10.8   STATED PREFERENCE SURVEY (SPS)

10.8.1 Methodology

(1) Purpose

The SPS is a type of survey which seeks to clarify people's choice activity response when some conditions will change in the future. Therefore, the SPS is generally utilized to analyze individual choice activity changes, in case the conditions changes drastically in the future.

For example, if a new transport mode is to be introduced, it is generally difficult to analyze how many ridership would be shifted or attracted to the new transport mode. In this case, an opinion survey is conducted to obtain peoples tendency to use the new mode, by showing its level of service and fare level. Based on this kind of survey (SPS), modeling work can cope with the issue. This method is also utilized to estimate people's choice changes when a drastic change happens to, for example, transport fare, fuel cost, travel speed and so on.

In the Nairobi Metropolitan Area, population to the city center has been a serious problem. As many peoples live in suburbs, transportation modes between suburbs and city center has been one of the big topics for years. It is believed that the existing road network would not be able to satisfy the transport demand in the future.

Based on the above discussion, the Study Team conducted the SPS by interviewing a sample of the residents of Nairobi City. The objectives of the survey were identified as follows:

- To obtain peoples intention to use public transport modes if the service is improved drastically.
- To obtain peoples intention to shift to the public transport from private cars in response to various public transport oriented improvement measures, and,
- To obtain peoples opinion on present transportation

(2) Survey Method

A total of 2,000 persons out of 10,000 households on Person Trip Survey were interviewed. Private car users, public transport users and non motorized users were covered by the interview.

10.8.2 Major Findings

(1) Potential Modal Shift of Car Users

Figure 10.8-1 and Figure 10.8-2 illustrate the responses of car users, to question that "If parking fee is increased by the cases (50%, 100%, 150%, 200%, 300%), do you change traffic mode?" and "If fuel price is increased by the cases (20%, 40%, 60%, 80%, 100%), do you change traffic mode?"

Many respondents answered that they would change traffic mode depending on the increase of parking fee and fuel price. But other 30% of respondents answered that they would not change even though increased rate of parking fee is 300% or that of fuel price is 100%.
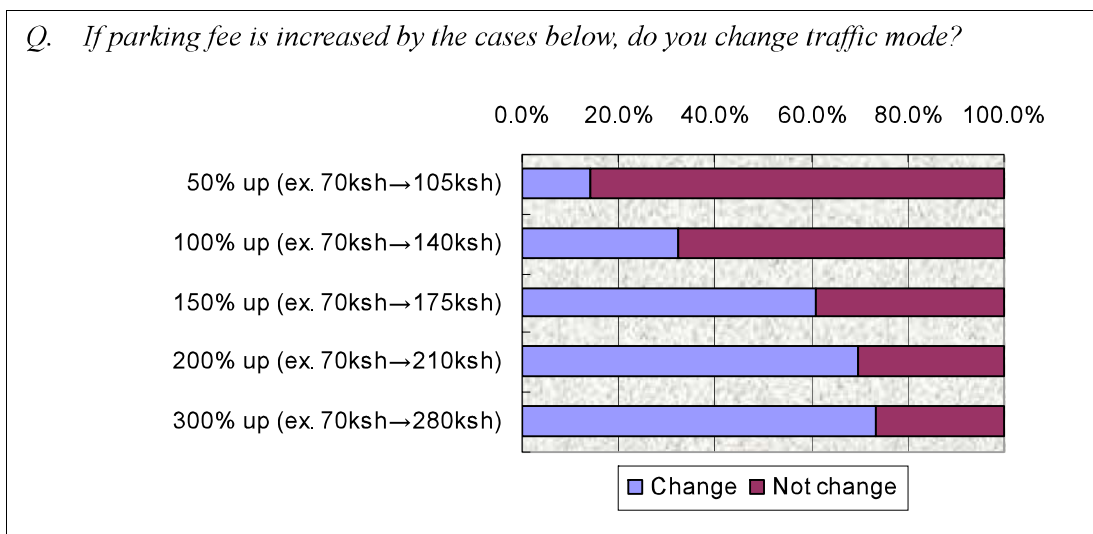

