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.
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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	Prof. Karega Mutahi, C.B.S.
Senior Representative	Permanent Secretary
Japan International Cooperation Agency, Kenya Office	Ministry of Local Government as Chair of JCC

Akifumi WATANABE	Odongo P.T.
Deputy Team Leader	Town Clerk
The Project Team on	City Council of Nairobi as Vice Chair of JCC
Integrated Urban Development Master Plan for the City of Nairobi	

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 explaning 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 GOVERNENT BOARDROOM, JOFOO 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	071540972
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)

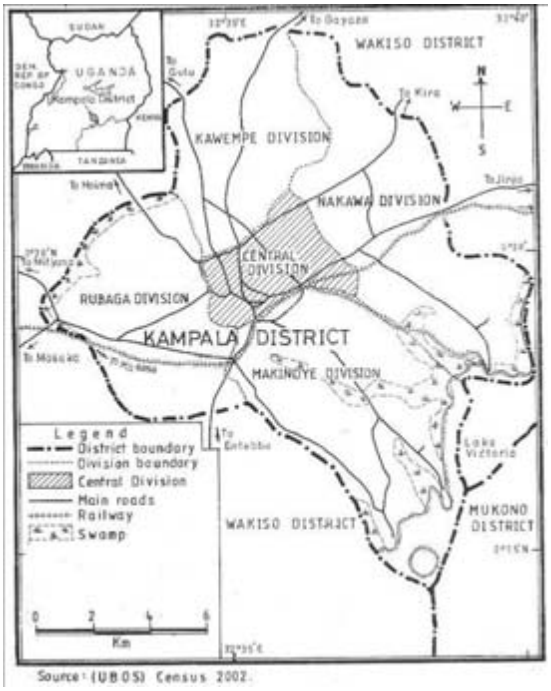
A2.1.1 Introduction

(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 relativity 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.



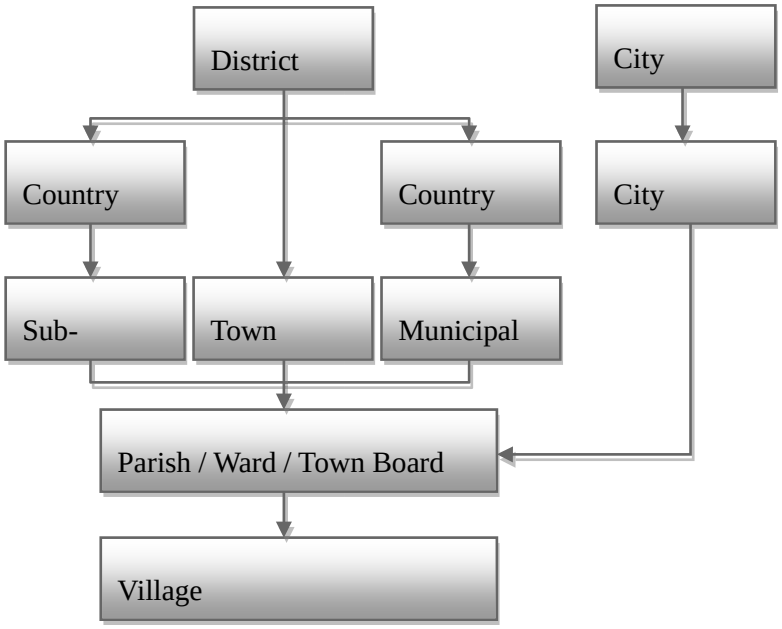
Source : JICA Study Team (JST)

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.

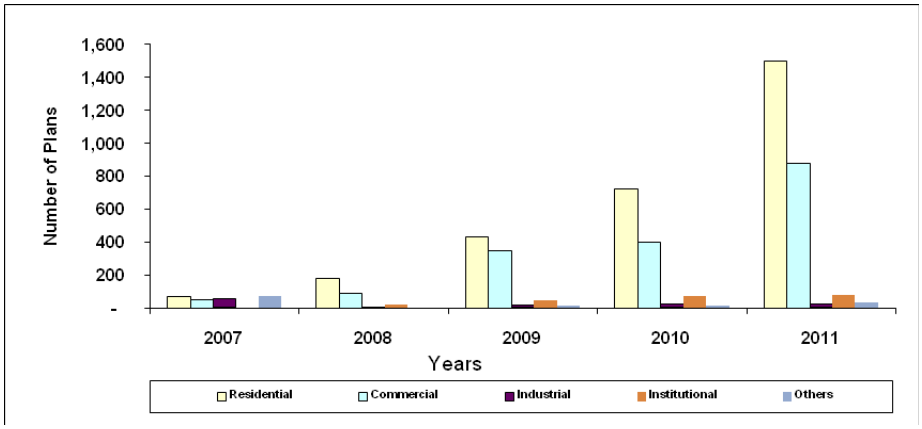


Source : JICA Study Team (JST)

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.



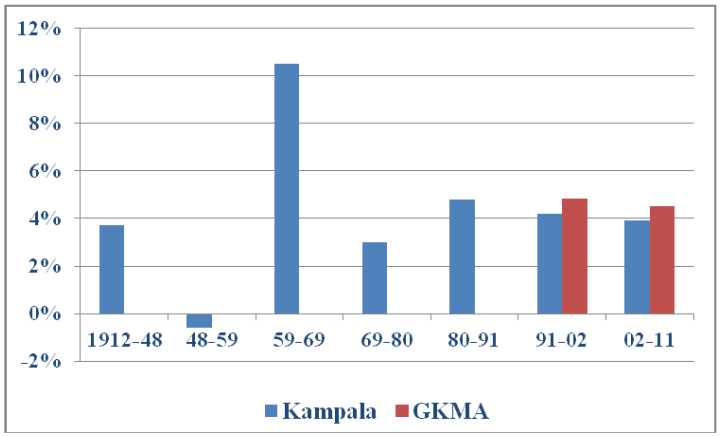
Source: Republic of Uganda, 2012

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).
- Requiringenormous 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 customery 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)

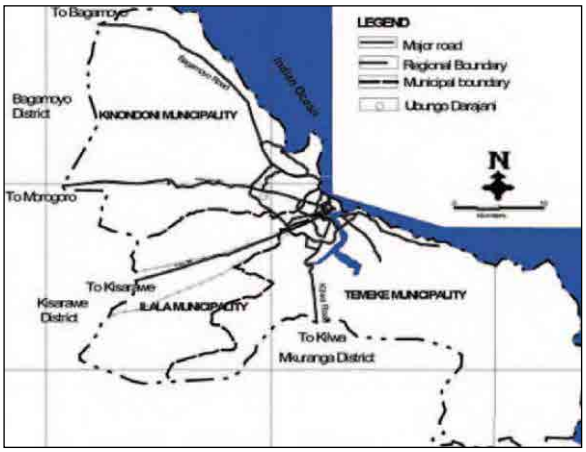
S/N	Year	Population
1	1948	67,227
2	1957	128,742
3	1961	272,821
4	1978	843,090
5	1988	1,360,850
6	2002	2,497,940

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

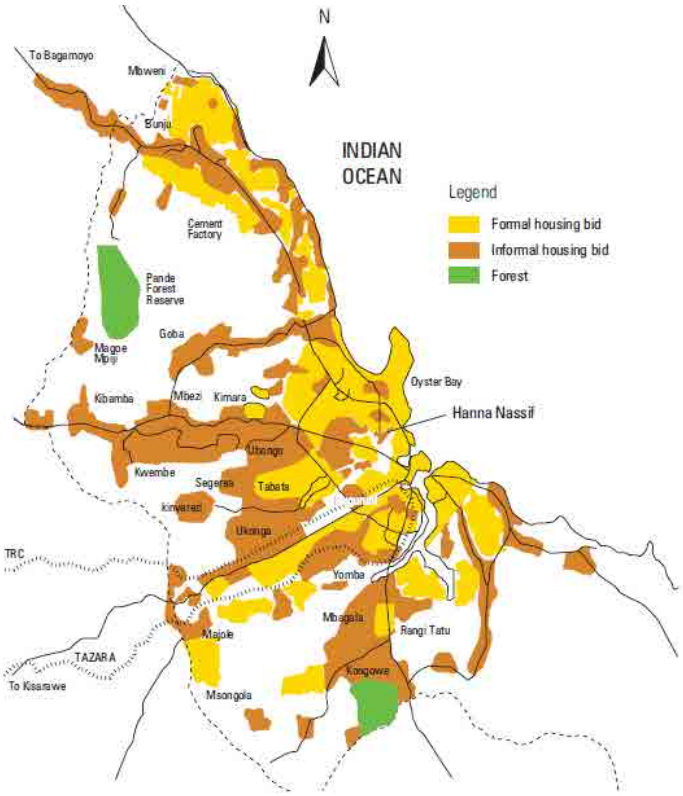
Dar es Salaam City development is partly influenced by the arterial road network consisting of five main radial roads and one ring road, all terminating in the central business district. The five radial roads are Kilwa Road, Nyerere Road, Morogoro Road, New and Old Bagamoyo roads, and Mandela Road as 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.

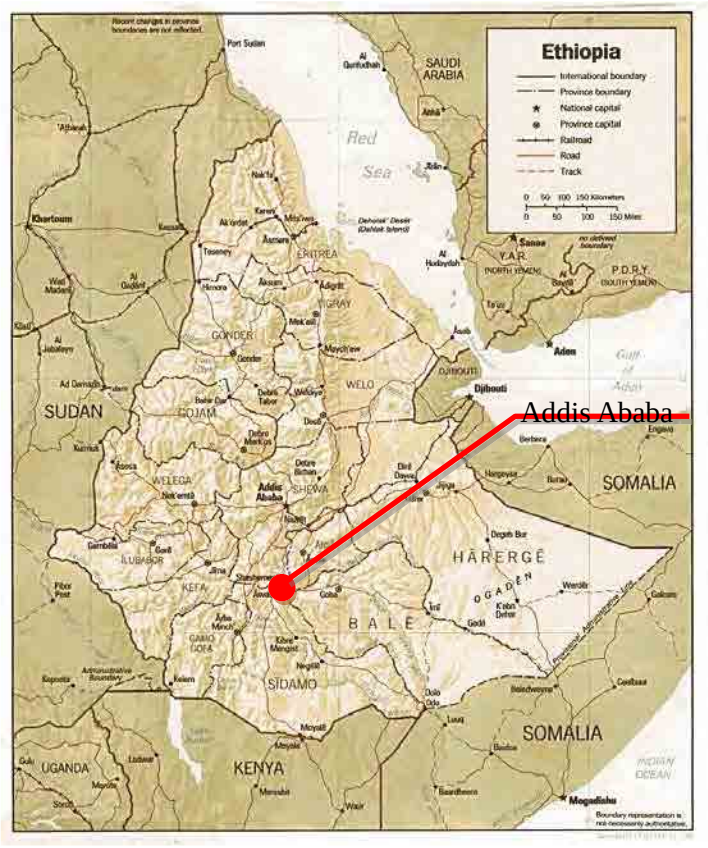


Figure A2.3.1 Map of Ethiopia

(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 I976 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 (AACPPO) 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

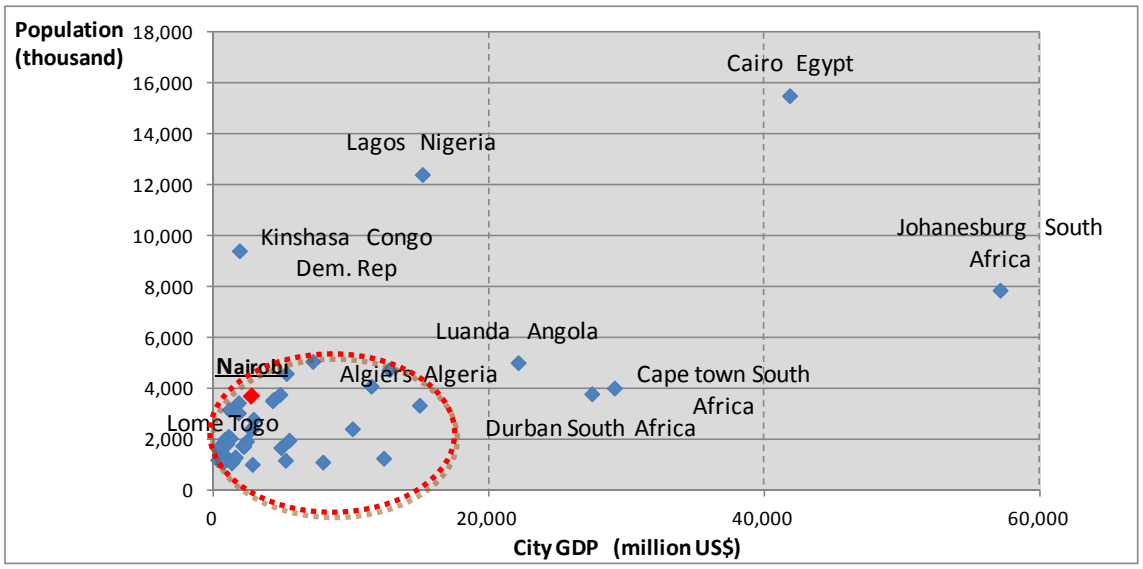
A2.4.1 Economy

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.

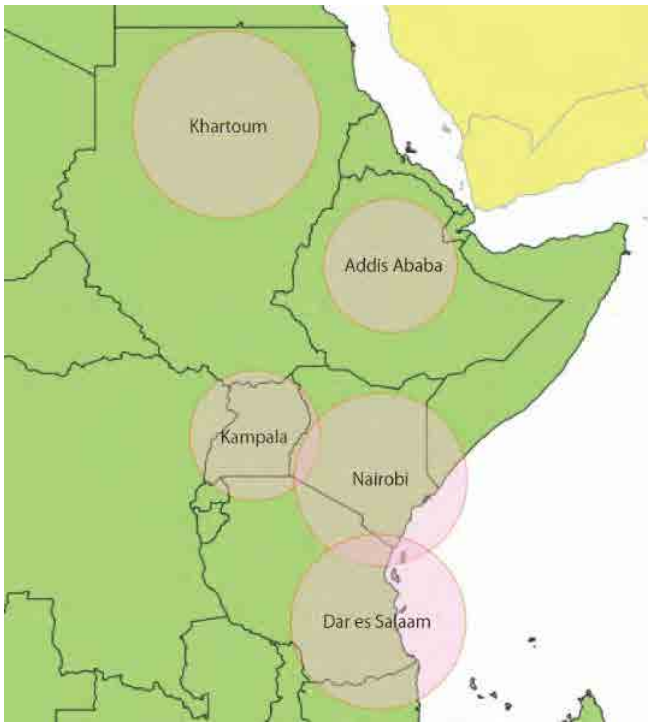
1 Although GPD per person of the capital city is much higher than GDP per person in the country, it substitutes this figure and calculates “City GDP (=”GDP per person in the country” * “metropolitan population”)”, because of lack of data to check GDP per person in the capital city.



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.

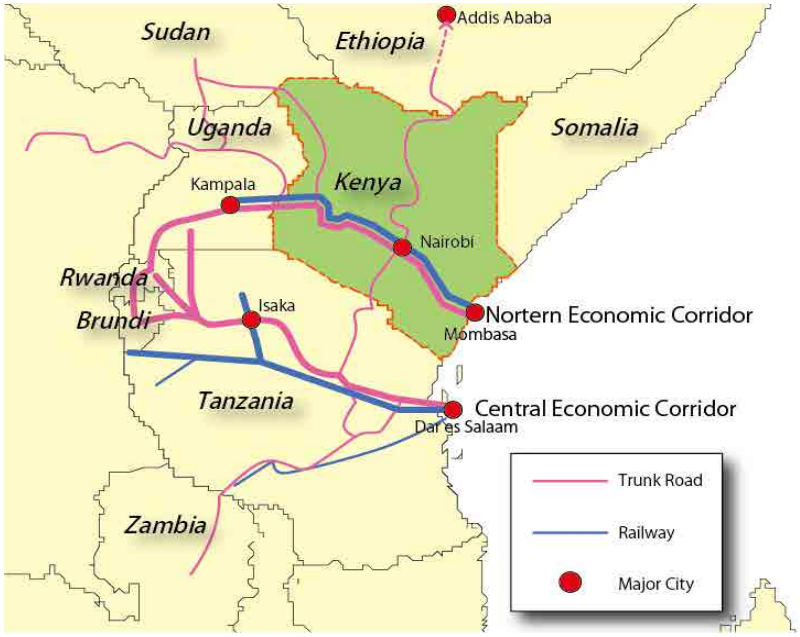


Source: JICA Study Team (JST)

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.



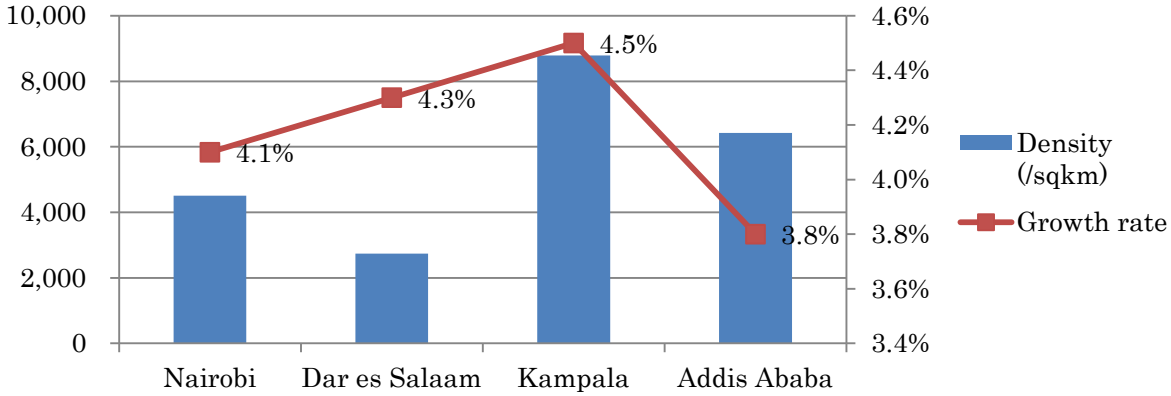
Source: JICA Study Team (JST)

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/km^2. 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	5	Haruma		
9	Huruma				
10	Ngara East	6	Ngara		
11	Ngara West				
12	Makongeni	7	Makongeni	2	Makadara
13	Kaloleni				
14	Harambee	8	Makadara		
15	Lumumba /Jericho				
16	Hamza				
17	Mbotela	9	Maringo		
18	Ofafa Maringo				
19	Landi Mawe	10	Viwandani		
20	Viwandani				
21	Hazina	11	Mukuru Nyayo		
22	Nairobi South				
23	Kariobangi North	12	Kariobangi	3	Kasarani
24	Korogocho				
25	Gitathuru /Nyayo				
26	Kiwanja	13	Kahawa		
27	kahawa West				
28	Kongo Soweto				
29	Kamuthi	14	Githurai		
30	Githrai				
31	Zimmerman				
32	Mathare 4A	15	Ruaraka		
33	Utalii				
34	Ruaraka				
35	Mathare North				
36	Roysambu	16	Roysambu		
37	Njathaini				
38	Garden				
39	Mwiki	17	Kasarani		
40	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	22	Njiru		
50	Maili Saba (Saika)				
51	Dandora 'A'	23	Dandora		
52	Dandora 'B'				
53	Kariobangi South	24	Kariobangi S		
54	Moulem				
55	Ruai	25	Ruai		
56	Ngundu				
57	Airbase	26	Eastleigh North		
58	Eastleigh North				
59	Eastleigh South /Kiambio	27	Eastleigh South		
60	California				
61	Majengo /Gorofani /Bondeni /Gikomba	28	Punwani	5	Kamukunji
62	Kimathi	29	Bahati		
63	Uhuru				
64	Shauri Moyo	30	Kamukunji		
65	Kamukunji				
66	Muthurwa				
67	Upper parklands	31	Parklands		
68	Spring Valley				
69	Loresho	32	Kitisuru		
70	Kyuna				
71	Kitsuru				
72	Muthaiga	33	Highridge		
73	Karura				
74	Highridge			6	Westlands
75	Gichagi	34	Kangemi		
76	Mountain View				
77	Kangemi				
78	Kilimani	35	Kilimani		
79	Kileleshwa				
80	Muthangari	36	Lavington		
81	Maziwa				
82	Waithaka	37	Waithaka		
83	Kabiria				
84	Kirigu	38	Mutuini		
85	Mutuini				
86	Ruthimitu	39	Uthiru /Ruthmitu		
87	Uthiru			7	Dagoretti
88	Kawangware	40	Kawangware		
89	Gatina				
90	Riruta	41	Riruta		
91	Ngando				
92	Kenyatta /Golf Course	42	Kenyatta		
93	Woodley	43	Golf Course		
94	Kibera /Makina	44	Kibera		
95	Siranga /Lindi				
96	Langata	45	Langata /Karen		
97	Hardy				
98	Karen				
99	Lenana				
100	Mugumoini	46	Mugumoini	8	Langata
101	Bomas				
102	Nairobi West	47	Nairobi West		
103	South 'C'				
104	Laini Saba	48	Laini Saba		
105	Nyayo Highrise				
106	Gatwikira /Olympic	49	Serangombe		

Table A.3.2: Zone Code Table Around the City of Nairobi

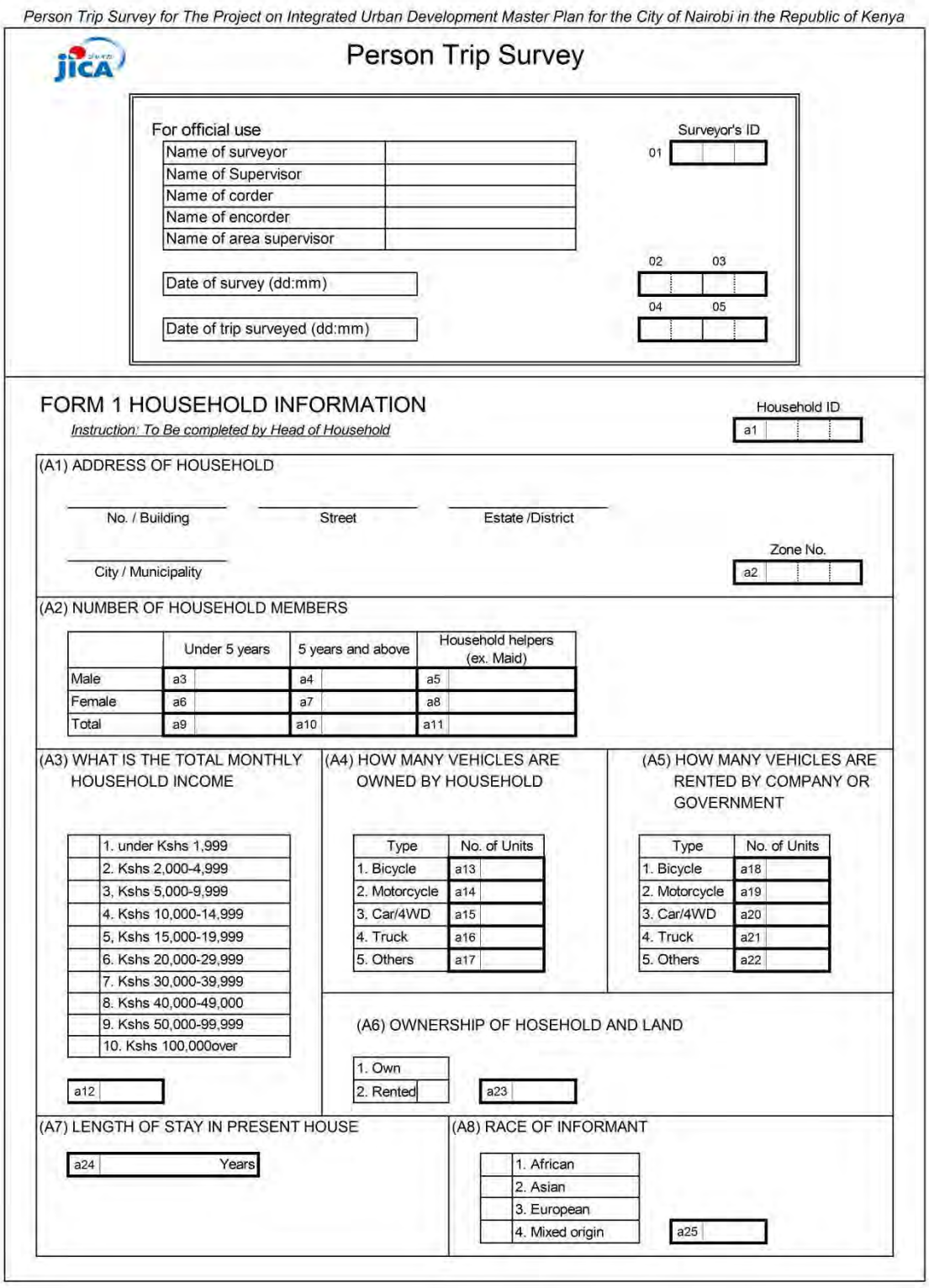
Small Zone System			Medium Zone System		Large Zoning System	
No.	Zone Code	Sub-location	Zone Code	Location	Zone Code	Division
107	301	Thika West (Biashara / Makongeni)	50	Around Thika	9	South-Eastern KIAMBU County
108	302	Thika East (Gatuanyaga / Munyu / Ngoliba)				
109	303	Kakuzi (Only Gituamba)	51	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)				
119	406	Limuru (Limuru / Karambaini / Tigoni / Ngecha / Rironi)	55	Limuru		
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	11	Northern KAJIADO County
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)	58	Around Kitengela		
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	

Surveyor's ID: 01

Date of survey (dd:mm): 02 03

Date of trip surveyed (dd:mm): 04 05

FORM 1 HOUSEHOLD INFORMATION

Instruction: To Be completed by Head of Household

Household ID: a1

(A1) ADDRESS OF HOUSEHOLD

No. / Building ____ Street ____ Estate /District ____

City / Municipality ____

Zone No.: a2

(A2) NUMBER OF HOUSEHOLD MEMBERS

	Under 5 years	5 years and above	Household helpers (ex. Maid)
Male	a3	a4	a5
Female	a6	a7	a8
Total	a9	a10	a11

(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
2. Motorcycle	a14
3. Car/4WD	a15
4. Truck	a16
5. Others	a17

(A5) HOW MANY VEHICLES ARE RENTED BY COMPANY OR GOVERNMENT

Type	No. of Units
1. Bicycle	a18
2. Motorcycle	a19
3. Car/4WD	a20
4. Truck	a21
5. Others	a22

