 7,500 passengers/day in 2011, and 3,950 passengers/day in 2012.

(iii) NRS – Embakasi Section

Operating 10 coach trains, 2 trains/day, total of 2,300 passengers/day in 2010. From 2011, 8 trains/day, 4,960 passengers/day in 2011, and 3,030 passengers/day in 2012.

(iv) Nairobi - Kikuyu Section

Operating 10 coach trains, 2 trains per day, total of 4,200 passengers/day in 2010, 1,100 passengers/day in 2011, and 1,910 passengers/day in 2012.

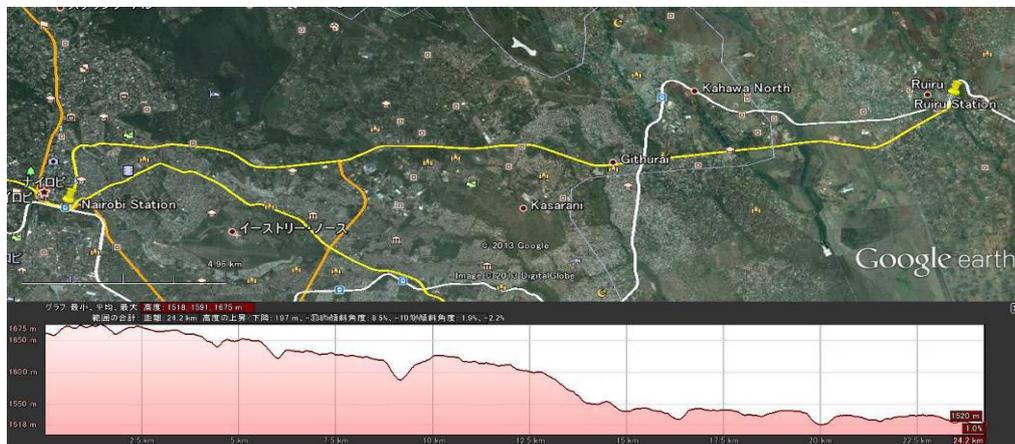
Operating 7 coach trains, 5 R.T. per day, total of 2,500 passengers.

(2) Planned Alignments of MRT/LRT

The Feasibility Study and Technical Assistance for Mass Rapid Transit System for the Nairobi Metropolitan Region has been prepared by Indian and Kenyan consultants in 2011. The MRT and LRT lines are planned on the following six major roads:

1) Thika Road (Elevated (EL): NRS – Githurai): 15.04 km

Thika Road has enough overall width for the construction of elevated structures for an MRT line. However, if the MRT structure is constructed at the centre of the road, the width of the existing median strip (central reservation) is not enough for the construction of viaduct piers because at least 2.5 m width is required for the construction of piers and its protective structure for collision of vehicles.



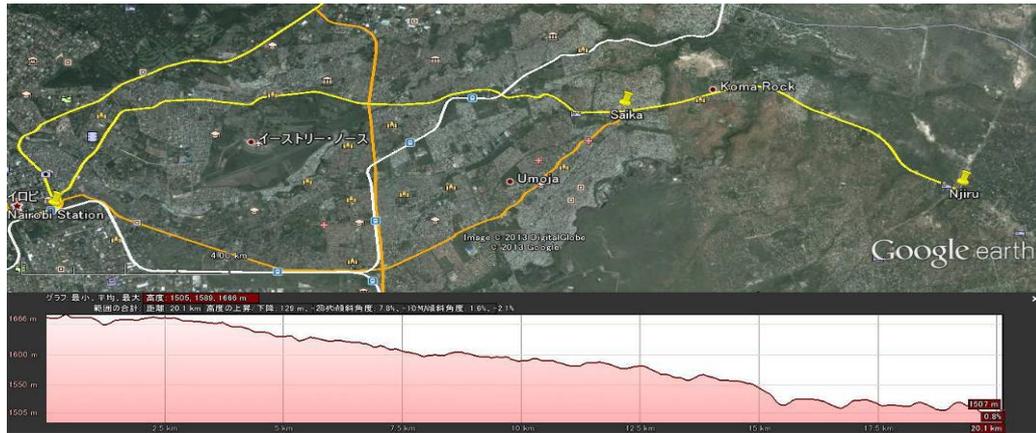
Source: JICA Study Team (JST)

Figure 4.2.8 Horizontal and Vertical Alignment of MRT on Thika Road

Although the first priority of MRT construction is given to this alignment, the construction schedule shall be planned carefully considering the capacity of the existing Thika Road and future demand forecast.

2) Juja Road (Underground (UG): NRS – Pangani + EL: Pangani – Njiru): 4.37 km + 9.45 km = 13.82 km

There seems to be no difficulty in the construction. The location of the transition section from the underground structure to the elevated structure shall be carefully selected in order not to block the vehicles on the surface road. Prior to the construction of the MRT, the road shall be widened with a wide median strip for the piers construction.



Source: JICA Study Team (JST)

Figure 4.2.9 Horizontal and Vertical Alignments of MRT on Juja Road

3) Jogoo Road (EL: NRS – Kayole Crossing): 12.79 km

Jogoo Road has a wide median strip enough for the construction of LRT piers up to the crossing with the Outer Ring Road. Enough space for the right of way (ROW) of the proposed LRT construction has also been reserved .

However, from the Outer Ring Road crossing up to Kayole Crossing, there is no median strip at all. Reservation of ROW is not enough at some locations.



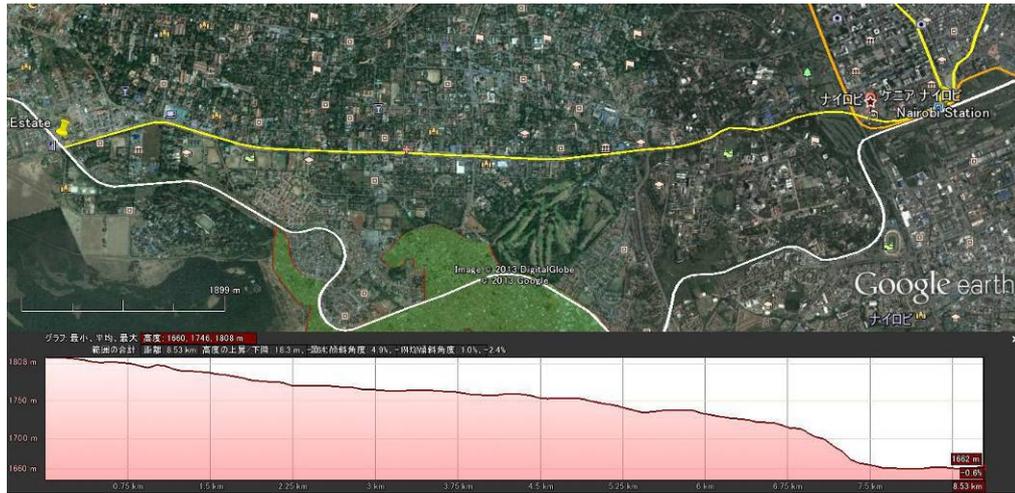
Source: JICA Study Team (JST)

Figure 4.2.10 Horizontal and Vertical Alignments of LRT on Jogoo Road

4) Ngong Road (UG: NRS – Hilton Hotel + El: Hilton Hotel – Dagoretti/Thompson Estate): 0.66 km + 7.87 km = 8.53 km

The description of Hilton Hotel seems wrong. The alignment will go through the Railway Club which is located at the west side of NRS. As shown in Figure 4.2.11, there is a steep slope between the Railway Golf Course and the Upper Hill area. The slope of the existing ground is 5.5% approximately. Since the maximum applicable gradient of the MRT system using steel wheel on steel rail is 3.5%, it is impossible to climb this steep slope via the planned alignment.

Except for the section between NRS and Upper Hill, there is a wide median strip where the piers of the viaduct structure can be constructed. The condition of the existing road is very good.



Source: JICA Study Team (JST)

Figure 4.2.11 Horizontal and Vertical Alignments of MRT on Ngong Road

5) Outer Ring Road (EL: Thika Road Crossing - Airport Road): 12.93 km

As shown in Figure 4.2.12 below, there are three river crossings along this alignment. In order to avoid flooding during the rainy season, the rail level shall be set higher than the highest level of the record flood.

The condition of the existing road is generally fair except in some locations where the pavement is severely damaged. ROW for future widening seems to be reserved already, however, the existing pavement width is very narrow. Therefore, prior to the construction of the LRT, the road shall be widened with a median strip for future pier construction.



Source: JICA Study Team (JST)

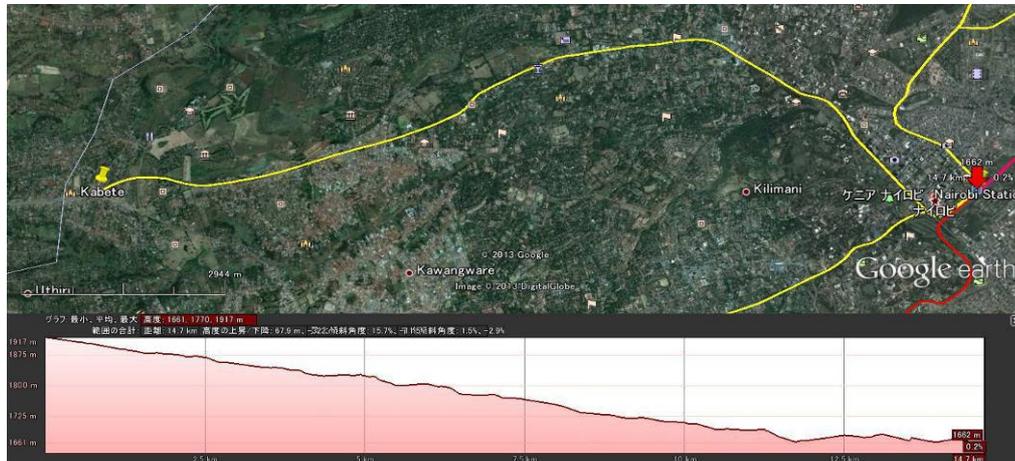
Figure 4.2.12 Horizontal and Vertical Alignments of LRT on the Outer Ring Road

6) Thika Road-2 (EL: Githurai – Ruiru): 9.71 km

The condition of this section is similar to that of the section between NRS–Githurai. However, widening of the median strip may not be required because of the wider existing median compared with the NRS – Githurai Section (refer to the Figure 4.2.8.).

7) Waiyaki Way (EL: NRS – Kabete): 12.4 km

Waiyaki Way consists of a four-lane road with a wide median strip. The condition of the pavement is very good. Therefore, there will be no difficulty in the construction of LRT along this road, except for the section between NRS – Waiyaki Way.



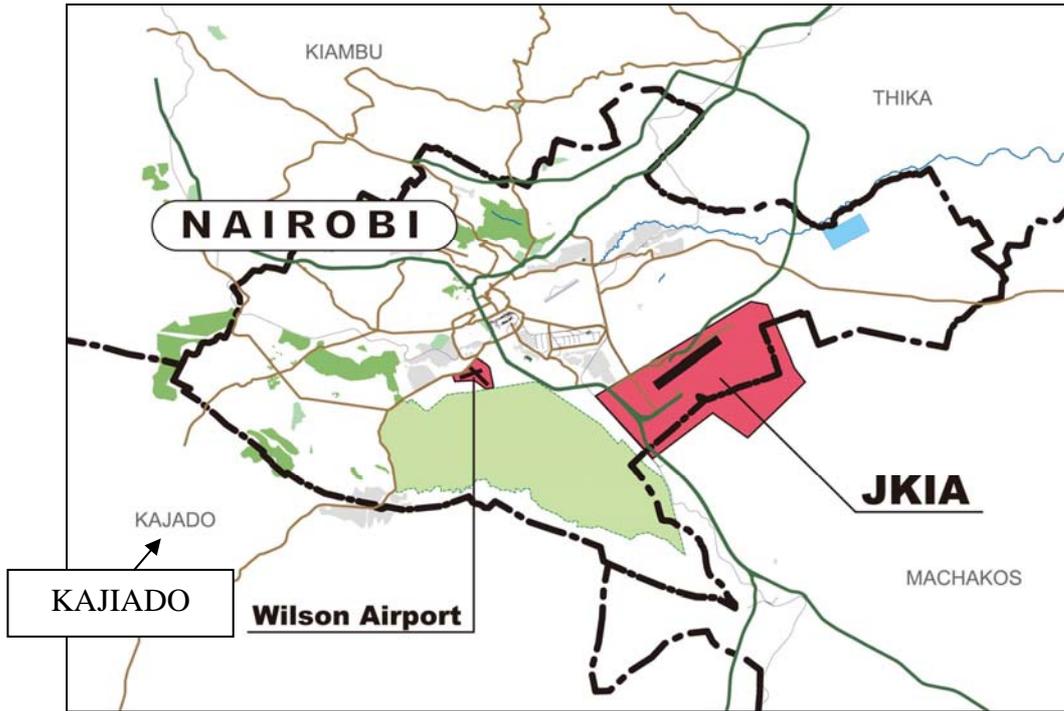
Source: JICA Study Team (JST)

Figure 4.2.13 Horizontal and Vertical Alignments of LRT on the Waiyaki Way

4.2.3 Airport

The airport sector has the shared responsibility of air transport mode. Air transport plays a significant role in the economic growth of developing country. In Kenya, it is the main transport mode for tourism, high value exports and imports, and perishable goods. Also, Kenya occupies a strategic position as an aviation centre in the Eastern and Central Africa regions. In the last ten years, air traffic through Kenya's airports has increased substantially from 4,748,000 to 8,584,000 annual passengers.

Nairobi City has two civil airports which are JKIA and Wilson Airport. JKIA is conveniently located 18 km from the city centre to serve as a domestic hub and international gateway in Kenya. JKIA is the 7th busiest airport in Africa and a major hub in East and Central Africa for tourist and cargo movement. Wilson Airport is located 5 km south of the city and neighbours Nairobi National Park. Wilson Airport is used mostly for both domestic and international general aviation traffic. This airport lies approximately 18 km west of JKIA. The location of the two airports is shown in Figure 4.2.14 below.



Source: JICA Study Team (JST)

Figure 4.2.14 Locations of JKIA and Wilson Airport

(1) Jomo Kenyatta International Airport (JKIA)

JKIA serves as the gateway for international air traffic and a hub for domestic airports in Nairobi City in Kenya. JKIA is situated at an altitude of 1,624.5 m MSL with one runway, two passenger terminal buildings, which are separated for departure and arrival, cargo terminal, and related airport facilities. Table 4.2.3 describes the major facilities at the airport; whereas Figure 4.2.15 shows the image of JKIA passenger terminal area.

Table 4.2.3 Major Facilities of JKIA

Item	Name		Description		
Principal Feature	Name		Jomo Kenyatta International Airport (JKIA)		
	Operation		International and domestic		
	Code		ICAO: HKJK IATA: NBO		
	Location		Latitude: 01°19'09.267"S		
			Longitude: 036°55'39.992"E		
	Access to airport		18 km from Nairobi City centre, approx. 30 min. by vehicle		
	Reference ground elevation		1,624.5 m +MSL		
	Temperature		Average 21°C		
	Operation		24 hours (Air Traffic Services: ATS)		
Operator		Airport facility: KAA, Navigation system: KCAA			
Runway	No.	Dimension	PCN	Slope/max	Strip Dimension
	06/24	4,117 m × 45 m	65/F/A/W/T	0.5365%	4,361 m × 300 m
Taxiway	Width		PCN	surface	
	23 m		65/F/A/W/T	Concrete, Asphalt	
Aircraft Parking	PCN			surface	
Apron	65/F/A/W/T			Concrete	
Approach and Runway Lighting	RWY06: PALS, LIL/ PAPI Left side of RWY				
	RWY24: SALS, LIL/ PAPI Left side of RWY				

Source: AIP



Source: JICA Study Team (JST)

Figure 4.2.15 View of JKIA Terminal Area from Control Tower

JKIA is projected to grow with the growth of Kenya's economy, as well as increase in foreign currency income. In 2011, JKIA had more than 80% of its total passenger traffic from international flights and around 40% from domestic flights. Moreover, JKIA had 65% of the total flights in Kenya in 2011.

(2) Wilson Airport

Wilson Airport is used mostly by both domestic and international general aviation traffic. The domestic flight is extensively used for tourism, health care, and agriculture. Safari is the most popular tourism attraction in Kenya, i.e., Maasai Mara, Mombasa, Kilimanjaro, Amboseli, Eldoret, and Lamu, which are all just a short flight away by Air Kenya, Aero Kenya, and Safarilink. Other flight operations are for humanitarian agencies such as Africa Medical and Research Foundation (AMREF), Mission Aviation Fellowship (MAF) as well as flight training. Wilson Airport also has major international flights, which are commonly used by business executives.

Table 4.2.4 Major Facilities of Wilson Airport

Item	Name	Description			
Principal Feature	Name	Nairobi/ Wilson			
	Operation	International and domestic			
	Code	ICAO: HKNW IATA: WIL			
	Location	Latitude: 01°19'16.578"S			
		Longitude: 036°48'53.881"E			
	Access to airport	5 km from Nairobi City centre, approx. 10 min. by vehicle			
	Reference ground elevation	1,687 m +MSL			
	Temperature	Average 23°C			
	Operation	0330 – 1730/ 14 hours (Air Traffic Services: ATS)			
Operator	Airport facility: KAA, Navigation system: KCAA				
Runway	No.	Dimension	PCN	Slope/max	Strip Dimension
	07/25	1,463 m x 24 m	18/F/B/X/U	1.42%	
	14/32	1,560 m x 23 m	13/F/A/W/T	1.0%	
Taxiway	Width	PCN	surface		
	23 m	15/F/B/X/U	Bitumen		
Aircraft Parking Apron	PCN	surface			
	15/F/B/X/U	Bitumen			
Approach and Runway Lighting	RWY07: SALS/ PAPI Left side, RWY25: NIL				
	RWY14: PAPI Both side, RWY 32: NIL				

Source: AIP



Source: JICA Study Team (JST)

Figure 4.2.16 View of Wilson Airport Airlines Hangar and Taxiway from Control Tower

Wilson Airport had mainly domestic flight operations and around 13% of its total passenger traffic are from domestic flights. However, Wilson Airport has historically the highest aircraft movement in Kenya. In 2011, the number of aircraft movement was 76,388 times.

4.2.4 Water Supply

(1) Water Resources

The existing water resources for the water supply system of Nairobi City were from Sasumua Dam, Thika Dam, Ruiru Dam, and Mwagu Intake on the Chania River, Kikuyu Springs, and boreholes for groundwater. The capacity for the water supply is summarised in Table 4.2.5. The outline map for the water supply of Nairobi City is presented in Figure 4.2.17.

Table 4.2.5 Existing Water Resources of Water Supply for Nairobi City

Name	Water Supply Capacity (m ³ /day)		Remark
Sasumua Dam	63,000	549,500	Chania River
Thika Dam -Mwagu Intake	460,000		Thika River
Ruiru Dam	21,700		Ruiru River
Kikuyu Springs	4,800		Two springs mainly supply raw water to Nairobi City.
Groundwater		45,000	Due to the shortage of water, private boreholes were developed in Nairobi City. Nairobi City Water Supply and Sewerage Company (NCWSC) owns 30 boreholes and 13 of those are in operation. Figure 4.2.17 shows total as expected by NCWSC in 2010.

Source: JICA Study Team (JST)

(2) Existing Water Supply Facilities

There are four water supply systems in Nairobi City based on its water resource, namely the Sasumua system, Ruiru system, Mwagu system, and Kikuyu system. Some of the facilities of the systems, such as raw/treated water transmission pipelines of Sasumua Water Treatment Plant (WTP) and Ngethu WTP exist outside of Nairobi City as presented in Table 4.2.5. Thus, countermeasure for complaints from the users in the area needs to be considered in the rehabilitation/expansion of facilities, some of

which may be located outside of Nairobi City. In fact, Nairobi City Water Supply and Sewerage Company (NCWSC) supplies bulk water from the systems to the WSP of the area.

The existing facilities of the Sasumua system, Ruiru system, Mwagu system, and Kikuyu system are presented in Tables 4.2.6, 4.2.7, 4.2.8, and 4.2.9, respectively. The outline of the connection between the facilities is presented in Figure 4.2.17.

Table 4.2.6 Existing Facilities of Sasumua System

Name	Capacity or Size
Raw Water Transmission	Total length from the dam to WTP is 686 m. D800 pipeline started from the dam was diverted to two pipelines of D600 and D450. Before inlet of WTP, hydropower generators were installed.
Sasumua WTP	63,000 m ³ /day
Treated Water Transmission	Form Sasumua Dam to Ruiru Chamber. Two parallel pipelines of D462.5 and 318.75 were installed. From Ruiru Chamber to Kabete and Kyuna reservoirs, pipeline of D600 was installed.

Source: JICA Study Team (JST)

Table 4.2.7 Existing Facilities of Ruiru System

Name	Capacity or Size
Raw Water Transmission	Three pipelines of D225, D300 and D400 were installed
Kabete WTP	21,700 m ³ /day, treated water is transmitted to Kabete Reservoir

Source: JICA Study Team (JST)

Table 4.2.8 Existing Facilities of Mwagu System

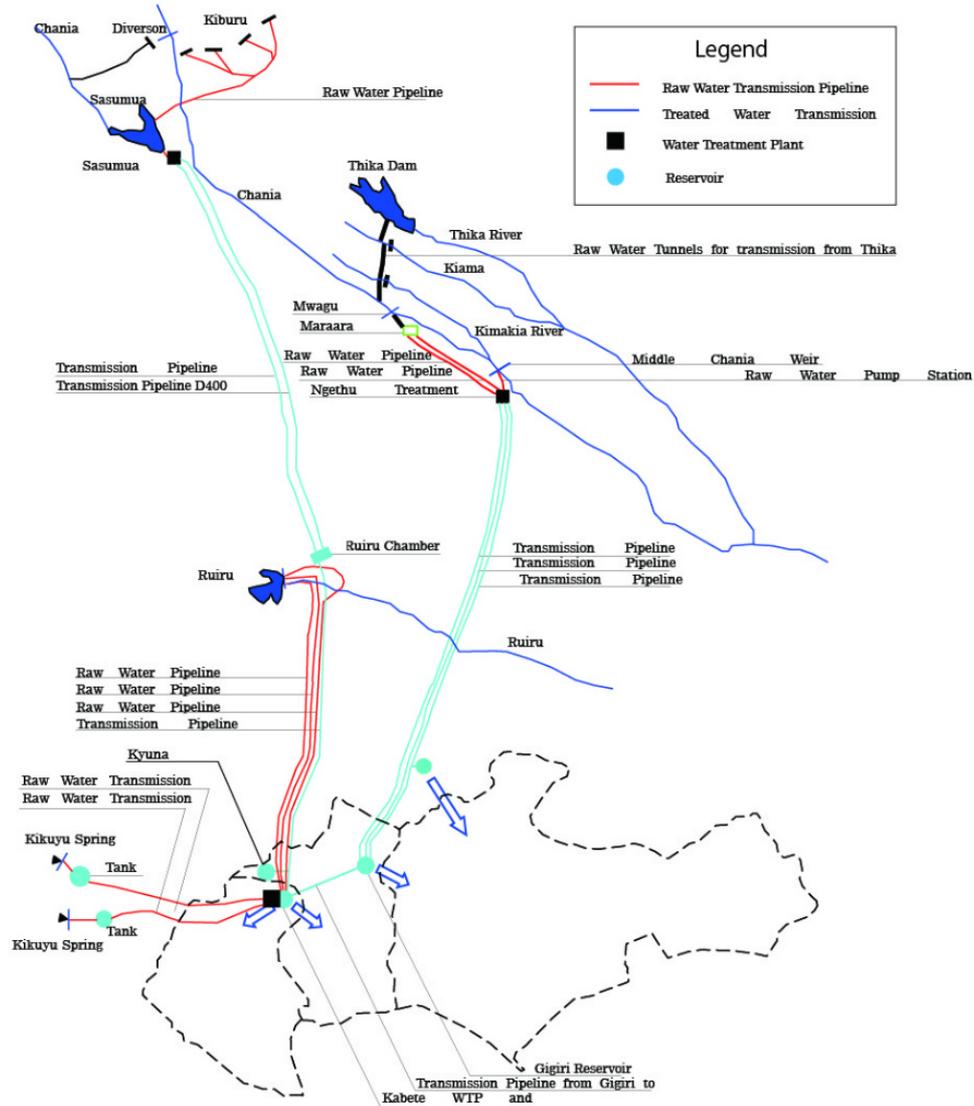
Name	Capacity or Size
Raw Water Transmission	Tunnel with diameter of three meters connected from Mwagu Intake to Mataara Chamber. From the chamber to Ngethu WTP, two parallel pipelines of D1,400 and D1,200 were installed.
Ngethu WTP	460,000 m ³ /day
Treated Water Transmission	Three parallel pipelines of D700, D1,000, and D1,000 - D1,400 connected from Ngethu WTP to the Gigiri and Kabete reservoirs. The pipelines were interconnected for bulk water supply to Ruiru, Gatundu, and Kiambu, which are environs of Nairobi City.

Source: JICA Study Team (JST)

Table 4.2.9 Existing Facilities of Kikuyu System

Name	Capacity or Size
Raw Water Transmission	Pipeline of D300 connected Kikuyu Spring no.1 to Kabete WTP via tank no.1 with volume of 150 m ³ . Pipeline of D200 connected Kikuyu Spring no.2 to Kabete WTP via tank no.2 with volume of 150 m ³ . The capacity is 4,800 (m ³ /day) in total.

Source: JICA Study Team (JST)



Source: JICA Study Team (JST)

Figure 4.2.17 Outline of Map of Water Supply to Nairobi City

The distribution network of Nairobi City receives treated water from four reservoirs, namely: Kabete, Kyuna, Kiambu, and Gigiri reservoirs and the distribution area is segmented into 13 zones based on the reservoir supplying the water to the zone. The distribution network is installed with high density in the western area of Nairobi City and low in the eastern area.

The zones of the distribution systems in Nairobi City are summarised in Table 4.2.10 and the general layout of the zones is presented in Figure 4.2.18.

Table 4.2.10 Zones of the Distribution System in Nairobi City

Zone Number	Reservoir Supplying Water	Capacity of Reservoir (m ³)
1	Kikuyu Tank no.1	250
	Kikuyu Tank no.2	250
2N	Kabete	42,000
2S	Kabete PS- Dagoretti	11,000
3N	Kabete PS- Uthiru	11,000
3S	Kabete PS- Dagoretti	11,000
4	Kyuna PS - Loresho Tower	450
5	Kyuna	9,000
6	Kiambu	59,000

Zone Number	Reservoir Supplying Water	Capacity of Reservoir (m ³)
7	Kabete PS - Hill Tank	18,000
8	Gigiri	61,000
9	Gigiri - Karura	9,000
10	Gigiri - Ring Road Tower	450
11	Kiambu – Kasarani	11,000

Source: JICA Study Team (JST)

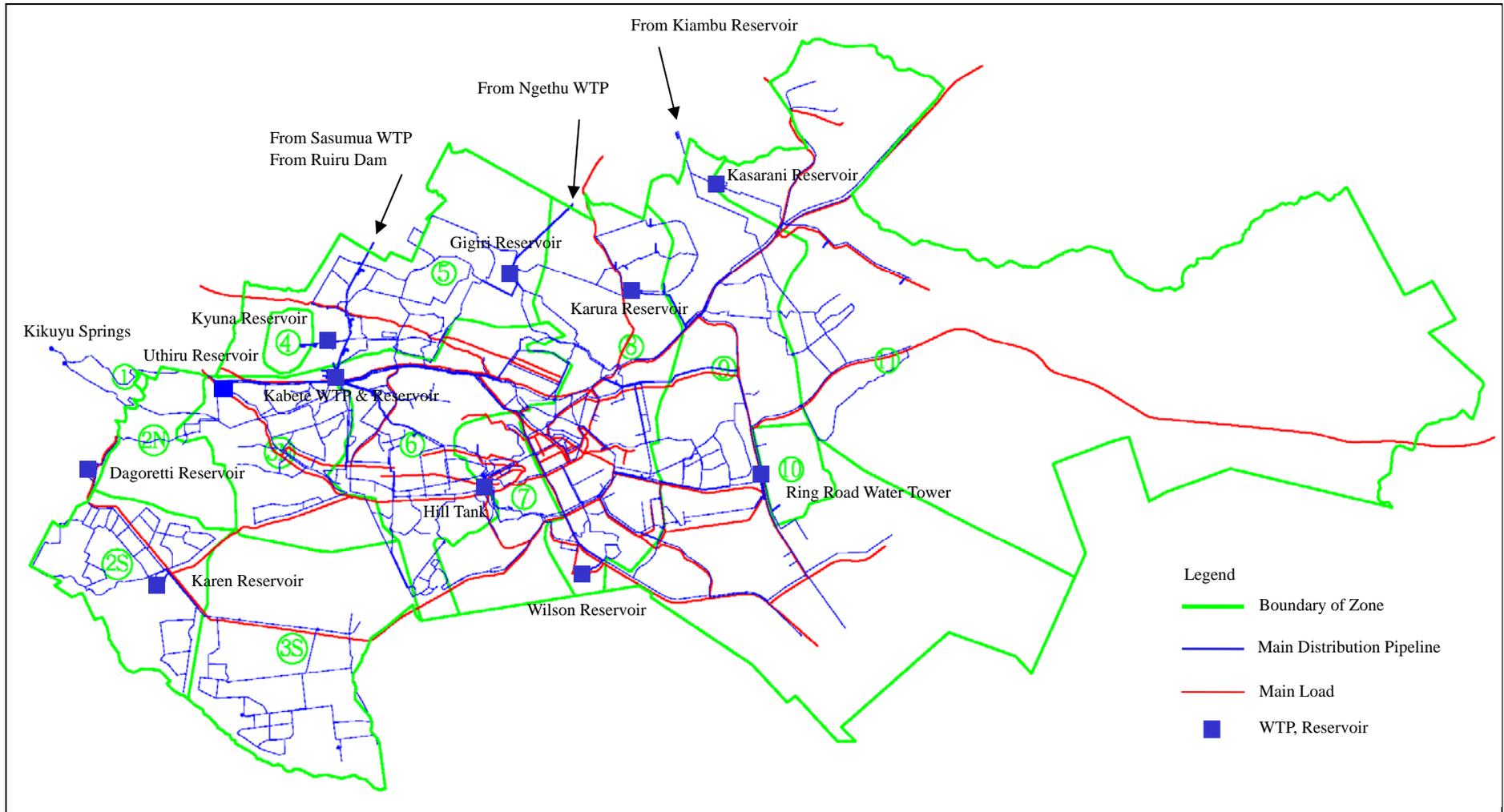
(3) Water Supply Services in Nairobi City

1) Produced/Served Water and Unaccounted for Water (UfW)

According to the performance report of Kenya's water services subsector, the produced water in 2008 was estimated at 423,000 m³/day and the served amount of water was estimated at 255,000 m³/day. The UfW in Nairobi City was approximately 40%.

In reference to FSMPNWS, the water demand in 2010, considering the 40% of UfW, was 578,643 m³/day. This estimate was in accordance with the practical manual of water supply issued by the Ministry of Water and Irrigation (MWI). As presented in Table 4.2.5, the total capacity of the water supply facilities of Nairobi City is 549,500 m³/day. Thus, the capacity of the facilities is a little short of the requirement of MWI.

On the other hand, the difference between the produced water and the total capacity is 126,500 m³/day. The main reason was that the inlet flow rate of Ngethu WTP was 360,000 m³/day as referred by FSMPNWS, while its capacity is 460,000 m³/day. On this issue, discussion is necessary regarding the further allocation of water resources and the rehabilitation of the facilities to fill the gap.



Source: JICA Study Team (JST)

Figure 4.2.18 General Layout of the Zones

2) Coverage Ratio

The served population of Nairobi City in 2008 was 2,157,826 as mentioned in the performance report. The total population of Nairobi City in 2008 was 3,138,369. The ratio of the served population is approximately 67% .

On the other hand, the actual figure is expected to be higher than the reported. Water supply projects for informal settlements were implemented as mentioned in Subsection 2.6.5. Few of the beneficiaries of these projects were reflected in the figure described above, because water kiosks and yard taps were provided by the projects and their customers were not fixed due to the style of the facilities.

3) Water Tariff

Water tariff in Nairobi City is issued by AWSB with the approval of the Water Service Regulatory Board pursuant to Water Act 2002 and is conducted by NCWSC.

The water tariff consists of water fees, rental fees of water meters, refundable deposits, connection fees, and fine penalties of illegal connections. NCWSC has managed the O&M works of the water supply system with the revenues from the water tariff.

(4) Rehabilitation of Facilities

On the rehabilitation of facilities for raw water transmission, water treatment plants, and transmission mains, projects financed by AFD are ongoing as of April 2013. The projects cover Sasumua system and Mwangu system.

For the distribution network, as UfW is targeted to decrease from 40% to 20% in the practical manual of water supply issued by MWI, the plan and schedule of rehabilitation/improvement of the distribution network need to be established.

(5) Existing Development Plan

In FSMPSNWS, the development plan of water resources was proposed as per the projection of population and water demand in Nairobi City based on the practical manual of water supply in force in Kenya.

In this study, the urban development plan of Nairobi City including the projection of the population and study of land use is carried out. Based on the projection, review of the plan will be carried out.

4.2.5 Stormwater Drainage and Sewerage

(1) Stormwater Drainage

1) Drainage System

Nairobi City is located in the uppermost part of the Athi Catchment area. The Nairobi River belongs to the Athi River system and its catchment area includes majority of the land area of the city. The northern and central areas of the city are drained by the tributaries of the Athi River, namely: Gitathuru, Rui Ruaka, Nairobi, and Ngong rivers. The south of the city, mostly occupied by the Nairobi National Park, belongs to another catchment that is drained by the Mbagathi River and associated streams.

In Nairobi City, the existing stormwater drainage system is developed mainly in the CBD and part of neighbouring areas, and is composed of roadside drains associated with the existing urban roads, storm sewers, and canalised trunk drains to collect stormwater from the catchment areas and discharge it to the tributaries mentioned above. Because the topography is generally sloping from west to east, the stormwater is drained by gravity. In the suburbs of Nairobi City, it is observed that stormwater is collected and discharged through roadside drains and small streams, which are not well developed as a whole.

2) Drainage Development Works

The regional office of the Water Resources Management Authority (WRMA) is in charge of the management of water resources in the Nairobi River basin. The tasks of the regional office include the river training works and canal works for the development of the stormwater drainage system.

The KURA is responsible for the development of urban roads including roadside drains, which comprise majority of the stormwater drainage facilities in Nairobi City.

The City Engineering Department of NCC is in charge of checking the design of stormwater drainages during the appraisal of road construction works and their maintenance. The main task of the department is to clean the roadside drains and canalised open channels. It was reported that the department carried out the cleaning of roadside drains along 700 km of existing roads out of the total of 2,400 km in 2010 but any identification and repair of deteriorated locations were not undertaken¹. At present, the department has prepared a map of the existing stormwater drainage system in Nairobi City and is making efforts to identify problematic locations that need to be improved.

The department is faced with the difficulty of managing the stormwater drainage system because previous maps and records for the stormwater drainage system were destroyed by a fire that engulfed the city hall in 2004. Most of the data was in hard copy with no back up of soft copies available elsewhere. At present, the department through the consultancies under the KMP and NaMSIP is initiating the preparation of a map of the existing major stormwater drainage systems in Nairobi City besides the existing roadside drains and making efforts to identify problematic locations that need to be improved.

3) Primary Observations

In April 2013, the JICA Study Team has initiated the infrastructure development planning for stormwater drainage in Nairobi City and made primary observations of its situation during the rainy season. The main points of the observations are described below.

Problems:

- (i) It is suggested that Nairobi City was suffering repeatedly from the localised inundation at many locations during the rainy season.
- (ii) During a rainstorm, the inundation on the main roads causes heavy traffic jam in the city centre.
- (iii) A number of roads were washed and pitted with puddles even the day after the rainstorm.
- (iv) Stormwater stagnation is attributed to the degradation of the living environment in housing areas, e.g., informal settlements formed in the lowlands.

¹ Preparatory Survey on Nairobi Urban Development Programme, JICA, October 2011

Suggested Causes:

- (i) Roadside drains are not functioning effectively due to improper design and/or construction, structural deterioration, and lack of removal of sediments and garbage.
- (ii) Stormwater drainage network is not functioning effectively. Many drainage sections and/or outfalls remain blocked/clogged, due mainly to the difficulty in identifying such locations in densely built-up areas (e.g., informal settlements).
- (iii) In general, there is no systematic identification of problems on the stormwater drainage system, and localised works on ad-hoc basis are done only to create another problem elsewhere.
- (iv) Urbanisation in higher areas increases bare/concreted ground surfaces with less infiltration capacity and results in the rapid concentration of stormwater to the downstream areas.
- (v) Developed areas where land topography forms a centralised low point (basin-like) with zero natural drainage for any generated stormwater without introduction of a significant stormwater drain to carry the water out of the low point (e.g., in Runda Estate).

4) Status of Planning

Meanwhile, any usable planning document for stormwater drainage in Nairobi City is unknown. It was reported that a stormwater drainage plan for Nairobi City had been prepared in 1980s with support from the WB and GTZ; however, such document was neither available nor used in the City Engineering Department of NCC².

Under the KMP, it is expected that the MOLG will initiate the preparation of a master plan, detailed designs, tender documents, and operations and maintenance manuals for storm water drainage works in Nairobi City within 2013. The MOLG issued a procurement notice on 11 March 2013 regarding the request for EOI by 26 March 2013. It is presumed that the MOLG would proceed with the process of selecting consultants by April 2013.

As suggested in the published information by the WB regarding the NaMSIP, the Ministry of Nairobi Metropolitan Development (MONMD) would be carrying out the preparation of the feasibility studies, final designs, and bidding documents for stormwater drainage in Nairobi City (Dagoretti, Langata, CBD and Embakasi), Thika (CBD and west of CBD), Mavoko and Ongata Rongai townships in 2013. Afterward, the bid submission and opening of the construction of Nairobi City storm water drainage works is scheduled in August 2013.

(2) Sewerage System

1) Sewerage Treatment Plants

There are 24 existing sewerage treatment plants (STPs) in Nairobi City, but most of them are localised STPs with a small capacity of less than 2,000 m³/day. The major STPs are Dandora STP (120,000 m³/day) and Kariobangi STP (32,000 m³/day). A report by the NCWSC indicates that these STPs are not well functioning in terms of actual sewerage treatment volume and water quality of treated outflow as shown in Table 4.2.11 below. In particular, the

² Preparatory Survey on Nairobi Urban Development Programme, JICA, October 2011

Kariobangi STP suffers from deterioration and mechanical troubles; hence, it is not operational substantially³.

Table 4.2.11 Operating Conditions of Existing Major STPs in Nairobi City

Type, Capacity, Inflow and Outflow

STP	Type	Capacity (m ³ /day)	Sewerage Inflow (m ³ /day)	Treated Outflow (m ³ /day)
Dandora	Lagoon	120,000	90,870	69,941
Kariobangi	Conventional biological aerated filter	32,000	11,933	(N/A)

Treatment

STP	Item	Water Quality (mg/L)		
		Sewerage Inflow	Treated Outflow	Effluent Standard
Dandora	BOD	375	66	30
	COD	924	245	50
	TSS	500	113	30
Kariobangi	BOD	340	194.8	30
	COD	774.7	373.1	50
	TSS	306.5	77.3	30

Source: NCWSC Quarterly Report, July-September 2011

2) Sewers

The majority of existing sewers are combined sewers, collecting both stormwater and wastewater, and are developed in the CBD and in other recent development areas. The total length of the existing trunk sewers is about 162 km that collect wastewaters from the sewerage service areas totaling about 208 km², which accounts for approximately 40% of the total area covered by the water supply service. But some of the sewerage service areas still need some reticulation lines (secondary sewers) locally and an actual percentage of service coverage is not clear yet accordingly⁴.

Wastewater collected from the sewerage service areas are conveyed to STPs located in the east of Nairobi City through the trunk sewers constructed along the rivers running west to east.

3) Sanitation

“Nairobi Sanitation Status” on the website of IWA Water Wiki⁵ summarises the existing situation of sanitation in Nairobi City as described below.

- (i) About 10% of the population is served by sewers while 20% has septic tanks and the remainder uses latrine, although these appear to be very crude data (UN-HABITAT, 2003).
- (ii) Business/institutional centre and wealthy/middle-income residential districts mostly are served by sewerage system or septic tanks.
- (iii) About 60% of the population live in informal settlements. Of this population, 24% is estimated to have a latrine (improved or unimproved) or a flush toilet, while 68% use public toilets (mostly overcrowded, low-quality latrines), and 6% resort to open defecation or in plastic bags that they call “flying toilets” (NCWSC/AWSB 2009).

³ Preparatory Survey on Nairobi Urban Development Programme, JICA, October 2011

⁴ - ditto -

⁵ [http://www.iwaterwiki.org/xwiki/bin/view/Articles/34\)+NAIROBI+\(Kenya\)+3](http://www.iwaterwiki.org/xwiki/bin/view/Articles/34)+NAIROBI+(Kenya)+3) (as of April 2013)

4) Sewerage Development Works

i) Athi Water Services Board (AWSB)

The AWSB is the agency responsible for planning, design, and implementation of projects for sewerage development works in the Athi Catchment area where Nairobi City is located. In Nairobi City, the AWSB has been implementing the following sewerage development works recently under the WaSSIP:

- (i) Construction of Gatharaini Trunk Sewers including Rui-Rwaka, Gatharaini North and Gatharaini South (Contract No. AWSB/WaSSIP/Comp.1/W-6/2009)
- (ii) Construction of Lavington-Riruta Trunk Sewers Extensions (Contract No. AWSB/WaSSIP/Comp.1/W-7/2009)
- (iii) Rehabilitation of Dandora Sewerage Treatment Works and Reconstruction of the Ngong River Trunk Sewers (Contract No. AWSB/WaSSIP/Comp.1/W-9/2009)

Besides, the AWSB has initiated the following sewerage development works under the Nairobi Rivers Rehabilitation and Restoration Program: Sewerage Improvement Project.

- (iv) Lot 1: Construction of the Kiu River and Dandora Estate Trunk Sewers, and Expansion of Dandora Waste Water Treatment Plant (Contract No. AWSB/NaRSIP/W/01/2012)
- (v) Lot 2: Construction of Mathare, Nairobi, Ngong Rivers Trunk Sewers, and Reticulation Network (Contract No. AWSB/NaRSIP/W/01/2012)

In addition to the above, the rehabilitation of the Kariobangi STP is also scheduled within the Sewerage Improvement Project.

ii) Nairobi City Water and Sewerage Company (NCWSC)

The NCWSC is a service provider appointed by the AWSB. The NCWSC takes charge of the provision of the water and sewerage services including the operation, maintenance, and management of the sewerage system consisting of the sewers and STPs.

5) Status of Planning

The current sewerage development works are implemented on the basis of the Nairobi Sewerage Master Plan Study (1998) and Nairobi Sewerage Master Plan Validation Report (2009).

The AWSB plans to carry out the updating of the Nairobi City Sewerage Master Plan as listed in the procurement plan of the WaSSIP from July 2012 to December 2013.

The AWSB and NCWSC, with the support of the Water and Sanitation Program, prepared jointly the Strategic Guidelines for Improving Water and Sanitation Services in Nairobi City's Informal Settlements (2009). The guidelines articulate the priorities and overarching principles adopted by AWSB and NCWSC to improve the water and sanitation services delivery in Nairobi City's informal settlements. These principles have been used to develop a framework that provides NCWSC with the practical tools to apply on a settlement-by-settlement basis.

The guidelines consist of six main parts, as follows:

- (i) context, relevance, and objectives;
- (ii) socio-economic, institutional, and legal issues;
- (iii) general technical guidelines;

- (iv) finance and ownership issues;
- (v) overarching principles for service provision in informal settlements; and
- (vi) action model guiding NCWSC's work in informal settlements.

4.2.6 Power Supply

(1) Power Companies in Kenya

The electric power sector of Kenya is under the jurisdiction of the Ministry of Energy (MOE). The sector comprises Kenya Power Generating Company (KenGen), Kenya Power, independent power producers (IPPs), Kenya Electricity Transmission Company (KETRACO), Geothermal Development Company (GDC), and Rural Electricity Authority (REA). As an independent regulatory body, the Energy Regulation Commission (ERC) is supervising the sector.

1) MOE

MOE is responsible for establishing the national energy policy and rural electrification plan, setting the direction for the growth of the electrical power sector, and making a long-term vision for the sector.

2) KenGen

KenGen, as well as other IPPs, generate electricity and sell it to Kenya Power. While KenGen is a state corporation, IPPs are basically private sector investments. IPPs currently provide about 20% of the whole demand and are expected to continue to play a significant role in power generation. KenGen will remain as a dominant power generation player in the long term. KenGen is listed at the Nairobi Stock Exchange, with 70% shares held by GOK and 30% by private shareholders.

3) Kenya Power

Kenya Power was renamed from the Kenya Power and Lighting Company (KPLC) in 2011. It is responsible for electricity transmission and all distribution systems in Kenya. The transmission system is composed of 220 kV, 132 kV, and 66 kV transmission lines. The National Social Security Fund (NSSF) and GOK own 50.1% of the stocks, whereas private shareholders own 49.9%.

4) IPPs

IPPs are essentially private investors in the power generation sector. Amongst the active IPPs, there are IberAfrica, Tsavo, Or-power, Rabai, Imenti, and Mumias. They account for about 28% of the country's installed capacity.

5) KETRACO

KETRACO was founded in 2008 with a full capital investment by GOK. KETRACO is responsible to plan, design, construct, own, operate, and maintain new 132 kV and above voltage electricity transmission infrastructure.

6) GDC

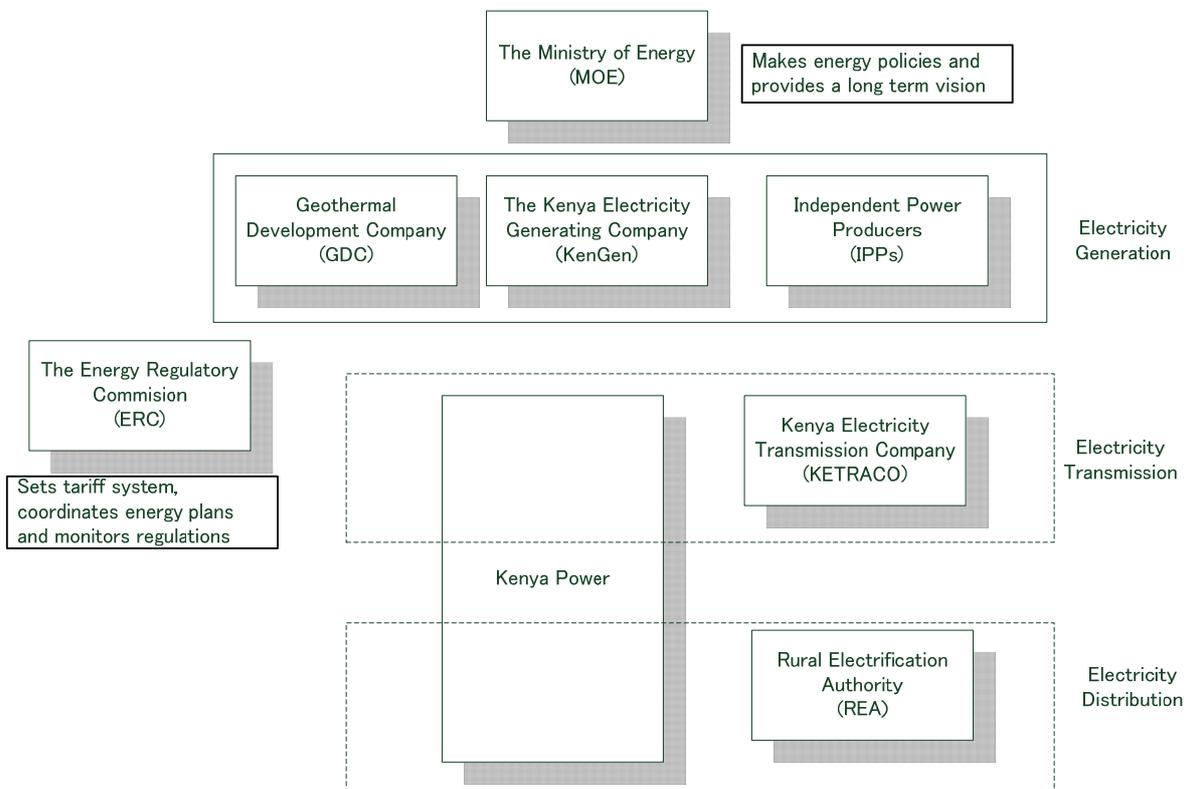
GDC is a state corporation owned 100% by GOK. GDC is tasked with developing steam fields to reduce upstream power development risks so as to promote rapid development of geothermal electric power. GDC will underwrite any dry wells sunk by private developers selected through a competitive bidding processes.

7) REA

REA was established in 2007 to accelerate the implementation pace of the Rural Electrification Programme, which is one of the most important challenges of the government. The rural customers have increased from 133,047 in 2007 to 251,056 in 2010.

8) ERC

ERC is responsible for establishing both technical and economical regulations of the energy sector. ERC settles disputes between stakeholders, sets the tariff system of Kenya Power, coordinates the energy plan, and monitors the sector regulations.



Source: JICA Study Team (JST)

Figure 4.2.19 Power Sector in Kenya

(2) Power Demand and Supply

1) Power Demand and Supply in Kenya

During the 2011/12 financial year, the number of customers for Kenya Power has exceeded 2,000,000. This was achieved due to an increase of customers in 2011/12 of about 285,000, or 16% from the previous year. Kenya Power aims at connecting new 300,000 customers every year, so the record was close to the target.

Total electricity sales as well as the number of customers increase every year. This is because of the increased in number of customers and electricity consumption despite the increased system losses. Especially, system losses during the 2011/12 financial year rose by 1.1% from the previous year. The causes of the rise are the large area expansion of the electricity distribution networks and increased transmission of electricity from the newly constructed Kipevu III generation plant in the coast area.

System peak demand increased to 1,236 MW in 2011/12 financial year. According to an official of Kenya Power, the system peak demand exceeded 1,350 MW in March 2013.

Table 4.2.12 Power Demand and Supply in Kenya

	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12
Number of Customers	924,329	1,060,383	1,267,198	1,463,639	1,753,348	2,038,625
Percent Increase in Number of Customers	15.2%	14.7%	19.5%	15.5%	19.8%	16.3%
SALES						
- Kenya Power System (GWh)	4,771	5,036	5,155	5,318	5,785	5,991
- Rural Electrification Programme (REP) System (GWh)	221	240	250	279	307	308
- Export to Uganda (GWh)	73	46	27	26	30	41
- Export to TanESCO (GWh)	0	0	0	1	1	1
TOTAL SALES (GWh)	5,065	5,322	5,432	5,624	6,123	6,341
System Losses (GWh)	1,104	1,062	1,057	1,068	1,180	1,329
Sales Percentage of Energy Purchased	82.1%	83.4%	83.7%	84.0%	83.8%	82.7%
Losses as Percentage of Energy Purchased	17.9%	16.6%	16.3%	16.0%	16.2%	17.3%
System Peak Demand (MW)	987	1,044	1,072	1,107	1,194	1,236

Source: Kenya Power Annual Report and Financial Statements 2012

2) Power Demand and Supply in Nairobi Region

Table 4.2.13 shows the number of customers, total sales, and maximum demand in Nairobi City. The number of customers in Nairobi City has increased by more than 100,000 annually from 2009/10 financial year. Moreover, according to the New Connections Report 2012 to 2013 of Kenya Power, the number of customers in Nairobi was recorded at 1,062,329 in April 2013.

On the other hand, the latest data on total sales in Nairobi region experienced a slight decrease from the previous year. This is probably because poor rainfall resulted in the reduction of hydropower generation in the first half of 2011/12 financial year, and thus suppressed the sales. Table 4.2.14 shows the sales by tariff type. From the table, the sales for domestic in 2011/12 financial year decreased from the previous year. Also, the sales for small and large commercial and industrial loads (11 kV) decreased.

Table 4.2.13 Power Demand and Supply in Nairobi Region

Nairobi Region	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12
Number of Customers	445,595	505,414	595,010	669,128	814,251	921,548
Total Sales (GWh)	2,595	2,782	2,950	3,071	3,332	3,290
Maximum Demand (MW)	522	548	568	588	623	662

Source: Kenya Power Annual Report and Financial Statements 2012

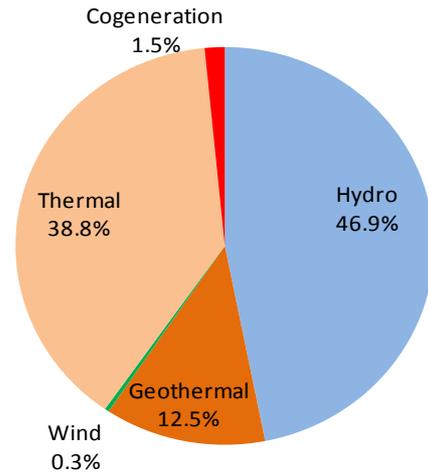
Table 4.2.14 Sales for Type of Customers Covered by Tariff

Tariff	Type of Customers Covered by Tariff (GWh)	2008/09	2009/10	2010/11	2011/12
DC	Domestic	800	804	888	841
SC	Small Commercial	400	402	435	426
CI1	Large Commercial and Industrial Load (415 V)	757	752	760	760
CI2	Large Commercial and Industrial Load (11 kV)	598	652	736	727
CI3	Large Commercial and Industrial Load (33 kV)	0	3	4	3
CI4	Large Commercial and Industrial Load (66 kV)	272	326	368	384
CI5	Large Commercial and Industrial Load (132 kV)	20	31	30	34
IT	Off-peak	40	34	36	41
SL	Street Lighting	11	11	12	11
	R.E.P. Schemes	52	55	63	63
	TOTAL	2,950	3,071	3,332	3,290

Source: Kenya Power Annual Report and Financial Statements 2012

(3) Power-generating Facilities

Figure 4.2.20 shows the composition of power-generating facilities in Kenya. The ratio is for the installed capacity of the facilities and is composed of only the total interconnected systems. As shown in the figure, hydropower occupies 46.9% of the total generated capacity for the main network system. Because of the large portion of hydropower, seasonal variations in power generation occurs due to the amount of rainfall.



Source: Kenya Power Annual Report and Financial Statements 2012

Figure 4.2.20 Classification of Power Plants by Installed Capacity

Table 4.2.15 shows a breakdown of the power-generating facilities. As shown in the table, the total generated capacity of the main network system is 1,680.4 MW as installed capacity and 1,253 MW as the actual output capacity. Besides the interconnected system, there are isolated systems mainly in the northern part of Kenya. The off-grid installed capacity is 10.1 MW in total.

Table 4.2.15 Power-generating Facilities

Type	Name	Installed Capacity (MW)	Effective Capacity (MW)
Hydro	KenGen	Tana	20.0
		Kamburu	94.2
		Gitaru	225.0
		Kindaruma	44.0
		Masinga	40.0
		Kiambere	164.0
		Turkwel	106.0
		Sondu Miriu	60.0
		Sangoro	21.2
	Small Hydros	13.7	
Total Hydro		788.1 (46.9%)	769.9 (48.0%)
Geothermal	KenGen	Olkaria I (KenGen)	45.0
		Olkaria II (KenGen)	105.0
		Eburru Hill	2.5
		Olkaria Wellhead OW37	5.0
	IPP	OrPower 4 Geothermal	52
Total Geothermal		209.5 (12.5%)	199.6 (12.5%)
Wind	KenGen	Ngong	5.3
	IPP	Imenti Tea Factory	0.3
	Total Wind		5.6 (0.3%)
Thermal	KenGen	Kipevu I Diesel	75.0
		Kipevu III Diesel	115.0
		Embakasi Gas Turbines	60.0
		Garissa and Lamu	8.7
	IPP	Iberafrika	108.5
		Tsavo	74.0
		Rabai Power	90.0
	Emergency	Aggreko energy to Kenyan Market	120
Total Thermal		651.2 (38.8%)	601.8 (37.5%)
Cogeneration	IPP	Mumias Cogeneration	26 (1.5%)
Total Interconnected System		1,680.4 (100%)	1,602.7 (100%)
Off-grid Stations	KenGen	Thermal	9.4
		Solar	0.6
		Wind	0.1
	Total Off-grid Capacity		10.1
Gross Capacity		1690.5	1,611.2

Source: Kenya Power Annual Report and Financial Statements 2012

(4) Power Transmission and Distribution Networks

1) Reliability of Power in Nairobi City

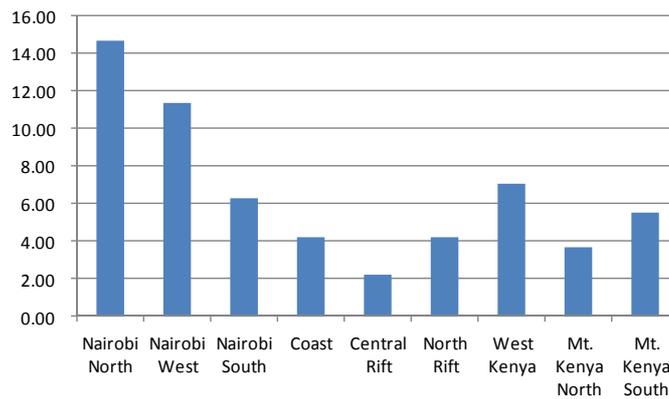
The Nairobi region is one of the areas with unreliable electricity. Table 4.2.16 shows the blackout incidence frequency according to sub region. The column under Target as of 29 April 2013 in the table shows the objective number of incidences from 1 to 29 April 2013. The incidences per 1000 customers as of 29 April 2013 show the following: Nairobi North and Nairobi West are particularly higher than other regions, Nairobi South is high as well. According to the table, the current condition of power quality in Nairobi is the worst amongst the regions. In many cases, blackouts occurred when a tree touches a distribution line or an uprooted tree causes a disconnection.

Based on this, Kenya Power has been putting in effort to deliver adequate and reliable power to Nairobi and other regions. During 2011/12 financial year, under the Energy Sector Recovery Project, Kenya Power installed modern equipment. Moreover, Kenya Power has struggled to implement the underground cable project as shown in Table.4.2.16.

Table 4.2.16 Daily Monitoring of Blackout Incidence

Sub Region	Target	Actual (All Incidences)	Incidences per 1000 Customers	% Variance
Nairobi North	1,236	6,256	14.68	-406.1%
Nairobi West	773	3,025	11.35	-291.3%
Nairobi South	1,072	2,323	6.29	-116.8%
Coast	700	1,023	4.24	-46.1%
Central Rift	536	409	2.21	23.7%
North Rift	369	541	4.25	-46.4%
West Kenya	729	1,774	7.06	-143.4%
Mt. Kenya North	610	764	3.63	-25.3%
Mt. Kenya South	444	844	5.51	-90.0%
TOTAL	6,469	16,959	7.60	-162.1%

Source: Kenya Power (As of 29 April 2013)



Source: Kenya Power

Figure 4.2.21 Incidences per 1,000 Customers as of 29 April 2013

Table 4.2.17 Underground Cable Projects

Description	Cost (Million US\$)
Nairobi CBD overhead lines	7.99
Nairobi Upper Hill and Westlands	15.98
Kileleshwa and Kilimani areas	26.63
Nairobi Industrial and Lavington areas	53.27
Nairobi Eastlands	66.58
Mombasa Island – Convert all overhead lines and secondary transformers	18.64
Kisumu City Centre	13.32
Thika town	21.31
Nakura City Centre	10.65
Nyeri City Centre	10.65
TOTAL	255.68

Source: Project Proposal for Possible Funding by Financing Institutions (KPLC)

2) Securing Distribution Networks

In Nairobi City, vandalism to the electricity system such as stealing electricity, stealing oil or copper from transformers, and eventually stealing transformers themselves sometimes happen. As countermeasures for vandalism, Kenya Power has been executing some preventive measures such as police patrols, spot-welding, reinforcement and relocation of transformers to safe areas, and installation of electronic burglar alarms. Figure 4.2.22 is a picture of a countermeasure against vandalism for a transformer. A ring-shaped 11 kV naked



Source: JICA Study Team

Figure 4.2.22 Countermeasure for Vandalism

electric wire is installed above the transformer. Moreover during 2011/12 financial year, penalty for vandalism became strict i.e., a jail term of 10 years, and/or a fine of KSh5 million. At present, underground cable projects for distribution lines have been proceeding, therefore these projects contribute to restraining vandalism.

(5) Tariff System

Table 4.2.18 shows the tariff system of Kenya Power, which was revised in June 2008 and has been applied to date. Besides the tariff system, customers need to pay for a new connection. For example, low voltage connection for customers within 600 m of the transformer costs KSh35,000 for single phase and KSh45,000 for three phases. In order to connect customers more easily, Kenya Power sets the loan funding option called “stima loan”. In addition, the Equity Bank operates loans for electricity connection.

Table 4.2.18 Retail Electricity Tariff Structure

Tariff	Type of Customer	Supply Voltage (V)	Consumption (kWh/month)	Fixed Charge (KSh/month)	Energy Charge (KSh/kWh)	Demand Charge (KSh/kVA/month)
DC	Domestic Consumers	240 or 415	0 - 50	120.00	2.00	-
			51 - 1,500		8.10	
			Over 1,500		18.57	
SC	Small Commercial	240 or 415	Up to 15,000	120.00	8.96	-
CI1	Commercial/ Industrial	415 - 3 phase	Over 15,000 No limit	800.00	5.75	600.00
CI2		11,000		2,500.00	4.73	400.00
CI3		33,000 / 40,000		2,900.00	4.49	200.00
CI4		66,000		4,200.00	4.25	170.00
CI5		132,000		11,000.00	4.10	170.00
IT	Interruptible Off-Peak Supplies	240 or 415	Up to 15,000	120.00	4.85	-
				240.00 – when used with DC or SC		
SL	Street Lighting	240	-	120.00	7.50	-

Source: Updated Retail tariffs Application to Energy Regulatory Commission Updated Version Dated 7 Feb 2013 (ERC)

(6) Relationship between Kenya Power and Nairobi City

In the power sector, Kenya Power has the closest relationship to Nairobi City. From an interview with an official of Kenya Power, the following arrangements are said to be in existence as some examples between Kenya Power and Nairobi City:

- (i) Kenya Power can cut a branch of tree if the branch is within 3 m from a distribution line. However, it has to pay KSh1,000 to Nairobi City.
- (ii) When the distribution network connects to customers, Kenya Power has to pay KSh1,000 to Nairobi City.
- (iii) If distribution facilities need to be removed for road maintenance and improvement, Nairobi City has to pay for the removal cost to Kenya Power. On the other hand, if Kenya Power installs them in Nairobi City, Kenya Power needs to pay Nairobi City.

Besides this arrangement, if Nairobi City has a plan of constructing a new road, it needs to inform Kenya Power of the plan.

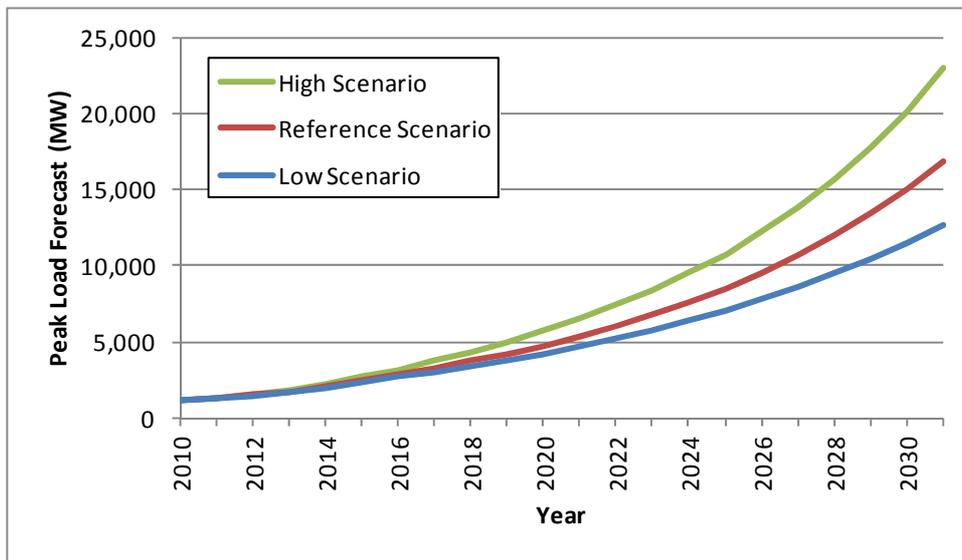
(7) Existing Demand Forecast and Existing Future Plan

The Kenyan power sector has been preparing the Least Cost Power Development Plan (LCPDP) as the power sector plan for 20 years. Kenya's power generation and transmission system plan is undertaken on the basis of LCPDP which is in consideration of Kenya Vision 2030.

1) Existing Demand Forecast

LCPDP describes the demand forecast from 2010 to 2031, as shown in Figure 4.2.23. The three scenarios depend on some factors. These are calculated by using the Model for Analysis of Energy Demand (MAED). Kenya Vision 2030 assumes some projects as vision 2030 flagship projects such as special economic zones, light rail for Nairobi City and suburbs, as well as resort cities. Besides the calculation of MAED, the demand forecasts are added to the demand of vision 2030 flagship projects.

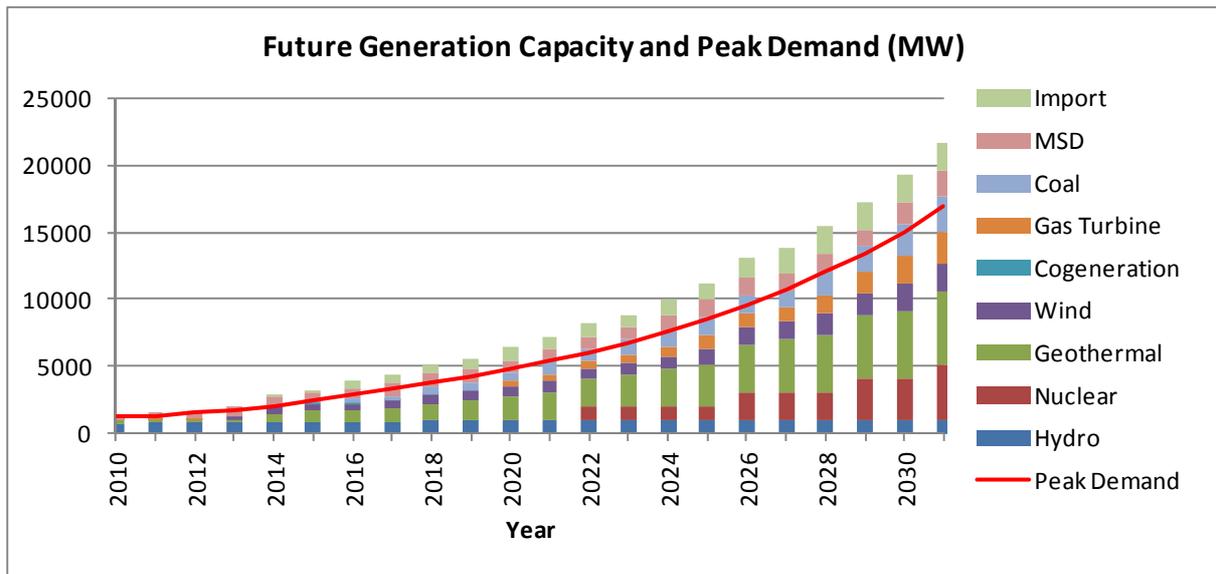
Amongst the three scenarios, most of the assumptions adopted for the reference case and the reference scenario demand were used for analysis of the future plan in LCPDP. In the case of the reference scenario, the peak demand of 2030 is about 12 times that of 2011/12 financial year.



Source: Updated Least Cost Power Development Plan Study Period: 2010 - 2031

Figure 4.2.23 Demand Forecast from 2010 to 2031

2) Existing Demand Forecast



Source: Updated Least Cost Power Development Plan Study Period: 2010 - 2031

Figure 4.2.24 Least Cost Expansion Plan and Peak Demand

LCPDP has the generation plan until 2031 as the least cost expansion plan. This planning is simulated by using Wien Automatic Simulation Package (WASP) and presumes the demand of the reference scenario. Figure 4.2.24 shows the future generation capacity as the least cost expansion plan in the country. In the figure, the reference scenario demand is also shown. The plan in 2031 indicates 5% from hydro plants, 19% from nuclear plants, 26% from geothermal plants, 11% from gas turbines, 12% from coal plants, 9% from medium speed diesel (MSD), and 9% from imports.

(8) Future Issues

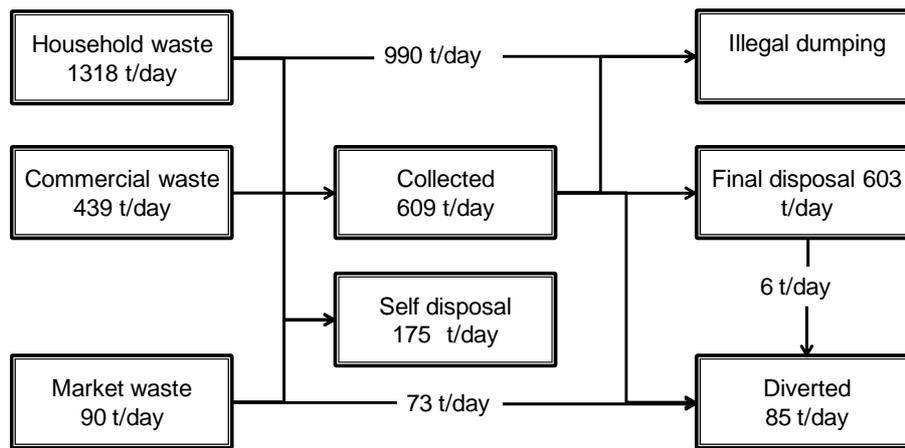
The technical working group held a meeting concerning the power sector on 6 May 2013 in order to:

- (i) Discuss what information is shared, who shares the information, and how to share the information. This is because the power sector is closely related to other sectors such as road, railway, airport, water supply, wastewater, and telecommunication. Therefore NCC hopes that the information on the power sector shall be shared amongst the concerned sectors.
- (ii) Get the GIS data of the distribution facilities for grasping the situation and for future land use plans. NCC is notable to overview the current condition of distribution facilities in Nairobi City.
- (iii) Study how to save electricity cost. NCC is not satisfied with the relatively high electricity cost for street lighting, because the lighting is not for commercial activities but for the safety of the citizens.
- (iv) Discuss the possibility that NCC owns its own facilities in order to generate and sell electric power with the cooperation of IPPs and Kenya Power or other power sector companies.
- (v) Identify the gap between the existing demand forecast and proposed demand forecast based on the master plan of this project.

4.2.7 Solid Waste Management (SWM)

(1) Overall Waste Management in Nairobi City County

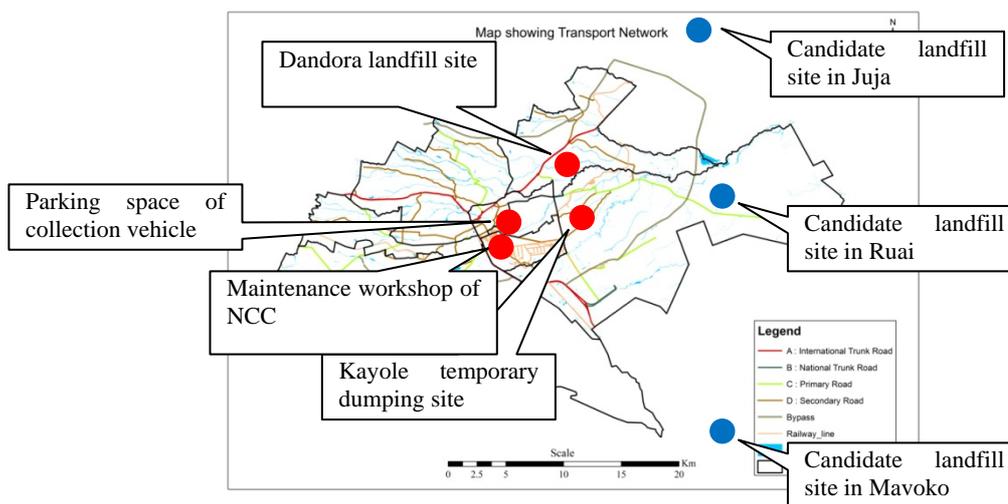
The Nairobi City County (NCC) has the responsibility of SWM in Nairobi City. The Department of Environment (DOE) in NCC collects the solid waste by themselves or subcontract it to private companies. On the other hand, private companies collect the solid waste through the contract with households, public, or private enterprises. The collected waste is transported into the Dandora landfill site or other dumping sites. Some of the collected waste is illegally dumped. There are some areas that cannot be collected by NCC or private companies due to the lack of access roads. In this area, CBO collects the waste. The waste flow from the generation source to the final disposal site is shown in Figure 4.2.25.



Source: JICA Survey Team (JST) prepared based on the data of JICA Preparatory Survey for Integrated Solid Waste Management (2010)

Figure 4.2.25 Solid Waste Flow in Nairobi City (2009)

The facilities related to SWM and management situation are shown in Figure 4.2.26.



Source: JICA Survey Team (JST)

Figure 4.2.26 Facilities Related to Solid Waste Management

(2) Legal Framework

1) Policy

Kenya Vision 2030 provides the development direction toward 2030 including the necessity of sustainable growth in Kenya. In the vision, the Solid Waste Management System Initiative as the flagship project is raised and relocation to Dandora dump site and the development of SWM systems in five leading municipalities have been proposed.

2) Law and Regulation

Environmental Management Coordination Act (EMCA, 2006) is an Act of parliament to provide for the establishment of an appropriate legal and institutional framework for the management of the environment including SWM. The Local Government Act (Cap 265 of Laws of Kenya) is one of the Acts in Kenya that establishes and governs local authorities. The Act spells out responsibility, jurisdiction, powers, and functions of the local authorities. Most functions related to SWM are undertaken by local authorities such as collection, transportation, and disposal of solid waste. According to this Act, decision making powers rest on council members as policy makers. The basic by-law of SWM in CCN is City Council of Nairobi (Solid Waste Management) By-law of 2007. The by-law describes the role and responsibility of CCN for SWM.

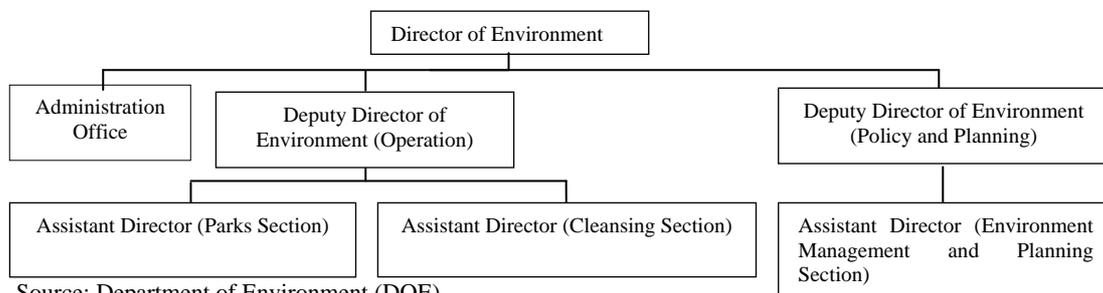
3) Guidelines

There are guidelines for private sector participation and license application of companies related to SWM including transportation, incinerator, landfill, recycling, transfer station, etc. However, there is no technical guideline for SWM or facility operation.

(3) Organisation Structure

The National Environmental Management Authority is the regulatory body of SWM at the national level. DOE in CCN is in charge of the implementation of SWM in Nairobi City. The cleansing section in DOE has the responsibility of SWM. In addition, the DOE also has the responsibility of EIA auditing and environmental conservation in CCN. The park section has the responsibility of conservation of green area and maintenance of park recreation as well as nurseries. The section of environmental management and planning has the responsibility for public awareness and environmental management and monitoring.

The organisation structure of DOE is shown in Figure 4.2.27 and Table 4.2.19.



Source: Department of Environment (DOE)

Figure 4.2.27 Organisation Structure of Department of Environment

Table 4.2.19 Number of Staff in Each Section

Administration Office	Environment Management and Planning	Cleansing	Park	Total
25	39	465	117	648

Source: Department of Environment (DOE)

(4) Waste Generation

JICA Preparatory Survey for Integrated Solid Waste Management in Nairobi City (2010) (hereafter JICA SWM Survey in 2010) implemented the solid waste amount and characterisation survey in the area of CCN.

1) Amount of Waste Generation

The latest data related to the amount of waste generation is the survey data in 2009 as shown in Table 4.2.20. According to the data, the total amount of solid waste is estimated to be 1,848 t/day and more than 60% of the total waste is generated from residential sources.

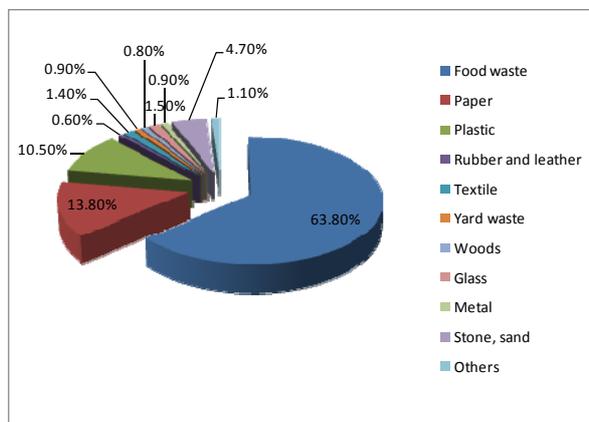
Table 4.2.20 Amount of Waste Generation

Generation source		Number [person or establishment]	Unit Generation Rate [kg/day/number]	Total [kg/day]
Residential	High income	397,362	0.621	246,635
	Middle income	1,066,393	0.474	505,076
	Low income	1,576,245	0.360	566,670
Commercial	Shop	47,941	0.5	23,970.5
	Restaurant	1,582	38	60,116
	Standard hotels	140	350	49,000
	Lodging house	586	100	58,600
	Public facilities	500	137	68,500
	School	2,847	32	91,104
	Industrial plant	501	150	75,150
	Other establishment	27,077	0.5	13,538
Market		44	2045	90,000
Street		563.3	106	(60,000)
Total				1,848 t/day

Source: JICA Preparatory Survey for Integrated Solid Waste Management in Nairobi City (2010)

2) Characterisation of Waste

For waste characterisation in Nairobi City, the survey data in 2009 is the latest one. The most recent data of physical composition in Nairobi City is the one shown in Figure 4.2.28. According to the figure, more than 60% of the total waste comes from food which occupies the larger portion of the pie graph of solid waste. As for the three contents including moisture contents, ash, combustible, high value of moisture content was confirmed to be from 65% to 80% for residential, restaurant, hotel, or market except generation sources such as shop or public facilities.



Source: JICA SWM Survey (2010)

Figure 4.2.28 Physical Composition of Waste in Nairobi City

(5) Collection and Transportation

The collection and transportation of solid waste are implemented by DOE, private companies contracted by DOE, private service providers (PSPs), and community based organisations (CBOs).

As for the collection service provided by CCN, the operation method is basically a station type collection. The operation team composed of one supervisor, three collectors and one driver collect the waste. The maintenance activity to repair the collection vehicle is carried out in the CCN transport depot. Regarding the service provided by the private companies contracted by CCN, most of the companies have three to five collection vehicles and half of the vehicles have a tipping function and they collect the waste from the station including the collection points transported by CBO, which collects by hand cart as its primary collection. Regarding the service provided by PSPs, the operation scale is different with each PSP. Some PSPs are only small companies that have only one collection vehicle but other PSPs are large companies which have more than 20 collection vehicles. Some of the collection vehicles of PSPs do not have a tipping function, and this causes inefficient unloading activity.



Waste picking activity during unloading of waste from collection vehicle

The collection time is 24 hours for CCN, and from 6 a.m. to 6 p.m. for private contractors of CCN and PSPs to prevent their illegal dumping activities. Therefore, they have to transport solid waste during daytime when the roads are congested.

The overall collection system in Nairobi City for each organisation is envisaged in Table 4.2.21.

Table 4.2.21 Collection System in Nairobi City

Organisation	Service Area	Collection Method	Equipment
CCN	CBD; Districts	Station type: common Door to door: very rare	Trucks with tipping function
Private company contracted with CCN	Districts	Station type	Trucks with/without tipping function
Private service provider	Middle and high income residential area	Door to door	Trucks without tipping function
CBOs and local youth group	Slum and low income areas	Door to door	Handcart

Source: JICA Survey Team (JST) based on the field survey and hearing from DOE

The total amount of collected waste is shown in Table 4.2.22.

Table 4.2.22 Collected Waste in Nairobi City

Year	CCN	Contractor	PSP	Total
2008	9.4 t/day	398.0 t/day	121.9 t/day	529.3 t/day
2009	29.6 t/day	446.5 t/day	132.2 t/day	608.4 t/day

Source: Department of Environment (DOE)

The collection rate of solid waste is approximately 33% in 2009 according to DOE and the remaining waste is presumed to be illegally dumped or self-disposed at the generation source. There are many illegal dumping sites in Nairobi City. In the area where waste is not collected such as low income area or in access road areas, illegal dumping occurs. As another case, even though CBO collects the waste

in collection points where CCN or the private company contracted by CBO will collect, the situation is sometimes similar to illegal dumping due to the improper discharging manner, low frequency collection, or absence of containers in collection points. There is another case that private companies such as the company contracted by CCN or PSP is illegally dumping. To prevent such illegal dumping, it is necessary to enforce the institutional system, to implement inspection and monitoring, to prepare suitable collection points and systems, and to implement environmental education for the staff related to SWM as well as for waste dischargers such as residents and business establishments.



Illegal dumping site in low income area and waste pickers who collect recyclables

(6) Reduce, Reuse, and Recycle (3R)

As for the reduction of waste, the campaign for environmental education for waste reduction is rare. Waste reduction is naturally carried out through daily life in low income areas. However, it is necessary to set up the campaign for environmental education for waste reduction activities by CCN to promote waste reduction. As for the reuse of waste, there are some second hand shops which handle second hand clothes, shoes, or electronics. Some people use the second hand shops. In addition, the low income people carry out reuse as a normal daily activity. As for recycling of waste, the collection of recyclable waste in Nairobi City mainly has three major flows. First, the discharged waste is collected by waste pickers in town and sold to junk buyers. Second, waste collection workers collect recyclable material in the waste collection vehicles. Third, recyclable waste is collected by waste pickers in dump sites including Dandora landfill site. There are no separate collection systems or sorting facilities in Nairobi City. The 3R activities are operated unofficially but so many waste pickers are engaged in waste picking activities. In addition, there are many CBOs which implement the collection of recyclables during the waste collection activities with some environmental education related to the separation of recyclables.

In the JICA SWM Survey (2010), they tried to identify the flow of recyclable waste and compostable waste. The amount of recyclables estimated in the study is shown in Table 4.2.23.

Table 4.2.23 Amount of Recyclables

Recyclable Material	Recyclable Material Handled by Junk Buyer/Brokers [t/day]	Recyclable Material Handled by Recyclers/Factory [t/day]
Recyclable	6.07	23
Plastics	4.99	8
Glass	2.27	50
Scrap metal	6.45	67
Others	0.41	-
Total	20.19	148

Source: JICA SWM Survey (2010)

However, as shown in the table above, the amount of recyclables handled by junk buyers is less than the amount of recyclables handled in factories, which indicates that it is so difficult to identify the recycling flow in Nairobi City, especially the condition of the recyclables handled by junk buyers. There is no monitoring system for this activity.

(7) Final Disposal

The main treatment and disposal method in Nairobi City is final disposal. There is an official landfill site in Dandora currently. However, there are many illegal dumping sites where the private contractors contracted by CCN and PSPs sometimes dispose their collected waste.

The information on the current official landfill site and temporary dump sites are shown in Table 4.2.24.

Table 4.2.24 Dumping Sites in Nairobi City

Name	Zone	Area [ha]	Planned Service Period	Present Condition
Dandora landfill site	Embakasi	46	1981-	Open dumping and no supervision of waste pickers, bad access and inland roads
Kayole temporary dumpsite	Embakasi	4	2009-	Area is historically a quarry area. Currently, there is open dumping and there are some waste pickers.

Source: JICA Survey Team (JST) based on information from DOE

The Dandora dumping site is currently the only official landfill site in Nairobi City. However, the operation of disposal in Dandora dumping site is open dumping, which means that there is no soil covering. This is located 7.5 km away from the northeast side of the city centre. The operation of the landfill site began in 1981 and the total area is approximately 46 ha. The total amount of disposed waste is estimated to be 3,550,000 t/day, according to DOE. There are many waste pickers who carry out waste picking activities during unloading operations of the collection vehicles and spreading activities by the landfill equipment as shown in the pictures below. The access road is muddy and in bad condition, especially during the rainy season. Therefore, the unloading area is different based on the climate condition, and collection vehicles are pulled by bulldozers when they get stuck in the muddy areas of the access road during the rainy season.



Waste picking activity during unloading of waste from collection vehicle



Waste picking activity during spreading of waste by excavator

The management of the Dandora dumping site is carried out by the cleansing section of DOE. The landfill operation is carried out by two bulldozers and one excavator through a contract with a private company. Due to the unsanitary operation conditions of Dandora dumping site, CCN considers the development of a new landfill site in or near Nairobi City. The JICA Preparatory Study for Nairobi Solid Waste Management Project (2012) has been conducted for the Ruai candidate landfill site. However, due to the issue of bird strikes to airplanes, the location of a new landfill site in Ruai has been opposed by the Civil Aviation Authority (CAA). Currently, DOE also considers other options such as another location for the landfill site or other technical options.

(8) Financial Aspect

1) Financial Condition

Currently, the revenue and expenditure of DOE were based on the general budget system of CCN. Based on the JICA SWM Survey (2010), the special budget for SWM as well as the establishment of Solid Waste Public Corporation (SWPC) were proposed.

According to DOE, the budget for SWM is 10% to 50%, which is fluctuating based on the situation of the county budget. Generally, the budget for SWM is not prioritised in comparison with other sectors. This results in no payment for the private contractors for collection and transportation as well as landfill operations. The latest data on the financial condition provided by DOE is shown in Table 4.2.25.

Table 4.2.25 Financial Condition of CCN and DOE

Year	Revenue (CCN) [KSh]	Expenditure (CCN) [KSh]	Expenditure (DOE) [KSh]	Expenditure (Solid Waste Management) [KSh]
2009/2010	8,612,928,000	9,951,002,000	544,217,000	356,091,000

Source: Department of Environment (DOE)

2) Waste Collection Service Charge

i) CNC

Business establishments are categorised into around 80 groups and the charge rates per ton are classified into five classes, namely; KSh100, 200, 320, 420, and 500. In addition, the following per ton rates are set: KSh1000 for supermarkets; KSh1500 for post offices, banks, and courts; KSh3000 for other institutions; and KSh5000 for hotels. In fact, the collection rate is less than 35%. The collection and transportation service will be suspended in case there is no payment from these establishments, which might result in illegal dumping. For households, waste collection service charge of KSh10 had been previously collected with the water supply service. After the the privatisation of the water supply service to the NCWSC in 2003, the collection was suspended. At this moment, DOE provides the service to households through the revenue from the general budget.

ii) Private Service Provider (PSP)

The licensed PSPs collect the waste collection service charge directly from waste generators such as households or business establishments. They mainly collect solid waste in high income and middle income areas where it is efficient to obtain the profit. The rates are not fixed in Nairobi City and depend on the business strategy of PSPs. Then, the waste generators in low and middle income areas cannot receive the collection services from PSPs.

3) Supervision of PSPs and CBOs

The DOE has responsibilities of supervision of PSPs and CBOs. There are lists of supervision of PSPs and CBOs related to SWM registered by the National Environment Management Authority (NEMA). However, there is no comprehensive information on the contract condition regarding waste discharging of PSPs and CBOs as well as their financial conditions. Then, it is difficult to supervise the activities of PSPs and CBOs. This might result in the illegal activities of PSPs.

4.2.8 Telecommunications

(1) Regulatory Bodies and Their Roles

The telecommunications policy in Kenya is formulated by the Ministry of Information, Communication and Technology (MOICT), with the Communications Commission of Kenya (CCK) acting as its overseeing body (established in 1998, following the Kenya Information Communications Act). Also, Kenya Vision 2030 stipulates the strategic guidelines for the ICT sector, with a target to raise Kenya's GDP to the world average.

CCK's scope of authority is as follows: i) granting operating licenses; ii) controlling service changes; iii) assignment of frequencies and telephone numbers; iv) managing the universal service fund; v) protection of end users; and vi) issuing technical standards and equipment type approvals.

The Kenya Information Communications Act (1998) regulates the establishment of CCK and sets the regulatory framework for the telecommunications sector and the license application procedures. In 2008, following global trends, CCK made a decision to issue telecommunications licenses under three categories, namely: i) telecommunications infrastructure; ii) application services; and iii) contents services. As of 2012, there were 29 licensed operators for infrastructure, 92 for application, and 140 for contents.

The Kenyan government's telecommunications policy features privatisation, interoperable connections (interconnection), and mobile number portability. In 2007, Telkom Kenya, a state owned operator, was privatised by the consortium of France Telecom and Alcazar Capital Limited's acquiring 51% of its stock shares. The above policy is one of the measures to create a competitive environment in the telecommunications sector.

Since 2009, fixed and mobile operators have been required to provide interoperable domestic connections. In 2011, Telkom Kenya and Safaricom were designated by CCK as major operators. In 2010, CCK carried out a 50% reduction in interoperable connection charges and a further cut of 40% is scheduled by 2014.

In 2011, the Kenya Network Information Center (KENIC), controlled by Porting Access Kenya, started its mobile number portability service. The number of service users stood at 36,224 in the first quarter of 2012.

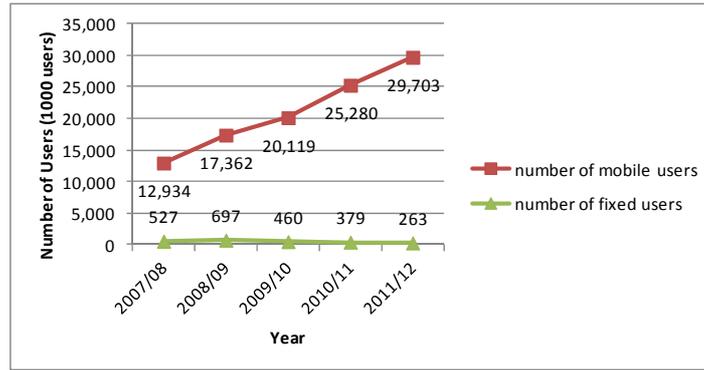
Another notable feature of the telecommunications policy targets information and communication technology (ICT). In line with the Kenya Vision 2030's objective to raise GDP to the international average by 2030, MOICT announced its ICT Policy Guideline in 2011, with the aim of providing a broadband connection to last one mile users and ICT services at schools and public institutions nationwide by 2015.

(2) Current Condition of Telecommunications

This section describes the current conditions of fixed/mobile telecommunication, broadcast and postal/courier services.

1) Fixed/Mobile Telecommunications/Internet

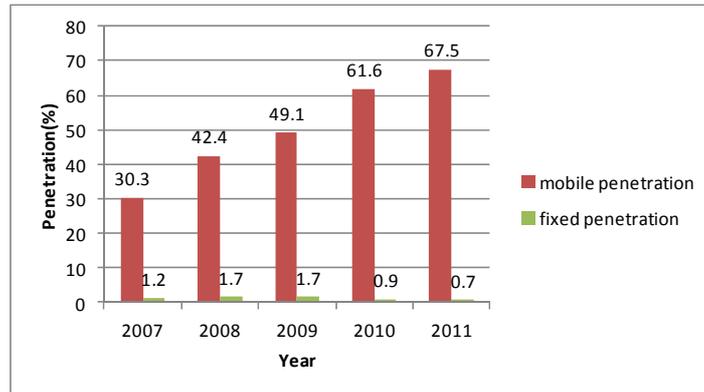
Figure 4.2.29 shows the number of fixed and mobile users. In 2011/12, there was a rapid growth of mobile users against a decline of 30% in the number of fixed subscribers from the previous fiscal year.



Source: JICA Study Team (JST) based on CCK Annual Report 2011/12

Figure 4.2.29 Number of Fixed and Mobile Users in Kenya

A clear contrast is observed in Figure 4.2.30 indicating the fixed telephone and mobile penetration ratio per 100 inhabitants. Between 2007 and 2011, the fixed telephone penetration ratio was close to 1% and had a year on year decreasing tendency. On the other hand, mobile penetration increased from 30% to 65% in the same period, which leads to the conclusion that most telephone users in Kenya are mobile users.



Source: JICA Study Team (JST) based on ITU (International Telecommunication Union) statistics

Figure 4.2.30 Proportion of Fixed and Mobile Telephones in Kenya

Over 98% of the internet subscribers have been mobile users since 2009/10 and over 50% of the internet users accessed the internet through their mobile handsets in 2011/12 as shown in Table 4.2.26. On the other hand, fixed line internet users make up less than 1% of the internet subscribers even though the number of fiber optic users is increasing rapidly.

Table 4.2.26 Subscriptions of Internet Users

Fiscal Year	2008/09	2009/10	2010/11	2011/12	May 2013
Terrestrial Mobile Data/Internet Subscription	1,562,065	3,059,906	4,189,720	7,655,576	9,589,851
Terrestrial Wireless Data/Internet Subscription	8,602	22,134	29,979	21,709	24,011
Satellite Data/Internet Subscription	26	953	960	519	727
Fixed Digital Subscriber Line(DSL) Data/Internet Subscription	7,822	9,631	15,168	11,682	10,390
Fixed Fiber Optic Data/Internet Subscription	851	4,303	22,460	49,371	55,007
Fixed Cable Modem (Dial Up) Data/Internet Subscription	21	25	-	25	25
Total Internet Subscription	1,824,203	3,096,952	4,258,287	7,738,882	9,680,011
Estimated Internet Users*	3,648,406	7,832,352	12,538,030	14,032,366	16,444,861

Note:* The number of internet users is estimated by multiplying the number of mobile data/internet subscriptions by one, the terrestrial wireless subscriptions by ten, and the fixed DSL, fiber optic and satellite subscriptions by 100. There is no scientific method of estimating internet users; for the purpose of this report, the methodology adopted is borrowed from the ITU recommendations and those of the Internet Market Study 2006 carried out by the Commission.

Source: CCK Annual Report 2011/12, CCK Sector Statistics Report (3rd quarter 2012/13)

Broadband subscriptions, with a bandwidth of over 256 kbps, are expanding dramatically as shown in Table 4.2.27, although the broadband subscriptions for 2012 represented only about 1.8% of the population of Kenya.

Table 4.2.27 Subscriptions of Broadband Services

Fiscal Year	2010/11	2011/12	May 2013
Fixed Broadband (DSL, Satellite, and Fiber)	6,552	35,265	N/A
Wireless (Wimax)	5,646	17,282	N/A
Mobile	108,928	674,255	N/A
Total	121,126	726,802	1,178,077

Source: CCK Annual Report 2011/12, CCK Sector Statistics Report (3rd quarter 2012/13)

The penetration ratio of telecommunications per province is presented in the National ICT Survey Report by the Kenya National Bureaus of Statistics and CCK (see Table 4.2.28). Fixed telephone and internet users are concentrated in Nairobi City. The regional gap in the penetration ratio between Nairobi City and the provinces is well recognised.

Table 4.2.28 Penetration Ratio of Telecommunications in Nairobi City and the Provinces

Province	Fixed Telephone (%)	Mobile Phone (%)	Internet (%)
Nairobi	11.9	76.2	28.3
Central	1.4	74.0	7.1
Coast	6.3	50.7	8.4
Eastern	2.0	64.2	4.9
North Eastern	1.2	41.1	3.6
Nyanza	1.8	57.3	5.8
Rift Valley	2.3	58.0	4.7
Western	1.2	49.5	1.5

Source: National ICT Survey Report 2011 June by Kenya National Bureaus of Statistics and CCK

Like almost all developing countries in the field of telecommunications, the rapid growth of mobile users is in stark contrast to the number of fixed line users. Safaricom, Airtel, Telkom Kenya (a.k.a. Orange), and Essar Telecom are major mobile operators in Kenya, covering all 90% of the population in 2011. In March 2013, the number of mobile users reached 29.8 million nationwide, with a penetration ratio of 69%. More than 99% of mobile users utilised prepaid services.

Mobile money services called M-Pesa were provided first by Safaricom in 2008 to transfer small amounts of money via mobile phones. The same service is now provided by Orange and Airtel as well. As of March 2013, 23.2 million users which account for 78% of total mobile subscribers used this service. The transaction amount between April and June 2012 reached KSh192.7 billion (US\$2.3 billion).

Regarding internet services, fixed connections are provided by Wananchi Telecom, Kenya Data Network (KDN), Access Kenya, and Telkom Kenya. Meanwhile, the mobile connection is provided by Safaricom. The above carriers provide ADSL, FTTx, and WiMAX for local access connections. In May 2013, the number of internet users reached 16 million, and 99% of them are accessing mobile internet services through the 3G network. In reality, however, 3G services do not seem to meet specified speed requirements, with less than 10% of mobile internet users being able to access with the maximum speed of 256 kbps.

Table 4.2.29 Major Operators

Category	Operator	Market Share as of March 2013
Fixed phone subscription	Telkom Kenya (Orange)	N/A
Mobile phone subscription M-Pesa	Safaricom	65.1%
	Airtel Network Kenya	16.9%
	Essar Telecom Kenya	10.9%
	Telkom Kenya (Orange)	7.1%
Internet subscription (Mobile Data/Internet)	Safaricom	74.4%
	Airtel Network Kenya	11.2%
	Telkom Kenya (Orange)	8.0%
	Essar Telecom Kenya	6.4%
Internet subscription (Other Fixed / Wireless Internet)	Wananchi Telecom	35.4%
	Kenya Data Network (KDN)	23.7%
	Access Kenya	12.9%
	Telkom Kenya	11.5%
	Safaricom	7.2%

Source: JICA Study Team based on CCK Sector Statistics Report (3rd Quarter 2012/13)

2) Broadcast

i) Radio

Kenya Broadcasting Corporation (KBC), the government-managed broadcaster, operates FM radio broadcast and middle-wave radio broadcast throughout the nation in English and Kiswahili for 24 hours. Over 100 FM broadcasters including local broadcasters are also licensed to broadcast.

ii) Television

KBC broadcasts a nationwide TV programme at Channel 1 in English and Kiswahili for an average of 19 hours a day. For commercial broadcasting, 17 broadcasters are licensed.

Digital terrestrial broadcast commenced in five cities including Nairobi City in January 2010. The analogue terrestrial broadcast was supposed to be shut down all over the country by 2012. However, the government made a decision to delay the shutdown until 2015 since digital terrestrial broadcasting could cover up to 80% of the population as of the end of 2012. For Nairobi City area, it was announced to be shut down in December 2013. The operators of digital terrestrial broadcasting are Mutlichoice and KBC. Multchoice provides over 50 programmes on its fee-TV service named "GOTv".

iii) *Satellite Broadcast*

Multichoice Kenya, a joint venture established by KBC and Multichoice, delivers 13 packages of TV programmes through Ku band on Eutelsat W4 which is operated by the European Telecommunications Satellite Organization. It reached 120,000 subscribers by the end of 2011.

iv) *Cable Television*

In October 2010, Wananchi Group launched ten packages of TV programmes and reached 50,000 subscribers as of May 2011.

3) *Postal and Courier Services*

As of 2012, CCK licenses 190 postal/courier operators, an increase of 14 new postal/courier operators compared with the previous year. This was due to a successful public awareness campaign on the postal and courier services regulatory requirements.

The postal/courier operators are categorised into seven types as shown in Table 4.2.30

Table 4.2.30 Number of Licensed Postal and Courier Operators

Category of Operators	2007 /08	2008/ 09	2009 /10	2010 /11	2011 /12	Remarks
Public Postal Licensee	1	1	1	1	1	Charged with the responsibility of ensuring provision of universal postal services as an obligation (USO) and has the widest international and domestic coverage.
International Operators	14	15	12	14	14	Operate internationally with both worldwide and domestic networks.
International In-bound Operators	11	11	9	11	13	One-way operators; receiving items from overseas for local delivery.
Regional Operators	10	11	12	13	13	Major operators within Kenya and within the East African network
Intra-country Operators	75	87	91	99	109	Operators within Kenya
Intra-city Operators	36	38	33	37	39	Operate within a city/town boundary
Document Exchange Operators	1	1	1	1	1	Operate a document mail exchange point for a particular clientele
Total	148	164	159	176	190	

Source: CCK Annual Report 2011/12, CCK website

As shown above, intra-country postal/courier operators remain the largest category of operators, accounting for 57.3% of the total number of licensed operators. This is followed by the intra-city operators that account for 20.5%. Furthermore, the postal and courier market segment continues to register positive growth with respect to network development, and this brings the operators into further competition.

(3) *Spread of ICT Equipment in Government Offices*

1) *Nairobi City County (NCC)*

According to a computer inventory list in 2011 prepared by the ICT department of Nairobi City County, the total number of computers is 668. Amongst these, desktop computers account for 627 and laptop computers for 41. The numbers of printers and copiers are 387 and 32, respectively. The number of officers who are recognised to use a computer based on personnel inventory in the human resources department is 4,010, which is more than the number of

computers. Thus, it is obvious that there is a lack of computers in the city county. The computers are for standalone use, with no intranet or data server. This makes enhancing information sharing amongst the offices difficult.

Table 4.2.31 Number of ICT Equipment and Computer Users

Equipment	Number of Sets	Officers	Number of Persons
Desktop computer	627	Total number of officers (approximately)	11,000
Laptop computer	41	Clerical officers	1,115
Printer	387	Technical officers	309
Copier	32	Officers recognised to use a computer	4,010

Source: Computer Inventory List (ICT Dept. of NCC), Hearing Survey (Human Resource Dept. of NCC)

Communication amongst officers is primarily conducted through the officers' private mobiles. The NCC headquarters' internal line system has not worked for internal communications for about five years. Most officers started to get their mobile sets at that time for internal use. The only fixed telephones to be found in the offices are broken. Significant business communications are made through letters and some officers use e-mail.

Each department has site offices for administrative management purposes. Correspondence between the NCC headquarters and the site offices by letters is prevalent. There are especially few officers using a computer in the site offices.

2) National Government Network

The Government Common Core Network (GCCN), the national governmental network, is operated and maintained by Telkom Kenya. The GCCN connects 32 buildings and is shared by national government offices, which is set to be linked with counties through the National Optic Fiber Backbone Infrastructure (NOFBI).

The NOFBI is a countrywide fiber optic network implemented by the government and operated and maintained by Telkom Kenya. It connects 29 county headquarters, including Nairobi City County, under phase I of the project. The government has also formulated an expansion plan for NOFBI under phase II to cover the remaining 18 counties.



Source: National Broadband Strategy 2013

Figure 4.2.31 NOFBI Coverage

(4) Strategy

1) Kenya Vision 2030

Kenya Vision 2030, launched in 2008, presents a roadmap for Kenya's transformation into a newly industrializing middle-income country. The vision is built upon a tripod of economic, social, and political pillars. As the ICT regulator for the country, CCK lays out the economic framework through the projects highlighted below.

i) *Migration from analogue to digital broadcasting*

The government initiative to migrate from analogue to digital broadcasting is a result of the Regional Radio Conference decision (2006, Geneva, Switzerland <RRC-06>) requiring all countries to migrate to the digital platform by 2015. CCK is on the Digital Television Committee that brings together various government bodies for implementation.

ii) *Information security*

Cyber security is a key factor in the growth of the ICT sector. CCK established the Kenya Incident Response Team Coordination Centre that serves as the national coordination and collaboration centre for cyber security management.

iii) *Facilitate universal access to ICT services*

CCK is responsible for ensuring that everyone in Kenya has access to affordable communications services. To address the gaps in ICT access across the country, CCK has undertaken pilot projects in certain parts of the country. The projects include the establishment of 16 school-based ICT centres, four tele-centres, and eight centres for persons with disabilities.

iv) *Fibre Optic Cables*

CCK has provided licenses for landing four undersea cables into the country. The cables have had a positive impact on internet access speed in the country. CCK, in collaboration with the Kenya ICT Board, developed an informative documentary for public information.

2) *National Broadband Strategy for Kenya*

MOICT, in collaboration with CCK, advocated the development of the National Broadband Strategy (NBS) with technical assistance from USAID's Global Broadband Initiative Program. The vision of this broadband strategy is to transform Kenya into a knowledge-based society, driven by a high capacity nationwide broadband network. NBS cites the following five issues as key to national broadband development:

- (i) Infrastructure, Connectivity, and Devices
- (ii) Content, Application, and Innovation
- (iii) Capacity Building and Awareness
- (iv) Policy, Legal, and Regulatory Environment
- (v) Financing and Investment

NBS's strategy and its implementation plan for five years from 2013 through 2017 are based on the above fundamentals.

As for connectivity, the NBS's minimum broadband speed forecast targets to meet Kenya Vision 2030 are indicated in Tables 4.2.32 and 4.2.33.

Table 4.2.32 Minimum Broadband Speed

	2013-2017	2018-2022	2023-2027	2028-2030
Urban	40 Mbps	300 Mbps	1024 Mbps	2048 Mbps
Rural	5 Mbps	50 Mbps	100 Mbps	500 Mbps

Source: National Broadband Strategy (NBS)

Table 4.2.33 Broadband Penetration Targets

	Baseline	Target by 2017
% of penetration by households	6.3%	35%
% of penetration by schools	43.4%	100%
% of penetration by health facilities	n/a	100%

Source: National Broadband Strategy (NBS)

3) Strategic Plan for 2008-2013

CCK implemented its first three-year (2005-08) strategic plan in line with the 9th National Development Plan (2002-08) and the Economic Recovery Strategy for Wealth and Employment Creation 2003-07 (ERS/ERSWEC). The first strategic plan ended on 30 June 2008 and the commission has developed its successor - a comprehensive five-year strategic plan that draws from the experience of the first strategic plan and takes into account rapid global developments in the sector. The preparation of the 2008-2013 strategic plan was carried out in a participatory manner that brought together all departments and units.

The previous vision of CCK was to “enable access to reliable communications services by all Kenyans”. This was redefined in order to align it with the mission statement and the core function of CCK of facilitating access to communications services. The redefined vision is timebound in line with the country’s vision to be a middle income state by 2030. The communications sector is expected to play a key role in the realisation of Kenya Vision 2030. Key outputs and outcomes are shown in Table 4.2.34.

Table 4.2.34 Key Outputs and Outcomes

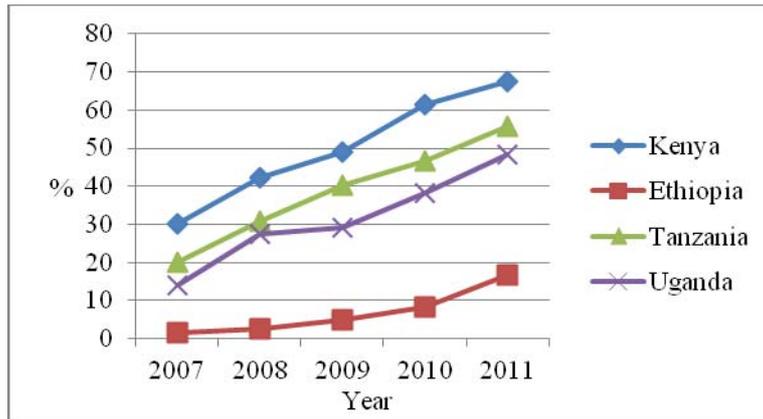
Outputs	Performance Indicators	Outcomes
<ul style="list-style-type: none"> • Mobile operators licensed • Broadcasting networks licensed • Number of equipment type approved • Numbers assigned • Frequencies assigned • Postal/courier operators licensed 	<ul style="list-style-type: none"> • Number of licenses issued • Timely standard and type approval • Number of type approval cases handled • Ranges of numbers and access codes assigned 	<ul style="list-style-type: none"> • Increased access to all varieties of communications services • Equipment compatibility and seamless services • “Better consumer experience” • Increased investment opportunities
<ul style="list-style-type: none"> • Policies, laws, and regulations enforced • Tariffs regulated • Guidelines issued 	<ul style="list-style-type: none"> • Timely enforcement of license conditions and regulation of tariffs 	<ul style="list-style-type: none"> • Fair play • License compliance • Clear rules • Governance improved • Reliability • “Better consumer experience”
<ul style="list-style-type: none"> • Improved access and connectivity • Universal access promoted 	<ul style="list-style-type: none"> • Levels of penetration 	<ul style="list-style-type: none"> • New services to the community which result in creation of job opportunities • “Better consumer experience”
<ul style="list-style-type: none"> • Interconnection agreements approved • Consumer education programmes implemented 	<ul style="list-style-type: none"> • Internal efficiency and effectiveness 	<ul style="list-style-type: none"> • Quality service • Improved and competitive business environment • Informed customers • Improved image

Source: Communications Commission of Kenya (CCK)

(5) Comparative Position of Kenya

1) Fixed/Mobile Telecommunication

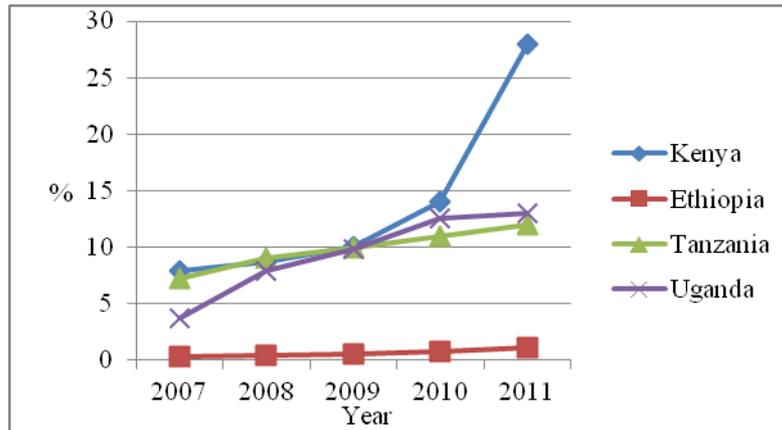
Figure 4.2.32 to Figure 4.2.34 show the percentage of mobile subscriptions, individual internet use, and fixed telephone subscriptions in Kenya and its neighbouring countries. The percentage of mobile subscriptions in Kenya is the highest amongst the countries (see Figure 4.2.32) while fixed subscriptions show a decreasing trend (see Figure 4.2.34).



Source: JICA Study Team (JST) based on ITU statistics

Figure 4.2.32 Percentage of Mobile Subscriptions Among Four Countries

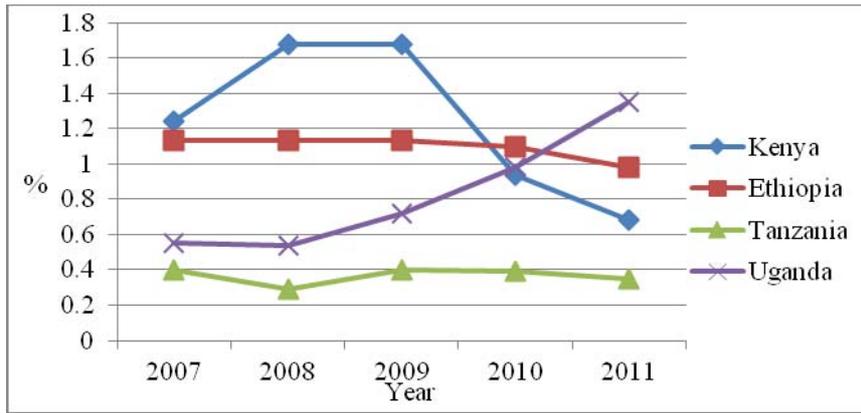
The increase in internet users in Kenya is particularly notable. With the number of fixed (wired) internet subscribers at 13,959 (ca. 0.04%), and internet use at 14% in 2010, most internet users are therefore mobile users. As for the number of broadband subscriptions, although fixed broadband subscriptions in Kenya jumped from 6,552 in 2011 to 35,265 in 2012, their share per 100 inhabitants is no more than 0.01% in 2010 and 0.10% in 2011. Most internet users, therefore, have little choice but to use narrow band internet.



Source: JICA Study Team (JST) based on ITU statistics

Figure 4.2.33 Percentage of Individual Internet Use Among Four Countries

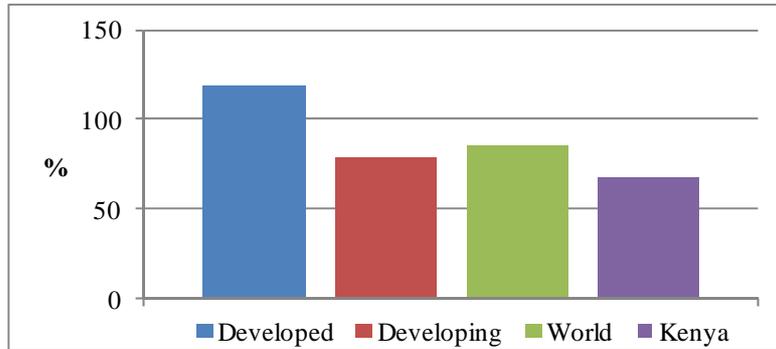
Fixed telephone subscription is evidently becoming marginal for communications in Kenya. There will be demand for fixed telephones in private offices, public institutions - schools, hospitals, police stations, public government, etc. However, local access by FTTx optic fibre cable should be developed within the frame of the current plan in order to maintain a certain level of system reliability.



Source: JICA Study Team (JST) based on ITU statistics

Figure 4.2.34 Percentage of Fixed Telephone Subscriptions Among Four Countries

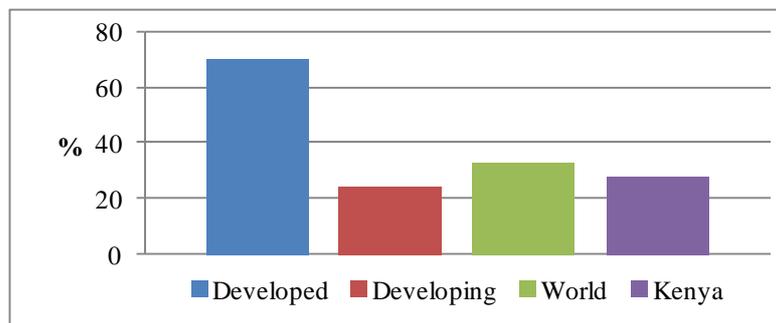
Figure 4.2.35 to Figure 4.2.37 compare Kenya globally, as well as with other developed and developing countries⁶ in terms of mobile subscriptions, individual internet use, and fixed telephone subscriptions in 2011. Mobile phone ownership and internet access in Kenya closely line up with the global average and those of the developing countries.



Source: JICA Study Team (JST) based on ITU statistics

Figure 4.2.35 Penetration Ratio of Mobile Subscriptions in Kenya Compared Globally

The penetration ratio for individual internet use in Kenya is close to the global ratio and that of the developing countries. A favorable network environment available to users will therefore bring a sharp rise in subscribers.

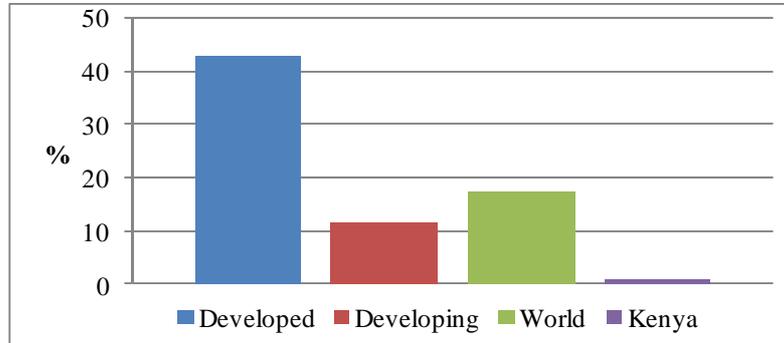


Source: JICA Study Team (JST) based on ITU statistics

Figure 4.2.36 Penetration Ratio of Individual Internet Use in Kenya Compared Globally

⁶ The developed/developing country classifications are based on the UN M49, referable URL: <http://www.itu.int/ITU-D/ict/definitions/regions/index.html>.

The low penetration ratio of fixed telephone subscriptions in Kenya stands out compared with the rest of the world. Since this is, however, a result of national policy by Kenya which emphasises mobile rather than fixed telephones, the low figure does not directly mean vulnerability in the telecommunications infrastructure classified as local access network in outside plants.

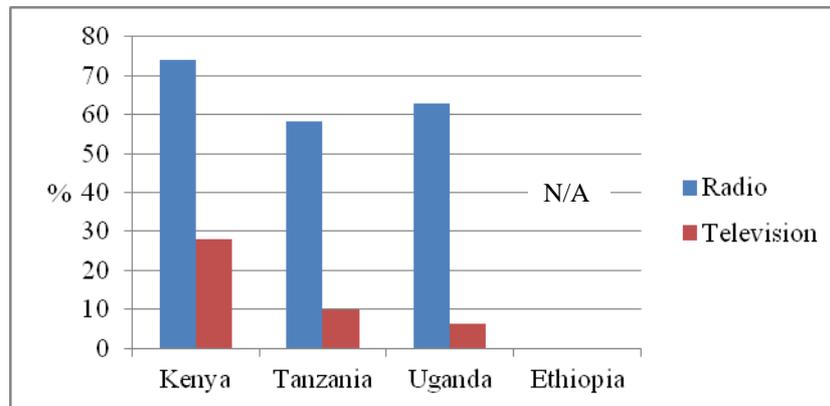


Source: JICA Study Team (JST) based on ITU statistics

Figure 4.2.37 Penetration Ratio of Fixed Telephone Subscriptions in Kenya Compared Globally

2) Broadcast

Figure 4.2.38 shows the percentage of households with radio and television in 2009 in Kenya and its neighbouring countries. The percentage of households with radio and television in Kenya is the highest amongst the countries. However, two thirds of all households in Kenya do not own a television.



Source: JICA Study Team (JST) based on ITU statistics

Figure 4.2.38 Percentage of Household with Radio and Television Among Four Countries

3) Postal and Courier Services

Although the number of licensed postal/courier operators in Kenya is approximately 200 as previously described, those in Tanzania and Uganda account for less than one third of the number of operators in Kenya as shown in Table 4.2.35. Compared with the difference in population amongst these countries, there is a great difference in the number of licensed postal/courier operators amongst neighboring countries. This means that the Kenyan postal/courier services market is more competitive than that of neighboring countries.

Table 4.2.35 Number of Licensed Postal and Courier Operators Among Four Countries

Category of Operators	Kenya	Tanzania	Uganda	Ethiopia
Public Postal Licensee	1	1	1	1
International Operators	14	5	8	N/A
International In-bound Operators	13	-	-	N/A
Regional Operators	13	3	7	N/A
Intra-country Operators	109	7	13	N/A
Intra-city Operators	39	31	-	N/A
Document Exchange Operators	1	-	-	N/A
Total	190	47	29	N/A

Source: JICA Study Team (JST) based on CCK Annual Report 2011/12, Uganda Communications Committee Website, Tanzania Communications regulatory Authority Website and Ethiopian Postal Service Enterprise Website

(6) Global Trend of Telecommunications

The International Telecommunication Union (ITU) published ICT Facts and Figures which shows continued and almost universal growth in ICT uptake in 2013. Some remarkable topics in this publication are shown below for comparison with the directions of Kenya Vision 2030.

1) In total, 6.8 billion mobile cellular subscriptions in 2013

The world population in 2013 will be 7.1 billion and the number of mobile subscriptions will be 6.8 billion. The mobile penetration ratios stand at 96% globally, 128% in developed countries, and 89% in developing countries. In 2013, the mobile penetration ratio in Kenya is estimated at about 80%, which exceeds the total African penetration ratio of 63.5%.

2) In total, 2.7 billion people, almost 40% of the world's population, are online in 2013

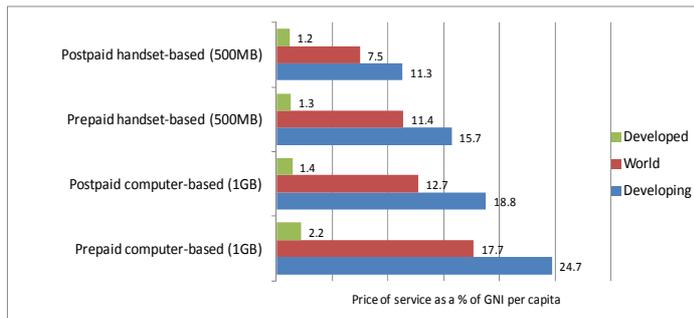
In 2013, over 2.7 billion people are using the internet, which corresponds to 39% of the world's population. In the developing world, 31% of the population is online, compared with 77% in the developed world. In Africa, 16% of the population uses the internet, which is only half the penetration ratio of Asia and the Pacific. In 2013, internet penetration in Kenya will reach 70%, far over the African figure and almost at the level of the developed world.

3) Continuous growth of mobile broadband is expected

Mobile broadband subscriptions have climbed from 268 million in 2007 to 2.1 billion in 2013. This reflects an average annual growth rate of 40%, making mobile broadband the most dynamic ICT market. In developing countries, the number of mobile broadband subscriptions more than doubled from 2011 to 2013 (from 472 million to 1.16 billion) and surpassed those in developed countries in 2013. Africa is the region with the highest growth rates over the past three years and mobile broadband penetration has increased from 2% in 2010 to 11% in 2013. This trend is followed by Kenya as well.

4) Mobile broadband is much more expensive in developing countries

By early 2013, the price of an entry-level mobile broadband plan represents between 1.2-2.2% of monthly GNI per capita in developed countries and between 11.3-24.7% in developing countries, depending on the type of service. However, in developing countries, mobile broadband services cost considerably less than fixed broadband services, i.e., 18.8% of monthly GNI per capita for a 1 GB postpaid computer-based mobile broadband plan compared to 30.1% of monthly GNI per capita for a postpaid fixed broadband plan with 1 GB of data volume. Amongst the four typical mobile broadband plans offered in the market, postpaid handset-based services are the cheapest and prepaid computer-based services are the most expensive, across all regions. A regional comparison highlights, that mobile broadband services remain largely unaffordable in Africa, where the price of a computer-based plan with 1GB of data volume represents, on average, more than 50% of GNI per capita. This situation can be applied to Kenya as well.



Source: International Telecommunication Union (ITU)

Figure 4.2.39 Price of Mobile Broadband Services, Early 2013

CHAPTER5 CONSTRAINTS AND PLANNING ISSUES

5.1 Overview of Constraints and Planning Issues

The overall constraints and issues are identified through thematic working groups as well as stakeholder and public meetings, which are compiled based on the points of view of urban planning, urban transport, and socioeconomic factors. Some of these are caused by outdated urban development management mechanisms, including the lack of a master plan, development implementation scheme, land use control, and institutions. The sectoral constraints and their resolutions are shown in Section 5.3.

(1) Urban Planning

- 1) Lack of Sufficient Urban Infrastructure (water supply, sewage, waste disposal, power supply, telecommunications, etc.)

A number of infrastructure plans have already been prepared but many are not implemented. In some cases, the lack of coordination between Nairobi City and the national governments hinders the process. Since population projection that can be shared by stakeholders has not been available and the land use plan that justifies the infrastructure has been weak, the feasibility and efficiency of the infrastructure plans were not secured.

- 2) Sprawl and Expansion of Uncontrolled Urban Development

The sprawl and expansion of uncontrolled urban development occurs for several reasons, and the main reasons are that the master plan is outdated, and the development permit and land use plan are not linked. In order to stop urban sprawl, the master plan has to be updated to match the development trend and implementation mechanism of the master plan. In addition, the development permit system has to be strengthened.

- 3) Uncontrolled Development by the Private Sector (insufficient affordable housing and unplanned development)

In addition to the issues mentioned in (2), the lack of proper public awareness on development control is another cause of uncontrolled development. Some people are unaware that development and building permits are required for development. Disseminating the master plan and rules of development is necessary to reduce uncontrolled development.

- 4) Excessive Concentration in the Central Business District (CBD)

One of the major issues in Nairobi City is heavy congestion in the urban centre, particularly in and around CBD, where existing radial roads bring all the traffic to CBD. An integrated development plan has not been prepared for CBD, railway yard, the upper hill, the Nairobi river front, and Moi Avenue, which have all been planned separately. Integrated CBD development and linkage between CBD and other areas have to be considered together.

Urban planning issues are summarised in Figure 5.1.1 below.

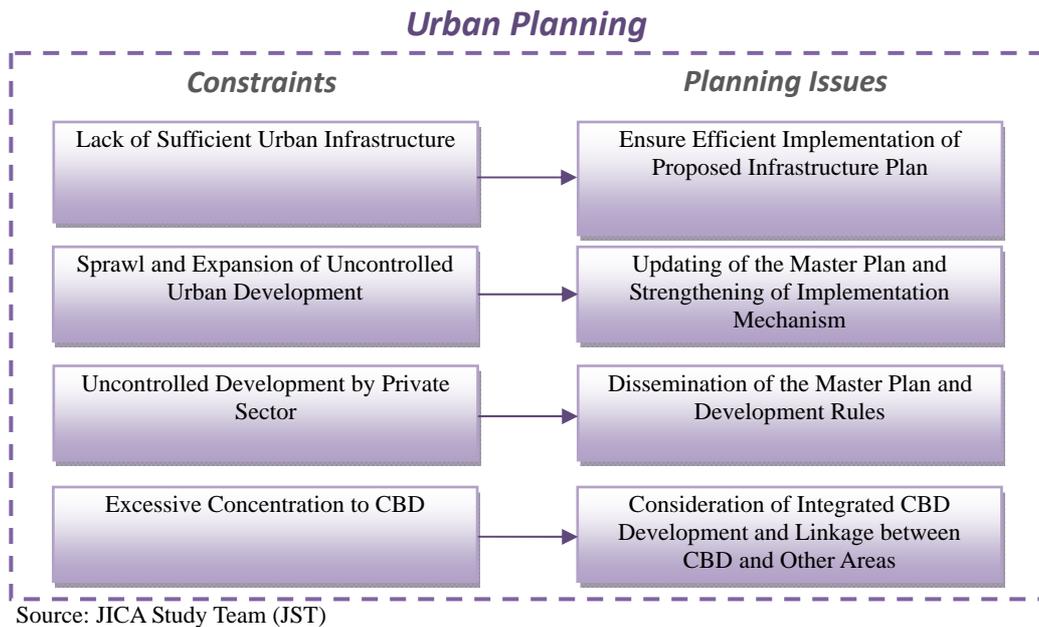


Figure 5.1.1 Urban Planning Issues in Nairobi City

(2) Urban Transport

1) Passage of International Transportation Route Through the Urban Centre

Uhuru Highway, which passes through the centre of Nairobi City, is a part of the main road connecting Mombasa to Kisumu and further constitutes the Northern Economic Corridor. Thus, a number of heavy trucks and trailers pass through Nairobi City. The road network within and around Nairobi City has to be improved to divert the through traffic to bypass routes, and reduce congestion in Nairobi City.

2) Rapid Increase of Private Vehicles

There has been a rapid increase in passenger cars in the past several years and road development cannot catch up with the number of vehicles. The road development mechanism, including planning, finance, rules for development, and coordination amongst stakeholders, has to be strengthened.

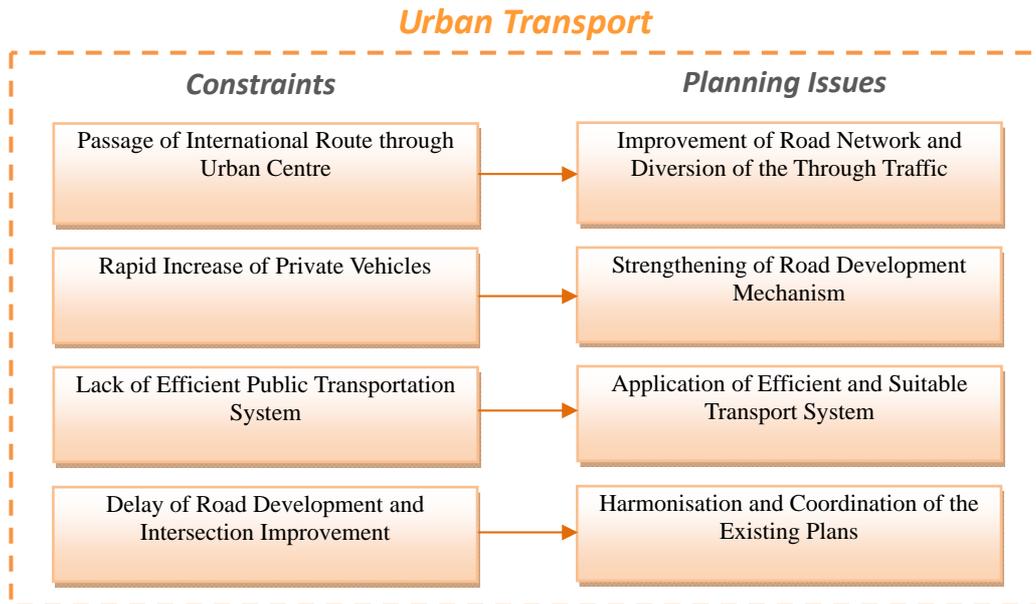
3) Lack of Efficient Public Transportation System (Mass Rapid Transit (MRT) and Bus Rapid Transit (BRT))

For a city with a population of more than three million, mass public transport mode is usually available, but Nairobi City does not have such transport mode yet. The improvement of roads is not sufficient to solve the traffic congestion once and for all, because the number of cars will increase. A public transportation system has to be considered together with the road improvement.

4) Delay of Road Development and Intersection Improvement (includes suburban areas)

There have been many transportation improvement plans but only a few plans have been implemented. In order for these plans to be efficiently implemented up to the year 2030, the land use plan and transport plan have to be synchronised and coordinated.

Urban transport issues are summarised in Figure 5.1.2 below.



Source: JICA Study Team (JST)

Figure 5.1.2 Urban Transport Issues in Nairobi City

(3) Socio-economy

1) Safety and Security in Districts

Safety and security is identified as a priority social concern. Poor planning, design, and management of the area are some of the numerous factors that give rise to crime and violence in the city. The existing governance, legal, and institutional frameworks have also failed in providing the much desired safe and secure city. The lack of safety and increasing insecurity in Nairobi City have contributed largely to the loss of property and even sometimes the loss of possible investment opportunities. Consequently, the county is losing in its economic development agenda both in terms of losses in human and financial resources. Proper urban development with a strong institution can mitigate the safety and security issues.

2) Inadequacy of Proper Housing for a Variety of Income Groups

Providing housing for all income levels of people is one of the challenging issues. The issues of housing can be characterised as high rent, poor housing conditions, congested residential areas, and not enough housing for low income people, which are believed to be one of the causes of urban sprawl. The government should control housing to provide proper housing through sub-centre development and institutional strengthening. Housing should also be provided through public and private collaboration.

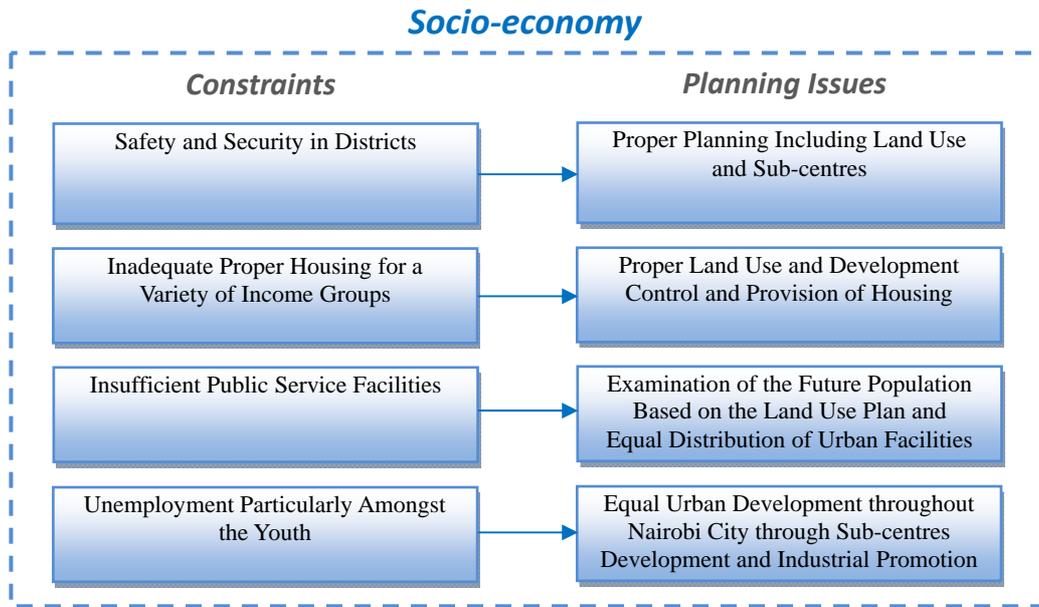
3) Insufficient Public Service Facilities (educational and health facilities, regional facilities, and open spaces)

Because the population projection and allocation of the population in Nairobi City are not clear, it is difficult to prepare plans for social facility development. A number of public facilities that need to be developed have to be examined based on the future population and its allocation based on the land use plan.

4) Unemployment Particularly Amongst the Youth

Unemployment, particularly amongst the youth, was identified as one of the social issues for most of the districts in Nairobi City, which is caused mainly by the lack of skills and poor access to the job market. Equal distribution of social facility development for capacity development and sub-centre development in order to improve access to employment opportunities are also expected to contribute to improving employment conditions. In addition, industrial development has to be promoted.

Socioeconomic issues are summarised in Figure 5.1.3 below.



Source: JICA Study Team (JST)

Figure 5.1.3 Socioeconomic Issues in Nairobi City

5.2 Issues of the 1973 Nairobi Strategic Plan

Section 2.4.2 (4) of the Nairobi Metropolitan Growth Strategy 1973 describes the outline of the plan. One of the issues that Nairobi City County faces is that the strategy has not been realised and this master plan should propose measures to secure implementation that were not covered in the strategy. Issues for the implementation of the strategy are compiled based on some reports and technical working group discussions.

- (1) Recommendation has not been realised.

Since the plan covers the development direction, the detailed plans/programmes based on the strategy have to be prepared. The action area proposal including detailed land use, road and utility planning areas for development, housing policy, programme, and implementation were amongst the recommendations in the strategy. Also, the short-term plan or priority has not been identified. The lack of a detailed plan and prioritisation have resulted in development without the guidance of a detailed localised zoning system and development without regard to the limitations of the existing infrastructure, transport, and utility facilities to support increased development in the planned area.

(2) Measures for private fund promotion are not clear.

Urban development requires public and private sector involvement. The private sector plays an important role in urban development, but the mechanism of private sector development was not developed which resulted in the lack of funding from the private sector. The mechanism of private investment promotion is necessary to be developed.

(3) Capacity of City Council of Nairobi (then) was not fully utilised in terms of number and skills.

Nairobi City County is now responsible for following up the action recommended in the strategy. Due to the lack of capacity of then City Council of Nairobi, in terms of number of staff and skills, follow up action was not taken. Such skills cover planning, control, and implementation management.

(4) Legal framework was not developed.

The legal framework for implementation of the strategy had not been developed for a long time. Even though some regulatory frameworks have been developed, such as the Physical Planning Act and Urban Areas and Cities Act, after the preparation of the strategy, the legal justification of implementation was not fully prepared, which resulted in uncontrolled land use management and infrastructure development.

(5) There is lack of commitment and political will.

Public awareness on urban development was weak both from the public side and political side. Resources (financial and human resources) have not been fully allocated for implementation. Urban development was not considered a priority.

5.3 Sector Constraints and Planning Issues

5.3.1 Constraints and Planning Issues for Land Use and Settlements

Constraints and planning issues for land use and settlements are cross-cutting and comprehensive. As discussed with the counterpart, the following constraints and planning issues are identified.

(1) Quarrying/Mining

1) Constraints

- Location and compatibility with other land uses, ways of extractions, pollution, and disasters

2) Planning Issues

- Develop a mining and reclamation policy

(2) Industry

1) Constraints

- Diminishing industrial sector with only 3% of the entire city workforce

- 2) Planning Issues
 - Create new industrial areas close to high density districts
- (3) Commercial
 - 1) Constraints
 - Primacy of the core CBD that contributes to traffic congestion
 - Proliferation of small-scale informal trading
 - Flight of major commercial functions from the CBD
 - 2) Planning Issues
 - Development of multi-storey CBD in formal trading centres close to high density estates
 - Creating mixed land use districts
 - Selling of development rights for developing beyond the permissible plot ratios - revenue streams to the county
- (4) Residential
 - 1) Constraints
 - Densification in existing residential areas
 - Strain on existing infrastructural services
 - Loss of neighbourhood architectural character
 - Loss of privacy
 - Lack of proper rationalisation criteria for plot ratios within neighbourhood
 - Loss of building lines and open spaces
 - Creation of parking on road reserves and loss of greens and pedestrian paths
 - 2) Planning Issues
 - Planning and design study towards sustainable local area redevelopment plan
 - Constant monitoring and review of redevelopment criteria
 - Neighbourhood commercial centres with core centre of higher plot ratios
- (5) Informal Residential
 - 1) Constraints
 - Lack of accessibility and connectivity to services

2) Planning Issues

- Planning for areas, servicing, site and service, and creation of employment centres

5.3.2 Constraints and Planning Issues for Urban Transport

(1) Urban Transport

1) Radial Network System

i) Constraints

Presently, the network system in Nairobi City is mainly composed of a radial pattern focusing on the CBD as its centre. Moreover, most essential radial roads also function as the international transport axes. In this way, traffic flow on the international roads affect the movement of local traffic in the entire Nairobi City.

ii) Planning Issues

To this day, development of circumferential roads to divert traffic away from the city centre is necessary.

2) Increase of Incoming Vehicles to Nairobi City

i) Constraints

As the urban activities in Nairobi City become more active, traffic flow into the Nairobi City area will also grow rapidly. Most of the incoming traffic seem to have a destination in the city centre area.

ii) Planning Issues

Dispersion of functions in the city centre, especially those that are not necessarily located in the city centre, is urgently required for relocation to a suburban location.

3) Chronic State of Traffic Congestion

Compared with the traffic condition in 2004, traffic congestion has worsened over time in terms of extent and area. Since the growth in population as well as the sharp increase in car ownership are inevitable in the future, quick fix-type measures will not solve the problem fundamentally.

4) Measures Necessary to Enhance Modal Shift to Public Transport

i) Constraints

A large number of passengers waiting for a bus or *matatu* are observed during peak hours. Moreover, facilities such as bus stops are inadequate and the timetable is seldom prepared. In some areas, the quality of public transport services is insufficient, which causes an extensive use of private vehicles.

ii) Planning Issues

The timetable of *matatu* or stable transportation system is essential for passengers who intend to transfer to other public transport modes. Measures for the convenience of public transport

passengers should be introduced before the development of an advanced mass transit system is started.

5) Strengthening of Traffic Management

i) Constraints

Traffic counting at major intersections was conducted in this survey, and is being analysed. Evidently, manual traffic control by a police officer is not efficient to achieve the maximum capacity of intersections. Immediate introduction of signal control system is necessary. In the near future, the number of motorcycles is presumed to increase rapidly.

ii) Planning Issues

In the circumstance that there would be a rapid increase of motorcycles, better regulation and improved driving manners shall be launched to create harmony with other vehicle operations.

6) Systematic Development of Road Network

i) Constraints

According to the staging plan in The Study on Master Plan for Urban Transport in the Nairobi Metropolitan Area, the short-term (2006-2010) measures include missing links (arterials) and radial roads within C-3. In the medium term (2011-2015), development of missing links (collector and local), radial roads outside C-3 (north and west), and circumferential road C-3 was scheduled. The bypass roads, link roads, link road extensions, radial roads outside C-3 (south and east), and circumferential roads C1 and C2 were expected in the long term. While many of the proposed measures have not been followed, routes not included in the proposal such as the eastern bypass and northern bypass were constructed, while the southern bypass is under construction.

ii) Planning Issues

Construction of roads in the city centre is not progressing much except for some missing links. Systematic road development should be examined again.

7) Requirement of Non-motorised Transport Protection

i) Constraints

While pedestrian crossings and pedestrian signals are not sufficiently installed in Nairobi City, non-motorised transport (NMT), especially pedestrians, are exposed to danger as the traffic volume increases. In the current condition, women, children, and persons with disability will have difficulty of travel not only in the city centre but also in suburban areas.

ii) Planning Issues

Road markings for pedestrian crossings and pedestrian signals are urgently required to be improved. Education on road safety for pedestrians should be conducted.

(2) Railway

1) Constraints

Based on the existing concession agreement between Kenya Railways Corporation (KRC) and Rift Valley Railways (RVR), RVR is responsible for the passenger train operation,

maintenance, and rehabilitation of the rolling stock owned by KRC. Although the government would provide US\$1 million annually, in the maximum case, RVR shall pay US\$5 million to KRC annually as the concession fee for the passenger train operation.

Considering the existing condition of the rolling stock and track structure, it is hard to gain such an amount from the passenger train operation. Although the main body of the RVR has been changed from Sheltam (South Africa) to Citadel (Egypt) in 2010, there is no clear sign of improvement in the passenger train operation, as typically seen in the available number of diesel locomotives which has not increased.



Source: KRC Annual Report



Source: JICA Study Team (JST)

Figure 5.3.1 Existing Passenger Train Operation by RVR (left), Sample Photo of DMU (right)

There is a high number of commuters with limited services to cater to the high demand; for instance, there are only one or two trains operating in the morning and evening hours. The trains have limited coaches that cannot serve the increasing demand. There has been no significant investment in commuter railway transport in Nairobi City over the years; increasing the number of trips per day on each corridor is essential and expansion of the tracks should be prioritised.

In order to improve the situation of the passenger train operation, the following ideas can be considered as short-term projects:

- Introduction of Diesel Multiple-Units (DMUs)

DMUs are passenger car units equipped with diesel engines below the floor of each car. DMU can be operated at non-electrified section without heavy investment.

DMU can be operated at higher speeds than passenger trains pulled by a diesel locomotive.

- Rehabilitation of track structure

Prior to the start of passenger train operation by the concessionaire, it was reported that 61 derailments occurred in a month due to the poor condition of the existing track structure. Therefore, the maximum speed is limited to a very low speed. If the track structure is rehabilitated to allow higher speed train operation, the traffic volume of each line can be increased accordingly.

2) Planning Issues (Future MRT/ Light Rail Transit (LRT) Projects)

Although the detailed design for the first MRT line along Thika Road was planned to commence in 2011 after the completion of the feasibility study, there has been no action taken so far. Because of the completed construction of the modern and wide highway on Thika Road, the requirement of MRT along the road does not seem to be very critical.

On the other hand, severe traffic congestions are observed along Ngong Road, Waiyaki Way, and Juja Road.

Therefore, review of the feasibility study report is urgently required in order to revise the priority of MRT/LRT projects.

(3) Airport

Air passengers and cargo volume are growing, so both transport and logistics in and around airport facilities are congested. The restriction of building height and land use for aircraft takeoff and landing is a constraint for solving urban issues. Especially, possible bird strikes above the planned landfill at Ruai is a controversial issue.

1) Constraints

- Inadequate existing cargo facilities
- Limited internal and external accessibility
- Inadequate sectoral plans
- Lack of integration between the airport and other modes
- Encroachment and incompatible land uses
- Accessibility challenges especially of Wilson Airport from Langata Road

2) Planning Issues

- Airports provide opportunities for medical evacuation and other rescue missions
- Provide opportunity for multimodal integration
- Availability of land for expansion
- Opportunity for business travel/tourism and national economy
- Opportunity for development of helipads

5.3.3 Constraints and Planning Issues for Infrastructure

(1) Water Supply

As described in this subsection, the water demand of Nairobi City is over the supplied amount at present. Furthermore, as the population of Nairobi City is projected to increase rapidly, the shortage of water is a critical issue. To resolve the issue, the following subjects need to be considered:

1) Development of Water Resource and Facilities for Water Supply

i) Constraints

To meet the increase of population in the future, the development of the water supply system including water resources is indispensable. The master plan of the development is studied under the Ministry of Water and Irrigation (MWI) and Athi Water Services Board (AWSB) with financing from the World Bank (WB) and Agence Francaise Developpement (AFD).

ii) Planning Issues

In this study, the population of Nairobi City is projected for the urban development plan of the city. The water demand will be estimated based on the population. Comparing the water demands estimated in this study and the master plan, the annually stepped development plan will be reviewed for adjustment of the development plans between water resources and water

supply facilities by MWI and AWSB as well as the urban development plan by the Nairobi City County (NCC).

2) Improvement of Unaccounted for Water (UfW)

i) Constraints

The improvement of UfW is targeted at 20% in the practical manual issued by MWI. To meet the target, periodical surveys of leakage in the distribution network need to be conducted. While the Nairobi City Water and Sewerage Company (NCWSC) is in charge of maintenance of the network, only repair after leakage breakout is conducted.

ii) Planning Issues

Technical support in order to establish the survey team in NCWSC and a study of the tariff to cover the budget of the team are necessary.

3) Schedule of Replacement of Water Supply Facilities

i) Constraints

As almost all water supply facilities were constructed from 1950 to 1980, the necessity of replacing the water supply facilities to recover the capacity of water supply has arisen in these years.

ii) Planning Issues

Comprehensive schedule based on the evaluation of the water supply facilities is necessary for maintaining the designed capacity of the facilities and discussing the financial plan for the replacement project.

4) Role of NCC in Water Supply

i) Constraints

The structure of organisations for water supply services has been already established under the Water Act 2002. While the main roles of planning, implementing, and operating the water supply projects were appointed to the Water Services Regulatory Board (WSRB), World Scout Bureau (WSB), and Water and Sanitation Program (WSP), NCC does not have a role directly concerning water supply under the structure.

ii) Planning Issues

The development of the water supply system is one portion of urban development. For its implementation, harmonisation amongst the sectors of transportation, sewerage and drainage, electricity, telecommunications, and water supply is indispensable.

From the situation described above, establishing a committee is necessary for NCC in order to collect/update information about water supply projects from the related organisations and to hold a meeting amongst the sectors for discussing how to reflect the information to the urban development plan. In this study, collecting plans and reviewing them based on the study results such as the projection of population and land use will be carried out to support the action.

(2) Stormwater Drainage and Sewerage

1) Stormwater Drainage

i) Constraints

There is no usable technical data (master plan, project documents, as-built drawings, etc.) available with the City Engineering Department of NCC for carrying out planning, design, construction, and maintenance of the stormwater drainage system in Nairobi City at present. The absence of such technical data makes it hard to properly manage the development and maintenance of the stormwater drainage system and results in problematic situations that remain unimproved as described before in subsection 4.1.6.

ii) Planning Issues

The Ministry of Local Government (MOLG) has a plan to carry out the preparation of a master plan for stormwater drainage in Nairobi City under the Kenya Municipal Program (KMP). The Nairobi Integrated Urban Development Master Plan (NIUPLAN) proposes a concept for infrastructure development including the stormwater drainage system in line with the formulation of an urban development master plan for Nairobi City. For coordinating urban development with the stormwater drainage development in the future, a concept for infrastructure development to be proposed by the NIUPLAN will need to be incorporated into the preparation of the master plan for stormwater drainage in Nairobi City by the MOLG.

From the issues identified in the process of the NIUPLAN, such a master plan for the stormwater drainage in Nairobi City needs to include the following principal requirements:

(i) Systematic identification of stormwater drainage network

Extensive baseline surveys should be carried out to identify the existing stormwater drainage network systematically from upstream to downstream; comprising the drainage segments such as roadside drains, secondary drains, trunk drains, and river channels in each of the catchment areas drained respectively by the tributaries of the Nairobi River (e.g., the Gitathuru, Rui Ruaka, Nairobi and Ngong rivers).

The results of the baseline surveys should be compiled into a database (e.g., GIS) for the identification of the type, location, and dimensions for each drainage segment as well as the problematic locations in each catchment area.

(ii) Hydraulic assessment

In each catchment area, hydraulic assessment for the stormwater drainage network should be performed systematically from upstream to downstream. As a result of the hydraulic assessment through the application of design rainfall intensity-duration-frequency (IDF), the required hydraulic capacity should be identified to design each drainage segment. For the purpose of the future plan, the hydraulic assessment should be performed on the basis of future land use conditions in each catchment area.

(iii) Overall development plan

Based on the baseline surveys and hydraulic assessment, an overall development plan of the stormwater drainage system should be prepared for each catchment area. The stormwater drainage system should be planned systematically from upstream to downstream for draining storm water eventually to the downstream end of the catchment area through a series of designed drainage segments. Stormwater retention facilities should be included in the plan as required for alleviating rapid concentration of stormwater drained from urbanised higher areas within the catchment area.

(iv) Implementation Plan

A series of stormwater drainage works under the overall development plan should be subject to evaluation from technical, economical, financial, social, and environmental viewpoints. The priority development works should be initiated in accordance with the implementation plan prepared with due consideration of the evaluation results.

From the technical viewpoint, the stormwater drainage works within the catchment area should be developed first from the downstream segments (e.g., river channel, trunk drains) and then extended over the upstream segments (e.g., secondary drains, roadside drains).

(v) Review of design standards and specifications

Design standards and specifications should be reviewed for improving the functional problems on existing stormwater drainage works. Reviewed design standards and specifications should be applied in the succeeding feasibility study, final design, construction works, and operation and maintenance (O&M) plan for upgrading the stormwater drainage works.

2) Sewerage

i) Constraints

The capacity of the existing sewerage system in Nairobi City is insufficient to cope with the sewerage generated at present in terms of sewerage collection and treatment. The available data suggest that the sewage generated would be less treated or untreated as a whole and then discharged eventually to the tributaries of the Nairobi River.

The total sewerage inflow received by the existing sewerage treatment works (STWs) is estimated in the order of 100,000 m³/day. Although, the water quality of treated outflow discharged from the STWs does not meet the effluent standards¹.

The total water distributed is estimated at around 400,000 m³/day² and the total billed water consumption is recorded at around 300,000 m³/day³. Assuming that the sewerage generation would be almost equivalent to the actual water consumption, the total amount of sewerage generated from the water supply service areas by NCWSC is estimated in the range of 300,000 to 400,000 m³/day. It is therefore presumed that more than 200,000 m³/day would not be conveyed to the existing STWs but discharged eventually to the rivers through existing sewers or other drains.

According to the NCWSC, buildings and households served by the existing sewerage system discharge their wastewater directly to the combined sewers. Other than the areas covered by the existing sewerage system, the majority of households have septic tanks or latrines. Septic tanks and latrines are emptied by registered private firms. Removed sludge is transferred by tankers and then disposed at the Dandora Estate STW. The number of registered private firms is 36. It is suggested that the removed sludge would be sometimes dumped illegally as the operations of these private firms are not monitored⁴.

In informal settlements, removal of sludge from latrines is handled by small-scale operators working under unsanitary conditions. Removed sludge is disposed into sewer inlets, rivers, and drainage ditches⁵.

1 NCWSC Quarterly Report, July-September 2011

2 Feasibility Study and Master Plan for Developing New Water Sources for Nairobi and Satellite Towns, MWI/AWSB, February 2011

3 Water Consumption by Consumer Category 2010/2011, NCWSC

4 Preparatory Survey on Nairobi Urban Development Programme, JICA, October 2011

5 Strategic Guidelines for Improving Water and Sanitation Services in Nairobi's Informal Settlements (NCWSC/AWSB, 2009)

ii) Planning Issues

The AWSB has been implementing a series of sewerage development works including the rehabilitation and expansion of the existing STWs as well as construction of trunk sewers and reticulation networks under the Water and Sanitation Service Improvement Project (WaSSIP) (2007-2015) and Sewerage Improvement Project (2011-2016).

According to the project appraisal report of the Sewerage Improvement Project (AfDB, July 2010), the following achievements are expected upon completion of the project:

- (i) Total capacity of existing STPs: 192,000 m³/day (= Dandora 160,000 + Kariobangi 32,000) to meet the effluent standards (BOD₅ < 30 mg/L)
- (ii) Percentage of population with sewerage access: increasing up to 59% (from 40% in 2009)

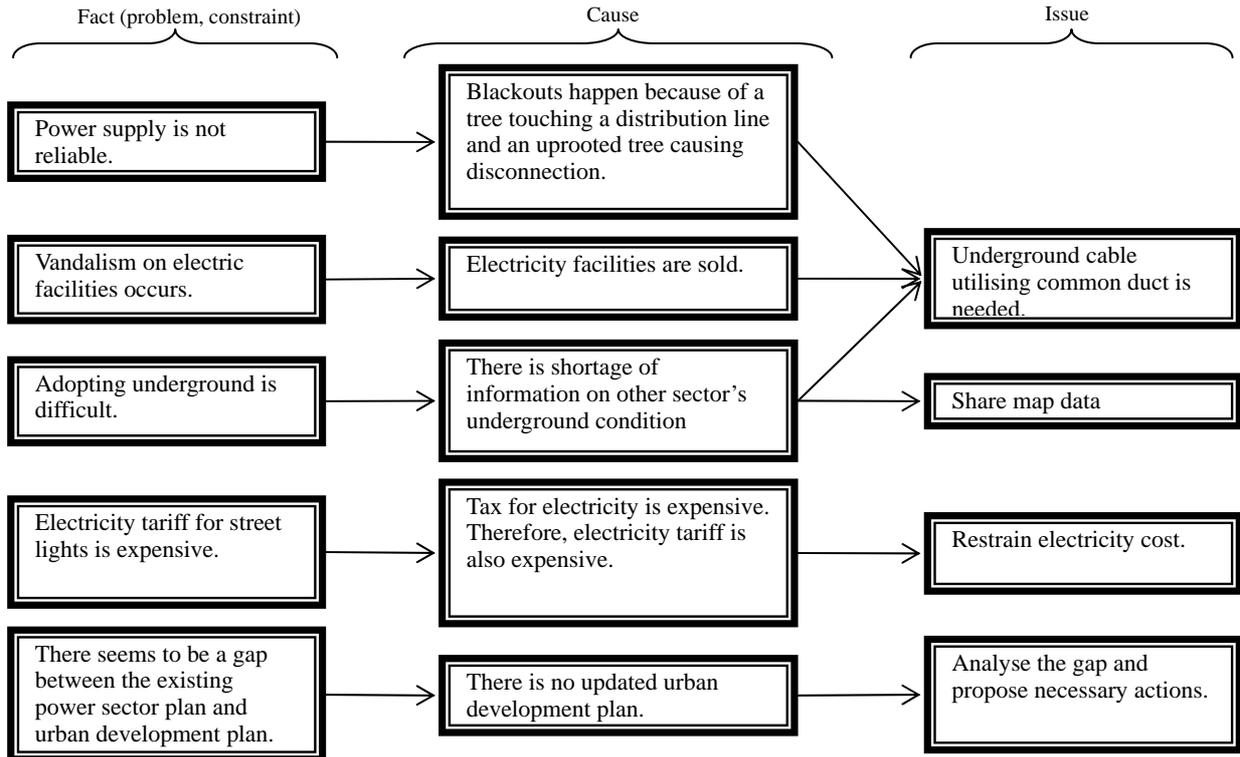
To ensure the achievements above, it is essential to carry out the activities to support the performance of the augmented sewerage system before commencement of its operation. The O&M for the STWs should be well organised to attain and keep the treated water quality satisfying the effluent standards. Household connections with existing and expanded reticulation network should also be accelerated for increasing the actual volume of sewerage collection and treatment.

Disposal of sludge removed from septic tanks and latrines should be managed properly through strengthening of the administrative system relevant to sanitation as well as augmentation of disposal site (e.g., Dandora Estate STW and/or possible alternatives). The improvement of unsanitary disposal of latrine sludge in informal settlements is being discussed and handled as a part of the water and sanitation improvements supported by different projects (e.g., Water and Sanitation Service Improvement Project (WaSSIP), Kenya Informal Settlements Improvement Project (KISIP)).

For further development of the sewerage system in Nairobi City, the AWSB plans to update the Nairobi City Sewerage Master Plan under the WaSSIP. Besides, the NIUPLAN proposes a concept for infrastructure development including the sewerage system in line with the formulation of an urban development master plan for Nairobi City. For coordinating urban development with the sewerage development in the future, it is expected that a concept for infrastructure development to be proposed by the NIUPLAN will need to be incorporated into the update of the sewerage master plan by the AWSB.

(3) Power Supply

As the population and economy grow in Nairobi City, power demand also grows. According to the field survey as well as discussion in the working group, the following issues (from fact finding to qualitative analysis) are preliminarily identified:

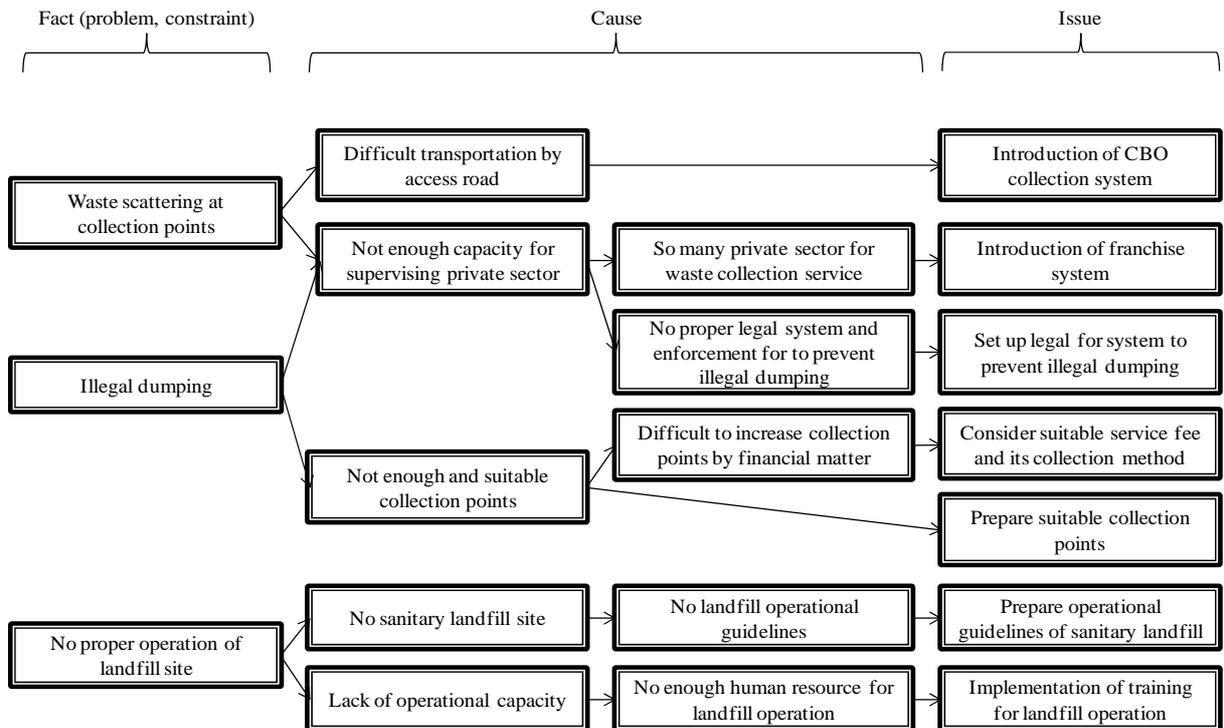


Source: JICA Study Team (JST)

Figure 5.3.2 Preliminary Identified Issues through the First Survey (Power Supply)

(4) Solid Waste Management

According to the field survey and hearing with Department of Environment (DOE) as well as discussions in the working group, the following issues are preliminarily identified (from fact finding to qualitative analysis). The identified issues will be reflected in the next stage planning.



Source: JICA Survey Team (JST)

Figure 5.3.3 Preliminary Identified Issues (Solid Waste Management)

(5) Telecommunications

1) Constraints

The current condition of telecommunications in Kenya is summarised below.

- (i) Mobile penetration in Kenya reached more than half the population. At the same time, fixed telephones, internet, and postal services are not widespread.

Table 5.3.1 Major Telecommunications Indicators

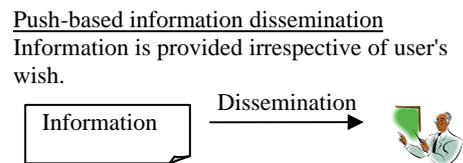
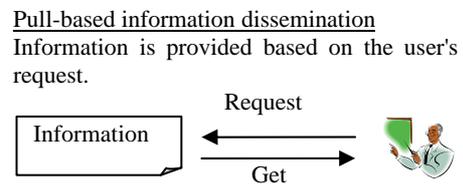
Indicators	Penetration Ratio	
Fixed Telephone Penetration Ratio	0.7%	(as of 2011)
Mobile Telephone Penetration Ratio	64.8%	(as of 2011)
Internet Use Penetration Ratio	28%	(as of 2011)
Broadband Users	1.8%	(as of 2012)
Postal Service Use	12%	(as of 2011)

Source: ITU, National ICT Survey Report 2011 (CCK), Annual Report 2011/12 (CCK)

- (ii) Indicators for Nairobi City are higher than the national figures. There is a difference in the distribution of the Information Communication Technology (ICT) equipment between urban and rural areas.
- (iii) Unintegrated telecommunications infrastructures of various service providers in Nairobi City has adverse effects on urban landscape preservation.
- (iv) Uneven quality of construction and installation works
- (v) Insufficiency in information sharing and inefficiencies in governmental administrative services
- (vi) Insufficiency in information dissemination to citizens

The above constraints are attributed to the following causes:

- (i) Local access network from the local exchange and base transceiver station is not expanded to all end users.
- (ii) Capacity of the metro trunk communication network is insufficient.
- (iii) Low reliability and insufficiency of postal services in contrast to availability and reliability of SMS, e-mail, and courier services
- (iv) Telecommunications operators deploy their infrastructure such as fibre optic cables and antenna towers individually in accordance with their own marketing strategy.
- (v) Not all telecommunications contractors comply with the government agencies' codes and regulations for installation and maintenance of communications infrastructure.
- (vi) Government officers have insufficient awareness of ICT and information sharing. There is a lack of ICT equipment and infrastructure including intranet and



Source: JICA Study Team (JST)

Figure 5.3.4 Pull-based and Push-based Information Dissemination

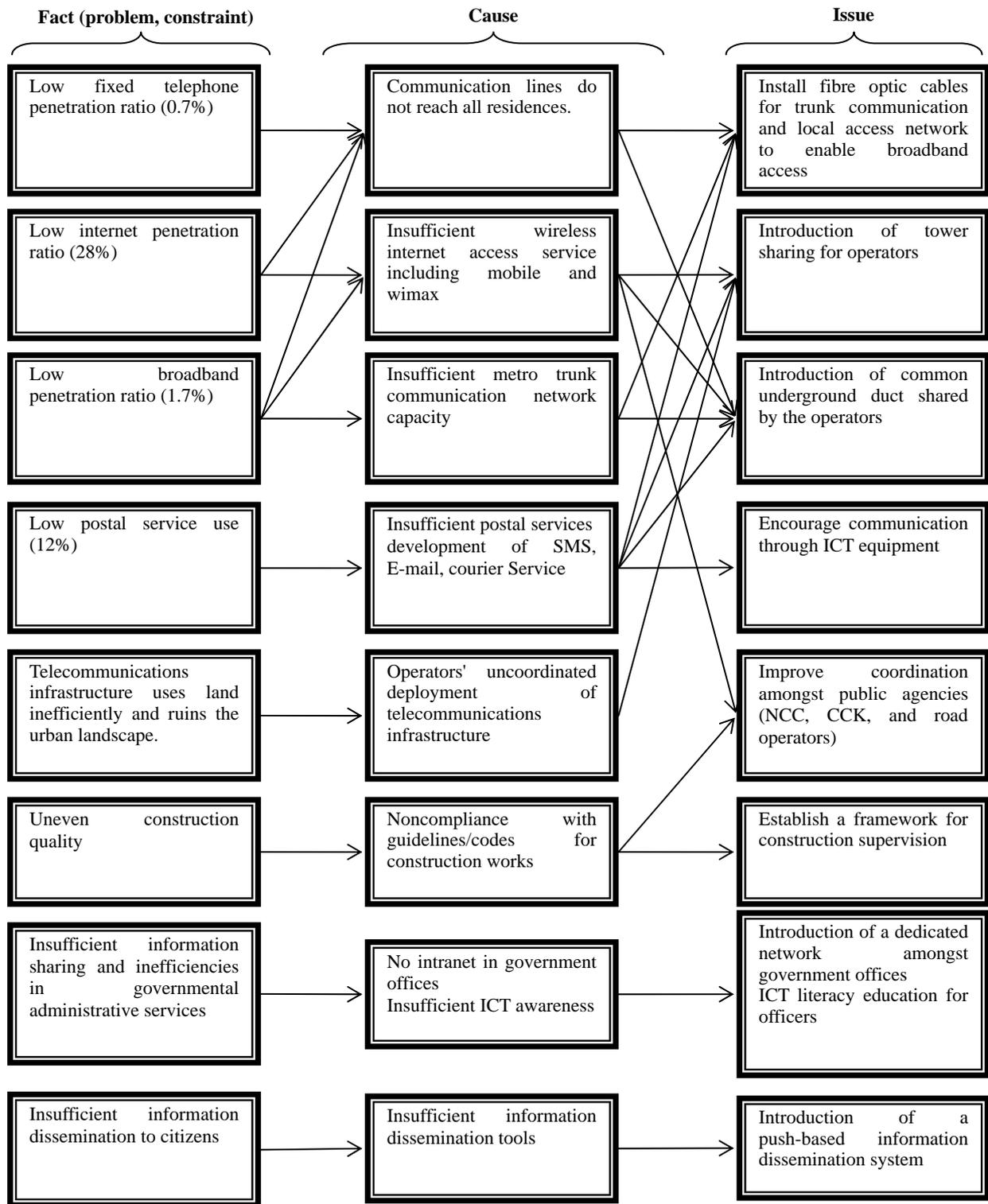
database servers for information sharing.

- (vii) NCC has a pull-based information dissemination tool including a webpage on the internet but has no push-based information dissemination tool. The pull-based information dissemination requires citizens' action such as accessing the internet and checking the website to get the information. Thus, not all the citizens can get the information at the same time. Emergency information to protect life and property shall be equally provided to all citizens.

2) Planning Issues

The following telecommunications infrastructures and policies are key to implementing the integrated urban development plan for Nairobi City:

- (i) Metro trunk communication network based on optic fibre cable
- (ii) Local access network provided through fibre optic cable and wireless access typified by Long Term Evolution (LTE)
- (iii) Common infrastructure including underground ducts and towers to be shared amongst the telecommunication operators for infrastructure aggregation
- (iv) Improve coordination amongst public agencies (NCC, CCK, and road operators)
- (v) Establish a framework for the construction and installation works' supervision
- (vi) Introduce dedicated networking amongst government offices
- (vii) Raise ICT awareness
- (viii) ICT literacy education to utilise ICT equipment
- (ix) Introduce a push-based information dissemination system



Source: JICA Study Team (JST)

Figure 5.3.5 Constraints and Planning Issues for Telecommunications

5.3.4 Constraints and Planning Issues for Governance and Institution

After the new constitution was in effect in 2010, new laws have been prepared and executed. The County Government Act (2012) and Urban Areas and Cities Act (2011) are amongst the newly developed acts. In addition, the Physical Planning Act, which is a base for physical development, will be replaced by the Spatial Planning Act. These acts show general instruction on urban development but the details on execution are not mentioned. Moreover, one of the issues of 1973 Nairobi Strategic Plan was the weak implementing organisation.

Institutional issues can be classified into: (i) development control, (ii) development management, (iii) private sector promotion, (iv) public participation, and (v) master plan implementation organisations.

- (1) Development control: Linkage (coordination) between building control and development control is not clear for development control.

NCC is responsible both for building control and land development control. Building control is managed by the Development Control Section and development control is managed by the Programme Implementation Section (PIS). The Development Control Section and PIS coordinate for building and land development, but the standard for urban development is not clearly stated. The building code, which is a base for building control, does not mention the so-called “performance-oriented bulk control system”, which consists of building restrictions in line with urban development such as setbacks, width of the road in front of the building, and building use.

In addition, detailed guidance on land use control is not available. The technical standard or planning handbook, which is used for evaluating the land development permit, was prepared more than ten years ago. The new building code is under preparation.

For proper land development control, the building code, land development permission, and technical standards have to be developed. Moreover, the relationships amongst the three documents have to be clearly defined.

- (2) Urban development management: Spatial development and infrastructure development are weak.

One of the criticisms of the master plan is that there are many master plans but none are implemented as planned. In the case of Nairobi City, there are many sector plans and urban development plans such as the “Railway City development” and “Upper Hill development”, but the implementation mechanism is weak. Urban development requires coordination amongst sectors, clear roles and responsibilities, and strong legal justification.

Infrastructure management is also facing difficulties. Due to the lack of coordination, lack of clear policy in infrastructure management, and the lack of a common database on infrastructure, infrastructure is developed separately by the concerned agencies with little coordination, which resulted in inefficient infrastructure development management including wayleaves management.

In order to secure proper urban development and infrastructure development, a new urban development scheme with a strong legal background has to be developed. Such laws shall include “land re-development project” and “land re-adjustment project”.

- (3) Private sector promotion: Private sector investment scheme and incentive are weak.

For successful urban development, the private sector has to be involved actively. The Nairobi Metro Strategy 1973 also addresses the importance of private sector involvement in urban development, but private sector has not been fully utilised up until now. There should be a mechanism for promotion of private sector involvement to guide urban development based on the master plan; otherwise, the private sector will maximise their interest, which may contradict the development direction of the

master plan.

The private sector promotion scheme should include incentives for the private sector in order to follow the master plan, including financial and other incentives such as easing the development conditions including building use, height, and other conditions.

(4) Public participation: Public awareness/understanding of urban development is weak.

In addition to private sector involvement, public or community involvement is necessary for efficient execution of the master plan. Even if the regulatory framework, such as the building code and land development permit mechanism, is established, execution will be difficult without public awareness and understanding.

For building construction, the permit from NCC is required, but almost half of the buildings are constructed without a permit because public awareness on building construction permits is low. In order for the master plan as well as the development and control rules for urban development to be executed effectively, the public awareness programme has to be strengthened.

In addition, any rules related to urban development have to be open to public to enhance public awareness and to be fair on development permits.

(5) Master plan implementation organisations is weak.

In order to secure development control, infrastructure development, and public participation, which are considered important components of master plan implementation, competent organisations have to be developed. Although NCC plays an important role in implementing the master plan and in coordinating with concerned agencies, it has not implemented the master plan since its establishment in 2013 due to its weak implementation capacity.

In addition, the coordination mechanism is weak. Coordination can be categorised as coordination within NCC, coordination between NCC and national government, and coordination amongst county governments.

Also, through public meetings, community participation was identified as one of the important issues for master plan implementation, but the community participation mechanism has not been established. Strengthening of organisations both for the government and for community participation is essential for implementation of the master plan.

5.3.5 Constraints and Planning Issues for Socio-economy

The rapid population increase, primarily due to a large number of in-migration and the disproportionate development of employment opportunities and urban services, has created a large gap between the demand and supply of urban functions.

Therefore, deceleration of the population growth, acceleration of employment generation, and urban service development are required, although the volume of in-migration depends not only on internal conditions of Nairobi City but also on various conditions at the national level.

Although Nairobi City is positioned higher than the national average in most socioeconomic indicators, the city faces serious socioeconomic issues that need to be addressed.

- The unemployment, underemployment, and working poor are serious issues for the city. The unemployment rate of 14.7% in the 2009 census might be an understatement. In addition, there are a number of informal settlement areas in the city, the total population of which may be around 1,300,000, but it is yet to be verified. Thus, there are large socioeconomic gaps between different groups and between different zones within Nairobi City.

- Safety and security is considered as one of the priority urban issues to be solved. The lack of proper planning and poor urban management play some role in safety and security issues.

Inclusive urban development is therefore required in socioeconomic and geographic terms. For example, the gap between relatively rich areas and relatively poor areas should be reduced.

Industrial development is the central area of the socioeconomy. For further industrial development, the following major issues need to be addressed:

- Poor nationwide infrastructure especially the lack of reliability and the high cost of power supply (this is interpreted as an investment opportunity).
- Delays in tax refund and customs clearance processes (the doing business rank in 2013 is 121 out of 185 economies).
- Competition with imported commodities, in particular those from China, affects local manufacturing.
- High reliance of GDP and export on agriculture.