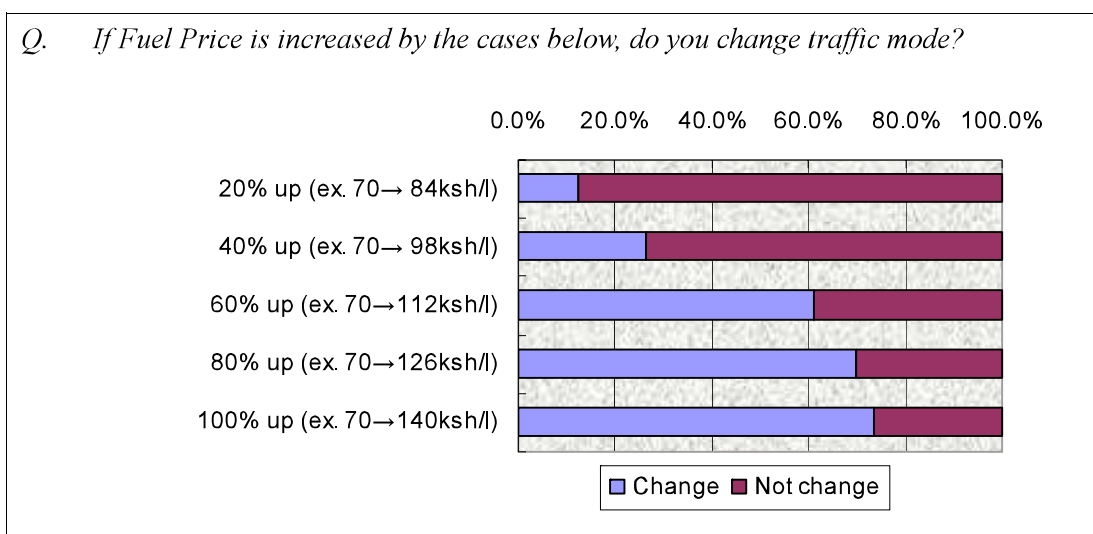**FIGURE 10.8-1 POTENTIAL MODAL SHIFT OF CAR USERS (PARKING FEE)**

FIGURE 10.8-2 POTENTIAL MODAL SHIFT OF CAR USERS (FUEL FARE)

Figure 10.8-3 illustrates the responses of car users, to question that "If new public transport system (ex. Bus exclusive road, LRT) is introduced in Nairobi City and average speed is faster than that of car, do you change traffic mode?"

46% of respondents answered "conditionally YES". They would expect the average reduction of time is 15 minutes and average affordable pay for new public transport is Ksh 27. Figure 10.8-4 shows the reason why they would not change traffic mode despite the improved public transport services.

Q. If New public transport system (ex. Bus exclusive road, Light Rail Transit) is introduced in Nairobi City and average speed is faster than that of car, do you change traffic mode?

New public transport system

Yes
46%

No
54%

Reason Why?