(A6) OWNERSHIP OF HOSEHOLD AND LAND

1. Own
2. Rented

a23

(A7) LENGTH OF STAY IN PRESENT HOUSE

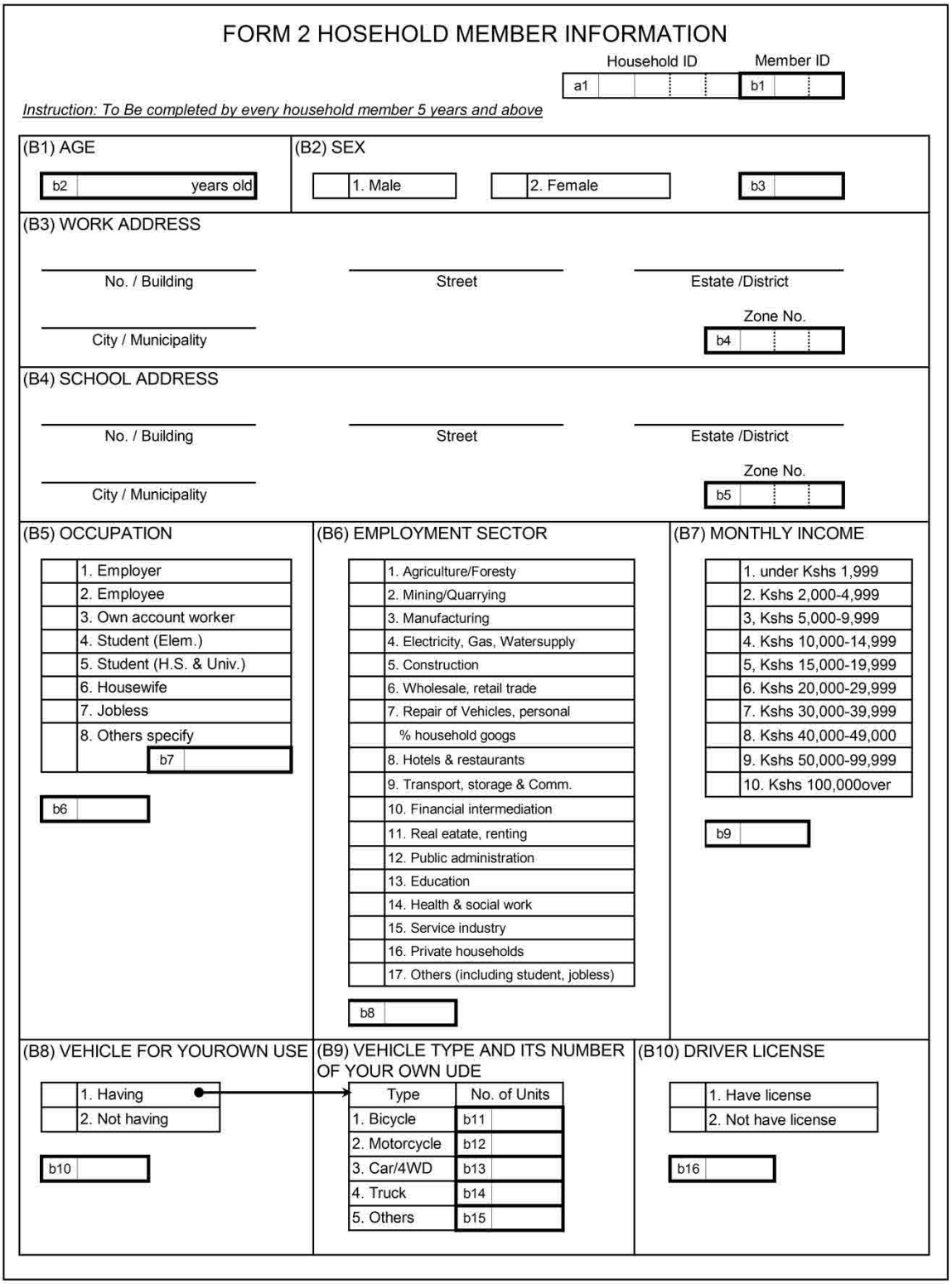
a24 Years

(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



FigureA.3.2: Household Member Information Form for Person Trip Survey

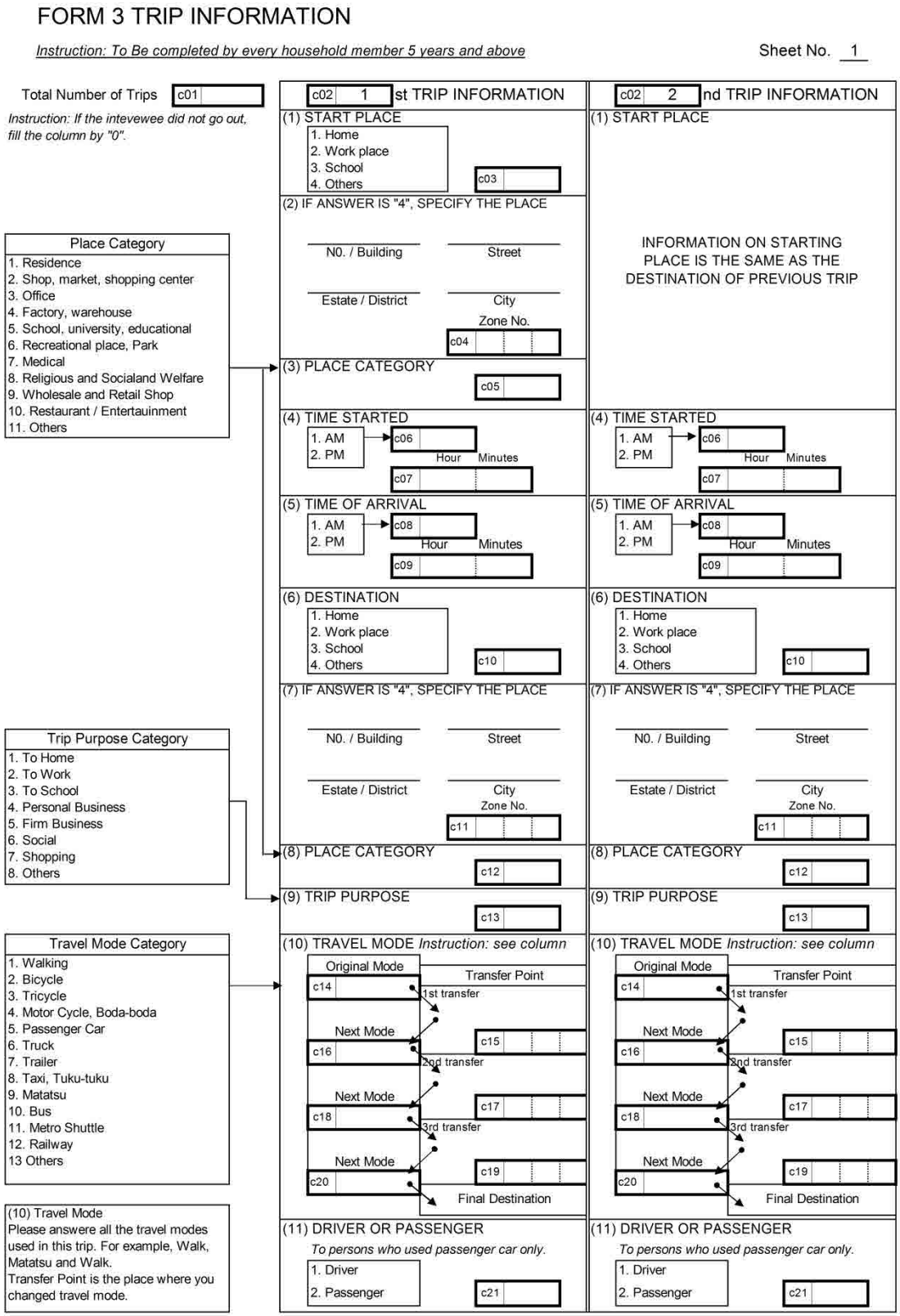


Figure A.3.3: Trip Information Form for Person Trip Survey

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 a1 | Member ID b1

STATED PREFERENCE SURVEY

Form A. FOR BUS AND MATATSU USERS

1. Is the alternative modes available for you?
   ☐ 1. Bycycle ☐ 2. Motorcycle ☐ 3. Private Car/Truck
   ☐ 4. Taxi ☐ 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?
   ☐ 1. Yes ☐ 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 ?
   ☐ 1. Bus/Matatsu is cheepest ☐ 2. Operation is frequent
   ☐ 3. Transfer is not necessary. ☐ 6. Other (specify)..... — d4

FORM B. FOR PRIVATE CAR AND MOTORCYCLE USERS

1. How much do you pay for parking at the travel destination?
   d5 kshs

2. f the Parking fee is increased by the cases below, do you change traffic mode?
   ☐ 1. 50% up (ex. 70→105kshs) ☐ 2. 100% up (ex. 70→140kshs)
   ☐ 3. 150% up(ex. 70→175kshs) ☐ 4. 200% up (ex. 70→210kshs)
   ☐ 5. 300% up (ex. 70→280kshs) — d6

3. If fuel price is increased by the cases below, do you change traffic mode?
   ☐ 1. 20% up (ex. 70→84kshs) ☐ 2. 40% up (ex. 70→98kshs)
   ☐ 3. 60% up (ex. 70→112kshs) ☐ 4. 80% up (ex. 70→126kshs)
   ☐ 5. 100% up (ex. 70→140kshs) — d7

4. Is the alternative modes available for you?
   ☐ 1. Bycycle ☐ 2. Motorcycle ☐ 3. Private Car/Truck
   ☐ 4. Taxi ☐ 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?
   ☐ 1. Yes ☐ 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 ?
   ☐ 1. Hate walking ☐ 2.Hate waiting ☐ 3. Travl time is long
   ☐ 4. Uncomfortable ☐ 5. Not flexible. ☐ 6.Security
   ☐ 7. Carring baggege 8. Others (specify) — d11

Bus Rapid Transit and Light Rail Transit are operated on exclusive route and their operation speed is faster than present public transport.

BRT

LRT

FigureA.3.4: Stated Preference Survey Form

A3.2.3 Cordon Line Survey Form

CORDON LINE SURVEY SHEET

Station No. ______ **Time** ___ : ___ **Sheet No.** ______

Dir. From ______ **To** ______ **Surveyor Name:** ______

No.	Type of Vehicle	ORIGIN: Location Name	ORIGIN: Small Zone No.	DESTINATION: Location Name	DESTINATION: Small Zone No.	Trip Purpose	Number of Persons (inncluding Driver)	VEHICLE REGISTERED PLACE: Location Name	VEHICLE REGISTERED PLACE: Small Zone No.	Commodity Type (for Truck & Trailer only)	Commodity Quantity (for Truck & Trailer only)	Net Load Capacity (for Truck & Trailer only)
		No. / Building Street District City /Municipality		No. / Building Street District City /Municipality				No. / Building Street District City /Municipality			kg. or ton	ton
		No. / Building Street District City /Municipality		No. / Building Street District City /Municipality				No. / Building Street District City /Municipality			kg. or ton	ton
		No. / Building Street District City /Municipality		No. / Building Street District City /Municipality				No. / Building Street District City /Municipality			kg. or ton	ton
		No. / Building Street District City /Municipality		No. / Building Street District City /Municipality				No. / Building Street District City /Municipality			kg. or ton	ton
		No. / Building Street District City /Municipality		No. / Building Street District City /Municipality				No. / Building Street District City /Municipality			kg. or ton	ton

(Columns No. through Vehicle Registered Place are headed "All the Passer"; Commodity Type, Commodity Quantity and Net Load Capacity are headed "for Truck & Trailer only".)

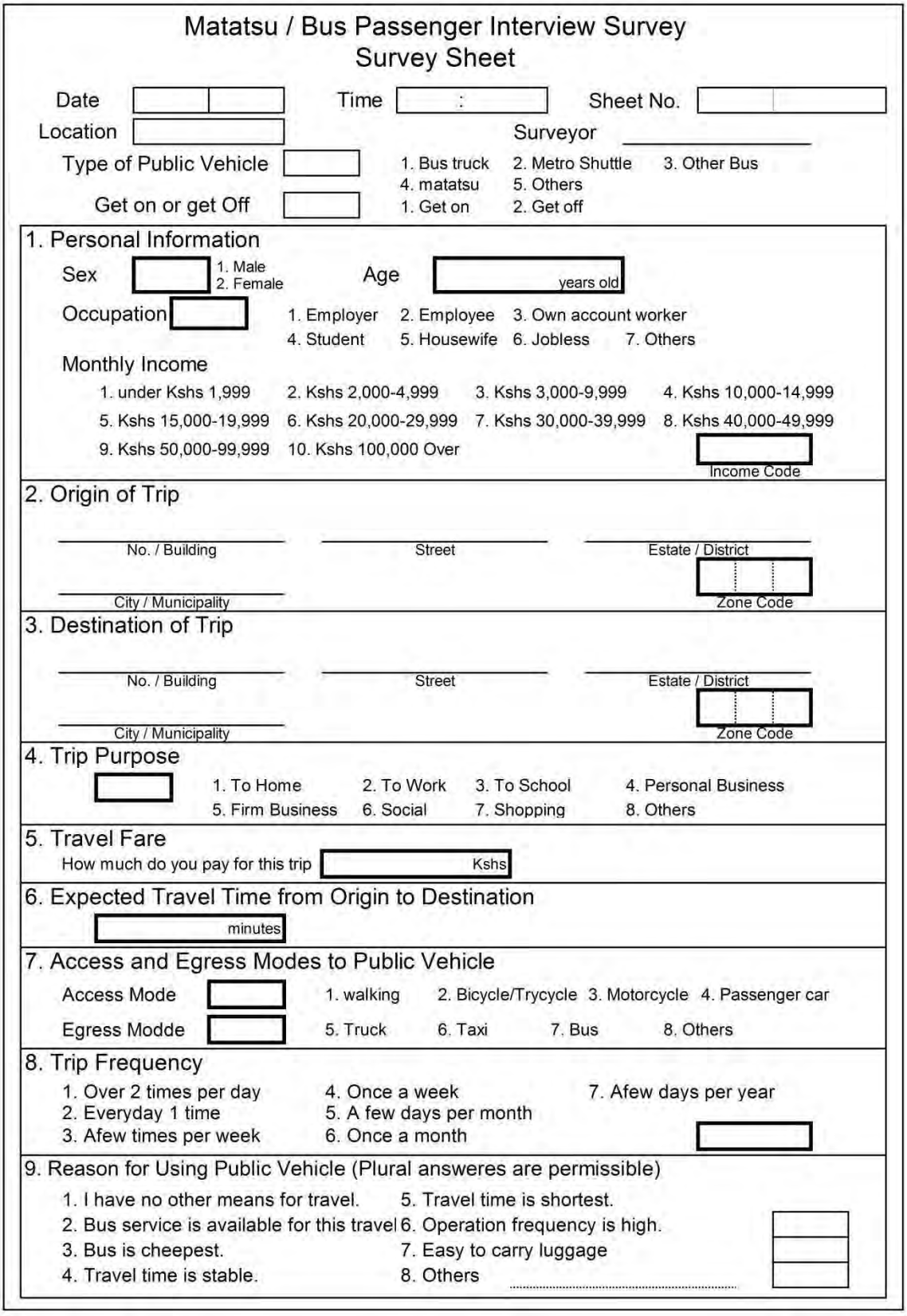
Type of Traffic Mode
1. Pedestrian
2. Bicycle, Tricycle, Push/Pull Cart
3. Motorcycle
4. Private Car, Taxi
5. Light Truck
6. Heavy Truck, Trailer
7. Matatsu
8. Bus, School/Co./Tourist Bus, Metro Shuttle

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 ____ Time ____ : ____ Sheet No. ____

Location ____ Surveyor ____

Type of Public Vehicle ____ 1. Bus truck 2. Metro Shuttle 3. Other Bus 4. matatsu 5. Others

Get on or get Off ____ 1. Get on 2. Get off

1. Personal Information

Sex ____ 1. Male 2. Female Age ____ years old

Occupation ____ 1. Employer 2. Employee 3. Own account worker 4. Student 5. Housewife 6. Jobless 7. Others

Monthly Income

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

Income Code ____

2. Origin of Trip

No. / Building ____ Street ____ Estate / District ____

City / Municipality ____ Zone Code ____

3. Destination of Trip

No. / Building ____ Street ____ Estate / District ____

City / Municipality ____ Zone Code ____

4. Trip Purpose

____ 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 ____ Kshs

6. Expected Travel Time from Origin to Destination

____ minutes

7. Access and Egress Modes to Public Vehicle

Access Mode ____ 1. walking 2. Bicycle/Trycycle 3. Motorcycle 4. Passenger car

Egress Modde ____ 5. Truck 6. Taxi 7. Bus 8. Others

8. Trip Frequency

1. Over 2 times per day 4. Once a week 7. Afew days per year
2. Everyday 1 time 5. A few days per month
3. Afew times per week 6. Once a month ____

9. Reason for Using Public Vehicle (Plural answeres are permissible)

1. I have no other means for travel. 5. Travel time is shortest.
2. Bus service is available for this travel 6. Operation frequency is high.
3. Bus is cheepest. 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 accessment 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.

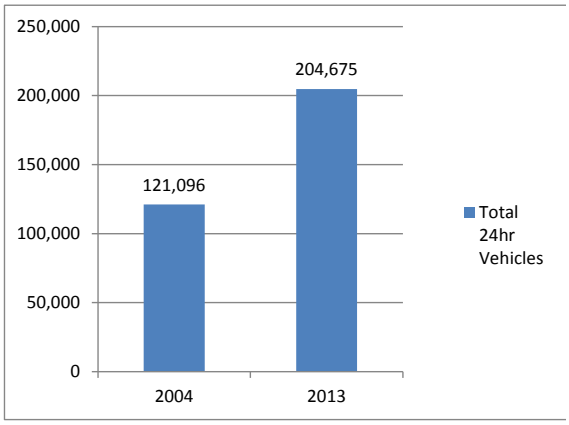
Figure A.3.7: Public Transport User Survey Form (2/2)

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.

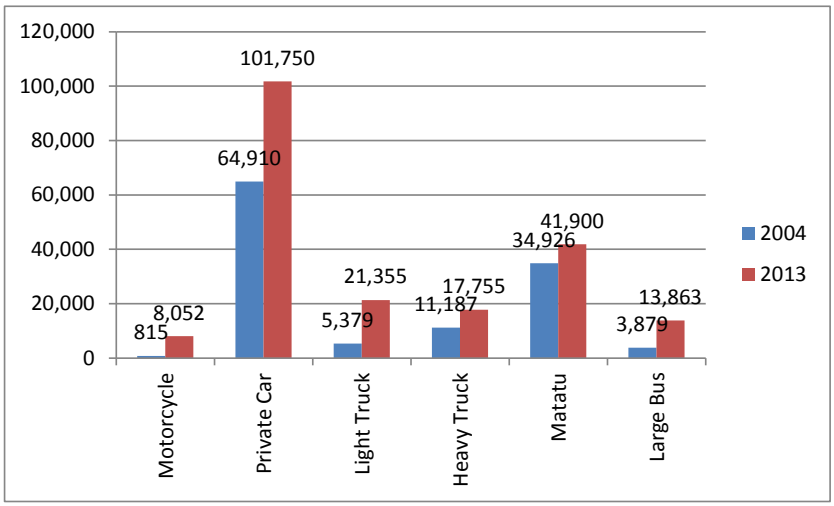


Source: JICA Study Team

FigureA.3.8: Comparison of Cordon Line Traffic Volume Between 2004 and 2013

(2) Vehicle Type Composition

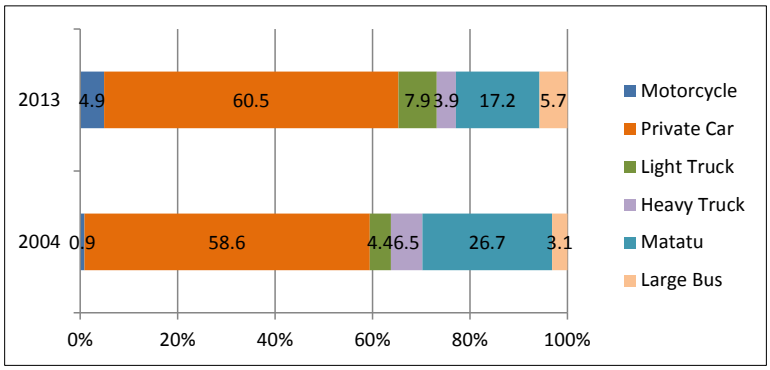
Figure A.3.9 shows the comparison of traffic volume by vehicle type in 2013 with that of 2004. Increase of private car has the largest proportion at 44% of the total increase of 84,000 vehicles. Regarding the increase ratio by vehicle type, the motorcycle category shows the largest increase rate of 9.9 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.

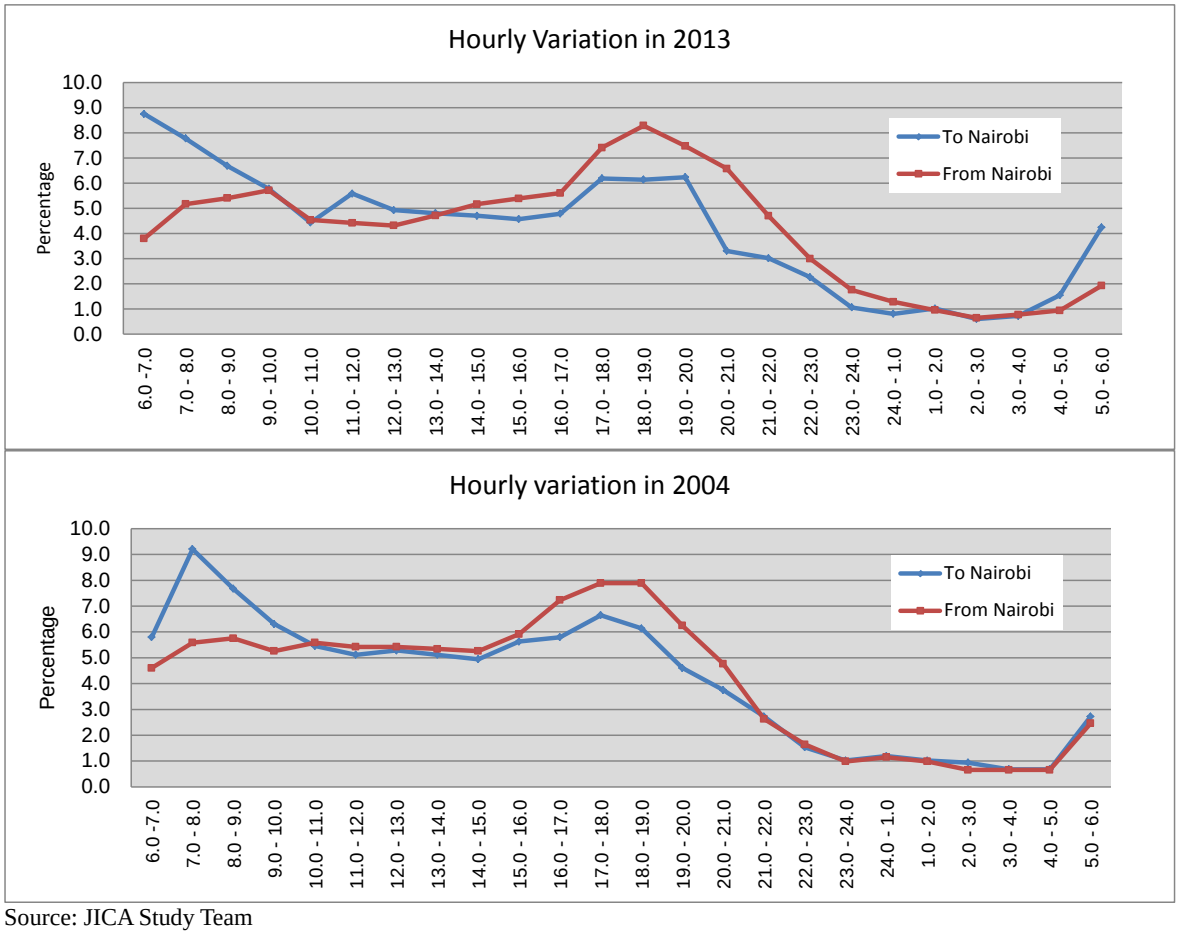


Source: JICA Study Team

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.



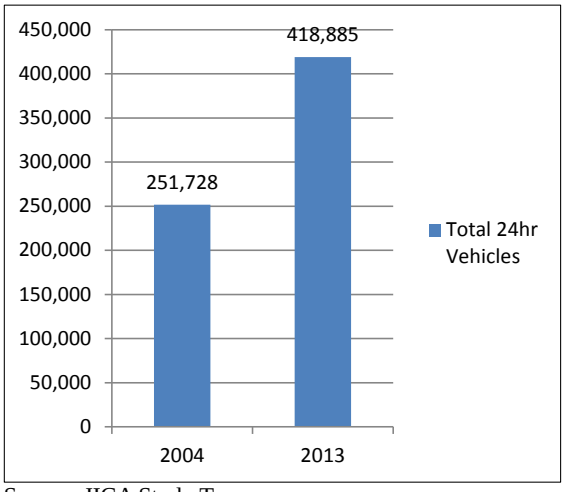
Source: JICA Study Team

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.

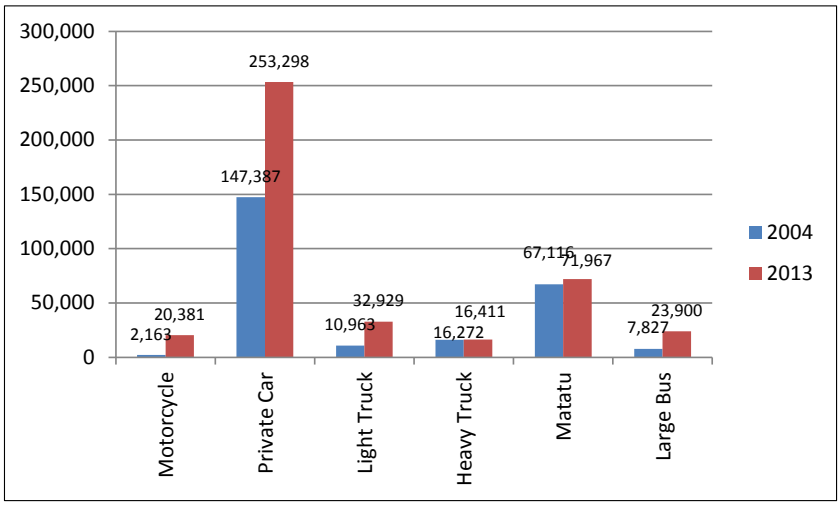


Source: JICA Study Team

Figure A.3.12: Comparison of Screen Line Traffic Volume Between 2004 and 2013

(2) Vehicle Type Composition

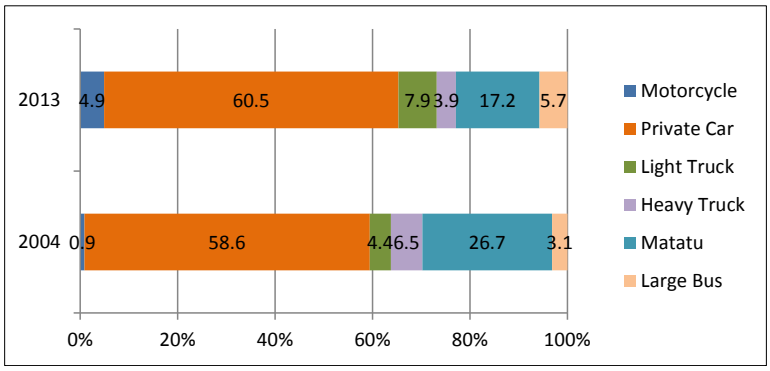
Figure A.3.13 shows the comparison of traffic volume by vehicle type in 2013 with that of 2004. The increase in private cars is 106,000, which occupies 63% of the total vehicle increase. Also, light trucks, motorcycles, and large buses increased by 22,000, 18,000, and 16,000, respectively.



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.

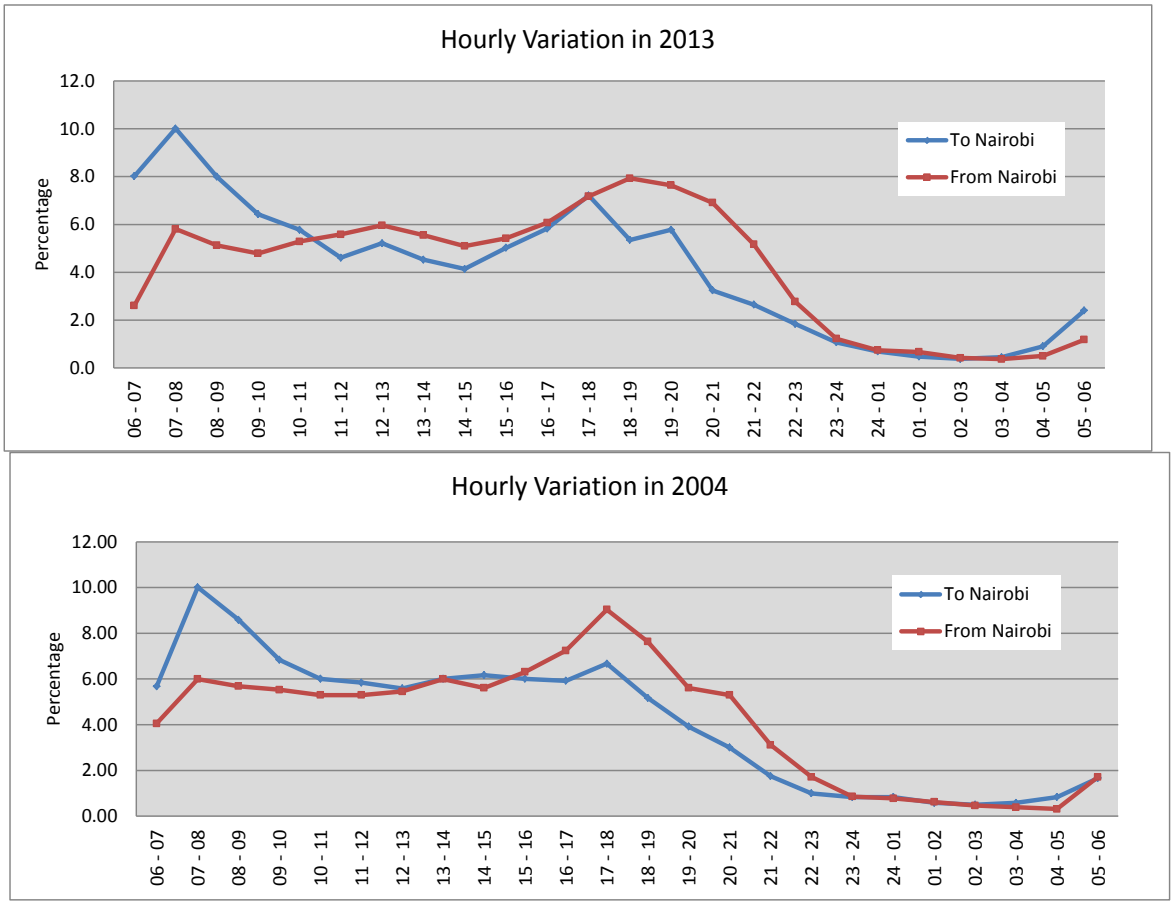


Source: JICA Study Team

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.