5.3.6 Constraints and Planning Issues for Environment

Constraints and planning issues for environment are summarised below.

(1) Protected Ecosystem/or Green Spaces

1) Constraints

- (i) There are several important green spaces which provide residents with shady recreational areas and a visitor's glimpse of Kenya's wildlife and vegetation while helping to maintain the local biodiversity, filter air pollutants, and act as minor water catchments within and on the outskirts of Nairobi City. Although these green spaces have been legally protected, much of the natural vegetation surrounding Nairobi City disappeared as city's boundaries were extended numerous times to accommodate the growing population.
- (ii) As the city expanded after its founding, most of the newly developed settlements were unplanned and had encroached some of the protected areas. These areas do not have proper infrastructure services and tend to cause secondary negative impacts on surrounding green spaces (e.g., discharge of untreated wastewater, illegal dumping of waste, illegal logging, and others).

2) Planning Issues

- (i) Need to establish organised citywide land use plan and sub-centres that would control the city expansion so as not to conflict with already existing protected areas such as forest reserves, national parks and surrounding water resource recharge areas while strengthening legal enforcement regarding the conservation of protected ecosystem/or green spaces.

(2) Air Pollution

1) Constraints

- (i) The main sources of atmospheric pollution are vehicles, industries, emissions from the use of charcoal and firewood, and other municipal sources such as open burning of waste. In particular, the rapid growing number of vehicles without proper inspection

and maintenance considerably worsens urban air pollution problems as well as urban transport conditions.

- (ii) Vehicles emit significant levels of air pollutants, including greenhouse gases and precursors of smog. Although relevant environmental standards and regulation already exist in Kenya, actual enforcement is weak.
- (iii) Several air quality surveys were conducted around the CBD of Nairobi City in the past, and it was found that there is a strong correlation between the recent urban air quality degradation and the vehicular emission therein. Also, recent citywide health statistics report a rapid increase of acute and chronic respiratory diseases such as asthma.
- (iv) No long-term, continuous, citywide air quality monitoring has been implemented such that reliable quantitative evaluation of urban air quality, which would be one of the important sources of baseline information for the development of effective environmental mitigation and management programme as well as effective on-the-job training (OJT)-based capacity building approaches for the environmental administrative staff, is not established yet.

2) Planning Issues

- (i) Need to establish a citywide air quality monitoring system that would provide important baseline information for the development of effective environmental mitigation and management programme.
- (ii) Need to strengthen the legal enforcement of vehicle inspection and the maintenance system while implementing capacity development of relevant administration agencies.
- (iii) Need to establish a comprehensive urban transport system that would restrict the circulation of ill-conditioned vehicles around CBD while alleviating the traffic congestion, which is one of the serious factors that accelerate roadside air quality degradation.

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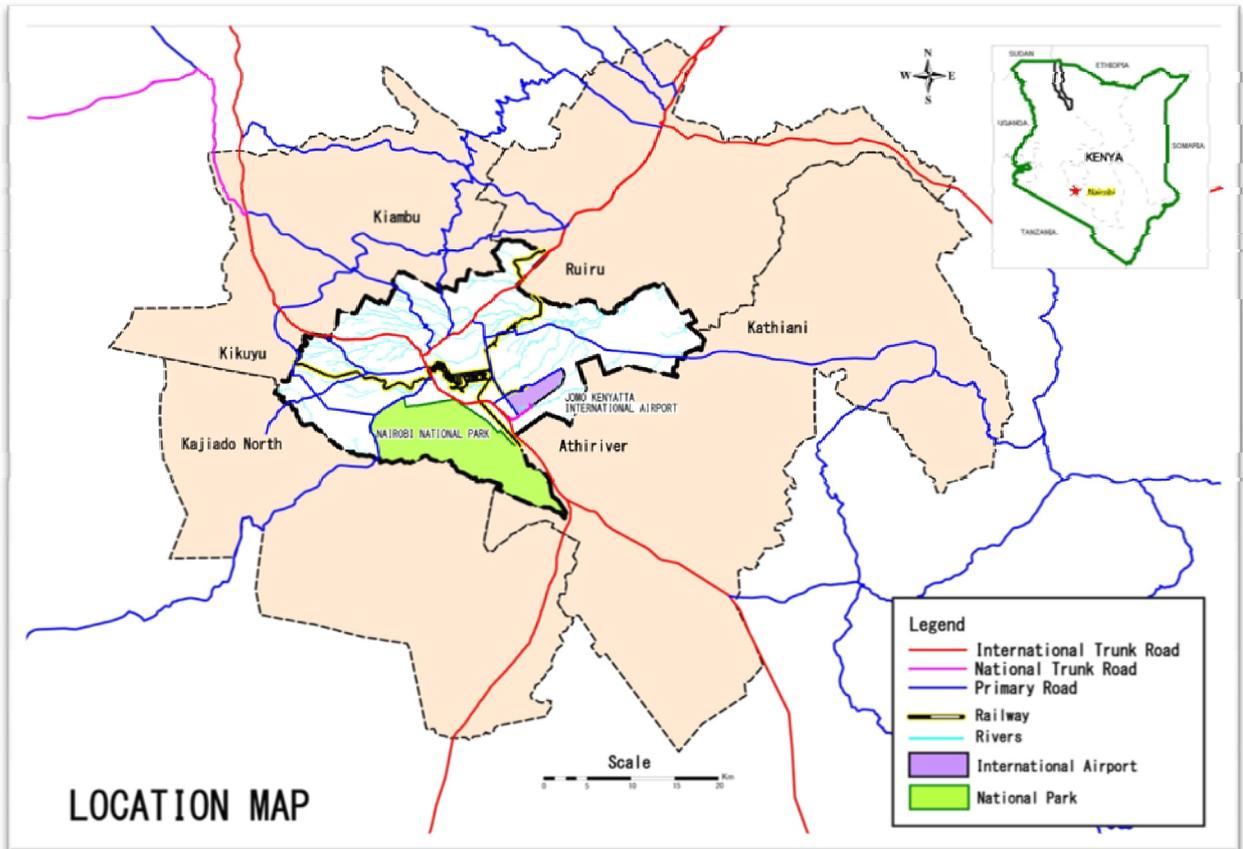
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LOCATION MAP



The Project on Integrated Urban Development Master Plan for the City of Nairobi in the Republic of Kenya

Final Report

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ABBREVIATIONS

AAK	Architectural Association of Kenya
ADC	Austrian Development Corporation
AFD	Agence Francaise Developpement (French development agency)
AfDB	African Development Bank
AMRF	Africa Medical and Research Foundation
APL	Adaptable Program Lending
ASAL	Arid and Semi-Arid Land
ASCAS	Accumulated Savings and Credit Associations
AWSB	Athi Water Services Board
BADEA	Arab Bank for Economic Development in Africa
BOD	Biochemical Oxygen Demand
BPO	Business Process Outsourcing
BPO	Business Process Off-shoring
BRT	Bus Rapid Transit
C/R	Circumferential/Radial
CAA	Civil Aviation Authority
CBD	Central Business District
CCK	Communications Commission of Kenya
CCN	City Council of Nairobi
CFAs	Community Forest Associations
CGA	County Government Act
CMA	Capital Market Authority
COD	Chemical Oxygen Demand
COK	Constitution of Kenya
CPD	City Planning Department
CSUD	Centre of Sustainable Urban Development
CWSB	Coast Water Services Board
DANIDA	Danish International Development Agency
DC	Development Control
DCG	Donor Coordination Group
DESTW	Dandora Estate STW
DfID	UK Department of International Development
DFIs	Development Finance Institutions
DGIS	Netherlands Ministry of Foreign Affairs (of Netherland)
DID	Department of International Development (of UK)
DMU	Diesel Multiple-Units
DOE	Department of Environment
DRSRS	Department of Resource Surveys and Remote Sensing
DSL	Digital Subscriber Line
EA	Environmental Audit
EAC	East African Community
EC	European Commission
ECM	Executive Committee Member
EEPCO	Ethiopia Electric Power Corporation
EIA	Environmental Impact Assessment
EMCA	Environment Management Coordination Act
EOI	Expressions of Interest
EPZA	Export Processing Zones Authority
ERC	Energy Regulation Commission
ERSWEC	Economic Recovery Strategy for Wealth and Employment Creation
EU	European Union
FAO	Food and Agriculture Organization
FSMPNWS	Feasibility Study and Master Plan for Developing New Water Sources for Nairobi and Satellite Towns
GC	Gross Coverage Ratio

GCCN	Government Common Core Network
GDC	Geothermal Development Company
GDP	Gross National Product
GIS	Geographical Information System
GNI	Gross National Income
GOK	Government of Kenya
GRDP	Gross Regional Domestic Product
HAC	Harmonization Alignment and Coordination
ICB	International Competitive Bidding
ICT	Information Communication Technology
IDA	International Development Association
IPP	Independent Power Producers
ITCZ	Inter Tropical Convergence Zone
ITS	Intelligent Transport System
JCC	Joint Coordinating Committee
JDA	Joint Development Agreement
JICA	Japan International Corporation Agency
JKIA	Jomo Kenyatta International Airport
JKUAT	Jomo Kenyatta University of Agriculture and Technology
JST	JICA Study Team
CAA	Kenya Airport Authority
KAM	Kenya Association of Manufacturers
KBC	Kenya Broadcasting Corporation
KCAA	Kenya Civil Aviation Authority
KDN	Kenya Data Network
KDN	Kenya Data Network
KEBS	Kenya Bureau of Standards
Ken Gen	Kenya Power Generating Company
KeNHA	Kenya National Highways Authority
KENIC	Kenya Network Information Center
KENSUP	Kenya Slum Upgrading Program
KEPSA	Kenya Private Sector Alliance
KETRACO	Kenya Electricity Transmission Company
KFS	Kenya Forest Service
KfW	Kreditanstalt für Wiederaufbau (German government-owned development bank)
KIA	Kenya Investment Authority
KIE	Kenya Industrial Estate Ltd
KIP	Kenya Institute of Planners
KIPI	Kenya Industrial Property Institute
KIPPRA	Kenya Institute of Public Policy Research an Analysis
KIRDI	Kenya Industrial Research and Development Institute
KISIP	Kenya Informal Settlements Improvement Project
KMP	Kenya Municipal Program
KNBS	Kenya National Bureau of Statistics
KNCC&I	Kenya National Chamber of Commerce and Industry
KPC	Kenya Pipeline Corporation
KPDA	Kenya Property Developers Association
KPLC	Kenya Power and Lighting Company
KPPRA	Kenya Institute of Public Policy Research an Analysis
KPTC	Kenya Post and Telecommunication Company's
KRC	Kenya Railways Corporation
KTB	Kenya Tourist Board
KTDC	Kenya Tourist Development Corporation
KURA	Kenya Urban Roads Authority
KWS	Kenya Wildlife Service
LCPDP	Least Cost Power Development Plan
LPDP	Local Physical Development Plan

LRT	Light Rail Transit
MAF	Mission Aviation Fellowship
MEMR	Ministry of Environment and Mineral Resources
MEWNR	Ministry of Environment, Water and Natural Resources
MFI	Microfinance Institutions
MLH&UD	Ministry of Lands, housing and Urban Development
MNPDV2030	Ministry of National Planning and Vision 2030
MODP	Ministry of Development and Planning
MOE	Ministry of Energy
MOE&P	Ministry of Energy and Petroleum
MOH	Ministry of Health
MOIC	Ministry of Information and Communication
MOICT	Ministry of ICT
MOL	Ministry of Land
MOLG	Ministry of Local Government
MOLHUD	Ministry Of Lands, Housing And Urban Development
MONMD	Ministry of Nairobi Metropolitan Development
MOPHS	Ministry of Public Health and Sanitation
MOR	Ministry of Roads
MORPW	Ministry of Roads and Public Works
MOTI	Ministry of Transport and Infrastructure
MOW&I	Ministry of Water and Irrigation
MRF	Material Recovery Facility
MRTS	Mass Rapid Transit System
MSD	Medium Speed Diesel
MSEA	Micro and Small Enterprises Authority
MSMEs	Micro Small and Medium Enterprises
MSL	Mean Sea Level
MWI	Ministry of Water and Irrigation
NaMSIP	Nairobi Metropolitan Service Improvement Project
NaRSIP	Nairobi Rivers Rehabilitation and Restoration Program: Sewerage Improvement Project
NASP	National Airports System Plan
NBS	National Broad Band Strategy
NCBA	Nairobi County Business Association
NCBDA	Nairobi Central Business District Association
NCC	Nairobi City County
NCWSC	Nairobi City Water and Sewerage Company
NEMA	National Environment Management Authority
NES	National Environment Secretariat
NESC	Nairobi City Water and Sewerage Company
NHC	National Housing Corporation
NIUPLAN	Nairobi Integrated Urban Development Master Plan
NMR	Nairobi Metropolitan Region
NMT	Non-Motorized Transport
NOFBI	National Optic Fiber Backbone Infrastructure
NRS	Nairobi Rail Station
NSSF	National Social Security Fund
NTSA	National Transport and Safety Authority
NUTRANS	The Study on Master Plan for Urban Transport in the Nairobi Metropolitan Area in the Republic of Kenya, March 2006
NUTRIP	National Urban Transport Improvement Project
O&M	Operation and Maintenance
OD	Origin Destination
OJT	On-the-Job Training
OPM	Office of the Prime Minister
PCU	Passenger Car Unit
PDF	Project Demand Forecast

PDP	Project Development Plan
PHPDT	Peak Hour Peak Direction Traffic
PID	Project Information Document
PIDG	Private Infrastructure Development Group Trust
PIS	Policy Implementation Section
PMU	Project Management Unit
PPCSCA	Permanent Presidential Commission on Soil Conservation and Afforestation
PPP	Public-Private Partnership
PR	Plot Ratio
PS	Permanent Secretary
PSP	Private Service Provider
PT	Person Trip
PVSs	Public Service Vehicles
QCBS	Quality- and Cost-Based Selection
RD	Record of Discussion
REA	Rural Electricity Authority
RFC	Regional Financial Centre
ROSCAs	Rotating Savings and Credit Associations
ROW	Right of Way
RTA	Research Triangle Africa
RVR	Rift Valley Railways
SACCOs	Savings and Credit Cooperative Societies
SEA	Strategic Environmental Assessment
SECE	Swiss State Secretariat for Foreign Affairs
SHM	Stakeholder Meetings
SIDA	Swedish International Development Cooperation
SMEs	Small and Medium Enterprises
SOK	Survey of Kenya
SSL	Salary Scale Level
STI	Science, technology and innovation
STP	Sewerage Treatment Plant
STRADA	System for Traffic Demand Analysis
STW	Sewerage Treatment Work
SWM	Solid Waste Management
SWPC	Solid Waste Public Corporation
TOD	Transit Oriented Development
TSS	Total Suspended Solids
TWG	Technical Working Group
UfW	Unaccounted for Water
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UN-HABITAT	United Nations Human Settlements Programme
UNHCR	Office of the United Nations High Commissioner for Refugees
UON	University of Nairobi
USAID	United States Agency for International Development
VCR	Vehicle Capacity Ratio
VRC	Volume Capacity Ratio
WASP	Wien Automatic Simulation Package
WaSSIP	Water and Sanitation Service Improvement Project
WATSAN	Kibera Integrated Water, Sanitation and Waste Management Project
WB	World Bank
WRMA	Water Resources Management Authority
WSB	Water Service Board
WSP	Water Service Providers
WSRB	Water Service Regulatory Board
WTP	Water Treatment Plant
WVK	World Vision Kenya

CHAPTER6 DEVELOPMENT VISION, STRUCTURE PLAN, AND LAND USE PLAN

6.1 Socioeconomic Framework

6.1.1 Future Population of Kenya, Nairobi City and its Environs

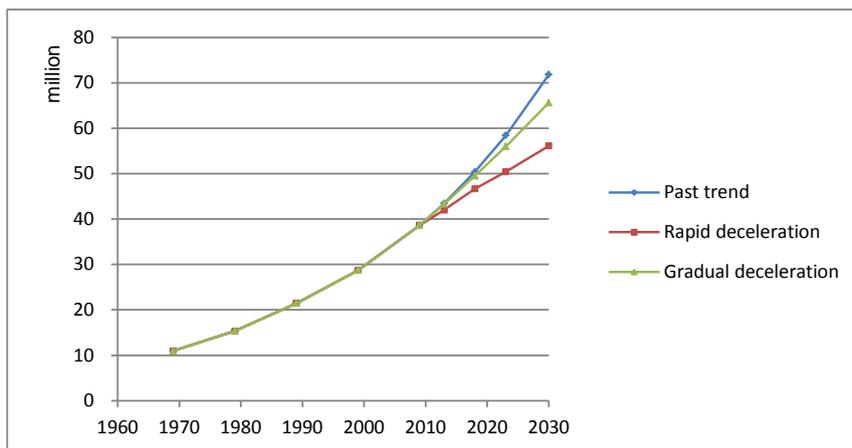
The populations of Nairobi City, Kenya and its environs are projected for the target year of 2030 as well as the intermediate years of 2013, 2018, and 2023.

(1) Future Population of Kenya

1) Alternative Scenarios

Three alternative scenarios are prepared as follows:

i) Past Trend Scenario	In this scenario, it is assumed that the average annual growth rate during 1999-2009, which is 3.0%, will be unchanged until 2030. Then, the population of Kenya will exceed 70 million before the target year.
ii) Rapidly Decelerating Scenario toward a Middle Income Country	In this scenario, it is assumed that the population growth rate will drop to the average level of the low income countries (2.1%) from 2009 and to an average level of the lower middle income countries (1.6%) from 2018. Then, the population of Kenya in the target year will be 56 million.
iii) Gradually Decelerating Scenario	In this scenario, it is assumed that the population growth will gradually decelerate from 3.0% to 2.3% toward 2030. Then, the population of Kenya in the target year will be 66 million.



Sources: Kenya Census 2009, World Development Indicators website (2013), and the JICA Study Team (JST)

Figure 6.1.1 Estimation of Population of Kenya

2) Recommended Scenario

The “**Gradually Decelerating Scenario**” is recommended for the following reasons:

- (i) The projection coincides with the projection in the World Population Prospects 2011 by the United Nations (66 million in 2030).
- (ii) It is between the Past Trend Scenario and the Rapidly Decelerating Scenario.
- (iii) The birth rate seems to be lowering but the life expectancy will be extended, and there is no indication of sudden deceleration of the population growth.

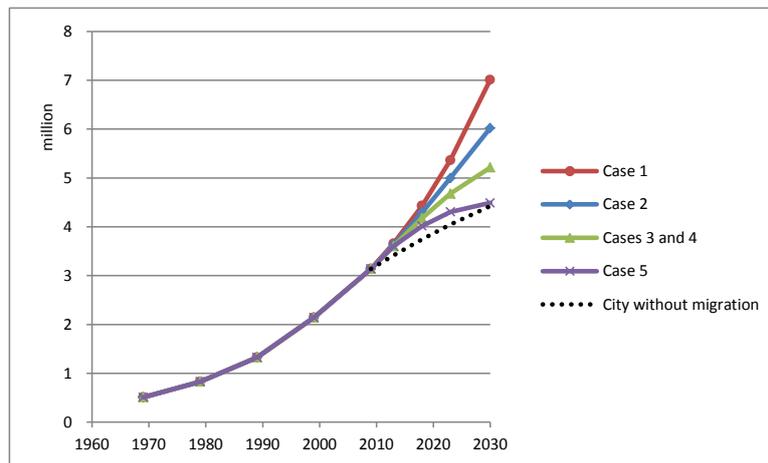
(2) Future Population of Nairobi City and its Environs

1) Alternative Scenarios

The population growth of Greater Nairobi has been considerably higher than that of Kenya. Within Greater Nairobi, Nairobi City was growing faster in the 1990s than its environs, then in the 2000s, conversely, the environs were growing faster. Considering the past trends and future development ideas of the area, five alternative scenarios are defined as follows:

Case 1	1999-2009 Growth Rate Scenario	This scenario adopts the latest growth rates of the city (3.9% per year) and the environs (4.1% per year) for the whole period until the target year of 2030.
Case 2	Decelerating City Population Scenario	This scenario assumes that the population growth of the city will gradually decrease from 3.9% per year to 2.7% per year toward 2030, while the environs will keep the past high growth rate at 4.1%.
Case 3	Containing City Population Scenario	This scenario assumes a rather contained population growth of Nairobi City as in the fourth scenario and the past trend of the environs' population growth at 4.1% per year.
Case 4	Nairobi Metropolitan Development Scenario	In this scenario, the population forecast for 2030 of the "Spatial Planning Concept for Nairobi Metropolitan Region" (2013) is assumed. The 2030 population of the city is contained to 5,212,500 according to the plan. Part of the forecast population for the Nairobi Metropolitan Region falls into the Greater Nairobi outside the city and that is counted as the population of the environs within Greater Nairobi.
Case 5	Aggressively Containing City Population Scenario	This scenario assumes an aggressive containment of the population growth in Nairobi City so that the population should not exceed 4.5 million in 2030. Outside of the city, this scenario assumes the forecast population of the fourth scenario.

The following figures summarise the outcomes of the scenarios.



Sources: Kenya Censuses 1989, 1999 and 2009, Spatial Planning Concept for Nairobi Metropolitan Region 2013, and the JICA Study Team (JST)

Figure 6.1.2 Alternative Scenarios of Population Estimation of Nairobi City

Table 6.1.1 Alternative Scenarios of Population Estimation of Nairobi City

Unit: number of people, %: percentage of annual growth rate

Year	Census Data			Estimates				Annual Growth Rate 2009-2030 (%)	(2030 pop.)/(2009 pop.)	Pop. - City Without Migration in 2030
	1989	1999	2009	2013	2018	2023	2030			
Kenya	21,448,047	28,686,607	38,610,097	43,300,000	49,500,000	56,000,000	65,600,000	2.6	1.7	
%	3.4	3.0	3.0	2.9	2.7	2.5	2.3			
City Without Migration										
Nairobi City			3,138,369	3,415,468	3,741,728	4,044,460	4,423,682	1.6	1.4	0
%				2.1	1.8	1.6	1.3			
Case 1 1999-2009 Growth Rate Scenario										
Nairobi City	1,324,570	2,143,254	3,138,369	3,657,347	4,428,370	5,361,937	7,008,588	3.9	2.2	2,584,906
%	4.8	4.9	3.9	3.9	3.9	3.9	3.9			
Outside City	935,854	1,259,569	1,877,652	2,205,048	2,695,701	3,295,530	4,365,967	4.1	2.3	
%		3.0	4.1	4.1	4.1	4.1	4.1			
Greater Nairobi	2,260,424	3,402,823	5,016,021	5,862,395	7,124,071	8,657,467	11,374,554	4.0	2.3	
%		4.2	4.0	4.0	4.0	4.0	4.0			
Case 2 Decelerating City Population Scenario										
Nairobi City	1,324,570	2,143,254	3,138,369	3,629,268	4,289,649	4,997,066	6,021,548	3.2	1.9	1,597,866
%	4.8	4.9	3.9	3.7	3.4	3.1	2.7			
Outside City	935,854	1,259,569	1,877,652	2,205,048	2,695,701	3,295,530	4,365,967	4.1	2.3	
%		3.0	4.1	4.1	4.1	4.1	4.1			
Greater Nairobi	2,260,424	3,402,823	5,016,021	5,834,316	6,985,349	8,292,596	10,387,515	3.5	2.1	
%		4.2	4.0	3.9	3.7	3.5	3.3			
Case 3 Containing City Population Scenario										
Nairobi City	1,324,570	2,143,254	3,138,369	3,601,351	4,174,952	4,677,671	5,212,500	2.4	1.7	788,818
%	4.8	4.9	3.9	3.5	3.0	2.3	1.6			
Outside City	935,854	1,259,569	1,877,652	2,205,048	2,695,701	3,295,530	4,365,967	4.1	2.3	
%		3.0	4.1	4.1	4.1	4.1	4.1			
Greater Nairobi	2,260,424	3,402,823	5,016,021	5,806,398	6,870,653	7,973,202	9,578,466	3.1	1.9	
%		4.2	4.0	3.7	3.4	3.0	2.7			
Case 4 Nairobi Metropolitan Development Scenario										
Nairobi City	1,324,570	2,143,254	3,138,369	3,601,351	4,174,952	4,677,671	5,212,500	2.4	1.7	788,818
%	4.8	4.9	3.9	3.5	3.0	2.3	1.6			
Outside City	935,854	1,259,569	1,877,652	2,423,734	3,318,544	4,574,701	7,049,832	6.5	3.8	
%		3.0	4.1	6.6	6.5	6.6	6.4			
Greater Nairobi	2,260,424	3,402,823	5,016,021	6,025,084	7,493,496	9,252,373	12,262,332	4.3	2.4	
%		4.2	4.0	4.7	4.5	4.3	4.1			
Case 5 Aggressively Containing City Population Scenario										
Nairobi City	1,324,570	2,143,254	3,138,369	3,601,351	4,015,317	4,304,371	4,488,441	1.7	1.4	64,759
%	4.8	4.9	3.9	3.5	2.2	1.4	0.6			
Outside City	935,854	1,259,569	1,877,652	2,423,734	3,318,544	4,574,701	7,049,832	6.5	3.8	
%		3.0	4.1	6.6	6.5	6.6	6.4			
Greater Nairobi	2,260,424	3,402,823	5,016,021	6,025,084	7,333,861	8,879,072	11,538,273	4.0	2.3	
%		4.2	4.0	4.7	4.0	3.9	3.8			

Note: Nairobi City can experience net in-migration even if its population growth rate is lower than the national rate, due to the city's relatively low birth rate.

Sources: Kenya Censuses 1989, 1999 and 2009, Spatial Planning Concept for Nairobi Metropolitan Region 2013, and the JICA Study Team (JST)

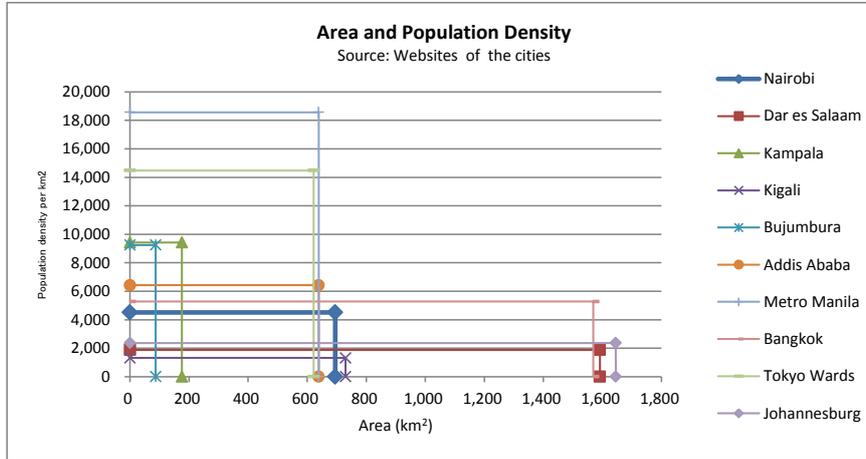
2) Comparison of Nairobi City's Annual Average Growth Rate and the Population Density in 2030

The annual average growth rate of Nairobi City in each alternative is summarised below, and the resultant population density in 2030 is shown. Area and population density of selected cities are depicted for reference. Unlike Nairobi City, the population growth of the environs in Greater Nairobi consists of changes in both urban and rural population and so the growth is not necessarily urban population growth.

Table 6.1.2 Comparison of Nairobi City’s Annual Average Growth Rate and Population Density in 2030

	Recent Years	Case 1	Case 2	Cases 3 and 4	Case 5
Annual average growth rate of Nairobi City	3.9%	3.2%	2.4%	2.4%	1.7%
Population density of Nairobi City in 2030 (The density in brackets is based on the city area excluding 117 km ² of Nairobi National Park.)	4,515/km ² (5,429/km ²)	10,000/km ² (12,000/km ²)	8,700/km ² (10,000/km ²)	7,500/km ² (9,000/km ²)	6,500/km ² (7,800/km ²)

Source: JICA Study Team (JST)



Sources: Websites of the cities (2013)

Figure 6.1.3 Area and Population Density of Selected Cities

3) Implications of the Alternative Scenarios

i) 1999-2009 Growth Rate Scenario	The estimated population of Nairobi City in this scenario is by far larger than the no-migration-case population. A total of 2.6 million net in-migrants and their children are expected. This scenario presents perhaps excessively rapid population growth of the city. It will require huge incremental supply of infrastructure and public services. Lack of them may jeopardise the urban functions and cause uncontrollable expansion of slums. The population growth of the environs is also high but it would be necessary to respond to Kenya’s momentum of industrial development including a shift from agriculture to secondary and tertiary industries, accompanying urbanisation, and migration pressure on Nairobi City.
ii) Decelerating City Population Scenario	This scenario assumes that the city’s population in 2030 would be one million less than the population in the previous scenario. The estimated population is much larger than the no-migration-case population. A total of 1.6 million net in-migrants and their children are expected. The city’s population growth may be still too high under the current conditions. But it may be the lowest possible range in view of the population and migration trends of Kenya, where substantial rural to urban population shift takes place to push up the urban population in large cities like Nairobi City. Therefore, this may be a realistic scenario, but it faces two challenges: how to decelerate the population growth and how to properly accommodate nearly double the current population within the city boundary.
iii) Containing City Population Scenario	This scenario is to divert the city’s population trend from a rapid expansion to a relatively moderate growth. The total number of net in-migrants and their children needs to be contained within 800,000. This may be ideal but how realistic it is remains as a challenge. Curbing the in-migration to the city requires a set of strong policy measures including, but not limited to, containment of the slum expansion.
iv) Nairobi Metropolitan Development Scenario	A basic idea of this scenario is to contain the city population and promote the environs to absorb increasing urban population in Greater Nairobi. Thus the migration pressure on Nairobi City would be largely absorbed in the environs. The reality of this scenario depends largely on creation of proposed new towns and satellite cities so as to absorb the incremental population over five million outside the city. As in the previous scenario iii, Nairobi City’s total number of net in-migrants and their children needs to be contained within 800,000.
v) Aggressively Containing City Population Scenario	In this scenario, the estimated population of Nairobi City in 2030 is close to the no-migration-case population with no substantial net in-migration. This is an extreme scenario in which the population growth rate of the city will be flattened out immediately. In addition to the question of its reality, whether it contributes positively to the national economy is an immediate question.

4) Recommended Scenario

The comparison of the above alternative scenarios was discussed in Thematic Groups by the Kenyan and Japanese sides. In conclusion, in view of the basic concept that Nairobi City should contain its population growth while its environs should rapidly develop to function as part of the expanding national capital to be called the Greater Nairobi, the Nairobi Metropolitan Development Scenario, or scenario iv above, is adopted. The estimated population of Nairobi City in 2030 is 5,212,500.

6.1.2 Future Day-time Population of Nairobi City

(1) Conditions for Estimation

1) Employees

The share of workforce in population of each census district of Nairobi City in the 2009 Census is assumed to be unchanged until 2030. On the other hand, the unemployment rate of each district in the 2009 Census is assumed to decrease from 15% in 2009 to 7% in 2030. Thus, the number of employees is calculated as the difference between the workforce and the unemployed. The number of employee will grow from 1,411,000 in 2009 to 2,555,000 in 2030, which is faster than the growth of the population.

2) Pupils and Students

The total number of pupils and students living in Nairobi City in 2009 is estimated at 780,000 consisting of pre-primary schools (109,200 based on the assumed enrolment rate of 50%), primary schools (396,400 based on the rate of 90%), secondary schools (122,500 based on the rate of 65%), and others, namely: youth polytechnic, tertiary, university, etc. (152,300 based on the 2009 Census).

The number of pupils and students of each census district in the 2009 Census is revised by multiplying the ratio of the estimated total to the census-based total. Then, the share of the revised number of pupils and students in the population in each district in 2009 is assumed to increase by 0.4% point per year due to rising enrolment rates. This way, the city's share of pupils and students in the population will rise from 25% in 2009 to 33% in 2030 and the total number of pupils and students will grow much faster than the population from 780,000 in 2009 to 1,737,000 in 2030.

3) Others

There are a total of 947,000 people not counted as "employees" nor "pupils and students" in the 2009 Census. They are people less than 3 years old, those who are of school-age but do not go to school, the unemployed, and those out of the workforce including housewives and elder people. This category of population will decrease to 920,000 in 2030 due to higher school enrolment rates and lower unemployment rates in spite of the population growth.

(2) Day-time Population

The number of cross-border commuters is estimated based on the cordon line survey and the person trip survey conducted in 2013. The inflow and outflow of pupils and students are thought to be relatively small and assumed to be equal.

Table 6.1.3 Estimation of Cross-border Commuters in 2013

	Inflow	Outflow	Net Inflow	References or Assumptions	
				Inflow	Outflow
Cross-border commuters	206,136	41,136	165,000	Cordon line survey considering missed number of commuters	Person trip survey
Commuting workers	187,102	22,102	165,000	Approximately 90% of the commuters	Person trip survey
Commuting pupils, students and others	19,034	19,034	0	In=Out	Person trip survey

Source: JICA Study Team (JST)

1) Work Places

The total number of jobs in Nairobi City in 2013 is estimated at 1,813,000 by adding the number of employees from Nairobi City and the net inflow of workers from outside of Nairobi City, who are assumed to be formal workers. Amongst the jobs in Nairobi City in 2013, there are approximately one million formal jobs according to an estimation based on the business registration data of the Nairobi City County (NCC) and so the remaining 813,000 jobs are informal as discussed in Chapter 2.1.2.

By assuming that the growth rate of the total number of jobs in Nairobi City is equal to that of the total number of employees and that the growth rate of the informal jobs is half the rate of the total number of employees, the total number of jobs in 2030 is estimated at 2,811,000, consisting of 1,797,000 formal jobs and 1,014,000 informal jobs.

Table 6.1.4 Estimation of Employees and Jobs in Nairobi City

	2009	2013	2018	2023	2030
Total number of employees living in Nairobi City	1,411,229	1,647,869	1,950,933	2,230,666	2,554,768
Annual growth rate (%)		4.0	3.4	2.7	2.0
Total number of jobs in Nairobi City	1,552,534	1,812,869	2,146,279	2,454,021	2,810,575
Annual growth rate (%)		4.0	3.4	2.7	2.0
Informal jobs (=Informal workers from Nairobi City)	751,678	812,869	885,095	946,850	1,013,636
Annual growth rate (%)		2.0	1.7	1.4	1.0
Formal jobs	800,856	1,000,000	1,261,183	1,507,172	1,796,939
Annual growth rate (%)		5.7	4.8	3.6	2.5
Formal workers from Nairobi City	659,551	835,000	1,065,838	1,283,816	1,541,131
Annual growth rate (%)		6.1	5.0	3.8	2.6
Net inflow of formal workers from outside of Nairobi City	141,305	165,000	195,346	223,355	255,807
Annual growth rate (%)		4.0	3.4	2.7	2.0

Source: JICA Study Team (JST)

2) School Enrolment

Based on the assumption that the inflow and outflow of pupils and students are equal, the total school enrolment of Nairobi City is equal to the total number of pupils and students, although in reality they are generally different at the zone level as shown by the person trip survey.

3) Others

Day population and night population of this category are thought to be equal.

4) Day-time Population

The day-time population of Nairobi City is estimated to grow from 3,280,000 in 2009 to 5,468,000 in 2030, by simply adding the net inflow of commuters from outside of the city to the night-time population. It is also equal to the total of the number of jobs, school enrolment and others.

Table 6.1.5 Estimation of Day-time Population in Nairobi City

	2009	2013	2018	2023	2030
Total number of jobs in Nairobi City	1,552,534	1,812,869	2,146,279	2,454,021	2,810,575
Annual growth rate (%)		4.0	3.4	2.7	2.0
Total school enrolment	780,379	953,813	1,190,009	1,427,494	1,737,357
Annual growth rate (%)		5.1	4.5	3.7	2.8
Others	946,760	999,669	1,034,010	1,019,511	920,375
Annual growth rate (%)		1.4	0.7	-0.3	-1.5
Day-time population	3,279,673	3,766,351	4,370,298	4,901,026	5,468,307
Annual growth rate (%)		3.5	3.0	2.3	1.6

Source: JICA Study Team (JST)

6.1.3 Future Gross Domestic Product (GDP) per Capita of Kenya and Nairobi City

Three sets of cases of future GDP per capita of Kenya and gross regional domestic product (GRDP) per capita of Nairobi City are examined assuming that the GRDP per capita will continue to be three times the GDP per capita of Kenya.

Although the Kenya Vision 2030 has set a target of 10% continuous growth, it seems safer to set a lower assumption in view of the past trend of Kenya and experiences of other countries. Therefore, Case 3, which is in between the current growth and the challenging Case 2, is thought to be a realistic and appropriate target.

Table 6.1.6 Alternative Cases of Future GDP per Capita of Kenya and Nairobi City

	Case 1	Case 2	Case 3
	Bottom Case to achieve the lowest GNI (GDP) per capita for the lower middle income (\$1,026 at 2011 prices) countries in 2030	GDP 10% Growth Case (Target of Kenya Vision 2030)	GDP 7% Growth Case (between Case 1 and Case 2)
Kenya	In 2011 Population: 40,881,954 GDP: KSh3,024,782 million GDP growth rate: 4.4% (Average GDP growth rate from 2006 to 2011: 4.3%) GDP per capita: KSh73,988		
Average GDP growth rate	3.7%	10.0%	7.0%
Average GDP per capita growth rate	1.2%	7.3%	4.4%
GDP per capita in 2030 at 2011 prices	KSh92,575 (1.3 times the 2011 level)	KSh281,963 (3.8 times the 2011 level)	KSh166,733 (2.3 times the 2011 level)
Nairobi City	In 2011 Population: 3,361,899 GRDP: KSh746,223 million GRDP per capita: KSh221,965		
Average GRDP growth rate	3.6%	9.8%	6.8%
Average GRDP per capita growth rate	1.2%	7.3%	4.4%
GRDP per capita in 2030 at 2011 prices	KSh277,726 (1.3 times the 2011 level)	KSh845,888 (3.8 times the 2011 level)	KSh500,200 (2.3 times the 2011 level)

Sources: Kenya Vision 2030 (2008) and JICA Study Team (JST)

6.2 Development Visions

6.2.1 Development Vision Formulation Procedure

Development vision of Nairobi City is formulated with reference to the related plans and inputs from stakeholders. The following are the steps for development vision formulation:

- Share and understand the development vision of “Kenya Vision 2030” and “Metropolitan Vision 2030”, and the position of Nairobi City in the East Africa Region amongst stakeholders.

- Discuss the ideas and image of Nairobi City in 2030 through technical working group and stakeholders meetings.
- Compile various ideas and prepare development vision based on technical working group discussion and stakeholder meetings.

6.2.2 Development Visions in the Related Plans and Strategies

(1) Kenya Vision 2030

Kenya Vision 2030 was formulated in 2007 and provides the baseline of the economic, social, and political frameworks, and also shows action to be taken to achieve the development goals such as the Millennium Development Goals (MDGs). The following box shows the outline of the Kenya Vision 2030.

<p>Overarching Vision: Overarching vision: A globally competitive and prosperous nation with a high quality of life by 2030</p> <p>Foundation for Kenya Vision 2030 on which Three Pillars (Economic, Social, Political) are based:</p> <ol style="list-style-type: none">(1) Macroeconomic stability for long-term development(2) Continuity in governance reforms(3) Enhance equity and wealth-creation opportunities for the poor(4) Infrastructure(5) Energy(6) Science, technology, and innovation (STI)(7) Land reform(8) Human resources development(9) Security(10) Public service <p>Three Pillars of Kenya Vision 2030</p> <p>Economic: To maintain a sustained economic growth of 10% p.a. over the next 25 years</p> <ol style="list-style-type: none">(1) Tourism(2) Increase in value in agriculture(3) A better and more inclusive wholesale and retail trading sector(4) Manufacturing for regional market(5) Business process off-shoring (BPO)(6) Financial service <p>Social: A just and cohesive society enjoying equitable social development in a clean and secure environment</p> <ol style="list-style-type: none">(1) Education and training(2) Health sector(3) Water and sanitation(4) Environment(5) Housing and urbanisation(6) Gender, youth, and vulnerable groups(7) Equity and poverty elimination <p>Political: An issue-based, people centred, result oriented, and accountable democratic political</p> <ol style="list-style-type: none">(1) Rule of law(2) Electoral and political process(3) Democracy and public service delivery(4) Transparency and accountability(5) Security, peace-building, and conflict management

(2) Nairobi Metro 2030

Nairobi Metro 2030, which was prepared by the Ministry of Nairobi Metropolitan Development and approved in 2008, states that it aims at developing Nairobi into a world-class African Region that is able to create sustainable wealth and offer a high quality of life for its residents, the people of Kenya, investors, and visitors.

The following box shows the outline of the vision of Nairobi Metro 2030.

Metropolitan Vision 2030:

To be a world-class African metropolis, supportive of the overall national agenda articulated in Kenya Vision 2030

Four Principles:

- (1) A world-class working environment
- (2) A world-class living environment
- (3) A world-class business environment
- (4) World-class metropolitan governance

Key Foundations for Metropolitan Vision 2030

- (1) Building internationally competitive and inclusive economy for prosperity
- (2) Deploying world-class infrastructure and utilised for the region
- (3) Optimising mobility through effective transportation
- (4) Enhancing the quality of life and inclusive in the region
- (5) Delivering a unique image and identity through effective place branding
- (6) Ensuring a safe and secure region
- (7) Building world-class governance system

(3) Position of Nairobi City in the East Africa Region

Nairobi City has been described as the gateway to Eastern and Central Africa, almost equidistant to Cairo and Cape Town (3,538 km and 4,107 km by road, respectively). Factors that make Nairobi City the hub for Eastern Africa are summarised below:

Nairobi City as a transport hub:

- Due to its access to the Port of Mombasa, much of inland-transit freight passes through Nairobi City by rail and by road to Kampala, by road to Kigali, Juba, Dar es Salaam and Addis Ababa.
- Jomo Kenyatta International Airport (JKIA) is the busiest airport in Eastern Africa with more than 5 million passengers using it per year. This acts as the gateway for most tourists and businessmen coming to the East African Region. Various international airlines use JKIA as a regional centre.
- Persons using smaller aircraft use the Wilson Airport, which is one of the busiest airports in Africa to access the rest of Kenya and the rest of Eastern Africa.
- The headquarters of the former East Africa Railways that served Kenya and Uganda, now Kenya Railways, is also located in Nairobi City.

Environmental conservation and management role played by Nairobi City in the region:

- It is the only capital city in the world that boasts of a national park that still offers natural habitat for environmental and wildlife conservation.
- Nairobi City has two natural forests within its boundaries which remain models for ecosystem conservation in the region.
- The city of Nairobi also has an arboretum, green recreational parks in the city and the central business district (CBD).

Socio-political and administrative roles of Nairobi City:

- Global headquarters of the United Nations Human Settlements Programme (UN-HABITAT) and the United Nations Environment Programme (UNEP). It also has the regional headquarters for the United Nations Development Programme (UNDP), United Nations High Commissioner for Refugees

- (UNHCR), Food and Agriculture Organization (FAO) and other United Nations (UN0 agencies).
 - Several international development agencies like the United States Agency for International Development (USAID), Japan International Cooperation Agency (JICA), Department for International Development (DfID), Swedish International Development Cooperation Agency (SIDA), etc. run their Eastern Africa functions from Nairobi City.
- Nairobi City as a centre for industrialisation, commerce and trade:**
- Multinational companies, industries, banks and commercial enterprises have their regional headquarters located in Nairobi City.
 - Nairobi City is an incubation centre for small- and medium-sized enterprises (SME) technologies in Eastern Africa.
 - People and traders come from East African capitals like Kampala and Dar es Salaam to access goods and services from Nairobi City.

6.2.3 Stakeholder Discussions on Development Vision

A technical working group attended by the NCC staff, experts from university, consultants and national government organisations was held to discuss development visions. Discussion was conducted in the following manner:

- Provide information on Kenya Vision 2030, Nairobi Metropolitan Region 2030, points of preparation of development vision (uniqueness and characteristics of Nairobi City).
- Conduct a brainstorming session for vision, expectation, and pillars of vision, which was facilitated by the secretary of the working group and a working group member.
- Compile the results and prepare development vision and discuss at stakeholder meetings.

The input from the participants is summarised below.

(1) Ideas for Development Vision

- Key Words:**
World-class, Attractive, Sustainable, Competitive, Livable
- Other Inputs:**
- Safe
 - Inclusive
 - Demonstrate excellence in city planning
 - World-class and competitive city
 - Planned and vibrant leading city
 - City that respects rights of all
 - Livelihood opportunities for all
 - Friendly city
 - Famous city where analogue and digital generation can contribute to the growth of city
 - High-yielding city that is safe and sustainable
 - World-class and unique city with functional features
 - Attractive city with excellent spatial order
 - World-class city of opportunities for all
 - Livable city appreciating all spheres of economic ,social ,environmental, and political
 - Coexistence of city with national park
 - Green and sustainable city
 - Able to generate employment, attractive to investors
 - Economically vibrant
 - Adequate housing for all residents
 - Water supply and waste management system that supports the population

(2) Expectation of NCC in 2030

Key Words:

- Balance of nature and humanity to achieve a world-class city
- City of champions (long distance athletes)-world class stadiums and sports facilities
- SAFARI city through addressing related facilities.
- City in the Sun City of Jua Kali where residents work under the sun

Other Inputs:

General:

- Equity in resource access
- Well planned and functioning city for all
- Inclusive and non-discriminatory, provide livelihood for all
- Safe and friendly city, orderly city, security in city, equity, and security
- Accommodating to diverse culture, religion, and robust governance structure
- Fully engaged public
- Efficient
- Resilient
- Competitive

Economy:

- Economically vibrant
- Investor-friendly environment, financial empowerment for county to deliver services, and governance systems promote ease of business
- Job opportunities
- Better paying jobs
- Planned environment

Living condition:

- Sustainability of built environment
- Liveability of the city, high standards of living
- Decent housing
- Reliable and safe public transport system
- Address issues of traffic and affordable housing
- Pedestrian walkways
- Clean city

Governance:

- City with public awareness
- Well planned city with clear demarcation of all trade and business activities
- Provide capacity building and development for unskilled population, qualified and adequate personnel

(3) Pillars of the Development Vision

Key Words:

- Economic
- Political
- Governance
- Socio-cultural
- Environment

Other Inputs:

- Security, Social justice
- Economic, social, cultural environment, and governance
- Infrastructure, economic, social, cultural, and political
- Economic, social, political, environment
- Cultural, inclusiveness/equity, safety and security
- Governance, economic/infrastructure, social cultural environment
- Sustainable and environmental
- Good governance and sustainability of the environment
- Governance, economic social environment
- Economic, social, political, and environment
- Good governance and sustainable environment
- Economic, social, political and environment
- Good governance economic environment

6.2.4 Vision for NCC 2030

Based on the discussion at the technical working groups and stakeholder meetings, the development vision is proposed as follows:

Nairobi 2030: An Iconic and Globally-attractive City Aimed at Regional Integration and Sustainability

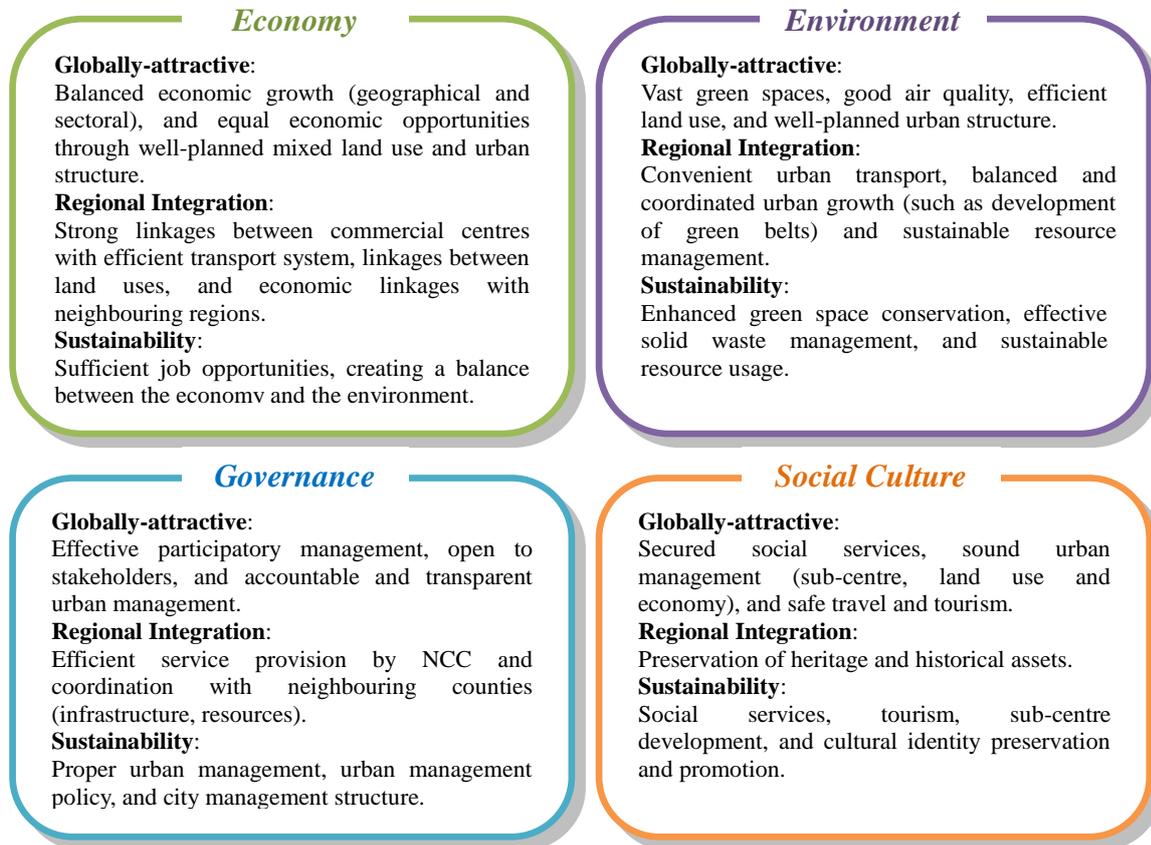


Figure 6.2.1 Proposed Vision for NCC 2030

6.3 Proposal and Discussion of Alternative Structure Plans

6.3.1 Structure Plan Formulation Procedure

The structure plan of NCC will be formulated based on the urbanisation trend of NCC, existing development plans, and the position of NCC in Nairobi Metropolitan Region (NMR). The steps for structure plan formulation are as follows:

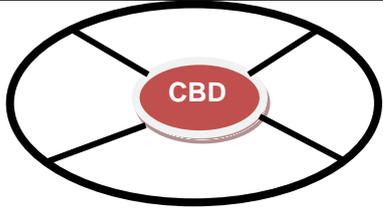
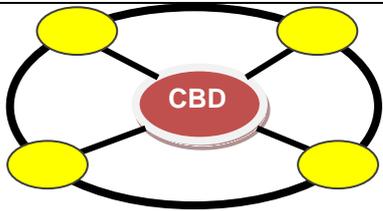
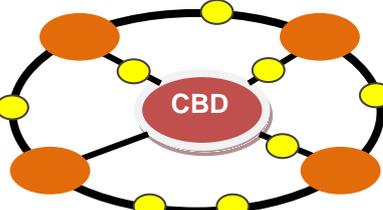
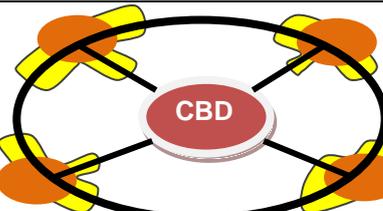
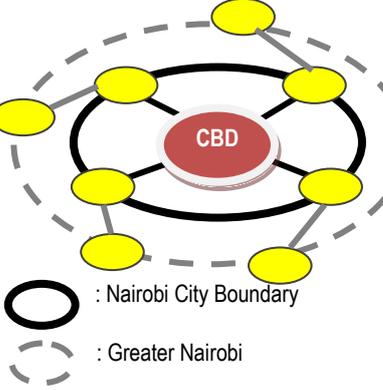
- Understand typical types of structure plan.
- Understand the conditions of Nairobi City: position of Nairobi City in NMR, trend of urbanisation.
- Discuss the urban development direction.
- Prepare alternative structure plans.

Technical working group (land use and settlements) was held several times to discuss the structure plan. The alternative structure plans were discussed at stakeholder meetings. The ideal structure plan was then selected.

6.3.2 Discussion of Alternative Prototypes of Structure Plans

Several prototypes of structure plan can be conceived for NCC. For discussion purposes, typical prototypes are introduced. The following Table 6.3.1 shows the types and characteristics of structure plans.

Table 6.3.1 Comparison of Types of Structure Plan

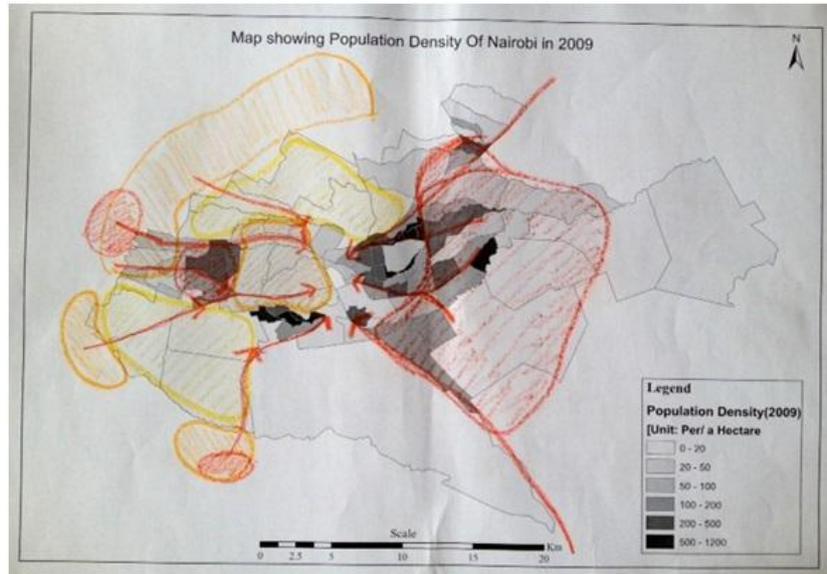
Types of Structure Plan	Image of Structure	Characteristics
<p>CBD One Core System (Mono Core) (present trend) Only one strong nucleus which develops and there is no existing or important function in other centres</p>		<p>[Positive aspect]</p> <ul style="list-style-type: none"> ● Strong growth of CBD with urban function concentrated in CBD ● Effectiveness for the early stage of development <p>[Negative aspect]</p> <ul style="list-style-type: none"> ● Stagnation on the surrounding areas causing disparity in living condition (CBD has easy access to urban function) ● Heavy traffic congestion and further worsening ● Less environmental consideration
<p>Sub-centre System (Poly Nucleated Development) There is no dominating single settlement; all nodes of the polycentric network have the same relevance of “spatial participation”</p>		<p>[Positive aspect]</p> <ul style="list-style-type: none"> ● Better mobility will be maintained by decentralising the CBD ● Accelerated growth of sub-centres ● Living condition in CBD will be maintained and more people will live in the suburbs with better living condition and lifestyle
<p>Sub-centre System (Bi-polar Corridor Development) Development of minor settlements along the transport corridor connecting two strong nodes.</p>		<p>[Positive aspect]</p> <ul style="list-style-type: none"> ● Better mobility will be maintained by decentralising the CBD ● Living condition in CBD will be maintained and more people will live in the suburbs with better living condition and lifestyle ● Strong axial development with strong polar forms. <p>[Other feature]</p> <ul style="list-style-type: none"> ● Multi modal transport along corridors is required
<p>Sub-centre System (Corridor cum Ring Development) Development of settlements along the corridor and ring</p>		<p>[Positive aspect]</p> <ul style="list-style-type: none"> ● High intensity development along city sub-centres ● Medium capacity transport system ● Network of transport (sectoral and regional centres) <p>[Negative aspect]</p> <ul style="list-style-type: none"> ● Requires high investment on transport infrastructure.
<p>Diffused Development System Development of two levels of corridor (within NCC and Greater Nairobi)</p>	 <p>○ : Nairobi City Boundary ○ : Greater Nairobi</p>	<p>[Negative aspect]</p> <ul style="list-style-type: none"> ● High investment cost <p>[Other features]</p> <ul style="list-style-type: none"> ● Self contained or independent development ● Dispersal development

Source: JICA Study Team (JST)

6.3.3 Stakeholder Discussions on Structure Plan

(1) Technical Working Group for Structure System

The technical working group for land use planning discussed alternative structure plans using some drawings showing analytical structural aspect, as shown below.



Source: JICA Study Team (JST)

Figure 6.3.1 Discussion Results

The key issues discussed during the technical working group meeting are as follows:

Key Issues:

- Proper density control
- Green conservation for recreation
- Historical building conservation
- Rearrangement of industrial areas
- Redevelopment of CBD to deliver accommodation and work place for increasing population
- Eco-friendly city centre with new transport system
- Sub-centre development in Karen, Westland, near JKIA, Kasarani and Njiru
- New sports facility for Nairobi City
- Sub-centre system (multi core development) is ideal for future of Nairobi City

(2) Selection of Prototype of Structure Plan

Current structure of NCC is characterised as “one core type” and already facing problems of heavy concentration of social and economic activities in CBD and heavy traffic congestion. Development of Nairobi is shifting from “one core system” to “dispersion of urban function type” then to “ring road type”.

Considering the urban development trend and problems that Nairobi City is facing, “Sub-centre System (Bi-polar Corridor Development)” is adopted as the type of structure plan of Nairobi City.

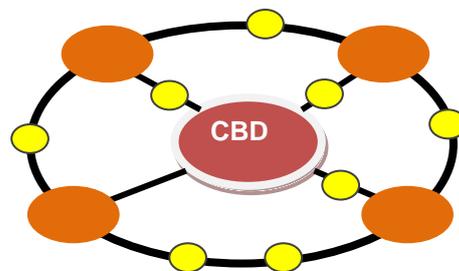


Figure 6.3.2 Sub Centre System (Bi-polar Corridor Development)

6.3.4 Proposed Structure Plan

Based on the selected Sub-centre System (Bi-polar Corridor Development) structure, the technical working group on land use and settlement discussed the structure plan with the existing conditions and location. The following sections are the results of a series of discussions:

(1) Road Network and Node

Several nodes which are located on the interchange of expected road network were proposed as sub-centres. The features and locations of each sub-centre are shown as follows:

- Residential and Commercial : Runda-Ruaka, Ruiru, Ruai, Karen and Langata
- Office and Commercial : Uthiru and Kabete
- Industrial and Commercial : Donholm and Airport, north
- Residential, Commercial and Entertainment (Sports Facilities) : Ruaraka (Kasarani)



Source: JICA Study Team (JST)

Figure 6.3.3 Road Network and Nodes

(2) Railway and Road Transit Interchange

The red line in Figure 6.3.5 shows a railway corridor which is proposed in the Nairobi Metropolitan Services Improvement Project (NaMSIP). As the railway stations are assumed to be utilised by a large number of passengers from surrounding areas, they have development potentials. It is expected to develop the area around main stations as sub-centres.



Source: JICA Study Team (JST)

Figure 6.3.4 Railway and Road Transit Interchange

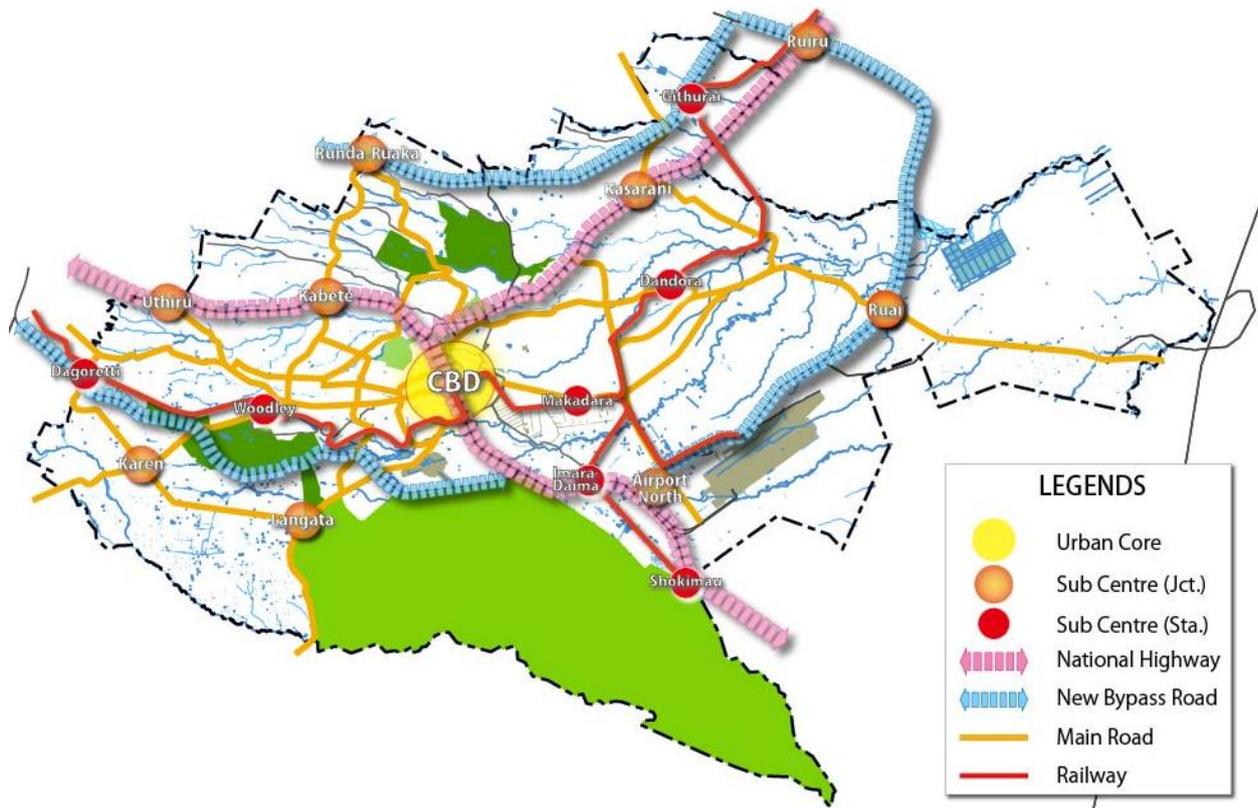
(3) Proposed Structure Plan

A structure plan for Nairobi City is proposed based on the urban conditions including CBD, transport, and proposed development vision. Justification of the structure plan is summarised below.

- To realise a symbolic status as the centre of Kenya, and a gateway to East Africa Region by strengthening the function of Nairobi City's CBD;
- To strengthen sub-centres to promote balanced development: narrowing the east-west gap, easing development pressure for the existing CBD, and dispersing social economic activities throughout NCC; and
- To establish sub-centres along the interchanges of urban transport system to synchronise urban development and urban transport development: interchanges of major road network, interchanges of road and railway (including Light Rail Transit (LRT)).

The sub-centres (Runda-Ruaka, Ruiru, Kasarani, Uthiru, Kabete, Ruai, Karen, Langata, Airport north, Githurai, Dandora, Dagoretti, Woodley, Makadara, Imara-daima, and Shokimau) are located on interchanges in consideration of the road network and railway corridor. It is expected to make economic activity more efficient by the promotion of distribution of daytime population which is concentrated in CBD currently. The location of proposed sub-centres is shown in Figure 6.3.6.

Hierarchy of sub-centres will be considered in the following Section 6.4.6 based on importance and priority for development.



Source: JICA Study Team (JST)

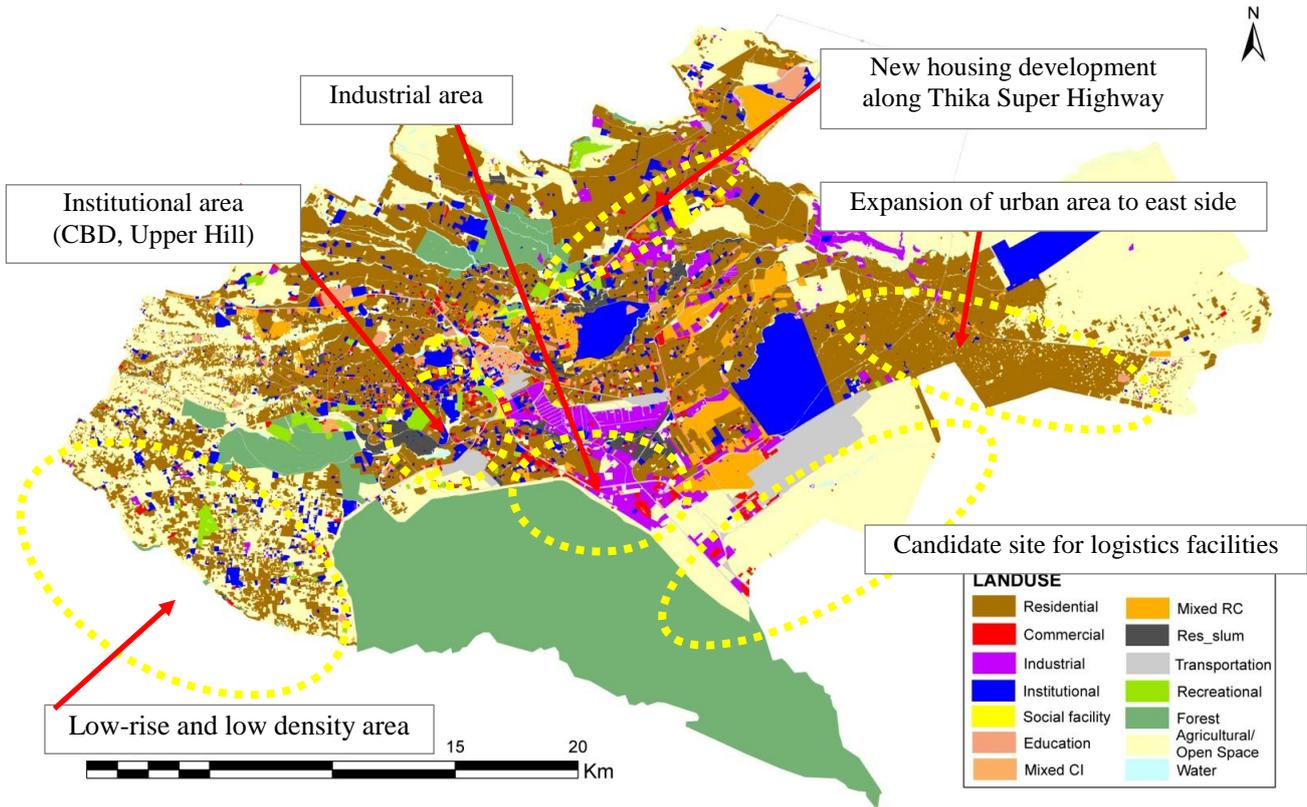
Figure 6.3.5 Proposed Structure Plan for Nairobi

6.4 Formulation of Land Use Policy

6.4.1 Present Land Use and Buildings

Majority of governmental institutions have their headquarters in the CBD and Upper Hill area. For this reason, the current land use of this area is mixed use with predominantly institutional and others. Some of the new office buildings for private companies, however, tend to be located outside CBD, principally along major roads, which are assumed to change the distribution of institutional use within the city. Karen-Langata area which is located in the southwestern part of Nairobi City still keeps low-rise and low density residential profile with ample open space. On the other hand, housing developments in and around Ruai are conducted by private developers without a clearly defined comprehensive development concept to become high density and low open space area.

Figure 6.4.1 shows the distribution of current land use of Nairobi City and their features.



Source: JICA Study Team (JST)

Figure 6.4.1 Current Land Use

6.4.2 Demand for Land Use

(1) Capacity of Existing Regulation

Based on the existing regulation, entitled “A guide of Nairobi City Development Ordinances and Zones” and population densities in each sub-location, the JICA Study Team (JST) made an estimate of the population capacity of Nairobi City.

1) Conditions for capacity estimation

The conditions of estimation are described in the following Table 6.4.1.

Table 6.4.1 Conditions for Capacity Estimation

<p>Calculation Accuracy</p> <ul style="list-style-type: none"> Population capacity is calculated based on the 106 sub-regions as shown below.  <p>Conditions for estimation of livable area</p> <p>1) Plot ratio</p> <ul style="list-style-type: none"> Assumed to follow the existing land use zoning in “Development Ordinances and Zones”. Assumed to follow the plot ratio (PR) in “Development Ordinances and Zones”. This means to keep the existing development image, i.e., low-density green residence in upper land, high density in east land, and low density in eastern area other than east land. <p>2) Livable land</p> <ul style="list-style-type: none"> Population distributed on “livable land” which was allotted based on the Land Use GIS data by Colombia University. Informal settlement areas are not to be expanded. Agricultural lands in suburban area are to be conserved. And institutional, transportation, recreational, natural reserve, and water land uses are also to be kept as they are. Open space and unknown land uses are counted as livable land. <p>Assumed population density</p> <ul style="list-style-type: none"> Assumed to follow the existing population density. Regarding informal settlement area, the plot ratio is estimated from census data (higher than development ordinance). <p>Calculation formula is shown as below:</p> <p>“Estimated population capacity” = “Assumed population density” * “Livable floor area”</p>
--

2) Estimation result

Based on the above conditions, the maximum capacity of population of NCC is estimated to be approximately five million.

This result means that if Nairobi City needs to accommodate more than five million population, the existing regulation in the Development Ordinance should be revised to change land use, i.e., to convert some non-residential land use to residential use, and also the plot ratio should be changed to higher value to promote higher population density to accommodate future population.

(2) Business Land Use

Based on the employment forecast, the number of employment will increase by approximately one million up to 2030. Amongst the forecasted increase, the office-employed population in priority industry, as shown in shadow in the following Table 6.4.2, comes to around 583,900.

Table 6.4.2 Employment Estimation for 2030

Type of Industry	2013	2013 (%)	Point Change	2030 (%)	2030	Increment 2030-2013
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1	Agriculture and forestry	43,831	2.4	-1.5	0.9	26,000	-17,800
2	Mining and quarrying	11,571	0.6	-0.2	0.4	12,000	430
3	Manufacturing	91,053	5.0	-1.0	4.0	113,000	21,950
4	Electricity, gas, and water supply	40,807	2.3	0.2	2.5	69,000	28,190
5	Construction	66,807	3.7	1.5	5.2	146,000	79,190
6	Wholesale and retail trade	307,061	16.9	0.0	16.9	476,000	168,940
7	Repair of vehicles, personal and household goods	71,205	3.9	0.0	3.9	110,000	38,800
8	Transportation, storage, and communication	86,471	4.8	1.0	5.8	162,000	75,530
9	Hotels and restaurants	160,013	8.8	1.0	9.8	276,000	116,000
10	Financial intermediation	102,413	5.6	0.8	6.4	181,000	78,600
11	Real estate and renting	32,518	1.8	0.0	1.8	51,000	18,500
12	Public administration	86,202	4.8	-1.0	3.8	106,000	19,800
13	Education	140,332	7.7	1.6	9.3	263,000	122,700
14	Health and social work	94,294	5.2	1.0	6.2	174,000	79,700
15	Other service industry	347,825	19.2	0.5	19.7	553,000	205,200
16	Private households	130,465	7.2	-3.9	3.3	93,000	-37,500
Total		1,812,869	100.0	0.0	100.0	2,811,000	998,100
Priority Industry							583,900

Source: JICA Study Team (JST)

Colored columns indicate priority industry, which was identified based on Kenya Vision 2030 and through Thematic Working Group.

JST estimated the office floor demand based on the employment gap as follows:

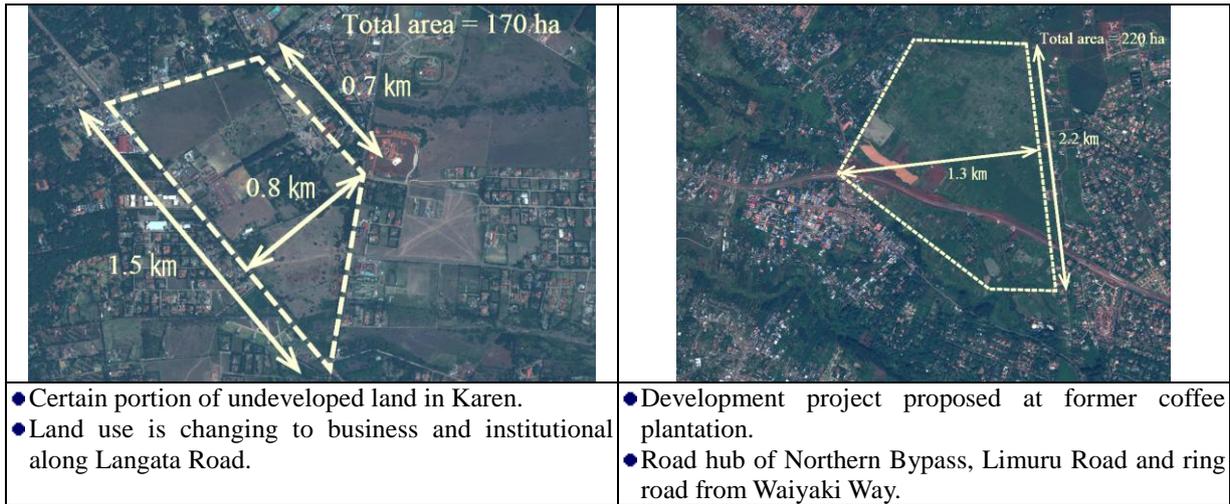
- Apply 30 m², which includes common facility area, for one office worker.
- 583,900 x 30 m² = 17.52 million m² = 1,752 ha.
- If PR (Plot Ratio) = 300%, land demand = 1,752/3 = 584 ha.

Approximately 600 ha of land will be necessary for the office demand.

(3) Available Land for Development

Figure 6.4.2 below shows the areas of some of the proposed sub-centres. For example, Upper Hill South area has approximately 260 ha. Most of the area is already somewhat developed or developing.

Upper Hill South	Railway City (CBD South)
	
<ul style="list-style-type: none"> • Available land limited. • Need land use change from residence to commercial. • Approx. 25 ha can be converted to office use. • But there are historical buildings in the area to be conserved for the future. 	<ul style="list-style-type: none"> • KR land = 112 ha • Need land use change from industry to commercial.
Karen	Runda-Ruaka



Source: Google Earth, JICA Study Team (JST)

Figure 6.4.2 Land Availability in Some Areas

(4) Large Land Occupants

Public institutions and facilities in Nairobi City County occupy a large size of land. Most of those lands are not utilised efficiently. The summary of zonal considerations of large land occupants is described in Table 6.4.3 below. These public service lands can be utilised partly for urban development, transportation facilities, or public activities by way of redevelopment or agglomeration.

Table 6.4.3 Zonal Considerations of Large Land Occupants

Location	Consideration
1 KRC (Kenya Railway Corporation)	<ul style="list-style-type: none"> • Nairobi central station yard • Industrial area (Makadara) yard • Railway workers residential estates (Makongeni, Muturwa)
2 NCC (Nairobi City County)	<ul style="list-style-type: none"> • Old housing scheme estates with low density in Eastland (Kaloleni, Shauri Moyo, and so forth)
3 KPLC (Kenya Power and Lighting Company)	<ul style="list-style-type: none"> • Power lines occupy large plot especially in Dandora area because of the main substation located in the area. • Restriction regulation of power line is old and strict for development near lines.
4 Schools	<ul style="list-style-type: none"> • Private schools especially in western part of Nairobi City (e.g., Lenana School, Nairobi School, and so forth.)
5 Police stations	<ul style="list-style-type: none"> • Police stations are also occupying large plot with low density.
6 Military	<ul style="list-style-type: none"> • Airbase occupies huge land east of Eastland. • Barracks also occupy large land at important location.
7 Church	<ul style="list-style-type: none"> • Churches have huge land for parking, used only in weekends.
8 Land buying company	<ul style="list-style-type: none"> • There is no clear information available. However, their active businesses are well known.

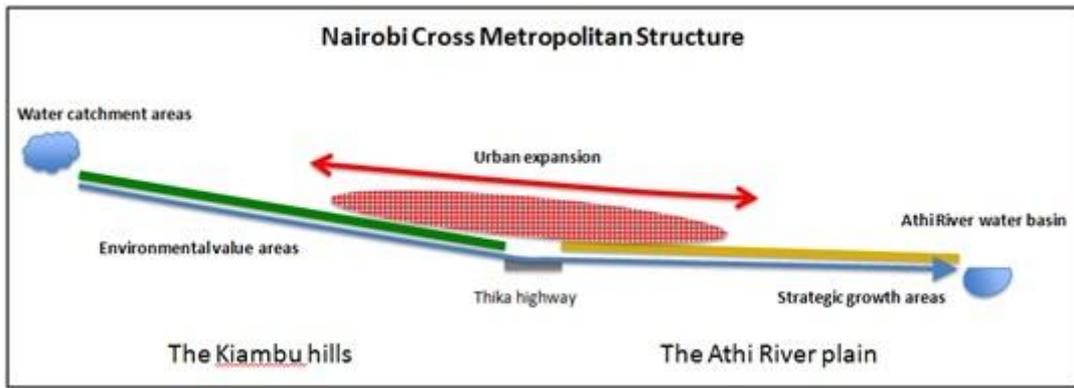
Source: JICA Study Team (JST)

6.4.3 Urban Characteristics and Zonal Considerations

(1) Urban Characteristics

1) Basic Urban Character

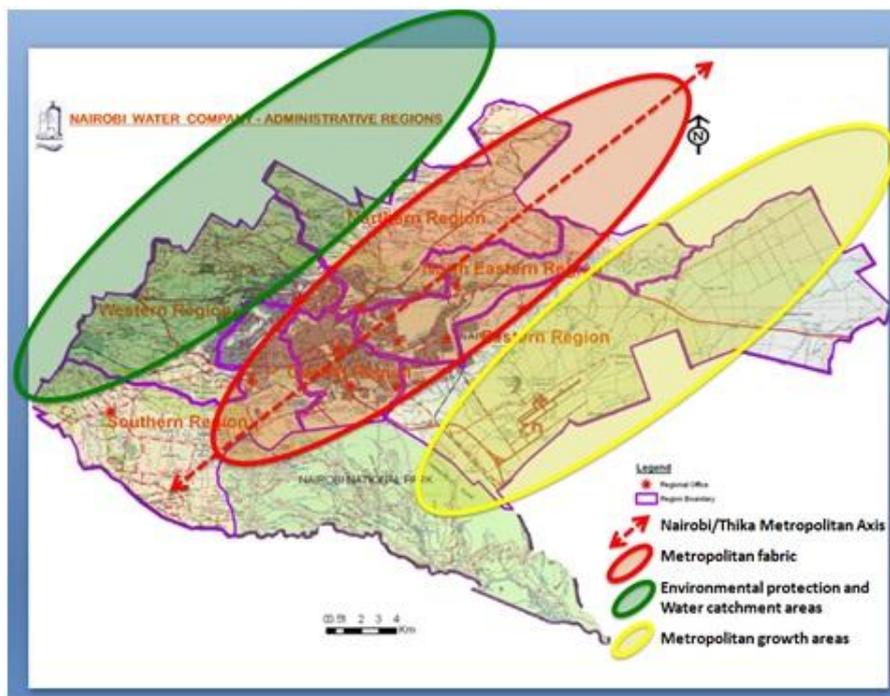
Nairobi City's cross-sectional profile is shown in Figure 6.4.3 below. Northeast to southwest axis is urban activity core areas. Northern and western areas are environmental value areas including agricultural activities. Eastern and southern parts are rapid urban growth areas.



Source: NaMSIP Consultant

Figure 6.4.3 Cross-sectional Profile of Nairobi City

This urban profile can be simplified on a map as shown in Figure 6.4.4 below. Red colour shows Nairobi Metropolitan Fabric; green colour shows an environmental value area; and yellow colour shows a metropolitan growth area.

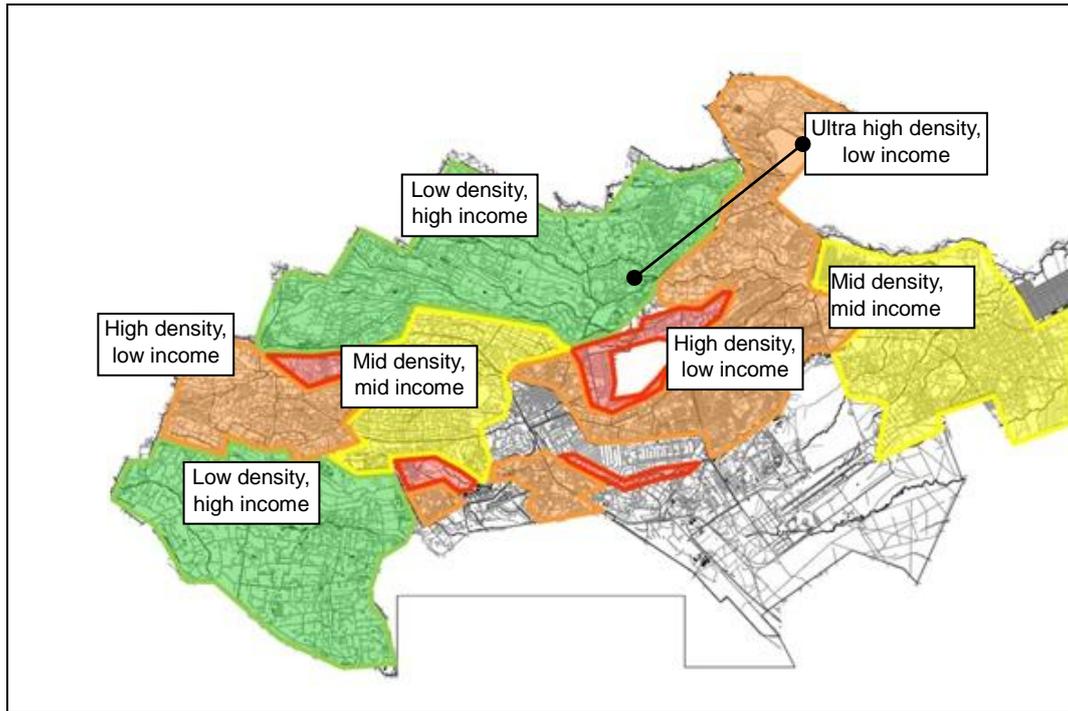


Source: NaMSIP Consultant PPT

Figure 6.4.4 Basic Urban Character

2) Population Distribution

Basically, population distribution in Nairobi tends to be low density in the west and high density in the east. Extremely high density areas are mainly slums or informal settlements.



Source: JICA Study Team (JST)

Figure 6.4.5 Land Availability in Some Areas

3) Obstacle Lands for Urban Planning

Nairobi City has several spatial obstacles for urban planning as shown in Table 6.4.4 below.

Table 6.4.4 Obstacle Lands for Urban Planning

Obstacle Lands	Condition
Nairobi National Park	Nairobi National Park occupies southern part of Nairobi City. Thus, almost all intercity traffic has to pass Mombasa Road and this causes heavy congestion on the road.
Kibera Slum to Ngong Forest	There is no connection road between Mbagathi Way and Karen Road for about 10 km. This causes severe traffic problem on Ngong and Langata Road.
Nairobi Central Station	Nairobi railway station and yard block CBD and southern industrial and business area. Thus, all traffic is concentrated on Mombasa and Jogoo Road.
KRC Land in Makadara	A 3.5 km long and 400 m wide strip of land is located between Jogoo Road and industrial area.
Airbase	An airbase located at Eastland is now a land obstacle in this area, which is 3.5 km x 3.0 km in size. This causes road congestion on Juja, Jogoo, Outer Ring Road and Eastleigh First Ave.
Rivers with informal settlements	Several rivers flowing from west highland to east divide the lands without certain bridge.

(2) Zonal Consideration

Recent brisk economical activities in Nairobi City have been changing its landscape everywhere except in CBD and Eastland.

Urban characteristics and zonal considerations are summarised in Table 6.4.5 below.

Table 6.4.5 Zonal Considerations

Zone	Status	Ideas/Consideration
<p>1A Central Business District (CBD) Business and commercial centre</p>	<ul style="list-style-type: none"> ● Has three subzones <ul style="list-style-type: none"> (1) Core – Kenyatta Avenue/Uhuru Highway/ Hail Salesia <ul style="list-style-type: none"> ➢ Edge – University area/Polytechnic Two peripherals – (2) Tom Mboya- Nairobi River <ul style="list-style-type: none"> ➢ has small plots and narrow streets ➢ low density/commercial development – no onsite parking ➢ general decay/urban blight (3) Ngara/Kamukjni/Gikomba <ul style="list-style-type: none"> ➢ no new investments for commercial /ngara ➢ many garages – <ul style="list-style-type: none"> - choking with informality - very vibrant - vehicular mobility is a problem <p>Overall</p> <ul style="list-style-type: none"> ● No major investment in CBD in recent decades. ● Heavy traffic jam is serious problem in CBD. 	<ul style="list-style-type: none"> ➢ Promote higher level/densification/compactness ➢ Promote compatible mixed use incl. residential ➢ Land readjustment ➢ Pedestrianisation of CBD ➢ Need enhanced plot ratio to enable higher development/zoning is restrictive ➢ Limited funding <ol style="list-style-type: none"> 1. Before residential – not viable anymore 2. Promote localised economic zone
<p>1E Upper Hill Area Office, government, hospital</p>	<ul style="list-style-type: none"> ● New office building and other development projects are quite active in this area. ● Road network improvement projects are also ongoing. ● Trend for offices – catering for onsite parking ● Apartments give low plot ratio ● Area is inaccessible 	<ul style="list-style-type: none"> ➢ Allow higher density ➢ Tending towards predominantly offices ➢ Promote mixed used ➢ Open alternative access/exit ➢ Transform to city character – no boundary walls
<p>2 Eastleigh, Ziwani, Sterehe, Pangani, High-rise residential area</p>	<ul style="list-style-type: none"> ● Population density is growing to 500 p/ha. ● Constructions of high-rise apartment are active ● Has a district centre with a core with higher plot ratio- challenge in parking ● Private development encroaching on the public way 	<ul style="list-style-type: none"> ➢ Land readjustment ➢ Pangani needs provision of parking ➢ Enhance the plot ratio and regulate ➢ Urban renewal for Ziwani and Starehe with enhanced plot ratio ➢ Model development in Pangani - Chinese
<p>3 Parklands, Westland Commercial, residence and office</p>	<ul style="list-style-type: none"> ● Commercial concentration in Westland CBD. ● New shopping centre and office building appeared in recent years. ● Growth of medical industry connected to Agha Khan and MP Shah ● Current development trends exceeding allowed levels 	<ul style="list-style-type: none"> ➢ Road network improvement required. ➢ Land readjustment to enable high rise with open spaces ➢ Discourage regularisation as a method of zoning (catching up).
<p>4 Upper Spring Valley, Kileleshwa, Kilimani, Thompsons, Woodley, etc. Medium-density residential for middle income level</p>	<ul style="list-style-type: none"> ● Detached houses are converting to high-rise apartments or office buildings. ● Some apartments seem not following height regulation (regulation states four storeys maximum). ● Very diverse – mixed characteristics – needs separation ● Kileleshwa fast growing but no shopping centre 	<ul style="list-style-type: none"> ➢ Very diverse – mixed characteristics ➢ needs separation to maintain high density mixed with low density
<p>5 Lower Spring Valley, Loresho, Lavington, Benard Low density residential for high income level</p>	<ul style="list-style-type: none"> ● Generally low density development with few designated local centres (dying) ● Have strong neighbourhood associations ● Some plots are converted to apartment buildings. 	<ul style="list-style-type: none"> ➢ Maintain the character/conservation
<p>6 Muthaiga Low density residential for diplomats and high income level</p>	<ul style="list-style-type: none"> ● Situation in this area has not changed. ● This area should be kept as it is. ● Do not want consular offices 	<ul style="list-style-type: none"> ➢ Maintain the character/conservation

	Zone	Status	Ideas/Consideration
7	Mathare Valley, Lower Haruma, Kariobangi, Dandora High density flats and informal settlements	<ul style="list-style-type: none"> Very high density sometimes over 1,000 p/ha. High-rise flat construction is active in this area. 	➤ Land readjustment
8	Old Eastland, Komarock, Kayole Old city council housing scheme.	<ul style="list-style-type: none"> High-rise and high-density redevelopments are planned. 	➤ Promote mixed use
9	Main Industrial Area Industries and godowns developed area	<ul style="list-style-type: none"> Transportation services change from rail to motor vehicle. Some factories are moving out of Nairobi City. Investment flight/with conversions/decay 	➤ Revitalisation of industrial area
9E	Other Industrial Area (Dandora, Kariobangi, Mathare North) All area developed.	<ul style="list-style-type: none"> Some industrial area changing to mixed development. 	➤ Promote mixed development
10	Nairobi West, Madaraka, South 'B' , Medium-density, low-rise residential in mixed type development	<ul style="list-style-type: none"> Lower density developments for middle-income families (less than 200 p/ha) are occurring in large area. 	➤ Promote residential environmental improvement for middle-income families
10E	Villa Franca, Imara-Daima, Embakasi Planned max. 35 units/ha	<ul style="list-style-type: none"> Some area 	➤ Imara-Daima station area need higher density development as sub-centre.
11	Kibera Slum, NHC Estates Informal mixed residential	<ul style="list-style-type: none"> Informal mixed residential improvement development schemes are ongoing. 	
12	Karen, Langata Low density residential for high income level	<ul style="list-style-type: none"> Land use change to office purpose along Langata Road can be seen. Growth of universities and related developments – hostels 	➤ Existing plan to be reviewed to reflect recent changes
13	Gigiri, Garden Estate, Safari Park Low density residential for diplomats and high income level	<ul style="list-style-type: none"> Unauthorised conversions of use but the building remain More UN and missions influx Hostels in Safari Park for University 	➤ Review to zone for low density and mixed development
14	Roysambu, Thome, Marurui Low density residential	<ul style="list-style-type: none"> Variety character – high rise, comprehensive development Former plantations converted into housing, land for public uses and circulation network/social infrastructure was irregularly allocated 	<ul style="list-style-type: none"> ➤ Re-zoned into two – high density mixed development and low density ➤ Provide for public uses and circulation network/social infrastructure
15	Dagoretti High-density residential and agricultural land use	<ul style="list-style-type: none"> Changing to high-rise residential development. Sections under agricultural land use. Tenure is freehold, rapid subdivision. 	➤ At district level planning policy and zoning of land use with regard to land use
16	Baba Dogo, Ngumba, Ruaraka Industrial zone, residential mixed	<ul style="list-style-type: none"> Big shopping mall and residential project started at former factory site. 	➤ Newly development should be well organized
17	Githurai, Zimmerman, Kahawa West Industrial zone, residential mixed	<ul style="list-style-type: none"> High-density residential mixed development is spreading. Thika Super Highway affects impact of magnitude. 	➤ Development ordinance should be re-considered
18	Kasarani (Cray work, Cray City, Kasarani, Mwiki, Ruai)	<ul style="list-style-type: none"> Many land subdivision without certain infrastructures can be seen in this area. Areas along main roads are already developed as residential mixed area. 	➤ Last mile infrastructure is required
19	Special Scheduled Area outside Nairobi City Boundary Njiru area for detached housing site development	<ul style="list-style-type: none"> Many land subdivision without certain infrastructures can be seen in this area. Solid waste dumping site is planned east of sewerage treatment plant. 	➤ Infrastructure installation is required.

	Zone	Status	Ideas/Consideration
20	Public/Strategic Reserved Area Include statehouse, airports, military sites	<ul style="list-style-type: none"> This land will remain to have the same purpose. 	<ul style="list-style-type: none"> Expansion area of JKIA will be reserved. Military site located north of JKIA might be considered for urban development.
20E	Recreational & Forest, National Park, Stadiums, Park	<ul style="list-style-type: none"> Basically, these areas should be conserved as they are. 	<ul style="list-style-type: none"> Area between Mombasa Road and National Park will be used for industrial and transport purposes.

Source: JICA Study Team (JST)

6.4.4 Principal Policy for Land Use Plan 2030

(1) Principal Policy for the Nairobi Land Use Plan 2030

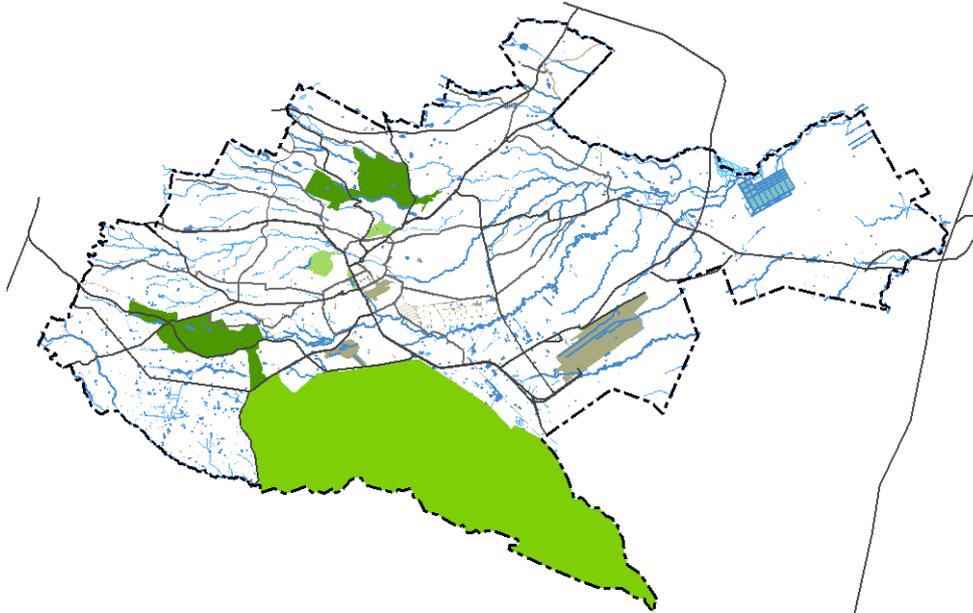
The following are the principal policies for the Nairobi Land Use Plan 2030.

Table 6.4.6 Principal Policy for Nairobi Land Use Plan

1	Decentralise business, administrative and commerce functions	<ul style="list-style-type: none"> Sub-centre system (bi-polar corridor development <i>*See Table 6.3.1</i>) will be adopted with new urban transport network to subdivide business functions. Land use regulation for sub-centre areas will be revised to activate their function and to accommodate growing population. CBD should be re-developed to revitalise city centre.
2	Expand and renovate CBD	<ul style="list-style-type: none"> KRC's railway yard to be developed for new urban core.
3	Supply appropriate housing for all	<ul style="list-style-type: none"> Urban re-development from low density residence to medium to high density residence is necessary. Appropriate housing scheme for low income is necessary as social services.
4	Preserve and restore green and water environment to create ecological network	<ul style="list-style-type: none"> Existing forests and woods should be preserved. River and river banks will be restored to open recreational space.
5	Conserve agricultural activities	<ul style="list-style-type: none"> Agricultural activities should be conserved for diversification of the land use.
6	Restructure industrial area	<ul style="list-style-type: none"> New industrial areas will be allocated in southern part of the city. Existing industrial area should be re-developed for new urban function.
7	Beautify the city for Kenyan pride	<ul style="list-style-type: none"> Urban landscape regulation should be established to keep historical beauty for the citizen.

(2) Decentralise Business, administrative and Commerce Function

The land use zoning and plot ratio of sub-centres will be changed to promote the decentralisation of business, administrative and commerce functions from the central to suburban locations.



Source: JICA Study Team (JST)

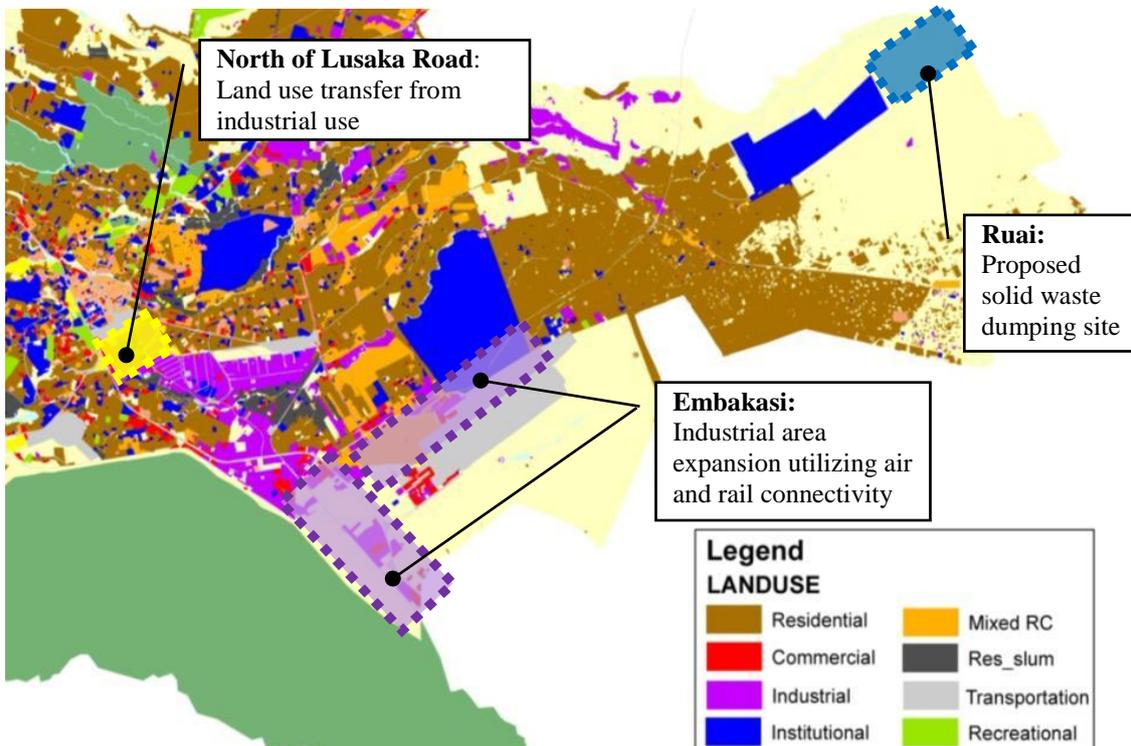
Figure 6.4.7 Ecological Environment in Nairobi City

(5) Conserve Agricultural Activities

Historically, the western part of Nairobi City was developed as a farm land with rich soil and rainfall. Staple agricultural activities should remain for the sake of land use diversity.

(6) Restructure Industrial Areas

The industrial area of Nairobi City will be expanded to the south near JKIA and the planned new railway freight station in Embakasi.



Source: JICA Study Team (JST)

Figure 6.4.8 Industrial Land Use Restructuring

6.4.5 Central Business District Development

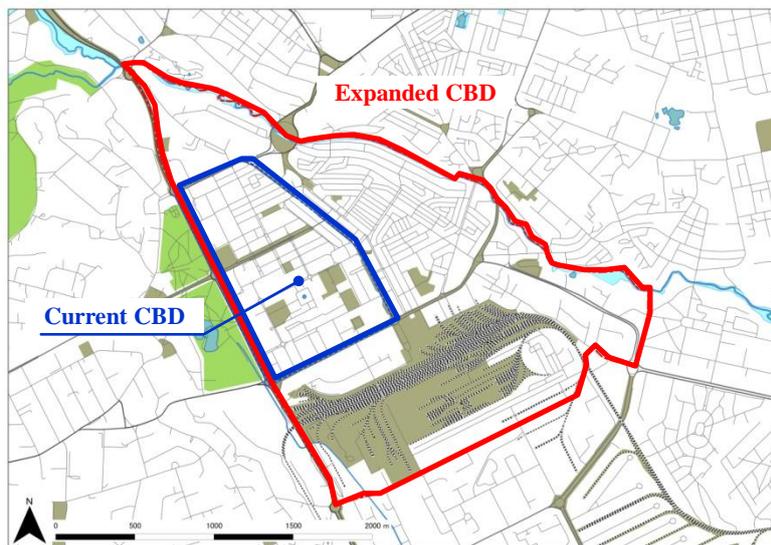
(1) Position and Issues of the Nairobi City's CBD

As discussed in the Development Vision of Nairobi City County 2030, Nairobi City is not only the capital city of Kenya but also one of the leading economic centres of East Africa Region, and thus its CBD should become a symbol of active economy and its function should be strengthened to match the vision. The strengthening of CBD is also critical to support an efficient urban transport system. Nairobi City has a predominantly radial road network structure which originates to and from CBD, and the proposed LRT and Bus Rapid Transit (BRT) are also concentrated to and from CBD.

Yet, the current condition of CBD is not as efficient as it should be, due mainly to a lack of coordination amongst stakeholders including the proposed Railway City Development and concentration of transport modes around Nairobi Station area. There are a few large inter-city bus terminals in one area within CBD, and this creates acute traffic congestion in CBD.

(2) Expansion of Nairobi City's CBD

The current CBD boundary is marked by roads such as Uhuru Highway on the west, University Avenue on the north and Haile Selassie Avenue. Throughout its history, CBD has been developed as an administrative centre and a market place. It was the hub for buying and selling of goods and services. As the city grew, CBD also developed, and CBD turned out to be a commercial and retail centre. In the mid-20th century, CBD developed into a centre of finance and provided for private and public office space. Additionally, a number of tall buildings made the area denser and lifted its skyline. Under the influence of this economic growth, the expanded CBD, which is shown in Figure 6.4.9, was proposed to consider the collective development strategy under the Spatial Planning Concept for Nairobi Metropolitan Region, which was adopted by JST.



Source: Spatial Planning Concept for Nairobi Metropolitan Region

Figure 6.4.9 Boundaries of the CBDs

(3) Building Survey for the Expanded CBD

Despite the fact that CBD plays important urban functions in Nairobi City, it was difficult to grasp the current situation closely, due to the absence of detailed investigation for this entire area. For this reason, a building survey for the expanded CBD has been implemented from 17 to 21 June 2013 by JST and NCC jointly to clarify the actual situation of the area and analyse obstacles for the economic

activities. This building survey covers most of the area of the expanded CBD except for Railway City area around Nairobi Station. The survey area is shown in Figure 6.4.10.



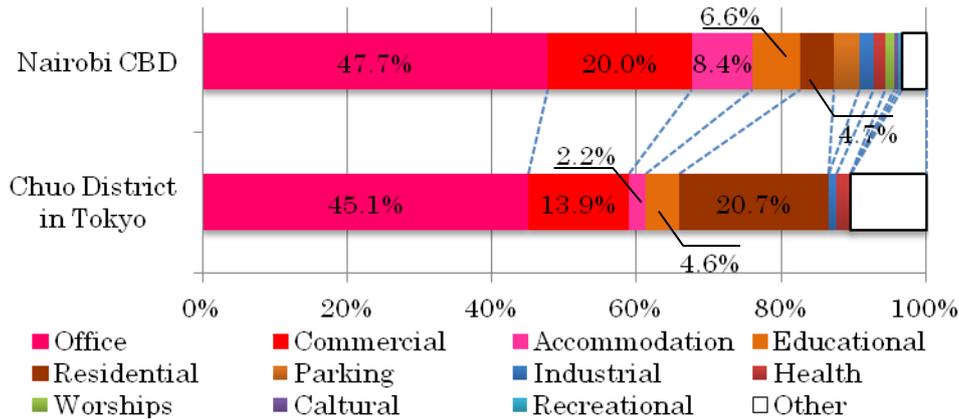
Source: JICA Study Team (JST)

Figure 6.4.10 Survey Area (Expanded CBD without Railway City)

The following are some of the observations from the survey:

1) Floor Use Distribution

In case of Nairobi City's CBD, more than 75% of the floor is utilised for commercial use (office, commercial and accommodation facilities including hotels and guest houses). This feature is a general feature of CBD, and it shows that commercial facilities and offices are accumulated in this area. One of the interesting features of the Nairobi City's CBD is the ratio of educational floor. The Nairobi City's CBD has the University of Nairobi and satellite campus of some other universities in its northern part called "University District". This area provides some potential opportunity for collaboration of the researching facilities and private companies, and provide for creating a new business by using the new skills, knowledge and human resources from the "University District". The residential buildings which are located in Nairobi City's CBD are medium/low-rise units standing on small lots (200 m² – 250 m²). For this reason, Nairobi City's CBD does not provide much residential space, and the percentage of the residential use is low (4.7%).



Note: In case of Chuo District of Tokyo, floor area of parking is included in each floor use. However, it is estimated at 10% from the “Land Use of Tokyo” published by Tokyo Prefecture in 2012.
 Source: JICA Study Team and Land Use of Tokyo in 2013

Figure 6.4.11 Floor Use Distribution

2) Current Ground Coverage Situation (Plot Ratio)

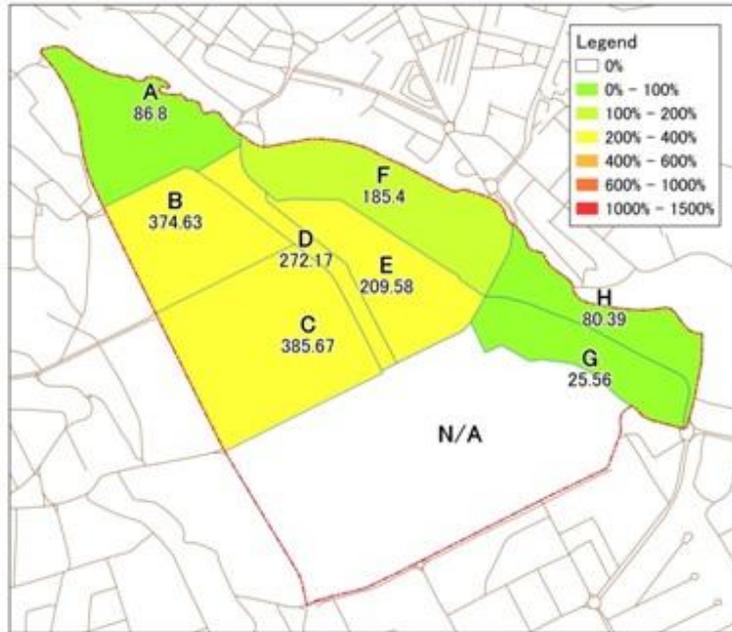
According to the Development Ordinance of Nairobi City, the maximum values of ground coverage (GC) and plot ratio (PR) of subzones are specified in the following Table 6.4.7.

Table 6.4.7 GC and PR in the Expanded CBD

Areas Covered	GC (%)	PR (%)	Type(s) of Development Allowed	Min. Area (ha)
Core CBD	80	600	Commercial Residential Light Industry	0.05
Peri- CBD	80	500		
West of Tom Mboya Street	60	600		
East of Tom Mboya Street	80	350		
Uhuru H/W, University Way, Kipande Road	80	500		

Source: A Guide of Nairobi City Development Ordinances and Zones

Figure 6.4.12 shows the average value of PR for each zone. In case of zone C, in spite of the PR specified by Development Ordinance as 600%, the current PR is 385%. The usage ratio of PR is only 64%. Majority of the zones in CBD have not adequately used up the maximum PR. Especially the average PR east of Tom Mboya Street is about 200% (zone E = 209%, zone F = 185%), and this ratio is for the low-rise residential area rather than for CBD. While CBD is generally supposed to have higher development potential than other areas, Nairobi City’s CBD does not utilise its full potential, and it has low-rise buildings in some crowded plots. It is expected to further extend the CBD vertically (or higher in the skyline) to solve the low-utilisation issue.



Source: JICA Study Team (JST)

Figure 6.4.12 Consumed Plot Ratio of Each Zone in the Expanded CBD

Table 6.4.8 Comparison between Development Ordinance and Ground Situation

Zone	Development Ordinance Specification		Current Ground Situation		B/A
	GC (%)	PR (%) A	GC (%)	PR (%) B	
A	80	500	30	87	17%
B	80	500	51	375	75%
C	80	600	36	386	64%
D	60	600	53	272	45%
E	80	350	59	210	60%
F	80	350	58	185	53%
G	50	75	23	26	34%
H	50	75	33	80	107%

Source: JICA Study Team (JST)

According to this survey, approximately 353 million m² in total of floors are remaining as unused and can be developed in the CBD. The remaining developable floors have a huge value, which is estimated to be equivalent to KSh466 billion/month, if rented at the market price.

Table 6.4.9 Remaining Developable Floor Area

Zone	Unit (1,000sqm)								Total
	A	B	C	D	E	F	G	H	
Current	21,922	95,814	187,493	21,557	46,647	50,200	6,054	12,441	442
Potential	126,276	127,879	291,689	47,522	77,902	94,768	17,764	11,607	795
Remaining	104,354	32,064	104,196	25,965	31,254	44,568	11,710	-834	353

Source: JICA Study Team (JST)

Table 6.4.10 Estimation of Value at Real Estate Market for Rent in the CBD

Floor Use	%	Remaining (1,000m ²)	Unit Price (ksh/sqm)	Amount (bln ksh)
Office	47.7%	168,390	1,000	168.4
Commercial	20.0%	70,602	2,500	176.5
Accommodation	8.4%	29,792	2,500	74.5
Educational	6.6%	23,167	1,000	23.2
Residential	4.7%	16,468	640	10.5
Parking	3.5%	12,443	300ksh/lot	5.2
Industrial	2.0%	6,929	300	2.1
Health	1.7%	5,939	1,000	5.9
Worships	1.1%	3,798	0	0.0
Cultural	0.6%	2,256	0	0.0
Recreational	0.5%	1,917	0	0.0
Other	3.3%	11,576	0	0.0
Total	100.0%	353,277		466.3

Source: JICA Study Team (JST)

3) Parking Analysis

The number of parking spaces in the CBD is estimated in Table 6.4.11 from their total area. Generally, the size of a parking lot for one ordinary vehicle is 30.0 m². This size includes a parking lot (2.5 m * 6.0 m) and an area for driveway and appurtenant facility such as a staircase. Therefore, approximately 6,000 lots are now available in CBD for visitors or workers that come to the CBD. (This figure does not include roadside parking.)

Table 6.4.11 Estimation of the Number of Parking Spaces in the CBD

	Multi-level Parking	Open-air Parking
Area	152,842 m ²	31,779 m ²
Parking Space	5,095 spaces	1,059 spaces
Total	6,154 spaces	

Source: JICA Study Team (JST)

According to the Building Regulation which is published by MoL, a total of 129,000 parking spaces will be required for the existing buildings, resulting in a gap of 123,000 parking spaces.

Table 6.4.12 Comparison between Japanese and Kenyan Parking Regulation

Japanese Standard		Kenyan Standard	
Land Use	Floor Area for 1 parking Space	Land Use	Floor Area for 1 parking Space
Commercial & Hospital	250 sqm	Commercial & Public	50 sqm
Office	300 sqm	Office	25 sqm
Residential and Others	300 sqm	Residential and Others	100 sqm
Result	14,129 spaces	Result	128,906 spaces
Gap	7,975 spaces	Gap	122,752 spaces

Source: JICA Study Team (JST)

This gap means that a large number of cars cannot park in either multilevel parking or public open-air parking in CBD. These cars, together with waiting taxis and *matatu*, are hindering traffic flow in major roads in CBD. For this reason, it is necessary to construct new multilevel parking and/or to develop a public transportation system instead of private cars.



Source: JICA Study Team

Figure 6.4.13 Low-utilised Open-air Parking and Roadside Parking in the CBD

(4) Development Concept for the CBD

1) Development Visions for the CBD

The development visions for CBD were discussed by the members in the Thematic Working Group (land use and human settlement) for a few occasions. Table 6.4.13 summarised the process of discussion. As a result, the Thematic Working Group created the following vision (No. 3) for CBD. One of the characteristic features of this development vision is to develop a pedestrian-friendly urban space which was strongly supported by the participants. As a result, a vision for “Urban Space” is elected independently.

Additionally, in the Thematic Working Group which was held on 1 October 2013, three important factors to implement the development plan, namely: 1) importance of a good master plan, 2) need of a strong commitment, and 3) multi-disciplinary approach, were shared from the development management method of world-class cities (Docklands of London, La Défense of Paris and West Shinjuku of Tokyo).

Table 6.4.13 Process of Discussion about Development Visions in Thematic Working Group

#	Date	Ideas
1	28 th May	Group 1 : Vibrant Green (and) 24-hr (attractive) city
		Group 2 : High Density Centre of Commerce
		Group 3 : Creative, Smart and Secure City that Promotes Vibrant Green Spaces and Efficient Transport System
2	12 th June	Vibrant, Efficient, Compact, Creative, Smart, Green, Competitive, Inclusive and Livable City
3	6 th Sep	1) Economy : Promote an inclusive urban economy 2) Transport : Efficient, effective, and inclusive transport system 3) Environment : Healthy, green, thriving, and secure Nairobi City 4) Urban Space : Pedestrian-friendly urban space
4	1 st Oct	Important factors to implement the development plan 1) Importance of a good master plan 2) Need of a strong commitment 3) Multi-disciplinary approach

Source: JICA Study Team

Based on the discussion, the development vision of CBD is proposed as “compact urban centre that is creative, livable, green, efficient, competitive and inclusive”. “Compact” means that a variety of urban functions is available in the limited area which provides

pedestrian-friendly environment and promotes efficient land utilisation for commercial, residential, and social activities.

Four pillars of development are identified as follows:

- 1) Economy : Promote an inclusive urban economy
- 2) Transport : Efficient, effective, and inclusive transport system
- 3) Environment : Healthy, green, thriving, and secure Nairobi City
- 4) Urban Space : Pedestrian-friendly urban space

The development vision and four pillars of development are illustrated in Figure 6.4.14 below.

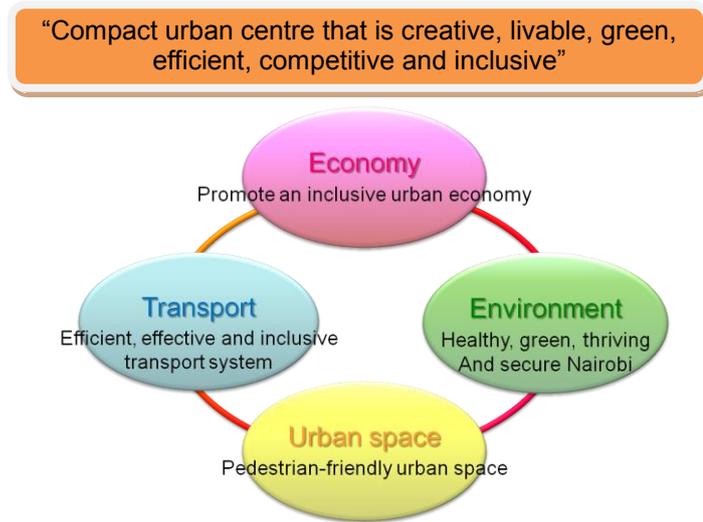


Figure 6.4.14 Development Vision of CBD

The functions of CBD are proposed to include business and commerce, residential, public, transport, art and culture, and academic functions.

2) Concept of the Greater CBD Development

In order to strengthen the CBD function, a comprehensive approach is necessary including enhancing the road network, possible introduction of a monorail, installation of new urban facilities, and promoting spatial development. In addition, the surrounding area of CBD including the Upper Hill and area along Lusaka Road should be consolidated to the existing CBD to make a greater and stronger CBD under this comprehensive approach. For this reason, JST proposed the greater CBD as shown in Figure 6.4.15 below.

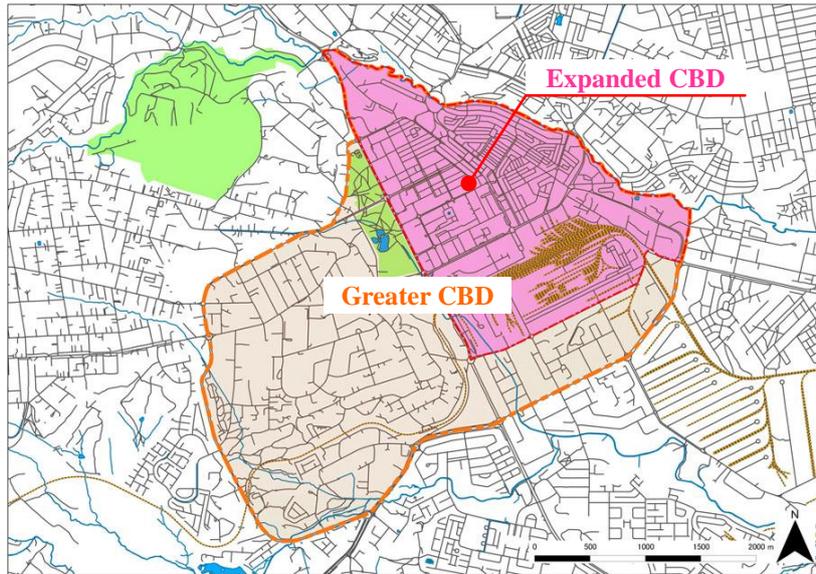


Figure 6.4.15 Area of the Greater CBD

The following components are proposed for CBD development:

i) *Road network:*

The road network is to be developed to strengthen linkage in CBD (CBD and railway city, and other areas), and based on hierarchy of types of roads to promote smooth traffic flow. The current poor and partial road connectivity causes heavy traffic concentration to particular roads and results in traffic congestion. Thus, JST proposes access roads to improve road connectivity in the Greater CBD as shown in Figure 6.4.16 below.

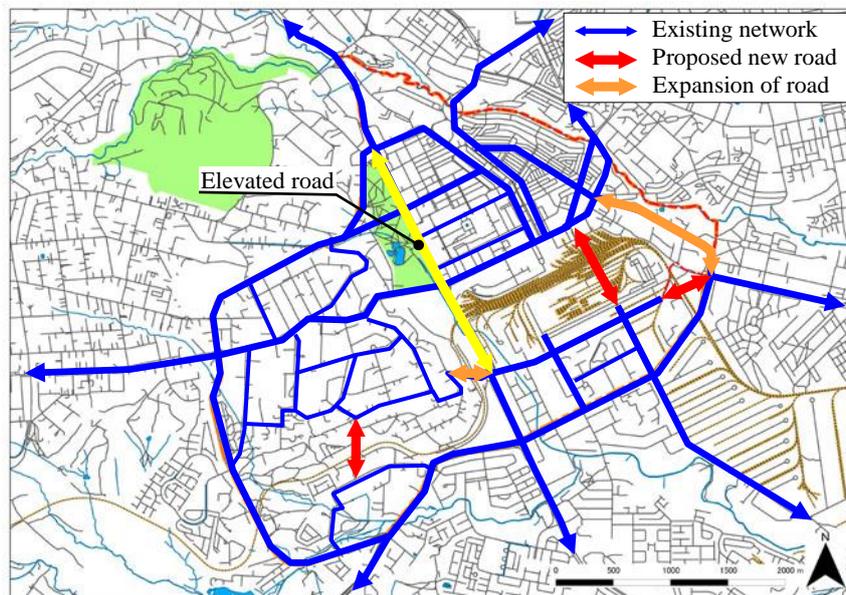


Figure 6.4.16 Road Network of the Greater CBD

In addition, pedestrian walkways will be developed because one of the characteristics of Nairobi CBD identified is a large number of pedestrians (pedestrian walkways will link CBD with open space and green corridor).

ii) *New Urban Transport System (Loop Monorail Line)*

A monorail line is proposed for consideration in a circular route in CBD, which will link Railway City and Upper Hill to reduce inflow of traffic to the existing CBD. Monorail stations also function as junction of radial roads that are concentrated around Nairobi Station.

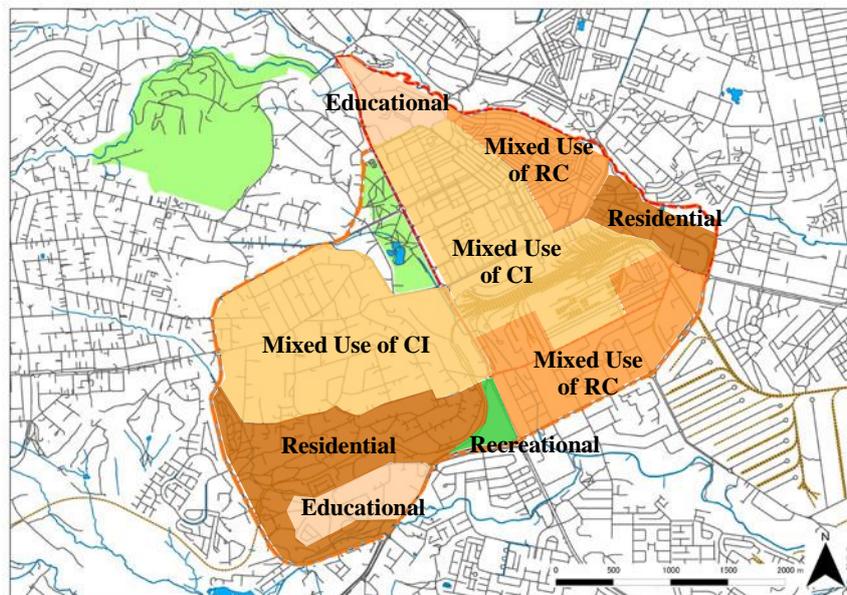
iii) *Urban Facilities*

Urban facilities include bus terminal, Nairobi Station Square, open space, and green corridor.

- Relocation of bus terminal: one of the major causes of traffic congestion in and around CBD is the existence of a number of bus terminals in CBD. Bus terminals are located in the centre of CBD and all bus routes terminate at this bus terminal. Bus terminals will be relocated and dispersed depending on the destination.
- Nairobi Station Square: Nairobi Station is a gateway of the city. Nairobi Station Square will be developed to provide multimodal function as well as serve the urban amenity for enhancing livable environment not only to residents but also to visitors.
- Open space and green corridor: Public parks (City Park, Uhuru Park) and enhanced green corridor are proposed to improve urban amenity for both residents and visitors. Together with Nairobi Station Square development, open space and green corridor are expected to create livable and green environment. Pedestrian path improvement is also implemented together.

iv) *Future Land Use Concept and Development Ordinance*

To clarify development policy for the Greater CBD, land use concept is proposed as below. The area where Nairobi Station is currently located is proposed for mixed commercial and institutional use to enhance urbanisation of CBD and utilise its development potential. Residential area and mixed residential and commercial use area are proposed for the periphery of the Greater CBD to ensure space for residents. Regarding the residential use, it should be noted that the southern part of the Upper Hill area has a potential as a residential area for middle-high income families.



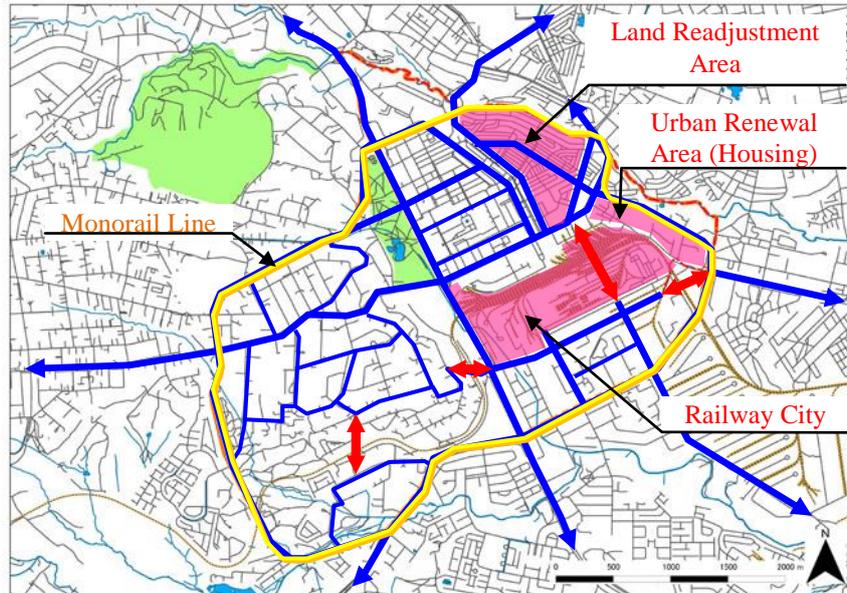
Note: Mixed Use of RC: means mixed use of residential and commercial use
Mixed Use of CI: means mixed use of commercial and institutional use

Figure 6.4.17 Land Use Concept of the Greater CBD

As mentioned in Subsection 6.4.5 (3), current development ordinance (plot ratio and ground coverage) is not fully utilised. For this reason, it is necessary to encourage maximum utilisation of the current development ordinance, rather than to increase the current development ordinance.

v) *Spatial Development*

Spatial development here means urban development in the selected area, and covers all aspects of urban development, infrastructure development, land management, and financing of the development. Land re-adjustment project and urban renewal projects are proposed to accelerate the spatial development in CBD. In addition, new land use zones for efficient land utilisation will be developed.



Source: JICA Study Team (JST)

Figure 6.4.18 Spatial Development Plan for the Greater CBD

6.4.6 Sub-centres Development Concept

(1) Sub-centres Discussion

Development directions of sub-centres were discussed during two Technical Working Group (TWG) meetings on 25 July and 27 August. The proposed sub-centres are as follows:

- (i) Upper Hill South
- (ii) Karen-Langata
- (iii) Runda-Ruaka
- (iv) Dandora
- (v) Imara-Daima
- (vi) Makadara
- (vii) Kasarani
- (viii) Ruai
- (ix) Other Sub-centres

The following are the main recommendations from the TWG members:

- (i) **Recognise restrictions and challenges in areas such as Karen:** Involve resident's associations
- (ii) **Encourage sustainable mixed use development in proposed nodes:** Safety, connectivity, walkability
- (iii) **Harmonise plot ratios in targeted areas:** Explore possibilities for developer incentives
- (iv) **Involve Kenya Railways:** Increase connectivity from CBD to industrial area and link with KRC Master Plan
- (v) **Considerations for Upper Hill:** Conservation of historic areas, road connectivity, increased plot ratios
- (vi) **Provide more nodes for Eastland Areas:** Increasing nodes in Eastland to manage high volume of trips
- (vii) **Need sub-centre around JKIA and Embakasi:** Hotel demand near JKIA and industrial potential also high in this area

(2) Priority of Sub-centres Development

The development hierarchy of sub-centres is summarised based on location, land use, and transportation connectivity for development potential as shown in Table 6.4.14 below.

Table 6.4.14 Priority of Sub-centres Development

Sub-centre	Location and Land Use	Transportation Connectivity	Priority
Upper Hill South	➤ Close to CBD ➤ Concentration of governmental functions	➤ Ngong Road is main access road to this area. Accessibility is required.	A
Westland	➤ Existing commercial and business concentration	➤ Node of Waiyaki Way and Ring Road	A
Makadara and Eastland	➤ Located at centre of Eastland is residential area and southern part is NRC unused land	➤ Node of Makadara Railway Station and Jogoo Road	A
Dandora	➤ Located south of Dandora estate where more than 130,000 people are living	➤ Dandora Railway Station and Koma Rock Road	B
Donholm	➤ Residential and commercial	➤ Node of Jogoo Road, Outer Ring Road and Railway	B
Imara-Daima	➤ Located between residential area and industrial area	➤ Node of railway and Mombasa Road	B
Kasarani	➤ Sport complex, commercial and residential mixed	➤ Node of Thika Super Highway and Kamiti road connecting to Northern Bypass	B
Guithurai	➤ Residential and military barrack	➤ Node of Guithurai Railway Station and Northern Bypass	C
Langata	➤ Commercial, residential, and institutional use	➤ Node of Langata Road and Magadi Road	B
Karen	➤ Residential and commercial use ➤ Located in low density residential	➤ Node of Ngong Road and Langata Road ➤ Southern Bypass will connect to Ngong Road soon.	B
Woodley	➤ Institutional, commercial and residential	➤ Node of Woodley Railway Station and Ngong Road	B
Dagoretti	➤ Residential	➤ Node of Dagoretti Railway Station and Dagoretti-Karen Road	C
Kabete	➤ Office and commercial use ➤ Recently developing as office area	➤ Node of Waiyaki Way and James Gichure Road	C
Uthiru	➤ Institutional and commercial	➤ Node of Waiyaki Way and Naivasha Road	C-

Sub-centre	Location and Land Use	Transportation Connectivity	Priority
Runda-Ruaka	➤ Residential and agricultural use	B ➤ Node of Northern Bypass and missing Ring Road	C B-
Airport North	➤ Industrial and residential	B ➤ Node of Eastern Bypass and Outer Ring Road	B B
Shokimau	➤ Industrial use and undeveloped land	B ➤ Node of Shokimau Railway Station and Mombasa Road ➤ Park and ride station facility for the southern area of Nairobi City	A B
Ruai	➤ Residential and undeveloped land but developing rapidly	C ➤ Node of Eastern Bypass and Kangundo Road	B B-

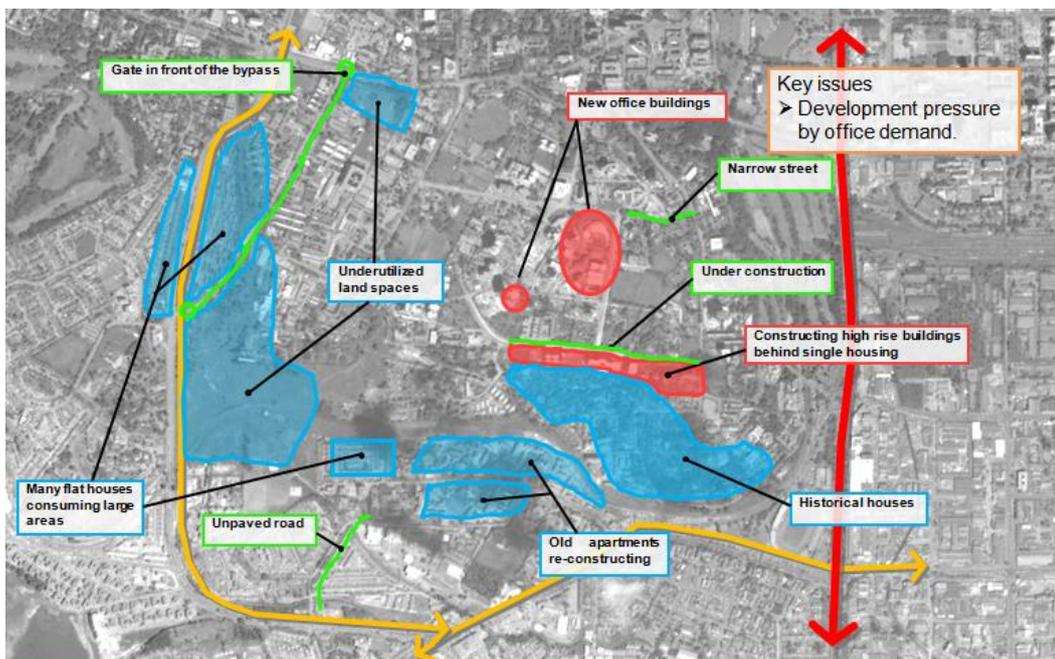
Source: JICA Study Team (JST)

(3) Sub-centres Development

1) Upper Hill South

i) Key Issues

- The land use zoning of this area was revised in 1993 in the Upper Hill Rezoning Plan, and was studied again in 2008.
- A number of large size buildings are under construction, mainly for offices and hotels. Development pressure is significantly high especially for financial offices.
- Road upgrading work is ongoing. Connectivity to Ngong Road is improving but connections to other roads such as Uhuru Highway, Langata Road and Mbagathi Road are insufficient.
- The southern fringe of the hill is for the single dwelling land use, and there are several historical housing buildings remaining, although some of them were demolished for redevelopment.
- Accessibility to Kenya National Hospital is a problem especially the access from Wilson Airport in case of emergency.

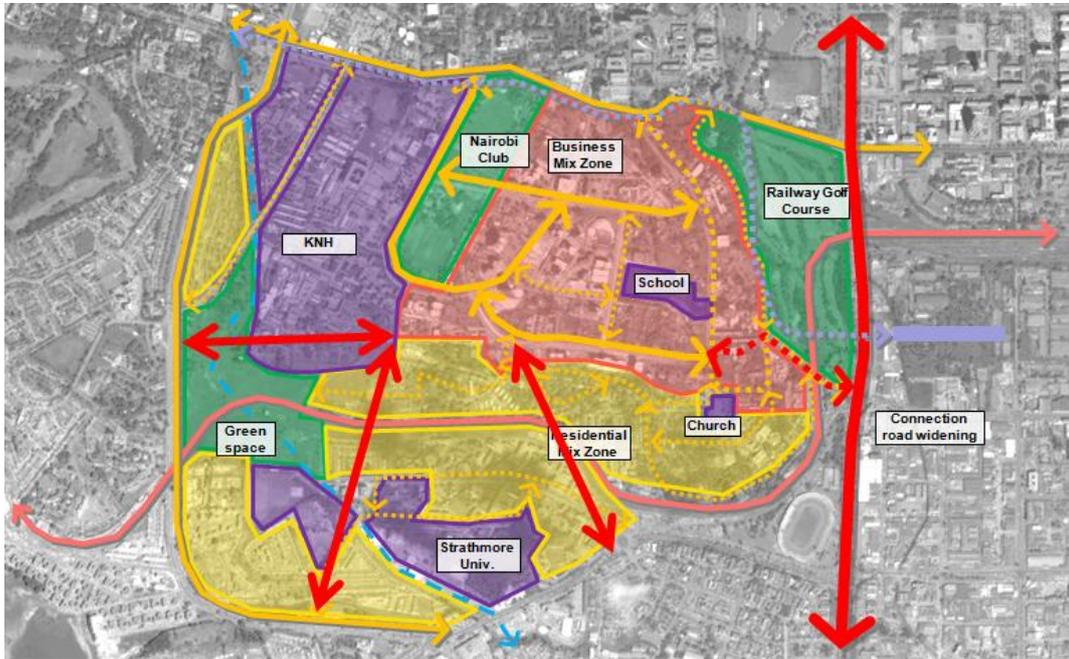


Source: JICA Study Team (JST)

Figure 6.4.19 Key Issues in Upper Hill South

ii) *Proposed Urban Function Structure*

- Main part of the area is business mixed use zone including some apartment land use.
- Additional access roads are necessary, especially to the west, east, and south.
- Historical single dwelling buildings should be preserved for the next generation.



Source: JICA Study Team (JST)

Figure 6.4.20 Proposed Urban Function Structure in Upper Hill South

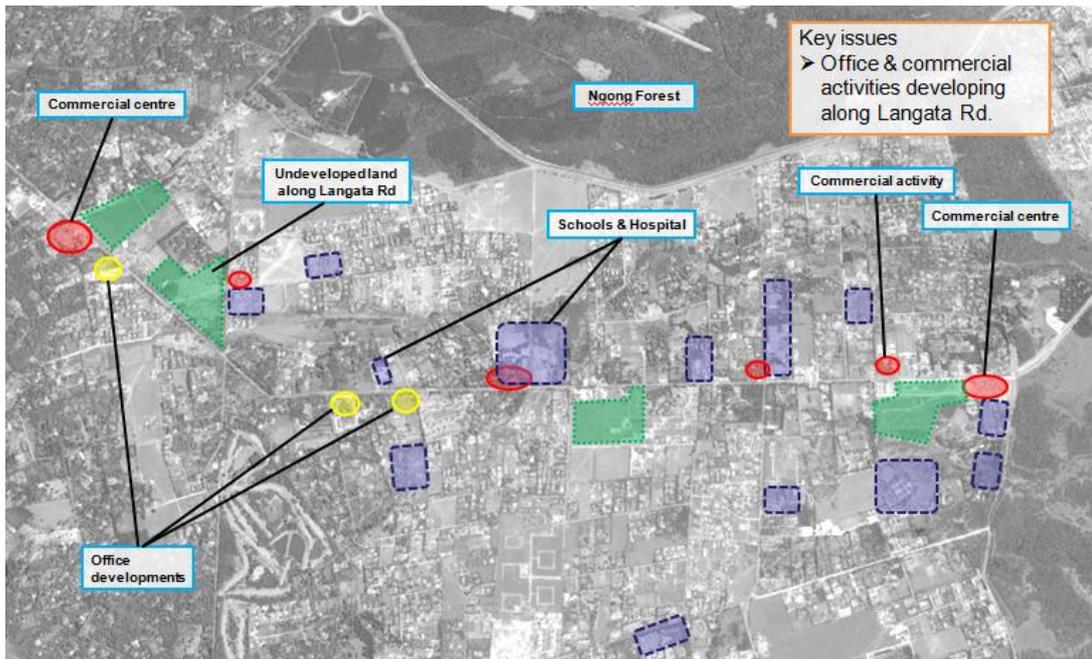
iii) *Discussion*

- Maximum height in this area should be determined from the aviation regulation.

2) *Karen-Langata*

i) *Key Issues*

- Local Physical Development Plan (LPDP) for Zone 6, 12 and 20 B was studied.
- Langata Road is planned to be widened to a four-lane road.
- Three office complex developments and some car garages can be seen along Langata Road.
- Some landowners plan to convert a part of their land for commercial purpose.

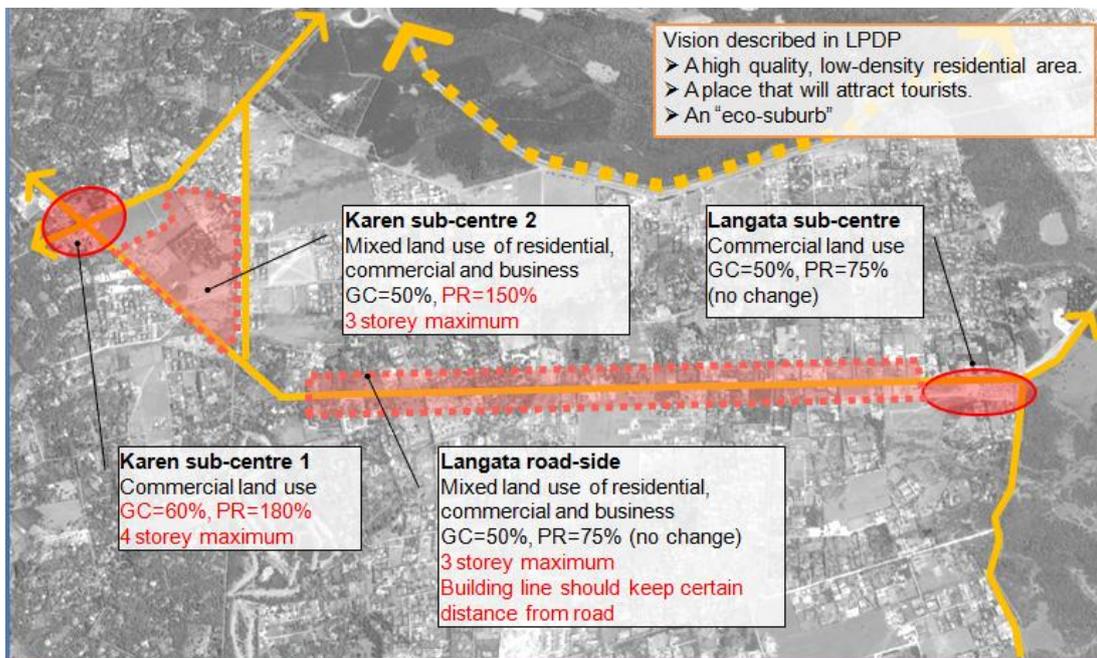


Source: JICA Study Team (JST)

Figure 6.4.21 Key Issues in Karen-Langata

ii) Proposed Urban Function Structure

- An existing shopping centre at the junction of Ngong Road and Langata Road will remain the same.
- The triangle area west of Karen Road will be developed for a new urban function. PR and maximum storey will be increased.
- Commercial activities will be allowed along the widened Langata Road to avoid land use change in other residential area.



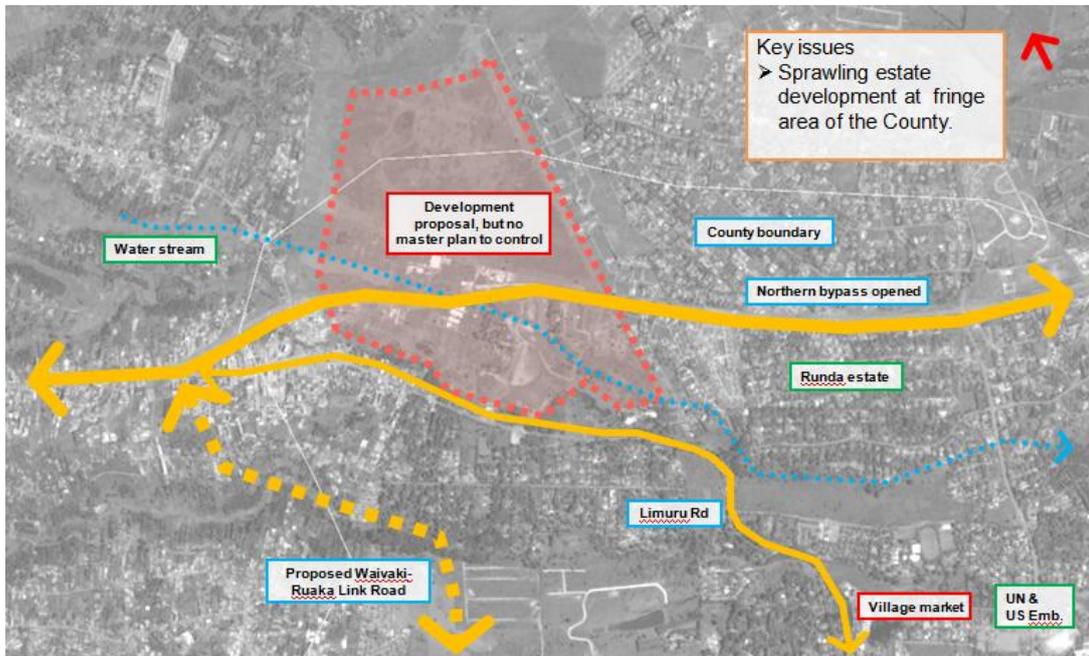
Source: JICA Study Team (JST)

Figure 6.4.22 Proposed Urban Function Structure in Karen-Langata

3) Runda-Ruaka

i) Key Issues

- There is a UN compound and several embassies including the United States Embassy in Runda and Gigiri estates.
- The area's character is a low density residential district for high income residents including diplomats and UN staffs.
- Northern Bypass has been opened north of this area, connecting to Limuru Road.
- Development projects for farm lands, which were formerly plantation, have applied for permissions with high-rise apartments.
- There are residents around this area who are against big projects which may change its environment.
- New road construction is planned to connect to Waiyaki Way and James Gichuru Road.

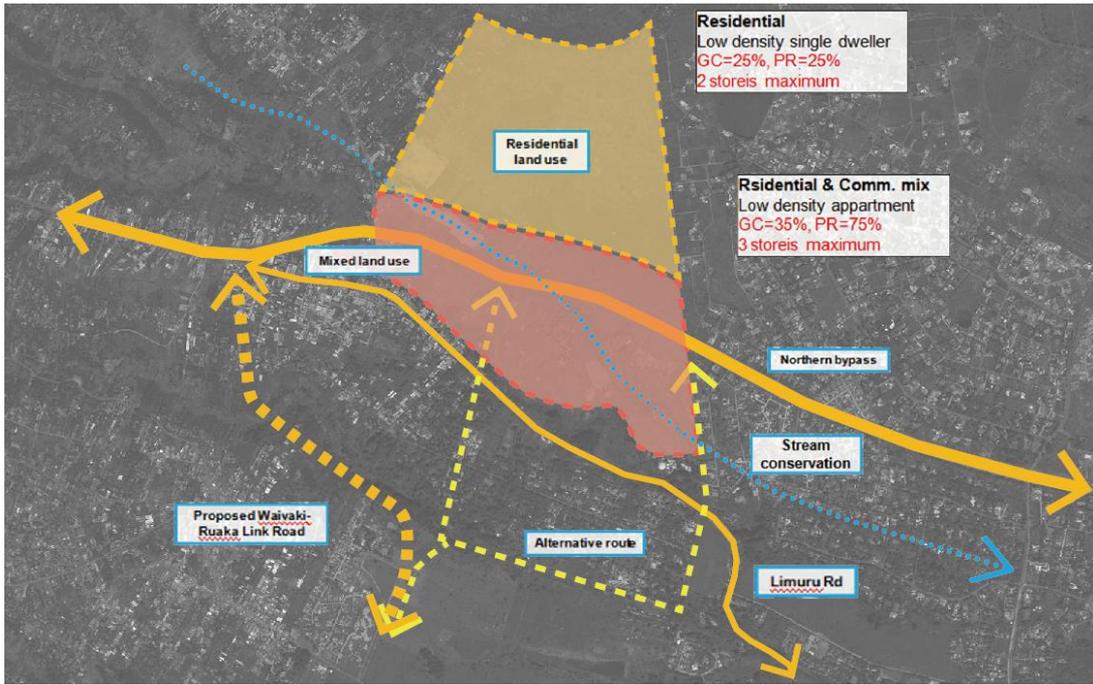


Source: JICA Study Team (JST)

Figure 6.4.23 Key Issues in Runda-Ruaka

ii) Proposed Urban Function Structure

- Some area near Northern Bypass and Limuru Road can be for residential and commercial mixed land use, but low density and low rise buildings.
- Northern part of the area should be for low density and low rise residential land use.
- The road from Waiyaki Way should be connected to near the junction of Northern Bypass and Limuru Road.



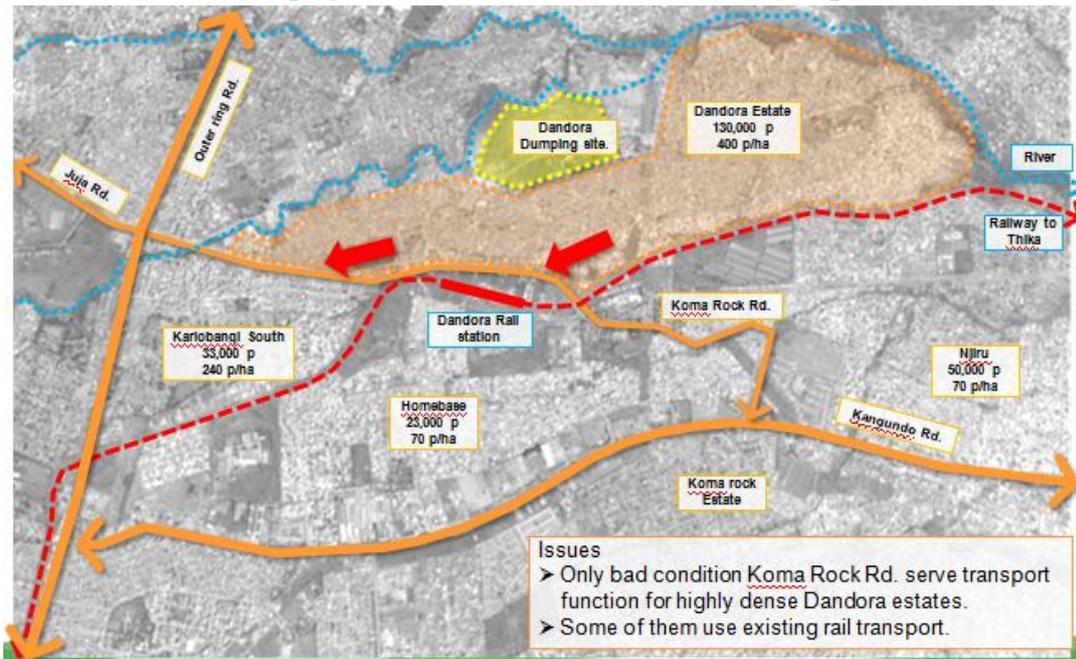
Source: JICA Study Team (JST)

Figure 6.4.24 Proposed Urban Function Structure in Runda-Ruaka

4) Dandora

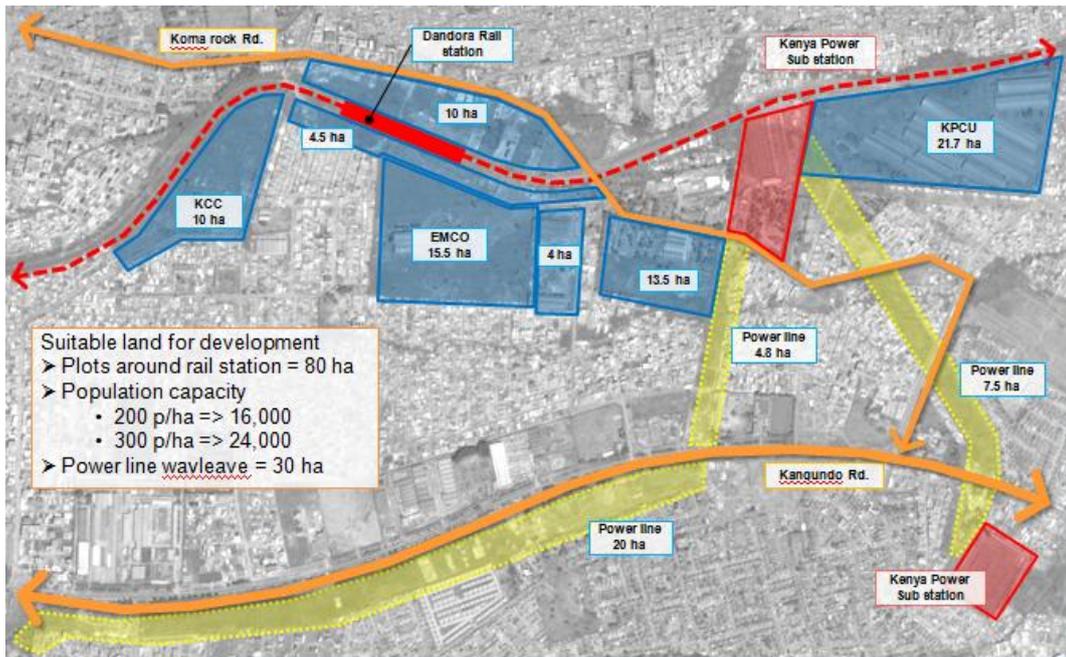
i) Key Issues

- Railway to Thika passes through a high population density residential area.
- Koma Rock Road serves the transport function poorly for high density Dandora.
- Public institutions' facilities and factories occupy a large plot around Dandora Station. Total of 80 ha of lands are suitable for sub-centre development.
- Power line wayleave is also occupying much area especially along Kangundo Road.
- Dandora Dumping Site will be closed soon because of its capacity.



Source: JICA Study Team (JST)

Figure 6.4.25 Key Issues in Dandora

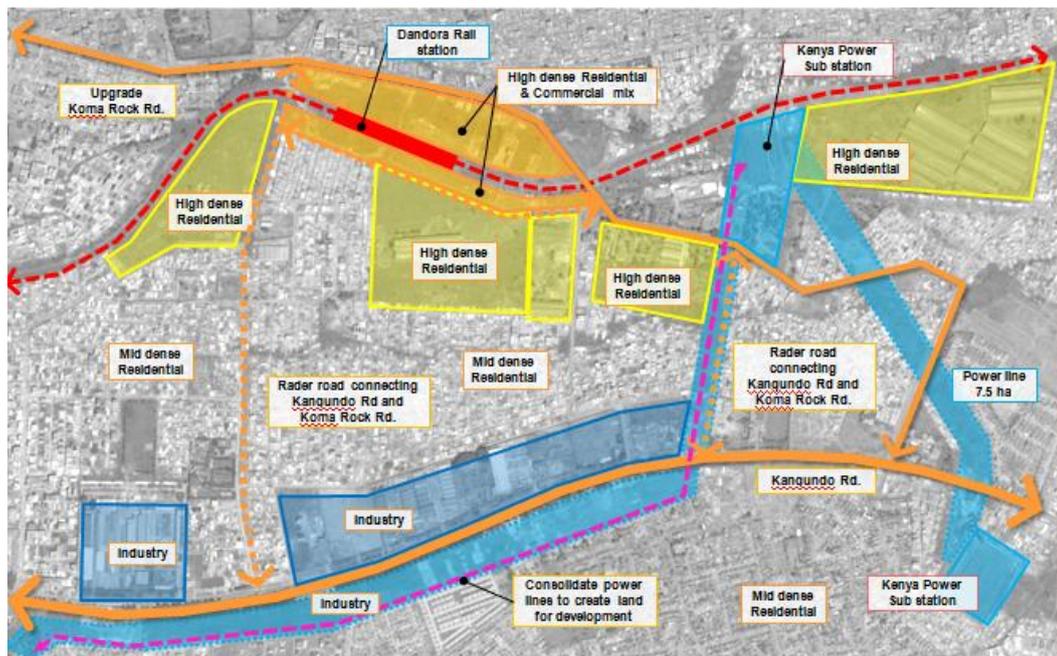


Source: JICA Study Team (JST)

Figure 6.4.26 Suitable Land for Development in Dandora

ii) Proposed Urban Function Structure

- Surrounding areas of Dandora Station should be developed into a high density residential and commercial mixed development.
- Access roads between Kangundo and Koma Rock roads are necessary.
- If PR=300% is to be applied, housing for about 24,000 population can be accommodated.
- Underground installation of power lines should be considered to utilise its wayleaves which account for more than 30 ha area.
- Koma Rock Road should be improved together with Dandora Station development.



Source: JICA Study Team (JST)

Figure 6.4.27 Proposed Urban Function Structure in Dandora

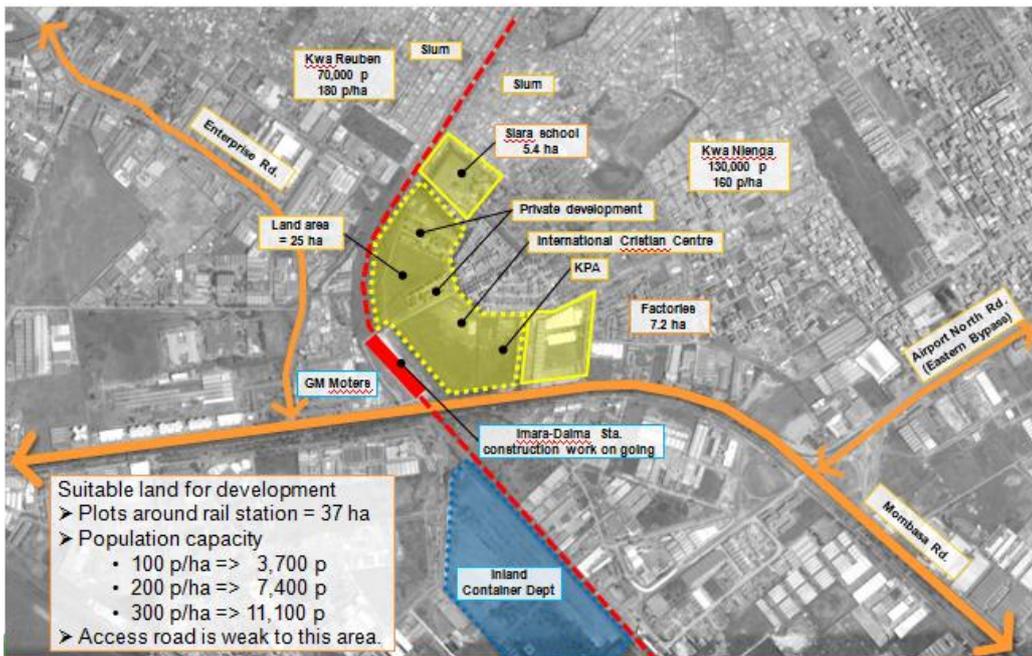
iii) Discussion

- Land ownership of power line wayleaves should be considered. Also, an attractive development scheme is required for redevelopment.

5) Imara-Daima

i) Key Issues

- Construction of the Kenya Railways Corporation (KRC's) commuter railway station is ongoing.
- Originally, zoning of this area is for light industrial land use. It should be changed to commercial and residential mixed use including social functions.
- The access road to the station is weak and is not adequate.
- North to east area of the station is Mukuru informal settlement area.
- Large numbers of informal settler live on the wayleave of railway and power line.
- Mukuru settlers need an access road to the main roads.
- Kenya Power Authority and a church occupy a large land near the station.
- The church (International Christian Church) has their development plan approved by NCC. Planning coordination is required.
- About 37 ha of land can be developed for urban function.



Source: JICA Study Team (JST)

Figure 6.4.28 Key Issues in Imara-Daima

ii) Proposed Urban Function Structure

- Direct access roads to the station from Mombasa Road and Enterprise Road should be installed.
- It is necessary to renovate the overpass of Mombasa Road to widen the underpass space and to secure the safety of pedestrian.



Source: JICA Study Team (JST)

Figure 6.4.29 Proposed Urban Function Structure in Imara-Daima

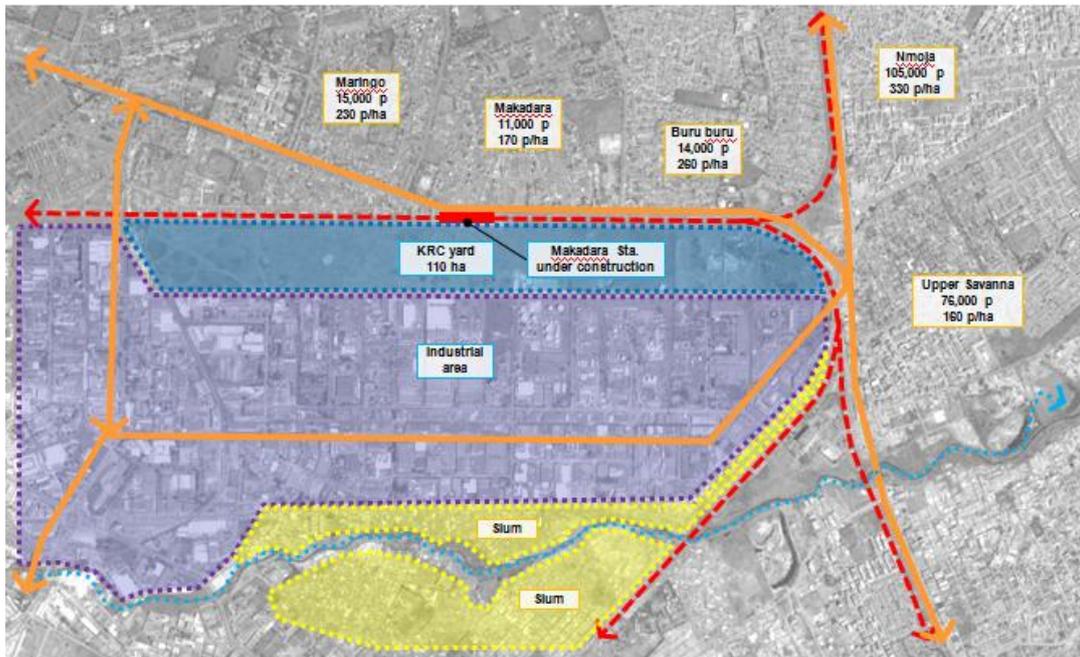
iii) *Discussion*

- Access road from Imara-Daima residential area and Mukuru informal settlement should be developed.

6) Makadara

i) *Key Issues*

- Most part of Eastland is constructed for African residents before the independence and is planned for re-development by NCC.
- Construction of KRC commuter rail station at Makadara is ongoing.
- More than 110 ha of the large KRC railway yard (3.5 km x 400 m) is located between existing railway and industrial area.
- The industrial area was developed with railway network during the British rule. However, the rail is seldom utilised nowadays.

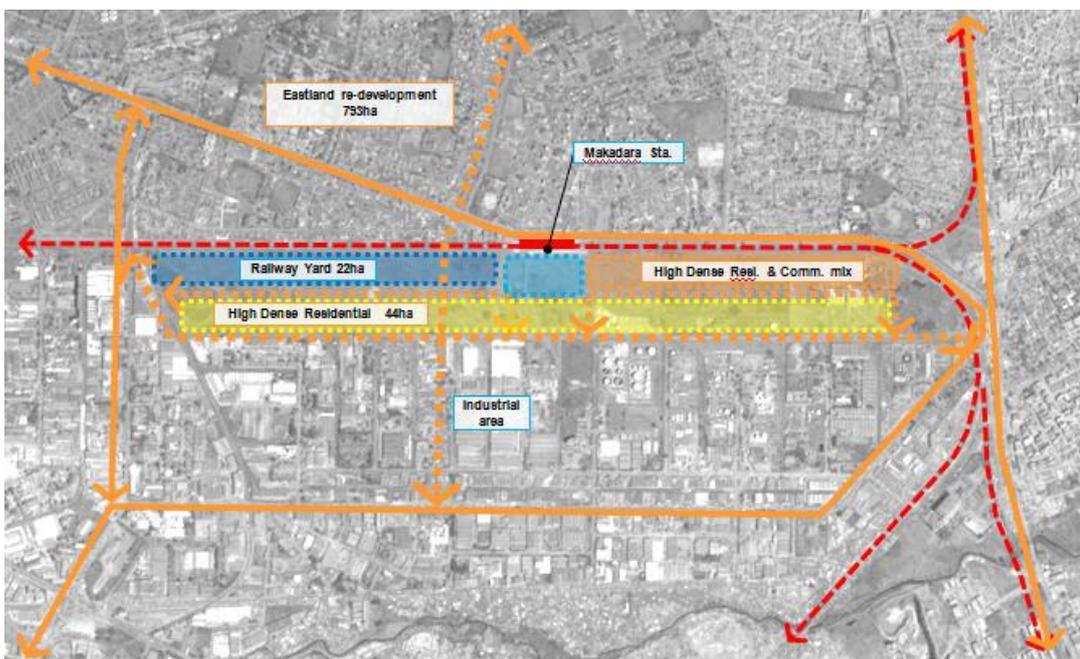


Source: JICA Study Team (JST)

Figure 6.4.30 Key Issues in Makadara

(ii) *Proposed Urban Function Structure*

- Station square should be developed next to Makadara Station to connect to Jogoo Road.
- Railway yard function of Nairobi Central Station should be relocated to a part of this area.
- Other part is developed as residential and commercial mixed land use. This area can be the relocation place for Eastland redevelopment project.



Source: JICA Study Team (JST)

Figure 6.4.31 Proposed Urban Function Structure in Makadara

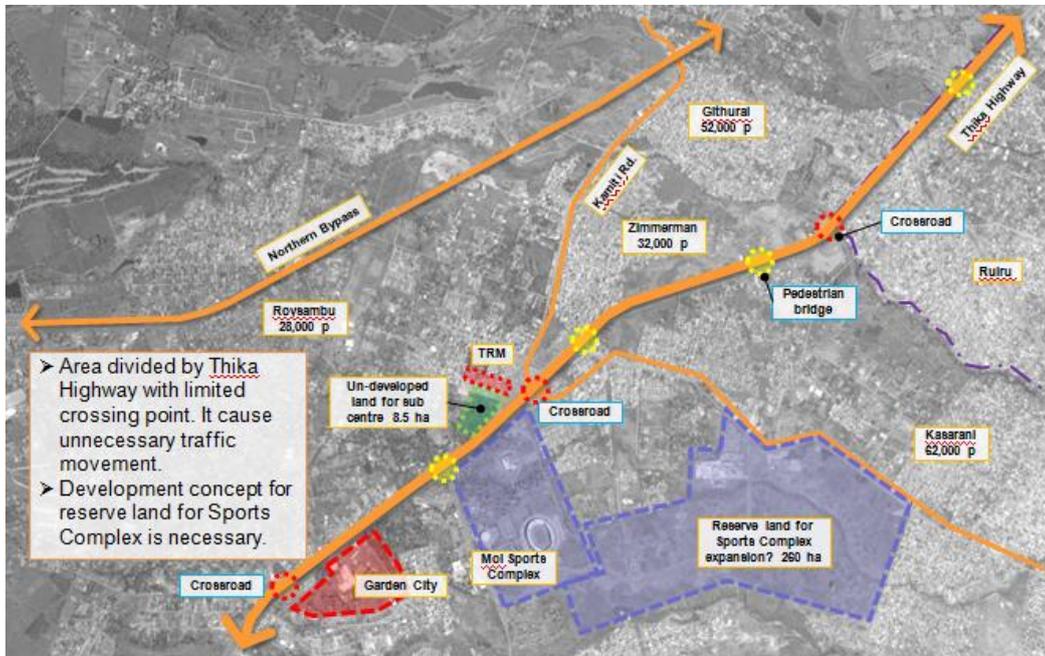
iii) Discussion

- Connection function between industrial area and Eastland should be considered especially connectivity to Makadara Station.

7) Kasarani

i) Key Issues

- Thika Super Highway construction was completed in 2012, which improved traffic flow along this road.
- However, the area was divided by Thika Super Highway with limited crossing points. The division causes unnecessary traffic movements.
- Development activities along Thika Super Highway are lively, and population growth in this area is quite high.
- A 2.5 km² reserve land is located next to Moi Sports Complex. District development concept is required.
- Garden City development is ongoing at the site where a beer factory previously stood.



Source: JICA Study Team (JST)

Figure 6.4.32 Key Issues in Kasarani

ii) Proposed Urban Function Structure

- Kasarani Sports Complex should be developed to invite international sports competition event. Surrounding vacant land could be utilised for accommodation and other sports and commercial facilities.
- Collector road network should be designed.

iii) Discussion

- Undeveloped 8.5 ha land located next to Thika Road Mall can be utilised for sub-centre function.
- Functional network system as a sub-centre is required in this district.
- Development concept for Moi Sports Complex District is required.

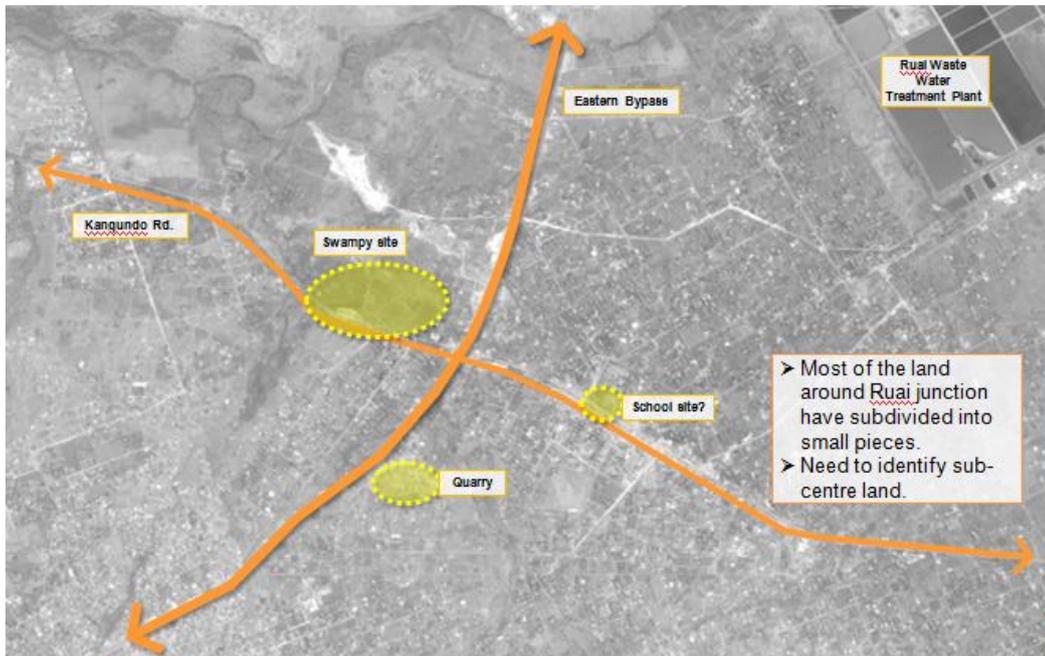
8) Ruai

i) Key Issues

- There are plenty of undeveloped lands in Ruai and Njiru areas.
- However, most of the lands near the junction of Southern Bypass and Kangundo Road are subdivided for detached housing, not for large development such as apartment or commercial building.
- Urban function such as commercial, business, institutions, and traffic terminal are not planned well in this area.

ii) Proposed Urban Function Structure

- Urban function zone should be planned near the Ruai junction to serve urban services.
- Collector road network is necessary to avoid traffic jam at the junction.



Source: JICA Study Team (JST)

Figure 6.4.33 Key Issues in Ruai

iii) Discussion

- Alternative location for Ruai Sub-centre should be considered. Ruai Town centre along Kangundo Road is recommended.

6.4.7 Priority Projects

(1) CBD Development

Amongst the development components, four priority projects for CBD development are selected to form CBD as follows:

1) Railway City Project

Utilisation of existing railway land by public-private partnership with KRC

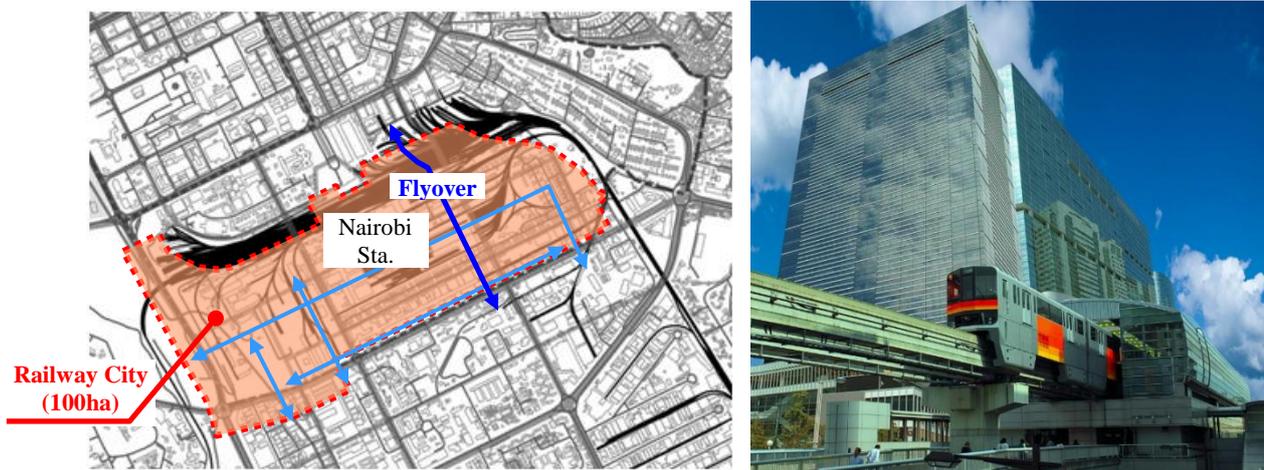


Figure 6.4.34 Development Image of Railway City

- 2) Land readjustment project for east of Tom Mboya Street (* long term project)
Improvement of existing road conditions, intensive land use, etc.

The land for Railway City project is owned by KRC, and the size is about 100 ha. In the Thematic Working Group held on 1st October, the participants shared a common view for the CBD development which was reconsideration about regeneration for this 100 ha area that was required to link with other functions and utilise the potential effectively. For the implementation, the linkage and coordination amongst national government including Ministry of Lands, Housing and Urban Planning, KRC, NCC, and private development partners are necessary.

The proposed implementation framework for the Railway City is shown as follows:



Figure 6.4.35 Implementation Framework for the Railway City Project

In order for securing smooth development, new implementing measures are introduced.

Conversion of the Development Right

Take the land use in core CBD for a historical building, such as the parliament as an example. Because of the heritage building, it is difficult and inappropriate to reconstruct the buildings in this area. Instead of reconstruction, a new regulation can be devised to make it possible for the landowner to sell/lease the right of the development (remaining plot ratio) to another party

in some specific area like inside of the extended CBD or sub-centre. Therefore, this regulation can support to utilise the idle PR, if there is a land which is difficult to use up the PR.

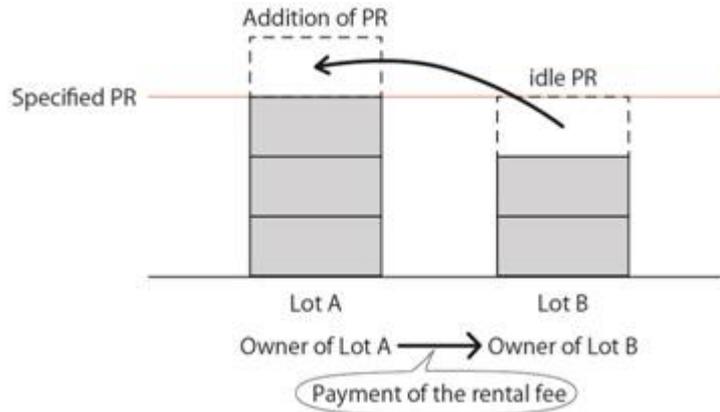


Figure 6.4.36 Conversion of the Development Right

Relaxation of Plot Ratio by Construction of Additional Car Parking

Parking survey showed a shortage of parking spaces in CBD. For this reason, it is necessary to construct new parking spaces to cater to the people's need for parking and remove roadside parking. With a scarce budget, it may be difficult to build new parking spaces. Thus, a new regulation can be devised to allow the developer to receive additional PR if they undertake additional parking spaces beyond the obligated.

(2) Sub-centre Development

JST picked up several sub-centre development areas in the above section. Some areas already have some development activities in progress or in preparation of development project plans. Consideration of detailed land use plan and urban facilities plan is necessary. The development areas listed below are priority development zones to be planned in the short-term period.