Others
20%

Hate walking
and waiting
29%

Baggage
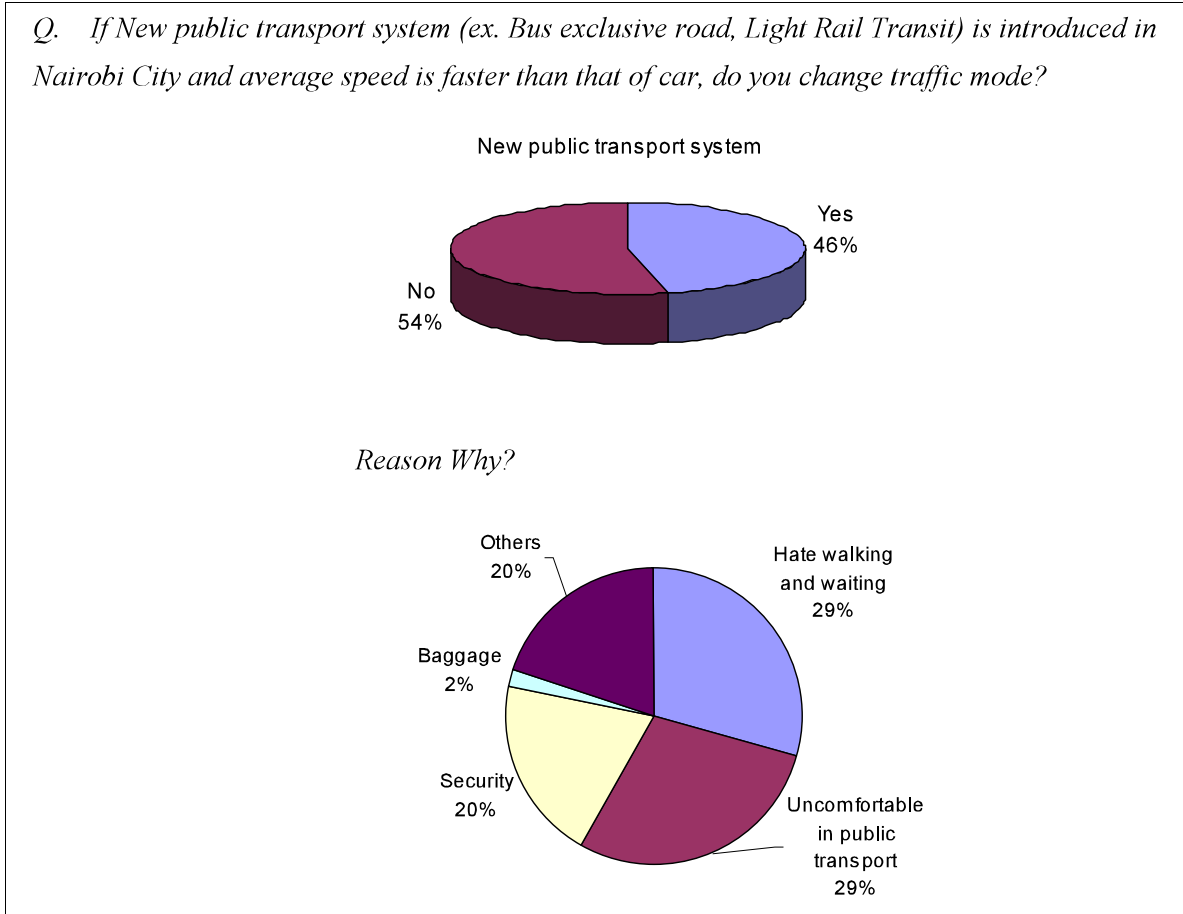2%

Security
20%

Uncomfortable
in public
transport
29%

FIGURE 10.8-3 POTENTIAL MODAL SHIFT OF CAR USERS (NEW TRANSPORT)

10.9   SUMMARY OF MAJOR FINDINGS

The results of survey are summarized below.

(1) Person Trip Survey

- The total number of person trips per day was 4,815,457 trips and the average number of trips per person was 2.25 trips. (See Table 10.2-2 and Figure 10.2-1)
- Trip composition by purpose was that "to Home" trips had a share of 47%, to work trips with a relatively high share of 25%, to school trips with a share of 10% and other trip purpose with a share of 19%. (See Figure 10.2-2)
- Trip compositions by travel mode was that "walking" trips had the highest share of 47%, while trips by private vehicles (car and taxi) is 15%. Matatu and Bus, which may represent the public transport share, handle about 29% and 4% of all trips. (See Figure 10.2-3)
- The main trip flows are concentrated into the central area from the west area (WESTLANDS) and the east area (KASARANI and EMBAKASI). (See Figure 10.2-4)

(2) Cordon Line, Screen Line and Traffic Count Survey

- The traffic composition at screen line stations in urbanized area was that "passenger car" had a share of 36%, "pick-up/4WD" with 23%, "Matatu and Bus", which may represent the public transport share, handled about 27% and 3% of all trips, respectively. (See Figure 10.4-2)
- Most of traffic (93%) at Nairobi boundary had to originate or arrive at Nairobi and a share of 7% of traffic had passing in Nairobi. (See Figure 10.3-1)

(3) Public Transport User Survey (Public Transport and Traffic Safety Opinion)

- Many respondents rated highly the present services of bus/matatu. (See Figure 10.6-1(1) and Figure 10.6-1(2))

(4) Travel Speed Survey

- Many roads in Nairobi urbanized area such as Outer Ring Rd., Ngong/Naivasha Rd., Juja/Forest/ Waiyaki Rd., Jogoo/Lusaka Rd. and Mbagathi/Valley Rd. have less than 30km/h travel speed. (See Table 10.7-1)

(5) Stated Preference Survey

- Increase of parking fee or fuel price is effective policy of modal shift from car mode to public transport mode. (See Figure 10.8-1, 2)

CHAPTER 11

FUTURE SOCIO-ECONOMIC FRAMEWORK

CHAPTER 11   FUTURE SOCIO-ECONOMIC FRAMEWORK

11.1   PROCEDURE

First, the future urban structure as the base for traffic forecast and transport corridors was established after the evaluation of future urban structure alternatives based on the study results. Next, GDP and GDP per capita were set as socio-economic frame work to estimate future vehicle ownership in the Nairobi Metropolitan Area. The future urban structure composed of land uses was then translated into distribution of population, working population at work place, and enrollment at study area to have a consistency with person trip survey results and forecast method.