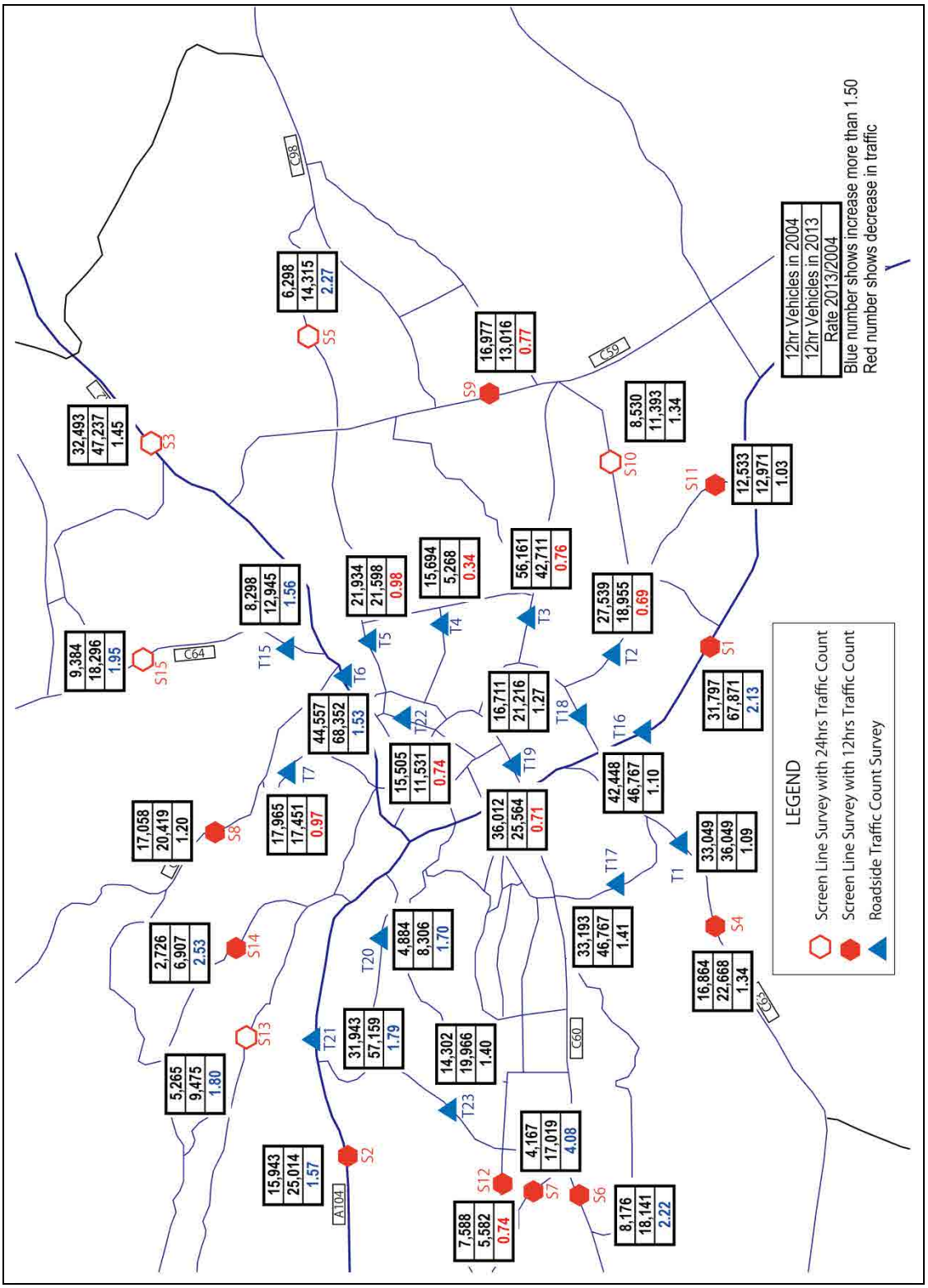


Figure A.3.16: Results of Traffic Count (12hr)

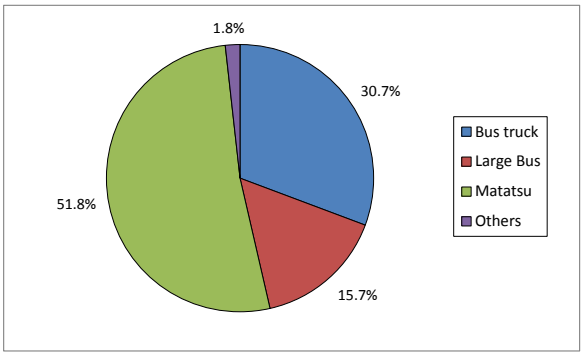
Source: JICA Study Team

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

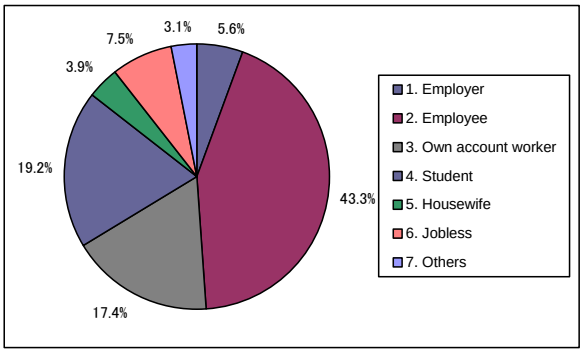
(1) Type of Public Transport and Passenger's Characteristics

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



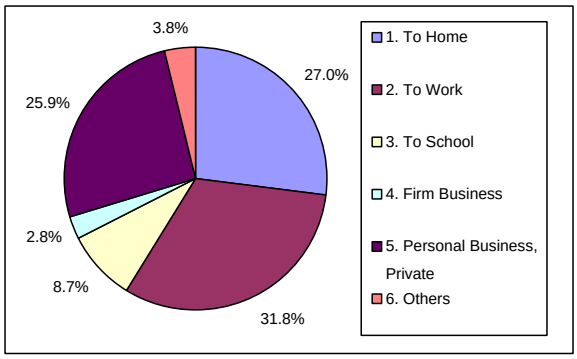
Source: JICA Study Team

Figure A.3.18: Occupation of Interviewed Bus and *Matatu* Passengers

(2) Trip Purpose and Access/Egress Mode

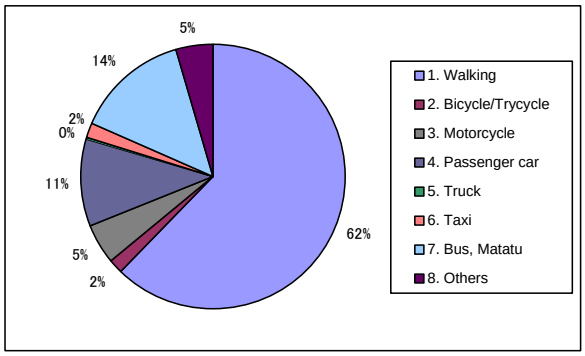
As shown in Figure A.3.19, three major trip purposes of public transport are "To home", "To work" and "Personal business".

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



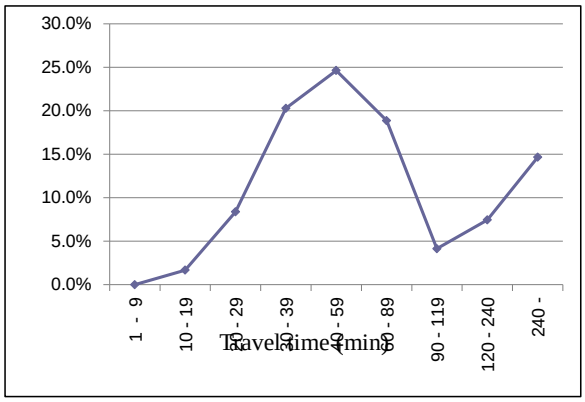
Source: JICA Study Team

Figure A.3.20: Access/Egress Mode of Bus and Matatu

(3) Travel Time and Fare

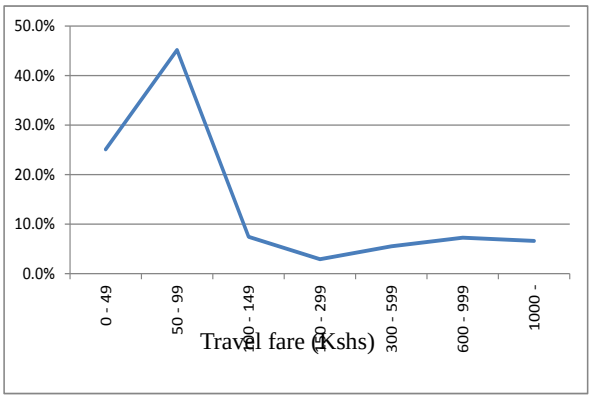
Figure A.3.21 shows the travel time frequency of bus and *matatu* passengers. About 65% of the passengers spend 30 to 90 min for their travel.

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

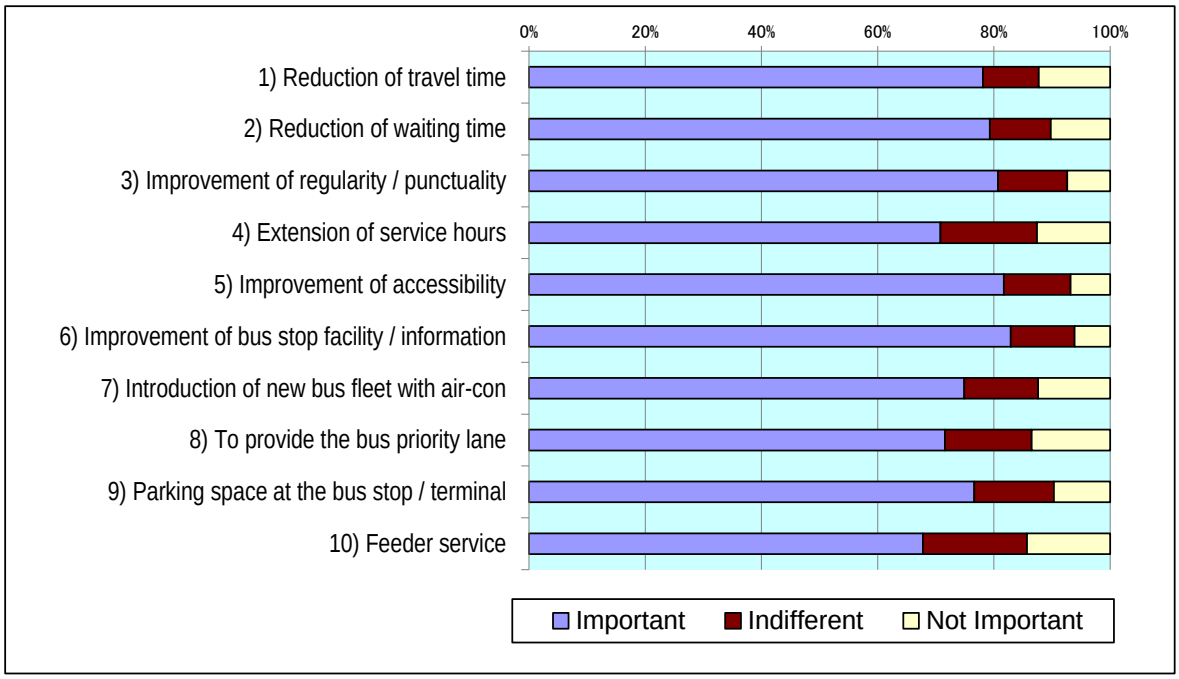


Source: JICA Study Team

Figure A.3.22: Travel Fare Frequency of Bus and Matatu Passengers

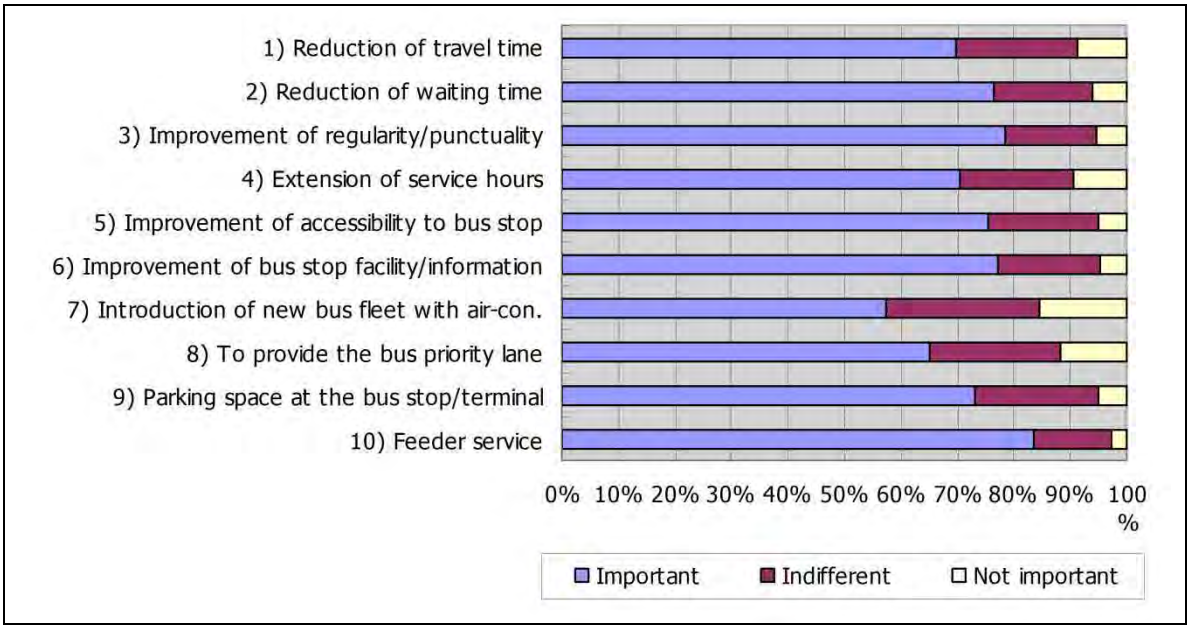
(4) Passenger's Opinion

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

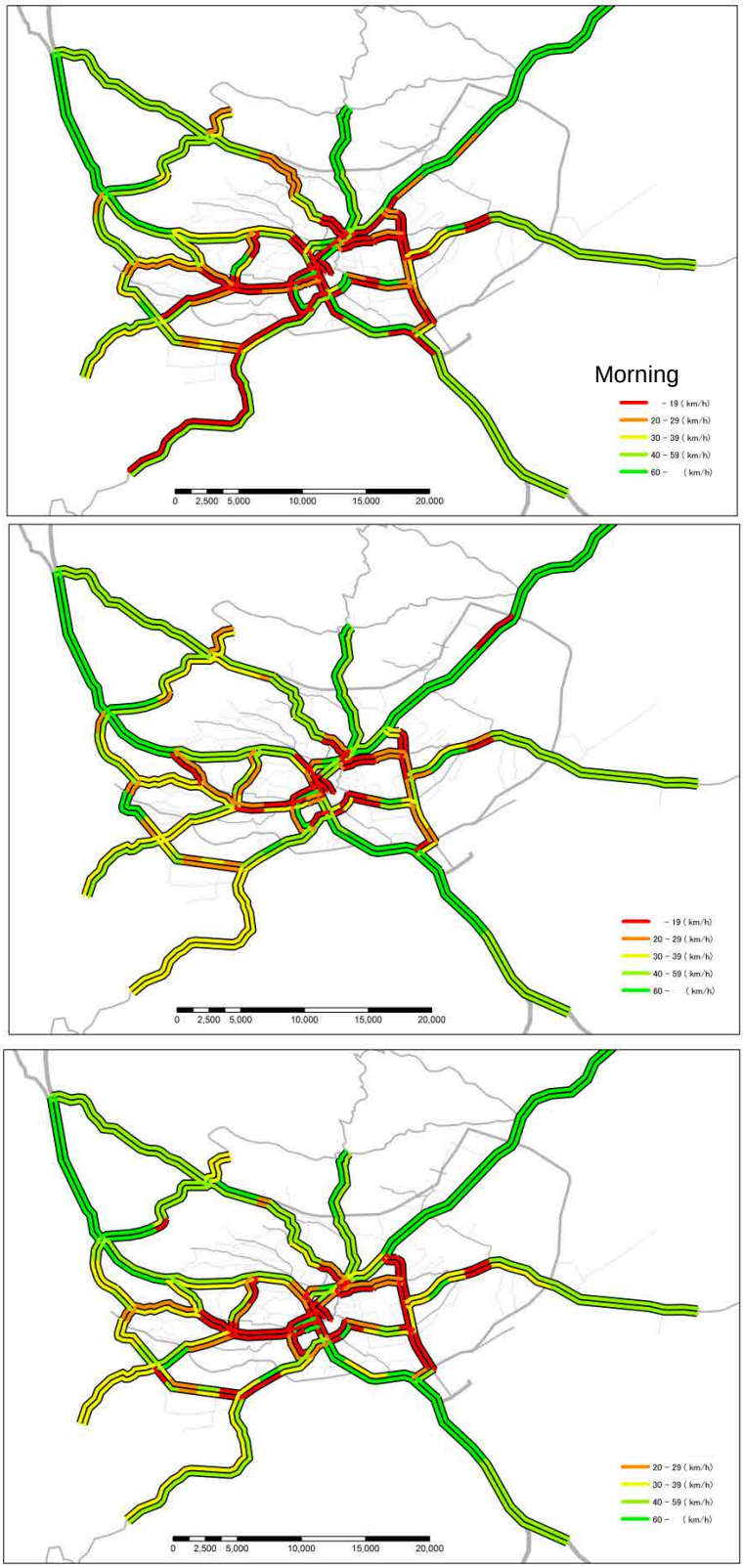
Figure A.3.24: Opinions for Improvement of Bus/Matatu Services in the 2004 Survey

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	5,348	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	Kawangware	22,262	226	45
36	Roysambu	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 courge	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	Umoja	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	Mugumoini	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	Maili 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

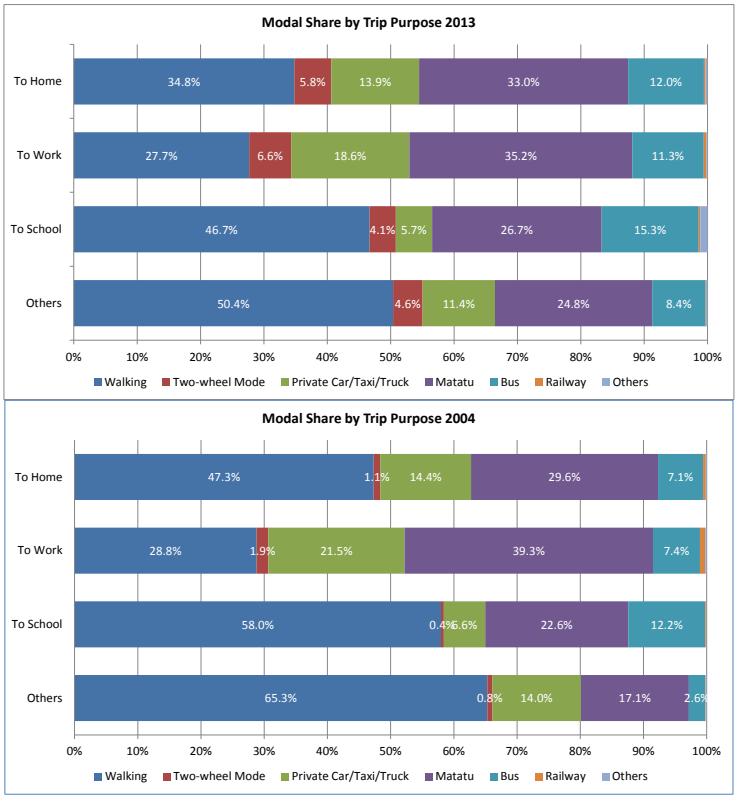
Source: JICA Study Team

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

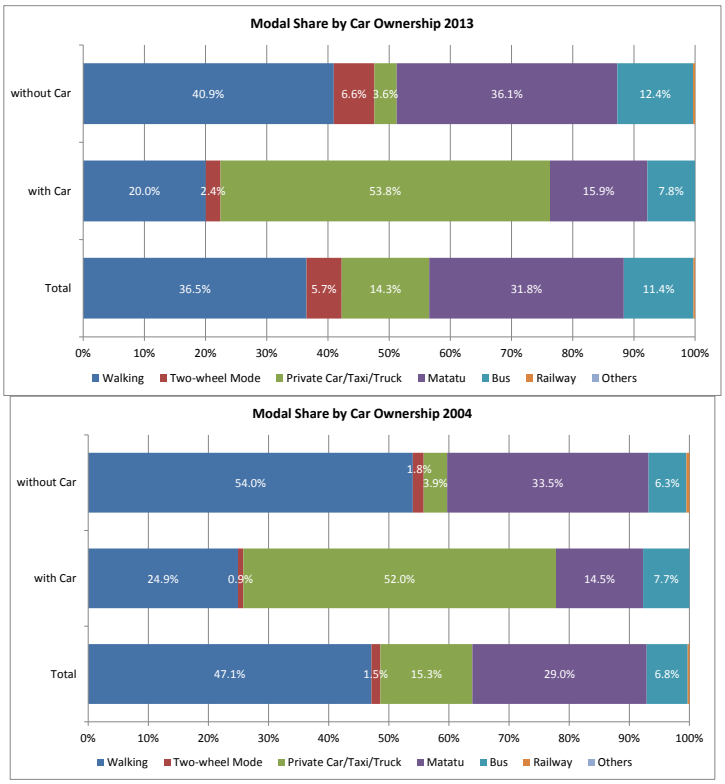
Figure A.3.26 shows the comparison of travel mode by trip purpose between 2004 and 2013. Generally, the percentage of walking decreased in every trip purpose. Regarding the trip purpose of "To work", the percentage of private cars and *matatus* decreased and the two wheel modes and large buses replaced these two modes. As for the trip purpose of "To school", the percentage of both *matatu*s 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

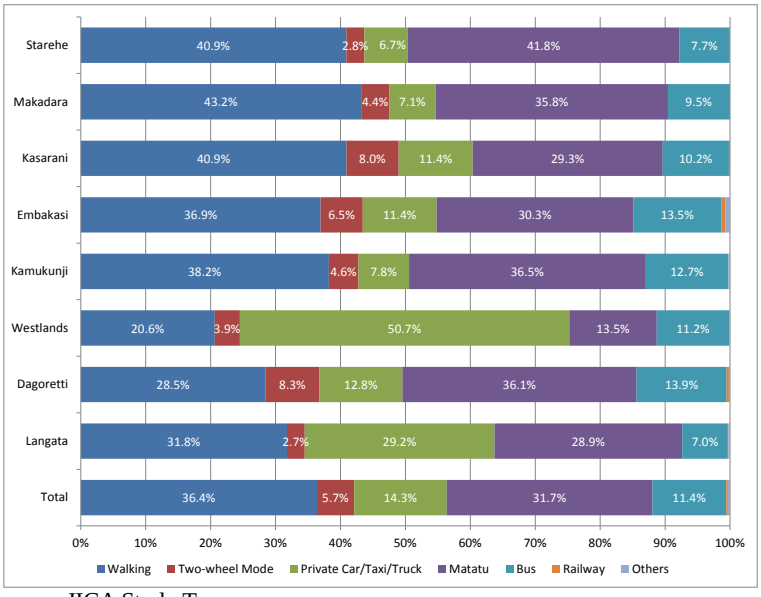
The use of cars has a strong relationship with car ownership. Figure A.3.27 shows the modal share of car owners and non-car owners in 2013 in comparison with that of 2004. The dependency on the cars of the car owners increased from 2004. For the non-car owners, the modal shares of the two wheel mode, *matatu*s 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.

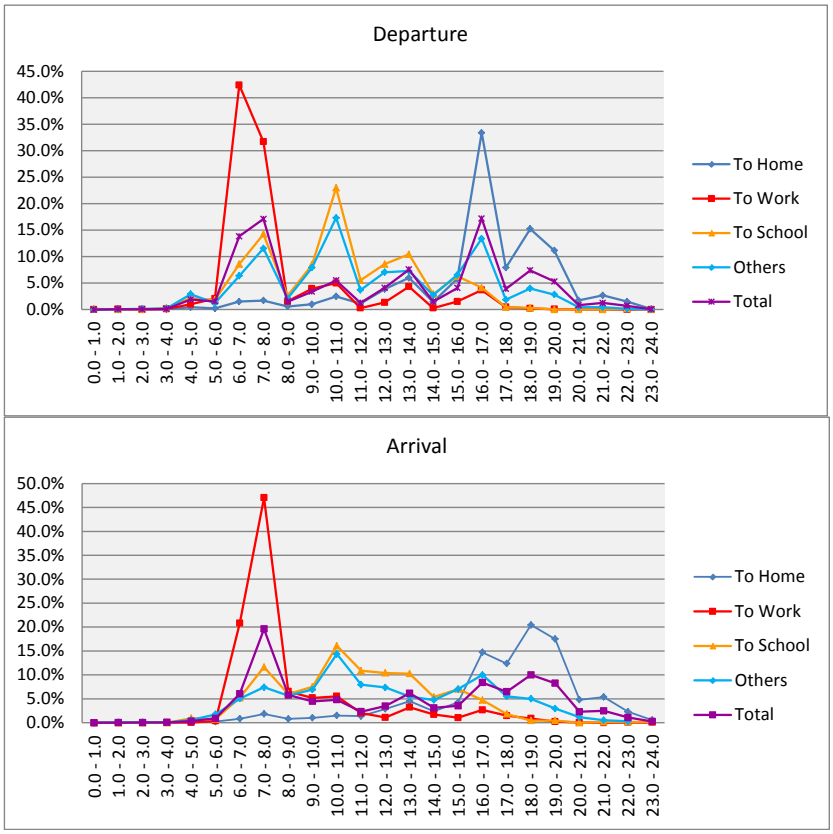


Source: JICA Study Team

Figure A.3.28: Comparison of Travel Mode by Large Zones

(2) Hourly Variation

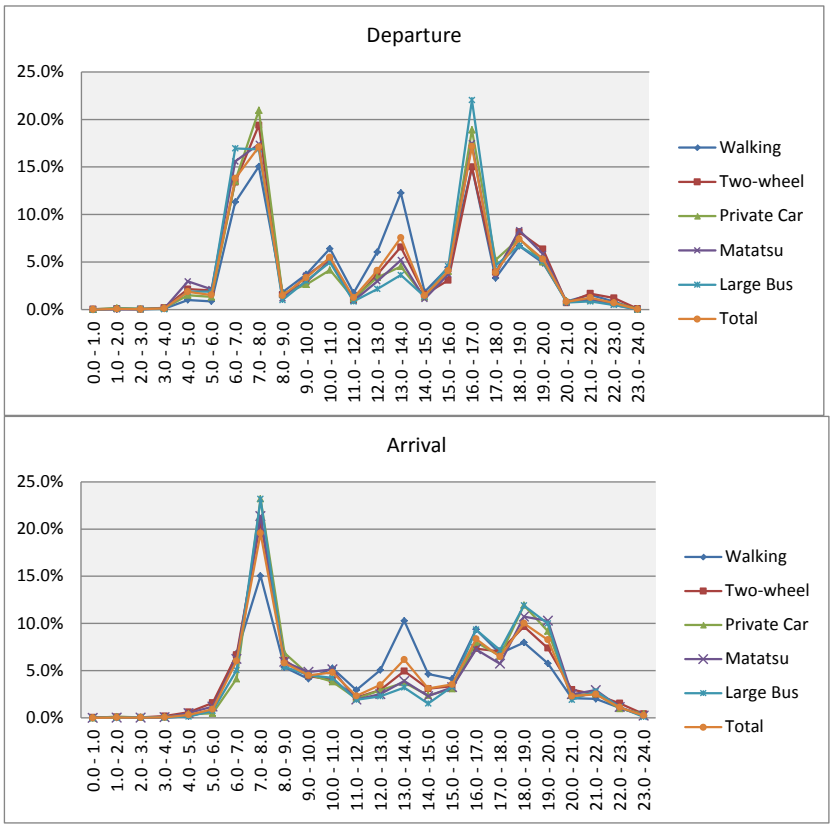
Figure A.3.29 shows the hourly variation of trip generation and attraction by trip purpose. Except for "To work" and "To Home" trip purposes, a high concentration in peak hours is not observed. But as for "To work", more than 40% of trip generation is concentrated during 6:00–7:00, and more than 45% 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.

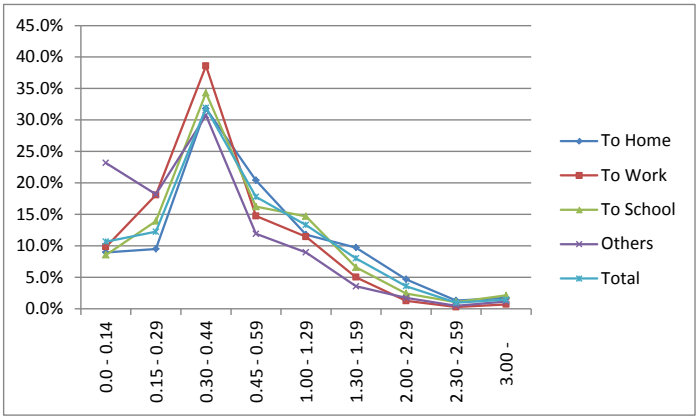


Source: JICA Study Team

Figure A.3.30: Hourly Variation of Trip Generation and Attraction by Travel Mode

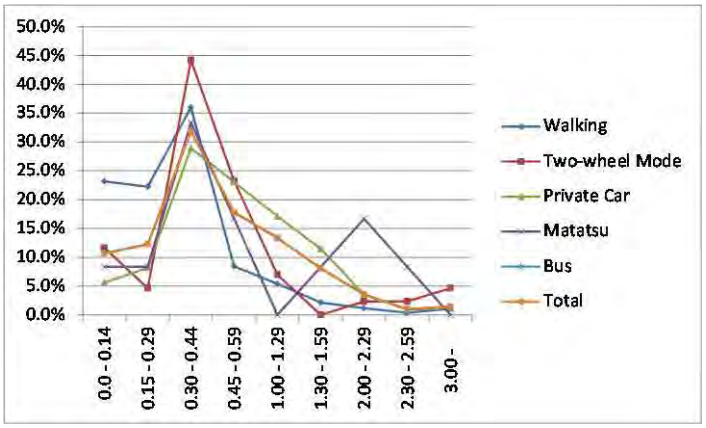
(3) Travel Time

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

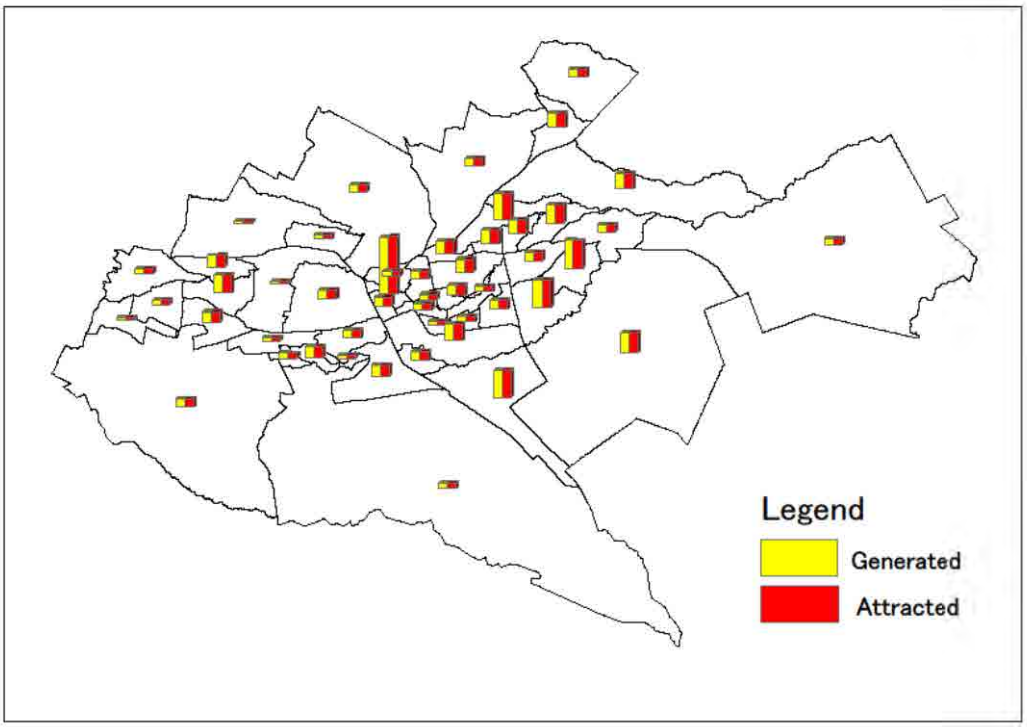


Source: JICA Study Team

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

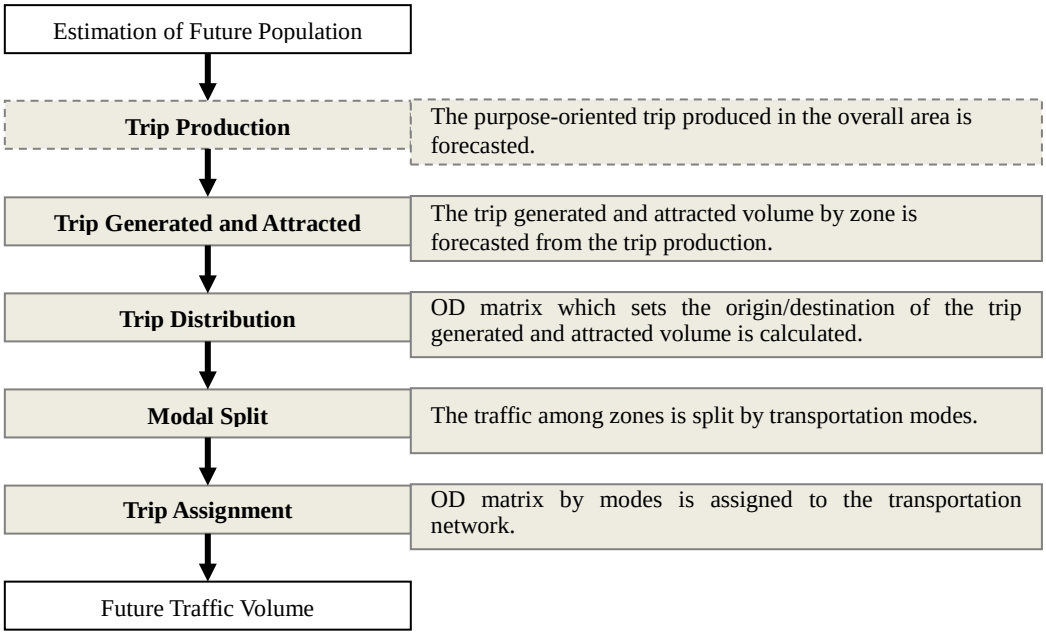
A4.1.1 General

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.