1) Objectives

To draw up the sub-centre development detailed plan to improve transportation network and to utilise development potential of these areas.

2) Possible area

(i) Dandora Station area

Dandora area is one of the inconvenient areas to commute to the city centre because of bad road condition and road network. Dandora Station is one of the commuter rail stations and there is a certain space for development around the station. It is a good case for re-development around rail stations.

(ii) Eastlands (including Makadara Station)

Re-development projects are going to start soon and new Makadara Station for commuter rail has just opened. It is good opportunity to change urban structure of this area. Certain detailed master plan for this area is necessary to manage all related projects.

(iii) Imara-Daima Station area

Imara-Daima Station has just opened as a commuter rail station. Large informal settlement area is just near the station. However, road connectivity and detailed plan have not been considered. Thus, it is necessary to consider detailed plan for this area.

(iv) Embakasi New Railway Station area

Construction of new railway line connecting Mombasa and Nairobi City has just started. New freight station is planned in Embakasi. Revision of land use regulation and detailed plan are necessary for this area to maximise the industrial potential of Nairobi City.

(v) Woodley Station area

Ngong Road is planned to be widened to a 4-lane road with the JICA fund. Also, new transport line is planned on Ngong Road. Woodley Station will be the transfer terminal station of these transportation networks. Detailed plan is required.

3) Development Items

- Detailed land use plan
- Road and transportation plan
- Implementation plan

4) Responsible Organisations

NCC will be the main responsible organisation. Others are possibly Kenya Railway Corporation, National Roads Authority (newly merged road authority), and National Housing Corporation.

(3) Local Physical Development Plan (LPDP)

NCC has currently been stopping approval of many development projects during the drafting period of the Nairobi Integrated Urban Development Master Plan (NIUPLAN) and consequently facing high pressure from developers to ease existing regulation and approve their plan especially in Zone 3 (Westland, Parkland), Zone 4 (Spring Valley, Kileleshwa, Kilimani), and Zone 5 (Upper Spring Valley, Lavington) areas. LPDPs or detailed land use plan studies are required immediately for control development activities.



Braxton Atamu, Martin Luther Primary School (Rank 3 of Class 5)

CHAPTER 7 URBAN TRANSPORT DEVELOPMENT PLAN

7.1 Urban Transport

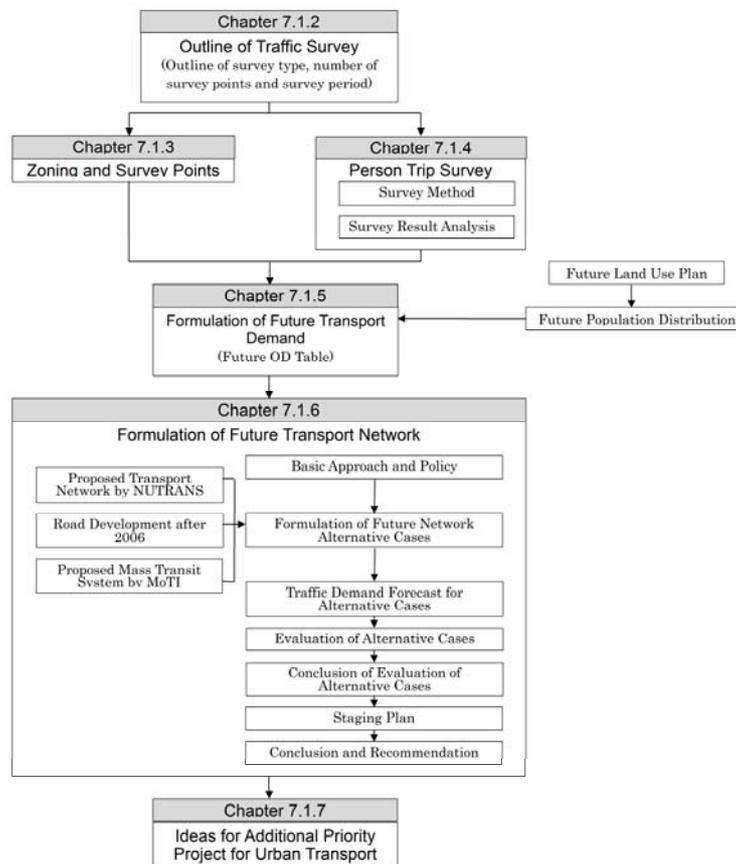
7.1.1 General

(1) Objective of Study on Urban Transport

Future transport network system is investigated taking into consideration the present network, road development projects, land and facility development projects, and land use plan. The basic level of the study is a conceptual plan and it identifies the gap between the existing and necessary capacity estimated by demand forecast, shows the direction about how to fill the gap, and suggests system and institutions for implementation.

(2) Study Procedure

The study procedure for urban transport development plan is shown in Figure 7.1.1.



Source: JICA Study Team (JST)

Figure 7.1.1 Procedure for Urban Transport Development Plan

7.1.2 Outline of Traffic Surveys

A comprehensive traffic survey was conducted by the previous Japan International Corporation Agency (JICA) project on urban transport for Nairobi, namely, The Study on Master Plan for Urban Transport in the Nairobi Metropolitan Area in the Republic of Kenya, March 2006 (hereinafter called NUTRANS). The actual traffic survey was conducted from March to September 2004.

The aim of the traffic surveys in the present Project is to update the result of the previous traffic surveys of 2006 and evaluate the variation of traffic movements thereafter.

(1) Objectives of the Traffic Survey

The major objectives of the traffic surveys in the Nairobi Integrated Urban Development Master Plan (NIUPLAN) are as follows:

- (i) To update the result of the previous survey and evaluate the variation of traffic movement.
- (ii) To analyse the effect of the transport infrastructure development after 2006.
- (iii) To formulate the database for traffic forecast in 2030 because the target year of previous study was 2025.

(2) Outline of Traffic Survey

Seven types of surveys were conducted as shown in Table 7.1.1. Selection of survey types and survey methods was done in consideration of consistency with the 2006 Master Plan surveys. All the surveys were conducted from the beginning to the end of February 2013 to avoid the influence of the general election on 4th March.

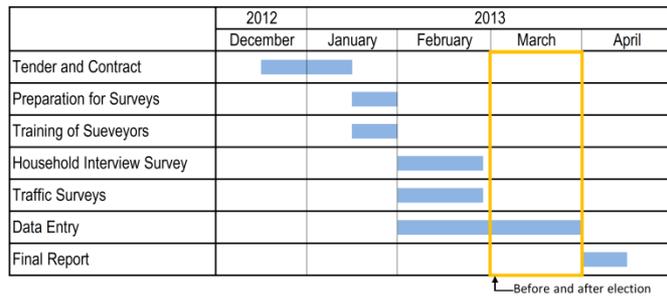
Table 7.1.1 Summary of Traffic Survey

No.	Type of Survey	Purpose	Method	Contents of Survey
1	Person trip survey	To acquire information on the travel activities of residents such as origin, destination, trip purpose, travel time, etc.	Interview to sampled household members at their home and make questions	Interview to 10,000 households in Nairobi City
2	Stated preference survey	To obtain factors for preference of traffic mode selection to enhance use of public transport.	Interview to household members in the person trip survey.	2,000 samples
3	Cordon line survey	To capture traffic movement from/to Nairobi City area and complement the person trip survey	Interview to person at the major road crossing the cordon line of Nairobi City	Roadside interview survey (12 hr, 6:30-18:30): 14 survey points on one workday Roadside traffic counts (12 hr, 6:30-18:30): 10 survey points on one workday Roadside traffic counts (24 hr, 6:00-6:00): 4 survey points on one workday
4	Screen line survey	To complement the person trip survey by capturing vehicle type, hourly variation, etc.	Traffic counts at the road crossing the screen line	Roadside traffic counts (12 hr, 6:30-18:30): 10 survey points on one workday Roadside traffic counts (24 hr, 6:00-6:00): 5 survey points on one workday
5	Traffic counts survey	To grasp general movement of traffic and to complement the traffic model	Roadside: traffic counts at major roads Traffic counts by direction at major intersections	Roadside traffic counts (12 hr, 6:30-18:30): 30 survey points on one workday Intersection traffic counts (12 hr, 6:30-18:30): 20 intersections on one workday
6	Public transport user survey	To acquire information on the movement and requirement of public transport passengers	Interview at the bus terminals to public transport passengers.	Interview to 1,500 passengers at major terminals in Nairobi city centre.
7	Travel speed survey	To analyse vehicle speed affected by traffic congestion	Investigation of travel time by running each route	Survey route: 15 routes, three times a day (morning, afternoon, and evening)

Source: JICA Study Team (JST)

(3) Survey Schedule

Traffic survey was conducted by re-entrustment to national consultants. Traffic survey commenced in the middle of January. January was devoted to preparation of survey including stationing of police officer and training of surveyors. The entire field survey was conducted during February to avoid the unexpected occurrence of the election held on 4th March. The survey schedule is shown in Figure 7.1.2.



Source: JICA Study Team

Figure 7.1.2 Traffic Survey Schedule

7.1.3 Zoning and Survey Points

(1) Zoning System

Zoning inside the study area is based on the locations defined by the 2009 Population and Housing Census. Zoning system has three sizes, namely: large zone, medium zone, and small zone.

Small Zone: Small zone in Nairobi City corresponds to the sub location of census.

Medium Zone: Medium zone in Nairobi City corresponds to the location of census

Large Zone: Large zone in Nairobi City corresponds to the division in 2006.

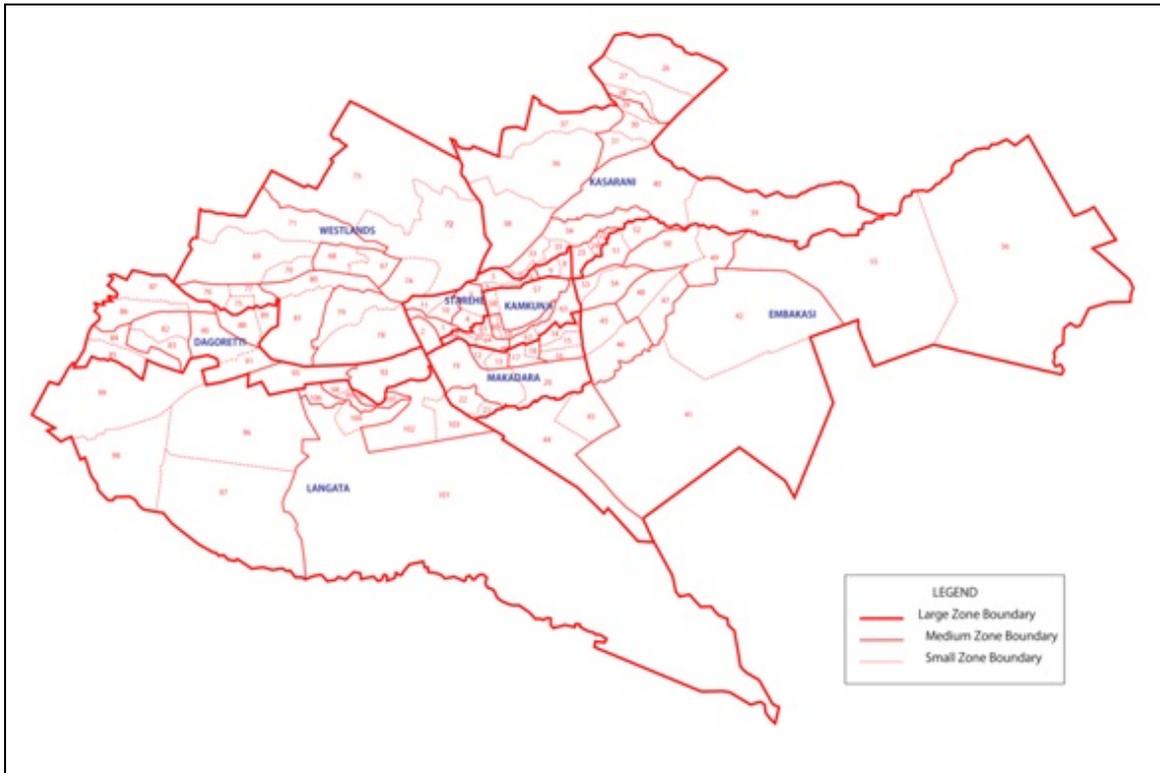
The extent of the surrounding area of the city of Nairobi corresponds to the area in the 2006 NUTRANS Study, but slight modification was made due to the variation of area of wards. In this way, the total number of zones is shown in Table 7.1.2. Detailed zone code table is attached in Appendix 3.

Table 7.1.2 Total Number of Traffic Zones

	Small Zone	Medium Zone	Large Zone
Nairobi City area	106	49	8
Surrounding area of Nairobi City	21	9	3
Outside area	23	16	4
Total	150	74	15

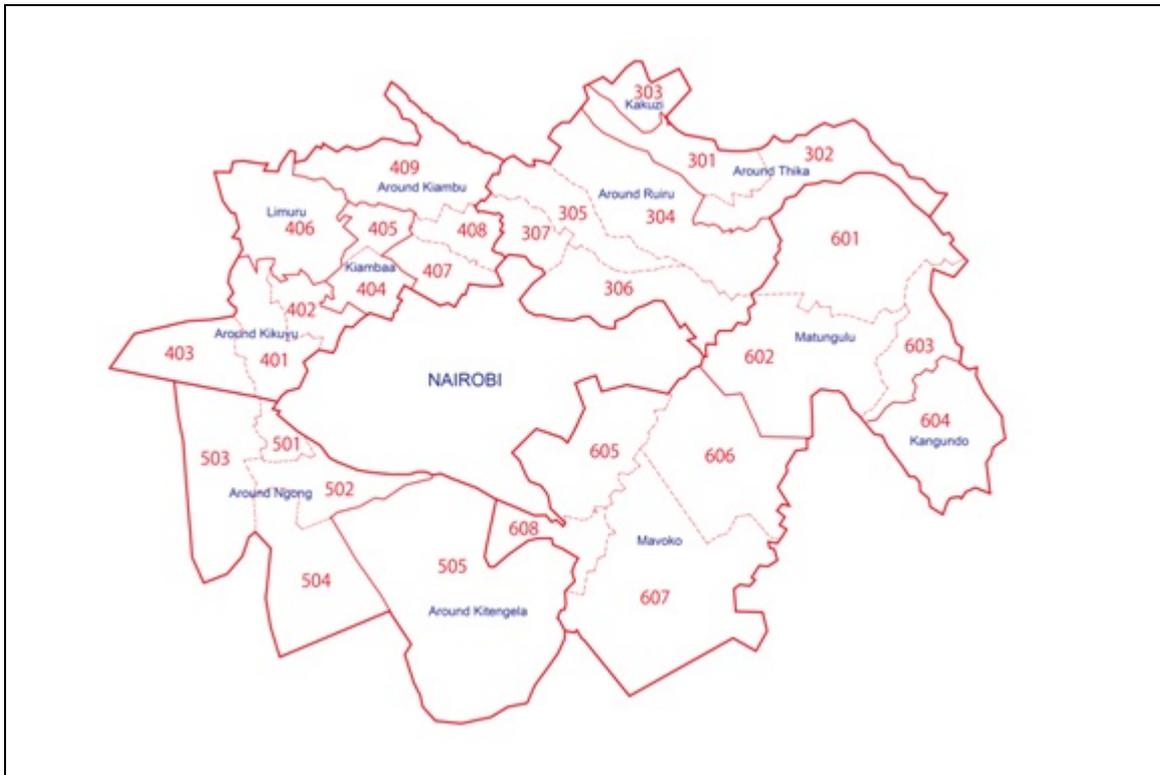
Source: JICA Study Team

Zone maps of Nairobi City area, surrounding area of Nairobi City, and the outside area are shown in Figures 7.1.3, 7.1.4, and 7.1.5, respectively.



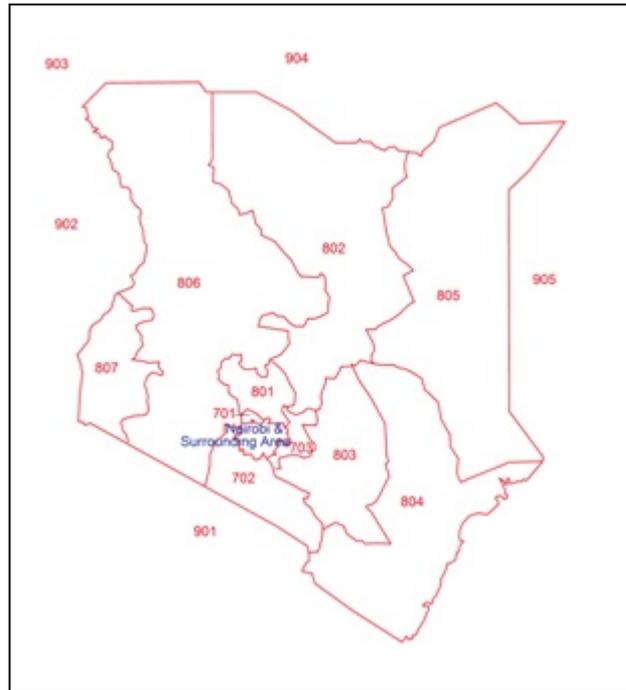
Source: JICA Study Team (JST)

Figure 7.1.3 Zone Map Inside the City of Nairobi



Source: JICA Study Team (JST)

Figure 7.1.4 Zone Map Around the City of Nairobi



Source: JICA Study Team (JST)

Figure 7.1.5 Zone Map Outside the City of Nairobi

(2) Survey Points

Amongst seven types of traffic surveys, five surveys were conducted at fixed survey points and routes.

1) Cordon Line Survey

Survey points for cordon line survey are located at the boundary of Nairobi City area along the major arterial roads.

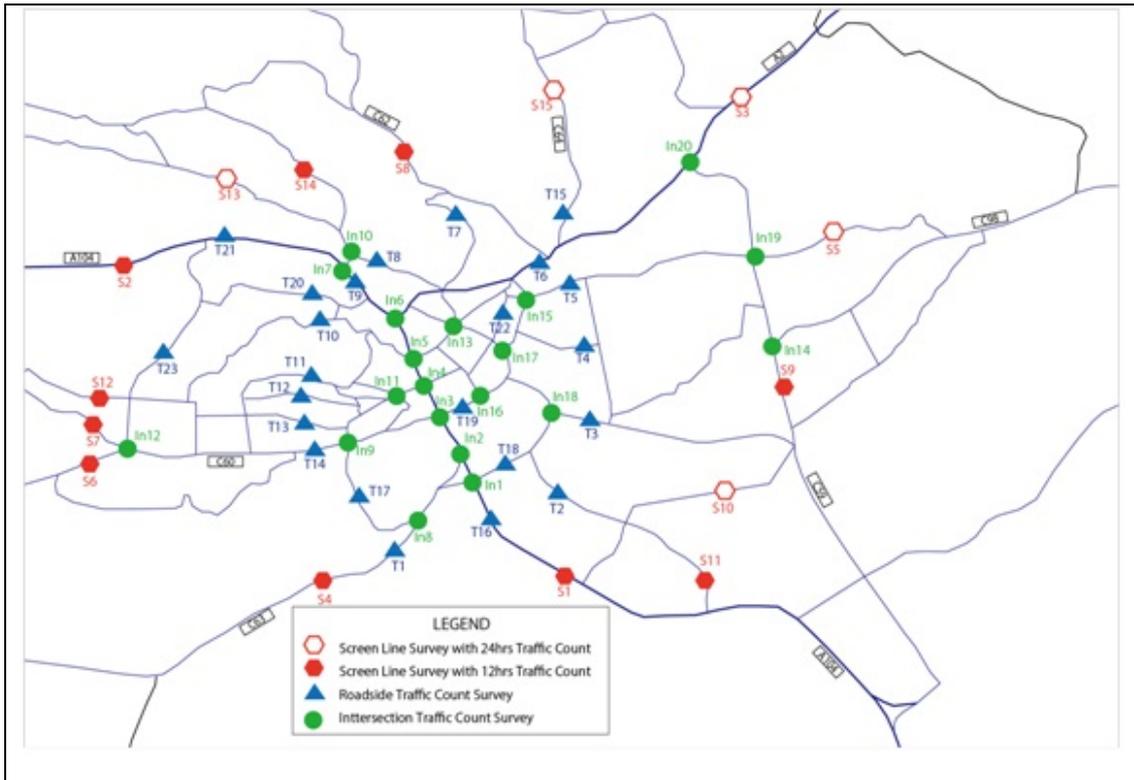
2) Screen Line Survey

Survey locations of screen line survey were set in consistency with the 2006 NUTRANS. Generally, screen line is conducted at the traffic barrier such as the river, but the objective of 2006 NUTRANS was to grasp the inflow and outflow from the densely urbanised area of Nairobi City.

3) Traffic Count Survey

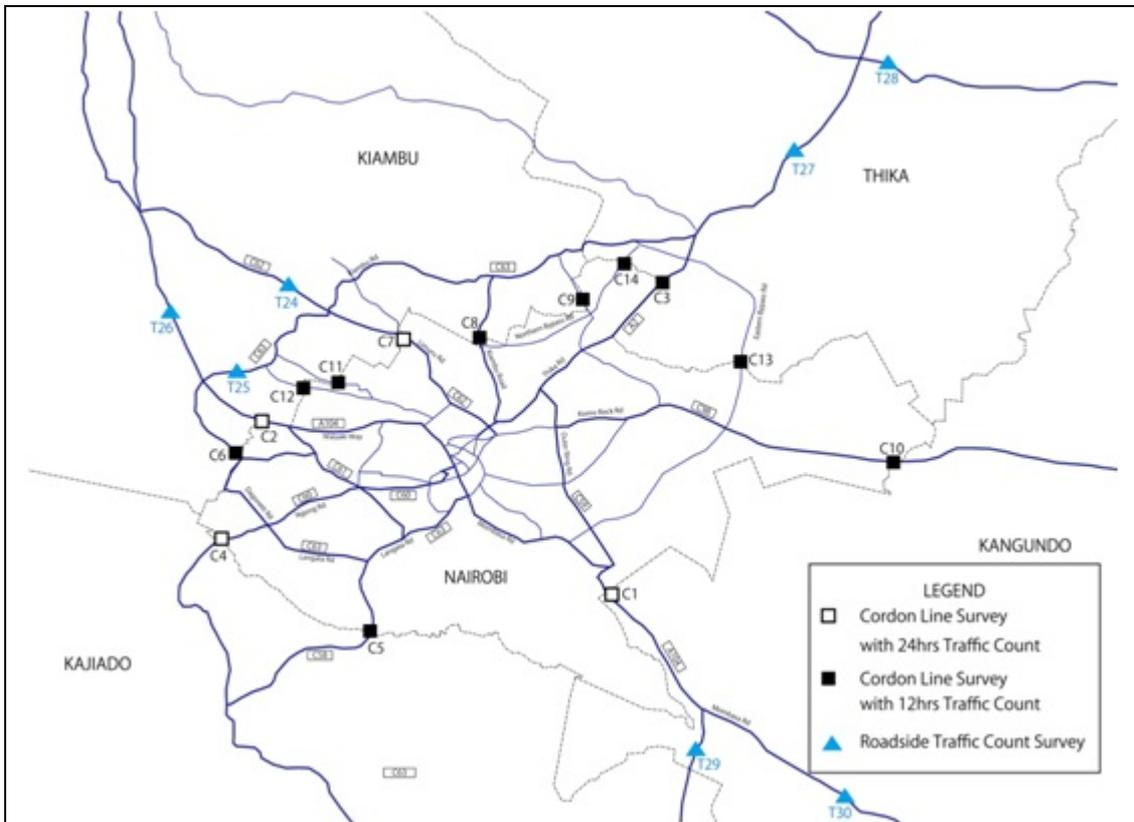
The traffic count survey was conducted based on two objectives. One is to capture the traffic movement/congestion inside Nairobi City centre area, and the other is to grasp the traffic volume along the arterial roads including outside the Nairobi City area.

The locations of the three types of traffic survey are shown in Figure 7.1.6 and Figure 7.1.7.



Source: JICA Study Team (JST)

Figure 7.1.6 Traffic Survey Point in Nairobi Urban Area



Source: JICA Study Team (JST)

Figure 7.1.7 Traffic Survey Point in Nairobi Urbanised Area

4) Public Transport User Survey

The objectives of public transport user survey was to collect public transport users' information regarding trip movement, fare, reason to use public transport, and required improvement in services. Survey location was in the centre of Nairobi City where various bus services are operated.

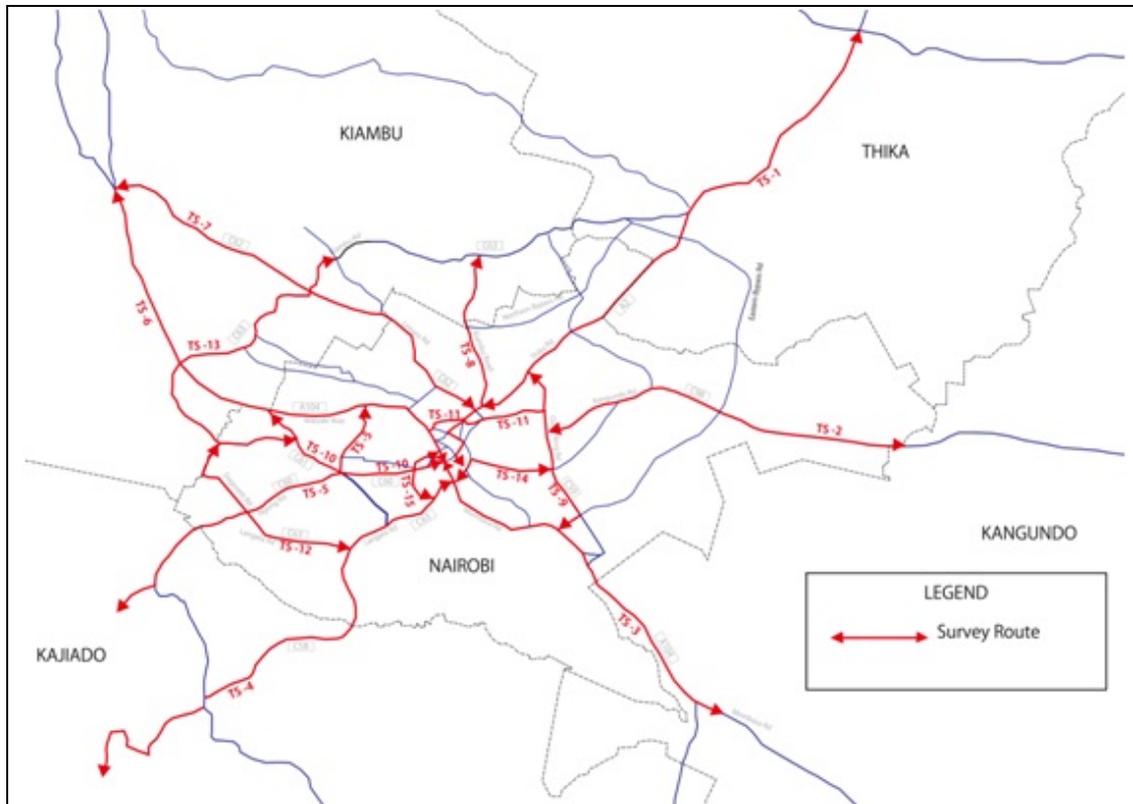


Source: JICA Study Team (JST)

Figure 7.1.8 Location of Public Transport User Survey

5) Travel Speed Survey

In total, 15 routes were selected for the travel speed survey as shown in Figure 7.1.9.



Source: JICA Study Team (JST)

Figure 7.1.9 Routes of Travel Speed Survey

7.1.4 Person Trip Survey

(1) Survey Method

1) General

Person trip survey is a method for analysing transport by capturing people's individual movement based on the concept that person's movement is the source of traffic. In order to capture the movement of persons, surveyors will visit households in the survey area and conduct interview about the movements (trips) of household members on a certain day. This was a sample survey, and the targeted households were selected randomly from the households of the survey area.

2) Survey Method

The survey area of the person trip survey is within the city of Nairobi. Total number of households to be interviewed shall be 10,000 households. According to the 2009 Census, the total households in Nairobi City was 985,016; therefore, the sampling rate of household is 1.02%.

The interview was made when the household head was present at home. The questionnaire is categorised into three, namely: household information, household member information, and trip information. Interview was made to cover persons 5 years old and above. Trip information was for trips made on workdays.

Interview items in the person trip survey are shown in Table 7.1.3.

Table 7.1.3 Interview Items in Person Trip Survey

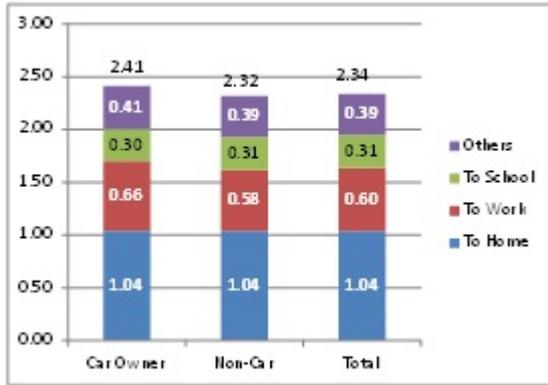
Household Information	Household Member Information	Trip Information
<ul style="list-style-type: none"> ● Home address ● Number of household members ● Household income ● Vehicle ownership ● Land and house ownership 	<ul style="list-style-type: none"> ● Address of workplace and/or school ● Sex and age ● Occupation ● Personal income ● Vehicle of its own use ● Driving license 	<ul style="list-style-type: none"> ● Origin and destination ● Trip purpose ● Travel mode ● Departing time and arrival time

Source: JICA Study Team (JST)

(2) Survey Results Analysis

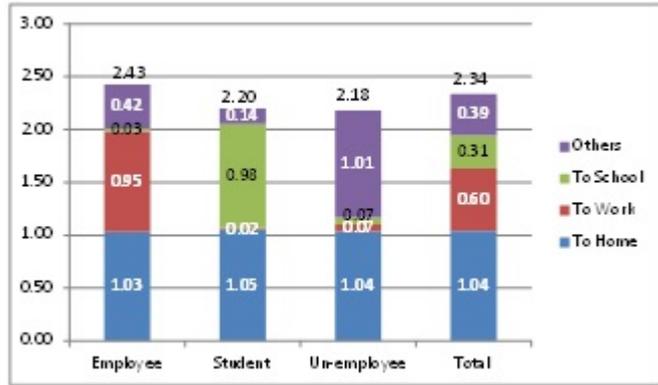
1) Trip Rate per Person

Trip rate per person is a fundamental and constant index by which the total number of trips in the future traffic demand will be controlled. Amongst the attributes obtained from the household information and the household member information by the person trip survey, car ownership and occupation can reflect a variation of characteristics of attributes in the future. As a result of the survey, car owner shows higher trip rate than non-car owner. As for the occupation, employee shows the highest trip rate amongst the three occupation categories.



Source: JICA Study Team (JST)

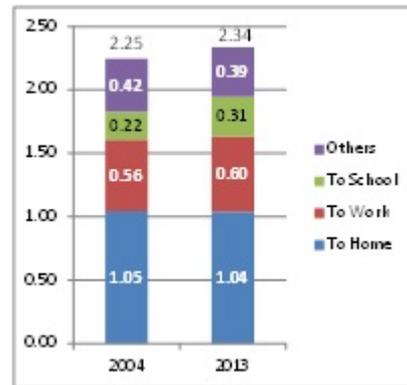
Figure 7.1.10 Trip Rate per Person by Car Ownership



Source: JICA Study Team (JST)

Figure 7.1.11 Trip Rate per Person by Occupation

Figure 7.1.12 shows the comparison of trip rate per person between 2004 and 2013. Trip rate increased from 2.25 in 2004 to 2.34 in 2013. Figure 7.1.10 shows the difference in trip rate per person by car ownership. Trip rate of car owners is higher than non-car owners. Figure 7.1.11 shows the difference in trip rate by occupation. Trip rate of employees is highest. Increase in trip rate from 2004 is attributed to increase in car ownership and increase of employees.



Source: JICA Study Team (JST)

Figure 7.1.12 Comparison of Trip Rate between 2004 and 2013

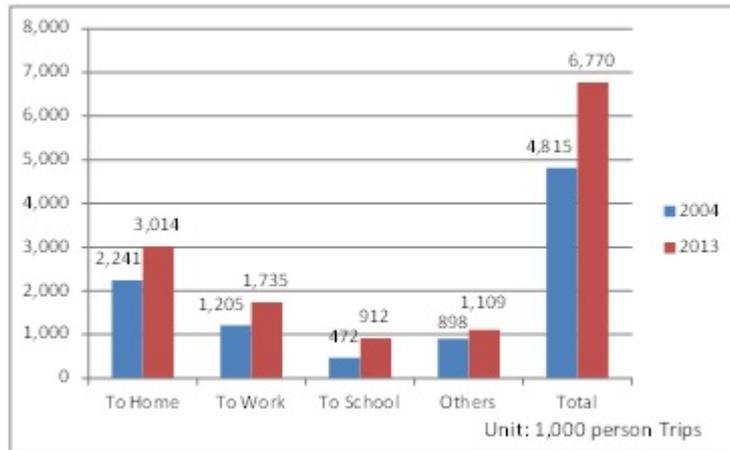
2) Trip Generation

Total person trip generation by persons living inside Nairobi City was 6.8 million person trips. Table 7.1.4 shows the growth rate of population, household, and trip generation. Due to the increase in trip rate, increase in trip generation is larger than increase in population and number of households.

Table 7.1.4 Increase in Population, Household, and Trip Generation from 2004 to 2013

	2004	2013	Rate 2013/2004
Population (persons)	2,656,997	3,601,351	1.36
Household (households)	889,317	1,154,279	1.30
Total trip generation (person trips)	4,815,457	6,769,861	1.43

Source: JICA Study Team (JST)

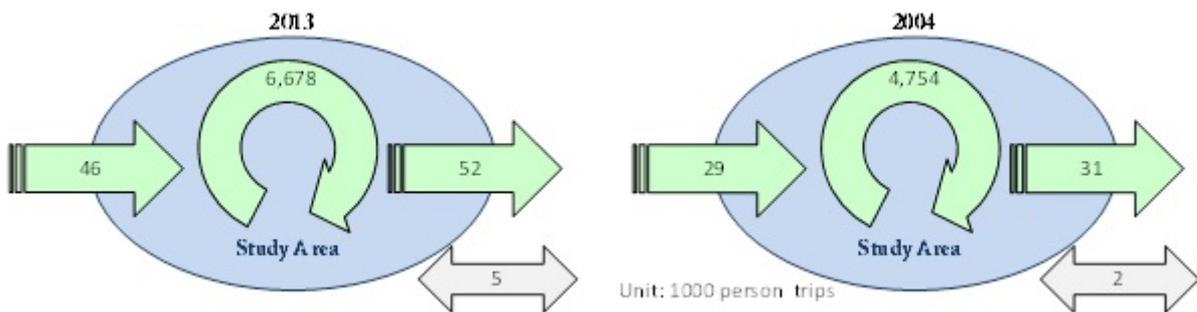


Source: JICA Study Team (JST)

Figure 7.1.13 Trip Generation by Trip Purpose in 2004 and 2013

3) Trip Distribution

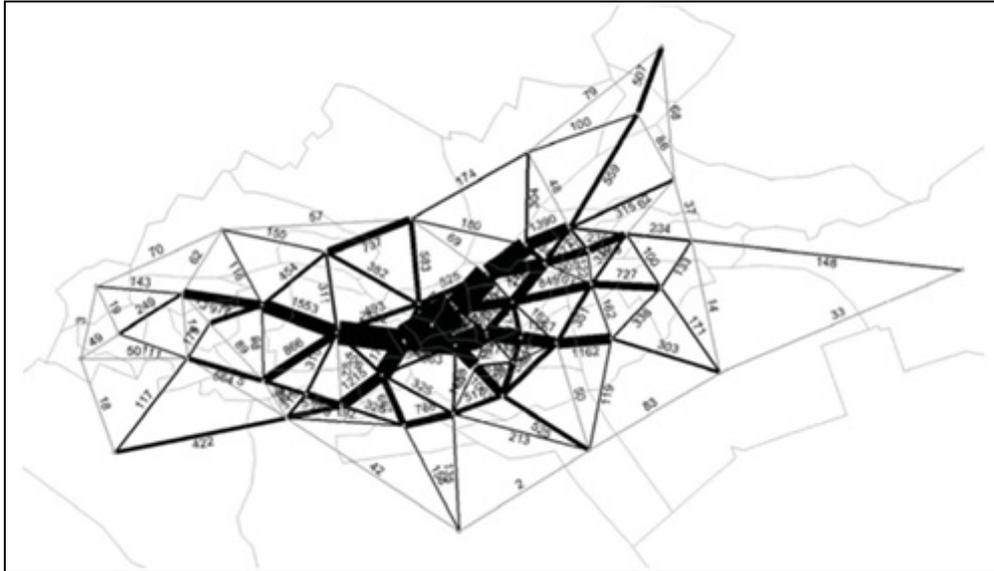
Figure 7.1.14 shows the person trip movement inside a wider area in 2004 and 2013. In 2013, the total number of trips coming to/from the outside of Nairobi City was 98,000 which occupied 1.4% of total trips. Compared with 1.2% in 2004, person trip movement in the wider area became more active.



Source: JICA Study Team (JST)

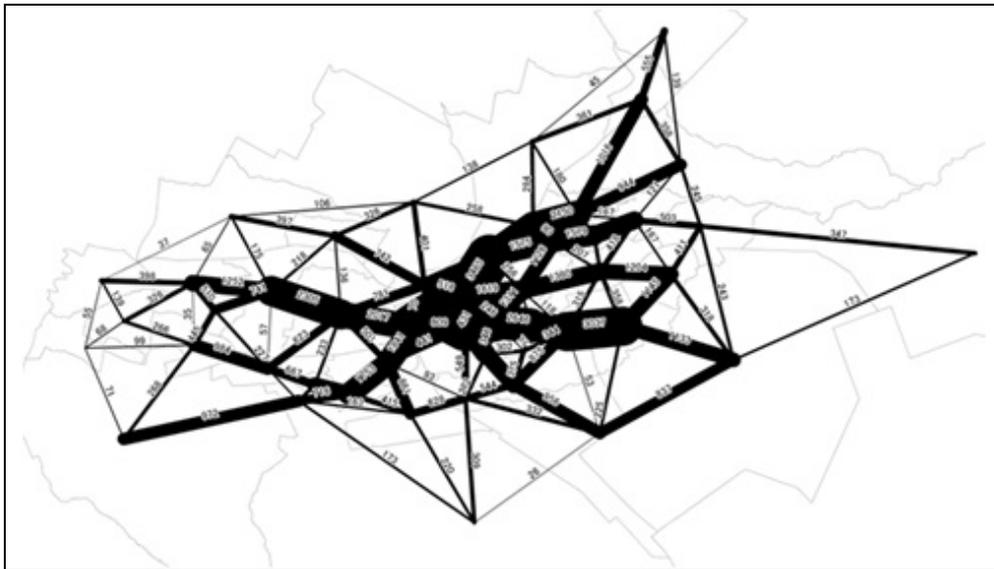
Figure 7.1.14 Person Trip Movement in a Wider Area in 2004 and 2013

Figures 7.1.15 and 7.1.16 show the person trip “desire line” inside Nairobi City in 2004 and 2013, respectively. Due to the distribution of recent population increase in the city area, trip movement in the east-west direction increased more than in the south-north direction. (Refer to Figure 2.1.2)



Source: JICA Study Team (JST)

Figure 7.1.15 Person Trip Desire Line inside Nairobi City in 2004

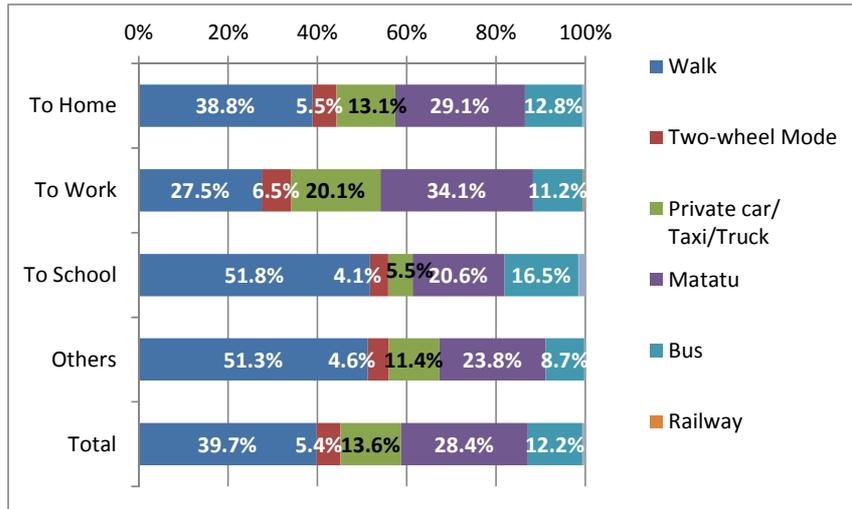


Source: JICA Study Team (JST)

Figure 7.1.16 Person Trip Desire Line inside Nairobi City in 2013

4) Travel Mode

Selection of travel mode has close relationship with trip purpose. Figure 7.1.17 shows the travel mode composition by trip purpose. In every trip purpose, except for “To Work”, walking occupies the largest share. *Matatu* occupies the largest share of “To Work” trip purpose, and has the second largest share for other trip purposes.



Source: JICA Study Team (JST)

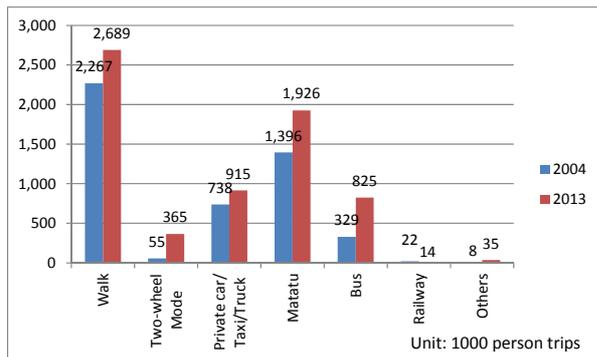
Figure 7.1.17 Travel Mode Composition by Trip Purpose

Table 7.1.5 Number of Trips by Trip Purpose by Travel Mode

	Walk	Two-wheel Mode	Private car/Taxi/Truck	Matatu	Bus	Railway	Others	TOTAL
To Home	1,170,560	165,266	392,633	878,839	383,876	5,512	17,349	3,014,035
To Work	479,317	112,098	347,084	591,842	195,493	6,708	2,313	1,734,855
To School	470,579	37,303	49,781	188,539	150,558	1,087	13,695	911,542
Others	568,351	50,332	125,901	266,587	95,424	699	2,135	1,109,429
Total	2,688,807	364,999	915,399	1,925,807	825,351	14,006	35,492	6,769,861

Source: JICA Study Team (JST)

Figures 7.1.18 and 7.1.19 show the comparison of travel modes between 2013 and 2004. Compared with 2002, walking decreased and bus and *matatu* increased. Between *matatu* and bus, the share of bus increased due to the promotion policy of the government.



Source: JICA Study Team (JST)

Figure 7.1.18 Comparison of Number of Trips by Travel Mode between 2013 and 2004



Source: JICA Study Team (JST)

Figure 7.1.19 Comparison of Composition of Travel Mode between 2013 and 2004

7.1.5 Formulation of Future Transport Demand

(1) Methodology

Transportation network is important in delineating the urban structure function as the base of urban development and growth. In parallel with transportation planning, clarifying the necessity for an improvement of the transportation facility is required. Therefore, it is important to forecast the future transport demand and to provide transportation facilities responding to it. Investment for appropriate transportation facilities will be discussed in this study.

A widely practiced method in transport demand forecasting is the four-step method. This study will also forecast transport demand in the future based on the four-step method. The method has four processes, namely: i) trip generated and attracted, ii) trip distribution, iii) modal split, and iv) trip assignment. The flow and outline of the four-step method are shown in Figure 7.1.20. Reproducibility of present condition by the models and detailed calculations of each step are shown in Appendix-4.

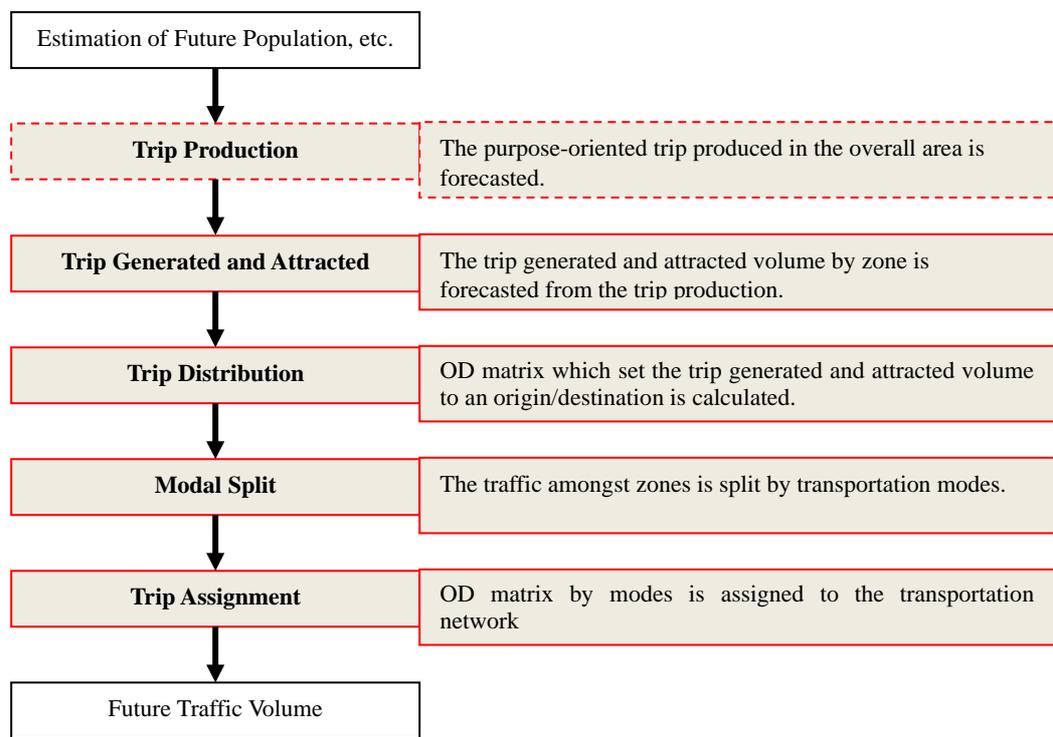


Figure 7.1.20 Flow of Four-Step Method

(2) Target Area and Zoning

In the future demand forecast, target area is mainly Nairobi City area, but some of its peripheral area is also considered in the calculation to reflect the movement of traffic from the outside area. The latter case will be referred to as Greater Nairobi hereinafter, as opposed to the former case of Nairobi City.

Zoning system for the forecast is basically a medium zone system which is described in Section 7.1.2 (1). Since the sample rate of person trip survey is relatively low, the number of zones of small zone system is too large for keeping the accuracy in the prediction. To this end, the medium zone system is selected for demand forecast although traffic survey was conducted based on the small zone system.

(3) Forecasting System

Software called JICA System for Traffic Demand Analysis (STRADA) and spreadsheets are used for the calculation of the model building and transport demand forecasting. The JICA STRADA is capable

of assigning future traffic volumes and showing the results visually. Then, Excel spreadsheets are used in the process in which traffic is assigned based on the person trip survey data. The traffic assignment method is the user equilibrium assignment method, which is also widely practiced.

(4) Traffic Assessments to Present Transport Network

Traffic demand forecast to present transport network is conducted for model building and analysis of present traffic condition.

1) Present traffic demand (2013) to present transport network (Existing Case)

This case is calculated to confirm the accuracy of traffic models and to analyse the traffic movement.

2) Future traffic demand (2030) to present transport network (Do-Nothing Case)

This case is calculated to analyse where traffic issues appear if the network is not improved. Based on the analysis, policy for future transport network shall be established.

The calculation of the demand forecast is shown in Appendix-4.

The primary indices of demand forecast for the Existing Case and the Do-Nothing Case are summarised in Table 7.1.6. Traffic assignment results for the Existing Case and Do-Nothing Case are shown in Figure 7.1.21 and Figure 7.1.22, respectively.

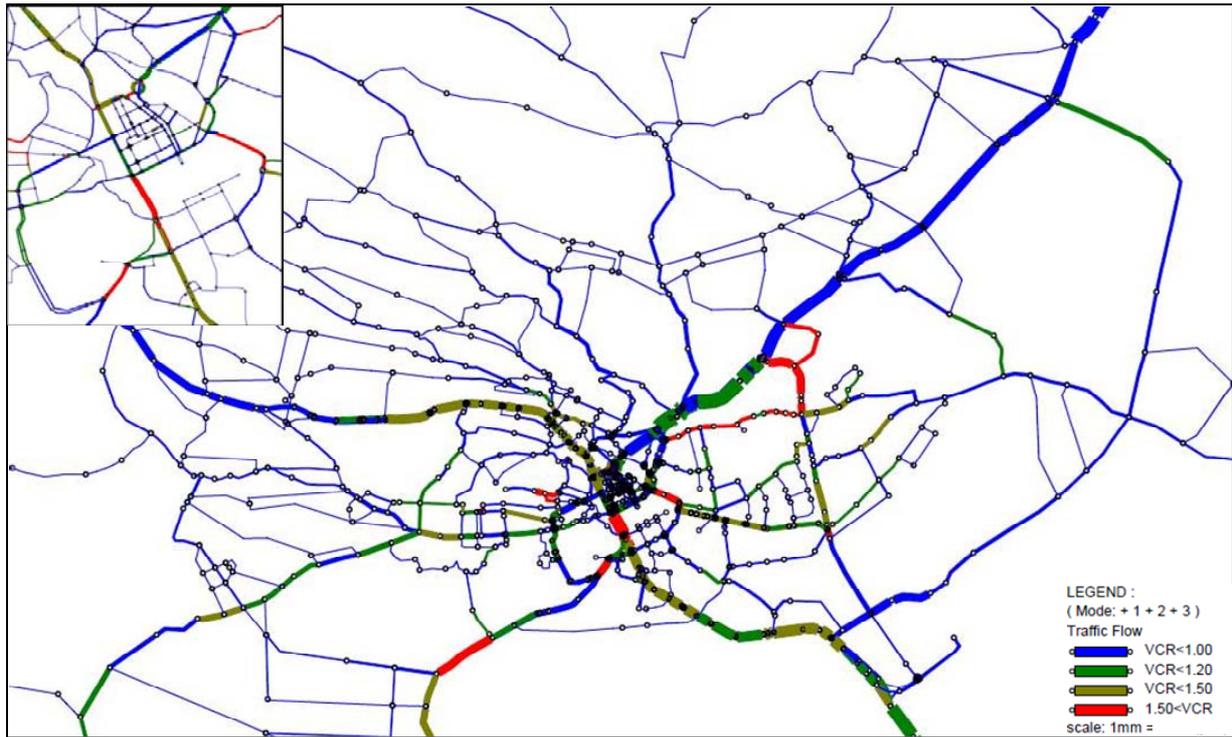
Table 7.1.6 Primary Indices by Vehicle Assignment Results in Existing Case and Do-Nothing Case

Area	Case	Year of Traffic Demand	Year of Network	Vehicle-km Total (PCU-km)(*000) (Increase rate)	Vehicle-hours Total (PCU-Hour) (Increase rate)	Average Speed (km/h)	Average VCR (Volume Capacity Ratio)
Greater Nairobi	Existing Case	2013	2013	17,780 (1.00)	431,690 (1.00)	41.2	0.54
	Do-Nothing Case	2030	2013	39,110 (2.20)	1,692,480 (3.92)	23.1	1.19
Nairobi City	Existing Case	2013	2013	10,960 (1.00)	273,910 (1.00)	40.0	0.69
	Do-Nothing Case	2030	2013	25,320 (2.31)	1,254,120 (4.58)	20.2	1.60

Source: JICA Study Team (JST)

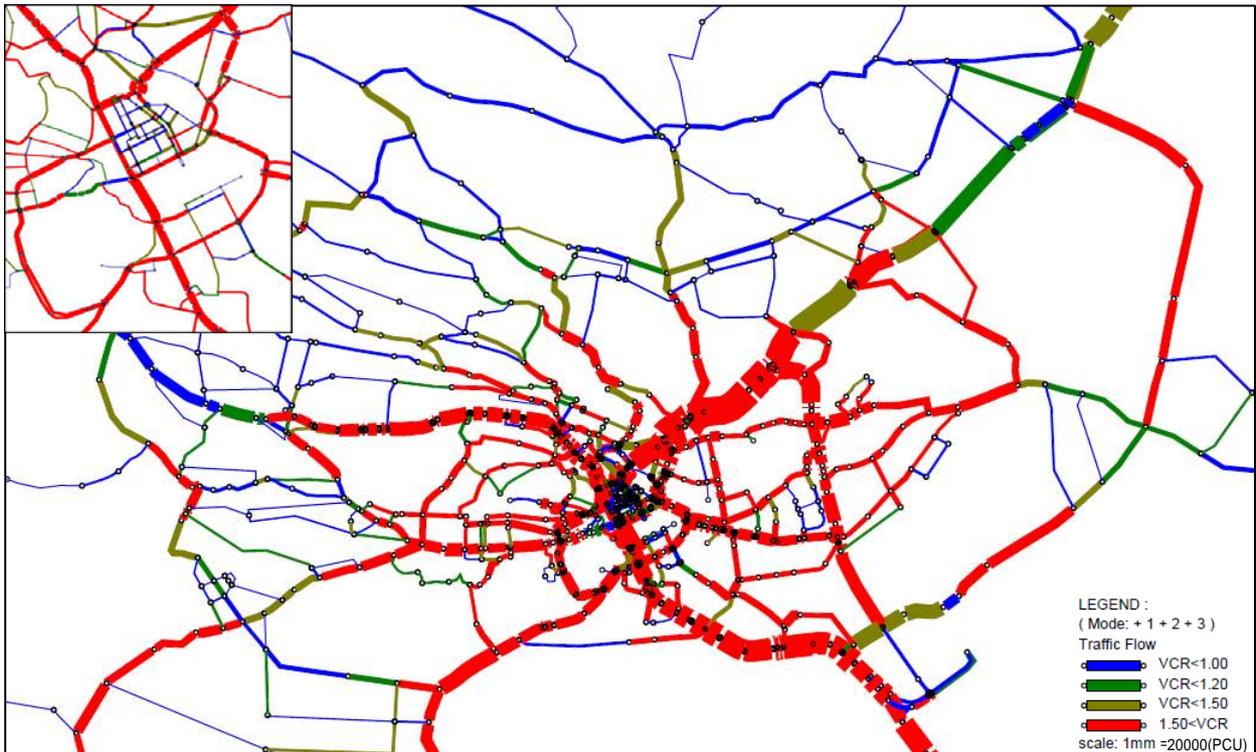
In the Do-Nothing Case, almost all the radial roads going to city centre, the circumferential roads, and the bypass roads such as Outer Ring Road and Eastern Bypass are heavily congested. Also, radial roads connecting the southern area of Nairobi City are heavily congested. Comparing the Do-Nothing Case and Existing Case, total vehicle-hours inside Nairobi City will increase by 5.3 times due to congestion while total vehicle-km will increase by 2.4 times. Congestion in Nairobi City will be more serious than in Greater Nairobi.

It is definite that the congestion of roads will become much more intense. Traffic volume will increase rapidly and road service level will become poorer than the existing condition. Therefore, several countermeasures which will decrease automobile traffic in the future and increase public transportation will be extremely necessary.



Source: JICA Study Team (JST)

Figure 7.1.21 Vehicle Assignment Result in “Existing Case” (2013)



Source: JICA Study Team (JST)

Figure 7.1.22 Vehicle Assignment Result in “Do-Nothing Case” (2030)

7.1.6 Formulation of Future Transport Network

(1) Basic Approach

1) Coordination with Proposed Land Use Plan

Since the future land use plan has been proposed by the JICA Study Team in Chapter 6, the land use plan shall be dealt with a major premise for the establishment of transport development policy.

2) Consistency with NUTRANS, 2006

JICA conducted NUTRANS from 2004 and issued the final report in March 2006. Since then, economic and social conditions have changed a great deal, but the roots of the transport issue did not change much and some of the proposals in the NUTRANS are still effective and valid. Therefore, this study shall be consistent with NUTRANS.

3) Conformity with Government Policies

Transport development policy should be in conformity with the government visions and policies. Kenya Vision 2030, Nairobi Metro Vision 2030, and Integrated National Transport Policy are essential policies in this aspect.

4) Preparation of Alternative Case for Evaluation

After the publication of NUTRANS in 2006, the Consultancy Service for Feasibility Study and Technical Assistance for Mass Rapid Transit System for the Nairobi Metropolitan Region (MRTS) was publicised by MOT. The concept of network of MRTS is reflected in the Nairobi Metro Vision 2030. Nairobi Metropolitan Services Improvement Project (NaMSIP), which emphasised the use of rail line, was issued by WB in 2012. In order to evaluate the measures in terms of reality and effectiveness, the JICA Study Team will prepare alternative cases in reference to MRTS and NaMSIP proposals.

5) Selection of Optimum Alternative Case

By conducting traffic demand forecast, alternative cases will be evaluated by indices regarding road congestion, possibility of coexistence of public and private modes, and mobility of person trips.

6) Staging Plan for Implementation

After selection of the alternative case, short-term plan (2018) and medium-term plan (2023) will be prepared and evaluated by the traffic demand forecast. As a result of evaluation, short-term plan and medium-term plan will be established.

(2) Basic Policy

Based on the present constraints and planning issues, and the policies articulated in the government plans and visions, the urban transport development policy in NIUPLAN is formulated as follows:

1) Key Concept: Ensuring World-class Mobility

Since the Nairobi Metro 2030 envisages a world-class metropolis, transport system should ensure the mobility enabling lively activity of citizens and industries.

2) Road Network Development Policy

i) Establishment of Circumferential/Radial (C/R) Network System

NUTRANS and the Spatial Planning Concept of Nairobi Metropolitan Region recommended the network system comprising radial and circumferential/orbital roads. Especially around the CBD area and in the peripheral area of the city centre, circumferential road is essential to divert the traffic which does not have origin or destination inside the city centre.

iii) Establishment of Hierarchical Classification of Roads

The Former Ministry of Road issued Road Classification Manual in 2009 and the manual classifies urban roads into class H to P. But existing road functions are not corresponding to the classification and the road density is not consistent with population distribution or industry distribution. Classification shall be reviewed considering the function of each road and improvement of road should be conducted by the classification.

iii) Exclusion of Through Traffic from Urban Traffic

According to the cordon survey result, about 46,000 vehicles passed through the Nairobi City area in 2013. As the development in the surrounding area of Nairobi City progresses, through traffic will increase more. Therefore, exclusion of through traffic from urban traffic by sufficient bypass will be required.

3) Public Transport Development Policy

i) Enhancement of Modal Shift to Public Transport

In reference to the demand forecast shown in Section 7.1.4, traffic demand in 2030 is estimated to increase to about two times of the traffic demand in 2013. To cope with the increasing traffic demand, increase in road capacity by road development is limited by the amount of investment and restriction in land acquisition. Modal shift to public transport with large capacity and high convenience is required. To this end, introduction of new public transport system as well as improvement of existing bus/*matatu* service will be examined.

ii) Strengthening of the Existing Railway

Railway is an existing infrastructure which should be utilised more. Although rolling stock is in aging and unreliable condition, infrastructure of railway is in good condition. Concept of commuter railway network is proposed by KR and Ministry of Nairobi Metropolitan Development (MONMD) and FS for commuter rail will be commenced soon. In this study, revamping of existing railway will be investigated as a measure to promote public transport.

iii) Promotion of Transit Oriented Development (TOD)

Viability of public transport depends on the concentration of passenger demand which has relationship with land use. The land use system which enhances public transport and thus reduces the use of private vehicles is called transit oriented development (TOD) and has been introduced to many countries. Land use plan will be established taking into account of this aspect.

4) Non-motorised Transport (NMT)

i) NMT as Prerequisite

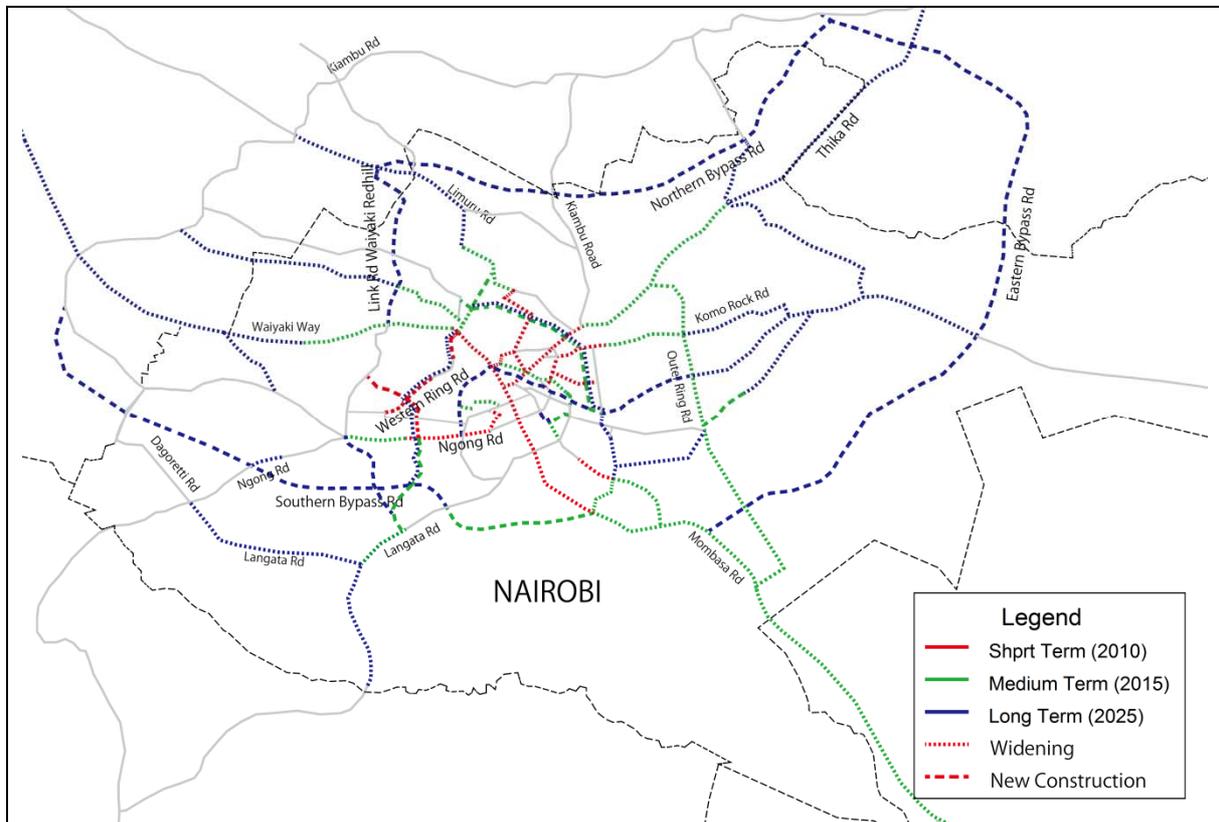
According to the person trip survey result, 40% of travel mode is walking. Additionally, walking is invariably necessary for bus, *matatu* and railway trips as the access/egress trip. Given this condition, facility for NMT is a prerequisite; therefore, development/improvement of facility is required in the entire Nairobi City area.

In developing the NMT facility, priority is given to the roads where demand is concentrated. Detailed description for the priority facilities will be shown in (4) NMT network plan.

(3) Road Network Plan

1) Progress of Road Development after 2006 M/P (NUTRANS)

Target years of the 2006 M/P (NUTRANS) are 2010 (short term), 2015 (medium term), and 2025 (long term). Figure 7.1.23 shows the road development/improvement in each target year by the NUTRANS.



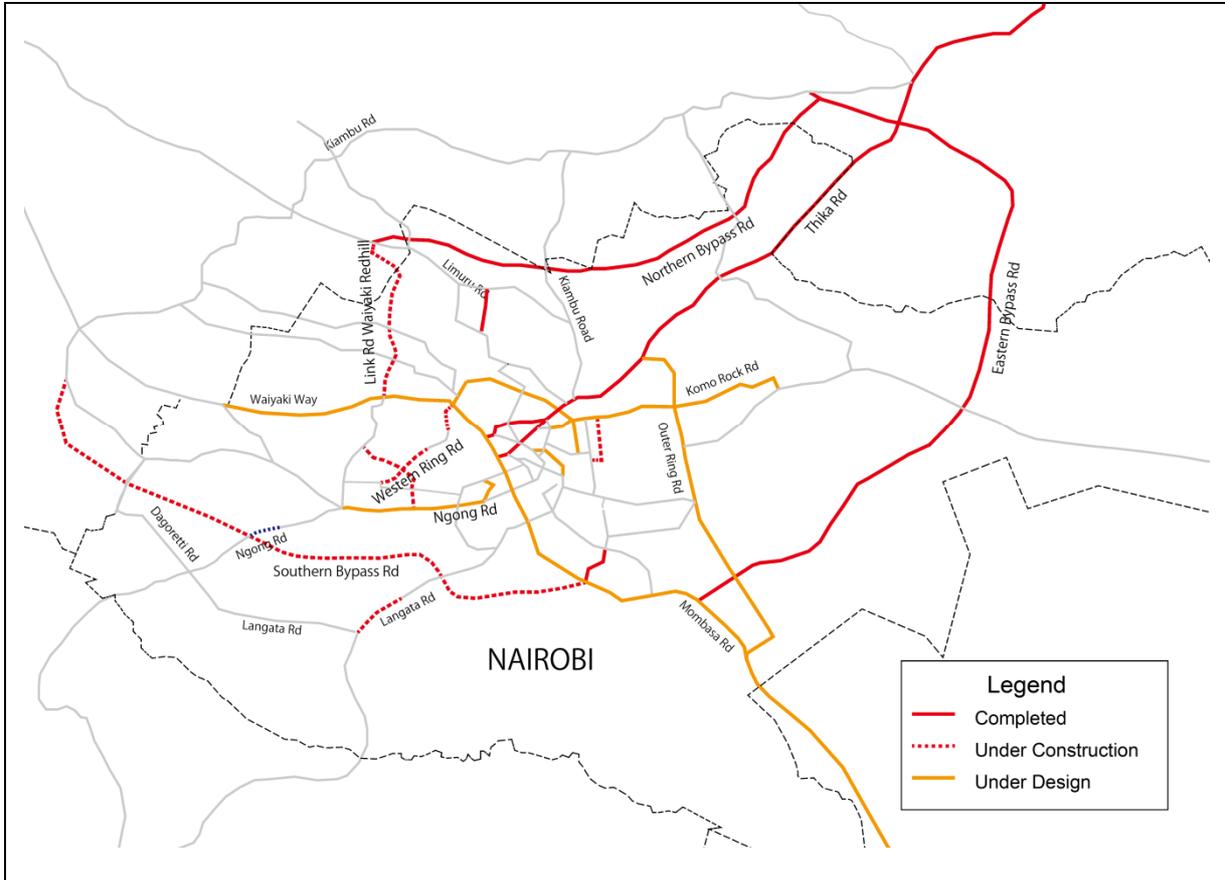
Source: The Study on Master Plan for Urban Transport in the Nairobi Metropolitan Area in the Republic of Kenya, Final Report, 2006

Figure 7.1.23 Recommended Road Development by the 2006 M/P (NUTRANS)

After issuance of 2006 NUTRANS, various developments/improvements of trunk roads made progress. Figure 7.1.24 shows the road developments/improvements after 2006. These developments/improvements are mainly financed by the Kenyan government, African Development Bank (AfDB), World Bank (WB), EU, Japan, and China. In the 2006 M/P, first priority was given to roads around the city centre area, and second priority was given to roads in the suburban area. On the contrary, road development made progress both around the city

centre area and outside the urbanised area. Considering the distribution of future traffic demand, development of roads around the city centre is still urgent; therefore, following the future network and the priority recommended by the 2006 M/P is one of the basic policy in this study.

Detailed information on NUTRANS and progress of development is attached in Appendix-5.



Source: Website of KURA, JICA Study Team (JST)

Figure 7.1.24 Progress of Road Development after 2006 M/P

2) Review of the Traffic Assignment of Future Traffic Demand

Since the target year in this study is 2030, which exceeds the target year of NUTRANS by five years, increase in traffic demand from 2025 to 2030 should be considered. By reviewing the traffic assignment for Do-Nothing Case shown in Figure 7.1.22, analysis on distribution of future traffic demand can be conducted.

Widening of the following roads which are not expected in 2025 is required for future network in 2030:

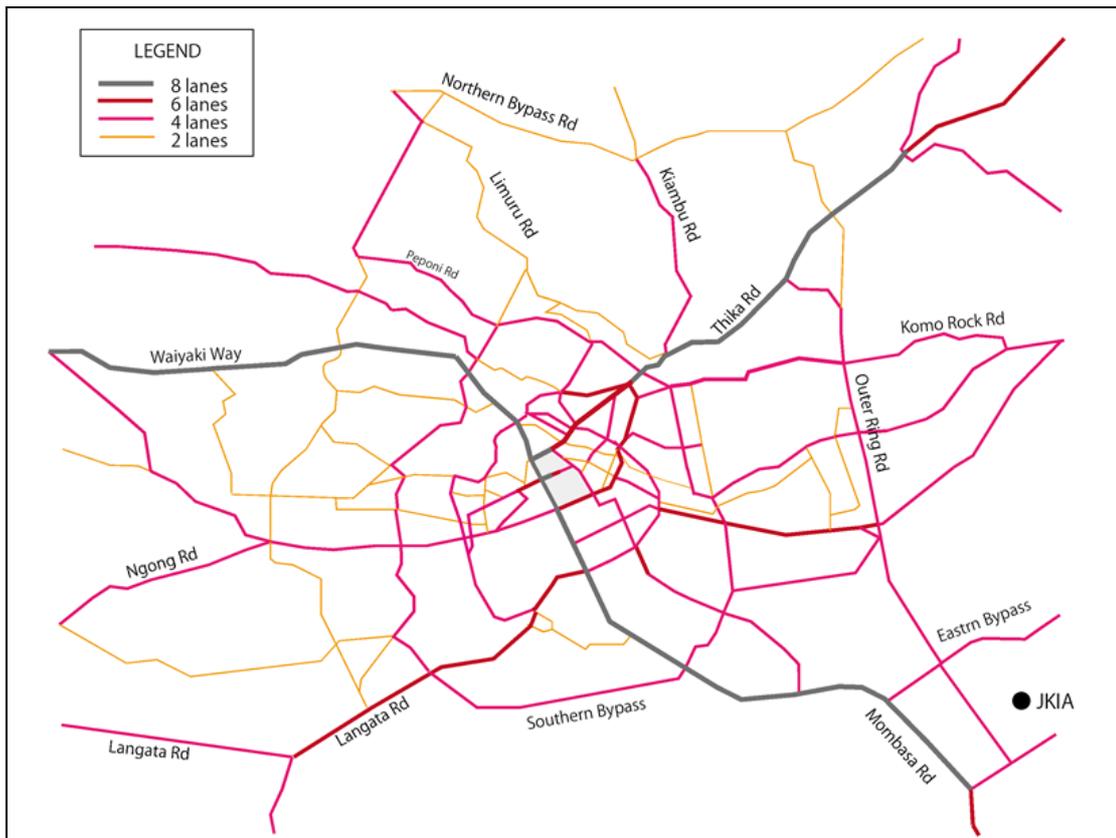
- Eastern Bypass (Mombasa Road-Thika Road)
- Ngong Road (Dagoretti-)
- Langata Road (Uhuru Highway-Magadi Road crossing)
- Jogoo Road (Lusaka Road-Outer Ring Road)
- Naivasha Road (Dagoretti-Kikkuyu Road crossing)
- Kiambu Road (Thika Rd.-Northern Bypass)

- James Gichuru Road (Waiyaki Way-Ngong Road)

3) Future Road Network

Based on the aforesaid analysis, future road network is established as shown in Figure 7.1.25. Modifications were made at the following two routes from NUTRANS:

- Route of circumferential road C-2 was altered due to the present land use.
- Widening of Limuru Road was avoided due to the present land use and instead Peponi Road will be widened.



Source: JICA Study Team (JST)

Figure 7.1.25 Future Road Network (2030)

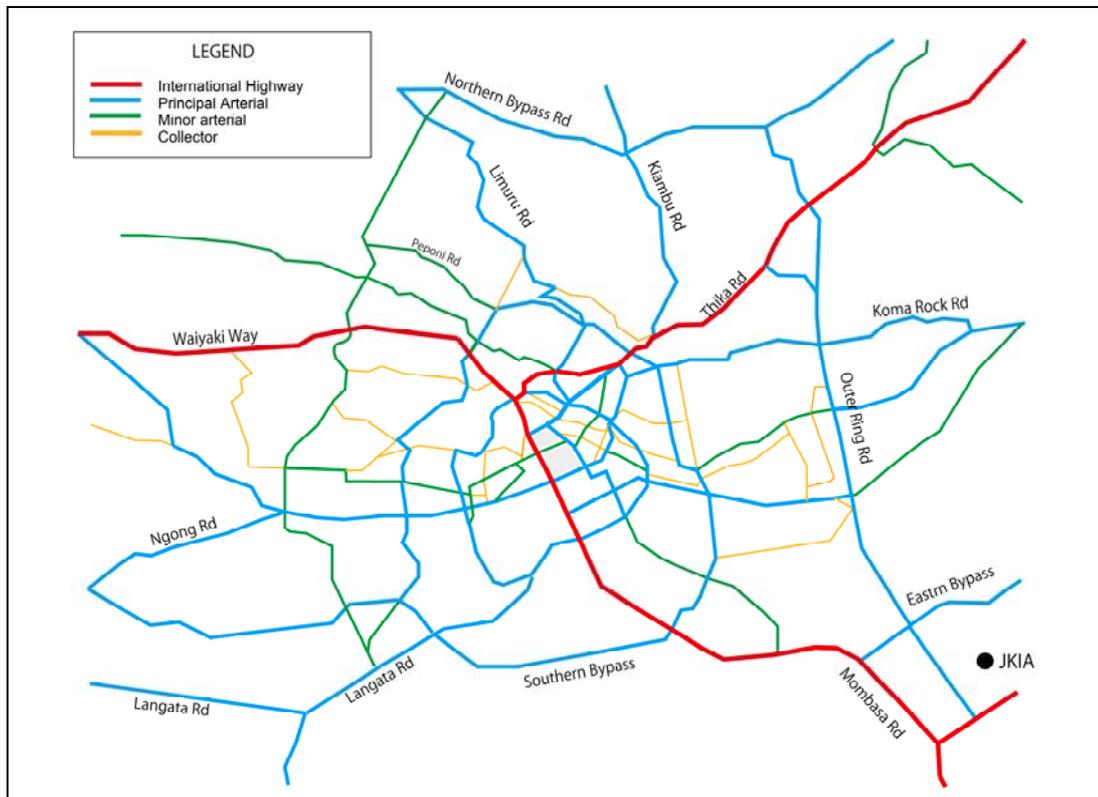
4) Road Classification of Future Network

Road classification was proposed in NUTRANS in 2006. In 2009, Kenya Roads Classification Manual was issued by the MOR. The classified existing road network is shown in Table 4.2.2 and Figure 4.2.1. Future road network in 2030 will be defined taking account of the manual as shown in Table 7.1.7 and Figure 7.1.26. Typical road cross section based on NUTRANS for each classification is shown in Appendix-7.

Table 7.1.7 Road Classification and Definition

International Highway	Roads forming strategic routes and corridors, connecting international boundaries and international terminals such as international ports. (Class A, Class B of the manual)
Major Arterial Road	Roads linking district headquarters and other major designated towns to the higher level network or to each other. Roads for through traffic and relatively long distance movements between widely separated parts of the town or city. (Class C and Class H)
Minor Arterial Road	Minor arterials provide the main means of moving between different zones of the urban area. (Class J)
Collector Road	Collectors provide the link between arterials and local roads, distributing traffic to residential and other defined zones. (Class K and Class L)
Local Road	Roads providing direct access to groups of residential properties, suitable for motorised transport. Roads providing direct access to social or economic activity, including industrial and commercial areas, and government institutions. (Class M, Class N and Class P)

Source: NUTRANS, JICA, Kenya Roads Classification Manual, MOR



Source: JICA Study Team (JST)

Figure 7.1.26 Classification of Future Road Network (2030)

(4) Public Transport Network Plan

1) Existing Public Transport Network Plan

In NUTRANS, the measure for improvement of public transport network plan was bus prioritisation and upgrading of existing railway. Introduction of LRT was envisaged after 2025. After NUTRANS, two public network plans were proposed, one was the MRTS by MOT and the other was NaMSIP by MONMD. Table 7.1.8 shows the summary of public transport network plan by NUTRANS, MRTS, and NaMSIP.

Table 7.1.8 Summary of Existing Public Transport Network Plans

	NUTRANS ^{*1}	MRTS ^{*2}	NaMSIP ^{*3}
Issued	2006	2011	2011
Ministry	Ministry of Road and Infrastructure	Ministry of Transport	Ministry of Nairobi Metropolitan Development
Assisted by	JICA	AfDB	WB
Project outline	Bus priority/exclusive lane and busway on the following corridors: 1) Northern corridor (Thika Road) 2) Eastern corridor (Juja Road and Jogoo Road) 3) Southwestern corridor (Mombasa Road) 4) Southwestern corridor (Langata Road) 5) Western corridor (Ngong Road, etc.) 6) Northwestern corridor (Waiyaki Way)	Introduction of LRT to the following corridors: 1) Waiyaki Way corridor 2) Jogoo Road corridor 3) Outer Ring Road corridor Introduction of METRO to the following corridors: 1) Thika Road corridor (NRS-Githurai) 2) Thika Road corridor (Githurai-Ruai) 3) Juja Road corridor 4) Ngong Road corridor Introduction of BRT to the following corridors: 1) Limuru Road corridor 2) Langata Road corridor 3) Mombasa Road corridor Introduction of BRT to METRO corridor extension	Improvement of existing railway to commuter train 1) NRS-Ruiru section 11 stations (including NRS) 2) NRS-Kikuyu section 9 stations (excluding NRS) 3) NRS-Syokimau 4) Introduction of Diesel Multiple Unit (DMU) Land development is associated with the opening of new station.
Total cost	KSh34,795 million (including all roads)	BRT: KSh74,441 million LRT: KSh134,740 million Metro: KSh218,969 million	KSh8,000/12,000 million ^{*4}
Target year	2025	2030	2012

Source: *1: The Study on Master Plan for Urban Transport in the Nairobi Metropolitan Area in the Republic of Kenya, March 2006

*2: Consultancy Services for Feasibility Study and Technical Assistance for Mass Rapid Transit system for the Nairobi Metropolitan Region, June 2011

*3: NaMSIP, Nairobi Metropolitan Leadership (Presentation document for 2 July meeting)

Remark: Since NaMSIP is in the conceptual stage, cost estimation was roughly conducted.

2) Future Public Transport Network

MRTS has its implementation schedule divided into two phases: the first phase is from 2011 to 2022, and the second phase is from 2019 to 2030. After the issuance of MRTS report, development of roads for the MRTS corridor has made progress such as Ngong Road and Juja Road, but the necessary process for the realisation of MRTS has not made much progress. This is because investment for MRTS, which was expected to be by PPP, is too large to handle easily. Considering this condition, future public transport network shall be based on NUTRANS incorporating the concept of MaMSIP. As for the proposal by the MRTS, BRT will be introduced to possible corridors and selected LRT corridors will be introduced until the target year.

Evaluation of the public transport system will be conducted by traffic demand forecast of alternative cases.

3) Public Transport Terminal Plan

Currently, most of the terminals for bus and *matatu* are concentrated in the city centre area. As a result, access roads to bus/*matatu* terminals are heavily congested. To alleviate the congestion by bus/*matatu*, the following measures are required:

i) *Development of New Terminal at the City Centre*

The location and the size of new terminal will be scrutinised through the detailed plan of city centre development.

ii) *Removal of Long Distance Bus Terminals to Outside the City Centre*

Disposition of the new terminals will be examined considering the location of sub-centres by the land use plan because new bus terminal will become the core of the sub-centre.

iii) *Development of Sub-terminal at the City Sub-centre*

During the stage when MRTS is the major public transport in the city, existing *matatu* will operate as feeder service mode and cover the area which MRTS will not cover. Therefore, sub-terminal is expected to function as transfer terminal from *matatu* to MRTS or large bus.

(5) Future Network Alternatives

(i) Objective of Evaluation of Alternative Case

In this study, road network is fundamentally based on the network recommended by NUTRANS. The basic policy for the network plan declares that enhancement of modal shift to public transport is requisite to address the increasing traffic demand. On the other hand, several public transport plans are proposed by the studies financed by development partners. Introduction of new public transport system will be studied under the MOTI initiative. Hence, the objectives of the evaluation of alternatives are as follows:

- 1) Evaluation of traffic condition by development of road network.
- 2) Evaluation of effect by introduction of public transport systems in decreasing vehicle traffic.
- 3) Proposal of a concept for introduction of new public transport, and the presentation of the demand forecast result.

(ii) Establishment of Alternative Cases

Since the future road network is based on NUTRANS with updates, the objective of network alternative case in 2030 is for the evaluation of the effectiveness and viability of public transport systems. Based on this concept, four alternative cases shown in Table 7.1.9 are established.

Table 7.1.9 Summary of Alternative Cases

	Name	Road Network	Public Transport Network	Remark
Alternative 0	On-going Project Case	Existing network and on-going road project	Existing network	
Alternative 1	Road Development Oriented Case	Future road network shown in Figure 7.1.15	Existing network	
Alternative 2	Utilisation of Commuter Rail Case	Same as Alternative 1	Existing network and introduction of commuter rail	Three commuter rail lines
Alternative 3	Introduction of Selective MRTS Case	Same as Alternative 1	Commuter rail and introduction of BRT, LRT	Four BRT routes and one LRT route

1) Alternative 0 (Ongoing Project)

Road network of alternative 0 is the existing network with the ongoing projects shown in Figure 7.1.24. This case is the base case for the comparison of effectiveness of measures selected in each alternative.

The following projects are included in the ongoing projects:

- Expanding and Upgrading of the Northern Corridor Road including the Elevated Highway over the Uhuru Highway
- Construction of Southern Bypass Road
- Construction of Missing Link Nos. 1, 5, 10, 15a, 15b, and 16
- Dualling of Outer Ring Road
- Construction of Western Ring Roads
- Widening of Ngong Road from Kenyatta Avenue Intersection to Dagoretti
- Widening of Juja Road
- Upgrading of Langata Road of KWS Gate-Bomas Junction Section
- Widening of Outer Ring Road

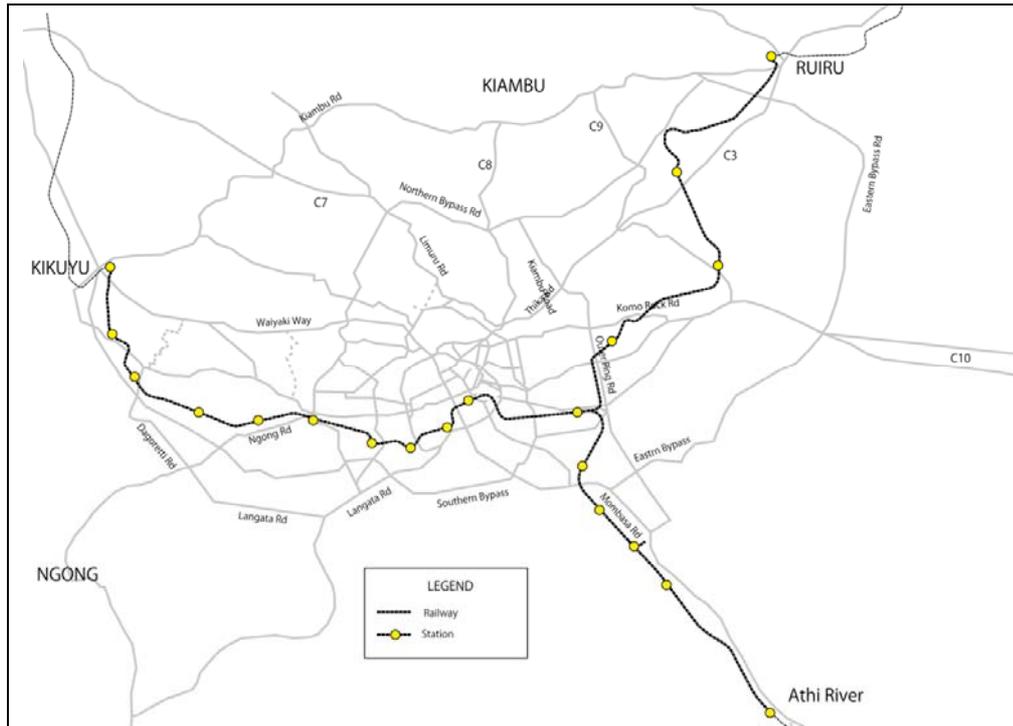
2) Alternative 1 (Road Development Oriented Case)

The objective of alternative 1 is to solve the transport issues solely by road development. Road network for alternative 1 is shown in Figure 7.1.25.

3) Alternative 2 (Utilisation of Commuter Rail Case)

To solve the transport issues, strengthening of public transport is inevitable. In alternative 2, commuter railway plan proposed by NaMSIP is introduced as the essential measure for public transport reinforcement. Proposed railway network is shown in Figure 7.1.27.

Introduction of diesel multiple unit (DMU), which is flexible for the variation of passenger demand, is recommended. On this premise, the assumption in this study is that the railway track is existing single with double track at the stations, the number of services per hour is two, and the schedule speed is 30 km per hour.



Source: NaMSIP, Nairobi Metropolitan Leadership (Presentation document for 2 July meeting)

Figure 7.1.27 Railway Network in Alternative 2

4) Alternative 3 (Introduction of Selective MRTS Case)

i) *Evaluation of Priority Corridor*

The objective of introduction of new public transport systems proposed by MRTS is to enhance modal shift to public transport and consequently to alleviate traffic congestion. Nine corridors are proposed for MRTS corridors. In this study, priority corridors are evaluated based on the following aspects:

- (i) Vehicle traffic volume: Concentration of large amount of vehicle traffic requires shifting to public transport because countermeasure by road development is limited against the increasing traffic.
- (ii) Vehicle capacity ratio (VCR): VCR also indicates the concentration of vehicle traffic demand in comparison with the road capacity.
- (iii) Demand overlapping with commuter rail: Commuter railway by NaMSIP was publicised after the MRTS, and thus nine corridors proposed by MRTS did not take into account the commuter rail. Therefore, routes for MRTS should be examined in terms of overlap with commuter rail. BRT will be introduced to the route with extremely large vehicle demand even if the route overlaps with the commuter rail.
- (iv) Possibility of widening to more than six lanes: On the MRTS corridors, roads with more than four lanes should be secured for the general vehicles. Decreasing road capacity for general vehicles into two lanes will give too large an impact and make it impossible to obtain consensus amongst the citizens.

Detailed evaluation of priority corridor is shown in Table 7.1.10.

Table 7.1.10 Evaluation of Priority of MRTS Corridors

No.	Road Name	Starting Station	Ending Station	Traffic Demand in Alt. 1 (Max) ('000)	VCR in Alt. 1 (Max)	Overlap with Commuter Rail	Possibility of Widening	Evaluation	Priority
1	Thika Road	NRS	Kasarani	253	>1.50	No overlap	Existing	Vehicle traffic demand is extremely large and VCR is highest . No route overlaps with commuter rail.	Highest
		Kasarani	Eastern Bypass	141	1.50> >1.20	Overlap	Existing	Vehicle traffic demand is very large and VCR is high. Route overlaps with commuter rail.	High
2	Juja Road	NRS	Outer Ring	77	>1.50	No overlap	Ongoing	Vehicle traffic demand is large and VCR is highest . No route overlaps with commuter rail.	Highest
		Outer Ring	Kayole	56	>1.50	Overlap	Possible	Vehicle traffic demand is large and VCR is highest . Route overlaps with commuter rail.	High
3	Jogoo Road	NRS	Outer Ring	96	>1.50	Overlap	Possible	Vehicle traffic demand is very large and VCR is highest . Route overlaps with commuter rail.	High
		Outer Ring	Kayole	49	1.50> >1.20	No overlap	Possible	Vehicle traffic demand is not large and VCR is high. No route overlaps with commuter rail.	Low
4	Mombasa Road-Athi River	NRS	JKIA North	243	>1.50	Overlap	Existing	Vehicle traffic demand is extremely large and VCR is highest . Route overlaps with commuter rail.	Highest
		JKIA North	Athi River	123	>1.50	Overlap	Ongoing	Vehicle traffic demand is very large and VCR is highest . Route overlaps with commuter rail.	High
5	Langata Road	NRS	Bomas of Kenya	105	>1.50	No overlap	Possible	Vehicle traffic demand is very large and VCR is highest . No route overlaps with commuter rail.	Highest
6	Ngong Road	NRS	Dagoretti Corner	53	1.50> >1.20	Overlap	Ongoing	Vehicle traffic demand is large and VCR is high. Route overlaps with commuter rail.	Low
		Dagoretti Corner	Karen Bus Stop	32	1.50> >1.20	No overlap	Possible	Vehicle traffic demand is not large and VCR is High. No route overlaps with commuter rail.	Low
7	Waiyaki Way	NRS	Kabete	198	>1.50	No overlap	Existing	Vehicle traffic demand is extremely large and VCR is highest . No route overlaps with commuter rail.	Highest
		Kabete	Kikuyu	61	1.20> >1.00	No overlap	Ongoing	Vehicle traffic demand is large and VCR is low. No route overlaps with commuter rail.	Low
8	Limuru Road	NRS	Ruaka Bus Station	66	1.50> >1.20	No overlap	Difficult (Forest)	Vehicle traffic demand is large and VCR is high. No route overlaps with commuter rail.	High
9	Outer Ring Road	GSU	Mombasa Road	98	>1.50	No overlap	Ongoing	Vehicle traffic demand is very large and VCR is highest . No route overlaps with commuter rail.	Highest

Source: JICA Study Team (JST)

Remark: Traffic demand - Extremely large: more than 150,000

Very large: more than 90,000

Large: more than 50,000

As a result of the evaluation, the following six corridors are selected as the priority corridors:

- (i) Thika Corridor (from Nairobi Station to Kasarani);
- (ii) Juja Corridor (from Nairobi Station to Outer Ring Road);
- (iii) Mombasa Corridor (from Nairobi Station to JKIA North);
- (iv) Waiyaki Corridor (from Nairobi Station to Kabete);
- (v) Langata Corridor (from Magadi Road Crossing to Nyayo Stadium); and
- (vi) Outer Ring Corridor (from Thika Road to Mombasa Road).

Additionally, circular mass transit route surrounding Central Business District (CBD) area is proposed by the CBD development policy in order to create high accessibility in CBD and reduce the vehicle traffic in CBD. This route is taken into consideration as one of the transit corridors.

ii) Selection of Transport Mode

The mode to be introduced to each corridor is re-examined through the following aspects:

- (i) Physical condition: In case of elevated LRT, a strip with sufficient width for the construction of piers is required.
- (ii) Progress of related project: Several roads which are supposed to be MRTS route are in the design stage. Design condition for the road development should be taken into consideration.

Table 7.1.11 shows the result of examination of transportation mode.

Table 7.1.11 Selection of Mode for MRTS Corridors

No.	Road Name	Starting Station	Ending Station	Proposed Mode by MRTS	Physical Condition for MRT/LRT	Progress of Related Project	Implementation Phase		
							Medium Term (2023)	Long Term (2030)	Long-long Term (after 2030)
1	Thika Road	NRS	Kasarani	Metro	The width of the existing median strip is not enough for the construction of viaduct piers.	Completed by AfDB finance		BRT	Metro
		Kasarani	Eastern Bypass	Metro		Completed by AfDB finance			Metro
2	Juja Road	NRS	Outer Ring	Metro	There seems to be no difficulty in the construction.	Design stage by WB finance including BRT lane		BRT	LRT
		Outer Ring	Kayole	Metro		Design stage by WB finance including BRT lane			BRT
3	Jogoo Road	NRS	Outer Ring	LRT	Jogoo Road has a wide median strip enough for the construction of LRT piers up to the crossing with the Outer Ring Road.	Not implemented			LRT
		Outer Ring	Kayole	LRT		Not implemented			LRT
4	Mombasa Road-Athi River	NRS	JKIA North	BRT	(BRT by MRTS)	Design stage by WB finance including BRT lane	BRT	BRT	BRT
		JKIA North	Athi River	BRT		Design Stage by WB finance including BRT lane			BRT
5	Langata Road	NRS	Bomas of Kenya	BRT	(BRT by MRTS)	Not implemented		BRT	BRT
6	Ngong Road	NRS	Dagoretti Corner	Metro	There is a steep slope of 5.5% between Railway Golf Course and Upper Hill. It is necessary to introduce system using rubber tire.	Design stage by Japanese finance including LRT lane			LRT
		Dagoretti Corner	Karen Bus Stop	Metro		Design stage by Japanese finance including LRT lane			LRT
7	Waiyaki Way	NRS	Kabete	LRT	There will be no difficulty in the construction of LRT along this road except for overpassing interchanges with crossing road.	Design stage by WB finance including BRT lane	BRT	BRT	BRT
		Kabete	Kikuyu	BRT		Design stage by WB finance including BRT lane			BRT
8	Limuru Road	NRS	Ruaka Bus Station	BRT	(BRT by MRTS)	Not implemented			BRT
9	Outer Ring Road	GSU	Mombasa Road	LRT	Prior to the construction of LRT, the road shall be widened with a median strip for future pier construction.	Design stage by AfDB finance including BRT lane		BRT	BRT
	CBD Circular Route	NRS	NRS	-	There is a steep slope of 5.5% between Railway Golf Course and Upper Hill.	None		LRT	LRT

Source: JICA Study Team (JST)

As a result of evaluation of priority corridors and examination of transportation mode, the following six routes are selected as the public transport development plan in the target year:

(i) BRT Route 1 (Thika Road, from Nairobi Station to Kasarani)

Development of Thika Highway was already completed, but the future traffic demand will exceed the capacity. In order to address this issue, introduction of BRT from Nairobi Station via Ring Road Ngara along Thika Road is a necessary measure. The route will attract passenger demand from the northeast direction.

(ii) BRT Route 2 (Juja Road, from Nairobi Station to Outer Ring Road)

Westward vehicle traffic demand is concentrated to Juja Road. Road widening including MRTS corridor is ongoing under WB finance. The BRT will attract passenger demand and improve the traffic condition in the western part of CBD.

(iii) BRT Route 3 (Mombasa Road, from Nairobi Station to JKIA North)

This is the route where traffic demand is concentrated. Road widening is under design by KeNHA including BRT route in the median. The BRT route will attract passenger demand from the south and east to CBD.

(iv) BRT Route 4 (Waiyaki Way, from Nairobi Station to Kabete)

This is the route where traffic demand is concentrated. Road widening is under design by KeNHA including BRT route in the median. The BRT route will attract passenger demand from the western area of CBD.

(v) BRT Route 5 (Langata Road, from Magadi Road Crossing to Nyayo Stadium)

Based on the future traffic assignment, traffic demand exceeds the current capacity and expansion of road to six lanes is required. In this case, by shifting two lanes to the BRT route, road capacity will increase. The route will attract passenger demand from the southwest direction.

(vi) BRT Route 6 (Outer Ring Road, from Thika Road to Mombasa Road)

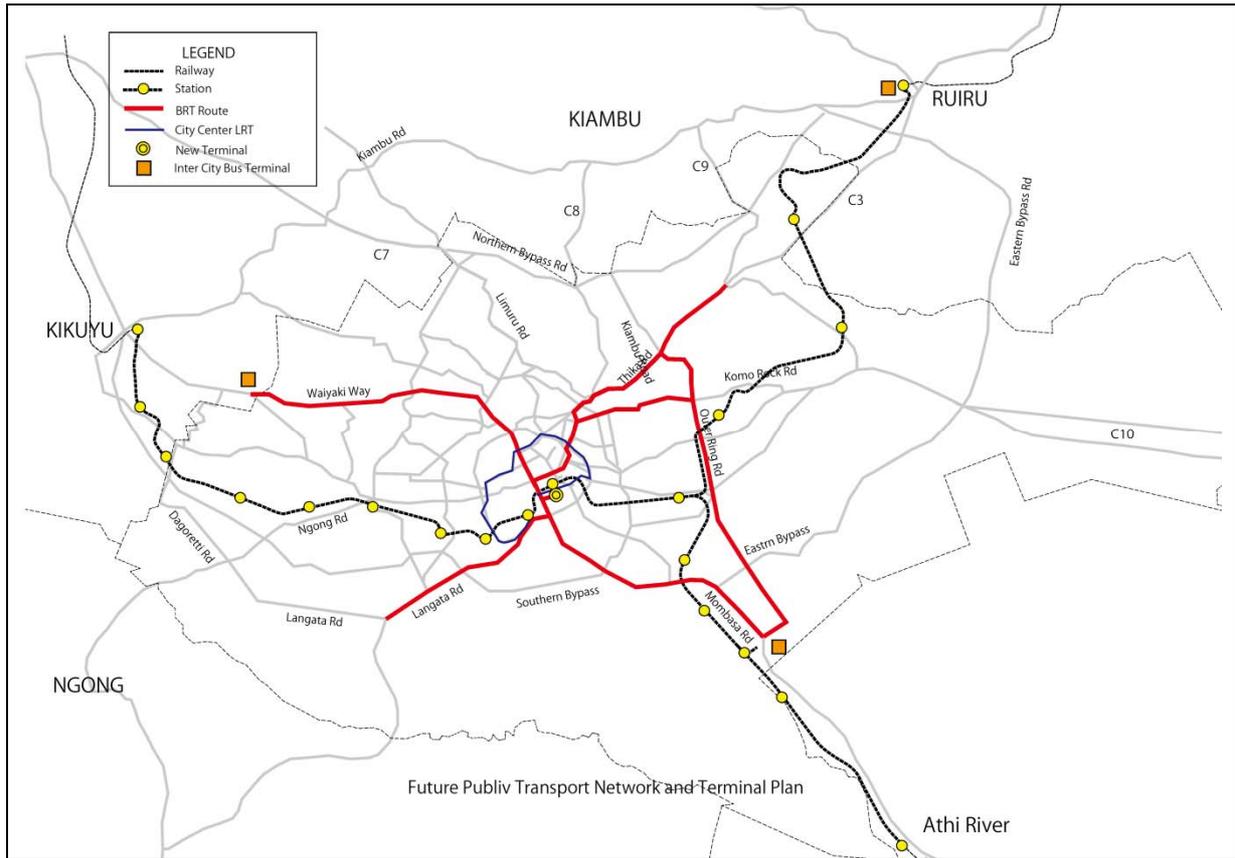
Vehicle traffic demand is large throughout the route. Introduction of BRT will disperse the traffic demand and ease the traffic demand on radial roads.

In addition to the six BRT routes shown above, the following option is added by the JICA Study Team for the smooth transportation in the city centre area.

(vii) LRT Circular Route in City Centre

Introduction of LRT in the city centre is based on the policy to realise world-class city centre. To create safe and high mobility city centre, LRT will provide the service around the city centre. Area inside the LRT route will be the NMT zone, where pedestrians and bicycles can move without obstacles by vehicles.

Based on the above concept, public transport network for alternative 3 is shown in Figure 7.1.28.

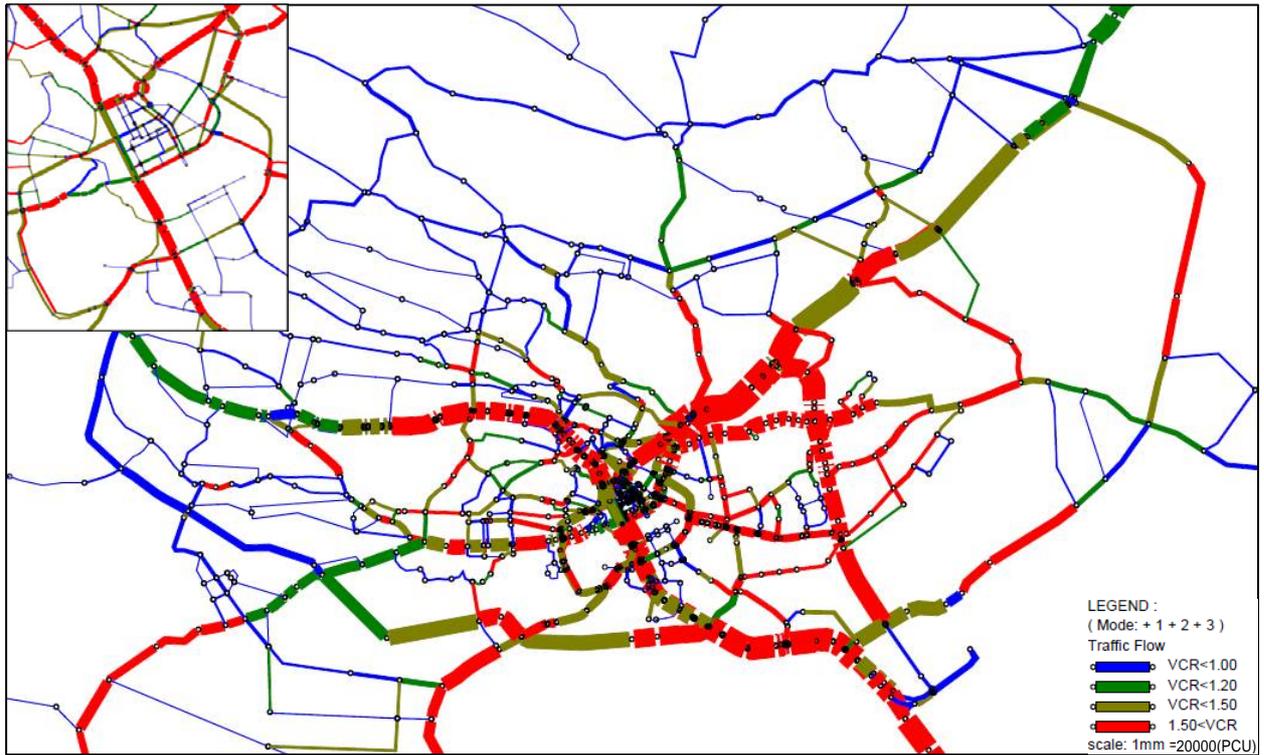


Source: JICA Study Team (JST)

Figure 7.1.28 Public Transport Network in Alternative 3

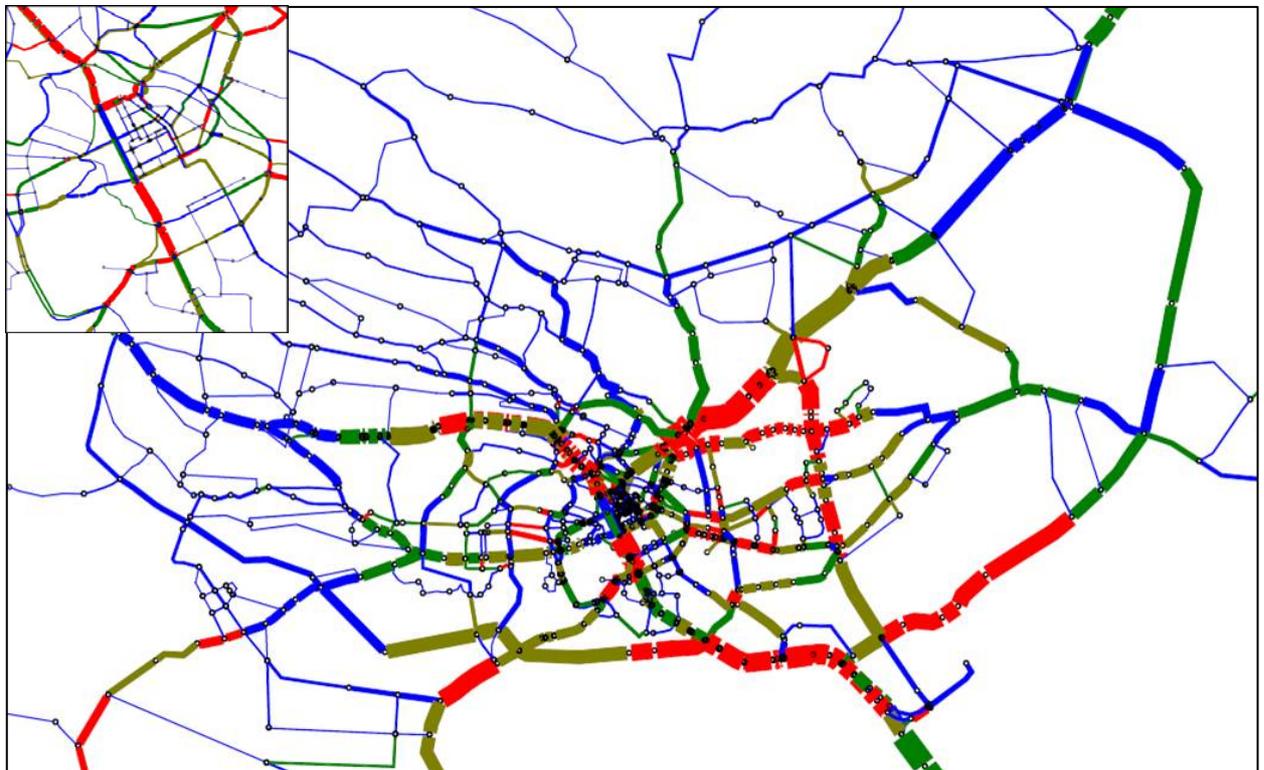
iii) Traffic Demand Forecast for the Alternative Cases

Future traffic demand in 2030 is forecasted by the traffic models established in Section 7.1.4. Results of vehicle assignment for alternative case 0, case 2, and case 3 are shown in Figures 7.1.29, 7.1.30, and 7.1.31, respectively. Results of passenger assignment of public transport (railway, BRT, and LRT) for case 3 are shown in Figure 7.1.32.



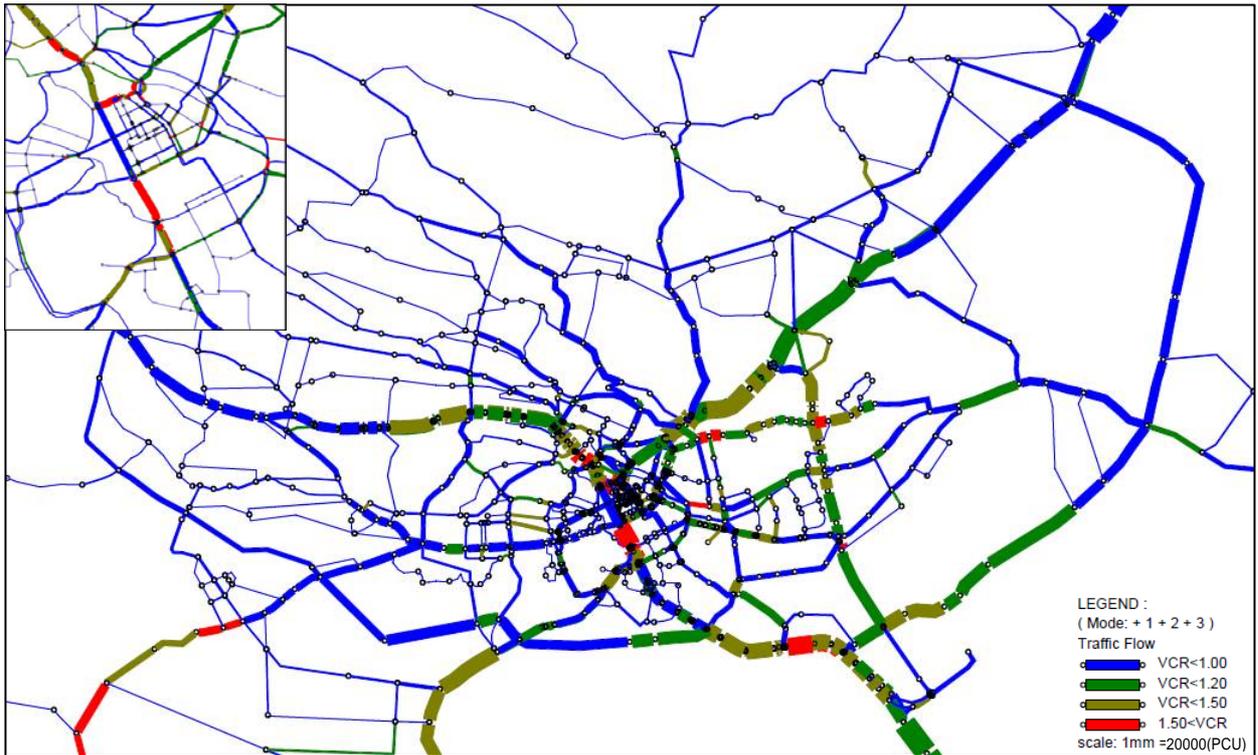
Source: JICA Study Team (JST)

Figure 7.1.29 Vehicle Assignment Result of Alternative 0 in 2030



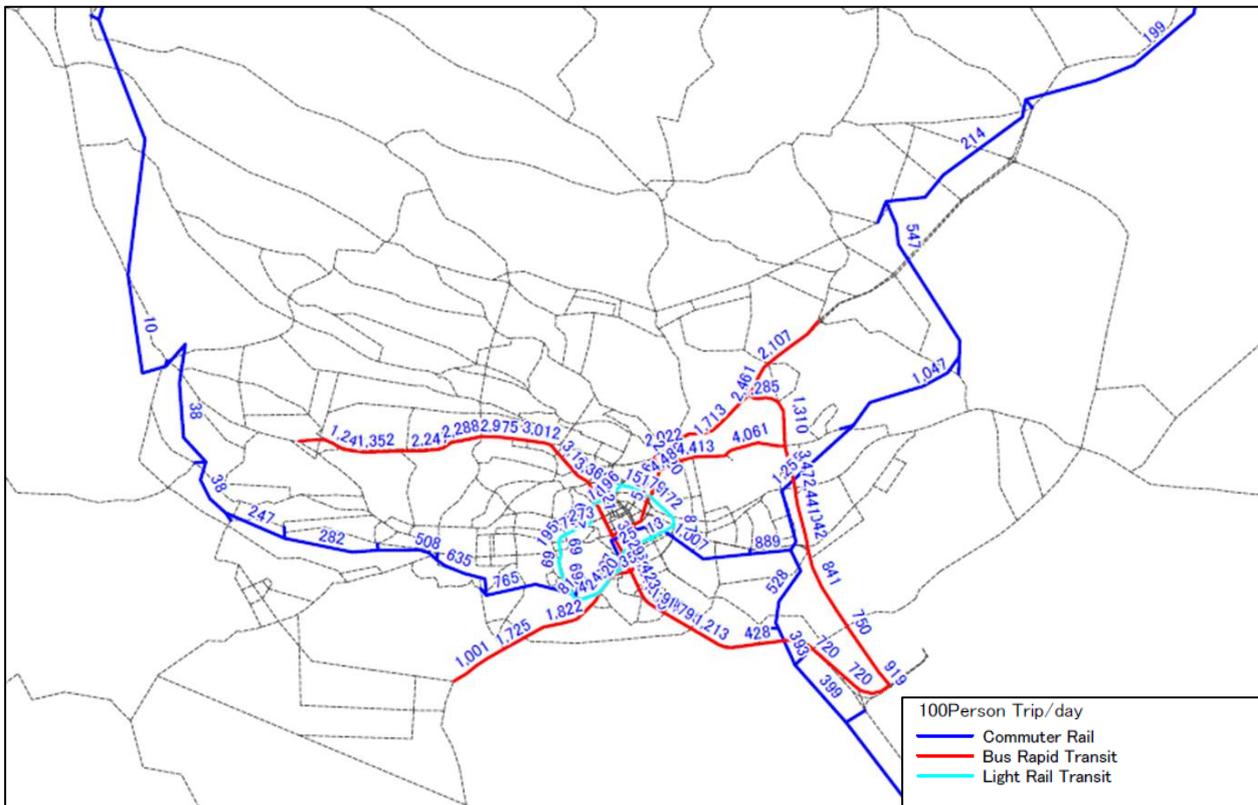
Source: JICA Study Team (JST)

Figure 7.1.30 Railway Passenger Assignment Result of Alternative 2 in 2030



Source: JICA Study Team (JST)

Figure 7.1.31 Vehicle Assignment Result of Alternative 3 in 2030



Source: JICA Study Team (JST)

Figure 7.1.32 Public Transport (Railway, BRT, and LRT) Passenger Assignment Result of Alternative 3 in 2030

(6) Evaluation of Alternative Cases

1) Modal Share by Alternative Case

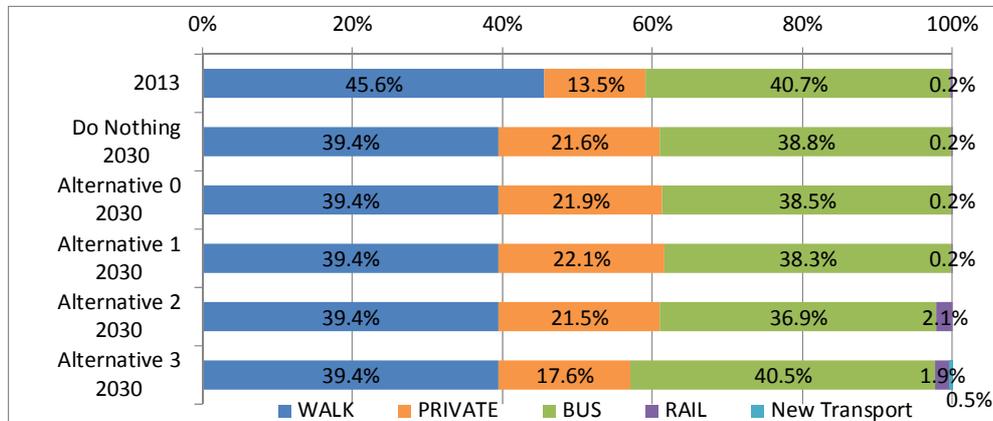
The number of trips by transport mode forecasted for each alternative case is shown in Table 7.1.12 and modal share for each alternative case is shown in Figure 7.1.33. In alternative 2, the number of railway trips is 215,000, and the number of private mode trips decreases by 58,000 from alternative 1. In alternative 3, the number of bus trips increases by 366,000 from alternative 2, and the number of new transport trips is 46,000. On the other hand, the number of private mode trips decreases by 388,000 and the modal share decreases by 3.9% from alternative 2.

Table 7.1.12 Number of Trips by Mode by Alternative Case in 2030

(Unit: km)

Alternative	Year	WALK	PRIVATE	BUS	New Transport	RAIL	TOTAL
Existing Case	2013	3,090,103	916,624	2,754,489	-	14,006	6,775,222
Do Nothing	2030	3,951,711	2,161,718	3,885,662	-	18,587	10,017,678
0 Ongoing Project	2030	3,951,711	2,195,331	3,852,215	-	18,421	10,017,678
1 Road Development Oriented	2030	3,951,711	2,213,695	3,833,869	-	18,403	10,017,678
2 Utilisation of Commuter Rail	2030	3,951,711	2,155,726	3,695,692	-	214,549	10,017,678
3 Introduction of Selective MRTS	2030	3,951,711	1,767,773	4,062,046	45,692	190,456	10,017,678

Source: JICA Study Team (JST)



Source: JICA Study Team (JST)

Figure 7.1.33 Modal Share by Alternative Cases in 2030

2) Average Speed and Average VCR by Alternative Case

As a result of vehicle traffic assignment, future traffic condition is indicated by total vehicle-km, total vehicle-hours, average speed, and average VCR as shown in Table 7.1.13. Compared with the existing case in 2013, the average speed and VCR worsen in the Do-Nothing case in 2030. But due to the measures introduced by the alternatives, the indices improve in alternatives 0–3.

In alternative 3, in which maximum measures are introduced, the average speed improves compared with the existing case. As for VCR, alternative 3 shows the least value, which is still larger than the existing case.

Table 7.1.13 Major Indices by Vehicle Traffic Assignment

Alternative		Year	Total Vehicle-km PCU-km(*000)	Total Vehicle-hours PCU-Hour	Average Speed (km/h)	Average VCR (Volume Capacity Ratio)
Study Area	Existing Case	2013	17,780	431,690	41.2	0.54
	Do Nothing Case	2030	39,110	1,692,480	23.1	1.19
	0 Ongoing Project Case	2030	37,670	1,173,180	32.1	1.02
	1 Road Development Oriented Case	2030	36,510	928,970	39.3	0.85
	2 Utilisation of Commuter Rail Case	2030	35,100	879,350	39.9	0.81
	3 Introduction of Selective MRTS Case	2030	30,500	723,920	42.1	0.71
Nairobi City	Existing Case	2013	10,960	273,910	40.0	0.69
	Do Nothing Case	2030	25,320	1,254,120	20.2	1.60
	0 Ongoing Project Case	2030	25,520	805,560	31.7	1.32
	1 Road Development Oriented Case	2030	24,850	620,560	40.1	1.04
	2 Utilisation of Commuter Rail Case	2030	23,780	581,190	40.9	1.00
	3 Introduction of Selective MRTS Case	2030	19,430	432,490	44.9	0.82

Source: JICA Study Team (JST)

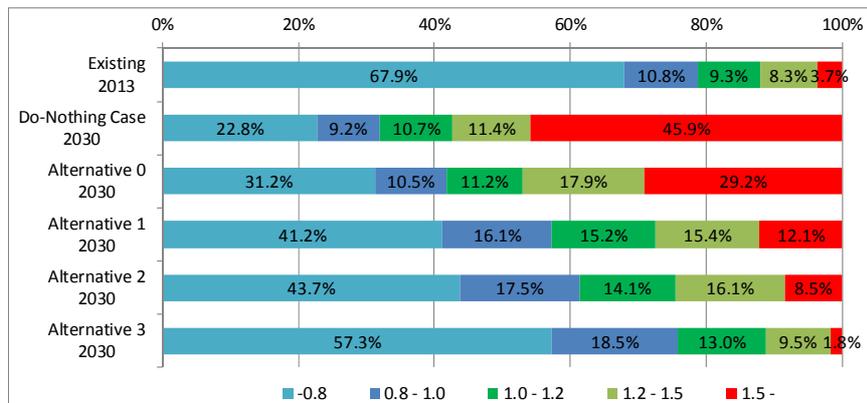
3) Distribution of VCR

Table 7.1.14 shows the road length distribution by VCR value in Nairobi City. It is observed that the roads with low VCR value increase as more measures to improve traffic condition are introduced from alternatives 1 to 3. Although average VCR of alternative 3 increases from the present, roads with high VCR value decrease.

Table 7.1.14 Road Length Distribution by VCR in Nairobi City Unit: km

VCR	Existing in 2013	Do Nothing in 2030	Alternative 0 in 2030	Alternative 1 in 2030	Alternative 2 in 2030	Alternative 3 in 2030
-0.8	510.2	171.1	243.3	337.8	358.5	469.7
0.8 - 1.0	81.0	69.2	81.8	132.1	143.8	151.4
1.0 - 1.2	69.5	80.6	87.2	124.2	115.8	106.7
1.2 - 1.5	62.3	85.8	139.1	126.2	132.3	77.6
1.5 -	28.1	344.5	227.4	99.6	69.4	14.4
TOTAL	751.2	751.2	778.9	819.8	819.8	819.8

Source: JICA Study Team (JST)



Source: JICA Study Team (JST)

Figure 7.1.34 Road Length Distribution by VCR in Nairobi City

4) Conclusion of Evaluation of Alternative Cases

- (i) Comparing the indices of alternatives 0 to 3, vehicle-km, vehicle-hours, and average VCR decrease due to the development of mass transit.
- (ii) Development of roads alone cannot solve the traffic congestion as shown in Figure 7.1.30. Reinforcement of mass transit and introduction of new transit system are requisite.
- (iii) By reinforcement of commuter rail and introduction of BRT to six corridors, traffic congestion is eased especially in the eastern area of the city centre.
- (iv) As a result, alternative 3 is recommended as the solution against the future increasing traffic demand.

(7) Staging Plan

1) Basic Strategy for Staging Plan

In the NUTRANS, staging plan for the short term (2010), medium term (2015), and long term (2025) was proposed. But in the years from 2006, conditions for network formation changed greatly, such as development of bypasses and Thika Highway. Therefore, staging plan by NUTRANS will be reviewed and reorganised in this study.

The target of road and urban transport development is:

- (i) Network in coordination with land use: The land use structure plan proposes to strengthen the function in CBD and to dispose the sub-centres. Road and urban transport network should support the formation of planned land use structure by harmonious flow of people and fleet.
- (ii) Network for world-class mobility: Nairobi Metro 2030 envisages a world-class metropolis. To encourage the realisation of world-class metropolis, road and urban transport network should have high mobility. To this end, principal measures to promote high mobility are expansion of efficient public transport network and establishment of circumferential/radial (C/R) road network.

In order to achieve the target, the required strategy in each phase is described in Table 7.1.15.

Table 7.1.15 Strategy for Staging Plan of Urban Transport Development

	1st Phase Present to 2018	2nd Phase 2019 to 2023	3rd Phase 2024 to 2030
Network in coordination with land use	<ul style="list-style-type: none"> • Study/technical assistance for development of infrastructure in CBD, sub-centres / Railway City. 	<ul style="list-style-type: none"> • Development of infrastructure in CBD, sub-centres / Railway City. 	<ul style="list-style-type: none"> • Network development to connect sub-centres.
Network for world-class mobility	<ul style="list-style-type: none"> • Improvement of network to solve existing issues. • Institutional arrangement for strengthening public transport. 	<ul style="list-style-type: none"> • Introduction of MRTS to pilot corridors. • Development of road corridors to introduce MRTS. • Strengthening of circumferential roads to form the C/R network. 	<ul style="list-style-type: none"> • Expand introduction of MRTS to plural corridors. • Establishment of C/R network system.

Source: JICA Study Team (JST)

2) Transport Network in the Short Term (2018)

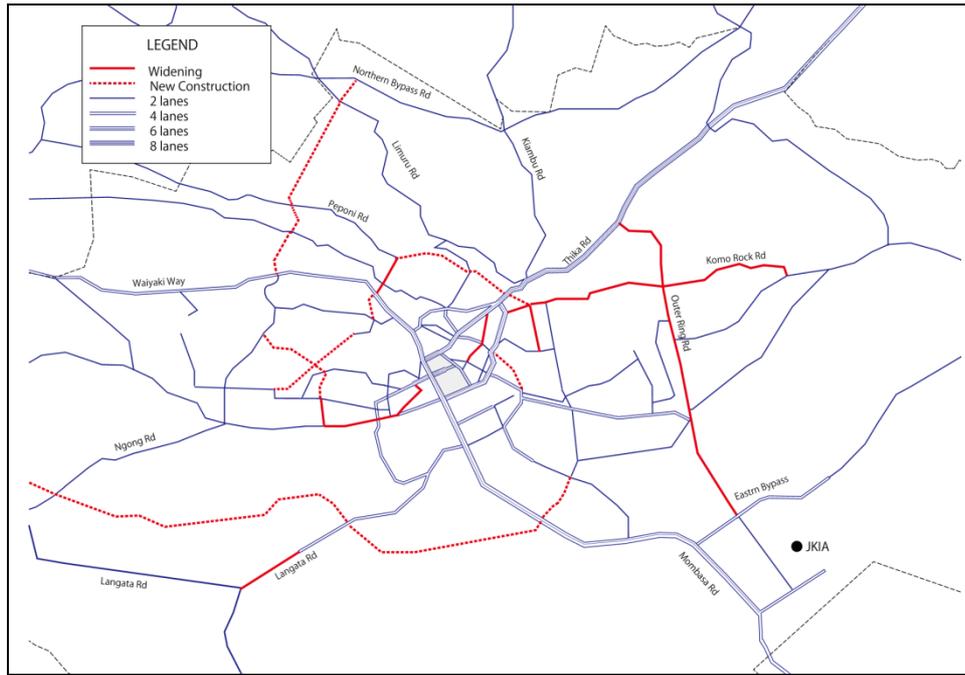
i) Road Network

The road network in the short term is basically composed of the present network and ongoing projects. Name and length of roads to be developed in the short term are shown in Table 7.1.16, and the road network is shown in Figure 7.1.35.

Table 7.1.16 Road Development Length in the Short Term (2018)

Type	Road Name	Section	Inside Nairobi (km)	Outside Nairobi (km)	Total (km)	
New Construction	Southern Bypass Road		20.7	7.8	28.5	
	Western Bypass Link Road	Northern Bypass - Waiyaki Way	6.5		6.5	
	Missing Link	M-3		0.8		0.8
		M-6		2.9		2.9
		M-7		3.0		3.0
		M-10		1.5		1.5
		M-15a		1.8		1.8
		M-15b		1.5		1.5
		M-5		3.2		3.2
		M-16		1.1		1.1
M-15b to M-5		0.8		0.8		
Total		43.8	7.8	51.6		
Widening	Langata Road	KWS Gate - Karen Shopping Centre	2.0		2.0	
	Outer Ring Road	Thika Road – Eastern Bypass	13.0		13.0	
	Ring Road Kilimani	Argwings Kodheck –Ngong Road	1.7		1.7	
	Missing Link	M-16 (Ring Road Parklands)	1.8		1.8	
	Ngong Road	Kenyatta Ave – Adams Arcade	4.5		4.5	
	Juja Road	Ring Road Ngara – Outer Ring Road	5.0		5.0	
	Park Road	Muranga Road – Ngra Road	0.8		0.8	
	Koma Rock Road	Outer Ring Road – Kangundo Road	4.5		4.5	
	Total		33.3	0.0	33.3	

Source: JICA Study Team (JST)



Source: JICA Study Team (JST)

Figure 7.1.35 Road Network in the Short Term (2018)

ii) *Public Transport Network*

Improvement of existing railway to commuter rail and development of BRT system including establishment of operator is thought to take more than five years. Therefore, public transport system in the short term is the same as the existing public transport network.

3) Transport Network in Medium Term (2023)

i) *Road Network*

The road network in the medium term consists of roads of the following four categories:

- a) Ongoing road projects to be completed until 2018;
- b) Roads which assist in the creation of the Railway City;
- c) Roads which form the C/R network system; and
- d) Roads which connect the proposed sub-centres.

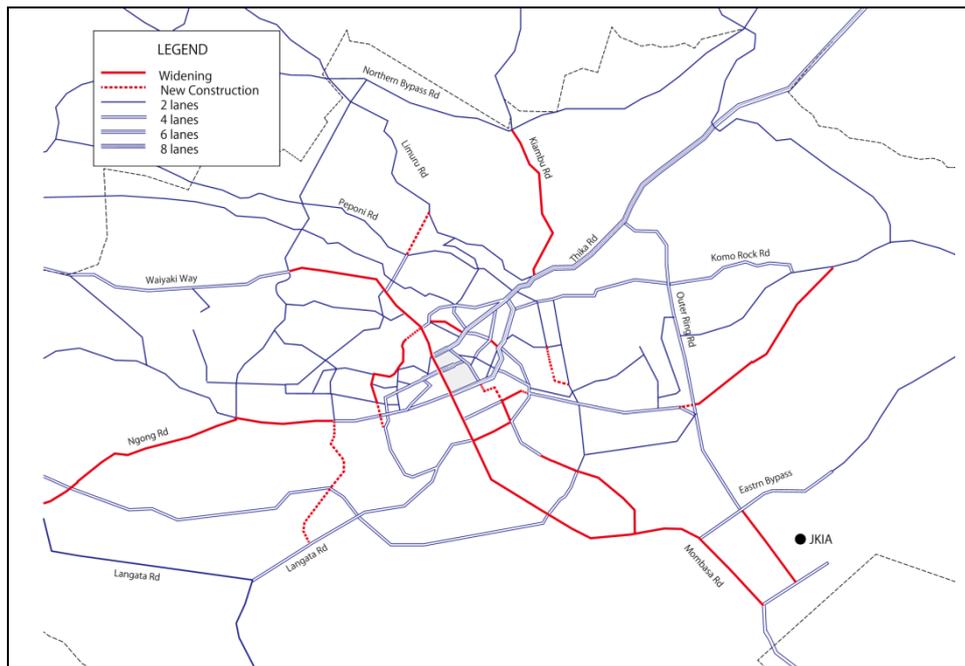
Name and length of roads to be developed in the medium term are shown in Table 7.1.17, and the road network is shown in Figure 7.1.36.

Table 7.1.17 Road Development Length in the Medium Term (2023)

Type	Road Name	Section	Inside Nairobi (km)	Outside Nairobi (km)	Total (km)
New Construction	Missing Link	M-12 (Ngong Road – Langata Road)	4.5		4.5
		M-15c	1.7		1.7
	Circumferential Road	C-2 (Uhuru Highway – State House Road)	2.4		2.4
		C-2 (Arwings Kodek – Magathi Way)	0.7		0.7
	Railway Viaduct	Over NRS	1.9		1.9
		Factory Street	0.3		0.3

Type	Road Name	Section	Inside Nairobi (km)	Outside Nairobi (km)	Total (km)
	Extension of M-5	M-5 – Eastleigh 1st Road	1.5		1.5
	Total		13.0	0.0	13.0
Widening	Mombasa Road	JKIA – James Gichuru Road	7.0		7.0
	Enterprise Road	Factory Street – Lusaka Road	2.5		2.5
		Homa Bay Rd – Mombasa Road	4.3		4.3
	Kiambu Road	Thika Road – Northern Bypass	5.5		5.5
	Ngong Road	Adams Arcade – Dagoretti Corner	2.1		2.1
		Dagoretti Corner – Langata Road	6.7		6.7
	Circumferential Road	C-2 (State House Road – Woodlands Road)	1.7		1.7
	Lusaka Road	Enterprise Road – Uhuru Highway	1.3		1.3
	Factory Street	Enterprise Road – Railway	0.7		0.7
	Kayole Road	Outer Ring Road – Kangundo Road	6.1		6.1
	Airport South Road	Eastern Bypass – Airport Terminal Road	2.7		2.7
	Ngara Road	Museum Hill – Muranga Road	1.1		1.1
		Park Road – Park Road Ngara	0.8		0.8
	Total		42.5	0.0	42.5

Source: JICA Study Team (JST)

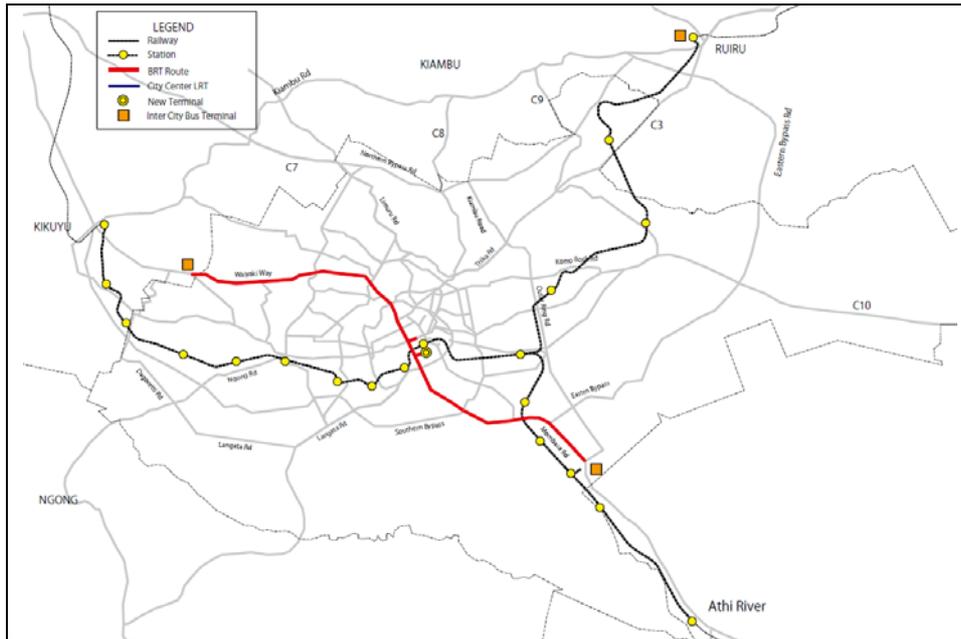


Source: JICA Study Team (JST)

Figure 7.1.36 Road Network in the Medium Term (2023)

ii) *Public Transport Network*

Public transport network in the medium term is composed of commuter rail and BRT pilot route. Location of sub-centres envisaged in the land use plan is connected to stations of commuter rail line. Therefore, in order to induce the creation of sub-centres, development of commuter rail line is prioritised. Because passenger demand is large and road development will progress on Waiyaki Corridor and Mombasa Corridor, these corridors are selected as the pilot corridor for BRT. The selected medium-term public transport network is shown in Figure 7.1.37.



Source: JICA Study Team (JST)

Figure 7.1.37 Public Transport Network in the Medium Term (2023)

4) Transport Network in the Long Term (2030)

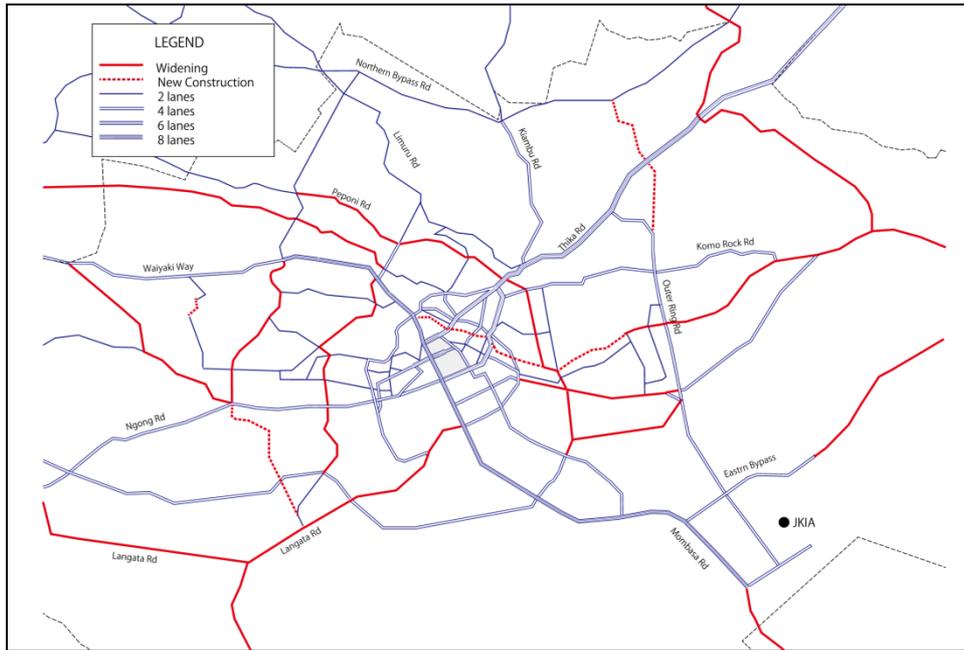
i) Road Network

Road network in the long term is the future road network in 2030. Roads to be developed in the 3rd phase (2024-2030) are shown in Table 7.1.18 and Figure 7.1.38.

Table 7.1.18 Road Development Length in the Long Term

Type	Road Name	Section	Inside Nairobi (km)	Outside Nairobi (km)	Total (km)
New Construction	Outer Ring Extension	Outer Ring Road – Northern Bypass	4.8		4.8
	Western Bypass Link Road	Ngong Road – Missing Link M-12	5.0		5.0
	Dandora Road Extension	Eastleigh 1 st Ave – Outer Ring Road	3.6		3.6
	Riverside Road	M-5 Extension – Waiyaki Way	4.7		4.7
	Total		18.1	0.0	18.1
Widening	Langata Road	Mombasa Road – Magadi Road	8.3		8.3
		Magadi Road – Ngong Road	7.4		7.4
	Magadi Road	Langata Road – Ongata Rongai	13.8	3.6	17.4
	Eastern Bypass	Airport North Road – Thika Road	13.0	9.2	22.2
	Kangundo Road	Outer Ring Road – Eastern Bypass	12.0		12.0
	Mombasa Road	JKIA - Athi River	12.7	10.8	23.5
	Naivasha Road	Dragotti Corner – Waiyaki Way	7.0		7.0
	Jogoo Road	Lusaka Road – Outer Ring Road	5.2		5.2
	Likoni Road	Jogoo Road – Enterprise Road	2.1		2.1
	Lunga Lunga Road	Likoni Road – Outer Ring Road	4.0		4.0
	Peponi Road	Ring Road Parkland - Western Bypass Link Road	4.3		4.3
	Lower Kabete Road	Ring Road Parkland - Gitaru/ndernderu Road	7.8	4.2	12.0
	Kamiti Road	Yhika Road – Northern Bypass	3.1		3.1
	Kasarani Road	Thika Road – Koma Rock Road	8.0		8.0
James Gichuru Road	Waiyaki Way – Ngong Road	5.2		5.2	
Total		105.6	27.8	141.7	

Source: JICA Study Team (JST)

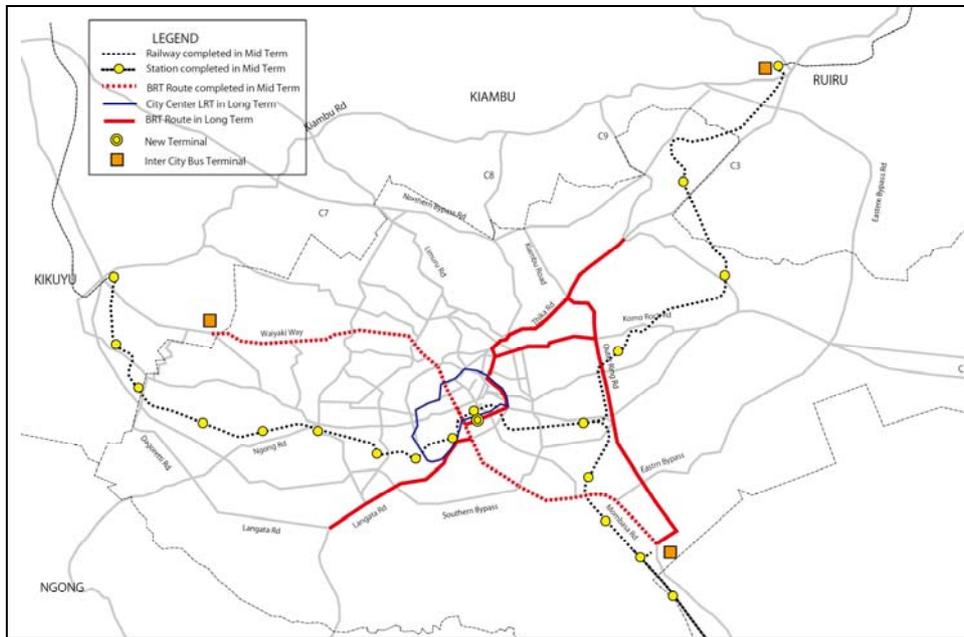


Source: JICA Study Team (JST)

Figure 7.1.38 Road Network in the Long Term (2030)

ii) *Public Transport Network*

Public transport network in the long term is shown in Figure 7.1.39. Development of four BRT corridors and development of LRT Circular Route are the major developments in the 3rd phase.



Source: JICA Study Team (JST)

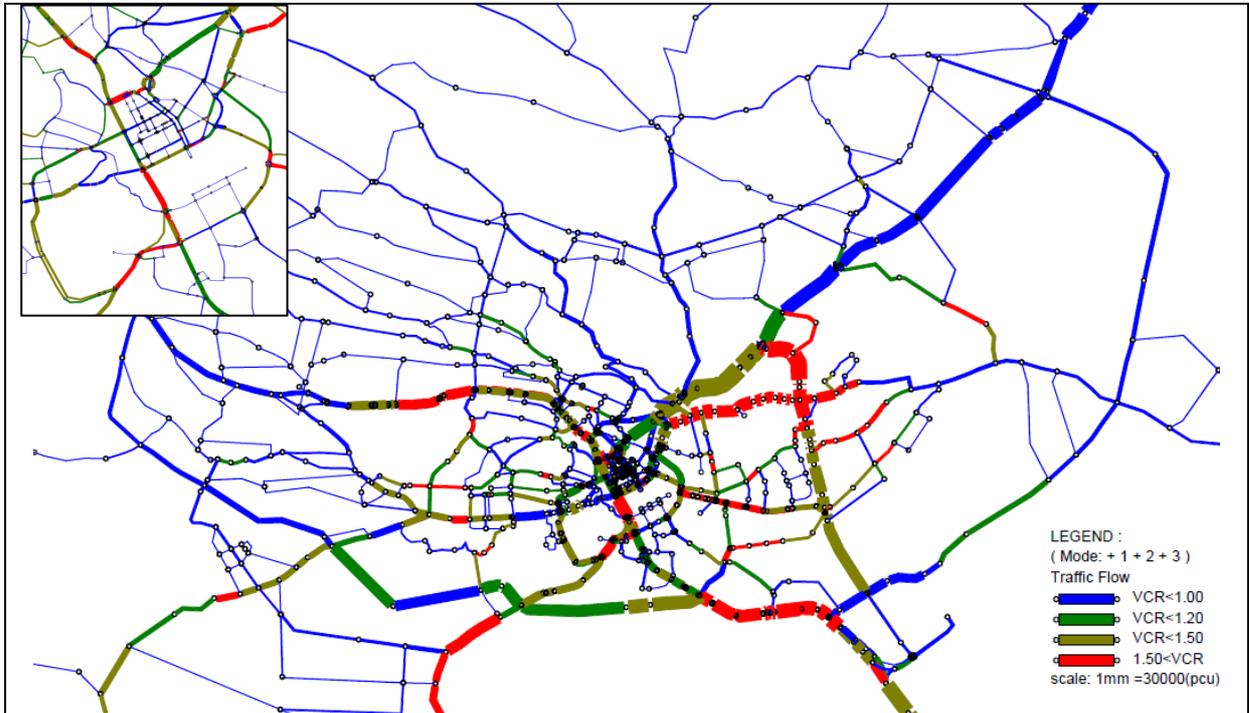
Figure 7.1.39 Public Transport Network in the Long Term (2030)

5) Traffic Demand Forecast in the Short Term, Medium Term and Long Term

Based on the established network staging plan, traffic demand forecast is conducted.

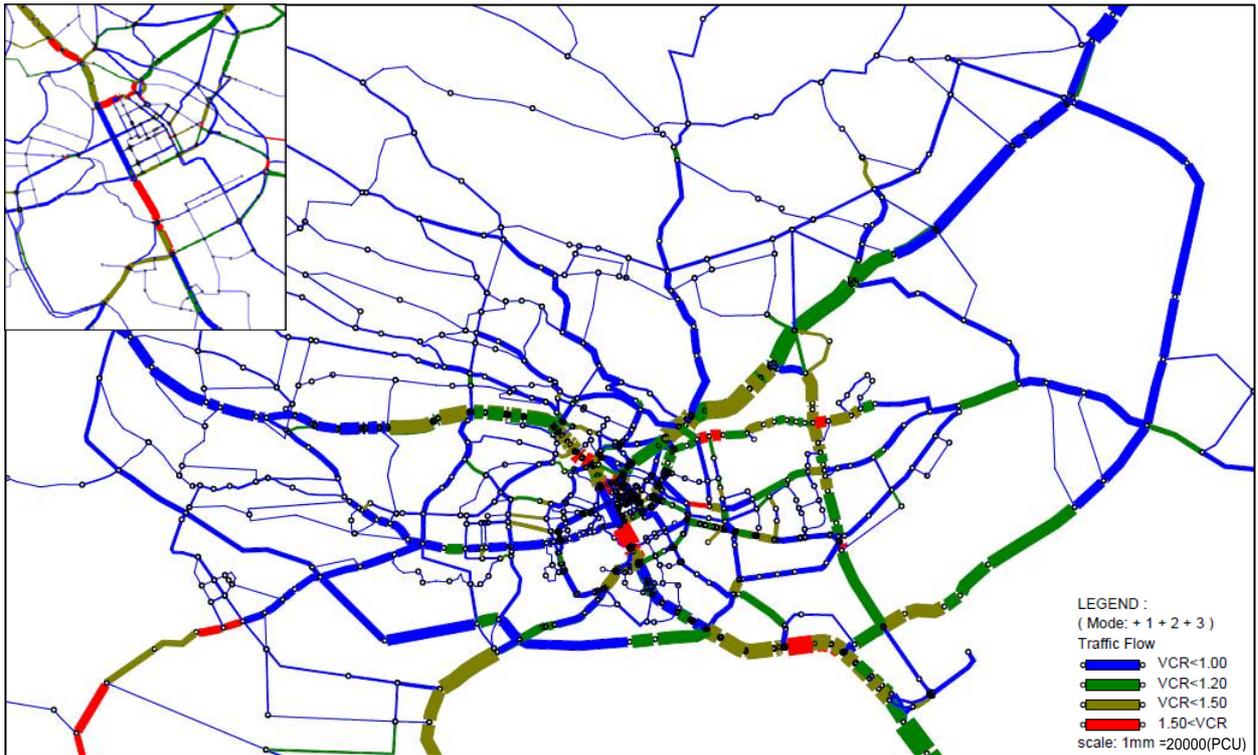
i) Traffic Assignment

Results of vehicle traffic assignment in the short term, medium term, and long term are shown in Figures 7.1.40, 7.1.41, and 7.1.43, respectively. Public transport passenger assignment results in the medium term and long term are shown in Figures 7.1.42 and 7.1.44, respectively.



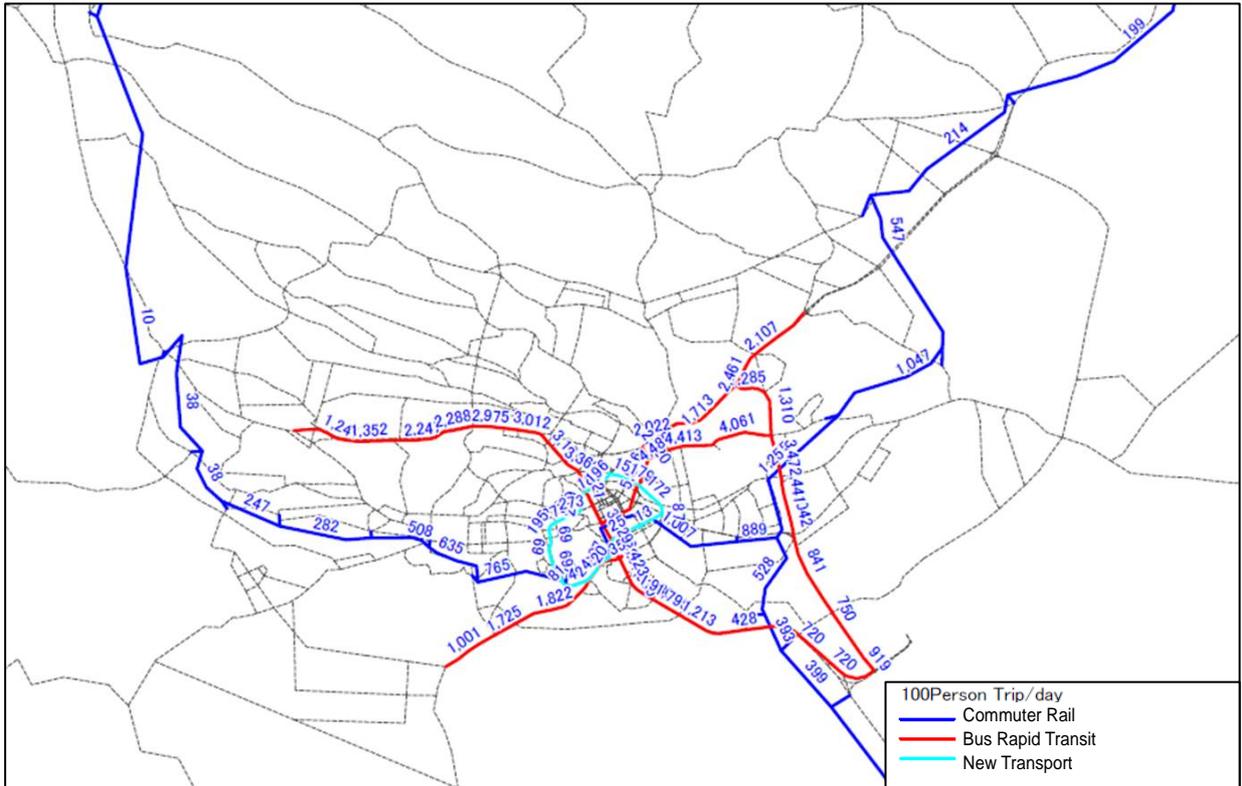
Source: JICA Study Team (JST)

Figure 7.1.40 Vehicle Assignment Result of Short-term Plan in 2018



Source: JICA Study Team (JST)

Figure 7.1.43 Vehicle Assignment Result of Long-term Plan in 2030



Source: JICA Study Team (JST)

Figure 7.1.44 Public Transport (Railway, BRT and LRT) Passenger Assignment Result of Long-term Plan in 2030

ii) Transition of Modal Share

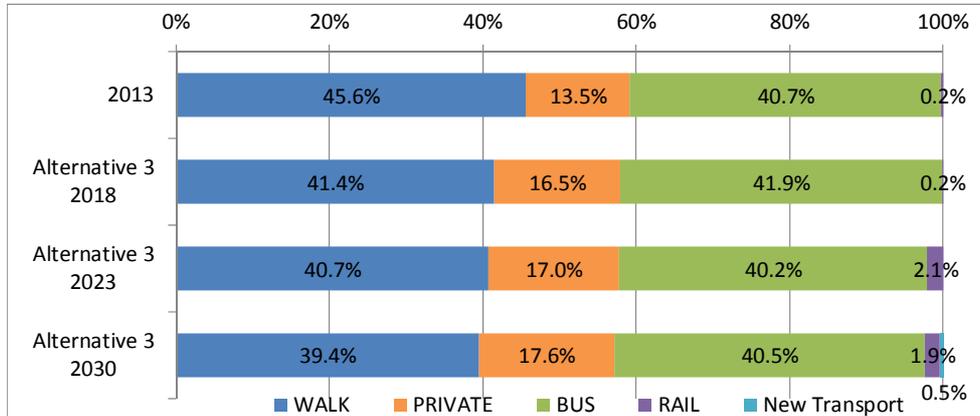
Table 7.1.19 and Figure 7.1.45 show the transition of modal share in the short, medium and long terms. Due to the increase in the number of vehicles, modal share of private mode gradually increases. But by the introduction of new public transport system, total share of bus and railway increases in the medium term and long term.

Table 7.1.19 Number of Trips by Mode in the Short, Medium, and Long Terms

Alternatives and Target Year	Walk	Private	Public	Rail	New Transport	Total
2013	3,090,103	916,624	2,754,489	14,006	--	6,775,222
Alternative 3 2018	3,246,051	1,289,796	3,281,824	14,416	--	7,832,087
Alternative 3 2023	3,606,326	1,506,186	3,564,101	181,736	--	8,858,349
Alternative 3 2030	3,951,711	1,767,773	4,062,046	190,456	45,692	10,017,678

Unit: Trips

Source: JICA Study Team (JST)



Source: JICA Study Team (JST)

Figure 7.1.45 Modal Share in the Short, Medium and Long Terms

iii) Transition of Average Speed and Average VCR

Table 7.1.20 shows the future traffic condition by total vehicle-km, total vehicle-hours, average speed, and average VCR. In the short term, average speed and average VCR worsen because improvement of network cannot catch up with the increasing traffic demand. In the medium term and long term, average speed and average VCR gradually improve compared with the short term condition.

Table 7.1.20 Major Indices by Vehicle Traffic Assignment in Nairobi City

Alternative	Year	Vehicle-km Total PCU-km ('000)	Vehicle-hours Total PCU-Hour	Average Speed (km/h)	Average VCR (Volume Capacity Ratio)
Existing Case	2013	10,960	273,910	40.0	0.69
3 Introduction of Selective MRTS Case	2018	16,210	424,160	38.2	0.92
3 Introduction of Selective MRrTS Case	2023	18,040	444,960	40.6	0.90
3 Introduction of Selective MRTS Case	2030	19,430	432,490	44.9	0.82

Source: JICA Study Team (JST)

iv) *Distribution of VCR*

Table 7.1.21 and Figure 7.1.46 show the road length distribution by VCR value in the short, medium, and long terms in Nairobi City. In the short term, the road length with VCR value of more than 1.0 increases. But in the medium term and long term, condition of congestion will be gradually improved.

Table 7.1.21 Road Length Distributions by VCR in the Short, Medium and Long Terms in Nairobi City

Unit: km

VCR	Existing in 2013	Alternative 3 in 2018	Alternative 3 in 2023	Alternative 3 in 2030
-0.8	510.2	404.6	431.4	469.7
0.8 - 1.0	81.0	122.6	116.9	151.4
1.0 - 1.2	69.5	77.7	95.9	106.7
1.2 - 1.5	62.3	100.9	93.1	77.6
1.5 -	28.1	83.0	64.3	14.4
TOTAL	751.2	788.7	801.7	819.8

Source: JICA Study Team (JST)



Source: JICA Study Team (JST)

Figure 7.1.46 Road Length Distribution by VCR in the Short, Medium, and Long Terms Nairobi City

(8) **Conclusion and Recommendation**

1) **Conclusion**

General

- (i) In the short term and medium term, traffic condition will worsen because improvement of transport network cannot catch up with the increasing traffic demand. In this regard, various measures should be implemented to avoid heavy traffic jam. Proposed measures are described in the recommendation.
- (ii) Under the condition that the proposed plan is implemented, transport condition will be improved in the target year of 2030. But road development alone cannot improve the traffic condition. The strengthening of public transport network is essential to improve the future transport condition.

Road Network

- (i) Road development/improvement shall be implemented based on the consistent programme. In this regard, implementation schedule by NUTRANS was not followed. In this study, the JICA Study Team presented the implementation schedule for the efficient and effective solution of the traffic issues and it is the most essential output of the study. Therefore, establishment of consensus amongst the stakeholders is expected in the next stage.

Public Transport Network

- (i) Public transport plan in this study is a recommendation based on the traffic survey results and their analysis. From now on, many studies and discussions will be conducted for the development of public transport. The JICA Study Team hopes that the recommendation will contribute to clarify the necessity and the effect of development of public transport.
- (ii) At present, for the introduction of the new public transport, relevant organisations are conducting studies individually but consistent policy for the development is not established, such as priority mode, priority corridor, physical standard for each mode, and financial method to attract investment. Comprehensive study for introduction of new public transport is required.
- (iii) In order to materialise the MRTS plan, not only the physical infrastructure but also institutional framework, especially establishment of operator, is the most crucial challenge requested to the relevant authorities.
- (iv) Obtaining general consensus for the improvement of transport network, especially introduction of BRT, amongst the passengers and operators of bus/*matatu* is highly requested.

2) Recommendation

Road Development

- (i) Currently, through traffic of heavy vehicles are passing through international highways, and obstructing traffic inside the city. After the completion of the Southern Bypass, heavy vehicles should be restricted in entering into the area surrounded by Eastern Bypass, Northern Bypass, and Southern Bypass.
- (ii) Land use policy emphasises the development of the central business district. Road development which will improve the accessibility in the central business district is required to be enhanced. Likewise, creation of circumferential/radial (C/R) road network system which enables diversion of traffic unnecessary to pass through CBD should be promoted.

Public Transport Development

- (i) Since the beneficiaries and the most affected participants of the public transport projects are the citizens of Nairobi City, deeper involvement of Nairobi City County (NCC) in the projects is essential. Moreover, NCC established the land use plan which should harmonise with the transport system. Therefore, NCC should be the prime member of transport development project team and the opinions from NCC should be reflected in the project.
- (ii) In order to demonstrate the effectiveness of the introduction of new system for public transport and to obtain the consensus amongst the citizens, pilot experiment is an effective way which was introduced to many countries. For the introduction of BRT

system, pilot experiment shall be implemented for a certain period, and effects will be evaluated after the implementation.

Short-term Measures

Result of traffic demand forecast shows that the traffic congestion will worsen in the short term and medium term. To cope with the issue, various measures should be undertaken.

i) System Signal Control

the Integrated Urban Surveillance System (IUSS) is now introduced to the CBD area. But because traffic congestion occurs in wider area, especially along the radial trunk road in the city, system signal control in the whole city area is expected.

ii) Introduction of Bus-exclusive Lane

Even before introduction of BRT, bus-exclusive lane is effective to enhance the use of public transport.

iii) Staggered Working Hours

During morning peak, more than 20% of private car arrival is from 7:00 to 8:00. But before and after the peak hour, traffic volume decreases to only 5%. The transport facilities can be used more efficiently in case of staggered working hours.

iv) Streamline the Freight Carrier

In the information age, volume of commodity has become smaller but frequency has become high. Introduction of cooperating distribution system is highly required to decrease the number of vehicle trips in the business area.

v) Development of Freight Terminal

Together with the policy to exclude heavy trucks within the city area, development of freight terminal outside urban area is required. Basic function of freight terminal is to consolidate freight at a port or a rail yard before onward shipment. Terminals may also be points of interchange involving the same mode of transport. In this regard, the Nairobi Freight Terminal will have two functions. One is modal exchange from freight train for the transport by trucks. The other is exchange of freight within trucks, from heavy trucks to light trucks for delivery in the urban area.

vi) Relocation of Bus Terminals

Along with the land use plan for development of sub-centres in the outskirts area, disposition of bus terminals is expected. These terminals will function as the transfer terminal from *matatu* to large bus.

7.1.7 Ideas for Additional Priority Project for Urban Transport

Considering the objective of the study, urban transport projects which promote the realisation of the land use plan are prioritised. Based on the future land use plan and future traffic demand, the following projects are recommended as the priority project for urban transport:

(1) Flyover in CBD for Railway City

1) Objective and Necessity of the Project

This project aims at the development of Railway City by harmonious planning of land use and urban transport.

- (i) To encourage development potential in the southern part of the Nairobi Station by improvement of accessibility to the area; consequently remove the functions unnecessary in the CBD; and promote the creation of the Railway City.
- (ii) To alleviate traffic congestion in the northern part of the station by means of relocation of the bus and *matatu* terminals to the new terminal in the Railway City.
- (iii) To guide traffic flow from the southern part of Nairobi City promptly and decongest the traffic in the peripheral area.

2) Relevant Organisation

KURA, NCC Engineering Department

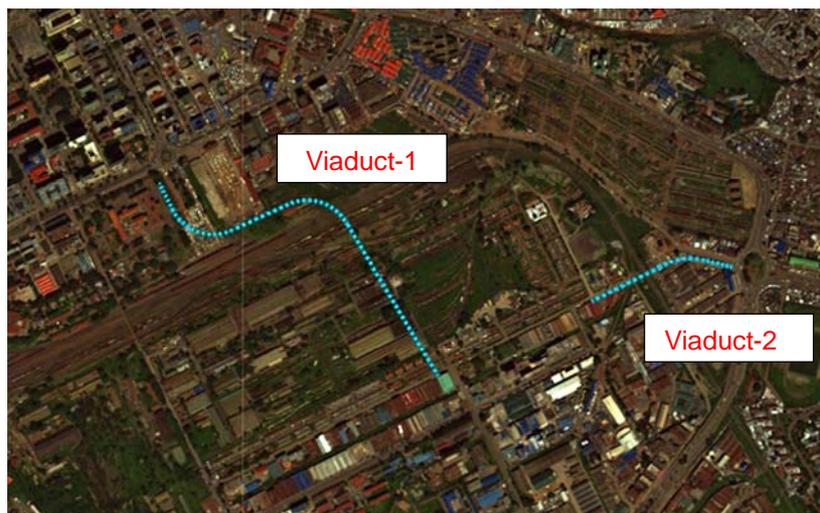
3) Summary of the Project

i) *Viaduct-1 (Length: 1,000 m, 4-lane, Project cost: US\$30-40 million)*

The viaduct connects Moi Avenue, which is the trunk road of CBD, and Enterprise Road, which is the trunk road of the southern area of the station. Moreover, the viaduct together with the widening of Enterprise Road to four lanes will disperse the traffic on Mombasa Road.

ii) *Viaduct-2 (Length: 400 m, 2-lanes, Project cost: US\$10 million)*

The viaduct guides bus and *matatu* traffic to the new terminal in the Railway City, removes the traffic on Landhies Road and thus alleviates the congestion around the terminus in the northern part of the station.



Source: JICA Study Team (JST)

Figure 7.1.47 Routes of Viaduct-1 and Viaduct-2

(2) Widening of Enterprise Road

1) Objective and Necessity of the Project

This project aims to promote the development of Railway City by improvement of accessibility.

- (i) To encourage the development potential of Railway City by improvement of accessibility from southern area.
- (ii) To disperse the traffic demand on Mombasa Road and Uhuru Highway especially during the construction stage of the northern corridor.

2) Relevant Organisation

KURA, NCC Engineering Department

3) Project Summary

- (i) Widening of existing 2-lanes section to 4-lanes (Length: 4.3 km, Project cost: US\$15 million): Existing 4-lane section of Enterprise Road is from Lusaka Road to Homa Bay Road. As a result of the project, the section from Homa Bay Road to Mombasa Road will be widened to a 4-lane road.
- (ii) Improvement of NMT along existing 4-lane section: After the development of Railway City, the number of pedestrians in Railway City will increase significantly. Therefore, comfortable facilities for NMT should be developed to make the Railway City more attractive.



Source: JICA Study Team (JST)

Figure 7.1.48 Route of Widening of Enterprise Road

(3) Construction of Northern Part of Circumferential Road C-2

1) Objective and Necessity of the Project

Road network system in Nairobi City at present is composed of radial roads. Development of western ring roads partially contributed to form the C/R road network system. If the circumferential road C-2 is developed, the network system in CBD will change fundamentally.

Additionally, the circumferential road C-2 will encircle the CBD area, and will ease the traffic movement around the CBD.

2) Relevant Organisation

KURA, NCC Engineering Department

3) Summary of the Project

Development of Circumferential Road C-2

Beginning Point: Thika Road/Uhuru Highway Intersection

Ending Point: Crossing with Mbagathi Way

Distance: (Widening) 2.2 km

(New construction) 1.5 km

Number of Lanes: 4 lanes



Source: JICA Study Team (JST)

Figure 7.1.49 Supposed Route of Northern Part of Circumferential Road C-2

(4) Creation of ITS City

1) Objective and Necessity of the Project

- (i) Traffic demand in Nairobi City is increasing in the entire area, and congestion of road is also spreading in the whole area. Through traffic in CBD is deteriorating the traffic congestion in CBD area. By introduction of ITS technology to Nairobi City area, traffic flow will be improved and traffic concentration to CBD will be rectified.
- (ii) In the current circumstances, ITS is introduced individually such as installation of CCTV. Comprehensive policy for development of ITS in Nairobi City does not exist. Hence, the project aims at the establishment of a comprehensive plan for the development of ITS in Nairobi City including the installation and management of ITS facilities.

2) Relevant Organisation

NCC Engineering Department, Police

3) Summary of the Project

- i) *Establishment of ITS Master Plan, Dispatch of Expert*
- ii) *Expected Component Technology*

Traffic Control and Surveillance System (TCSS) Centre, Traffic Signal Optimisation System, Illegal Parking Control System, Traffic Accident Detection System, Bus Location System, Public Transport Transfer Information System, Flooding Detector System, Parking Guidance System, Variable Message Sign (VMS) Information System, and Transport Database (road and facility, statistics for traffic accident, etc.).

iii) *Other Supplemental Function*

Traffic Demand Management (TDM), Traffic Safety

- iv) *The ITS project in CBD will play a role as a showcase of this project.*

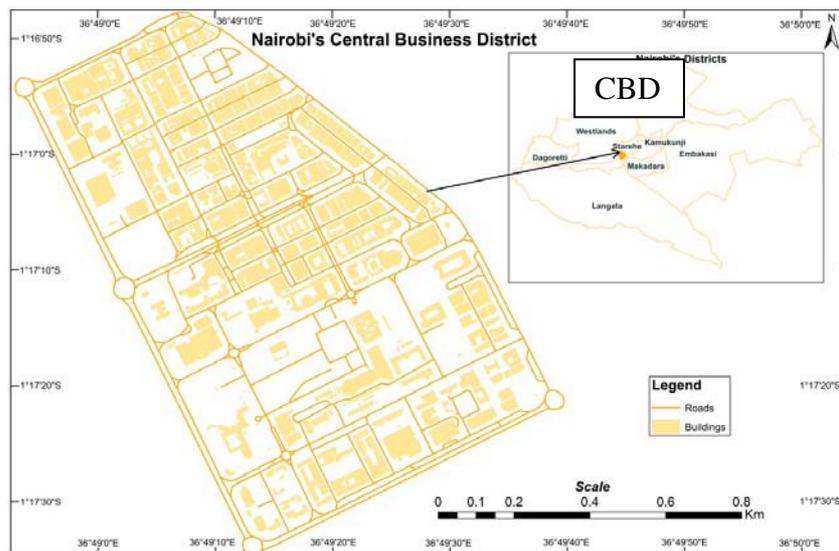


Figure 7.1.50 Project Area for Creation of ITS City

7.2 Railway

7.2.1 Demand and Gap Analysis

There is no doubt that the potential demands for the commuter train operation in Nairobi City and surrounding areas are always higher than actual capacities. Due to the insufficient locomotives and wagons, RVR is operating only one or two commuter trains on each line in the morning. Due to the poor condition of railway track, trains are running at a very low speed and the quality of service is not good enough so that a number of commuters are using bus transportation rather than the railway. Unless substantial improvement is made on the railway system, the present situation would not change much.



Source: Nairaland Forum
(<http://www.nairaland.com/51356/nairobi-photos-kenya-beautiful-east/103>)

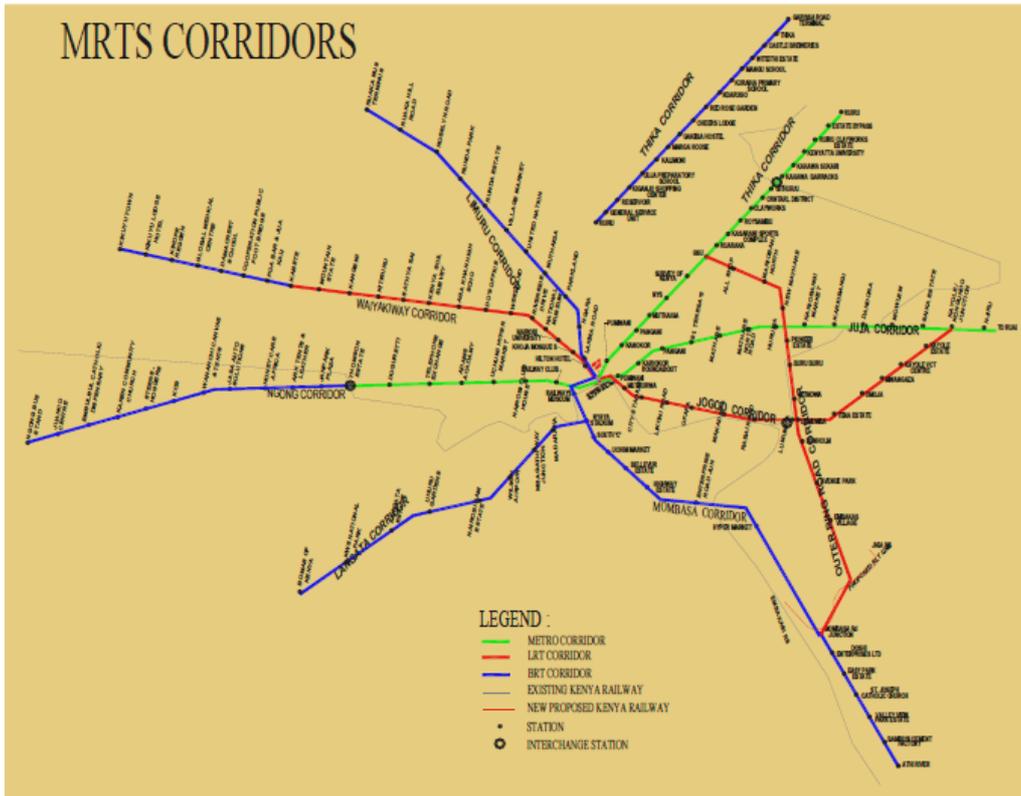
Figure 7.2.1 Commuter Train Operation by RVR

7.2.2 Development Policy

There seems to be insufficient coordination between the Ministry of Transportation and Kenya Railways Corporation (KRC) on the planning of urban transportation by rail. MRT/LRT lines planned in MRTS (2011) were not considered in the new line construction plan recently prepared by KRC. In order to avoid overlapping of projects, close coordination and communication shall be kept amongst those authorities concerned.

Since railway projects have time and cost consuming natures, projects shall be classified into short-, medium-, and long-term plans.

The projects utilising the existing railway facilities and equipment, such as introduction of DMU on the existing lines, can be categorised under short-term projects. Those new line constructions, such as MRT/LRT construction, shall be categorised as medium- or long-term projects.



Source: MRTS Report

Figure 7.2.2 Planned MRTS Corridors

7.2.3 Priority Projects

Considering current transportation demands, development policy and site conditions, higher priority to the following projects shall be given:

(1) Introduction of DMU for the Existing KRC Lines

As described in Section 7.2.1, the existing commuter train operation by RVR using diesel locomotives and wagons is insufficient in the aspects of capacity, speed, and riding comfort. Because of the high demands and low capacity, trains are always fully loaded and passengers are forced to tolerate the uncomfortable condition.

In order to ease such situation, introduction of DMU is suggested. It was calculated by a preliminary analysis that three train sets (consisting of six cars each) can carry 7,000 to 10,000 passengers within two hours in the morning between Ruiru-Nairobi, Kikuyu-Nairobi, and the Athi River-Nairobi, respectively.

Introduction of DMU does not mean procurement of DMU only, but also provision of the maintenance facilities and equipment, spare parts, and staff training.

(2) Track Rehabilitation of Existing KRC Lines

Rehabilitation of the existing track is another way to increase the transportation capacity of a railway. If the schedule speed (average speed including stopping time at stations) can be doubled, transportation capacity of the train will be doubled. Due to the existing poor condition of track, the schedule speed at this moment is less than 20 km/h. If the rail is welded and placed on properly shaped ballast, the schedule speed can be doubled easily. This track rehabilitation project shall include staff training and provision of track maintenance equipment, if required.

(3) Introduction of Signaling System for DMrU Operation

When introduction of DMU and track rehabilitation are planned, introduction of a modern signaling system shall also be planned in order to keep the safety of train operation. At this moment, there is no signal system existing on the KRC Lines. Train operation is controlled by telephone communication between stations and using a paper sheet instead of tablet for the confirmation of track occupancy. Radio communication system can be adopted for communication between stations and between station and train driver. GPS can be utilised for positioning of trains.

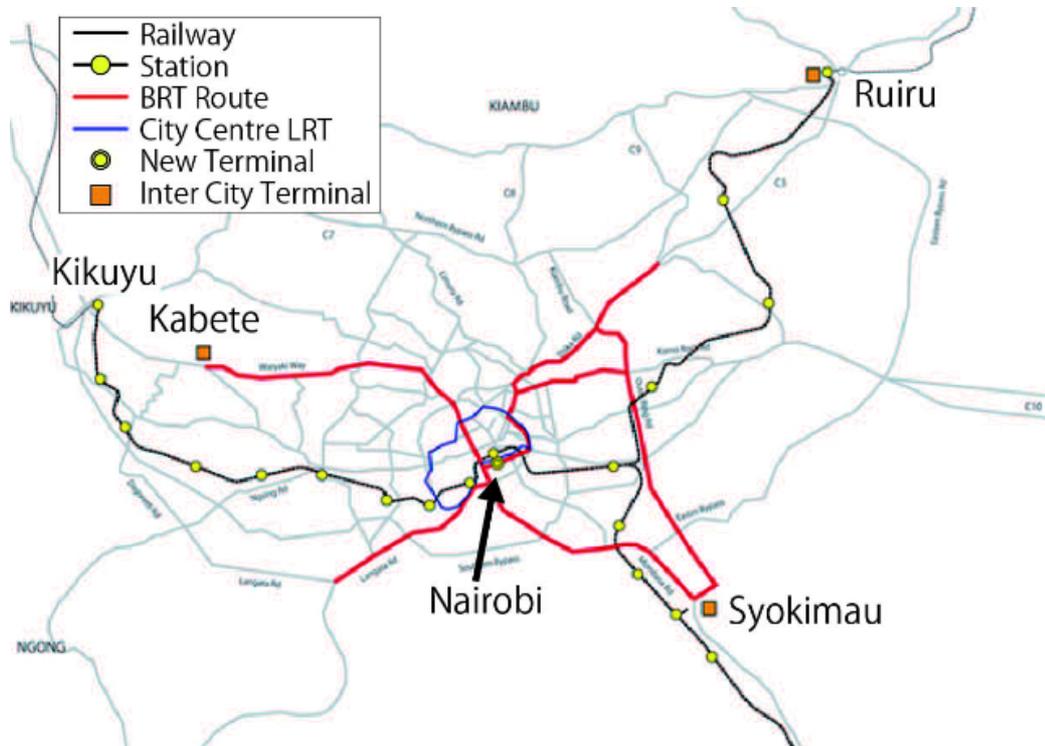
(4) Feasibility Study for the East-West Corridor MRT Line

The MRTS report has been prepared in June 2011. Three MRT lines and three LRT lines along the existing major roads are planned in the report, and the first priority was given to a MRT line along Thika Road.