The official forecast population by Central Bureau of Statistics (CBS) up to 2020 was employed to estimate population of Nairobi Metropolitan Area until 2025 based on the extrapolation method. Population forecast at division level was based on the future population density in residential areas that was set by utilizing GIS data analysis. As for the working population at work places and number of pupils/students in the Study Area, participation rates and enrollment rates for future population distribution by age group, and district were applied to the forecast.

11.2   CONSIDERATION OF FUTURE URBAN DEVELOPMENT

11.2.1   Development Potential and Constraint

(1)   Constraint

As stated previously, the "Nairobi Metropolitan Growth Strategy" was derived mainly from the viewpoint of urbanization density by comparison of transport cost and land development cost. However, the evolved urban structure showed considerable discrepancy from the proposed urban structure. The reasons for this discrepancy are attributed to the lack of revision and adjustment of the proposals in the strategy to accommodate the changes in environment and delay in basic infrastructure improvement due to financial problems. The main reason, however, is the lack of development controlled by law due to lack of adequate institutional and organizational policies.

As a result, informal housing development and development of housing without clear guidelines have been carried out by real estate companies and Cooperative Societies. Such vulnerability in development control was the basic problem in the effectiveness of urban planning. However, after the enactment of the Physical Planning Act in 1996, a favorable turn of the situation in terms of institutional reform is expected. The following constraints were studied with regard to the planning of urban structure and land use in the Nairobi Metropolitan Area:

- Water Supply Capacity (See Section 11.1 of Appendix 11)
- Sewerage Treatment Plan (See Section 11.1 of Appendix 11)
- Traffic Capacity (See Chapter 10)

- Distribution of Lands to be Conserved

(2) Distribution of Lands to be Conserved

The southern part of Nairobi City is designated as Nairobi National (Game) Park where urban land use is prohibited and preservation of the natural environment fostered as an important tourism resource. High potential lands for agriculture are located in the gently rolling grassland to the northwest of Rift Valley and in the highland hilly areas to the north of Nairobi City.

In the "Economic Recovery Strategy for Wealth and Employment Creation 2003-2007", recovery of land coverage by forest to 10% of total national land is anticipated. Therefore, the present forest areas can be regarded as a constraint for urban land use development though the strictness of constraint depends on individual forest areas (See Figure 11.2-1).
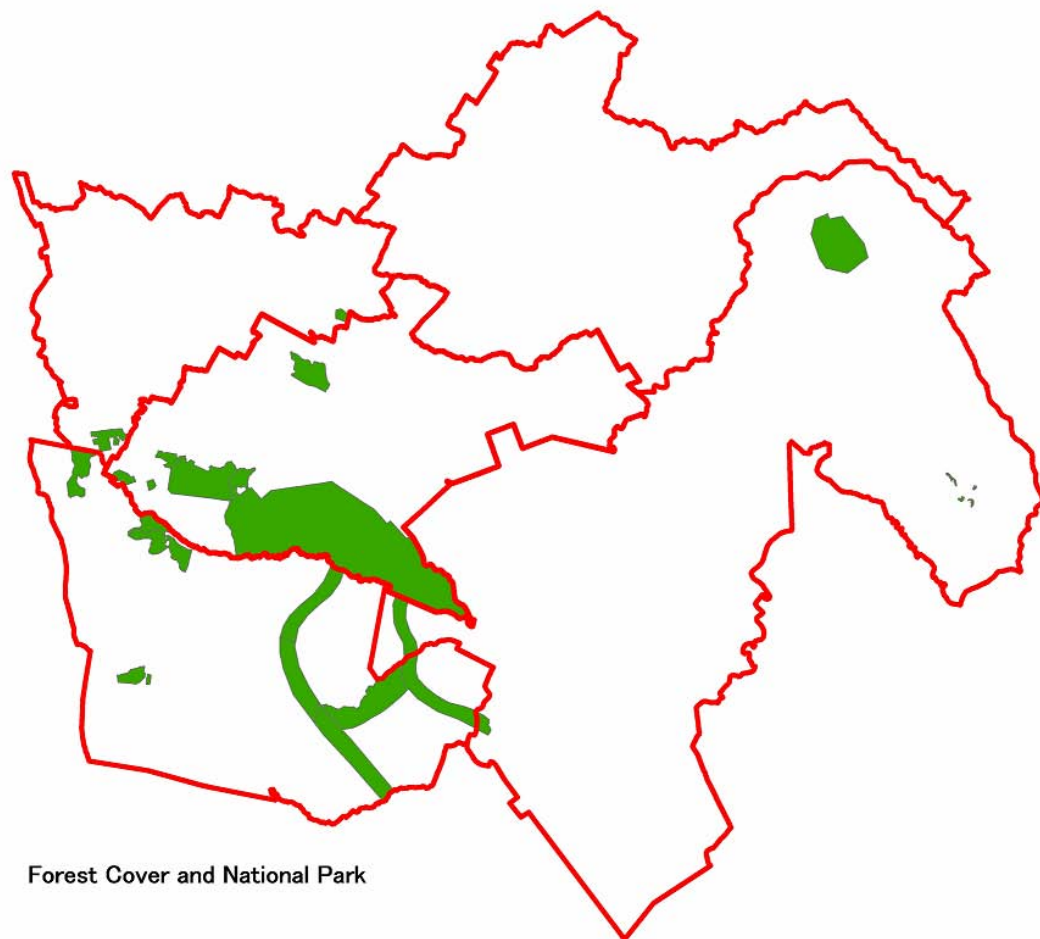