Source: JICA Study Team (JST)

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

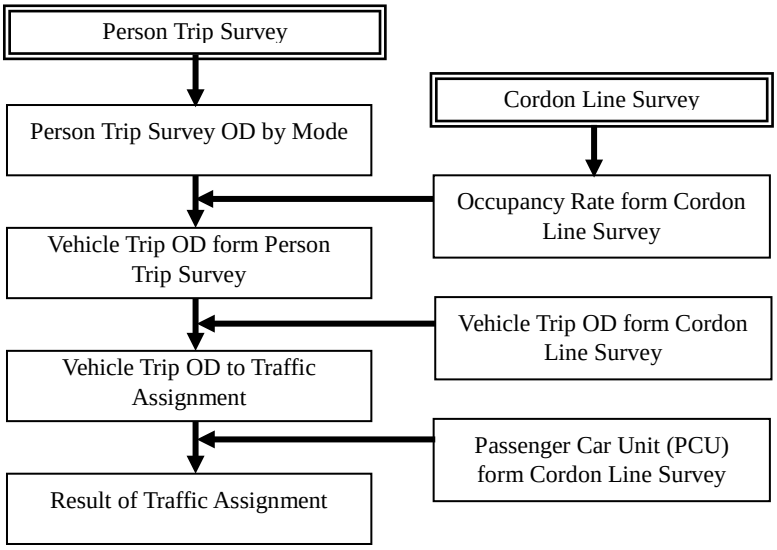
The JICA STRADA and spreadsheet are used in the calculation step of the model development and transport demand forecasting. JICA STRADA is a transport demand forecasting software. This software is capable of assigning future traffic volumes and showing the results visually. Then, Excel spreadsheet is 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)

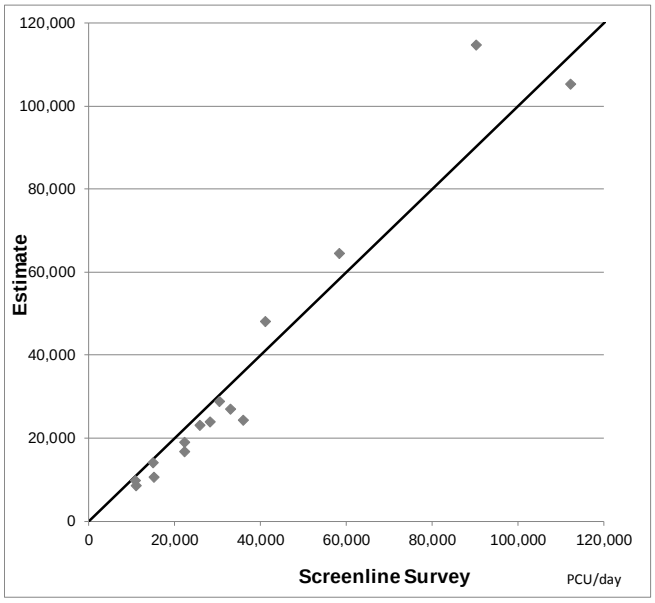
Figure A4.1.2: Traffic Assignment Flow

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.



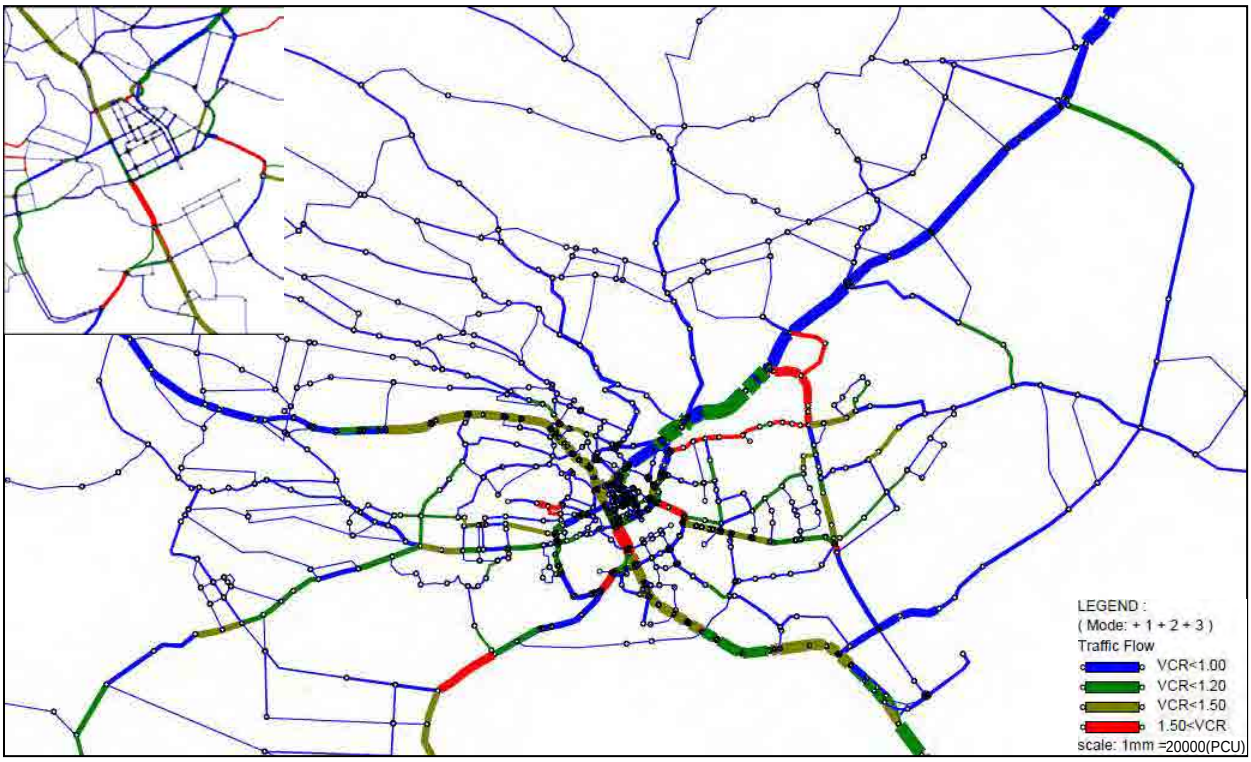
Source: JICA Study Team (JST)

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			Urban	Pavement	4	50	50,000
6		Undivided	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.

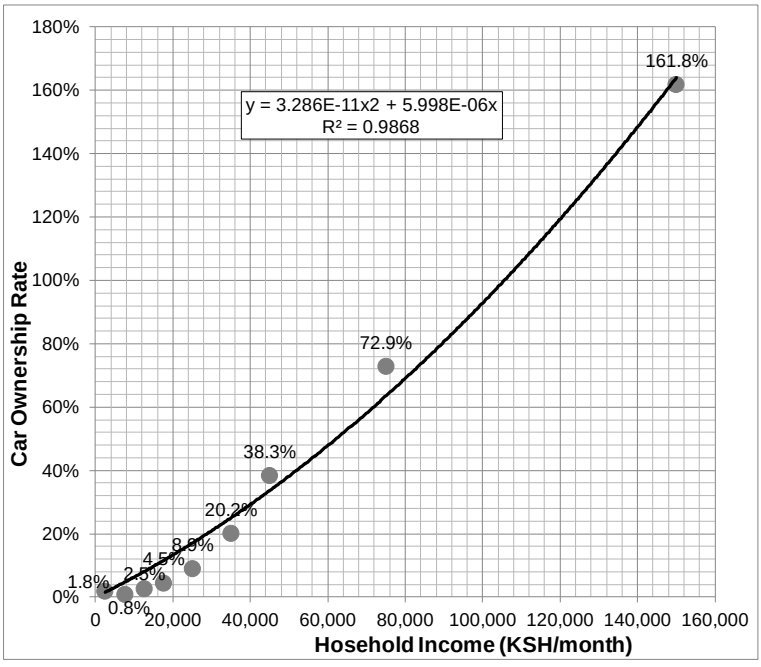
Table A4.2.1: Trip Rate per Person by Classification

			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%	$y = 3.286E\text{-}11x^2 + 5.998E\text{-}06x$
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)

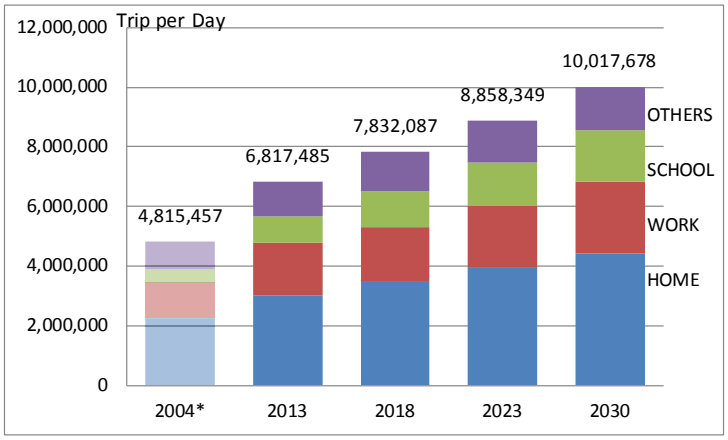
A4.2.4 Future Total Trip Production

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.

$$G_i = a_i * X1_i + b_i * X2_i +$$

$$A_j = a_j * X1_j + b_j * X2_j +$$

Where, G_i: Trip Generation in Zone i

A_j: Trip Attraction in Zone j

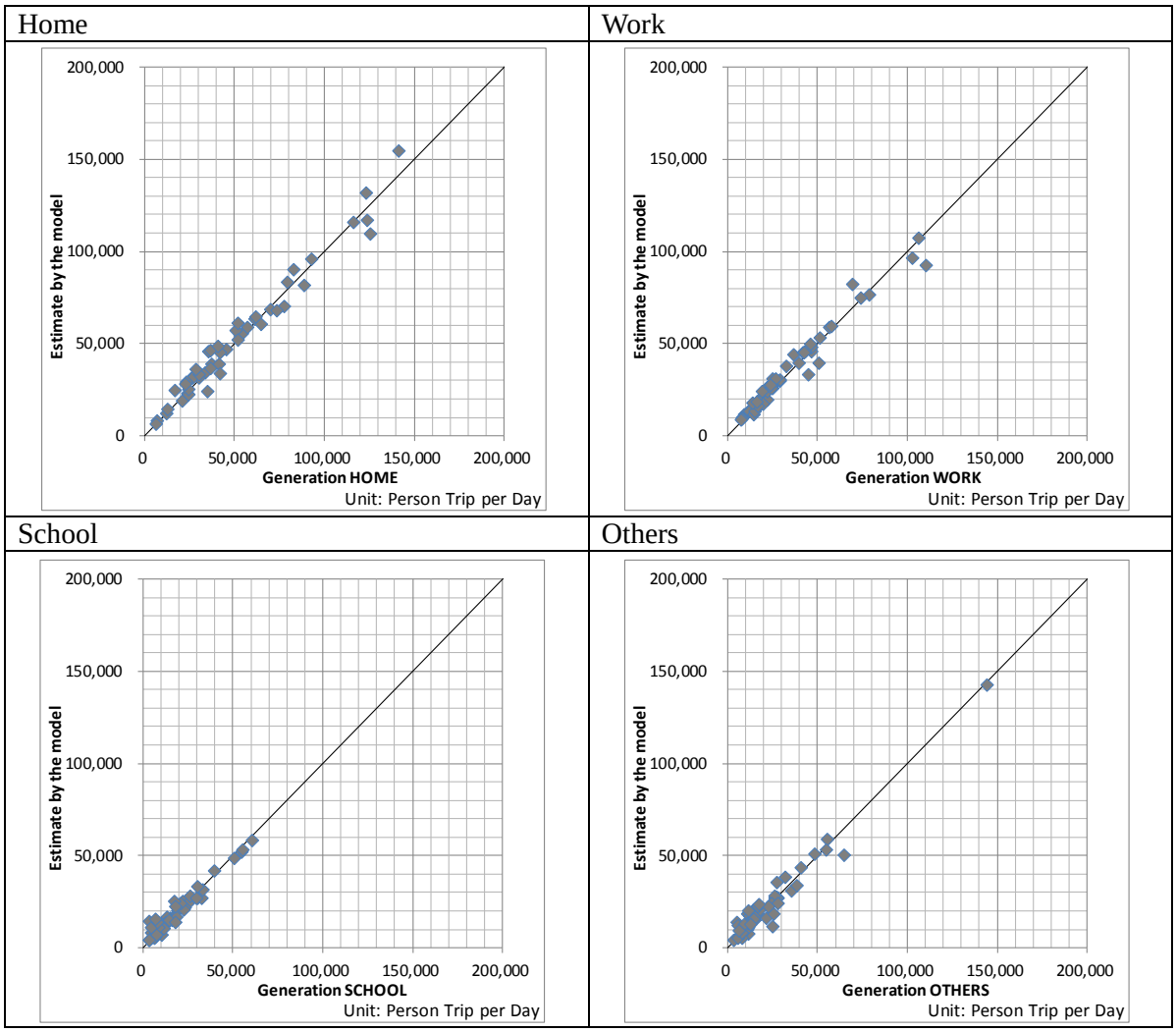
$X1_i$, $X2_j$: Attributes in Zone i, j

a_i, a_j, b_i, b_j: Coefficient

Table A4.3.1: Trip Generation and Attraction Model Parameters

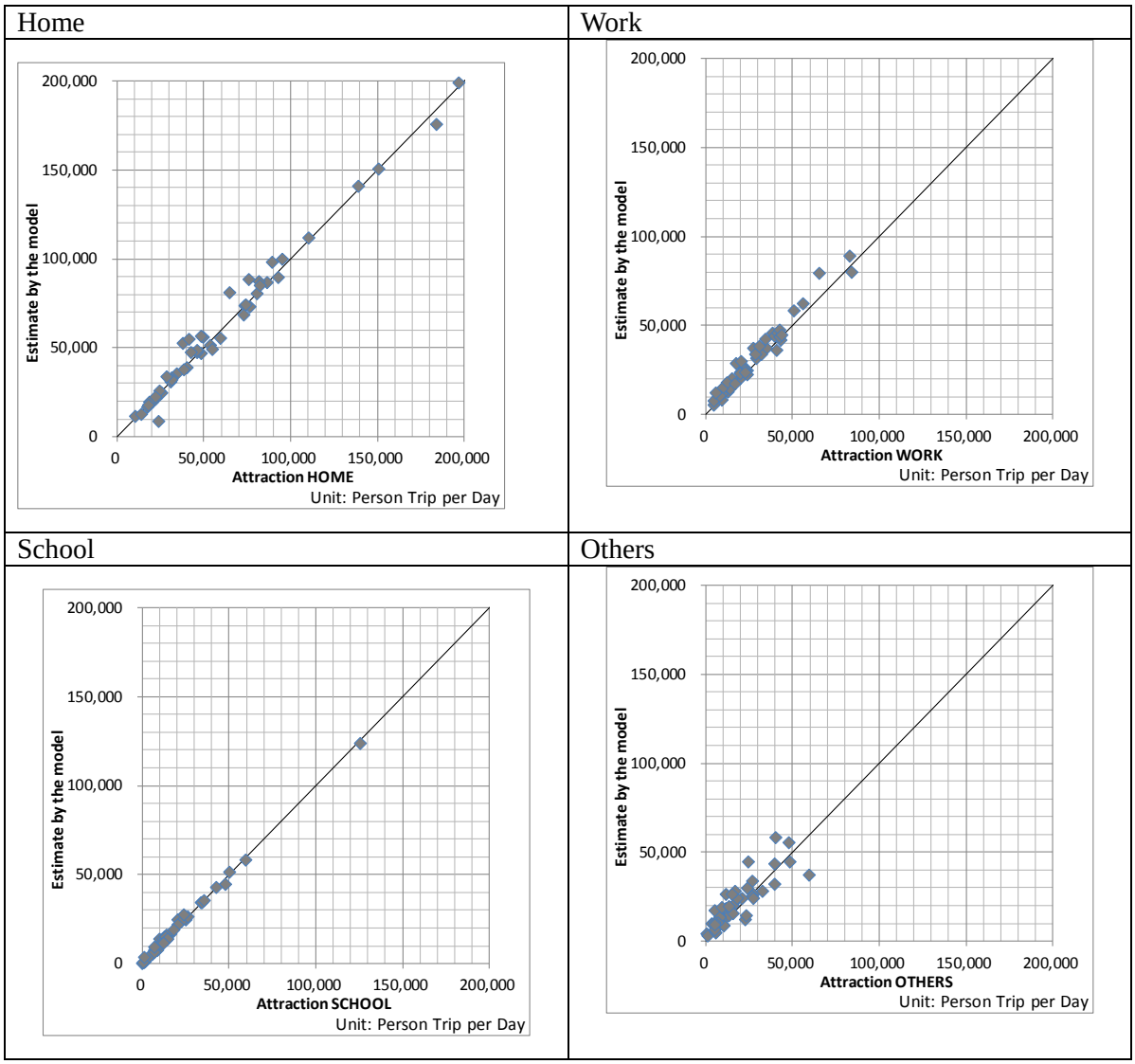
Model Type	Purpose	Population, 5 & Above	Number of Employees	Worker at Office Base	Student at Enrolment Base	R-squared
Trip Generation	Home	--	--	0.9857	1.2880	0.9747
	Work	--	0.8586	0.1884	--	0.9664
	School	0.2425	--	--	0.1786	0.9578
	Others	0.0994	--	0.2238	0.4273	0.9545
Trip Attraction	Home	0.9682	--	--	--	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



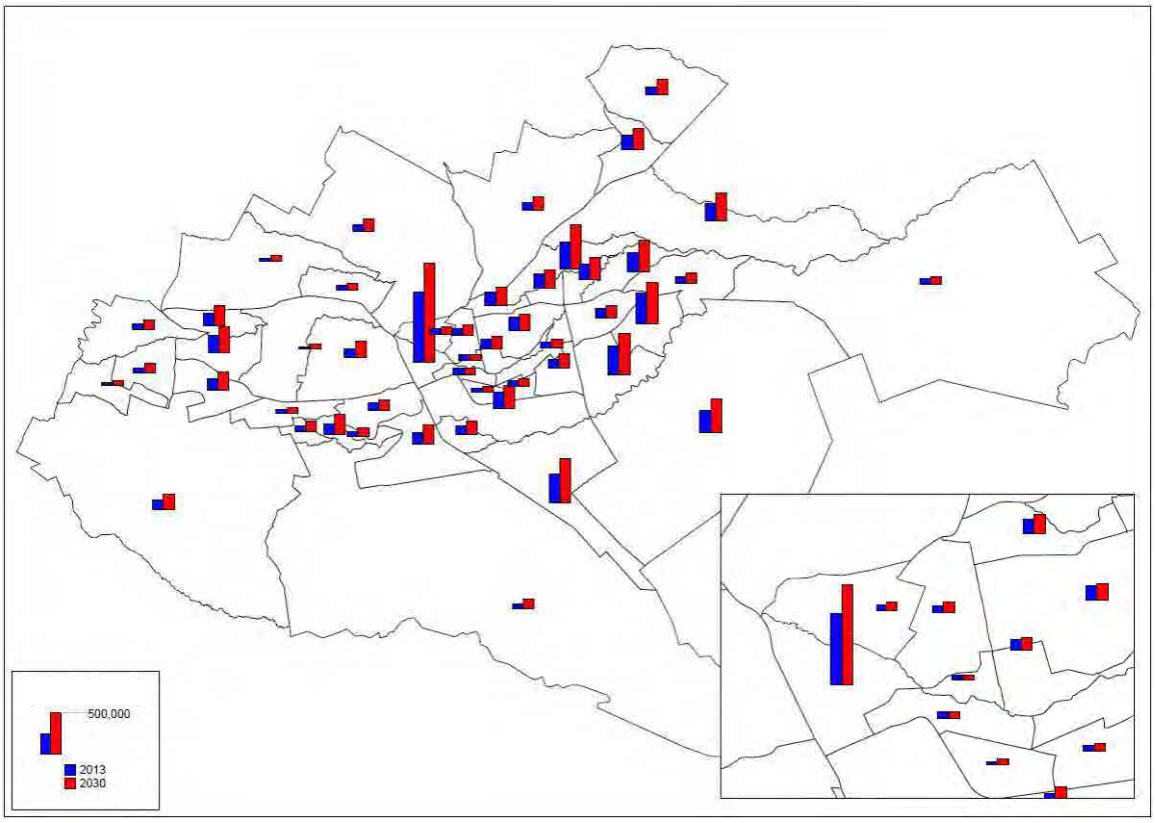
Source: JICA Study Team (JST)

Figure A4.3.2: Model Estimate and Observed Result for Trip Attraction

A4.3.3 Future Trip Generation and Attraction

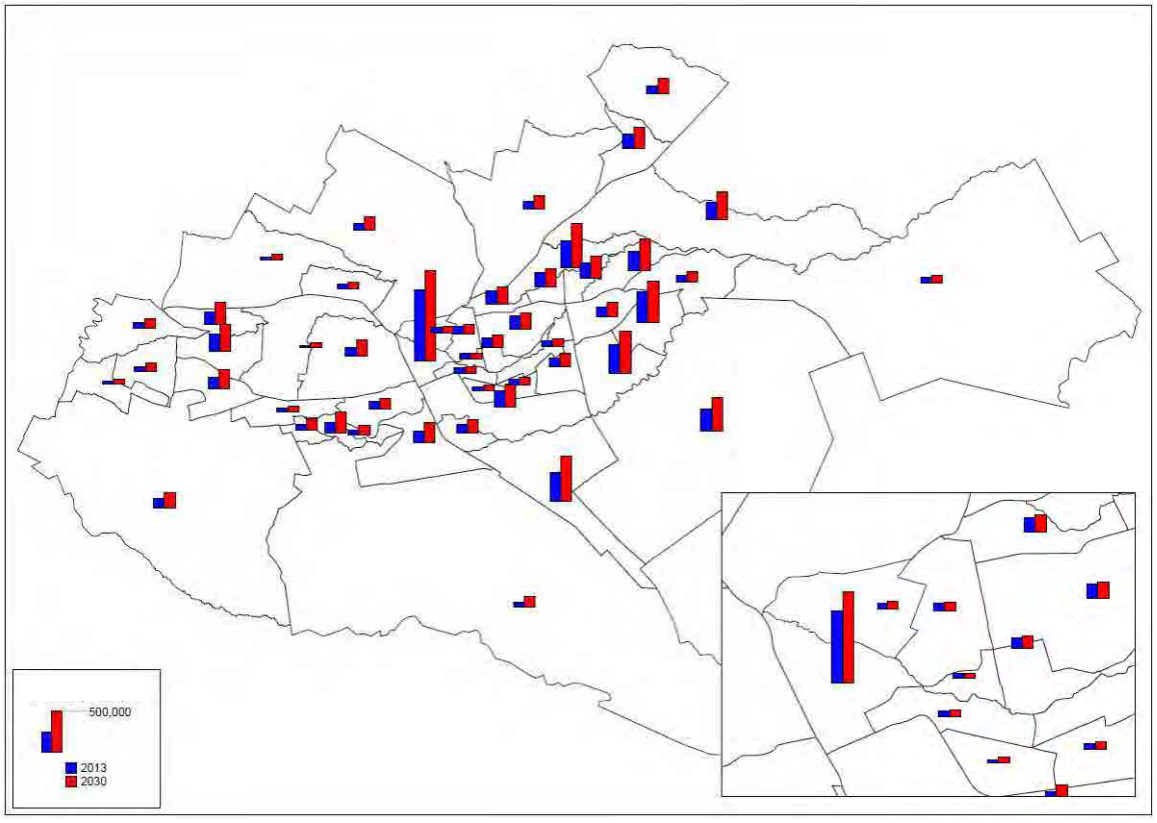
It is necessary to balance generation and attraction before the forecast of trip distribution. Each generation must be paired with a corresponding attraction. Then, the volume of generation and attraction forecast by each zone and trip purpose was adjusted with the overall trip production forecast result.

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.

Interzonal trip $X_{ij} = K * O_i^{\alpha} * D_j^{\beta} / L_{ij}^{\gamma}$

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.

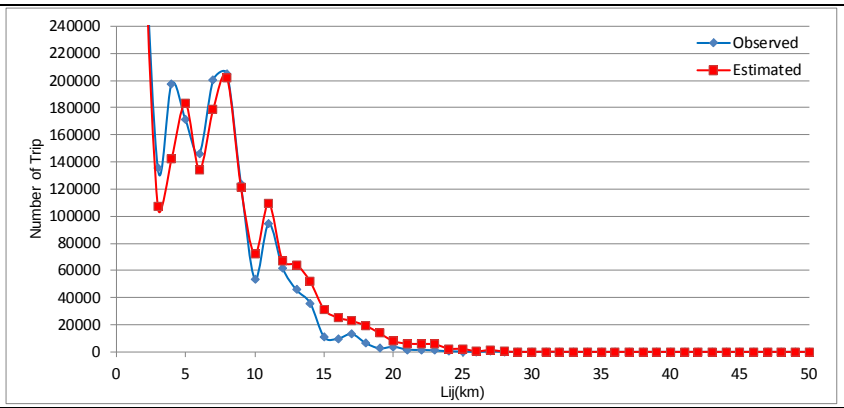
The observed and estimated values of trip length are shown in Figure A4.4.1. The trip length is mostly adjusted by the model. Trip amongst zones will be forecasted by this model in each zone.