Table 7.2.1 Existing Condition of Planned MRT/LRT Routes

Priority in NMRTS	Route	Construction	Existing Condition of the Route
1	Thika Road	2013–2016	Expressway is completed. KRC line is available.
2	Juja Road	2015–2018	Road widening is required at east side of the route.
3	Jogoo Road	2017–2020	Road widening is required at east side of the route.
4	Ngong Road	2019–2022	90% of the route is ready for construction.
5	Waiyaki Way	2021–2024	80% of the route is ready for construction.
5	Outer Ring Road	2021–2024	Road widening is required at whole route.

Source: JICA Study Team (JST)



Source: JICA Study Team (JST)

Figure 7.2.3 Existing KRL Lines and Planned MRT/LRT Lines

According to the results of the site visits, it was found that the 6-lane expressway between Nairobi and Ruiru and the 4-lane expressway between Ruiru and Thika were completed. In addition, KRC is planning to improve the commuter train operation up to Thika. Therefore, the first priority of MRT construction between Nairobi and Ruiru can be reduced.

There seems to be right of way problems at the second priority MRT route (Juja Road) and the third priority LRT route (Jogoo Road).

The site is ready for construction at the fourth priority MRT route (Ngong Road) and the fifth priority LRT route (Waiyaki Way).

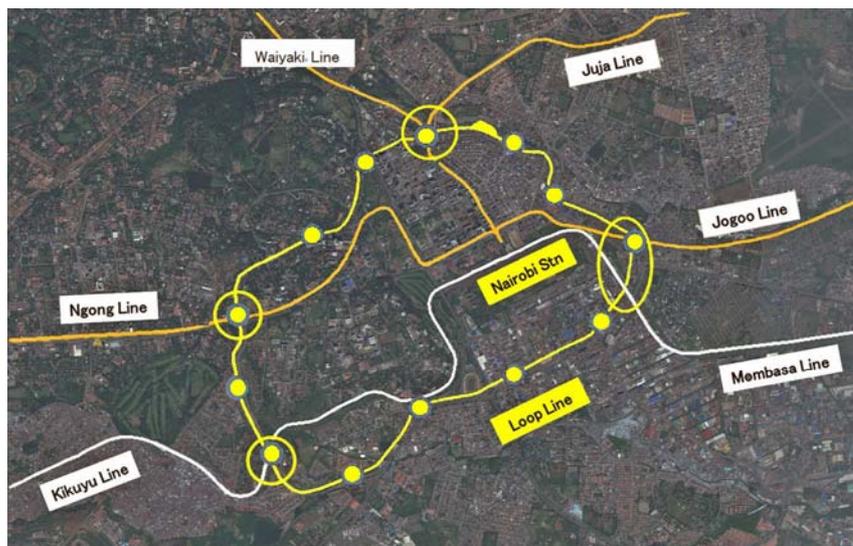
The whole section of LRT route (Outer Ring Road) requires road widening. It will take time for it to be ready for construction.

Considering demand forecast and site condition, the first priority MRT/LRT route shall be selected for a feasibility study for construction purpose.

(5) Feasibility Study for the Ring Line

All the urban railway lines radiating from Nairobi station proposed in NMRTS study. It may cause severe traffic congestion at CBD area. In order to avoid the concentration at CBD near Nairobi station, provision of a Loop Line can be considered. AGT or Monorail system will be suitable for the Loop Line circulating sub-centers which may be formed at the interchange stations.

The blue line shown on the following map is an example of the Loop Line.



Source: JICA Study team

Figure 7.2.4 Loop Line circulating CBD and Sub-centres

At the same time of the feasibility study for the first MRT Line, this Loop Line shall also be studied.



Bovins Otieno, Martin Luther Primary School (Rank 1 of Class 6)

CHAPTER8 URBAN INFRASTRUCTURE DEVELOPMENT STRATEGY

8.1 Water Supply

8.1.1 Demand and Gap Analysis

(1) Water Demand Projection

1) Population

The projected population in this study has adopted the water demand projection. The projected population is presented in Table 8.1.1.

Table 8.1.1 Population Projection of Nairobi City

City	2009	2013	2018	2023	2030
Nairobi City	3,138,372	3,601,351	4,174,952	4,677,677	5,212,500

Source: JICA Study Team (JST) and Census 2009 data

2) Unit demand

i) Residential, institutional, and commercial demand

The residential demand was based on the figures stipulated in the Guidelines for Water Allocation issued by the Water Resources Management Authority (WRMA) 2009 (hereafter referred to as the WRMA guidelines).

The allowance of water loss stipulated in the WRMA guidelines was deducted from the residential unit demand. Enough information on water loss of water treatment plants, raw water pipelines, treated water pipelines, pump stations, and distribution network for Nairobi City is not available. The rate of unaccounted for water (UfW) in 2008 reported in Impact No. 3 (Water Services Regulatory Board (WSRB), 2010) is twice the allowable rate, although UfW includes the amount caused by the maloperation of water tariff. Thus, water loss in the projection does not simply utilise the allowable rate. It will be discussed in the latter sections.

The minimum requirement of unit demand at 25 litres/capita/day mentioned in the draft of Water Act 2012 was adopted as an adjustment to the figure. The basis of the residential water demand from the WRMA guidelines is presented in Table 8.1.2.

Table 8.1.2 Basis of the Residential Water Demand from the WRMA Guidelines

Category of Area	For High-class Housing (litres/capita/day)		For Medium-class Housing (litres/capita/day)		For Low-class Housing (litres/capita/day)	
	Including 20% of Water Loss ^{*1)}	Without Water Loss	Including 20% of Water Loss	Without Water Loss	Including 20% of Water Loss	Without Water Loss
With Individual Connection	250	200	150	120	75	60
Without Individual Connection	-	-	-	-	30	30

Note *1): Allowance for water loss stipulated in the guidelines is 20%.

Source: JICA Study Team (JST) and the Guidelines for Water Allocation (WRMA 2009)

As there is not enough information for demand projection on the population of the high-, medium- and low-class housing, the population ratio of the income level proposed in the Feasibility Study and Master Plan for Developing New Water Sources for Nairobi City and Satellite Towns (FSMPNWS) was utilised for the projection.

In the study, the high-, medium-, and low-income groups are regarded as the high-, medium- and low-class housing, respectively.

Categorising the low-class housing with/without individual connection was based on the coverage ratio of water supply by the Nairobi City Water and Sewerage Company Limited (NCWSC). The ratio of the high-, medium-, and low-class housing is presented in Table 8.1.3 and the calculated residential demand based on the ratio is presented in Table 8.1.4.

Table 8.1.3 Ratio of the High-, Medium-, and Low-Class Housing

Class		2009	2013	2018	2023	2030
High-class Housing		6 %	6 %	6 %	6 %	6 %
Medium-class Housing		50 %	50 %	50 %	50 %	50 %
Low-class Housing	With Individual Connection	9 %	12 %	16 %	18 %	22 %
	Without Individual Connection	35 %	32 %	28 %	26 %	22 %

Source: JICA Study Team (JST) and FSMPNWS

Table 8.1.4 Ratio of the High-, Medium-, and Low-class Housing

Class	Unit Demand	2009		2013		2018		2023		2030		
		Ratio	Demand									
High-class Housing		200	6	12	6	12	6	12	6	12	6	12
Medium-class Housing		120	50	60	50	60	50	60	50	60	50	60
Low-class Housing	With Individual Connection	60	9	5	12	7	16	10	18	11	22	13
	Without Individual Connection	30	35	11	32	10	28	8	26	8	22	7
Total (litres/capita/day)			88		89		90		91		92	

Source: JICA Study Team (JST) and FSMPNWS

Institutional and commercial demand was assumed at 10% and 15% of the residential demand by the study team, respectively. The assumption was adopted from the projection to cover the lack of raw data in line with international practice.

From the conditions showed in this section, the residential unit demands were set without water loss as presented in Table 8.1.5.

Table 8.1.5 Residential Unit Demand without Water Loss

Year	2009	2013	2018	2023	2030
Residential Unit Demand (litres/capita/day)	88	89	90	91	92
Institutional Unit Demand (litres/capita/day) (10% of Residential Demand)	9	9	9	9	9
Commercial Unit Demand (litres/capita/day) (15% of Residential Demand)	13	13	14	14	14
Total (litres/capita/day)	110	111	113	114	115

Source: JICA Study Team (JST)

ii) *Industrial Demand*

In the projection of industrial demand, the rate of residential demand for the current demand and growth of gross domestic product (GDP) in Nairobi City for future demand were adopted, considering the following situations:

Industrial demand depends on the type and size of the firm's activity. The data such as number of workers, type of products, process taken by the factory, and water demand of the existing industries for each type of industry are necessary to evaluate and analyse industrial demand. On that note, there is not enough data available for evaluation.

An approach was taken from the Aftercare Study 1998 on the National Water Master Plan in 1992 to set the ratio of residential demand for Nairobi City at 25%. In this study, the approach is adopted to consider the current industrial demand.

From the above conditions, the industrial demand is presented in Table 8.1.6.

Table 8.1.6 Industrial Demand

Year	2009	2013	2018	2023	2030
Industrial Demand (litres/capita/day)	22	22	23	23	23

Source: JICA Study Team (JST)

3) *Water loss*

According to the WRMA guidelines, water loss is defined as the total leakage and wastage with an allowance of 20%. The targeted non-revenue water (NRW) was declared in the Water Service Strategic Plan 2009 prepared by the Ministry of Water and Irrigation (MWI) based on Kenya Vision 2030. From the two facts mentioned above, the targeted water loss in 2030 is 20%.

In line with the current water loss, there is not enough information available to evaluate its ratio.

The UfW was 40% in 2008 as reported by Impact No. 3 (WSRB, 2010). Since UfW includes part of the amount of supplied water such as illegal connection and human error in the operation of water tariff, the total amount of UfW is larger than water loss. In the demand projection, the study team, however, considered that the adoption of UfW in the current situation is applicable to evaluate higher risk than the actual.

From the situation described above, the water loss in 2009 is 40% or the same as the UfW reported in 2010 and is linearly reduced to 20% in 2030 in the demand projection.

4) *Summary of water demand*

Based on the conditions mentioned above, the water demand of Nairobi City is presented in Table 8.1.7.

Table 8.1.7 Water Demand of Nairobi City

Class		2009	2013	2018	2023	2030
Population (capita)		3,138,372	3,601,351	4,174,952	4,677,677	5,212,500
Residential, Institutional, and Commercial Demand	Unit Demand (litres/capita/day)	110	111	113	114	115
	Demand (m ³ /day)	345,221	399,750	471,770	533,255	599,437
Industrial Demand	Unit Demand (litres/capita/day)	22	22	23	23	23
	Demand (m ³ /day)	69,044	79,229	96,024	96,024	119,888
NRW	Ratio (%)	39	35	31	26	20
Total		576,000	647,000	744,000	808,000	864,000

Source: JICA Study Team (JST)

(2) Existing Demand Projection and Development Plan

As mentioned in Subsection 4.1.5, FSMPNWS was carried out under the Athi Water Services Board (AWSB) with the assistance of the World Bank (WB) and the French Development Agency (Agence Francaise de Developpement: AFD). The demand projection and development plan recommended in FSMPNWS are presented as follows:

1) Demand Projection

The characteristic conditions of demand projection in FSMPNWS are as follows:

- (i) Demand projection in FSMPNWS utilised the method pursuant to the WRMA guidelines,
- (ii) Projected population is the same as that of this study, and
- (iii) Water loss is set by the study team of FSMPNWS.

The projected water demand in FSMPNWS is presented in Table 8.1.8.

Table 8.1.8 Water Demand of FSMPNWS

Class	2010	2017	2020	2030
Population (capita)	3,250,338	4,004,325	4,403,791	5,693,457
Water Demand (m ³ /day)	378,495	480,068	533,560	746,174
NRW (%)	53	40	37	37
Total (m ³ /day)	579,000	672,000	731,000	1,022,000

Source: FSMPNWS

2) Development Plan of the Water Resources and Water Supply System in FSMPNWS

In order to meet the requirement presented in Table 8.1.8, one plan was recommended by FSMPNWS after reviewing and evaluating several alternative scenarios.

The recommended plan comprises five phases and its components are presented in Table 8.1.9 and the general layout is presented in Figure 8.1.1.

Table 8.1.9 Recommended Water Resources Development Plan of Nairobi City

Phase	Component	Financer	Completion Year	Planned Capacity (m ³ /day)	Status of the Plan as of September 2013
1	Well Field in Kinyu	WB	2014	34,560	Detailed Design
	Well Field in Uriru	WB	2015	30,240	
2	Northern Collector Tunnel Phase I to Thika Dam	WB	2016	120,960	Detailed Design
	Ngorongo WTP	AFD	2016		
3	S. Mathioya Transfer	-	2020	132,192	Master Plan
	Maragua Dam				

*The Project on Integrated Urban Development Master Plan for
the City of Nairobi in the Republic of Kenya*

	Ndunyu Chege WTP				
4	Northern Collector Tunnel Phase II to Tika Dam	-	2026	120,096	Master Plan
5	Ndarugu Dam	-	2029	216,000	Master Plan
	Raw Water PS				
	Ndarugu WTP				
	Treated Water PS				
	Kasarani BPS				
Total				654,000	

Source: FSMPNWS

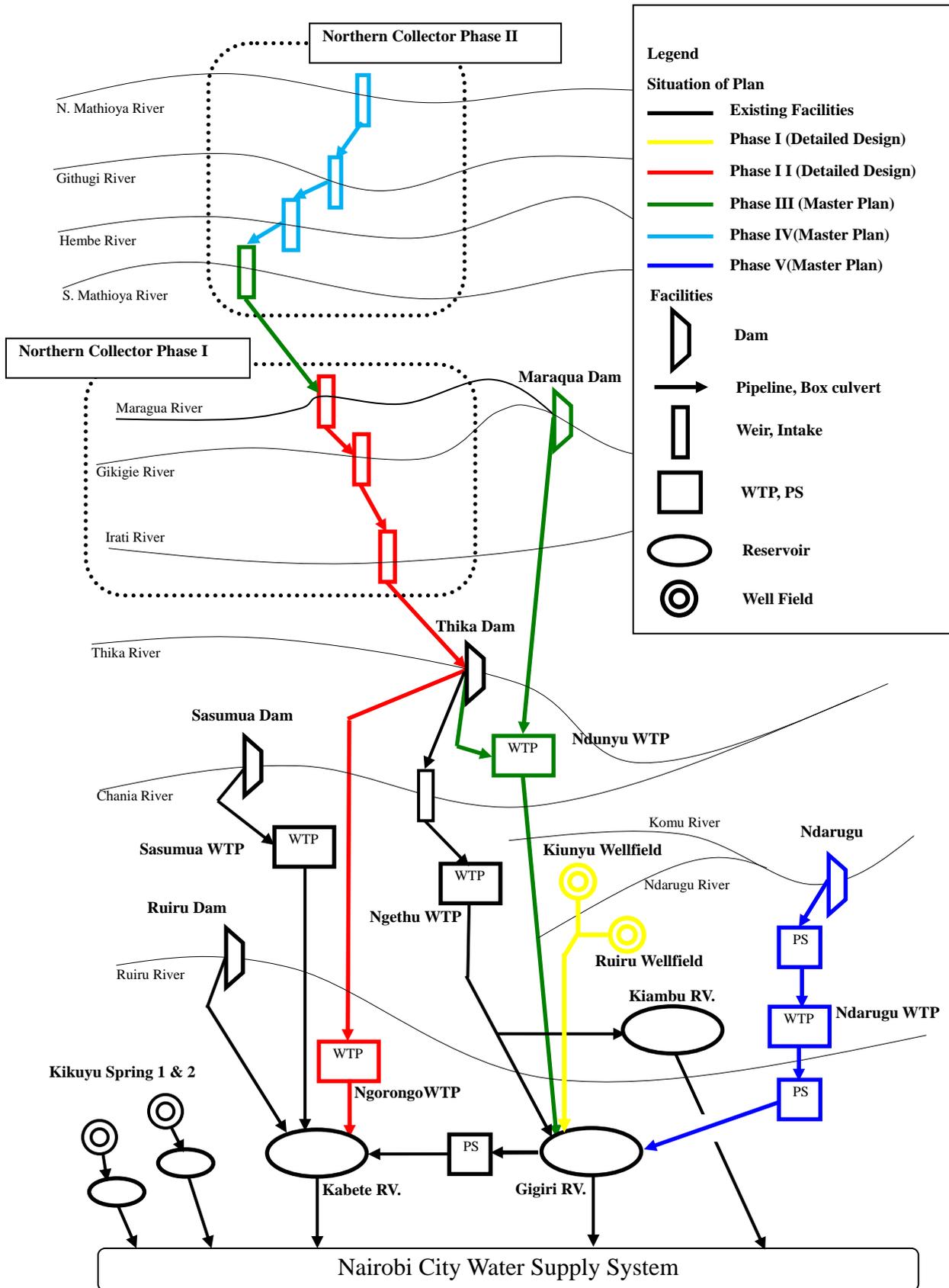


Figure 8.1.1 General Layout of the Existing and Planned Facilities

(3) Gap of Demand Projection between FSMPNWS and this Project and its Analysis

1) Summary of Demand Projection and Water Supply Capacity

The comparison amongst the demand projected in FSMPNWS (hereafter referred to as the demand by WB) and that of the study team (hereafter referred to as the demand by the study team) is presented in this section.

The trend of the demand by WB is in almost gradual increment until 2035 and the capacity of water supply is developed to cover the demand.

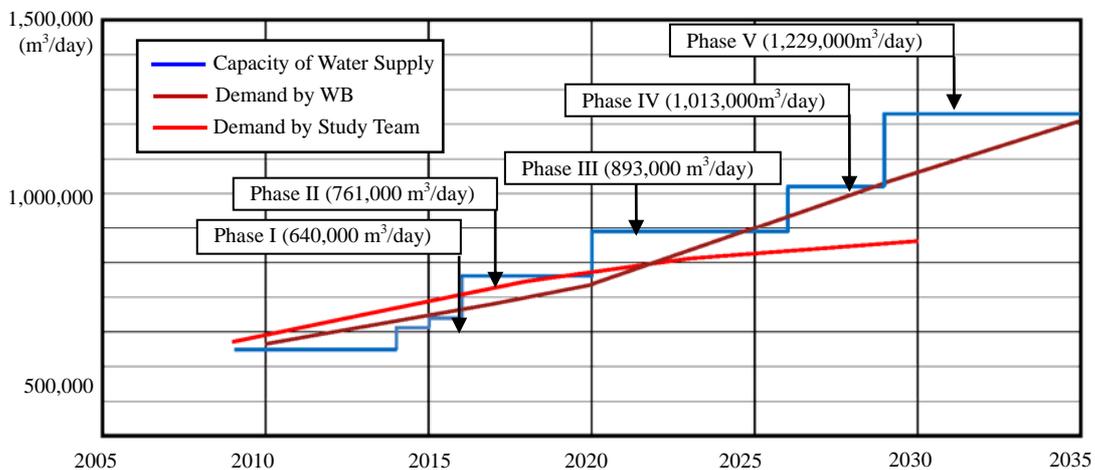
On the other hand, the demand by the study team gradually increases until 2017 and the degree of increment falls down until 2030.

Until 2023, the trends of the two projections will be kept almost on the same line. After 2023, the gap between the projections will occur and expand year by year. The demand by WB is higher with 158,000 m³/day than that of the study team. The summary of demand projections and the capacity of water supply is presented in Table 8.1.10 whereas the comparison between water demands and capacity of water supply is presented in Figure 8.1.2.

Table 8.1.10 Summary of Demand Projections and Capacity of Water Supply

Class		2009	2010	2013	2017	2020	2023	2030
Population (capita)	WB		3,250,338		4,004,325	4,403,791		5,693,457
	ST ¹⁾	3,138,372		3,601,351			4,677,677	5,212,500
Water Demand (m ³ /day)	WB		579,000		672,000	731,000		1,022,000
	ST	576,000		647,000			808,000	864,000
Water loss (%)	WB		53		40	37		37
	ST	39		35			26	20

Source: JICA Study Team (JST) and FSMPNWS



Note: ST (the Study Team)

Source: JICA Study Team

Figure 8.1.2 Comparison between Water Demand and Capacity of Water Supply

2) Gap Analysis

The main reason of the gap between the water demand by WB and that of the study team is the difference on water loss assumptions included in the demands. As presented in Table 8.1.10, the adopted water loss in the demand by WB is much higher than that of the study team. The difference approximately accounts for the gaps.

The water loss adopted in the demand by WB was estimated based on the current situation in Nairobi City as of July 2012. The water loss composed of distribution losses, transmission losses, and treatment losses. In the study, the transmission loss and treatment loss were fixed. The improvement of distribution loss changed from 40% in 2010 to 25% in 2020. The distribution loss is fixed at 25% in the period from 2020 to 2035. The total water loss adopted in FSMPNWS is presented in Table 8.1.10.

According to Impact No. 3 (WSRB, 2010), the UfW in Nairobi City was 40% in 2008. The amount is the same as the distribution loss in 2010 adopted in the demand by WB. The UfW composes physical loss, illegal connection losses, and administrative mistakes in the operation of water tariff. As the amount of illegal connection losses and administrative mistakes is the water supplied to people without collecting fees, it is not included in the water demand. The reason of the adoption is assumed that the lack of data on water loss in the water supply system of Nairobi City and the portion was regarded as the allowance of the projection.

On the other hand, the study team set the transition of water loss as declining from 40% in 2008 to 20% in 2030 as mentioned in Item (1) 3) of Subsection 8.1.1.

From the situation described above, the difference on water loss accounts to the gaps as presented in Table 8.1.10 and Figure 8.1.2.

8.1.2 Development Policy

The master plan of water supply in the area including Nairobi City with the target for completion in 2035 (FSMPNWS) has been prepared by AWSB supported by WB and AFD. The development of water supply is carried out in accordance with the master plan.

As mentioned in Item (2) of Subsection 8.1.1, the development plan of water resources and facilities for intake, raw water transmission, water treatment plant, and treated water transmission has already been established and is expected to be conducted in five phases.

Phase I is the well field development in Kiunyu and Ruiru and Phase II of the northern collector and water supply system including Ngorongo Water Treatment Plant (WTP) have commenced with WB and AFD funds. Although the development includes raw water transmission, water treatment plant, and treated water transmission, the distribution network to cover the expanded capacity of water supply has not been included in the proposed plan under FSMPNWS. Thus, the development plan of the distribution network needs to be studied separately.

Phase III of the S. Mathioya River transfer, Maragua Dam, and Ndunyu Chege WTP is under planning stage. Expanding the capacity through development is necessary to cover water demand after 2020. The water resources and facilities are located outside Nairobi City. Thus, an agreement between counties on the development of the water supply facilities for Nairobi City is indispensable. Phases IV and V of the northern collector's second phase and Ndarugu Dam, Ndarugu WTP, three pump stations, and pipelines are planned on the basis of the demand projection by WB for 2030 and 2035, respectively. Phases IV and V could be postponed after 2035 subject to the improvement of water loss. The projected demand with 20% of the water loss will be below the total capacity of Phases I, II, and III as presented in Figure 8.1.2. Depending on the improvement level of water loss, revision of the master plan of the development needs to be studied.

8.1.3 Priority Project

(1) Background

The comprehensive plan of the distribution network in Nairobi City needs to be considered as a priority project for the following reasons;

According to the information presented by NCWSC participated in by the working group of the water sector, the pipelines and reservoirs of the distribution network need to be rehabilitated due to overage and unsuitable material for potable water as well as construction of buildings for pipeline alignments.

The necessity of expanding the distribution network has become significant year by year in response to the drastic urbanisation of Nairobi City, especially in the area along Thika Road.

The development of the water supply system up to the main reservoirs of Nairobi City has commenced with the support of WB and AFD. To cover the strengthened capacity based on the development, the comprehensive plan of the distribution network is urgently required.

According to the Water Service Strategic Plan 2009 prepared by MWI, the UfW rate should be improved to 20% from the current UfW of 40% in 2008 for efficient water use. As physical water losses of UfW mainly occur in the distribution network, the comprehensive plan of the distribution network is one of efficient activities to improve UfW.

(2) Outline of the Project

In order to establish the policy and direction of the distribution network in Nairobi City, the master plan of the distribution network is meaningful and necessary considering the situation described above.

Since the construction works of pipelines in the distribution network need to be carried out stepwise due to budgetary requirements and the necessity to coordinate with other activities in the city such as transportation, the master plan followed by detailed design of the immediate phase of implementation is indispensable.

In the master plan, technical issues such as arrangement of pipelines and its pressure are mainly discussed. Expected activities to complete the project are presented below.

1) Survey of the Current Situation

To prepare a concrete plan of expansion, rehabilitation, and replacement of the distribution network, concrete technical information is indispensable. For this purpose a detailed site survey to complement the existing information needs to be carried out.

- (i) Location of pipeline, diameter, and material,
- (ii) Water pressure in distribution network,
- (iii) Topographic information including road, administrative, and distribution network boundaries, and
- (iv) Existing facilities and equipment such as reservoirs and pumps.

2) Study of Pipeline Arrangement in the Distribution Network

Some alternatives of the pipeline arrangement are prepared and evaluated on the reduction of NRW and the possibility of its realisation.

The arrangement of pipeline is studied considering the following:

- (i) Clustering of looped pipelines to main distribution pipeline for identification of problems such as physical leakage, illegal connection, and malfunctioning water meter,
- (ii) Arrangement of reservoirs to keep regular release pressure between the main pipeline and pipelines connected to each customer,
- (iii) Utilisation of the existing pipelines, and
- (iv) Stepwise development based on the development of water resources.

3) Preparation of Direction on the Rehabilitation and Replacement of Pipelines

The direction for the evaluation of existing pipelines for its required rehabilitation and replacement needs to be studied and recommended in the master plan.

In the existing distribution network, overaged pipes, harmful materials such as asbestos pipe, and unsuitable location of pipelines installed under buildings are reported through the interview with NCWSC. These problems on the existing pipes are evaluated in order to clarify the direction of improvement.

4) Preliminary cost estimates to complete the development of the distribution network

Based on the above, preliminary cost for the proposed development of the distribution network shall be estimated.

(3) Rainwater Collection Equipment for Buildings

The Urban Development Department of the Nairobi City County (NCC) is interested in introducing the equipment or instrument for the collection of rain water in urban development in order to use the water for non-drinking purposes such as gardening and washing cars.

While the quantification of its effect has not been carried out due to lack of sufficient information such as the number of buildings that have the instrument, its capacity, legal framework for enforcement to equip the instrument in urban development, and responsible organisation, the effects of the instrument have not been reflected in the projection of water demand.

The issue on law enforcement and organisation on NCC's recommendation need to be discussed in the department which is in charge of building development.

In relation to the issue, comprehensive development of recycled water in the sewerage system and rain water in the drainage system as alternative source of water will be discussed in the section on sewerage and drainage in Nairobi City.

(4) Priority Project Operated by AWSB

With regard to water supply for Nairobi City, many projects by AWSB are in progress to meet the demand for water. NCC needs to monitor its progress in order to update the comprehensive information on urban development for its provision to other sectors such as transportation, electricity, and telecommunications.

1) Development of the Spring Fields and the Northern Collector Phase I

In Nairobi City, the lack of water supply has been one of the most serious problems due to the drastic expansion of its population. The capacity of the water supply system is below the demand, which causes the development of private boreholes in Nairobi City.

The development of new water resources and water supply system is one of the main measurements to meet the demand. From the above situation, the project is considered a high priority.

2) Improvement of Operation on Leakage Detection, Repair and Water Tariff

One of the causes of water shortage in Nairobi City is UfW based on physical leakage, illegal connection, and malfunctioning/non-installation of water meter. Reinforcement of skillful organisation in terms of technical and administrative activity is one of the priority projects.

On the above issue, AWSB, in cooperation with NCWSC and financial aid of AFD, set some pilot areas in Nairobi City and has carried out a survey on the condition of pipelines, valves, and water meters as well as the performance on collecting water tariff.

The MWI and Kenya Water Institute supported by JICA have carried out the Technical Cooperation Project for the Project for Management of Non-revenue Water in Kenya. Some pilot areas in the satellite city of Nairobi City were set in the project and transferring of engineering skills on leak detection methods in the distribution network.

8.2 Stormwater Drainage and Sewerage

8.2.1 Demand and Gap Analysis

(1) Stormwater Drainage

1) Management of Rivers

In Nairobi City, stormwater is collected through both natural and man-made drainage systems and drained to the Nairobi River system comprising the Gitathuru, Rui Ruaka, Nairobi, and Ngong rivers and then discharged through the main stream of the Nairobi River.

The development and maintenance of these rivers should be regarded as a primary task for the management of stormwater drainage in Nairobi City. Each of these rivers should be maintained with a hydraulic capacity sufficient for discharging stormwater runoff concentrated from its catchment area. Within the catchment area of the river, the stormwater drainage systems draining the individual subcatchment areas should be designed in conformity with the hydraulic capacity of the river. In the meantime, the riparian reserves need to be delineated and secured to maintain better river environment.

The principal activities for the development and maintenance of these rivers are as follows:

- (i) Longitudinal and cross section survey of the river,
- (ii) Investigation of associated works (e.g., dikes, revetments, drainage outfalls, bridges, culverts, etc.),
- (iii) Evaluation of stormwater runoff from catchment area and hydraulic capacity of the river,
- (iv) Identification of river stretches to be developed and/or maintenance requirements,
- (v) Plan, design, and implementation of river training works,
- (vi) Maintenance of river and associated works, and
- (vii) Monitoring and feedbacks.

Within the catchment area of each river, stormwater drainage systems draining the subcatchment areas should be designed in conformity with the hydraulic capacity of the river.

The regional office of WRMA is responsible for the abovementioned activities, but the status of the activities is not clearly identified as there is no sharing of information or coordination with the City Engineering Department of NCC regarding such activities in Nairobi City.

2) Management of Drains and Sewers

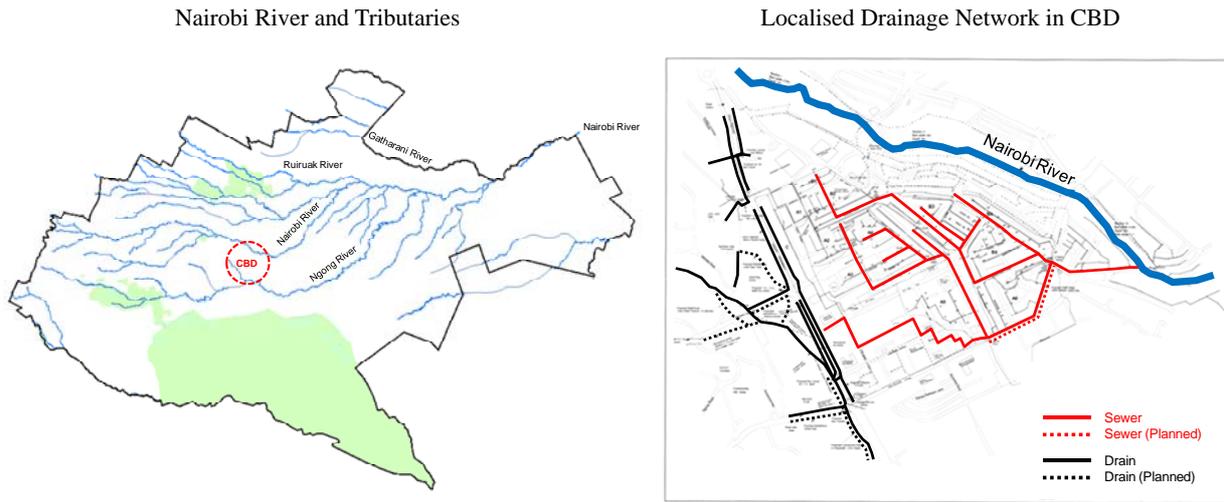
The stormwater drainage system comprises a network of canalised trunk drains, ditches, and storm sewers for draining a subdivided catchment area. The City Engineering Department is responsible for checking the design of the stormwater drainage system and/or elements in the appraisal of construction works. Moreover, it is also responsible for carrying out the maintenance of the stormwater drainage systems constructed by the public sector.

These activities of the City Engineering Department, however, are not functioning satisfactory due to the following situations that are attributable to the essential problems on stormwater drainage in Nairobi City as previously described in Subsection 4.2.5:

- (i) Most of the technical data (master plan, project documents, as-built drawings, etc.) for the existing stormwater drainage systems were lost in a fire which engulfed the city hall in 2004. The loss of technical data makes it hard for the City Engineering Department to carry out proper maintenance of the existing stormwater drainage systems;
- (ii) The appraisal of construction works including stormwater drainage by the City Engineering Department is difficult, as the report on the master plan for stormwater drainage in 1998 was misplaced and often neglected; and
- (iii) The development of stormwater drainage in Nairobi City is envisaged by the government under the ongoing projects; the Kenya Municipal Programme (KMP) and Nairobi Metropolitan Services Improvement Project (NaMSIP) financed by WB. But the involvement of the City Engineering Department in the projects is limited and details of the projects (project descriptions, schedule, current progress, etc.) are not available in their department.

3) Major Issues

At present, the development of stormwater drainage in Nairobi City is likely to focus on the localised drainage network consisting of canalised trunk drains, ditches, and storm sewers in the urban areas individually. Due to the manner of development, in the future, it is anticipated that an integrated stormwater runoff drained from the localised drainage networks developed and extended toward the future would be excessive and inconsistent with the hydraulic capacity of the river. Therefore, the stormwater drainage should be developed by integrating the river and localised drainage networks as a system.



Source: JICA Study Team (JST)

Source: NCWSC

Figure 8.2.1 River and Localised Drainage Network

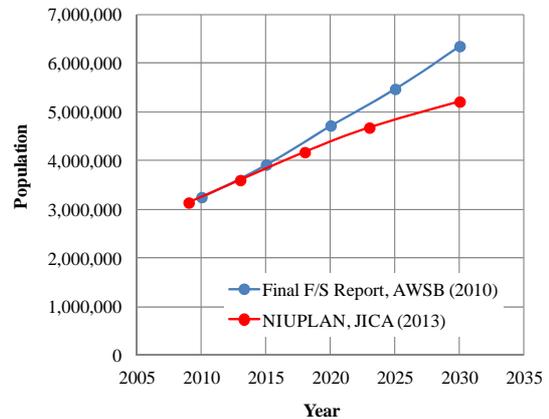
The City Engineering Department should restore its functions to manage the stormwater drainage systems in Nairobi City. The principal needs are the following: (i) collection, review, and update of technical data for the maintenance of the existing stormwater drainage systems, (ii) involvement in the development of the stormwater drainage under KMP and NaMSIP, and (iii) development of capability for the appraisal of construction works including stormwater drainage and maintenance of the existing stormwater drainage systems.

(2) Sewerage

1) Estimates of the Required Sewerage Treatment Capacity

i) Population

The Final Feasibility Study Report of the Nairobi Rivers Rehabilitation and Restoration Program: Sewerage Improvement Project (NaRSIP) indicates that the population in Nairobi City is projected to be 6.35 million by year 2030. This estimate is lower than the 5.21 million projected by Nairobi Integrated Urban Development Master Plan (NIUPLAN).



Source: JICA Study Team (JST)

Figure 8.2.2 Comparison of Population Projections

The Final Feasibility Study Report of NaRSIP used 3.8% for 2011-2020 and 3.0% for 2021-2030, while NIUPLAN applies a population growth rate of 2.4%/year for the period of 2009-2030.

Table 8.2.1 Comparison of Population Projections

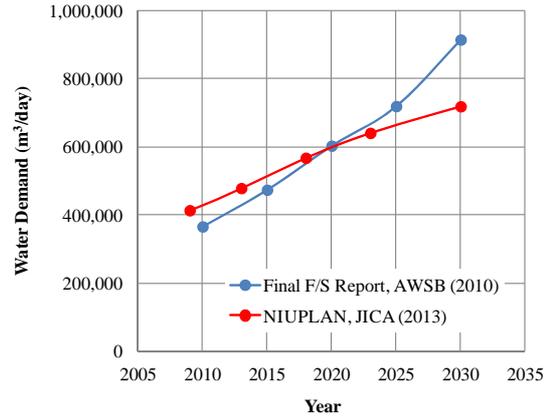
Final F/S Report	Year	2010	2015	2020	2025	2030
AWSB (2010)	Population	3,251,219	3,917,716	4,720,845	5,472,753	6,352,396
NIUPLAN	Year	2009	2013	2018	2023	2030
JICA (2013)	Population	3,138,372	3,601,351	4,174,952	4,677,677	5,212,500

Source: JICA Study Team (JST)

ii) Water Demand

The Final Feasibility Study Report of NaRSIP estimated that the water demand in Nairobi City excluding UfW would increase up to 914,812 m³/day by year 2030.

The water demand projection by NIUPLAN is discussed in Subsection 4.4 previous to this chapter. The water demand in year 2030 is projected to be 719,000 m³/day excluding UfW.



Source: JICA Study Team (JST)

Figure 8.2.3 Comparison of Water Demand Projections

Table 8.2.2 Comparison of Water Demand Projections

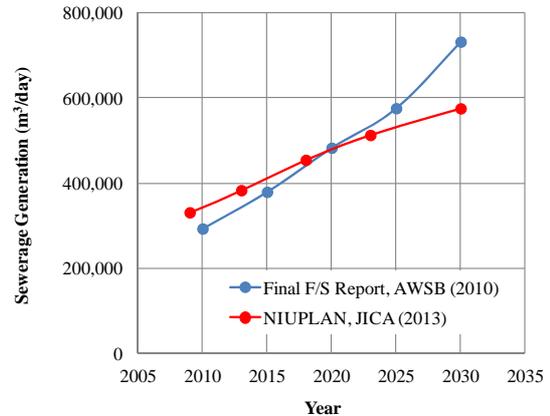
Final F/S Report		Year	2010	2015	2020	2025	2030
AWSB (2010)	Demand		366,418	474,199	603,493	719,529	914,812
	Year	2009	2013	2018	2023	2030	
NIUPLAN JICA (2013)	Demand		414,000	479,000	568,000	641,000	719,000

Source: JICA Study Team (JST)

iii) Sewerage Generation

For the purpose of sewerage development planning, AWSB assumes that sewerage generation would be 80% of water demand. Accordingly, the Final Feasibility Study Report of NaRSIP estimated that the sewerage generation in Nairobi City would be 731,850 m³/day in year 2030.

NIUPLAN estimates the sewerage generation in the same manner as above. The estimated sewerage generation is 575,200 m³/day in year 2030.



Source: JICA Study Team (JST)

Figure 8.2.4 Comparison of Sewerage Generation Estimates

Table 8.2.3 Comparison of Sewerage Generation Estimates

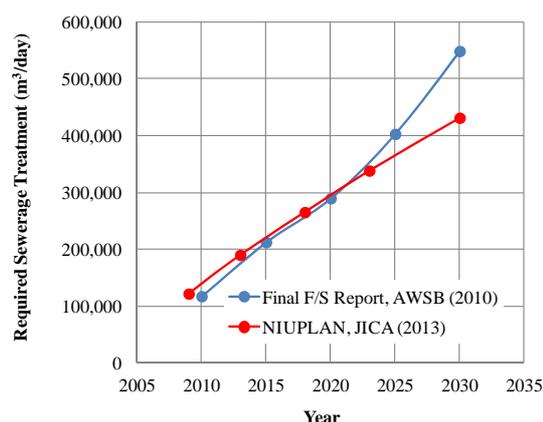
Final F/S Report		Year	2010	2015	2020	2025	2030
AWSB (2010)	Sewerage		293,134	379,359	482,794	575,623	731,850
	Year	2009	2013	2018	2023	2030	
NIUPLAN JICA (2013)	Sewerage		331,200	383,200	454,400	512,800	575,200

Source: JICA Study Team (JST)

iv) *Required Sewerage Treatment Capacity*

In the Final Feasibility Study Report of NaRSIP, a service coverage rate of the existing sewerage system was estimated at 40% in year 2010 and assumed to increase up to 75% by year 2030. The required sewerage treatment capacity in year 2030 was estimated at 548,887 m³/day accordingly.

NIUPLAN estimates the required sewerage treatment capacity in the same manner as above. The estimated sewerage generation is 431,400 m³/day in year 2030.



Source: JICA Study Team (JST)

Figure 8.2.5 Comparison of Required Sewerage Treatment Capacity Estimates

Table 8.2.4 Comparison of Required Sewerage Treatment Estimates

Final F/S Report	Year	2010	2015	2020	2025	2030
AWSB (2010)	Coverage	40%	56%	60%	70%	75%
	Treatment	117,254	212,441	289,677	402,936	548,887
NIUPLAN JICA (2013)	Year	2009	2013	2018	2023	2030
	Coverage	37%	50%	58%	66%	75%
	Treatment	121,882	190,067	265,370	338,448	431,400

Source: JICA Study Team (JST)

v) *Summary*

The estimates of required sewerage treatment capacity in year 2030 are summarised below. Based on the socioeconomic framework prepared by NIUPLAN, results showed that the required sewerage treatment capacity is lower in comparison with the Final Feasibility Study Report of NaRSIP.

Table 8.2.5 Summary of Estimated Required Sewerage Treatment Capacity (2030)

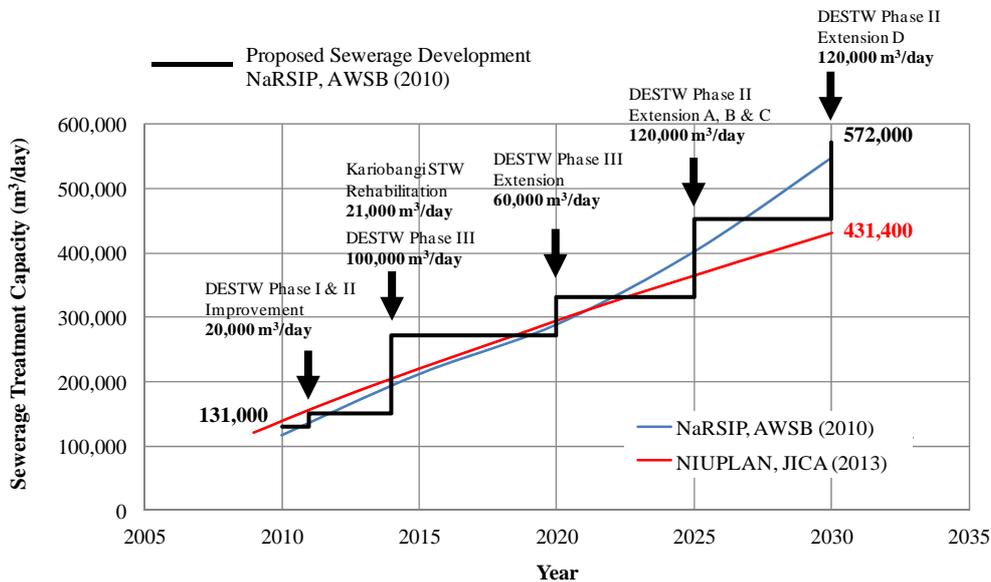
Planning Indicators	NaRSIP AWSB (2010)	NIUPLAN JICA (2013)	Remarks
(i) Population	6,352,396	5,212,500	
(ii) Water Demand, m ³ /day	914,812	719,000	Excluding UFW
(iii) Sewerage Generation, m ³ /day	731,850	575,200	80% of (ii)
(iv) Required Sewerage Treatment Capacity, m ³ /day	548,887	431,400	75% of (iii)

Source: JICA Study Team (JST)

2) *Development of Sewerage Treatment Works*

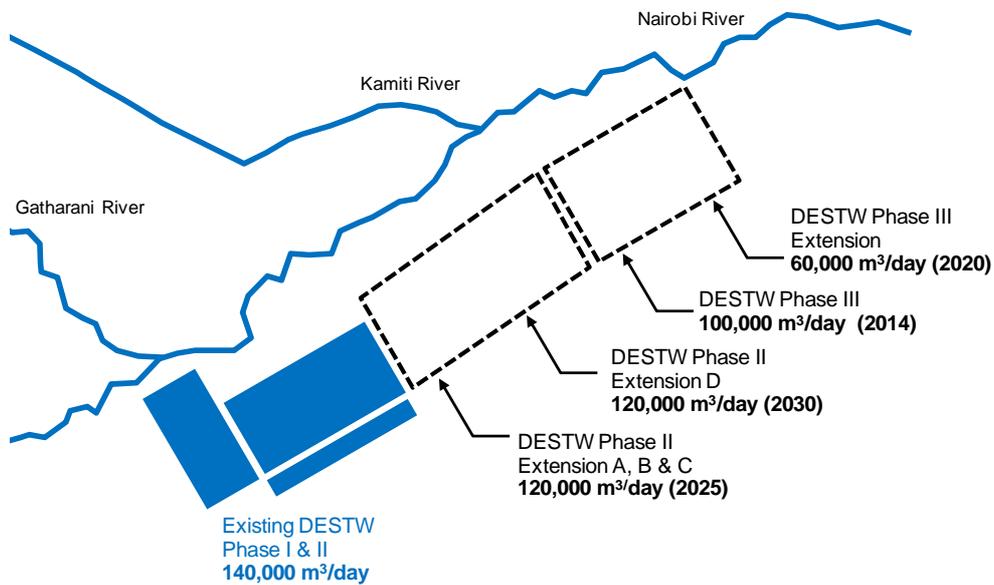
The Final Feasibility Study Report of NaRSIP describes the development of sewerage treatment works (STWs) toward year 2030. The total capacity of STWs is planned to be incremented from 131,000 m³/day in 2010 to 572,000 m³/day utilising the extension of the Dandora Estate STW (DESTW) and rehabilitation of the Kariobangi STW. The planned development of sewerage treatment capacity by 2030 is enough to meet the required sewerage treatment capacity of 431,400 m³/day estimated by NIUPLAN.

Of the planned development of STWs, the improvement of DESTW Phase I and II was completed by the Water and Sanitation Service Improvement Project (WaSSIP). The NaRSIP includes the rehabilitation of Kariobangi STW and part of the development of DESTW Phase III.



Source: JICA Study Team (JST)

Figure 8.2.6 Development of Sewerage Treatment Works



Source: Nairobi City Water and Sewerage Company Limited (NCWSC)

Figure 8.2.7 Planned Development of the Dandora Estate STW

3) Development of Sewerage Collection and Conveyance System

The existing trunk sewers is 162.7 km long, and collect wastewater from the sewerage service areas of about 208 km², which accounts for approximately 40% of the total area covered by the water supply service.

The WaSSIP developed the trunk sewers with a total length of 81 km including Gatharaini Trunk Sewers (construction: 49 km), Lavington-Riruta Trunk Sewers (extension: 8 km), and Ngong Trunk Sewers (rehabilitation/reconstruction: 24 km).

The Final Feasibility Study Report of the NaRSIP describes the development of trunk sewers to cope with the sewerage collection and conveyance that will be required toward year 2030. The proposed development consists of the following 12 trunk sewers that were prioritised by the sewerage master plan in 1998 and also covers 40 km of reticulation lines (secondary sewers).

Table 8.2.6 Existing Trunk Sewers (Separated Sewers) in Nairobi City

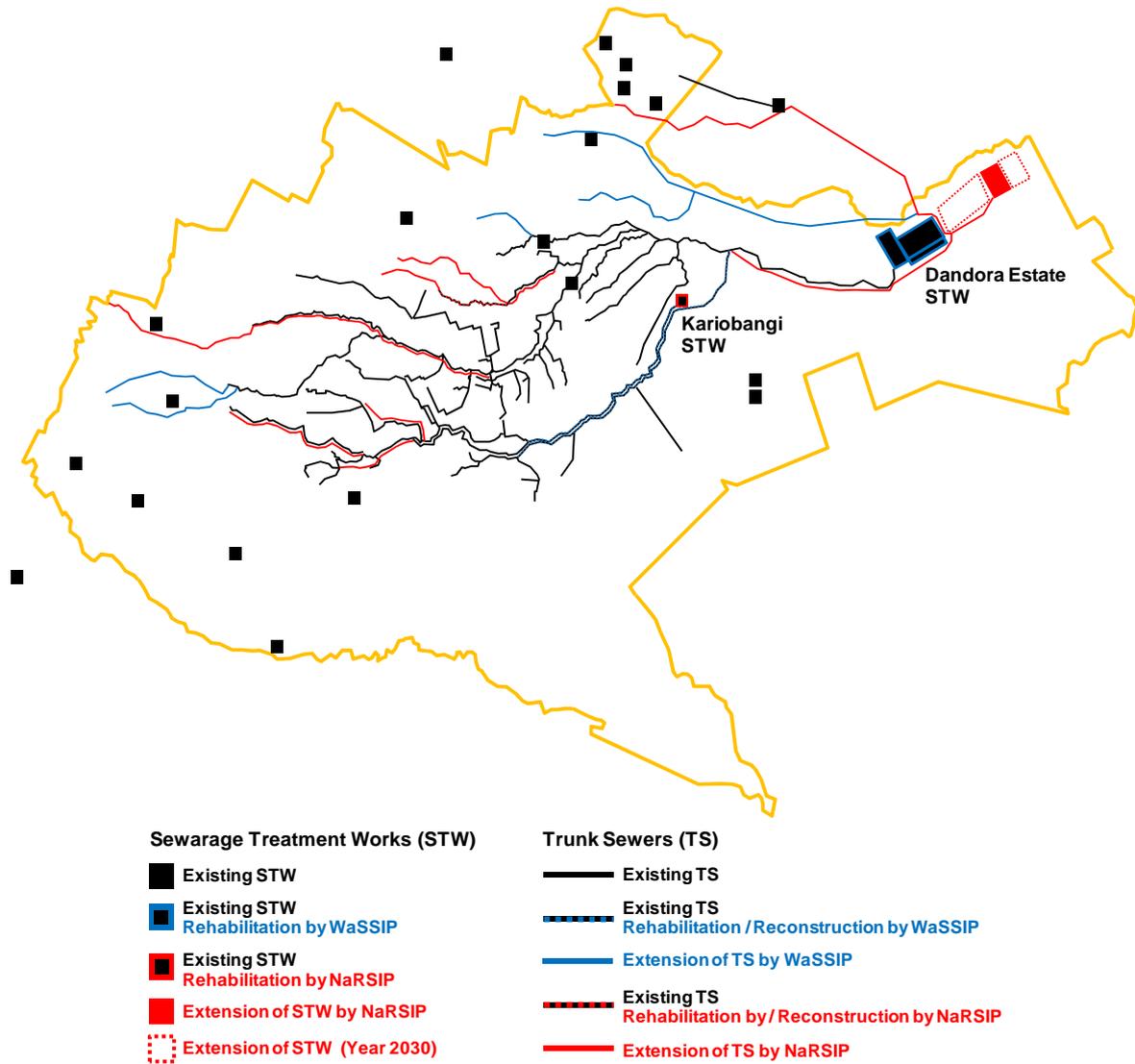
Trunk Sewer	Length (km)
1 Dandora Estate	12.3
2 Kariobangi - Ruiruaka	4.6
3 Ngong River (several phases)	15.1
4 Mombasa - Enterprise road	3.5
5 Southern Outfall	5.0
6 Kayole Estate	2.3
7 Dandora Community Phase I	5.3
8 Dandora Community Phase II	4.3
9 Dandora Industrial Area	5.8
10 Ruiruaka	1.2
11 Gitathuru	1.2
12 Chiromo (several phases)	8.4
13 Kibera	5.2
14 Upper Hill	6.1
15 Karura	1.7
16 Kahawa West	3.0
17 Lavington & Bernard Estate	3.0
18 Uhuru Highway By-pass	2.6
19 Mathare River	3.2
20 Nairobi River (several phases)	15.7
21 Parklands - Eastleigh	3.1
22 Upper Parklands	0.8
23 Milimani	3.1
24 Others	46.2
Total	162.7

Source: Final Feasibility Study Report of NaRSIP, AWSB (2010)

Table 8.2.7 Planned Development of Trunk Sewers under NaRSIP

Trunk Sewer	Length (km)
1 Getathuru Trunk Sewer duplication	5.4
2 Mathare Trunk Sewer extension	3.5
3 Getathuru Trunk Sewer extension	4.0
4 Upper hill trunk sewer duplication	2.8
5 Dandora Estate Trunk Sewer duplication, Ngong River confluence to DESTW	7.5
6 South Nairobi Dam Trunk Sewer	2.6
7 Nairobi River Trunk Sewer duplication	4.3
8 Riruta North Trunk Sewer	1.7
9 Nairobi River Trunk Sewer Phase VIII extension up to Dagoretti Market	8.5
10 Kiu River Trunk Sewer	5.5
11 Riara River (Githurai) Trunk Sewer	2.4
12 Kiu River Outfall Trunk Sewer	5.8
Total	54.0

Source: Final Feasibility Study Report of NaRSIP, AWSB (2010)



Source: Nairobi City Water and Sewerage Company Limited (NCWSC)

Figure 8.2.8 Existing and Planned Development of Trunk Sewers

4) Major Issues

i) Effluent Quality from Dandora Estate STW

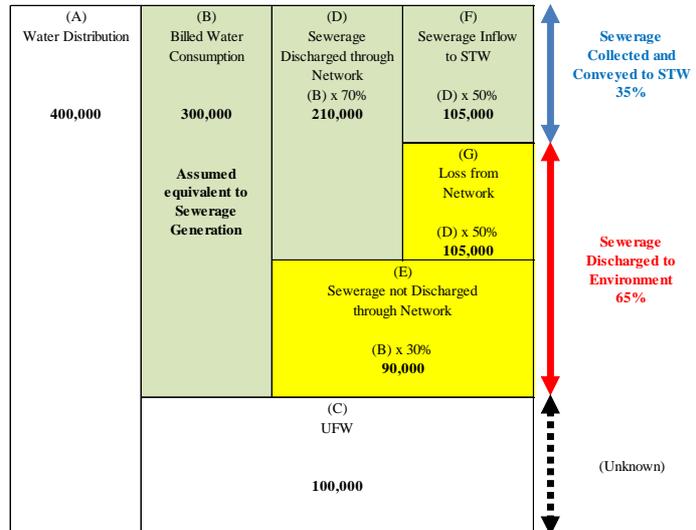
The development of STWs is planned to cope with the estimated sewerage generation in year 2030. Early stages of the development have already been implemented and/or on-going under WaSSIP and NaRSIP.

Most of the sewerage generated within Nairobi City is planned to be conveyed to and treated in the Dandora Estate STW. In the early stage of the development of STWs, the rehabilitation of the Dandora Estate STW was implemented under WaSSIP. However, the water quality data of the effluent from STW (for the period of July-September 2011) indicates that the values of biological oxygen demand (BOD), chemical oxygen demand (COD), and total suspended solids (TSS) do not meet the effluent standards of Kenya even after the completion of the rehabilitation works. During NIUPLAN, NCWSC reported that the effluent quality still remains unimproved for the period of April-June 2013.

It is presumed that some trouble still remains in the Dandora Estate STW even after the rehabilitation by WaSSIP. The cause of low treatment efficiency at the Dandora Estate STW should be investigated in pursuit of countermeasures to improve the effluent quality in order to meet the effluent standards of Kenya. Consequently, feedbacks from the investigation should be taken into account for operation and maintenance (O&M) and further sewerage development.

ii) Sewerage Collection and Conveyance

The available data suggests that the total water distribution in Nairobi City is around 400,000 m³/day during the recent years. The billed water consumption was 295,597 m³/day as of 2010/2011. The sum of the recorded sewerage inflows to the Dandora Estate STW and Kariobangi STW in 2010 was 102,803 m³/day accounting for 35% of the billed water consumption. Assuming that the sewerage generation would be equivalent to the billed water consumption, the sewerage collection rate is approximately 35% (= 102,803 / 295,597).



Source: Prepared by the JICA Study Team (JST)

Figure 8.2.9 Estimate of Present Sewerage Generation, Collection and Conveyance

The NCWSC has around 240,000 of the water supply service connections and 170,000 of the sewerage service connections as of 2013. In terms of service connections, the service coverage rate of the sewerage system is approximately 70% (= 170,000 / 240,000).

From the above figures, the following points are identified regarding the sewerage collection and conveyance:

- (i) Volume of sewerage collected and conveyed to STWs accounts for 35% of the sewerage generation and the remaining 65% are discharged to the environment without treatment.
- (ii) 70% of the sewerage generated is collected once by the sewerage network but half of the volume is lost from the sewerage network.
- (iii) 30% of the sewerage generated is not collected by the sewerage network and is discharged directly to the environment.

Assuming that the sewerage collection rate should be equivalent to the percentage of service coverage area as planned, the sewerage development will need to attain a sewerage collection rate of 75% by 2030. The sewerage collection rate should be improved with the rehabilitation and development of the sewerage network comprising trunk sewers, reticulation lines, and service connections accordingly. Effects of sewerage development (trunk sewers and reticulation lines) by WaSSIP and NaRSIP should be monitored continuously. And then feedbacks from the monitoring should be taken into account for O&M and further sewerage development.

8.2.2 Development Policy

The stormwater drainage in Nairobi City should be developed by integrating the river and localised drainage networks. Within the catchment area of the river, the development and maintenance of the river should be initially planned and implemented to ensure the required hydraulic capacity for the stormwater drainage as well as the riparian reserves in order to maintain better water environment. The localised drainage networks should be developed under these conditions given by the plan for the development and maintenance of the river.

The sewerage development is currently implemented to extend the capacity of treatment. Moreover, the sewerage system in Nairobi City needs to improve its performance in terms of effluent quality from STWs and sewerage collection/conveyance.

The comprehensive framework for water environment management in Nairobi City was elaborated by the former Nairobi River Basin Programme (NRBP) supported by the United Nations Environment Programme (UNEP) during the last decade. Under the said framework, the development of stormwater drainage and sewerage should be recognised as part of the subsequent activities being taken by the Nairobi Rivers Basin Rehabilitation and Restoration Programme. At present, the activities relevant to the water environment management in Nairobi City are taken by the initiatives of the government organisations in charge. For further enhancement of the activities, NCC should increase its involvements with such activities through its capacity development.

8.2.3 Priority Projects

(1) River Improvement Project

1) Objectives

The project aims at the following: (i) establishment of a river management master plan for integrating the river and localised drainage networks as a stormwater drainage system and; (ii) development of the river channels and riparian reserves to restore and maintain better water environment. The target areas are the river stretches and corresponding riparian areas of the Nairobi River and its major tributaries.

2) Descriptions

i) Phase-1: Preparation of the master plan and feasibility study,

- (i) Longitudinal profile and cross section survey of river stretches,
- (ii) Investigation of associated works (e.g., dikes, revetments, drainage outfalls, bridges, culverts, etc.) along the surveyed river stretches,
- (iii) Estimates of stormwater runoff drained from catchment area to the river,
- (iv) Analysis of hydraulic capacity required for each of the river stretches,
- (v) Preparation of design discharge and water level for each of the river stretches,
- (vi) Identification of the river stretches to be improved,
- (vii) Delineation of riparian reserve to be secured,
- (viii) Preliminary design of river training works, riparian reserves, and associated works including localised drainage networks,
- (ix) Evaluation for justification of the works through cost-benefit analysis and social/environmental impact assessment, and
- (x) Preparation of implementation plan for river training works, riparian reserves, and associated works including localised drainage networks.

ii) Phase-2: Detailed Design and Implementation

- (i) Detailed surveys and investigations for the detailed design of the selected river stretches (e.g., topographic mapping, longitudinal profiles and cross sections, soils, utilities, associated works, resettlement requirements, etc.);
- (ii) Detailed design of river training works, riparian reserves, and associated works including localised drainage networks;
- (iii) Preparation of construction plan and cost estimates;
- (iv) Preparation of O&M plan, environment management plan (EMP), and resettlement action plan (RAP);
- (v) Preparation of tender documents;
- (vi) Procurement; and
- (vii) Implementation.

3) Implementation Arrangements

The regional office of WRMA will be the responsible organisation for implementing the project. Meanwhile, it is recommended that WRMA should focus on sharing the responsibility for the management of the rivers within Nairobi City to NCC in the future. Therefore, a project management unit (PMU) needs to be jointly organised by the representatives of WRMA and NCC.

The project will formulate the river management master plan for each of the Nairobi River and its major tributaries. The subsequent stormwater drainage developments in the individual subcatchment areas will need to be kept consistent with the river improvement master plan. Furthermore, the project will need to coordinate closely with the stormwater drainage master

plan that will be prepared under KMP for common understanding of the basic planning conditions amongst each other.

4) Outcomes/Benefits

The project will prepare a river management master plan to define clear guidelines for the systematic development of the stormwater drainage systems in different urban centres in Nairobi City. The development and maintenance of the river channels and riparian reserves will provide a basic framework to practice a series of activities for the betterment of the water environment.

(2) Sewerage Improvement Project

1) Objectives

The project aims at the following: (i) carrying out countermeasures to improve the effluent quality from the Dandora Estate STW to comply with the effluent standards of Kenya and; (ii) improving sewerage collection and conveyance through the sewerage network comprising trunk sewers, reticulation lines, and sewerage connections.

2) Descriptions

i) Phase-1: Preparation of Improvement Plan

- (i) Monitoring and analysis of the sewerage treatment performance of the Dandora Estate STW to identify the needs for improvement;
- (ii) Investigation and analysis of trunk sewers, reticulation lines, and sewerage connections to identify the needs for improvement;
- (iii) Plan and design the improvements for the Dandora Estate STW;
- (iv) Plan and design the improvements for trunk sewers, reticulation lines, and sewerage connections; and
- (v) Preparation of the implementation plan including cost estimates and budgetary arrangement.

ii) Phase-2: Implementation

- (vi) Implementation of the improvement for the Dandora Estate STW;
- (vii) Implementation of the improvement for trunk sewers, reticulation lines, and sewerage connections;
- (viii) Monitoring, review, and analysis of the sewerage treatment performance of the Dandora Estate STW;
- (ix) Monitoring, review, and analysis of the sewerage collection and conveyance by the sewerage network comprising trunk sewers, reticulation lines, and sewerage connections; and
- (x) Preparation of feedbacks for O&M and further sewerage development.

3) Implementation Arrangements

The AWSB will be the responsible organisation for implementing the project. Meanwhile, it is recommended that AWSB should focus on sharing the responsibility for managing the

sewerage system within Nairobi City to NCC in the future. Therefore, a PMU needs to be jointly organised with the representatives of AWSB and NCC. NCWSC as the operator of the sewerage system will also be essentially involved with the project management.

4) Outcomes/Benefits

The project will contribute to: (i) alleviating the water pollution in the Nairobi River and its tributaries through an increase in the sewerage collection and conveyance as well as improvement of the sewerage treatment performance to cope with the effluent standards of Kenya; and (ii) evolving further improvements of the sewerage system through feedbacks.

(3) Capacity Development Project for Water Environment Management

1) Objectives

The project consists of the following three components:

Component 1 – Water Environment Management, aims at supporting capacity development for NCC; (i) to establish an administrative framework for implementing the water environment management in Nairobi City; and (ii) to strengthen the administrative capability of the county departments to implement water environment management.

Component 2 – Storm Water Drainage Management, aims at supporting capacity development for the City Engineering Department; (i) to restore its administrative functions to maintain the stormwater drainage systems; (ii) to establish its administrative capability to manage the plan, design, and construction of stormwater drainage works within the catchment areas of the Nairobi River and its major tributaries in conformity with a river management master plan of the proposed river improvement project.

Component 3 – Sewerage Management, aims at supporting capacity development for the City Engineering Department; (i) to establish its administrative capability to manage the plan, design, construction, and O&M of the sewerage system; and (ii) to supervise NCWSC to carry out O&M of the sewerage system in order to ensure the improvements through the proposed Sewerage Improvement Project.

2) Descriptions

i) Component 1 – Water Environment Management

- (i) Review of the actions to be taken by the county under the Nairobi Rivers Basin Rehabilitation and Restoration Programme and update the issues and approaches for implementing the water environment management in Nairobi City;
- (ii) Study on the administrative system comprising the county's departments to perform their roles for water environment management;
- (iii) Practices for operating the administrative system, e.g., water quality monitoring, regulation of industrial effluent, riparian reserve conservation and utilisation, and information, education, and communication (IEC) for creating social understandings; and
- (iv) Review of outcomes from the practices and feedbacks.

ii) Component 2 – Stormwater Drainage Management

- (i) Collection, review, and update of technical data (master plan, project documents, as-built drawings, etc.) for the maintenance of the existing stormwater drainage systems;
- (ii) City Engineering Department to practice the maintenance of the existing stormwater drainage systems in the systematic approaches based on the technical data;
- (iii) Organisational reform for the City Engineering Department to take the responsibility for managing the Nairobi River and its major tributaries and associated stormwater drainage systems in the individual subcatchment areas;
- (iv) City Engineering Department to be involved in the proposed river improvement project to prepare the river management master plan for integrating the river and localised drainage networks and securing the riparian reserves; and
- (v) Review, update, and application of design standards and specifications for the stormwater drainage works through O&M practices and feedbacks.

iii) Component 3 – Sewerage Management

- (i) Organisational reform for the City Engineering Department to take the responsibility for the administrative management of plan, design, construction, and O&M of the sewerage system in Nairobi City;
- (ii) City Engineering Department to be involved in the proposed sewerage improvement project to improve the performance of the sewerage system;
- (iii) City Engineering Department to supervise NCWSC to practice O&M methods applied resulting from the sewerage improvement project and feedbacks; and
- (iv) Review, update, and application of design standards and specifications for the sewerage works through O&M practices and feedbacks.

3) Implementation Arrangements

The NCC will be the responsible organisation for implementing the project with the support from relevant organisations including Ministry of Environment and Mineral Resources (MEMR), National Environmental Management Authority (NEMA), WRMA, Road Authorities, AWSB, and NCWSC. Because the project will include technical, organisational, and institutional subjects to be coordinated with different organisations, the council will need to organise a project coordination committee with the representatives of the council and relevant organisations.

In preparing the project, further details on stakeholder coordination should be discussed in conformity with the comprehensive framework for water environment management under the Nairobi Rivers Rehabilitation and Restoration Programme.

4) Outcomes/Benefits

The administrative system for water environment management will be clearly defined and activated under the responsibility of NCC. The council's departments will be able to activate their respective roles for the betterment of the water environment as envisaged by the Nairobi Rivers Rehabilitation and Restoration Programme. The City Engineering Department will be able to take the initiatives in managing the stormwater drainage and sewerage in Nairobi City through its involvement in the proposed projects.

8.3 Power Supply

8.3.1 Demand and Gap Analysis

(1) Power Demand Forecast

The existing power demand forecast described in Section 4.1.7 is based on the Updated Least Cost Power Development Plan Study Period: 2011-2031 (LCPDP). JST reviewed the GDP growth rate and the future population, and reviewed the demand forecast using the GDP growth rate and future population projected by NIUPLAN in order to study appropriate demand forecast. The demand forecast by NIUPLAN will be called the project demand forecast (PDF).

The PDF will follow the method of projection by LCPDP. According to the structure of LCPDP, first of all, the power demand forecast of Kenya will be calculated. Secondly, the power demand forecast of NCC will be examined. The sequence in calculating PDF is as follows:

- (i) Calculate the rate of power demand at 7% GDP growth rate each year from the power demand at 8% GDP growth rate (low scenario), 9% (reference scenario), and 10% (high scenario) in LCPDP,
- (ii) Calculate the power demand of Kenya by 2030 from the demand of Kenya at the first year and the rate of power demand calculated above,
- (iii) Estimate the rate of population number of the PDF in Kenya to LCPDP,
- (iv) Calculate the PDF of Kenya from the ratio of (iii) and power demand of (ii),
- (v) Calculate the proportion of power demand of NCC to Kenya in order to seek the PDF of NCC, and
- (vi) Grasp the PDF of NCC from the proportion calculated in (v) and the PDF of Kenya calculated in (iv).

The following description evaluates the concrete value of the PDF of Kenya and of NCC:

1) Power Demand Forecast for Kenya

The PDF of LCPDP has three scenarios, namely, high scenario, reference scenario, and low scenario. The difference of the three scenarios is due to the difference of the GDP growth rate. For example, high scenario is 10% as the GDP growth rate in 2030. This is because Kenya Vision 2030 assumes the GDP growth rate at 10% by 2030 and high scenario adopts the GDP growth rate of Kenya Vision 2030. Reference scenario's and low scenario's GDP growth rate are 9% and 8%, respectively, based on high scenario. On the other hand, NIUPLAN sets GDP growth rate at 7% as discussed in Section 6.3.3, therefore, PDF adopts 7% as GDP growth rate.

Regarding population, the existing demand forecast assumes that the population will increase to 60.5 million by 2030 in reference to the Kenya Vision 2030 and all scenarios assume this population. While the project sets the future population as 65.6 million as discussed in Section 6.1.1, PDF assumes the population to be 65.6 million by 2030.

Table 8.3.1 and Figure 8.3.1 show the PDF by 2030 with using the GDP growth rate and the future population forecast assumed by JST. From the figure, it is confirmed that PDF is always the lowest in the scenarios. The table also shows 9,343 MW as the value of PDF in 2030 is less than 70% of 15,026 MW as the reference scenario's value.

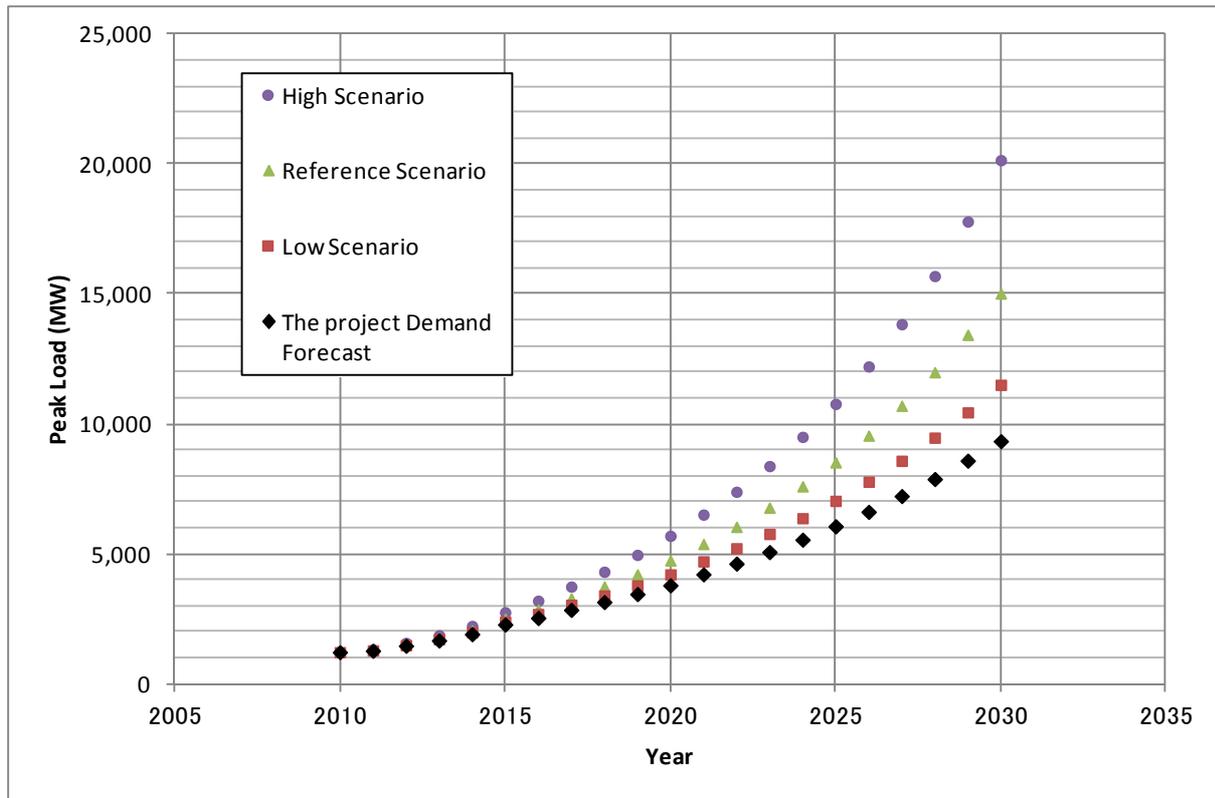
The result is due to following reasons: Regarding the assumption of future population, the values of NIUPLAN forecast are larger than the LCPDP forecast. The proportion of the population in the Project forecast to LCPDP forecast is 8.4% larger. This result brings PDF to a higher figure. However, regarding the assumption of GDP growth rate, the Project forecast is the lowest in all scenarios. The proportion of GDP growth rate in the Project forecast (7%) to

low scenario (8%) is 12.5% lower. This result effectively brings PDF to a lower figure. Therefore, even the assumption of future population of the Project forecast is higher than the LCPDP forecast, PDF becomes lower because of the low rate of GDP growth.

Table 8.3.1 Demand Forecast of Kenya by 2030

YEAR	Project Demand Forecast	Low Scenario	Reference Scenario	High Scenario
	MW			
2010	1,227	1,227	1,227	1,227
2015	2,292	2,398	2,511	2,760
2020	3,800	4,220	4,755	5,703
2025	6,069	7,050	8,528	10,778
2030	9,343	11,510	15,026	20,156

Source: JICA Study Team (JST)



Source: JICA Study Team (JST)

Figure 8.3.1 Demand Forecast of Kenya by 2030

2) Demand Forecast of NCC

The LCPDP also forecasts the power demand of NCC as indicated in Table 8.3.2. The table shows the demand forecast of NCC and Kenya. However, the numbers of Kenya in the table below is different from the previous numbers of Kenya shown in Table 8.3.1. This is because the approach to the demands is different. The previous data is calculated based on a model simulation but the latter data is based on the section of the transmission line network project in LCPDP. Yet the power demand of NCC is described only in the latter data, therefore, the latter data will be used as the existing power demand of NCC.

Table 8.3.2 Existing Demand Forecast of LCPDP

Region	Year	2015	2020	2025	2030
Nairobi	(MW)	1,241	2,214	3,726	5,996
Kenya		2,386	4,519	8,102	14,273
Demand Ratio of Nairobi to Kenya		52%	49%	46%	42%

Source: LCPDP

In order to calculate the PDF of Nairobi City, first of all, the ratio of NCC demand to Kenya demand as existing data will be calculated. Table 8.3.3 below describes the demand forecast ratio of NCC to Kenya, so the PDF adopts the ratio in the table. From the table, it is confirmed that the ratio is decreasing as time advances. This is because LCPDP assumes lower demand growth of NCC compared with other regions in the longer term.

As already discussed, the PDF of Kenya has been assumed. Therefore, it is possible to calculate the PDF of NCC by utilising the PDF of Kenya and the ratio of NCC demand to Kenya demand. As a result of calculation, the PDF of NCC is shown in Table 8.3.3 and Figure 8.3.2.

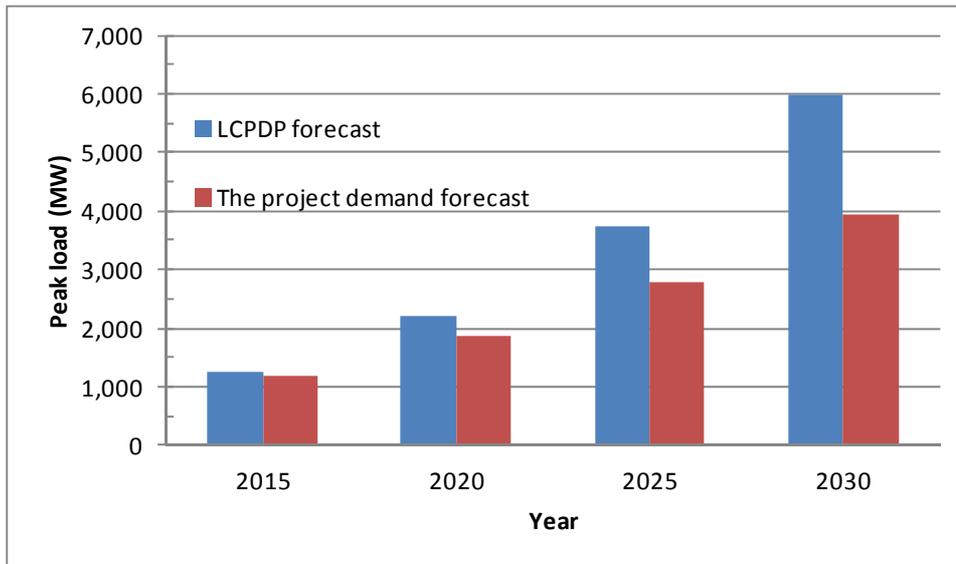
Table 8.3.3 shows the PDF of Nairobi City and Kenya. As a result, the PDF assumes approximately 4,000 MW of demand in Nairobi City by 2030. The maximum demand of Nairobi City in 2011/12 was 662 MW, so the demand in 2030 is expected to increase six times as compared with the demand in 2011/12.

Table 8.3.3 Project Demand Forecast of NCC and Kenya

Region	Year	2015	2020	2025	2030
Nairobi City	(MW)	1,192	1,862	2,791	3,925
Kenya		2,292	3,800	6,069	9,343

Source: JICA Study Team (JST)

Moreover, the following chart describes the demand forecast of NCC. One is the existing data from LCPDP and the other is from the Project forecast. From the chart, PDF is lower than the LCPDP forecast at any time. The Project forecast of NCC is assumed to be two-thirds of the LCPDP forecast by 2030.



Source: JICA Study Team (JST)

Figure 8.3.2 Demand Forecast of NCC Compared with the Project and LCPDP

According to the above consideration, the PDF of NCC and Kenya is assumed to be less than the current power sector forecast. The demand of NCC in 2030 is estimated to be 4,000 MW

and the number equals to two-thirds of the LCPDP forecast. The main reason for this is that the GDP growth rate of the Project is lower than the LCPDP assumption.

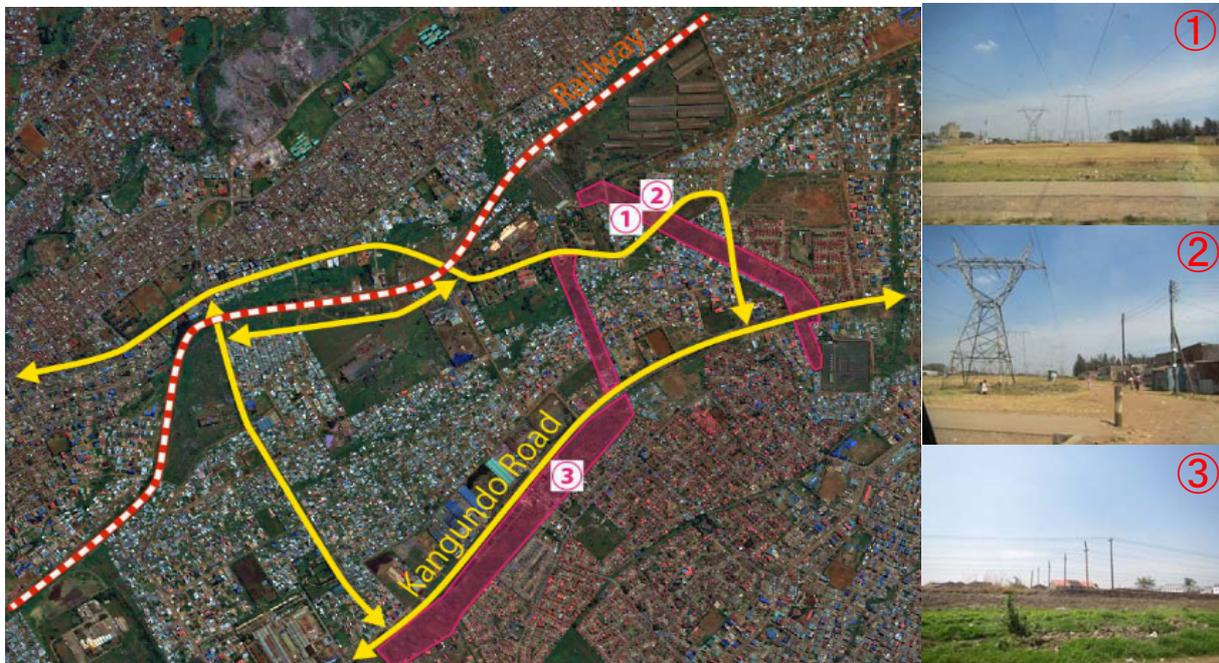
By the way, NCC and the infrastructure sectors hope for the realisation of electric trains. Although some trains are running as commuter train, the trains in NCC are operated using diesel locomotives. In addition, the priority project of railway does not consider adopting the electric railroad system in the immediate future. Diesel locomotives do not consume electricity, so there is no need to consider the electric requirement for railway at the current situation.

Moreover, at present, the new building is supposed to have solar water heating system under certain conditions due to the Energy Act published in 2012. This is one of the provisions to suppress electricity demand. Like this example, if regulations to restrain electricity demand become effective, it will contribute to the taming of the sharp increase in electricity demand.

The recommendation to the power sector, therefore, is to review the demand projection with the setting of the GDP growth rate and future population forecast. It may be important to ensure adequate power equipment, but excess forecast may lead to excess construction of power equipment, which would result to the increase in electricity cost.

(2) Development of Land around the Dandora Railway Station

The JST proposes the Dandora Railway Station area to be one of sub-centres to supplement the present central business district (CBD). Figure 8.3.3 below shows the land around the Dandora Station with some pictures of the site. The orange lines show the roads and the yellow belts show the power line areas. From this figure, the power lines occupy quite sizable areas. Picture No. 1 and No. 2 show 132 kV transmission lines and picture no. 3 shows five 66 kV transmission lines and one 11 kV distribution line. This area is the sub-centre for NIUPLAN, so the land of power line needs to be effectively utilised. Regarding the problem on land use, the following two measures are considered: 1) reviewing regulations, and 2) laying underground.



Source: JICA Study Team (JST)

Figure 8.3.3 Land around the Dandora Railway Station

1) Reviewing Regulation

Reviewing the regulation concerning transmission lines could be one of the solutions for using land effectively. Figure 8.3.3 shows the pictures of the 132 kV transmission line shown as No. 1 and No. 2. From these pictures, the ample vacant land is spread around the transmission line. Therefore, if the regulation changes, it may be possible to use the land for buildings or houses. Concerning regulation, the contention is divided into two points, i.e., wayleaves and minimum clearance.

First, consideration of the regulation focuses on the wayleaves. Wayleaves are defined by Kenya Power as follows:

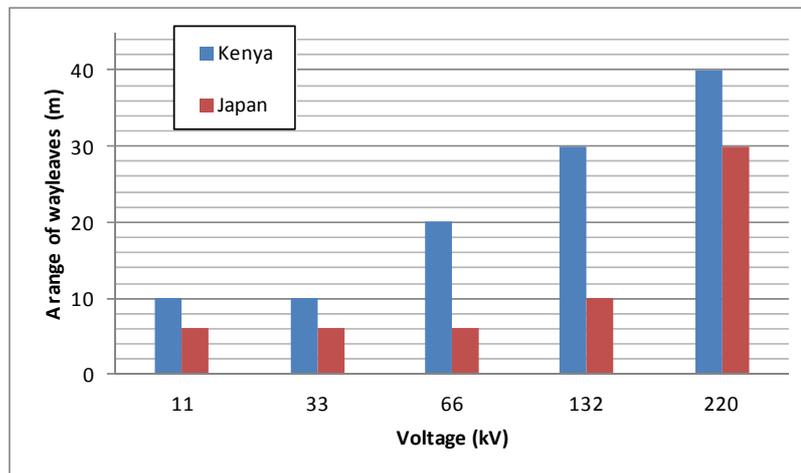
8.1 WHAT IS WAYLEAVES?

Definition
It is an easement or rights of way (ROW) which gives the right of use or restricts the use of land of another in a way that benefits other people other than the owner of the land. Other than KPLC, rights of way are also established for railways, roads, airways, pipelines.

Source: Design Standards and Guidelines (Kenya Power and Lighting Company)

Figure 8.3.4 Definition of Wayleaves

It seems that the range of wayleaves in Kenya are too large. Figure 8.3.5 shows the comparative chart of Kenya and Japan, showing the range of wayleaves from 11 kV to 220 kV. Apparently, in all the ranges, the wayleaves of Kenya are higher than that of Japan. In more detail, 11 kV and 33 kV of a range of wayleaves is of the same distance as 10 m. However, a range of wayleaves that is more than 33 kV increases as the voltage increases and finally, a range is 40 m at 220 kV. On the other hand, Japan's regulation reaches 30 m at 220 kV. Particularly, the difference of Kenya and Japan at 132 kV is as large as 20 m, so it can be said that a range of wayleaves in Kenya is wide, and may need to be reviewed.

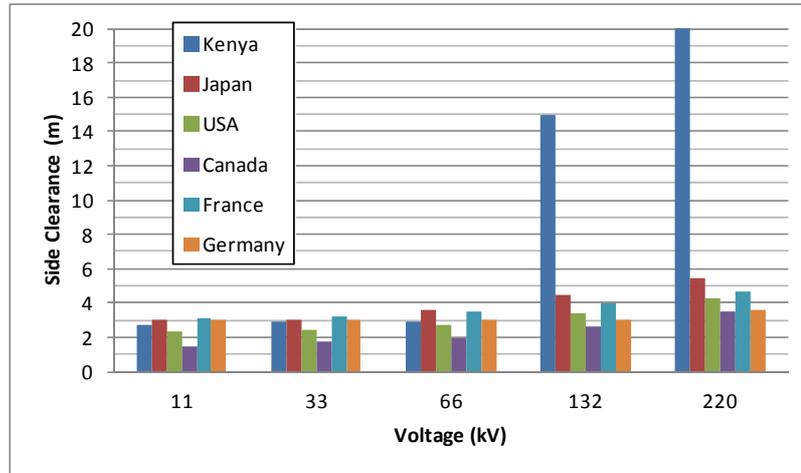


Source: JICA Study Team (JST) based on the following documents:
Wayleaves trace for power lines (Kenya Power),
Kenya Electricity Expansion Project (EASP)-KPLC Distribution Component (Kenya Power),
The Survey on the Transition from Overhead Line to Underground Cable 2010 (Geo-space Engineering Center).

Figure 8.3.5 Comparison of Wayleaves between Kenya and Japan

The second point is the minimum clearance. Minimum clearance is the distance from the overhead lines to buildings, trees, and vegetation. Especially, the side clearance from the overhead lines to buildings is discussed here. The comparison of minimum side clearance is

shown in Figure 8.3.6 below. The side clearance of 66 kV or less in Kenya is almost the same as that of other countries, yet the requirement in Kenya over 66 kV is much higher than that of other countries. As a result, minimum clearance over 132 kV of Kenya might also be large.



Source: JICA Study Team (JST) based on the following documents:
Design Standards and Guidelines (Kenya Power)
Wayleaves Trace for Power Lines (Kenya Power),
Clearance of Transmission Line over 170 kV
(Japan Electrotechnical Standards and Codes Committee)

- * Side clearance of Kenya 132 kV and over is the distance from center of wayleaves, while the others assume the distance from the edge of wires.
- * Side clearance of Kenya 132 kV and over is based on “Wayleaves Trace for Power Lines” as a result of hearing from an official of Kenya Power.

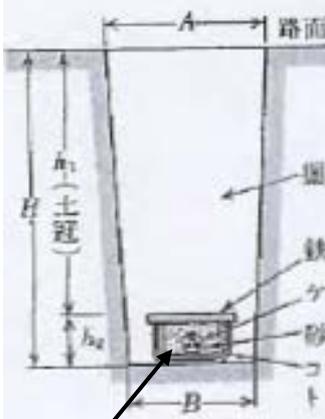
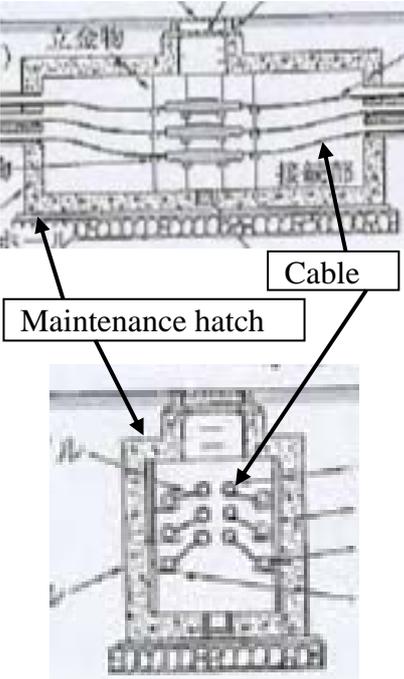
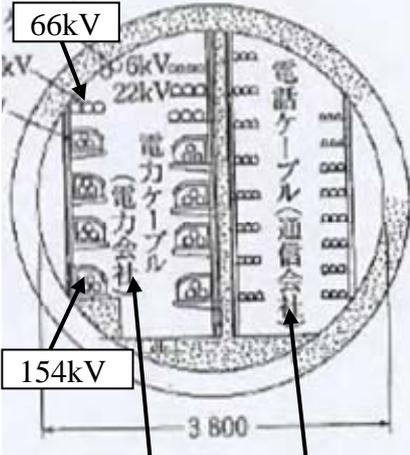
Figure 8.3.6 Comparison of Side Clearance

According to these examinations, there might be opportunities to review the regulations concerning transmission lines, which could lead to increase of usable lands along the transmission lines. This could be advantageous for NCC as well as for Kenya Power. Therefore, it is recommended to review regulations.

2) Developing Underground Cable

Another method for effective use of land along the transmission lines is to adopt underground cables. By laying cables underground, overhead lines can be removed and the land after removal can be used for other purposes such as commercial facilities or for industry area.

Table 8.3.4 Features of Underground Cable

Direct Buried System	Duct System	Common Duct
		
Low cost	High cost	Very high cost
Disadvantageous for addition and removal of cables	Possible for addition and removal of cables	Advantageous for many cables
Disadvantageous for maintenance	Advantageous for maintenance	Advantageous especially for maintenance

Source: Transmission and Distribution Engineering (Denki-gakkai)

The underground cable is divided into three types, namely, direct buried system, duct system, and common duct system. The features of the underground cables are shown in Table 8.3.4 above. Direct buried system is common in Kenya, as it can be constructed at a low cost. However, additional cables and maintenance for cables are troublesome, posing a disadvantage. Furthermore, it may incur high cost for the duct system but additional cables and maintenance are easier than direct buried system. The common duct is the most expensive method, but the system can offer easy maintenance and easy addition of cables. Moreover, the common duct system is shared by some other sectors such as the telecommunications sector and road sector. Consequently, even the cables for street lighting or communication cables can be kept in the same duct.

According to an official of Kenya Power, the area which is shown in picture No. 3 along Kangundo Road in Figure 8.3.3 seems to have a plan to install more overhead lines in the future. Under such circumstances, the duct system or common duct is suitable for the area because these two ways have the opportunities to install additional cables after construction.

(3) Information Sharing of Map

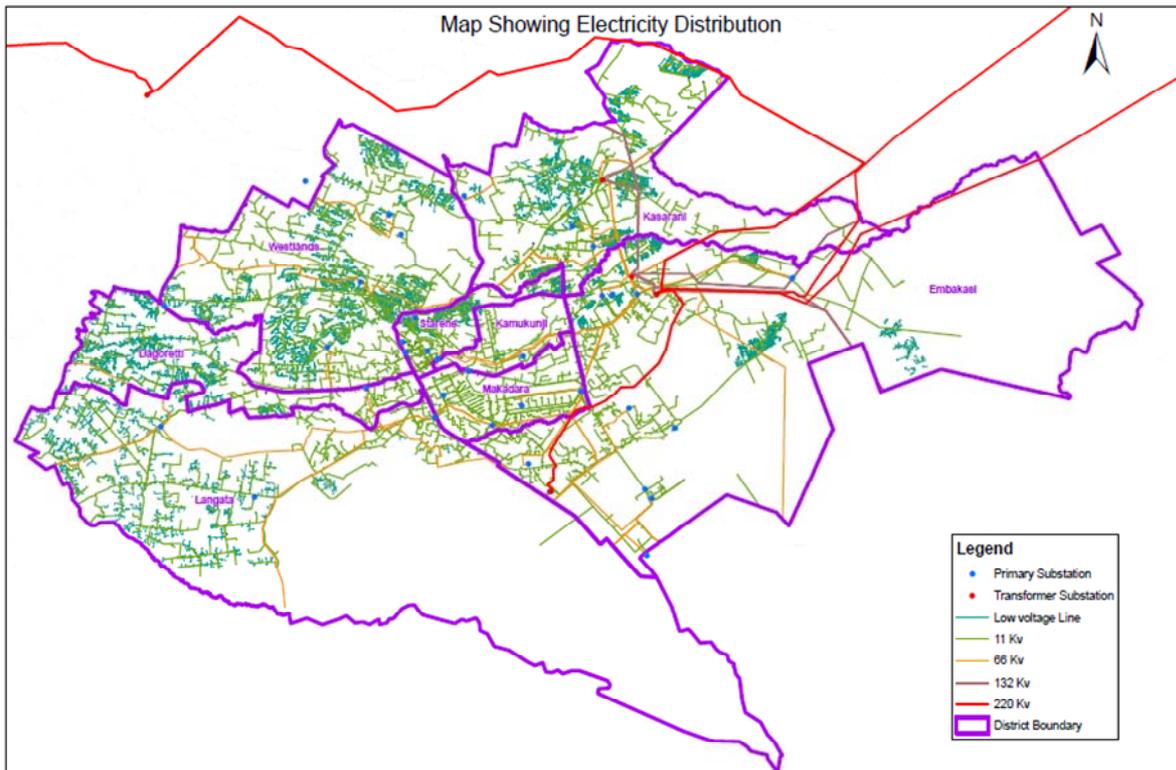
In the Technical Working Group (TWG), NCC requested for the geographic information system (GIS) data from the power sector because NCC needed the information on the location of the power equipment in order to make the land use plan. On the other hand, Kenya Power also wants to obtain other sector's mapping data because underground cables are related to the facilities of other sectors such as telecommunications, water, drainage, and gas. From the TWG discussions, it was noted that

the mapping information of all sectors seems to be useful for NCC and other sectors, so it may be necessary to share mapping data.

Figure 8.3.7 is the GIS data based on the data owned by Kenya Power. The figure shows transmission lines, low voltage lines, and substations. From this figure, it seems that Kenya Power manages the GIS data without any problem.

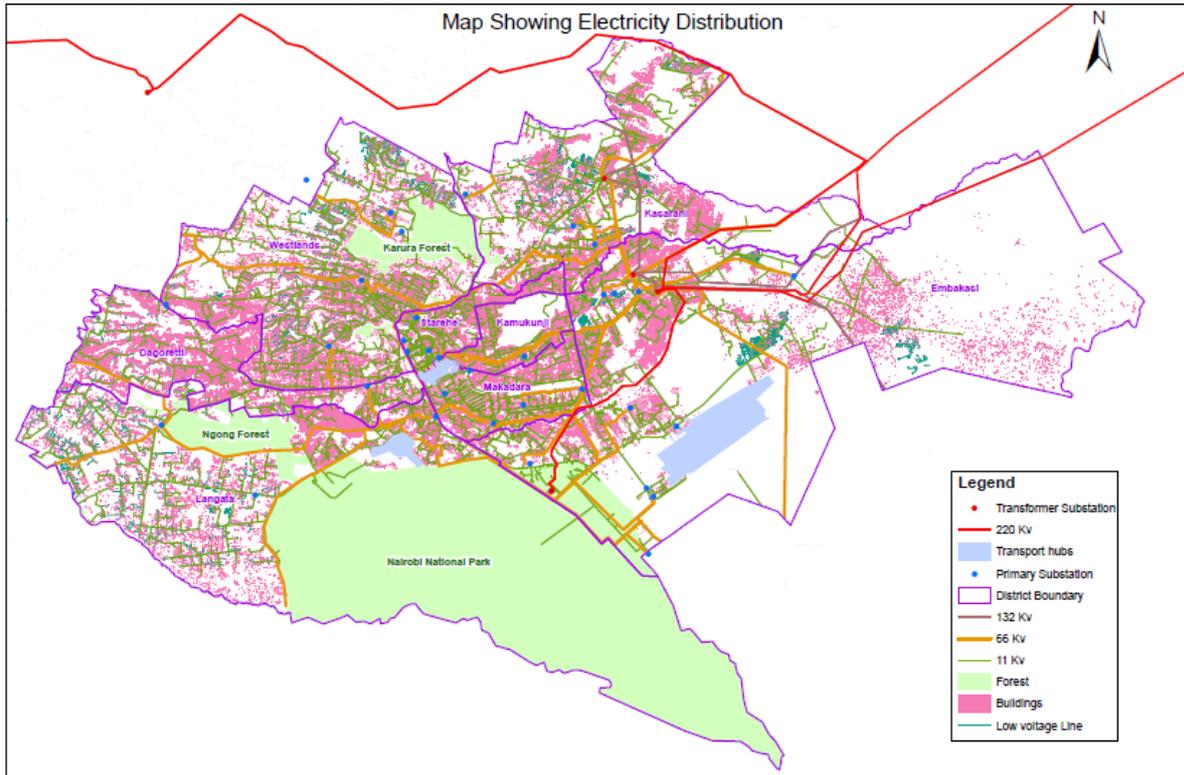
Moreover, Figure 8.3.8 is the data which adds buildings and transport hubs to Figure 8.3.7. However, these added data are used as data of JST, because the data of JST is more precise than that of Kenya Power. From this viewpoint, it is profitable for Kenya Power to share the land data.

As an example, paying attention to Embakasi, which is shown in the right side of Figure 8.3.8, it can be seen that there are buildings, but it seems that there are no 11 kV lines and low voltage lines in the area. To confirm this point, Figure 8.3.9 describes the power facilities on the satellite image. In the said figure, the 11 kV line shown in orange colour is running from the left side but stops at the centre of the figure. As another example, the red lines which represent low voltage lines can be seen in the left part of the the figure, but there are no red lines in other areas. On the other hand, it is no wonder that these buildings can utilise electricity. Therefore, the GIS data is thought to be uncompleted yet.



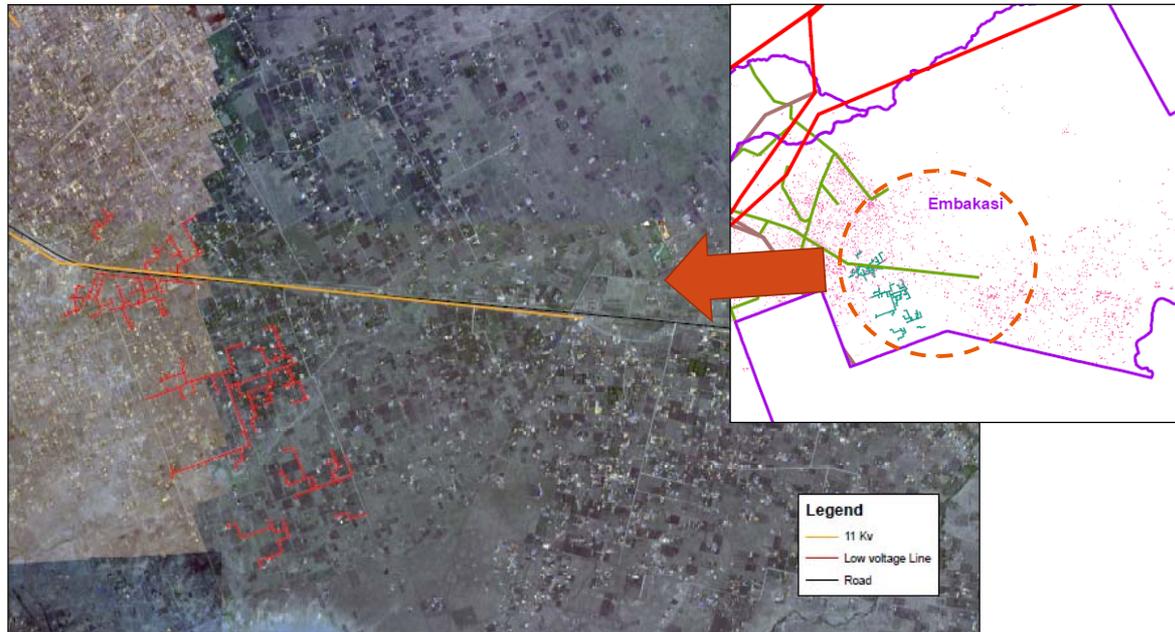
Source: JICA Study Team (JST) based on Kenya Power

Figure 8.3.7 GIS Data of Kenya Power



Source: JICA Study Team (JST)

Figure 8.3.8 Combination of GIS Data of Kenya Power and JST



Source: JICA Study Team (JST)

Figure 8.3.9 Data of Power Facilities in Embakasi

From this, it is required to forward the GIS data to Kenya Power. According to an official of Kenya Power, progress has been seen in the current GIS data, and continuous updating work is expected. Besides, the current GIS data has no underground information, so the information is recommended to be added to GIS.

(4) Gas Distribution for Buildings

Liquefied petroleum gas (LPG) which is a product of fractional distillation of crude oil has wide and increasing domestic and commercial use in Nairobi City. Various oil companies have facilities where they fill the LPG into gas cylinders of 6 kg, 13 kg, 25 kg, and 50 kg which are sold to consumers.

In Kenya, there are no gas pipelines for distributing gas to household and commercial premises. When gas is exhausted in the cylinders, the consumers exchange the empty cylinders with filled ones at a cost. Even though consumers do not bring cylinders to a facility for filling gas, a person from the oil company comes to the consumer's house or shop and exchange empty cylinders with full cylinders. The average cost for refilling 6 kg and 13 kg cylinders is KSh1,200 and KSh2,500, respectively. The various oil companies have different retail names for their LPG products like TotalGaz, K Gas, Hashi Gas.

Taking into account this condition, NCC and the infrastructure sectors discussed the problem and hoped to realise the construction of distribution pipelines to eliminate use of gas cylinders. In Kenya there are more than ten oil companies that sell LPG to customers, and it does not seem easy to implement the distributed pipeline in NCC. If the pipelines will be constructed by development partners such as WB or JICA for a particular gas company to utilise, it would be unfair for other companies. Because of the competition amongst gas companies, constructing the pipelines does not seem to be an easy task for NCC.

8.3.2 Development Policy

From the demand and gap analysis, two points are set for development policy of the power sector, i.e., appropriate planning for the energy sector and development based on the concept of sub-centres.

(1) Appropriate Planning for the Energy Sector

This is the policy for effective and appropriate planning, not to plan with excess design. From the previous section, there seems to be excessive capacity in planning and design. For example, according to the analysis of demand forecast, the existing demand forecast is substantially higher than the PDF. As another example, the wayleaves and minimum clearance of overhead lines are higher than the regulation of other countries. Therefore, appropriate planning is needed for the current energy sector.

(2) Development based on the Concept of Sub-centres

The main overall objective of NIUPLAN is to implement sustainable urban development and the improvement of living conditions in Nairobi City. Hence, the energy sector needs to assist partly in this objective. For example, as already mentioned, the Dandora area can be the place to be assisted by the power sector. Although there is much area of power-line wayleaves in Dandora under the current condition, this area is assumed to become sub-centres. Therefore, effective use of the lands currently used for power lines may be considered.

8.3.3 Priority Projects

As the priority project, the following table can be listed.

Table 8.3.5 Priority Projects

Priority	Project	Estimated Cost	Implementing Organisation	Possible Funding Source
1st	Amendment for Technical Criteria of the Overhead Line	US\$0.5 million	Kenya Power	ODA (Technical Cooperation)
2nd	Reviewing the LCPDP	US\$0.5 million	Energy Regulatory Commission	ODA (Technical Cooperation)
3rd	Development of the System for Map Information Sharing	Refer to Section 9.4.2 Management Proposal of GIS Data		
4th	Development of Underground Cable in Dandora Area	US\$10 million	NCC	ODA Loan
5th	Power Supply for Dandora Industrial Area	US\$5 million	NCC	ODA Loan

Source: JICA Study Team (JST)

The first, second, and third projects are for appropriate planning for the energy sector in line with the development policy. The rest of the projects are for development based on the concept of sub-centres. These projects are set as priority projects of the power sector and the following explains the detail:

(1) Amendment for Technical Criteria of the Overhead Line

As first priority project, the Amendment for Technical Criteria of the Overhead Line” needs to be executed. This project will review the current wayleaves regulation and current minimum clearance for overhead line. The background for the project is mainly for the following four accounts:

- (i) First account is that a range of wayleaves in Kenya seems excessive. Comparing the range of wayleaves in Kenya with that of Japan, the wayleaves in Kenya are larger than the Japanese range of wayleaves. Moreover, the range of wayleaves, where it is assumed that steel towers and power poles have collapsed, have not been previously reviewed;
- (ii) Next point is the minimum clearance. Minimum clearance over 132 kV from electrical wires to buildings is much larger than other countries. Thus, there is still a necessity to review the regulation;
- (iii) NCC is expected to develop or utilise their land more effectively in the future. As the economy of NCC grows steadily, the land within NCC is much needed for housing units, offices, and commercial facilities; and
- (iv) If the land for overhead line is reduced, the cost to an electric power company might be reduced and might possibly decrease electricity tariff for consumers.

The project has two objectives. One is to reduce the cost of wayleaves for an electrical power company and the other is to reduce the land of overhead line, so that the land could be used more effectively for NCC. The project is assumed to be carried out in consideration of the following viewpoints:

- (i) The technical criteria may be revised in consideration of construction techniques, quality of electrical power equipment, and safety; and
- (ii) The project will review the criteria of Kenya in comparison with other country’s technical criteria. From the comparison and investigation, the criteria of Kenya may be revised.



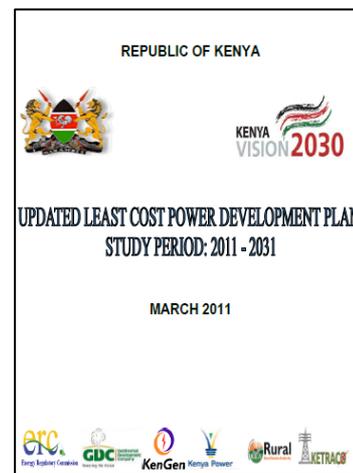
Source: JICA Study Team (JST)

Figure 8.3.10 Current Wayleaves of Transmission Lines

(2) Reviewing the LCPDP

Review of LCPDP is proposed for the future project.

In Section 4.6.1, the LCPDP was referred to in relation to electrical demand. The chapter concluded that review of the GDP growth rate and future population forecast are recommended. Hence, if the power sector of Kenya has the ability to review LCPDP without an external consultant to help, this project is not needed. If they need external consulting services, the proposed project should be required. Actually, LCPDP was made by the power sector of Kenya together with the AFD assistance. Therefore, it is possible to require the consulting services for revising LCPDP.



Source: Energy Regulatory
Commission

**Figure 8.3.11 The Latest
LCPDP**

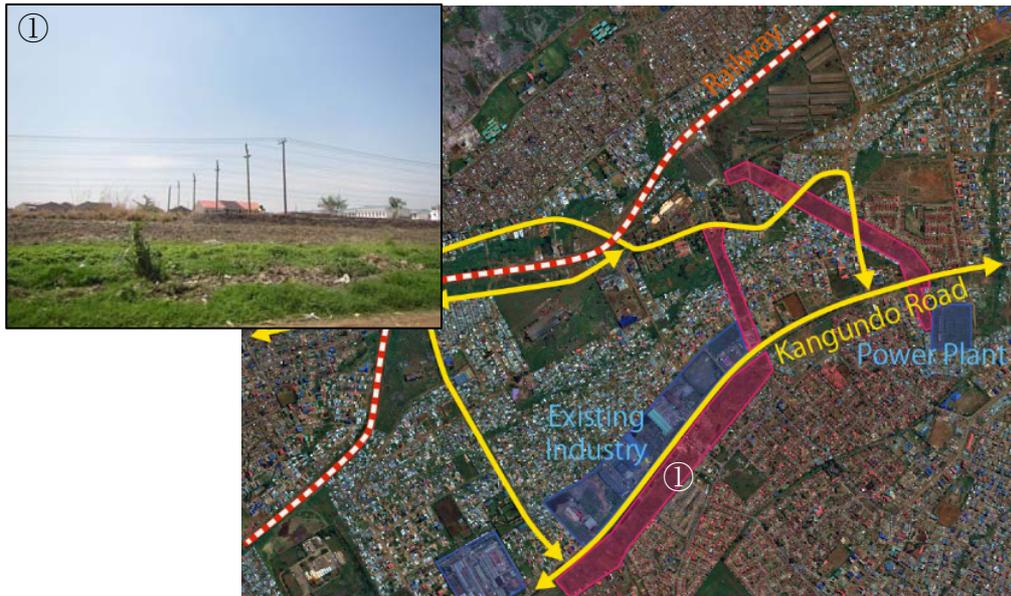
(3) Development of the System for Map Information Sharing

As the third priority project, it may be needed to develop the system for map information sharing with NCC, Kenya Power, and other infrastructure sectors. Information sharing of map was discussed by using GIS in Section 4.6.1. As a result of the discussion, it was clear that much data of actual situation has been reflected in the GIS by Kenya Power.

However, there are some problems in sharing map data. The main point of the problem is what kind of data is needed for other sectors such as NCC and the infrastructure sectors. Although the information of underground cable is needed for those sectors at least, they do not grasp each other's requirements for mapping. Therefore, first of all, it may be important to understand the requirement of other concerned parties. Second, construct a system of information sharing. There is no circumstance to share GIS at the current condition, and if this project starts, building the system of map sharing may be needed from scratch.

(4) Development of Underground Cable in Dandora Area

The next priority project is the development of underground cables in Dandora area, which is one of the proposed sub-centres. As mentioned earlier, the Dandora area has more than 30 ha of land used for power line wayleaves and the development concept of sub-centres demands the utilisation of the wayleaves. From this view point, installation of underground cables can be considered as a practical option. Specifically, the area along Kangundo Road with a length of 2 km, which is shown in Figure 8.3.12, can be proposed for underground cables.



Source : JICA Study Team (JST)

Figure 8.3.12 Proposed Industry Area along Kangundo Road in Dandora

In order to implement the project, the following three points need to be considered:

- (i) Firstly, there will be a need to decide who should bear the costs for the construction of the underground cables. The existing overhead lines are Kenya Power's property, but Kenya Power does not need to replace the overhead lines with underground cables. On the other hand, NCC hopes that Kenya Power will replace them. Therefore, there is a need to establish which part should be shouldered by NCC or Kenya Power. Furthermore, a scheme with a third party is also conceivable;
- (ii) The second point is to define the concrete construction area in Dandora. The purpose of the construction of underground cables is to utilise the vacant land after the overhead line. Thus, before discussing underground cables, first, there is a need to define which area is industrialised; and
- (iii) The third point is to study the type of underground cable. Although Subsection 4.6.1 introduced three types of underground cables, each type should be studied considering technical aspects, costs, and operation, etc.

(5) Power Supply for Dandora Industrial Area

As the previous fourth project is described, the Dandora area is the proposed sub-centre. Moreover, the area along Kangundo Road was considered to become an industrial area, and the total site for the industrial park is 45 ha. Because of this concept, power supply for the area is required when industrialisation is realised.

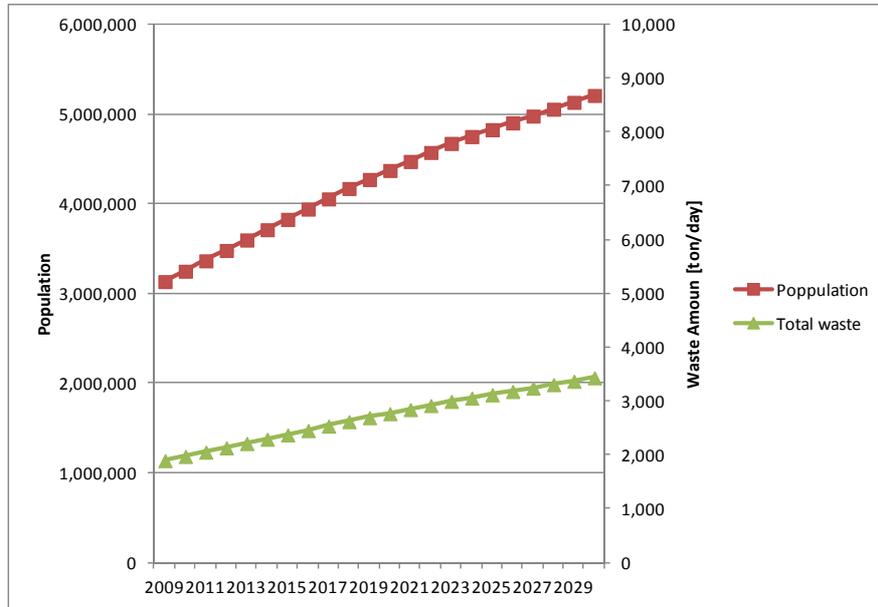
In this project, there is a need to construct transmission lines from a substation to the Dandora industrial area. There are two substations near the proposed industrial area and both substations, Juja Substation and Dandora Substation, are about 1 km from the industrial area. Moreover a substation inside the industrial area and distribution lines are needed.

8.4 Solid Waste Management

8.4.1 Demand and Gap Analysis

(1) Basic Condition of Demand Analysis

Future amount of solid waste generation is projected based on the socioeconomic framework of this study as shown in Figure 8.4.1.



Source: JICA Survey Team (JST)

Figure 8.4.1 Waste Generation Project based on Population

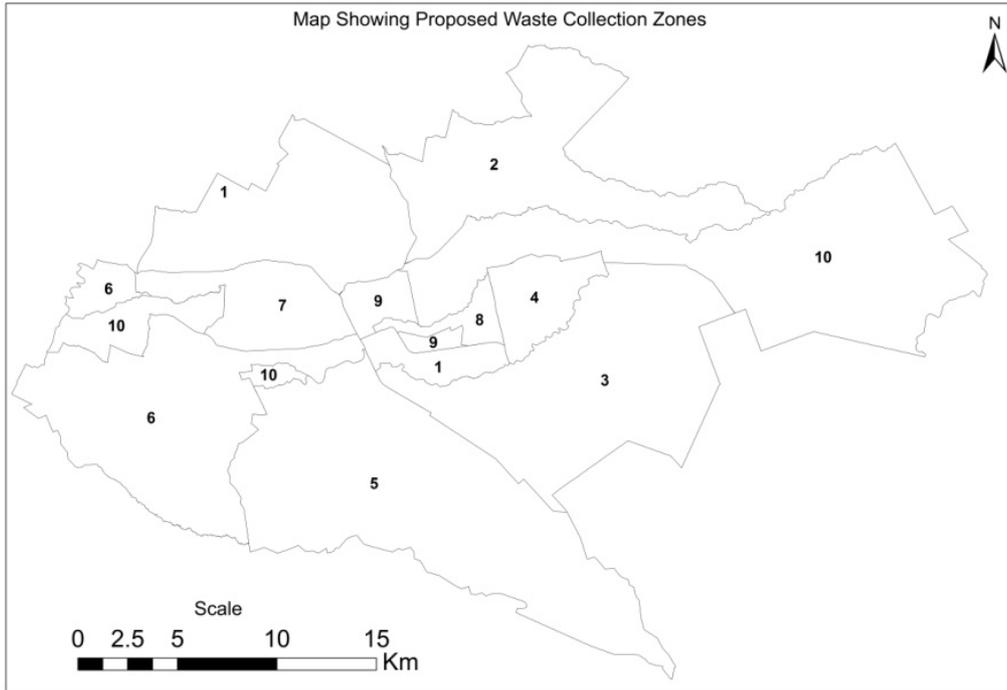
According to the JICA Solid Waste Management (SWM) Survey (2010), the collection is separated for every collection zones in consideration of income levels.

Based on the total population projection in this study, the population projection for collection zones (refer to Figure 8.4.2) is summarised as Table 8.4.1.

Table 8.4.1 Projected Population in Each Collection Zone

Name of Collection Zone	2013	2018	2023	2030
Collection Zone 1	197,724	235,405	268,699	304,618
Collection Zone 2	343,333	406,378	461,147	518,525
Collection Zone 3	401,897	475,141	538,545	604,549
Collection Zone 4	482,778	574,086	654,493	740,737
Collection Zone 5	214,232	257,613	296,949	341,215
Collection Zone 6	234,453	275,657	310,699	346,013
Collection Zone 7	182,367	223,132	261,512	307,223
Collection Zone 8	119,909	127,887	133,917	138,561
Collection Zone 9	156,270	163,750	169,403	173,757
Collection Zone NCC/SWMP	1,268,388	1,435,904	1,582,306	1,737,302
Total (Residential)	3,601,351	4,174,952	4,677,671	5,212,500

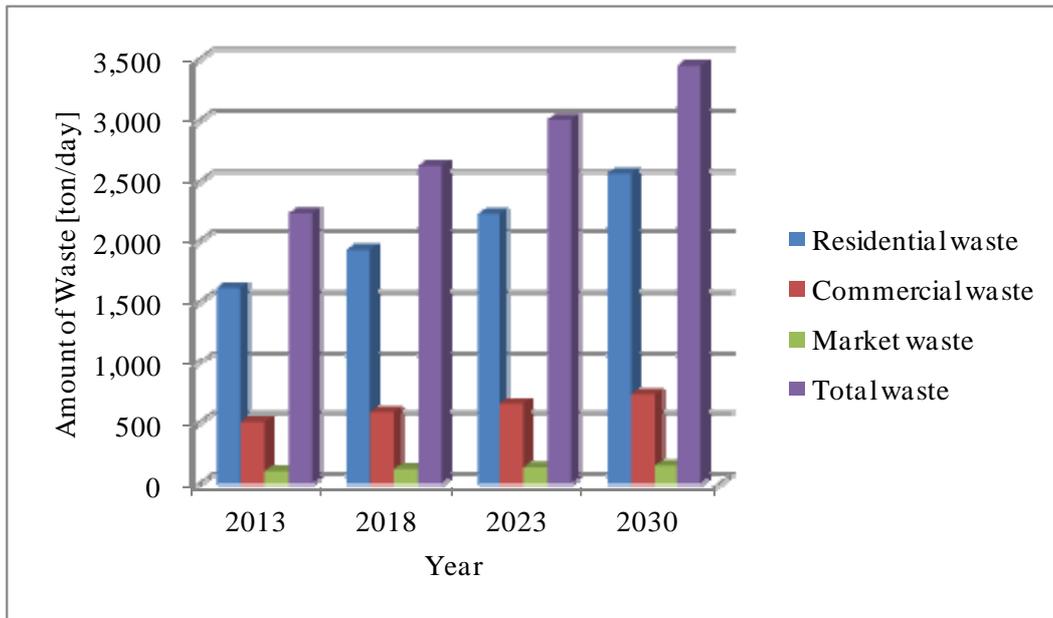
Source: JICA Survey Team (JST)



Source: JICA Survey Team (JST)

Figure 8.4.2 Map of Each Collection Zone

According to the JICA SWM Survey (2010), future solid waste amount by year 2030 is projected based on the field survey conducted in 2010. As there are no other field survey data from 2010 to 2013, it is assumed that there is no significant change in solid waste generation during the period. Therefore, the unit generation ratio of solid waste used in 2010 and the projected socioeconomic data in this study will be used in this demand analysis. Based on the assumption, the estimated solid waste is shown in Figure 8.4.3.



Source: JICA Survey Team (JST)

Figure 8.4.3 Estimated Solid Waste Projection

According to the above Figure 8.4.3, the amount of generated waste in 2030 will be approximately 1.5 times as that of 2013. In addition, there are many issues related to solid waste management. While the solid waste collection, transportation, treatment, and disposal system are not sufficient, which cause environmental issues like illegal dumping or pollution of the surrounding environment as discussed in Subsection 4.2.7. Main gaps from the current desirable situation are shown in Table 8.4.2.

Based on the demand of solid waste generation and disposal, it is necessary to prepare the development of the collection and transportation system and waste disposal and treatment system.

Table 8.4.2 Current Situation of Solid Waste Management and its Gaps between Desirable Situations

Item	Current Situation	Demand/Desirable Situation	Gap
Waste Generation	Generated waste is not properly treated and there is no suitable action for waste reduction.	All the generated waste is treated properly.	Suitable system of solid waste based on the projection should be developed.
Collection and Transportation	The ratio of collection and transportation is less than 50%.	The collection ratio should be almost 100% to prevent illegal dumping.	Necessity of collection and transportation system.
Reuse and Recovery System	Reuse and recovery is carried out by waste pickers for only a part of recyclable waste in illegal dumping site, waste collection points, and the Dandora Dumping Site.	Recycling system of suitable scale is necessary.	Recycling system at community level should be developed.
Waste Disposal	Waste is disposed in the open dumping site in Dandora, which causes pollution problem to the surrounding environment.	Waste should be disposed of in a sanitary manner through a suitable waste disposal method.	A sanitary landfill site is necessary.
Institutional Framework	There is no comprehensive institutional framework for solid waste management.	Comprehensive institutional framework for solid waste management and future establishment of recycling-based society.	Establishment of the revision of the law and new regulation is necessary.
Financial Situation	There is little capacity to cover the solid waste management by the current waste collection tariff.	It is necessary to increase the revenue from waste collection tariff, benefit from 3R activities, and subsidy as well as reduction of expenditure.	Improvement of the current financial system of solid waste management is necessary.

Source: JICA Survey Team (JST)

(2) Future Waste Stream and Future Demand of Each System

Currently, some of the wastes are illegally dumped which causes environmental pollution in NCC. In addition, it is necessary to implement the 3R (Reduce, Reuse, Recycle) activities to divert wastes into the landfill site to prolong its life as well as reduction of collection and transportation costs as considered in the JICA SWM Survey (2010). The target collection, diversion, and disposal rates set as target indicators are follows:

$$WCR_i = WCA_i / WGA_i$$

$$WDIVR_i = WDIVA_i / WGA_i$$

$$WDISR_i = WDISA_i / WGA_i$$

Where, WGA_i is the amount of waste generated in a year i

WCA_i is the amount of waste collection in a year i

$WDIVA_i$ is the amount of waste disposal in a year i

WCR_i is collection ratio in a year i

$WDIVR_i$ is diversion ratio in a year i

$WDISR_i$ is disposal ratio in a year i

The target indicators in each year are shown in Table 8.4.3.

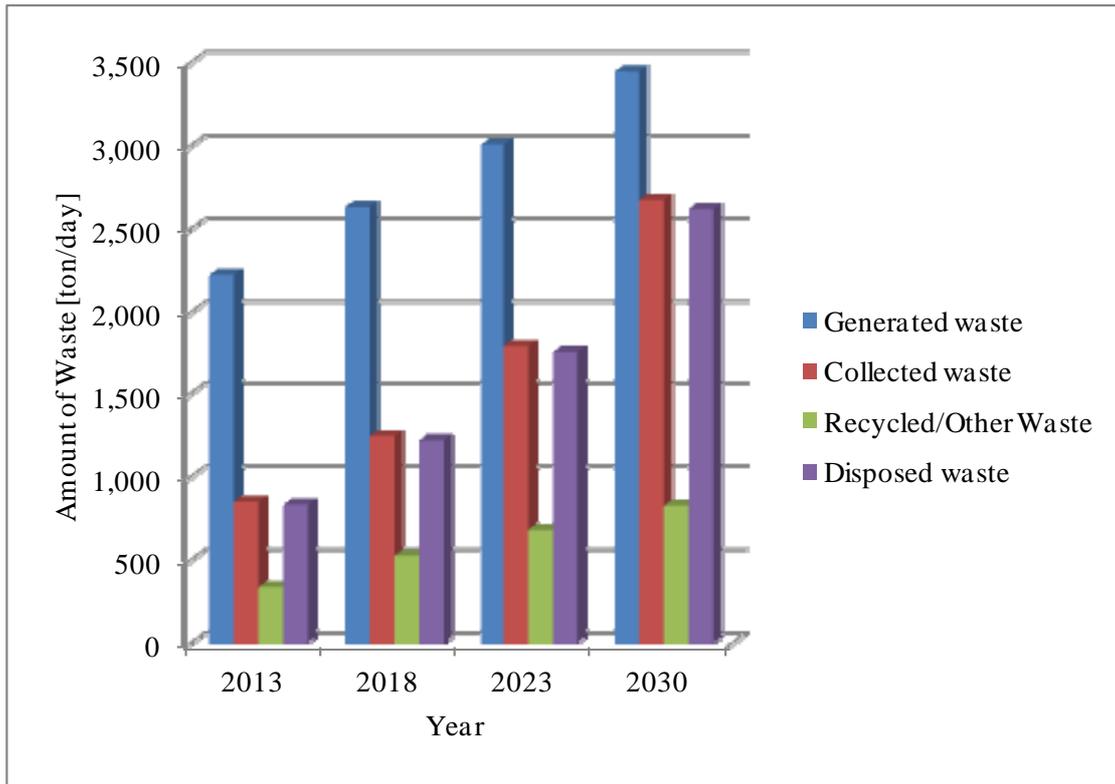
Table 8.4.3 Target Indicators for Future Waste Stream

Item	2013	2018	2023	2030
Collection Ratio	38%	47%	60%	78%
Diversion Ratio	15%	20%	23%	24%
Disposal Ratio	37%	46%	59%	76%

Source: JICA Survey Team (JST)

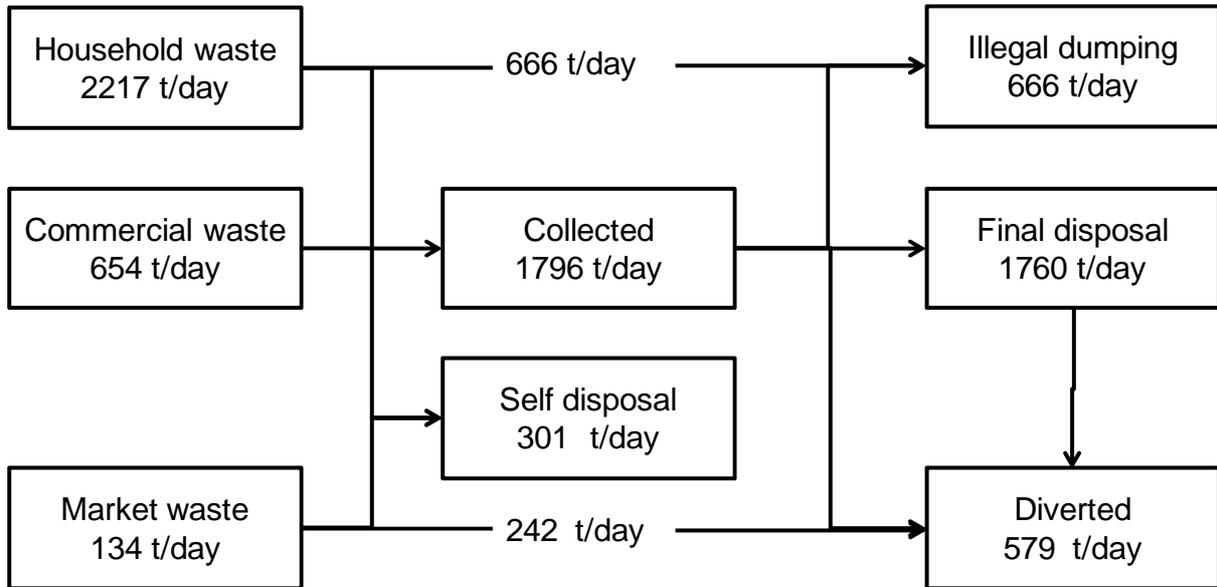
Future projection on the amount of generated, collected, recycled, and other wastes and disposed waste are calculated based on the target indicators shown in Table 8.4.3 above.

In addition, the waste stream in 2023 and 2030 is shown in Figure 8.4.5 and Figure 8.4.6.



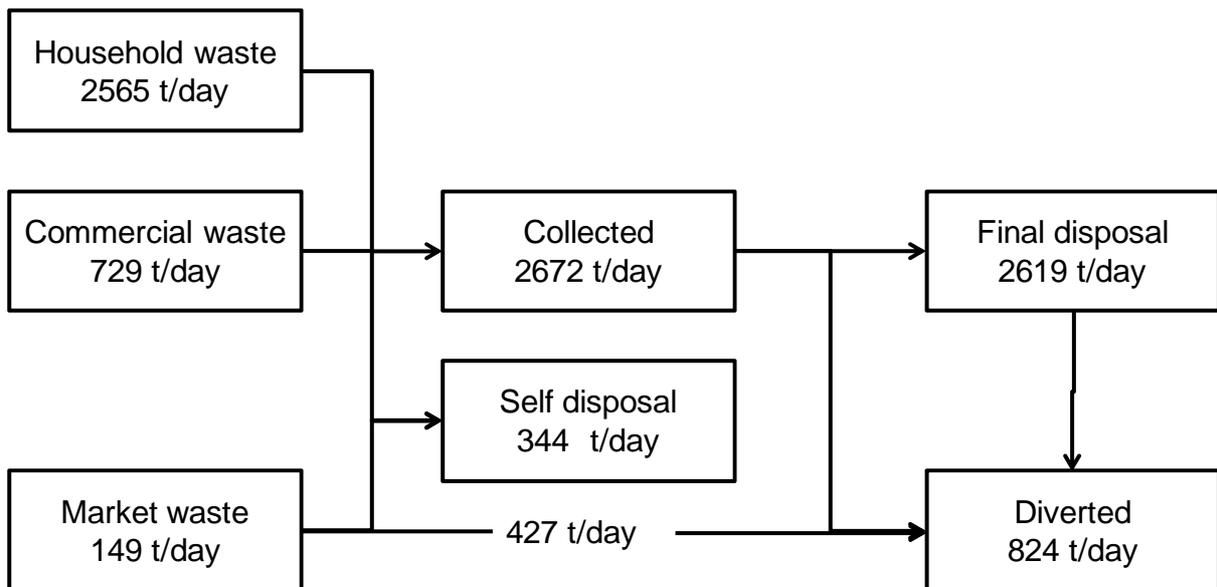
Source: JICA Survey Team (JST)

Figure 8.4.4 Estimated Solid Waste Projection



Source: JICA Survey Team (JST)

Figure 8.4.5 Estimated Solid Waste Projection in 2023



Source: JICA Survey Team (JST)

Figure 8.4.6 Estimated Solid Waste Projection in 2030

8.4.2 Development Policy

(1) General Development Policy of Solid Waste Management

Based on the proposal of JST and the discussion in the TWG, “clean” and “safe” are two of the keywords for the development of NCC. The purpose of solid waste management is mainly to ensure safe and clean environment for the people by reducing and removing the hazardous, toxic, and infectious materials with suitable treatment and disposal. This process has to be carried out in consideration of the technical, financial, and organisational aspects toward environmental friendly society as well as in line with the change of life style towards less environmental impacts. In this context, the development policy of the solid waste management sector is set as follows:

- 1) Application of feasible methods of waste management in terms of environmental, social, economic, and technical aspects to keep a clean and safe environment for the people;
- 2) Development of a system to manage various stakeholders including private contractors, licensed private companies, waste dischargers, and waste pickers; and
- 3) Implementation of capacity development for target organisations and staff in a suitable manner.

(2) Responsibility of Relevant Organisations and Stakeholders

There are various relevant organisations and stakeholders related to solid waste management in NCC. Amongst the organisations, NCC has the main responsibility for the implementation of solid waste management. The responsibilities of relevant organisations are clarified as shown in Table 8.4.4.

Table 8.4.4 Responsibility of Relevant Organisations and Stakeholders

Organisation/Stakeholder	Responsibilities
Central Government (National Environmental Management Agency)	<ul style="list-style-type: none"> - To formulate national law and regulations related to solid waste management. - To prepare solid waste management plan in the national level. - To prepare the guidelines and technical standards. - To provide guidance to local governments.
Nairobi City County	<ul style="list-style-type: none"> - To formulate the local policy of Nairobi City County - To implement and finance solid waste management in Nairobi City County
Private Contractors	<ul style="list-style-type: none"> - To provide waste collection, transportation, and street sweeping services based on the contract.
Business Waste Generators (Industrial and Commercial)	<ul style="list-style-type: none"> - To manage their waste except the municipal waste handled by the local government.
Residents	<ul style="list-style-type: none"> - To comply with the law and regulations related to solid waste management. - To reduce waste generation and recycle the recyclable waste. - To discharge the waste to determined places and time. - To burden the waste collection service fee based on polluters pay principle.

Source: JICA Survey Team (JST) based on the hearing with NCC

(3) Planning Strategy of Solid Waste Management

Based on the general development policy, the planning strategy is formulated as follows:

1) Collection and Transportation Plan

It is necessary to consider an effective collection and transportation system for maximum service provision with utilisation of current resources such as equipment and human capacity. In this moment, there are so many private companies which implement solid waste collection services but it is focused only on high income areas, which have the capacity to pay the tariff waste collection service. NCC cannot supervise such activity with so many private companies. Therefore, participation of a few private companies which has the capability of collecting and transporting solid wastes is necessary. It may also be necessary to introduce a franchise system for collection and transportation services for the comparatively higher and middle-income areas in consideration of the balance of income level, and introduction of collection by the public for low-income or slum areas.

2) 3R and Intermediate Treatment Plan

It is necessary to introduce the 3R system and intermediate treatment system to divert wastes to be disposed in the landfill site. In this context, the waste characterisation in NCC should be considered as well as with the financial and technical capability of the existing organisations. The calorific value of the waste generated in NCC is too low to consider incineration or gasification, and organic waste occupies the higher portion of waste composition. However, it

will be difficult to introduce large-scale compost or methanisation technology because the technology needs slightly higher technical capability. Therefore, small- or middle-scale composting will be considered as 3R and intermediate for NCC.

3) Final Disposal

The final disposal is necessary for waste disposal and treatment as one of the cheapest and technical feasible options. However, the current final disposal method of NCC is open dumping which causes environmental deterioration in the surrounding environment. To improve this situation, the development of a sanitary landfill site and its operation procedure should be considered taking into account its financial and technical capability. The safe closure of the existing dumping site should be considered in parallel with the development.

4) Organisational Restructuring Plan

The development of the organisational capacity is critical to manage the private contractors and franchised company as well as improvement of the operational capacity of direct collection and transportation.

5) Legal and Institutional Improvement Plan

The related acts, regulations, and by-laws should be improved for better enforcement of solid waste management in consideration of a PPP structure, tariff setting, proper zoning, and cross-subsiding system as well as future 3R society.

6) Financial Management Plan

It is necessary to establish a special account for solid waste management in consideration of possible increase of revenue and budgetary allocation as well as waste collection charge.

7) Private Sector Participation Plan

Private sector participation is crucial for effective solid waste management. It is important to establish a management system for the private sector in consideration of suitable schemes such as introduction of a franchise system.

8) Community Participation Promotion Plan

Public education is important for effective solid waste management, especially in the low income or slum areas in case of NCC as there may not be sufficient roads for solid waste collection and transportation services. Source segregation system in community base or waste bank system should be considered in community participation plan as well as environmental education in schools.

(4) Consideration of Technical Options

In the JICA SWM Survey (2010), technical options have been considered for collection, transportation, treatment, and final disposal. These options are considered to be valid in the present study, as summarised below.

1) Treatment and Disposal

Considering the current financial situation and technical and organisational capacity of NCC, the easiest feasible technical option considering financial and technical aspects, especially for short term should be selected. According to the waste characterisation survey in the JICA SWM Survey (2010), the low calorific value of waste is approximately 3,300 kJ/kg, which is

considerably lower than the required average value for incinerators without power generation, which is approximately 7,500 kJ/kg in Japan. The low calorific value is considered to be too low to adopt the incineration technology. If NCC will not succeed in segregating biodegradable wastes that have high moisture contents, incineration is not a suitable technology.

For organic wastes, the methanisation also needs high technical skill for operation and requires appropriate segregation before the treatment. In this context, the combination of the segregation of plastic, paper, and metal for 3R and small-scale composting will be an adoptable technology. The residual waste should be disposed of in a sanitary landfill site.

Table 8.4.5 Merit and Demerit of Each Technical Option for Treatment and Disposal

Options	Merit	Demerit
Landfill	- Comparatively cheaper option - Technically feasible	- No waste reduction
3R+Landfill	- Comparatively cheaper option - Technically feasible	- If no cooperation with waste generator, there is not enough waste reduction
3R+Incineration+Landfill	- Effective volume reduction of wastes	- Expensive for initial cost and O&M cost
3R+Composting+Landfill	- Effective volume reduction of organic wastes - Not an expensive option	- Waste separation is necessary and there is a need to market the compost

Source: JICA Survey Team (JST)

Considering the merits and demerits of the options for treatment and disposal, it will be better to select the option of “3R+Composting (including home composting and community composting)+Landfill” will be the most suitable option for waste treatment in NCC.

2) Collection and Transportation

According to the JICA SWM Survey (2010), various technical options of the transport system including secondary transportation system for various site selection options have been studied in the economic aspects. Finally, the site for final disposal is selected in Ruai and direct hauling is recommended due to economic aspects. However, the directly hauled wastes will include recyclable materials for market or commercial wastes, which can be removed in the material recovery facility (MRF). In addition, the waste pickers may lose their jobs after the closure of the Dandora Open Dumping Site, if there is no other facility in Dandora. In this context, JST recommends the preparation of MRF for the segregation of wastes for recyclable and biodegradable in the Dandora Open Dumping Site.

8.4.3 Priority Projects

Based on the development policy, it is necessary to develop a new sanitary landfill site, carry out the safe closure of the existing dumping site and develop an MRF in Dandora. In addition, it is necessary to improve the collection and transportation system in consideration of financial and organisational requirements. Furthermore, promotion of 3R and the establishment and improvement of laws, regulations, and guidelines for effective solid waste management is necessary.

In this regard, the following projects are proposed as priority projects:

(1) Development of a New Landfill Site

As proposed in the JICA Preparatory Survey (2012), a new sanitary landfill is necessary for final disposal of residual wastes. In the JICA Preparatory Survey (2012), the project site is surveyed based on findings of the previous JICA SWM Survey (2010). The site was proposed in Ruai which is approximately 28 km from the central business district of Nairobi City. The whole area of 80 ha is owned by NCC, although the procedure of obtaining title deeds is still ongoing.

It is proposed that the new landfill will be for a total usage period of about 15 years and approximately 9.8 million tons of wastes will be disposed of in the landfill. In consideration of the soil for soil cover, in total, 13.1 million tons of waste and soil will be accumulated at the site for the entire design life of the project.

The following table shows the outline of the new sanitary landfill structure:

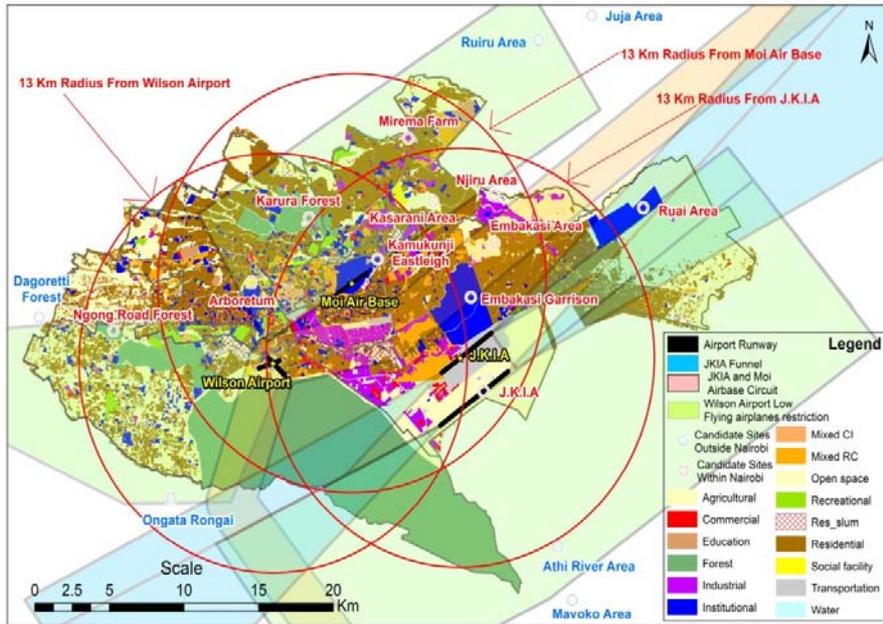
Table 8.4.6 Outline of the New Sanitary Landfill Structure

Category	Facility	Description	
Principal Facilities	Landfill	Waste disposal facility	Soil embankment for retaining solid waste
		Lining system	Waterproof liner using black cotton soil available at the site
		Leachate collection facility	Leachate collection piping network at the bottom of the disposal area
	Landfill gas exhaust facility	Distribution of landfill gas exhaust pipes	
	Leachate treatment facility	Anaerobic pond, facultative pond, coagulating sedimentation pond, etc.	
	Stormwater drainage	Prevention of rainwater flowing into the disposal area	
	Monitoring facility	Monitoring well	
Administration	Administration building	Office building and transport control station	
	Others	Weigh bridge, parking lots	
Others	Road network	Hauling road, access road, on-site road	
	Enclosure facilities	Fence, gate, etc.	

Source: JICA Survey Team (JST)

The sanitary landfill system will include the waste disposal area, a leachate treatment area, and a small area for administration. The semi-aerobic method will be applied for this sanitary landfill for quicker decomposition of organic matter in the accumulated waste and for reduction of the methane gas which is greenhouse gas. The system will prevent environmental pollution of the surrounding area.

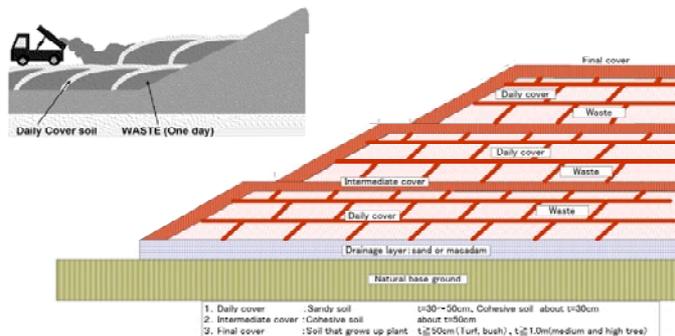
However, the Kenya Airport Authority (KAA) and the Kenya Civil Aviation Authority (KCAA) opposed to the proposed Ruai site, as it is on the flight path of the Jomo Kenyatta International Airport (JKIA). Although there are no international and local regulations that specifically prohibit the development of a landfill site in this location. In addition, they also opposed to the utilisation of the circuit area for take-off and landing in JKIA, Wilson Airport, and the army base. The restricted areas based on the suggestions of KAA and KCAA are shown in Figure 8.4.7. The restricted areas cover most area of NCC and all the possible candidate sites proposed in the JICA SWM Survey (2010) are in the restricted areas.



Source: JICA Study Team (JST)

Figure 8.4.7 Candidate Sites of New Landfill Site and Restriction Areas

Therefore, JST suggested the importance of the methods of soil cover during landfill operation for sanitary landfill site to protect disposed waste from birds, as well as the introduction of semi-aerobic landfill method such as leachate collection and treatment system, lining system at the bottom of the site by using black cotton soil, and gas collection system. The landfill area is divided into six sections of landfill areas which are designed by the JICA SWM Survey (2010).



Source: JICA Study Team

Figure 8.4.8 Image of a Cell Method Operation

Regarding the operation of this sanitary landfill, a cell method, in which the waste cell is covered with soil every day, will be recommended following the JICA Preparatory Survey (2012). In order to secure the reliability of this sanitary landfill activity, it is also strongly recommended to train the landfill operators with required skills. There are various methods to prevent birds in the landfill sites. JST suggested that a pilot project for sanitary landfill operation should be implemented by NCC with relevant stakeholders including NEMA, KAA, and KCAA as shown in Figure 8.4.9, as well as the preparation of site visits of the best practices in other areas and holding workshops with relevant stakeholders related to sanitary landfill and airport operations.

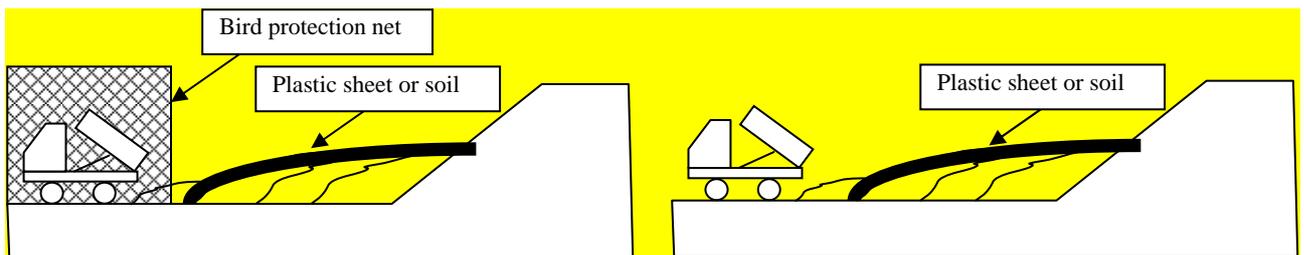


Figure 8.4.9 Image of Landfill Operation Options

(2) Safe Closure of the Existing Landfill Site

The site at Dandora has been utilised as the area for dumping wastes since 1981, and has gradually expanded to 46 ha. According to the current site boundary map provided by the City Planning Department of NCC to JST on 27 September 2011, about 1.5 ha of the area within the dumping site is currently privately owned. In addition, some structures such as houses and schools built by some private individuals and religious and community organisations have been observed and immediately around the dumping site.

Existing landfill of Dandora Dumping Site is poorly managed and the area is not designed for a sanitary landfill. In addition waste disposal in Dandora has exceeded the design capacity for landfill operation.

Considering the current conditions at the site, it is better to decommission the Dandora Dumping Site. The following design concepts should be applied for the decommissioning of the Dandora Dumping site as described in the JICA Preparatory Survey (2012):

- (i) Existing dumped waste shall not be transported outside of Dandora Dumping Site;
- (ii) Part of the NCC area where no waste has been dumped will remain in that state;
- (iii) A buffer zone should be secured for the surrounding environment;
- (iv) Waste located on the private land and the area adjacent to the project site shall be cleansed and removed from the project site; and
- (v) Environmental impact of leachate and bird strikes shall be paid to mitigate for environmental protection.

The following table shows the necessary facility and the role of the decommissioning of the Dandora Dumping Site:

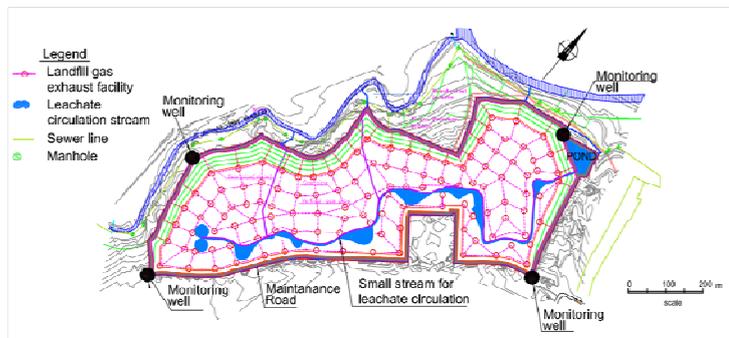
Table 8.4.7 Outline of the Decommissioning of the Dandora Dumping Site

Category	Facility	Description
Principal Facilities	Landfilling area	Disposal area shall be limited and controlled in accordance with the decommissioning plan and waste quantity to be continuously disposed of at the site until the Ruai site will become operational.
	Leachate collection facility	Concrete ditch with collection pipes along the boundary facing the Nairobi River
	Stormwater drainage	Prevention of rainwater from flowing into the closed dumping site
	Landfill gas exhaust facility	Distribution of landfill gas ventilation network
	Leachate treatment facility	Leachate storage pond and artificial stream
Administration	Monitoring facility	Distribution of monitoring wells
Others	Perimeter facility	Surrounding wall, gate etc.

Source: JICA Study Team based on the JICA Preparatory Survey in 2012

Some of the accumulated waste shall be moved to another part of the site with a stable slope and flat the surface of waste layer. Then, the surface cover soil will be put on the whole surface of the waste. The thickness of this final cover soil will be 1 m or more to protect the surrounding environment from waste layer.

Landfill gas will be captured by a gas collection pipe installed in the surface layer of the site and released to the atmosphere through gas ventilation pipes.



Source: JICA Preparatory Survey in 2012

Figure 8.4.10 Layout Plan of Decommissioning of the Dandora Dump Site

Leachate will be collected using a concrete ditch with collection pipe installed along the site boundary and will be diverted to the storage pond and tanks. The collected leachate will be circulated within the area by pumping it up to the small pond prepared and then allowing it to flow down to the pond through the artificial stream for evaporation and natural purification.

As mentioned above, development of the new landfill site in Ruai cannot be secured due to the opposition by KCAA, and NCC is considering using the Dandora Dumping site as an alternative measure. The use of the Dandora Dumping Site can be considered only if new technology can be applied to reduce the burden of environmental condition.

(3) Development of MRFs

According to the JICA SWM Survey (2010), there is a sizable quantity of biodegradable waste for composting and recyclable waste for recycling, based on the waste characterisation survey. For the diversion of such compostable and recyclable wastes, the development of material recovery facility (MRF) near the source of waste generation is crucial for effective solid waste management in regard to the reduction of transportation cost and the cost for segregation. Then, it is necessary to divert the waste from the landfill site to extend the life of the landfill site.

Basically, waste characteristics are different from various generation sources. Therefore, the waste at specific generation sources such as market or office will be the target waste in MRF for compost or recycling process, respectively.

The preliminary proposed flow of waste to MRF is as follows:

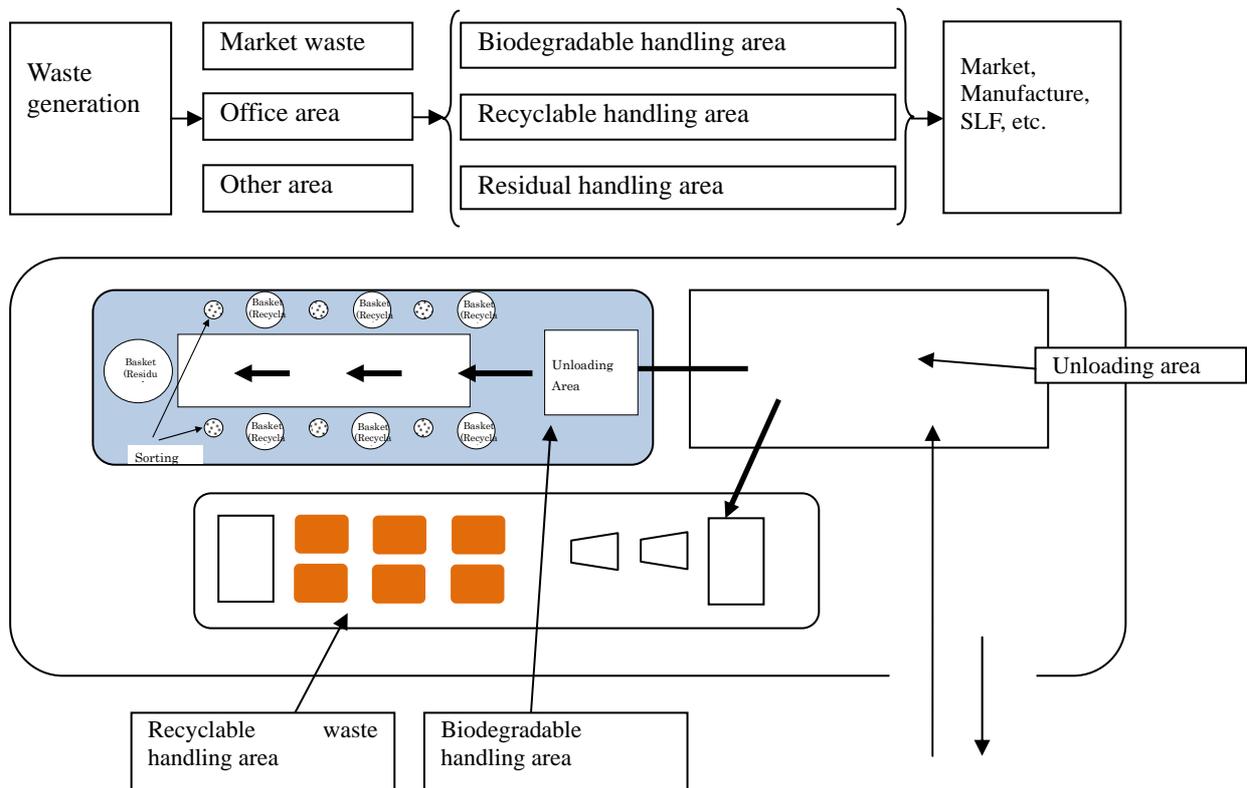
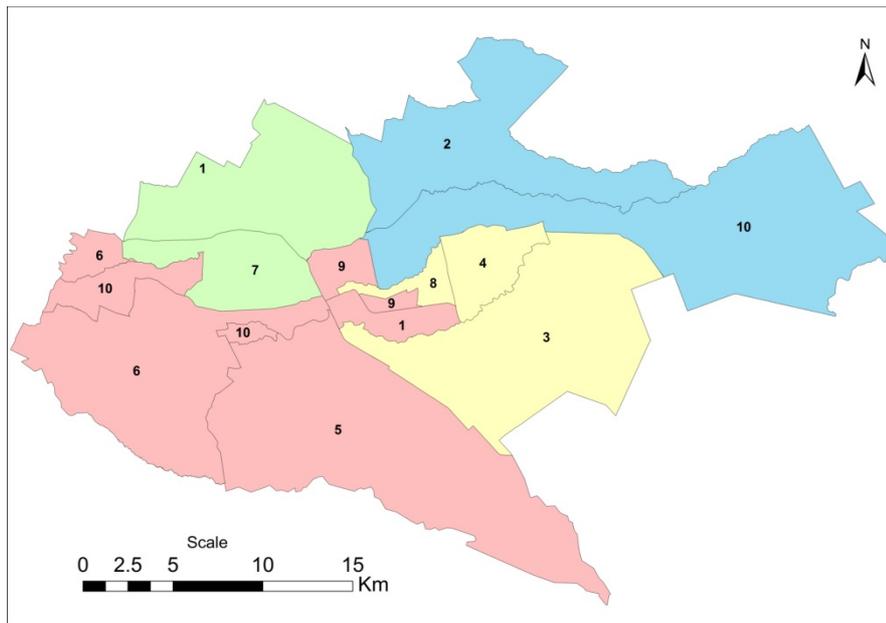


Figure 8.4.11 Image of the Operation of MRF

(4) Improvement of Collection and Transportation System

At present, solid waste collection and transportation services are provided by NCC, although there are a number of private contractors and registered private companies in NCC. In this situation, there are

various issues regarding the supervision of activities including the following: 1) Insufficient supervision of the private contractors and registered private companies, and 2) Unequal waste collection service charges for waste generators in each income level. To improve the condition, it is necessary to set up the collection zone by considering the socioeconomic level (especially, income level) in order to consider the waste collection service charges in each zone. Also the location of the collection zone and franchised system need to be examined to utilise the technology and know-how of each private company related to the collection and transportation services. In addition, waste diversion of market waste and other domestic waste after collection is recommended as described in Subsection 4.2.7, for which an MRF needs to be considered for waste separation. In this context, the collection and transportation area for each MRF are specifically proposed, as shown in Figure 8.4.12 with the number of zones and colour. Currently, the pilot project for zone 7 is being implemented in the JICA technical cooperation project.



Source: JICA Study Team

Figure 8.4.12 Collection Zone and Proposed Four Areas for the Transportation System

If the private sector participates in the collection and transportation service, NCC should supervise the activities of the private sector suitably. After the introduction of a franchise system, the franchise company will provide the collection and transportation service in one zone and manage the system under their own responsibility with the supervision of NCC. In this context, it is important to introduce a robust system as follows, as described in the JICA SWM Survey (2010):

- 1) Step-wise establishment of an operational zone based on cross-subsidy within the zone

In Nairobi City, income levels have been identified based on the poverty map prepared by WB. Based on the concept of affordability to pay (ATP), it is better to adjust the collection fee with the income level. Each zone in a franchise system should be in similar income level on average for each franchise company. In this context, the area of the zone and its location should be considered with the income level of waste generators as well as the location of zone. Therefore, the collection area is proposed in Figure 8.4.12 as described in the JICA SWM Survey (2010).

- 2) Suitable Collection System

Appropriate waste collection and transportation systems need to be considered to cope with the current waste generation source and type. As for collection, there are a number of options such as house to house collection and station collection. Station collection is suitable for

apartment or housing complex and possibly, in densely populated areas. Individual collection is suitable for detached housing areas and suburbs. As for the collection equipment, the merits and demerits of equipment shall be considered, and the selection of collection equipment should be in accordance with the area characteristics. The proposed collection method and collection equipment for each area is described as follows:

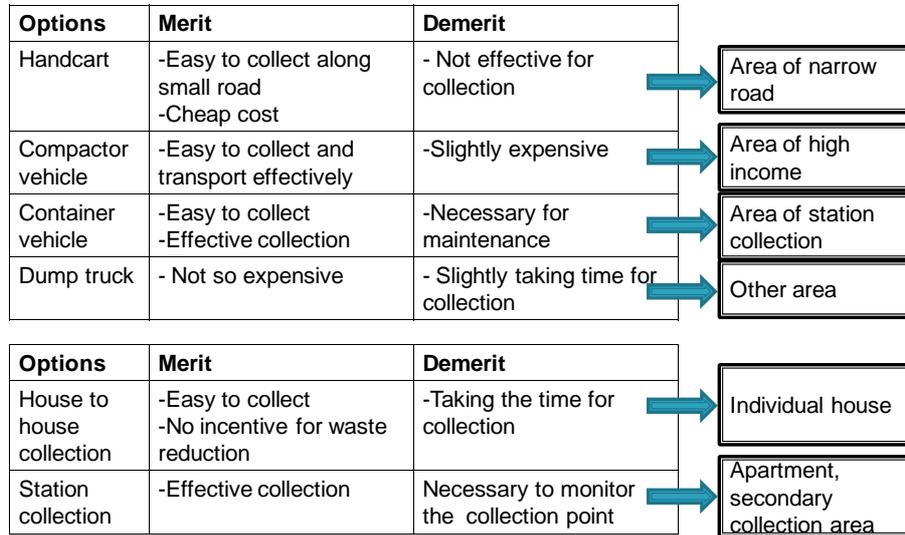


Figure 8.4.13 Proposed Collection Methods and Equipment

(5) Establishment and Improvement of Laws, Regulations, and Guidelines for Effective Solid Waste Management

While the Environmental Management and Coordination Regulation (2006) is the basic law in Kenya and the NCC bylaws of 2007 have been established, there are no specific regulations or guidelines for the planning and operation of solid waste management in the national and county levels. It is necessary to establish the institutional system in the national level. NEMA has the responsibility of solid waste management in the national level to set up the law, regulations, and guidelines. NEMA should take an initiative to establish the institutional system for solid waste management. The proposed system is shown in Figure 8.4.14, which includes the institutional system about basic laws on waste management and sound material-recycle society for future establishment of the regulation for promotion of utilisation of resources, regulation on the promotion of green purchasing, and regulations related to E-waste, etc..

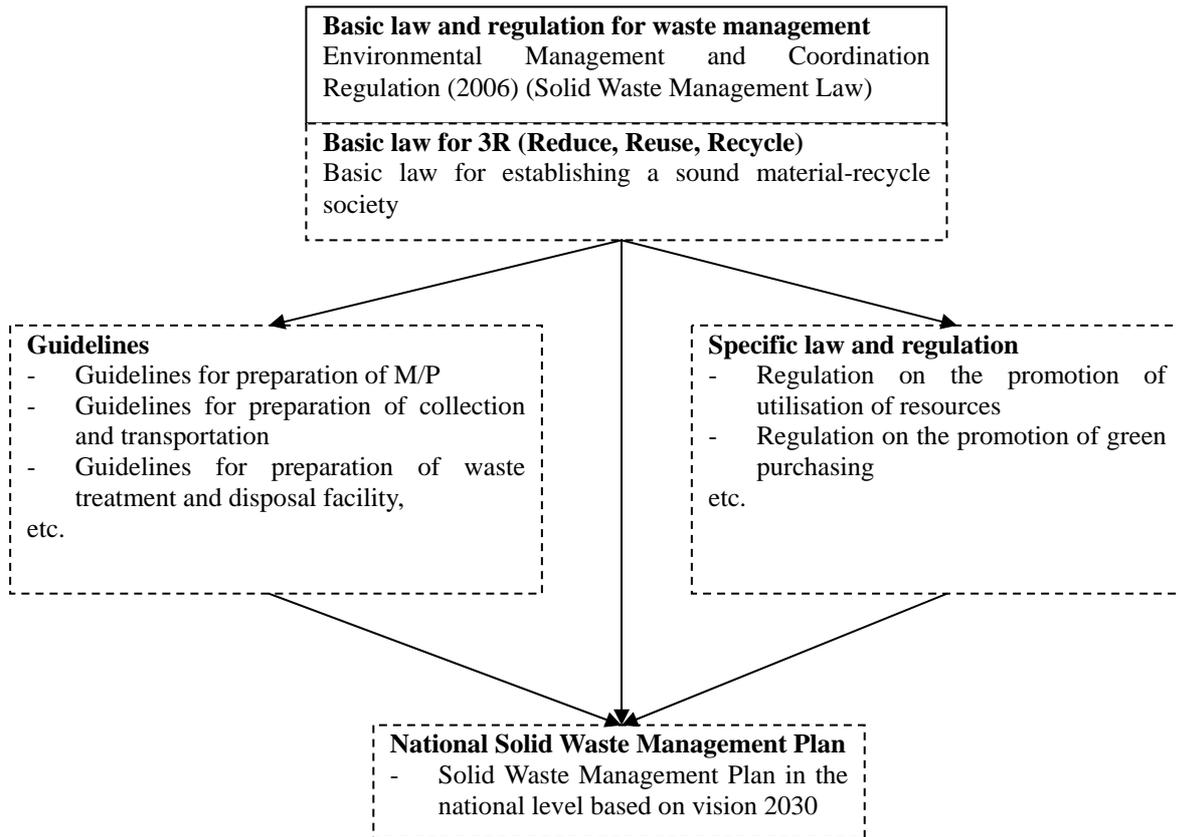


Figure 8.4.14 Image of Future Institutional System for Solid Waste Management

8.5 Telecommunications

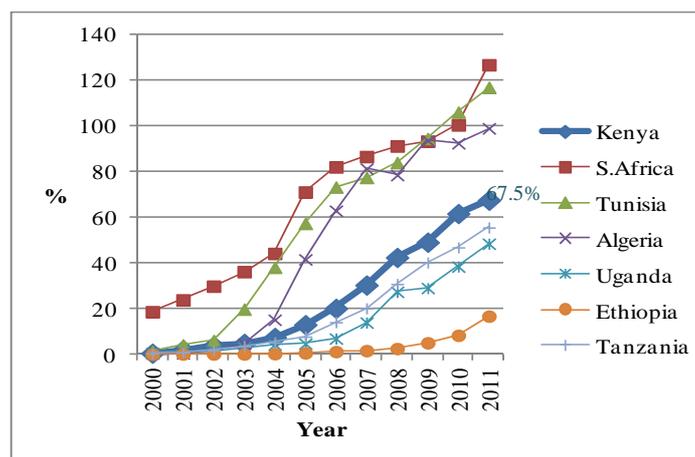
8.5.1 Demand and Gap Analysis

Future demand for telecommunications is calculated in consideration of the future population studied in this report and the world trends of the telecommunications sector.

(1) Mobile Telephone

Figure 8.5.1 shows the mobile penetration ratio of countries in Africa. The mobile penetration ratio of Kenya was 67.5% in 2011 according to the International Telecommunications Union (ITU) statistics and it is expected to reach 69% based on the Communications Commission of Kenya (CCK) sector statistics report (3rd quarter 2012/13). The mobile penetration ratio of South Africa, Algeria, and Tunisia started to rise after around 2005 while that of Kenya's neighbouring countries - Uganda, Ethiopia, and Tanzania - rose one year later. The growth rate of mobile penetration ratio in each country was nearly constant after the mobile penetration started to rise. On the other hand, as shown in Table 8.5.1, mobile penetration of G7 countries moved up at 50% points per decade on average. Applying this growth rate to calculate the future mobile penetration ratio in Kenya, mobile demand is expected to grow as shown in Table 8.5.2.

From Table 8.5.2, it is observed that mobile subscriptions will exceed the current capacity of mobile phones before 2018.



Source: JICA Study Team (JST) based on ITU statistics

Figure 8.5.1 Mobile Phone Penetration Ratio of African Countries

Table 8.5.1 Penetration Ratio of Developed Countries

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Growth Rate (2011)-(2001)
France	49.20	62.29	64.55	69.29	73.51	78.84	84.17	89.66	93.36	92.75	92.03	94.79	32.50
Japan	53.12	59.43	64.35	68.67	72.43	76.34	78.94	84.84	87.24	91.90	97.43	104.95	45.52
United Kingdom	73.80	78.32	82.96	91.03	99.66	108.75	115.76	121.25	125.24	130.17	130.76	130.75	52.44
United States	38.75	45.00	49.16	55.15	62.85	68.63	76.64	82.47	85.68	89.14	91.86	92.72	47.72
Germany	58.53	68.13	71.73	78.56	86.43	96.04	103.78	116.62	127.95	127.42	127.04	132.30	64.17
Canada	28.46	34.39	37.95	42.05	47.02	52.71	57.46	61.49	66.29	70.71	75.92	79.73	45.34
Italy	74.13	89.59	94.26	98.11	107.70	121.87	136.11	150.94	150.84	149.44	154.64	157.93	68.34
Average Growth Rate of the Decade													50.86

Source: JICA Study Team (JST) based on ITU statistics

Table 8.5.2 Mobile Telephone Demand

Year	2013	2018	2023	2030
Population	43,300,000	49,500,000	56,000,000	65,600,000
Mobile Penetration (%)	69	102	127	162
Estimated Mobile Subscriptions	29,849,336*1	50,490,000	71,120,000	106,272,000
Capacity	49,977,000*2			
Note				
*1: Sector Statistics Report Q3 2012/13 issued by CCK on July 2013				
*2: Figure of capacity is as of 2012 based on CCK Annual Report 2011/12				

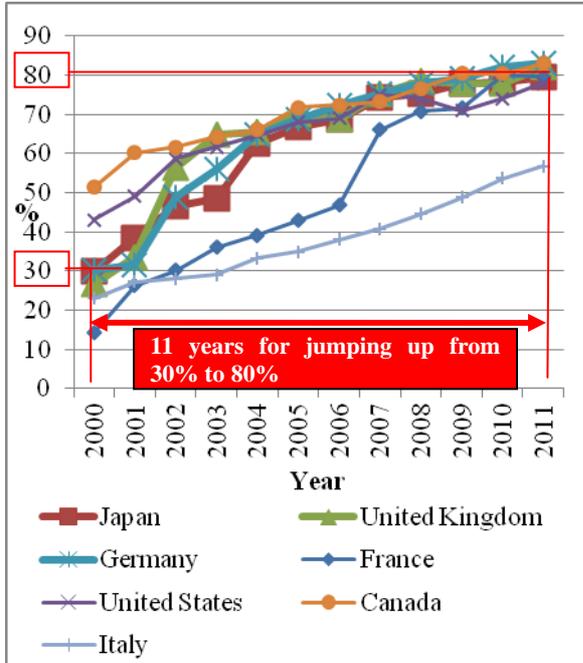
Source: JICA Study Team (JST) based on CCK Report

(2) Internet Use

Internet use penetration ratio in Kenya has been rising sharply and came up to approximately 28% in 2011 based on ITU statistics. This is due partly to the introduction of affordable internet access devices, including smart phones and social networking applications as well as aggressive promotion, special offerings, and reduced tariffs launched by operators. Furthermore, the internet use ratio is estimated to stand at around 37% in 2013, calculated based on the CCK sector statistics report in the 3rd quarter of 2012/13. From 30%, it took 11 years for the internet use penetration ratio of G7 countries to reach up to 80% (Figure 8.5.2). Furthermore, in Nordic Countries, where a much higher penetration ratio is seen, such as Norway, Sweden, and Iceland, it took approximately eight years for the ratio to rise from 80% to 90%. Applying this growth rate to calculate the internet use penetration in Kenya, the demand is assumed as shown in Table 8.5.3. Following the trend of developed countries

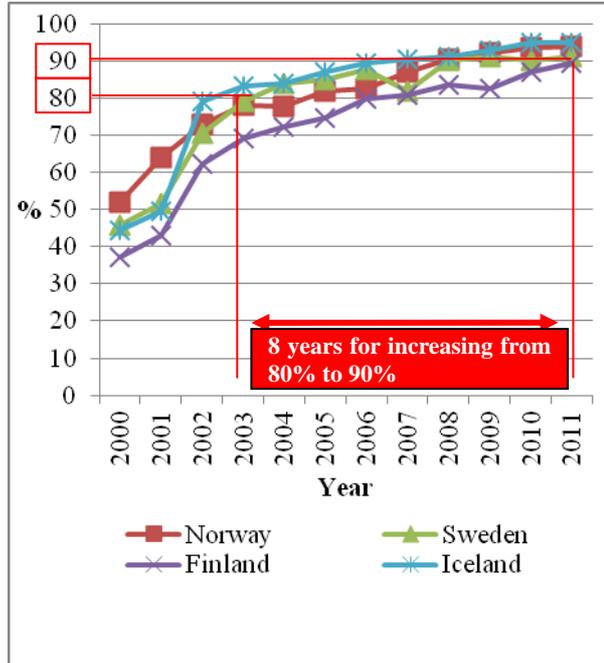
worldwide, the internet penetration ratio of Kenya will reach 60% by 2018, 81% by 2023, and 90% in 2030.

As seen on Table 8.5.3, it is expected that the majority of Kenya’s population will use the internet by 2030. With reference to the increasing internet penetration ratio, the expansion of the international communication bandwidth capacity to be connected outward through undersea cable and satellite will become necessary. Demand forecast for international communication bandwidth capacity is studied next.



Source: JICA Study Team (JST) based on ITU statistics

Figure 8.5.2 Penetration of Internet Use of Developed Countries



Source: JICA Study Team (JST) based on ITU statistics

Figure 8.5.3 Penetration of Internet Use of Nordic Countries

Table 8.5.3 Internet Use Demand

Year	2013	2018	2023	2030
Population	43,300,000	49,500,000	56,000,000	65,600,000
Internet Penetration (%)	37	60	81	90
Estimated Internet User	16,444,861*	29,700,000	45,360,000	59,040,000

Note

*: Sector Statistics Report (Q3 2012/13) issued by CCK on July 2013

Source: JICA Study Team (JST) based on ITU statistics

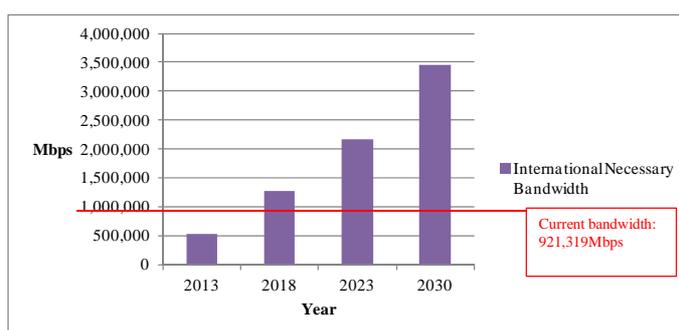
(3) International Communication Bandwidth Capacity

The international communications of Kenya is provided through undersea fibre optic cables and by satellite. The total international communication bandwidth capacity is 921 Gbps as of May 2013 according to the CCK sector statistics report (3rd quarter 2012/13). Amongst the total international communication bandwidth capacity, the capacity of the undersea fibre optic cables accounts for more than 99% while the satellite communication has little share. As for the undersea fibre optic cables, four undersea cable operators named SEACOM, TEAMS (The East African Marine System), EASSY (Eastern Africa Submarine Cable System), and LION2 (Lower Indian Ocean Network) land their undersea cables at Mombasa, on the East Coast of Kenya.