Forest Cover and National Park

FIGURE 11.2-1 FOREST COVER, NATIONAL PARK AND CONSERVATION AREA IN THE STUDY AREA

(3) Development Potential

The Development potential of each zone in the Nairobi Metropolitan Area is summarized as follows:

	Area	Development Potential
1	Thika Municipality and Its Surroundings	This area has a potential to develop into a more or less self-reliant area with the Thika Town effectively becoming a satellite town of Nairobi City. The area has productive agricultural land around the town with fertile and well drained soil and flat topography. The area is endowed with ample water resources due to high precipitation in the north-western mountainous area in the Thika district. This area may be designated for suburban agriculture to produce high value crops such as vegetables, and cut flowers.
2	Kiambu – Kikuyu Area	The several towns in Kiambu District closer to Nairobi City are bound to stay or become bed towns of Nairobi due to good transport links to the city center and favourable environmental condition. Potential for suburban agriculture should be further developed together with agro-processing particularly in the Upper Midland parts of the area having favourable soil conditions. Promising commercial activities include vegetables, fruits and cut flower production and processing, dairy farming under zero-grazing and dairy products, fish products including fish meal, poultry, and animal feed industry.
3	Western Area out of Nairobi City	The area has low potential for urbanization due to poor soil conditions and limited water availability. Tourism potential may be developed.
4	Ngong Area	Owing to Ngong Hills, the area has favourable surface water availability, and the groundwater quality is reported to be good. The area has relatively large potential for agriculture. It has also potential to receive spill over population and economic activities from Nairobi City.
5	Athi River Town and Its Surroundings	Water supply is already insufficient, and water pollution by industrial effluents has been reported. Groundwater potential ranges from moderate to low in the Division. Athi River Division has low land productivity. Further urbanization in the area, therefore, is constrained by limited water availability and low land productivity outside the town.
6	Eastern Area	The area up to part of Kangundo Division in the District is considered within a commuting zone for Nairobi City. Upper slopes of Kangundo Hills have relatively high precipitation (1,000 mm annually) and support citrus production and dairy farming as well as food crops cultivation. Plain areas between Kangundo and Nairobi City where groundwater level is low has a potential for urban development only on condition that water supply and infrastructure improvement projects are implemented.

11.2.2 Consideration of Future Urban Structure Based on Trend Pattern

The present concentric urban structure generates large volumes of person trips to/from the central area to work, school and other private activities. The future urban structure from the viewpoint of distribution of residents and work places was studied.

(1) Population

A forecast was made based on the following assumptions:

- Migration of population from rural area to urban area and expansion of urban area will continue.
- Population ratio of Nairobi Metropolitan Area to the whole country population will increase.
- Current population ratio of Nairobi City to the NMA population will be sustained.

The forecast results by Central Bureau of Statistics (CBS) were used as the base line for the total country population as well as Nairobi City and Nairobi Metropolitan Area population (See Figure 11.2-2).