Table A4.4.1: Intrazonal Trip Distribution Model Parameters

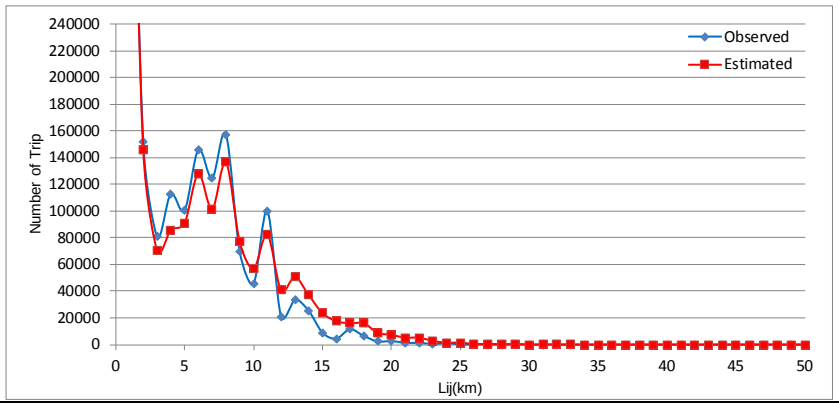
Trip Purpose	α	β	Γ	Log (K)	R-squared
Home	0.61945	0.45702	-0.75966	-1.82231	0.74090
Work	0.53011	0.67989	-0.68057	-2.31429	0.78405
School	0.11171	0.42457	-0.43606	0.73126	0.68236
Others	0.30109	0.55044	-0.59065	-0.22105	0.77531

Source: JICA Study Team (JST)

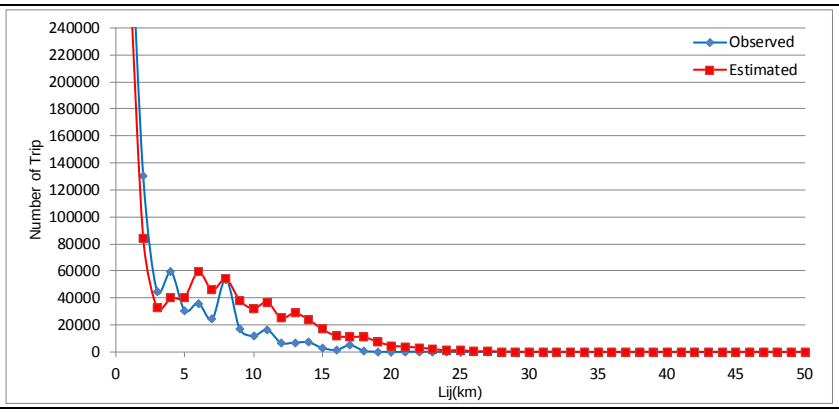
Home



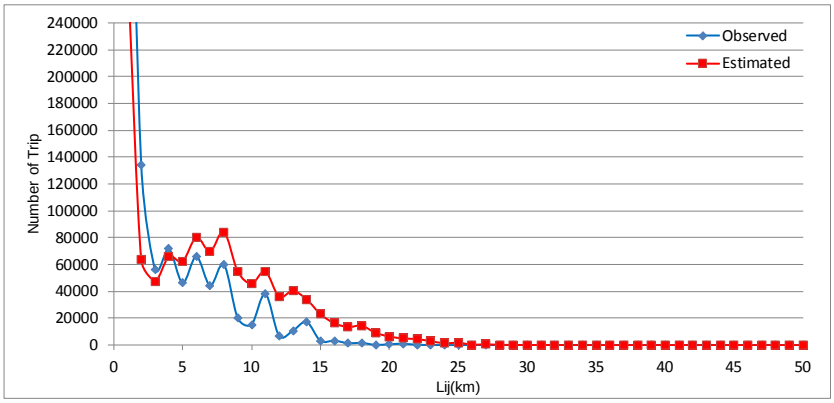
Work



School



Others

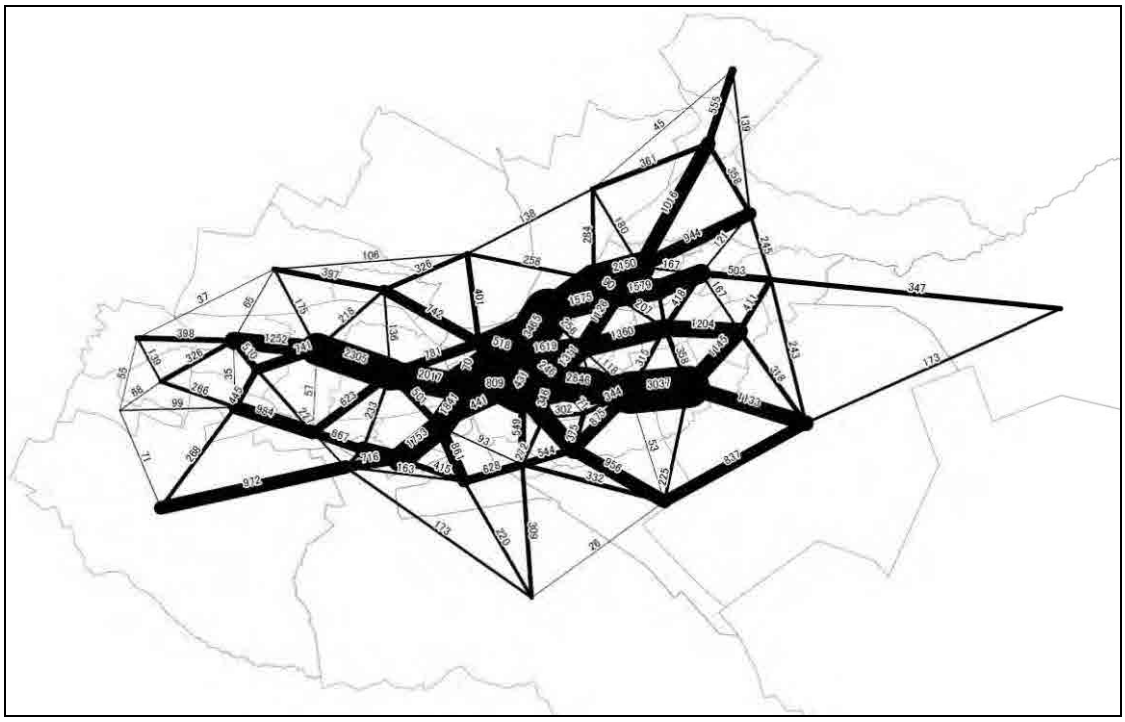


Source: JICA Study Team (JST)

Figure A4.4.1: Verification of Trip Distribution Models

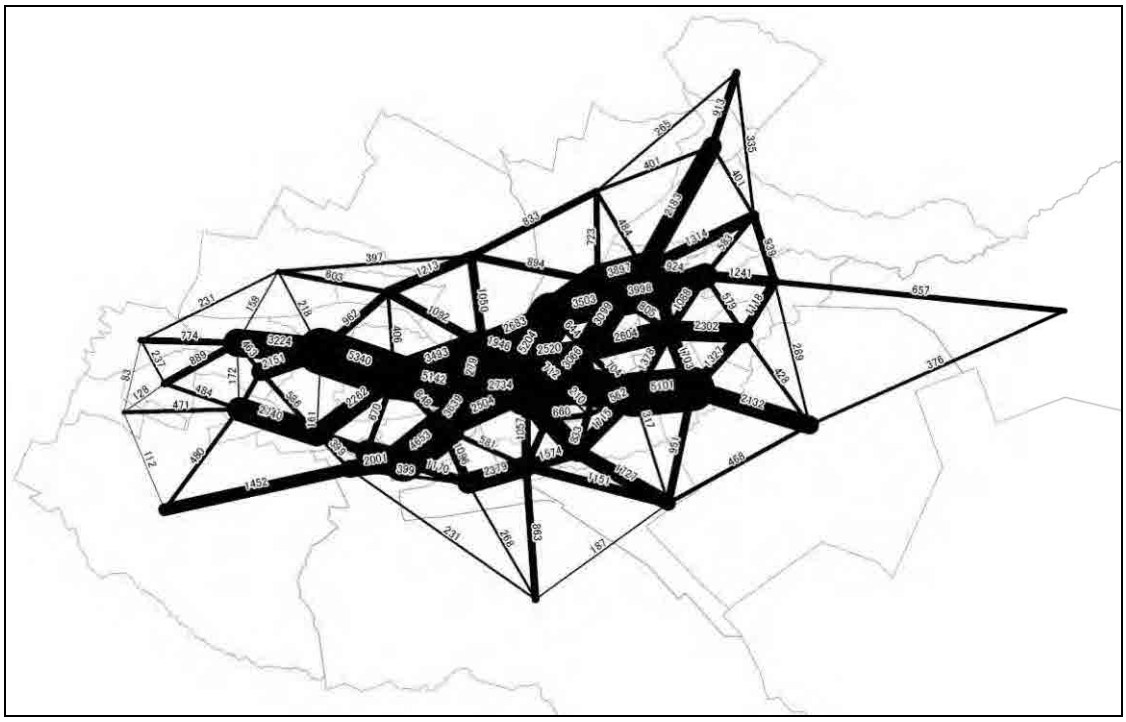
A4.4.3 Future Trip Distribution Forecasting

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

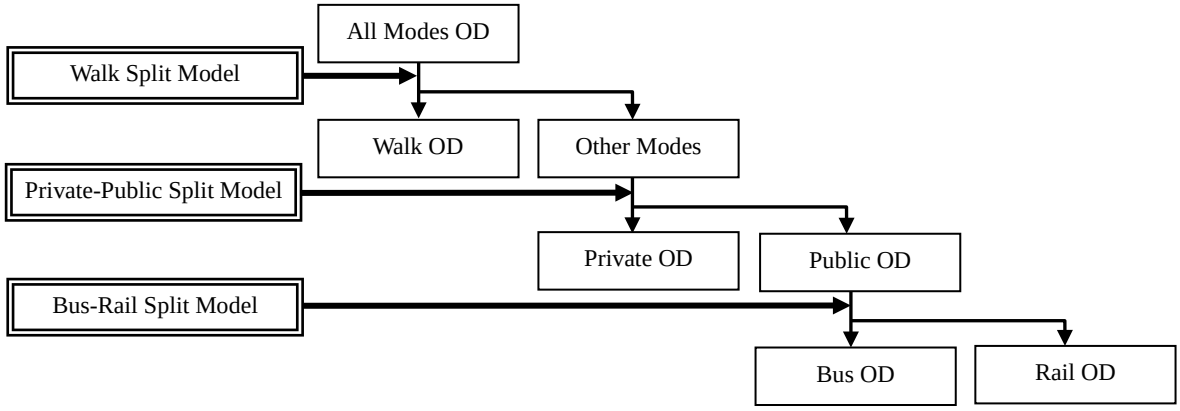
A4.5 Modal Split Forecasting

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.



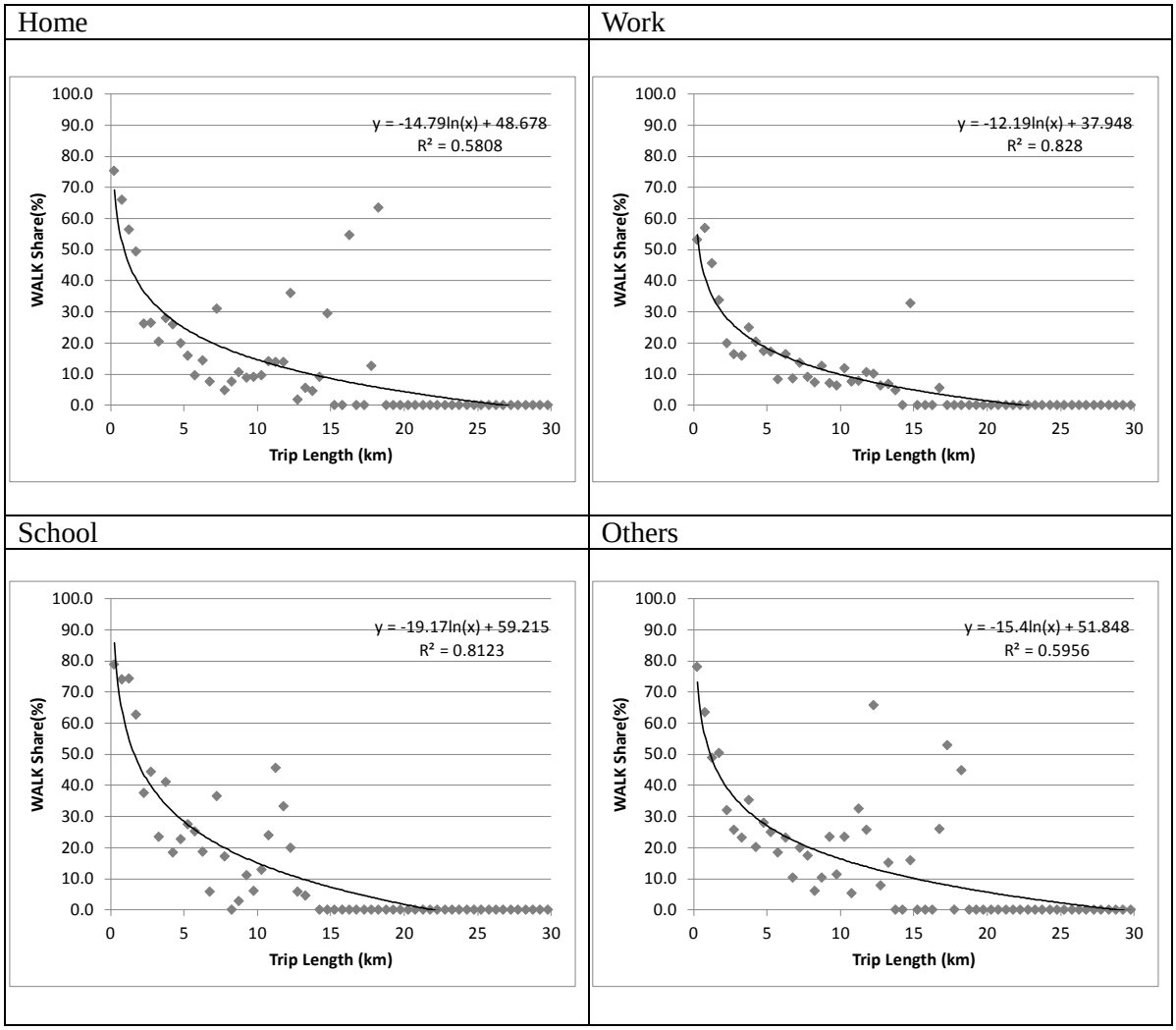
Source: JICA Study Team (JST)

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:

$$P_i = (P_j walk\_W/Ocar * Pop\_W/Ocar + P_i walk\_W/car * Pop\_W/car) / Pop\_Total$$

Where, P_i: Walk share

$P_i$walk_W/Ocar: Walk share by non-car owning household (2013 zone i)

$P_i$walk_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*T_{ij}_car

U_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 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)
T*ij*_car(b)	b	-0.29845 (-34.87190)	-0.26265 (-27.90580)	-0.35603 (-12.59710)	-0.25524 (-17.815209
T*ij*_public(c)	c	-0.22927 (-18.92980)	-0.18623 (-13.73400)	-0.29753 (-7.49780)	-0.18788 (-8.20790)
C*ij*_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*private_W/Ocar * Pop_W/Ocar + P*i*private_W/car * Pop_W/car) / Pop_Total

Where, P*i*: Private share

P*i*private_W/Ocar: Private share by non-car owning household (2013 zone *i*)

P*i*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)

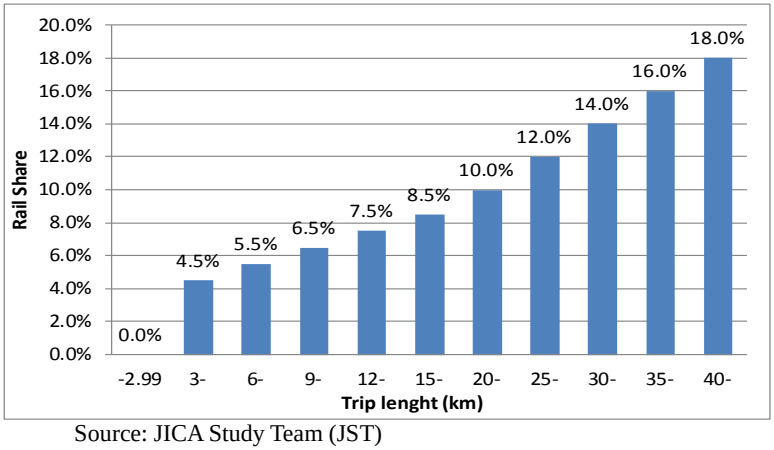
Target Year	HH Car Ownership Rate	Trip Purpose (Person Trip per Day)			
		Home	Work	School	Others
2013	29.0%	25.2%	36.7%	15.1%	38.7%
2018	32.8%	30.6%	41.5%	13.5%	38.6%
2023	41.3%	32.8%	45.6%	15.7%	42.9%
2030	58.6%	36.4%	52.9%	19.7%	51.1%

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%.

$$LR = (L_{ij}\_Access + L_{ij}\_Egress) / L_{ij}\_Total$$



Source: JICA Study Team (JST)

Figure A4.5.3: Diversion Curve of Rail Share by LR<0.25

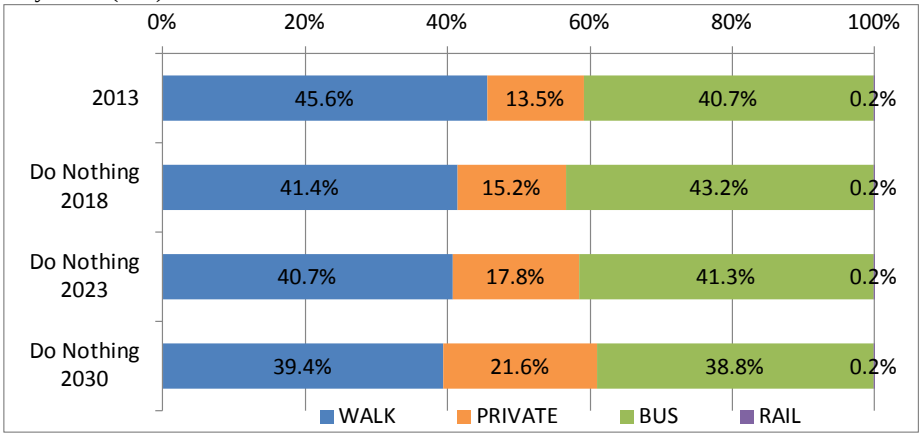
A4.5.6 Future Modal Split Forecasting

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%

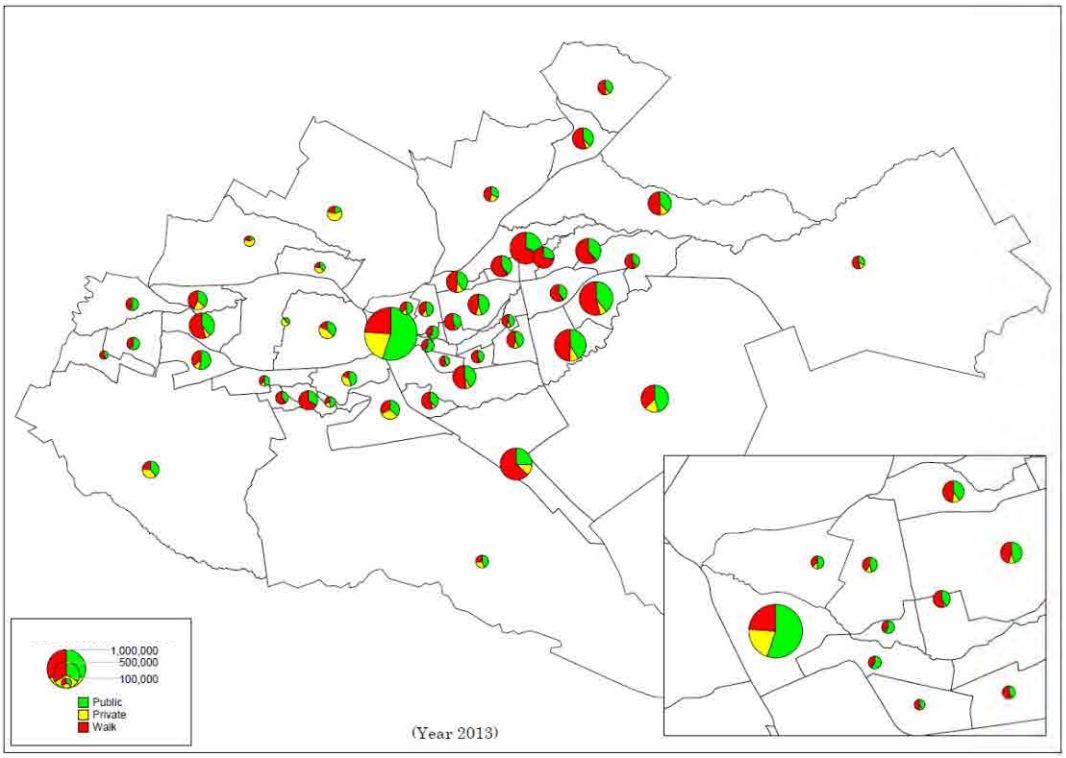
Source: JICA Study Team (JST)



Source: JICA Study Team (JST)

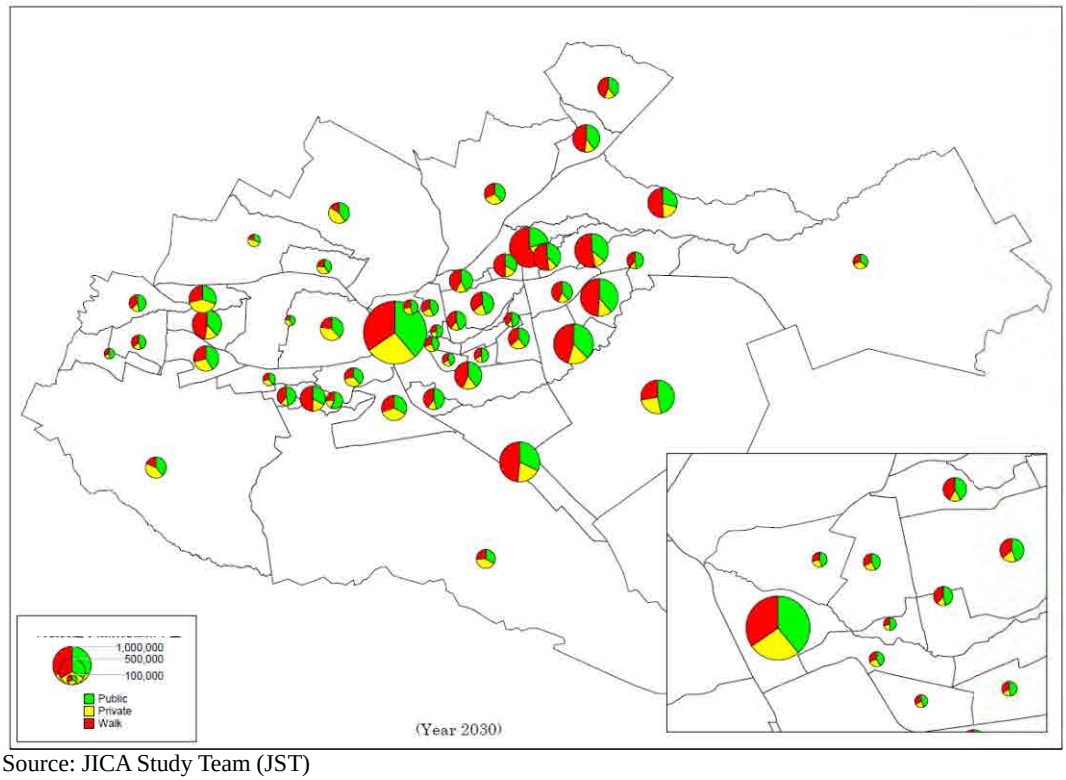
Figure A4.5.4: Future Modal Share

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)

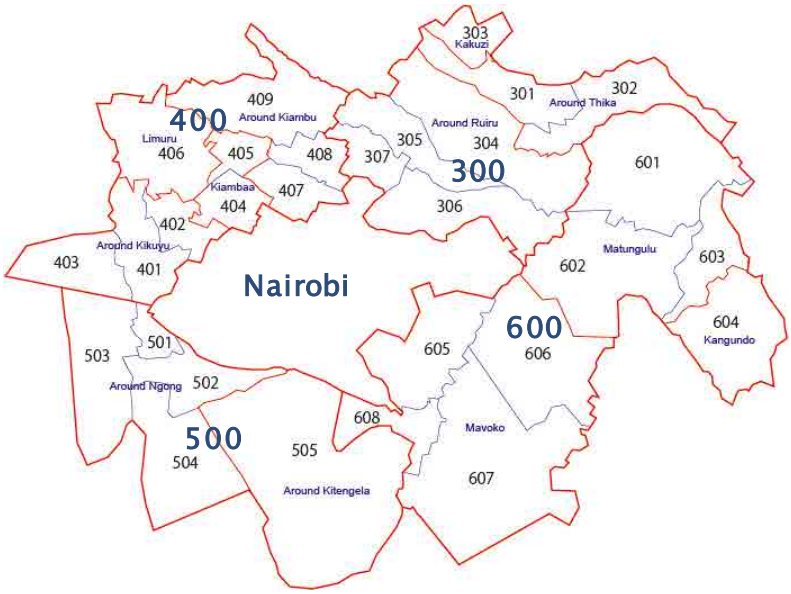
A4.6 External Zone Demand Forecasting

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.

$$Vc = Vo / [1+\alpha (Vol / C)^{\beta}]$$

Where, Vc: Congested Speed
Vo: Free-Flow Speed
Vol: Traffic Volume (PCU)
C: Ideal Traffic Capacity (PCU)
α =0.48, β =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.

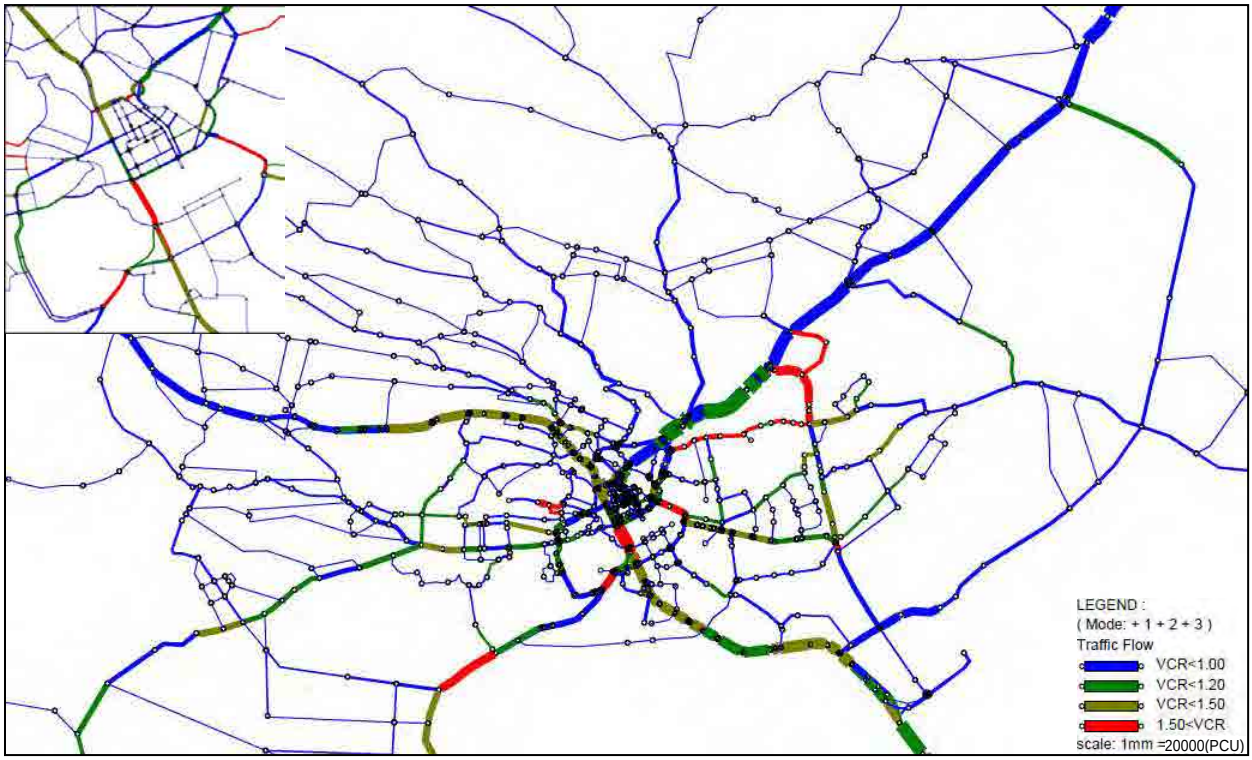
The evaluation result of each index under the "Existing Case" in 2013 and the "Do-Nothing Case" in 2030 is summarised in Table A4.7.1. Moreover, the "Existing Case" is shown in Figure A4.7.1, and the "Do-Nothing Case" in 2030 is shown in Figure A4.7.2. The "Existing Case" in 2013 is shown again in Figure 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

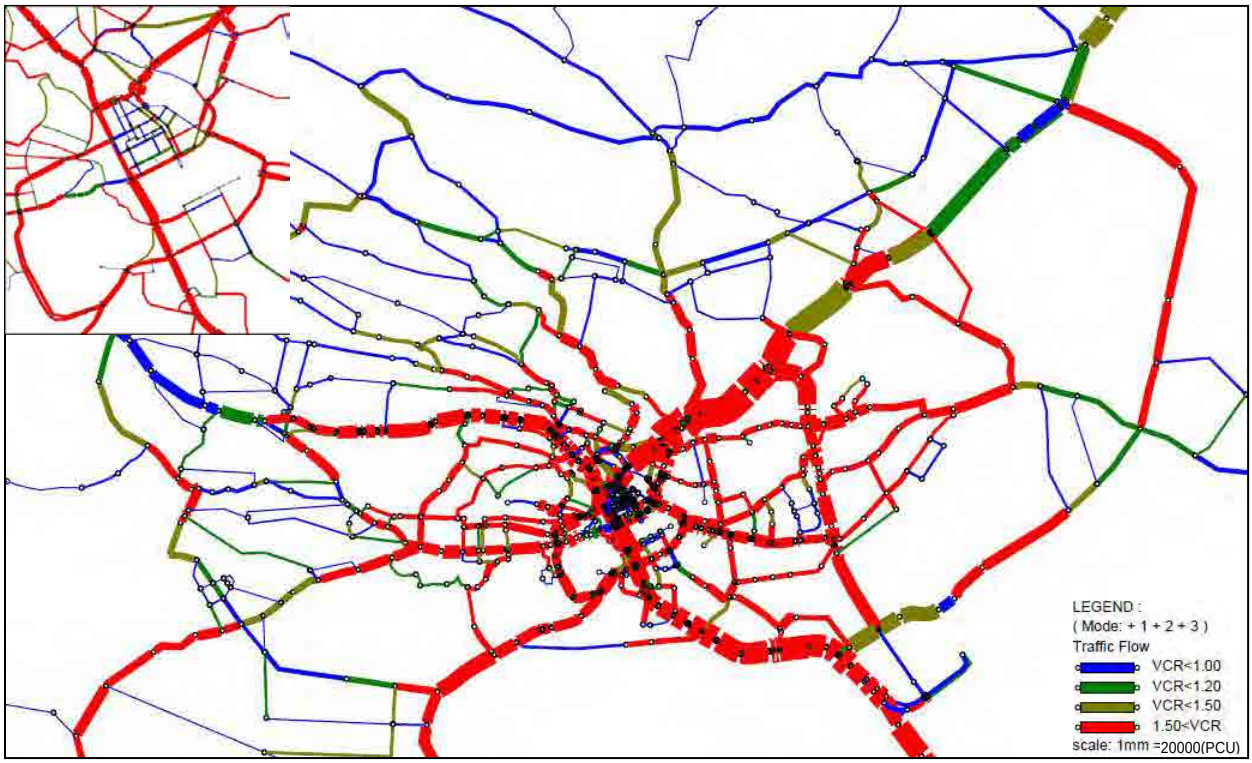
Source: JICA Study Team (JST)

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} car = exp (U_car) / (exp (U_car) + exp (U_public))

P_{ij} public = 1.0 - P_{ij} car

U_car = a*Car_owner + b*T_{ij}_car

U_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)

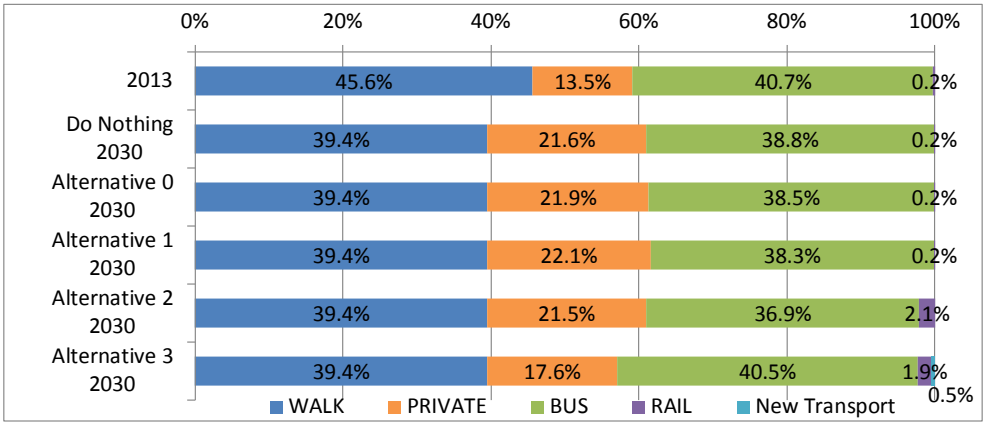
A4.8.3 Forecast Result of Alternative Plan