With the increase in the number of internet users, there is a need for the international communication bandwidth capacity to expand in order to provide smooth internet connection for users. Demand for international communication bandwidth capacity is studied based on the following assumptions listed below. Table 8.5.4 shows the result of demand forecast for international communication bandwidth capacity.

Assumption	
● Broadband subscription	:Linear increase
● Individual data usage per day	:3 GByte (broadband user) :300 MByte (narrowband user)
● International connection ratio	:0.7
(Not all data go outward through the undersea fibre optic cables and satellite communications)	

As shown in Table 8.5.4, although the current available international communication bandwidth capacity is 921 Gbps, the estimated international capacity will be 1,270 Gbps in 2018 as highlighted in green. This forecast shows that the international communication bandwidth capacity will exceed the current capacity before 2018 (Figure 8.5.4).



Source: JICA Study Team (JST)

Figure 8.5.4 International Communication Bandwidth Capacity Demand

Table 8.5.4 International Communication Bandwidth Capacity Demand

No.	Items	Unit	2013	2018	2023	2030	Calculation
1	Population		43,300,000	49,500,000	56,000,000	65,600,000	
2	Internet User		16,444,861	29,700,000	45,360,000	59,040,000	
3	Internet User Ratio	%	38	60	81	90	
4	Broadband User Ratio	%	2.7	8	13	20	
5	Broadband user		1,178,077*	3,960,000	7,280,000	13,120,000	No.1 x No.4 /100
6	Individual Data Use per day	Mbyte	3,000	3,000	3,000	3,000	
7	Individual Data Use per day	Mbit	24,000	24,000	24,000	24,000	
8	Total Data Per day	Mbit	28,273,848,000	95,040,000,000	174,720,000,000	314,880,000,000	No.5 x No.7
9	Necessary Bandwidth (Broadband User)	Mbps	327,244	1,100,000	2,022,222	3,644,444	No.8/24/60/60
10	Narrowband user		15,266,784	25,740,000	38,080,000	45,920,000	No.2-No.5
11	Individual Data Use per day	Mbyte	300	300	300	300	
12	Individual Data Use per day	Mbit	2,400	2,400	2,400	2,400	
13	Total Traffic Per day	Mbit	36,640,281,600	61,776,000,000	91,392,000,000	110,208,000,000	No.10 x No.12
14	Necessary Bandwidth (Narrowband User)	Mbps	424,077	715,000	1,057,778	1,275,556	No.13/24/60/60
15	Necessary Bandwidth (Internal)	Mbps	751,321	1,815,000	3,080,000	4,920,000	No.9+No.14
16	Internal Connection Ratio		0.7	0.7	0.7	0.7	
17	International Necessary Bandwidth	Mbps	525,925	1,270,500	2,156,000	3,444,000	No.15 x No.16
18	International Available Bandwidth	Mbps	921,319*				

Note: Figures with * comes from CCK Quarterly Sector Statistics Report Q3 2012/13 issued on July 2013

Figures colored in red comes from the assumption.

Source: JICA Study Team (JST) based on ITU statistics

8.5.2 Development Policy

(1) Development Policy

Based on the study of the current conditions previously stated in Chapter 2, JST set up the following policies for the development of telecommunications in NCC to achieve Kenya Vision 2030 and the National Broadband Strategy.

Development Policy

1. High Speed and Reliable Communications Network and its Connectivity,
2. Collaboration amongst Governmental Players and Operators,
3. Policy, Regulation, and Institution Development,
4. Promotion of E-government, and
5. Protecting Citizens from Disasters and Emergencies.

1) High Speed and Reliable Communications Network and its Connectivity

Building reliable information and communications infrastructure is essential to develop the country and to improve the quality of life. Furthermore, it contributes to operating and maintaining other sector infrastructures effectively and reasonably. To realise this, all communication infrastructure layers including the national backbone communication network, the metro trunk communication network, and the access network - which is an interface with users, need to be improved. Similarly, the bottleneck of data stream should be solved by introduction of proper network equipment that can process the increasing data bandwidth that goes together with the expansion of internet users.

2) Collaboration amongst Governmental Players and Operators

Telecommunications network is a public infrastructure. Therefore NCC shall administer the construction, installation, and maintenance works conducted by the telecommunications contractors/operators, because telecommunications infrastructure partially occupying municipal roads or lands and antenna towers built operator-by-operator impair the urban landscape. Thus, the public-private sector partnership should be improved to optimise telecommunications infrastructure development in Nairobi City.

3) Policy, Regulation, and Institution Development

According to the enforcement of a new law after the elections in 2013, NCC is supposed to have the authority to consider and approve all development applications and grant all development permissions. Moreover, it is expected to control the use and development of land and buildings in the city area, and to have jurisdiction over the control of the use and development of land and infrastructure in the interests of proper and orderly development. For this reason, NCC is required to formulate and enforce the policy, regulations, and institutions when developing the telecommunications infrastructure.

4) Promotion of E-government

E-government delivers a next generation of administrative services that enable the share and utilisation of information and data amongst the national and local governments through computer network instead of the current administrative services conducted face-to-face through documents. To promote E-government, raising the level of information and communications technology (ICT) literacy education and developing an exclusive government network that is not affected by data stream of the private sector, are recommended to be introduced.

5) Protecting Citizens from Disasters and Emergencies

Disasters and emergencies occur without previous notice and they usually cause damage to the people as well as damage to the infrastructure. In Kenya, most people receive disaster information through the media such as television and radio broadcasting. Most people in the disaster zone may panic for lack of information brought on by the unavailability or disability of the media due to the disaster. Thus, correct disaster information and its prompt dissemination are essential to minimise the damage of the disaster and to prevent a secondary disaster which may occur sequentially.

(2) Development Goals

According to the development policy, JST's development goals for the telecommunications sector are as follows:

Development Goals

1. Expansion of Broadband Services to the Whole Area under Nairobi City County,
2. Provision of Prompt and Reliable Governmental Administrative Services to Nairobi City Citizens,
3. Establishment of the National Infrastructure Sharing Policy,
4. Improvement of the Digital Literacy of Nairobi City Citizens, and
5. Disaster Prevention Information Dissemination to the Citizens.

8.5.3 Priority Projects

(1) Projects Necessary to Achieve the Developmental Goals

The JST proposes nine projects to be carried out by 2030 to achieve the goals set for the telecommunications sector; they are as follows: These projects are divided into two categories. The six projects from No. 1 to No. 6 are to be carried out for telecommunications infrastructure development. Meanwhile, the three projects from No. 6 to No. 9 are for institutional development. Since Project 1 is on communication network development, the operators shall be fully involved. Projects 2 to 9, on the other hand, shall be implemented with government initiative because these projects promote e-government and improve government services to Nairobi City residents. Outline, objectives, and effects of each project are explained in this section.

Projects to Achieve the Development Goals

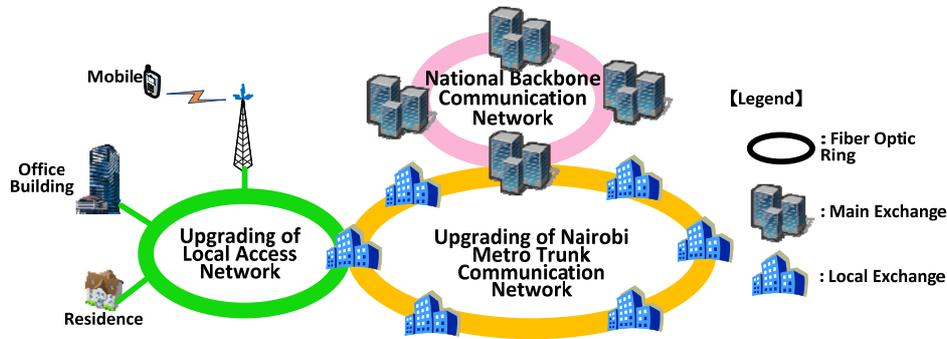
1. Optic Trunk Communication Network in Nairobi City
2. Common Infrastructure for Operators
3. Introduction of a Dedicated Government Network amongst Government Offices
4. Disaster Information Gathering and Dissemination System
5. Local Government Data Centre and Cyber Security
6. Upgrading the National Addressing System
7. ICT Literacy Education for Citizens
8. Establishment of Framework on Construction Supervision and Maintenance Works
9. Infrastructure Sharing Policy

1) Fibre Optic Trunk Communication Network in Nairobi City

Upgrading the optic fibre trunk network for the metro trunk communications and local access network is essential to solve the telecommunications infrastructure issues. Similarly, the undersea cables landing at Mombasa should be enhanced to remove the fundamental bottleneck that decreases internet speed. Enhancement of communications network contributes not only to the improvement of internet user convenience but also to the introduction of the

Intelligent Transport Systems (ITS) which provide innovative services to different modes of transport and traffic management and enable various users to be better informed and make safer, more coordinated, and 'smarter' use of transport networks.

This development, the conceptual diagram of which is shown in Figure 8.5.5, is in line with the global trends of ICT as well as with the development policy. The initiative to develop the fibre optic trunk communications network should be taken on by the operators.



Source: JICA Study Team (JST)

Figure 8.5.5 Conceptual Diagram of the Telecommunications Network

i) Objectives

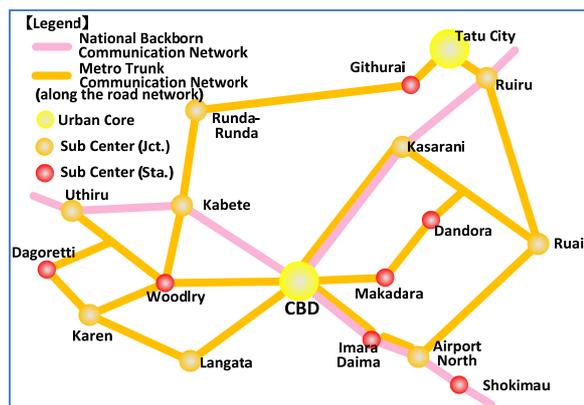
- To establish high speed networks,
- To improve connectivity for users, and
- To upgrade submarine cable capacity.

ii) Effects

- Increase in the number of internet users,
- Enhanced convenience in the use of the internet,
- Promotion of the citizens' participation in e-government (access to on-line government services), and
- Promotion of ITS.

iii) Development Items

- Upgrade the trunk communications network and accessibility
 - Network construction amongst the urban cores and sub-centres by connecting fibre optic cables laid along the roads and railways as shown in Figure 8.5.6.
 - Upgrade the networking equipment including optical transmission device, router, switch, and network control unit to expand the network bandwidth capacity.
 - Introduce the Long-Term Evolution (LTE) for accessibility improvement.
- Upgrade undersea cable bandwidth capacity
 - The government should assist operators to expand the undersea cable bandwidth capacity.



Source: JICA Study Team (JST)

Figure 8.5.6 Network Construction Plan

iv) Responsible Organisations

- Operators in partnership with the Ministry of Information Communications and Technology (MOICT)

2) Common Infrastructure for Operators

Currently, operators deploy their telecommunications infrastructure based on their own marketing strategy. Thus, cable laying works under the road conducted by every operator affect road traffic and increase the workload of officers in the road sections of NCC. On the other hand, a few antenna towers are shared based on the rent paid by a borrower to the owner of a tower. However, the majority of the antenna towers are installed by individual operators. These antenna towers have an adverse effect on urban landscape.

The JST recommends the development of a common infrastructure for operators to facilitate the expansion of telecommunications services. JST proposes a common underground duct for cables and shared antenna towers for mobile base transceiver stations and fixed wireless access to be shared amongst operators. Comprehensively, common infrastructure will not only expand the telecommunications services but also reduce operators' burden for its expansion.

The common underground duct buried under the ground accommodates indispensable primary infrastructure that includes communication and power cables. NCC should charge common underground duct users a fee to operate and maintain the common underground duct instead of applying for the wayleaves fee for laying the cable under the road. The common underground duct is environmentally friendly and leads to a reduction in road construction and provides for an urban infrastructure that is resistant against disasters.

Shared antenna towers are proposed to be operated and maintained by local governments such as NCC or a third party partially funded by public sources. It would be particularly beneficial because operators would provide their telecommunications services nationwide, not limited to the Nairobi City area. Shared antenna towers will improve urban landscape by reducing the number of antenna towers of individual operators and will promote effective land use. It is essential to expand the services with shared antenna towers to rural areas, because operators have a negative stance on offering their services there.

i) Objectives

- To avoid uncoordinated infrastructure deployment by operators.

ii) Effects

- Enhancement of the expansion of the telecommunications services,
- Coordinated land use,
- Improvement of urban landscape,
- Reduction of road construction and increase in road users' satisfaction,
- Reduction of operators' burden for construction and maintenance works,
- Enhancement of the expansion of telecommunications infrastructure (operator's investment), and
- Protection against vandalism.

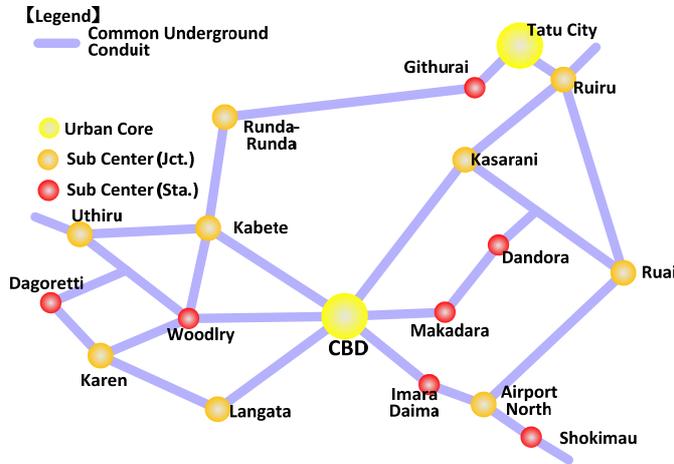
iii) Development Items

- Common underground ducts along trunk roads connecting the urban cores with the sub-centres
 - Infrastructure to be accommodated: communications, power, water, and drainage water; and
 - Accommodation capacity of the telecommunications operators: over 16 operators.

- Shared antenna towers in rural areas to promote operators' expansion of mobile service areas

iv) *Responsible Organisation*

- NCC



Source: JICA Study Team (JST)

Figure 8.5.7 Network Construction Plan

Table 8.5.5 Current Operators Who have their Own Infrastructure

1	Airtel Networks Kenya Limited
2	Accesskenya Group Limited
3	Alldean Satellite Networks (Kenya) Limited
4	Bell Western Limited
5	Essar Telecommunications Kenya Ltd
6	Frontier Optical Networks Limited
7	Gateway Telecommunications (kenya) Limited
8	Iway Africa Kenya Limited
9	Jamii Telecommunications Limited
10	Kenya Data Networks Limited
11	Mobile Telephone Networks Business Kenya Limited
12	Safaricom Limited
13	Sea Submarine Communications Ltd
14	Simbanet Com Limited
15	Telkom Kenya Limited
16	Wananchi Group (Kenya) Limited

Source: JICA Study Team (JST) based on hearing survey to CCK

3) Introduction of a Dedicated Government Network amongst Government Offices

This fibre optic network is developed exclusively for the use of government offices in order to share information and data, to promote effective administrative management as well as to provide prompt administrative services to citizens. Currently, the network for 38 national government buildings is connected through a telecommunications operator's leased network. However, it has a high risk for communication failure in case of disasters and emergencies due to the concentration of communication traffic on the telecommunications operator's network.

Efficient administrative management needs a reliable and sound exclusive network built on fibre optic cables connecting government offices, its site offices, ministries, and agencies. This also promotes prompt and effective implementation of administrative management and provides the groundwork to introduce e-government. It is considered reasonable and proper that the NCC Headquarters is connected to the Ministry of Devolution and Planning as these two organisations have a close relationship with each other in terms of local administration affairs. The fibre optic cables have the advantage, which is ordinarily consisting of multiple cores. Some cores are used for the government network, while the other cores can be leased to operators or private companies for their network expansion.

Figure 8.5.8 shows a conceptual diagram on the introduction of the dedicated government network.

i) *Objectives*

- To establish a dedicated government network unaffected by the private sector data streaming; and
- To share information amongst government offices, its site offices, ministries, and agencies.

ii) *Effects*

- Prompt and effective implementation of administrative management,
- Provision of prompt administrative services to citizens,

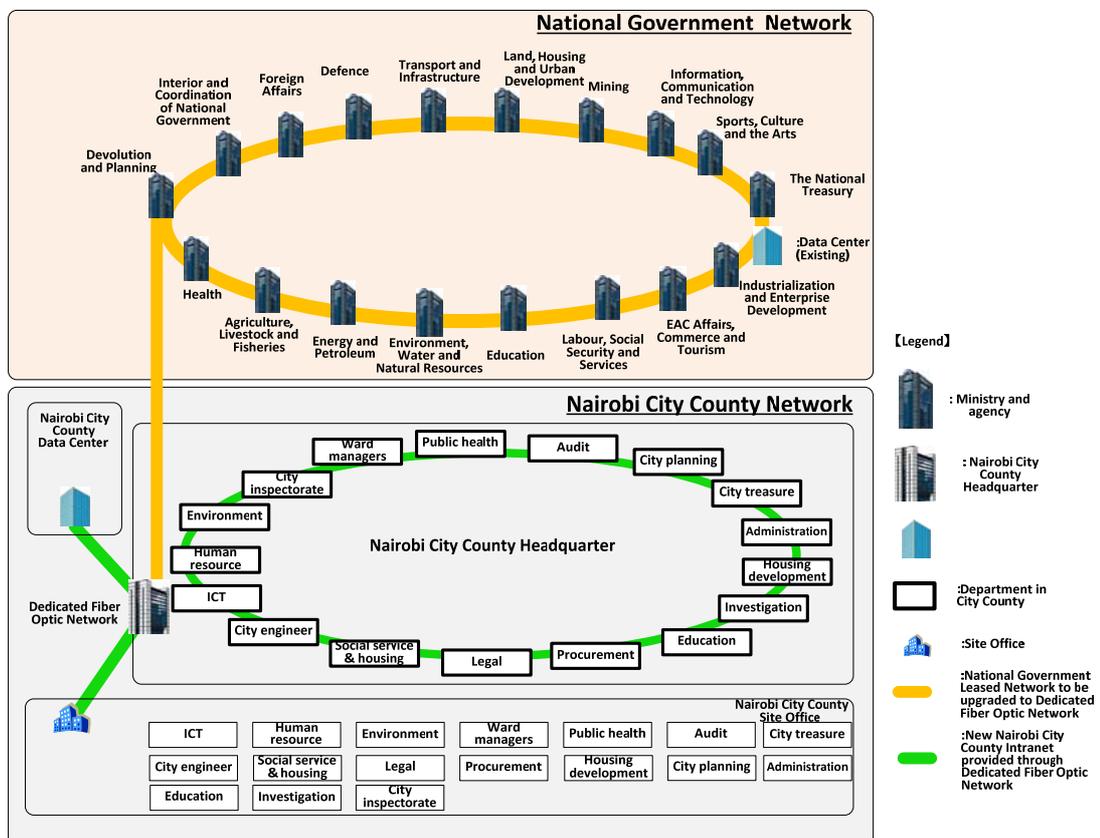
- Implementation of an efficient business continuity planning (BCP) during disasters/emergencies ,
- Basis for the introduction of e-government,
- Promotion of ITS by information sharing, and
- Fibre optic core lease.

iii) *Development Items*

- Introduction of intranet in NCC,
- Introduction of the NCC internal dedicated fibre optic network including site offices,
- Connection between the NCC headquarters and the national government (Ministry of Devolution and Planning), and
- Upgrading the existing national government network connecting the national government offices to a dedicated fibre optic network.

iv) *Responsible Organisations*

- NCC for NCC internal dedicated fibre optic network and intranet, and
- MOICT for a dedicated national government fibre optic network.



Source: JICA Study Team (JST)

Figure 8.5.8 Conceptual Diagram of a Dedicated Government Network for Government Offices

4) **Disaster Information Gathering and Dissemination System**

Widespread and coinstantaneous information dissemination helps citizens evacuate to safety in case of disasters or emergencies; hence, the disaster information gathering and dissemination system is proposed to be introduced in NCC.

Currently, the Kenya Meteorological Department and the Kenya National Disaster Operation Centre are in charge of meteorological information and river water level information concerning disaster prevention. To improve information dissemination, it is recommended that

NCC disseminates information to citizens through various ICT equipment including internet, message boards, and public megaphones. NCC needs to share the collected information with the relevant organisations through the dedicated government network previously mentioned. Furthermore, it is recommended that NCC should have its own observation station to stay informed about the current rainfall and water level conditions in the city area. The rainfall and water level information observed at the site will be sent to NCC Headquarters at regular intervals through dedicated wireless radio communications. When the rainfall and river water levels rise and there is a potential for flooding, the NCC Headquarters will announce the information on rising water levels to give notice in order to evacuate the residents living near the river.

i) Objectives

- Widespread and coinstantaneous information dissemination to citizens

ii) Effects

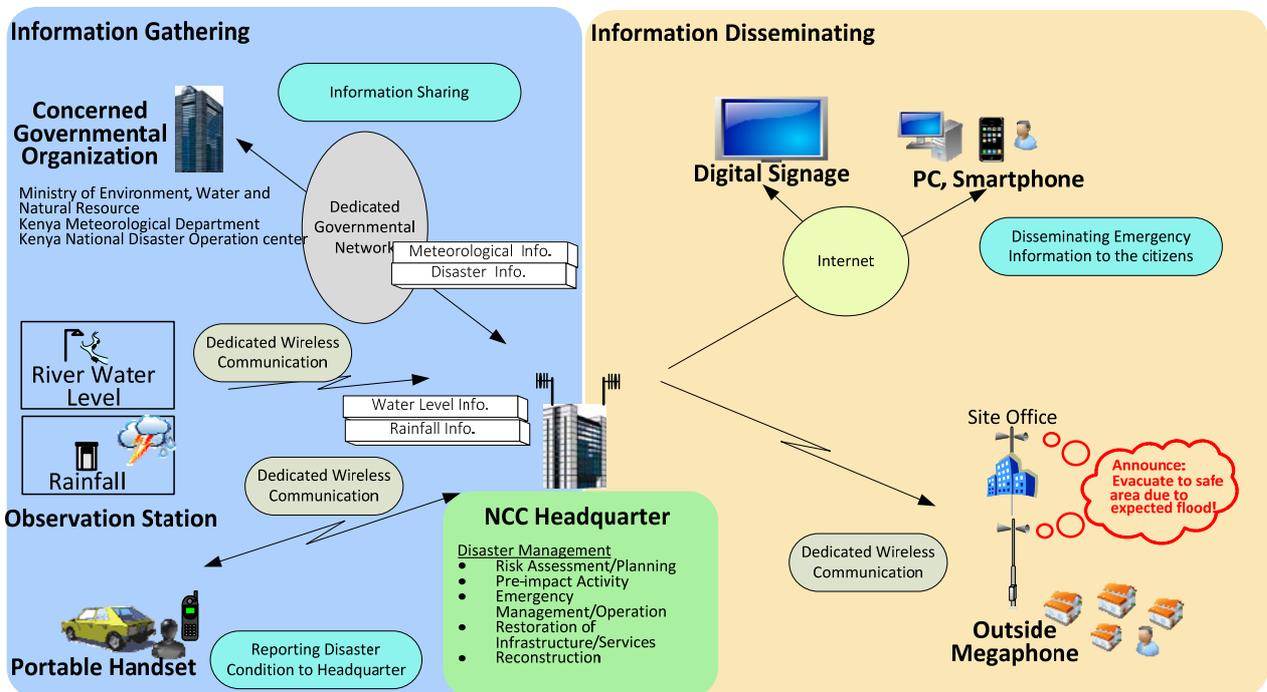
- Protection of lives and property, and
- Provision of regular public announcements.

iii) Development Items

- Rainfall and river water level information observation and telemetric information transmission system with security fence, and
- Wireless information dissemination including outside message boards and public megaphones with security fence.

iv) Responsible Organisation

- ✓ NCC



Source: JICA Study Team (JST)

Figure 8.5.9 Conceptual Diagram of the Disaster Information Gathering and Dissemination System

5) Local Government Data Centre with Cyber Security

The data centre is a centralised repository, either physical or virtual, for the storage, management, and dissemination of data and information. On the national government level, the Government of Kenya has built a government data centre for processing and storage of government applications and data through the Directorate of e-Government. The national governmental data centre implementation started in 2008 and is now ready to host government systems and services. Pursuant to the national government level, it is recommended that NCC set up their local government data centre. For efficient data exchange between the local government data centre and NCC, the dedicated government network can be utilised effectively to centralise the governmental information in the data centre. The conceptual drawing of the local government data centre is incorporated in Figure 8.5.8.

In addition, cyber attacks of fraudulent access and distributed denial of service (DDoS) have hit and damaged the intranet system of companies and government offices and concurrently might have caused a leak of confidential information or an organisation’s defamation. Cyber attack protection does not only serve to block an attack from outside of the intranet, but also includes countermeasures which are premised on intrusion into the intranet (Figure 8.5.10).

i) Objectives

- To centralise data and information, and
- To protect data and information against cyber attacks.

ii) Effects

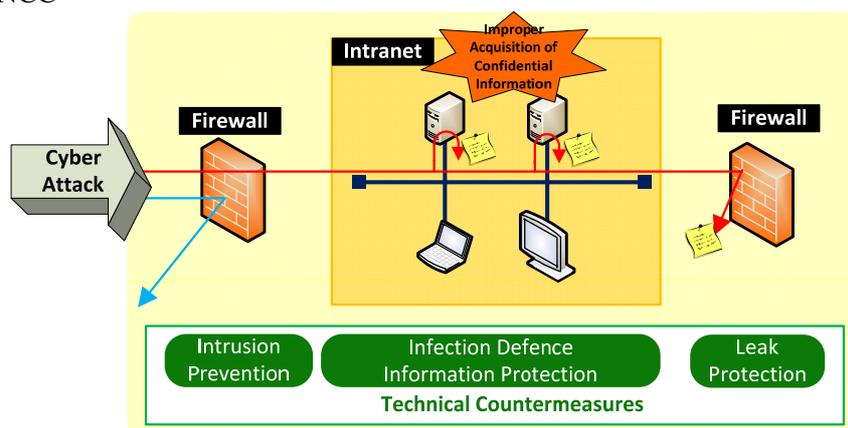
- Ensuring the security of government information and data,
- Efficient implementation of administrative management,
- Optimal use of the human resources, and
- Building a society with a sense of security.

iii) Development Items

- NCC data centre

iv) Responsible Organisation

- NCC



Source: JICA Study Team (JST)

Figure 8.5.10 Cyber Security

Countermeasures against cyber attacks are categorised into three types, namely, technical, human, and physical countermeasures. The methodologies of each countermeasure are proposed as shown in Table 8.5.6.

Table 8.5.6 Countermeasures against Cyber Security

Item		Methodology
Technical Countermeasure	System	<ul style="list-style-type: none"> ● Update the operating system and install security patch on personal computers ● Introduce user authentication system ● Apply strict access control to network resources
	Network	<ul style="list-style-type: none"> ● Monitor the network and detect malfunctions ● Install firewall to avoid intrusion from outside ● Install the Intrusion Detection System (IDS) and Intrusion Prevention System (IPS) for prompt detection and intrusion prevention
	Data Security	<ul style="list-style-type: none"> ● Encipher data and hard disk
	Virus	<ul style="list-style-type: none"> ● Install antivirus software ● Update virus definitions
Human Countermeasure	Information Security Policy	<ul style="list-style-type: none"> ● Establish an information security policy ● Compliance with the information security policy
	Internal Rule	<ul style="list-style-type: none"> ● Stipulate ethical codes and punitive clauses to prevent improper use
	Information Security Education	<ul style="list-style-type: none"> ● Raise awareness about the importance of information security
	Password Control	<ul style="list-style-type: none"> ● Periodic renewal of passwords ● Select a difficult password
Physical Countermeasure	Disaster	<ul style="list-style-type: none"> ● Earthquake resistance for buildings ● Fire prevention system and fire alarm box ● Waterproofing floor, wall, and ceiling
	Crime	<ul style="list-style-type: none"> ● Locking premises, building, and room ● Entering/leaving record system and monitoring camera
	Equipment Trouble	<ul style="list-style-type: none"> ● System redundancy ● Data backup

Source: JICA Study Team (JST)

6) Upgrading the National Addressing System

The National Addressing System is a database and provision system to facilitate identification of citizens, revenue collection, improved city management, and provision of efficient rescue services. The system would also assist the provision of security and utility services, and a host of other services including efficient delivery of postal/courier items. There is a system for identifying streets, buildings, and plots. However, the existing system is unable to keep up with the pace of urbanisation. As a result, most of the streets in urban areas have no names or address.

The outline of the National Addressing System is described below. Basic data for the system consisting of property number, name of landlord and property owner, street name, and its geographical coordinates, etc. are given by each county and stakeholder including power and water utility companies and telecommunications operators. Each county sends the data to a processing server that will be installed in MOICT. MOICT will manage the data for information provision to relevant organisations such as postal/courier operators, emergency/security service organisations, and tax office. Similarly, information on residents shared by the stakeholders will be used to improve the accuracy of the information sent by each county. Each county should collect and provide the data necessary for the system early on to make the system useful.

i) Objectives

- To make a property and road database by linking geographical coordinates, and
- To provide information to relevant organisations.

ii) Effects

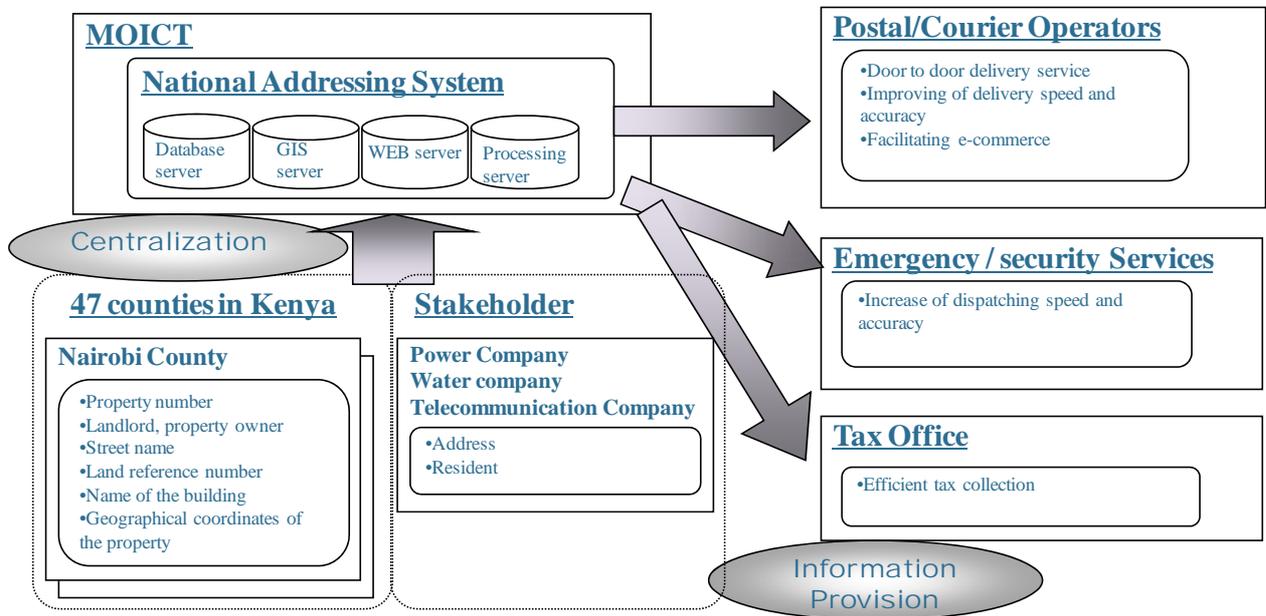
- Efficient city management,
- Speedup of administrative services, and
- Facilitate identification of citizens, revenue collection, and provision of efficient rescue services.

iii) *Development Items*

- National Addressing System including data gathering and provision

iv) *Responsible Organisations*

- MOICT



Source: JICA Study Team (JST)

Figure 8.5.11 Upgraded National Addressing System

7) *ICT Literacy Education for Citizens*

With reference to the introduction of the dedicated government network connecting government offices and the current ICT education programme in which MOICT plans to distribute computers to all pupils attending primary school in 2014, it is essential to improve the officers' ICT literacy. Consequently, it will promote efficient administrative management through the dedicated government network as well as raise citizens' ICT literacy to achieve social and economic benefits based on improved productivity and further promote e-commerce.

People who have low ICT literacy are not familiar with computers. Therefore, it is necessary to provide basic ICT education such as what computers are and how they work (Table 8.5.7). Operating word processing, spreadsheet, and presentation software are the minimum ICT literacy requirement for productivity improvement and effective city management.

i) *Objectives*

- To improve the citizens' ICT literacy.

ii) *Effects*

- Prompt and effective implementation of administrative management,
- Job creation,
- Growth of investment opportunities, and
- Access to online government services.

iii) *Development Items*

- The ICT Department is in charge of ICT literacy education for government officers and citizens.
- ICT literacy education for students in primary and secondary schools is under the authority of the Ministry of Education.

iv) *Responsible Organisations*

- NCC in collaboration with MOICT and MOE

Table 8.5.7 Basic ICT Literacy Education

Step	Content
1.Computer Fundamentals	<ul style="list-style-type: none"> ● Why do we need computers ● Major computer components ● Computer terminologies ● Performance and functions ● Operating system
2. Internet and World Wide Web	<ul style="list-style-type: none"> ● About the internet ● How to operate browser softwares ● E-commerce ● How to send and receive e-mail messages
3.Raise Productivity through the Use of Computers	<ul style="list-style-type: none"> ● Word processing ● Spreadsheet ● Presentation ● Database
4.Security and Privacy	<ul style="list-style-type: none"> ● Outlines of computer security and privacy ● Privacy protection ● Securing computer with latest security conditions ● Computer ethics

Source: JICA Study Team (JST)

8) *Establishment of a Framework on Construction Supervision and Maintenance Works*

The quality of construction or maintenance works for telecommunications infrastructure are various and nonconstant. This comes from insufficiency of regulations or codes to define the procedure of the works. Meanwhile due to the expansion of the jurisdiction of NCC based on the enforcement of the new law after the election in 2013, NCC was supposed to have the power to consider and approve all development applications and grant all development permissions, and control the use and development of land and buildings in the city area. In this situation, in order to upgrade the quality of the telecommunications infrastructure works, the regulations and codes for developing supervision and maintenance works on telecommunications infrastructure should be strengthened and strictly complied with. In view of this, NCC has the responsibility for managing and controlling the works without depending on operators and contractors.

i) *Objectives*

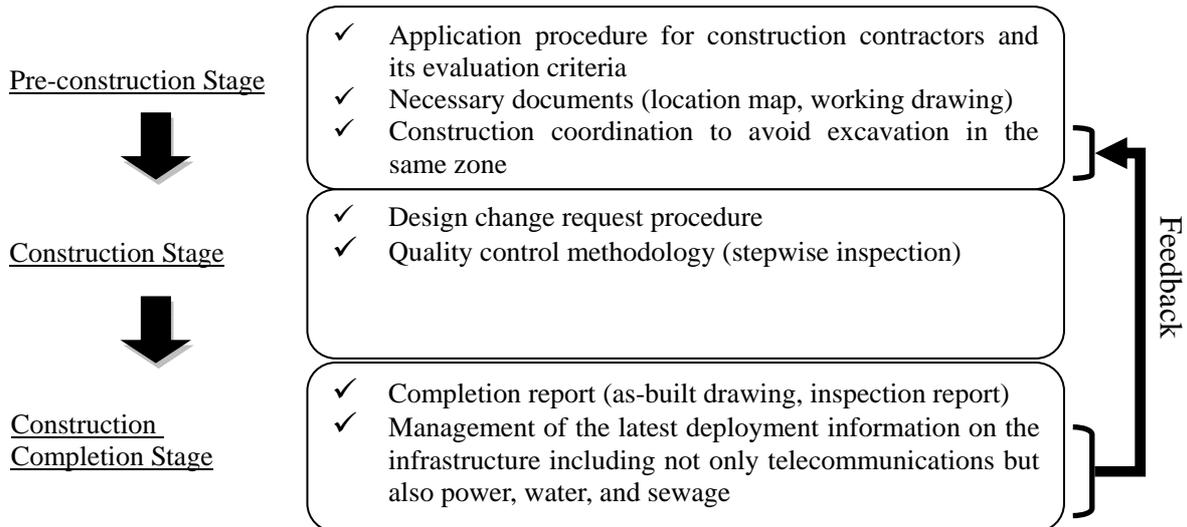
- Improvement of construction and maintenance works' quality.

ii) *Effects*

- Prolonging the life of infrastructure,
- Improved reliability of telecommunications infrastructure,
- Reduction of maintenance costs, and
- Promotion of cooperation amongst operators, contractors, and NCC.

iii) *Development Items*

- Framework on Construction Supervision and Maintenance Works.



Source: JICA Study Team (JST)

Figure 8.5.12 Framework on Construction Supervision and Maintenance Works

iv) *Responsible Organisation*

- NCC

9) *Infrastructure Sharing Policy*

The introduction of common infrastructure provides benefits to both NCC and the operators in terms of cost, infrastructure management, urban landscape, and future planning of urban development. With reference to the introduction of common infrastructure, JST proposes to set up an operation and maintenance policy for each operator to use the common infrastructure fairly and efficiently as well as for NCC to administer it securely and effectively. Since the properties of various operators will be committed to the common infrastructure, NCC should operate the common infrastructure responsibly according to the O&M policy.

i) *Objectives*

- To consolidate management of common infrastructure, and
- To set the methodology and procedures for the common infrastructure.

ii) *Effect*

- Effective infrastructure management

iii) *Development Items*

- Infrastructure sharing policy
 - Administration and management of common infrastructure,
 - Formulate application and operation procedures for common infrastructure users,
 - Equipment, cables, and related apparatus allowed to be installed on common infrastructure,
 - Loss and damages and dispute treatment, and
 - Cost sharing for construction and maintenance of common infrastructure.

iv) *Responsible Organisation*

- NCC

(2) Priority Projects

1) Selection of Priority Projects

From amongst the nine projects, five were selected for priority implementation based on their urgency, the rate of involvement of NCC, and the range of beneficiaries that can be reached. Projects that receive high evaluation scores are selected as priority projects.

As a result of the evaluation, JST proposes the prompt implementation of the following five projects. The evaluation results are shown in Table 8.5.8.

Priority Projects	
1.	Optic Trunk Communication Network in Nairobi City
2.	Common Infrastructure for Operators
3.	Introduction of Dedicated Government Network amongst Government Offices
4.	Disaster Information Gathering and Dissemination System
5.	Infrastructure Sharing Policy

Table 8.5.8 Evaluation of the Project

Project	Urgency	Score	NCC's involvement	Score	Range of Beneficiaries of the project (Direct benefit)	Score	Evaluation Score	Note
1. Optic Trunk Communication Network in Nairobi City	High	2	Middle	1	NCC/Operator/Government/User	2	5	Selected
2. Common Infrastructure for Operators	High	2	High	2	NCC/Operator	1	5	Selected
3. Introduction of Dedicated Government Network among Government Offices	High	2	High	2	NCC/Government	1	5	Selected
4. Disaster Information Gathering and Disseminating System	High	2	High	2	NCC/User	1	5	Selected
5. Government Data Center with Cyber Security	Middle	1	High	2	NCC	0.5	3.5	
6. Upgrading National Addressing System	Middle	1	Middle	1	NCC/Government	1	3	
7. ICT Literacy Education for Citizens	Middle	1	High	2	User	0.5	3.5	
8. Establishment of Framework on Construction Supervision and Maintenance Works	Middle	1	High	2	NCC/Operator	1	4	
9. Infrastructure Sharing Policy	High	2	High	2	NCC/Operator	0.5	4.5	Selected
Note: Evaluation scores	High:2 pt. Middle:1 pt.		High:2 pt. Middle:1 pt.		4 players: 2 pt. 3 players: 1.5 pt. 2 players: 1 pt. 1 player: 0.5 pt.			

Source: JICA Study Team (JST)

2) Evaluation

Each project is evaluated based on the following: a) urgency, b) role of NCC to the initiative, and c) beneficiary of the project. Contents of the evaluation conditions are explained below.

i) *Urgency*

Either "High" or "Middle" is put for each project based on its urgency. "High" is applied to a project that needs to commence as soon as possible in consideration of the current condition of the telecommunications sector. The evaluation chart is presented in Table 8.5.8.

ii) *NCC's Involvement in the Implementation of the Project*

To evaluate NCC's involvement in the development of the project, similarly either "High" or "Middle" mark is put for each project. "High" is marked to a project where NCC should be involved in its implementation. JST proposes that NCC should be involved in the implementation of the following projects:

Project No.2: Common Infrastructure for Operators

Project No.3: Introduction of Dedicated Government Network amongst Government Offices

Project No.4: Disaster Information Gathering and Dissemination System

Project No.5: Local Government Data Centre and Cyber Security

Project No.7: ICT Literacy Education for Citizens

Project No.8: Establishment of Framework on Construction Supervision and Maintenance Works

Project No.9: Infrastructure Sharing Policy

iii) Range of Beneficiaries of the Project

The projects are also evaluated according to the number of people they benefit. A high rating is given to projects that will benefit a large number of people.



Doris Severino, Kileleshwa Primary School (Rank 2 of Class 6)

CHAPTER9 CROSS-CUTTING ISSUES

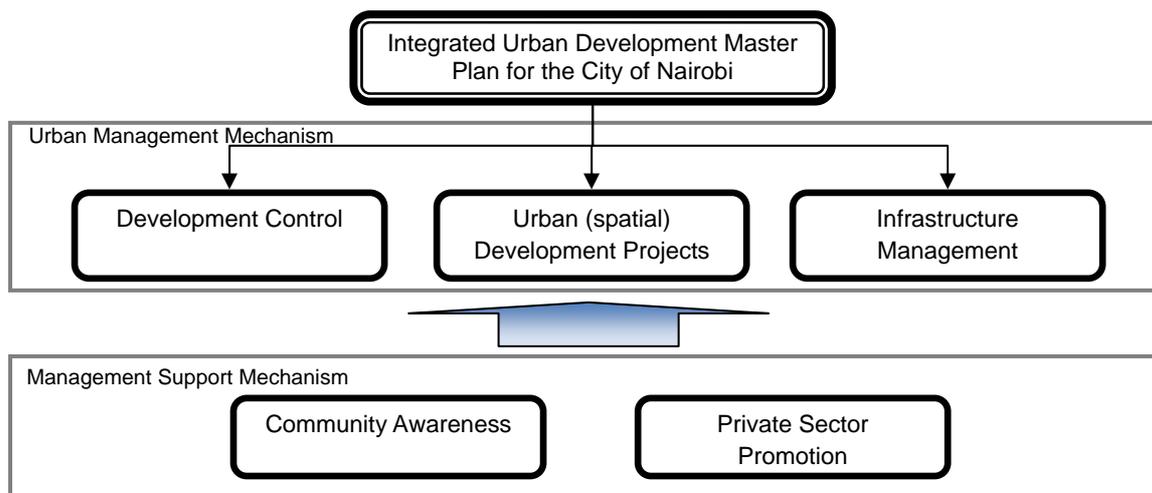
9.1 Governance and Institution

9.1.1 Policy and Strategy for Institutions

Based on the issues raised in the previous sections, the policy and strategy on governance and institution are proposed. Details are shown below.

(1) Basic Policy for Institutional Strengthening

The basic policy for institutional strengthening includes strengthening “development control”, implementing “urban (spatial) development projects”, and enhancing “infrastructure development management”. Figure 9.1.1 illustrates an urban development mechanism to be developed for the implementation of the NIUPLAN.



Source: JICA Study Team (JST)

Figure 9.1.1 Institutional Framework to be Developed

(2) Strategy for Institutional Strengthening

- 1) Strengthening of development control: Comprehensive development control mechanism development

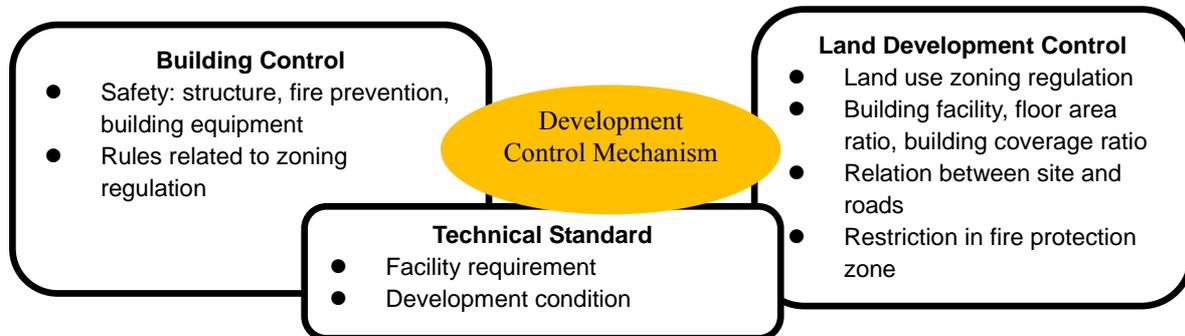
Development control mechanism including building control, land development control, and introduction of technical standard will be developed and their relationship will be clearly defined. The mechanism will also show procedure and responsible agencies.

Building control: building control is based on the building code to secure building safety which is also linked with the zoning regulations to contribute to the creation of urban

environment. Strengthening of the building control management is important to provide housing with proper conditions such as safety and utility.

Land development control: land development control is for area development and based on land use zoning and technical standard.

Technical standard: technical standard shows infrastructure and facility and their standard for land development which can be developed for the entire Nairobi City or for each sub-centre. The technical standard will be used for land development permission process.



Source: JICA Study Team (JST)

Figure 9.1.2 Overview of the Development Control Mechanism

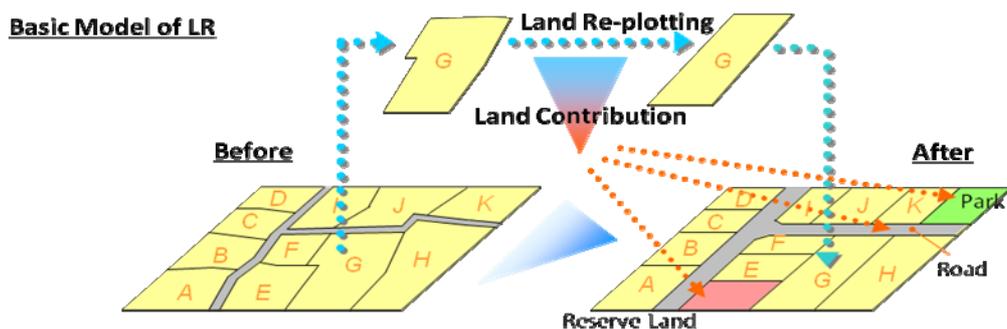
2) Facilitation of urban development schemes

Sub-centre development is proposed to realise the proposed structure plan (multicore development). In order to promote sub-centre development, the urban development scheme comprising spatial development together with infrastructure development has to be facilitated. In regard to an implementation body of urban development projects, the public sector (central government only/combination of central government and local government) is one option, and another option is the combination of public sector and private sector. In the latter situation, it is general that the public sector supports regulatory function such as public meeting and study on relaxation of the regulations. Typical types of urban development schemes include the “land readjustment project” and “land redevelopment project”.

Key features of the land readjustment project are summarised below.

- Change and improvement of land condition,
- Securing necessary public space,
- Designation of the land readjustment project in urban planning,
- Fair and transparent legal procedures,
- Preservation of private land rights,
- Consensus building amongst land right holders, and
- Fair sharing of profit and cost.

One of the characteristics of the project scheme is that land owners can participate in the project and there is no land acquisition or relocation. Also, land owners can stay after the project is completed.



Source: JICA Study Team (JST)

Figure 9.1.3 Image of the Land Readjustment Project

Urban redevelopment is another scheme used for urban development to moderate high-density urban area by verticalization. This scheme involves the relocation of businesses, demolition of structures, and relocation of people. This scheme is suitable for areas which are made up of a lot of small plots, because this scheme supports the right conversion between land ownership and floor ownership.

For the implementation of these schemes, land ownership, property value system, and floor value on multifloor building systems has to be developed.

3) Infrastructure development management mechanism

Infrastructure development management for urban development schemes requires coordination management and information sharing as shown below.

- Coordination management

Quality control, coordination, and enforcement are key components of infrastructure management. An organisation or department must be nominated or established in the county government to oversee the allocation and sharing of infrastructure. This organisation will act to accomplish the following:

- Streamline approvals for utilities according to a common system,
- Enforce the current two-year infrastructure audit requirement,
- Manage the costs of maintaining infrastructure by cost sharing amongst users,
- Agree on affordable charges for infrastructure provision, and
- Ensure quality control and reinstatements.

- Information Sharing

Information sharing will ensure that updates in policy and infrastructure are consolidated with up to date spatial information and the management is well informed of it. Information sharing must begin with the formulation of a common geospatial database of existing and proposed infrastructure from all major service providers. There must also be civic engagement on environmental consciousness and public awareness on infrastructure including wayleaves. For quality control of information, mapping and development of common ducts and other survey projects must be consolidated and all mapping projects and professionals must uphold standards. However, the Survey of Kenya does not fill this role. Thus, as a guiding framework, the policies for data management must be created on unified data coordination and sharing of projects and designs. On this basis, the Survey of Kenya should preside and control the data management system.

4) Private sector promotion scheme

Private sector involvement is important for both development control and urban development. In order for effective urban management to come about, a mechanism in which the private sector can be widely involved has to be developed.

Development control: For effective execution of development control, the private sector including developers has to understand the rules. The control mechanism proposed in (i) above has to be disseminated to developers to ensure understanding of the rules.

Urban development: A public-private partnership (PPP) framework is often used for urban development. To regulate promotion of private sector development including an incentive for development, a clear definition of the government's role in supporting private sector development has to be developed.

5) Develop information dissemination mechanism

All information for urban development management including the Nairobi Integrated Urban Development Master Plan (NIUPLAN), control measures, and development mechanism has to be opened to the public in view of improving public awareness and transparency for control and development. The website, which is developed for the strategic environmental assessment (SEA) procedure of this project, can be used as one of the tools for information dissemination. In addition, to disseminate the information, the Nairobi City County (NCC) has to provide civic education to promote awareness on urban development management rules.

6) Strengthen organisations for urban management

For securing the NIUPLAN implementation, urban management mechanism including NCC strengthening, coordination mechanism strengthening, and stakeholder strengthening have to be developed. The points in urban management strengthening are described below.

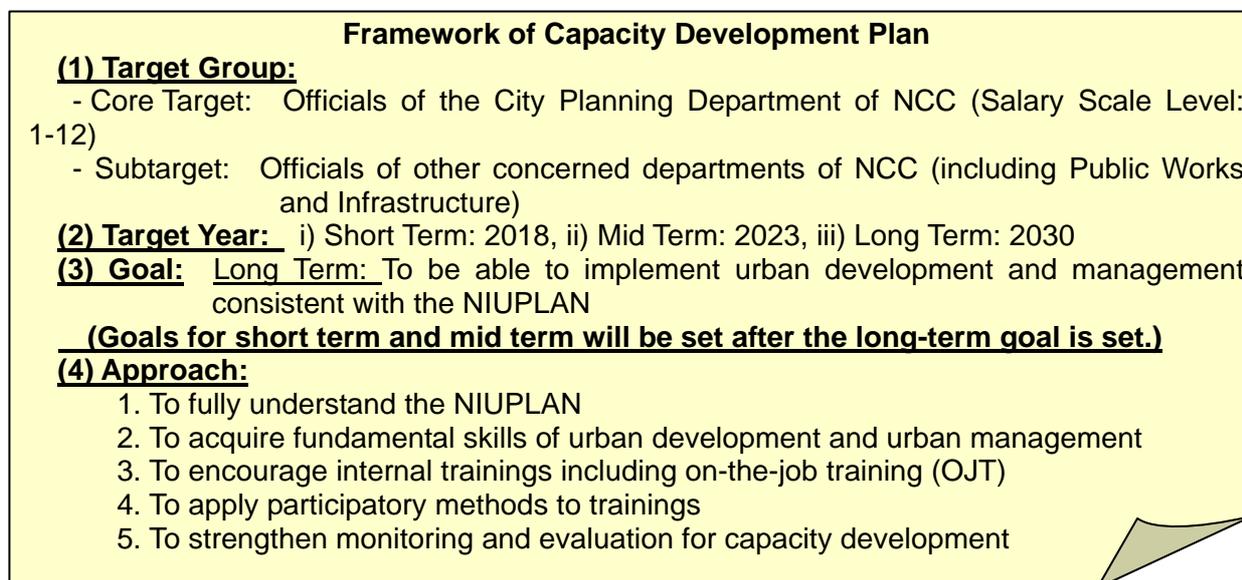
- NCC strengthening: NCC plays an important role in the NIUPLAN implementation. The capacity of NCC in terms of skills and number has to be strengthened. Skills include development control, building control, and infrastructure development management. It is also necessary to increase the number of staff, particularly for development control in which more development permit applications are expected once the E-Permit System has been in full operation.
- Coordination mechanism strengthening: Coordination amongst concerned agencies is crucial for infrastructure implementation. Coordination includes coordination within NCC, coordination between NCC and the national government, and coordination amongst county governments. NCC should take the initiative in establishing the coordination mechanism.
- Stakeholder strengthening: Since stakeholder participation is guaranteed in the Constitution of Kenya and the NIUPLAN has been prepared through stakeholder participation, the stakeholder participation mechanism has to be developed for implementation. One of the methods is the development of community forum, through which communication between the community and NCC can be enhanced.

9.1.2 Capacity Development Plan

To realise integrated urban development based on the NIUPLAN, the capacity of human resources to execute the strategy for institution as mentioned in Subsection 9.1.1 should be developed.

The working group members have formulated the capacity development plan composed of the following six items: (1) target group, (2) target year, (3) goal, (4) approach, (5) activity, and (6) plan of operation.

Figure 9.1.4 illustrates a framework of capacity development plan composed of the abovementioned items (1) to (4).



Source: JICA Study Team (JST)

Figure 9.1.4 Framework of Capacity Development Plan

(1) Target Group

Through discussion in working groups, two different target groups have been identified. One is a core target group, to which the highest priority is given in capacity development. The officials of the City Planning Department of NCC are the core target group of capacity development. The other is a subtarget group, which is the second most important target group following the core target group.

While there are 18 salary scale levels in NCC, the working group members will focus on the officials of salary scale level (SSL) 1 to 12 to seek for efficient and effective capacity development. In the future, the outputs of capacity development of the officials of SSL 1 to 12 will trickle down to the officials of SSL 13 to 18.

Core Target Group: Officials (Salary Scale Level: 1-12) of the City Planning Department of NCC

Subtarget Group: Concerned officials of the following seven other departments of NCC:

- (i) Public Works and Infrastructure Department,
- (ii) Education, Youth Affairs, Sports, Culture, and Social Services Department,
- (iii) Environment and Forestry Department,
- (iv) Trade and Development Department,
- (v) Finance and Economic Planning Department,
- (vi) Governance and Administration Department, and
- (vii) Justice and Inspectorate Department.

(2) Target Year

The target year of the capacity development plan should be set. The year of achieving the goals in Item (3) is the target year. It will be consistent with the target year of the NIUPLAN, since the capacity development plan is part of it. As such, the target year of capacity development is year 2030, which is the target year of the NIUPLAN. As benchmarks up to 2030, intermediate target years are also set such as the short-term goal and mid-term goal. The following are tentatively set as the target years of capacity development:

- Short-term Target Year: 2018
- Mid-term Target Year: 2023
- Long-term Target Year: 2030

(3) Goal

Goal is the desirable and achievable state of capacity development by the target years. The thematic working group members will discuss how to set the goals for each target year in the succeeding thematic working group meetings.

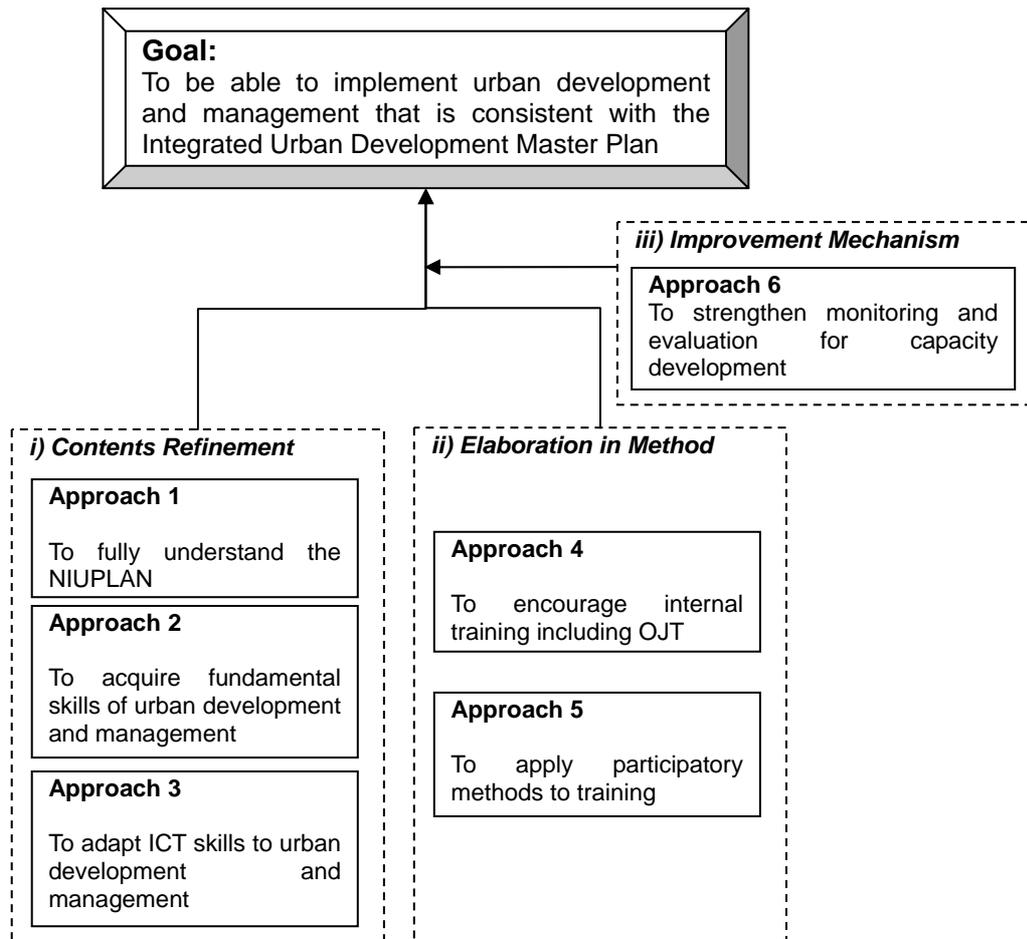
According to the policy and strategy for institution as mentioned in Subsection 9.1.1, implementation of the NIUPLAN is the ultimate purpose of governance and institution. Capacity development is also required to contribute to the implementation of the NIUPLAN. To make more concrete statement of the goal, the JST proposes to divide the implementation of the NIUPLAN into urban development and urban management. Both notions of urban development and urban management include three pillars of the institutional strategy such as “development control”, “urban (spatial) development projects”, and “infrastructure development management”.

As such, JST proposes that the goal of capacity development plan in 2030, long-term target year, is “To be able to implement urban development and management consistent with NIUPLAN” in order to kick off further discussion with the thematic working group members for governance and institution. To be more precise, the indicator corresponding to the goal will also be discussed in the forthcoming study. The goals as benchmarks of the short-term and mid-term target years will be set based on the goal of the long-term target year to be discussed in the thematic working group.

(4) Approach

An approach is a method of achieving the goal. The approaches of the capacity development plan are methods to implement urban development and management through development control mechanism as shown in Figure 9.1.2. The approaches are closely connected with the issues of capacity development, which include both strengths and weaknesses of the current state of capacity development in NCC. The approaches are classified into three types, namely, i) contents refinement, ii) elaboration in method, and iii) improvement mechanism. The three approaches are described as follows:

i) Contents refinement is an approach to elaborate the contents of capacity development on what knowledge and skills should be acquired; ii) Elaboration in method is an approach to introduce new methods for capacity development on how to acquire knowledge and skills; and iii) Improvement mechanism is an approach to improve both contents and methods of capacity development. The relation between goal and approaches is shown in Figure 9.1.5.



Source: JICA Study Team (JST)

Figure 9.1.5 Relation between Goal and Approaches of Capacity Development Plan

1) Contents Refinement

Approach 1: To fully understand the NIUPLAN.

To achieve the goal, the target officials need to understand the NIUPLAN in full. Otherwise, urban development and management in Nairobi City might progress without consistency with the NIUPLAN. Since the NIUPLAN is a road map toward the vision, full understanding of it and frequently referring to it are crucial in keeping the related programmes and projects aligned with it.

The officials of both core target group and subtarget groups are required to understand the NIUPLAN.

Approach 2: To acquire fundamental skills of urban development and management.

It is necessary to acquire fundamental skills of urban development and management to achieve the goal. A system of urban development and urban management, linkage and position amongst the skills, basic concepts of development and management, are the fundamental skills. It will help the target officials to develop their capacities more by realising how each skill will work in urban development and urban management. The items mentioned in are the key items of urban development and management.

Now NCC has introduced various E-permits such as development permit, construction permit, and inspection of construction for land and building control under IFC support. Ensuring the operation and maintenance of the E-permit system should be attained through capacity

development of the officials of the Development Control Section, Enforcement Section, and Policy Implementation Section.

Approach 3: To adapt information and communications technology (ICT) skills to urban development and management.

To efficiently manage necessary information for planning and urban development, acquiring ICT skills is necessary. Now NCC is formulating a road map of ICT, so the ICT system to be developed in urban development and management should be consistent with the road map. The target officials should acquire skills of necessary software such as GIS, documentation, spreadsheet, and CAD. The officials of the Land Survey Section should be mainly targeted although the officials of other sections are also related.

2) Elaboration of Method

Approach 4: To encourage internal trainings including on-the-job training (OJT)

To acquire more practical skills rather than academic knowledge, applying on-the-job training (OJT) in capacity development should be encouraged. OJT provides learning opportunities through practice in the real world of urban development and management. In addition, internal trainings should be more encouraged. It is because the menu of internal trainings can flexibly meet the needs of the target officials. It is also expected that internal trainings can cover more practical contents than external trainings. The executive level staffs in the City Planning Department such as director, deputy director, and section manager, needs to lead the other target officials to carry out OJT.

Approach 5: To apply participatory methods to trainings

To entail successful capacity development and achieve the goal, active involvement by the target officials should be encouraged. A lecture, in which a trainer delivers ideas to trainees in one way, is a conventional method of trainings. However, the lectures have limitations to encourage active participation by the trainees. To overcome difficulty, participatory methods including workshops and group discussions are worth considering for active involvement. The Central Administration Section, in cooperation with the executive level of the City Planning Department, should organise training programmes with participatory methods.

3) Improvement Mechanism

Approach 6: To strengthen monitoring and evaluation for capacity development

Capacity development should be monitored and evaluated periodically to effectively and efficiently ensure that it is on the right track and to find ways to improve and enhance it. Without monitoring and evaluation, it is impossible to measure how far the goal has been achieved and judge if the programmes and activities are on the right track.

The Central Administration Section, in cooperation with the executive level staff of the City Planning Department, should monitor and evaluate the capacity development activities periodically, to improve the programmes.

The results of monitoring and evaluation should also be reflected in consideration of the reforms in the organisation and institutional system. For example, the performances of the concerned sections of development control, namely, i) Development Control Section for building permit, ii) Enforcement Section for building inspection, and iii) Policy Implementation System for development permit are to be monitored and evaluated. Then, how capacity development contributes to the performance of their tasks such as operating the E-permit system should be scrutinised. The monitoring and evaluation results might imply

some constraints such as systems, organisations, and institution, in which repeating capacity development is difficult to overcome.

Through this approach, capacity development starting from individual level aims to stretch out to the organisational and institutional levels.

(5) Activity

To execute the policy and strategy for institution and the capacity development approaches mentioned above, the activities shown in Table 9.1.1 will be taken in capacity development. Categories 2 to 6 are related with the policy and strategy for institutions, and Categories 1 and 7 as well as possible training methods for each category are added to support the capacity development approaches. The activities will also be discussed and elaborated in the forthcoming thematic working group meetings.

Table 9.1.1 Activities and Methods on Capacity Development

Category of Capacity Development	Training Items (Activities)	Possible Training Method
1. Introduction	1-1 NIUPLAN 1-2 Overview of Urban Development and Urban Management	Lecture
2. Development Control	2-1 Building Control 2-2 Land Development Control 2-3 Technical Standard	Lecture, OJT
3. Urban (Spatial) Development Projects	3-1 Land Readjustment 3-2 Land Redevelopment 3-3 Funding Schemes	Lecture, OJT
4. Infrastructure Management	4-1 Coordination Management 4-2 Information Sharing	Lecture, OJT
5. Community Awareness	5-1 Cooperation with Civil Society 5-2 Communication with Civil Society	Lecture, OJT, Group Discussion, Workshop
6. Private Sector Promotion	6-1 Public-Private Partnership (PPP) 6-2 Communication with the Private Sectors	Lecture, OJT, Group Discussion, Workshop
7. Supporting Skills	7-1 Data Management/GIS 7-2 Monitoring and Evaluation	Lecture, Group Discussion, OJT

Source: JICA Study Team (JST)

(6) Plan of Operations

Table 9.1.2 shows an image of the plan of operations for the activities (sample). The plan of operations shows project specifics such as the expected results, schedule, person-in-charge, parties responsible for implementation, necessary resources and equipment, and costs for each activity. The plan of operations is an effective tool for implementation and management for capacity development, and it provides important data for monitoring and evaluation. The plan of operation will also be discussed in the forthcoming thematic working group meetings for governance and institution.

Table 9.1.2 Image of Plan of Operations for Capacity Development Activities (Sample)

Activities	Expected Result	Schedule	Person in Charge	Target Group	Materials and Equipment	Estimated Cost
1. Introduction						
1-1 NIUPLAN	Consistent urban development and urban management with the NIUPLAN	Once a year at the beginning of each fiscal year	Director of the City Planning Department	City Planning Department of NCC Concerned Department of NCC	Hardcopy of the NIUPLAN Presentation of summary	(To be estimated)
1-2 Overview of Urban Development and Urban Management	Acquire broad viewpoints for executions of urban development and urban management	Once a year at the beginning of each fiscal year	Deputy Director of the City Planning Department	City Planning Department of NCC	Text introducing overview of urban development and urban management Presentation of summary	(To be estimated)

Source: JICA Study Team (JST)

9.1.3 Priority Projects

Priority projects are proposed for institutional and organisational aspects as well as human resources development to enhance urban development management.

(1) Urban Development Mechanism Development

Priority of institutional strengthen is development of urban development mechanism. As described in Sections 6.4.5 and 6.4.6, Central Business District (CBD) development and sub-centre are identified as urban development, which is expected to form urban structure and to improve urban conditions through spatial and infrastructure development.

Urban development mechanism includes land re-adjustment project and land re-development project, covering spatial development, infrastructure development, and financial arrangement, have to be developed. In addition, incentive measure to promote CBD and sub-centres, including conversion of the development right, relaxation of plot ratio, and other measures will be developed.

(2) Organisational strengthening

The priorities of organisational strengthening is NCC strengthening, stakeholder strengthening, and intercounty strengthening.

1) NCC strengthening

The objective is to strengthen NCC capability on urban management including development control, coordination, and infrastructure development.

Components of the NCC strengthening are shown below.

- Increase in the number of staff for development permit and building permit to accommodate increase in the number of permit applications once the e-permit system has been in full operation. Also, increase in the number of inspectors to monitor construction for completion certificate;
- Strengthen participatory mechanism including formulation and management of community forum; and
- Conduct training on urban management including planning, development control, and infrastructure management.

2) Stakeholder strengthening

Community participation from planning stage to implementation stage is required to understand the importance of urban management. The objective of stakeholder strengthening is to establish and manage community groups (forum) as a participatory mechanism which will be utilised for urban management.

Components of the stakeholder strengthening are shown below.

- Community groups (forum) will be established in each district in Nairobi City to participate in urban development including participation in the detailed plan formulation, sub-centre development, and infrastructure development.
- Training will be conducted to enhance understanding of urban management including necessity of building permit, development permit, and infrastructure development.

3) Intercounty coordination mechanism

Intercounty coordination was raised as one of the key elements for the NIUPLAN implementation. The objective is to develop intercounty coordination mechanism for promotion of efficient infrastructure development. Intercoordination mechanism should function as coordinating body for infrastructure development such as roads, water supply, drainage, and solid waste management, which are physically linked with neighboring counties.

(3) Human Resources Development

To support the institution and organisation mentioned above, human resources development through providing learning opportunities is necessary. The NCC officials should acquire knowledge and skills of urban development and management with supporting ICT skills such as GIS and CAD through lecture, OJT, and group discussions. The NCC officials are expected to utilise what they learn through human resources development for strengthening institution and organisation.

9.2 Industrial Development

9.2.1 Industrial Development Vision of Kenya for 2030

(1) Foundations of Socioeconomic Development

Kenya Vision 2030 stipulates that the three pillars, economic, social, and political, are anchored on the foundations of the following: (i) macroeconomic stability; (ii) infrastructural development; (iii) science, technology, and innovation (STI); (iv) land reforms; (v) human resources development; and (vi) security and public sector reforms.

(2) Priority Sectors

Kenya Vision 2030 sets the following six priority sectors:

- Tourism,
- Agriculture and Agro-industries,
- Wholesale and Retail Trade,
- Manufacturing,
- IT enabled services (previously known as business process off-shoring), and
- Financial Services.

(3) Major Project Proposals

In order to strengthen the foundations of socioeconomic development and the priority sectors, the following projects are proposed (Table 9.2.1 and Table 9.2.2).

Table 9.2.1 Major Investment Projects of Kenya Vision 2030

Sector	Major Investment Projects
(1) Energy Sector	(1.1) Olkaria V Geothermal Power Generation Plant (2X70 MW) (1.2) Isiolo 50 MW Wind Power (1.3) Liquefied Natural Gas (LNG) Storage and Regasification Facility with Associated Power Generation (1.4) Transformer Manufacturing (1.5) Solar PV Panels Manufacturing (1.6) Mombasa Petroleum Trading Hub - Single Buoy Mooring (SBM)
(2) Transportation Sector	(2.1) Nairobi City Commuter Rail (2.2) Railway Cities (2.3) Lamu Port (LAPSSET- Lamu Port Southern Sudan Ethiopia Transport Corridor Project) (2.4) Thika Toll Road (completed as a non-toll road)
(3) ICT Sector	(3.1) Konza Technology City
(4) Tourism Sector	(4.1) Eco Lodges and Tourism Adventure Facilities (4.2) Revolving Restaurant (at Kenyatta International Convention Centre (KICC)) (4.3) Amusement Park and 5-Star Hotel at Bomas of Kenya
(5) Real Estate - Recreation, Sports, Tourism, and Heritage Social Infrastructure	(5.1) Nairobi Galleries at the Nairobi National Museum (5.2) International Sports Academy in Kasarani
(6) Agriculture	(6.1) Establishment of a Fertilizer Plant (6.2) Privatisation of Sugar Factories (6.3) LAPSSET Corridor Projects (6.3.1) Establishment of a Sugar Factory (6.3.2) Establishment of Mango Production and Processing (6.3.3) Establishment of the Beef Industry (6.4) Rice Irrigation Scheme

Note: The above major investment projects of Kenya Vision 2030 were presented during the Investment Summit on 31 July 2012 in London.

Source: Kenya Vision 2030 website (2013)

Table 9.2.2 Other Project Proposals related to Kenya Vision 2030 presented by the Kenya Investment Authority

Project Category	Remarks
(1) Mining and geology roadmaps	- Oil and gas exploration and investment opportunities
(2) Telecommunications and ICT	- Telecommunications licenses, procedures, and costs
(3) Tourism development	- Conference tourism - Betting control and licensing board roadmaps - Heritage tourism - Tourism in protected areas - Kenya Wildlife Service (KWS) roadmap
(4) Development of niche tourism product	- This initiative introduces new high-value niche products such as cultural, eco-sports and water-based tourism. There have been notable achievements in the period under review. About 200 high-quality home stays have been licensed. The repairing and upgrading of the Kasarani Sports Complex is complete with a view to enhance sports tourism.
(5) New Towns	- Tatu City - New towns proposed in the Spatial Planning Concept for Nairobi Metropolitan Region
(6) Agricultural development	- Horticulture development - Coffee industry development - Dairy - Tea

Project Category	Remarks
(7) Financial business development	- Insurance license industry roadmap - Opportunities for investors at the Nairobi Securities Exchange - Roadmap to conducting banking, financial institution, and mortgage finance
(8) Deepening of capital markets (Capital Markets Roadmaps)	- To promote long-term investments and create a conducive environment to fund Kenya Vision 2030 through the capital markets.
(9) Industrial property institute road maps	- Upgrading the Industrial Property Institute
(10) Development of five small and medium enterprises (SME) parks	- A pilot metal SME park will be located in Nairobi City due to its proximity to most important markets. - Nairobi Industrial and Technology Park: A joint venture with Jomo Kenyatta University of Agriculture and Technology (JKUAT) who has provided the 32 acres of land. A project proposal, work plan, and zoning concept have been developed.
(11) Development of mini and integrated iron and steel mills	- The project is in Machakos County.

Source: Kenya Investment Authority website (2013)

9.2.2 Industrial Development of Nairobi City towards 2030

(1) Development Direction

The industrial development of Nairobi City is expected to realise both advancement of the industry and generation of employment by linking the two aspects and upgrading informal businesses.

1) Main engine for economic development

Nairobi City should continue to be a main engine for national development while decelerating its population growth. This requires Nairobi City to accommodate advanced-skills-intensive businesses including headquarters and management functions and to increase high-end employment opportunities so that the industrial structure will be advanced towards higher-value addition. In migration of simple labour or expansion of large-scale heavy industries should not be sought for.

2) Generating sustainable employment

On the other hand, one of the most serious socioeconomic requirements in industrial development is to solve unemployment, underemployment, and working poor problems. Generating employment opportunities is, therefore, a mission with a view to establishing supporting industries and innovative or creative individual businesses, upgrading micro, small and medium enterprises, and also absorbing young graduates and even dropouts.

(2) Priority Sectors

The priority industrial sectors of Nairobi City are identified by the following criteria:

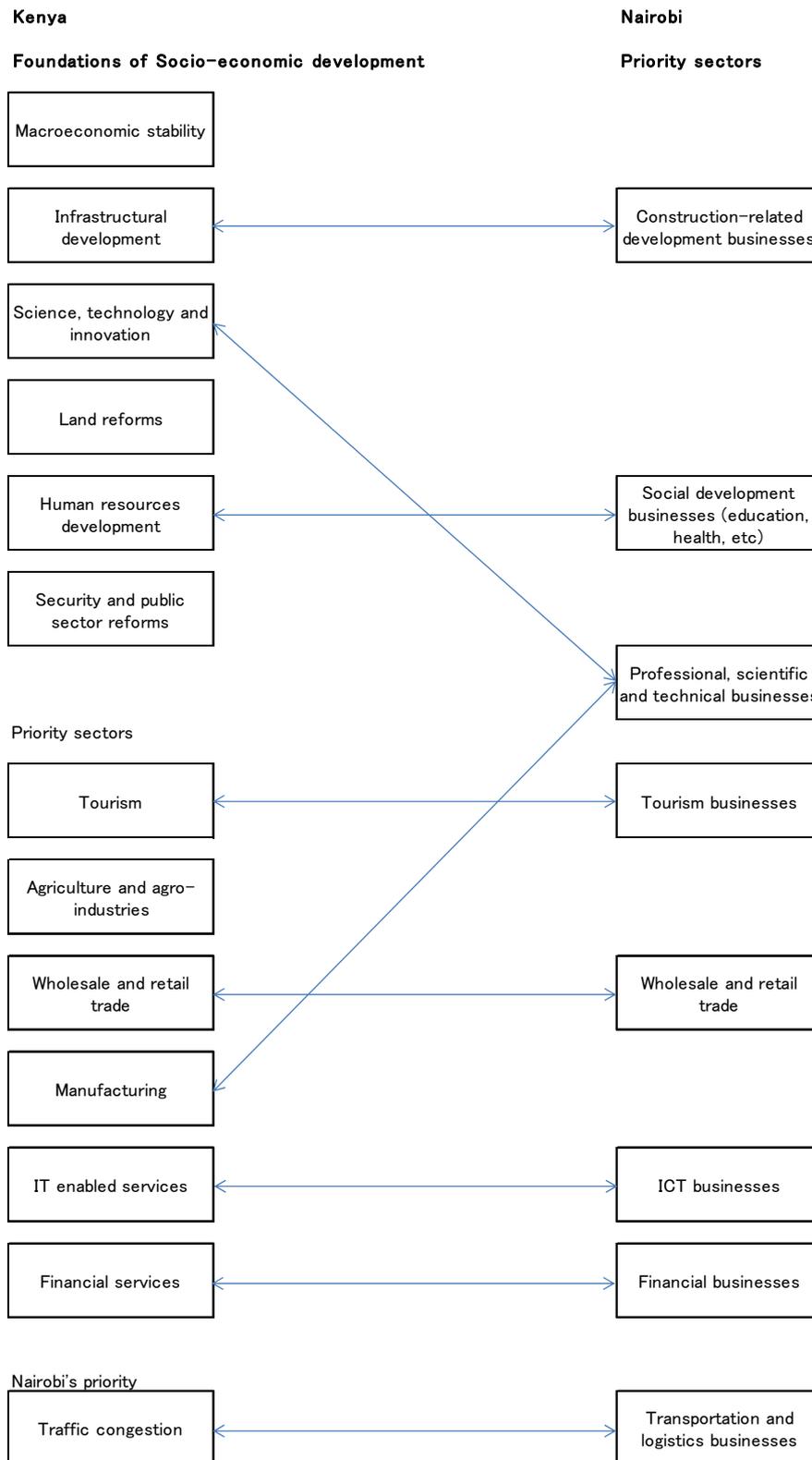
- Include the sectors of high importance for national development as manifested in Kenya Vision 2030,
- Exclude sectors to be promoted in rural areas, local towns, and suburban areas, and
- Include other sectors of special importance in view of Nairobi City's specific issues.

Amongst the foundations of socioeconomic development and the priority sectors identified by Kenya Vision 2030, the agriculture and agro-processing sector is more desired in rural, local, and fully

suburban areas, and mass production or heavy industry requiring large area is also expected outside of urbanised areas. Innovative light manufacturing based on research and development of scientific and technological advancement should be promoted in Nairobi City, as it has accumulated resources of science and technology. Considering the traffic congestion and the measures to address it in the coming years, the transportation and logistics business is identified as an additional priority sector of Nairobi City. (Figure 9.2.1)

Consequently, the following priority sectors are selected for Nairobi City:

- (i) Construction-related development businesses (construction, consulting, planning, design, infrastructure provision and operation, low cost housing, etc.),
- (ii) Social development businesses (education, health, etc.),
- (iii) Professional, scientific, and technical businesses,
- (iv) Tourism businesses,
- (v) Wholesale and retail trade,
- (vi) ICT businesses,
- (vii) Financial businesses, and
- (viii) Transportation and logistics businesses.



Source: Kenya Vision 2030 and JICA Study Team (JST)

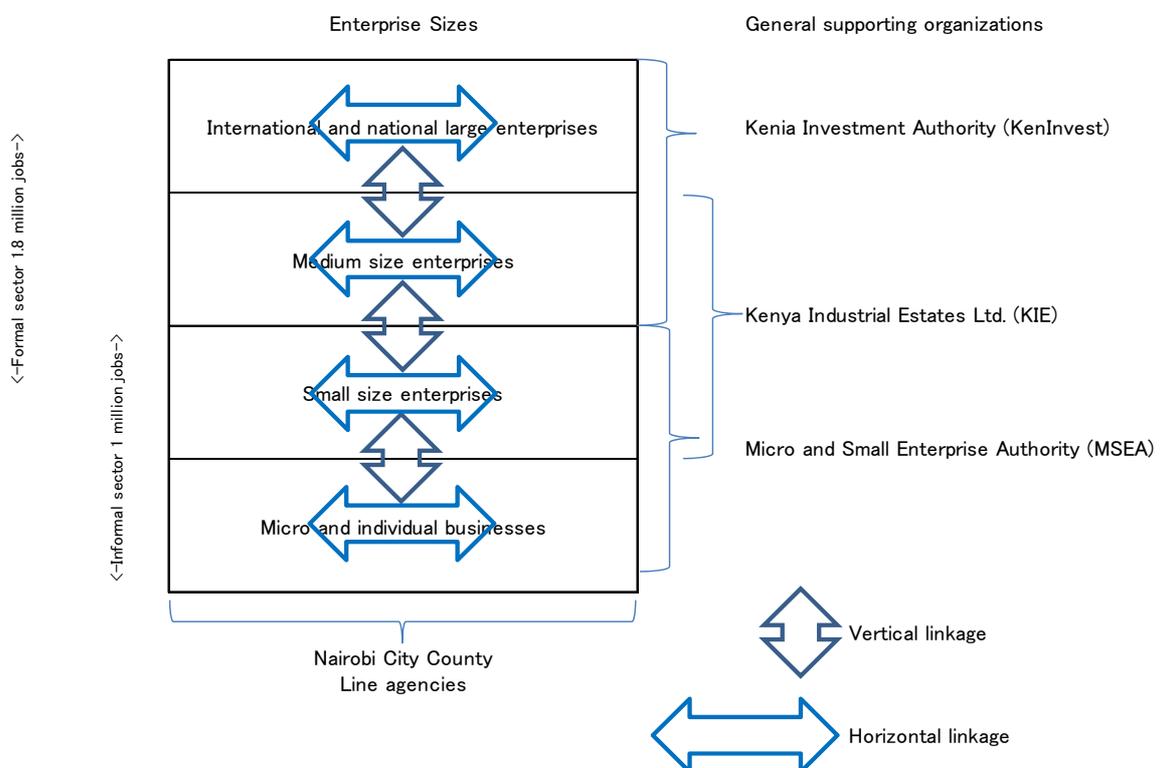
Figure 9.2.1 Correspondence between Priorities of Kenya and Nairobi City

(3) Generation of Sustainable Employment

Generation of sustainable employment can be promoted by activating the labour market. Mobilising the workforce, disseminating job information, and match-making functions should be strengthened by both private and public organisations.

The labour market can be activated by job placement offices and temporary staff dispatching offices. Such offices may operate on a contract basis public facilities like social centres, digital centres, and libraries, and also business processes of private and public organisations.

Capacity and skills development can be conducted not only by education or vocation institutions but also through on-the-job training. Organisational capacity and skills will be upgraded by entering into subcontracts under larger enterprises, which control the quality, quantity, and delivery time of the products. Even buyers can help improve suppliers' products by demanding rational conditions. Such market-led skills development mechanism as part of industrial linkages can function better than off-the-job training, if the latter lacks enough motivation. (Figure 9.2.2)



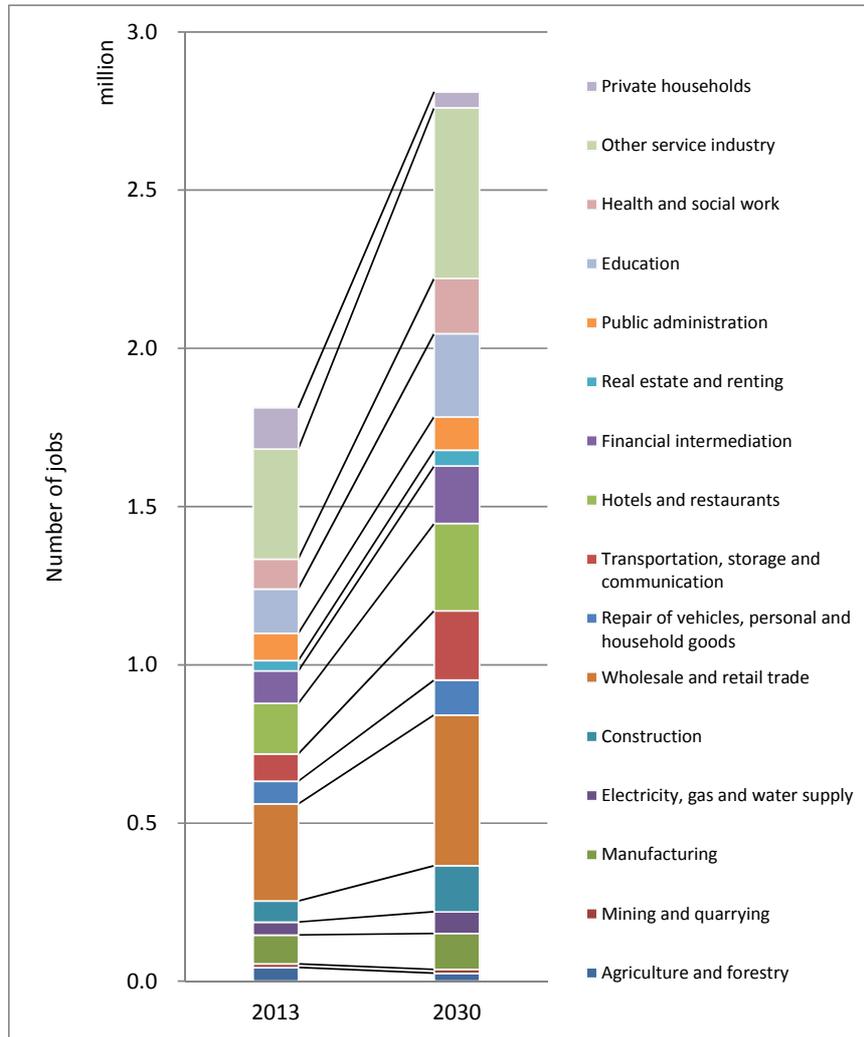
Source: JICA Study Team (JST)

Figure 9.2.2 Expected Structure of the Industries of Nairobi in 2030

(4) Expected Employment

Based on the results of the person trip survey and considering the rapid growth of the priority sectors and the trend of formalisation of the industries in Nairobi City, a scenario of future employment distribution can be assumed (Figure 9.2.3, Tables 9.2.3 and 9.2.4). It is noted that the categories in the person trip survey are different from the standard industrial classification. The person-trip-based category of “other service industry” is interpreted to include professional, scientific, and technical business, which is expected to increase its share although the increase is not apparent due to the decrease of the rest in the “other service industry” category. The total increments of employment during the plan period is approximately 1 million, consisting of 0.8 million formal jobs and 0.2 million of informal jobs.

The scenario manifests necessity to accommodate a large amount of rapidly growing businesses such as information and communication businesses, financial businesses, and professional, scientific, and technical businesses.



Source: JICA Study Team (JST)

Figure 9.2.3 Expected Scenario of Employment Distribution by Type of Industry

Table 9.2.3 Expected Scenario of Employment Distribution by Type of Industry

Type of industry	2013	2013 %	% point change	2030 %	2030	2030-2013
1 Agriculture and forestry	43,831	2.4	-1.5	0.9	26,000	-18,000
2 Mining and quarrying	11,571	0.6	-0.2	0.4	12,000	1,000
3 Manufacturing	91,053	5.0	-1.0	4.0	113,000	22,000
4 Electricity, gas and water supply	40,807	2.3	0.2	2.5	69,000	28,000
5 Construction	66,807	3.7	1.5	5.2	146,000	79,000
6 Wholesale and retail trade	307,061	16.9	0.0	16.9	476,000	169,000
7 Repair of vehicles, personal and household goods	71,205	3.9	0.0	3.9	110,000	39,000
8 Transportation, storage and communication	86,471	4.8	3.0	7.8	218,000	132,000
9 Hotels and restaurants	160,013	8.8	1.0	9.8	276,000	116,000
10 Financial intermediation	102,413	5.6	0.8	6.4	181,000	79,000
11 Real estate and renting	32,518	1.8	0.0	1.8	51,000	18,000
12 Public administration	86,202	4.8	-1.0	3.8	106,000	19,000
13 Education	140,332	7.7	1.6	9.3	263,000	122,000
14 Health and social work	94,294	5.2	1.0	6.2	174,000	80,000
15 Other service industry	347,825	19.2	0.0	19.2	539,000	192,000
16 Private households	130,465	7.2	-5.4	1.8	51,000	-80,000
Total	1,812,869	100.0	0.0	100.0	2,811,000	998,000

Source: JICA Study Team (JST)

Table 9.2.4 Correspondence between Categories in the Person Trip Survey and Industrial Classification

Categories in the Person Trip Survey	Standard Industrial Classification
1 Agriculture and forestry	1 Agriculture, forestry, and fishing
2 Mining and quarrying	2 Mining and quarrying
3 Manufacturing	3 Manufacturing
4 Electricity, gas, and water supply	4 Public utility related industries (electricity, water, sewerage, waste management, etc.)
5 Construction	5 Construction
6 Wholesale and retail trade	6 Wholesale and retail trade; repair of motor vehicles and motorcycles
7 Repair of vehicles, personal and household goods	
8 Transportation, storage, and communication	7 Transportation and storage 9 Information and communication
9 Hotels and restaurants	8 Accommodation and food service activities
10 Financial intermediation	10 Financial and insurance activities
11 Real estate and renting	11 Real estate activities
12 Public administration	14 Public administration
13 Education	15 Education
14 Health and social work	16 Human health and social work activities
15 Other service industry	12 Professional, scientific, and technical activities 13 Administrative and support service activities 17 Arts, entertainment, and recreation 18 Part of other service activities
16 Private households	18 Part of other service activities
	19 Tourism industry (integration of some of the above industries)

Source: JICA Study Team (JST), United Nations website (2013)

(5) Development of Industrial Sectors

Development of industrial sectors is broadly outlined below, according to the United Nation's International Standard Industrial Classification of All Economic Activities, Rev.4.

1) Agriculture

Farming in Nairobi City is mostly informal on a small scale. Horticulture and floriculture are amongst the popular activities. Strong urbanisation pressure causes unplanned urbanisation in agricultural lands such as scattered housing development without proper infrastructure. This issue is remarkable in the peripheral areas such as Dagoretti.

Farming in Nairobi City should be high value-added, taking advantage of the proximity of the urban market. The typical examples are perishable vegetables, fruits, and flowers. Agricultural land should also be regarded as part of the green and open space network. Thus, the zoning of the agricultural areas should be discussed from an urban environment view point as well as an agricultural production view point. Land use zoning and enforcement, tax incentives and disincentives, and infrastructure provision should be studied, paying due consideration to the land market mechanism.

Agriculture including agro-processing/industry is one of the six priority sectors of Kenya Vision 2030, and Nairobi City should function to sell, export by air, as well as coordinate, market, and finance the sector in close cooperation with the production fields.

2) Mining and quarrying

There are some large-scale quarry sites in Embakasi and Njiru divisions. One of the issues is the deterioration of the quarry sites where not only sustained land use would be difficult but also risks of accidents and water-borne diseases would be associated, unless the sites were properly reclaimed after quarrying activities. The operators should be enforced to reclaim the sites after quarrying.

For development of the mining and quarrying sector of Kenya including exploration of oil and gas deposits, Nairobi City should function as a hub for research, investment promotion, and exploration.

3) Manufacturing

According to the business registration data of NCC as of February 2013, there are 454 large manufacturing businesses. Amongst them 289 are located in Makadara, 83 in Embakasi, and 52 in Kasarani. They are mostly in industrial areas in Makadara and Ruaraka, and along Mombasa Road. Their products are diverse from food and beverages to transport equipment (e.g., East African Breweries, Nestle, Coca Cola, Pepsi Cola (new), GM, Honda (new)). It seems that a number of unskilled workers commute to such industrial areas on foot from informal settlements such as Mukuru and Kibera to Makadara and Korongocho to Ruaraka.

There are several clusters of informal light manufacturing (Jua Kali) like fabrication and repair of metal products. Kamukunji and Kariobangi are such examples. It is expected that such informal businesses generate job opportunities and some may grow to become formal enterprises. On the other hand, the elaboration level of their products is not yet very high in general. In addition, some of their waste materials are polluting the environment. There are also small furniture workshops at many places. They imply existence of a craftsman culture.

One important characteristic of the manufacturing sector is weak industrial/business linkages, which are a cause and also a result of weak competitiveness of each enterprise.

For development of internationally competitive manufacturing of Kenya, which is one of the six priority sectors of Kenya Vision 2030, Nairobi City should seek high value-added manufacturing such as knowledge intensive, research and development oriented, prototype development, ICT related, and market-led. Relatively large scale and labour intensive industries may find better operation environments in the environs of the city rather than inside the city. Therefore, the existing designated large-scale industrial zones may not need to be expanded, but they need renovation of infrastructure and facilities such as roads and street lights. In such a general direction, whether to promote or to control new factories needs careful location-specific study from both employment generation and population control viewpoints.

Upgrading informal small businesses and creating a supporting industry system are expected. Whether to upgrade them on site or by relocation to more appropriate sites needs to be studied. If they are to be relocated, the new site needs to be provided with new common facilities for the enterprise groups to enjoy better operating environment. Open space in the industrial area can also be a candidate relocation site for informal manufacturers, who may be able to take advantage of proximity to the large-scale formal manufacturers. According to Kenya Vision 2030 Economic Pillar, a pilot metal small and medium enterprises (SME) park will be located in Nairobi City due to its proximity to most important markets. In any case, it is expected that the SMEs can train themselves by responding to the market demand, for example, through sales under supermarkets, who can pinpoint the demand, or by being subcontracted from large manufacturers. The subcontracting and partnership exchanges (SPXs) scheme of the United Nations Industrial Development Organisation (UNIDO) may be utilised. Another way to support SMEs is through government organisations' procurement of their products, although they have to meet specified conditions in quality, quantity, delivery, and costs. NCC can coordinate with the stakeholders for micro, small, and medium enterprises (MSME) development. One of the actions is to secure sites for MSMEs.

4) Public utility related industries

Energy and water are two of the bottlenecks for national development. Various power generation and supply projects are presented for participation of the private companies on a

PPP basis. For such projects, Nairobi City can provide liaison offices for project management, procurement, logistical support, etc. of the power plants. On the other hand, Nairobi City needs more reliable power supply and wider distribution including informal settlements. To complement the national supply, relatively small-scale green energy plants such as wind energy, solar energy, and bioenergy can be promoted in the city or the environs. In addition, electrification of informal settlements can be supported by approaches called social businesses or base of the pyramid businesses, for example, through the introduction of solar lanterns.

Due to insufficient distribution of tap water, water venders are common in Nairobi City. The water-related sector is also one of the areas where the private sector can play more roles in a more coordinated way.

Operation and management of electricity and water networks can be optimised by using ICT, as this business is emerging.

5) Construction-related development businesses

There are 708 large construction businesses. Amongst them 298 are located in Makadara, 130 in Westlands, and 83 in Embakasi. Currently, many construction projects of residential and office buildings and infrastructure such as roads are ongoing. Toward 2030, a large amount of construction will be required in and around Nairobi City in order to expand and upgrade the current inadequate infrastructure systems that cause high costs to businesses.

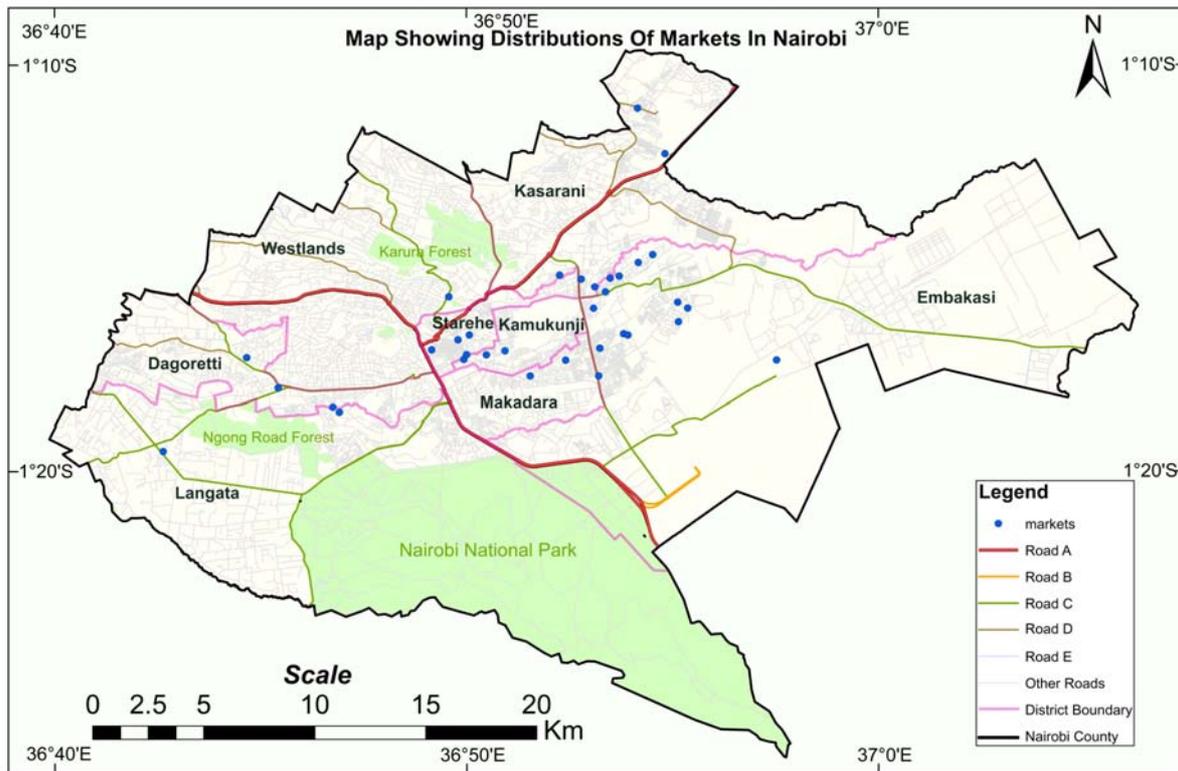
At the national level, a huge amount of construction demand for socioeconomic development necessitates various construction-related businesses, including building material companies, contractors, and designers, of which a number of businesses such as architectural and consulting firms will be located in Nairobi City. Many company headquarters are also in Nairobi City.

Thus construction-related enterprises need to be developed through various means such as joint works with international enterprises and participation in PPP.

6) Wholesale and retail trade; repair of motor vehicles and motorcycles

There are a number of subcategories under this title. They include shopping zones in the commercial business district (CBD), various types of markets, supermarkets, shopping malls, individual shops, informal vendors, hawkers, and internet shops. There are 2,992 large businesses in this category. Amongst them 929 are located in the Central Division, 644 in Makadara, and 601 in Westlands.

The wholesale and retail trade sector is one of the six priority sectors of Kenya Vision 2030. The growth of retail trade for individuals will be accelerated by the expanding middle class. General trends of increasing car ownership and business women will increase the share of supermarkets and malls in the retail trade. On the other hand, the peripheries of the city where markets are sparsely located may need new markets (Figure 9.2.4).



Source: Department of Social Services and Housing, NCC (2013)

Figure 9.2.4 Market Locations

The existing and new shopping zones need to contribute to maximising urban functions and attractions in relation to urban structure, land use configuration, and transportation network. Especially locations of new large shopping malls should be guided to optimise overall urban functions and attractions. On the other hand, markets can be upgraded either on site or at relocation sites for safer and more comfortable shopping environment. They may have more functions such as ordinary shops, restaurants, and other community support functions. Some of them may become tourist attractions. Informal markets are commonly seen especially around informal settlement areas. A number of informal vendors open shops by occupying public spaces on streets. They should be guided to places better for the public and themselves.

Repairers of vehicles and motorcycles are required to be more environmentally-sensitive in two ways. First, they need to pay due attention to their neighbouring environment. If it is difficult, relocation as a group is one way to improve their operation environment as well as their neighbouring environment. The second environmental issue is that strict vehicle exhaust emissions inspection should be enforced and should be passed by their maintenance work.

7) Transportation, storage, and logistics businesses

There are 311 large businesses in this category. Amongst them 108 are located in Makadara, 71 in Embakasi, and 41 in Westlands. To cope with the current traffic congestion and meet the increasing transportation demand, transportation, storage, and logistics (advanced operation of material flows) businesses should have high development potential.

A number of road and transportation projects are being implemented or proposed including the Nairobi Commuter Rail services and bus rapid transit systems. Current and new passenger transportation businesses and logistics businesses can be upgraded in parallel with the introduction of improved infrastructure and ICT. The existing bus and *matatu* system can

redesign their division of roles to structure a more hierarchical network and improve their services. They also need to improve their passengers' safety and to mitigate air pollution.

8) Accommodation and food service activities

Hotels in Nairobi City accommodated 1,681,900 bed-nights including 1,155,700 by high class hotels in 2011. They accounted for 24% of the national figure while the Coast Province accounted for 50%. In Nairobi City, there are 1,357 large businesses in this category. Amongst them 517 are located in the Central District and 332 in Westlands, together accounting for 63%. Thus, Nairobi City's large hotels and restaurants are concentrated in the Central and Westlands divisions, forming a hub of tourism and business trips.

As tourism is one of the six priority sectors in Kenya Vision 2030 for which Nairobi City is a hub, accommodation and food services are expected to grow to cater for domestic and international demands. Moreover, the expected growth of the middle class will promote eating-out at restaurants.

9) Information and communication businesses

There are 251 large businesses in this category. Amongst them 118 are located in Westlands, 73 in the Central District, together accounting for 76%.

The ICT of Kenya has gained international reputation as M-pesa being a good example. However, according to the Kenya Vision 2030 Sector Plan for Information and Communication Technology 2008-2012, the following issues and challenges are emerging:

- Limited access and availability of infrastructure,
- High cost of access and lack of affordable solutions,
- Language and content limitations,
- Lack of regulatory and legislative framework,
- How to respond to impacts of the globalisation,
- Roles to be played by the government,
- Maintaining healthy competition,
- Human resource development,
- Enhancing research, innovation, and protection of intellectual property,
- Strengthening the industry structure and capacity, and
- Spectrum management.

As one of the six priority sectors of Kenya Vision 2030 is the IT enabled services (previously known as business process off-shoring), development of ICT infrastructure and business is recognised to be critically important.

The priority programmes to meet the above issues and challenges are as follows:

- Establishment of the Information and Communication Technology/Business Process Outsourcing (ICT/BPO) park,
- ICT infrastructure development,
- Development of local digital contents,

- E-government strategy, and
- Development of policy, legal, and institutional framework.

Konza City, some 50 km south of Nairobi City, was launched responding to the government's strategy. However, there are much more to do, and the optimal locations for a number of them will be in Nairobi City. The District Development Plans of the three districts in Nairobi City also regard ICT as a base for development regardless of sectors, and emphasise the importance of ICT dissemination at the community level.

On the demand side, the introduction of ICT to diverse sectors and activities such as management of traffic, energy, and safety as well as businesses is worth studying. On the supply side, small-scale ICT entrepreneurs can be fostered by such measures like linking small and large enterprises, providing special spaces, or granting other incentives. It is also important to raise ICT literacy especially amongst the youth. Enhancing the Digital Villages (Pasha Centre) Project involving the youth is one way of achieving this direction.

10) Financial businesses

According to the Kenya Vision 2030 Sector Plan for Financial Services 2008-2012, the financial sector in Kenya comprises banking, insurance, capital markets, pension funds, and quasi-banking institutions, which comprise savings and credit cooperative societies (SACCOs), microfinance institutions (MFIs), building societies, development finance institutions (DFIs), and informal financial services such as rotating savings and credit associations (ROSCAs), merry go rounds, and accumulated savings and credit associations (ASCAS). In Nairobi City, there are 238 large businesses of financial and insurance activities. Amongst them, 101 are in the Central Division and 93 are in Westlands, together accounting for 82%.

The financial services sector is one of the six priority sectors of Kenya Vision 2030 and Nairobi City, in particular Nairobi City's Hill/Upper Hill, is expected to be a globally competitive financial hub or a regional financial centre (RFC), serving a large part of the Eastern Africa Region. The aspiration requires the following: (1) skilled human resources, (2) efficient financial sector regulations, (3) a critical mass of financial institutions, and (4) a conducive business environment.

Roadmaps for financial business development including capital market and insurance business are prepared and present investment opportunities. Nairobi City needs to fulfill the above four requirements and also to create an environment that is not only business-friendly but also resident-friendly.

11) Real estate activities

As a large number of residential and business buildings and complexes are being constructed, the real estate businesses are active at least in some areas in Nairobi City.

Toward realisation, of well-planned land development, public support, or incentives may be granted to qualified urban development projects contributing not only to quality environment inside the sites but also to proper environment of the neighboring zones.

12) Professional, scientific, and technical businesses

There are 202 large businesses of professional, scientific, and technical activities. Amongst them 98 are in Westlands, accounting for nearly 50%.

According to the Kenya Vision 2030 Sector Plan for Science, Technology, and Innovation 2008-2012, development of strategic partnerships between higher education and industries is

one of the important approaches. The plan also proposes the following: (1) creating technopreneurship (seeking high technology venture business) and industry-led clusters, involving small and large firms, both indigenous and foreign owned, and (2) attracting targeted foreign direct investment and focusing activities of government agencies in creating knowledge-based economy. In order to improve science, technology and innovation infrastructure, and equipment, a project called the "Establishment of Science and Technology Parks and Industrial Incubators Project" is proposed. It aims to establish technology parks and industrial incubators in Kenya to enhance the transfer of knowledge into products and services. It also aims to enhance PPP and to encourage growth of SMEs. One of the candidate locations may be Nairobi City or its environs.

On the other hand, according to Kenya Vision 2030 Economic Pillar, the Nairobi Industrial and Technology Park is being developed in JKUAT, who has provided 32 acres of land in their campus in Kiambu County. JKUAT and Nissin Food Holdings launched the instant noodles business in partnership. The park is a pioneer for research and development oriented collaboration between businesses and universities. Such initiatives are also expected in Nairobi City, involving universities or research institutes, companies, and government bodies.

13) Administrative and support service activities

Under this category are the following: (1) rental and leasing activities, (2) employment activities, (3) travel agencies, tour operators, reservation services and related activities, (4) security and investigation activities, (5) services to buildings and landscape activities, and (6) office administrative, office support, and other business support activities. Some of these businesses are already very active. In the coming years, demands for such service industries are expected to grow especially in highly urbanised areas like Nairobi City.

In order to activate labour market, qualified placement businesses such as recruiting, dispatching temporary staff, business process outsourcing in a wide sense, and dispatching workforce to overseas labour market can play important roles.

For security of not only individual houses and business establishments but also streets and districts against crimes and disasters, private security firms can play important roles in collaboration with public agencies and citizens by building a network, in particular, an ICT network.

Moreover, business to support urban management with innovative ICT systems is emerging.

14) Public administration

In Kenya, there are 53,253 wage employees in government services excluding law and order, defense, education services and other specialised services. Its national share is 2.5% of the total private and public wage employment of 2,127,700. In Nairobi City, however, the employment share of overall public administration is approximately 4.8% according to the person trip survey. Taking advantage of such concentration, public administrators of different line organisations in Nairobi City are expected to collaborate efficiently for the nation's common socioeconomic agenda.

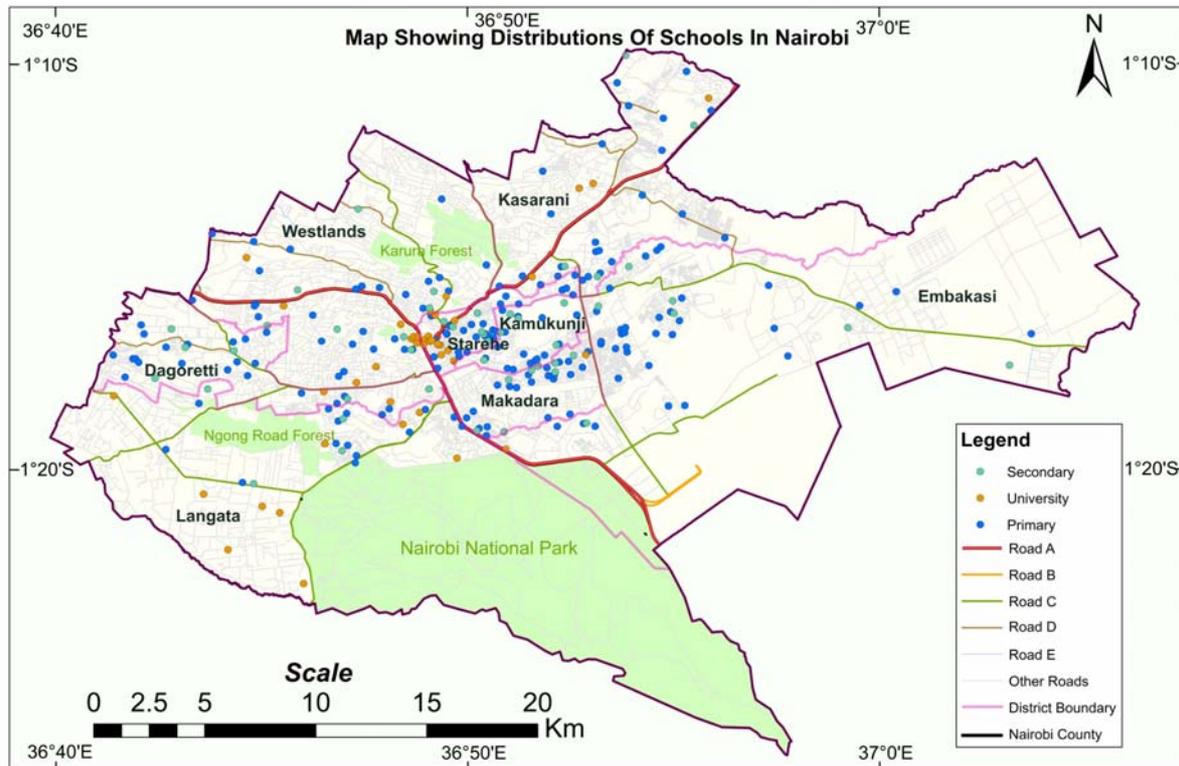
15) Education

There are approximately 900 primary schools including pre-primary schools and 250 secondary schools (Table 9.2.5 and Figure 9.2.5). There are also a number of tertiary education and vocational training institutions. Although they are not profit-making bodies, they provide employment and undertake economic activities.

Table 9.2.5 Number of Primary and Secondary Schools

School Category	Primary Schools (including pre-primary)	Secondary Schools
Public	216	80
Private	149	160
Non-formal	542	10
Total	907	250

Source: Education Department NCC (2013), former City Council of Nairobi (2013)



Source: Education Department, NCC (2013), , former City Council of Nairobi (2013)

Figure 9.2.5 School Locations

During the period from 2013 to 2030, as both population and enrolment rates increase, the total enrolment of schools and institutions is estimated to increase by 82% from 954,000 to 1,737,000. Moreover, quality education and training are increasingly demanded. Therefore, not only ordinary education but also various human development and skills development services need to be expanded and upgraded.

16) Human health and social work activities

There are 23 large institutions of human health and social work activities, of which ten are located in Westlands, six in Makadara, and five in Langata. Currently, there is a big gap between demand and supply of health and social services. Toward a more equitable society, expansion of the services is required. In this regard, social businesses should also be promoted.

Operation of community facilities such as social halls, community halls, and parks can be contracted out to non-governmental organisations or community organisations or youth groups in order to realise efficient operation and the communities' sense of commitment.

17) Arts, entertainment, and recreation

There are 90 large businesses of arts, entertainment, and recreation, of which 40 are located in Westlands and 19 in the Central Division. This category of businesses can be developed in line with tourism promotion, as cultural tourism, traditional, and modern, has the potential to expand.

18) Other service activities

Many people are engaged in this category such as washing, hair dressing, housekeeping, and shoe shine. Some of these activities will grow as the population and economy grow, while others like housekeeping and shoe shine may decrease as the income gap decreases.

19) Tourism businesses

According to a tourist guide in Kenya, Nairobi City's best natural attractions are the following: (1) Nairobi National Park, (2) David Sheldrick Wildlife Trust, (3) Giraffe Centre, and (4) Ngong Hills. Moreover, the best cultural attractions are the following: (1) Bomas of Kenya, (2) National Museum, (3) African Heritage House, (4) Karen Blixen Museum, and (5) Carnivore Restaurant.

In addition to the above, the CBD including Uhuru Park and Central Park is a popular destination for many holiday makers. The workshop road zone south of the railway yard is emerging as a creative spot.

On the other hand, Nairobi City is generally regarded as a dangerous place. Regarding the operation of some of the above best attractions, services such as the reception procedures and design of the websites can be evaluated to be less client-oriented than expected.

Kenya Vision 2030 includes tourism in the six priority sectors and encourages various types of tourism, such as ecotourism, wildlife tourism, heritage tourism, conference tourism, and sports tourism. It also proposes the following projects in Nairobi City:

- Amusement Park and 5-Star Hotel at Bomas of Kenya,
- Nairobi Galleries at the Nairobi National Museum,
- Revolving Restaurant (at Kenyatta International Convention Centre (KICC)), and
- International Sports Academy in Kasarani.

In addition to these, Nairobi City is a hub of tourists who visit other sites in and around Kenya. Based on the general understanding that tourism contributes substantially to Nairobi City's employment and economy, it can be promoted through the following city-wide measures amongst others:

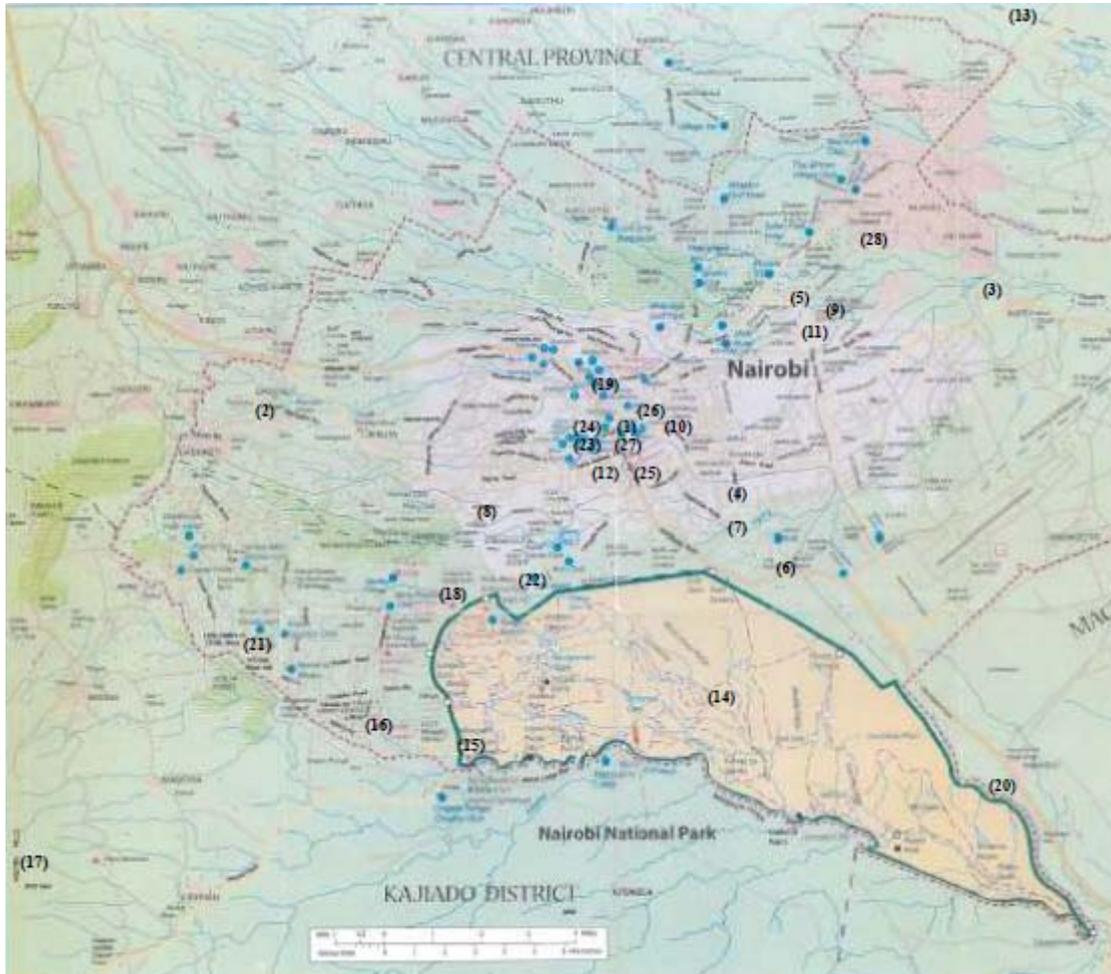
- Improvement of public safety,
- Improvement of product quality and diversity,
- Improvement of infrastructure and public services especially decongestion of traffic along tourist networks,
- Recovery of clean environment and creation of tourist streets,
- Enhancement of the shops, streets, crossings, and bus stops, and
- Opening of exclusive pedestrian streets or car free zones on weekends.

For example, the Nairobi River and its banks especially between Museum Roundabout and Race Course Roundabout should be cleaned and beautified as part of the stroll network in CBD together with the increase of urban amenities around the area.

Another idea is to create marathon tours, as a number of marathon, half-marathon, and 10-km marathon tours in various countries are attracting many amateur marathon fans from abroad.

For many foreigners, Africa's image is Kenya's image including wild animals. Some Japanese have mistakenly thought that Mt. Kilimanjaro is in Kenya. Such Kenya's strong brand should be protected from decaying with reputation of insecurity. The Nairobi National Park may be promoted as the most convenient safari park in the world. Tourism promotion can be included in the missions of the Kenyan embassies.

Location-specific items discussed in this section are indicated in Figure 9.2.6.



Agenda for Industrial and Tourism Development

- (1) Sole Central Business District (CBD)
- (2) Unplanned urbanisation of agricultural lands in Dagoretti
- (3) Deterioration of quarry sites in Embakasi and Njiru
- (4) Industrial area in Makadara
- (5) Industrial area in Ruaraka
- (6) Industrial area along Mombasa Road
- (7) Informal settlements of Mukuru
- (8) Informal settlements of Kibera
- (9) Informal settlements of Korongocho
- (10) Informal light manufacturing (Jua Kali) in Kamukunji
- (11) Informal light manufacturing (Jua Kali) in Kariobangi
- (12) Regional Financial Centre (RFC) at Nairobi Hill/Upper Hill
- (13) Nairobi Industrial and Technology Park in Jomo Kenyatta University of Agriculture and Technology (JKUAT)
- (14) Nairobi National Park
- (15) David Sheldrick Wildlife Trust
- (16) Giraffe Centre
- (17) Ngong Hills
- (18) Bomas of Kenya
- (19) Nairobi National Museum
- (20) African Heritage House
- (21) Karen Blixen Museum
- (22) Carnivore Restaurant
- (23) Uhuru Park
- (24) Central Park
- (25) Workshop Road Zone
- (26) Nairobi River Zone
- (27) Kenyatta International Convention Centre (KICC)
- (28) International Sports Academy in Kasarani

Source: JICA Study Team (JST)

Figure 9.2.6 Location-specific Agenda for Industrial and Tourism Development

9.2.3 Prospects of Industrial Development in the Environs

The Spatial Planning Concept for Nairobi Metropolitan Region prepared by the then Ministry of Nairobi Metropolitan Development in 2013 planned rapid development in the environs out of Nairobi City within Greater Nairobi. Urban centres are planned to contribute to economic development and new towns are to be self-contained. None of them will be dormitory towns. Major functions of urban centres are envisaged and those of new towns are as indicated by their names. In manufacturing, agro-based industries tend to be featured in the north-west environs with high agricultural potential, while other industries are planned at the urban centres of Thika, Ngong, and Mavoko. Those urban centres and new towns can complement the urban functions of Nairobi City, so that the city does not need to be equipped with a full set of industrial functions (Figure 9.2.7 and Table 9.2.6).



Note: The area of each district shown in the figure does not include the part outside the Greater Nairobi.

Sources: District Development Plans (2008-2012) and JICA Study Team (JST)

Figure 9.2.7 District Demarcation in the Environs of Nairobi City within Greater Nairobi

Table 9.2.6 Estimation of Population and Employment of the Environs in Greater Nairobi

Population Estimation		2009	2013	2015	2018	2020	2023	2025	2030	Proposed new towns (planned population)
County	District									
Nairobi City		3,138,369	3,601,351	3,820,673	4,174,952	4,369,208	4,677,671	4,824,618	5,212,500	
Kiambu	Thika	497,140	624,536	688,234	851,199	959,842	1,180,572	1,327,725	1,829,662	Aerotropolis (100,000), Tatu City (70,000) (construction started.)
	Kiambu East	401,514	385,233	377,093	458,241	512,340	625,036	700,166	961,198	
	Kiambu West	370,574	585,410	692,829	830,577	922,409	1,106,920	1,229,927	1,645,893	Knowledge-cum-Health City (100,000)
Kajiado	Kajiado	249,819	311,360	342,130	417,027	466,958	570,063	638,801	875,427	
Machakos	Machakos	139,502	207,107	240,910	309,251	354,811	445,115	505,318	707,503	Sports City (100,000)
	Kangundo	219,103	310,087	355,579	452,249	516,696	646,995	733,861	1,030,149	Cyber City (100,000)
Nairobi City's Environs in Greater Nairobi		1,877,652	2,423,734	2,696,775	3,318,544	3,733,056	4,574,701	5,135,798	7,049,832	
Assumptions		2009	2013	2015	2018	2020	2023	2025	2030	
Share of workforce (%)		52.7	52.7	52.7	52.7	52.7	52.7	52.7	52.7	52.7
Unemployment rate as defined in 2009 Census (%)		14.7	13.2	12.5	11.4	10.7	9.6	8.8	7.0	
Share of employees in population (%)		45.0	45.7	46.1	46.7	47.1	47.7	48.0	49.0	
Employment Estimation		2009	2013	2015	2018	2020	2023	2025	2030	Proposed new towns
Kiambu	Thika	223,480	285,575	317,362	397,443	451,881	562,641	637,903	896,736	Aerotropolis, Tatu City (construction started.)
	Kiambu East	180,493	176,152	173,887	213,963	241,203	297,882	336,394	471,093	
	Kiambu West	166,585	267,685	319,481	387,815	434,258	527,540	590,917	806,689	Knowledge-cum-Health City
Kajiado	Kajiado	112,301	142,373	157,765	194,719	219,837	271,683	306,911	429,055	
Machakos	Machakos	62,710	94,702	111,090	144,396	167,040	212,135	242,779	346,754	Sports City
	Kangundo	98,494	141,790	163,966	211,165	243,254	308,347	352,582	504,886	Cyber City
Nairobi City's Environs in Greater Nairobi		844,063	1,108,277	1,243,550	1,549,501	1,757,473	2,180,228	2,467,486	3,455,193	
Employment of Urban Centres and New Towns according to "Spatial Planning Concept for Nairobi Metropolitan Region" in Greater Nairobi										
County	District	Urban centre	Envisaged functions	2009	% in district employment	2030	% in district employment			
Kiambu	Thika			121,281	54.3	648,170	72.3			
		Ruiru	Trading	75,694		340,869				
		Thika	Industrial	43,187		199,581				
		Juja	Service	2,400		57,720				
		Aerotropolis		0		50,000				
	Kiambu			66,518	36.9	326,329	69.3			
		Kiambu	Administrative cum Agro-based industrial	28,980		126,823				
		Karuri	Agro-based industrial	37,538		185,426				
		Githunguri	Agro-based industrial cum Administrative	0		14,080				
		Kiambu		107,513	64.5	532,831	66.1			
Kajiado	Kajiado	Limuru	Agro-based industrial	32,265		148,819				
		Kikuyu	Agro-based industrial	75,248		334,012				
		Knowledge-cum-Health City		0		50,000				
				36,320	32.3	301,316	70.2			
Machakos	Machakos	Ngong	Industrial	17,937		144,424				
		Kitengera	Service	5,031		78,374				
		Ongata Rongai	Service	9,474		54,136				
		Kiserian	Service	3,878		24,382				
				44,546	71.0	264,032	76.1			
	Kangundo	Mavoko	Industrial service	44,546		209,020				
		Kathiani		0		5,012				
		Sports City		0		50,000				
				45,351	46.0	377,757	74.8			
		Kangundo/Tala	Trading	45,351		327,757				
Nairobi City's Environs in Greater Nairobi				421,529	49.9	2,450,435	70.9			

Note: Spatial Planning Concept for Nairobi Metropolitan Region plans new towns as self-contained cities and as means for promoting economic development, therefore, the number of jobs in each new town is assumed to be 50% of the population.

It is assumed that each district will have no net cross-border commuters, based on the self-contained concept.

Sports City is assumed to be in Greater Nairobi, because it is either partly inside of or neighbouring on Greater Nairobi although it cannot be pinpointed.

Tatu City is not amongst the new towns planned by the Spatial Planning Concept for Nairobi Metropolitan Region.

Sources: "Spatial Planning Concept for Nairobi Metropolitan Region" (2013) Ministry of Nairobi Metropolitan Development, JICA Study Team (JST)

9.2.4 Required Policy Measures and Expected Functions of Nairobi City County

The socioeconomic framework set above requires policy measures to make it happen. The target population of Nairobi City in 2030 is 166% of its population in 2009. At the same time, the target population growth rate is substantially lower than the recent trend of population growth. Therefore, the framework requires a mixed policy for employment generation and deceleration of in-migration amongst others.

Regulating industrial location and advancing the industrial structure can be two of the important policy measures including regulations to restrict certain industries in some of the central zones and to promote relocation of industries to new and suburban sites with better operational environment.

It is worth studying for Nairobi City County to have a facilitation function for its industrial development through the following activities. It is not recommendable for a government organisation to be an implementer of businesses.

- (i) Expedite and improve NCC's procedures for doing business of private establishments so that Kenya's rank in the "Ease of Doing Business" of the International Finance Corporation is significantly raised.
- (ii) Identify potential sites for public or private investment as there are a lot of areas, in which the potential value is not yet partly realised due to the malfunctioning property taxation mechanism.
- (iii) Facilitate investment and operation of businesses by making use of the land use zoning, business licensing, land rents, property taxation, and related incentives and disincentives.
- (iv) Facilitate investment and operation of businesses in collaboration with other relevant organisations such as Kenya Investment Authority (KenInvest), Kenya Industrial Estate Ltd. (KIE), Micro and Small Enterprise Authority (MSEA), sector-wise agencies, and infrastructure agencies as well as private sector organisations.
- (v) Take the initiative in the redevelopment or renewal of potential sites owned by NCC involving the private businesses both as developers in the project stage and as tenants in the business zones or floors in the operation stage. For example, in addition to residential use, commercial and office units, and industrial apartments for light manufacturers can be developed within a project site.
- (vi) Contract out operation of the social facilities to non-governmental organisations, or community organisations, or youth groups on contracts for fixed periods of time with monitoring and evaluation mechanisms.
- (vii) Make city markets better places for customers, tenant traders, and neighbourhoods.
- (viii) Increase transparency of roadside parking management.
- (ix) Build up industrial statistics, for example, by augmenting or independently of the business licensing data.

Besides the above activities for industrial development, the following measures to decelerate population growth are worth studying.

- (i) Disincentive measures or prohibition to restrict building and expanding facilities larger than specified standards.
- (ii) Incentive measures to promote relocation of large facilities from congested areas to under-urbanised areas.

9.3 Urban Facilities

9.3.1 Demand and Gap Analysis

(1) Health Facilities

According to the Nairobi City County Public Health Department, there are around 79 health centres. Nairobi City has a total population of 3,138,369 according to the 2009 Population Census.

In previous studies, it has been proposed that a health centre should be provided for every 25,000 people. Based on this, Nairobi City has a shortage of 47 health centres. The table below summarises the number of health centres within the districts of Nairobi City and their consequent population.

Table 9.3.1 Number of NCC Health Centres and Dispensaries by District

District	No. of NCC Health Centres and Dispensaries	Population
Starehe	12	274,607
Kamukunji	9	261,855
Kasarani	12	525,624
Westlands	10	247,102
Dagoretti	4	329,577
Kibera	3	355,188
Embakasi	9	925,775
Makadara	20	218,641

Source: JICA Study Team (JST)

From Table 9.3.1 above, it is clear that more health centres are needed in Embakasi than in any other district. Providing health centres in Embakasi should therefore be a priority project since it lacks about 29 health centres to cater for its population.

Using the Nairobi Metropolitan Development Scenario, Nairobi City is predicted to have 5,212,500 inhabitants. Based on this, 101 more health centres will be required to serve Nairobi City's populace.

Similarly, for every population of 25,000 people, a large market should be provided. Table 9.3.2 below shows the number of large markets within the districts of Nairobi City and their consequent populations respectively as provided by the Nairobi City County markets section.

Table 9.3.2 Types and Capacity of City Council Markets by Ward

District	No. of Markets	Population
Starehe	3	274,607
Kamukunji	5	261,855
Kasarani	2	525,624
Westlands	2	247,102
Dagoretti	0	329,577
Kibera	3	355,188
Embakasi	6	925,775
Makadara	2	218,641

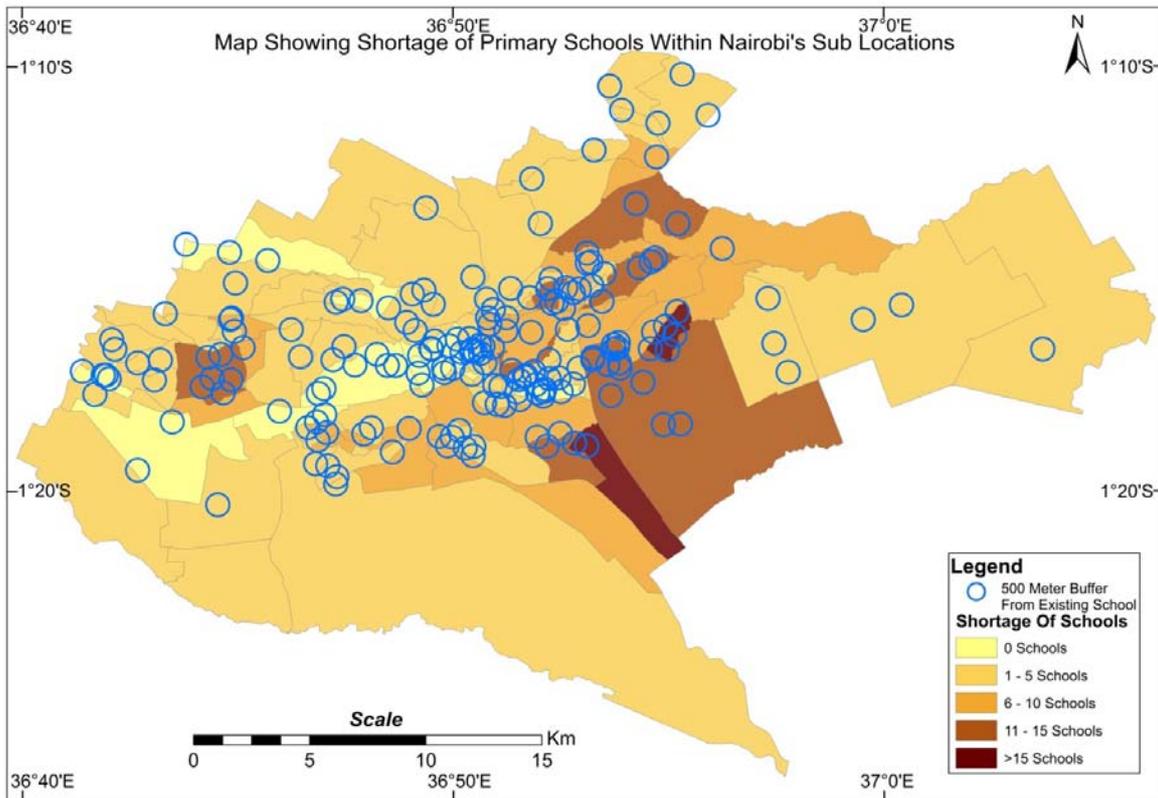
Source: JICA Study Team (JST)

There also exist 20 open air markets within Nairobi City. About 126 markets are needed for the whole of Nairobi City even though there are only 23 large markets. From the above Table 9.3.2, the priority area is Embakasi which has the biggest deficit of 32 markets.

By 2030, a total of 209 markets will be required to serve the population of Nairobi City.

(2) Primary Schools

According to the draft physical planning handbook, a school is required for a population of 5,000 people. Currently, there are 185 public primary schools in Nairobi City and, thus, Nairobi City has a deficit of 443 primary schools. Further, a primary school should be within a 500 m walking distance. See the map below which contains the 500 meter buffer.



Source: JICA Study Team (JST)

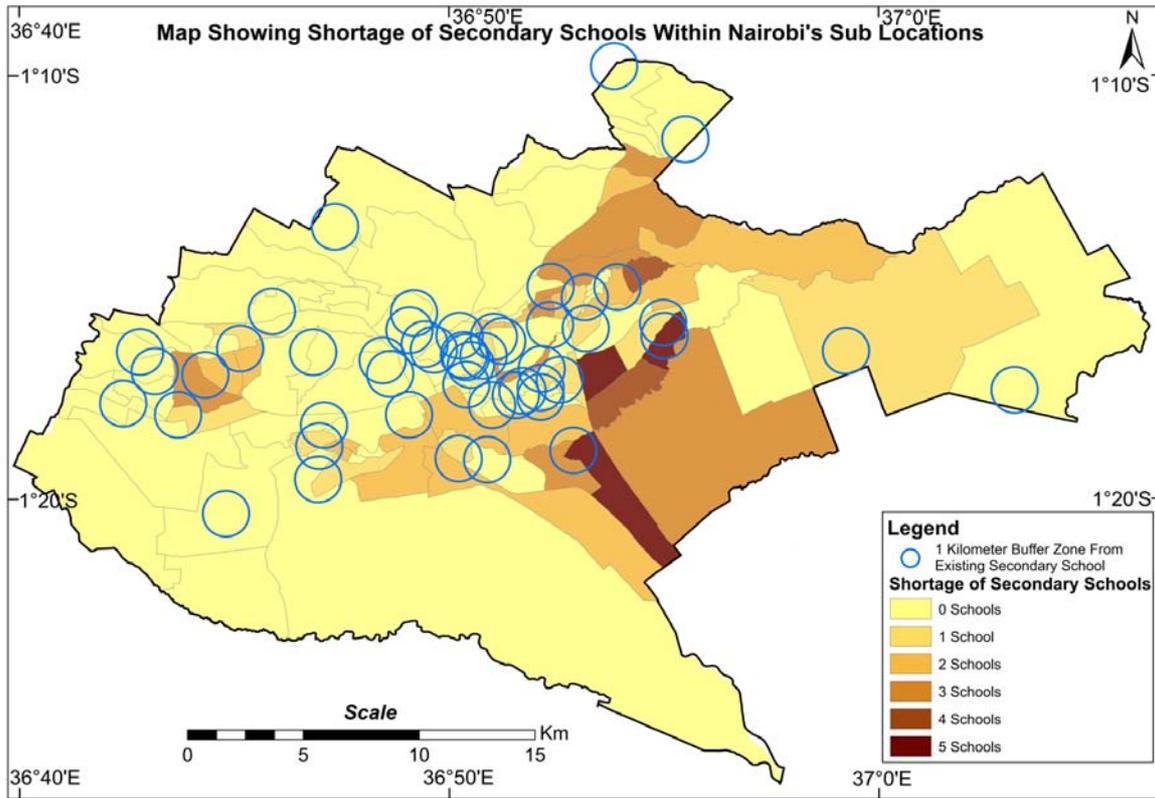
Figure 9.3.1 Map Showing Shortage of Primary Schools

From Figure 9.3.1 above, Mukuru Kwa Njenga and Kayole have a deficit of more than 15 schools. Therefore, key priority areas for establishment of new schools in the areas not covered by the buffer zones should be formed. By 2030, a total of 1,043 primary schools will be required to serve Nairobi City's growing population.

(3) Secondary Schools

For every population of 25,000 people, a secondary school is required based on the draft physical planning handbook. Further, the school should serve a buffer region of 1 km. Currently, there are 49 public secondary schools in Nairobi City which can only serve 1,225,000 people. About 77 more schools are required to serve the remaining population and should be located away from the buffer zones.

From Figure 9.3.2 below, Umoja, Kayole, and Mukuru Kwa Njenga require five more schools. This is the highest compared to all the other sublocations. These are, therefore, the priority areas for any proposal to build a government school. Proposed schools should be outside the buffer zones.



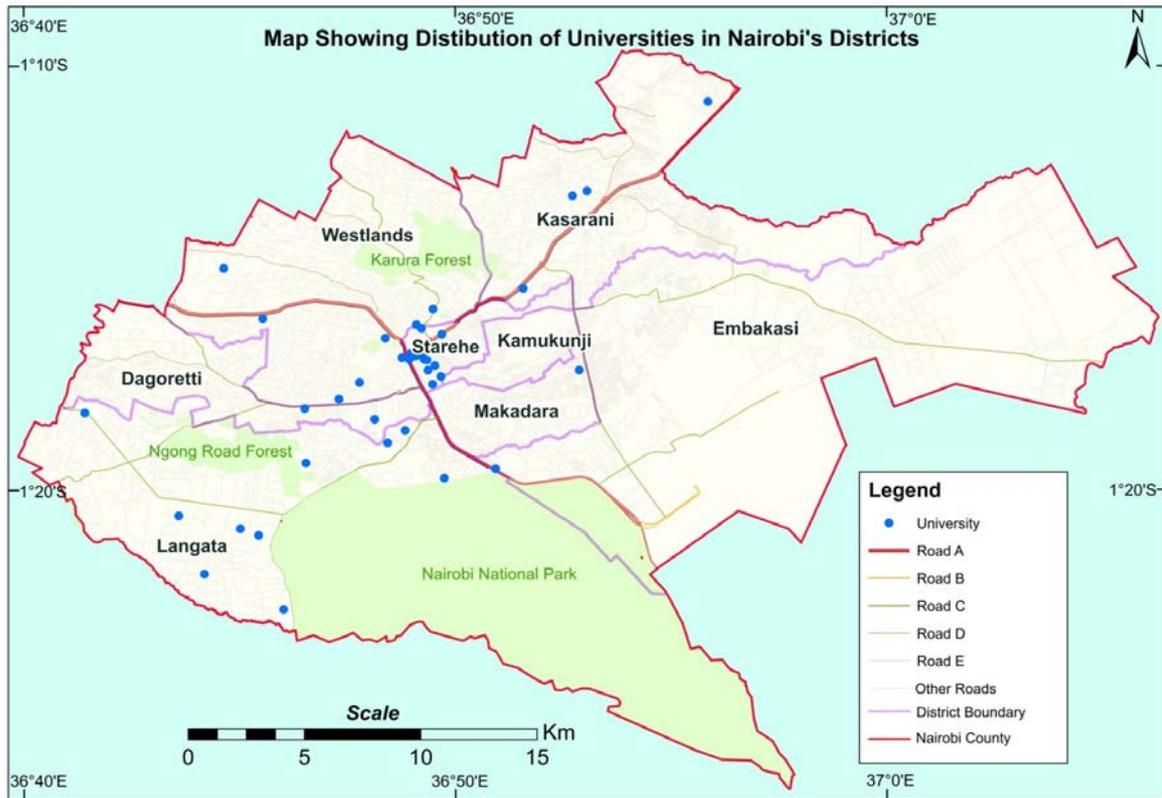
Source: JICA Study Team (JST)

Figure 9.3.2 Map Showing Shortage of Secondary Schools in Nairobi

(4) Universities

The rise of both private and public universities within Nairobi City's CBD has seen an increase in traffic towards the CBD especially in the evening, thereby, creating congestion on the roads that direct traffic into the CBD.

In the future, universities should be redirected to areas outside the CBD in the proposed sub-centres, which have a good transportation network. Figure 9.3.3 below shows the distribution of universities within Nairobi City.



Source: JICA Study Team (JST)

Figure 9.3.3 Map Showing Distribution of Universities in Nairobi City

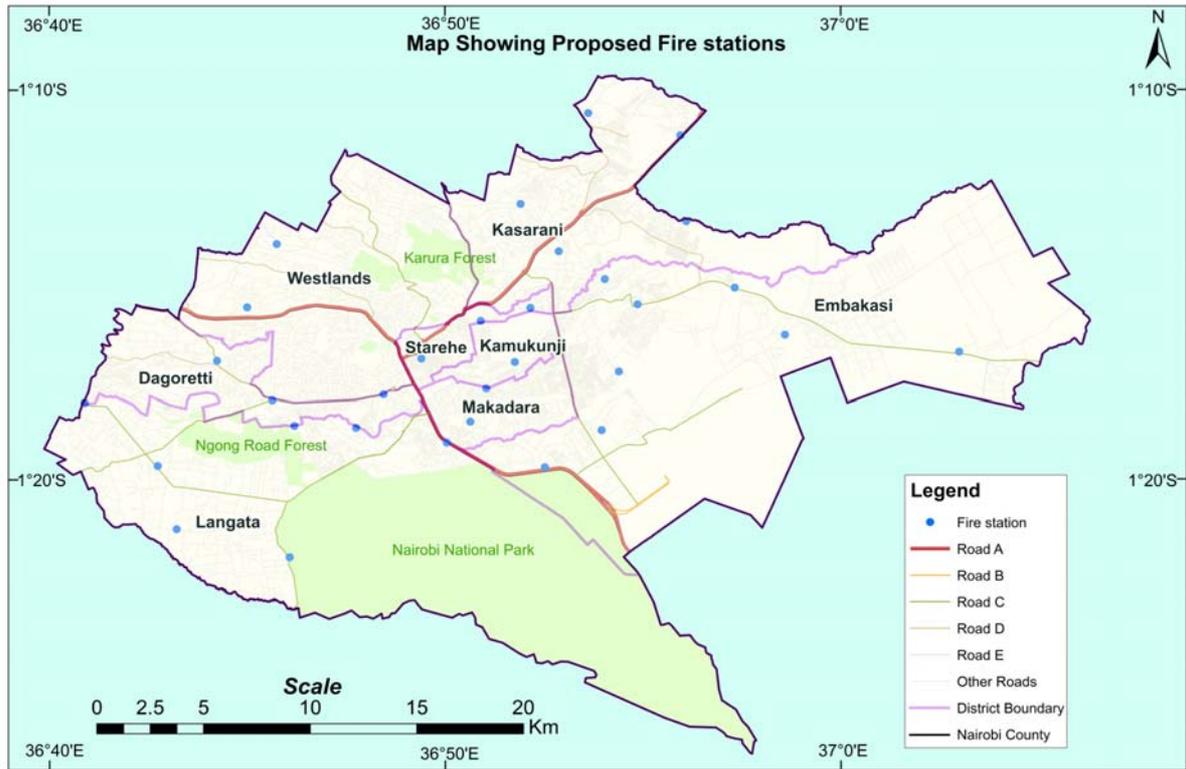
(5) Fire Stations

According to the physical planning handbook, for every 50,000-100,000 people, a fire station should be provided. Therefore, Nairobi City requires 32 fire stations. Currently, there are only three fire stations in Nairobi City.

In order to provide suitable sites for the fire stations, it is important to consider the following:

- Proximity to roads,
- Availability of land,
- Population of surrounding area, and
- Land use in the surrounding area.

Below, find Figure 9.3.4 showing the suggested sites for the new fire stations.

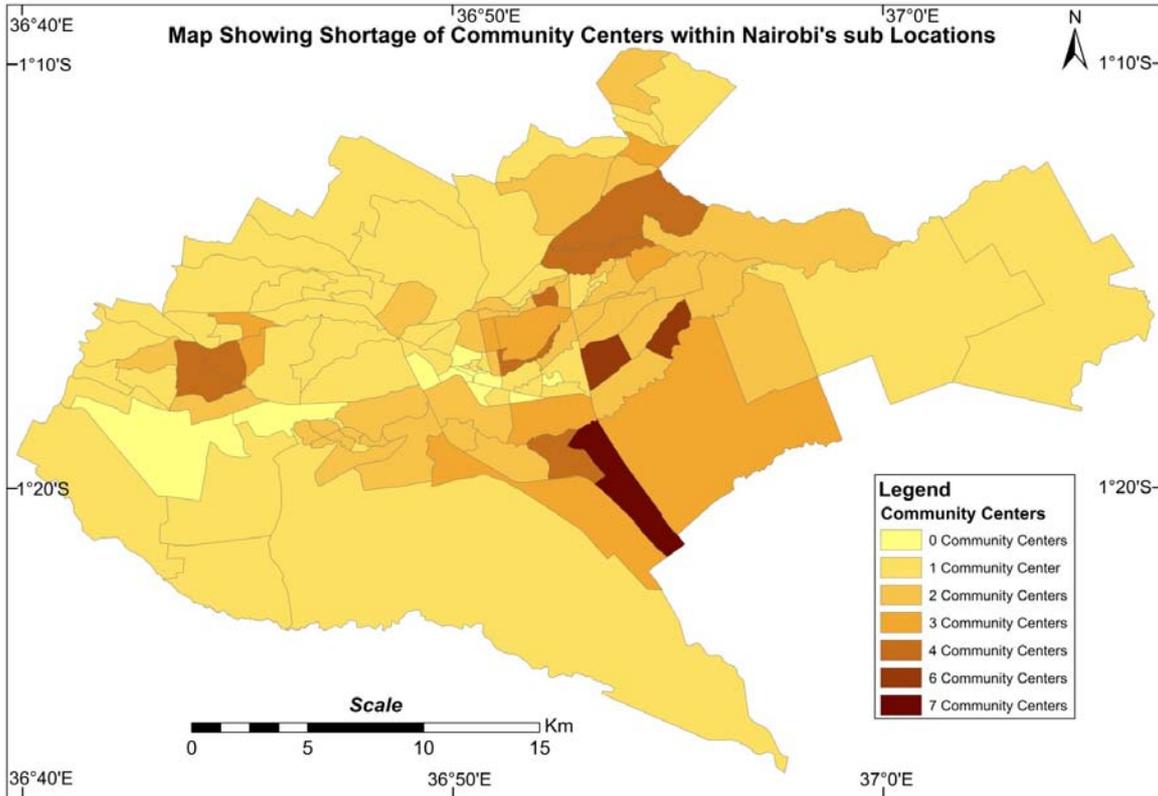


Source: JICA Study Team (JST)

Figure 9.3.4 Map Showing the Proposed Fire Stations

(6) Community Facilities

From the draft physical planning handbook, a community centre should be provided for every 5,000 people. Currently, there are only 25 community centres in Nairobi City. This leaves a deficit of 603 community centres based on the current population.



Source: JICA Study Team (JST)

Figure 9.3.5 Map Showing Shortage of Community Facilities

From the above Figure 9.3.5, Mukuru Kwa Njenga has the highest deficit of seven community centres followed by Kayole and Umoja which require six community centres each. Therefore, these sublocations form the basis of candidate sites for the priority projects. By 2030, a total of 1,043 community centres will be required to serve the population.

9.3.2 Development Policy

Develop the areas where facilities are not enough: number of facility per population (future) and the number facility based on the guidelines. Development to support sub-centre development should be encouraged.

9.4 Geographic Information System (GIS)

9.4.1 Background of the Issues

A geographical information system (GIS) is a computer-based tool used to consolidate various locational, topographical, social, administrative, and infrastructure information. It also facilitates the creation of informed decisions. The usefulness of GIS, however, highly depends on the availability and quality of data to be used.

Acquisition of data from different sources comes with a problem of their own. This is partly because different data sources differ in accuracies. Other reasons why the accuracies of data differ include but are not limited to the following:

- Age of data,
- Projection, coordinate system, and datum used,
- Format in which the data is kept,
- Human error, and
- GIS system users.

Inaccuracy leads to positional errors and attribute errors. Positional errors are errors arising when spatial entities are fixed in space by incorrect coordinates, whereas attribute errors are errors arising from incorrect labelling of spatial entities in the GIS database.

9.4.2 Situation of Nairobi City's GIS

There were several existing problems in the non-harmonious geographic data of Nairobi City which include the following:

Incorrect spatial referencing of acquired shape files; although it was indicated on some shape files that the mapping datum used was WGS 84 reference ellipsoid, a study on their spatial location revealed that they were mapped using Arc datum 1960. There was a similar mistake on the datum information on the orthophotos of Nairobi City. This misrepresentation generated a position shift of about 300 m between the orthophotos and other sets of GIS data mapped using the WGS 84 reference ellipsoid. The most likely reason for the incorrect datum information on the orthophotos is that they might have been outputted through a reprojection from Arc Datum 1960 to WGS84 reference ellipsoid that did not register, thus, giving the spatial shift.



Source: JICA Study Team (JST)

Figure 9.4.1 Difference in the Satellite Image

The topographic data available in the National Mapping Agency was only in CAD format.

The present GIS data has been based on the orthophoto of 2003 procured by JST (The Study for the Establishment of the Spatial Data Framework for the City of Nairobi in the Republic of Kenya) in March 2005 along the terrain map GIS data specifications. Therefore, updating of the GIS database is required to fill up and include developments after 2003 to date.

(1) Map Data

1) Data Model

All GIS database shall be developed by ArcGIS Personal Geodatabase Format.

2) Coordinate System

The following items shall be used: Projection system is Universal Transverse Mercator (UTM) in Zone 37/ Origin of Meridian is 39° East of Greenwich/ Origin of Latitude is Equator/ Scale factor at origin is 0.9996/ False easting is 500,000 m/ False northing is 10,000,000 m/ Unit of measurement is meter/ Spheroid is Clarke 1880 Arc/ Semi-major axis is 6,378,249.145 m/ Inverse flattening is 293.465.

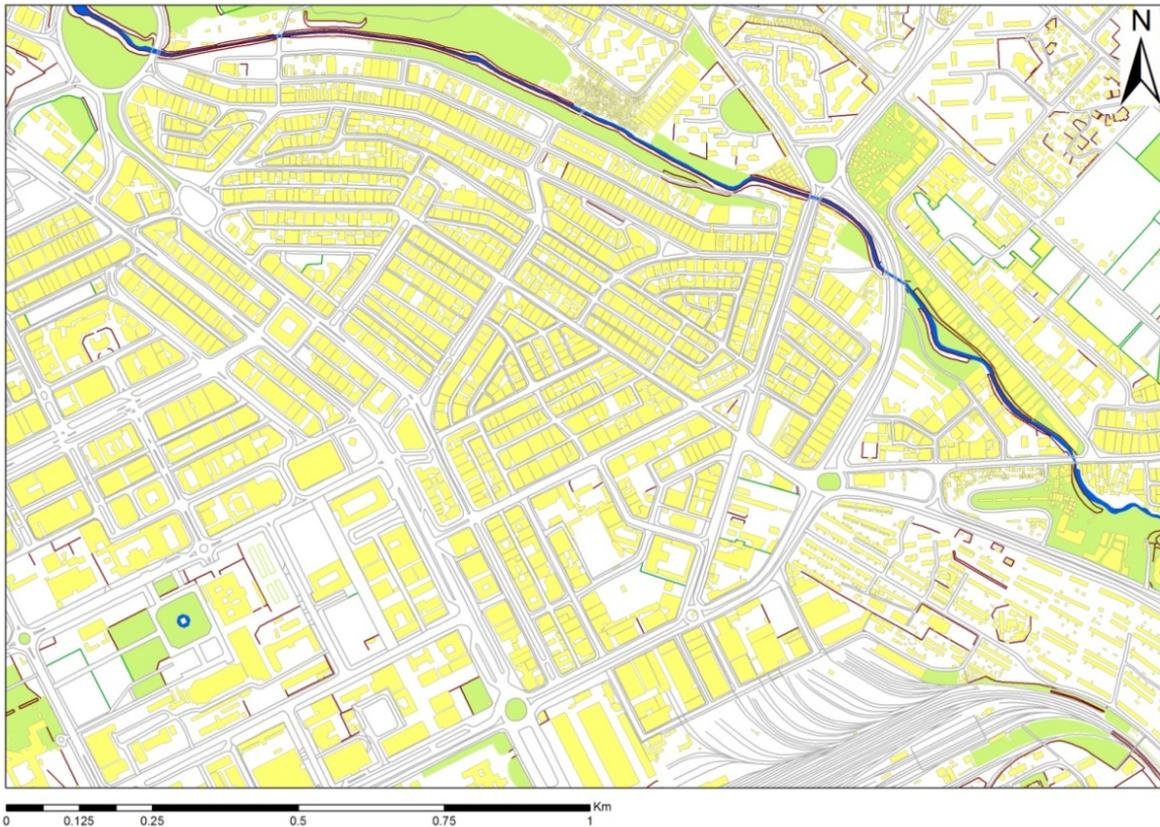
(2) Dataset

The geodatabase shall be organised around 13 dataset, namely: adm_bnd, annotation, buildings, centreline, control_pnt, map_index, small_obj, surround, symbol, topographic, transportation, vegetation, and water_area. In addition, each dataset shall include some feature classes (Table 9.4.1).

Table 9.4.1 Contents of the Geodatabase

Name of Personal Geodatabase	Name of Feature Dataset	Name of Feature Class	Data Description
Nairobi_GISDB	Adm_bnd	Constituency_poly	Polygon data of constituency boundary
		Location_poly	Polygon data of location boundary
		Sublocation_poly	Polygon data of sublocation boundary
	Annotation	Annotation_pnt	Point data of annotation
	Buildings	Buildings_pnt	Point data of building symbol
		Buildings_line	Line data of gate, etc
		Buildings_poly	Polygon data of building
	Centreline	Centreline_line	Line data of centre road
	Control_pnt	Control_pnt	Point data of control point
	Map_index	Each feature class includes a polygon showing the coverage of one map sheet.	
	Small_obj	Small_obj_pnt	Point data of small object
		Small_obj_line	Line data of small object
	Surround	Surround_line	Line data of surround
	Symbol	Symbol_pnt	Point data of symbol for open space
		Symbol_line	Line data of symbol for open space
	Topographic	Topographic_line	Line data of contour and geographical feature
	Transportation	Transportation_line	Line data of road, railway, and those facility
	Vegetation	Vegetation_pnt	Point data of vegetation
		Vegetation_line	Line data of vegetation
		Vegetation_poly	Polygon data of Vegetation
Water_area	Water_area_pnt	Point data of water area's object	
	Water_area_line	Line data of water area	
	Water_area_poly	Polygon data of lake, pond, and big river	

Source: JICA Study Team (JST)

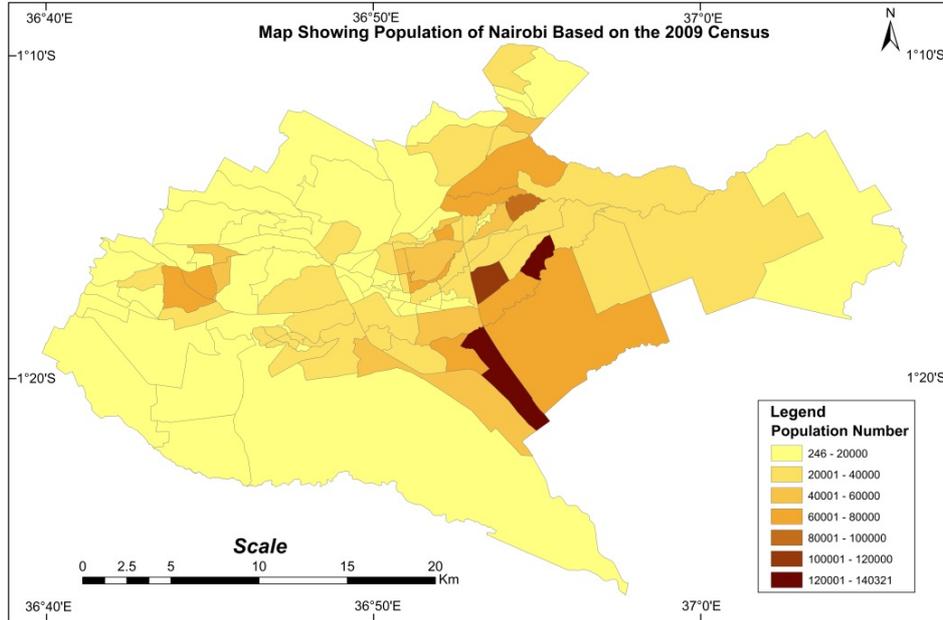


Source: JICA Study Team (JST)

Figure 9.4.2 Topographic GIS Map (1:5000)

Other issues include:

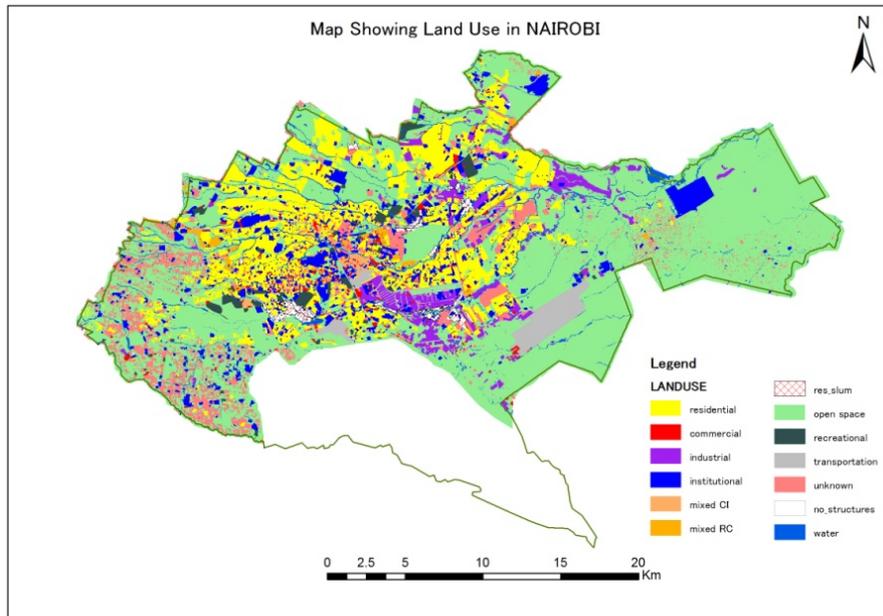
The 1999 Census GIS data provided had no coordinate system. It was also particularly difficult for JST to acquire GIS data on the 2009 population census even though the data was an important input for the formulation of the NIUPLAN. Geo-referenced population census data for 2009 had to be procured by JST.



Source: JICA Study Team (JST)

Figure 9.4.3 Census Map 2009

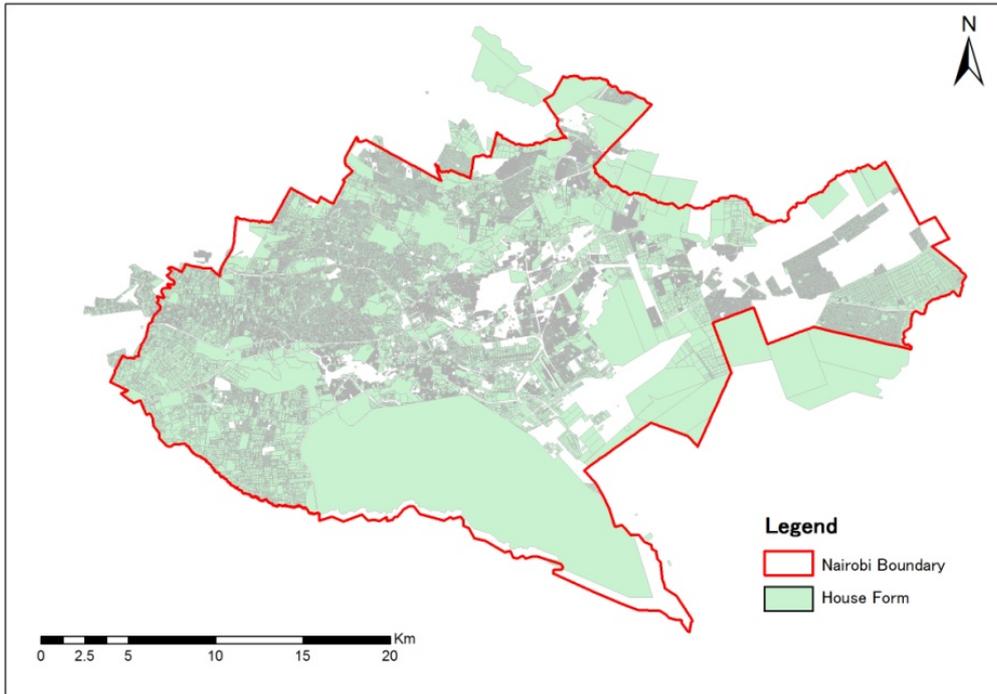
Land use data with all the important attributes is required for effective planning. While comprehensive land use data in Kenya is not available, some limited land use data is made available by the Columbia University of United States. The land use map legend was not well categorised, for example, a land use is categorised as “Unknown” or “No structures”, which needs some additional interpretation or analysis. Therefore, modification of the attributes is required.



Source: JICA Study Team (JST) based on a map produced by the Columbia University

Figure 9.4.4 Land Use Map from the Columbia University

Cadastral Data Unavailability: Figure 9.4.5 shows the cadastral data held by NCC. It does not cover the whole of Nairobi City. The updated status of the data is also not clear.



Source: JICA Study Team (JST)

Figure 9.4.5 Cadastral Map (held by NCC)

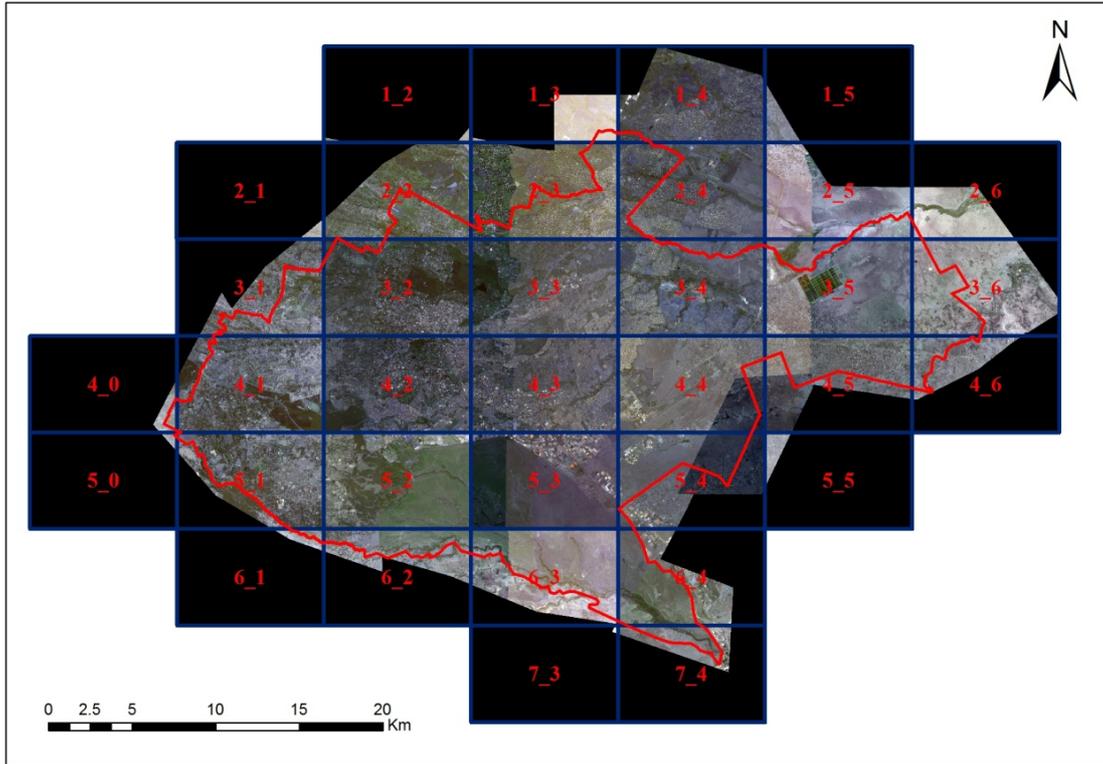
9.4.3 Current Status of the GIS Data under the NIUPLAN

Satellite imagery for the City of Nairobi has been acquired (2012 Imagery) which will be used for this project.

Table 9.4.2 Specifications of the Satellite Imagery (WorldView-2)

	Item	Specifications
1	Image Processing	Ortho/Pansharpen
2	Map Projection	UTM Zone 37 South WGS84
3	File Format	GeoTiff
4	Ground Resolution	50 cm
5	Image Quality (Geotiff)	16 bit
6	Resampling System	CC (Cubic Convolution)
7	Band	4 band (B,G,R,IR)

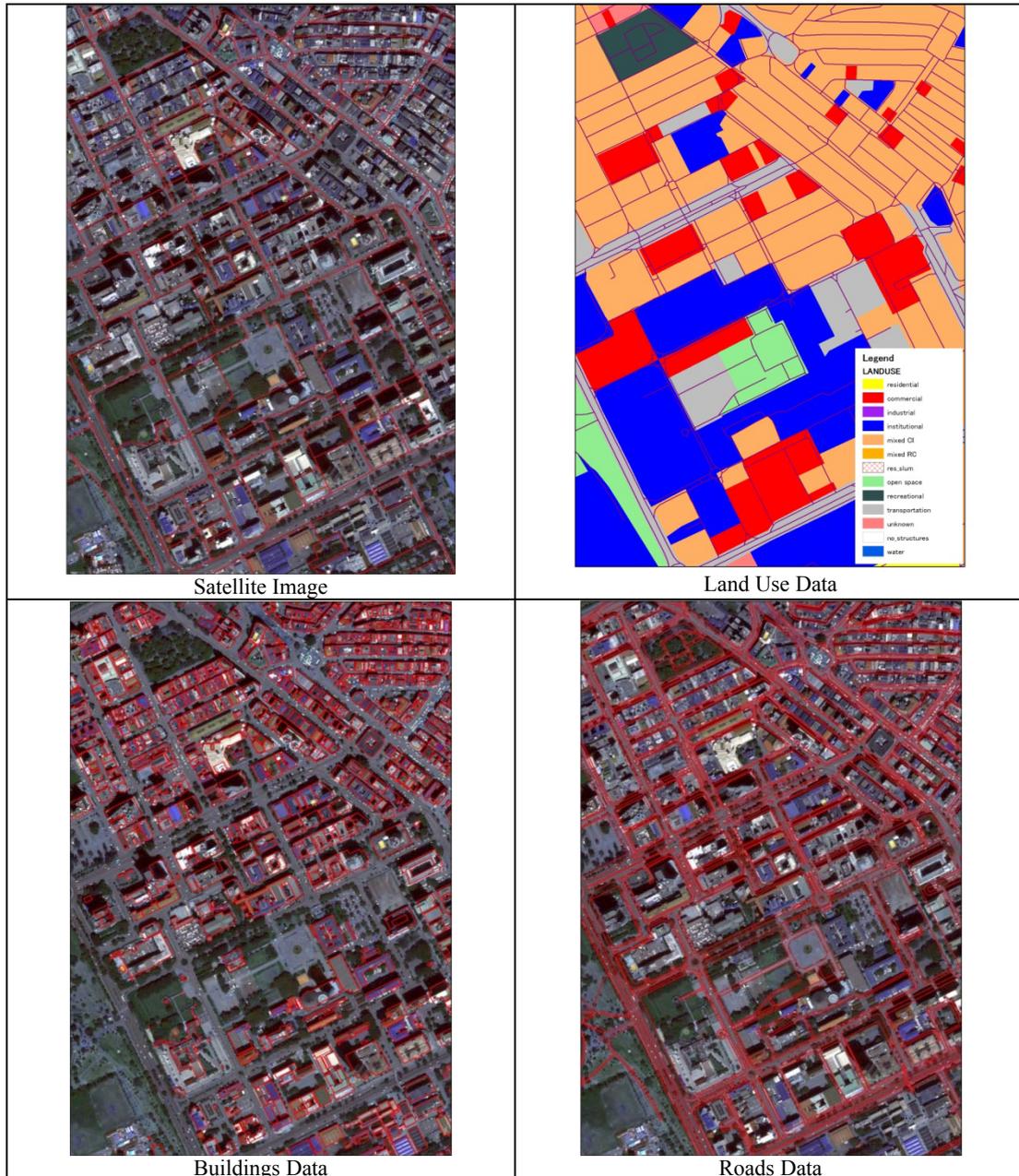
Source: JICA Study Team (JST)



Source: JICA Study Team (JST)

Figure 9.4.6 Aerial Photos of Nairobi City

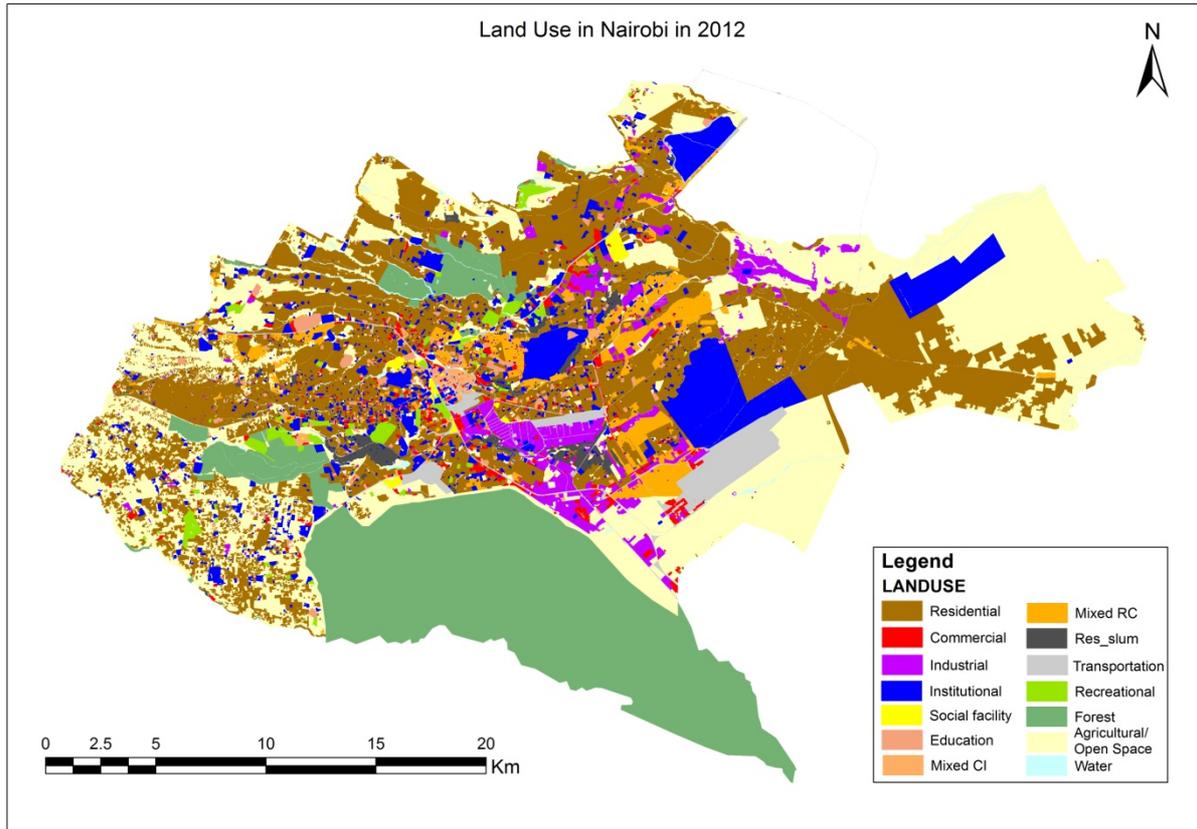
Shape files to be used for the NIUPLAN have been projected to WGS 84 UTM Zone 37's projection which is the coordinate system to be adopted for the project. The topographic data, land use data, building data, and road data are consistent with the newly acquired satellite imagery as shown in Figure 9.4.7.



Source: JICA Study Team (JST)

Figure 9.4.7 Fair Consistency between the Imagery and Land Use, Buildings, Roads Shape File

The land use data have been updated to match the satellite imagery of 2012. A more detailed layer management than the Columbia University data set has been devised in the GIS database.



Source: JICA Study Team (JST)

Figure 9.4.8 Land Use Map

9.4.4 Current Status of Database under the NIUPLAN

The JST and NCC have collected data for the planning of the NIUPLAN. Table 9.4.3 shows the current status of database development. After that, NCC will continue to collect the necessary data shown in Table 9.4.3.