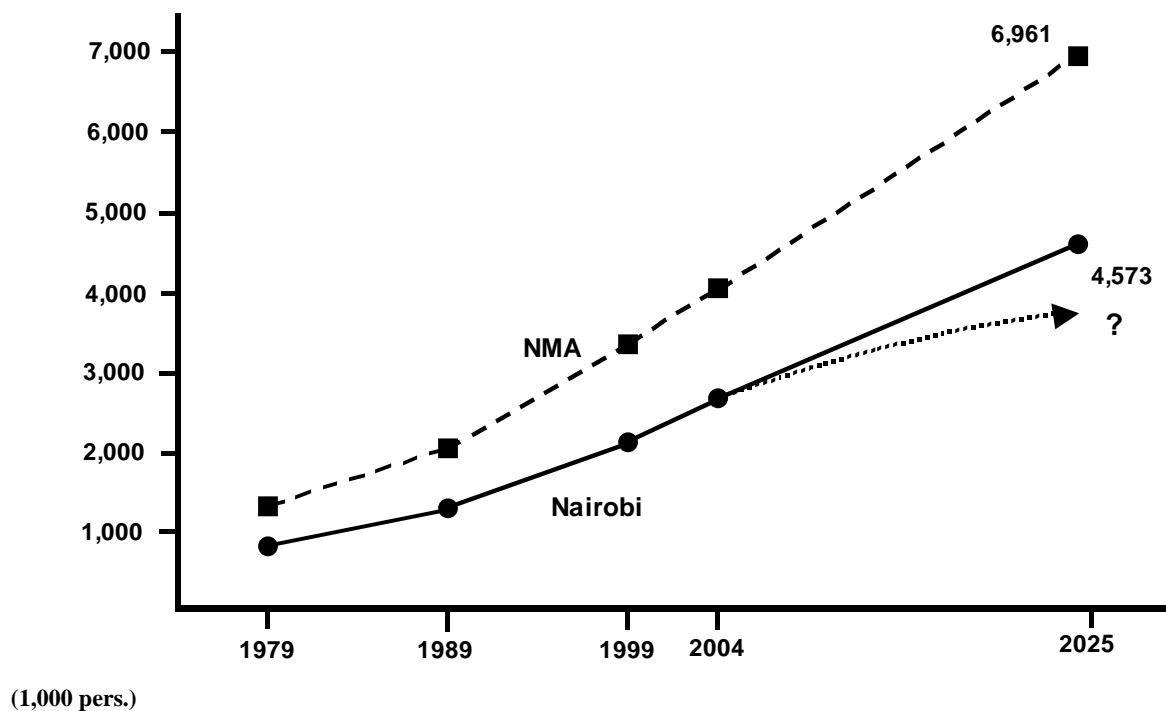| Year / Pop	1999	2025
Nairobi City	2.143 mil	4.573 mil
Nairobi Metropolitan Area		6.961 mil

FIGURE 11.2-2 POPULATION PROJECTION (TREND PATTERN)

(2) Work Places

Future work places were estimated based on the forecast results of population in the Nairobi Metropolitan Area. Major assumptions are as follows:

- Participation rate (rate of employment to labour base population) will increase.
- Employment population in the informal sector will continue to expand.
- Concentration rate of work places in Nairobi City to those in NMA will not change.

Workers from outside of Nairobi City to Nairobi City were estimated as follows:

                     2004: 0.70 million/day   2025: 1.60 million/day

(3) Findings

- The urban structure problems presented earlier will remain and will have more detrimental effect on urban activities.
- Traffic congestion on radial trunk roads will worsen in the absence of any counter measures.
- Large investment in the transport infrastructure will be indispensable to mitigate traffic congestion on trunk roads.
- Concentric urban structure with radial transport corridors is not justifiable for a megalopolis.
- Sole decentralization of population will not be effective to mitigate traffic congestion due to concentration of work places in Nairobi City.
- Relocation of unnecessary urban functions to create a strong connection between the CBD and suburbs in relation to housing development, while fostering regional growth centers is likely to be the solution to urban structure problems.

11.2.3 Desirable Direction of Future Urban Structure

(1) Development Direction of Future Land Use

<u>Development Density</u>

Efficiency of land investment and reduction of total transport costs without undue expansion of public services can be achieved by intensified land use. Although there is an opinion that low density housing development by construction of single storied houses is preferable, such development will highly be dependent on the improvement of such facilities as transport, infrastructure, and public service costs.

In the Nairobi Metropolitan Area, such low density housing development has already taken place, and a large expectation for improved public services and infrastructure is anticipated by the inhabitants in those areas. However, it is against beneficiary-pay principle in case of excessive expectation. Taking financial problems in the public service sector into account, such low density housing development of self-built the houses is not recommendable.