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%

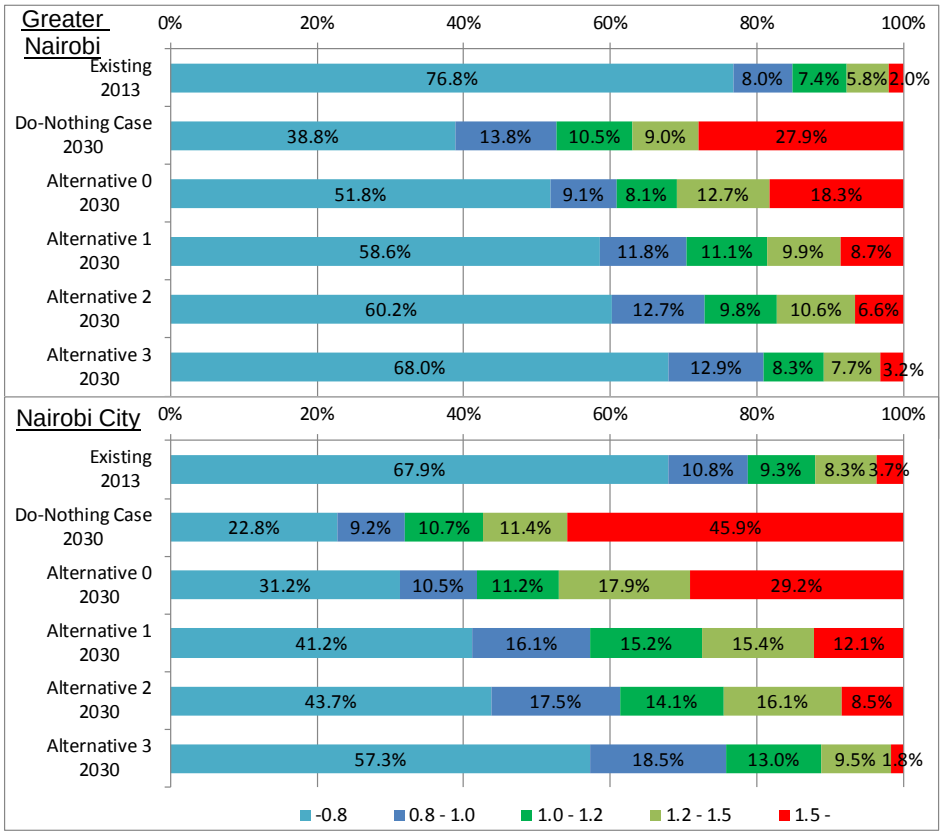
Source: JICA Study Team (JST)



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

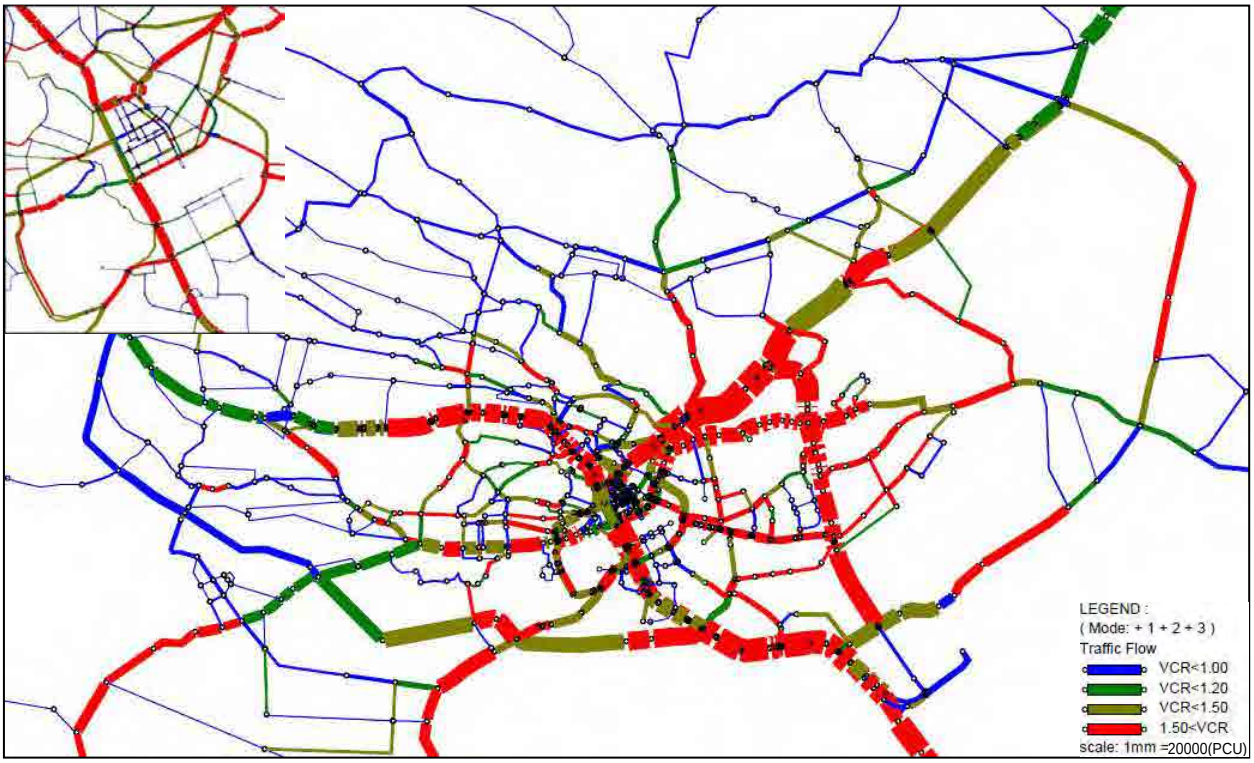
Alternative	Description
Do Nothing Case	Heavy congestion in almost all roads in Nairobi City.
Alternative 0	Congestion in many roads; there will still be congestion.
Alternative 1	Congestion in some trunk roads.
Alternative 2	Congestion in some major sections; the commuter rail overlap area will decrease.
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

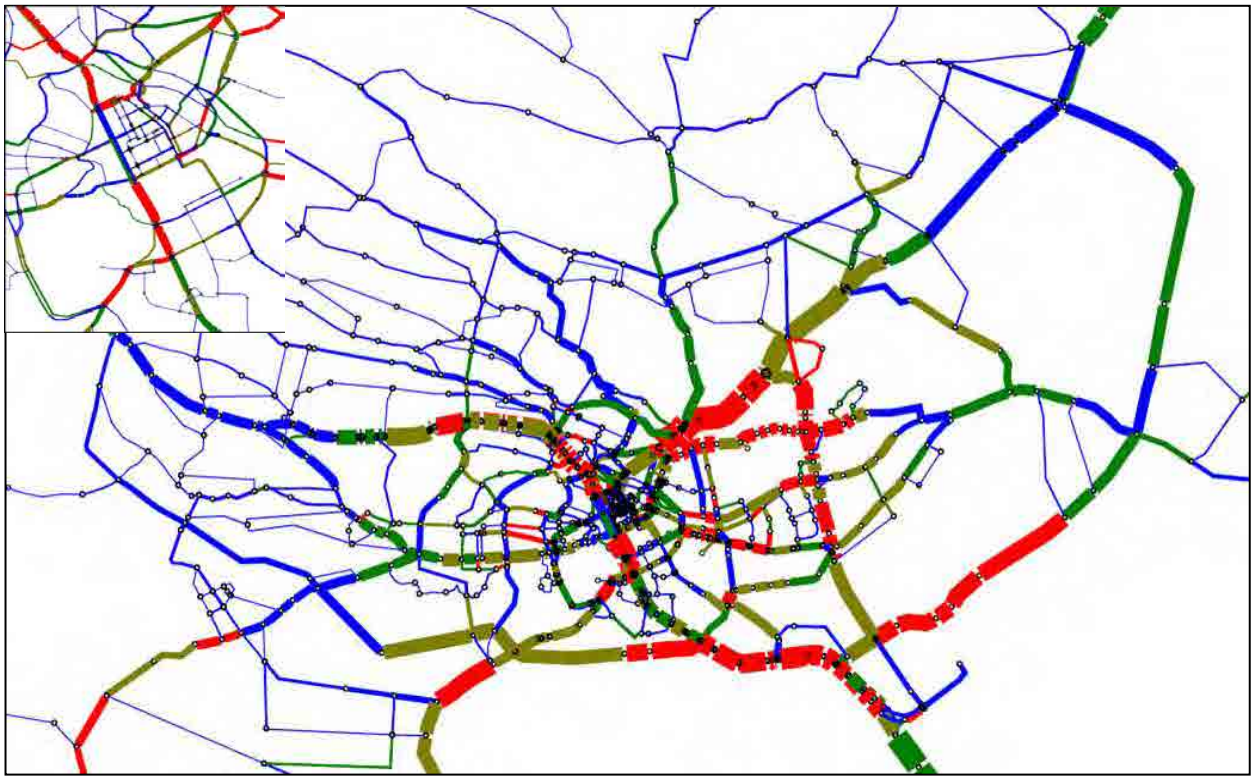
Case				Existing	Do-Nothing Case	Alternative			
						0	1	2	3
Year				2013	2030	2030	2030	2030	2030
Modal Split of Person Trips			Walk	45.6%	39.4%	39.4%	39.4%	39.4%	39.4%
			Car	13.5%	21.6%	21.9%	22.1%	21.5%	17.6%
			Bus	40.7%	38.8%	38.5%	38.3%	36.9%	40.5%
			New transport	-	-	-	-	-	0.5%
			Railway	0.2%	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)



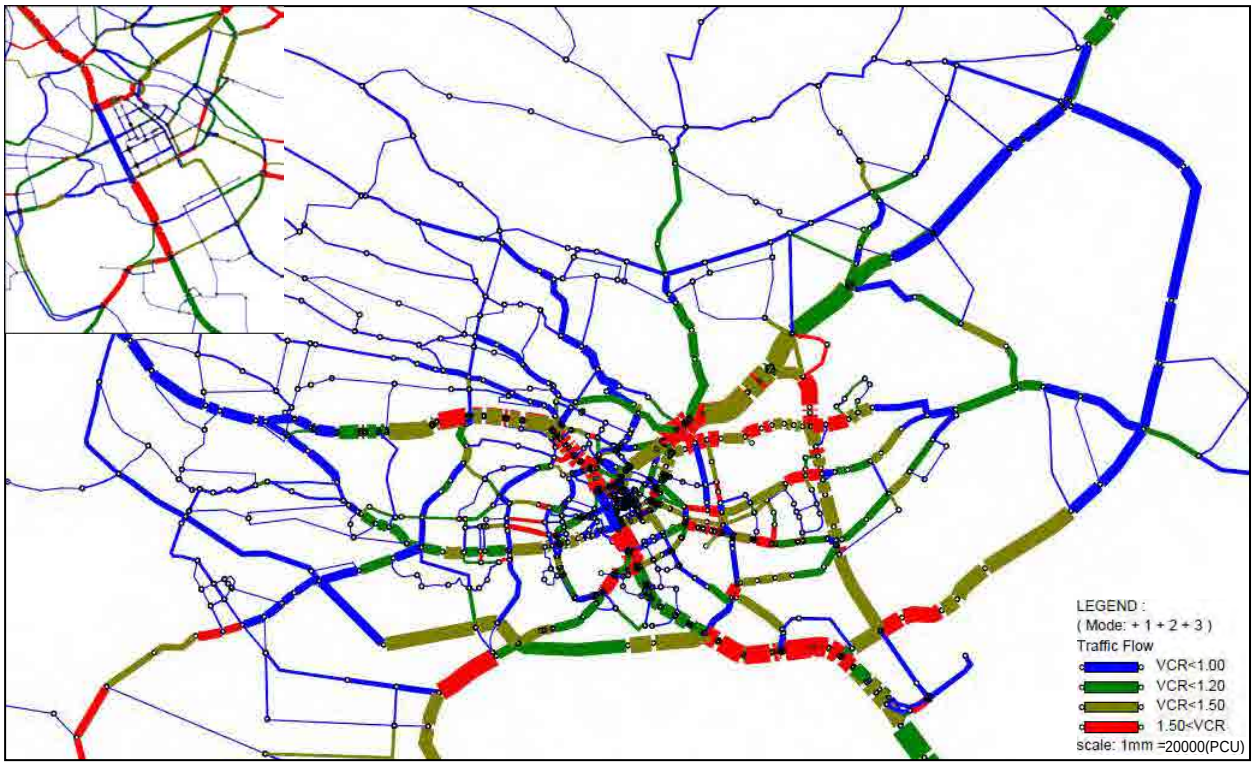
Source: JICA Study Team (JST)

Figure A4.8.3: Vehicle Assignment Result of "Alternative 0" in 2030



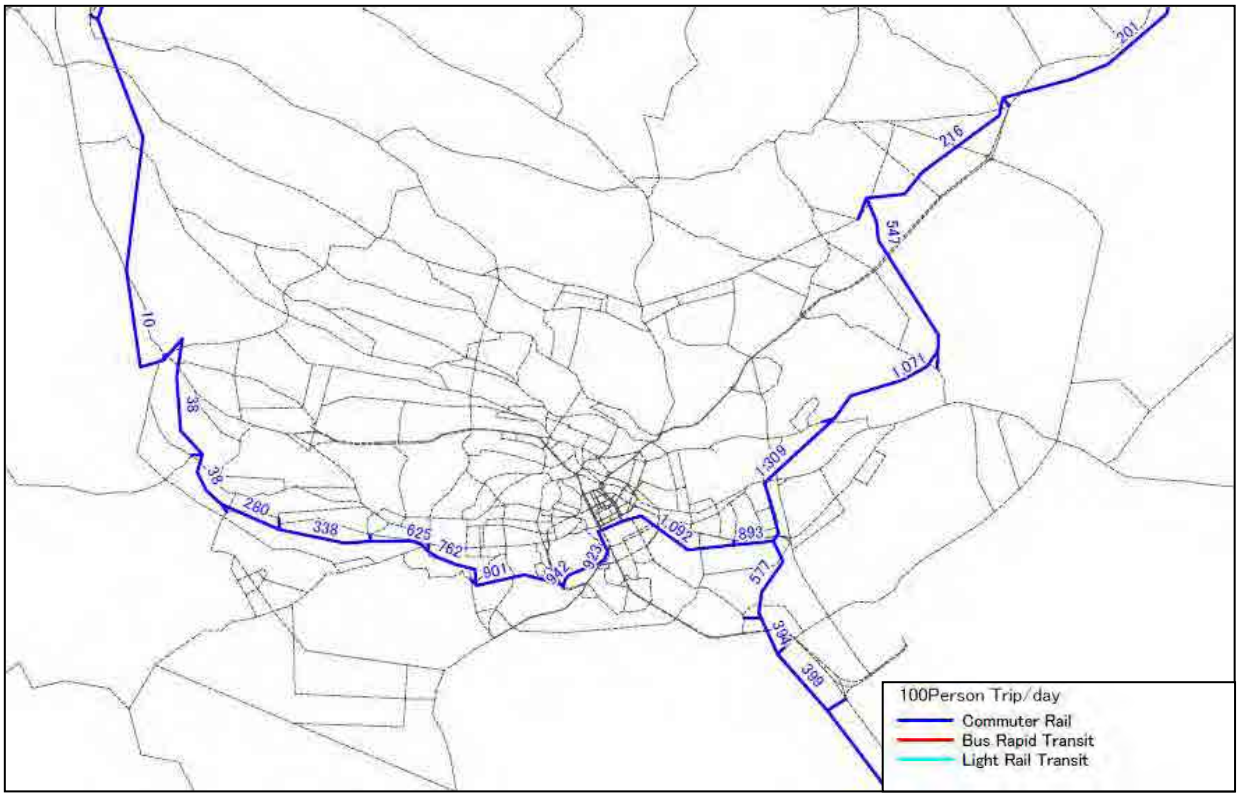
Source: JICA Study Team (JST)

Figure A4.8.4: Vehicle Assignment Result of "Alternative 1" in 2030



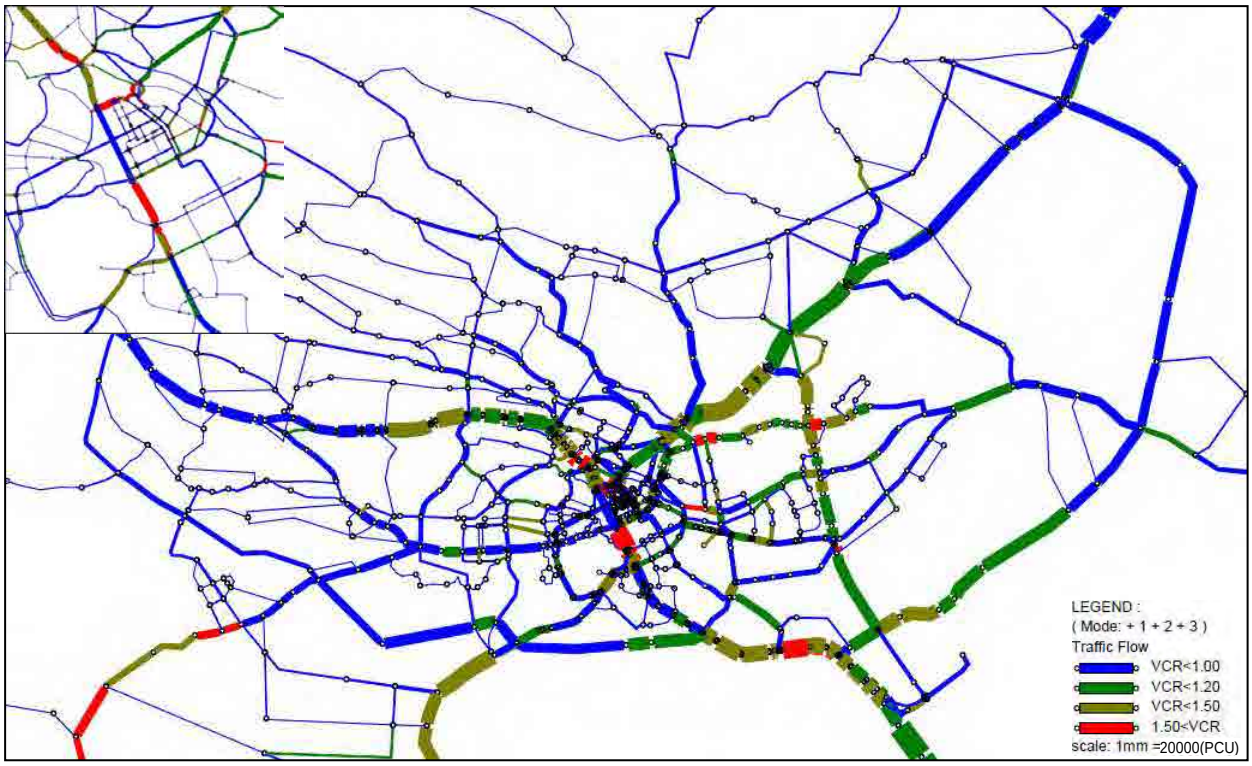
Source: JICA Study Team (JST)

Figure A4.8.5: Vehicle Assignment Result of "Alternative 2" in 2030



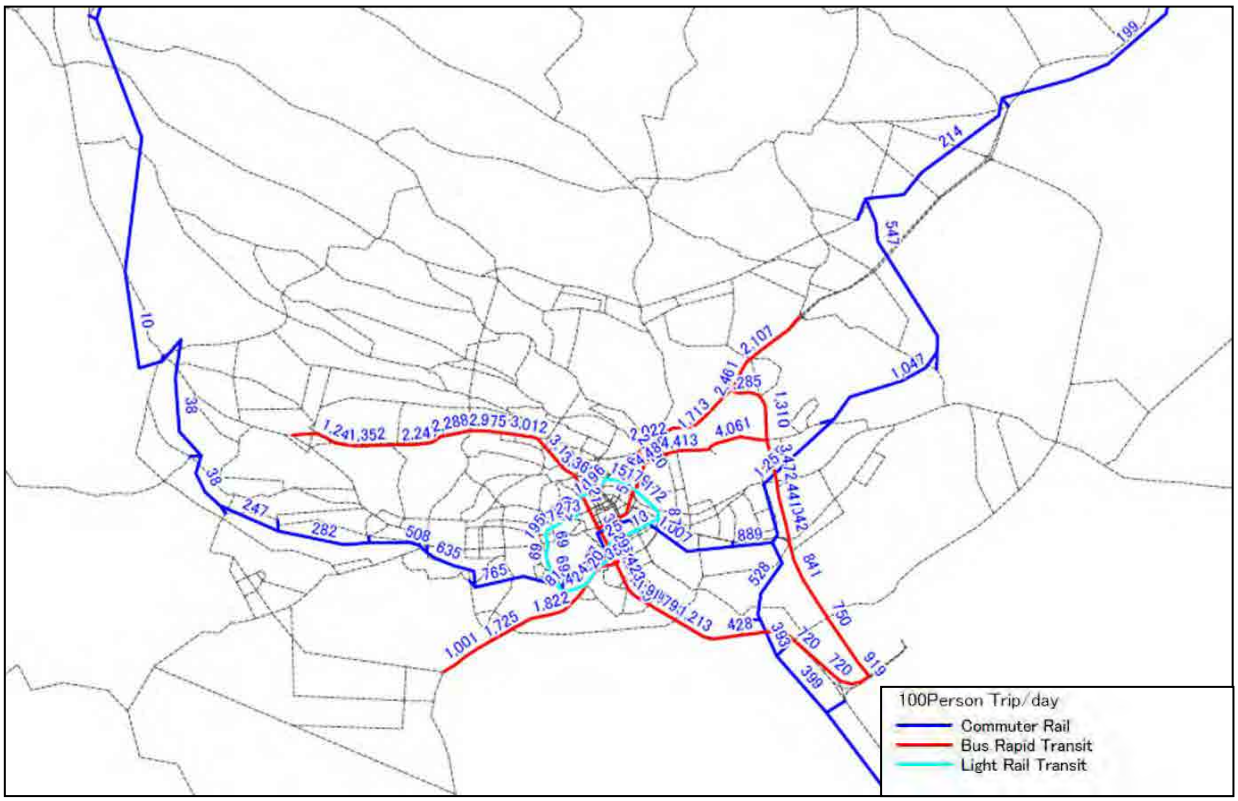
Source: JICA Study Team (JST)

Figure A4.8.6: Public Transport Assignment Result of "Alternative 2" in 2030



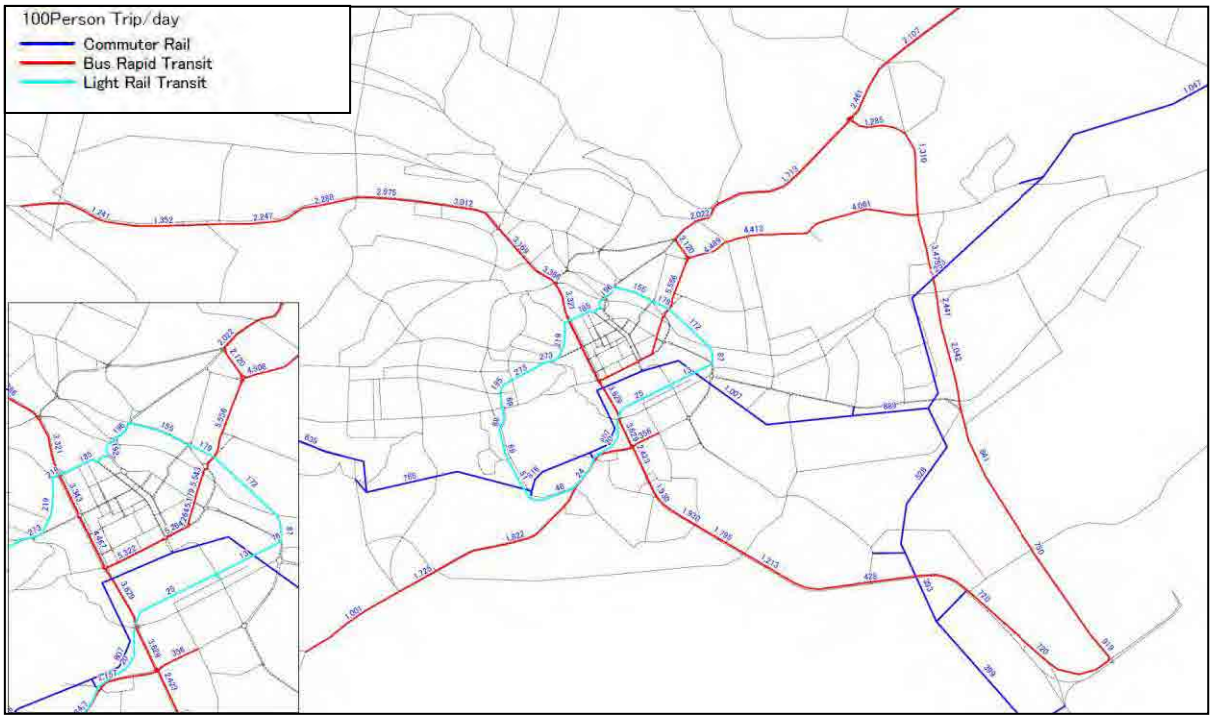
Source: JICA Study Team (JST)

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.

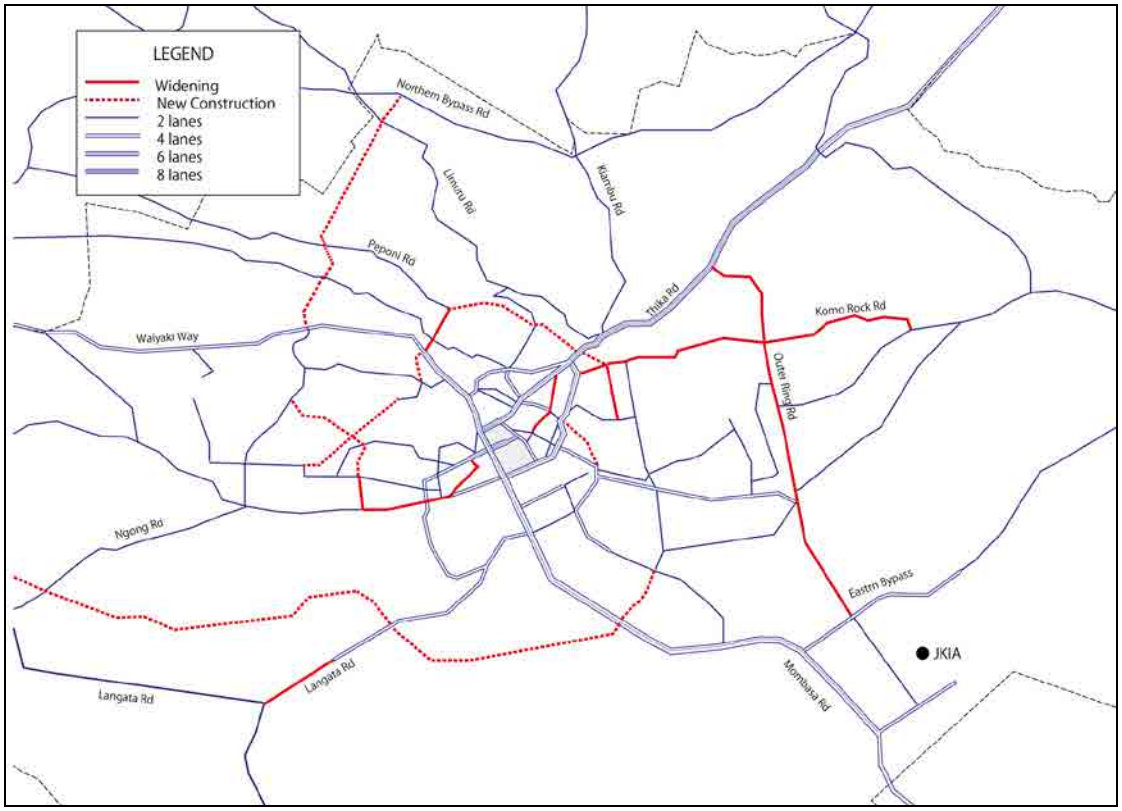
A4.9 Evaluation for the Short Term and the Medium Term

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.

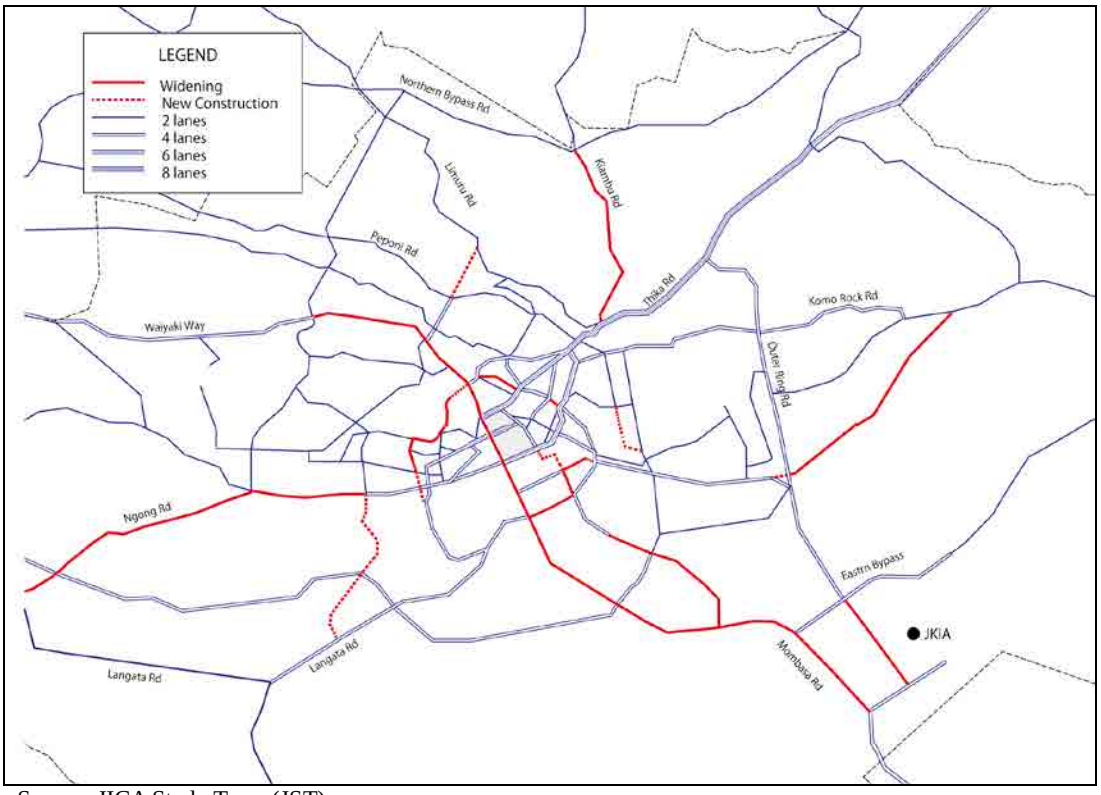
A4.9.2 Staging Plan of Alternative 3

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.