Table 9.4.3 Current Status of Database Development

Group	Data	Source	Status				Required Additional Data
			Type of Data 1	Type of Data 2	Location Data	Attribute Data	
Population, Urban Economy and Social Cultural Issues	1. Census	KNBS (Kenya National Bureau Statistics)	1979 census with 1 sublocation	GIS/Shp (not coordinate)	located	:Population :Population Density	
			1989 census with 62 Sublocations	GIS/Shp (not coordinate)	located	:Population :Population Density	
			1999 census with 111 Sublocations	GIS/Shp (not coordinate)	located	:Population :Population Density	
			2009 census with 112 Sublocations	GIS/Shp	located	:Population :Population Density	
	2. Social Facilities	NCC (Nairobi City County)	Children's Homes	GIS/Shp	4 located	:Positional Information	
			Community Centres	GIS/Shp	25 located	:Approximate capacity for the centres is available. :Additional information on floor area is required	
			Fire Stations	GIS/Shp	3 located	:Number of employees and area of land	
			Libraries	GIS/Shp	5 located	:Seating capacity	
			Markets	GIS/Shp	37 out of 46 located	:The following information is required. :Number of stalls within	<input checked="" type="checkbox"/>

Group	Data	Source	Status				Required Additional Data
			Type of Data 1	Type of Data 2	Location Data	Attribute Data	
						24 markets :The remaining markets are open air markets. :6 more markets require mapping :Information on storage facilities	
			Recreational Parks	GIS/Shp	9 located	:Positional Information	
			Public Playgrounds	GIS/Shp	10 located	:Positional Information	
			Public Primary Schools	GIS/Shp	185 located	:The following information is required. :Number of classes. :Name of schools. :Information on classroom capacity and student capacity	
			Public Secondary Schools	GIS/Shp	49 located	:The following information is required. :Name of school :Number of classes :Information on classroom capacity and student capacity	
			Universities and Colleges	GIS/Shp	34 located	:The following information is required. :Name of institution. :Information on classroom capacity and student capacity	
			Stadia	GIS/Shp	3 located	:Positional Information	
			Vocational Institutes	GIS/Shp	9 out of 11 located	:Positional Information	<input checked="" type="checkbox"/>
			NCC's Health Centres	GIS/Shp	50 out of 74 located	:Type of Facility :Services Provided	<input checked="" type="checkbox"/>
			Museums	GIS/Shp	2 located	:Positional Information	
			Nairobi Arboretum	GIS/Shp	located	:Positional Information	
	3. Crime	Kenya Police	Type of crimes, location and time crime was committed	—	—	—	<input checked="" type="checkbox"/>
Land Use and Human Settlements	1. Topographic	SOK (Survey Kenya)	2005 Topographic Data	GIS/Shp	located	:Digitised Buildings :Constituency Boundary :Location Boundary :Roads as Line Data :Sublocation Boundary :Vegetation as Polygon and PolyLine Data :Water Area as Polygon and Polyline Data	
	2. Cadastral		Cadastral Data	—	—	—	<input checked="" type="checkbox"/>
	3. Land Use	Columbia University	2010 Land use GIS Data	GIS/Shp	located	:Some names of features are available	
	4. Historical building	National Museums of Kenya	Heritage sites and historical buildings	—	—	—	<input checked="" type="checkbox"/>
Urban Transport	1. Road	Kenya Roads Board	2010 Road Data for Kenya	GIS/Shp	located	:Road ID :Surface Condition :Number of Lanes :Availability of Road Shoulder and its Condition :Direction(whether one way or two way) :Description of Drainage, its Location and Condition	
	2.	Ministry of	Proposed	GIS/Shp	located	:LRT Corridor	

Group	Data	Source	Status				Required Additional Data
			Type of Data 1	Type of Data 2	Location Data	Attribute Data	
	MRTS Corridor	Transport	Alignment of MRTS			Underground :LRT Corridor Elevated :Elevated BRT Corridor :At grade BRT Corridor	
	3. Airport	Kenya Airports Authority	Proposed Airport Plan	CAD/DXF	located	—	
Infrastructure	1. Water	NCWSC (Nairobi City and Water Sewerage Company)	Water Distribution Lines and Valves	GIS/Shp	located	:Size of Pipe :Material of Pipe	
	2. Sewerage		Sewer Lines Manholes	GIS/Shp	located	:Size of Pipe :Material Manhole Description	
	3. Drainage	NCC (Nairobi City County)	Drainage	—	—	—	<input checked="" type="checkbox"/>
	4. Electricity Transmission	Kenya Power	:Power lines :Circuit breakers :Switches :Capacitors :Towers :Fuses :Substations	GIS/Shp	located	:Voltage transmitted through the power lines :Name of circuit breakers, origin, Structure :Type of switches, feeder, function, design, voltage, mode of operation :Name of capacitor, origin, feeder, type, manufacturer :Tower ID :Fuse ID, origin, feeder :Substations mane, region, street	
	5. Telecommunications	CCN (Communications Commission of Kenya)	Distribution of infrastructure	—	—	—	<input checked="" type="checkbox"/>
Environment	1. Land Cover	KFS (Kenya Forest Services)	Greenery	—	—	—	<input checked="" type="checkbox"/>
	2. Air Quality	UON (University Of Nairobi)	Pollution Levels	—	—	—	<input checked="" type="checkbox"/>
	3. Geology		Distribution of Rock Structure	—	—	—	<input checked="" type="checkbox"/>

Note: — Means that the data is not in our database, Means that additional data is required

Attribute data is the information contained within the datasets for example, the attribute data for the primary schools dataset includes name of school and number of classes within the schools. For hospitals, you may find location of hospital with the attribute data being the bed capacity within the hospital.

Source: JICA Study Team (JST)

9.4.5 The Management Proposal of GIS Data

The GIS data should have metadata which provides certain information about an item's content. For example, an image may include metadata that describes how large the picture is, the colour depth, when it was created, and the image resolution. Metadata allows the user to manage GIS data in a better way since he/she has a history of certain data.

Public organisations and private companies undertaking GIS activities within the country should involve the Survey of Kenya especially in checking the integrity and accuracy of the data. The Survey of Kenya should in turn be the repository of GIS data where all agencies involved in GIS activities store and accumulate their data. This stored data can also be used by other institutions carrying out GIS activities in the country. In addition, JST suggests that there should be a standard schema/data model for the county so as to improve the consistency and integrity of data being currently used and those that will be used in the future. The county should also adopt some standards for data collection, validation, management, and use. Also, cartographic standards should be established to ensure that data is updated

frequently and efficiently with less effort to ensure that the process becomes less of a task.

Integrated GIS will improve the integrity and reliability of data since all the data will be handled as a package. This will help in identifying errors within the data. Therefore, JST recommends and urges the Survey of Kenya to adopt package management of GIS data as a way of ensuring that GIS data meets the required standards. Regular updates should also be done by the Survey of Kenya.

9.4.6 Management Proposal of an Integrated GIS

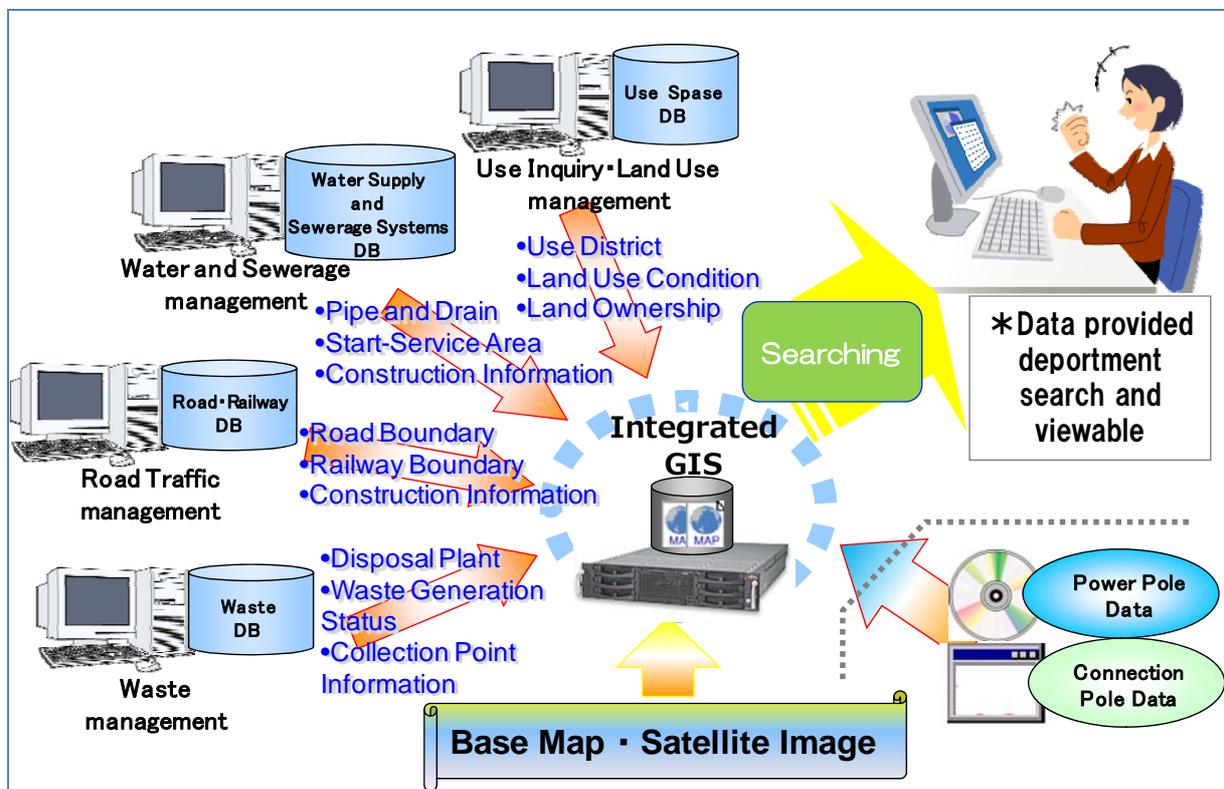
The JST proposes an Integrated GIS for management of GIS data. An Integrated GIS is a system that enables electronic sharing of data integrated on a map and may include information such as roads, urban areas (land use), buildings, rivers, development approvals, zoning policy, urban facility improvement plans, and any other information that is available within the departments being served by the integrated system.

Currently, in the NCC structure, each sector creates and maintains its own information. It is not possible to share data within the sectors and therefore, there is a duplication of data and effort that leads to loss of resources, time, and productivity.

By constructing a system (security of accuracy and quality of data, operating rules, and cooperation with the development organisations) there will be a high degree of operations, rapid exchange of information, and a reduction on the maintenance costs of the data. In addition, overlay analysis of data will be made possible by working with external organisations where high-level information can be shared.

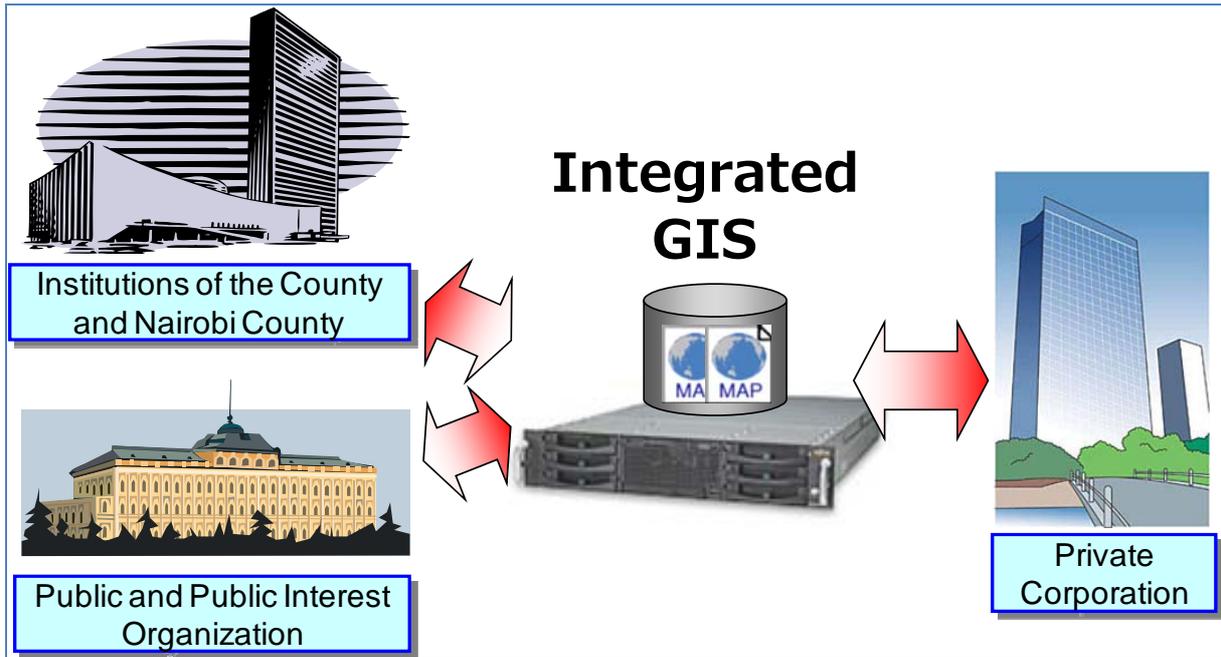
Other advantages of having an Integrated GIS in public office operations are the following:

- Operational efficiency and effective use of existing assets,
- Availability of a comprehensive range of administrative services to respond to diverse needs, and
- Improvement of policy management.



Source: JICA Study Team (JST)

Figure 9.4.9 Image of an Integrated GIS



Source: JICA Study Team (JST)

Figure 9.4.10 Cooperation with External Organisations (Data Sharing)

9.4.7 Management Proposal for an Open Policy on GIS Data

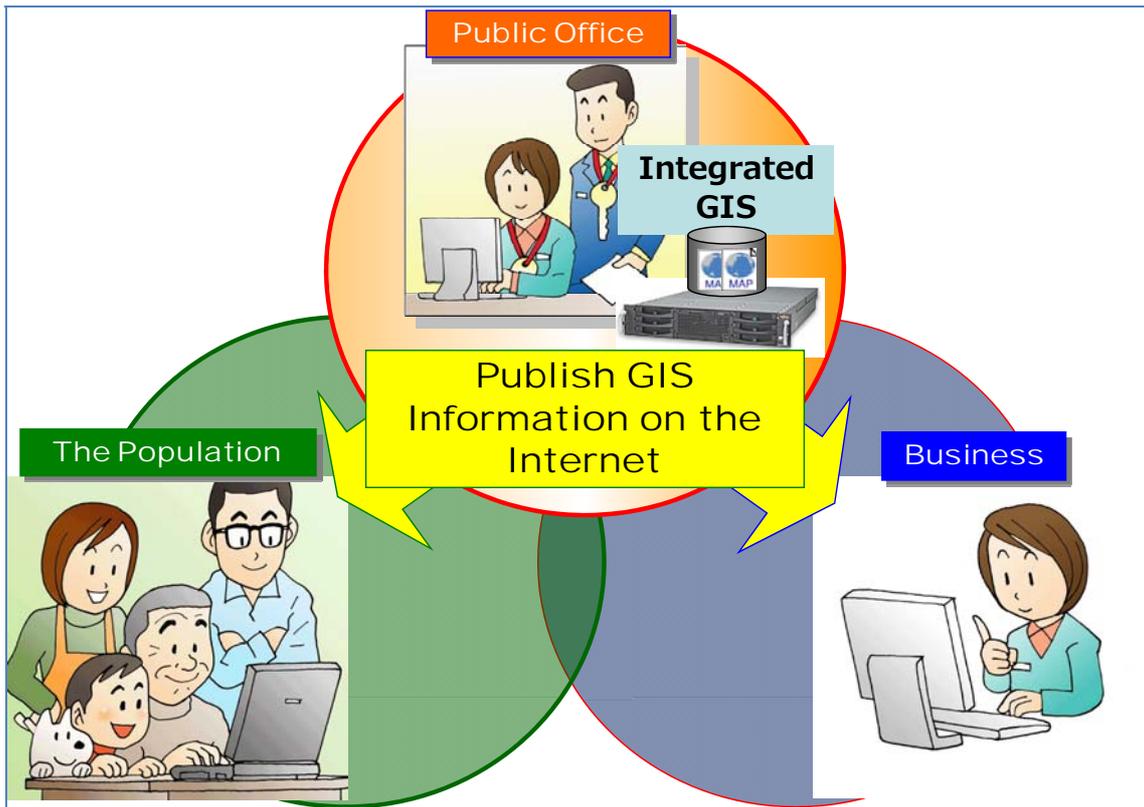
The JST also proposes an open policy on GIS data in order to promote the sharing of data developed by an integrated GIS.

An open policy is meant to assist residents and businesses to view maps through the internet or an intranet based on publicly available data shared from an Integrated GIS. It promotes information sharing which leads to improved communication, improved service delivery, and efficiency in administrative functions.

Introduction of an open policy makes it possible for a resident to browse from a tablet device or a computer any information held by the government for the general public. Residents may also opt to share information with the government.

In summary, the advantages of having an open policy in front office public operations include the following:

- Dissemination of information to residents,
- Bi-directional information transmission between the local community and residents,
- Creation of opportunities through the use of locally available information,
- Provision of an online and one-stop service point for administrative functions, and
- Improvement of government accountability through the sensitisation of local residents on matters to do with administrative evaluation.



Source: JICA Study Team (JST)

Figure 9.4.11 Image of an Open-type GIS

CHAPTER10 SOCIAL AND ENVIRONMENTAL CONSIDERATIONS

10.1 Social and Environmental Considerations for Master Plan Formulation

10.1.1 Basic Policy for Social and Environmental Considerations for Nairobi Integrated Urban Development Master Plan (NIUPLAN)

It is essential to establish relevant environmental and social management programs or plans within the development of long-term urban development master plan (MP). Within this NIUPLAN, the environmental and social considerations related with the implementation of NIUPLAN is achieved through a series of intensive participatory and information disclosure process, based on the Constitution of Kenya (2010), County Government Act (hereinafter referred to as County Government Act (CGA)) No. 12 of 2012, Urban Areas and Cities Act No. 13 of 2011, the National Environment Management Authority's (NEMA) SEA Guideline (2012), the JICA Guidelines for Environmental and Social Considerations (2010), and other enabling legislation on civic education. In particular, Kenya's Constitution (2010), CGA, and the Urban Areas and Cities Act 2011, mentioned above, stress out the importance of public participation, and regard it as one of its key principles and value for sustainable development. Subsequently, the right of timely access to information, data and/or documents, public participation, and relevant education for any policy formulation processes are legally protected under this legal framework in Kenya.

Within this NIUPLAN, most of public participatory processes are achieved throughout a series of stakeholder meeting program, developed and implemented within the strategic environmental assessment (SEA) of NIUPLAN. More detailed descriptions of this SEA study and stakeholder meeting and its relevant activities are described in following sections.

10.1.2 Requirement of the Strategic Environmental Assessment (SEA)

The Environmental (Impact Assessment and Audit) Regulations, 2003, mentioned that lead agencies should subject all public policies, plans, and programs (PPP) to SEA. During the SEA process, the likely significant effects of a PPP on the environment shall be identified, described, evaluated, and reported. The full range of potential effects and impacts are covered, including secondary, cumulative, synergistic, short-, medium- and long-term, permanent, and/or temporary impacts. It is noted that Nairobi City County (NCC) is the lead agency within the NIUPLAN study.

Basically, with close consultation with NEMA, the lead agencies, public and private institutions as well as individuals can initiate the SEA process. Section 42 (3) of the Environmental (Impact Assessment and Audit) Regulations, 2003, commits the government and all lead agencies to incorporate principles of the SEA in the development of public sectoral, national, and regional policies. Based on this rationale, the SEA study is conducted within NIUPLAN. More detailed descriptions of the SEA procedures will be described in the following sections.

10.1.3 Framework of SEA Study for NIUPLAN

(1) Outline

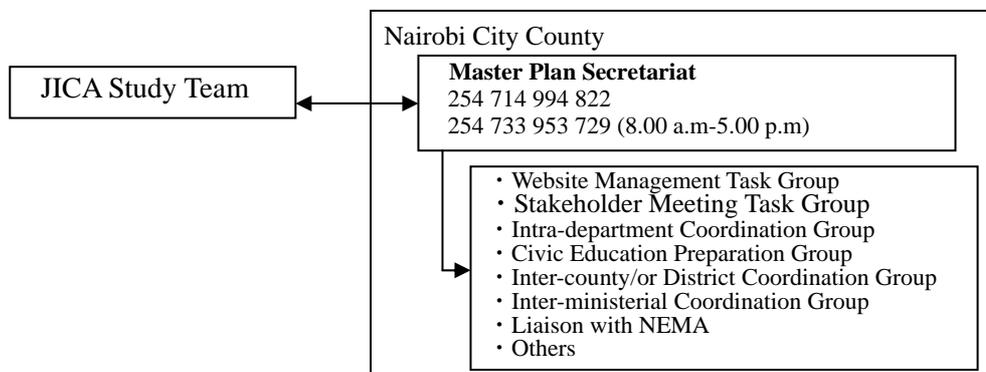
As mentioned above, the SEA study for this NIUPLAN is conducted based on both the NEMA’s SEA Guideline (2012) and the JICA Guidelines for Environmental and Social Considerations (2010). Terms of Reference (ToR) development of the SEA study consists of two steps. The first one was started in January and February 2013 throughout a series of discussions with NEMA and the City Council of Nairobi, CCN (currently NCC), and then, the first ToR (fundamental version) was developed in February 2013 while initiating relevant NIUPLAN-SEA study. More detailed descriptions of this fundamental version of ToR are summarised in Section 10.2 of this report.

After the administrative reform, conducted in April 2013, CCN was transformed into Nairobi City County (NCC), and then, the on-going NIUPLAN had to unconditionally incorporate several important concepts of CGA into its SEA study implementation. Eventually, the amendment of the fundamental version of ToR, mentioned above, was initiated and finalised around August 2013. More detailed descriptions of this amended version of ToR is summarised in Section 10.3 of this report.

(2) County Government Act (CGA)

The CGA was enacted in 2012, and stipulates the strong and comprehensive public participation process within the SEA study of NIUPLAN. Within the CGA, public participation (Part VIII), communication and access to information (Part IX), and civic education regarding the PPP development work by NCC (Part X) are specifically emphasised for implementation (more detailed descriptions of CGA are summarised in Section 2.2.1 of the Progress Report). In this regard, the ToR for the SEA procedure undertaken by a subcontract, contract of which had been concluded in February 2013, was duly amended to incorporate several key concepts of CGA mentioned above.

Throughout this ToR amendment, an entire SEA process of NIUPLAN becomes a strong “stakeholder meeting”- centered (or community participatory) SEA. To achieve a smooth implementation of this SEA, a new ad-hoc group, named as the “Master Plan Secretariat”, is established under the supervision of the Director of the City Planning Department, NCC (see Figure 10.1.1). The main role of this newly created secretariat is to supervise all SEA process with relevant technical assistances of the JICA Study Team (JST). Also, this secretariat will establish liaisons with NEMA, relevant governmental organisations, universities, schools, and international development partners including JICA, NGOs, and key stakeholder. Public relation program, which is one of the key components of this SEA process, is developed and implemented by this secretariat with technical support from JST. Information disclosure through the website of this master plan and SEA will be organised by this secretariat.



Source: JICA Study Team (JST), 2014

Figure 10.1.1 SEA Implementation Framework

10.2 SEA (Fundamental Version)

10.2.1 Development of the Terms of Reference reflecting the SEA Guideline

Based on the SEA Guideline of Kenya, mentioned above, the ToR for successful SEA study for NIUPLAN (fundamental version) was developed in February 2013. Key SEA study steps, to be required for this NIUPLAN study and incorporated into ToR development, are summarised in Table 10.2.1.

Table 10.2.1 Main Tasks of SEA specified by the SEA Guideline of Kenya

<p>1 Preparatory Work (Preparation and Submission of PPP Brief)</p> <p>2. Scoping</p> <p>2-1 Determine the Scope of SEA</p> <p>2-2 Carry out Scoping</p> <p>2-3 Process Criteria</p> <p>2-4 Stakeholder Identification and Schedule of Stakeholder Meeting</p> <p>2-5 Alternative Plan Identification</p> <p>2-6 Preparation and Submission of the Scoping Report</p> <p>3 Detailed SEA Study</p> <p>3-1 Collection of Baseline Information</p> <p>3-2 Situation Analysis</p> <p>3-3 Identification, Prediction, and Evaluation of Potential Impacts</p> <p>3-4 Alternative Comparison</p> <p>3-5 Impact Mitigation and Opportunities Enhancement</p> <p>3-6 Preparation and Submission of the Draft SEA Report</p> <p>4. Public Review</p> <p>5 Stakeholder Meeting</p> <p>4-1 Conduct Stakeholder Meeting</p> <p>4-2 Collect all comments and/or opinions from those meetings</p> <p>6 Revision of the Draft SEA Report, Preparation and Submission of the SEA Final Report</p> <p>All revision works shall be conducted based on collected comments and/or opinions mentioned above.</p> <p>7 Stakeholder Validation Meeting</p> <p>8 Approval of the SEA Final Report</p> <p>9 Monitoring and Evaluation</p>

Source: NEMA, 2012

More detailed descriptions for each SEA step, mentioned above, are summarised as follows:

(1) Submission of PPP (Policy, Plan, and Program) Brief

The SEA Review Applicant shall prepare the Policy, Plan and Program (PPP) brief and submit it to NEMA for guidance. Then, NEMA will undertake the screening in order to determine whether SEA is required or not for the PPP concerned. The result shall be noticed within seven working days. If it is concluded that SEA is required, NEMA will advise the SEA applicant on the recruitment of the registered SEA consulting firm and/or expert. A selected consulting firm and/or expert are required to perform a successful SEA-related study. Throughout the SEA study in Kenya, the first deliverable to be submitted to NEMA is the scoping report, to be described in the next section.

(2) Preparation of the Scoping Report

A registered consultant shall conduct scoping work for this SEA-related work. During this scoping process, the consultant shall develop an appropriate ToR for SEA (i.e., a detailed SEA study, to be described in the subsequent section) for NIUPLAN, prepare the scoping report, and then, submit both documents to NEMA for those approvals. NEMA will review the adequacy of both the scoping report and ToR (draft) of a detailed SEA study, and then, a decision is reached on whether more information is required or approval should be granted. This decision will be notified to the proponent within twenty one working days.

(3) Detailed SEA Study

After obtaining both approvals of the scoping report and ToR for SEA, a detailed SEA study shall be initiated. Following are key tasks to be conducted within the detailed SEA Study:

- (i) Collection of baseline information,
- (ii) Situation analysis,
- (iii) Identification, prediction, and evaluation of potential impacts,
- (iv) Alternative comparison,
- (v) Impact mitigation and opportunities enhancement, and
- (vi) Preparation and submission of the draft final SEA report.

Then, the SEA final report shall be summarised, reflecting all comments obtained from the following review processes, to be required within SEA in Kenya:

- 1. Administrative reviews, and
- 2. Stakeholder reviews.

In Kenya, the stakeholder reviews, mentioned above, consist of following three parts, i.e., (i) public review, (ii) review by lead agencies, and (iii) review by an expert committee.

(4) Public Review

In Kenya, the PPP owner shall ensure that two notices regarding the draft final SEA report are published, a week apart from each other in both the Kenya Gazette and a credible newspaper with the nationwide circulation. Generally, the public has thirty working days (from the first advertisement) to submit comment on a plan- or program-level SEA process.

(5) Stakeholder Meeting

As discussed earlier, the stakeholder meeting is one of the important parts of this SEA-related technical assistance study for NIUPLAN. According to the discussion between NEMA and JST, held on 22 January 2013, NEMA suggested to have multiple stakeholder meetings for different social tiers such as: (i) groups consisting of district government officials and school, NGOs, and (ii) general stakeholder meetings at each district. Based on these discussions, a comprehensive stakeholder meeting program was developed for the SEA study of NIUPLAN. Basically, all stakeholder meetings are categorised into the following two groups, depending on the SEA study phases, i.e., (i) preliminary stakeholder meetings, conducted during the scoping study phase, and (ii) full-scale stakeholder meetings, conducted during a detailed SEA study. Within the SEA process of this NIUPLAN study, eighteen (18 meetings=2 meetings/district x 9 districts) preliminary stakeholder meetings and fifty four (54 meetings=2 meetings/district x 9 districts x 2 + 18 selected sector groups) meetings are scheduled to be conducted. Besides, 23 public consultations are organised and held by NCC in order to discuss the key sectoral issues of NIUPLAN with stakeholders at the final stage of a detailed SEA study period. More detailed descriptions of this stakeholder meeting and the public consultation are summarised in Sections 10.3 and 10.4.

(6) Stakeholder Validation Workshop

Beside those stakeholder meetings, mentioned above, the stakeholder validation workshop is required to be held for the presentation of the SEA final report. The validation meeting of this NIUPLAN-SEA was conducted on 24th September, 2014. Before this meeting, 10 comments, obtained from the report examinations of SEA (D/F), submitted on 17th May, 2014, were collected, and then, passed forward to NCC from NEMA. Based on these comments, report revising was conducted, and then, summary of all comment-response, made by NCC, were explained within that validation meeting.

(7) Entire Schedule of the NIUPLAN SEA Study

As mentioned earlier, the SEA study is conducted in order to obtain approval from NEMA and make the proposed NIUPLAN official urban development master plan in Kenya. Following are the key milestones of the NIUPLAN SEA study:

A. Correspondence with NEMA	
1. Submission of PPP Brief to NEMA	6 April 2013
2. Reply from NEMA (PPP)	16 April 2013
3. Submission of the Scoping Report and SEA-ToR to NEMA	28 October 2013
4. Reply from NEMA (Scoping Report)	10 December 2013
5. SEA DF preparation and submission to NEMA	17 May 2014
6. SEA Final Report submission to NEMA	08 October 2014
7. Preliminary Approval of NIUPLAN-SEA	27 October 2014
B. Major Activities	
1. Preliminary Stakeholder Meeting	August and September 2013
2. 1 st Stakeholder Meeting Campaign	November and December 2013
3. 2 nd Stakeholder Meeting Campaign	December 2013–March 2014
4. 3 rd Stakeholder Meeting Campaign	January 2014
5. NCC's Public Consultation	January 2014–February 2014
6. Civic Education	10 March–28 March 2014
7. SEA Validation Meeting	24 September, 2014

10.2.2 NCC Internal Preparatory Meeting

Prior to the preliminary stakeholder meeting, to be described in the following section, three preparatory meetings, i.e., (i) NCC internal meeting, (ii) NCC assembly meeting, and (iii) Sensitisation meeting (see Table 10.2.2) were held in order to achieve and consolidate the internal study consensus within NCC as well as to prepare for a well-organised start in a series of stakeholder meetings. After these three preparatory meetings, 18 preliminary meetings were conducted during the scoping study period in order to grasp the current urban issues and baseline concern for NIUPLAN from the general public.

Table 10.2.2 Three Preparatory Meetings

		Objectives
1	NCC Internal Meeting	To explain the MP and SEA outlines to the directors of each department of NCC while achieving study consensus internally.
2	NCC Assembly Meeting	To explain the MP and SEA outlines to the NCC Assembly and district commissioners while achieving study consensus.
3	Sensitisation Meeting	First general stakeholder meeting. To explain the MP and SEA outline and a series of public participation process to be followed during both scoping and detailed SEA studies periods to stakeholders.

Source: JICA Study Team (JST)

10.2.3 Preliminary Stakeholder Meeting

The NCC consists of the following nine districts, i.e., Kasarani, Westlands, Starehe, Kamukunji, Dagoretti, Langata, Makadara, Embakasi, and Njiru. Each district is further divided into wards, and the entire Nairobi City is divided into 85 wards in total. As mentioned earlier, two preliminary stakeholder meetings were held at each district in order to grasp current baseline urban issues such as environmental and social concerns that residents including government officials of each county have. The advertisement of those meetings was conducted by posters, radio, newspaper, and TV. Table 10.2.3 summarises the schedule of preliminary stakeholder meetings conducted at each district.

Table 10.2.3 Schedule of 18 Preliminary Stakeholder Meetings

	District	Number of Wards	1st Meeting	2nd Meeting
1	Kasarani	14	29 August 2013	5 September 2013
2	Westlands	7	30 August 2013	6 September 2013
3	Starehe	12	28 August 2013	4 September 2013
4	Kamukunji	5	27 August 2013	10 September 2013
5	Dagoretti	8	26 August 2013	10 September 2013
6	Langata	10	28 August 2013	4 September 2013
7	Makadara	4	28 August 2013	4 September 2013
8	Embakasi	23	27 August 2013	5 September 2013
9	Njiru	2	29 August 2013	30 August 2013

Source: JICA Study Team (JST), 2014

Table 10.2.4 shows an example of the meeting program of this preliminary stakeholder meeting held at Dagoretti on 26 August 2013. Basically, the other 17 preliminary meetings were held using a similar program as this, reflecting specific features of each district.

Table 10.2.4 Meeting Program of Preliminary Stakeholder Meeting held at Dagoretti District

	TIME	ACTIVITY
1	09:00-10:00	Arrival and Registration of Participants
2	10:00-10:15	Introduction of Participants
3	10:15-10:30	Opening Remarks by the Dagoretti Deputy County Commissioner
4	10:30-10:45	Speeches by the Dagoretti Sub-county Members of the Parliament and County Assembly
5	10:45-11:05	Presentation of the Master Plan-NCC
6	11:05-11:20	Presentation of the SEA-GIBB
7	11:20-12:15	Question and Answer Session
8	12:15-12:30	Questionnaire Survey
9	12:30-12:45	Closing Remarks
10	12:45-13:00	Tea/Guests Leave at their own pleasure

Source: JICA Study Team (JST), 2014

10.3 County Government Act and Public Participation

10.3.1 Development of Terms of Reference Reflecting the County Government Act

Upon reviewing the CGA, two new tasks, i.e., (i) website creation of NIUPLAN - SEA and its operation (see Section 10.3.2 for more detailed descriptions), and (ii) civic education (see Section 10.3.4 for more detailed descriptions), are added into the original ToR (fundamental version), developed in February 2013, in order to encourage comprehensive information disclosure and make the entire MP development process more participatory through this SEA process (see Table 10.3.1). Besides, a more comprehensive public advertisement scheme, using poster, TV, radio, newspaper, and website are also employed. More detailed descriptions of this public advertisement scheme, developed within this SEA study, are summarised in Section 10.3.2.

Table 10.3.1 Newly Added Task to Previous SEA

	Newly Added Task	Task Descriptions
1	Civic Education	Convene in three weeks, open house seminar at the city hall and display all MP study results by sector. Any citizen who is interested can visit and have MP explanation.
2	Website Creation of SEA and its Operation	To encourage strong public participation into this MP development, a website of SEA and MP will be developed. The main purpose of this website creations are as follows: (i) Establish good communication between NCC, Nairobi City's citizens, and other key stakeholders. (ii) Enhance prompt information disclosure.

Source: JICA Study Team (JST), 2014

Table 10.3.2 summarises the main tasks of amended SEA-ToR, combining both SEA Guidelines and CGA.

Table 10.3.2 Main Tasks of SEA, specified by both SEA Guideline of Kenya and CGA

<p>1. Preparatory Work (Preparation and submission of PPP Brief) This task will be conducted by both NCC and JST.</p> <p>2. Scoping 2-1 Determine the Scope of SEA 2-2 Carry out Scoping 2-3 Process Criteria 2-4 Stakeholder Identification and Schedule of Stakeholder Meeting 2-5 Alternative Plan Identification 2-6 Preparation and Submission of the Scoping Report</p> <p>3. Detailed SEA Study 3-1 Collection of Baseline Information 3-2 Situation Analysis 3-3 Identification, Prediction, and Evaluation of Potential Impacts 3-4 Alternative Comparison 3-5 Impact Mitigation and Opportunities Enhancement 3-6 Preparation and Submission of the Draft SEA Report</p> <p>4. Public Review</p> <p>5 Stakeholder Meeting 4-1 Conduct Stakeholder Meeting 4-2 Collect all comments and/or opinions from those meetings</p> <p>6. Civic Education (newly added)</p> <p>7. Website Creation of SEA and its Operation (newly added)</p> <p>8. Revision of the Draft SEA Report, Preparation and Submission of the SEA Final Report All revision works shall be conducted based on collected comments and/or opinions, mentioned above.</p> <p>9. Stakeholder Validation Meeting</p> <p>10. Approval of the SEA Final Report</p> <p>11. Monitoring and Evaluation</p>
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Note: Tasks 6 and 7 (Civic Education and Website Creation, respectively) are added to the original ToR.
Source: NEMA, 2012 and County Government Act of 2012

10.3.2 Public Advertisement

In order to encourage interaction between the MP owner (i.e., NCC) and Nairobi City's citizens, and to raise wide MP concerns therein while responding to both CGA and Urban Areas and Cities Act No. 13 of 2011, a comprehensive public advertisement scheme is developed, by poster, TV, radio, newspaper and the NIUPLAN website (see Table 10.3.3).

Table 10.3.3 Summary of Public Advertisement

		Descriptions
1	Poster	500 copies of advertisement posters are put on notice boards of the city hall, district commissioner's office, and other public places (e.g., bus stops, railway stations, churches, mosques, venues of meetings) across the city in the following four different times: <ul style="list-style-type: none"> • First: 24 August 2013 (for Preliminary SHMs) • Second: 22 November 2013 (First Campaign of SHMs) • Third: 3 January 2014 (Second Campaign of SHMs) • Fourth: 13 January 2014 (Third Campaign of SHMs)
2	TV	Advertisements in English and Ki-Swahili were conducted four times. As of March 2014, the following two TV advertisements were done: <ul style="list-style-type: none"> • First: 27 August 2013 (First Campaign of SHMs) • Second: 19 and 20 March 2014 (Civic Education)
3	Radio	Advertisements in English and Kiswahili were conducted eight times <ul style="list-style-type: none"> • First: Late of August of 2013 • Second: 9 January 2014 (Third Campaign of SHMs) • Third: 13 January 2014 (Third Campaign of SHMs) • Fourth: (9 days x 4 times/day = 36 times): 18, 19, 20, 21 March and 24, 25, 26, 27 and 28 March (Civic Education)

		Descriptions
4	Newspaper	Advertisements in English were conducted eleven times (as of March 2014) <ul style="list-style-type: none"> • First: 22 July 2013 (for First Workshop) • Second: 31 July 2013 (for First Workshop) • Third: 24 August 2013 (for preliminary SHMs) • Fourth: 29 August 2013 (for preliminary SHMs) • Fifth: 22 November 2013 (for First Campaign of SHMs) • Sixth: 3 January 2014 (for Second Campaign of SHMs) • Seventh: 13 January 2013 (for Third Campaign of SHMs) • Eighth: 7 March 2014 (Civic Education) • Ninth: 14 March 2014 (Civic Education) • Tenth: 21 March 2014 (Civic Education) • Eleventh: 27 March 2014 (Civic Education)
5	Website	Specific website for the NIUPLAN study and its SEA is established as follows: http://citymasterplan.nairobi.go.ke/ Specific Email Address for the Proposed Master Plan, citymasterplan@nairobi.go.ke Its full-scale operation started on 10 September 2013

Source: JICA Study Team (JST), 2014

10.3.3 Public Meeting

During the detailed SEA study period, a series of stakeholder meetings were conducted. Basically, the entire stakeholder meeting consists of the following three parts, i.e., (i) first stakeholder campaign, (ii) second stakeholder campaign, and (iii) third stakeholder campaign (see Tables 10.3.4–10.3.6). Within the first and third stakeholder campaigns, a focused group meeting (e.g., participants from county government officials, local NGOs representative, community leaders, and other key persons) and a general public meeting were held at each county. Within the second stakeholder meeting campaign, consultations were conducted for several selected sector groups. The selection of each sector group was conducted throughout a series of discussion with NCC.

Table 10.3.4 Summary of the First Stakeholder Meeting (Detailed SEA Study)

	Subcounty/ District	Meeting 1: Focused Group		Meeting 2: Public Meeting	
		Date and Time	Attendance	Date and Time	Attendance
1	Kamukunji	26 Nov 2013, 10 am	15	26 Nov 2013, 2 pm	160
2	Kasarani	27 Nov 2013, 2 pm	16	27 Nov 2013, 10 am	114
3	Dagoretti	29 Nov 2013, 10 am	15	29 Nov 2013, 2 pm	32
4	Lang'ata	2 Dec 2013, 2 pm	18	2 Dec 2013, 10 am	95
5	Njiru	2 Dec 2013, 10 am	34	3 Dec 2013, 2 pm	66
6	Makadara	4 Dec 2013, 10 am	42	4 Dec 2013, 2 pm	70
7	Embakasi	5 Dec 2013, 10 am	20	5 Dec 2013, 2 pm	92
8	Westlands	11 Dec 2013, 10 am	18	11 Dec 2013, 2 pm	82
9	Starehe	9 Dec 2013, 10 am	18	17 Dec 2013, 10 am	108
Total			196	Total	819

Source: JICA Study Team (JST), 2014

Table 10.3.5 Summary of the Second Stakeholder Meeting (Selected sectoral group, Detailed SEA Study)

	Target Groups	Date	Attendance
1	Women	9 January 2014	3
2	Elderly*	Cancelled	-
3	Youth	9 January 2014	8
4	Disabled	10 January 2014	3
5	Children	12 December 2013	7
6	Residents Association	13 January 2013	22
7	Professional Associations	14 January 2014	8
8	Business Associations	14 January 2013	4
9	Implementing Agencies	23 January 2013	7
10	Regulatory Agencies	23 January 2014	13
11	Learning Institutions (universities)	16 January 2014	11
12	County Executives*	Cancelled	-
13	Kiambu	4 March 2014	30
14	Machakos	25 February 2014	17
15	Kajiado	27 February 2014	31

	Target Groups	Date	Attendance
16	Nyandarua	5 March 2014	27
17	Murang'a*	Cancelled	-
18	National Level *	Cancelled	-
19	Solid Waste Management*	Cancelled	-
Total			191

Source; JICA Study Team (JST), 2014

Table 10.3.6 Summary of the Third Stakeholder Meeting (Detailed SEA Study)

	Subcounty/ District	Meeting 1: Focused Group		Meeting 2: Public Meeting	
		Date and Time	Attendance	Date and Time	Attendance
1	Kamukunji	14 Jan 2014, 10 am	22	14 Jan 2014, 2 pm	84
2	Kasarani	8 Jan 2014, 2 pm	19	8 Jan 2014, 10 am	74
3	Dagoretti	9 Jan 2014, 10 am	13	9 Jan 2014, 2 pm	79
4	Lang'ata	13 Jan 2014, 10 am	13	22 Jan 2014, 10 am	98
5	Njiru	15 Jan 2014, 10 am	29	15 Jan 2014, 2 pm	93
6	Makadara	16 Jan 2014, 10 am	13	16 Jan 2014, 2 pm	141
7	Embakasi	17 Jan 2013, 10 am	29	17 Jan 2014, 2 pm	107
8	Westlands	10 Jan 2014, 10 am	21	10 Jan 2014, 2 pm	26
9	Starehe	21 Jan 2014, 10 am	10	21 Jan 2014, 2 pm	99
Total			169	Total	801

Source; JICA Study Team (JST), 2014

10.3.4 Stakeholder Validation Workshop

As mentioned before, the validation meeting of this NIUPLAN- SEA was conducted at Kenya School of Monetary Studies on 24th September, 2014. The main objective of this meeting is to explain NCC's approaches to comments for SEA (D/F), submitted on 17th May, 2014, to the public, and then, establish consensus to move forward to the next step, i.e., the preparation of the SEA Final Report. During the report examination period of SEA DF Report, 10 comments were collected. Most of comments show concerns about the integrity of NIUPLAN with other urban policies and plans. Based on these comments, the report revising was conducted, and then, summary of all comment-response, made by NCC, were explained within that validation meeting (see Figure 10.3.1).



Source: JICA Study Team, 2014

Figure 10.3.1 Photo Records of SEA Stakeholder Validation Workshop

Additional issues were also raised during that meeting. Incorporating those comments, then, the SEA final report was prepared, and then, submitted to NEMA on 8th October, 2014. Final report examination was conducted by NEMA and the preliminary approval of NIUPLAN-SEA study was issued on 27th October, 2014.

10.3.5 Website Management

(1) Introduction

The website for NIUPLAN is developed (its domain name is <http://citymasterplan.nairobi.go.ke/>). The main objectives of this website development are the following: (i) to promote public participation, (ii) to provide opportunities for the general public and key stakeholders to learn the master plan formulation, (iii) to educate the general public about the master plan development process (i.e., support for the empowerment) and provide opportunities for citizenry participation during the formulation process, (iv) to obtain feedback from the general public and key stakeholders, and (v) to respond to both CGA and Urban Areas and Cities Act No. 13 of 2011. Those feedbacks will be integrated within the master plan formulation process.

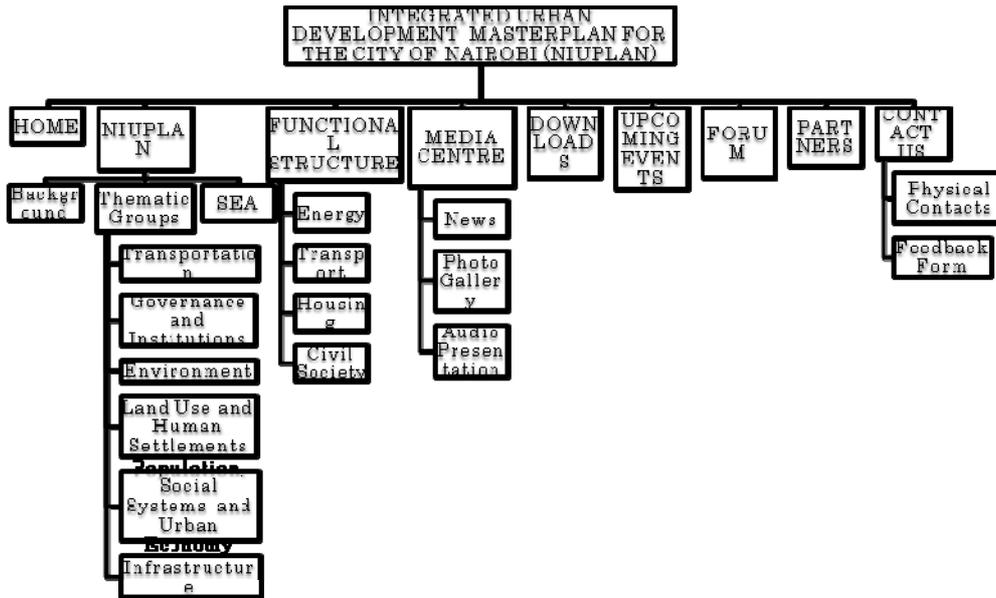
The website development is part of the strategies for strengthening public participation in the formulation of NIUPLAN. This is alongside public advertisement in the newspapers, television, radio, and targeted posters.

(2) Content

This website contains the following features:

- (i) Outline of the entire MP Study,
- (ii) Relevant information regarding the proposed MP Study (e.g., material of JCC, Thematic meeting),
- (iii) Interim, Progress, Draft Final, and Final Report,
- (iv) Stakeholder program (e.g., notice of date, venue, and others),
- (v) Question and answers session,
- (vi) List of past question and answer session with attendance list,
- (vii) Civic education program (notice of date, venue, and others), and
- (viii) All education material used for civic education.

Figure 10.3.2 shows the website outline and architecture, developed for this master plan study. Throughout this website, the following three goals were established, including: (i) comprehensive information disclosure, (ii) learning opportunity, and (iii) constructive interaction between NCC and the general public. Figure 10.3.3 shows the front page image of the developed website for this integrated urban development MP Study. It is noted that all questions and/or comments, obtained through this website are received by the NIUPLAN website management task group, and then, some of them are passed forward to relevant sections and/or specialists for more detailed examination as well as appropriate response preparations.



Source: JICA Study Team (JST), 2014

Figure 10.3.2 Website Architecture



Source: JICA Study Team (JST), 2014

Figure 10.3.3 Front Page of the Website of NIUPLAN

(3) Website Operation Framework and Policy

The website will be operated by the NIUPLAN Secretariat with support from the selected subcontractor for the work (see Table 10.3.7).

Table 10.3.7 Website Operation Policy

	Task/Activity	Frequency of Task/Activity
1	Contents Collection	Daily
2	Content Approval	Weekly (Friday)
3	Website/Content Updating	Weekly (Friday)
4	Question and Answer (Website)	Daily
5	Minites of Meeting of Public Meetings	Promptly after the meeting

Source: JICA Study Team (JST), 2014

Table 10.3.8 summarises examples of minutes of meeting of the weekly website/content updating meeting held on 20 September 2013 (Friday). Table 10.3.9 shows a summary of this periodical website management meeting held during the period between September 2013 and March 2014.

Table 10.3.8 Summary of Approved Contents for Website Updating

A Thematic Working Group Materials
· Transport: 17 September 2013
· Land Use and Human Settlement: 17 September 2013
B Sensitisation Meeting of 5 August 2013
· Minutes of Meeting
· Attendance List
· Related Articles
· Photos
C Update of Members of the Technical Working Groups (six Thematic Groups)

Note that the content approval listed above was made on 20 September 2013 (Friday).

Source: JICA Study Team (JST), 2014

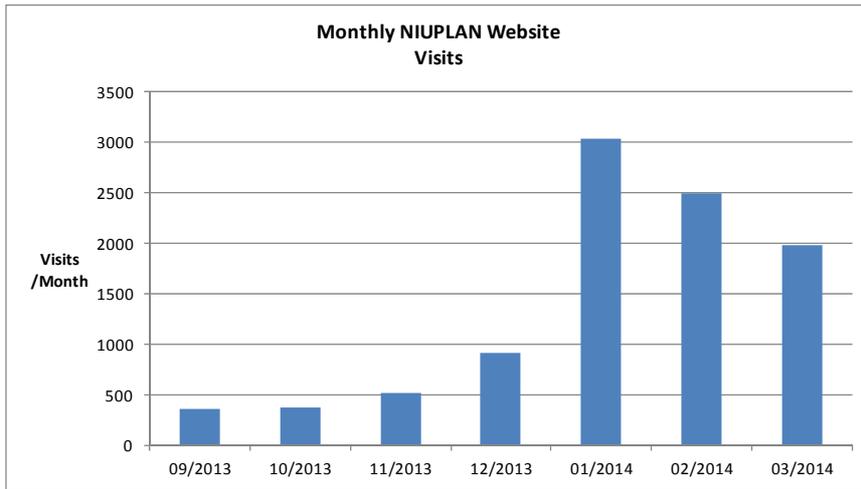
Table 10.3.9 Summary of Website Management Meeting

	Date	Key Agendas
1	20 September 2013	Inauguration. Update of the NIUPLAN website
2	27 September 2013	Issues carried over from previous meeting. Upload contents and sharing of Website User Rights. Contents for approval in the next meeting.
3	4 October 2013	Issues carried over from previous meeting. Upload contents. Statistics on the activity on the website., Contents for approval in the next meeting.
4	11 October 2013	Issues carried over from previous meeting. Upload contents, Correspondence Report, Contents for approval in the next meeting.
5	18 October 2013	Same as above.
6	25 October 2013	Issues carried over from previous meeting. Integration of another contact e-mail address within the website feedback form. Contents for approval in the next meeting.
7	1 November 2013	Issues carried over from previous meeting. Correspondence and website user statistics.
8	22 November 2013	Issues carried over from previous meeting. Contents for approval.
9	20 December 2013	Issues carried over from previous meeting. Contents for approval (meeting material of the first campaign SHM and environment technical working group). Website user statistics.
10	7 February 2014	Issues carried over from previous meeting. Contents for approval. The NIUPLAN e-mail correspondence and reporting. Website user statistics.

Note: This table was prepared based on the records summarised as of March 2014.

Source: JICA Study Team (JST), 2014

Figure 10.3.4 shows the number of monthly website visits after its full operation started in September 2013. As of February 2014, a total number of recorded visits is 5,634. As shown in this Figure 10.3.3, a sudden increase in the number of website visitors is recognised after January 2014. This increase may correspond to the intensity and activeness of the public participation program, implemented within the SEA study of NIUPLAN. During last January and February, a series of second and third stakeholder meetings were held (see Tables 10.3.5 and 10.3.6). Besides, NCC conducted their NIUPLAN public consultation separately (see Table 10.4.1).



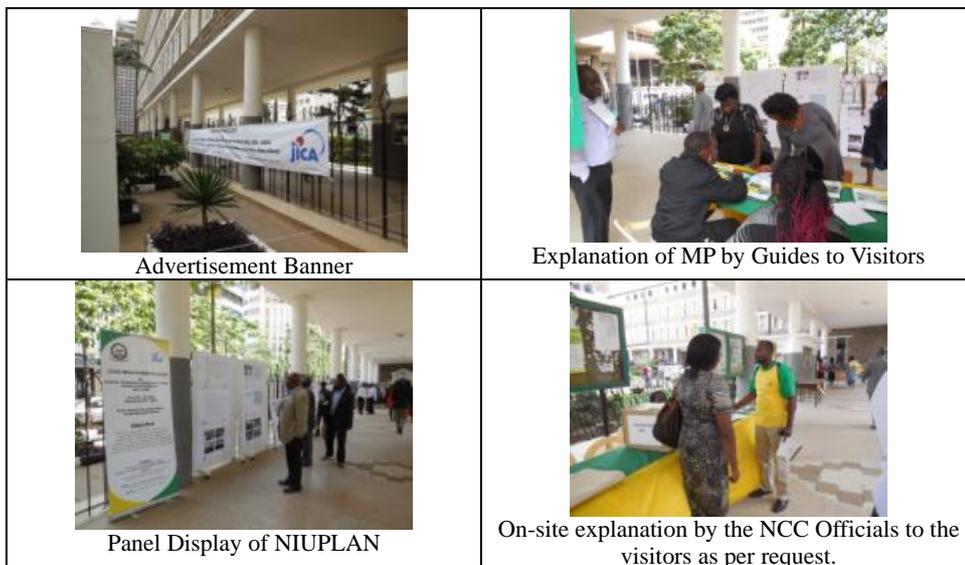
Note that the total number of visits as of March 2014 is a recorded value on 24 March 2014.
Source: JICA Study Team (JST), 2014

Figure 10.3.4 Monthly Website Number of Visits

10.3.6 Civic Education

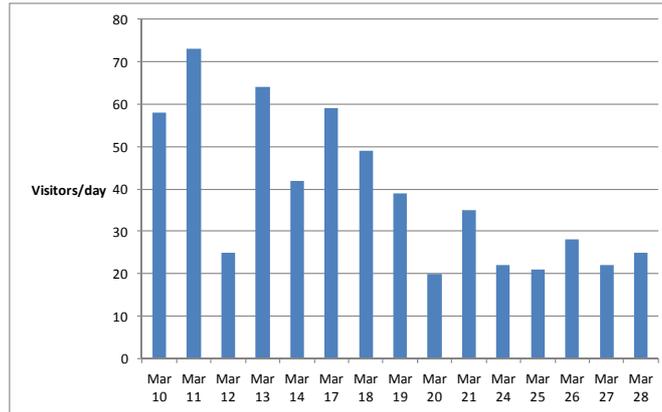
As required by CGA, a civic education was held for three weeks, which started from 10 March 2014 (Monday) and finished on 28 March 2014 (Friday). The main objective of this civic education is to set up an open-house discussion place for Nairobi City’s Citizens who are interested in NIUPLAN and make possible a direct talk between Nairobi City’s citizens and NCC, and then, to disseminate relevant information of the proposed NIUPLAN to the general public. It is noted that no specific guideline for the duration of the civic education is specified in CGA, and the three weeks civic education was tentatively determined based on the internal discussion of NCC. In order to establish easy access to the venue of this civic education for the general public, the open space at the main gate is selected, and two permanent guides were assigned during this civic education program (see Figure 10.3.5). There were several times that the NCC personnel of the Department of Urban Planning attended this civic education to provide more professional explanation to visitors as per requests.

It is noted that the civic education program is not a one-time event but to be continued periodically in order to disseminate NIUPLAN information across the county as well as neighbouring regions. So, it is likely that more civic educations will be held in the near future. Figure 10.3.6 shows the time variation of the number of daily visitors for this civic education.



Source: JICA Study Team (JST), 2014

Figure 10.3.5 Photo Records of the Civic Education Program



Source: JICA Study Team (JST), 2014

Figure 10.3.6 Number of Daily Visitors during the Civic Education

10.4 Analysis on Planning Alternatives (Structure Plan)

(1) Outline

Table 10.4.1 summarises five development structure alternative strategies proposed within this NIUPLAN study. In order to conduct an evaluation of the five proposed development structure alternative strategies, the following two matrices, namely: (i) Compound Matrix, and (ii) Risk and Opportunity Matrix, are developed.

Table 10.4.1 Summary of Proposed Development Structure Alternative Plans

Structure Plan	Image of Structure	Characteristics
STR-1 CBD One Core System (mono core) (present trend)		Regarded as the “No Action” plan. Only one strong nuclei which will develop and there is no existence or important function in other centres.
STR-2 Sub-centre System (poly nucleated development)		There is no dominating single settlement; all nodes of the polycentric network have the same relevance as “spatial participation”.
STR-3 Sub-centre System (bi-polar development) System corridor		Development of minor settlements along the transport corridor connecting two strong nodes.
STR-4 Sub-centre System (corridor cum ring development) System ring		Development of settlements along the corridor and ring.

Structure Plan	Image of Structure	Characteristics
STR-5 Diffused Development System		Development of two levels of corridor (within NCC and Greater Nairobi)

Source : JICA Study Team (JST), 2014

The compound matrix, mentioned above, is principally used to evaluate individual PPPs (Policy, Plan and Program) against a range of environmental criteria, which serve as indicators of the existing environmental and social conditions. This approach was used for the SEA study of Kumashi Urban Development Master Plan Study conducted in Ghana (JICA, 2013). Basically, this evaluation is conducted regarding four subcategories such as: (i) natural resources, (ii) socio-cultural, (iii) economic, and (iv) institutional. Table 10.4.2 shows a summary of the evaluation factors.

The environmental risk and opportunities matrix also mentioned earlier, helps to assess the potential risks and opportunities associated with each individual PPP, so that remedial and/or mitigation measures for the risk can be proposed and factored in the design of the PPP. Within this SEA study, a similar methodology used in Ghana is applied, reflecting the site-specific features across the study area.

Table 10.4.2 Evaluation Factors for SEA (draft)

Natural Resources	Socio-Cultural	Economic	Institutional
Water Pollution	Waste Management	Unemployment	Urban Development Control
Erosion	Traffic Congestions	Poor Accessibility to	Urban Development
Deforestation	Noise/Vibration	Market or Business	Promotion System (Private
Ecosystem	Air Quality	Districts	Sector)
Conservation	Illegal settlement	Poor Road Network	Public Participation/Public
Flood	Improvement of Safety and	Low Income	Awareness
	Amenity		Information Disclosure
	Land Litigation		System

Source: JICA Study Team (JST), 2014

(2) Compound Matrix

Table 10.4.3 shows a summary of the compound matrix of each development structure alternative, as summarised in Table 10.4.1. Specific negative risks, associated with the implementation of each development structure alternative is summarised in the following section.

As summarised in Table 10.4.3, no positive impact can be recognised for STR-1 scenario (i.e., “No Action Plan”, and current city traffic congestion and its resultant roadside environmental conditions such as the air quality and noise are getting worse. By implementing any strategy from STR-2 to STR-5, certain amounts of alleviation of traffic congestions and the improvement of related roadside environment are expected to occur although several infrastructure developments shall be conducted around the current suburb areas of Nairobi City. More detailed pros and cons of each development structure alternative are summarised, using the risk and opportunity matrix in the next section.

Table 10.4.3 Compound Matrix for Selected Development Structure Alternatives

Evaluation Factors	Natural Resources					Socio-Cultural Issues						Economic Issues			Institutional					
	Water body pollution	Erosion	Deforestation	Ecosystem Conservation	Flooding	Waste Management	Traffic Congestion	Noise/Vibration	Air Quality	Illegal settlement	Improvement of Urban Safety and Amenity	Land Lencroachment	High unemployment	Poor accessibility to markets/or business district due to traffic jams	Poor roadnetwork	Low Income	UrbanDevelopment Control	Urban Development Promotion System (Private Sector)	Public Participation/public awareness	Information Disclosure System
STR-1	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0	-	-	?	?
STR-2	-	-	-	-	-	-	?	?	?	?	?	?	+	+	+	0	+	+	+	+
STR-3	-	-	-	-	-	-	?	?	?	?	?	?	+	+	+	0	+	+	+	+
STR-4	-	-	-	-	-	-	?	?	?	?	?	?	+	+	+	0	+	+	+	+
STR-5	-	-	-	-	-	-	?	?	?	?	?	?	+	+	+	0	+	+	+	+
Note																				
	+ : Likely to be Positive																			
	- : Likely to be Negative																			
	0 : Likely to be Neutral																			
	? : Uncertain																			

Source: JICA Study Team (JST), 2014

(3) Risk and Opportunity Matrix

Table 10.4.4 shows a summary of the environmental risk and opportunity matrix for selected development structure alternatives as summarised in Table 10.4.1. As shown in Table 10.4.4, each development structure alternative has its own advantage and disadvantage of its implementation, and preparation of relevant environmental and social management plan or program would be essential to make environmentally and socially sound implementations of those options. In the “Do-nothing scenario (i.e., STR-1, listed in Table 10.4.4)”, it would be obvious that the current county-wide issues such as disorganised land use conditions, traffic congestion, illegal settlement, improper waste treatment system, deforestation, and others will not be changed (most likely will be worsened).

From the urban development and management points of views, potential advantages to lessen the difficulties for implementation of urban development and/or improvement programs in the future would be significant. Besides, it can be expected that chronic shortage of basic infrastructure facilities such as waste disposal sites, one of the important current urban issues, would be solved by the implementation of NIUPLAN. It is noted that temporal environmental degradations would be inevitable within construction activities due to its implementation. It would be beneficial to prepare mid-term or long-term comprehensive regional management plans or strategies for the implementation of future urban development program based on any development structure alternatives (i.e., from STR-2 to STR-5, listed in Table 10.4.4). More specific environmental and social programs shall be developed after specific development projects including relevant construction plans are delineated.

Table 10.4.4 Environmental Risk and Opportunity Matrix for Selected Development Structure Alternative

Development Structure Alternative	Anticipated Risk	Proposed Mitigation/Implementation Guideline
STR-1	<ul style="list-style-type: none"> • More worsened and disorganised land use across the entire county and resultant traffic congestion, illegal settlement, waste dumping, deforestation, and others. • More traffic congestion inside the CBD, and resultant loss of business opportunities, more disorganised traffic safety, worsened roadside environment such as noise, vibration and air quality, and deterioration of urban amenity and environmental quality. 	<ul style="list-style-type: none"> • Need to establish organised comprehensive urban development program covering from land use, transport, social safety and services, and environment as well as relevant capacity development.

Development Structure Alternative	Anticipated Risk	Proposed Mitigation/Implementation Guideline
	<ul style="list-style-type: none"> • Difficulties for implementation of urban development and/or improvement programs in the future remain. • Worsened chronic shortage of basic infrastructure facilities (e.g., construction of new waste disposal sites). • Difficulties in the implementation of city-wide environmental and social management programs in the future remain. 	
STR-2	<ul style="list-style-type: none"> • Compared with STR-1, congestion and crowdedness observed in CBD would be alleviated. • Increased risk of temporal traffic jams during construction period of the new sub-centre. • Possibilities that the newly developed sub-centre would become a new source of pollution exist. • Possible future urban amenity degradation of the CBD area due to mass exodus of population to sub-centres (e.g., Detroit, USA). • Risk of reduction of open spaces such as green, wetland, and forest areas would be increased due to the construction of new sub-centres. 	<ul style="list-style-type: none"> • Need to establish organised comprehensive regional development plan covering from basic infrastructure (e.g., transport network, adequate water supply, sewerage, waste management, and power supply) to other basic social services (e.g., school, medical centre, market, and others). • Need to establish a region-wide comprehensive environmental and social management program covering social safety and services and environment for each sub-centre as well as relevant capacity development before its setup while establishing integrity with the regional development plan mentioned above.
STR-3	<ul style="list-style-type: none"> • Compared with STR-1 and STR-2, congestion and crowdedness observed in CBD would be further alleviated. • Increased risk of temporal traffic jams during construction period of the new sub-centre. • Increased risk of temporal traffic jams during construction period of the new sub-centre and residential areas. • The possibilities that the newly developed sub-centre and residential areas would become new pollution source would be larger than STR-2, but possible intensity and/or the order of the magnitude of future negative impacts of each sub-centre and residential area would be lessened due to the wider distribution of future population. • Possible future urban amenity degradation of the CBD area due to mass exodus of population to new sub-centres and residential areas (e.g., Detroit, USA). • Risk of reduction of open spaces such as green, wetland, and forest areas would be increased due to the construction of new sub-centres and residential areas. 	<ul style="list-style-type: none"> • Same as above. • Need more organised operation of regional transport network, water supply, and waste management system due to the increase of collective residential areas and sub-centres.
STR-4	<ul style="list-style-type: none"> • Similar to STR-3, congestion and crowdedness observed in CBD would be further alleviated. • Increased risk of temporal traffic jams during construction period of the new sub-centre. • The possibilities that the newly developed sub-centre and residential areas would become new pollution source exist and possible intensity and/or the order of magnitude of future negative impacts of the sub-centre combined with residential areas would be larger than STR-3. • Possible future urban amenity degradation of the CBD area due to mass exodus of population to new sub-centres and residential areas (e.g., Detroit, USA). • Risk of reduction of open spaces such as green, wetland, and forest areas would be increased due to the construction of new sub-centres and residential areas. 	<ul style="list-style-type: none"> • Need to establish organised comprehensive regional development plan covering from basic infrastructure (e.g., transport network, adequate water supply, sewerage, waste management, and power supply) to other basic social services (e.g., school, medical center, market, and others). • Need to establish region-wide comprehensive environmental and social management program covering social safety and services, and environment for each sub-centre as well as relevant capacity development before its setup while establishing integrity with the regional development plan mentioned above.
STR-5	<ul style="list-style-type: none"> • Compared with STR-1, congestion and crowdedness observed at CBD would be alleviated. • Increased risk of temporal traffic jams during construction period of the new sub-centre. • Relevant development activities such as construction of the new sub-centres and its transport system and basic infrastructure will be wide-spread, and the risk to jeopardise the local flora/fauna would be increased (e.g., destruction of ecological corridors). • The possibilities that the newly developed sub-centre and residential areas would become new pollution source would 	<ul style="list-style-type: none"> • Same as above. • Need to establish inter-county coordination system to control transboundary pollutions and/or conflicts.

Development Structure Alternative	Anticipated Risk	Proposed Mitigation/Implementation Guideline
	<p>be wider than the previous four options, but possible intensity and/or the order of magnitude of the future negative impacts of each sub-centre and residential area would be lessened due to the wider distribution of future population.</p> <ul style="list-style-type: none"> • Risk of reduction of open spaces such as green, wetland, and forest areas, possibly wider than other structure plans would be increased due to the construction of new sub-centres and residential areas. • Possible future urban amenity degradation of the CBD area due to mass exodus of population to new sub-centres and residential areas (e.g., Detroit, USA). 	

Source: JICA Study Team (JST), 2014

10.5 Integration of Public Comments in the Master Plan

Based on the stakeholder meetings, held during the SEA study of NIUPLAN, NCC organised 23 public consultations across the city county (equivalent to one consultation/one constituency) to encourage the citizens to contribute and share their desired aspirations in the development of the city (see Table 10.5.1).

Table 10.5.1 Schedule of NCC's 23 Public Consultation Meetings

	Constituency/or Venue	Date		Constituency	Date
1	Westland (1)	20 January 2014	13	Mathare North	29 January 2014
2	Kangemi	21 January 2014	14	Mathare	1 February 2014
3	Kileleshwa/Lavington	21 January 2014	15	Embakasi South	3 February 2014
4	Dagoretti North	22 January 2014	16	Starehe	12 February 2014
5	Dagoretti South	22 January 2014	17	Kamukunji	11 February 2014
6	Gigiri/Runda	23 January 2014	18	Embakasi West	5 February 2014
7	Kenya police CID Pavilion, South C	23 January 2014	19	Makadara	6 February 2014
8	Kibra	27 January 2014	20	Embakasi East	8 February 2014
9	Karen/Langata	27 January 2014	21	Embakasi North	3 February 2014
10	Roysambu constituency	28 January 2014	22	Embakasi central	4 February 2014
11	Garden Estate	28 January 2014	23	Embakasi East/Kasarani	13 February 2014
12	Roysambu/Kasarani	29 January 2014			

Source: NCC, 2014

The purpose of the consultations is to share information of the current city situation, challenges, and opportunities as well as contents of NIUPLAN, to have sectoral discussions with various stakeholders, and then, to further consolidate the study consensus. Within the forum, validity of development options were discussed in order to build consensus and agreements for selected priority programs and projects. In order to encourage more interactive deliberations and to gain more insights into the sectoral issues, thematic working group discussions were organised and more sector-specific discussions were conducted in each district. Tables 10.5.2–10.5.6 summarise major findings and remarks, commonly found within each sectoral discussion. More detailed minutes of meeting summaries of public consultation held at each constituency are attached in Appendix A. It is noted that those findings and remarks mentioned above are incorporated into NIUPLAN.

The entire consultation programs were divided into three sessions. The first session focused on the participant's urban development-related expectations, general issues, and the current development situation including various sectors and emerging proposals. Within the second session, four thematic working group discussions were conducted, and all the participants further analysed the presentations, identified missing gaps, suggested proposals, and build consensus on priority programs and projects.

Then, within the third sessions, participants were encouraged to provide feedback and to share their comments and/or proposals while agreeing to make the MP move forward to the next steps.

Table 10.5.2 Major NIUPLAN Remarks obtained from Public Consultation (Urban Transport)

Issues	Findings and Proposals to NIUPLAN
A radial pattern focusing on the CBD as its centre	<ul style="list-style-type: none"> Construct strategic bypasses and ring roads
Inefficient public transport	<ul style="list-style-type: none"> Introduce reliable and efficient mass rapid transport systems either through rail or bus services
Inefficient traffic management	<ul style="list-style-type: none"> Functioning and synchronised traffic lights
Poor non-motorised transport (NMT) provision	<ul style="list-style-type: none"> Make provisions for non-motorised transport

Source: NCC, 2014

Table 10.5.3 Major NIUPLAN Remarks obtained from Public Consultation (Urban Infrastructure)

Issues	Findings and Proposals to NIUPLAN
Water loss and development of water supply facilities	<ul style="list-style-type: none"> Explore the possibility of existing soft water boreholes
Storm water drainage not integrated	<ul style="list-style-type: none"> Integrated storm water and rain water management
Sewerage water not meeting the effluent standards	<ul style="list-style-type: none"> Development of new drainages systems and sewer lines Provision of better water and sewer policies
Energy supply - insufficient supply and high tariffs	<ul style="list-style-type: none"> Consider renewable energy Shift street lighting to solar energy Provide incentives for the installation and use of solar energy
Solid waste management insufficient collection, disposal	<ul style="list-style-type: none"> Collaboration with NCC and public for waste management Waste recycling; recycling plants

Source: NCC, 2014

Table 10.5.4 Major NIUPLAN Remarks obtained from Public Consultation (Land Use, Resettlement, and Social Service)

Issues	Findings and Proposals to NIUPLAN
Land grabbing	<ul style="list-style-type: none"> Mapping out and repossession of public land that has been previously grabbed Embracing the construction of good quality high-rise development
Land tenure	<ul style="list-style-type: none"> Consult with communities when preparing zone plans
Land use change	<ul style="list-style-type: none"> Enforce land tenure systems that encourage modern development
Uncontrolled development	<ul style="list-style-type: none"> Awareness creation on proper planning and planning regulations NCC should be fully responsible for the approval of all development plans
Housing	<ul style="list-style-type: none"> Proper zoning as well as slum upgrading
Social amenities including health facilities and education facilities	<ul style="list-style-type: none"> Decentralisation of social facilities
Uncontrolled livestock farming	<ul style="list-style-type: none"> NCC should consider advocating and funding urban agriculture
Increasing crime	<ul style="list-style-type: none"> Empowerment of the youth Development of rehabilitation centres Provide street and estate lighting

Source: NCC, 2014

Table 10.5.5 Major NIUPLAN Remarks obtained from Public Consultation (Governance, Legislation, and Institutional Aspects)

Issues	Findings and Proposals to NIUPLAN
Public participation	<ul style="list-style-type: none"> Engage the youth in the decision Hold periodic public forums between national and county governments Set up a committee comprising of members of the public on matters of development Member of the County Assembly (MCAs) to sign a memorandum for public engagement.
Planning and policy formulation	<ul style="list-style-type: none"> Coordination in the county offices should be enhanced and officers informed on processes Employ more architects and planners
Communication	<ul style="list-style-type: none"> Use of community radio program for dissemination of information Develop proper information dissemination and feedback mechanisms
Institutional management	<ul style="list-style-type: none"> Involve stakeholders in the policy making process Harmonise city by laws with the 2010 Constitution Decentralise county offices and services to bring services

Source: NCC, 2014

Table 10.5.6 Major NIUPLAN Remarks obtained from Public Consultation (Cross-cutting Issues)

Issues	Findings and Proposals to NIUPLAN
Safety and security	<ul style="list-style-type: none"> • There is a need to take security as a civic responsibility • Protecting the whistle blowers/witnesses • Economic and social empowerment
Sensitisation and capacity enhancement	<ul style="list-style-type: none"> • Sensitisation on specific roles in the planning process • Capacity enhancement in areas where the skills are lacking or inadequate and where necessary outsourced
Transparency and accountability	<ul style="list-style-type: none"> • Establish proper transparency and accountability mechanisms subject to monitoring and evaluation • Set standards for service delivery with performance indicators and performance contracts
Law and enforcement	<ul style="list-style-type: none"> • Introduce mandatory site visits for evaluation of approved and upcoming developments • Repeal old, punitive, and contradictory legislation and by-laws and formulate policies that are more enabling

Source: NCC, 2014

In addition to stakeholder meetings, Validation Workshop was held on September 24, 2014 to validate SEA Report, confirming SEA recommendation to NIUPAN, as well as confirming contribution of SEA process to NIUPALN. Contribution of SEA process to NIUPLAN is summarized below.

- Discussions and consensus building with thematic / stakeholder groups for incorporation of certain environmental and social considerations into the NIUPLAN development process. Specific contributions were on:
 - Environmental Guidelines for future planning for the proposed urban structure plans;
 - Detailed environmental analysis and ranking of structure plan alternatives;
 - Identification of sub-centres and stations that would require special guidelines and approvals to protect Nairobi National Park and gazetted forests within the City. These are Lang'ata, Karen, Woodley and Syokimau;
 - Participation in task-force to develop recommendations for consensus building on solid waste management in the City, specifically the issue of decommissioning of Dandora Dumpsite and the proposed Ruai Sanitary Landfill Site;
 - As a result of the discussions on solid waste management, the task-force recommended a change in NIUPLAN proposals to convert Dandora into a materials recovery facility. This is expected to ensure that any wastes disposed at the sanitary landfill site are inert, thus reducing the risk of bird strikes by aircraft;
- Validation of the situational analysis sections of NIUPLAN through confirmation by stakeholders through-out the 68 meetings and 3 workshops held under the SEA for NIUPLAN;
- The public meetings and discussions with residence associations were important for information dissemination on NIUPLAN and they also provided a platform for the citizens at sub-county level to question and contribute to the master plan and SEA processes;
- The Focus Group Discussions and Key Informant Interviews with both civil society and public services allowed for validation of key issues by professionals in the City;
- Contributions through submission of summary papers to NIUPLAN Secretariat for consideration in development of the City County Government policies and laws for both environmental and planning purposes. These contributions were based on the findings of the SEA for NIUPLAN;
- Inter-county consultations organised under the SEA study that resulted in the following:
 - Proposal of joint committees and collaborative mechanisms towards sustainable development between Nairobi, Kajiado, Machakos and Kiambu;

- Proposals for contributions by Nairobi County Government to conservation of the Aberdare Water Tower as a result of discussions between Nyandarua and Nairobi County;
- Provision of a platform for implementation of a Civil Education Program as required by the County Government Act and as informed by the Nairobi City County Planning Department;
- Provision of a platform for stakeholder engagement and feed back to the NIUPLAN secretariat through-out the NIUPLAN preparation process.

10.6 Priority Project for Urban Environmental Sector

(1) Citywide Air Quality Management

As discussed in the previous section, several environmental issues such as waste management, water quality improvement of urban tributaries, urban air quality, vehicular emissions, and others were raised and most of stakeholders pay great concerns. As one of the priority projects in the environmental sector, a “citywide air quality management program” is identified for the urban environmental management sector.

The proposed technical cooperation program can play an essential role to support the setup of the urban air quality monitoring system and make great contributions to improve the capacity of the regional environmental management across Nairobi City, that would eventually provide a sustainable and harmonious growth through the implementation of the NIUPLAN.

Recently, the urban air pollution is recognised as one of major public health and environmental issues in Nairobi City. The main sources of air pollution are vehicles, industries, emissions from the use of charcoal and firewood, and other municipal sources such as the open burning of wastes. Amongst them, the increasing number of cars circulating inside the city intensifies worsened traffic conditions and relevant vehicular pollution problems. Vehicles emit significant levels of air pollutants including greenhouse gases and the precursors of smog. Charcoal burning, a very prevalent energy source in the city, emits methane (CH₄) and carbon monoxide (CO) and sends tiny particulates into the surrounding air.

Besides, the current vehicle inspection and maintenance system in Kenya is not sufficient to enforce the periodical vehicle maintenance activities, one of essential components to achieve significant vehicular emission reduction. So, most of public transport, *matatu* (mini-buses used for the citywide transport), are in poor conditions and are circulating while emitting black smoke along major roads of Nairobi City.

No specific environmental section responsible for urban air quality management exists within the Department of Environment of NCC. NCC has no authorised power to enforce the proper vehicle integrated management (I/M) system, either.

Also, NCC does not have its own urban air quality monitoring system to scientifically analyse the air qualities. So, it is quite difficult to grasp the latest air quality information by NCC promptly. Under this situation, it is difficult to develop comprehensive and effective air quality management program including the air quality monitoring and/or inspection. Without any actions to improve, it would be quite difficult for NCC to implement effective citywide environmental management program. Thus, NCC will not be able to cope up with the rapid growth of the vehicle circulation and resultant worsened urban air quality condition. The citywide environmental governance, compliance, and enforcement in Nairobi City would be weakened further.

(2) Objectives

The proposed technical cooperation program aims to provide relevant technical supports for setting up NCC's own urban air quality monitoring system in order to achieve a comprehensive citywide air quality management while strengthening the capacity of the environmental audit, enforcement, and governance, to be conducted by NCC. By setting up urban air quality monitoring stations at strategically important sites such as the downtown of Nairobi City, it would be possible to smoothly obtain first-hand scientific air quality data. Using these air quality information, NCC can develop relevant environmental mitigation measures or provide directions while accumulating reliable fundamental urban air quality information that would lead to a creation of nationwide environmental database in the long-term period. As a result, it would make the establishment of a regionwide air quality monitoring network system possible while making the development of a citywide air quality management program more meaningful.

The second objective of this proposed program is to provide the capacity development for NCC in order to improve the entire performance quality of the environmental audits including environmental monitoring activities. This capacity building program would cover the upgrading of air quality monitoring skills as well as the development of the monitoring program, periodical inspection, and maintenance of the monitoring equipment for its quality control. In general, the equipment that will be used within the proposed monitoring system are expensive and sophisticated ones. Once a full-scale operation of monitoring system starts, those equipment will be under heavy-duty usage conditions, and most of them are prone to malfunction. Therefore, it is important to develop a suitable periodical maintenance framework prior to the long-term citywide monitoring operation. In that aspect, it is also imperative to acquire relevant discipline for NCC in order to maintain all monitoring equipment in its best condition at all times.

The third objective is to strengthen the environmental governance in conjunction with this environmental laboratory setup. No matter how meaningful NCC can obtain relevant urban air quality information, its usefulness would be hampered without a proper environmental governance and enforcement. In that aspect, a capacity to develop a meaningful environmental audit program including periodical monitoring activities shall be strengthened. Also, it would be required to conduct several improvements within the current environmental legal framework. For instance, it would be better to enact relevant legal codes in the periodical reporting of environmental compliances, in particular, pollutant emission into the surrounding atmosphere. It shall be a mandatory task for all project and/or factory owners, and relevant reliable environmental laboratory tests shall be conducted with their expenses. Also, it is imperative to strengthen the current vehicle I/M system to reduce the total amount of vehicular emission.

Throughout this proposed, technical supports for the proposed citywide air quality monitoring framework including the setting up of monitoring systems would be possible to make a great contribution to improve the environmental monitoring performance of NCC as well as the entire country. To achieve this goal, it is imperative to establish their own monitoring system and have equipment with proper comprehensive technical assistance program, to be conducted both in Japan and Kenya. A summary of this proposed priority project is described in Chapter 11 of this main report.

CHAPTER 11 PRIORITY PROGRAMS OF NIUPLAN

11.1 Justification of Priority Programs

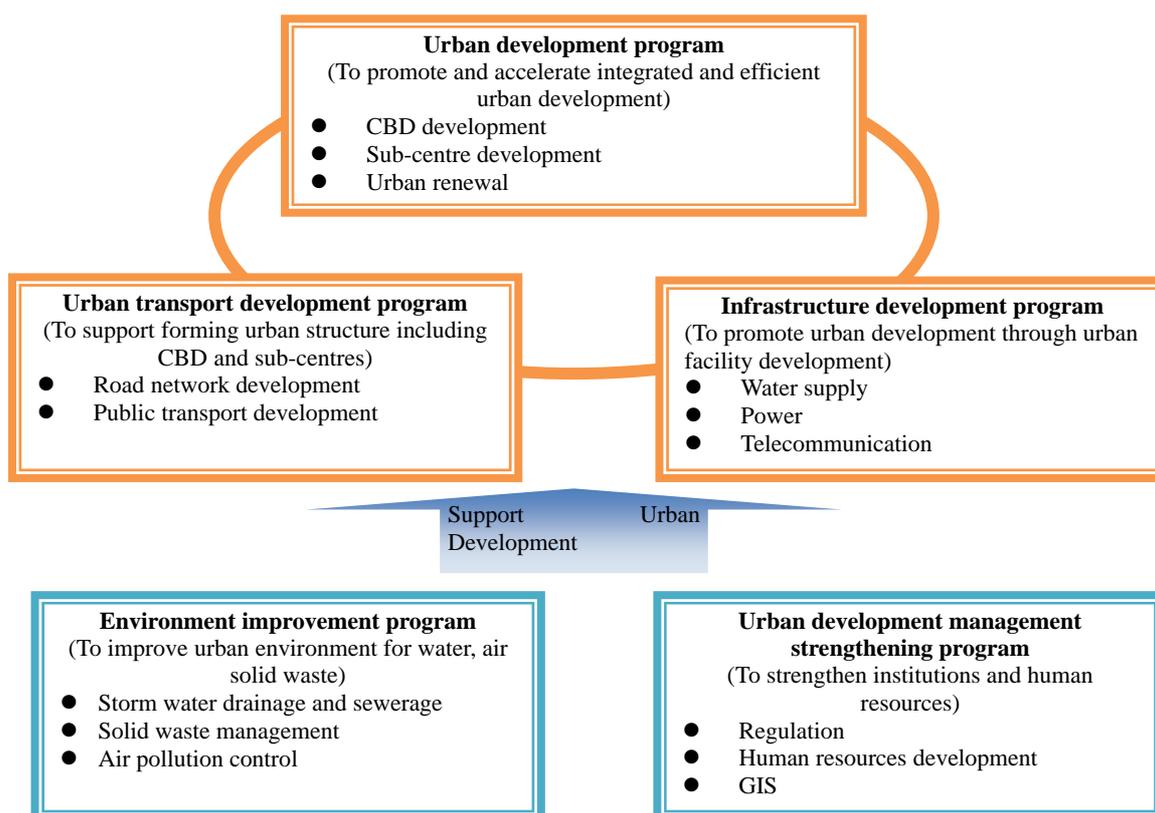
Priority programs are proposed as a first step for the implementation of Nairobi Integrated Urban Development Master Plan (NIUPLAN) which is expected to be implemented (start) in the short term (~2018). Instead of implementing individual projects, the projects are compiled as a “program” to clarify objectives and promote efficient implementation. Five programs are proposed to be implemented in the short run, namely: (i) urban development program, (ii) urban transport development program, (iii) urban infrastructure development program, (iv) environment improvement program, and (v) urban development management strengthening program.

Priority Programs for the Nairobi Integrate Urban Development Master Plan

- (i) **Urban development program:** to promote and accelerate integrated and efficient urban development;
- (ii) **Urban transport development program:** to support forming urban structure including CBD and sub-centres;
- (iii) **Infrastructure development program:** to promote urban development through urban facility development;
- (iv) **Environment improvement program:** to improve urban environment for water, solid waste, and air quality; and
- (v) **Urban development management strengthening program:** to strengthen institutions and human resources.

The following programs aim to form the urban structure: (i) urban development program, (ii) urban transport development program, (iii) urban infrastructure development program, whereas the following programs aim to support urban development: (iv) environment improvement program, and (v) urban development management strengthening program. Components of each program are selected from the point of view of accelerating urban development and urgency of the sector requirements.

Figure 11.1.1 shows the structure of the priority programs.



Source: JICA Study Team (JST)

Figure 11.1.1 Priority Program Structure

Outline of the priority programs are summarised in Table 11.1.1 below.

As mentioned in Chapters 6 to 9, the JICA Study Team (JST) proposed priority projects to be carried out by 2030 to solve the gaps between the current supply and demand forecast. From these projects which are shown in Table 11.1.1, 16 high priority programs are selected considering “Readiness of the program”, “NCC’s involvement”, and “Range of beneficiaries of the projects”. The evaluation criteria are shown at the bottom of the table.

Table 11.1.1 List of All Priority Programs

Sector	Project	Timing of implementation	Score	NCC's Involvement (Organisation)	Score	Range of Beneficiaries of the Project	Score	Total Score	Cost US\$ Mil
Urban Development	Railway City Development*	Short	1	High	2	NCC, KRC	1	4	100
	East of Tom Mboya St. Development	Medium	0	High	2	NCC, developer	0.5	2.5	
	Dandora Sub-Centre Development	Short	1	High	2	NCC, developer	0.5	3.5	5
	Eastlands Urban Renewal Project	Short	1	High	2	NCC, NHC	1	4	5
Urban Transport	Flyover in CBD for Railway City*	Short	1	High	2	NCC, KURA	1	4	40-50
	Widening of Enterprize Road	Short	1	High	2	NCC, KURA	1	4	15
	Construction of Northern Part of Circumferential Road C-2*	Short	1	High	2	NCC, KURA	1	4	12
	Development of New Bus & Matatu Terminal in Railway City	Short	1	High	2	KURA, NCC	1	4	8
	Formulation of Public Transport System Policy and Guideline	Short	1	Middle	1	MoTI, MoDP, NCC	1.5	3.5	8
	Vitalization of Commuter Train Operation*	Immediately	2	Middle	1	KRC	0.5	3.5	2
	Feasibility Study for the East-West Corridor MRT Line	Short	1	Middle	1	KRC	0.5	2.5	
	Feasibility Study on Nairobi Loop Line	Short	1	High	2	NCC, KRC	1	4	1.6
	Formulation of ITS City Master Plan	Immediately	2	Middle	1	NCC, Police	0.5	3.5	5

Sector	Project	Timing of implementation	Score	NCC's Involvement (Organisation)	Score	Range of Beneficiaries of the Project	Score	Total Score	Cost US\$ Mil
Infrastructure Development	Master Plan of Distribution Network in Nairobi	Short	1	High	2	NCC	0.5	3.5	5
	Equipment of collecting rainwater for Building	Short	1	Middle	1	NCC	0.5	2.5	
	Priority Project operated by AWSB	Short	1	Middle	1	NCC, AWSB	1	3	
	Amendment for Technical Criteria of Overhead Line	Immediately	2	Middle	1	Kenya Power	0.5	3.5	0.5
	Reviewing the LCPDP	Short	1	Low	0	Energy Regulatory Commission	0.5	1.5	
	Development of Underground Cable in Dandra Area	Medium	0	High	2	NCC	0.5	2.5	
	Power Supply for Dandra Industry Area	Medium	0	High	2	NCC	0.5	2.5	
	Fiber Optic Trunk Communication Network in Nairobi City	Immediate	2	Middle	1	NCC, Government, Operator	1.5	4.5	300-400
	Common Infrastructure for Operators	Medium	0	High	2	NCC, Operator	1	3	
	Introduction of Dedicated Government Network among Government Offices	Medium	0	High	2	NCC, Government	1	3	
	Disaster Information Gathering and Dissemination System	Medium	0	High	2	NCC	0.5	2.5	
	Infrastructure Sharing Policy	Medium	0	High	2	NCC, Operator	1	3	
Environment	River Improvement Project	Short	1	Middle	1	WRMA, NCC	1	3	
	Sewerage Improvement Project	Short	1	Middle	1	AWSB, NCC	1	3	
	Capacity development for storm water drainage system in Nairobi city	Short	1	High	2	NCC	0.5	3.5	5
	Capacity development for sewerage system in Nairobi city	Short	1	High	2	NCC	0.5	3.5	5
	Development of new landfill site	Short	1	High	2	NCC	0.5	3.5	50
	Safe closure of existing landfill site	Medium	0	High	2	NCC	0.5	2.5	30
	Nairobi solid waste management	Short*	1	High	2	NCC	0.5	3.5	4, 10,000
	Development of MRFs	Medium	0	High	2	NCC	0.5	2.5	
	Improvement of Collection and Transportation System	Medium	0	High	2	NCC	0.5	2.5	
	Establishment and improvement of laws, regulations and guidelines for effective solid waste management	Medium	0	Low	1	NCC	0.5	1.5	
	City-wide Air Quality Management Program	Short	1	High	2	NCC, MoTI, MoLHUD	1.5	4.5	10-20
Urban Development Management	Installation of Integrated GIS for NCC Data Management System	Medium	0	High	2	NCC	0.5	2.5	
	Urban development management strengthening (institution, capacity development)*	Immediately	2	High	2	NCC	0.5	4.5	5
Note : Evaluation Score		Immediate(2-3yrs) : 2, Short(4-5yrs) : 1 Medium(more than 5 yrs) : 0		High : 2 Middle : 1 Low : 0		3 players : 1.5 2 players : 1 1 players : 0.5			

Note :

Hatched programs are selected as high priority programs.

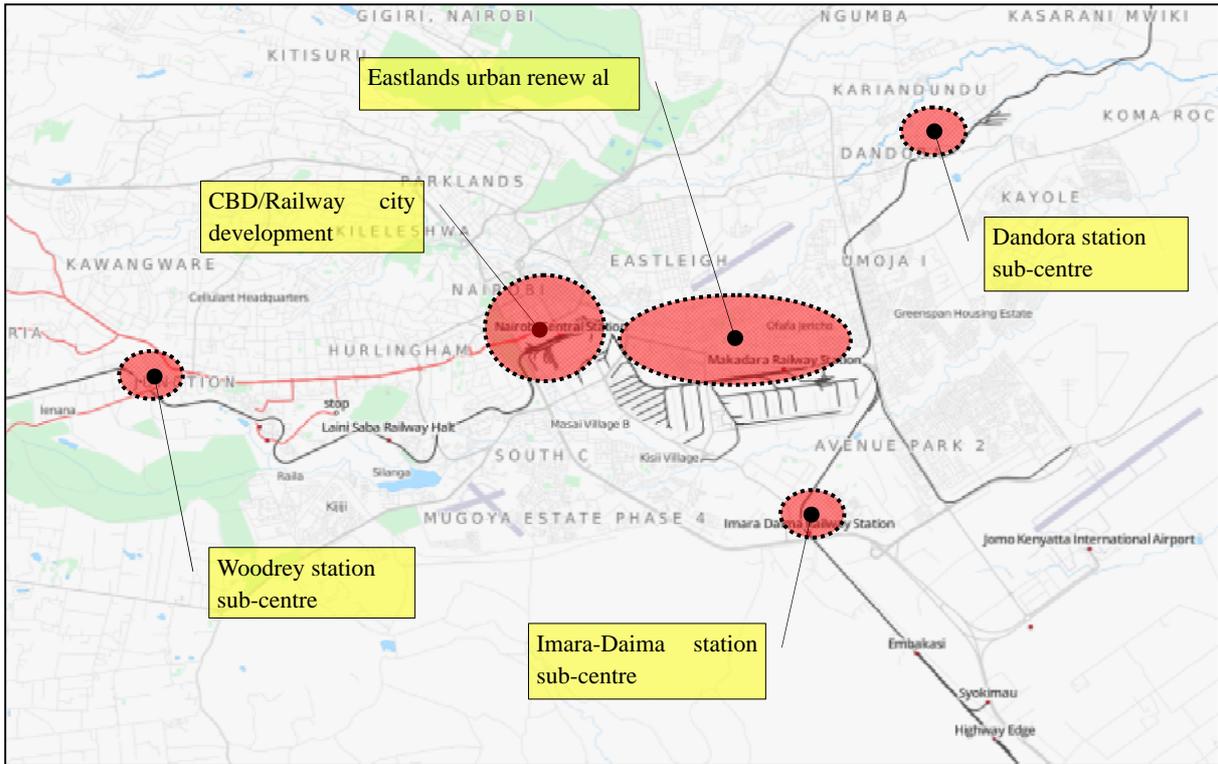
The projects with “ * “ mark represent high priority projects among priority programs

Source : JICA Study Team (JST)

11.2 Urban Development Program

Several urban development programs are proposed as priority programs. Following figure shows the location of sub-centres for urban development or urban renewal. Some of the sub-centres are

identified as priority projects including “Railway city development”, “Dandora sub-centre development”, and “Eastlands urban renewal project”.



Source: JICA Study Team (JST)

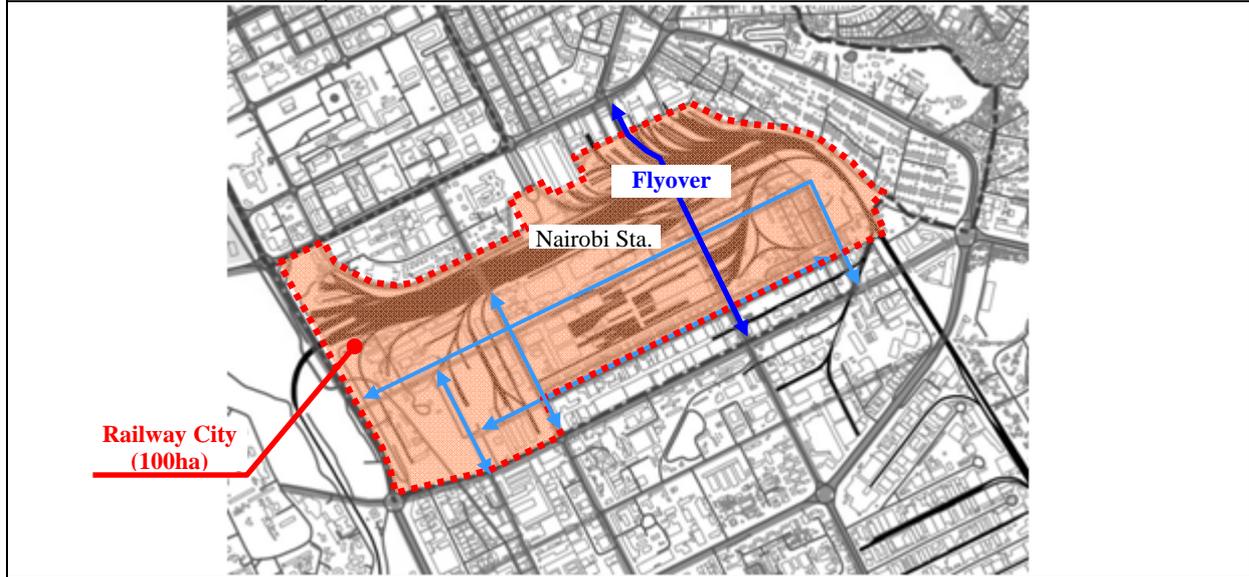
Figure 11.2.1 Location of Urban Development Sites

11.2.1 CBD development program

“Railway city development” is identified as a priority project for land use, railway and urban transport sector. Project outline is summarized in the table below.

1 Project title	Railway city development
2 Background	<ul style="list-style-type: none"> ● Nairobi central station area is one of obstacles for CBD expansion toward south. ● KRC is planning to develop this area as “Railway City”. However, their first master plan is not adequately considered current CBD situation.
3 Objective	To revise master plan for the area to strengthen traffic and pedestrian network, and utilize development potential of the expanded CBD area.
4 Components	<ol style="list-style-type: none"> (1) Survey of current situation <ul style="list-style-type: none"> ● Land ownership, land use, existing infrastructure condition (2) Revision of KRC’s master plan <ul style="list-style-type: none"> ● Detailed land use plan ● Basic design of infrastructure ● Development control guideline (3) Priority project design <ul style="list-style-type: none"> ● New railway station, station square and transfer terminals design ● Flyovers and new connection road ● KRC worker housing re-development ● Urban renewal project in front of Nairobi station (4) Urban management scheme <ul style="list-style-type: none"> ● Urban re-development scheme ● Area management scheme (5) Projects implementation

5	Responsible organization	PPP (KRC, KURA, NCC)
6	Cost	US \$ 100 million
7	Possible fund source	ODA (Loan, Technical Cooperation)



11.2.2 Sub-centre Development Program (priority area)

“Dandora Sub-Centre Development” is identified as a priority project for land use sector. Project outline is summarized in the table below.

1	Project title	Dandora Sub-Centre Development
2	Background	<ul style="list-style-type: none"> ● This Master Plan study recommends multi-core sub-centre system for Nairobi city. NRC is also planning to develop commuter train service including Dandora station to utilize existing railway lines. ● Dandora estate and surrounding area are one of heavily populated area without appropriate road network. It is necessary to re-develop urban function to improve current conditions. ● Dandora dumping site need to plan to transfer its function.
3	Objective	To draw up sub-centre development detailed plan of Dandora station area to improve transportation network and to utilize development potential in this area.
4	Components	<p>(1) Survey of current situation</p> <ul style="list-style-type: none"> ● Land ownership, land use, existing infrastructure condition <p>(2) Detailed land use plan</p> <ul style="list-style-type: none"> ● Basic design of infrastructure ● Detailed land use plan <p>(3) Dandora station development plan</p> <ul style="list-style-type: none"> ● Railway station urban re-development ● Dandora Dumping site renewal plan
5	Responsible organization	NCC, KRC
6	Cost	US \$ 5 million
7	Possible fund source	ODA (Technical Cooperation)

11.2.3 Eastlands Urban Renewal Project

“Eastlands Urban Re-development” is identified as a priority project for land use sector. Project outline is summarized in the table below.

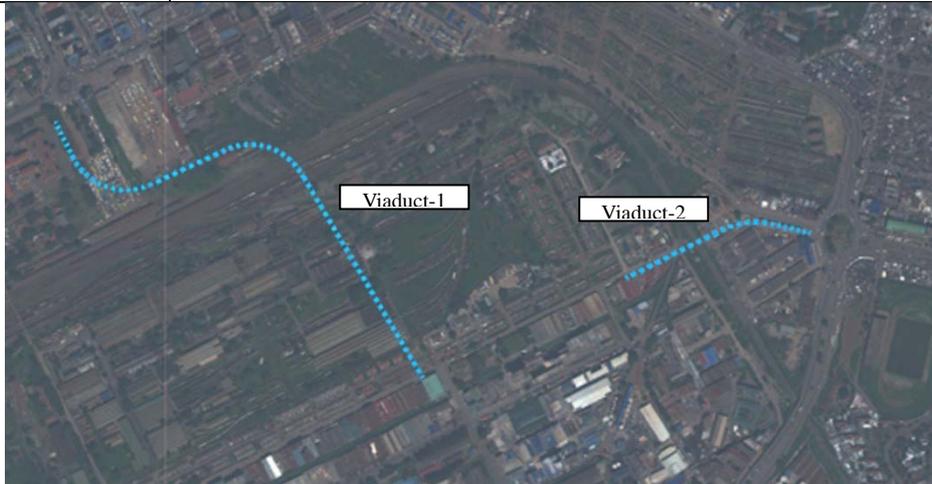
1	Project title	Eastlands Urban Renewal Project
2	Background	<ul style="list-style-type: none"> ● Eastlands estate was developed for local residents before the Independence. NCC has a plan to re-develop this area to upgrade existing infrastructure. ● The buildings in these estates are antiquated and the population density is still low compare to other residential areas in Nairobi City.
3	Objective	To draw up urban renewal master plan for Eastlands
4	Components	<p>(1) Preparation of development plan</p> <ul style="list-style-type: none"> ● Land use plan ● Road network plan ● Public transport plan <p>(2) Development scheme</p> <ul style="list-style-type: none"> ● Funding or financial framework ● Legal framework ● Implementation framework <p>(3) Schedule and implementation of development plan</p> <ul style="list-style-type: none"> ● Project time framework ● Project management framework
5	Responsible organization	NCC, NHC(National Housing Corporation)
6	Cost	US \$ 5 million (Technical Cooperation)
7	Possible fund source	ODA (Technical Cooperation)

11.3 Urban Transport Development Program

In order to ensure the smooth transition or implementation of the Master Plan, recommendations are prepared as follows:

11.3.1 Road network development program

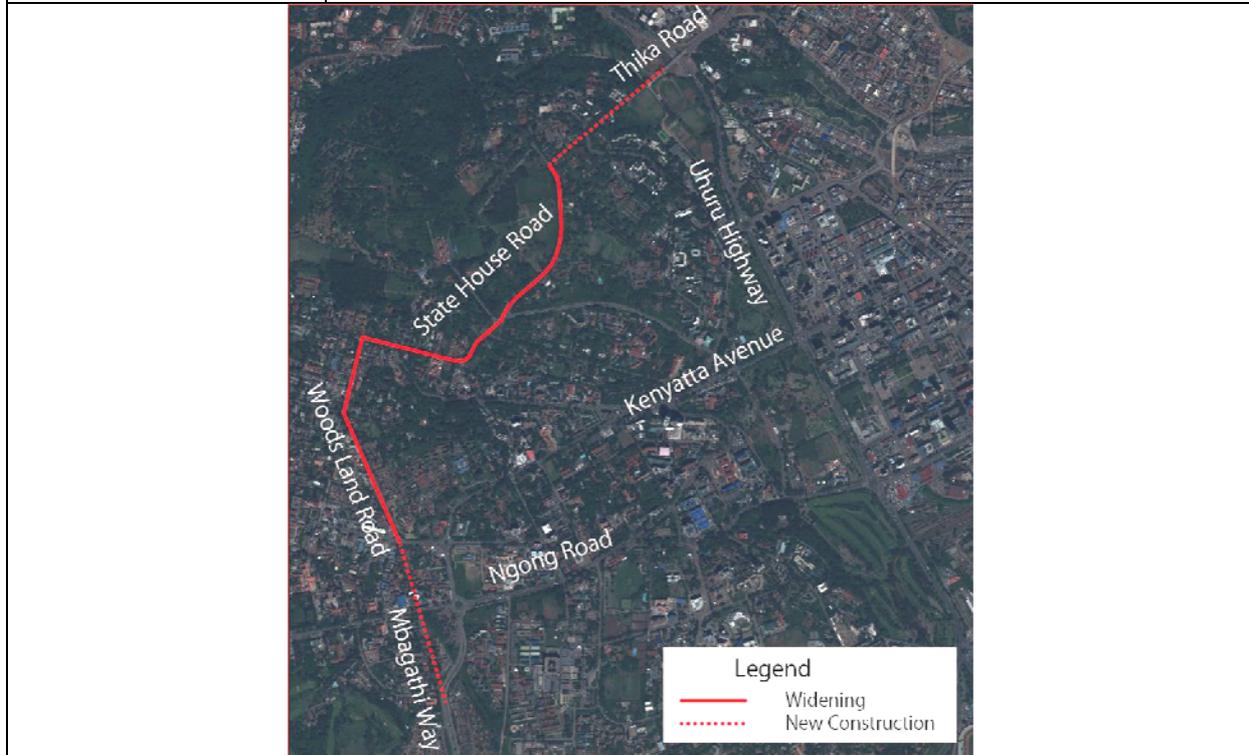
1 Project title	Flyover in CBD for Railway City
2 Background	This project aims at development of Railway City by harmonious planning of land use and urban transport
3 Objective	<ul style="list-style-type: none"> ● To encourage development potential in southern part of the Nairobi Station by improvement of accessibility to the area, consequently remove the functions unnecessary in the CBD, and promote the creation of the Railway City. ● To alleviate traffic congestion in northern part of the station by means of removal of the bus and <i>matatu</i> terminus to new terminal in the Railway City. ● To guide traffic flows from southern part of the Nairobi city promptly and decongest the traffic in peripheral area.
4 Components	<ul style="list-style-type: none"> ● Viaduct-1 (Length: 1,000m, 4-lanes, Project cost: 30-40 million USD) The viaduct connects Moi Avenue, trunk road of CBD, and Enterprise Road, trunk road of southern area of the station. Moreover, the viaduct together with widening of Enterprise Road to 4-lanes will disperse the traffic on Mombasa Road. ● Viaduct-2 (Length: 400m, 2-lanes, project cost: 10 million USD) The viaduct guides bus and <i>matatu</i> traffic to new terminal in the Railway City, remove the traffic on Landhies Road and thus alleviates the congestion around terminus in northern part of the station.
5 Responsible organization	KURA, NCC Engineering Department
6 Cost	Total 40-50 million USD
7 Possible fund source	ODA (Grant Aid / Loan)



1 Project title	Widening of Enterprize Road
2 Background	This project aims at promotion of development of Railway City by improvement of accessibility
3 Objective	<ul style="list-style-type: none"> ● To encourage development potential in Railway City by improvement of accessibility from southern area. ● To disperse the traffic demand on Mombasa Road and Uhuru Highway especially at the construction stage of northern corridor.
4 Components	<ul style="list-style-type: none"> ● Widening of existing 2-lanes section to 4-lanes (Length: 4.3km, Project cost: 15 million USD) Existing 4-lane section of Enterprise Road is from Lusaka Road to Homa Bay Road. By the project, road section from Homa Bay Road to Mombasa Road will be widened to 4-lane road. ● Improvement NMT along existing 4-lane section After development of Railway City, number of pedestrians concentrating to Railway City will increase largely. Therefore comfortable facilities for NMT should be developed to make the Railway City more attractive.
5 Responsible organization	KURA, NCC Engineering Department
Cost	Total 15 million USD
7 Possible fund source	ODA (Grant Aid)



1 Project title	Construction of Northern Part of Circumferential Road C-2
2 Background	Road network system in Nairobi City at present is composed of radial roads. And development of western ring roads contributed to form C/R (Circumferential/Radial) road network system partially.
3 Objective	<ul style="list-style-type: none"> ● Development of the circumferential road C-2 will change the traffic movement around CBD fundamentally. ● Additionally, the circumferential road C-2 will encircle the CBD area, and will lubricate the traffic movement around the CBD.
4 Components	<ul style="list-style-type: none"> ● Construction of Northern Part of Circumferential Road C-2 (From Thika Highway-Uhuru Highway Intersection to Mbagathi Way, Length: 3.7 km (widening 2.2 km; new construction 1.5 km), Project cost: 12 million USD, 4-lanes) ● This Circumferential road is 2nd circumferential road encircles the city centre area proposed by NUTRANS. Proposed route by NUTRANS had many constraints, so alternate route has been proposed in this study.
5 Responsible organization	KURA, NCC Engineering Department
Cost	12 million USD
7 Possible fund source	ODA (Grant Aid)



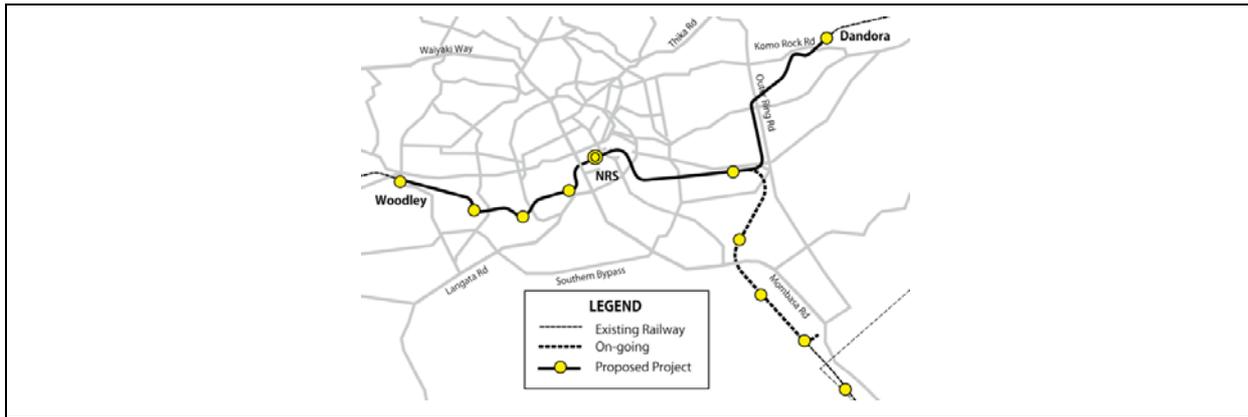
11.3.2 Public transport development program

In order to improve the efficiency of current bus terminal which is located in northern part of Nairobi station, the new bus and matatu terminal development plan is proposed as follow:

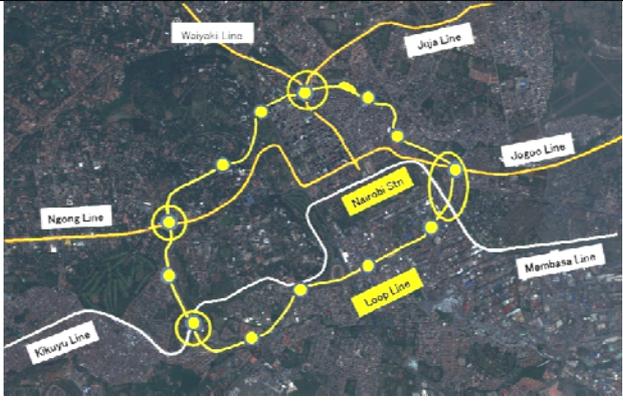
1 Project title	Development of New Bus & Matatu Terminal in Railway City
2 Background	Bus terminals and <i>Matatu</i> terminals are located in the northern part of Nairobi Station. Too much concentration of bus and <i>Matatu</i> into narrow area is causing heavy traffic congestion in the area. Moreover, introduction of new public transport system which will accelerate congestion more and more is expected in near future.
3 Objective	<ul style="list-style-type: none"> ● Development of new Bus and <i>Matatu</i> will ease the current congestion in the northern part of Nairobi Station ● Development of new terminal will attract many passengers who will be the source of prosperity in the Railway City. Therefore development of new terminal will contribute to the attractive town.
4 Components	<ul style="list-style-type: none"> ● Construction of Bus and <i>Matatu</i> Terminal (Expected Area: 50,000m²) ● Opening of south gate of the station ● Facilities for Passengers (Waiting room, Time Table, Ticket office, Restaurant, KIOSK, etc.)
5 Responsible organization	KURA, NCC Engineering Department
Cost	8 million USD
7 Possible fund source	ODA (Grant Aid)

In order to support KRC's commuter train operation plan, the following feasibility study is recommended to introduce diesel cars and modern signal and telecommunication system together with rehabilitation of station and track structure.

1 Project title	Vitalization of Commuter Train Operation
2 Background	<ul style="list-style-type: none"> ● Due to insufficient number of locomotives, commuter train operation is limited. ● Existing commuter train operation is inefficient due to lack of proper signalling and telecommunication systems. ● Running speed of commuter trains are very low due to poor track condition.
3 Objective	<ul style="list-style-type: none"> ● To improve existing commuter train operation (train pulled by diesel locomotive) by replacing with DMU (Diesel Multiple Unit), including detailed plan of DMU maintenance equipment and facilities. ● To modernize existing signalling and telecommunication systems to suit with the vitalized commuter train operation. ● To rehabilitate existing track and station structures in the sections where DMU commuter train to be operated.
4 Components	<ol style="list-style-type: none"> (1) Detailed planning of DMU (Diesel Multiple Unit: Diesel car) operation replacing existing commuter trains pulled by diesel locomotives, including detailed plan of DMU maintenance equipment and facilities. (2) Detailed planning of modernized signalling and telecommunication systems to suit with the vitalized DMU commuter train operation. (3) Detailed planning and basic design of track and station rehabilitation where DMU commuter train to be operated.
5 Responsible organization	Kenya Railways Corporation (KRC)
6 Cost	US \$ 2 million
7 Possible fund source	ODA (Technical Cooperation)



In order to avoid traffic congestion at CBD due to radiating structure of MRT/LRT lines, it is recommended to construct a loop line circulating around CBD. For that purpose, the following feasibility study is recommended.

1 Project title	Feasibility Study on Nairobi Loop Line
2 Background	<ul style="list-style-type: none"> The existing MRTS plan indicates that all the MRT/LRT corridors are radiating from Nairobi Railway Station. Therefore, severe congestion at CBD around Nairobi Station will be unavoidable.
3 Objective	<ul style="list-style-type: none"> To avoid congestion at CBD, diverting MRT/LRT passengers by the loop line. To provide sub-centres plan around interchange stations To provide train operation plan based on the demand forecast.
4 Components	<p>(1) Detailed planning of a loop line circulating the CBD including demand forecast.</p> <p>(2) Detailed planning of interchange stations including land use plan to form sub-centres.</p> <p>(3) Basic design of the system selected for the loop line.</p>
5 Responsible organization	Ministry of Transport and Infrastructure (MOTI)
6 Cost	US \$ 1.6 million
7 Possible fund source	ODA (Technical Cooperation)
	
<p>Pictures above shows the idea of loop line with total length of 13.2 and 13 stations</p>	

11.3.3 Intelligent Transport System Development Program

Formulation of ITS(Intelligent Transport System) City Master Plan is recommended to establish comprehensive plan to install ITS for Nairobi city.

1 Project title	Formulation of ITS City Master Plan
2 Background	<p>Traffic demand in Nairobi City is increasing in the entire area, and congestion of road is also spreading in the whole area. Through traffic in CBD is deteriorating the traffic congestion in CBD area. By introduction of ITS technology to Nairobi City area, traffic flow will be improved and traffic concentration to CBD will be rectified.</p> <p>In the current circumstances, ITS is introduced individually such as installation of CCTV concentrates in CBD, and comprehensive policy for development of ITS in Nairobi City does not exist. The transportation control using intelligent information will be necessary also not only the inside of CBD but before flowing into CBD, in order to mitigate congestion of CBD. Hence, the project aims at the establishment of comprehensive plan for development of ITS in Nairobi City including the installation and management of ITS facilities.</p>
3 Objective	<p>In the current circumstances, ITS is introduced individually such as installation of CCTV, and comprehensive policy for development of ITS in Nairobi City does not exist. Hence, the project aims at the establishment of comprehensive plan for development of ITS in Nairobi City including the installation and management of ITS facilities.</p>
4 Components	<ul style="list-style-type: none"> Review of current condition of introduction of ITS to Nairobi City <ul style="list-style-type: none"> Equipment, software, personnel and capacity, network, budget, etc. Analysis on requirement for information technology in Nairobi City <ul style="list-style-type: none"> Traffic control, accumulation of traffic data, supporting public transport operation, parking control, crime prevention, etc.

	<ul style="list-style-type: none"> ● Establishment of basic policy for ITS <ul style="list-style-type: none"> - Clarification of objective of ITS in Nairobi City - Prioritization of required system and target area/road - Institutional framework for implementation of ITS system ● Basic design of ITS system in Nairobi City <ul style="list-style-type: none"> - Formation of basic function of ITS system ● Phasing plan <ul style="list-style-type: none"> - Prioritization of major function and establishment of phasing plan into short and medium term. ● Capacity development plan <ul style="list-style-type: none"> - Technical training of personnel in charge ● Institutional plan <ul style="list-style-type: none"> - Establishment of institutional plan including sustainable budget acquirement ● Implementation of Pilot Project
5 Responsible organization	NCC Engineering Department, Police, MoDP
6 Cost	5 million USD (Including Pilot Project)
7 Possible fund source	ODA (Technical Cooperation)

11.4 Infrastructure Development Program

Infrastructure development program includes water supply, power and telecommunication sectors.

11.4.1 Water Supply

“Master plan for distribution network” is identified as a priority project for water supply sector. Project outline is summarized in the table below.

1 Project title	Master Plan of Distribution Network in Nairobi City
2 Background	<ul style="list-style-type: none"> ● Pipelines and the reservoirs of the distribution network need to be rehabilitated due to the overage material, the unsuitable material for potable water and the construction of buildings on the alignment of pipeline. ● The necessity of expanding the distribution network had become higher year by year corresponding with the drastic urbanization of Nairobi City ● To cover the strengthened capacity based on the development, the comprehensive plan of the distribution network in is required.
3 Objective	Since the construction works of pipelines in the distribution network need to be stepwise carried out due to the requirement of budget and other activities in the city such as transportation, master plan shows the necessary components for implementation.
4 Components	<p>(1) Survey of current situation</p> <ul style="list-style-type: none"> ● Location of pipeline, diameter and material ● Water pressure in distribution network ● Topographic information including road, administrative and distribution network boundaries ● existing facilities and equipment such as reservoirs and pumps <p>(2) Study of pipeline arrangement in distribution network</p> <ul style="list-style-type: none"> ● Clustering looped pipelines to main distribution pipeline for identification of the problems such as physical leakage, illegal connection and malfunction of water meter, ● Arrangement of reservoirs to keep regular pressure with releasing pressure between main pipeline and pipeline connecting to each customer, ● Utilization of existing pipelines, and ● Stepwise development based on the development of water resources. <p>(3) Preparation of direction on rehabilitation and replacement of pipeline</p> <p>(4) Preliminary cost estimate to complete the development of the distribution network</p>
5 Responsible organization	NCC
6 Cost	US \$ 5 million
7 Possible fund source	ODA (Technical Cooperation)

11.4.2 Power

“Amendment for technical criteria of overhead line” is identified as a priority project for power sector. Project outline is summarized in the table below.

1 Project title	Amendment for technical criteria of overhead line
2 Background	<ul style="list-style-type: none"> ● A range of wayleaves in Kenya is excessive and has not been updated. ● Minimum clearance over 132 KV from electrical wires to buildings is much larger than that for other countries and need to be reviewed. ● More land is needed for development.
3 Objective	<ul style="list-style-type: none"> ● To reduce the cost of wayleaves for a electrical power company and to reduce the land of overhead line for NCC ● To reduce the land for overhead line and create more land for development.
4 Components	<p>(1) The technical criteria may be revised with considering construction techniques, the quality of electrical power equipment and safeness.</p> <p>(2) The project reviews other country’s technical criteria in addition to the criteria of Kenya and compares them. From the consideration of comparing investigation, the criteria of Kenya may be revised.</p>
5 Responsible organization	Kenya Power
6 Cost	US \$ 0.5 million
7 Possible fund source	ODA (Technical Cooperation)

11.4.3 Telecommunications

“Fiber optic trunk communication network in Nairobi city” and “Introduction of leased network among government offices” are identified as priority projects for telecommunications sector. Project outline is summarized in the table below.

1 Project title	Fibre optic trunk communication network in Nairobi city
2 Background	<ul style="list-style-type: none"> ● Upgrading the optic fiber trunk network for the metro trunk communications and local access network is essential to solve telecommunications infrastructure issues. ● Undersea cables landing at Mombasa should be enhanced to remove the fundamental bottleneck that decreases internet speed. ● Enhancement of communications network contributes not only to the improvement in internet user convenience but also to the introduction of Intelligent Transport Systems(ITS) which provide innovative services to different modes of transport and traffic management and enable various users to be better informed and make safer, more coordinated, and 'smarter' use of transport networks.
3 Objective	<ul style="list-style-type: none"> ● To Increase in the number of internet users, enhance the convenience of the internet, promote citizens' participation in e-government (access to on-line government services), promotion of ITS
4 Components	<p>(1) Upgrade the trunk communication network and accessibility</p> <ul style="list-style-type: none"> ● Network construction among the urban cores and sub-centres by connecting fiber optic cables laid along the roads and railways. ● Upgrade the networking equipment including optical transmission device, router, switch and network control unit to expand network bandwidth capacity ● Introduce LTE for accessibility improvement <p>(2) Upgrade undersea cable bandwidth capacity</p> <ul style="list-style-type: none"> ● Government should assist operators to expand the undersea cable bandwidth capacity.
5 Responsible organization	Telecommunication operators, MOICT
6 Cost	US \$ 300 million ~ 400 million
7 Possible fund source	ODA (Loan)

11.5 Environment Improvement Program

Environment improvement program includes storm water drainage and sewerage, solid waste management, and air pollution management.

11.5.1 Storm water drainage and sewerage

“Capacity development for storm water drainage system in Nairobi city” is identified as a priority project for storm water drainage sector. Project outline is summarized in the table below.

1 Project title	Capacity development for storm water drainage system in Nairobi city
2 Background	<ul style="list-style-type: none"> ● Nairobi city faces flood and roads are inundated which cause traffic congestion and worsening living environment. ● The project aims at supporting the capacity development for the City Engineering Department of the Nairobi City County; (i) to restore its administrative functions to maintain the storm water drainage systems; (ii) to establish its administrative capability to manage the plan, design and construction of storm water drainage works within the catchment areas of the Nairobi River and its major tributaries.
3 Objective	<ul style="list-style-type: none"> ● to restore its administrative functions to maintain the storm water drainage systems, to establish its administrative capability to manage the plan, design and construction of storm water drainage works within the catchment areas of the Nairobi River and its major tributaries.
4 Components	<ul style="list-style-type: none"> ● Collection, review and update of technical data (master plan, project documents, as-built drawings, etc.) for the maintenance of the existing storm water drainage systems, ● Practices for the maintenance of the existing storm water drainage systems in the systematic approaches, ● Review, update and application of design standards and specifications for the storm water drainage works, ● City Engineering Department to be involved with the proposed River Improvement Project to prepare the river improvement master plan as the definitive framework for the management of storm water drainage entirely in Nairobi City, ● City Engineering Department to be involved with the plan, design and implementation of the storm water drainage developments in the individual sub-catchment areas in conformity with the river improvement master plan, and ● Organizational reform for the City Engineering Department to take the responsibility for the administrative management of the storm water drainage including plan, design, construction and maintenance for the Nairobi River and its major tributaries and associated storm water drainage systems in the individual sub-catchment areas.
5 Responsible organization	NCC, NCWSC
6 Cost	US \$ 5 million
7 Possible fund source	ODA (Technical Cooperation)

“Capacity development for sewerage system in Nairobi city” is identified as a priority project for storm sewerage sector. Project outline is summarized in the table below.

1 Project title	Capacity development for sewerage system in Nairobi city
2 Background	<ul style="list-style-type: none"> ● Sewerage development is implemented based on 1998 master plan. Since Nairobi City has become city county, NCC is expected to manage sewerage and capacity development is needed for sewerage management, water quality improvement and sewer treatment. ● The project aims at supporting the capacity development; (i) for the City Engineering Department of the Nairobi City County to establish its administrative capability to manage the plan, design, construction and O&M for the sewerage system in Nairobi City; and (ii) for the Nairobi City Water Supply and Sewerage Company (NCWSC) to carry out O&M for the sewerage system in order to ensure the improvements by the proposed Sewerage Improvement Project.
3 Objective	<ul style="list-style-type: none"> ● For the City Engineering Department of the Nairobi City County to establish its administrative capability to manage the plan, design, construction and O&M for the sewerage system in Nairobi City; and for the Nairobi City Water Supply and Sewerage Company (NCWSC) to carry out O&M for the sewerage system in order to ensure the improvements by the proposed Sewerage Improvement Project.
4 Components	<ul style="list-style-type: none"> ● City Engineering Department to be involved with the proposed Sewerage Improvement Project to improve the performance of the sewerage system, ● City Engineering Department to be involved with the plan, design and implementation of the sewerage development in conformity with the sewerage master plan, ● NCWSC to practice O&M manners to be applied resulting from the Sewerage Improvement Project and feedbacks, ● Review, update and application of design standards and specifications for the sewerage works through the O&M practices and feedbacks, ● Organizational reform for the City Engineering Department to take the responsibility for the administrative management of plan, design, construction and O&M for the sewerage system in Nairobi City.
5 Responsible organization	NCC, NCWSC
6 Cost	US \$ 5 million
7 Possible fund source	ODA (Technical Cooperation)

11.5.2 Solid waste management

“Development of new landfill site” is identified as a priority project for solid waste management sector. Project outline is summarized in the table below.

1 Project title	Development of New Landfill Site
2 Background	A new sanitary landfill is necessary for final disposal of residual waste with consideration of environmental protection for surrounding environment. In the JICA preparatory survey in 2012, the project site is surveyed based on the JICA M/P study in 2010. The site was proposed in Ruai which is approximately 28 km from the central business district of Nairobi City. The whole area of 80 ha is owned by the NCC though the procedure of obtaining title deeds is still ongoing.
3 Objective	To improve solid waste condition through proper land fill site construction
4 Components	<p>(1) Principal facilities</p> <ul style="list-style-type: none"> ● Landfill: waste disposal facility, lining system, leachate collection facility ● Landfill gas exhaust facility ● Leachate treatment facility ● Storm water drainage ● Monitoring facility <p>(2) Administration</p> <ul style="list-style-type: none"> ● Administration building <p>(3) Others</p> <ul style="list-style-type: none"> ● Road network, enclosure facilities
5 Responsible organization	NCC
6 Cost	US \$ 50 million
7 Possible fund source	ODA (Loan)

“Closure of existing dumping site” is identified as a priority project for solid waste management sector after the development of new landfill site. Project outline is summarized in the table below.

1 Project title	Decommissioning of Closure of Existing Open Dump Site
2 Background	Safe closure of existing open dump site is necessary for environmental protection for surrounding environment. In the JICA preparatory survey in 2012, the project site for the decommissioning has been surveyed based on the JICA M/P study in 2010. The existing open dump site was located near the city central business district as well as the international airport in Nairobi City which will affect the surrounding environment.
3 Objective	To improve solid waste condition through proper decommissioning of existing open dump site
4 Components	(1) Principal facilities <ul style="list-style-type: none"> ● Final cover soil ● Landfill gas exhaust facility ● Leachate collection and treatment facility ● Storm water drainage ● Maintenance road ● Environmental monitoring facility (2) Others <ul style="list-style-type: none"> ● Retaining wall
5 Responsible organization	NCC
6 Cost	US \$ 30 million
7 Possible fund source	ODA (Loan)

“Nairobi solid waste management” is identified as a priority project for solid waste management sector. Project outline is summarized in the table below.

1 Project title	Nairobi Solid Waste Management Project in the Republic of Kenya
2 Background	<p>Solid waste generated in Nairobi County is landfilled in Dandora dump site in Nairobi County. Dandora dump site is open-dump type disposal site and there is no embankment for retaining solid waste, lining system, landfill gas exhaust facility, storm water drainage and leachate collection and treatment facilities which are necessary for sanitary landfill site, as identified issues.</p> <p>Development of new sanitary landfill site is urgently needed as well as the segregation of recyclable material by 3R promotion. In this context, JICA supported the preparatory survey of Nairobi Solid Waste Management Project in Republic of Kenya in the landfill site in Ruai proposed in the JICA M/P study in 2010.</p> <p>However, the site is around 13 km from the airport and on the way of landing pass, which may cause bird strike, which is suggested by KAA. Due to their concern, the EIA has not been approved yet.</p> <p>Based on various stakeholders concern, the Pilot Project (P/P) of sanitary landfill development is recommended as JICA technical cooperation project in the process of the development of sanitary landfill site, including capacity development and involvement of and consensus building among various stakeholders, to implement sanitary landfill development project development.</p>
3 Objective	To improve solid waste condition through proper solid waste management
4 Components	<ul style="list-style-type: none"> ● P/P of sanitary landfill site (approximately 1ha) ● Review and revision of development plan of new sanitary landfill site (80ha) based on the P/P of sanitary landfill site (project contents, basic design, construction plan, operation and maintenance plan, cost estimation, etc). ● Review and revision of closure plan of Dandora dump site (46ha) (project contents, basic design, construction plan, operation and maintenance plan, cost estimation, etc).
5 Responsible organization	NCC, NEMA, KCAA, KAA
6 Cost	Technical Cooperation US \$ 4 million, Loan: US \$ 10 billion
7 Possible fund source	ODA (Technical Cooperation Project, Loan)

11.5.3 City-wide Air Quality Management Program

“City-wide Air Quality Management Program” is identified as priority projects for the urban environmental management sector. Project outline of each are summarized in the table below, separately.

1. Project Title	City-wide Air Quality Management Program
2. Background	<ul style="list-style-type: none"> ● Set up reliable, city-wide air quality monitoring system is essential task to implement effective urban air quality management program. Currently, it is reported that the main sources of atmospheric pollution are vehicles, industries, emissions from the use of charcoal and firewood, and other municipal sources such as the open burning of waste. ● So, following two type of city-wide air quality monitoring systems, i.e., i) monitoring system for roadside air quality, and ii) monitoring system for industry complex and waste disposal sites, are required.
3. Components	<ul style="list-style-type: none"> ● Set up A/Q Unit responsible for city-wide air quality management. ● Set up following facilities and/or equipment for a long-term city-wide air quality monitoring system, <ol style="list-style-type: none"> (1) Construction of fixed monitoring stations across the city while preparing development of environmental information database. (2) Set of portable air quality measurement equipment for the measurement of specific pollutant emission sources (e.g., factory). (3) Air quality monitoring vehicle . ● Capacity building for A/Q Unit Staff. ● Capacity building for upgrading of vehicle inspection and maintenance. ● Set up environmental police unit (or convert traffic police to environmental police). ● Upgrade Vehicle I/M – related legal framework ● Upgrade environmental enforcement and governance regarding vehicle I/M. ● Capacity Building for Motor Vehicle Inspection Unit. ● Raise Public Awareness of Vehicle I/M
4. Responsible Organization	<ul style="list-style-type: none"> ● Department of Environment, Nairobi City County ● Motor Vehicle Inspection Unit, National Transport Safety Authority, Ministry of Transport and Infrastructure ● Ministry of Land, Housing and Urban Development
5. Cost	US\$ 10 million – 20 million
6. Possible Fund Source	ODA (Technical Co-Operation)

11.6 Urban Development Management Strengthening Program

“Urban development management” is identified as priority projects for urban management sector. Project outline is summarized in the table below.

1 Project title	Urban development management strengthening
2 Background	<ul style="list-style-type: none"> ● One of the reasons for poor implementation of 1973 Strategic Plan is capacity of staff of NCC and related agencies were poor. In order to secure proper implementation of the MP requires capacity development, particularly NCC staff. ● Kenya, on the other hand, after the new constitution has been enacted, new legislation has been issues but the legislation for urban development and management has not been prepared. Thus, institutional strengthening is also important to secure implementation. ● In order to secure realization of the MP, capacity development is conducted to strengthen institution and human resources.
3 Components	<ul style="list-style-type: none"> ● Institutional strengthening for urban development (spatial development) <ul style="list-style-type: none"> ➢ CBD development and sub-centre development is proposed to form strong urban structure. Legislation for urban development project (e.g. land re-adjustment project, urban renewal project) still does not exist in Kenya, which becomes constraints for urban development. Also related legislation, such as land management, land value assessment) has to be strengthened. ➢ Urban development requires private sector participation. PPP mechanism will be developed. ● Urban facility (infrastructure) management strengthening

	<ul style="list-style-type: none"> ➤ Since infrastructure development is managed by concerned agencies independently so infrastructure management is considered weak and not efficient (construction at same location, no common database, land management). Infrastructure management mechanism is established (NCC as facilitator, GIS database management). ● Land development permission <ul style="list-style-type: none"> ➤ Building permit system is already established and operated but land development permit is still under development. Land development system is developed. ● Urban development management by GIS <ul style="list-style-type: none"> ➤ Data necessary for urban development management is compiled as one GIS database system and utilized for development permit, urban development project management and infrastructure development management. ● Urban transport planning by using the JICA System for Traffic Demand Analysis (STRADA) ● This project is efficient if it can be implemented together with “CBD development” and “Sub-Centre development” proposed in Urban development program.
4 Responsible organization	NCC
5 Cost	US \$ 5 million
6 Possible fund source	ODA (Technical Cooperation)



Charles, Buruburu Primary School (Rank 3 of Class 6)

CHAPTER12 CONCLUSION AND RECOMMENDATION FOR IMPLEMENTATION OF THE MASTER PLAN

12.1 Conclusion

The Integrated Urban Master Plan covers the development vision, structure plan, sub-centre development, urban transport development, infrastructure development, and capacity development. Through the process of the master plan formulation, a series of technical working group and stakeholder meetings was conducted. In addition, the geographic information system (GIS) database was developed and priority programs are proposed. The following points of the master plan are:

- Development vision is proposed for Nairobi City County (NCC) to become not only the centre of Kenya but also to become the centre of the East African Region;
- Sub-centre system (multi-core development) is proposed which includes strengthening of the Central Business District (CBD) and development of seven sub-centres;
- Urban transport development proposes multi-modal development including road network public transport network, and traffic management;
- Infrastructure covers water supply, storm water drainage and sewerage, power supply, solid waste management, and telecommunication in which the development policy is proposed;
- Capacity development proposed to strengthen urban development management from planning, controlling, and development;
- GIS database covers land use, infrastructure, and urban facilities, and
- Priority programs are proposed to be implemented in the short term.

12.2 Recommendation

In order to ensure the smooth transition or implementation of the master plan, recommendations are prepared for institutional aspect and technical aspect as actions to be taken:

Institutional aspect

- (1) Dissemination of the Nairobi Integrated Urban Development Master Plan (NIUPLAN) to NCC

The NIUPLAN, which shows the policy and direction of urban development of Nairobi City, is considered as an umbrella plan and has to be a base for sector development plans, detail plans, as well as feasibility studies to be prepared by concerned sectors. In order to secure consistency of the NIUPLAN and related plans, the NCC staff and NCC assembly have to understand the contents of the NIUPLAN. The City Planning Department of NCC should take initiative in disseminating the NIUPLAN to the NCC staff and NCC assembly.

(2) Organization strengthening for the master plan implementation

Organization strengthening, which includes technical aspect and coordinating aspect is one of the key elements for the master plan implementation. Technical aspect covers land use control and urban development and infrastructure development. Coordinating aspect covers coordination within NCC, coordination between NCC and the national government, and coordination amongst county governments. Coordination amongst county government has become important after county government system has been in place as a part of decentralization policy, thus coordinating mechanism amongst county government has to start immediately.

(3) Capacity development

Capacity development is considered as one of important non-structural measures. Failure of capacity development is identified as one of the reasons for the weak implementation of 1973 Strategic Plan. In order to secure the implementation of the master plan, capacity development should start as soon as possible. Capacity development covers the following aspects:

- To fully understand the master plan,
- To acquire fundamental skills of urban development and management,
- To adapt the information and communication technology (ICT) skills to urban development and management, and
- To place capacity development method including on-the-job training (OJT), participatory method, monitoring, and evaluation.

(4) Sustainable stakeholder involvement for the master plan implementation

Sustainable urban development requires active stakeholder involvement in many ways, amongst them are: following the rules such as building permit and development permit and changing socioeconomic pattern of general public.

Changing socioeconomic pattern also has significant impact on urban development. Traffic congestion can be eased by shifting working hours to avoid the rush hours and promoting school bus in commuting to/from the school instead of using private cars.

Thus, in addition to the implementation of structural and non-structural measures, NCC has to encourage changing the public pattern and also develop mechanism which connects NCC and the general public.

Technical aspect

(1) Development of CBD and Sub-Centres

The CBD development is an “icon” for NCC to become a centre of Kenya, as well as, a centre of East Africa as shown in the development vision. The ideas behind CBD/Railway city and sub-centre development are to ensure that urban development should cover infrastructure development, spatial development, and implementation mechanisms. Thus, CBD/Railway city and sub-centre should be developed as a program not as individual infrastructure development. The following actions are needed for CBD/Railway city and sub-centre development:

- Establish an urban development mechanism including role and responsibility amongst public and private sectors.

- Conduct a detailed survey for implementation, including traffic volume and land ownership in the target area.
 - Prepare detail plan for CBD and for selected sub-centres as a part of urban development implementation.
 - Develop an urban development implementation scheme such as land re-adjustment and urban redevelopment that matches the condition of Nairobi City.
- (2) Implement the urban transport in accordance with the development plan proposed as short-term measures

The results of the traffic demand forecast showed the traffic congestion worsens in the short term and medium term. To cope with these issues, various measures should be taken as shown below.

- Provision of a signal control system on the radial trunk road in the city and signal control system in the whole city,
 - Introduction of a bus-exclusive lane which is effective even before the introduction of the bus rapid transit (BRT),
 - Staggered working hours to ease morning peak hours,
 - Streamline the fleet carrier to decrease vehicle trips in the business area, and
 - Relocation of bus terminal in the sub-centres.
- (3) Infrastructure development to form Nairobi urban structure and support urban development

Infrastructure is a key element of forming Nairobi urban structure and support urban development. Priority programs are proposed for a key infrastructure and it is important to start preparing for the implementation. The following actions should be taken for infrastructure development:

- Establish a coordination mechanism amongst concerned agencies. Infrastructure development is the responsibility of the national government. NCC should be able to coordinate concerned agencies for an efficient infrastructure development.
- Conduct survey or study (feasibility study, detailed design) for implementation.



Simon Wamira, Muthangari Primary School (Rank 2 of Class 5)

**The Project on Integrated
Urban Development Master Plan
for the City of Nairobi
in the Republic of Kenya**

Final Report

Part III: Appendix

December 2014

**Nairobi City County
(NCC)**

**Technical Support From
Japan International Cooperation Agency (JICA)**

**Nippon Koei Co., Ltd.
IDCJ Inc.
EJEC Inc.**

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**The Project on Integrated
Urban Development Master Plan
for the City of Nairobi
in the Republic of Kenya**

Final Report

Part III: Appendix

December 2014

**Nairobi City County
(NCC)**

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Japan International Cooperation Agency (JICA)**

**Nippon Koei Co., Ltd.
IDCJ Inc.
EJEC Inc.**

**APPENDIX 1: CONTRACT AND MINUTES OF MEETING
FOR THE INCEPTION MEETING**

**MINUTES OF MEETING
OF
THE JOINT COORDINATING COMMITTEE
ON
THE PROJECT ON INTEGRATED URBAN DEVELOPMENT
MASTER PLAN FOR THE CITY OF NAIROBI IN THE
REPUBLIC OF KENYA**

December 11, 2012

Kazumasa SANUI

Senior Representative

Japan International Cooperation
Agency, Kenya Office

Prof. Karega Mutahi, C.B.S.

Permanent Secretary

Ministry of Local Government as Chair of
JCC

Akifumi WATANABE

Deputy Team Leader

The Project Team on

Integrated Urban Development Master
Plan for the City of Nairobi

Odongo P.T.

Town Clerk

City Council of Nairobi as Vice Chair of JCC

Minutes of Meeting for the Joint Coordinating Committee on 11 December 2012 at 15:00 hours, the Permanent Secretary Ministry of Local Government Boardroom, Jogoo House.

1 Members present (see appendix 1)

2 Agenda (see appendix 2)

3 Contents of JCC Meeting

The meeting started with a word of prayer by Mr J.K Barreh, thereafter the Chairman allowed each member to introduce himself/herself.

(1) Remarks by the JCC member

Permanent Secretary of the Ministry of Local Government

- The chairman started the meeting by giving basic information about the geopolitical and economic significance of Nairobi City including its contribution of over 50% of Kenya's GDP. In addition to its over three million population, about one million people from outside Nairobi enter the city every day for work, studies, or on transit to other areas. Thus, it is important to think not only of Nairobi City proper but also the relation of the city with its neighbouring areas.
- He explained that JCC derives its mandate from the Records of Discussion (RoD) signed between the Kenyan and the Japanese governments on 23 July 2012.
- He explained that JCC was conceived in the (RoD) to be the sole policy-making organ of the master plan process.
- He further gave a planning chronology of Nairobi City from 1926 to 1948, then from 1973 to date, where uncoordinated sector plans have exacerbated and catalyzed urban challenges. Also the integrated master plan will correct this and guide the fast growing Nairobi City in line with Vision 2030 development blueprint.
- The chairman further emphasised the need for Kenyan members to work as a team with the JICA experts to achieve the ultimate output and that each member has to effectively handle his responsibility.
- He mentioned that members could refer to the draft National Urban Policy prepared by his ministry to guide the master plan process.
- Lastly, the chairman welcomed the contributions of the Permanent Secretary, Ministry of Nairobi Metropolitan, and thereafter, allowed other members' contributions before explaining the inception report.

Permanent Secretary, Ministry of Nairobi Metropolitan Development

- He reiterated the chairman's comments about the lack of implementation of the 1973, Nairobi Metropolitan Growth Strategy and pointed out that their main challenge is how to implement or develop Nairobi based on the anticipated master plan.
- He encouraged the members not to invent the wheel but capitalise/refer to existing studies such as the Urban Transport Master Plan conducted by JICA.
- Further, he pledged to share GIS data and facilities domiciled in his ministry to the team and in the master plan preparation process.

Town Clerk of the City Council of Nairobi

- Integrated urban development approach should be applied for the anticipated master plan formulation, and that they must entirely move from a sectoral approach.
- For preparation of the master plan, gap between the policy and socioeconomic condition has to be considered and consensus amongst stakeholders should be achieved.
- He expressed his jubilation in partaking in the master plan formulation process.

Director of Urban Development Department, Ministry of Local Government

- He expressed his jubilation in partaking in the master plan formulation process, adding that it is the dream of many planners to prepare new strategy on urban development in Nairobi.
- He emphasised that for the preparation and exhaustive implementation of the master plan, strong political will is necessary.

Director of City Planning Department, City Council of Nairobi City

- She expressed her jubilation in partaking in the master plan formulation process, especially in view of the myriad of urban development related challenges facing the city.
- She explained that there exist many studies and reports regarding urban development. In order to execute the project efficiently and effectively, these studies and reports have to be reviewed and integrated in the master plan.
- The anticipated plan must be geared towards achieving sustainable urban development.

Senior Representative, JICA Kenya Office

- He explained that Nairobi is a significant hub of the region and fastest growing city which faces many challenges including urban transport and solid waste management which JICA has been assisting.

- The JICA Study Team will conduct comprehensive analysis on all thematic areas based on the socioeconomic framework.
- Eventually, they anticipate not only to prepare a land use plan and leave but to participate in its implementation and capacity development.

(2) Comments on the project implementation

Reactions after explanation of the inception report were inclined to:

- Nairobi City changing to a county based on the new constitution.
- Nairobi City to be managed by city managers who are considered professional. There is a plan to establish an entity to professionally manage urban development.
- The media raised concerns about informal settlements and filth within Nairobi and how the plan and the council could manage these issues.
- Implementation management was weak, particularly coordination amongst stakeholders.

(3) Conclusion

- JCC has approved the inception report and started the implementation of the Project. In order to establish an implementing organisation in the Government of Kenya, internal meetings will be held to consider how to set up the coordinating organs.
- Inaugural secretariat and technical working group meetings are scheduled in January 2013.

JOINT COORDINATING COMMITTEE MEETING

PERMANENT SECRETARY, MINISTRY OF LOCAL GOVERNMENT BOARDROOM, JOFOD HOUSE NAIROBI

MEETING HELD DECEMBER 11, 2012

	Members Name	Section/Agency	TELNO.	
1	KAREGA MUTAHI	PS	MOLG	0721265315
2	Philip O. Sika	PS	Nairobi	0722514897
3	Amb. P.R. O. Owade	SLAA	MOLG	0714706462
4	Odongo P. T.	Town Clerk	CCB	0722213653
5	George Ndichu	AD/Housin	MOH	0722346373
6	Daniel N. Mwaura	P.E.	Muspndv2030	0722.265056
7.	Patrick Adolwa	D/director	MOLG	0722830920
8	Rose K. Muema	DCP	CCN	0722774345
9	Peter Kibinda	AMP&E	MONED	0722788044
10	Eng. Macharia Waithaka	D/Director W&S	MOW&I	0722562636
11	Silvester Kasuku	Sec. Infrastructur	OPM	0723716842
12	John Koyier Barreh	DDCP	CCN	0722309854
13	James M. Meanzia	C. Economist	MOLG	0722451310
14	Charles Mutiso	Deputy AS. Pacif	TREASUR	0722752047
15	Naboru Shimizu	Traffic survey		0703167899
16	Yasushi Ohwaki	JICA Study team		0703167809
17	Akio Odake	Land Use Planning	JICA study team	0702240255
18	Kazungu K. Raphael	Planner	CCN	0723518559
19	Akivumi Watanabe	Deputy Team Lead	JICA study team	0702240253
20	Koji Noda	Representative	jica Study	0706511835
21	Eng. Julius Mwathani	SPSE (M)	MOE	0722686455
22	Dr. Steve Mogere	A dinfrastructure	JICA	0722619788
23	Kazumasa Sanui	Senior ReP	JICA	0714127337
24	Kinguru Wahome	SAD	MEMR	0722275237

25	Ruth Njeri	PRO	MOLG	071395310
26	Grace Mwaura	PRO	MOLG	07154097
27	Juliet Mwikali	Register	MOLG	071016940
28	NTOE Njagi	NTV/QTV	NTV/QTV	072243856
29	Robert Mbaraga	Reporter/NTV	NMG	072444244
30	Alex Mwangi	Reporter	NMN	072589807

**THE PROJECT ON INTEGRATED URBAN DEVELOPMENT MASTER
PLAN FOR THE CITY OF NAIROBI.**

(JAPAN INTERNATIONAL COOPERATION AGENCY)

JOINT COORDINATING COMMITTEE (1)

11TH DECEMBER, 2012.

AGENDA

Introductions	JCC members
Opening Remarks	P.S. Ministry of Local Government- Prof. Karega Mutahi, CBS
Remarks	Patrick Odongo, Town Clerk City council of Nairobi
Remarks	Director Urban Development, Ministry of Local Government
Brief on integrated Urban Development Master plan	Ms. Rose Muema, Director of City Planning
Confirmation of Inception Report	JICA study team
Discussions/ issues for consideration	

APPENDIX 2: REVIEW OF URBAN DEVELOPMENT IN NEIGHBOURING COUNTRIES

A2.1 Kampala (Uganda)

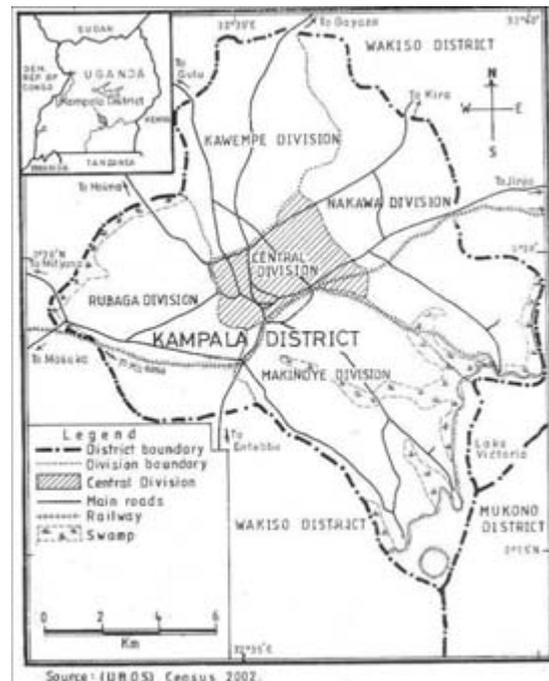
A2.1.1 Introduction

(1) Geography and Climate

Kampala is approximately 32 km to the equator and has a moderate climate largely because of its 1,220 m altitude and with a high water table. Based on the 2009 data published by the United Nations Human Settlements Programme (UN-HABITAT), Kampala City's mean annual temperature is 21.9 °C with annual rainfall being 1,750-2,000 mm peaking in March to May and September to November. The dry seasons are June to July and December to January with relative humidity being 53% to 89%.

(2) Demographic

Based on the National 2011 Census estimated by the Uganda Bureau of Statistics (UBOS), Kampala has a total population of 1,659,600 and the population density is 9,429.6/sq.km.



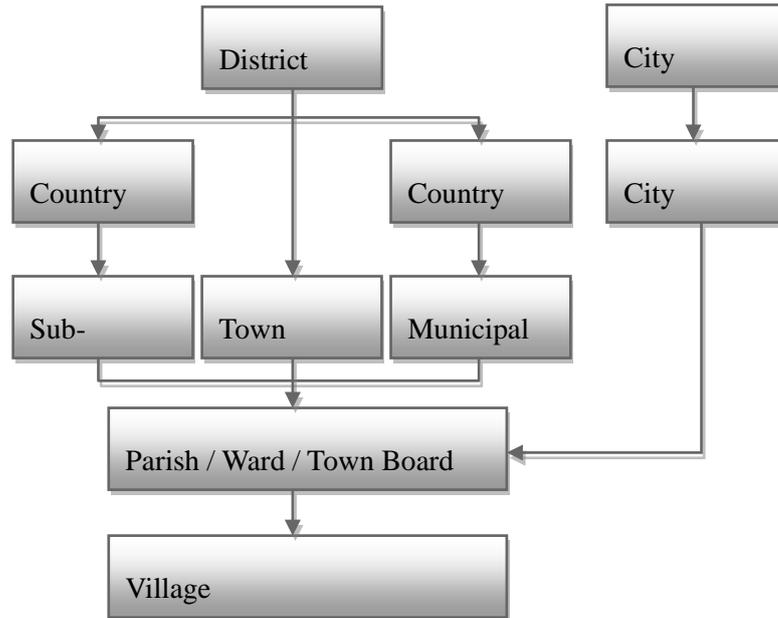
Source : JICA Study Team (JST)

Figure A2.1.1 Map of Kampala District

A2.1.2 City Government

(1) Governance

The UN-HABITAT reported Kampala suffers from inadequate solid waste collection which currently stands at 55% in 2009. Kampala City Council (KCC) had retained the statutory monopoly in solid waste collection, storage, and disposal but due to the inherent inefficiencies that included accumulation of rotting garbage and the emergence of illegal dumping sites in the city, the city of Kampala embarked on policy reforms that allowed private sector involvement in collection and transportation with KCC retaining disposal of the garbage.

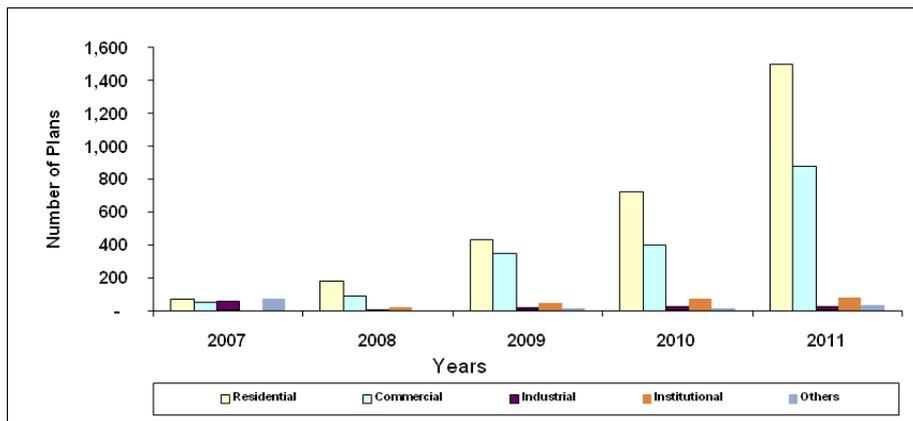


Source : JICA Study Team (JST)

Figure A2.1.2 Local Government Structure

(2) Rationale for Planning

Whereas, there is a great need to control and whereas there is a growing need of most Ugandans to embrace Ugandans (Figure A2.1.3), development control is difficult in line with the absence of a development control framework. Over the years, structures for development planning permission have been put in place, and with a master plan in place, almost 100% development control will be achieved across all land uses.



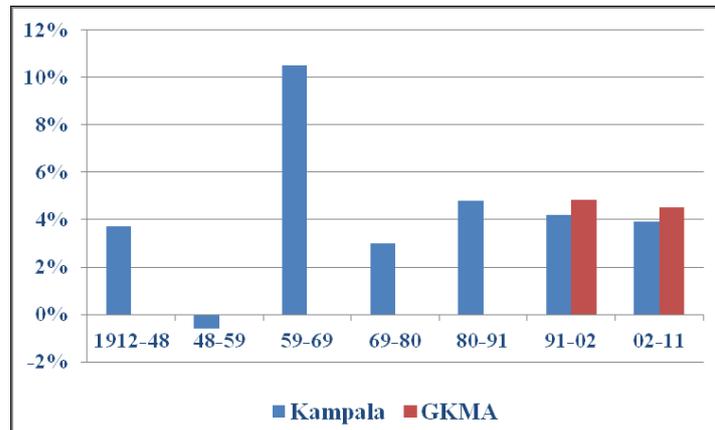
Source: Republic of Uganda, 2012

Figure A2.1.3 Plans Approved, 2007-2011

A2.1.3 Urban Problems

(1) Rapid Population Growth

Kampala has seen an ongoing rapid growth of 4.5% to 5.0% per annum over the past generation. The rapid rate, over such a long period, has overwhelmed the city. It simply could not and cannot keep pace with the ever growing demand for housing, employment, services, and utilities.



Source: ROM Transportation Engineering Ltd, et al (2012)

Figure A2.1.4 Population Growth of Kampala City and the Greater Kampala Metropolitan Area (GKMA)

(2) Lack of Appropriate Urban Plans

Early planning included the 1919 and 1930 schemes, which covered Nakasero Hill and some of the immediate surrounds. The 1951 Outline Scheme, which covered additional areas to the east and was the last colonial regime plan, remained in force until it was revoked in 1968, after which the “1972 Structure Plan” came into force. The 1972 Structure Plan, more accurately the “Kampala Development Plan 1972 - Structure Report” was part of this. Even then its authors indicated that the jurisdiction of the then- KCC would be unlikely to accommodate the growing population.

Nearly two decades of institutional decay, unplanned or unregulated urban development, and neglect of infrastructure are the legacies that are extremely difficult for any urban system to get rid of, even under good financial conditions and with external assistance. It was against this background that the 1994 Kampala Urban Study, commonly known as the “1994 Structure Plan”, was prepared.

(3) Land Tenure and Access to Land

According to ROM Transportation *et al.* (2012), Land Tenure System is one of the major impediments to the development of Kampala, impacting on multiple fields and in numerous ways including:

- Limiting the supply of land for housing, public services, economic activity, particularly for activities requiring large parcels and/or concentrations of activity (e.g., primary institutions, industrial, and business zones, etc.).

- Enabling and encouraging land speculation and distorting the property market.
- Limiting the supply of developable land and consequently directing development to where land is available, thereby distorting the spatial structure of the metropolitan, city, and local (parish and neighbourhood).
- Requiring enormous financial resources to enable land acquisition for infrastructural development and public service facility provision, effectively restricting infrastructural and service provision.
- Entrenching poverty by effectively placing home ownership beyond reach, even for families with two working bread-winners.
- Constricting and limiting local initiative and entrepreneurship by limiting access to mortgage finance for most home owners with unregistered properties.
- Significantly complicating and delaying the planning and implementation of assorted projects, both public and private, often even scuttling projects.
- Deterring foreign investors; and much more.

Currently, land tenure in the city of Kampala is large accounting for 75% of total land, while 15% is for leasehold, 7 % is Kabaka’s land, and 3% is freehold.

Table A2.1.1 Scope of Land Tenure and Occupancy Question in Kampala

Land tenure category	Percentage (%)	Status	Planning issues
Private mailo	75	Fully titled with estimated 45,000 land titles	Slum infestation and unplanned
Leasehold	15	Higher % titled	Largely planned
Kabaka’s land (largely customary land)	7	Titled	Largely unplanned
Freehold	3	Titled	Partly planned

Source: Amin T. Kiggudu, 2011

(4) Transportation Problems

The main problems associated with the current transport system are:

- Lack of vision and strategy toward the creation of a sustainable urban transport system (SUT).
- Lack of hierarchy and capacity on the road network.
- Lack of a traffic management system.
- Lack of integrated and regulated public transport system.
- Lack of proper non-motorized transport (NMT) facilities.
- Lack of integration between urban planning and transport planning.

(5) Unserviceable and Unmanageable City

Kampala today is currently unserviceable given:

- Levels of poverty placing many services beyond reach.
- Lack of an effective tax-base.
- Absence of any mechanisms for the recovery of investment costs.
- Lack of resources (manpower, tools, technology, and experiences).

- Lack of facilities and available land, particularly in the more densely built-up areas.
- Expectations are low, job security is lower, motivation even lower, and initiative is rare.

The city is also currently unmanageable given:

- The land tenure system.
- Lack of enforcement in capacity and tools.
- Reported politicisation, dependence, and endemic corruption.
- Lack of alternatives (e.g., employment for illegal hawkers, shelter for residents of the wetlands, public transportation, and NMT).

A2.2 Dar es Salaam (Tanzania)

A2.2.1 Introduction

(1) Geography and Climate

Topographically, the city is divided into three main terrain units of lowlands around the Indian Ocean shores and river valleys, the middle plateau and the hilly areas found in the north and west of the city. The main land uses according to JICA in the built up area are residential at 13.2%, industry at 1.3%, and other land uses including government institutions at 3.2%. The total built up area is 21.7% while the remaining 78.3% is sparsely built or covered by natural or semi-natural vegetation, and the agriculture lands are mostly in peri-urban areas.

Dar es Salaam climate is characterised by hot and humid climate throughout the year. The average temperature is 29 °C with maximum and minimum temperatures of 35 °C and 25 °C, respectively. The city receives about 1,000 to 1,300 mm per annum.

(2) Demographic

Dar es Salaam City has seen substantial growth in its human population from a total of 67,227 people in 1948 to slightly over 3 million by 2010. This growth was slow during the years preceding the independence and rose slowly immediately afterwards owing to the adoption of socialist (*ujamaa*) policies that emphasised rural development and discouraged urbanisation. This however changed from the late 1970s due to adoption of liberalisation and capitalist policies and had the effect of increasing urban population and to further calibration of the physical and social geography of Dar es Salaam.

Table A2.2.1 Dar es Salaam Population Growth (1948–2002)

S/N	Year	Population
1	1948	67,227
2	1957	128,742
3	1961	272,821
4	1978	843,090
5	1988	1,360,850
6	2002	2,497,940

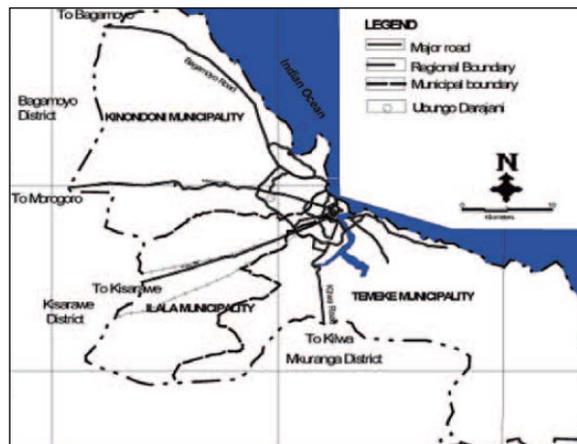
Source: United Republic of Tanzania (URT), 2002 Population and Housing Census Report Summary

*Growth rate = 4.3% per annum (2002)

A2.2.2 City Government

(1) Governance

The city of Dar es Salaam is managed by a mayor and an executive director/city director who also serves as head of the Dar es Salaam City Council. The city administration is divided further into three municipalities/districts: Kinondoni, Ilala, and Temeke. These three units are headed by municipal directors appointed by and accountable to the minister of regional administration and local government. There are also other lower administrative levels; ward and sub-ward (Mtaa) leaders and in some areas there are also villages (*vijiji*) and hamlets (*vitongoji*), all appointed by and accountable to the municipal director.



Source: Tanzania: Dar es Salaam City Profile, United Nations Human Settlements Programme (UN-HABITAT), 2009-Nairobi Kenya

Figure A2.2.1 Dar es Salaam Administrative

(2) Rationale for Planning

The following is a summary of the main land use plans undertaken by the city of Dar es Salaam detailing year. The main planning concepts are emphasised in the plan.

Plan published in 1947

This plan had planning concepts such as zoning functions, zoning of residential areas according to density and races, neighborhood units breeze lanes, open space provision, geometric street layouts, density, and building standards.

Plan published in 1968

The planning concepts are: Plan 2000 (long range concept), systems approach, ecosystem of growth/hierarchical modular urban structure including neighborhood units, satellite sub-cities, city region planning, green belt, parkways, landscape, corridors, open space provision, sector strategies, and a five-year capital works program.

Plan published in 1979

Planning concepts: Flexibility-population attained rather than target years, hierarchical urban structure based on planning module. Sub-classification of residential areas/recognition of squatter areas, participation of implementing agencies, detailed implementation program including 47 priority projects.

A2.2.3 Urban Problems

(1) Lack of Appropriate Urban Plans

Dar es Salaam has known planning since 1891 when the first scheme was drawn up by the German colonial authorities. Other plans were prepared and published in 1949, 1968, and 1979. There is the 2012-2032 Master Plan which is in its final stage of preparation and aimed at providing the land use policy guidance to developers and all stakeholders within the city of Dar es Salaam in terms of development. It is to be noted that, until now, the updating of the master plan has been delayed for almost 30 years since the last master plan was done in 1979.

(2) Land Tenure and Access to Land

The land tenure in Dar es Salaam and indeed Tanzania is governed by the Land Ordinance of 1923, under which all land is publicly owned and vested in the President. This means that in principle, any Tanzanian national, including the poor is entitled to this commodity. There is poor performance of formal land delivery system in meeting the demand for land. For instance, less than 10% of the land demand for housing is provided by the formal system leaving the gap to be filled by the informal sector in a semi-legal and socially regularised procedure. In summary, informal access to urban land in Tanzania can be secured through three distinct channels: a) land invasion, b) allocation by local leaders, elders or acknowledged owners, for a token fee, and c) frequently, land is purchased in unplanned areas from an acknowledged owner and registered with a local leader or the local branch of a political party.

(3) Trunk Infrastructure

Water stress (excessive demand) and flooding worsen sanitation conditions in low-income areas. Dar es Salaam Municipal Council has privatised water supply and waste management to improve service delivery, which has indeed largely happened. Challenges still remain such as better access to adequate water and sanitation services keep eluding the poorer segments of the population.

(4) Transportation

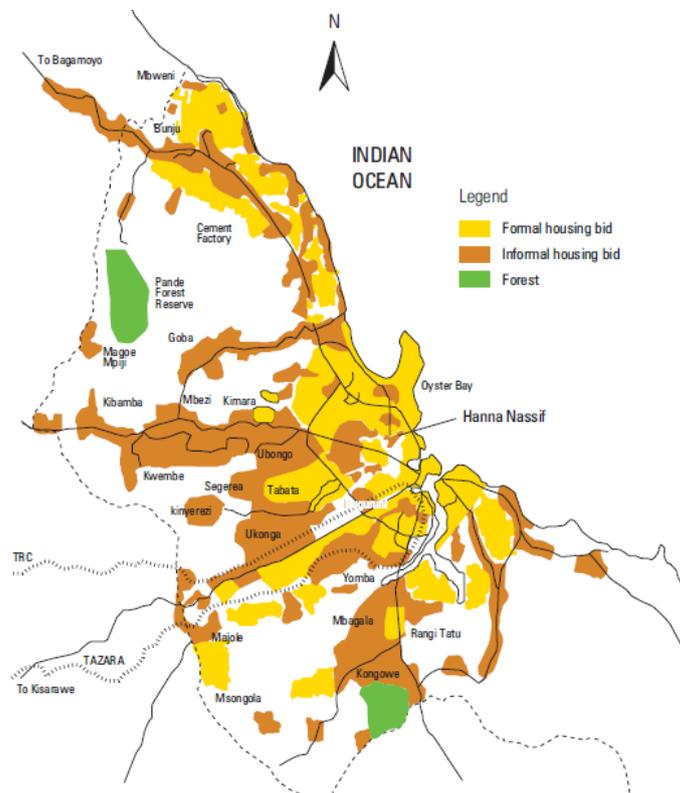
Dar es Salaam City development is partly influenced by the arterial road network consisting of five main radial roads and one ring road, all terminating in the central business district. The five radial roads are Kilwa Road, Nyerere Road, Morogoro Road, New and Old Bagamoyo roads, and Mandela Road as the main ring road. The total length of roads based on 2005 data is about 1,717 km out of which 395 or 23% are paved, mostly are arterial roads.

Traffic congestion is one of the key problems in Dar es Salaam, Tanzania especially during the peak hours of the mornings and evenings. This can be attributed to increase in population, number of cars, rapid physical development of the CBD, and an increase in social and economic activities in the city.

(5) Proliferation of slums

It is to be noted that the process of in formalisation which was a feature of the late colonial Dar es Salaam accelerated after independence. By 1979, a majority of the urban population was housed in unplanned settlements, about 478,489 out of the 769,445 population. This included not only impoverished communities such as Manzese or Mikoroshoni, but also middle class residential areas like Kimara and Mlalakua.

Around 65% of households in Dar es Salaam should be considered slum households under the UN-HABITAT definition.



Source: Kimani. M. Investigating the effects of Property Rights Formalization on property Market in informal settlements: The Case of Dar es Salaam City, 2007

Figure A2.2.2 Dar es Salaam: Formal and Informal Housing (2002)

A2.3 Addis Ababa (Ethiopia)

A2.3.1 Introduction

(1) Geography and Climate

Addis Ababa lies at an altitude of 2,300 meters above sea level and is a grassland biome, located at 9°1'48"N 38°44'24"E. The city lies at the foot of Mount Entoto. From its lowest point, around Bole International Airport, at 2,326 meters above sea level in the southern periphery, the city rises to over 3,000 meters in the Entoto Mountains to the north.

Addis Ababa has a subtropical highland climate. The city has a complex mix of highland climate zones, with temperature differences of up to 10 °C, depending on elevation and prevailing wind patterns. The high elevation moderates temperatures year-round, and the city's position near the equator means that temperatures are very constant from month to month.

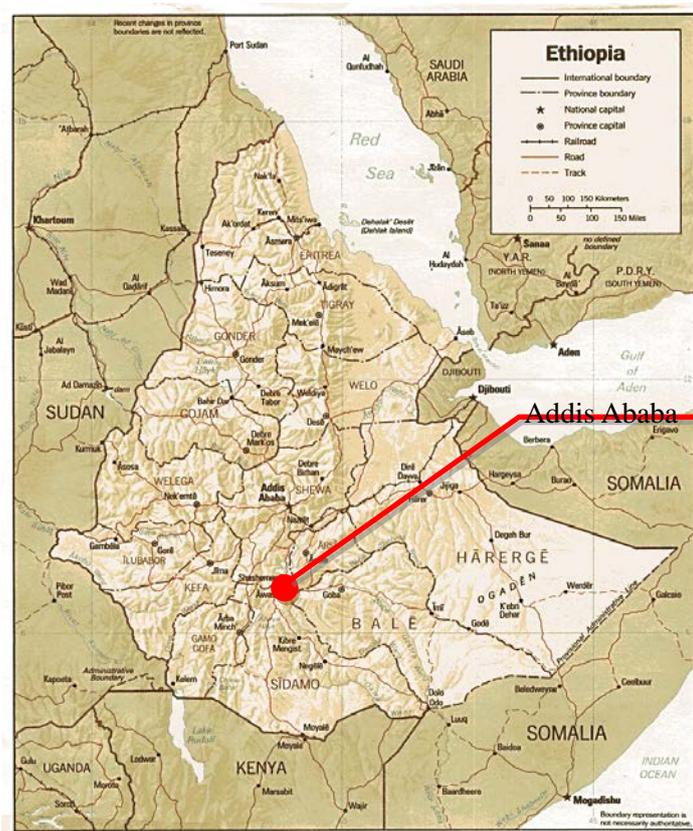


Figure A2.3.1 Map of Ethiopia

(2) Demographic

Based on the 2007 Census conducted by the Population Census Commission (PCC), Addis Ababa has a total population of 2,739,551 of whom 1,305,387 are men and 1,434,164 are women; all of the population is urban inhabitants. For the capital city, 662,728 households were counted living in 628,984 housing units, which results in an average of 4.1 persons to a household. Although all

Ethiopian ethnic groups are represented in Addis Ababa due to its position as the capital of the country, the largest groups include the Amhara (47.04%), Oromo (19.51%), Gurage (16.34%), Tigray (6.18%), Silt'e (2.94%), and Gamo (1.68%). Languages spoken include Amharic (71.0%), Oromiffa (10.7%), Gurage (8.37%), Tigrinya (3.60%), Silt'e (1.82%), and Gamo (1.03%). The religion with the most believers in Addis Ababa is Ethiopian Orthodox with 74.7% of the population, while 16.2% are Muslims, 7.77% are Protestants, and 0.48% are Catholics.

A2.3.2 City Government

(1) Governance

Each city and town in Ethiopia is organised through smaller units called *woredas*, or sub-cities/districts. Depending on the size of the city, the *woredas* are further divided into *kebeles*/municipalities. Both are formally independent administrative units, but face a number of challenges.

Woredas are the third-level administrative divisions of Ethiopia and are managed by a local government. *Woredas* are composed of a number of *kebele*, or neighborhood associations, which are the smallest unit of local government in Ethiopia. *Woredas* are typically collected together into zones, which form a region; districts which are not part of a zone are designated special districts and function as autonomous entities.

In July 1975, the Derg issued Proclamation No. 47, which established the *kebeles*, or urban dwellers' associations, in Addis Ababa and five other urban centers. Organised similarly to peasant associations, Addis Ababa's 291 *kebeles* possessed neighborhood constituencies ranging from 3,000 to 12,000 residents each. Like the peasant associations in the countryside, the *kebeles* were initially responsible only for the collection of rent, the establishment of local judicial tribunals, and the provision of basic health, education, and other social services in their neighborhoods. *Kebele* powers were expanded in the late 1976 to include the collection of local taxes and the registration of houses, residents, births, deaths, and marriages.

(2) Rationale for Planning

Addis Ababa has long been growing in a disorganized manner. At present, the city has 3-4 million inhabitants, expected to reach anywhere between 6 and 9 million within the next 10-15 years. Many people fear that such unconstrained growth could make it unmanageable. How can governance (leadership, policy-making, and urban management) be enabled to initiate and foster a more gradual and benign evolution of the capital? To answer this question, a project was launched to develop a long-term strategy and "Master Plan" for the development of the city.

It is the belief of the author from the available web sources that the preparation of the plan is incomplete and ongoing. Addis Ababa City Planning Project Office (AACPPPO) within the City Government as an existing institution is still in operation to review and prepare the plan for Addis Ababa. The areas of focus in the new Addis Ababa plan under preparation include:

1. Housing supply;
2. Service provision;
3. Tackling congestion;
4. Infrastructure provision;
5. Poverty alleviation; and
6. Employment creation.

A2.3.3 Urban Problems

(1) Urban Morphology

Addis Ababa is surrounded by smaller cities on the rail line and major roads leading into the city which relies on it as a market for products of the industries. Nearby towns include Akaki on the outskirts of Addis Ababa is a center for light industries including textiles and food processing, and Nazareth a sugar processing center is located southeast of the capital. Debre Zeyt is the headquarters of the Ethiopian Air Force and a weekend resort for many citizens of Addis Ababa is also in the southeast. A vacation destination for city people is Lake Bishofu, a crater lake swimming hole to the east of Addis Ababa.

Because of its desirable central location and primate city status, 'all roads' do indeed, lead to Addis, which offers a blending of modern and traditional living patterns, according to the Area Handbook for Ethiopia.

(2) Lack of Appropriate Urban Plans

Addis Ababa has experienced rapid physical expansion, though this has not been properly controlled by appropriate planning intervention. Almost none of the plans prepared at different times by different planners have been effective, nor have they been ever been fully implemented. This unsuccessful planning history of the city is reflected in its development, which has largely been characterised by spontaneous growth. As a result of rapid horizontal expansion and the spontaneous growth, Addis Ababa is now confronted with different types of problems such as the emergence and development of slums, inadequate housing, mushrooming of slums, amongst others.

(3) Land Tenure and Access to Land

The problem of land tenure and access to land dates back decades. Until the fall of Haile Selassie's Monarchist Regime, most urban (and rural) land was owned by few elites. The majority of formal housing in Addis Ababa (accounting for about 40% of the housing stock) was thus provided by them. The impossibility of access to land by the poor ensured the raising of informal structures amid the formal - today a prevalent feature of the city.

Basic indicators clearly show the extent of the problem. For instance, 26% of the houses have no toilet facility (not counting the informal houses), 33% of households share toilet with more than six families, 29% has no separate room for cooking, 34% of the residents depend on water from

frequently interrupted public taps.