<u>Self-Supporting</u>

Spatial expansion of Nairobi Metropolitan Area occurred as the population and economy expanded. However, concentric urban structure has not changed so much yet. Concentration of

commuting and shopping activities in the central area has already led to economic loss by increasing congestion costs in the central area, transport costs and environmental costs to mitigate the degradation. Areas currently absorbing workers and/or customers considerably, such as work places and/or commercial areas shall have to remain or become self-supportive.

Expansion of Athi River Town

As stated in the section for development potential analysis, this area has relatively low productivity for agriculture due to the shortage of water and water pollution problems. The area is located along the Mombasa Road with the sole advantage of convenient transport. However, further urbanization is not presumable and justifiable taking the water supply problem and low productivity into account. Demand of land for new housing and industrial development is likely to be shifted to other areas of the Nairobi Metropolitan Area.

Construction of Sub Centre and New Town

Many merits can be expected from the concentration of urban functions in the same central area. However, in the case where economic efficiency is lowered by excessive concentration, emerging congestion, noise and pollution, sub centers undertaking some urban functions from the central area of the city and towns, such as relocation of factories in the industrial zones located in built-up area to newly established industrial zones, become necessary.

As assumed in the previous section, the future population of Nairobi Metropolitan Area will increase to about 1.5 to 2 times of the present. Introduction of sub-centres and new towns at an early stage culminating in the induction of urban structure along this line will be vital.

New Urban Functions

Distribution functions were formerly considered as a part of industrial and/or commercial functions. While the progress of the economy entails the segregation of goods and information exchange in trade and segregation of production and distribution, it is desirable to consider such distribution functions as a new urban function clearly constituting urban structure.

Urban Land Use Types and Distributing Principles

In consideration of characteristics of preferable location regarding surrounding and transport conditions, the principle "right function right place" shall be applied (see Section 11.2 of Appendix 11).

(2) Development Direction of Transport Corridors

Three regional arteries exist in the Nairobi Metropolitan Area; however, actual urbanization is not confined in these three directions. Other than three regional arteries, urbanization is observed in the directions to Tala/Kangundo, Kiambu and Kikuyu. Future transport network shall be proposed

to enhance the mobility in the whole Nairobi Metropolitan Area whilst realizing the planned future land use.

Bearing the above viewpoints, the development direction of transport corridors is discussed and proposed in this section. Several bypass plans currently proposed were selected in consideration to development direction of transport corridors.

Increase of Access and Egress Points to/from the Central Area

Presently many urban functions are located within the central area of the Nairobi City and derive merits of accumulated urban functions as a result of concentration in terms of communication and trade. However, traffic congestion in the central area has become serious year by year. Consequently, accessibility to the central area should be improved by reducing the traffic currently concentrating on specific routes through the increase in number and/or capacity of routes to/from the central area.

Segregation of Inter-Regional and Intra-Regional Traffic in the Metropolitan Area

Through traffic and inter-regional traffic by road is mainly composed of trucks. Accordingly, such traffic causes environmental problems, such as noise, dust and vibration. Furthermore, it affects the movement of intra-regional traffic in the Nairobi Metropolitan Area.

Usually, counter measures such as bypass construction, and traffic zoning system to restrict large trucks to enter the central area, are adopted to cope with such situations in many large cities in the world. In the Nairobi Metropolitan Area, segregation of inter-regional traffic and intra-regional traffic also should be promoted by utilizing proposed bypasses to secure smooth traffic movement and mitigate the environmental problems.

Formation of Transport Corridors Corresponding to Urbanization

In the former "Nairobi Metropolitan Growth Strategy" established in 1973, urbanization sprawl was proposed to take place to the west of Nairobi and Thika. However, actual urbanization occurred not only to those two directions but also to Tala/Kangundo, Kiambu, and Kikuyu. Transport corridors should be enhanced to accommodate the directions of actual urbanization.

Formation of Transport Corridors corresponding to New Urban Functions

There is a general tendency that distribution functions for intra-regional and inter-regional freight traffic is spatially separated from the central business district where information, currency, and business personnel concentrate to form core areas for easier value-added activities. In the Nairobi Metropolitan Area, such urban functions were not clearly reflected in the urban planning. They are spontaneously located along the arteries, mostly Mombasa Road. Such new distribution functions

should be intentionally allocated in the formation of future urban structure of the Nairobi Metropolitan Area and corresponding regional arteries and intra-regional arteries should be incorporated.