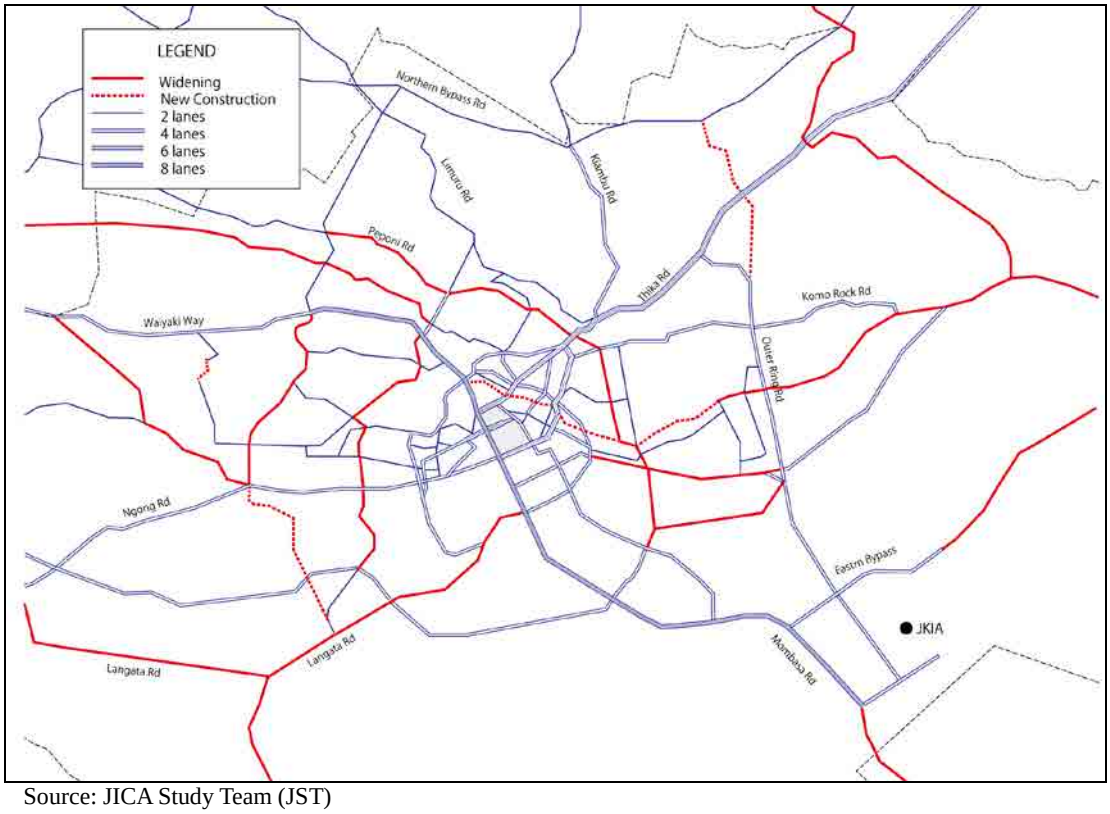
Source: JICA Study Team (JST)

Figure A4.9.1: Road Network Staging Plan in 2018



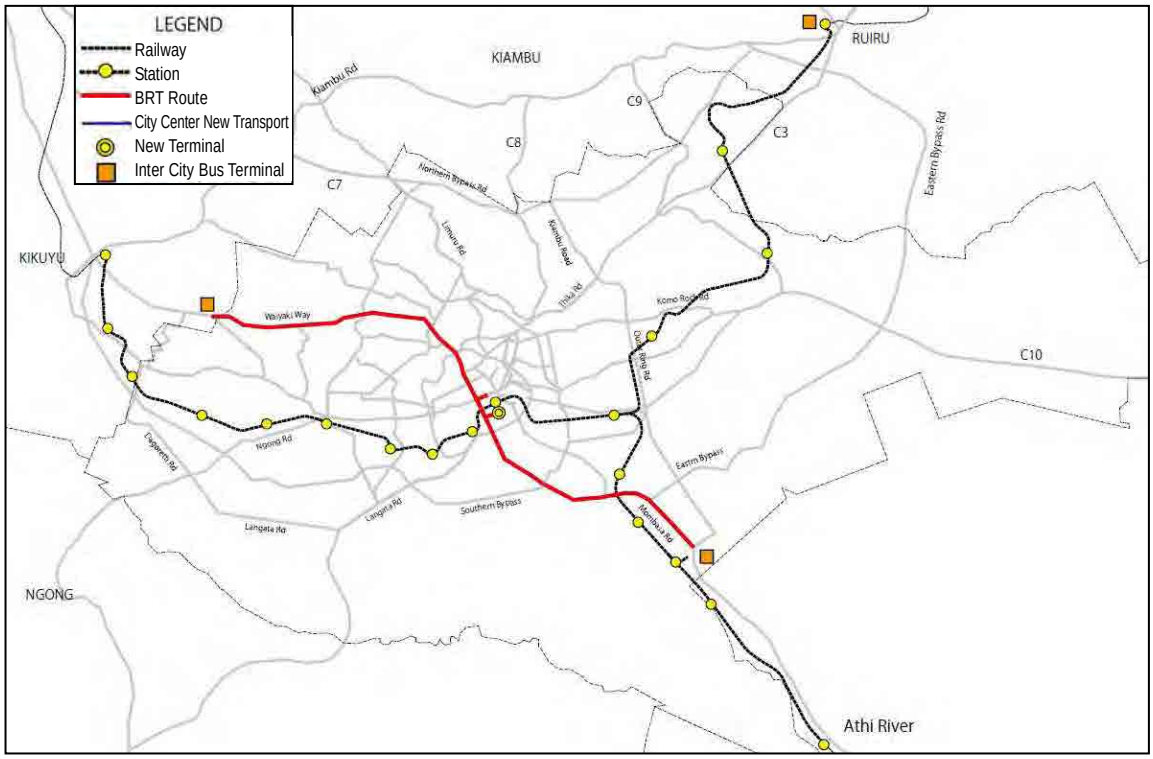
Source: JICA Study Team (JST)

Figure A4.9.2: Road Network Staging Plan in 2023



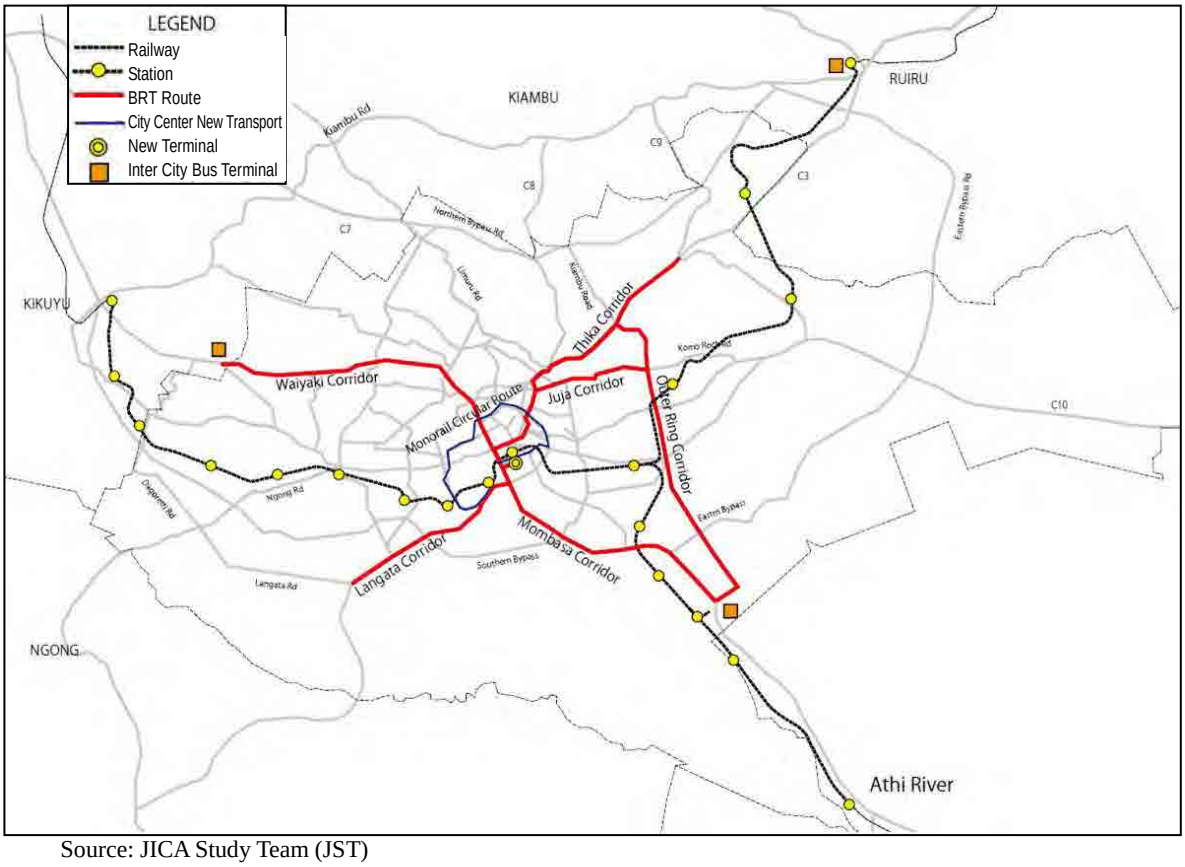
Source: JICA Study Team (JST)

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

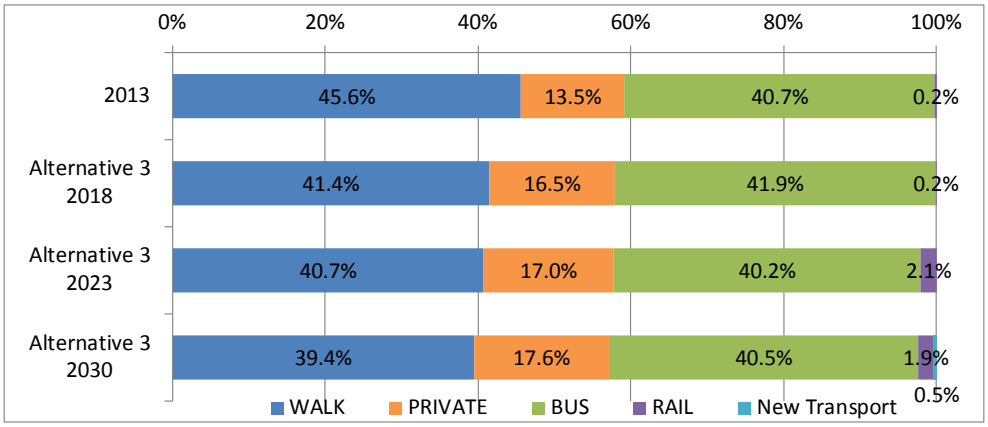
A4.9.3 Forecast Result of the Short Term and the Medium Term of Alternative 3

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	916,624	2,754,489	14,006	--	6,775,222
	45.6%	13.5%	40.7%	0.2%	--	100.0%
Alternative 3 2018	3,246,051	1,289,796	3,281,824	14,416	--	7,832,087
	41.4%	16.5%	41.9%	0.2%	--	100.0%
Alternative 3 2023	3,606,326	1,506,186	3,564,101	181,736	--	8,858,349
	40.7%	17.0%	40.2%	2.1%	--	100.0%
Alternative 3 2030	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%

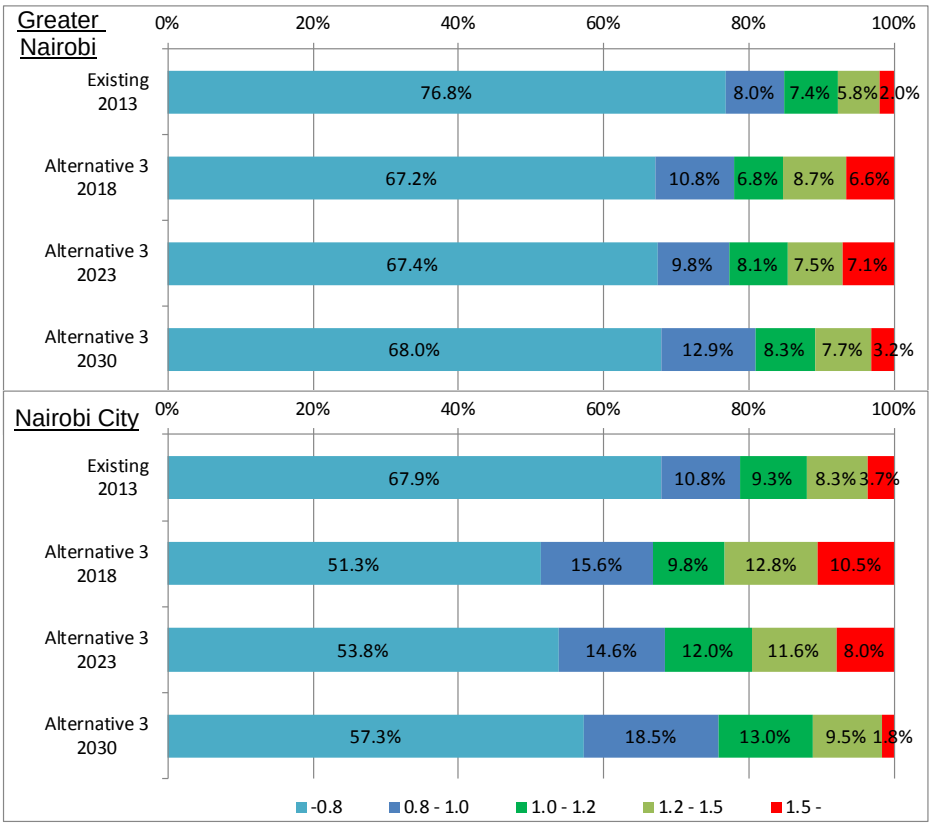
Source: JICA Study Team (JST)



Source: JICA Study Team (JST)

Figure A4.9.6: 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)

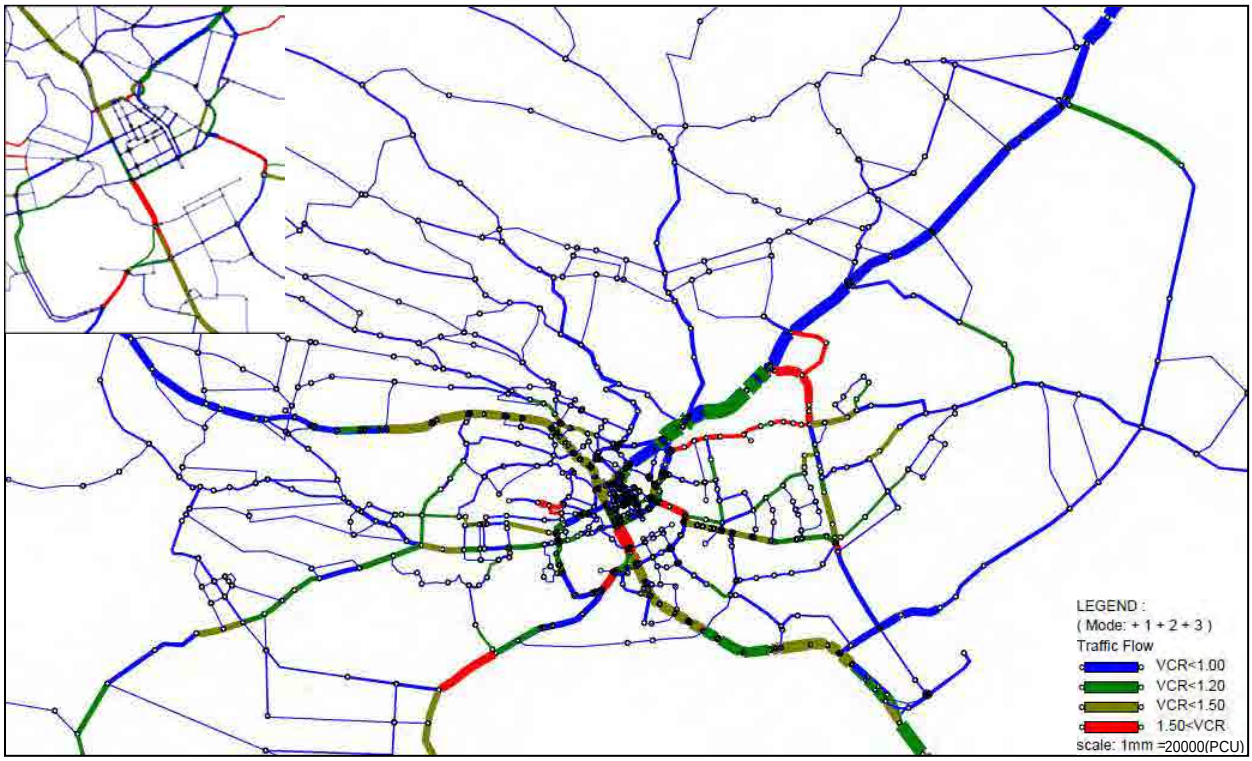
Figure A4.9.7: Congestion Ratio of Alternative 3 by Target Year

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

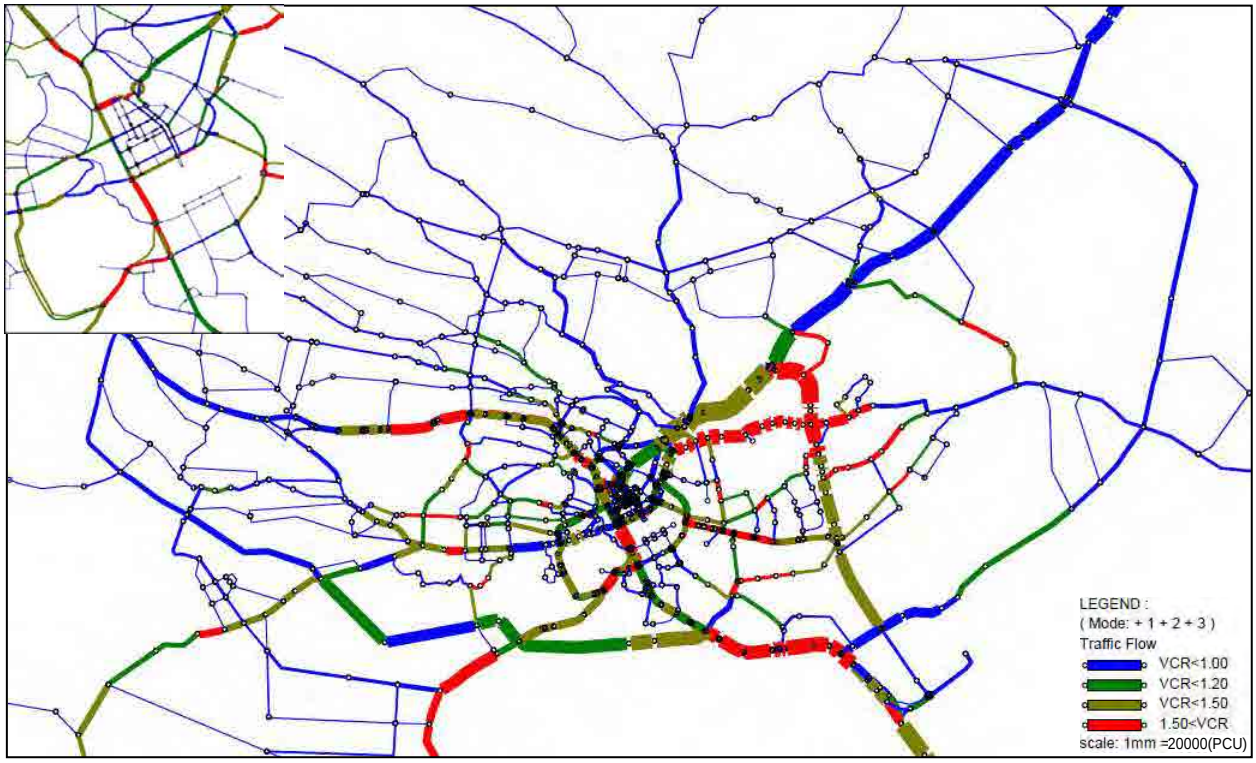
Case				Existing	Alternative 3		
Year				2013	2018	2023	2030
Modal Split of Person Trips			Walk	45.6%	41.4%	40.7%	39.4%
			Car	13.5%	16.5%	17.0%	17.6%
			Bus	40.7%	41.9%	40.2%	40.5%
			New transport	-	-	-	0.5%
			Railway	0.2%	0.2%	2.1%	1.9%
Greater Nairobi	Vehicle-km total (PCU-km)('000)			17,780	24,170	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)



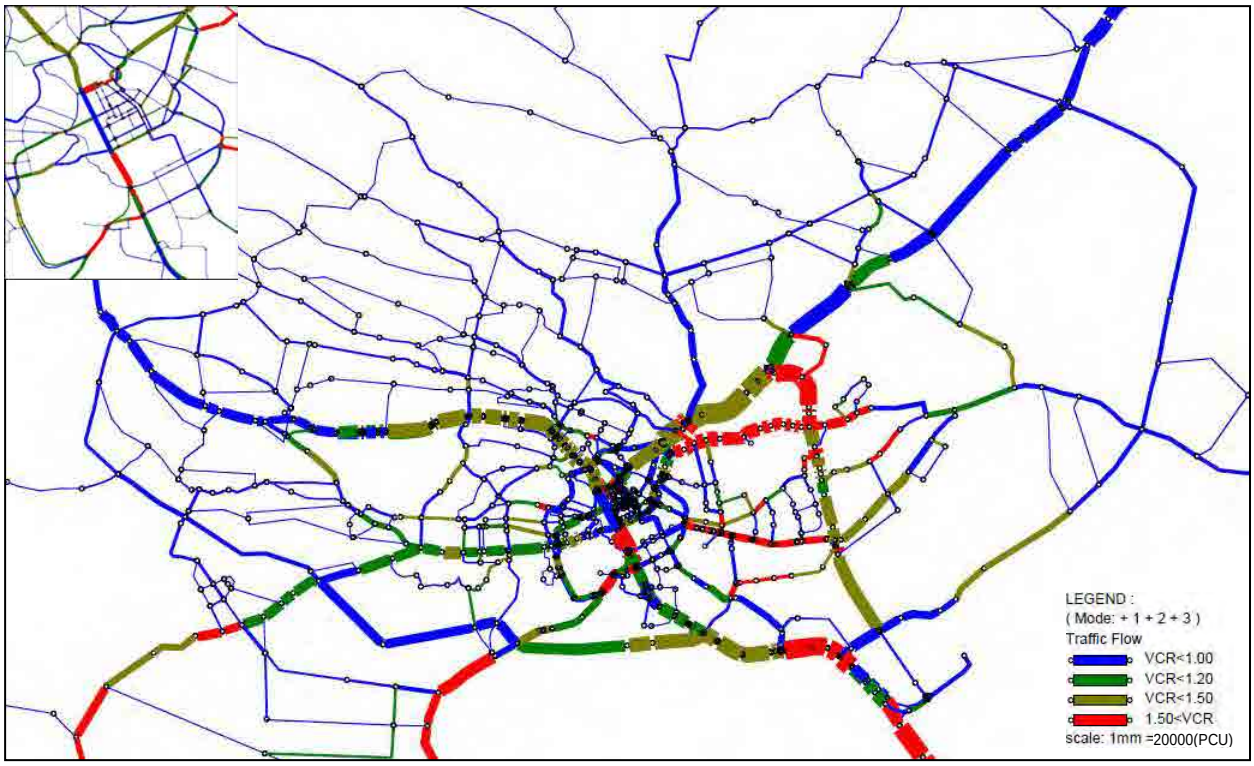
Source: JICA Study Team (JST)

Figure A4.9.8: Vehicle Assignment Result of "Existing Case" in 2013



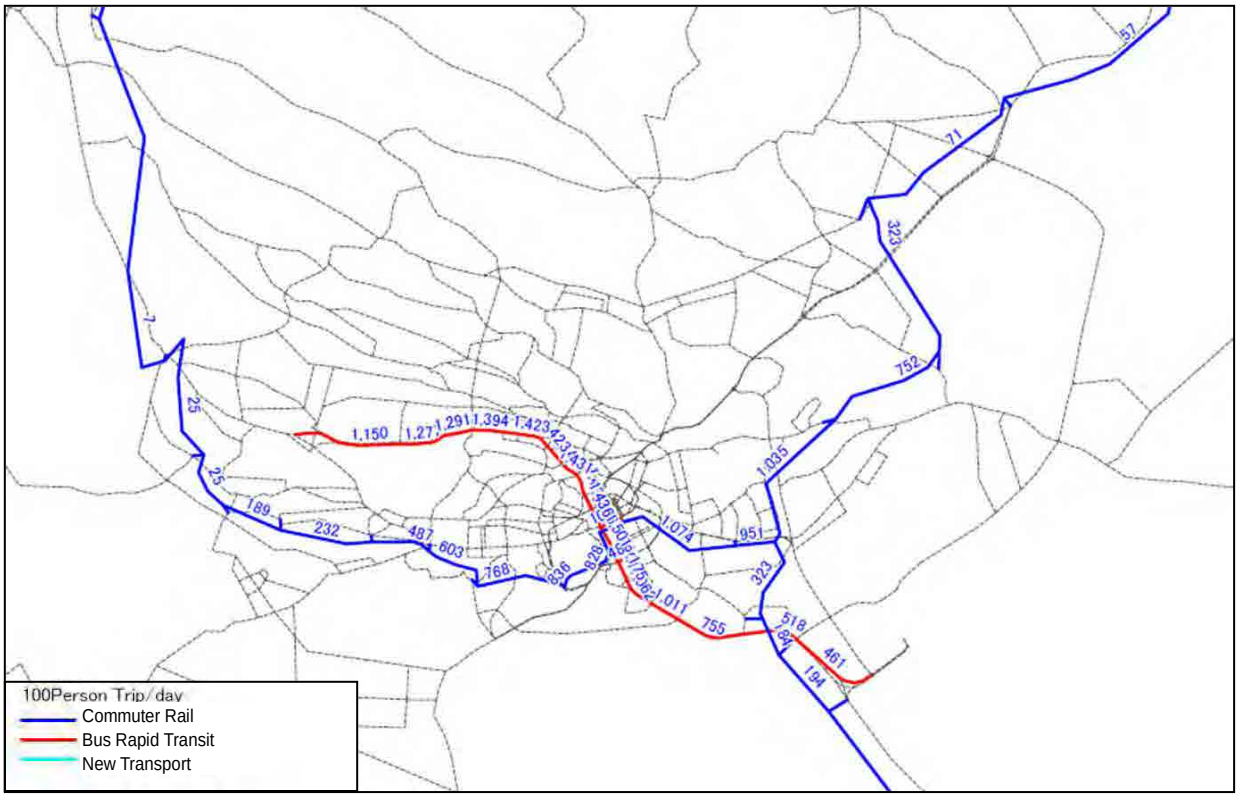
Source: JICA Study Team (JST)

Figure A4.9.9: Vehicle Assignment Result of "Alternative 3" in 2018



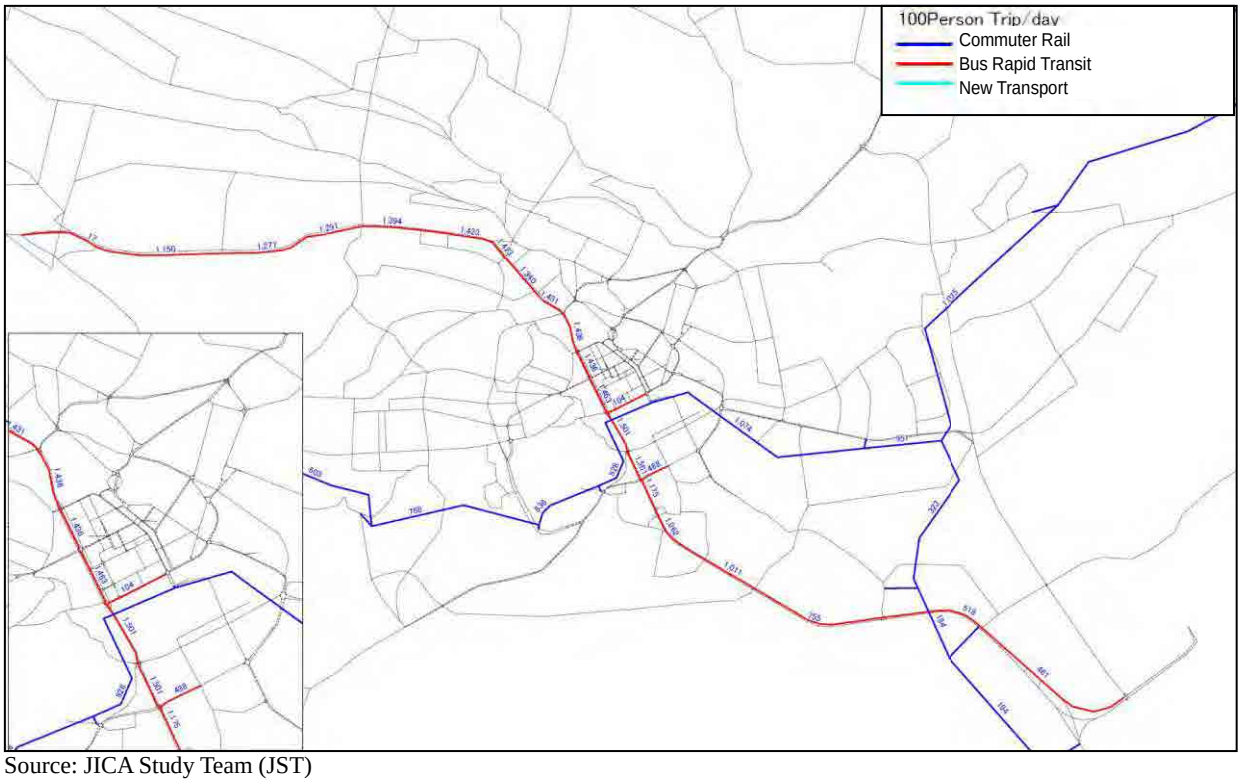
Source: JICA Study Team (JST)