(4) Transportation

Addis Ababa is an important regional and international transportation hub. The Addis Ababa-Djibouti Railway, the only major rail link in Ethiopia today (Asmara railway is now in Eritrea) has been the most influential in the development of the capital as a primate city. This line stretches 480 miles connecting Addis Ababa to the nearest major port at the entrance to the Red Sea as well as Dire Dawa and Nazareth. Through this line, the majority of Ethiopia's agricultural and manufactured products are prepared for export.

The construction of the Addis Ababa Ring Road was initiated in 1998 to implement the city master plan and enhance peripheral development. The Ring Road was divided into three major phases that connect all the five main gates in and out of Addis Ababa with all other regions (Jimma, Debre Zeit, Asmara, Gojjam, and Ambo). For this project, China Road and Bridge Corporation (CRBC) was the partner of Addis Ababa City Roads Authority (AACRA). The Ring Road has greatly helped to decongest and alleviate city car traffic.

(5) Trunk Infrastructure

Poor maintenance and lack of new facilities combined with rapid population growth has been causing water shortages in Addis Ababa. This shortage particularly affects the low income section of the city dwellers. The majority of slum dwellings have no easy access to water supply. For instance, 34% of the residents get water from public taps, which are frequently interrupted. High volume of wastage due to faulty piping (as high as 35%), and needs priority given to industries, also contribute to the shortage. The sanitation problem of Addis Ababa is one of the worst in the country. For instance, 26% of the houses - and the majority of slum-dwellers, have no toilet facility, and thus, use rivers, ditches, and open spaces. A shortage of water-supply, ensure that the same areas are used for public baths and washing. The existing sewerage system is inadequate, and sucking by trucks is common. Hence, the sanitary situation may get worse in the coming few years, unless extensive funding and participatory urban plans are developed.

(6) Proliferation of Slums

As one of the cities in the developing countries, Addis Ababa has experienced a rapid rate of physical expansion. This trend is largely influenced by spontaneous growth, which has resulted in the emergence and development of squatter settlements. As new houses are being built in the existing squatter settlements, the number and size of squatter settlements in Addis Ababa has been increasing over time. High building standards of the legal houses, delayed responses and procedural problems of the legal land provision, and high housing rents in the city centre were identified by respondents as the causes of squatting in the study area. In addition, less government control of open spaces, the limited capacity of the code enforcement service to control illegal house construction, lack of a comprehensive legal response towards the problem of squatting, and the practice of land sale by land speculators as a means of making profit are other factors that have contributed to the emergence and proliferation of squatter settlements.

(7) Unemployment and Underemployment

Because of its primacy, and arising from the high rates of rural-urban migration, the city of Addis Ababa, there is a difficulty in matching of employment to the rate of population increase. This has led to high rates of unemployment. Further, the commercial and trade sector employs the majority of the population in Addis Ababa. This implies the need to strengthen other economic activities, especially the industrial sector to ensure sustained purchasing power of the citizens which if lowered, then, the commercial sector cannot perform.

A2.4 Comparison amongst Nairobi and Neighbor Cities

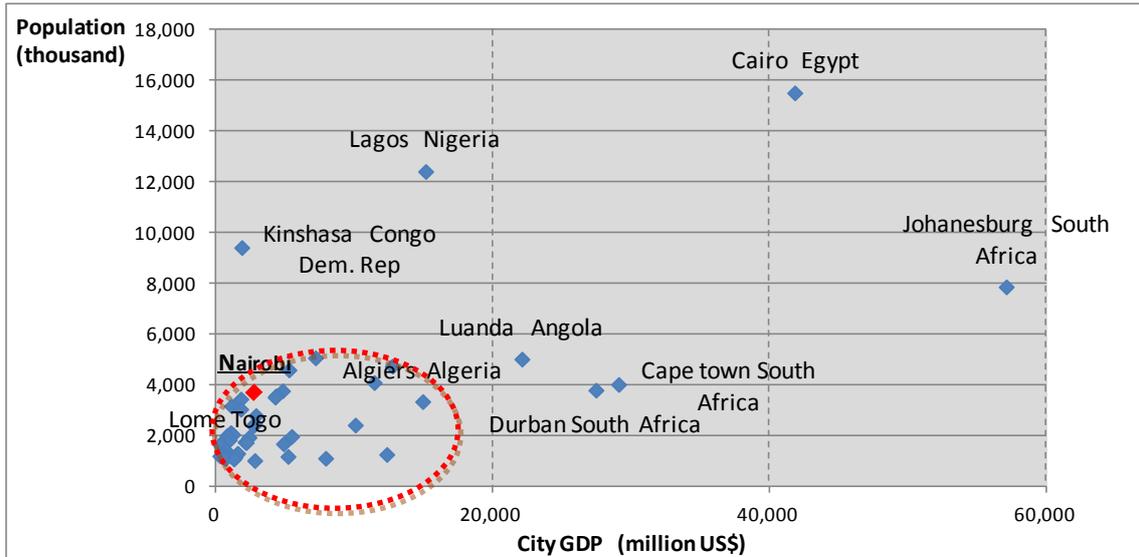
A2.4.1 Economy

According to a grouping scheme by Africa United, Africa is divided into five areas, namely; Northern Africa, Central Africa, Western Africa, Eastern Africa, and Southern Africa. Kenya is located in Eastern Africa. In this composition, Northern Africa accounts for 47% of the gross domestic product (GDP) of the whole African countries, and Southern Africa has 30% of GDP share. Eastern Africa, to which Kenya belongs, however, has only 11% of GDP share, which shows a rather humble economic presence of this area to the entire Africa, though its strength is increasing rapidly.

Total population of the whole Africa is about one billion, and Kenya makes up 0.4% (39.8 million), and 3.4 million residents are living in Nairobi City. Total GDP of all 52 African countries without Madagascar is US\$1,730 billion (2010), and Kenya ranks 10th (US\$321.6 billion) amongst them, although it corresponds to only 2% of the total African GDP.

Figure A2.4.1 shows comparison of city level by using urban agglomeration population and “city GDP index¹” which is defined as the product of urban agglomeration population and the country’s GDP per capita. The latter is an index of a city’s economic activities for comparison.

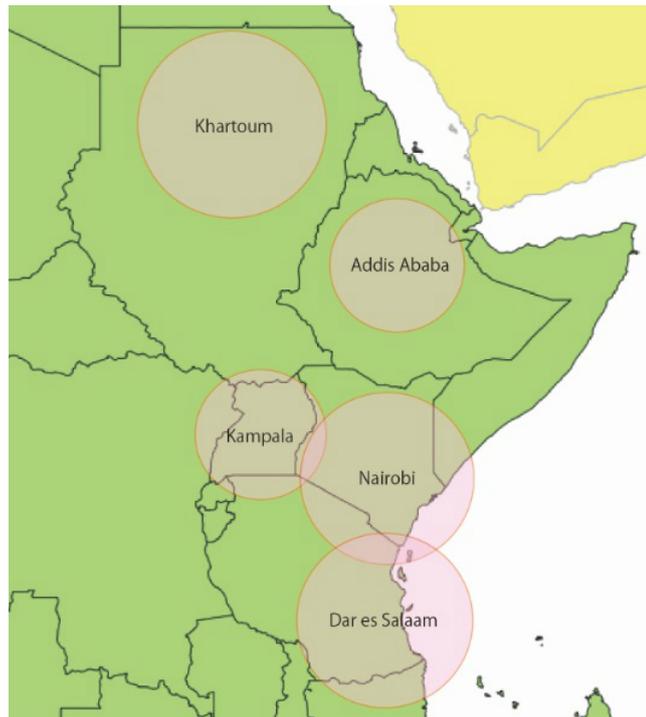
¹ Although GDP per person of the capital city is much higher than GDP per person in the country, it substitutes this figure and calculates “City GDP (=”GDP per person in the country” * “metropolitan population”)", because of lack of data to check GDP per person in the capital city.



Source: JICA Study Team (JST)

Figure A2.4.1 Distribution of Cities' GDP in African Countries

Majority of the cities in African countries belongs to the lower left group as shown in Figure A2.4.1, which has lower population and lower city GDP index, and Nairobi is included in the group.



Source: JICA Study Team (JST)

Figure A2.4.2 Distribution of City GDP of Major Cities in Eastern Africa

The GDP of Sudan ranks as first in Eastern Africa, followed by Kenya which makes up 16% of the whole Eastern Africa. In regard to the city GDP, Nairobi is one of the biggest in Eastern Africa after Khartoum (capital city of Sudan). Especially, amongst countries along the Indian

Ocean, Nairobi is the leading economic centre in the region.

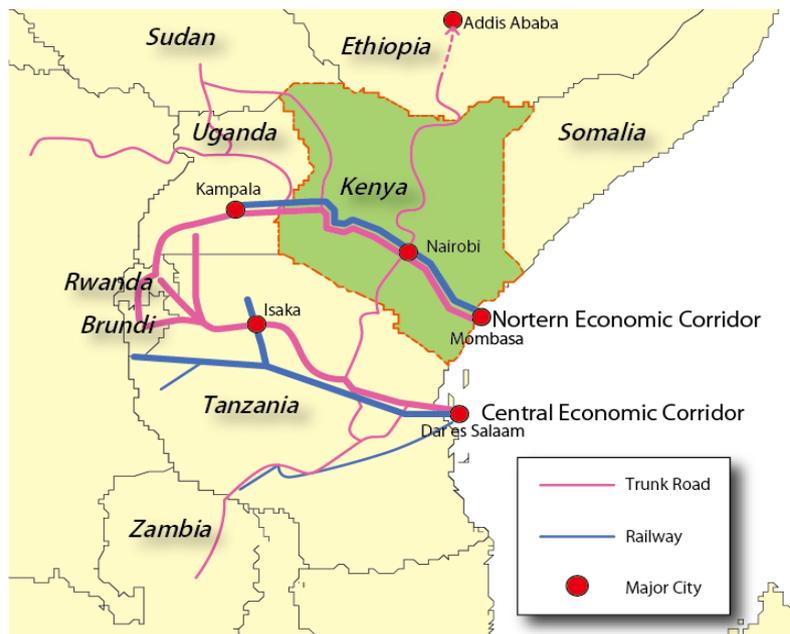
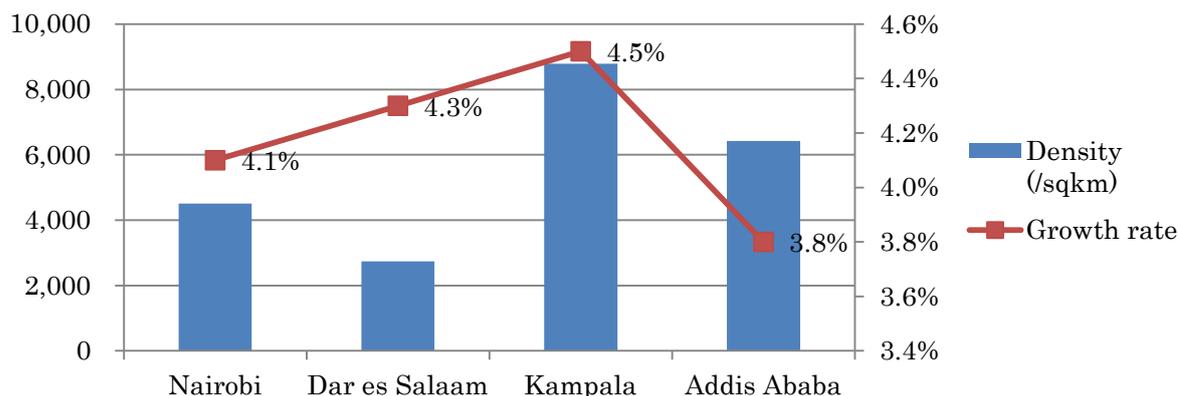


Figure A2.4.3 Economic Corridor in Eastern Africa

Recently, intensive development of economic corridors such as cross-border economic development strategy attracts the attention of Sub-Saharan countries. More than 30 ongoing projects are moving. Nairobi is located in a strategic point of the northern economic corridor that connects the gateway in Mombasa with a major seaport, and extends to Uganda and other countries along Victoria Lake.

A2.4.2 Population

The population of Nairobi City and other large cities in neighbouring countries are expanding due to rapid urbanisation. Additionally, the population density of these cities is high; the density for Kampala is exceeding 8,000/km². The density will be increasing continuously based on rapid population growth rates (3.8% to 4.5%) for each city. Because of this, residential environment of the urbanised area will be high density, and it is expected to take the measures to improve the residential environment.



City name	Nairobi	Dar es Salaam	Kampala	Addis Ababa
Population (thousand)	3,138	4,365	1,660	3,385
Data year	2009	2012	2011	2008
Area (sq.km)	696	1,591	189	527
Density (/sq.km)	4,509	2,744	8,783	6,423
Growth rate	4.1%	4.3%	4.5%	3.8%

Note : Bold figure is the highest of all.

Source : The Central Bureau of Statistics (Kenya), The National Bureau of Statistics (Tanzania), The Uganda Bureau of Statistics (Uganda), and The Central Statistics Agency (Ethiopia)

Figure A2.4.4 Comparison of Population Statistics

A2.4.3 Appropriate Urban Plan

All cities without Addis Ababa do not have an updated master plan, and the latest ones are more than two decades old. This situation causes unplanned or unregulated urban developments, and it is difficult to solve urban problem as they occur.

Table A2.4.1 Newest Urban Plan

City Name	Nairobi	Dar es Salaam	Kampala	Addis Ababa
Newest plan	Master Plan	Plan of Township	Structure Plan	Development Plan
Planned in	1973	1979	1994	2002

Source: JICA Study Team

A2.4.4 Legal and Institutional Environments

The legal and institutional frameworks of Nairobi, Kampala, and Dar es Salaam are similar at least up to March 2013. Kenya's planning law is the Physical Planning Act (1996), Tanzania follows the Physical Planning Act (2003), and Uganda has the Physical Planning Act (2010) and the National Physical Planning Standards and Guidelines (2010). Nairobi is currently under the County Government and headed by a governor effective from 4 March 2013. This new organisational structure replaces the City Council as the administrative unit of the city of Nairobi. Administratively, the city is further divided into nine districts. Dar es Salaam City is managed by a mayor and city director who is the head of the city of Dar es Salaam. The city is further divided into three municipalities which are also districts. There are also other lower administrative levels, namely; ward, sub ward leaders, and in some areas there are also villages and hamlets, all

appointed by and accountable to the municipal director.

A2.4.5 Lack of Urban Development Plan

All of Nairobi, Dar es Salaam, and Addis Ababa suffer from lack of land use plans to guide investments and physical development of the city. Nairobi's Master Plan of 1973 is currently under review through a grant by JICA, thirteen years after it was outdated (2000). For instance, Dar es Salaam's 1979 Plan has not been updated for slightly over three decades. This phenomenon has led to the chaotic nature of the urban space in both towns where different sectors operate independently without the guidance of a land use framework. Whereas, Kampala has the plan, but it has not been implemented. Such unimplemented plans have derailed the potential for development of the city.

A2.4.6 Proliferation of Slums

Nairobi's informality is quoted as 68%-75% whereas Dar es Salaam's is considered to be over 65%. This appears to be inevitable without a clear policy framework to guide development.

A2.4.7 Traffic Congestion

Traffic congestion is a common problem in Dar es Salaam and Nairobi especially during morning and evening peak hours. There are a number of contributing factors to this problem and the key amongst them is the poor implementation of strategies proposed in the physical plans and in some cases lack of plans. The 1979 Dar es Salaam Master Plan had good strategies for reducing future traffic congestion but were never implemented, whereas the city of Nairobi has adopted a sectoral approach to road network expansion that ignores the integrative approach through land use planning necessary for addressing traffic congestion.

A2.4.8 Other Urban Problems

Nairobi City and other large cities in neighbouring countries are facing some similar urban problems based on the background as stated before. These problems are shown as below.

- (i) Unclear land tenure and data management of cadastral data.
- (ii) Insufficient development of trunk infrastructure.
- (iii) Chronic traffic congestion during peak hours of mornings and evenings.
- (iv) Expansion of slums.

APPENDIX 3: RESULTS OF THE TRAFFIC SURVEYS

A3.1 Zone Code Table

Table A.3.1: Zone Code Table Inside the City of Nairobi

Small Zone System		Medium Zone System		Large Zone System	
Zone Code	Sub-location	Zone Code	Location	Zone Code	Division
1	City Centre1, 2, 3	1	Starehe1	1	Starehe
2	City Square1, 2, 3	2	Starehe2		
3	Pangani	3	Kariokor		
4	Ziwani /Kariokor				
5	Mathare	4	Mathare		
6	Mabatini				
7	Mlango Kubwa				
8	Kia Maiko				
9	Huruma	5	Haruma		
10	Ngara East	6	Ngara		
11	Ngara West				
12	Makongeni	7	Makongeni		
13	Kaloleni				
14	Harambee	8	Makadara	2	Makadara
15	Lumumba /Jericho				
16	Hamza				
17	Mbotela				
18	Ofafa Maringo				
19	Landi Mawe				
20	Viwandani				
21	Hazina				
22	Nairobi South	11	Mukuru Nyayo		
23	Kariobangi North				
24	Korogocho	12	Kariobangi		
25	Gitathuru /Nyayo				
26	Kiwanja				
27	kahawa West				
28	Kongo Soweto	13	Kahawa		
29	Kamuthi				
30	Githurai	14	Githurai		
31	Zimmerman				
32	Mathare 4A				
33	Utalii	15	Ruaraka		
34	Ruaraka				
35	Mathare North				
36	Roysambu				
37	Njathaini				
38	Garden	16	Roysambu		
39	Mwiki				
40	Kasarani	17	Kasarani		
41	Embakasi	18	Embakasi	4	Embakasi
42	Mihang'o				
43	Mukurukwa Njenga	19	Mukurukwa Njenga		
44	Imara Daima				
45	Umoja	20	Umoja		
46	Savannah				
47	Kayole				
		21	Kayole		

Small Zone System		Medium Zone System		Large Zone System	
Zone Code	Sub-location	Zone Code	Location	Zone Code	Division
48	Komarock				
49	Niuru				
50	Maili Saba (Saika)	22	Njiru		
51	Dandora 'A'				
52	Dandora 'B'	23	Dandora		
53	Kariobangi South				
54	Moulem	24	Kariobangi S		
55	Ruai				
56	Ngundu	25	Ruai		
57	Airbase				
58	Eastleigh North	26	Eastleigh North		
59	Eastleigh South /Kiambio				
60	California	27	Eastleigh South		
61	Majengo /Gorofani /Bondeni /Gikomba	28	Punwani	5	Kamukunji
62	Kimathi				
63	Uhuru	29	Bahati		
64	Shauri Moyo				
65	Kamukunji	30	Kamukunji		
66	Muthurwa				
67	Upper parklands				
68	Spring Valley	31	Parklands		
69	Loresho				
70	Kyuna	32	Kitisuru		
71	Kitsuru				
72	Muthaiga				
73	Karura	33	Highridge	6	Westlands
74	Highridge				
75	Gichagi				
76	Mountain View	34	Kangemi		
77	Kangemi				
78	Kilimani				
79	Kileleshwa	35	Kilimani		
80	Muthangari				
81	Maziwa	36	Lavington		
82	Waithaka				
83	Kabiria	37	Waithaka		
84	Kirigu				
85	Mutuini	38	Mutuini		
86	Ruthimitu				
87	Uthiru	39	Uthiru /Ruthmitu	7	Dagoretti
88	Kawangware				
89	Gatina	40	Kawangware		
90	Riruta				
91	Ngando	41	Riruta		
92	Kenyatta /Golf Course	42	Kenyatta		
93	Woodley	43	Golf Course		
94	Kibera /Makina				
95	Siranga /Lindi	44	Kibera		
96	Langata				
97	Hardy				
98	Karen	45	Langata /Karen		
99	Lenana				
100	Mugumoini				
101	Bomas	46	Mugumoini	8	Langata
102	Nairobi West				
103	South 'C'	47	Nairobi West		
104	Laini Saba				
105	Nyayo Highrise	48	Laini Saba		
106	Gatwikira /Olympic	49	Serangombe		

Table A.3.2: Zone Code Table Around the City of Nairobi

Small Zone System			Medium Zone System		Large Zoning System	
No.	Zone Code	Sub-location	Zone Code	Location	Zone Code	Division
107	301	Thika West (Biashara / Makongeni)	50	Around Thika	9	South-Eastern KIAMBU County
108	302	Thika East (Gatuanyaga / Munyu / Ngoliba)				
109	303	Kakuzi (Only Gituamba)	51	Kakuzi		
110	304	Juja (Juja / Kalimoni / Komo)	52	Around Ruiru		
111	305	Ruiru1 (Theta / Mugutha)				
112	306	Ruiru2 (Gikumari / Githurai / Kahawa Sukari)				
113	307	Ruiru3 (Old Ruiru)				
114	401	Karai1 (Old Karai, Gikambura) / Kikuyu / Kinoo1 (Gitiba, Thogoto, Old Kinoo)	53	Around Kikuyu	10	Southern KIAMBU County
115	402	Kinoo2 (Only Uthiru) / Muguga / Nyathuna / Kabete				
116	403	Karai2 (Nachu, Renguti, Lusigetti)				
117	404	Kihara / Kiambaa / Ruaka / Waguthu1 (Only Gathanga)	54	Kiambaa		
118	405	Cianda (Cianda, Kawaida)	55	Limuru		
119	406	Limuru (Limuru / Karambaini / Tigoni / Ngecha / Rironi)				
120	407	Waguthu2 (Kanunga, Ngegu) / Kiambaa S/A (Kiambu Town, Kiambi, Thindigua) / Ndumberi / Riabai	56	Around Kiambu Town		
121	408	Kamiti / Ting'ang'a				
122	409	Ikinu / Githiga / Githunguri / Ngewa / Komothai / Kiratina				
123	501	Ngong1 (Only Ngong Township) / Oloolua (Bulbul, Kerarapon, Oloolua)	57	Around Ngong		
124	502	Kiserian2 (Upper Matasia) / Lemelepo / Nkaimurunya (Empakasi, Kandis) / Olkeri / Ongata Rongai				
125	503	Enstashat (Kimuka, Olosho-Oibor) / Ngong2 (Only Kibiko)				
126	504	Kiserian1 (Naserian, Olteyani) / Olchorro-Onyore1 (Only Kipeto)				
127	505	Kitengela / Oloosirkon / Olturoto (Only Kisaju)				
128	601	Komarock1 (Kwale) / Kyanzavi / Kyeleni	59	Matungulu	12	Western MACHAKOS County
129	602	Nguluni / Koma rock2 (koma, Mungengesya, Matuu) / Kalandini				
130	603	Tala / Matungulu				
131	604	Kawethei / Kakuyuni / Kangundo / Kivaani / Kanzalu	60	Kangundo		
132	605	Katani	61	Mavoko		
133	606	Lukenya1 (Only Muthwani)				
134	607	Lukenya2 (Mathatani, Kinanie)				
135	608	Athi River (North, Township)				

Table A.3.3: Zone Code Table Outside the Survey Area

Small Zone System			Medium Zone System		Large Zone System	
No.	Zone Code	Sub-location	Zone Code	Location	Zone Code	Division
136	701	Kiambu County except [L9] Southeastern Kiambu County, [L10] Southern Kiambu County	62	North KIAMBU	13	Nairobi Vicinity
137	702	Kajiado County except [L11] Northern Kajiado County	63	South KAJIADO		
138	703	Machakos County except [L12] Western Machakos County	64	East MACHAKOS		
139	801	Central Province except Kiambu County	65	CENTRAL	14	KENYA
140	802	Marsabit, Isiolo, Meru, Tharaka Nithi, Embu in Eastern Province	66	EASTERN		
141	803	Kitui, Makueni in Eastern Province				
142	804	All Coast Province	67	COAST		
143	805	All North Eastern Province	68	NORTH EASTERN		
144	806	Rift Valley Province Except Kajado County	69	RIFT VALLEY		
145	807	All Nyanza Province, All Western Province	70	NYANZA, WESTERN		
146	901	Tanzania	71	South country	15	Abroad
147	902	Uganda	72	West country		
148	903	Sudan and South Sudan				
149	904	Ethiopia	73	North country		
150	905	Somali	74	East country		

A3.2 Survey Forms

A3.2.1 Person Trip Survey Form

Person Trip Survey for The Project on Integrated Urban Development Master Plan for the City of Nairobi in the Republic of Kenya



Person Trip Survey

For official use

Name of surveyor	
Name of Supervisor	
Name of corder	
Name of encorder	
Name of area supervisor	

Date of survey (dd:mm)

Date of trip surveyed (dd:mm)

Surveyor's ID

01

02 03

04 05

FORM 1 HOUSEHOLD INFORMATION

Instruction: To Be completed by Head of Household

Household ID

(A1) ADDRESS OF HOUSEHOLD

No. / Building Street Estate /District

City / Municipality

Zone No.

(A2) NUMBER OF HOUSEHOLD MEMBERS

	Under 5 years	5 years and above	Household helpers (ex. Maid)
Male	a3 <input style="width: 40px;" type="text"/>	a4 <input style="width: 40px;" type="text"/>	a5 <input style="width: 40px;" type="text"/>
Female	a6 <input style="width: 40px;" type="text"/>	a7 <input style="width: 40px;" type="text"/>	a8 <input style="width: 40px;" type="text"/>
Total	a9 <input style="width: 40px;" type="text"/>	a10 <input style="width: 40px;" type="text"/>	a11 <input style="width: 40px;" type="text"/>

(A3) WHAT IS THE TOTAL MONTHLY HOUSEHOLD INCOME

1. under Kshs 1,999
2. Kshs 2,000-4,999
3. Kshs 5,000-9,999
4. Kshs 10,000-14,999
5. Kshs 15,000-19,999
6. Kshs 20,000-29,999
7. Kshs 30,000-39,999
8. Kshs 40,000-49,000
9. Kshs 50,000-99,999
10. Kshs 100,000over

a12

(A4) HOW MANY VEHICLES ARE OWNED BY HOUSEHOLD

Type	No. of Units
1. Bicycle	a13 <input style="width: 40px;" type="text"/>
2. Motorcycle	a14 <input style="width: 40px;" type="text"/>
3. Car/4WD	a15 <input style="width: 40px;" type="text"/>
4. Truck	a16 <input style="width: 40px;" type="text"/>
5. Others	a17 <input style="width: 40px;" type="text"/>

(A5) HOW MANY VEHICLES ARE RENTED BY COMPANY OR GOVERNMENT

Type	No. of Units
1. Bicycle	a18 <input style="width: 40px;" type="text"/>
2. Motorcycle	a19 <input style="width: 40px;" type="text"/>
3. Car/4WD	a20 <input style="width: 40px;" type="text"/>
4. Truck	a21 <input style="width: 40px;" type="text"/>
5. Others	a22 <input style="width: 40px;" type="text"/>

(A6) OWNERSHIP OF HOSEHOLD AND LAND

1. Own

2. Rented

a23

(A7) LENGTH OF STAY IN PRESENT HOUSE

a24 Years

(A8) RACE OF INFORMANT

1. African
2. Asian
3. European
4. Mixed origin

a25

Figure A.3.1: Household Information Form for Person Trip Survey

Nippon Koei Co., Ltd.
IDCJ Inc.
EJEC Inc.

Appendix 3-5

Final Report

FORM 2 HOSEHOLD MEMBER INFORMATION

Household ID Member ID

a1					
----	--	--	--	--	--

b1					
----	--	--	--	--	--

Instruction: To Be completed by every household member 5 years and above

(B1) AGE <table border="1" style="width: 100%;"> <tr> <td style="width: 20px;">b2</td> <td style="width: 60px;">years old</td> </tr> </table>	b2	years old	(B2) SEX <table border="1" style="width: 100%;"> <tr> <td style="width: 30px;">1. Male</td> <td style="width: 30px;">2. Female</td> <td style="width: 20px;">b3</td> </tr> </table>	1. Male	2. Female	b3																																						
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(B3) WORK ADDRESS <table style="width: 100%;"> <tr> <td style="width: 33%;">_____ No. / Building</td> <td style="width: 33%;">_____ Street</td> <td style="width: 33%;">_____ Estate /District</td> </tr> <tr> <td>_____ City / Municipality</td> <td></td> <td style="text-align: right;">Zone No. <table border="1" style="display: inline-table; width: 40px;"> <tr> <td>b4</td> <td></td> <td></td> <td></td> </tr> </table></td> </tr> </table>			_____ No. / Building	_____ Street	_____ Estate /District	_____ City / Municipality		Zone No. <table border="1" style="display: inline-table; width: 40px;"> <tr> <td>b4</td> <td></td> <td></td> <td></td> </tr> </table>	b4																																			
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(B4) SCHOOL ADDRESS <table style="width: 100%;"> <tr> <td style="width: 33%;">_____ No. / Building</td> <td style="width: 33%;">_____ Street</td> <td style="width: 33%;">_____ Estate /District</td> </tr> <tr> <td>_____ City / Municipality</td> <td></td> <td style="text-align: right;">Zone No. <table border="1" style="display: inline-table; width: 40px;"> <tr> <td>b5</td> <td></td> <td></td> <td></td> </tr> </table></td> </tr> </table>			_____ No. / Building	_____ Street	_____ Estate /District	_____ City / Municipality		Zone No. <table border="1" style="display: inline-table; width: 40px;"> <tr> <td>b5</td> <td></td> <td></td> <td></td> </tr> </table>	b5																																			
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(B5) OCCUPATION <table border="1" style="width: 100%;"> <tr><td>1. Employer</td></tr> <tr><td>2. Employee</td></tr> <tr><td>3. Own account worker</td></tr> <tr><td>4. Student (Elem.)</td></tr> <tr><td>5. Student (H.S. & Univ.)</td></tr> <tr><td>6. Housewife</td></tr> <tr><td>7. Jobless</td></tr> <tr><td>8. Others specify</td></tr> </table> <table border="1" style="width: 100%; margin-top: 5px;"> <tr> <td style="width: 20px;">b6</td> <td style="width: 60px;"></td> </tr> </table>	1. Employer	2. Employee	3. Own account worker	4. Student (Elem.)	5. Student (H.S. & Univ.)	6. Housewife	7. Jobless	8. Others specify	b6		(B6) EMPLOYMENT SECTOR <table border="1" style="width: 100%;"> <tr><td>1. Agriculture/Forestry</td></tr> <tr><td>2. Mining/Quarrying</td></tr> <tr><td>3. Manufacturing</td></tr> <tr><td>4. Electricity, Gas, Watersupply</td></tr> <tr><td>5. Construction</td></tr> <tr><td>6. Wholesale, retail trade</td></tr> <tr><td>7. Repair of Vehicles, personal</td></tr> <tr><td>8. % household googs</td></tr> <tr><td>9. Hotels & restaurants</td></tr> <tr><td>10. Transport, storage & Comm.</td></tr> <tr><td>11. Financial intermediation</td></tr> <tr><td>12. Real eatate, renting</td></tr> <tr><td>13. Public administration</td></tr> <tr><td>14. Education</td></tr> <tr><td>15. Health & social work</td></tr> <tr><td>16. Service industry</td></tr> <tr><td>17. Private households</td></tr> <tr><td>18. Others (including student, jobless)</td></tr> </table> <table border="1" style="width: 100%; margin-top: 5px;"> <tr> <td style="width: 20px;">b8</td> <td style="width: 60px;"></td> </tr> </table>	1. Agriculture/Forestry	2. Mining/Quarrying	3. Manufacturing	4. Electricity, Gas, Watersupply	5. Construction	6. Wholesale, retail trade	7. Repair of Vehicles, personal	8. % household googs	9. Hotels & restaurants	10. Transport, storage & Comm.	11. Financial intermediation	12. Real eatate, renting	13. Public administration	14. Education	15. Health & social work	16. Service industry	17. Private households	18. Others (including student, jobless)	b8		(B7) MONTHLY INCOME <table border="1" style="width: 100%;"> <tr><td>1. under Kshs 1,999</td></tr> <tr><td>2. Kshs 2,000-4,999</td></tr> <tr><td>3. Kshs 5,000-9,999</td></tr> <tr><td>4. Kshs 10,000-14,999</td></tr> <tr><td>5. Kshs 15,000-19,999</td></tr> <tr><td>6. Kshs 20,000-29,999</td></tr> <tr><td>7. Kshs 30,000-39,999</td></tr> <tr><td>8. Kshs 40,000-49,000</td></tr> <tr><td>9. Kshs 50,000-99,999</td></tr> <tr><td>10. Kshs 100,000over</td></tr> </table> <table border="1" style="width: 100%; margin-top: 5px;"> <tr> <td style="width: 20px;">b9</td> <td style="width: 60px;"></td> </tr> </table>	1. under Kshs 1,999	2. Kshs 2,000-4,999	3. Kshs 5,000-9,999	4. Kshs 10,000-14,999	5. Kshs 15,000-19,999	6. Kshs 20,000-29,999	7. Kshs 30,000-39,999	8. Kshs 40,000-49,000	9. Kshs 50,000-99,999	10. Kshs 100,000over	b9	
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b9																																												
(B8) VEHICLE FOR YOUROWN USE <table border="1" style="width: 100%;"> <tr> <td style="width: 30px;">1. Having</td> <td style="width: 20px;"><input checked="" type="radio"/></td> </tr> <tr> <td>2. Not having</td> <td><input type="radio"/></td> </tr> </table> <table border="1" style="width: 100%; margin-top: 5px;"> <tr> <td style="width: 20px;">b10</td> <td style="width: 60px;"></td> </tr> </table>	1. Having	<input checked="" type="radio"/>	2. Not having	<input type="radio"/>	b10		(B9) VEHICLE TYPE AND ITS NUMBER OF YOUR OWN UDE <table border="1" style="width: 100%;"> <thead> <tr> <th style="width: 40%;">Type</th> <th style="width: 20%;">No. of Units</th> </tr> </thead> <tbody> <tr><td>1. Bicycle</td><td>b11</td></tr> <tr><td>2. Motorcycle</td><td>b12</td></tr> <tr><td>3. Car/4WD</td><td>b13</td></tr> <tr><td>4. Truck</td><td>b14</td></tr> <tr><td>5. Others</td><td>b15</td></tr> </tbody> </table>	Type	No. of Units	1. Bicycle	b11	2. Motorcycle	b12	3. Car/4WD	b13	4. Truck	b14	5. Others	b15	(B10) DRIVER LICENSE <table border="1" style="width: 100%;"> <tr><td>1. Have license</td></tr> <tr><td>2. Not have license</td></tr> </table> <table border="1" style="width: 100%; margin-top: 5px;"> <tr> <td style="width: 20px;">b16</td> <td style="width: 60px;"></td> </tr> </table>	1. Have license	2. Not have license	b16																					
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b16																																												

FigureA.3.2: Household Member Information Form for Person Trip Survey

FORM 3 TRIP INFORMATION

Instruction: To Be completed by every household member 5 years and above

Sheet No. 1

Total Number of Trips

Instruction: If the interviewee did not go out, fill the column by "0".

		<input type="text" value="c02"/> 1 st TRIP INFORMATION	<input type="text" value="c02"/> 2 nd TRIP INFORMATION																	
<p>Place Category</p> <ol style="list-style-type: none"> Residence Shop, market, shopping center Office Factory, warehouse School, university, educational Recreational place, Park Medical Religious and Social and Welfare Wholesale and Retail Shop Restaurant / Entertainment Others 	(1) START PLACE	<ol style="list-style-type: none"> Home Work place School Others <input type="text" value="c03"/>	<p>INFORMATION ON STARTING PLACE IS THE SAME AS THE DESTINATION OF PREVIOUS TRIP</p>																	
	(2) IF ANSWER IS "4", SPECIFY THE PLACE	NO. / Building _____ Street _____ Estate / District _____ City _____ Zone No. <input type="text" value="c04"/>																		
	(3) PLACE CATEGORY	<input type="text" value="c05"/>																		
	(4) TIME STARTED	<ol style="list-style-type: none"> AM PM <input type="text" value="c06"/> Hour <input type="text" value="c07"/> Minutes																		
	(5) TIME OF ARRIVAL	<ol style="list-style-type: none"> AM PM <input type="text" value="c08"/> Hour <input type="text" value="c09"/> Minutes																		
	(6) DESTINATION	<ol style="list-style-type: none"> Home Work place School Others <input type="text" value="c10"/>																		
	(7) IF ANSWER IS "4", SPECIFY THE PLACE	NO. / Building _____ Street _____ Estate / District _____ City _____ Zone No. <input type="text" value="c11"/>																		
	(8) PLACE CATEGORY	<input type="text" value="c12"/>																		
	(9) TRIP PURPOSE	<input type="text" value="c13"/>																		
	<p>Travel Mode Category</p> <ol style="list-style-type: none"> Walking Bicycle Tricycle Motor Cycle, Boda-boda Passenger Car Truck Trailer Taxi, Tuku-tuku Matatsu Bus Metro Shuttle Railway Others 	(10) TRAVEL MODE <i>Instruction: see column</i>		<table border="1"> <tr> <td>Original Mode</td> <td>Transfer Point</td> </tr> <tr> <td><input type="text" value="c14"/></td> <td>1st transfer</td> </tr> <tr> <td>Next Mode</td> <td></td> </tr> <tr> <td><input type="text" value="c16"/></td> <td>2nd transfer</td> </tr> <tr> <td>Next Mode</td> <td></td> </tr> <tr> <td><input type="text" value="c18"/></td> <td>3rd transfer</td> </tr> <tr> <td>Next Mode</td> <td></td> </tr> <tr> <td><input type="text" value="c20"/></td> <td>Final Destination</td> </tr> </table>	Original Mode	Transfer Point	<input type="text" value="c14"/>	1 st transfer	Next Mode		<input type="text" value="c16"/>	2 nd transfer	Next Mode		<input type="text" value="c18"/>	3 rd transfer	Next Mode		<input type="text" value="c20"/>	Final Destination
		Original Mode		Transfer Point																
<input type="text" value="c14"/>	1 st transfer																			
Next Mode																				
<input type="text" value="c16"/>	2 nd transfer																			
Next Mode																				
<input type="text" value="c18"/>	3 rd transfer																			
Next Mode																				
<input type="text" value="c20"/>	Final Destination																			
(11) DRIVER OR PASSENGER	<p>To persons who used passenger car only.</p> <ol style="list-style-type: none"> Driver Passenger <input type="text" value="c21"/>																			
<p>Trip Purpose Category</p> <ol style="list-style-type: none"> To Home To Work To School Personal Business Firm Business Social Shopping Others 	(8) PLACE CATEGORY	<input type="text" value="c12"/>																		
	(9) TRIP PURPOSE	<input type="text" value="c13"/>																		
<p>Place Category</p> <ol style="list-style-type: none"> Residence Shop, market, shopping center Office Factory, warehouse School, university, educational Recreational place, Park Medical Religious and Social and Welfare Wholesale and Retail Shop Restaurant / Entertainment Others 	(1) START PLACE	<ol style="list-style-type: none"> Home Work place School Others <input type="text" value="c03"/>																		
	(2) IF ANSWER IS "4", SPECIFY THE PLACE	NO. / Building _____ Street _____ Estate / District _____ City _____ Zone No. <input type="text" value="c04"/>																		
	(3) PLACE CATEGORY	<input type="text" value="c05"/>																		
	(4) TIME STARTED	<ol style="list-style-type: none"> AM PM <input type="text" value="c06"/> Hour <input type="text" value="c07"/> Minutes																		
	(5) TIME OF ARRIVAL	<ol style="list-style-type: none"> AM PM <input type="text" value="c08"/> Hour <input type="text" value="c09"/> Minutes																		
	(6) DESTINATION	<ol style="list-style-type: none"> Home Work place School Others <input type="text" value="c10"/>																		
	(7) IF ANSWER IS "4", SPECIFY THE PLACE	NO. / Building _____ Street _____ Estate / District _____ City _____ Zone No. <input type="text" value="c11"/>																		
	(8) PLACE CATEGORY	<input type="text" value="c12"/>																		
	(9) TRIP PURPOSE	<input type="text" value="c13"/>																		
	(10) TRAVEL MODE <i>Instruction: see column</i>	<table border="1"> <tr> <td>Original Mode</td> <td>Transfer Point</td> </tr> <tr> <td><input type="text" value="c14"/></td> <td>1st transfer</td> </tr> <tr> <td>Next Mode</td> <td></td> </tr> <tr> <td><input type="text" value="c16"/></td> <td>2nd transfer</td> </tr> <tr> <td>Next Mode</td> <td></td> </tr> <tr> <td><input type="text" value="c18"/></td> <td>3rd transfer</td> </tr> <tr> <td>Next Mode</td> <td></td> </tr> <tr> <td><input type="text" value="c20"/></td> <td>Final Destination</td> </tr> </table>	Original Mode	Transfer Point	<input type="text" value="c14"/>	1 st transfer	Next Mode		<input type="text" value="c16"/>	2 nd transfer	Next Mode		<input type="text" value="c18"/>	3 rd transfer	Next Mode		<input type="text" value="c20"/>	Final Destination		
	Original Mode	Transfer Point																		
<input type="text" value="c14"/>	1 st transfer																			
Next Mode																				
<input type="text" value="c16"/>	2 nd transfer																			
Next Mode																				
<input type="text" value="c18"/>	3 rd transfer																			
Next Mode																				
<input type="text" value="c20"/>	Final Destination																			
(11) DRIVER OR PASSENGER	<p>To persons who used passenger car only.</p> <ol style="list-style-type: none"> Driver Passenger <input type="text" value="c21"/>																			

Figure A.3.3: Trip Information Form for Person Trip Survey

A3.2.2 Stated Preference Survey Form

Instruction: Select one person out of eight persons who used Matats, Bus, Car or Motorcycle. Fill in the form A or B according to the used travel mode.

	Household ID	Member ID
a1	b1	
STATED PREFERENCE SURVEY		
Form A. FOR BUS AND MATATSU USERS		
1. Is the alternative modes available for you?		
<input type="checkbox"/> 1. Bicycle	<input type="checkbox"/> 2. Motorcycle	<input type="checkbox"/> 3. Private Car/Truck
<input type="checkbox"/> 4. Taxi	<input type="checkbox"/> 5. Other	d1
2. If new public transport system (Bus Rapid Transit or Light Rail Transit) is introduced in Nairobi City, will you use the new public transport system?		
<input type="checkbox"/> 1. Yes	<input type="checkbox"/> 2. No	d2
3. If your answer is "Yes", how much will you pay for new public transport system?		
d3		kshs
4. If your answer is "No", what is the reason ?		
<input type="checkbox"/> 1. Bus/Matatsu is cheapest	<input type="checkbox"/> 2. Operation is frequent	d4
<input type="checkbox"/> 3. Transfer is not necessary.	<input type="checkbox"/> 6. Other (specify).....	
FORM B. FOR PRIVATE CAR AND MOTORCYCLE USERS		
1. How much do you pay for parking at the travel destination?		
d5		kshs
2. If the Parking fee is increased by the cases below, do you change traffic mode?		
<input type="checkbox"/> 1. 50% up (ex. 70→105kshs)	<input type="checkbox"/> 2. 100% up (ex. 70→140kshs)	d6
<input type="checkbox"/> 3. 150% up(ex. 70→175kshs)	<input type="checkbox"/> 4. 200% up (ex. 70→210kshs)	
<input type="checkbox"/> 5. 300% up (ex. 70→280kshs)		
3. If fuel price is increased by the cases below, do you change traffic mode?		
<input type="checkbox"/> 1. 20% up (ex. 70→84kshs)	<input type="checkbox"/> 2. 40% up (ex. 70→98kshs)	d7
<input type="checkbox"/> 3. 60% up (ex. 70→112kshs)	<input type="checkbox"/> 4. 80% up (ex. 70→126kshs)	
<input type="checkbox"/> 5. 100% up (ex. 70→140kshs)		
4. Is the alternative modes available for you?		
<input type="checkbox"/> 1. Bicycle	<input type="checkbox"/> 2. Motorcycle	<input type="checkbox"/> 3. Private Car/Truck
<input type="checkbox"/> 4. Taxi	<input type="checkbox"/> 5. Other	d8
5. If new public transport system (Bus Rapid Transit or Light Rail Transit) is introduced in Nairobi City, will you use the new public transport system?		
<input type="checkbox"/> 1. Yes	<input type="checkbox"/> 2. No	d9
6. If your answer is "Yes", how much will you pay for new public transport system?		
d10		kshs
7. If your answer is "No", what is the reason ?		
<input type="checkbox"/> 1. Hate walking	<input type="checkbox"/> 2. Hate waiting	<input type="checkbox"/> 3. Travel time is long
<input type="checkbox"/> 4. Uncomfortable	<input type="checkbox"/> 5. Not flexible.	<input type="checkbox"/> 6. Security
<input type="checkbox"/> 7. Carrying baggage	<input type="checkbox"/> 8. Others (specify)	d11
<p>Bus Rapid Transit and Light Rail Transit are operated on exclusive route and their operation speed is faster than present public transport.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>BRT</p> </div> <div style="text-align: center;">  <p>LRT</p> </div> </div>		

FigureA.3.4: Stated Preference Survey Form

A3.2.3 Cordon Line Survey Form

CORDON LINE SURVEY SHEET

Station No. Sheet No.

Dir. From To Time :

Surveyor Name:

No.	Type of Vehicle	ORIGIN		D E S T I N A T I O N		Number of Persons (including Driver)	Trip Purpose	for Truck & Trailer only				
		Location Name	Small Zone No.	Location Name	Small Zone No.			Commodity Type	Commodity Quantity	Net Load Capacity		
		No. / Building Street		No. / Building Street								
		District		District								
		City /Municipality		City /Municipality								
		No. / Building Street		No. / Building Street							kg. or ton	ton
		District		District								
		City /Municipality		City /Municipality								
		No. / Building Street		No. / Building Street							kg. or ton	ton
		District		District								
		City /Municipality		City /Municipality								
		No. / Building Street		No. / Building Street							kg. or ton	ton
		District		District								
		City /Municipality		City /Municipality								
		No. / Building Street		No. / Building Street							kg. or ton	ton
		District		District								
		City /Municipality		City /Municipality								

Type of Traffic Mode

1. Pedestrian
2. Bicycle, Tricycle, Push/Pull Cart
3. Motorcycle
4. Private Car, Taxi
5. Light Truck
6. Heavy Truck, Trailer
7. Matsuo
8. Bus, School/Co./Tourist Bus, Metro Shuttle

Trip Purpose

1. To Home
2. To Work
3. To School
4. Personal Business
5. Firm Business
6. Social
7. Shopping
8. Others

Commodity Type

1. No Luggage
2. Timber
3. Agriculture
4. Oil
5. Mineral
6. Machinery
7. Chemicals
8. Construction Materials
9. Miscellaneous

Figure A.3.5: Cordon Line Survey Form

A3.2.4 Public Transport User Survey

Matatsu / Bus Passenger Interview Survey Survey Sheet															
Date	<input style="width: 100%;" type="text"/>	Time	<input style="width: 100%;" type="text"/> : <input style="width: 100%;" type="text"/>												
Location	<input style="width: 100%;" type="text"/>	Sheet No.	<input style="width: 100%;" type="text"/>												
Type of Public Vehicle	<input style="width: 100%;" type="text"/>	1. Bus truck	2. Metro Shuttle 3. Other Bus												
Get on or get Off	<input style="width: 100%;" type="text"/>	4. matatsu	5. Others												
		1. Get on	2. Get off												
1. Personal Information															
Sex	<input style="width: 100%;" type="text"/>	1. Male 2. Female	Age <input style="width: 100%;" type="text"/> years old												
Occupation	<input style="width: 100%;" type="text"/>	1. Employer 2. Employee 3. Own account worker 4. Student 5. Housewife 6. Jobless 7. Others													
Monthly Income	<table style="width: 100%; border: none;"> <tr> <td style="width: 25%;">1. under Kshs 1,999</td> <td style="width: 25%;">2. Kshs 2,000-4,999</td> <td style="width: 25%;">3. Kshs 3,000-9,999</td> <td style="width: 25%;">4. Kshs 10,000-14,999</td> </tr> <tr> <td>5. Kshs 15,000-19,999</td> <td>6. Kshs 20,000-29,999</td> <td>7. Kshs 30,000-39,999</td> <td>8. Kshs 40,000-49,999</td> </tr> <tr> <td>9. Kshs 50,000-99,999</td> <td>10. Kshs 100,000 Over</td> <td></td> <td></td> </tr> </table>			1. under Kshs 1,999	2. Kshs 2,000-4,999	3. Kshs 3,000-9,999	4. Kshs 10,000-14,999	5. Kshs 15,000-19,999	6. Kshs 20,000-29,999	7. Kshs 30,000-39,999	8. Kshs 40,000-49,999	9. Kshs 50,000-99,999	10. Kshs 100,000 Over		
1. under Kshs 1,999	2. Kshs 2,000-4,999	3. Kshs 3,000-9,999	4. Kshs 10,000-14,999												
5. Kshs 15,000-19,999	6. Kshs 20,000-29,999	7. Kshs 30,000-39,999	8. Kshs 40,000-49,999												
9. Kshs 50,000-99,999	10. Kshs 100,000 Over														
	<input style="width: 100%;" type="text"/>	Income Code													
2. Origin of Trip															
<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>													
No. / Building	Street	Estate / District													
<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>													
City / Municipality		Zone Code													
3. Destination of Trip															
<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>													
No. / Building	Street	Estate / District													
<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>													
City / Municipality		Zone Code													
4. Trip Purpose															
<input style="width: 100%;" type="text"/>	1. To Home	2. To Work	3. To School												
	4. Personal Business	5. Firm Business	6. Social												
	7. Shopping	8. Others													
5. Travel Fare															
How much do you pay for this trip <input style="width: 100%;" type="text"/> Kshs															
6. Expected Travel Time from Origin to Destination															
<input style="width: 100%;" type="text"/> minutes															
7. Access and Egress Modes to Public Vehicle															
Access Mode	<input style="width: 100%;" type="text"/>	1. walking	2. Bicycle/Tricycle												
Egress Modde	<input style="width: 100%;" type="text"/>	3. Motorcycle	4. Passenger car												
		5. Truck	6. Taxi												
		7. Bus	8. Others												
8. Trip Frequency															
1. Over 2 times per day	4. Once a week	7. A few days per year													
2. Everyday 1 time	5. A few days per month														
3. A few times per week	6. Once a month	<input style="width: 100%;" type="text"/>													
9. Reason for Using Public Vehicle (Plural answers are permissible)															
1. I have no other means for travel.	5. Travel time is shortest.	<input style="width: 100%; height: 40px;" type="text"/>													
2. Bus service is available for this travel	6. Operation frequency is high.														
3. Bus is cheapest.	7. Easy to carry luggage														
4. Travel time is stable.	8. Others														

Figure A.3.6: Public Transport User Survey Form (1/2)

10. What is your assessment of present Bus / Matatu service?					
	1.Very good	2.good	3.fair	4.bad	5.very bad
1) Travel time / speed	1.	2.	3.	4.	5.
2) Waiting time	1.	2.	3.	4.	5.
3) Punctuality	1.	2.	3.	4.	5.
4) Service hours	1.	2.	3.	4.	5.
5) Transfer to other routes	1.	2.	3.	4.	5.
6) Safety on B/A at bus stop	1.	2.	3.	4.	5.
7) Feet quality	1.	2.	3.	4.	5.
8) On board comfort	1.	2.	3.	4.	5.
9) On board security	1.	2.	3.	4.	5.
10) Operational information	1.	2.	3.	4.	5.
11) Driver's skill	1.	2.	3.	4.	5.
12) Staff behaviors	1.	2.	3.	4.	5.
13) Fare	1.	2.	3.	4.	5.
14) Ticketing system	1.	2.	3.	4.	5.
15) Feeder service	1.	2.	3.	4.	5.
16) Air quality	1.	2.	3.	4.	5.
17) Noise level	1.	2.	3.	4.	5.
Questions 18,19 and 20 are only for bus passengers					
18) Bus stop location / number	1.	2.	3.	4.	5.
19) Bus stop facility	1.	2.	3.	4.	5.
20) Operational info at bus stop	1.	2.	3.	4.	5.
11. Please express how important are the following criteria to improve the Bus / Matatu service?					
Criteria	1.important	2.indifferent	3.Not important		
1) Reduction of travel time	1.	2.	3.		
2) Reduction of waiting time	1.	2.	3.		
3) Improvement of regularity / punctuality	1.	2.	3.		
4) Extension of service hours	1.	2.	3.		
5) Improvement of accessibility	1.	2.	3.		
6) Improvement of bus stop facility / information	1.	2.	3.		
7) Introduction of new bus fleet with air-con	1.	2.	3.		
8) To provide the bus priority lane	1.	2.	3.		
9) Parking space at the bus stop / terminal	1.	2.	3.		
10) Feeder service	1.	2.	3.		

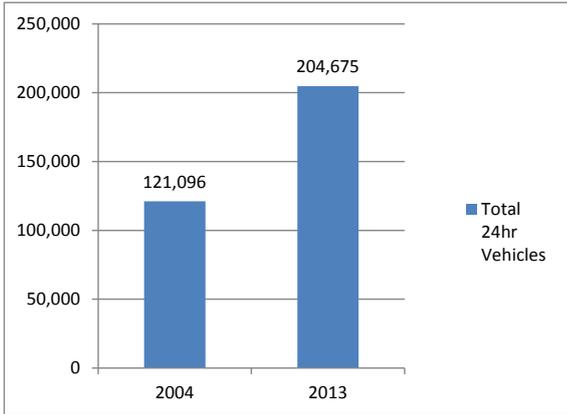
Figure A.3.7: Public Transport User Survey Form (2/2)

A3.3 Traffic Survey Results

A3.3.1 Cordon Line Survey

(1) Total Traffic Volume

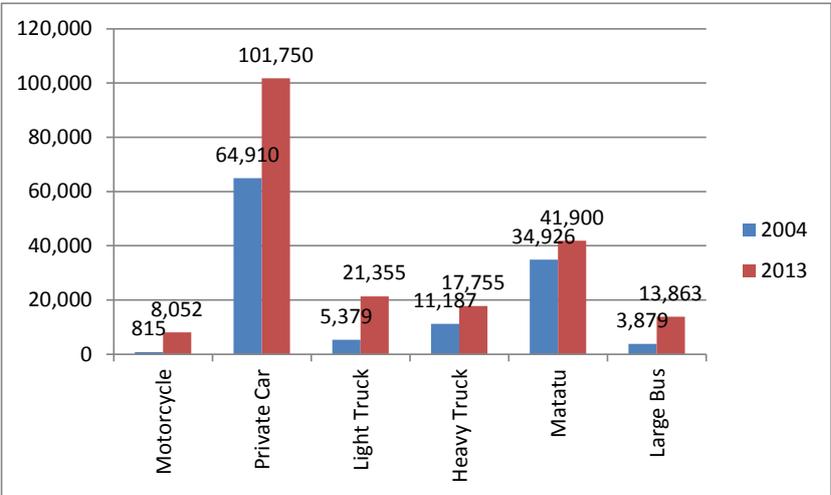
Along the boundary of Nairobi County, a cordon line survey was conducted at 14 points, of which 12 points were the same location as in the cordon line survey in 2004. Figure A.3.8 shows the comparison of 24 hour total traffic volume with the 2004 survey. The traffic volume increased 1.69 times, from 121,000 to 205,000.



Source: JICA Study Team
Figure A.3.8: Comparison of Cordon Line Traffic Volume Between 2004 and 2013

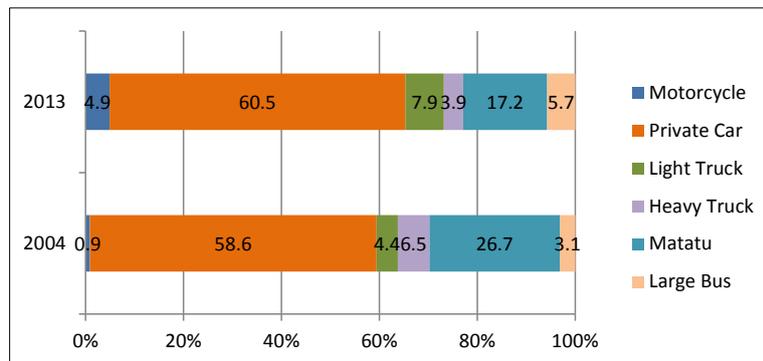
(2) Vehicle Type Composition

Figure A.3.9 shows the comparison of traffic volume by vehicle type in 2013 with that of 2004. Increase of private car has the largest proportion at 44% of the total increase of 84,000 vehicles. Regarding the increase ratio by vehicle type, the motorcycle category shows the largest increase rate of 9.9 times. Compared with large buses, the *matatu* did not increased much, owing to the government policy to shift to large bus and cheaper fare.



Source: JICA Study Team
Figure A.3.9: Comparison of Cordon Line Traffic Volume by Vehicle Type Between 2004 and 2013

The comparison of vehicle type composition in 2013 with that of 2004 is shown in Figure A.3.10. It is notable that the composition of the private mode such as motorcycles, private cars, and light trucks increased while public mode such as the matatu and large buses decreased.

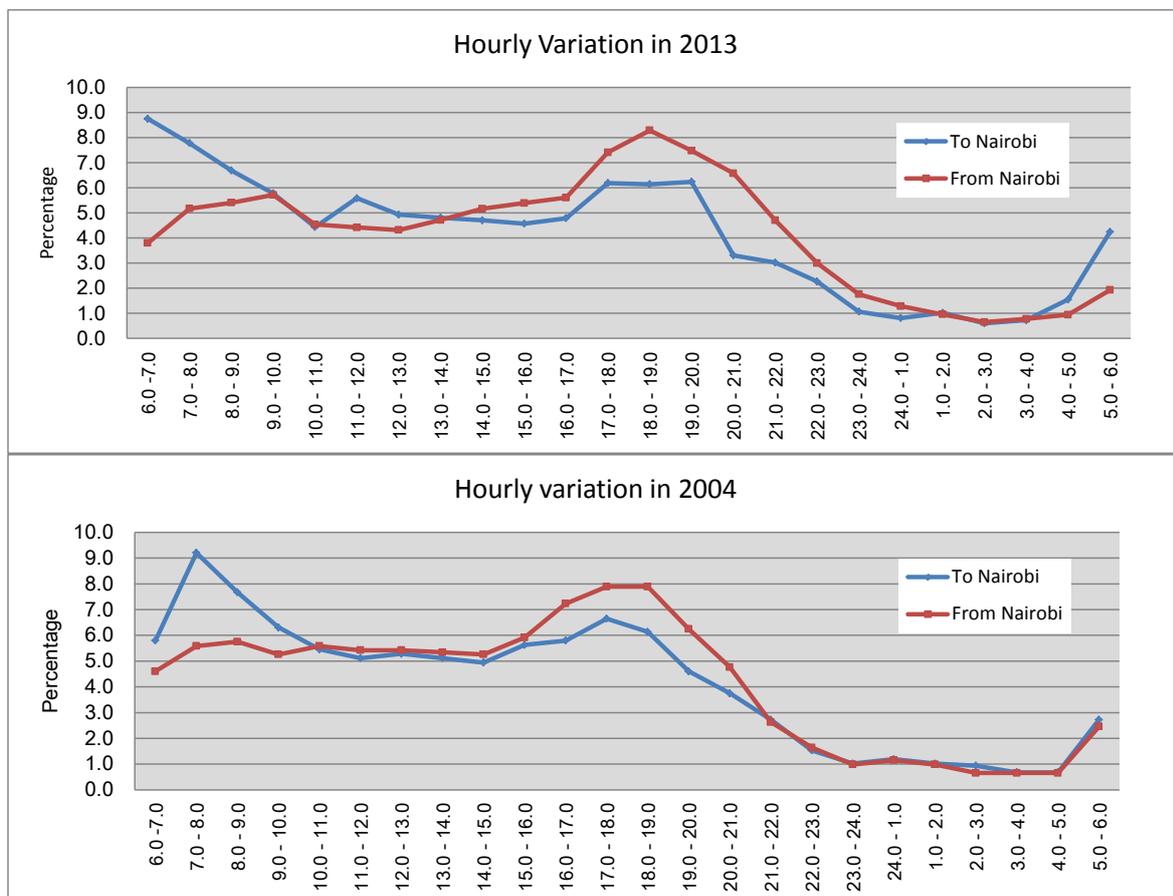


Source: JICA Study Team

Figure A.3.10: Comparison of Cordon Line Vehicle Type Composition Between 2004 and 2013

(3) Hourly Variation

Figure A.3.11 shows the hourly variation of total traffic inbound and outbound of Nairobi in 2013 and compares it with that of 2004. Evidently, morning peak hours of inbound traffic shifted to 6:00–7:00 from 7:00–8:00, and even from 5:00–6:00. The same tendency is observed in the evening peak hours. The concentration of outbound traffic continued from 20:00 to 21:00.



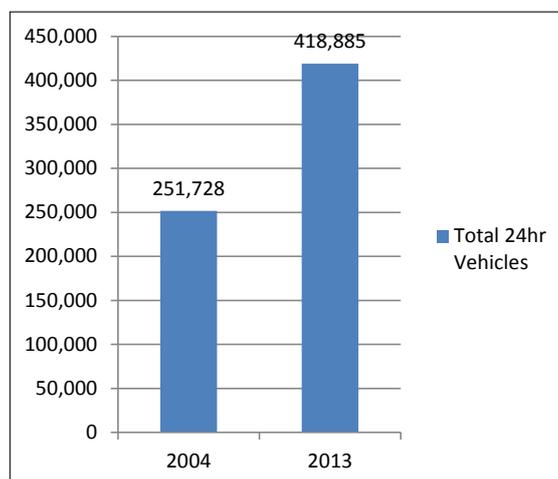
Source: JICA Study Team

Figure A.3.11: Comparison of Cordon Line Hourly Traffic Variation Between 2004 and 2013

A3.3.2 Screen Line Survey

(1) Total Traffic Volume

Screen line surveys were conducted around densely urbanized areas at 15 points. Figure A.3.12 shows the comparison of 24 hour total traffic volume in 2013 with that of 2004. The traffic volume increased 1.66 times, from 252,000 to 419,000. The rate of increase is similar to that of the cordon line survey.

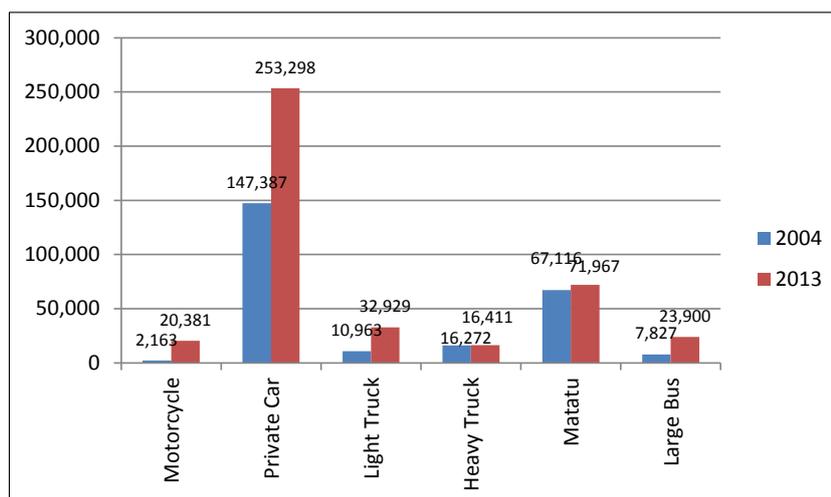


Source: JICA Study Team

Figure A.3.12: Comparison of Screen Line Traffic Volume Between 2004 and 2013

(2) Vehicle Type Composition

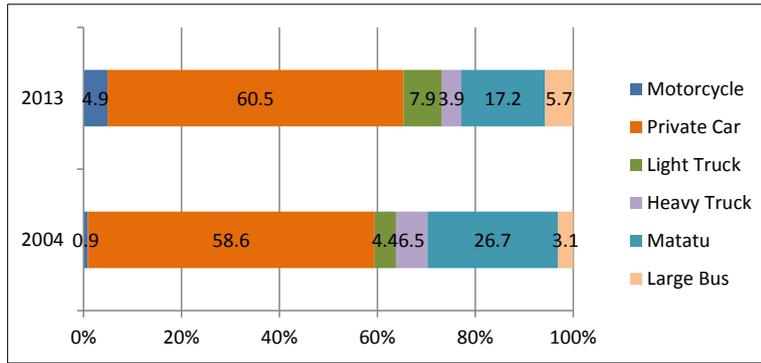
Figure A.3.13 shows the comparison of traffic volume by vehicle type in 2013 with that of 2004. The increase in private cars is 106,000, which occupies 63% of the total vehicle increase. Also, light trucks, motorcycles, and large buses increased by 22,000, 18,000, and 16,000, respectively.



Source: JICA Study Team

Figure A.3.13: Comparison of Screen Line Traffic Volume by Vehicle Type Between 2004 and 2013

The comparison of vehicle type composition in 2013 with that of 2004 is shown in Figure A.3.14. The same phenomenon observed in the cordon line is found, i.e., private mode such as motorcycles, private cars, and light trucks increased while the public mode such as the *matatu* and large buses decreased.

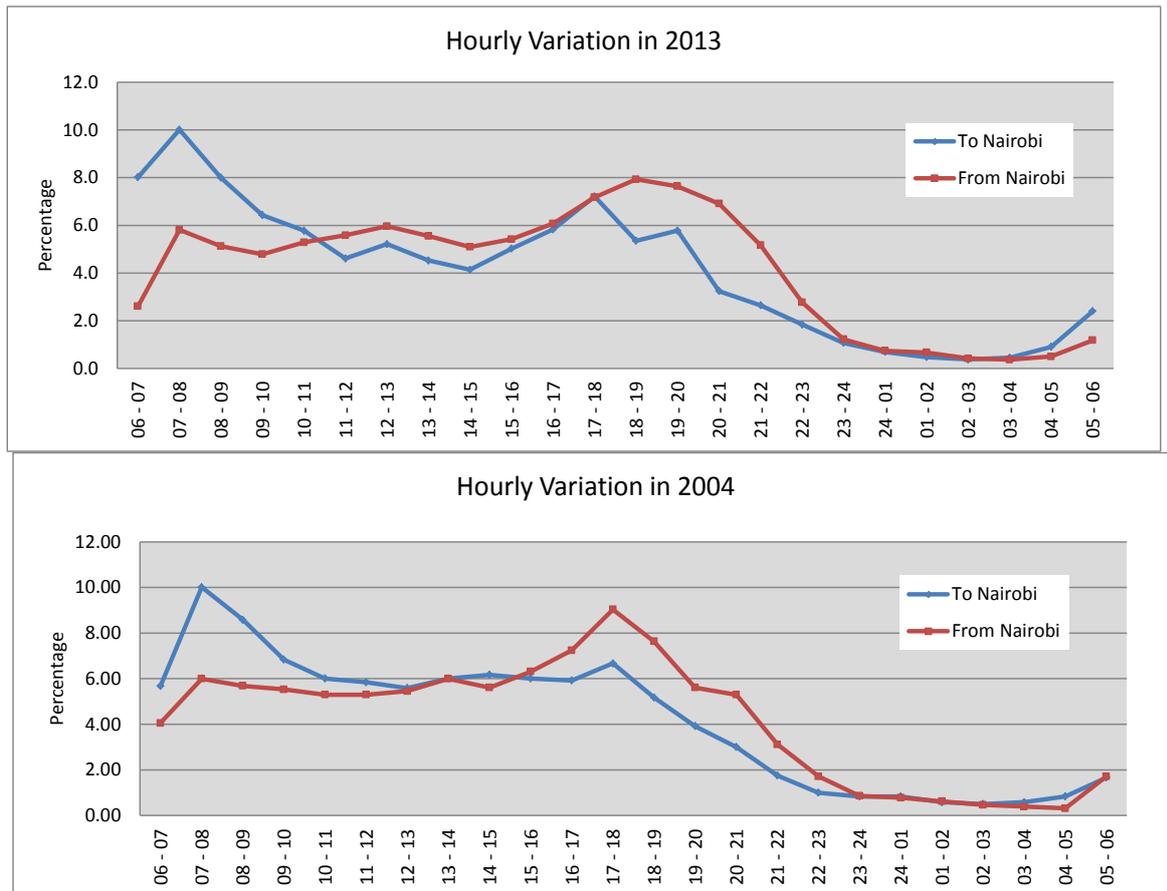


Source: JICA Study Team

Figure A.3.14: Comparison of Vehicle Type Composition Between 2004 and 2013

(3) Hourly Variation

Like the traffic variation at the cordon line, morning peak hours in 2013 appeared earlier compared in 2004. Likewise, evening peak hours extended longer, from 18:00 to 21:00. Like the traffic at the cordon line, congestion extended from morning and evening peak hours to throughout the day, except deep in the night.



Source: JICA Study Team

Figure A.3.15: Comparison of Screen Line Hourly Traffic Variation Between 2004 and 2013

A3.3.3 Traffic Count Survey

Figure A.3.16 shows the results of the roadside traffic count and screen line survey in 2013 and their comparison with those of the 2004 survey in the urban area of Nairobi.

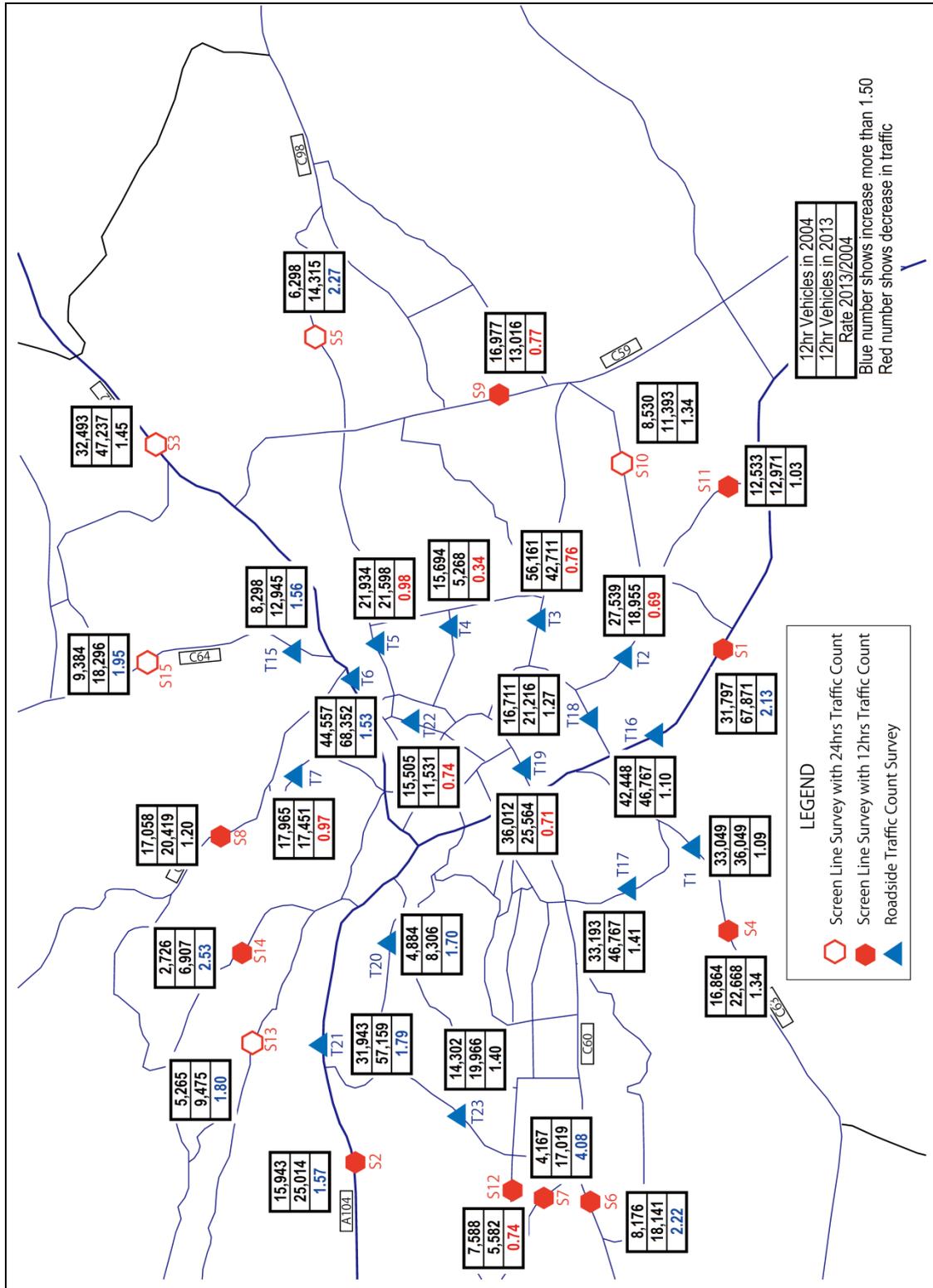


Figure A.3.16: Results of Traffic Count (12hr)

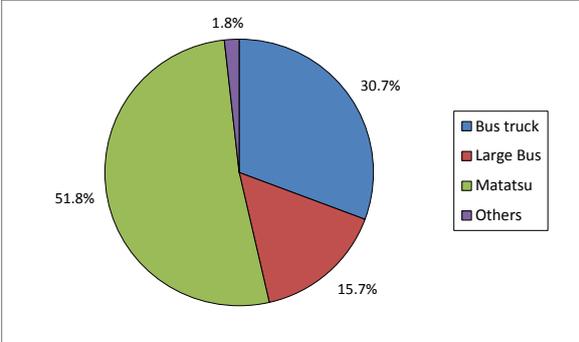
Source: JICA Study Team

At many points in the city centre and its peripheral area, the traffic volume in 2013 decreased from that in the 2004 survey. Since the traffic count was conducted along the major trunk road, it can be surmised that the total traffic volume did not decrease but vehicles dispersed into small minor roads and penetrated into residential or industrial roads due to the congestion on major trunk roads.

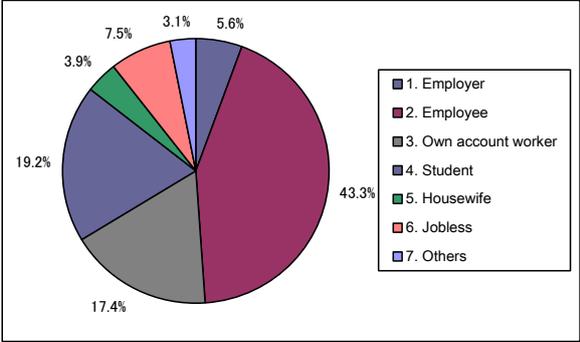
A3.3.4 Public Transport User Survey

(1) Type of Public Transport and Passenger’s Characteristics

About 3,700 bus and *matatu* passengers were interviewed at 15 terminals in the city centre. Amongst the 3,700 passengers, 2,500 were departing, and 1,400 were arriving. The type of public transport is shown in Figure A.3.17. *Matatu* passengers occupy more than half. Figure A.3.18 shows the occupation of passengers. Employer, employee, and own account workers occupy about two thirds of the passengers.



Source: JICA Study Team
Figure A.3.17: Type of Public Transport of Interviewed Bus and *Matatu* Passengers

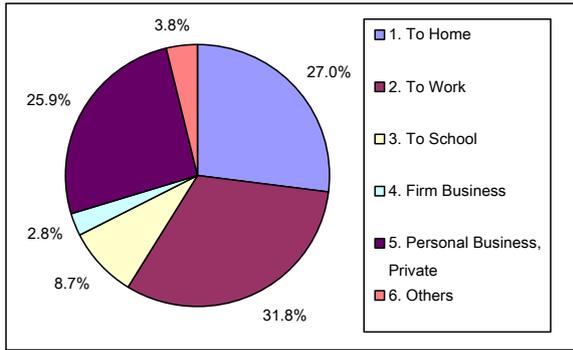


Source: JICA Study Team
Figure A.3.18: Occupation of Interviewed Bus and *Matatu* Passengers

(2) Trip Purpose and Access/Egress Mode

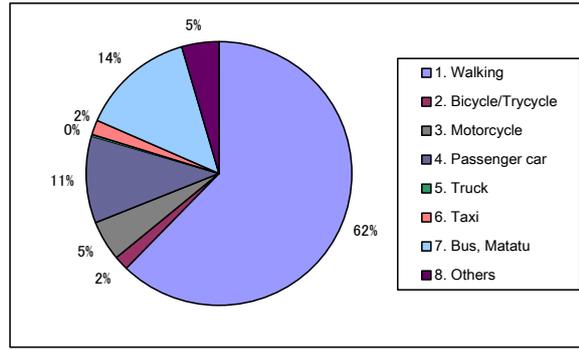
As shown in Figure A.3.19, three major trip purposes of public transport are “To home”, “To work” and “Personal business”.

The access and egress modes of public transport are shown in Figure A.3.20. Walking occupies the largest percentage for the access/egress mode of public transport. The second largest is buses and *matatus*, indicating that frequently connecting with other bus/*matatu* is necessary for one trip.



Source: JICA Study Team

Figure A.3.19: Trip Purpose of Interviewed Bus and Matatu Passengers



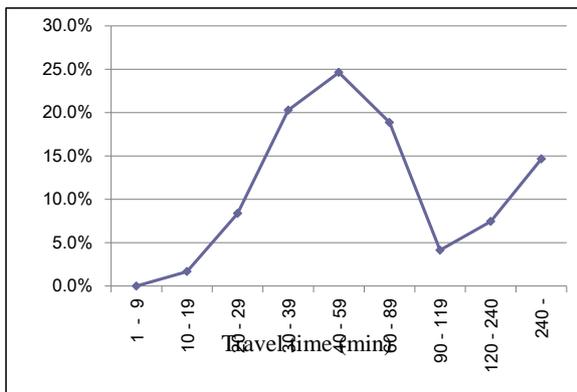
Source: JICA Study Team

Figure A.3.20: Access/Egress Mode of Bus and Matatu

(3) Travel Time and Fare

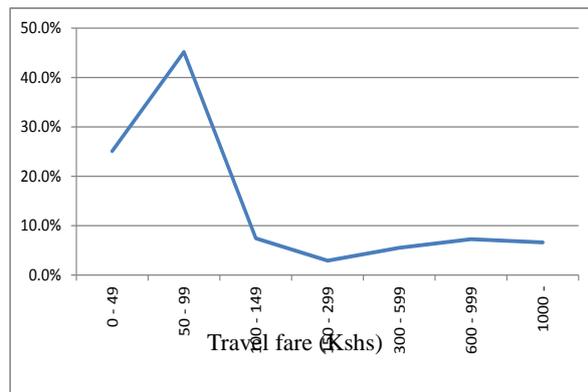
Figure A.3.21 shows the travel time frequency of bus and *matatu* passengers. About 65% of the passengers spend 30 to 90 min for their travel.

Figure A.3.22 shows the travel fare frequency of bus and *matatu* passengers. Around 70% of the passengers pay less than KSh100.



Source: JICA Study Team

Figure A.3.21: Travel Time Frequency of Bus and Matatu Passengers

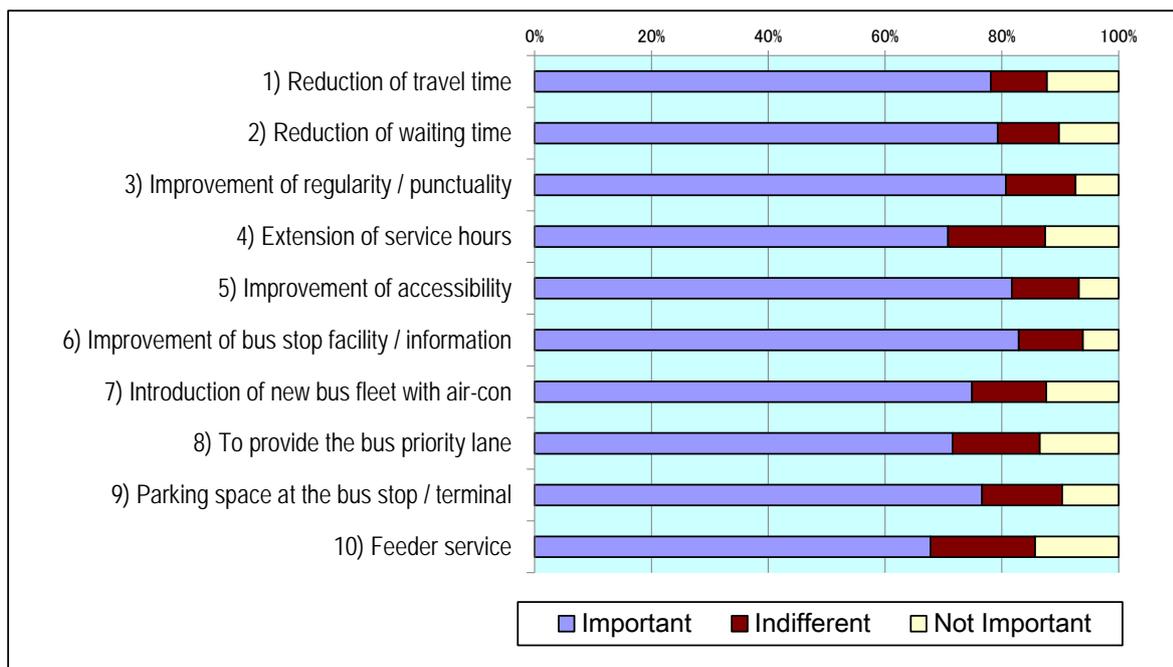


Source: JICA Study Team

Figure A.3.22: Travel Fare Frequency of Bus and Matatu Passengers

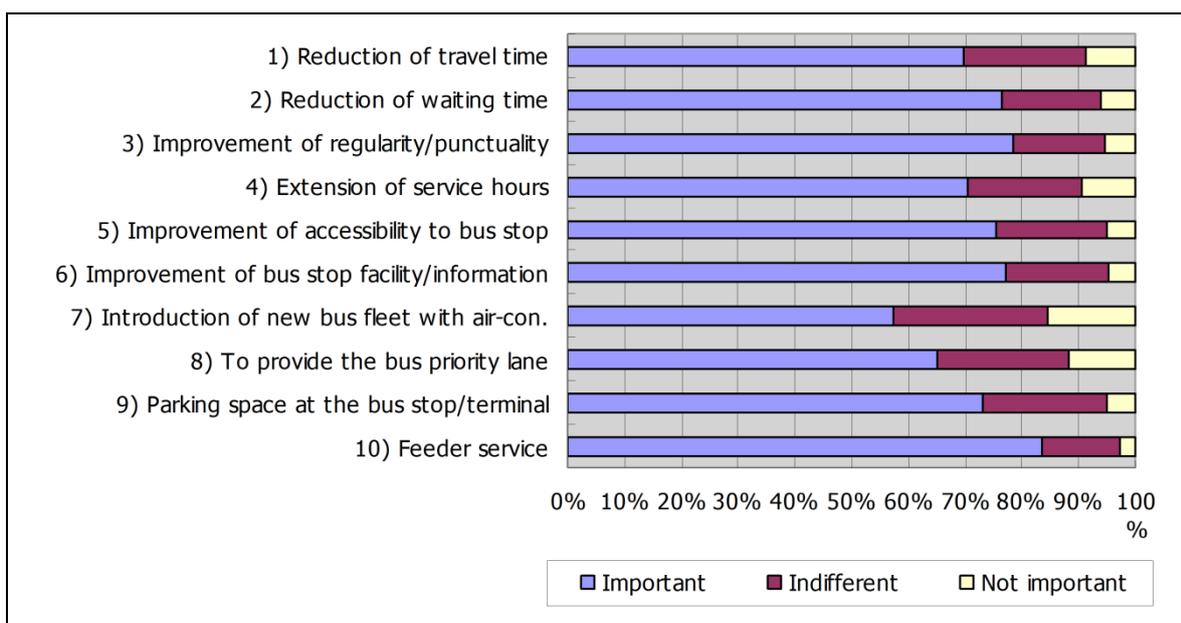
(4) Passenger's Opinion

During the interview, a question was made about the passenger's opinion and requirement on bus and *matatu* operation. The most important answer was the improvement of bus stop facility/information; the second was the improvement of accessibility; and the third was the improvement of regularity/punctuality. The same question was made in the 2004 public transport user survey. The answers at that time were: 1) feeder service, 2) improvement of regularity/punctuality, and 3) improvement of bus stop facility/information. Generally, the proportion of those that answered "important" increased in 2013.



Source: JICA Study Team

Figure A.3.23: Opinions for Improvement of Bus/Matatu Services in the 2013 Survey



Source: The Study on Master Plan for Urban Transport in the Nairobi Metropolitan Area in the Republic of Kenya, Final Report

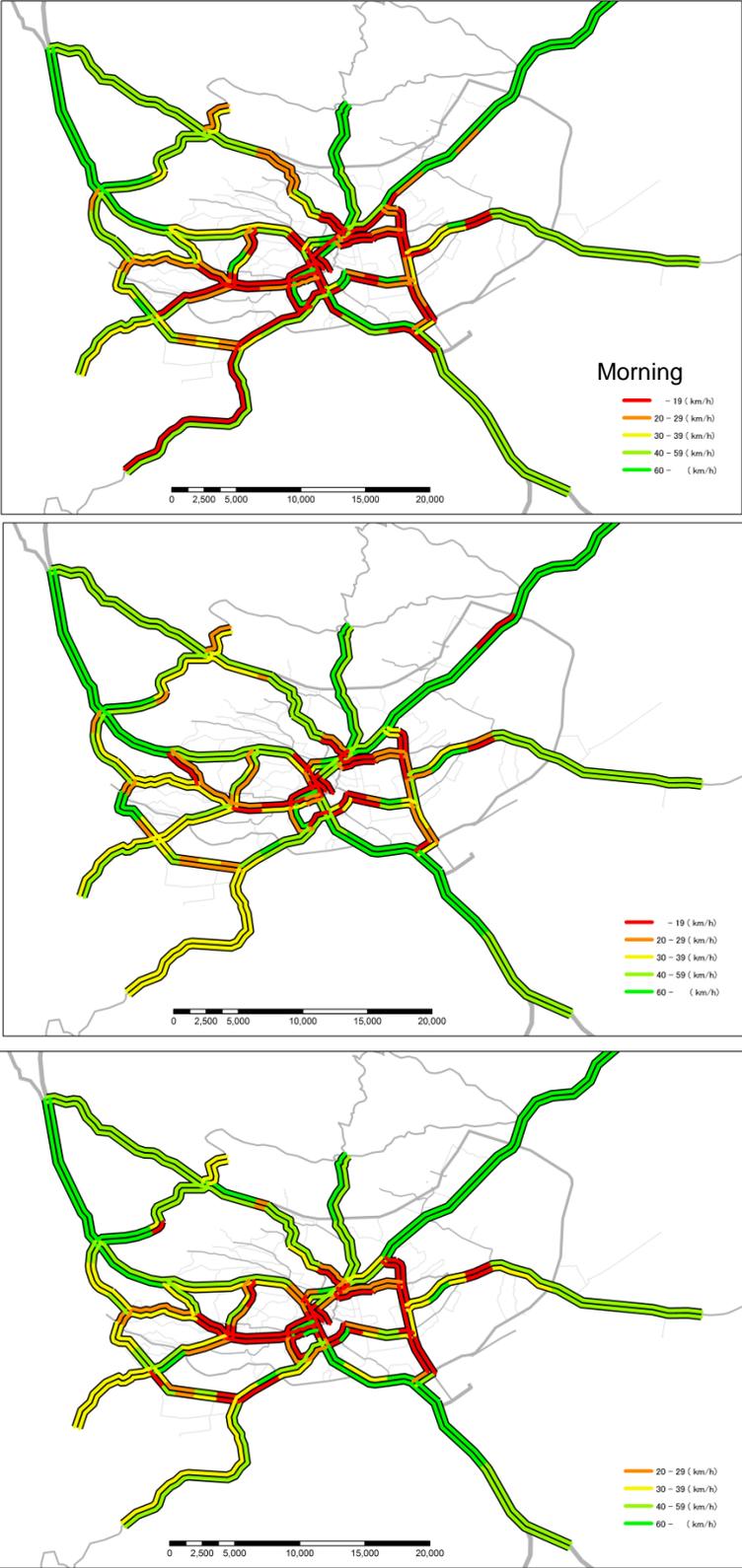
Figure A.3.24: Opinions for Improvement of Bus/Matatu Services in the 2004 Survey

A3.3.5 Travel Speed Survey

Travel speed surveys were conducted on 15 major trunk roads, three times a day, i.e., in the morning, daytime, and evening.

The roads which showed especially low speeds throughout the day were Kangundo Road, Outer Ring Road, Juja Road, Jogo Road, Kenyatta Avenue, and Haile Selassie Avenue-Ngong Road. Comparing

the north-south direction roads with the east-west direction roads, east-west roads are rather congested due to the east-west expansion of the city area.



Source: JICA Study Team

Figure A.3.25: Result of Travel Speed Survey

A3.4 Person Trip Survey

A3.4.1 Sampling

The number of sampled households according to the small zone system is shown in Table A.3.4. According to the 2009 population housing census, the total number of households in Nairobi was 985,016. Therefore, the sampling rate of a sample size of 10,000 households is 1.02%.

Table A.3.4: Number of Sampled Households for Person Trip Survey

Small Zone System					Small Zone System				
Zone Code	Sub-location	Households	Sample Households	PS Survey Sample	Zone Code	Sub-location	Households	Sample Household	PS Survey Sample
1	City center1, 2, 3	2,331	24	5	54	Moulem	7,250	74	15
2	City square1, 2, 3	35	0	0	55	Ruai	7,316	74	15
3	Pangani	9,343	95	19	56	Ngundu	2,532	26	5
4	Ziwani /Kariokor	2,618	27	5	57	Airbase	10,317	105	21
5	Mathare	6,617	67	13	58	Eastleigh North	9,408	96	19
6	Mabatini	9,809	100	20	59	Eastleigh South/Kiambio	21,433	218	44
7	Mlango Kubwa	15,000	152	30	60	California	6,662	68	14
8	Kia Maiko	10,217	104	21	61	Majengo /Gorofani /Bondeni /Gikomba	7,539	77	15
9	Huruma	23,800	242	48	62	Kimathi	6,989	71	14
10	Ngara East	5,067	51	10	63	Uhuru	6,450	65	13
11	Ngara West	2,682	27	5	64	Shauri Moyo	5,340	54	11
12	Makongeni	3,744	38	8	65	Kamukunji	113	1	0
13	Kaloleni	2,536	26	5	66	Muthurwa	1,304	13	3
14	Harambee	6,561	67	13	67	Upper parklands	1,934	20	4
15	Lumumba/Jericho	1,607	16	3	68	Spring Valley	1,378	14	3
16	Hamza	5,348	54	11	69	Loresho	5,907	60	12
17	Mbotela	3,304	34	7	70	Kyuna	2,130	22	4
18	Ofafa Maringo	4,727	48	10	71	Kitsuru	2,105	21	4
19	Landi Mawe	9,814	100	20	72	Muthaiga	3,225	33	7
20	Viwandani	17,926	182	36	73	Karura	4,721	48	10
21	Hazina	6,445	65	13	74	Highridge	8,075	82	16
22	Nairobi South	10,912	111	22	75	Gichagi	6,409	65	13
23	Kariobangi North	12,802	130	26	76	Mountain View	5,194	53	11
24	Korogocho	3,129	32	6	77	Kangemi	15,256	155	31
25	Gitathuru/Nyayo	9,780	99	20	78	Kilimani	7,419	75	15
26	Kiwanja	3,813	39	8	79	Kileleshwa	4,592	47	9
27	Kahawa West	6,074	62	12	80	Muthangari	3,151	32	6
28	Kongo Soweto	5,063	51	10	81	Maziwa	3,931	40	8
29	Kamuthi	1,190	12	2	82	Waithaka	6,491	66	13
30	Githrai	17,966	182	36	83	Kabiria	2,948	30	6
31	Zimmerman	10,309	105	21	84	Kirigu	3,694	38	8
32	Mathare 4A	5,627	57	11	85	Mutuini	1,760	18	4
33	Utalii	6,572	67	13	86	Ruthimitu	4,434	45	9
34	Ruaraka	18,651	189	38	87	Uthiru	5,434	55	11
35	Mathare North	18,450	187	37	88	Kawangwari	22,262	226	45
36	Royambu	9,002	91	18	89	Gatina	15,987	162	32
37	Njathaini	2,348	24	5	90	Riruta	20,245	206	41
38	Garden	3,653	37	7	91	Ngando	11,162	113	23
39	Mwiki	12,213	124	25	92	Kenyatta/Golf course	5,987	61	12
40	Kasarani	17,712	180	36	93	Woodley	3,414	35	7
41	Embakasi	19,815	201	40	94	Kibera /Makina	11,163	113	23
42	Mihang'o	6,167	63	13	95	Silanga /Lindi	17,715	180	36
43	Mukurukwa Njenga	49,198	497	100	96	Langata	2,866	29	6
44	Imara Daima	26,222	266	53	97	Hardy	2,568	26	5
45	Umoya	28,097	284	58	98	Karen	2,861	29	6
46	Savannah	23,516	239	48	99	Lenana	1,362	14	3
47	Kayole	45,672	463	94	100	Mugomoini	8,478	86	17
48	Komarock	8,039	82	16	101	Bomas	4,601	47	9
49	Njuru	7,496	76	15	102	Nairobi West	9,166	93	19
50	Mailli Saba (Saika)	7,945	81	16	103	South 'C'	13,759	140	28
51	Dandora 'A'	20,163	205	41	104	Laini Saba	9,927	101	20
52	Dandora 'B'	27,645	280	57	105	Nyayo Highrise	8,414	85	17
53	Kariobangi South	9,869	100	20	106	Gatwikira /Olympic	15,597	158	32
Total							985,016	10,000	2,000

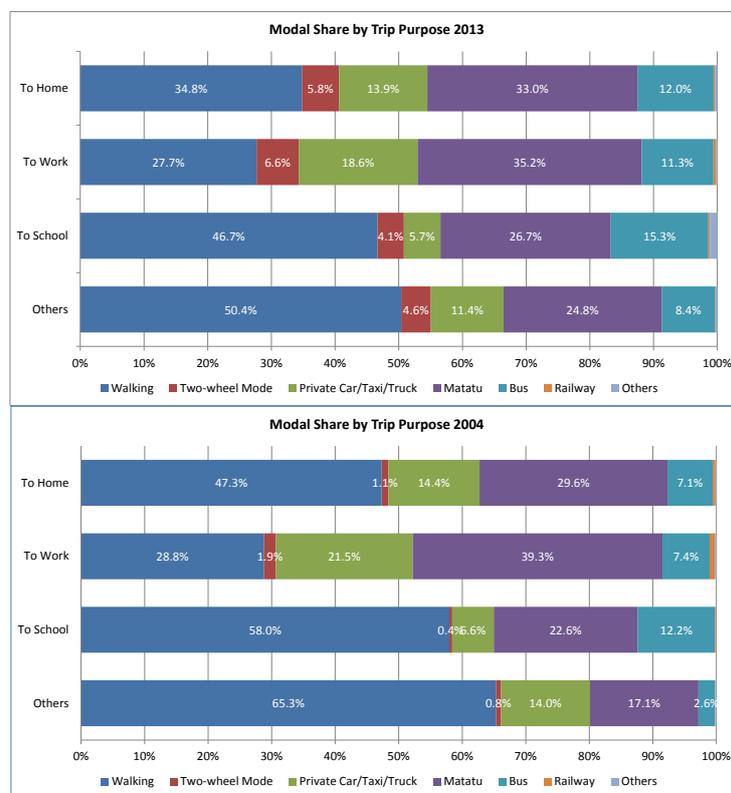
Source: JICA Study Team

A3.4.2 Survey Result

Since the person trip survey is a sample survey, collected data needs expansion considering the population. As the expansion is not completed at this stage, the data before expansion is shown hereafter.

(1) Travel Mode

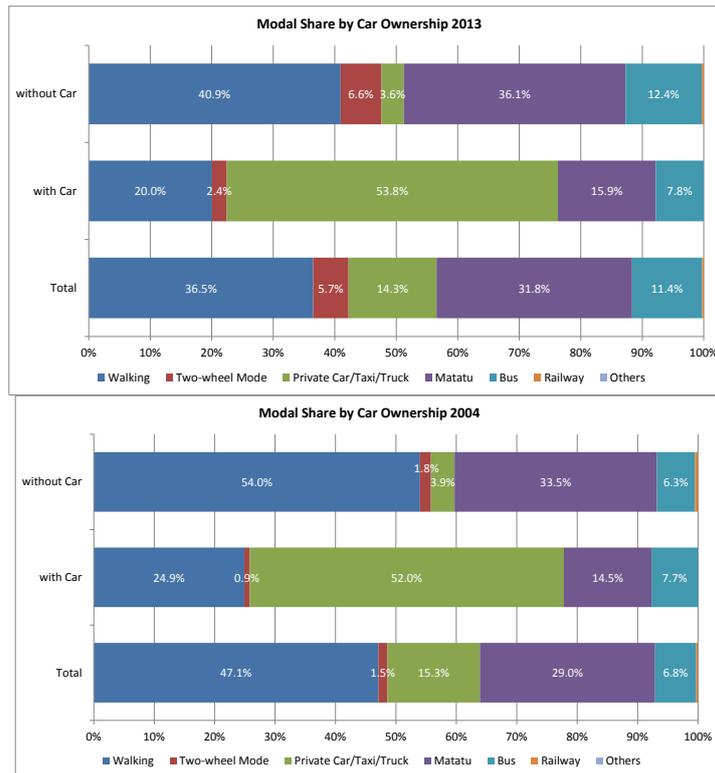
Figure A.3.26 shows the comparison of travel mode by trip purpose between 2004 and 2013. Generally, the percentage of walking decreased in every trip purpose. Regarding the trip purpose of “To work”, the percentage of private cars and *matatus* decreased and the two wheel modes and large buses replaced these two modes. As for the trip purpose of “To school”, the percentage of both *matatus* and large buses increased.



Source: JICA Study Team

Figure A.3.26: Comparison of Travel Mode by Trip Purpose Between 2004 Survey and 2013 Survey

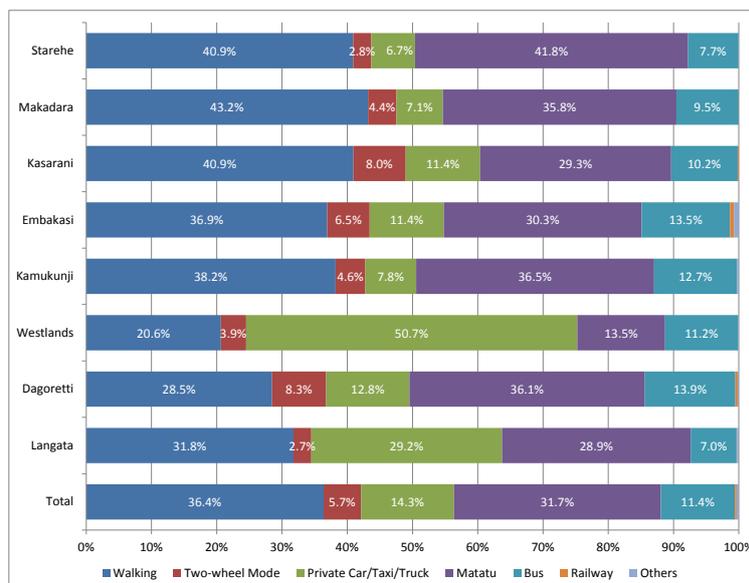
The use of cars has a strong relationship with car ownership. Figure A.3.27 shows the modal share of car owners and non-car owners in 2013 in comparison with that of 2004. The dependency on the cars of the car owners increased from 2004. For the non-car owners, the modal shares of the two wheel mode, *matatus* and large buses are increasing. It is anticipated that the use of the two wheel mode such as motorcycles will increase more in the near future.



Source: JICA Study Team

Figure A.3.27: Comparison of Travel Mode by Car Ownership Between 2004 and 2013

The modal share of the residential areas according to the large zone system is shown in Figure A.3.28. Large differences are observed amongst large zones, especially in the use of private cars. One of the causes is the difference in income level and another cause is the service level of public transport. A high percentage of car use in Westlands can be explained from both aspects.

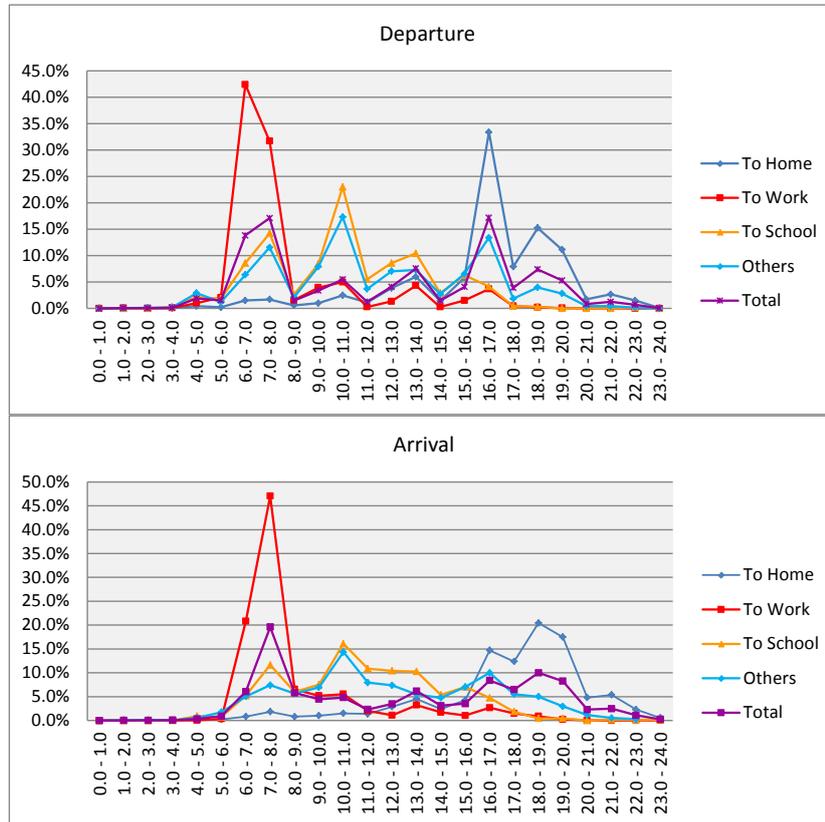


Source: JICA Study Team

Figure A.3.28: Comparison of Travel Mode by Large Zones

(2) Hourly Variation

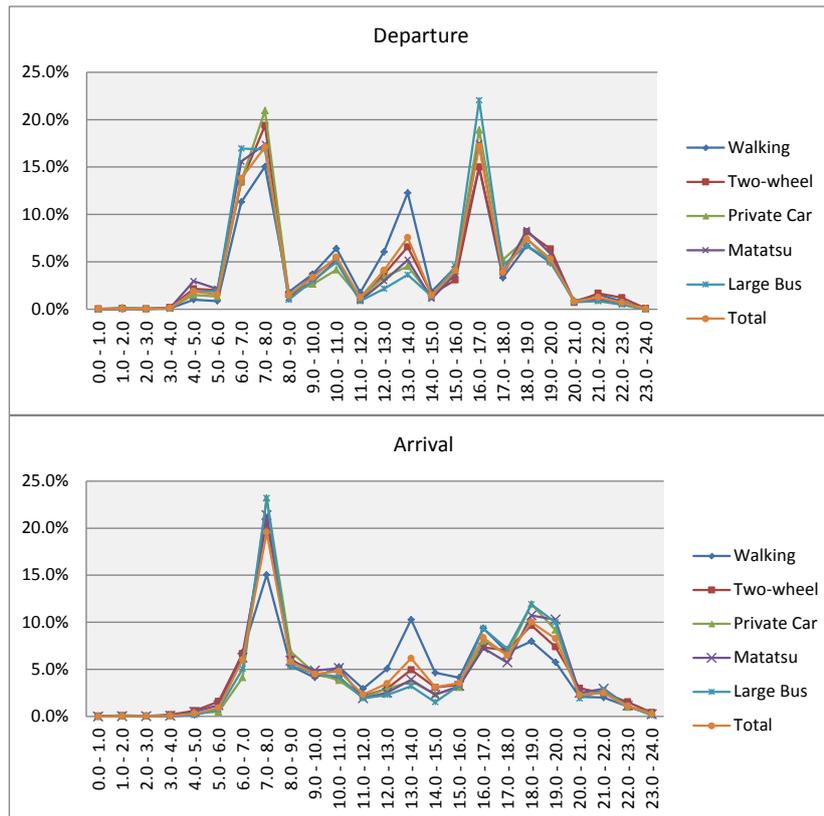
Figure A.3.29 shows the hourly variation of trip generation and attraction by trip purpose. Except for “To work” and “To Home” trip purposes, a high concentration in peak hours is not observed. But as for “To work”, more than 40% of trip generation is concentrated during 6:00–7:00, and more than 45% of trip attraction is concentrated during 7:00–8:00. Generally, it is said that staggered working hours is one of the measures to alleviate peak hour congestion.



Source: JICA Study Team

Figure A.3.29: Hourly Variation of Trip Generation and Attraction by Trip Purpose

Figure A.3.30 shows the hourly variation of trip generation and attraction by travel mode. The difference in hourly variation between travel modes is not observed. The hourly movement of person trip is primarily influenced by trip purpose. Therefore, the hourly distribution shows similar variation in every travel mode.

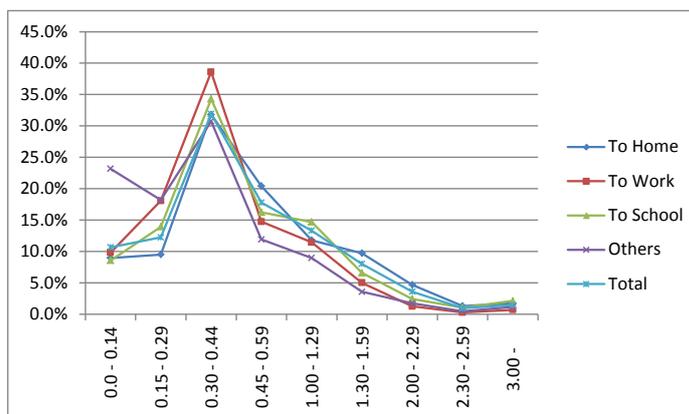


Source: JICA Study Team

Figure A.3.30: Hourly Variation of Trip Generation and Attraction by Travel Mode

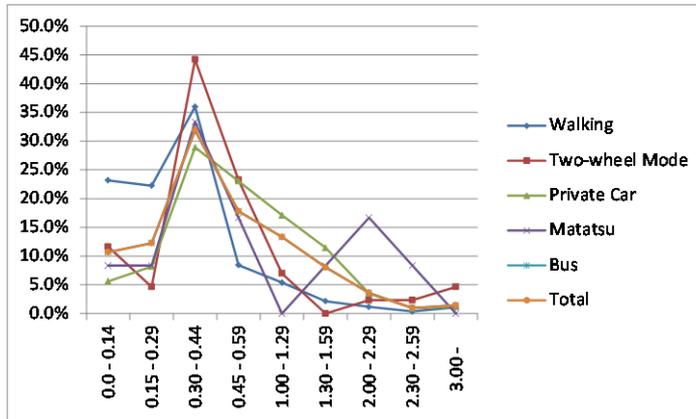
(3) Travel Time

Travel time distribution by trip purpose shows similar variation in every trip purpose with the highest frequency at 30 to 44 min. On the other hand, travel time distribution by travel mode shows some difference between travel modes. Walking takes shorter time, while private cars and *matatus* take longer time.



Source: JICA Study Team

Figure A.3.31: Travel Time Distribution by Trip Purpose

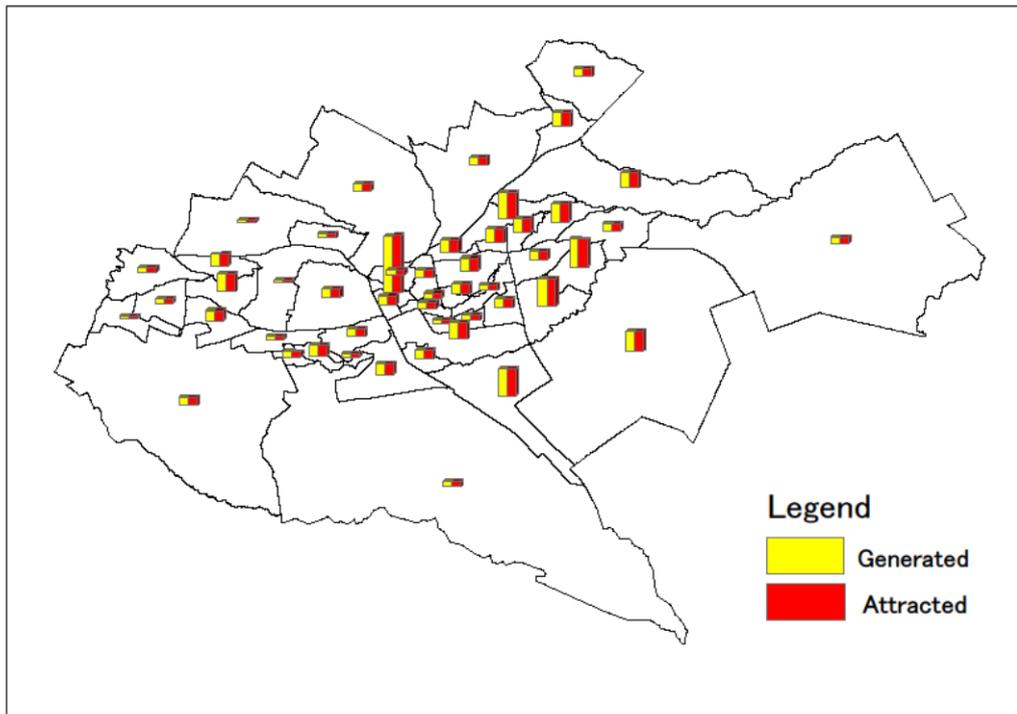


Source: JICA Study Team

Figure A.3.32: Travel Time Distribution by Travel Mode

(4) Trip Production

The total trips generated and attracted by zone are shown in Figure A.3.33.



Source: JICA Study Team (JST)

Figure A.3.33: Total Trips Generated and Attracted in 2013

APPENDIX 4: FORMULATION OF FUTURE TRANSPORT DEMAND

A4.1 Methodology

A4.1.1 General

Creating a transportation network is important in delineating the urban structure function as the base of urban development and growth. In parallel with transportation planning, clarifying the necessity for an improvement of the transportation facility is required. Therefore, it is important to forecast the future transport demand and to provide transportation facilities responding to it. Investment on appropriate transportation facilities will be discussed in this study.

A widely practiced method in transport demand forecasting is the four-step method. This study will also forecast the future transport demand based on the four-step method. The method has four processes, namely: i) trip generation and attraction, ii) trip distribution, iii) modal split, and iv) trip assignment. The advantage and characteristics of the four-step method are shown below. Moreover, the flow and outline of the four-step method are shown in Figure A4.1.1.

Advantages and Characteristics

- Although the process flow is very simple, various calculations can be incorporated at each step.
- It is used for transport demand forecasting in various situations, and it is the most recognised method.
- The data from person trip survey can be used in most of the processes.
- Five steps including an added step of trip production forecast may be considered.

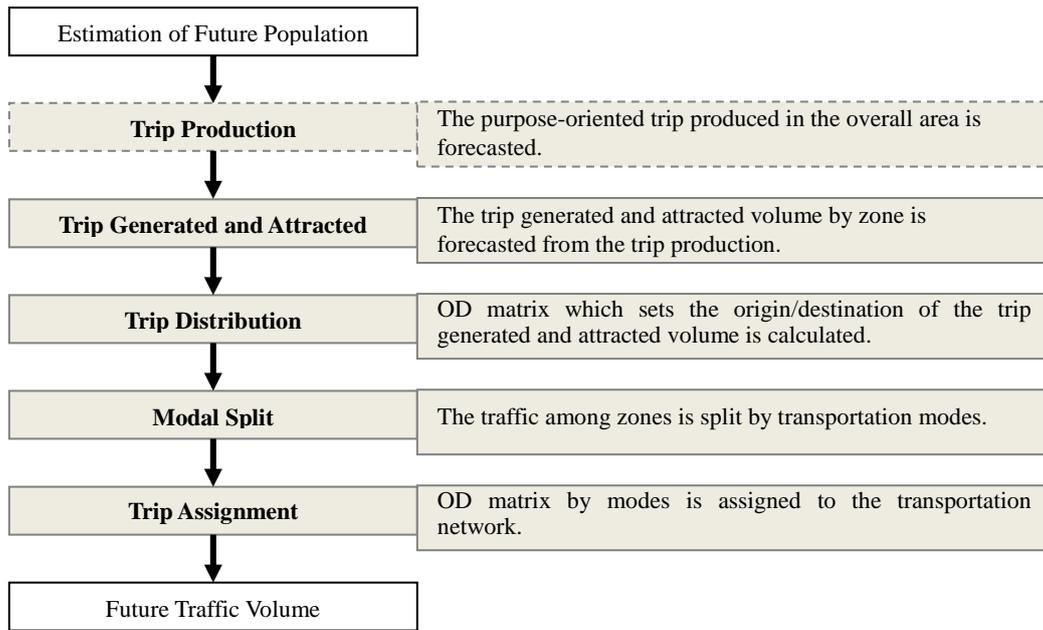


Figure A4.1.1 Flow of Four-Step Method

A4.1.2 Classifications

(1) Target Area and Zoning

The forecasting target area consists of Nairobi City and its surrounding area as Greater Nairobi, and is split into 15 large zones, 74 medium zones, and 150 small zone areas. Nairobi City is split into 106 small zones, 49 medium zones, and 8 large zones. In the future demand forecast, target area is mainly the Nairobi City area, but some of its peripheral area is also taken into consideration to reflect the movement of traffic from the outside area. The latter case will be referred to as Greater Nairobi hereinafter, as opposed to the former case of Nairobi City. The number of zone splits is shown in Table A4.1.1. The person trip survey was conducted in Nairobi City, and it illustrated the trip of those who live in Nairobi City. Therefore, the primary object of transport demand forecasting is for the Nairobi City area.

In transport demand forecasting, the transportation network based on the characteristics of the zone (including the population, workers, students, etc.) is used. In the model development of transport demand forecasting, zone setting is an important factor for analysis. Although a target area is split into 150 small zones, as sometimes the small zone of a person trip survey may have only few samples, it tends to produce a variation in the zone characteristics. By grouping into 74 medium zones, the characteristic becomes more stable. In the transport demand forecasting, medium zones will be mainly used in order to obtain statistically stable performance of the forecast.

Table A4.1.1 Number of Zone Splits for Forecasting

Area	Zone		
	Small	Medium	Large
Nairobi City	106	49	8
Outside Nairobi	44	25	7
Total	150	74	15

Source: JICA Study Team (JST)

(2) Trip Purpose

Trip purpose of person trips is classified into four main trip purposes, grouped from the eight categories of the person trip survey as shown in Table A4.1.2. These trip purposes will achieve association of each characteristic at each step of transport demand forecasting in the future.

Table A 4.1.2: Trip Purpose Category

In Person Trip Survey		In Demand Forecasting	
1	To Home	1	Home
2	To Work	2	Work
3	To School	3	School
4	Personal Business	4	Others
5	Firm Business		
6	Social		
7	Shopping		
8	Others		

Source: JICA Study Team (JST)

(3) Travel Mode

The travel mode of person trips is classified into three main travel modes, grouped from 13 categories of the person trip survey as shown in Table A4.1.3. By grouping, it is easy to capture the characteristic and the number of samples for each classification is obtained. The accuracy of prediction in the forecast of modal split will increase.

Table A4.1.3: Trip Mode Category

In Person Trip Survey		In Demand Forecasting	
1	Walking	1	Walk
2	Bicycle		
3	Tricycle		
4	Motorcycle		
13	Others		
5	Passenger Car	2	Private
6	Truck		
7	Trailer		
8	Taxi		
9	Matatu	3	Public
10	Bus		
11	Metro Shuttle		
12	Railway		

Source: JICA Study Team (JST)

A4.1.3 Forecasting

(1) Forecasting System

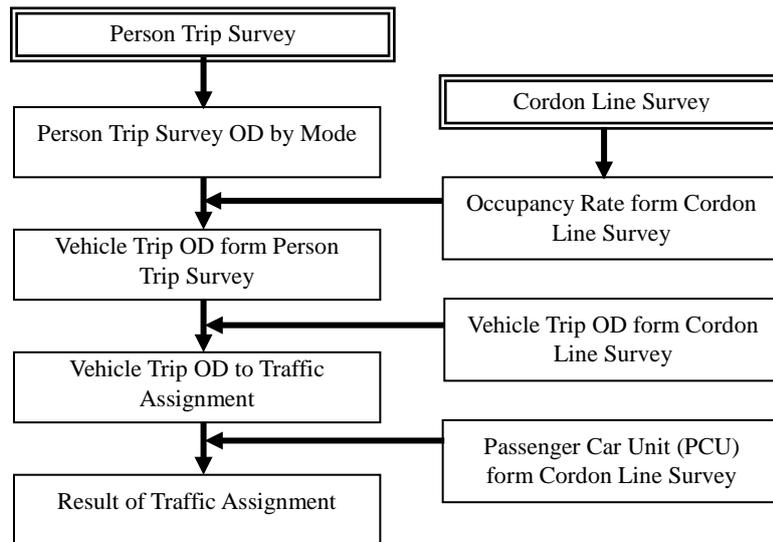
The JICA STRADA and spreadsheet are used in the calculation step of the model development and transport demand forecasting. JICA STRADA is a transport demand forecasting software. This software is capable of assigning future traffic volumes and showing the results visually. Then, Excel spreadsheet is used in the process in which traffic is assigned based on the person trip survey data. The traffic assignment method is the user equilibrium assignment method, which is also widely practiced.

(2) Transportation Network

The traffic assignment aims at evaluating the macro transportation network of an urban scale. The transportation network follows the various road levels, i.e., rural road classes S (Super Highway), A (Major Arterial), H (Major Arterial: Highway), B (Minor Arterial), J (Minor Arterial: Principal Arterial), and K (Major Collector: Primary Distributor) levels. The roads lower than class K are basically minor collector roads and are not used in the road network. In order to enforce vehicle assignment, the road network was prepared using JICA STRADA. There are 1,965 links, 1,380 nodes, and 150 zones.

(3) Present Vehicle Assignment

Present vehicle assignment builds the origin and destination (OD) table in 2013 by major travel mode from the person trip survey result, and builds the vehicle trip OD which constitutes a base using the occupancy rate from the cordon line survey. The person trip survey calibrated this vehicle trip OD using the result of cordon line survey, for generating and attracting only in the target area. The flow of the vehicle assignment calculation is shown in Figure A4.1.2. The occupancy rate and passenger car unit based on cordon line survey are shown in Table A4.1.4. The road capacity of each category is shown in Table A4.1.5.



Source: JICA Study Team (JST)

Figure A4.1.2: Traffic Assignment Flow

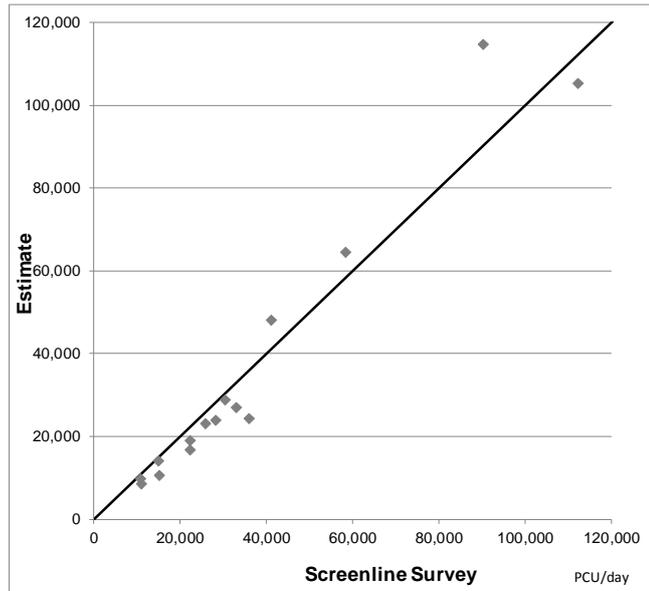
Table A4.1.4: Occupancy Rate and Passenger Car Unit

Year	Auto Occupancy Rate		Passenger Car Unit (PCU)		
	Private	Public (Bus)	Private	Public (Bus)	Truck
2004*	1.70	19.00	1.15	1.60	3.00
2013	1.96	16.14	1.10	1.74	3.00

Note: PCU: Passenger Car=1.0, Matatu=1.5, Light Truck=1.5

Source: JICA Study Team (JST), * Reference: 2006 survey (NUTRANS)

The volume of vehicle trip is forecasted by JICA STRADA's user equilibrium assignment model to the present road network using vehicle trip OD matrix in 2013. The result of the vehicle assignment is shown in Figure A4.1.4. Comparison with present estimate and screen line survey observed is shown in Figure A4.1.3. The r-squared by PCU is 0.973 in this correlation. Reproducibility is obtained mostly.



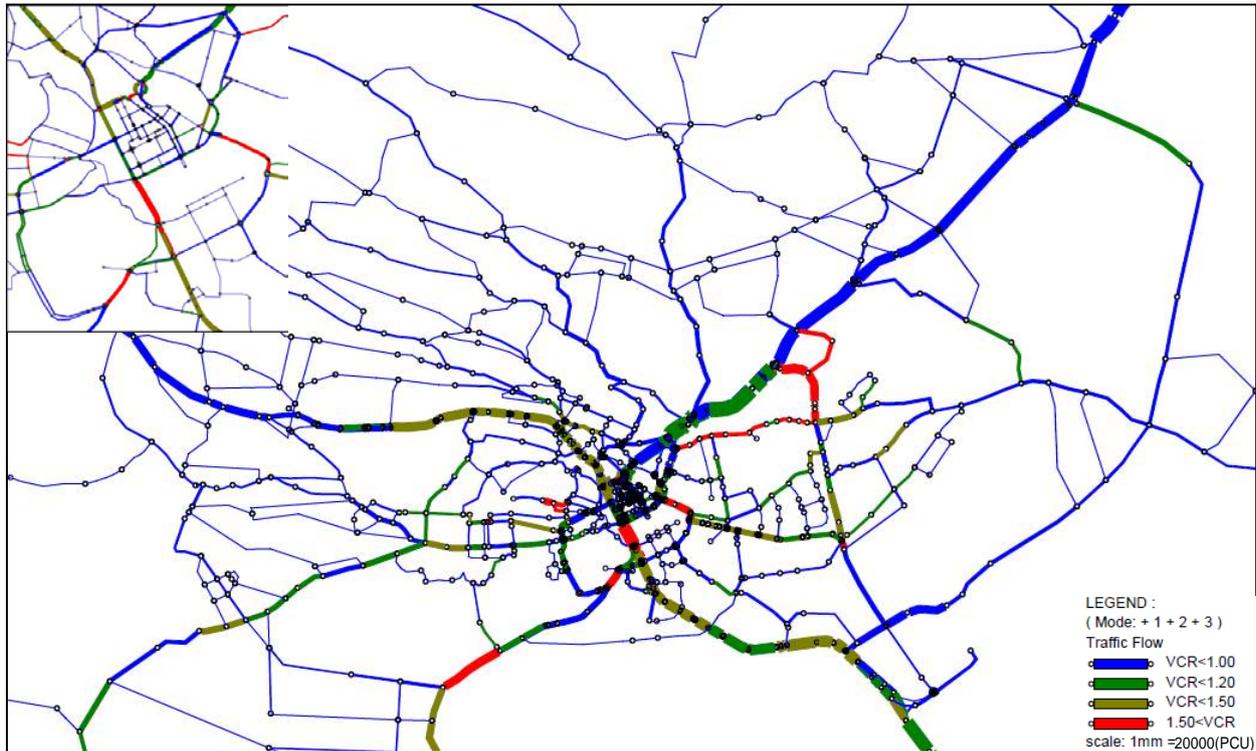
Source: JICA Study Team (JST)

Figure A4.1.3: Comparison with Estimate and Observed

Table A4.1.5: Free Flow Speed and Capacity by Road Class

No.	Rank	Divide	Location	Surface	Lane	Speed	Capacity
1	S, A, B, C, H : Trunk, Major Arterial	Divided	Suburban and Rural	Pavement	8	80	120,000
2			Suburban and Rural	Pavement	6	80	90,000
3			Urban	Pavement	6	60	75,000
4			Suburban and Rural	Pavement	4	60	60,000
5		Undivided	Urban	Pavement	4	50	50,000
6			Suburban and Rural	Pavement	4	45	50,000
7			Suburban and Rural	Pavement	2	40	25,000
8			Urban	Un-pavement	2	20	15,000
9	J, K: Minor Arterial, Major Collector	Divided	Urban	Pavement	6	50	60,000
10			Urban	Pavement	4	45	40,000
11		Undivided	Suburban and Rural	Pavement	4	40	35,000
12			Suburban and Rural	Pavement	2	35	15,000
13		Non-center	Suburban and Rural	Pavement	2	30	10,000
14			Urban	Un-pavement	2	20	10,000
21	Other:	Ramp	--	Pavement	2	30	20,000
22			--	Pavement	1	30	10,000
23		Roundabout	--	Pavement	4	30	60,000
24			--	Pavement	3	30	45,000
25			--	Pavement	2	30	30,000
26			--	Pavement	1	30	15,000

Source: JICA Study Team (JST)



Source: JICA Study Team (JST)

Figure A4.1.4: Vehicle Assignment Result in “Existing Case” (2013)

A4.2 Trip Production Forecasting

A4.2.1 General

The trip production forecasting is the first major step in the traffic demand forecasting process. In this step, the total trip volume per day in the Greater Nairobi area will be forecasted. The personal characteristics, such as employment conditions, trip purpose, etc., are taken into consideration by the trip production forecasting model.

A4.2.2 Modeling Trip Rate

The trip production forecast is dependent on the trip rate which is the volume of trips per person per day. The per capita trip generated will be calculated as the trip rate, and the total trip production for all the population in the Greater Nairobi area will be forecasted. This trip rate is calculated by each trip purpose. The per capita trip rate is obtained from the result of person trip survey, and the characteristic is different with employment classifications. The trip rate based on the person trip survey result is shown in Table A4.2.1. The trip rate of an employee is the highest with a total of 2.3370 trips per day, and the car owner is higher than the non-car owner. It is thought that an unemployed (1.5684 trips per day) has a low trip rate, and has little movement. Although the trip rate is decreasing as a whole compared with the survey in 2004, the difference amongst the employment classifications is becoming little.

Table A4.2.1: Trip Rate per Person by Classification

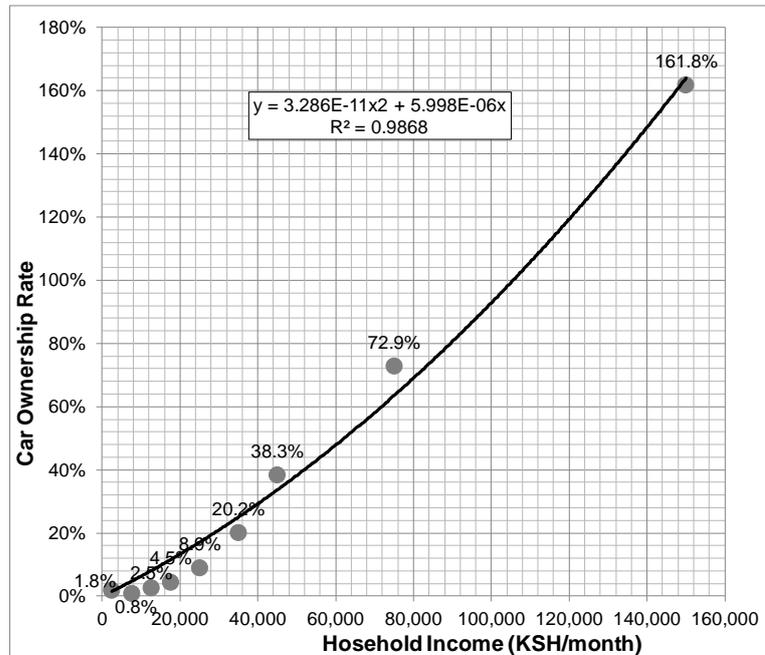
			Trip Purpose (Trip per Person per Day)					
			Home	Work	School	Others	Invalid	Total
2004*	Total	Employee	1.1745	0.9184	0.0246	0.4507	--	2.5682
		Student	1.0769	0.0471	0.8193	0.2824	--	2.2257
		Unemployed	0.6430	0.1878	0.0230	0.5067	--	1.3605
		Total	1.0455	0.5622	0.2201	0.4191	--	2.2469
2013	Car owner	Employee	0.9733	0.9194	0.0287	0.4383	0.0003	2.3600
		Student	0.9979	0.0248	0.9482	0.1479	0.0000	2.1188
		Unemployed	0.5404	0.0365	0.0532	0.5354	0.0000	1.1655
		Invalid	0.6664	0.1794	0.0861	0.4171	0.0000	1.3490
		Total	0.9403	0.6002	0.2756	0.3692	0.0002	2.1856
	Non-car owner	Employee	0.9990	0.9108	0.0256	0.3944	0.0002	2.3300
		Student	1.0304	0.0132	0.9561	0.1385	0.0003	2.1384
		Unemployed	0.7862	0.0488	0.0468	0.7662	0.0000	1.6480
		Invalid	0.9228	0.4795	0.0781	0.4479	0.0000	1.9283
		Total	0.9817	0.5452	0.2960	0.3660	0.0002	2.1891
	Total	Employee	0.9930	0.9128	0.0263	0.4046	0.0003	2.3370
		Student	1.0237	0.0156	0.9545	0.1404	0.0002	2.1344
		Unemployed	0.7457	0.0468	0.0479	0.7281	0.0000	1.5684
		Invalid	0.8742	0.4227	0.0796	0.4421	0.0000	1.8186
		Total	0.9727	0.5571	0.2916	0.3667	0.0002	2.1884

Note: Gross value including those who do not go out.

Source: JICA Study Team (JST), * Reference: 2006 survey (NUTRANS)

A4.2.3 Future Framework and Trip Rate

The future socioeconomic prediction is presented in Chapter 2 of the main report. The outline of the framework of the Greater Nairobi area is summarised in Table A4.2.2. The growth of household income is established by the growth of GRDP per household of Nairobi. The car ownership rate per household was forecasted by the car ownership rate against household income in the person trip survey shown in Figure A4.2.1. It shows the correlation equation between household income and car ownership rate. Car ownership increases according to the income per household. In the future, as the income per household also



Source: JICA Study Team (JST)

Figure A4.2.1: Model of Car Ownership Rate per Household

increases based on this model, it will be expected that the car ownership per household will be double to 58.6% in 2030 from 29.9% in 2013.

Table A4.2.2: Future Framework

		2013	2018	2023	2030	Remark
a	GRDP per Capita (Nairobi) (at 2011 constant Price: KSh)	240,005 (1.000)	294,637 (1.228)	365,247 (1.522)	500,200 (2.084)	
b	GRDP per Household (Nairobi) (at 2011 constant Price: KSh)	748,816 (1.000)	901,589 (1.204)	1,092,089 (1.458)	1,445,578 (1.930)	
c	Household Size: (Person per Household)	3.12	3.06	2.99	2.89	
d	Population: (Person)	3,601,351	4,174,952	4,677,671	5,212,500	
e	Number of Household	1,154,279	1,364,364	1,564,439	1,803,633	
f	Average Household Income: (KSh)	36,540	44,000	53,300	70,500	
g	Car Ownership Rate per Household	29.9%	32.8%	41.3%	58.6%	$y = 3.286E-11x^2 + 5.998E-06x$
h	Number of Private Car	345,685	447,500	646,100	1,056,900	
i	Population, Age 5 & Above: (Person)	3,141,928	3,642,920	4,082,148	4,549,696	
j	Student at Residence Base: (Person)	953,813	1,190,009	1,427,494	1,737,357	
k	Worker at Residence Base: (Person)	1,647,869	1,950,933	2,230,666	2,554,768	
l	Student at Enrolment Base: (Person)	953,813	1,190,009	1,427,494	1,737,357	= j
m	Worker at Work Place Base: (Person)	1,812,869	2,146,279	2,454,021	2,810,575	
n	Unemployed: (Person)	540,245	501,978	423,987	257,571	= i - j - k

Source: JICA Study Team (JST)

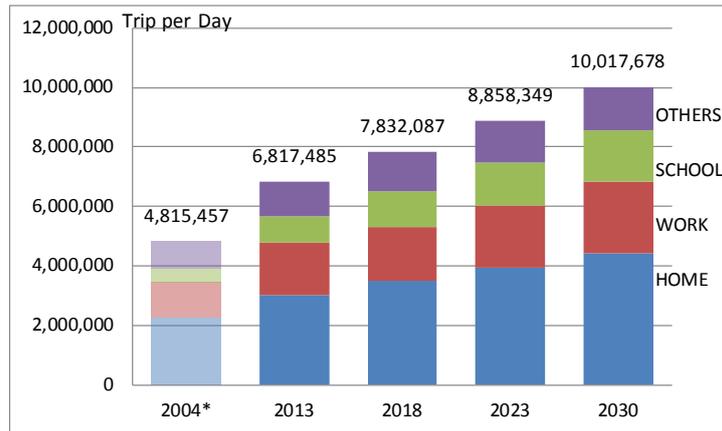
A4.2.4 Future Total Trip Production

The growth of the trip production of the Greater Nairobi area to 10.0 million trips per day in 2030 based on the future framework of the trip rate is shown in Table A4.2.3 and Figure A4.2.2. It will be about 1.5 times the 6.8 million trips per person in 2013.

Table A4.2.3: Future Total Trip Production by Trip Purpose

Target Year	Trip Purpose (Person Trip per Day)				
	Home	Work	School	Others	Total
2004*	2,240,692	1,204,926	471,665	898,174	4,815,457
2013	3,028,719	1,736,990	913,351	1,138,425	6,817,485
2018	3,507,184	1,815,483	1,202,824	1,306,596	7,832,087
2023	3,952,799	2,072,784	1,430,768	1,401,998	8,858,349
2030	4,441,442	2,372,514	1,723,124	1,480,598	10,017,678

Source: JICA Study Team (JST), * Reference: 2006 survey (NUTRANS)



Source: JICA Study Team (JST), * Reference: 2006 survey (NUTRANS)

Figure A4.2.2: Future Total Trip Production by Trip Purpose

A4.3 Trip Generation and Attraction Forecasting

A4.3.1 General

Trip generation and attraction forecasting is handled as part of the trip production forecasting by the four-step method. In this forecast, the trip generated, which departs from each zone, and the trip attracted, which arrives to each zone, will be forecasted.

A4.3.2 Trip Generation and Attraction Model

The future traffic volume which departs and arrives at each zone will be forecasted by the trip generation and attraction model. The model parameters of the forecasting model are established in Table A4.3.1 using linear regression models. The predictive accuracy of the model is shown by the r-squared in Table A4.3.1. Although the models with the lowest r-squared are for the other purposes of attraction, the r-squared shows 0.9424 and it is a high value.

$$G_i = a_i \cdot X_{1i} + b_i \cdot X_{2i} +$$

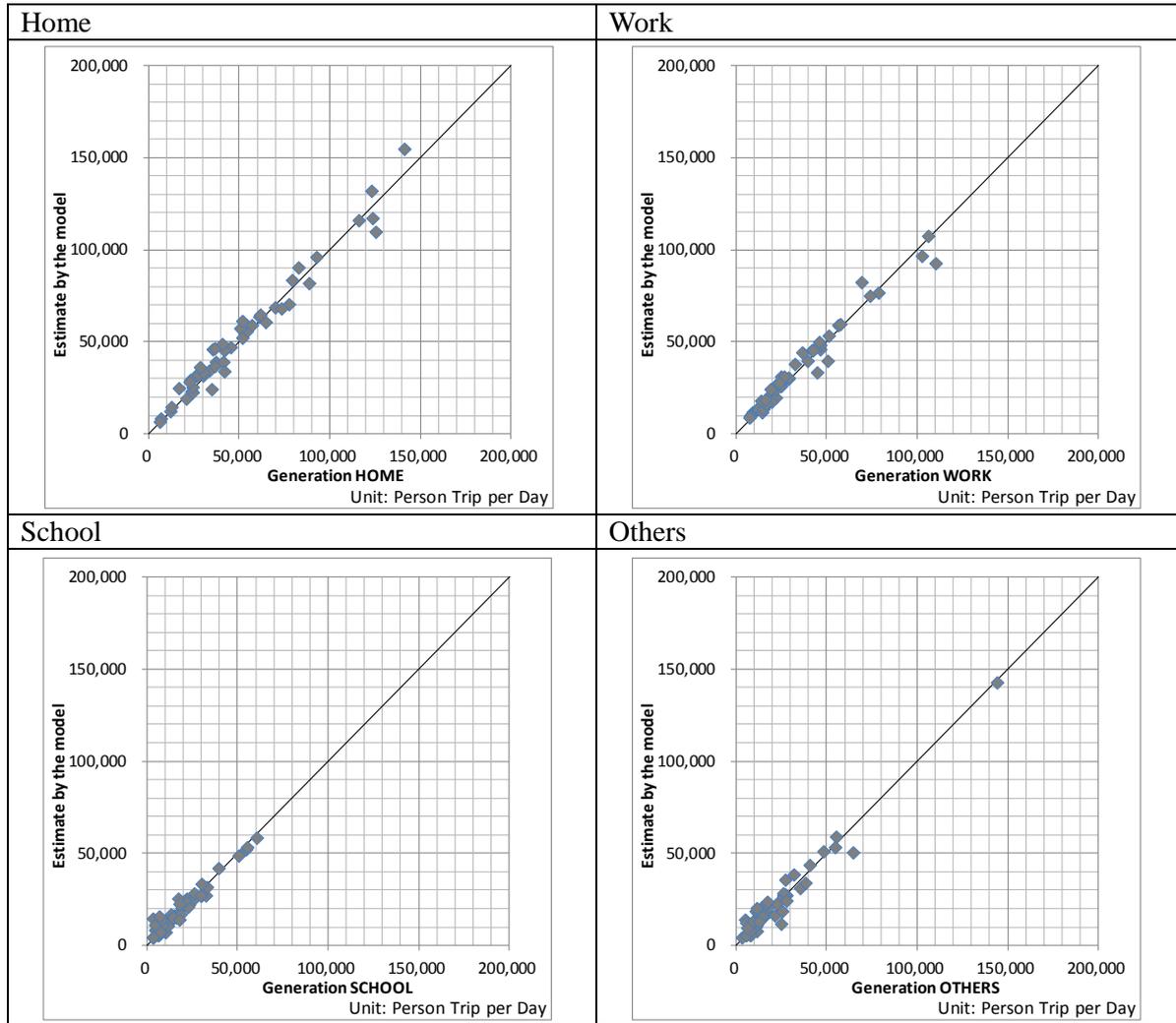
$$A_j = a_j \cdot X_{1j} + b_j \cdot X_{2j} +$$

Where, G_i : Trip Generation in Zone i
 A_j : Trip Attraction in Zone j
 X_{1i}, X_{2j} : Attributes in Zone i, j
 a_i, a_j, b_i, b_j : Coefficient

Table A4.3.1: Trip Generation and Attraction Model Parameters

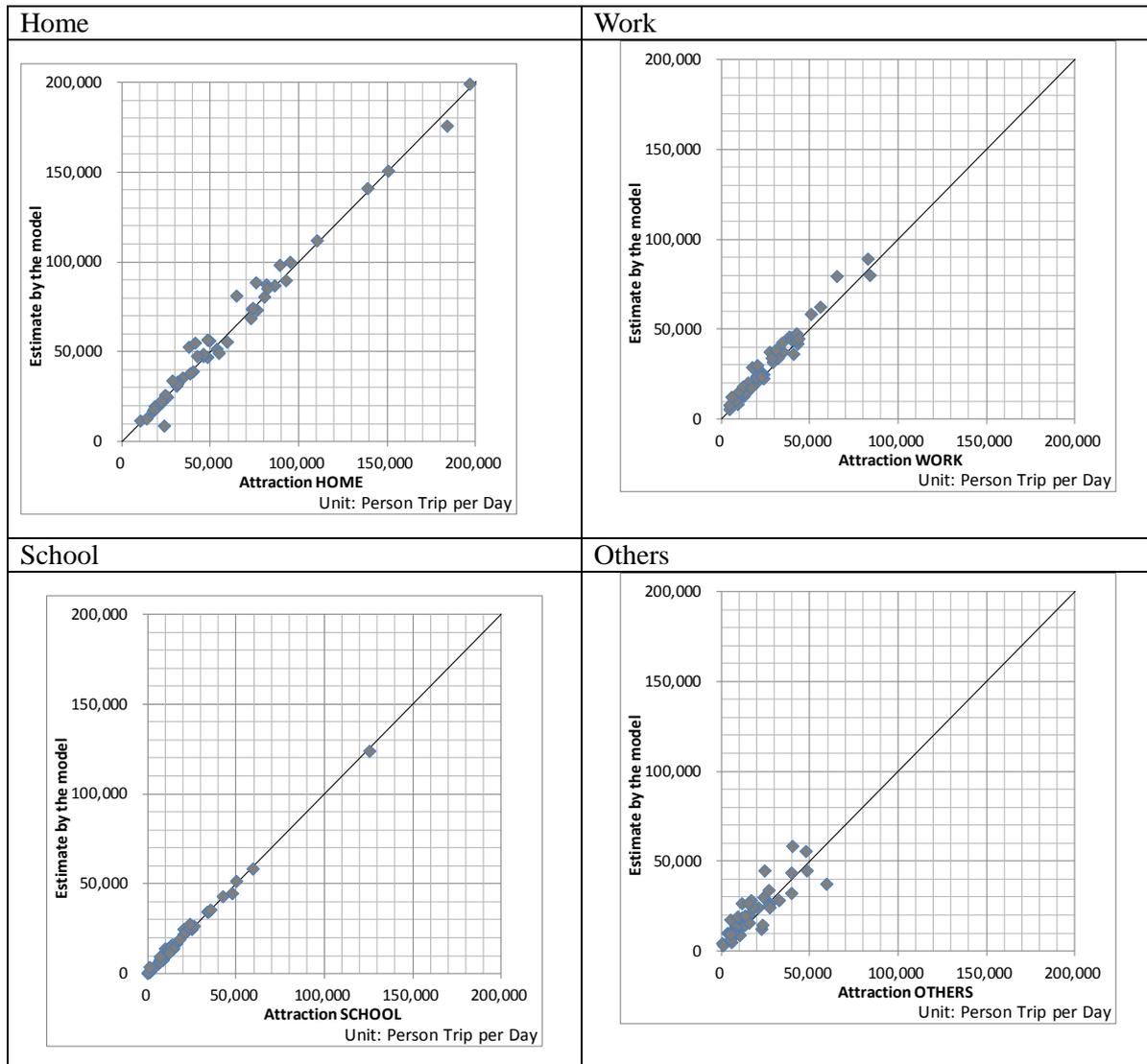
Model Type	Purpose	Population, 5 & Above	Number of Employees	Worker at Office Base	Student at Enrolment Base	R-squared
Trip Generation	Home	--	--	0.9857	1.2880	0.9747
	Work	--	0.8586	0.1884	--	0.9664
	School	0.2425	--	--	0.1786	0.9578
	Others	0.0994	--	0.2238	0.4273	0.9545
Trip Attraction	Home	0.9682	--	--	--	0.9711
	Work	--	--	1.0200	--	0.9726
	School	--	--	--	0.9615	0.9759
	Others	--	--	0.5136	0.3003	0.9424

Source: JICA Study Team (JST)



Source: JICA Study Team (JST)

Figure A4.3.1: Model Estimate and Observed Result for Trip Generation



Source: JICA Study Team (JST)

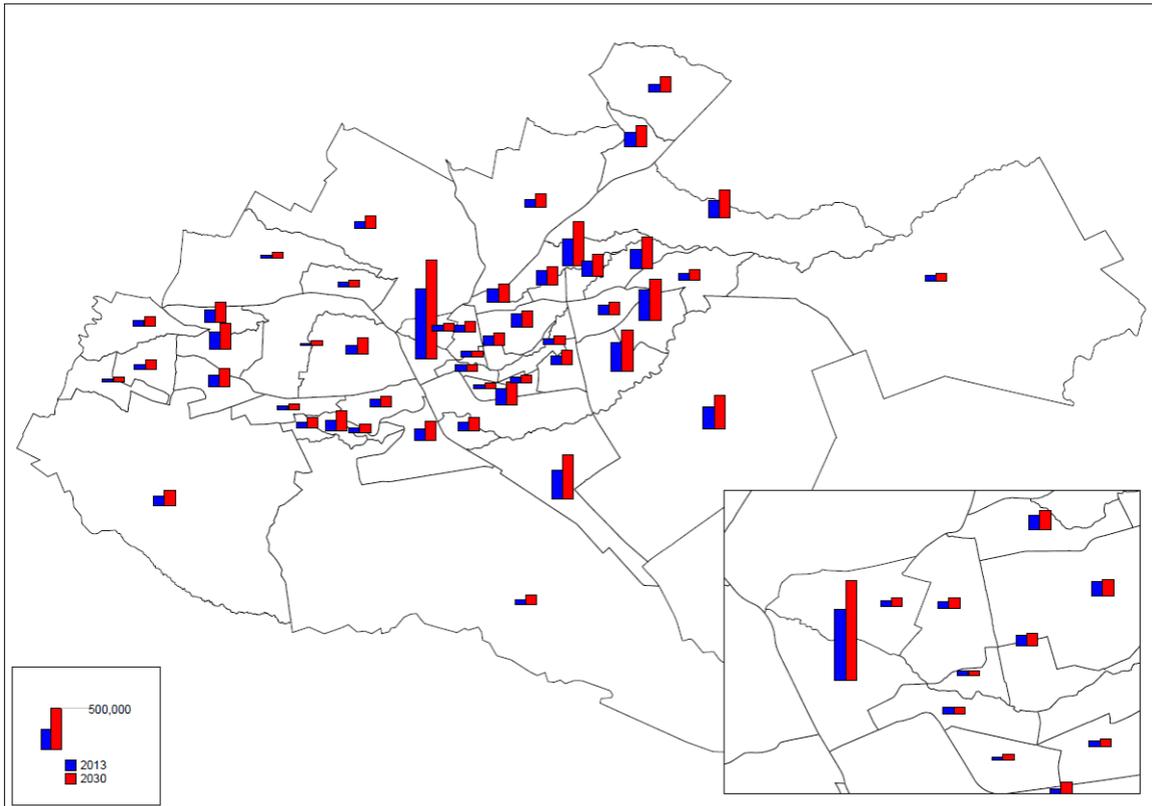
Figure A4.3.2: Model Estimate and Observed Result for Trip Attraction

A4.3.3 Future Trip Generation and Attraction

It is necessary to balance generation and attraction before the forecast of trip distribution. Each generation must be paired with a corresponding attraction. Then, the volume of generation and attraction forecast by each zone and trip purpose was adjusted with the overall trip production forecast result.

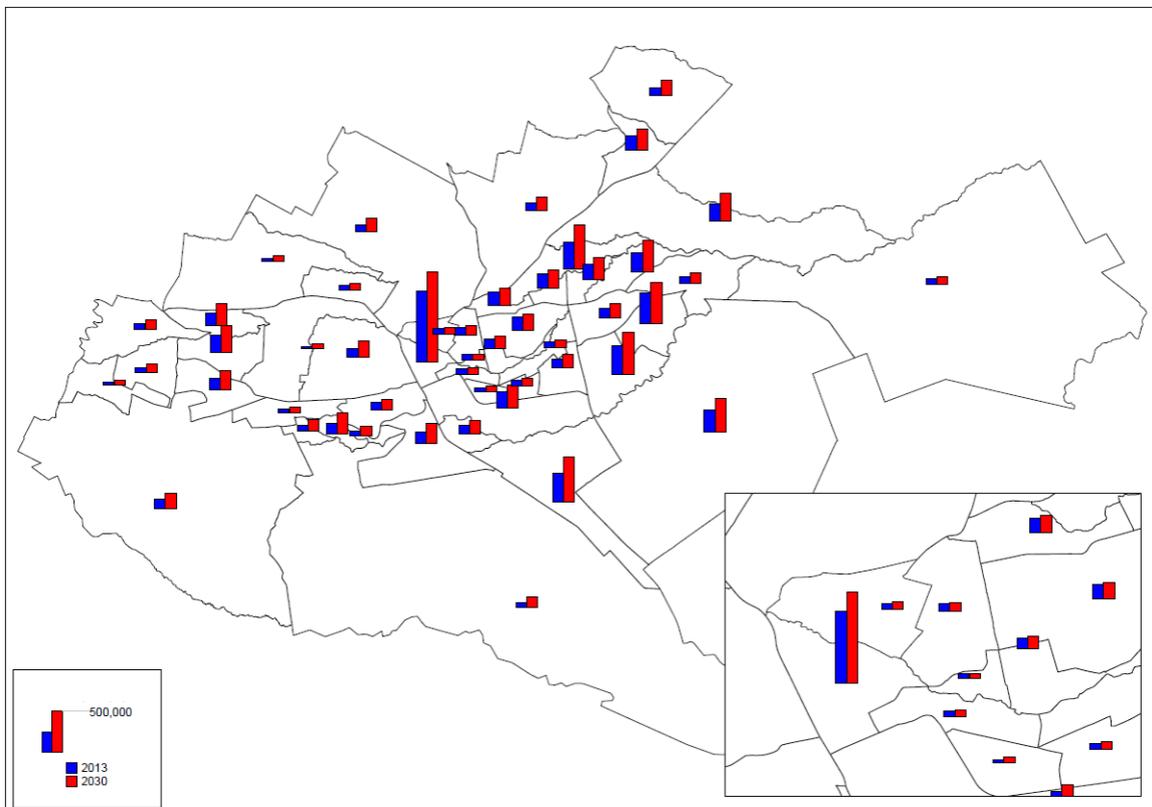
Based on the future framework for each zone, the trip generation and attraction of each zone was forecasted by the linear regression models established in Table A4.3.1. The forecast result is shown in Figure A4.3.3 and Figure A4.3.4. A CBD has many volumes of trip generation and attraction. Although there are few increases in the zone surrounding the CBD, its outside has increased volumes.

The zone with many volumes of generation and attraction is a high population density zone



Source: JICA Study Team (JST)

Figure A4.3.3: Trip Generation in 2013 and 2030 by Medium Zone



Source: JICA Study Team (JST)

Figure A4.3.4: Trip Attraction in 2013 and 2030 by Medium Zone

A4.4 Trip Distribution Forecasting

A4.4.1 General

Trip distribution forecasting is the second major step in the traffic demand forecasting process. The trip generation and attraction volume in each zone by purpose will be forecasted by the trip production forecasting, which is the first step. By the distribution forecasting step, generation and attraction volumes between each zone are linked. The volume of travels between zones, i.e., as the trip departs one zone and arrives to another zone, will be forecasted.

A4.4.2 Trip Distribution Model

The gravity model for interzonal trips and trip rate model for intrazonal trips are applied in trip distribution forecasting, as shown in the following equations. The intrazonal trip length (L_{ii}) created the model as 0.5 km in each zone.

$$\text{Interzonal trip } X_{ij} = K * O_i^\alpha * D_j^\beta / L_{ij}^\gamma$$

$$\text{Intrazonal trip } X_{ij} = R_i * O_i$$

$$R_i = X_{ii} / O_i$$

Where, X_{ij} : Interzonal trip distribution zone i to j

X_{ii} : Intrazonal trip distribution in zone i

O_i : Trip generation in zone i

D_j : Trip attraction in zone j

L_{ij} : Travel length from zone i to j (km)

R_i : Intra trip rate

K, α, β, γ : Model parameters

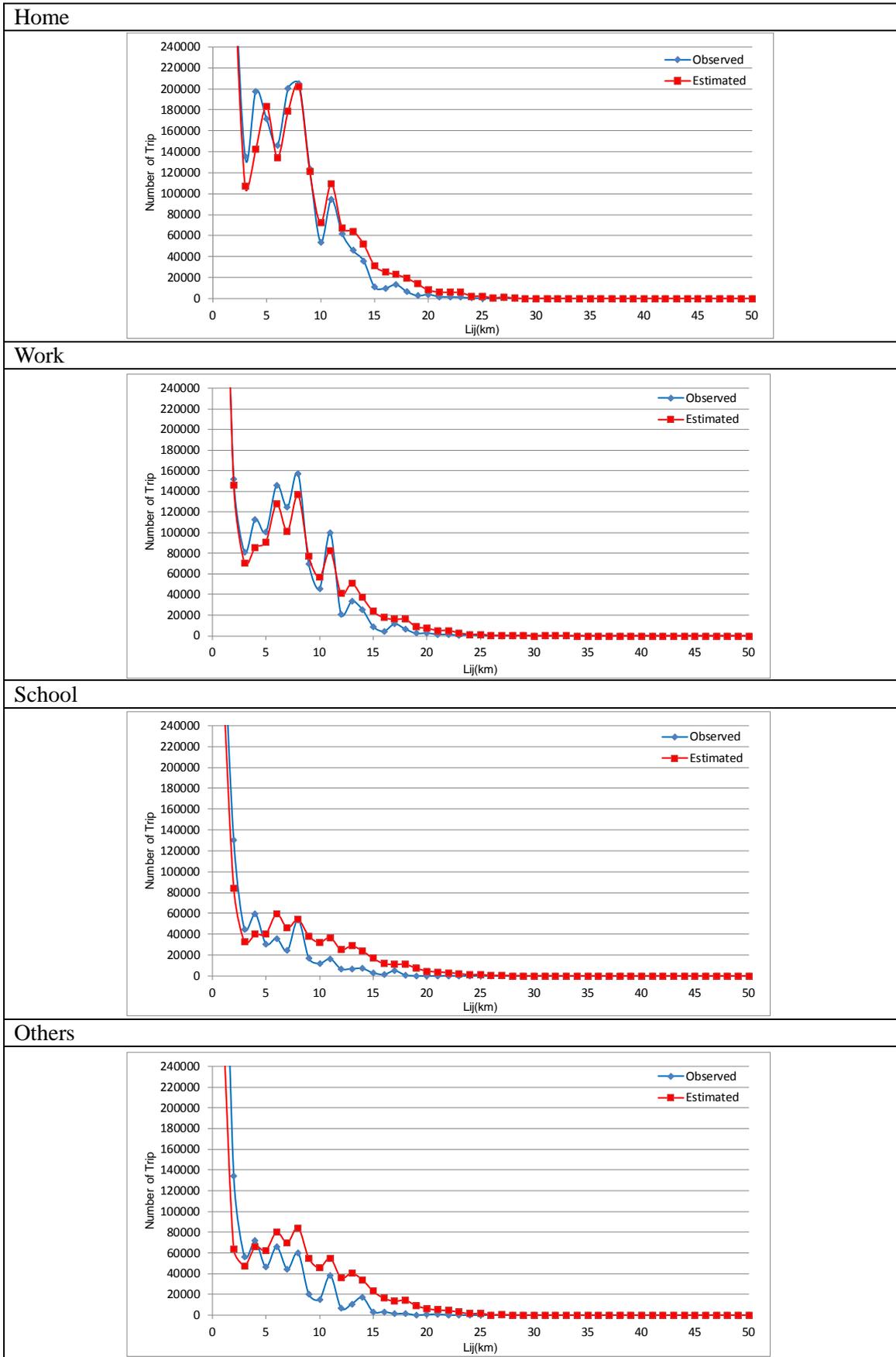
To adjust the total of the trip generation and attraction volume by each zone, the distribution forecast by gravity model was calculated. The parameter for the gravity model is shown in Table A4.4.1. After forecasting by the gravity model, the double-constrained method is applied. This is known as a frater balancing method and is a model of convergence calculation. The total trip generation and attraction volume for each zone is converged according to trip generation and attraction volume of the zone.

The observed and estimated values of trip length are shown in Figure A4.4.1. The trip length is mostly adjusted by the model. Trip amongst zones will be forecasted by this model in each zone.

Table A4.4.1: Intrazonal Trip Distribution Model Parameters

Trip Purpose	α	β	Γ	Log (K)	R-squared
Home	0.61945	0.45702	-0.75966	-1.82231	0.74090
Work	0.53011	0.67989	-0.68057	-2.31429	0.78405
School	0.11171	0.42457	-0.43606	0.73126	0.68236
Others	0.30109	0.55044	-0.59065	-0.22105	0.77531

Source: JICA Study Team (JST)

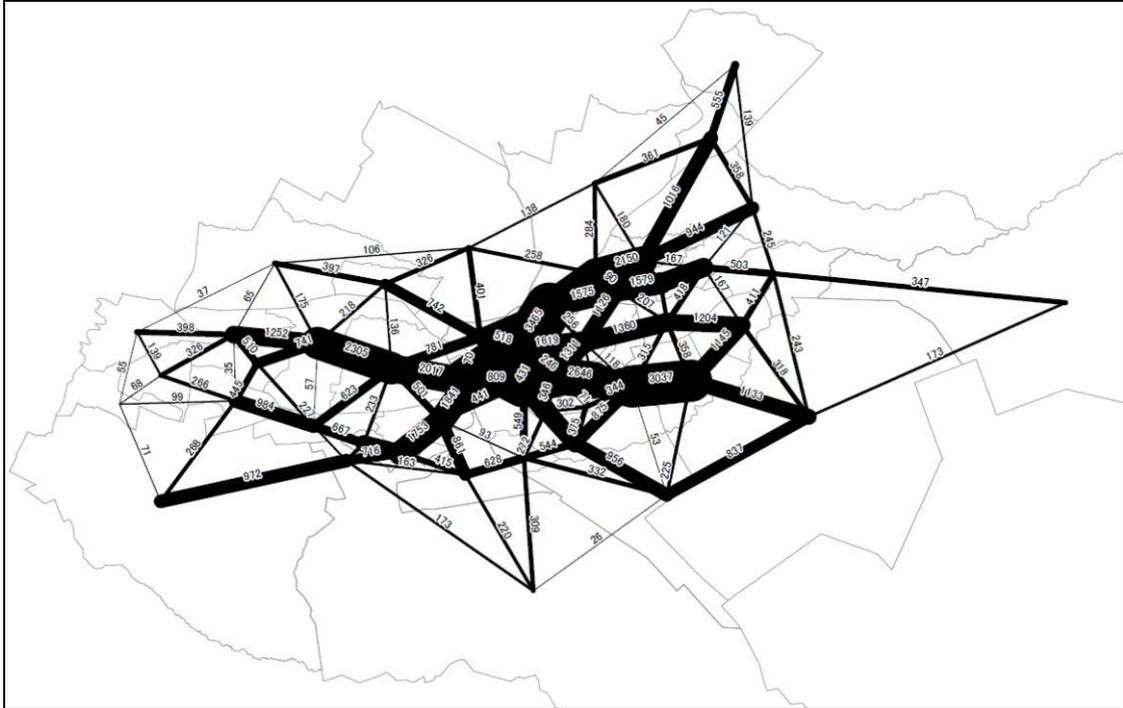


Source: JICA Study Team (JST)

Figure A4.4.1: Verification of Trip Distribution Models

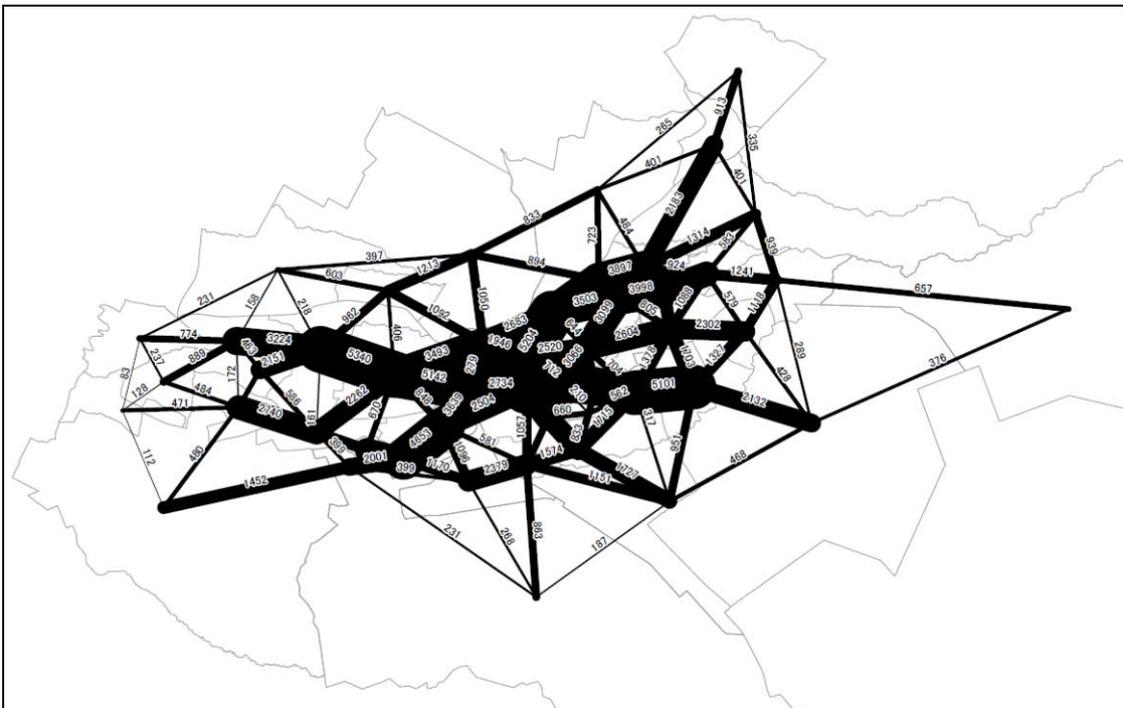
A4.4.3 Future Trip Distribution Forecasting

The spider network assignment charts based on the trip distribution forecast results in 2013 and 2030 are shown in Figure A4.4.2 and Figure A4.4.3. The connection of the relation amongst zone pairs is shown in this figure. Person trip of east-west direction will increase more than that of the north-south direction. Concentration of person trip into the city center will increase more.



Source: JICA Study Team (JST)

Figure A4.4.2: Trip Distribution of Total Trips in 2013



Source: JICA Study Team (JST)

Figure A4.4.3: Trip Distribution of Total Trips in 2030

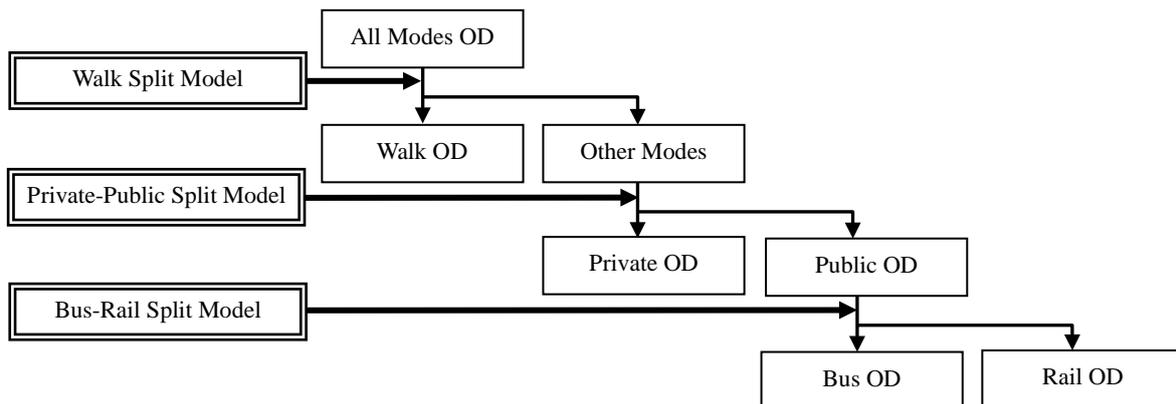
A4.5 Modal Split Forecasting

A4.5.1 General

Trip modal split forecasting is the third major step in the traffic demand forecasting process. The trip modal split forecasting model is based on the forecast and analysis of transportation mode choice at the time of a particular trip of an individual or group. Generally, the volume of trips and share for each traffic mode will be forecasted. The most commonly applied method to study modal split is the logit model.

A4.5.2 Modal Split Hierarchy

The modal split models consist of three models, namely: Walk Split Model, Private-Public Split Model, and Bus-Rail Split Model, as shown in Figure A4.5.1. It is the binary choice method split into two transportation modes by each step. The split of these models is established as trip purpose using the person trip survey data. The Walk Split Model splits a trip into walk and other traffic. The Private-Public Split Model splits a trip, other than walk, into a private trip (a privately-owned car and a taxi) and a public transportation mode (a railway and a bus). The Bus-Rail Split Model splits public transportation modes into a bus and a railway.



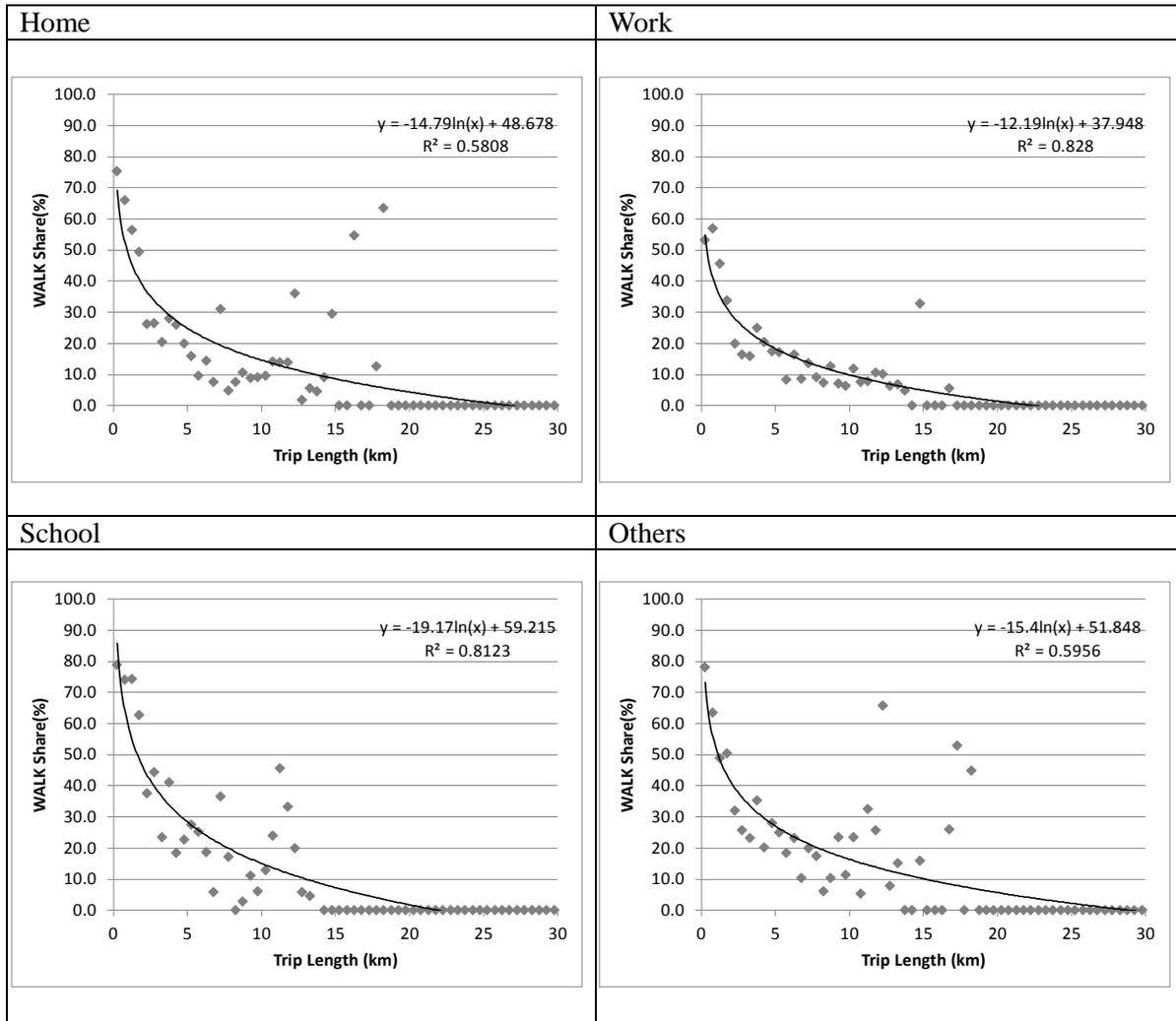
Source: JICA Study Team (JST)

Figure A4.5.1: Modal Split Model Basic Flow

A4.5.3 Walk Split Model

(1) Interzonal Walk Split Model

The diversion curve models are used in the Walk Split Model. The independent variable used by this model is the trip distance of the shortest path on the road network. Although walk share is mostly based on trip distance, it is different also with the trip purpose or car ownership conditions. Then, the car ownership conditions established in the future framework are also taken into consideration. A walk share curve is a model for each trip purpose in consideration of car ownership rate. The model equation taken by the person trip survey is shown in Figure A4.5.2.



Source: JICA Study Team (JST)

Figure A4.5.2: Interzonal Walk Split Model

(2) Intrazonal Walk Split Model

A model is built based on person trip survey data. As for the walk share in a zone, there is a correlation that the walk share decreases as the car ownership rate increases. As shown in Table A4.5.1 by person trip survey data, since the intrazonal walk share is greatly influenced by car ownership conditions, the walk share is calculated using the following equations:

$$P_i = (P_{jwalk_W/Ocar} * Pop_W/Ocar + P_{iwalk_W/car} * Pop_W/car) / Pop_Total$$

Where, P_i : Walk share

$P_{iwalk_W/Ocar}$: Walk share by non-car owning household (2013 zone i)

$P_{iwalk_W/car}$: Walk share by car owning household (2013 zone i)

$Pop_W/Ocar$: Population of non-car owning household

Pop_W/car : Population of car owning household

Pop_Total : Total population (= $Pop_W/Ocar + Pop_W/car$)

Table A4.5.1: Intrazonal Walk Share by Trip Purpose and Car Ownership

Trip Purpose	Car Owner	Non-car Owner
Home	46.8%	80.1%
Work	35.4%	74.6%
School	45.3%	82.3%
Others	66.8%	87.3%

Source: JICA Study Team (JST)

The future average walk share was forecasted using the above model. The forecast result for the Greater Nairobi area is shown in Table A4.5.2. The work purpose has low walk rate compared with the other purposes. The walk share for the trip purpose to work is low compared with the other purposes.

Table A4.5.2: Intrazonal Walk Share (Average in the Greater Nairobi Area)

Target Year	HH Car Ownership Rate	Trip Purpose (Person Trip per Day)			
		Home	Work	School	Others
2013	29.0%	74.6%	67.2%	76.5%	82.7%
2018	32.8%	71.0%	63.1%	75.9%	80.0%
2023	41.3%	69.5%	60.6%	74.0%	78.2%
2030	58.6%	66.6%	56.0%	70.0%	74.9%

Source: JICA Study Team (JST)

A4.5.4 Private-Public Modal Split Model

(1) Interzonal Private-Public Modal Split Model

The logit model is generally used and the application is also certified. The logit model means that an individual acts based on the rule of "choosing the preferable alternative out of the group of alternatives which can be used". The desirability (following U_{car} , U_{public}) of some alternative is different with the characteristic which the alternative has, or personal social attributes. The parameters of the model must be able to be forecasted at the existing situation and the future.

$$P_{ij\ car} = \exp(U_{car}) / (\exp(U_{car}) + \exp(U_{public}))$$

$$P_{ij\ public} = 1.0 - P_{ij\ car}$$

$$U_{car} = a * Car_owner + b * Tij_car$$

$$U_{public} = c * Tij_public + d * Cij_public$$

Where, P_{ij} : Modal share

Car_owner : Car owner (=1), Non-car owner (=0)

Tij_car : Travel time by car mode

Tij_public : Travel time by bus or rail mode

Cij_public : Travel cost by bus or rail mode

a, b, c, d : Parameters

The estimated parameters of Table A4.5.3 are determined by maximum likelihood. The parameters were based from the person trip survey data, and they were deemed to be the most appropriate parameters.

Table A4.5.3: Private-Public Split Model Parameters

	Parameter	Home	Work	School	Others
Car_owner(a)	a	3.53127 (49.45440)	3.84075 (48.32340)	2.41788 (9.77470)	3.30726 (26.29860)
Tij_car(b)	b	-0.29845 (-34.87190)	-0.26265 (-27.90580)	-0.35603 (-12.59710)	-0.25524 (-17.815209)
Tij_public(c)	c	-0.22927 (-18.92980)	-0.18623 (-13.73400)	-0.29753 (-7.49780)	-0.18788 (-8.20790)
Cij_public(d)	d	-0.01915 (-5.23420)	-0.02075 (-5.16480)	-0.01081 (-0.89610)	-0.01576 (-2.405909)
Likelihood rate		0.52396	0.52132	0.60183	0.49675
Matching ratio (%)		87.6	88.8	89.3	87.0

Note: (t Value)

Source: JICA Study Team (JST)

(2) Intrazonal Private-Public Modal Split Model

Based on the person trip survey data, it is shown that the private modal share and car ownership rate in a zone are correlated. A private modal share also rises according to the rise in car ownership rate. As shown in Table A4.5.4 by person trip survey data, since the intrazonal private share is greatly influenced by car ownership conditions, the private share is calculated using the following equations:

$$P_i = (P_{j\text{private_W/Ocar}} * \text{Pop_W/Ocar} + P_{i\text{private_W/car}} * \text{Pop_W/car}) / \text{Pop_Total}$$

Where, P_i : Private share

$P_{j\text{private_W/Ocar}}$: Private share by non-car owning household (2013 zone i)

$P_{i\text{private_W/car}}$: Private share by car owning household (2013 zone i)

Pop_W/Ocar: Population of non-car owning household

Pop_W/car: Population of car owning household

Pop_Total: Total population (=Pop_W/Ocar + Pop_W/car)

Table A4.5.4: Intrazonal Private Share by Trip Purpose and Car Ownership

Trip Purpose	Car Owner	Non-Car Owner
Home	56.5%	8.5%
Work	80.0%	11.4%
School	28.9%	7.1%
Others	75.0%	11.5%

Source: JICA Study Team (JST)

The average of future intrazonal private modal share which appeared using the model shown in the above equations is shown in Table A4.5.5.

Table A4.5.5: Intrazonal Private Modal Share (Average in the Greater Nairobi Area)

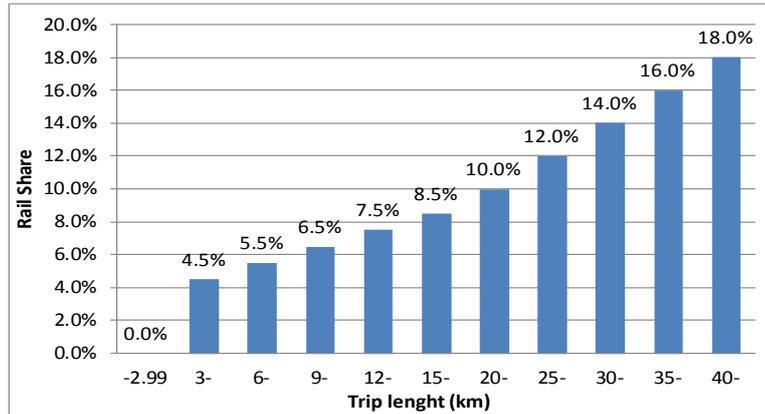
Target Year	HH Car Ownership Rate	Trip Purpose (Person Trip per Day)			
		Home	Work	School	Others
2013	29.0%	25.2%	36.7%	15.1%	38.7%
2018	32.8%	30.6%	41.5%	13.5%	38.6%
2023	41.3%	32.8%	45.6%	15.7%	42.9%
2030	58.6%	36.4%	52.9%	19.7%	51.1%

Source: JICA Study Team (JST)

A4.5.5 Bus-Rail Modal Split Model

The diversion curve model which took into consideration the rate of departure or arrival trip distance against the overall trip distance is used in the Bus-Rail Split Model. The railway share is shown in Figure A4.5.3. If the percentage (LR) of trip length (access and egress) against the overall trip length is more than 30%, the rail share is set to 0%.

$$LR = (Lij_Access + Lij_Egress) / Lij_Total$$



Source: JICA Study Team (JST)

Figure A4.5.3: Diversion Curve of Rail Share by LR<0.25

A4.5.6 Future Modal Split Forecasting

The future modal share was forecasted using the built modal split model as abovementioned. The forecast is estimated using the “Do-Nothing Case” framework in the future.

Table A4.5.6: Future Modal Share in “Do-Nothing Case”

Target Year	Walk	Private	Public	Rail	Total
2013	3,090,103	916,624	2,754,489	14,006	6,775,222
	45.6%	13.5%	40.7%	0.2%	100.0%
2018	3,246,051	1,191,385	3,379,562	15,089	7,832,087
	41.4%	15.2%	43.2%	0.2%	100.0%
2023	3,606,326	1,578,091	3,657,755	16,177	8,858,349
	40.7%	17.8%	41.3%	0.2%	100.0%
2030	3,951,711	2,161,718	3,885,662	18,587	10,017,678
	39.4%	21.6%	38.8%	0.2%	100.0%

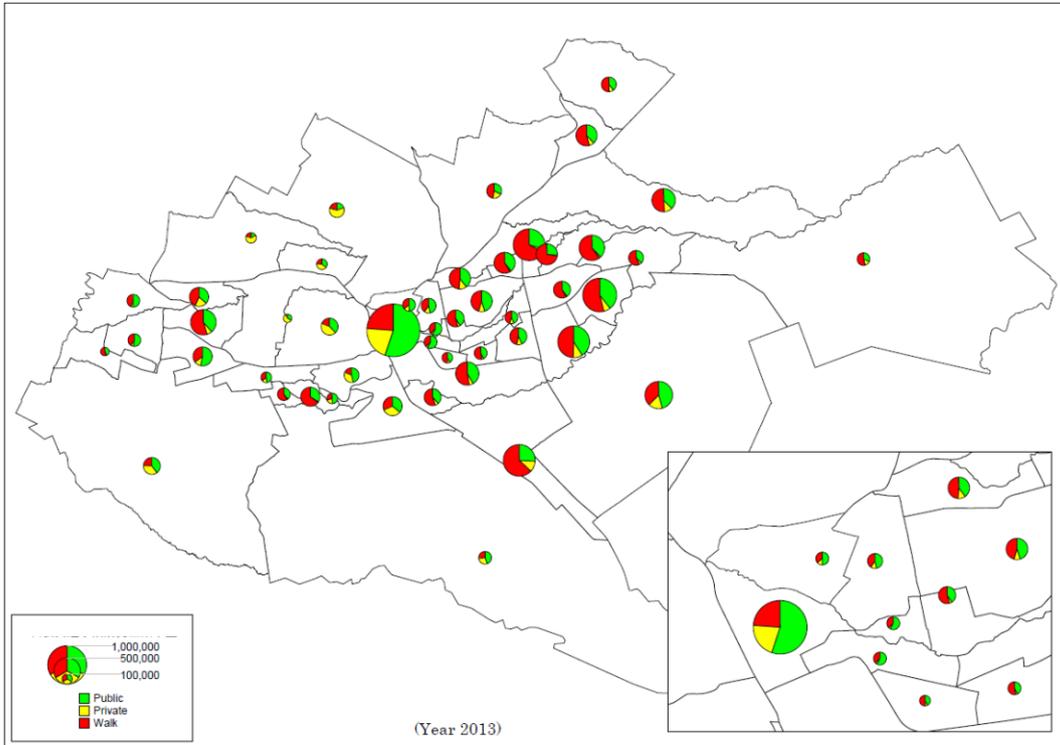
Source: JICA Study Team (JST)



Source: JICA Study Team (JST)

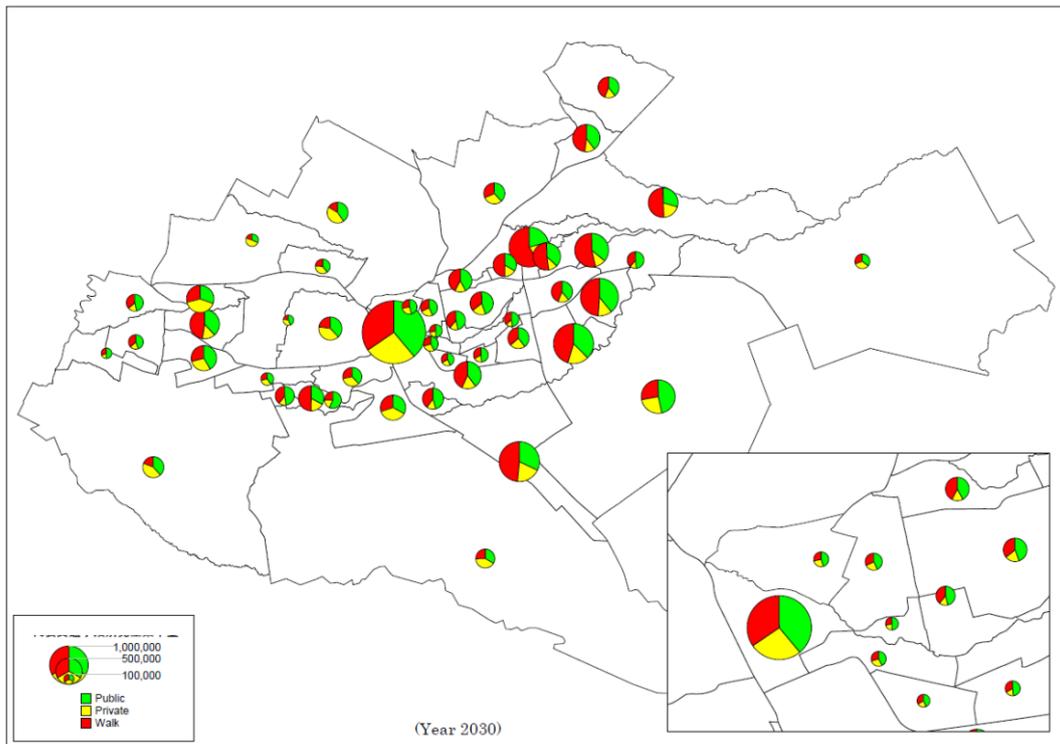
Figure A4.5.4: Future Modal Share

The future demand of the private trips constitutes 2.5 million trips, and public trips constitute 3.5 million trips in 2030. Comparing the future forecast and presently observed, the private trips will increase by about 2.7 times. Modal shares by each zone (generation base) in 2013 and 2030 are shown in Figures A4.5.5 and A4.5.6.



Source: JICA Study Team (JST)

Figure A4.5.5: Modal Share by Medium Zone in 2013 (Generation Base)



Source: JICA Study Team (JST)

Figure A4.5.6: Modal Share by Medium Zone in 2030 (Generation Base)

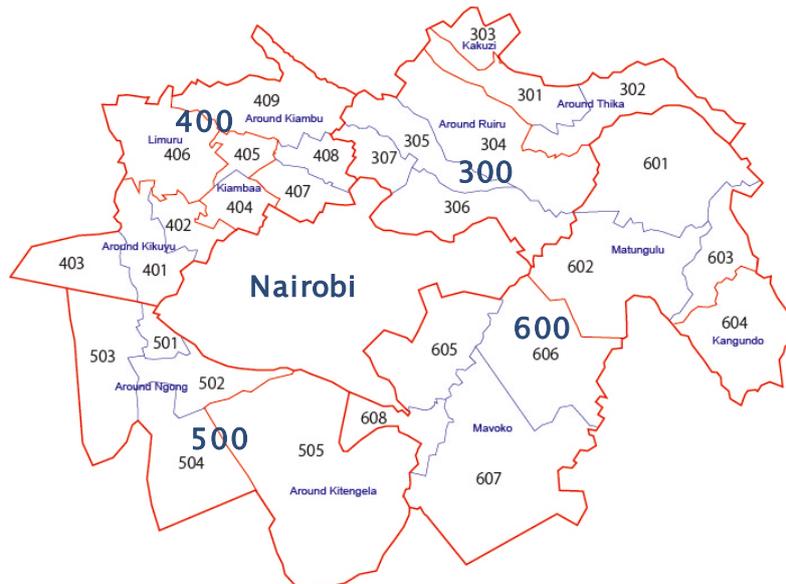
A4.6 External Zone Demand Forecasting

From the volume of generations and attractions of each zone calculated by the generation and attraction model, the OD matrix is calculated for a part of Nairobi City, and created by making frater correction using the related inside and outside OD matrix of Nairobi City. The correction for demand is obtained by the cordon line survey of the present situation and the population growth rate outside Nairobi City is given by Table A4.6.1.

Table A4.6.1: Population Growth Rate for External Zone

Area	Zone	2013	2018	2023	2030
Kiambu	300	624,536	851,199	1,180,572	1,327,725
		1.00	1.36	1.89	2.13
	400	970,644	1,288,818	1,731,956	2,607,091
		1.00	1.33	1.78	2.69
Kajiado	500	311,360	417,027	570,063	875,427
		1.00	1.34	1.83	2.81
Machakos	600	517,194	761,500	1,092,110	1,737,652
		1.00	1.47	2.11	3.36
Outside Nairobi		2,423,734	3,318,544	4,574,701	6,547,895
		1.00	1.37	1.89	2.70

Source: JICA Study Team (JST)



Source: JICA Study Team (JST)

Figure A4.6.1: Zoning of External Zone

A4.7 Future Traffic Assignment Forecasting

A4.7.1 General

Future traffic assignment forecasting is the final major step in the traffic demand forecasting process. The traffic volume which passes through each link that constitutes the transportation network will be forecasted. The traffic assignment forecasting model calculates whether the traffic volume amongst the zones will be assigned on some routes amongst the zone. By forecasting the traffic volume of each link, it will be considered as the basis of the solution of the traffic problem forecast in the future.

A4.7.2 Vehicle Assignment Model

Vehicle trip is assigned to the individual road link in the trip assignment forecasting process. This step takes as input the OD matrix that indicates the volume of vehicle trip between origin and destination pairs. User equilibrium assignment is used for the estimation in this study. User equilibrium assignment is formulated as all the person trips have information on the road characteristics which choose the road link, and choose the minimum route for travel time or cost.

The input of link performance function is necessary for user equilibrium assignment. This function describes the travel time which passes through the link under conditions with various congestion by the ratio of traffic and capacity. The Bureau of Public Roads (BPR) function is the most common and the equation is shown below.

$$V_c = V_o / [1 + \alpha (V_o / C)^\beta]$$

Where, V_c : Congested Speed

V_o : Free-Flow Speed

V_o : Traffic Volume (PCU)

C : Ideal Traffic Capacity (PCU)

$\alpha = 0.48, \beta = 2.82$

A4.7.3 Assessments of Present Transport Network

The present transportation network case where the present transportation network is maintained in the future as a basic case for studying the progress of an effective transport policy (“Do-Nothing Case”) is assumed. The existing road network is constituted in the Greater Nairobi area by 1,380 nodes and 1,965 links. The user equilibrium assignment of JICA STRADA was used for the vehicle assignment.

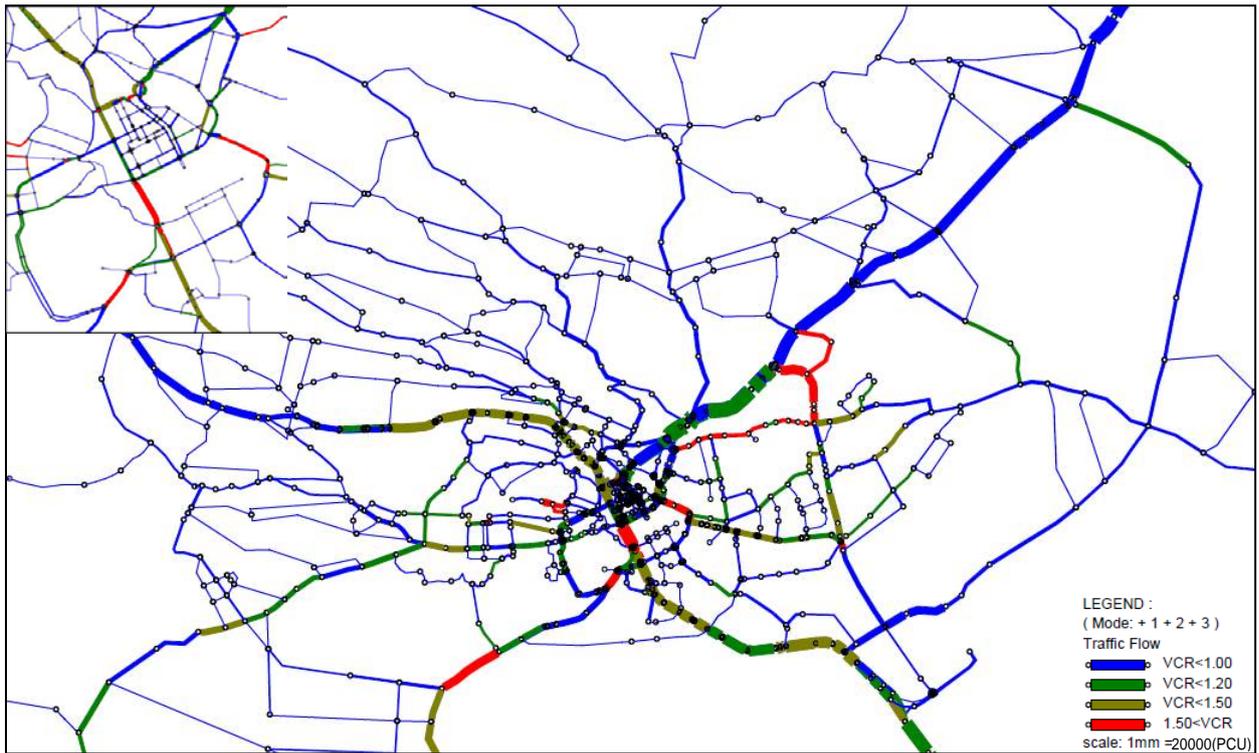
The evaluation result of each index under the “Existing Case” in 2013 and the “Do-Nothing Case” in 2030 is summarised in Table A4.7.1. Moreover, the “Existing Case” is shown in Figure A4.7.1, and the “Do-Nothing Case” in 2030 is shown in Figure A4.7.2. The “Existing Case” in 2013 is shown again in Figure A4.1.4.

Table A4.7.1: Vehicle Assignment Results in “Do-Nothing Case”

Area	Case	Year	Vehicle-km Total (PCU-km)('000)	Vehicle-hours Total (PCU-Hour)	Average Speed (km/h)	Average VCR (Volume Capacity Ratio)
Greater Nairobi	Existing Case	2013	17,780	431,690	41.2	0.54
	Do-Nothing Case	2030	39,110	1,692,480	23.1	1.19
Nairobi City	Existing Case	2013	10,960	273,910	40.0	0.69
	Do-Nothing Case	2030	25,320	1,254,120	20.2	1.60

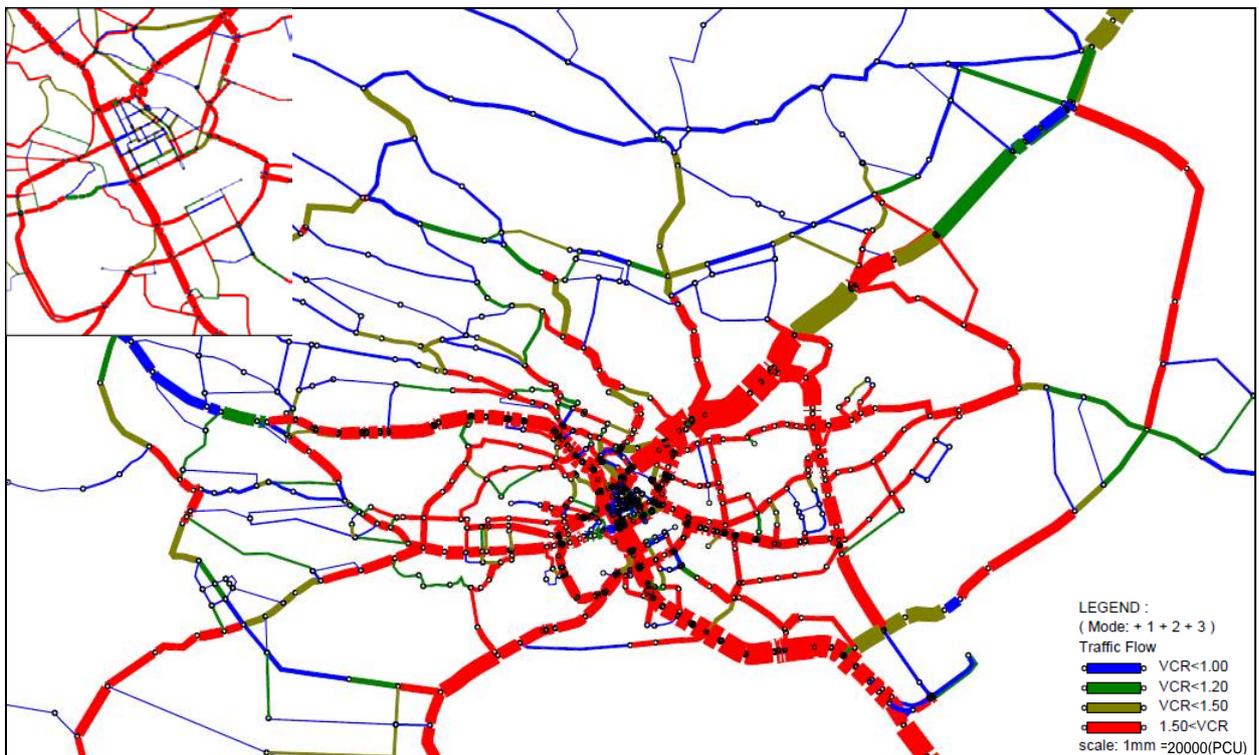
Source: JICA Study Team (JST)

Comparing the “Existing Case” in 2013 with “Do-Nothing Case” in 2030, almost all the radial roads going to the city centre, circumferential roads and bypass roads such as Outer Ring Road and Eastern Bypass, and radial roads connecting the southern area of Nairobi City will be heavily congested. The total vehicle-hours inside Nairobi will increase by 4.6 times due to congestion while total vehicle-km will increase by 2.3 times. Nairobi City will be more serious than Greater Nairobi.



Source: JICA Study Team (JST)

Figure A4.7.1: Vehicle Assignment Result of “Existing Case” in 2013



Source: JICA Study Team (JST)

Figure A4.7.2: Vehicle Assignment Result of “Do-Nothing Case” in 2030

A4.8 Forecast of the Future Alternative Cases

A4.8.1 General

The future alternative cases will be forecasted as shown in Chapter 3 of the main report. The summary of the alternative cases is shown in Table A4.8.1.

Table A4.8.1: Summary of Alternative Cases

Alternative Case		Road Network	Public Transport Network	Remark
0	Ongoing Project Case	Existing network and ongoing road project	Existing network	
1	Road Development Oriented Case	Future road network	Existing network	
2	Utilisation of Commuter Rail Case	Same as Alternative 1	Existing network and introduction of commuter rail	Three commuter rail line
3	Introduction of Selective MRTS Case	Same as Alternative 1	Commuter rail and introduction of BRT, new transport system	Four BRT routes and one new transport system routes.

Source: JICA Study Team (JST)

The flow of forecast is the same as in the above section. Future transport demand forecasting can be used for Alternatives 0 and 1 as it is for the case which assigns basic future traffic demand to a future road network. However, it is assumed that public traffic is newly prepared and the shift to public transportation network is created in Alternatives 2 and 3. Therefore, the volume of shifts to public transport is forecasted based on the modal share shown in Appendix 4.5.

A4.8.2 Modal Split Model for Alternative

Alternatives 2 and 3 will change the share of private transport and public transport, for the public transportation network will become more convenient compared to now. Therefore, a private-public modal split model is rebuilt. Walk will not be basically shifted to public transport. Car user shifts to public transport. For walk and public transport, choice of transportation will not overlap, since neither moving distance nor travel cost will compete. The private-public modal split model built by Appendix 4.5.4 as shown below was used for the forecasting model.

$$P_{ij} \text{ car} = \exp(U_{\text{car}}) / (\exp(U_{\text{car}}) + \exp(U_{\text{public}}))$$

$$P_{ij} \text{ public} = 1.0 - P_{ij} \text{ car}$$

$$U_{\text{car}} = a * \text{Car_owner} + b * T_{ij_car}$$

$$U_{\text{public}} = c * T_{ij_public} + d * C_{ij_public}$$

Where, P_{ij} : Modal share

Car_owner : Car owner (=1), Non-car owner (=0)

T_{ij_car} : Travel time by car mode

T_{ij_public} : Travel time by bus or rail mode

C_{ij_public} : Travel cost by bus or rail mode

a, b, c, d : Parameters

The shift within the public mode was established based on the use mind rate of the stated preference survey. However, if the percentage (LR) of trip length (access and egress) against the overall trip length becomes more than 50% in case of new transport system, more than 30% in case of a commuter rail and BRT (50% if outside Nairobi), it is decided not to choose the shift to public transport. As for the service level of each public transportation, the average queuing time, which was established from operation frequency, was taken into consideration in the total travel time. Average queuing time was established with the service level shown in Table A4.8.2.

Table A4.8.2: Setting of the Public Mode Service Level for Forecasting

Mode	Operation Head	Waiting Time	Boarding-and-Alighting Location
Commuter Rail	30.0 min	15.0 min	Existing Station
BRT	3.0 min	1.5 min	500 m interval
New Transportation System	5.0 min	2.5 min	300-500 m interval

Source: JICA Study Team (JST)

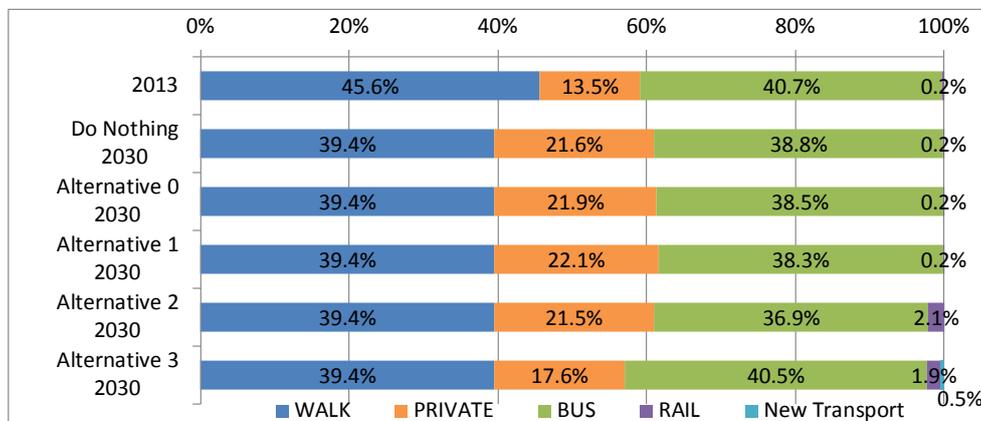
A4.8.3 Forecast Result of Alternative Plan

The future modal shares by alternatives in 2030 were forecasted using the built modal split model. The result of forecast is shown in Table A4.8.3 and Figure A4.8.1.

Table A4.8.3: Future Modal Share by Alternatives in 2030

Alternatives	Walk	Private	Public	Rail	New Transport	Total
2013	3,090,103	916,624	2,754,489	14,006	--	6,775,222
	45.6%	13.5%	40.7%	0.2%	--	100.0%
Do Nothing	3,951,711	2,161,718	3,885,662	18,587	--	10,017,678
	39.4%	21.6%	38.8%	0.2%	--	100.0%
Alternative 0	3,951,711	2,195,331	3,852,215	18,421	--	10,017,678
	39.4%	21.9%	38.5%	0.2%	--	100.0%
Alternative 1	3,951,711	2,213,695	3,833,869	18,403	--	10,017,678
	39.4%	22.1%	38.3%	0.2%	--	100.0%
Alternative 2	3,951,711	2,155,726	3,695,692	214,549	--	10,017,678
	39.4%	21.5%	36.9%	2.1%	--	100.0%
Alternative 3	3,951,711	1,767,773	4,062,046	190,456	45,692	10,017,678
	39.4%	17.6%	40.5%	1.9%	0.5%	100.0%

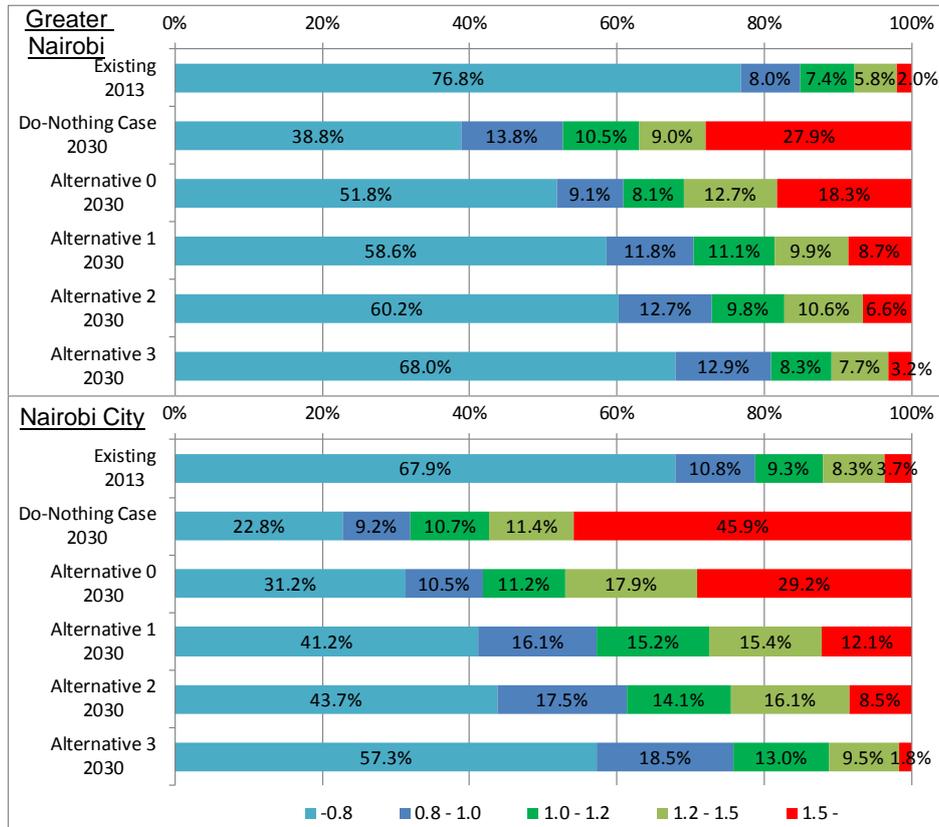
Source: JICA Study Team (JST)



Source: JICA Study Team (JST)

Figure A4.8.1: Future Modal Share by Alternatives

The congestion ratio of each alternative in Nairobi City is shown in Figure A4.8.2 and the forecast result of the traffic flow indicator and modal share of each alternative are shown in Table A4.8.4.



Source: JICA Study Team (JST)

Figure A4.8.2: Congestion Ratio of Alternatives

The forecast results of the volume of vehicle and public transport user in 2030 of each alternative are shown in Figure A4.8.3 to Figure A4.8.9. Vehicle assignment is shown in PCU and public transport is shown in trip volume. The shift from walk or trip within zone as short length trips is not included in new transport system.

The situation of road congestion for each alternative by vehicle assignment results shown in Figures A4.8.3 to A4.8.5 and A4.8.7 is summarised in Table A4.8.5. Alternative 3 will be indispensable to mitigate road congestion appropriately.

Table A4.8.5: Situation of Road Congestion for Each Alternative

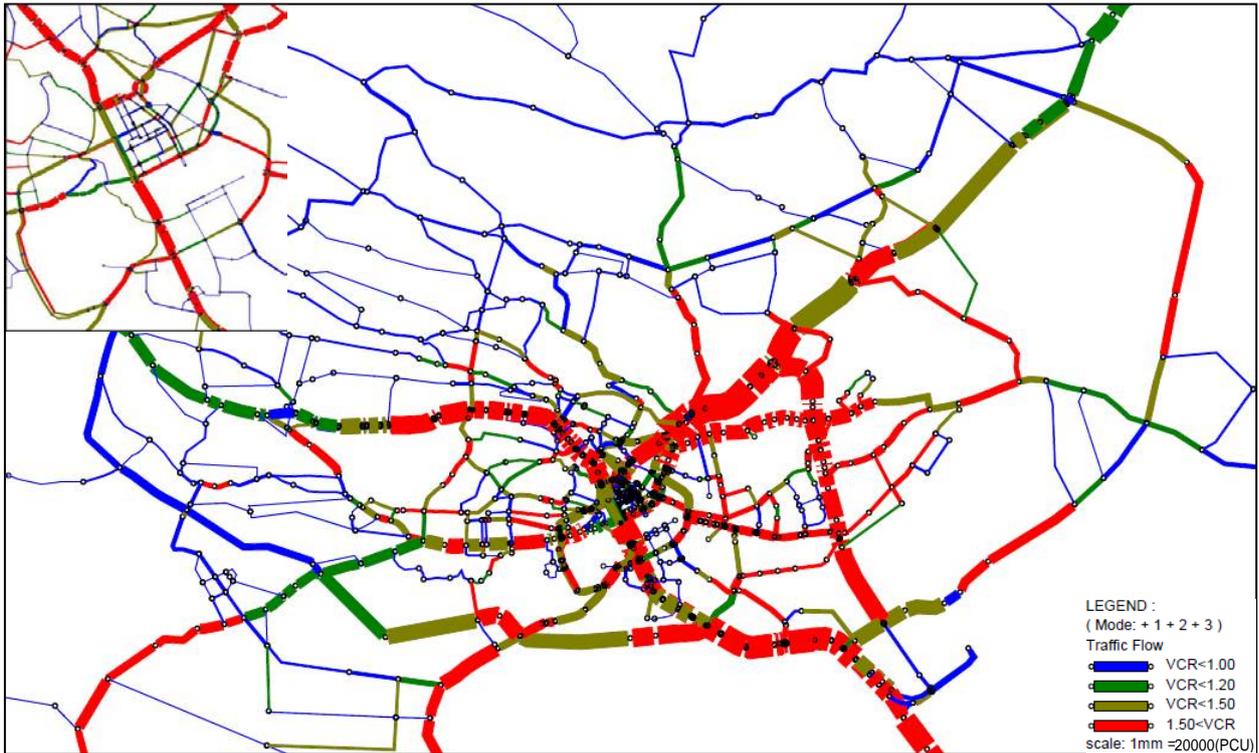
Alternative	Description
Do Nothing Case	Heavy congestion in almost all roads in Nairobi City.
Alternative 0	Congestion in many roads; there will still be congestion.
Alternative 1	Congestion in some trunk roads.
Alternative 2	Congestion in some major sections; the commuter rail overlap area will decrease.
Alternative 3	Congestion of almost all roads will decrease; congestion is seen at some sections and major intersections.

Source: JICA Study Team (JST)

Table A4.8.4: Vehicle Assignment Result of Alternatives

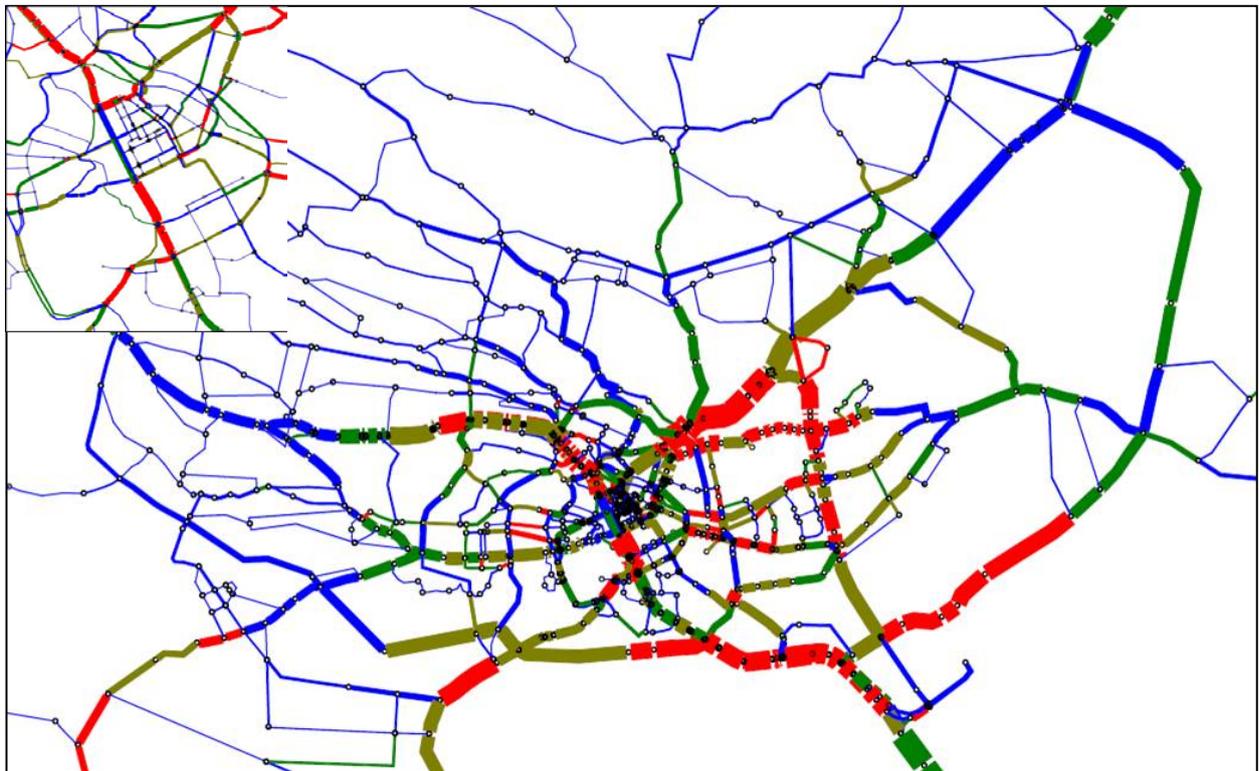
Case		Existing	Do-Nothing Case	Alternative					
				0	1	2	3		
Year		2013	2030	2030	2030	2030	2030		
Modal Split of Person Trips	Walk	45.6%	39.4%	39.4%	39.4%	39.4%	39.4%		
	Car	13.5%	21.6%	21.9%	22.1%	21.5%	17.6%		
	Bus	40.7%	38.8%	38.5%	38.3%	36.9%	40.5%		
	New transport	-	-	-	-	-	0.5%		
	Railway	0.2%	0.2%	0.2%	0.2%	2.1%	1.9%		
Greater Nairobi	Vehicle-km total (PCU-km)(‘000)		17,780	39,110	37,670	36,510	35,100	30,500	
	Vehicle-hours total (PCU-Hour)		431,690	1,692,480	1,173,180	928,970	879,350	723,920	
	Average Speed (km/h)		41.2	23.1	32.1	39.3	39.9	42.1	
	Average VCR (Volume Capacity Ratio)		0.54	1.19	1.02	0.85	0.81	0.71	
	Congestion Ratio	-0.8	km	1,114.7	563.5	770.2	894.8	920.0	1,038.3
			%	76.8%	38.8%	51.8%	58.6%	60.2%	68.0%
		0.8 - 1.0	km	116.4	199.7	134.8	179.7	193.9	196.8
			%	8.0%	13.8%	9.1%	11.8%	12.7%	12.9%
		1.0 - 1.2	km	106.9	151.9	120.3	169.3	149.9	126.8
			%	7.4%	10.5%	8.1%	11.1%	9.8%	8.3%
		1.2 - 1.5	km	84.1	131.3	188.2	151.5	162.6	117.7
			%	5.8%	9.0%	12.7%	9.9%	10.6%	7.7%
		1.5 -	km	29.2	405.0	272.3	132.5	101.4	48.2
			%	2.0%	27.9%	18.3%	8.7%	6.6%	3.2%
TOTAL		km	1,451.4	1,451.4	1,485.8	1,527.8	1,527.8	1,527.8	
		%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	
Nairobi City	Vehicle-km total (PCU-km)(‘000)		10,960	25,320	25,520	24,850	23,780	19,430	
	Vehicle-hours total (PCU-Hour)		273,910	1,254,120	805,560	620,560	581,190	432,490	
	Average Speed (km/h)		40.0	20.2	31.7	40.1	40.9	44.9	
	Average VCR (Volume Capacity Ratio)		0.69	1.60	1.32	1.04	1.00	0.82	
	Congestion Ratio	-0.8	km	510.2	171.1	243.3	337.8	358.5	469.7
			%	67.9%	22.8%	31.2%	41.2%	43.7%	57.3%
		0.8 - 1.0	km	81.0	69.2	81.8	132.1	143.8	151.4
			%	10.8%	9.2%	10.5%	16.1%	17.5%	18.5%
		1.0 - 1.2	km	69.5	80.6	87.2	124.2	115.8	106.7
			%	9.3%	10.7%	11.2%	15.2%	14.1%	13.0%
		1.2 - 1.5	km	62.3	85.8	139.1	126.2	132.3	77.6
			%	8.3%	11.4%	17.9%	15.4%	16.1%	9.5%
		1.5 -	km	28.1	344.5	227.4	99.6	69.4	14.4
			%	3.7%	45.9%	29.2%	12.1%	8.5%	1.8%
TOTAL		km	751.2	751.2	778.9	819.8	819.8	819.8	
		%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	

Source: JICA Study Team (JST)



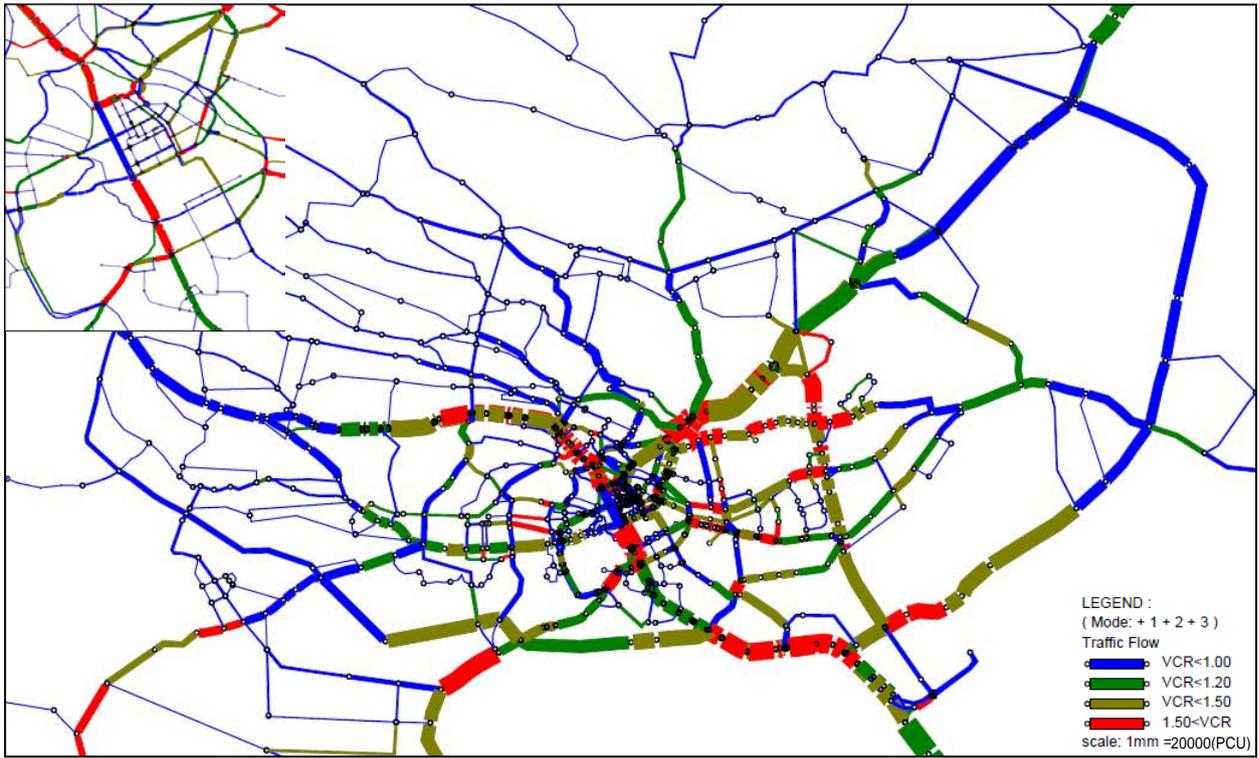
Source: JICA Study Team (JST)

Figure A4.8.3: Vehicle Assignment Result of “Alternative 0” in 2030



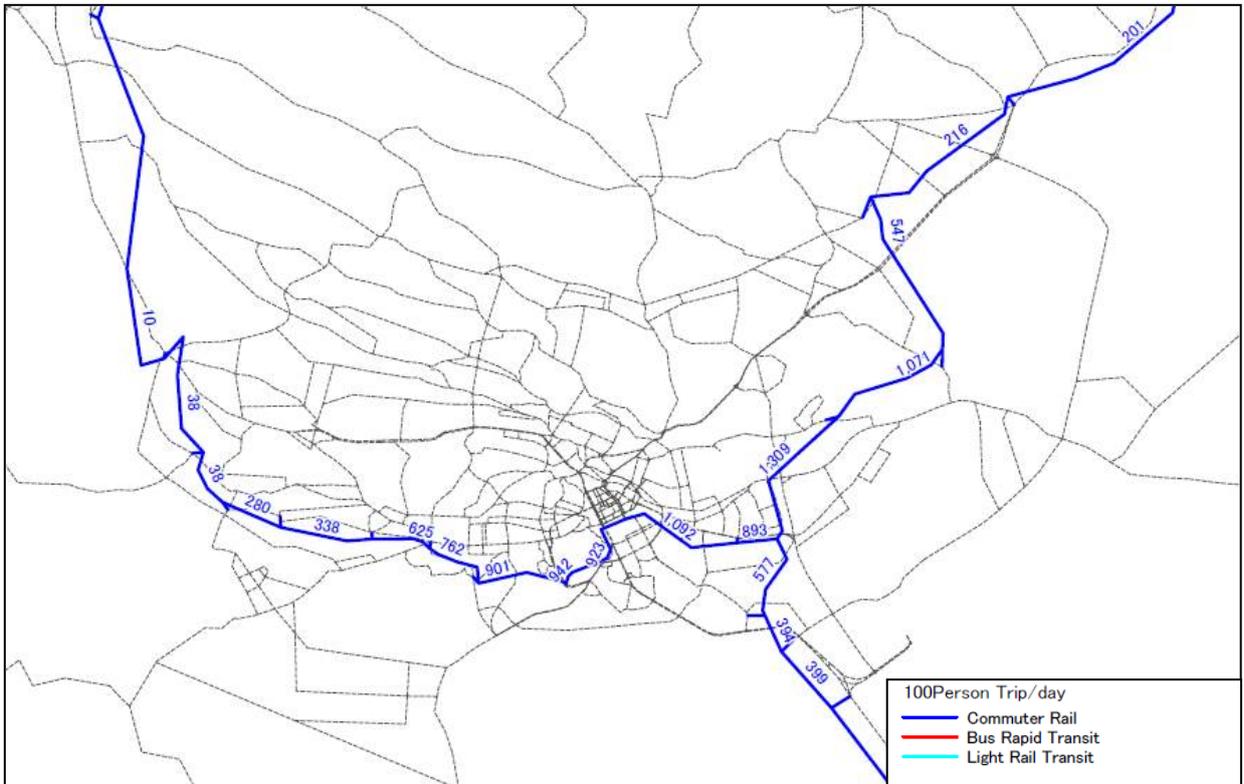
Source: JICA Study Team (JST)

Figure A4.8.4: Vehicle Assignment Result of “Alternative 1” in 2030



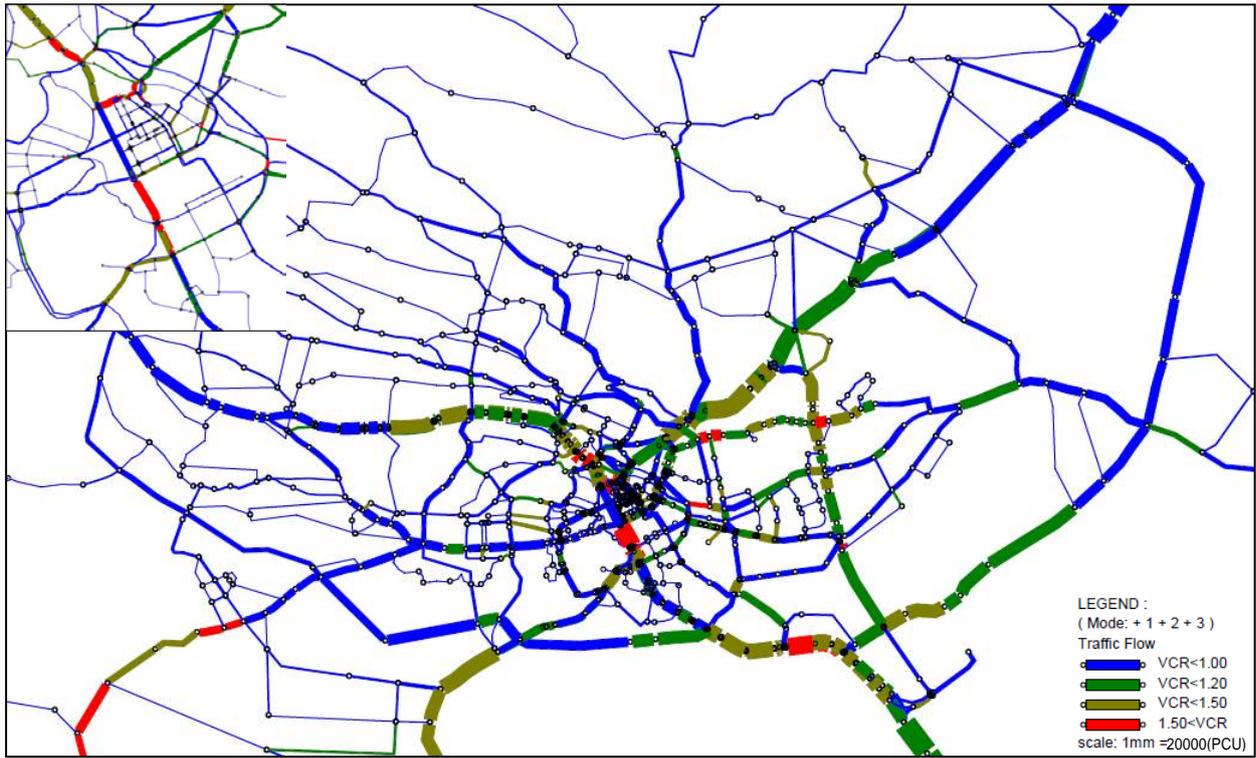
Source: JICA Study Team (JST)

Figure A4.8.5: Vehicle Assignment Result of “Alternative 2” in 2030



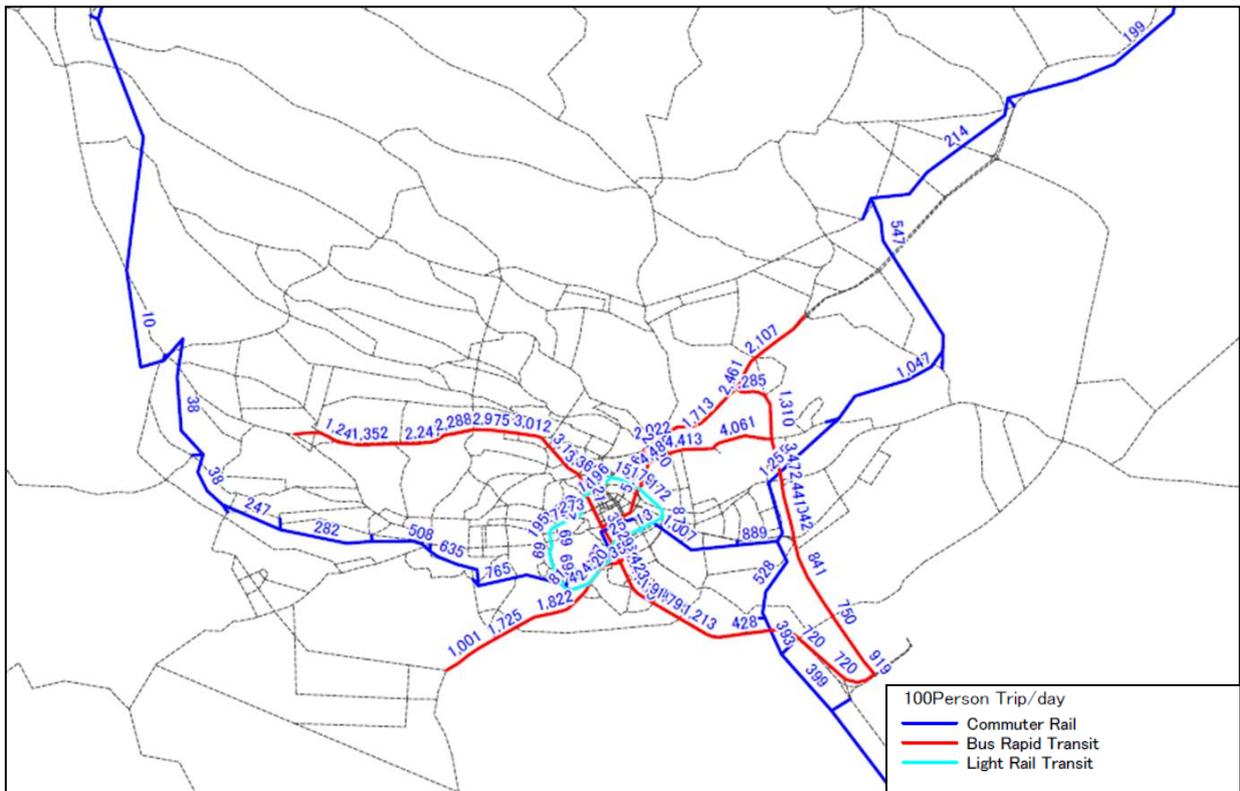
Source: JICA Study Team (JST)

Figure A4.8.6: Public Transport Assignment Result of “Alternative 2” in 2030



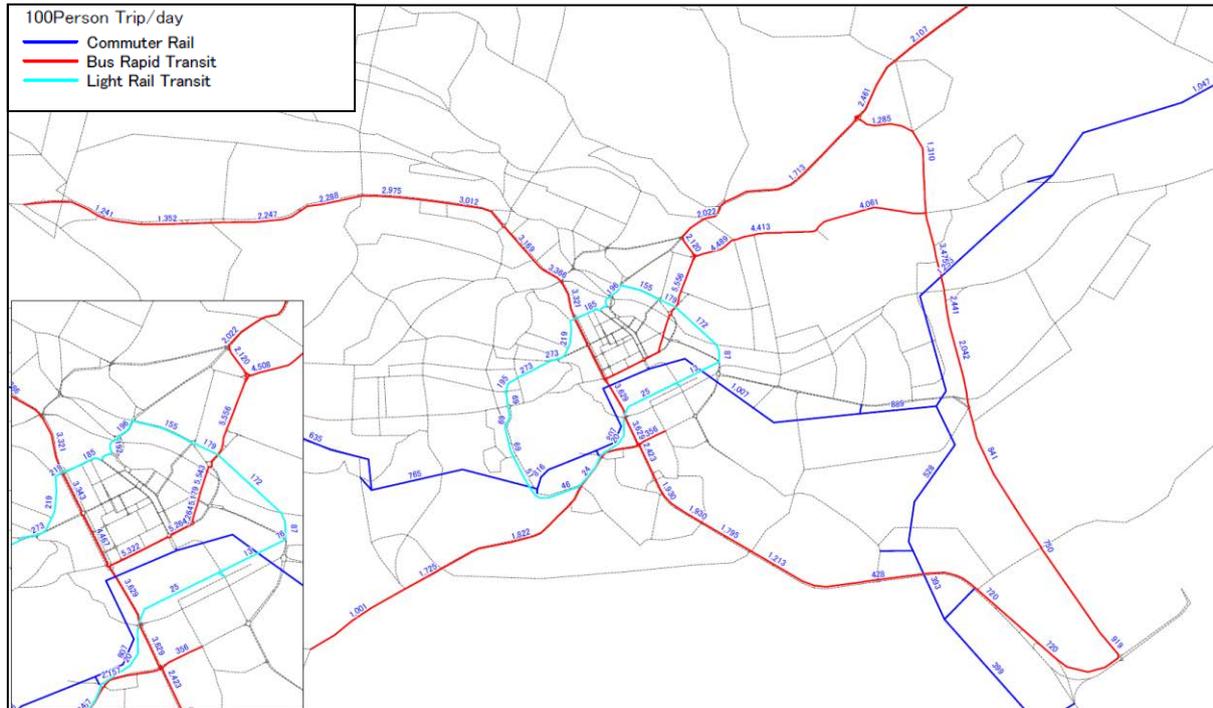
Source: JICA Study Team (JST)

Figure A4.8.7: Vehicle Assignment Result of “Alternative 3” in 2030



Source: JICA Study Team (JST)

Figure A4.8.8: Public Transport Assignment Result of “Alternative 3” in 2030



Source: JICA Study Team (JST)

Figure A4.8.9: Public Transport Assignment Result of “Alternative 3” in 2030 (Scaled up)

A4.8.4 Evaluation of Alternatives

Comparing the future traffic demand of Alternatives 0 to 3 with the existing, the following can be observed:

- Comparing the indices of Alternatives 0 to 3, vehicle-km, vehicle-hours, and average VCR will decrease due to the development of mass transit.
- Development of roads cannot solve the traffic congestion. Reinforcement of mass transit and introduction of new transit system are requisite.
- By reinforcement of commuter rail and introduction of BRT to 6 corridors, traffic congestion is eased especially in the eastern area of the city centre.
- As a result, Alternative 3 is the recommended solution against the increasing future traffic demand.

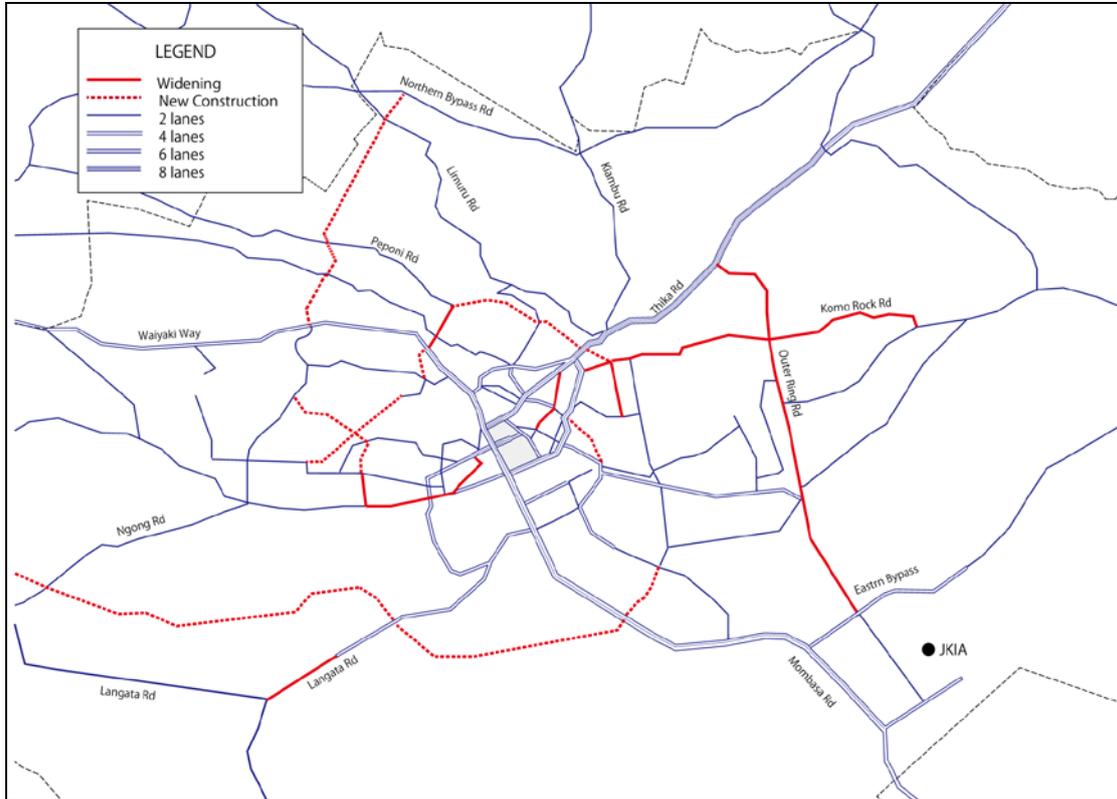
A4.9 Evaluation for the Short Term and the Medium Term

A4.9.1 General

The transportation situation in the medium term is evaluated in case of Alternative 3 which mostly leads to transportation reform amongst the cases evaluated in the above paragraph. The transportation network in the medium term is as shown in the main report. The transport demands in 2018 and 2023 are calculated based on the transport demand in 2030, and assigned on this transportation network.

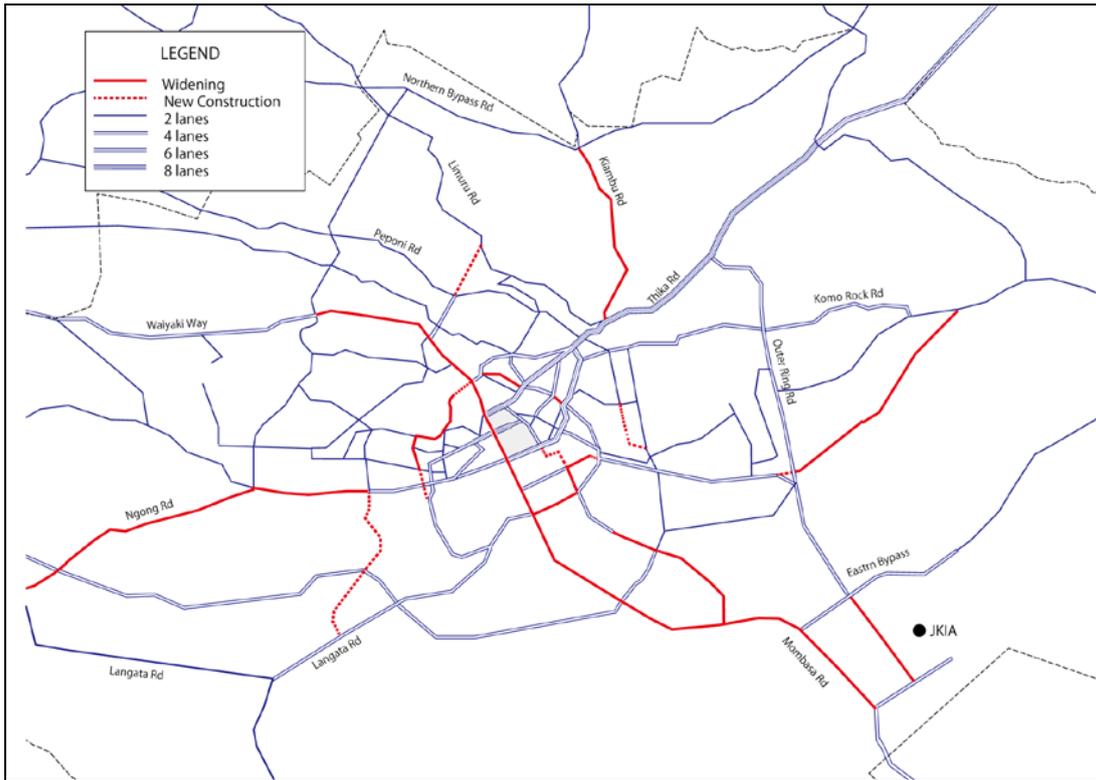
A4.9.2 Staging Plan of Alternative 3

The development project is shown by the basic strategy described in the main report. Each development project is shown in Figures A4.9.1 to A4.9.5. They are developed in the target years of 2018 and 2023. Depending on the road network developed, the future traffic demand is forecasted by the target year. Then, the forecast result will be evaluated.



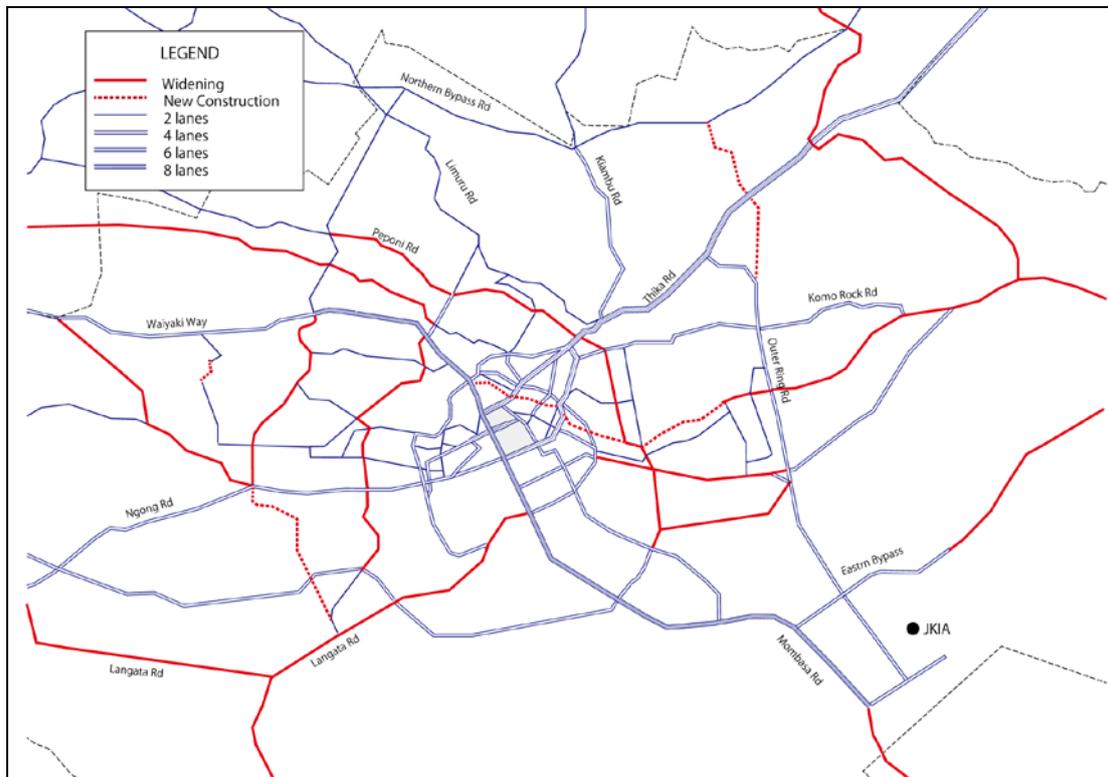
Source: JICA Study Team (JST)

Figure A4.9.1: Road Network Staging Plan in 2018



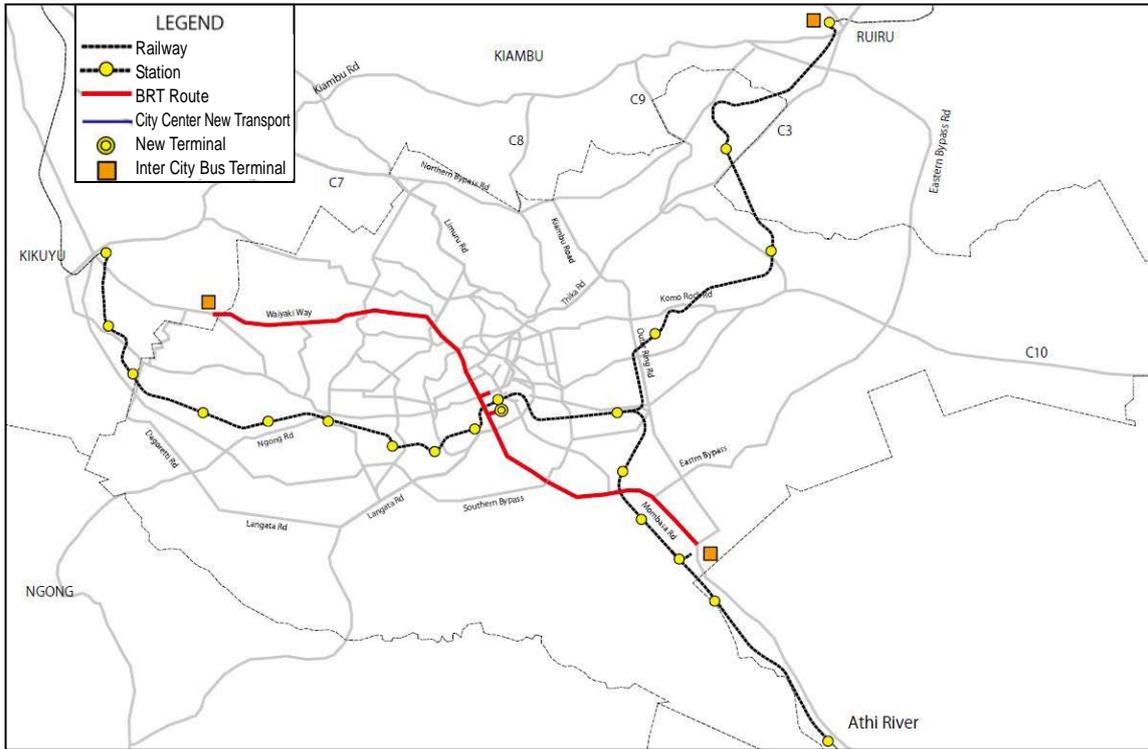
Source: JICA Study Team (JST)

Figure A4.9.2: Road Network Staging Plan in 2023



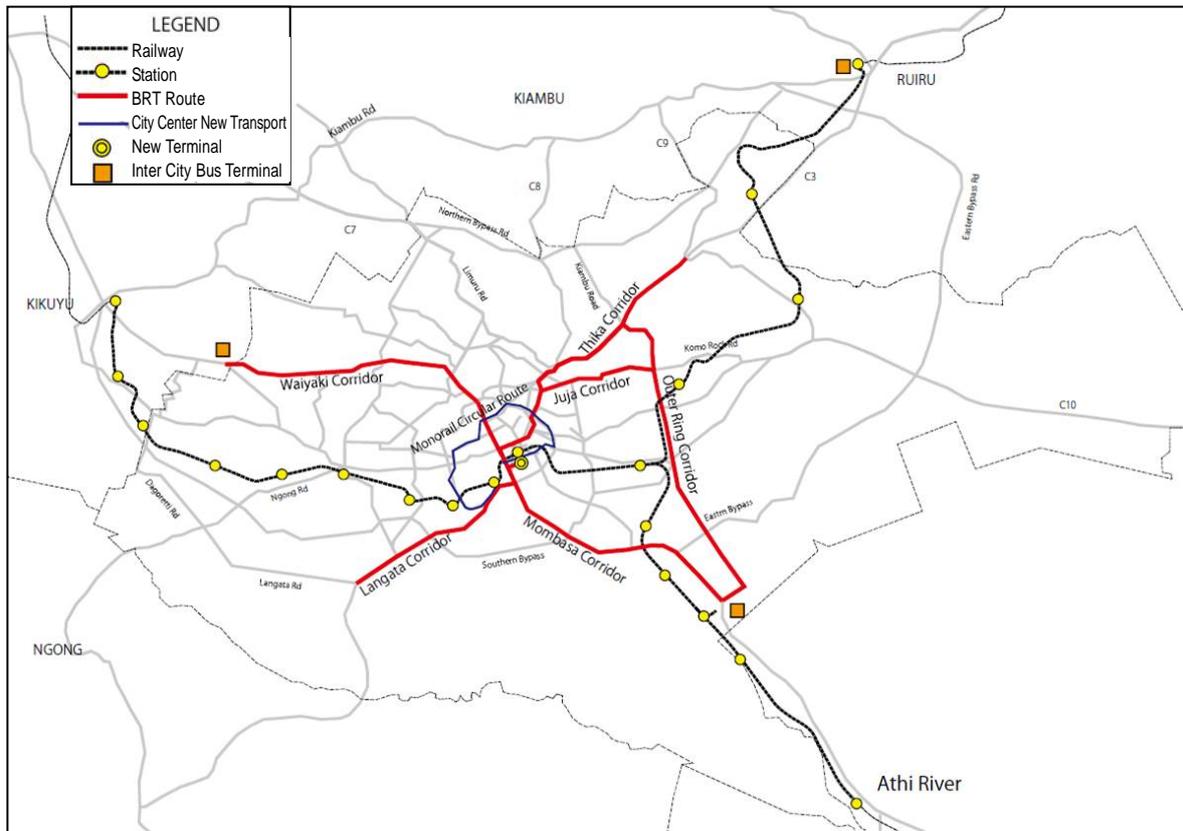
Source: JICA Study Team (JST)

Figure A4.9.3: Road Network Staging Plan in 2030



Source: JICA Study Team (JST)

Figure A4.9.4: Public Transport Network Staging Plan of “Alternative 3” in 2023



Source: JICA Study Team (JST)

Figure A4.9.5: Public Transport Network Staging Plan of “Alternative 3” in 2030

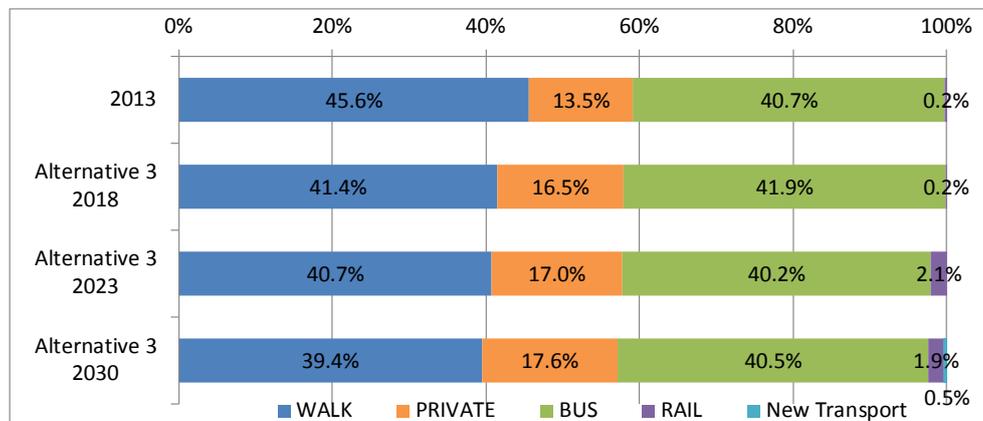
A4.9.3 Forecast Result of the Short Term and the Medium Term of Alternative 3

The future modal share for Alternative 3 by each target year was forecasted using the built modal split model. The result of the forecast is shown in Table A4.9.1 and Figure A4.9.6.

Table A4.9.1: Future Modal Share of Alternative 3 by Target Year

Alternatives and Target Year	Walk	Private	Public	Rail	NewTransport	Total
2013	3,090,103 45.6%	916,624 13.5%	2,754,489 40.7%	14,006 0.2%	--	6,775,222 100.0%
Alternative 3 2018	3,246,051 41.4%	1,289,796 16.5%	3,281,824 41.9%	14,416 0.2%	--	7,832,087 100.0%
Alternative 3 2023	3,606,326 40.7%	1,506,186 17.0%	3,564,101 40.2%	181,736 2.1%	--	8,858,349 100.0%
Alternative 3 2030	3,951,711 39.4%	1,767,773 17.6%	4,062,046 40.5%	190,456 1.9%	45,692 0.5%	10,017,678 100.0%

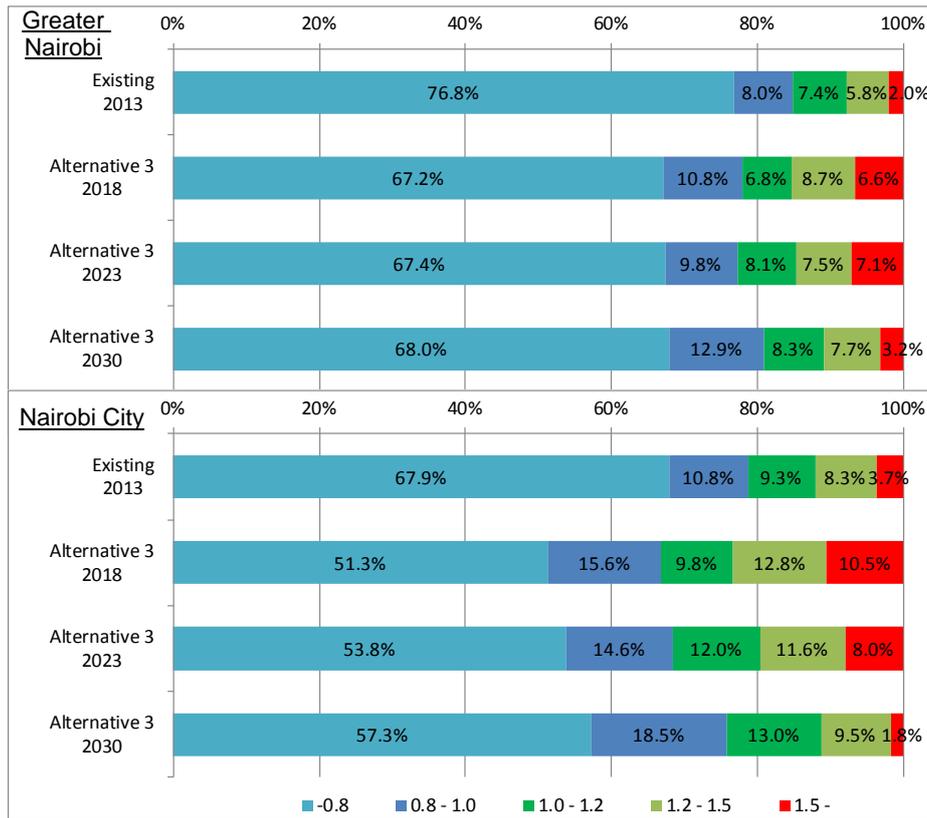
Source: JICA Study Team (JST)



Source: JICA Study Team (JST)

Figure A4.9.6: Future Modal Share of Alternative 3 by Target Year

The congestion ratio of Alternative 3 is shown in Figure A4.9.7, and the forecast results of the future traffic flow indicator and modal share in the short term and medium term of Alternative 3 are shown in Table A4.9.2.



Source: JICA Study Team (JST)

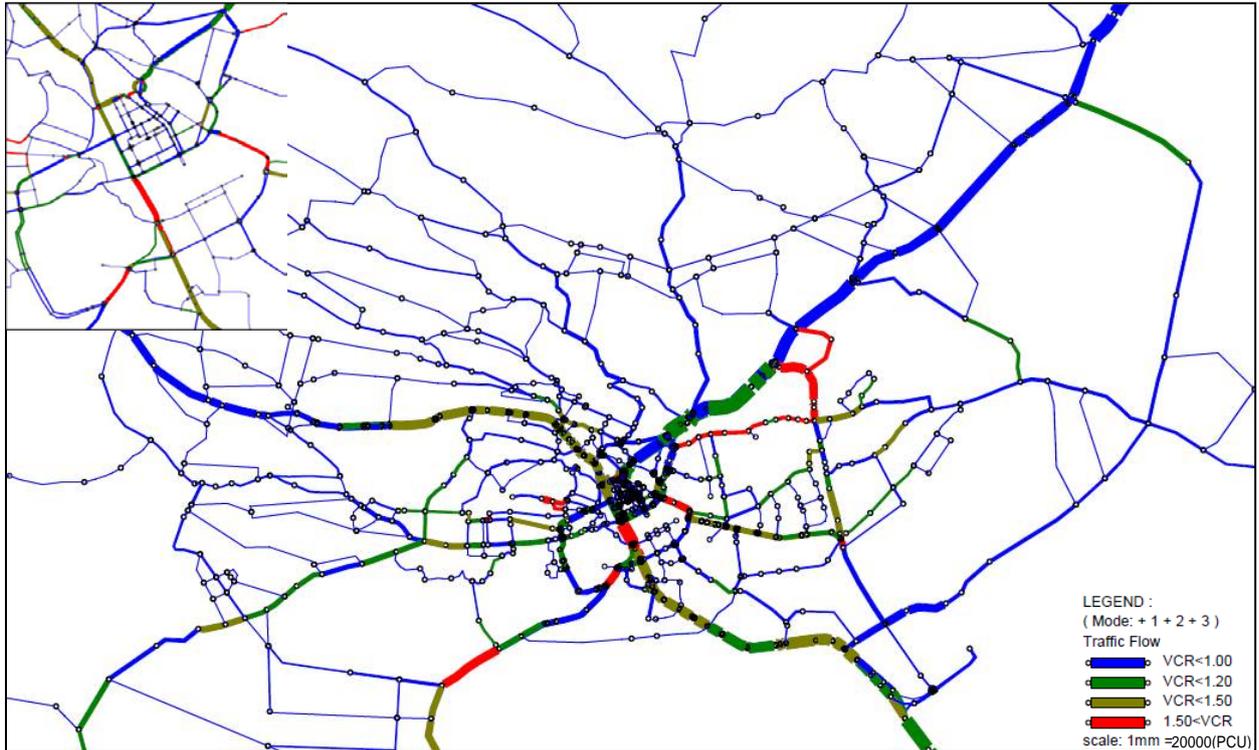
Figure A4.9.7: Congestion Ratio of Alternative 3 by Target Year

The forecast results of the volume of vehicle and public transport user in each target year are shown in Figure A4.9.8 to Figure A4.9.15. Vehicle assignment is shown in PCU and public transport is shown in trip volume. The shift from walk or trip within zone as short length trips is not included in the new transport system.

Table A4.9.2: Vehicle Assignment Result in Alternative 3 by Target Year

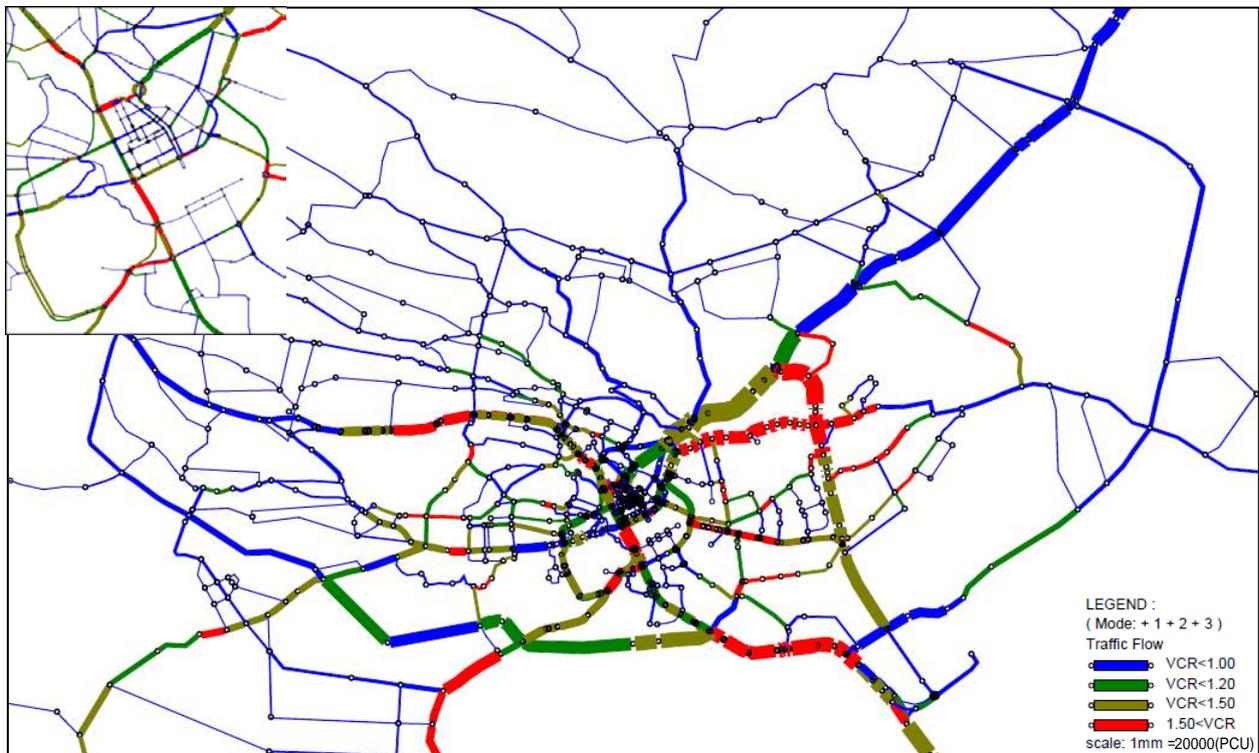
Case		Existing	Alternative 3				
Year		2013	2018	2023	2030		
Modal Split of Person Trips	Walk	45.6%	41.4%	40.7%	39.4%		
	Car	13.5%	16.5%	17.0%	17.6%		
	Bus	40.7%	41.9%	40.2%	40.5%		
	New transport	-	-	-	0.5%		
	Railway	0.2%	0.2%	2.1%	1.9%		
Greater Nairobi	Vehicle-km total (PCU-km)('000)		17,780	24,170	27,000	30,500	
	Vehicle-hours total (PCU-Hour)		431,690	618,900	680,230	723,920	
	Average Speed (km/h)		41.2	39.1	39.7	42.1	
	Average VCR (Volume Capacity Ratio)		0.54	0.69	0.72	0.71	
	Congestion Ratio	-0.8	km	1,114.7	1,005.2	1,017.6	1,038.3
			%	76.8%	67.2%	67.4%	68.0%
		0.8 - 1.0	km	116.4	161.4	148.7	196.8
			%	8.0%	10.8%	9.8%	12.9%
		1.0 - 1.2	km	106.9	101.1	122.3	126.8
			%	7.4%	6.8%	8.1%	8.3%
		1.2 - 1.5	km	84.1	130.9	113.9	117.7
	%		5.8%	8.7%	7.5%	7.7%	
	1.5 -	km	29.2	98.1	107.1	48.2	
		%	2.0%	6.6%	7.1%	3.2%	
	TOTAL	km	1,451.4	1,496.7	1,509.7	1,527.8	
	%	100.0%	100.0%	100.0%	100.0%		
Nairobi City	Vehicle-km total (PCU-km)('000)		10,960	16,210	18,040	19,430	
	Vehicle-hours total (PCU-Hour)		273,910	424,160	444,960	432,490	
	Average Speed (km/h)		40.0	38.2	40.6	44.9	
	Average VCR (Volume Capacity Ratio)		0.69	0.92	0.90	0.82	
	Congestion Ratio	-0.8	km	510.2	404.6	431.4	469.7
			%	67.9%	51.3%	53.8%	57.3%
		0.8 - 1.0	km	81.0	122.6	116.9	151.4
			%	10.8%	15.6%	14.6%	18.5%
		1.0 - 1.2	km	69.5	77.7	95.9	106.7
			%	9.3%	9.8%	12.0%	13.0%
		1.2 - 1.5	km	62.3	100.9	93.1	77.6
	%		8.3%	12.8%	11.6%	9.5%	
	1.5 -	km	28.1	83.0	64.3	14.4	
		%	3.7%	10.5%	8.0%	1.8%	
	TOTAL	km	751.2	788.7	801.7	819.8	
	%	100.0%	100.0%	100.0%	100.0%		

Source: JICA Study Team (JST)



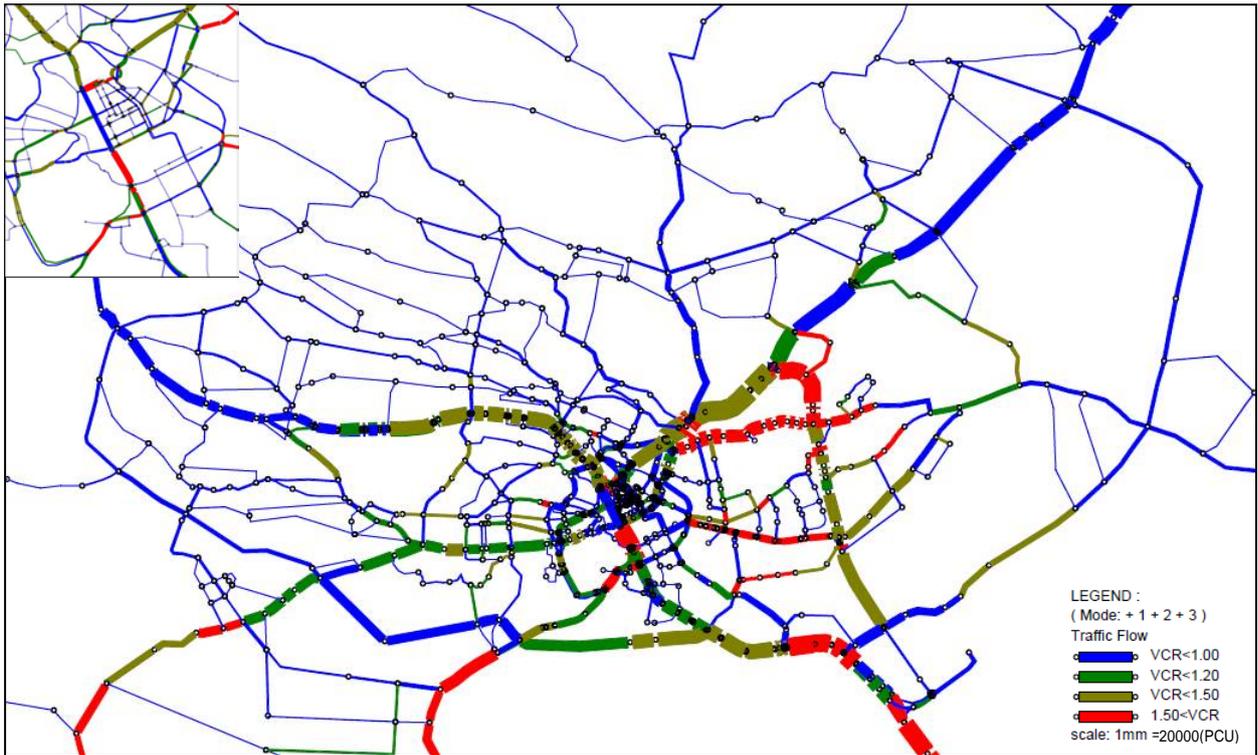
Source: JICA Study Team (JST)

Figure A4.9.8: Vehicle Assignment Result of “Existing Case” in 2013



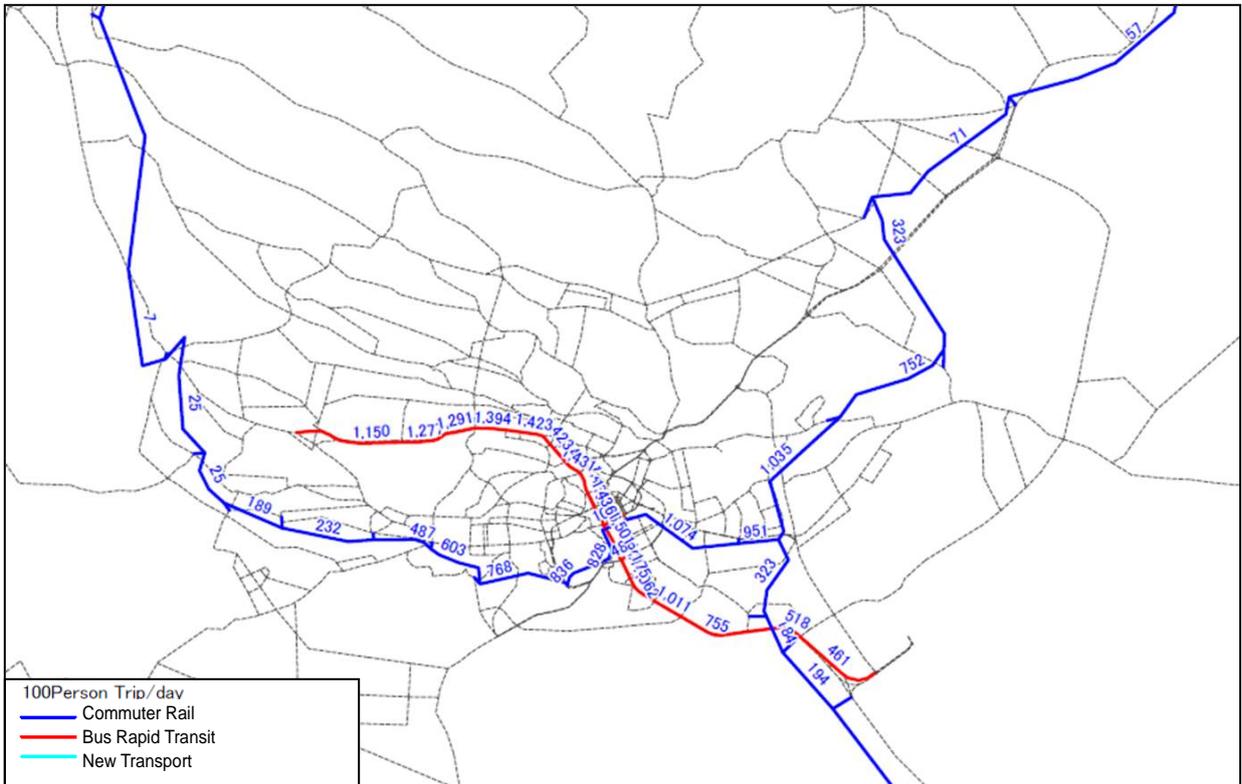
Source: JICA Study Team (JST)

Figure A4.9.9: Vehicle Assignment Result of “Alternative 3” in 2018



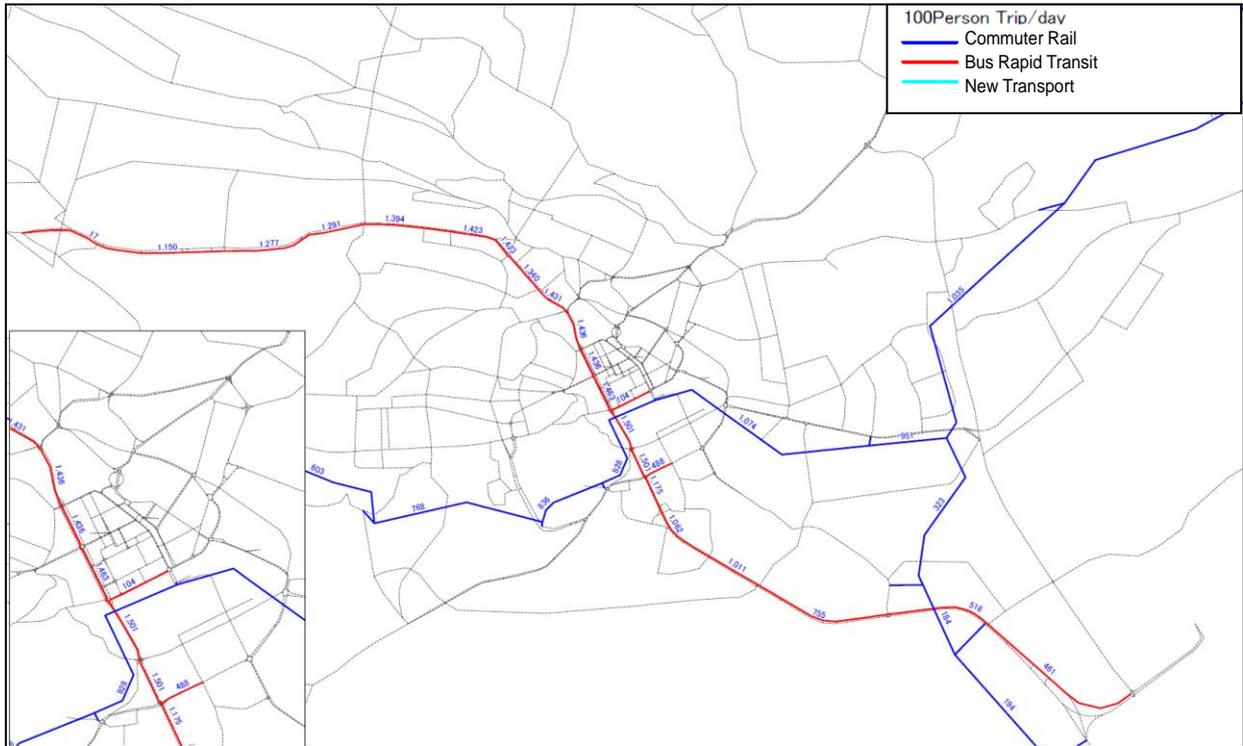
Source: JICA Study Team (JST)

Figure A4.9.10: Vehicle Assignment Result of “Alternative 3” in 2023



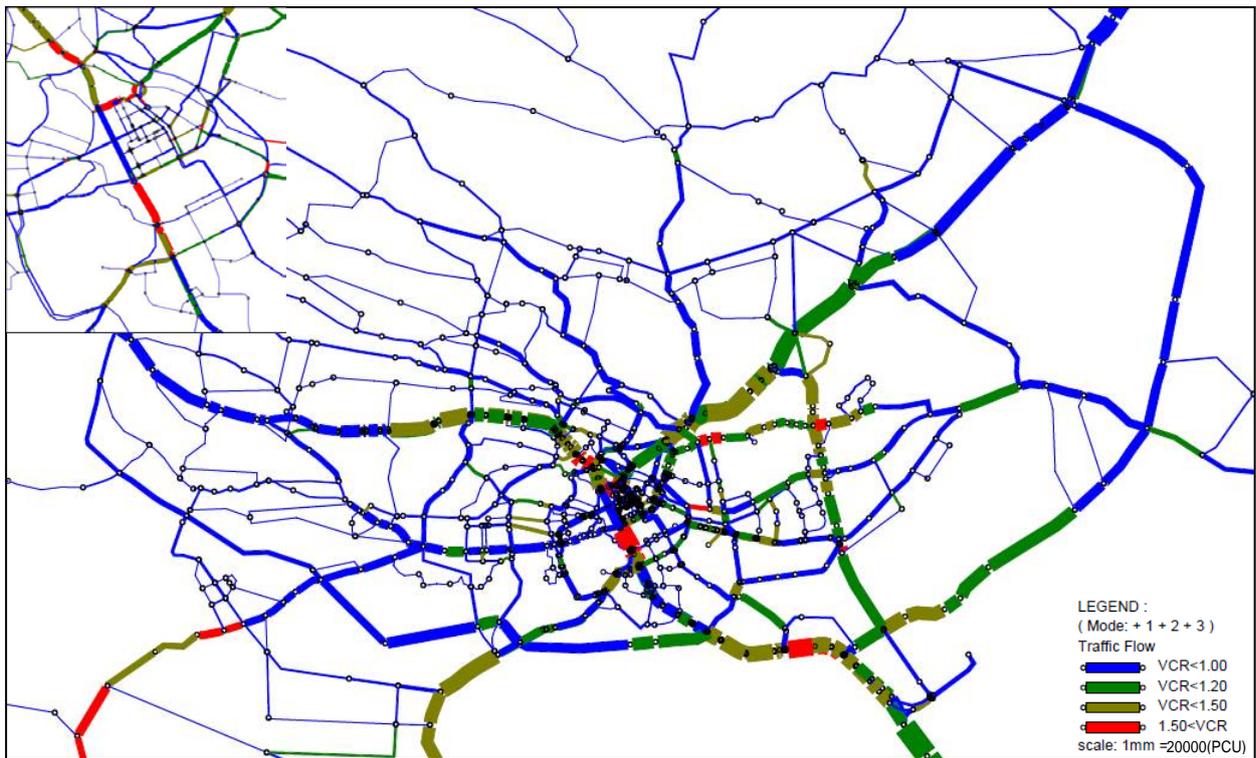
Source: JICA Study Team (JST)

Figure A4.9.11: Public Transport Assignment Result of “Alternative 3” in 2023



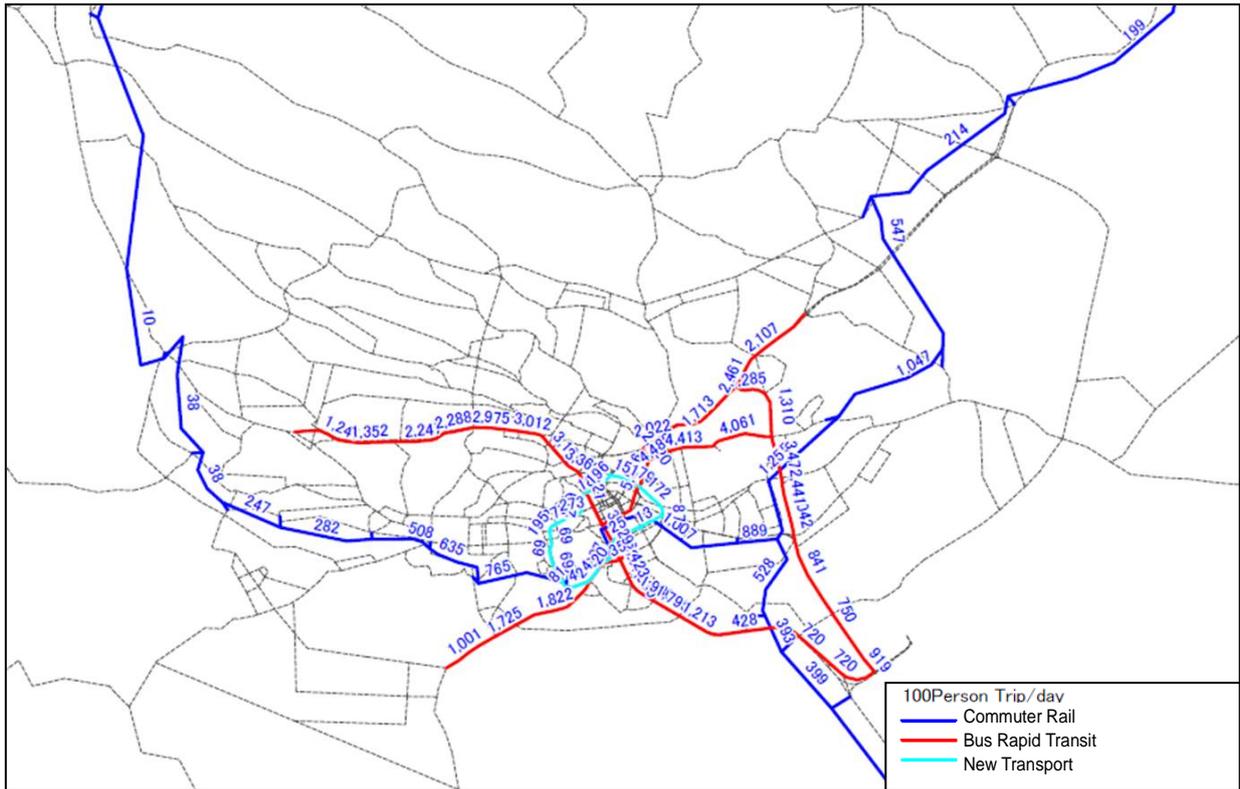
Source: JICA Study Team (JST)

Figure A4.9.12: Public Transport Assignment Result of “Alternative 3” in 2023 (Scaled up)



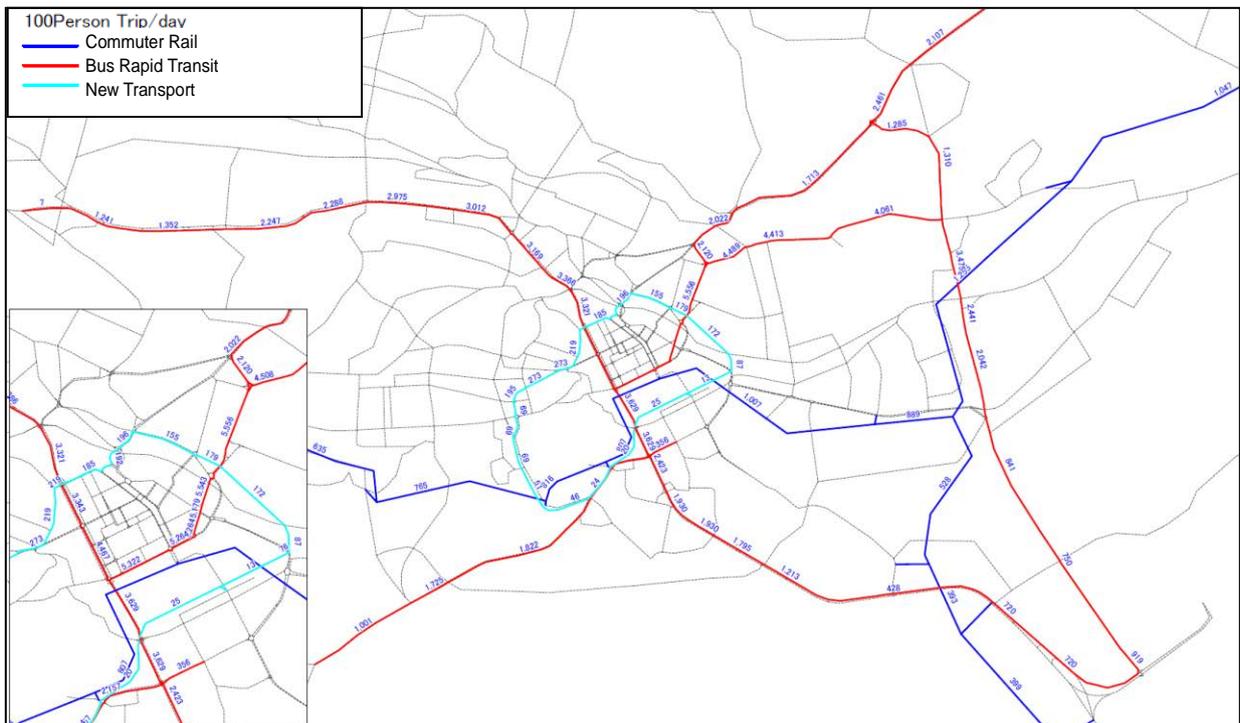
Source: JICA Study Team (JST)

Figure A4.9.13: Vehicle Assignment Result of “Alternative 3” in 2030



Source: JICA Study Team (JST)

Figure A4.9.14: Public Transport Assignment Result of “Alternative 3” in 2030



Source: JICA Study Team (JST)

Figure A4.9.15: Public Transport Assignment Result of “Alternative 3” in 2030 (Scaled up)

A4.9.4 Evaluation of Staging Plans

Comparing the future traffic demand of the staging plan with the existing, the following can be noted:

- In the short and medium terms, traffic condition will become worse because improvement of the network cannot catch up with the increasing traffic demand.
- Under the condition that the proposed plan is implemented, the transport condition will be improved in the target year.
- Improvement of public transport network as well as road network is essential to realise the future transport network.

APPENDIX 5: PROGRESS OF ROAD DEVELOPMENT AFTER 2006

Number of planned lanes is by 2006 M/P

		Category	No. by 2006 M/P	Road Name	New/ Widening	No. of lane existing	No. of lane planned	Progress	
1. Bypass and Link Roads	Mid-term	Bypass roads	L-2	Outer Ring Road - Airport North Rd	W	2	4	To be constructed by AfDB finance	
			B-1	Southern Bypass (Mombassa Rd - Langata Rd)	N	-	2	Under construction by Chinese finance	
			B-3	Eastern Bypass (Airport North Rd.)	W	-	2		
	Long term	Bypass and Link Roads	B-3	Eastern bypass	N	-	2	Completed by Chinese finance	
			B-2	Northern bypass	N	-	2	Completed by Chinese finance	
			B-1	Southern bypass (Langata Rd.-)	N	-	2	Under construction by Chinese finance	
			L-1	Western Link Rd (n)	N	-	2	Partly under construction finance not fixed	
			L-2	Eastern Link Rd (Outer Ring Rd extension)	N	-	2		
L-2	Airport South Rd	W	4	4					
2. Missing Link	Short term	Missing links (arterial)	M-1	No. 1 River Rd to Ngara Rd	N	-	2	To be constructed by EU finance	
	Mid-term	Missing Links (arterial)	M-10	No.10 Likoni Rd extension	N	-	4	Completed by EU finance (2 lanes)	
			Missing links (collector)	M-5	No. 5 Muratina St	N	-	2	Completed by EU finance
				M-11	No. 11 Paw Paw Rd extension	N	-	2	
		M-13		No.13 Muthiora Rd to Hinga Rd	N	-	2		
		M-15c		No. 15c Ring Road Parkland extension (to Limuru Rd thru Karua Forest)	N	-	2		
		Missing links (local)	M-2	No.2 Ole Odume Rd-part	N	-	2		
			M-4	No. 4 Mpaka Rd	N	-	2		
			M-8	No. 8 Procession Way	N	-	2		
			M-9	No. 9 Minimal Rd	N	-	2		
			M-14	No. 14 Convent Drive extension	N	-	2		
	M-15d	No. 15d Ring Rd Parkland extension (to Peponi Rd)	N	-	2				
3. Radial Roads	Short term	Radial roads within C-3	R-3	Ngong Rd (to Elegeyo Marakwet Rd)	W	2	4	To be constructed by Japanese finance	
			R-6	Muranga Rd	W	2	4	Completed by AfDB finance	
			R-5	Limuru Rd (- Muthaiga Rd)	W	2	4		
				Ring Rd Ngara	W	2	4		
			R-7	Juja Rd (- Muratina Rd)	W	2	4		
	Mid-term	Radial roads outside C-3	R-6	Thika Rd (to Kenyatta Univ)	W	2	6-8	Completed by AfDB finance	
			R-7	Juja Rd (Easteleigh 1st Ave - Outer Ring Rd)	W	2	4		
			R-3	Ngong Rd (Elegeyo Marakwet Rd - Naivasha Rd)	W	2	4		
			R-2	Langata Rd (Missing link No. 12 to Magadi Rd)	W	2	4	Under construction by Govt finance	
			R-8	Kayole Rd extension (- Jogoo Rd)	N	-			
			R-8	Factory St	W	2	4		
			R-5	Limuru Rd. (-Red Hill Rd.)	W	2	4		
	Long term	Radial roads outside C-3	R-6	Thika Rd (to Kenyatta Univ - Thika)	W	2	6	Completed by Chinese finance	
			R-5	Limuru Rd (Red Hill Rd -)	W	2	4		
			R-7	Komarock Rd (Outer Ring Rd -)	W	2	4		
			R-8	Kayole Rd (Outer Ring Rd -)	W	2	4		
R-8			Railway viaduct	N	-				
R-2	Langata Rd (Missing link No. 12 to Magadi Rd)	W	2	4					

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Number of planned lanes is by 2006 M/P

		Category	No. by 2006 M/P	Road Name	New/ Widening	No. of lane existing	No. of lane planned	Progress
4. Circumferential Arterial Roads	Short term		M-6	No. 6 Oloitokitok Rd to Ring Rd Kileshwa	N	-	2	To be completed in **** by Japanese finance
			M-7	No.7 Argwings kodhek Rd to James Gichuru Rd	N	-	2	To be completed in **** by Japanese finance
			C-3	Ring Road Kilimani	W	2	2	To be completed in **** by Japanese finance
	Mid-term	Circumferential arterial roads C-3	M-12	No.12 Kung'u KanumbaRd to Ngong Rd	N	-	2	
			M-15a	Missing Link No. 15a Ring Road Parkland	N	-	4	To be constructed by EU finance (2 lanes)
			M-15b	Missing Link No. 15b Ring Road Parkland extension	N	-	4	To be constructed by EU finance (2 lanes)
		Circumferential arterial roads C-2	C-2	Ngara Rd	W	2	4	
			C-2	Quarry Rd	W	2	4	
			M-16	No. 16 Quarry Rd extension	N	-	4	To be constructed by EU finance (2 lanes)
	Long term	Circumferential roads C-2	C-2	Uhuru Highway-Thika Rd junction to Woodlands Rd	N	-	4	
			C-2	Woodlands Rd	W	2	4	
			C-2	Woodlands Rd to Mbagathi way	N	-	4	
		Circumferential roads C-3	C-3	Missing Link No. 5, 15a & 15b	W		4	
			M-5	Missing Link No. 3 and extension to Eastleigh south road	W, N	2	4	
			C-3	Likoni Rd	W	2	4	
			M-3	Missing Link No. 3	W	2	4	
			C-3	Ring Road Riverside	W	2	4	
			M-6	Missing Link No. 6 northern part (w)	W	2	4	
			M-7	Missing Link No. 7 southern part	W	2	4	
C-3	Ring Rd Kilimani	W	2	4				
M-12	Missing Link No. 12 northern part	W	-	4				
5. Secondary Arterial Roads	Short term		S-1	Enterprize Rd (ma Bay Rd - Likoni Rd)	W	2	4	
			R-6	Park Rd	W	2	4	Completed by AfDB finance
			R-6	Museum Hill - Forest Rd (Limuru Rd junction)	W	2	4	Completed by AfDB finance
				General Waruingi St.	W	2	4	
	Mid-term		S-4	Lower Kabete Rd (- Kyuna Rd)	W	2	4	
			S-1	Enterprize Rd (Factory St - Lusaka Rd)	W	2	4	
			S-1	Enterprize Rd (M-10-Mombasa Rd.))	W	2	4	
	Long term	Secondary arterial roads (south-west)	S-3	Naivasha Rd (Kikuyu Rd - Waiyaki Way)	W	2	4	
		Secondary arterial roads (north-east)	S-4	Lower Kabete Rd (Kyuna Rd.- Gitaru/Ndenderu Rd.)	W	2	4	
			S-5	Kiambu Rd (outside Nairobi city)	W	2	4	
			S-6	Kamiti Rd	W	2	4	
			S-6	Kasarani Rd	W	2	4	
			S-8	Lunga Lunga Rd	W	2	4	
			S-7	Dandora Rd extension	N	-	2	
			S-7	Riverside Rd.	N	-	2	
S-2			Magadi Rd	W	2	4		
S-1	Enterprize Rd (Around Likoni Rd crossing)	W	2	4				
6. Intersection Improvement	Short term	Intersection improvement (stage 1)						
	Mid-term	Intersection improvement (stage 2)						
	Long term	Intersection improvement (stage 3)						

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		Category	No. by 2006 M/P	Road Name	New/ Widening	No. of lane existing	No. of lane planned	Progress
7. Non-Motorised Transport (NMT)	Short term	NMT (north & west)						
	Mid-term	NMT (south & west (part))						
	Long term	NMT (south & west (part))						
8. Uhuru Highway	Short term		R-1	Mombasa Rd (Southern Bypass-) Chimoro Rd (w)	W			Under design by WB finance
	Mid-term		R-1	Mombasa Rd (Southern Bypass-) (w)	W			Under design by WB finance
	Long term		R-1	Waiyaki way (Kaptagat Rd.-) (w)	W			Under design by WB finance
9. Traffic Circulation	Short term	Traffic circulation (stage 1)						
	Mid-term	Traffic circulation (stage 2)						

APPENDIX 6: SUMMARY OF MINUTES OF MEETING DURING NCC'S PUBLIC CONSULTATION

Tables A.1 - A.9 summarises the discussion results, obtained through this consultation process. It is noted that all comments were not incorporated into the NIUPLAN, but all minutes of consultations are recorded and disclosed, and are to be reflected in future regional or local development projects or programs, which are to be delineated based on NIUPLAN.

Table A.1 Summary of NCC's Consultation Process (Kasarani District)

Issues	Opportunities	Challenges	Possible Options/Proposals
Urban Transport and Infrastructure			
1) Urban transport roads <ul style="list-style-type: none"> • Poor access within the estate • Management of public service transport • Traffic congestion • Non-motorised transport • Road maintenance • Road accidents Railway <ul style="list-style-type: none"> • Insufficient stations • Encroachment on reserved railway space • Railway accidents 	<ul style="list-style-type: none"> • Modernisation of railway transport • Link with other modes of transport • Tenants willing to participate; organised groups, SACCOs • Available experts and labor • Job creation • Regularisation of land/subdivision 	<ul style="list-style-type: none"> • Encroachment and land grabbing • No access to parts of the estate • Lack of bus terminus • Lack of discipline • Encroachment on reserved road space • No bumps for speed control • Vandalism and corruption • Underutilisation of railway transport 	<ul style="list-style-type: none"> • Improve access roads within the estates • Keep minimum reserved road space • Public private partnerships in road construction, maintenance, and rehabilitation. • Naming and classification of roads • Enforcement incentives • Removal of illegal structures • Proper maintenance unit, equipment, and facilities • Share infrastructure concerning roads and buildings • Link roads within the city
2) Infrastructure <ul style="list-style-type: none"> • Solid waste management • Water supply • Stormwater and sewerage • Power and telecommunication 	<ul style="list-style-type: none"> • Introduce waste conversion • Establish common transport ducts • Need to find alternative energy 	<ul style="list-style-type: none"> • Poor maintenance • Cartels • Encroachment • Vandalism 	<ul style="list-style-type: none"> • Localised and designated waste collection points • 3Rs (reduce, reuse and recycle) • Own and take care of own wastes • Biodegradable waste can be used for energy production • Expansion of sewerage • Water harvesting • Water recycling • Plan for green city; renewable energy
Governance, Legislation, and Institutional Frameworks			
<ul style="list-style-type: none"> • Security and safety • Corruption • Lack of accountability and transparency 	<ul style="list-style-type: none"> • Security provision set aside and can be used for police department or patrol base 	<ul style="list-style-type: none"> • Increasing insecurity • Insufficient lighting and security forces • No protective policies but reactive measures • No access to relevant information • Review and implementation of laws and policies • Following the law to the letter • Change morals • Public participation in levies and taxes • Giving back to the community • Political interference • Poor implementation frameworks 	<ul style="list-style-type: none"> • Make security everyone's concern • Street lighting • Security agents to coordinate activities • Review laws and policies; repeal old regulations • New ways for information to reach citizens • Ensure transparency and accountability • Follow the law to the letter; change in attitude • Enable public participation in levies and taxing • Give back to community • Team work within institutions • One stop centres for all services • Youth involvement and empowerment
<ul style="list-style-type: none"> • Institutions 		<ul style="list-style-type: none"> • Poor coordination • Bureaucracy • Duplication of roles • Incompetence • Negligence • Corruption and greed 	<ul style="list-style-type: none"> • Accommodate all stakeholders in the planning process • Work in harmony with different departments; check on previous failures • Introduce more flexible processes • Get rid of redundant positions

Issues	Opportunities	Challenges	Possible Options/Proposals
Urban Economy, Social Service, and Environment			
<ul style="list-style-type: none"> Increased population Increased crime Accelerated migration from countryside to city 	<ul style="list-style-type: none"> Expanding market demand for goods and services Migration brings diversity Ready labor market for industries People come with new ideas that are innovative Cooperative and community projects are fostered 	<ul style="list-style-type: none"> Interference with current national planning Increase in crime/insecurity 	<ul style="list-style-type: none"> Take census more frequently for every county government Integrate national security with county security Community policing Introduction of security facilities, e.g., CCTV, security lights Have suggestion boxes in the city Create website or incorporate use of technology for crime reporting
Environmental pollution		Poor waste management systems	<ul style="list-style-type: none"> Garbage collection centres Recycling plants Change of attitude; personal responsibility Civic education on importance of environmental preservation
Urban agriculture		No markets for produce	<ul style="list-style-type: none"> Economic free trade zones policy for business/economic stimulation VAT for food stuff should be checked
Social stress		Lack of public utilities, e.g., social halls and playgrounds	Provision of social amenities
Uncontrolled livestock farming		Influx of livestock into residential areas and public spaces	<ul style="list-style-type: none"> Regulate livestock keeping in residential areas Land use planning
Health issues		Disease outbreaks	<ul style="list-style-type: none"> Enhance sanitation Increase and upgrade health facilities
Education		<ul style="list-style-type: none"> Low education quality Alcohol, drugs, and substance abuse 	<ul style="list-style-type: none"> Increase and upgrade schools and learning institutions Employ more teachers and pay them well Feeding programs in primary schools
Congested centres		Congestion in the city	<ul style="list-style-type: none"> Re-introduce organised transport system (e.g., KBS, railway, commuter trains) Decentralise offices from the city centre
Land and Human Settlement			
<ul style="list-style-type: none"> Land tenure and land rates 	<ul style="list-style-type: none"> Processing of title deeds 	<ul style="list-style-type: none"> Squatters Absentee landlords Idle land Brokers/land cartels Inconsistency in developments leading to confusion No title deed Disorder Lacking coordination amongst different authorities 	<ul style="list-style-type: none"> Compensation Regularisation of ownership Institute land control board Title deeds for land Valuation of land and re-evaluation of land rates
Illegal structures	Existing laws and policies	<ul style="list-style-type: none"> Lack of political goodwill Poor enforcement of existing legislation Different rates for same services, e.g., surveying 	<ul style="list-style-type: none"> Regularisation of illegal structures Sensitisation on regularisation process Encourage political goodwill Involve physical planners Involve local leaders
<u>Insufficient public social facilities/utilities;</u> <ul style="list-style-type: none"> There's only one public school, no health centres, access roads, markets, drainage, and sewer systems <u>Social issues</u> <ul style="list-style-type: none"> Drug and alcohol abuse Employment or lack thereof Lacking social amenities 	<ul style="list-style-type: none"> Public utility space available; Marioka – Mwiki Provision for construction in terms of land for public facility available 	<ul style="list-style-type: none"> Land grabbing Encroachment resistance 	<ul style="list-style-type: none"> Transparent, accountable and fair share of county development resources for development of social and physical infrastructure Upgrade existing dilapidated facilities; Kahawa health centre and maternity hospital Foot bridge for children crossing on the bypass Upgrade education systems and facilities Make plans for eco villages (self-sustaining neighborhoods) available

Issues	Opportunities	Challenges	Possible Options/Proposals
			<ul style="list-style-type: none"> Enhance social economic welfare Reacquire grabbed lands Restore areas that have been encroached upon Survey and register reserves Erect fences around public lands Residents vigilance Rehabilitation centres Establish resident committees to manage public facilities Secure tenure Community sensitisation Economic empowerment of the youth
Increased informal settlements		Squatter settlements	<ul style="list-style-type: none"> Upgrade informal settlement Inclusion of slums in planning process Enforcement
Wetlands	<ul style="list-style-type: none"> Afforestation Recreational parks 	<ul style="list-style-type: none"> Lack of awareness Resistance Encroachment Pollution 	<ul style="list-style-type: none"> Protection of wetlands Resettlement and compensation Establish tree nurseries Survey and registration of existing wetlands
<ul style="list-style-type: none"> Land use and land use change Uncontrolled development Urban agriculture 	<ul style="list-style-type: none"> Existing legislation No provisions for some installation of resources 		<ul style="list-style-type: none"> Regularisation Community sensitisation Political goodwill By-laws to be changed to accommodate urban agriculture; "Nairobi should feed itself."

Table A.2 Summary of NCC's Consultation Process (Westland District)

Issues	Opportunities	Challenges	Possible Options/Proposals
Urban Transport and Infrastructure			
<ul style="list-style-type: none"> Traffic management 	<ul style="list-style-type: none"> Synchronise traffic lights 	<ul style="list-style-type: none"> Clash between traffic police and existing traffic lights causing confusion Dysfunctional traffic lights 	<ul style="list-style-type: none"> Maintain and synchronise traffic lights Synchronise traffic lights and traffic police Improvement of road networks
<ul style="list-style-type: none"> No provisions for non-motorised transport 	<ul style="list-style-type: none"> Pedestrian walkways Cyclists lanes 	<ul style="list-style-type: none"> Policy makers do not understand the plight of the normal citizens 	<ul style="list-style-type: none"> Urgent construction of bicycle lanes and foot paths
<ul style="list-style-type: none"> Mass rapid transport within the city 	<ul style="list-style-type: none"> Intercity transport system 		<ul style="list-style-type: none"> Construction and expansion of railways and road systems
<ul style="list-style-type: none"> Stormwater drainage: non-existent drainage systems for stormwater leading to increased surface runoff and flooding in some areas 	<ul style="list-style-type: none"> Water harvesting Water harnessing for non-consumptive use 	<ul style="list-style-type: none"> Public awareness on water harvesting and management Need for attitude change 	<ul style="list-style-type: none"> Water harvesting directives to be included in planning for all city developments Adopt water recycling at a large scale County government shall make provisions for water collection in reservoirs Programs on public awareness
<ul style="list-style-type: none"> Sewerage systems: lack of data for proper planning Poor design of developments 	<ul style="list-style-type: none"> Modern sewerage management systems (shall learn lessons from other countries) 	<ul style="list-style-type: none"> Poor enforcement Poor planning Corruption; approvals/licenses for plans without sewerage provisions 	<ul style="list-style-type: none"> Upgrade existing sewerage systems Sewer pipeline network expansions Expand coverage of existing sewerage systems Localise sewer treatment units
<ul style="list-style-type: none"> Solid waste management: haphazard waste disposal Unplanned dumping sites Public health issues 	<ul style="list-style-type: none"> Modern solid waste treatment practices (shall learn lessons from other countries, e.g., sanitary landfills) 		<ul style="list-style-type: none"> Waste separation at source Sensitisation and public awareness Adopt the 3Rs (reducing, recycling, and reuse of waste) Provide several local landfills Encourage public private partnerships
<ul style="list-style-type: none"> Telecommunication: service provision and tariffs 		<ul style="list-style-type: none"> All service providers put up their own infrastructure Poor connectivity 	<ul style="list-style-type: none"> Use of common duct Sharing infrastructure Use modern technology
<ul style="list-style-type: none"> Energy: insufficient power Regular power outages 	<ul style="list-style-type: none"> Renewable energy 	<ul style="list-style-type: none"> Power supply monopoly 	<ul style="list-style-type: none"> Alternative sources of energy (e.g., introduce solar and wind power) Incentives for use of alternative energy Formulate and enforce proper policies

Issues	Opportunities	Challenges	Possible Options/Proposals
			for renewable energy • Education and capacity building
Governance, Legislation, and Institutional Frameworks			
• Communication: improved interactive communication	• Platform for input in service delivery • Increased capacity for county staff	• Poor communication between county and stakeholders	• Establish communication centres • Create an active interactive website • Establish information and intelligence gathering systems
• Monitoring and evaluation (M&E): establish procedures for M&E • Evaluation of indicators known to stakeholders	• Qualified professional staff • Opportunity to strengthen staff capacity	• Weak capacity for M&E	• Public private partnership • Multi-stakeholder M&E
• Strengthening enforcement framework: review the enforcement laws • Advocacy	• Existing but weak legal framework • Goodwill of city residents to participate in enforcement	• Poor morale and values amongst residents • Corruption	• Inculcate social values in society-awareness creation and sensitisation • Outreach programs on values • Self-regulation • Provide a legal mechanism for public bodies, i.e., resident associations to participate in plan approval process
• Safety and security: establish social programs on crime prevention and against drug abuse • Enhance security in public transport sector	• Existing safer cities program • Alcoblow • Mututho laws • Control through inspection of liquor licenses	• Many unemployed youth populations • Boda boda contributing to insecurity • Domestic gender conflicts • Drug abuse and armed robbery	• Strengthen and broaden safer cities program • Create employment for the youth • Establish registration centres for the jobless youth – cottage industries • Establish up-to-date crime prevention strategy • Local security management mechanisms • Adequate provisions for bus stops, enhance security lighting • Partner with private security firms in parks security • CCTV surveillance to be installed in the city • Fast track establishment of county police service
Urban Economy, Social Service, and Environment			
• Construction-related development business (contractor, consulting, planning, design, infrastructure provision and operation, and low cost housing): NCC to establish low cost housing schemes to take care of low income earners (e.g., Kangemi informal settlement) • Have a standard for rental houses in informal settlements	• Available local construction materials • NCC can use underutilised county land to build low cost housing • Partnership with private sector to improve/develop infrastructure • Integrate social activities in places that lack churches, mosques, etc.	• Lack of harmonisation within the government • Inadequate financial resources • Lack of private partnership between the government and public sector to develop infrastructure	• NCC should set up required standard of privately owned rental houses in informal settlement • NCC to subsidise prizes of local building materials • Establish/strengthen the links between informal and formal (e.g., garbage collection, prevention of communicable diseases, water, and sanitation) • Give public sector incentives/opportunities to build multi-storey parking to reduce double parking
Social development, business (education) health and others: increase access to affordable education and health facilities within walking distance	Meaningful participation of the CSO's in promoting public health.	• Inadequate public government schools • Land scarcity • Inadequate public health facilities • Inadequate social amenities	N/A
Professional, scientific, and technical businesses: • Integration of offices in residential areas • One-stop shop for business licenses • Licenses should be	Homes and residential areas	• Insecurity • Illegal businesses	

Issues	Opportunities	Challenges	Possible Options/Proposals
affordable, accessible, and inclusive			
Tourism business: have central parking place for taxis	Nairobi is a commercial hub for Eastern Africa		Preserve national parks and historic sites
Wholesale and retail: • Level playing field for the traders and consumers • Protect the consumers from substandard goods and exploitation	Ready market	Exploitation of commuters in public transport	<ul style="list-style-type: none"> • Reduce the number of taxis in the CBD • Have alternative modes of transport, e.g., light rail transport • Additional lanes for cyclist and motorcycle riders
Transportation and logistics: • Encourage more organised transport system • Diversify in other modes of transport • Standardisation of transport charges in public transport • Have central parking place for taxis	<ul style="list-style-type: none"> • NCC should establish efficient affordable public transport system • Possible source of revenue for NCC as well as regulation of transport cost for the general public 	Exploitation of commuters in public transport	<ul style="list-style-type: none"> • Reduce number of taxis in CBD • Have alternative modes of transport e.g., light rail transport • Additional lanes for cyclist and motorcycle riders
Population	<ul style="list-style-type: none"> • Available opportunities in the neighboring counties • Availability of human capital 	Rural-urban migration	Networking with the neighbouring counties
Land and Human Settlement			
Land Use • Haphazard land use transformation (e.g., change of single plot use to multiple dwellings without considering infrastructural capacity) • Development of former industrial lands without remediation plans, subsequent effects on public health • Increased commercial development along major highways and ribbons • Increased mixed use developments in the city • Increased number of derelict/old buildings	<ul style="list-style-type: none"> • Expiration of leases; proposals to terminate leases on idle land • Exploit opportunities such as alternative energy sources • Change to non-motorised transportation • Availability of skills and human capital • Exploit land banking as an option for banking • Landscaping that provides for protection of existing scenery • Favorable weather – incentives for green cities 	<ul style="list-style-type: none"> • Land reclamation; decontamination of land that has been reclaimed • Poor waste management • Lack of political goodwill • Lack of resources to improve infrastructure and amenities • Lack of adequate capacity in all functions including enforcement and implementation 	<ul style="list-style-type: none"> • Transparency and capacity building for residents also in slum areas • Need for urban renewal (refurbishing old buildings) • Revise building codes • Research on building materials (e.g., cheap and appropriate) • Policy to secure open spaces and public utility land • Review plans approval meeting arrangement so that there is more transparency and capacity building for the residents • Standardise measurements on land sizes
• Congested city centre	• Decentralisation: i.e., shift of CBD		<ul style="list-style-type: none"> • Establish nodes around the city to decentralise the government • Land use standards to be documented and instituted • All key scheme is to have provisions for schools, hospitals, and commercial facilities so that populations do not cross from one area of the city to another in search of better services
• Increase in slum dwellings	• Unemployment/inadequate employment opportunities		<ul style="list-style-type: none"> • Improve income earning capacity so they are able to afford better livelihood and better homes • Empower populations by opening up opportunities

Table A.3 Summary of NCC's Consultation Process (Starehe District)

Issues	Opportunities	Challenges	Possible Options/Proposals
Urban Transport and Infrastructure			
<u>Urban Transport: Roads:</u> <ul style="list-style-type: none"> • Safety • Uncontrolled developments • bus/matatu terminal 	<ul style="list-style-type: none"> • Road expansion ongoing on some roads • Road maintenance • Roads are in place • Refurbishment of roads 	<ul style="list-style-type: none"> • Encroachment on pathways/roads • Dilapidated roads • Diversions of roads leaving the areas destroyed after projects are completed • No bridges; safety of pedestrians and children compromised • Existing bridges and tunnels misused and not secure • Poor drainage and sewer systems leading to flooding of roads • Garbage on the roadside • No terminal for buses and matatus 	<ul style="list-style-type: none"> • Youth and local authority collaboration • Upgrade drainage systems • Refurbish current roads with concrete • Expand sewer systems • Involve local leaders for quality control on roads • Provide clearly marked pathways for pedestrians • Bridges and tunnels to be constructed • Proper maintenance for existing structures; lighting and cleanliness • Unblock existing drainages and put in place a proper waste management system • Have designated areas for business communities • NCC should not give permits for roadside businesses • Periodic road repair programs to be implemented • Permits • Renaming of roads using names of local heroes • Designate specific pick up and drop points for all public service vehicles
<u>Urban Transport: Railway</u>		<ul style="list-style-type: none"> • Lacking signages along railway crossings • Uncontrolled timing system causing delays for regional transports 	<ul style="list-style-type: none"> • Improved infrastructure • Introduction of subways • Public private partnership for funding of up to standard transport systems • Proper signages on railway crossings • Designated crossing areas • Civic responsibility
<u>Urban Infrastructure: Energy</u>		<ul style="list-style-type: none"> • Lights on flyovers not functional thus leading to insecurity • Theft 	<ul style="list-style-type: none"> • Use existing infrastructure • Make sure floodlights are operational • Regular maintenance and service management • Conserve energy; switch off lights at daybreak • Alternative energy • Solar lighting options • Solar panels to be put on higher ground for theft control
<u>Urban Infrastructure: Drainage systems</u>		<ul style="list-style-type: none"> • Uncovered manholes • Blocked drainage systems 	<ul style="list-style-type: none"> • Introduce plastic drainage covers • Individual ownership/civic responsibility and community policing • Overhaul drainage and sewer systems and/or expand existing sewer lines • Incorporate the youth in ensuring cleanliness of drainage and sewers to avoid blockages
<u>Urban Infrastructure: Telecommunication</u>		<ul style="list-style-type: none"> • Overhead cabling • Dilapidated surfaces as companies dig to install cables 	<ul style="list-style-type: none"> • Switch to underground cabling • Have designated areas/tunnels for cabling to be shared by all service providers • Introduce ICT centres in each ward to enhance communication and learning • NCC to implement the Huduma centres to enable residents to raise their concerns
<u>Urban Infrastructure: Solid Waste Management</u>		<ul style="list-style-type: none"> • No collection points • Haphazard dumping of solid waste • Insufficient delivery vehicles 	<ul style="list-style-type: none"> • Provide designated garbage collection points • Designate garbage collection trucks for each ward • Encourage waste separation on site /or at household level • Provide special bins to accommodate separation of waste

Issues	Opportunities	Challenges	Possible Options/Proposals
			<ul style="list-style-type: none"> • Involve the use in waste management • Awareness and communication on solid waste management
<u>Urban Infrastructure: Stormwater Management</u>		<ul style="list-style-type: none"> • Flooding and destruction of roads • Blockage of sewer and drainage systems • Pollution of river waters 	<ul style="list-style-type: none"> • Self-discipline to avoid blocking of drainages and sewers (proper waste disposal) • Awareness creation and communication • Introduce stormwater harvesting and policies • Stun action on companies emitting waste into rivers • Stop approvals for developments along riverbanks • Rehabilitate rivers to a cleaner usable state • Policy implementation and enforcement
Governance, Legislation, and Institutional Frameworks			
<ul style="list-style-type: none"> • Leadership and legislation • Lack of implementation • County and national government • Existing laws and legislation • Communication channels • Corruption and tribalism in governance 		<ul style="list-style-type: none"> • Poor implementation • Illegal structures • Unclear mandates between the county and national government • Lack of awareness on existing legislation • Inefficient reporting channels • Misuse of resources by leaders 	<ul style="list-style-type: none"> • Education and awareness on the structure of devolution • Public sensitisation and communication through available channels: barazas, media, etc. • Community policing • Timeframe and follow up on issues • Teamwork • Accountability and transparency of leaders
<ul style="list-style-type: none"> • Service delivery 		<ul style="list-style-type: none"> • Inefficient service provision; long processes, poor communication lines between county and national governments 	<ul style="list-style-type: none"> • Ensure fairness in service delivery • Devolve service delivery
Fees and charges		Increased parking fees	Set fees based on amount of time parking is used
Security		<ul style="list-style-type: none"> • Illegal structures • Lack of coordination between NCC and public administration 	Encourage Nyumba Kumi initiative
<ul style="list-style-type: none"> • Social issues • Family values • Unemployment leading to insecurity 			<ul style="list-style-type: none"> • Parents to be role models to their children • Public sensitisation: barazas, media, etc. • Community policing
Urban Economy, Social Service, and Environment			
<ul style="list-style-type: none"> • Housing; • Population increase • Old housing units • Ownership of housing units 	<ul style="list-style-type: none"> • Availability of land • Political goodwill 	<ul style="list-style-type: none"> • Inadequate funding • Inadequate housing • Insecurity 	<ul style="list-style-type: none"> • Acquire donor support for upgrading project • Bring down old houses and build new high-rise buildings • Transition to the new houses to be actualised • Tenant-owned houses through tenant purchase scheme • Residents to be given first priority on new housing units • Build parameter walls for security; provide street and estate lighting • Provide garbage collection and disposal areas • Provide shopping centre within the compound • Include recreational areas/ leisure parks in new housing developments

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Issues	Opportunities	Challenges	Possible Options/Proposals
Education	Political goodwill	<ul style="list-style-type: none"> • Improper land use planning • Lack of public primary schools in some wards 	<ul style="list-style-type: none"> • Build additional primary and secondary schools • Build tertiary learning institutions; vocational training institutions, polytechnics, etc. • Government to support learning institutions through funding and provision of learning materials
Health	Political goodwill	<ul style="list-style-type: none"> • Lack of awareness on health-related problems • Drug and substance abuse • Easy access to illegal brews • Increasing teenage pregnancies 	<ul style="list-style-type: none"> • Upgrade Ziwani clinic to health centre, to be equipped with all necessary facilities including ambulance • Reintroduce pest and rodent control • Civic responsibility • Create awareness on importance of good health to the community and eradication of health hazards • Awareness creation on reproductive health to the youth
Social facilities (e.g., social halls, open spaces, recreational areas)		Environmental pollution	<ul style="list-style-type: none"> • Make social hall accessible to all • Constructive youth empowerment • Upgrade social hall to accommodate more facilities (e.g., resources centre and library) • Upgrade the existing Meme sports ground • Provide recreational and leisure parks
Urban economy (e.g., markets and urban farming)	<ul style="list-style-type: none"> • Available space • Political goodwill of NCC 	<ul style="list-style-type: none"> • Resistance of market owners in the local area • Political interests • Corruption of NCC 	<ul style="list-style-type: none"> • Provide both open air and closed modern markets • Upgrade existing Kariokor market; build Mwariro open air market • Create designated business premises for garages, stalls, etc. • Provide necessary access to markets for businessmen and clients • Introduce modern urban farming; greenhouses, poultry • Revise punitive county by-laws • Encourage continued consultation with stakeholders
Land and Human Settlement			
<ul style="list-style-type: none"> • Illegal structures; stalls, garages, etc. • Illegal sale of petrol and petrol products • Illegal allocation and planning permission • Erratic water supply • Dilapidated sewer systems • Increasing insecurity • Lack of enforcement of existing legislation • Interference with role of county government 	<ul style="list-style-type: none"> • City county by-laws • Local administration 	<ul style="list-style-type: none"> • Corruption within local administration • Role of chief in land issues not clear • Increasing populations • Failure in enforcement of relevant by-laws • Land grabbing 	<ul style="list-style-type: none"> • NCC to enforce by-laws • Have performance contracts for all NCC grassroots teams • Chiefs to have no role in land allocation • Upgrade existing infrastructure • Chiefs and local administration to deal with insecurity issues • All grabbed lands to be repossessed and used as planned • Proper follow up of issues raised in the consultation and information dissemination on the way forward
• No coordination within NCC		<ul style="list-style-type: none"> • Lack of cooperation between county planning department and local leaders in development planning 	<ul style="list-style-type: none"> • Consult stakeholders on rates and fees with business community • Priority in housing for residents after upgrading/new developments • Recognise neighborhood associations in partnership with NCC • Performance contracts and monitoring mechanisms
Increasing rates and fees		No consultation with stakeholders	Undertake meaningful consultation with stakeholders
Youth and women empowerment		No space allocated for business activities for youth and women	Provide space for business activities for women and youth

Issues	Opportunities	Challenges	Possible Options/Proposals
<ul style="list-style-type: none"> • Social facilities and structures • Health centres • Emergency response • Schools • Resident association 		<ul style="list-style-type: none"> • Substandard health facilities • Poorly equipped health facilities • Absence of firefighting equipment • Lack of teaching staff in public schools due to poaching from private schools • Powerless resident associations 	<ul style="list-style-type: none"> • Upgrade health facilities, i.e., clinics to hospitals • Proper facilities for clinics and upgrade • Provide professional and skilled staff in available health facilities • Provide emergency response facilities for ward, e.g., firefighting equipment and trucks, ambulances and hotlines • Neighborhood association should be formed, recognised, and empowered to take charge of grassroot issues • By-laws to reflect and allow partnership with the city county
Housing (rent, rates, and fees)		Old housing units	<ul style="list-style-type: none"> • High-rise developments to be put up in Ziwani • Provide housing at affordable rates • Give priority to old residents for housing scheme • No increment of rates/fees without consultation with stakeholders • Service provision should be commensurate to rates paid

Table A.4 Summary of NCC's Consultation Process (Kamukunji District)

Issues	Opportunities	Challenges	Possible Options/Proposals
Urban Transport and Infrastructure			
Urban transport (roads, railway, and airport)		<ul style="list-style-type: none"> • No proper engineering of current roads • Developments on road reserves • No bumps on roads leading to increasing accidents • Roadside hawkers 	<ul style="list-style-type: none"> • Provide walkways for pedestrians • Provide areas for relocation of roadside hawkers • Construct modern kiosks • Provide link roads • Include bumps and road barriers during road construction • Relocation of airbase in Nairobi
Urban infrastructure (sewer pipelines)		<ul style="list-style-type: none"> • Old piping in the current system • Dilapidated systems leading to mixture of sewer water and clean water • Inadequate capacity of existing sewer and drainage systems 	<ul style="list-style-type: none"> • Modern strong pipes • Set apart sewer lines and water supply pipes • Expand existing sewer lines to hold increasing population • Proper maintenance of existing systems
Water		<ul style="list-style-type: none"> • Dilapidated water supply pipeline • Sabotage of water supply systems 	<ul style="list-style-type: none"> • Computerise water supply system • Conservation of water resources • Public sensitisation on water resources management
Energy	Alternative energy	<ul style="list-style-type: none"> • Tapping of electricity • Power outages • High tariffs 	<ul style="list-style-type: none"> • Find options for alternative energy • Underground cabling
Waste management		<ul style="list-style-type: none"> • No collection points • Haphazard dumping • No disposal sites in Kamukunji 	<ul style="list-style-type: none"> • Open up a recycling plant • Designate garbage collection points • Provide trucks for collection and transportation • Public sensitisation on integrated solid waste management
Telecommunication	Economic empowerment of youth		<ul style="list-style-type: none"> • Establish a fully equipped resource centre • Provide reliable internet connection to everyone
Governance, Legislation, and Institutional Frameworks			
Leadership		<ul style="list-style-type: none"> • Leaders not available • Mandates of leaders not clear • Lack of offices for leaders 	<ul style="list-style-type: none"> • Establish local offices for leaders for accessibility • Public awareness on job descriptions for leaders

Issues	Opportunities	Challenges	Possible Options/Proposals
Policy regulations		<ul style="list-style-type: none"> • Lack of citizen engagement framework • Limited access to information 	<ul style="list-style-type: none"> • Make accessible policy sources (e.g., ward manager and county rep offices) • Civic education to be conducted by local leaders in collaboration with residents and local CBOs, NGOs
Public representation			<ul style="list-style-type: none"> • Public participation • Develop and adopt citizen engagement framework
Capacity building			<ul style="list-style-type: none"> • Capacity building and training of officers within their work environment • Training on their mandates and responsibilities
Accountability		<ul style="list-style-type: none"> • Corruption • Inaccessible leaders 	<ul style="list-style-type: none"> • Administrators on the ground • Friendly administrators
Urban Economy, Social Service, and Environment			
<u>Population</u> <ul style="list-style-type: none"> • Population increase • Rural-urban migration 	<ul style="list-style-type: none"> • Cheap labor in light industries • Market/consumers for products and business 	<ul style="list-style-type: none"> • Increased informal settlements • Poverty • Pressure on existing facilities • Food insecurity • Traffic congestion • Insecurity • Inadequate resources allocation (e.g., schools and health facilities) 	<ul style="list-style-type: none"> • Family planning • Provide affordable housing for increasing population
<u>Urban economy</u> <ul style="list-style-type: none"> • Retail and wholesale business; Eastleigh, Gikomba • Urban agriculture • Construction industry • Light industries • Social related businesses, e.g., schools and hospitals • Informal sector; Juakali sector • Transport industry • Cottage industry: weaving, carvings, and others 		<ul style="list-style-type: none"> • Insecurity • Long process in licensing procedures • Brokers making goods expensive • Market for cottage industry • Inadequate power supply • Poor access roads • No parking facilities • Garbage problem 	<ul style="list-style-type: none"> • Street lighting • Provide more job opportunities for the youth (e.g., in waste management) • Expansion of social facilities • Make the city a 24 hour operational economy • Pick between Gikomba and Gorofani markets
Land and Human Settlement			
<ul style="list-style-type: none"> • Vacant and underutilised land • Grabbing of public land and congestion of houses • Lack of agricultural demonstration farms • Lack of garbage collection area • Illegal extensions • Fears that slum upgrading will bring people from other areas • Slums not captured in master plan • Buildings constructed on drainage electricity lines, way leaves and sewer trunks • Encroachment of business activities along road reserves • Illegal conversion of houses to accommodate changaa brewing and cottage industries • Lack of public awareness on planning for urban renewal • Lack of space for public/social amenities • Channeling of sewer to river 			<ul style="list-style-type: none"> • Vacant land to be put to use (for residential, business and rescue centres) • Provide affordable high-rise housing • Encourage use of local materials to reduce construction costs • Designate specific areas for garbage collection • Make way for emergency exits • Encourage mixed developments to reduce commuting • Repossess all grabbed lands • Disseminate information on planning and upgrading (more public consultations) • Public participation in project oversight, planning, and implementation (committees chosen by residents) • Convert underutilised schools along Gen. Waruinge Street to include secondary schools • Provide more primary and secondary schools • All slums in city must be captured in the master plan

Table A.5 Summary of NCC's Consultation Process (Dagoretti District)

Issues	Opportunities	Challenges	Possible Options/Proposals
Urban Transport and Infrastructure			
Urban Transport: narrow roads, lack of non-motorised transport, no terminals, encroachment on reserved road space, and poor road conditions		<ul style="list-style-type: none"> • Poor planning • Mindset on non-motorised transport 	<ul style="list-style-type: none"> • Expansion of existing road • Provision of pedestrian paths • Designate trading areas (markets) • Decentralisation of business (i.e., relocation of business from CBD) • Public sensitisation program for attitude change <ul style="list-style-type: none"> • Proper traffic management/enforcement • Modernised railway transport • Modal shift from matatus to high-capacity buses
Solid waste (lack of dumping sites and poor transportation of wastes)			<ul style="list-style-type: none"> • Have common collection point • Routine and proper transport of solid waste • Waste recycling • Empower youth and CBOs • Public-private partnerships
Stormwater drainage (lack of stormwater drains, poor conditions of existing ones)			<ul style="list-style-type: none"> • Build and maintain stormwater drainage system • Implement policies • Consider water harvesting
Sewer (lack of sewer pipelines, inadequate sewer line capacity)			<ul style="list-style-type: none"> • Build more sewer pipelines • Expand existing sewer line • Proper management of the sewer pipelines
Energy (poor infrastructure and inadequate power supply)			<ul style="list-style-type: none"> • Upgrade existing infrastructure • Increase power capacity (e.g., transformers) • Consider renewable energy • Installation of underground cables
Governance, Legislation, and Institutional Frameworks			
Public participation	Right to info under constitution	<ul style="list-style-type: none"> • Lack of involvement • Improve perceptions 	<ul style="list-style-type: none"> • Engage the youth in such forums • Carry out social audits • Public forums between national and county governments and public • Legislation and policy on public participation <ul style="list-style-type: none"> • Recognition of representatives (e.g., ward reps, women reps, and others) • Volunteer program amongst youth • Right to information; residents to get information on how resources are being used and how money they pay is used/accountability
Safety and security	<ul style="list-style-type: none"> • Existing policies • Nyumba Kumi 		<ul style="list-style-type: none"> • Maintenance of existing infrastructure • Increase security instruments (e.g., flood lights) • Sharing information between national and county governments
Communication		No clear channels	<ul style="list-style-type: none"> • Huduma centres replica at sub-county level • Use community radio program for information dissemination • ICT • Reform existing government structures to make them more engaging • Partnership between county and government and other departments • Public-private partnerships
Monitoring & Evaluation			<ul style="list-style-type: none"> • Engage public in decision-making processes • Social audits • Provide information to public

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Issues	Opportunities	Challenges	Possible Options/Proposals
Social values, drug and substance abuse, prostitution, etc.			<ul style="list-style-type: none"> • County government to partner with NACADA • Establish rehabilitation, trading as well as training centres
Corruption			<ul style="list-style-type: none"> • Establish transparency and accountability mechanisms • Reshuffle county government officials
Planning and policy formulation (poor housing, poor transport system, and uncoordinated development structures)			<ul style="list-style-type: none"> • Identify, repossess, and reclaim public utilities • Adequately use public utilities • Need for policies • Need to review outdated planning policies
Support small-scale traders			<ul style="list-style-type: none"> • Affordable rates to traders and other businesses • Encourage cooperatives and societies
Urban Economy, Social Service, and Environment			
Insecurity		<ul style="list-style-type: none"> • Lack of capacity of security personnel • Lack of security office employment 	<ul style="list-style-type: none"> • Embrace Nyumba Kumi initiative • Equip security personnel • Introduce technical institutions for provision of skills to youth as well as reducing idling • Job creation • Community workers to represent local areas • Need for training on fire fighting • Provide basic facilities (e.g., dispensaries and schools) • Review expansion of industrial area • Provision of security office
Drug abuse			<ul style="list-style-type: none"> • Vocational centres • Rehabilitation centres • Awareness creation on drugs and alcoholism
Open air market			<ul style="list-style-type: none"> • Need for more markets • Repossession of grabbed public lands so as to develop public utilities like markets
High population			<ul style="list-style-type: none"> • Family planning initiatives for both men and women
Inequality			<ul style="list-style-type: none"> • Gender balancing • Implement by-laws • Change in culture
Water and sewerage systems (encroachment on sewer lines, water shortage, and unsafe water)			<ul style="list-style-type: none"> • Upgrade drainage system • Upgrading of slum area • Embrace urban agriculture • Zoning of Kawangware
Land and Human Settlement			
Land grabbing (Encroachment on roads)	Availability of public land		<ul style="list-style-type: none"> • Identify grabbed public land • Proper land use planning in consultation with community • Identify and repossess grabbed public land
Poor land management (uncontrolled development, conflicting land use, un-serviced land, and irregularity in sub-division)			Monitor and evaluate all development initiatives
Lack of dumpsite			Identify new spaces for dumpsites/waste collection points

Issues	Opportunities	Challenges	Possible Options/Proposals
Land rates, rent and service charges: poor coordination of land rates, rents and service charges with physical social infrastructure			Standardise rents in accordance with facilities provided and condition of houses
Lack of information/awareness of development guidelines: lack of coordination on development implementation (construction) between NCC and local administration			Awareness creation
Human settlement: uncontrolled development and poor drainage, sanitation, water pollution, and substandard housing			
Lack of public utilities (e.g., social halls, playgrounds)			Provision of social and physical infrastructures like roads, piped sewerage, health facilities, schools, social halls, bus terminus, parking, etc.

Table A.6 Summary of NCC's Consultation Process (Langata District)

Issues	Opportunities	Challenges	Possible Options/Proposals
Urban Transport and Infrastructure			
Urban Transport <ul style="list-style-type: none"> • Poor connectivity to neighbouring areas • Congestion at road convergence points • Half-done roads – mandate changing from Kenya Urban Roads Authority to NCC • Road standards within private subdivision schemes • Congestion in the CBD • Uneven and discontinuous road improvement • No non-motorised transport • Livestock invasion from neighbouring townships 	<ul style="list-style-type: none"> • Rongai via Karen • Ngong Road dualing • Extension of Langata Road to Karen (define extent, character, and impact) • Mbagathi Road improvements • Karen structure plan for road improvement • Decentralisation of CBD functions • Local public transport improvement plan 	<ul style="list-style-type: none"> • Funding for roads • Move from public to private transport • Dark streets 	<ul style="list-style-type: none"> • Road characterisation and hierarchy subdivision; highways to boulevards; neighborhood roads • Traffic to flow and not to fly • Engage KLDA to engage with roads authority; graphic presentation and structure; plan for roads in Karen • Road standards that are codified; stormwater drainage and related enabling works • Decentralise city council services • Strategic bypasses and ring roads • Introduce light rail and train • Public-private partnerships • Provide walkways • Street lighting
Urban Infrastructure (Water supply) <ul style="list-style-type: none"> • Erratic water supply • Poor stormwater drainage 	<ul style="list-style-type: none"> • Substitutes; rain water • Community sensitisation 	<ul style="list-style-type: none"> • Outdated bulk water supply infrastructure • Change in demand points • Not knowing way leaves • Unwilling to let stormwater flow in natural way leaves • Blocked out ways for stormwater by individuals 	<ul style="list-style-type: none"> • Water storage at individual sites • Man-made lakes and reservoirs to avoid overdependence on existing resources • Efficiency and recycling • Rainwater harvesting • Way leaves for stormwater to follow its natural course • Non-revenue water (rainwater and stormwater catchments) • Integrated stormwater and rainwater management between roads and water authorities • Codify requirements for water management • Set standards for both private and public infrastructure • Public education and awareness

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Issues	Opportunities	Challenges	Possible Options/Proposals
Solid waste management and sewers	Willingness of agencies and the community to engage		<ul style="list-style-type: none"> Public education on solid waste management Integrated solid waste management Solid waste for energy generation Improvement of Karen ponds Respect available infrastructure
Energy (insufficient power supply)	Alternative energy	Lacking policies	<ul style="list-style-type: none"> Solar power supplementation Public awareness Policies on alternative energy
Telecommunication			Codify data cables installations
Governance, Legislation, and Institutional Frameworks			
<ul style="list-style-type: none"> Communication and information sharing protocol Legal framework Implementation monitoring and evaluation 		<ul style="list-style-type: none"> Poor communication between NCC and the public Lack of dissemination of procedures Lack of coordination mechanism Corruption 	<ul style="list-style-type: none"> Establish proper communication channels Decentralise government functions Sensitise NCC officials Proper implementation frameworks
Transparency and accountability		<ul style="list-style-type: none"> Incompetence Lack of point persons 	<ul style="list-style-type: none"> Sensitise NCC officials Sign charter between NCC and members of public; clear demonstration of NCC in implementation of by-laws, policies, etc.
Service delivery		<ul style="list-style-type: none"> Poor standards of service delivery Preferential treatment for reasons of ethnicity or corruption 	<ul style="list-style-type: none"> Establish minimum standards for service delivery Encourage public-private partnerships
Planning and development		Weak enforcement and development control	<ul style="list-style-type: none"> Clear planning policy on subdivision of lands for development Effective development controls
Public participation/involvement			<ul style="list-style-type: none"> MCAs to sign memorandum for public engagement Operationalise county government act provision Set up committee comprising members of the public on matters of development
Safety and security			<ul style="list-style-type: none"> Economic empowerment of youth by providing employment opportunities in trade centres Implementation of Nyumba Kumi initiative Policy to enforce developers to install CCTV surveillance in their properties Street lighting
Urban Economy, Social Service, and Environment			
<u>Population</u> <ul style="list-style-type: none"> Growing population Student population; temporary basis; universities, hostels, etc. Entertainment population serving people beyond the area (i.e., wedding grounds) 		<ul style="list-style-type: none"> No exact figures of demographic information Pressure on existing infrastructure 	
<u>Urban economy</u> <ul style="list-style-type: none"> Small-scale agriculture Retail and commercial Tourism Education Cottage industry Residential services 	<ul style="list-style-type: none"> Tax contribution Rewards from investment Pros and cons of laws and frameworks to abide by Half acre per dwelling demand for Karen area accommodation 	<ul style="list-style-type: none"> Control of retail activities Noise and land pollution 	<ul style="list-style-type: none"> Designate areas of trade and agriculture sticking to them Concentrate on already existing developments for commercial purposes Housing student population between premises Set requirements and implement set rules and regulation Accommodate many more people without affecting current regional status

Issues	Opportunities	Challenges	Possible Options/Proposals
Land and Human Settlement			
<ul style="list-style-type: none"> Development control not complying with areal plan Proliferation of tertiary institutions in the area Conflicting interests of stakeholders (neighborhoods associations/developers) Lack of awareness on planning issues Lack of communication of planning decisions to residents Rampant flooding due to encroachment of drainage way leaves 	Set regulations	<ul style="list-style-type: none"> Developments out of scale with neighbourhoods character Demand for support facilities and infrastructure for new developments Weak enforcement mechanisms 	<ul style="list-style-type: none"> Keep institutions out of residential areas Create buffer between institutions and residential areas Control development within institutions Transport hubs for public transportation (e.g., for enhanced mass public transport, set up metro from Bomas interchange to town) Subcentres to be located at Bomas and Karen triangle
<ul style="list-style-type: none"> Sporadic rise of commercial nodes (Dagoretti Road) Growth of informal settlements 	Plan for Karen approved in 2005	<ul style="list-style-type: none"> Approval of illegal businesses establishments Current economic situation 	<ul style="list-style-type: none"> Entrench commercial zones at designated areas Enforce compliance on buildings under construction that deviate from zoning guidelines Regularise informal settlements Upgrade informal settlements and include them in master plan Prepare zonal plans to guide developments (area specific plans in consultation with residents) Stipulate minimum standards on building materials so all housing units are decent
Dumping of waste material outside upcoming learning institutions		Poor enforcement	Approvals and enforcement
Food security	Farming areas available		<ul style="list-style-type: none"> Change by-laws to allow for small domestic farming activities Designate specific areas for urban agriculture: confine it towards Keraropon
Road widening	<ul style="list-style-type: none"> Willingness by citizens Existing Karen master plan to incorporate new initiatives and proposals 		Citizens willing to surrender some land for land widening with fair compensation

Table A.7 Summary of NCC's Consultation Process (Makadara District)

Issues	Opportunities	Challenges	Possible Options/Proposals
Urban Transport and Infrastructure			
<u>Urban transport (roads and railway)</u> <ul style="list-style-type: none"> Monitoring and evaluation mechanisms Roads in between the estates Traffic congestion Mass public transport Non-motorised transport 	Reserved road space could be used for economic empowerment	<ul style="list-style-type: none"> Blocked bypass roads Tree nurseries on reserved road space Accidents along rail tracks Blocked public passages 	<ul style="list-style-type: none"> Signboards for road construction Monitoring and evaluation mechanism Protect bypasses and road reserves Road widening at Muthurwa Proper maintenance of roads Provide reliable intercity transport system (mass public transport) Flyover between Muthurwa and Landmawe Proper access roads into Muthurwa market Reliable transport system Insist on public passages and cyclist lanes Reacquire grabbed public lands Construct railway line from Landmawe through Dandora Resume construction of railway to

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Issues	Opportunities	Challenges	Possible Options/Proposals
			Nanyuki for business purposes <ul style="list-style-type: none"> • Open up public road between Harambee and Pink Court • Protect reserved road space from Tom Mboya hall to outer ring along Rabai Road
<u>Urban infrastructure</u> <ul style="list-style-type: none"> • Water supply • Wastewater management • Solid waste management • Security • Telecommunication 	Economic empowerment	<ul style="list-style-type: none"> • Illegal cartel jeopardizing supply • Dumping into drainage systems • Dilapidated pipes and drainage systems • Plastic bags causing blockage of drainages • Illegal construction on sewer lines 	<ul style="list-style-type: none"> • Rehabilitate existing drainage and sewer systems • Use vegetable waste for trees and flower planting • Avoid use of plastic bags unless recycled • Use registered garbage collectors • Provide security lights in dark alleys • Telecommunication service providers to share infrastructure to counter haphazard erection of masts
Governance, Legislation, and Institutional Frameworks			
<ul style="list-style-type: none"> • Housing (new housing units, system for allocation, and relocation of displaced people) • Rent amounts • No action on research • Garbage collection 	<ul style="list-style-type: none"> • Youth opportunities • Budget for street children • Maintenance department 	<ul style="list-style-type: none"> • No clarity on ownership of houses and land around them • Increase in rates and no services • Poor waste management 	<ul style="list-style-type: none"> • Consider current residents first for new housing units • Issue new form of ownership of existing houses • Rates paid to be commensurate with services provided • Put research into work • Reliable garbage collection
<ul style="list-style-type: none"> • Health • Security 	Grabbing public spaces	<ul style="list-style-type: none"> • No doctors • No health facilities 	<ul style="list-style-type: none"> • Rehabilitate hospitals • More doctors • Repossession of grabbed land • Form committees to deal with issues on security
Urban Economy, Social Service, and Environment			
<ul style="list-style-type: none"> • Population • Housing • Schools • Water and sewer networks: housing construction on water and sewer ways • Poor waste management • Increasing insecurity 		<ul style="list-style-type: none"> • Lack of housing for increasing population • Less learning institutions for growing population • Overstretched health facilities • Pressures on existing infrastructure: water and sewer lines • Unemployment 	<ul style="list-style-type: none"> • Stabilise rent • Build affordable modern houses (e.g., high-rise buildings to accommodate more people on less land) • County to repossess grabbed land Slum upgrading • More learning institutions • Invest in high-rise developments • Establish more polytechnics for tertiary education • Localised schools to give opportunities first to local students • Rehabilitation of water and sewer systems • Reintroduce dumping collection points and bins • Promote recycling • Hold clean up days once a month Grass trimming • Ban use of polythene bags and get alternatives • Get rid of corrupt officials • Reintroduce community policing • Build more health facilities and upgrade existing ones • Introduce street lighting in all areas • Empower and support youth groups
Urban economy		<ul style="list-style-type: none"> • Lack of market for local goods • Less working hours 	<ul style="list-style-type: none"> • Create markets for local products and services • Legalise 24 hour working days • Regulate goods prices by introducing one-stop markets

Issues	Opportunities	Challenges	Possible Options/Proposals
Land and Human Settlement			
<ul style="list-style-type: none"> • Illegal acquisition of land • Inappropriate land use • Illegal settlements • Lacking social amenities • Social issues: drugs and substance abuse, gender-based violence, etc. 		<ul style="list-style-type: none"> • Land grabbing • Illegal businesses along roads • Dumping soil and rocks along roads and rivers • No clarity on houses belonging to the city county • Informal extensions on city county houses and estates • No open markets • No school • No hospitals 	<ul style="list-style-type: none"> • Repossess public land that was grabbed and use for public utilities • Relocate businesses on road reserves • Remove businesses around schools • Provide space to conduct business • Revoke licenses of illegal businesses • Provide open markets and rehabilitate existing ones (e.g., Uhuru market) • Revoke illegal structures • Tenancy profiling • Upgrade NCC housing • Parameter wall to secure neighbourhoods • Social facilities: toilets, social halls, etc. • Minimum three universities shall be set up in Eastlands • Child rescue centre planning available, awaiting approval • Former KANU office location as a public utility land and to be used as such • Rehabilitation centres for youth, women, street children, victims of violence, etc.

Table A.8 Summary of NCC's Consultation Process (Embakasi District)

Issues	Opportunities	Challenges	Possible Options/Proposals
Urban Transport and Infrastructure			
<u>Urban transport (road, railway, airport)</u> <ul style="list-style-type: none"> • Congestion on roads • Not sufficient roads • Dilapidated roads; potholes, poor drainage, etc. • Construction on reserved road space • No emergency exits for railway • Railway barriers • Wayleaves 	Proper transport systems promoting businesses in the area	Encroachment on road reserves	<ul style="list-style-type: none"> • Expansion of existing roads to reduce traffic congestion (e.g., Mombasa Road, Utalii Road, Enterprise Road) • Maintain and repossess reserved road space • Cooperation between NCC and the national governments to improve the current road situation • Barriers from railway tracks to reduce accidents • Construct railway posts • Observe wayleaves
<u>Urban Infrastructure (water supply and sewerage)</u> <ul style="list-style-type: none"> • Insufficient water supply • Non-equitable distribution of water resources • Sale of water resources limiting access • Water supply going through sewer pipelines leading to contamination of clean water • Sewer lines close to water supply systems leading to health hazards • Construction over toilets; restricting flow of sewerage water within the village • Water pollution 		Cartels tapping water and selling for personal gain	<ul style="list-style-type: none"> • Look into procedures for water distribution • Equitable water supply • Storage tanks for water • Water harvesting • Substations for proper communication • Sewerage and drainage systems to be worked on • Clean river for water resources
<u>Solid Waste Management</u> No trucks, no disposal sites, current systems not working			<ul style="list-style-type: none"> • Trucks for waste collection • Designated waste disposal sites • Arrangements for waste management systems that work • Proper, clean, healthy, and safe environment

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Issues	Opportunities	Challenges	Possible Options/Proposals
Governance, Legislation, and Institutional Frameworks			
Corruption		<ul style="list-style-type: none"> • Coalition of law enforcers with law offenders and administration/police • No certainty on security for whistleblowers (leading to increased insecurity) 	<ul style="list-style-type: none"> • Don't repeat mistakes of past governments • Realise difference through comparison amongst different sets of government • Transparency in governance
Leadership	Existing enabling structures	Confusion on leaders and their mandate (e.g., role of chief in this new devolved government structure)	<ul style="list-style-type: none"> • Make amends in existing offices to serve citizens and avoid conflicts amongst different offices • Volunteer land for local administration • Cooperation between local administration and NCC
Security and safety	<ul style="list-style-type: none"> • Information sharing • Provide free information to residents 	<ul style="list-style-type: none"> • Not enough security personnel • Police colluding with law breakers Nyumba Kumi initiative not well understood • Long response period for emergencies 	<ul style="list-style-type: none"> • Transparency in police dealings • Unpack Nyumba Kumi initiative • Economic empowerment of youth • Need for awareness and sensitisation
Urban Economy, Social Service, and Environment			
Population increase		<ul style="list-style-type: none"> • Resettlement and migration • Rural urban migration • Uncontrolled developments to provide opportunities for housing • Economic manpower reduction • Increased rate of disease spread • Unskilled manpower • Cheap labor • Exploitation of increasing poor people • Unemployment and idleness • Illiteracy 	
Small-scale business opportunities	Economic empowerment	Lacking employment opportunities	Open markets
Land and Human Settlement			
Land tenure (two year land leasing)	Improved participatory planning by residents		<ul style="list-style-type: none"> • Issue title deeds under NCC • Issue title deeds to slum dwellers • Options to issue people in informal settlements land (e.g., relocation to Konza City) • Create community committees to deal with land issues • Proper representation in case of land-related cases • Reclaim land from private owners to government ownership
Rehabilitation centres Industrial centres		Drug and alcohol abuse Gender violence Industrial pollution	<ul style="list-style-type: none"> • Put in place rehabilitation centres for drug and substance addicts • Rehabilitation to cater to other social needs, e.g., victims of gender violence • Cleaning/scrubbing gases from industries before release
Public social facilities: schools, markets, hospitals, social halls, and others		Lack of security of land tenure	<ul style="list-style-type: none"> • Security of land tenure • Ward administration to be made closer to communities • Provide new health and education facilities within villages • Rehabilitate existing facilities

Issues	Opportunities	Challenges	Possible Options/Proposals
			<ul style="list-style-type: none"> • Provisions for open air market • Provide community stall markets • Provide more police posts at Mukuru, kwa Njenga, and kwa Reuben

Table A.9 Summary of NCC's Consultation Process (Njiru District)

Issues	Opportunities	Challenges	Possible Options/Proposals
Urban Transport and Infrastructure			
<u>Waste Management</u> • Lack of access roads for waste collection trucks • Too much wastes all over			<ul style="list-style-type: none"> • Provide high-rise to reduce road encroachment • Need big tanks for putting wastes to avoid over use of Dandora dumping site
Drainage and sewerage system			<ul style="list-style-type: none"> • Improve drainage and sewer • Rainwater harvesting
Insecurity			<ul style="list-style-type: none"> • There is a need for 24 hours active economy; this will help reduce security • Provide security lights
Lack of foot bridges		Increased accidents	<ul style="list-style-type: none"> • There is a need for clear road signs • Build foot bridges
Social amenities like schools, health centres		Inadequate social amenities	<ul style="list-style-type: none"> • Need awareness creation on importance of education and proper health • Every Nairobi resident to acquire NHIF card; this will help improve health issues • Provide polytechnics and other learning institutions
Transport			<ul style="list-style-type: none"> • Need for designated parking and bus terminus and bus stops • Development control is required • Public-private partnerships incorporation since public and private sector cannot work in isolation
Encroachment of footpaths			<ul style="list-style-type: none"> • Proper planning and enforcement of the law; e.g., areas designated for such paths should be respected • Need to embrace efficiency; sensitisation of the public on proper use of resources like energy and water
Governance, Legislation, and Institutional Frameworks			
Misuse of revenue collected			<ul style="list-style-type: none"> • Money to be directed to development instead of having leaders holding meetings in posh hotels and traveling abroad
Inaccessibility of county representatives; County reps not participating in resident meetings			<ul style="list-style-type: none"> • Reduce expenditure by county representatives • Need for accountability and transparency • Reduction of budgets directed towards county representative's expenditure
Urban Economy, Social Service, and Environment			
High population	Youth population	Youth do not participate in forums and development meetings	<ul style="list-style-type: none"> • Encourage youths to participate in such forums • Need to find ways of involving youths in economic development
Youth participation	ICT		Need for more information on their participation
Marketing and supply			<ul style="list-style-type: none"> • Need to decentralise warehouses instead of just the industrial areas • Need for regulation of training institutes to ensure legitimate and eligible institutions
Tourism	Availability of national parks and game parks within the city		Need to find ways of retaining income from these activities

Issues	Opportunities	Challenges	Possible Options/Proposals
High population			<ul style="list-style-type: none"> • Nairobi to be developed vis-a-vis other counties; this will help control rural-urban migration • Other neighbouring counties also need to protect their resources, for example, residents of Kiambu should stop uprooting their coffee plantation to create settlement areas • Need for decentralisation of institutions/public utilities, e.g., hospitals and universities • Need for integrated approach in dealing with issues that affect the economy
Small-scale businesses and traders emerging all over	Availability of Jua Kali and other informal businesses	NCC is not collecting revenue tax from these businesses	<ul style="list-style-type: none"> • There is a need for NCC to identify informal businesses and provide facilities, spaces, and model structures for them so as to be able to collect revenues well • Provide better sanitation and good drainage in these areas to be able to get more revenue • Provide good designated areas for Jua Kali areas
Waste management			Find ways of turning wastes like plastics into use to provide income to youths
Land and Human Settlement			
Lack of packing area	Northern bypass corridor and Kabete Road makes region more connected		Need for more packing areas
Mushrooming markets	Available city council market extension		<ul style="list-style-type: none"> • Extension of market for Kahawa Sukari • Need common markets for every estate • Need for a warehouse for storage of market products
Land title deeds: process of acquiring them is very slow		Bureaucracy	Reduction of bureaucracy to help speed up the process
Construction of high-storey buildings without plans of parking and access roads and others			Awareness on proper planning before building structures
Lack of social amenities like playgrounds due to mushrooming of buildings			Consider proper planning that ensures space is left for such facilities
Poor roads		Unpaved roads	Need well paved and serviced roads within Kahawa West (e.g., Kamae, Laisani, Bima Road)
Drainage system: poor drainage system for stormwater leading to flooding of houses and displacement of people			<ul style="list-style-type: none"> • Public participation in development of drainage system • Sub-drainage systems to connect to main drainage system
Public amenities		Land grabbing	Repossession of land that can be used for setting up public social amenities
Encroachment of roads: houses have been built very close to road blocking space for setting up electricity		Land is becoming scarce	<ul style="list-style-type: none"> • Build more high-rise houses for accommodation • Need SACCO to provide loans for construction of high-rise housing
Bypass			Encourage commercial area along bypass
Lack of playgrounds like football pitches	Available unutilised land	Procedure of using idle land to set up playground is cumbersome	Use of the unutilised public lands to set up public amenities like playgrounds
Land use - upcoming slums in Mathare		Are the slums on private or public land? How can	Build better structures/houses that provide space for access roads, drainage

*The Project on Integrated Urban Development Master Plan for
the City of Nairobi in the Republic of Kenya*

Issues	Opportunities	Challenges	Possible Options/Proposals
		we improve these structures?	systems, and other social amenities
Urban sprawl – city growing outwards			<ul style="list-style-type: none"> • Need to make sure master plan incorporate issues • Nairobi to plan together with other counties • Map out areas so as to plan together with other neighbouring counties

APPENDIX 7: TYPICAL ROAD CROSS SECTION

Typical Cross Section of Classified Road

Classification	Cross Section
Principal Arterial Road	<p>6-Lane Carriageway with BRT Lanes</p>
	<p>6-Lane Carriageway</p>
	<p>6-Lane Carriageway with Frontage Road</p>
Minor Arterial Road	<p>4-Lane Carriageway with BRT Lanes</p>
	<p>4-Lane Carriageway</p>

Classification	Cross Section
<p>Minor Arterial Road</p>	<p style="text-align: center;">4-Lane Carriageway</p>
<p>Collector Road</p>	
<p>Local Road</p>	