Figure A4.9.10: Vehicle Assignment Result of "Alternative 3" in 2023



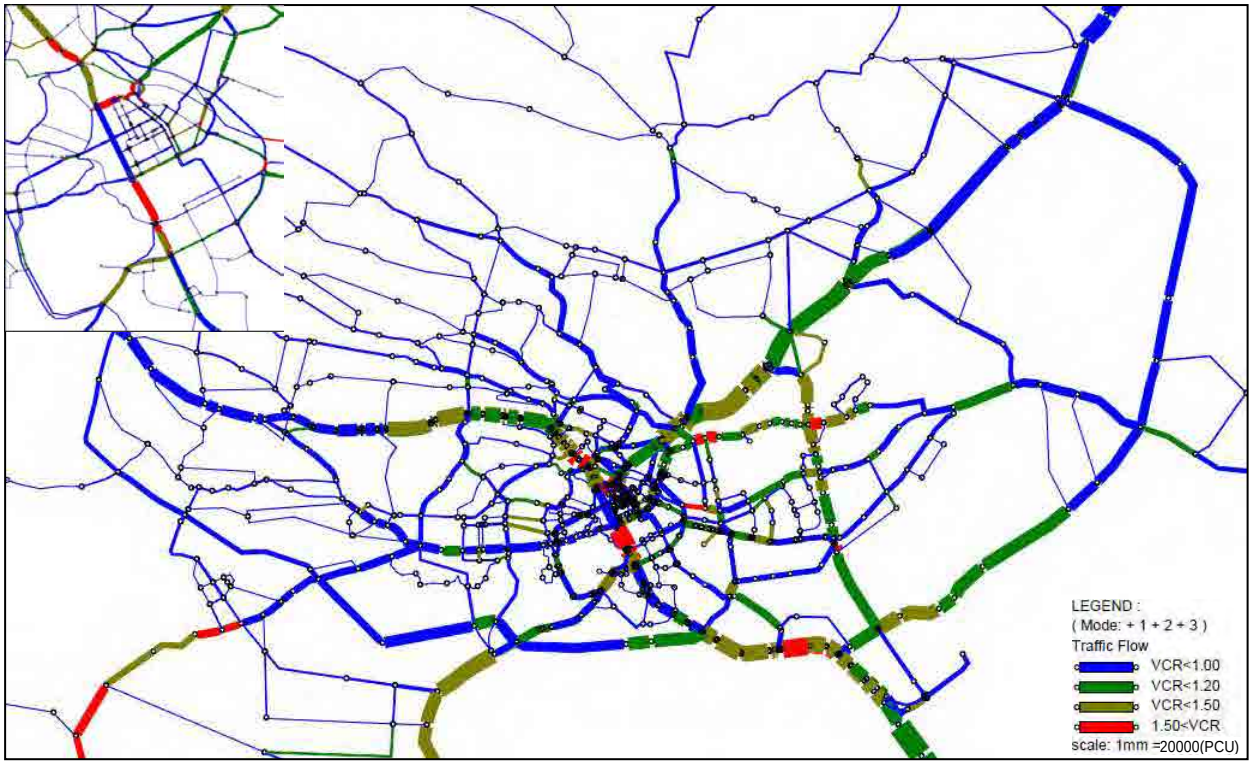
Source: JICA Study Team (JST)

Figure A4.9.11: Public Transport Assignment Result of "Alternative 3" in 2023



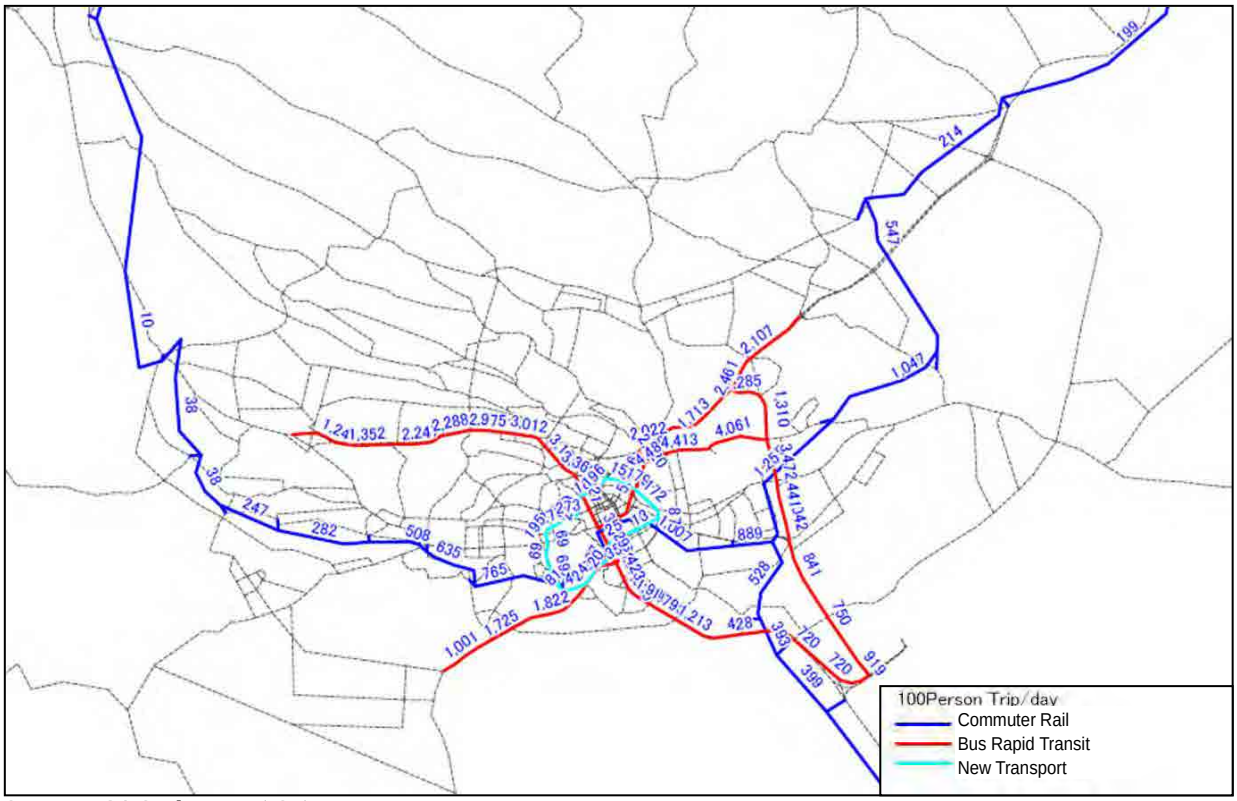
Source: JICA Study Team (JST)

Figure A4.9.12: Public Transport Assignment Result of "Alternative 3" in 2023 (Scaled up)



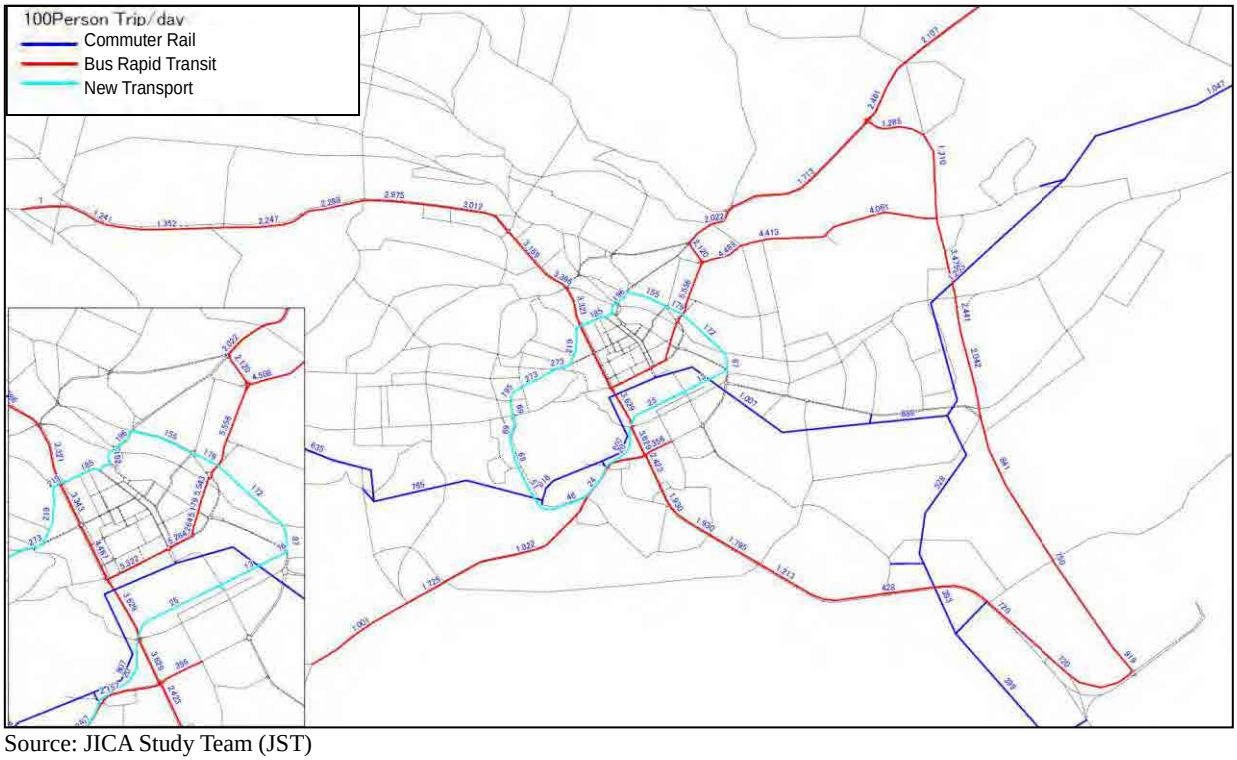
Source: JICA Study Team (JST)

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 Cinese 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 bu 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 Minimali 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 Cinese 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	

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)						

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
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 ・Poor access within the estate ・Management of public service transport ・Traffic congestion ・Non-motorised transport ・Road maintenance ・Road accidents Railway ・Insufficient stations ・Encroachment on reserved railway space ・Railway accidents	・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	・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	・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 ・Solid waste management ・Water supply ・Stormwater and sewerage ・Power and telecommunication	・Introduce waste conversion ・Establish common transport ducts ・Need to find alternative energy	・Poor maintenance ・Cartels ・Encroachment ・Vandalism	・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			
・Security and safety ・Corruption ・Lack of accountability and transparency	・Security provision set aside and can be used for police department or patrol base	・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	・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
・Institutions		・Poor coordination ・Bureaucracy ・Duplication of roles ・Incompetence ・Negligence ・Corruption and greed	・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			
・Increased population ・Increased crime ・Accelerated migration from countryside to city	・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	・Interference with current national planning ・Increase in crime/insecurity	・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	・Garbage collection centres ・Recycling plants ・Change of attitude; personal responsibility ・Civic education on importance of environmental preservation
Urban agriculture		No markets for produce	・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	・Regulate livestock keeping in residential areas ・Land use planning
Health issues		Disease outbreaks	・Enhance sanitation ・Increase and upgrade health facilities
Education		・Low education quality ・Alcohol, drugs, and substance abuse	・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	・Re-introduce organised transport system (e.g., KBS, railway, commuter trains) ・Decentralise offices from the city centre
Land and Human Settlement			
・Land tenure and land rates	・Processing of title deeds	・Squatters ・Absentee landlords ・Idle land ・Brokers/land cartels ・Inconsistency in developments leading to confusion ・No title deed ・Disorder ・Lacking coordination amongst different authorities	・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	・Lack of political goodwill ・Poor enforcement of existing legislation ・Different rates for same services, e.g., surveying	・Regularisation of illegal structures ・Sensitisation on regularisation process ・Encourage political goodwill ・Involve physical planners ・Involve local leaders
<u>Insufficient public social facilities/utilities</u>; ・There's only one public school, no health centres, access roads, markets, drainage, and sewer systems <u>Social issues</u> ・Drug and alcohol abuse ・Employment or lack thereof ・Lacking social amenities	Public utility space available; Marioka – Mwiki Provision for construction in terms of land for public facility available	・Land grabbing ・Encroachment resistance	・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
			・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	・Upgrade informal settlement ・Inclusion of slums in planning process ・Enforcement
Wetlands	・Afforestation ・Recreational parks	・Lack of awareness ・Resistance ・Encroachment ・Pollution	・Protection of wetlands ・Resettlement and compensation ・Establish tree nurseries ・Survey and registration of existing wetlands
・Land use and land use change ・Uncontrolled development ・Urban agriculture	・Existing legislation ・No provisions for some installation of resources		・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			
・Traffic management	・Synchronise traffic lights	・Clash between traffic police and existing traffic lights causing confusion ・Dysfunctional traffic lights	・Maintain and synchronise traffic lights ・Synchronise traffic lights and traffic police ・Improvement of road networks
・No provisions for non-motorised transport	・Pedestrian walkways ・Cyclists lanes	・Policy makers do not understand the plight of the normal citizens	・Urgent construction of bicycle lanes and foot paths
・Mass rapid transport within the city	・Intercity transport system		・Construction and expansion of railways and road systems
・Stormwater drainage: non-existent drainage systems for stormwater leading to increased surface runoff and flooding in some areas	・Water harvesting ・Water harnessing for non-consumptive use	・Public awareness on water harvesting and management ・Need for attitude change	・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
・Sewerage systems: lack of data for proper planning ・Poor design of developments	・Modern sewerage management systems (shall learn lessons from other countries)	・Poor enforcement ・Poor planning ・Corruption; approvals/licenses for plans without sewerage provisions	・Upgrade existing sewerage systems ・Sewer pipeline network expansions ・Expand coverage of existing sewerage systems ・Localise sewer treatment units
・Solid waste management: haphazard waste disposal ・Unplanned dumping sites ・Public health issues	・Modern solid waste treatment practices (shall learn lessons from other countries, e.g., sanitary landfills)		・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
・Telecommunication: service provision and tariffs		・All service providers put up their own infrastructure ・Poor connectivity	・Use of common duct ・Sharing infrastructure ・Use modern technology
・Energy: insufficient power ・Regular power outages	・Renewable energy	・Power supply monopoly	・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	・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	・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	・Reduce number of taxis in CBD ・Have alternative modes of transport e.g., light rail transport ・Additional lanes for cyclist and motorcycle riders
Population	・Available opportunities in the neighboring counties ・Availability of human capital	Rural-urban migration	Networking with the neighbouring counties
Land and Human Settlement			
<u>Land Use</u> ・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	・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	・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	・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		・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		・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			
Urban Transport; Roads: ・Safety ・ Uncontrolled developments bus/matatu terminal	・ Road expansion ongoing on some roads ・Road maintenance ・Roads are in place ・ Refurbishment of roads	・ 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	・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
Urban Transport: Railway		・Lacking signages along railway crossings ・ Uncontrolled timing system causing delays for regional transports	・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
Urban Infrastructure: Energy		・Lights on flyovers not functional thus leading to insecurity ・Theft	・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
Urban Infrastructure: Drainage systems		・Uncovered manholes ・ Blocked drainage systems	・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
Urban Infrastructure: Telecommunication		・Overhead cabling ・Dilapidated surfaces as companies dig to install cables	・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
Urban Infrastructure: Solid Waste Management		・No collection points ・Haphazard dumping of solid waste ・Insufficient delivery vehicles	・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
			・Involve the use in waste management ・Awareness and communication on solid waste management
Urban Infrastructure: Stormwater Management		・ Flooding and destruction of roads ・ Blockage of sewer and drainage systems ・ Pollution of river waters	・ 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			
・ Leadership and legislation ・ Lack of implementation ・ County and national government ・ Existing laws and legislation ・ Communication channels ・ Corruption and tribalism in governance		・ 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	・ 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
・ Service delivery		・ Inefficient service provision; long processes, poor communication lines between county and national governments	・ 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		・ Illegal structures ・ Lack of coordination between NCC and public administration	Encourage Nyumba Kumi initiative
・ Social issues ・ Family values ・ Unemployment leading to insecurity			・ Parents to be role models to their children ・ Public sensitisation: barazas, media, etc. ・ Community policing
Urban Economy, Social Service, and Environment			
・ Housing; ・ Population increase ・ Old housing units ・ Ownership of housing units	・ Availability of land ・ Political goodwill	・ Inadequate funding ・ Inadequate housing ・ Insecurity	・ 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

Issues	Opportunities	Challenges	Possible Options/Proposals
Education	Political goodwill	・ Improper land use planning ・Lack of public primary schools in some wards	・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	・Lack of awareness on health-related problems ・ Drug and substance abuse ・Easy access to illegal brews ・ Increasing teenage pregnancies	・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	・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)	・Available space ・Political goodwill of NCC	・Resistance of market owners in the local area ・Political interests ・Corruption of NCC	・ 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			
・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	・City county by-laws ・Local administration	・Corruption within local administration ・Role of chief in land issues not clear ・Increasing populations ・Failure in enforcement of relevant by-laws ・Land grabbing	・NCC to enforce by-laws ・ Have performance contracts for all NCC grassroot 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		・Lack of cooperation between county planning department and local leaders in development planning	・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
・ Social facilities and structures ・Health centres ・Emergency response ・Schools ・Resident association		・ 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	・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	・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)		・No proper engineering of current roads ・Developments on road reserves ・ No bumps on roads leading to increasing accidents ・Roadside hawkers	・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)		・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	・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		・ Dilapidated water supply pipeline ・ Sabotage of water supply systems	・Computerise water supply system ・Conservation of water resources ・Public sensitisation on water resources management
Energy	Alternative energy	・Tapping of electricity ・Power outages ・High tariffs	・Find options for alternative energy ・Underground cabling
Waste management		・No collection points ・Haphazard dumping ・ No disposal sites in Kamukunji	・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		・Establish a fully equipped resource centre ・Provide reliable internet connection to everyone
Governance, Legislation, and Institutional Frameworks			
Leadership		・Leaders not available ・Mandates of leaders not clear ・ Lack of offices for leaders	・Establish local offices for leaders for accessibility ・Public awareness on job descriptions for leaders

Issues	Opportunities	Challenges	Possible Options/Proposals
Policy regulations		・ Lack of citizen engagement framework ・ Limited access to information	・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			・Public participation ・Develop and adopt citizen engagement framework
Capacity building			・ Capacity building and training of officers within their work environment ・ Training on their mandates and responsibilities
Accountability		・Corruption ・Inaccessible leaders	・Administrators on the ground ・Friendly administrators
Urban Economy, Social Service, and Environment			
Population ・Population increase ・Rural–urban migration	・ Cheap labor in light industries ・Market/consumers for products and business	・ Increased informal settlements ・Poverty ・ Pressure on existing facilities ・Food insecurity ・Traffic congestion ・Insecurity ・ Inadequate resources allocation (e.g., schools and health facilities)	・Family planning ・ Provide affordable housing for increasing population
Urban economy ・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		・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	・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			
・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			・ 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		・Poor planning ・Mindset on non-motorised transport	・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 ・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)			・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)			・Build and maintain stormwater drainage system ・Implement policies ・Consider water harvesting
Sewer (lack of sewer pipelines, inadequate sewer line capacity)			・Build more sewer pipelines ・Expand existing sewer line ・Proper management of the sewer pipelines
Energy (poor infrastructure and inadequate power supply)			・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	・Lack of involvement ・Improve perceptions	・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 ・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	・Existing policies ・Nyumba Kumi		・Maintenance of existing infrastructure ・Increase security instruments (e.g., flood lights) ・Sharing information between national and county governments
Communication		No clear channels	・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			・Engage public in decision-making processes ・Social audits ・Provide information to public

Issues	Opportunities	Challenges	Possible Options/Proposals
Social values, drug and substance abuse, prostitution, etc.			・County government to partner with NACADA ・Establish rehabilitation, trading as well as training centres
Corruption			・Establish transparency and accountability mechanisms ・Reshuffle county government officials
Planning and policy formulation (poor housing, poor transport system, and uncoordinated development structures)			・Identify, repossess, and reclaim public utilities ・Adequately use public utilities ・Need for policies ・Need to review outdated planning policies
Support small-scale traders			・Affordable rates to traders and other businesses ・Encourage cooperatives and societies
Urban Economy, Social Service, and Environment			
Insecurity		・Lack of capacity of security personnel ・Lack of security office employment	・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			・Vocational centres ・Rehabilitation centres ・Awareness creation on drugs and alcoholism
Open air market			・Need for more markets ・Repossession of grabbed public lands so as to develop public utilities like markets
High population			・Family planning initiatives for both men and women
Inequality			・Gender balancing ・Implement by-laws ・Change in culture
Water and sewerage systems (encroachment on sewer lines, water shortage, and unsafe water)			・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		・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 ・ 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 form neighbouring townships	・ 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	・ Funding for roads ・ Move from public to private transport ・ Dark streets	・ 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) ・ Erratic water supply ・ Poor stormwater drainage	・ Substitutes; rain water ・ Community sensitisation	・ 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	・ 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

Issues	Opportunities	Challenges	Possible Options/Proposals
Solid waste management and sewers	Willingness of agencies and the community to engage		・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	・Solar power supplementation ・Public awareness ・Policies on alternative energy
Telecommunication			Codify data cables installations
Governance, Legislation, and Institutional Frameworks			
・Communication and information sharing protocol ・Legal framework ・Implementation monitoring and evaluation		・Poor communication between NCC and the public ・Lack of dissemination of procedures ・Lack of coordination mechanism ・Corruption	・Establish proper communication channels ・Decentralise government functions ・Sensitise NCC officials ・Proper implementation frameworks
Transparency and accountability		・Incompetence ・Lack of point persons	・Sensitise NCC officials ・Sign charter between NCC and members of public; clear demonstration of NCC in implementation of by-laws, policies, etc.
Service delivery		・Poor standards of service delivery ・Preferential treatment for reasons of ethnicity or corruption	・Establish minimum standards for service delivery ・Encourage public-private partnerships
Planning and development		Weak enforcement and development control	・Clear planning policy on subdivision of lands for development ・Effective development controls
Public participation/ involvement			・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			・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			
Population ・Growing population ・Student population; temporary basis; universities, hostels, etc. ・Entertainment population serving people beyond the area (i.e., wedding grounds)		・No exact figures of demographic information ・Pressure on existing infrastructure	
Urban economy ・Small-scale agriculture ・Retail and commercial ・Tourism ・Education ・Cottage industry ・Residential services	・Tax contribution ・Rewards from investment ・Pros and cons of laws and frameworks to abide by ・Half acre per dwelling demand for Karen area accommodation	・Control of retail activities ・Noise and land pollution	・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			
・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	・Developments out of scale with neighbourhoods character ・Demand for support facilities and infrastructure for new developments ・Weak enforcement mechanisms	・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
・Sporadic rise of commercial nodes (Dagoretti Road) ・Growth of informal settlements	Plan for Karen approved in 2005	・Approval of illegal businesses establishments ・Current economic situation	・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		・Change by-laws to allow for small domestic farming activities ・Designate specific areas for urban agriculture: confine it towards Keraropon
Road widening	・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			
Urban transport (roads and railway) ・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	・Blocked bypass roads ・Tree nurseries on reserved road space ・Accidents along rail tracks ・Blocked public passages	・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

Issues	Opportunities	Challenges	Possible Options/Proposals
			Nanyuki for business purposes ・ Open up public road between Harambee and Pink Court ・Protect reserved road space from Tom Mboya hall to outer ring along Rabai Road
Urban infrastructure ・Water supply ・Wastewater management ・Solid waste management ・Security ・Telecommunication	Economic empowerment	・ Illegal cartel jeopardizing supply ・Dumping into drainage systems ・Dilapidated pipes and drainage systems ・ Plastic bags causing blockage of drainages ・Illegal construction on sewer lines	・ 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			
・Housing (new housing units, system for allocation, and relocation of displaced people) ・Rent amounts ・No action on research ・Garbage collection	・Youth opportunities ・ Budget for street children ・ Maintenance department	・ No clarity on ownership of houses and land around them ・Increase in rates and no services ・ Poor waste management	・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
・Health ・Security	Grabbing public spaces	・No doctors ・No health facilities	・Rehabilitate hospitals ・More doctors ・Repossession of grabbed land ・Form committees to deal with issues on security
Urban Economy, Social Service, and Environment			
・Population ・Housing ・Schools ・ Water and sewer networks: housing construction on water and sewer ways ・Poor waste management ・Increasing insecurity		・Lack of housing for increasing population ・ Less learning institutions for growing population ・ Overstretched health facilities ・Pressures on existing infrastructure: water and sewer lines ・Unemployment	・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		・ Lack of market for local goods ・Less working hours	・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			
・Illegal acquisition of land ・Inappropriate land use ・Illegal settlements ・Lacking social amenities ・Social issues: drugs and substance abuse, gender-based violence, etc.		・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	・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> ・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	・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> ・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	・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			・Trucks for waste collection ・Designated waste disposal sites Arrangements for waste management systems that work ・Proper, clean, healthy, and safe environment

Issues	Opportunities	Challenges	Possible Options/Proposals
Governance, Legislation, and Institutional Frameworks			
Corruption		・ Coalition of law enforcers with law offenders and administration/police ・ No certainty on security for whistleblowers (leading to increased insecurity)	・ 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)	・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	・Information sharing ・ Provide free information to residents	・ Not enough security personnel ・Police colluding with law breakers Nyumba Kumi initiative not well understood ・Long response period for emergencies	・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		・ 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		・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	・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	・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
			・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)

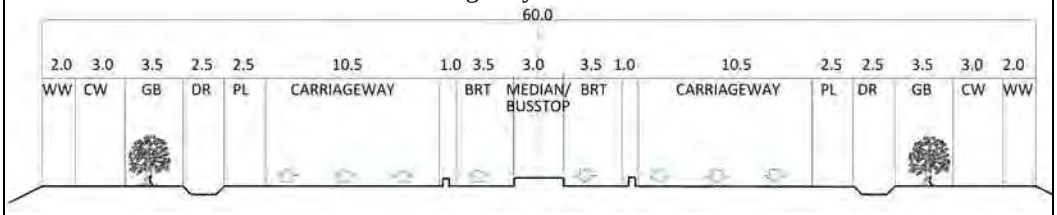
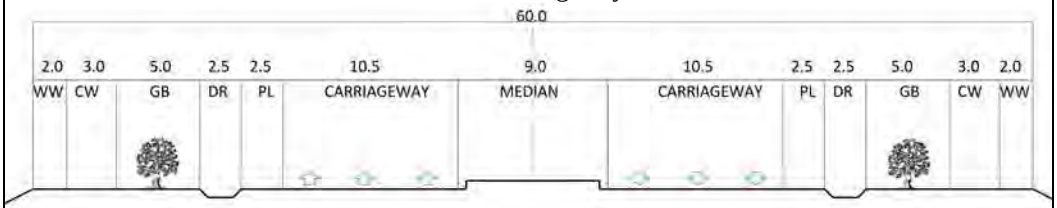
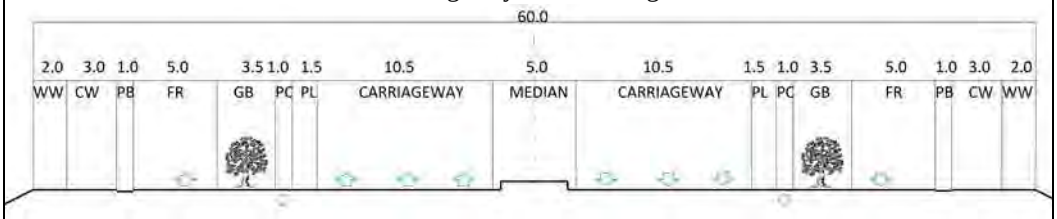
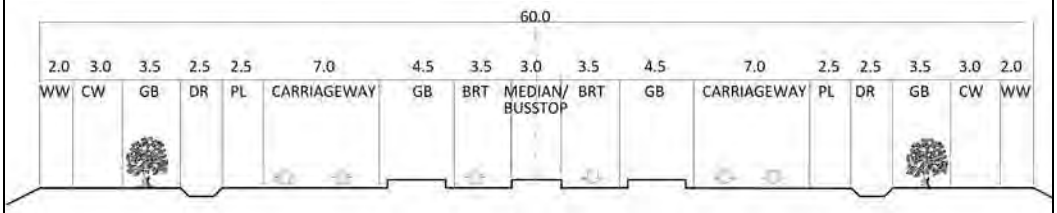
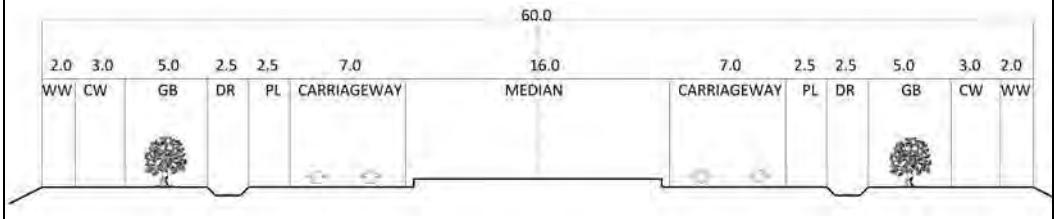
Issues	Opportunities	Challenges	Possible Options/Proposals
Urban Transport and Infrastructure			
Waste Management ・Lack of access roads for waste collection trucks ・Too much wastes all over			・Provide high-rise to reduce road encroachment Need big tanks for putting wastes to avoid over use of Dandora dumping site
Drainage and sewerage system			・Improve drainage and sewer ・Rainwater harvesting
Insecurity			・There is a need for 24 hours active economy; this will help reduce security ・Provide security lights
Lack of foot bridges		Increased accidents	・There is a need for clear road signs ・Build foot bridges
Social amenities like schools, health centres		Inadequate social amenities	・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			・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			・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			・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			・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	・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			・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

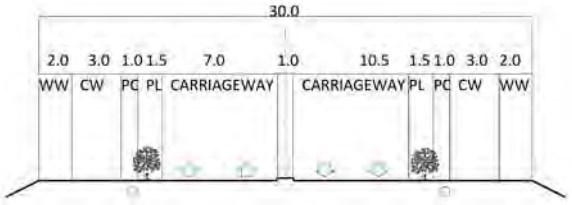
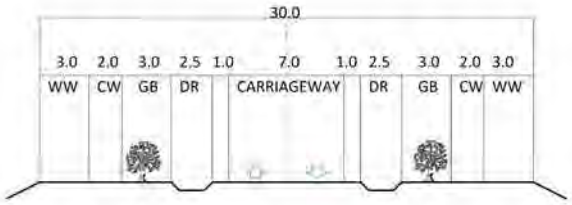
Issues	Opportunities	Challenges	Possible Options/Proposals
High population			・Nairobi to be developed vis-a-vis other counties; this will help control rural-urban migration ・Other neighbouring counties also need to protect their resources, for example, residents of Kiambu should stop uprooting their 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	・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		・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			・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	・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

Issues	Opportunities	Challenges	Possible Options/Proposals
		we improve these structures?	systems, and other social amenities
Urban sprawl – city growing outwards			・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	6-Lane Carriageway with BRT Lanes 
	6-Lane Carriageway 
	6-Lane Carriageway with Frontage Road 
Minor Arterial Road	4-Lane Carriageway with BRT Lanes 
	4-Lane Carriageway 

Classification	Cross Section
Minor Arterial Road	4-Lane Carriageway 
Collector Road	
Local Road