<u>Formation of Transport Corridors connecting Self-Supportive New Town, Urbanized Center in the Peripheral Area and Sub Centers</u>

Burgeoning move from the past concentric urban structure to multi-core urban structure can be observed along with the expansion of Nairobi Metropolitan Area. Transport corridors within expected future urban cores including self-supportive towns, new towns and sub centers, such as Thika, Limuru, Kikuyu, and Athi River, should be formed to reinforce mutual cooperation and totality as the Nairobi Metropolitan Area.

11.3   FUTURE URBAN STRUCTURE AND LAND USE PLAN

11.3.1   Standpoint

The Study objective is to formulate a transport Master Plan and not to formulate a land use Master Plan. However, future land use and urban structure is an inevitable pre-requisite to formulate transport Master Plan. Traffic forecast, which is the most important part to facilitate identification of the necessity of projects in the transport sector, depends on the future distribution of urban functions and resultant population and work places.

New Metropolitan Strategy is being prepared to undertake. However, due to the limited time schedule, the outcomes from the new Metropolitan Strategy will not be in time for this Study. In this regard, the Study Team is required to formulate a conceptual urban structure of the NMA as the base for formulating a transport Master Plan. However, it should be emphasized that the future land use plan in this Study will not be made in detail, only in terms of a conceptual urban structure lest gross discrepancy between the Study and the outcome of the new Metropolitan Strategy prevails.

11.3.2   Urban Structure Alternatives to Solve Problems

First, the typical future land use patterns of the Nairobi Metropolitan Area were considered. Next, the transport corridor patterns logically supporting the land use patterns were studied. Consequently, the following urban structure alternatives were considered as a result of the combination of future urban land use patterns and supportive transport corridors (See Figure 11.3-1 through 11.3-4).

Land Use Transport Corridor	I. Trend Type	II. Belt Type	III. Circular Type
a. Belt-Ring Type	-	Alternative-IIa	Alternative-IIIa
b. Belt Type	-	Alternative-IIb	-
c. Radial Type	Alternative-Ic	-	-

Alternative-Ic

- Land Use Pattern:
  - urbanization along trunk roads (Mombasa Road, Thika Road and Kangundo Road) and expansion of built-up areas outwards in peripheral areas (Trend Type-I)
- Transport Corridor Pattern:
  - Bypass roads and radial transport corridors (Radial Type-c)

Future Urban Structure Alt-Ic

FIGURE 11.3-1 FUTURE URBAN STRUCTURE ALTERNATIVE-IC

Alternative-IIa

- Land Use Pattern:
  - Urbanization along trunk roads (Mombasa Road and Kangundo Road), expansion of built-up areas outwards in peripheral areas and belt type development from west to northeast along Thika Road. (Belt Type-II)
- Transport Corridor Pattern:
  - Ring roads, radial and belt type transport corridors (Belt-Ring Type-a)
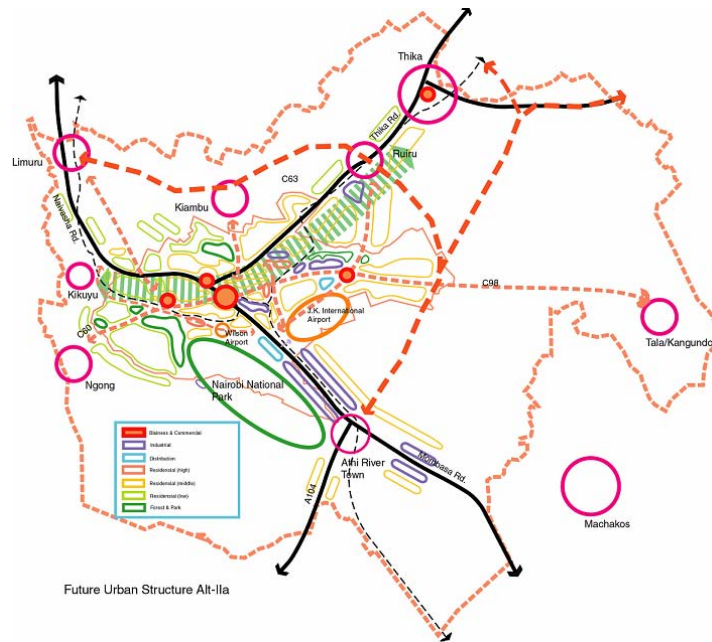
FIGURE 11.3-2 FUTURE URBAN STRUCTURE ALTERNATIVE-IIA

Alternative-IIb

- Land Use Pattern:
  - Urbanization along trunk roads (Mombasa Road and Kangundo Road), expansion of built-up areas outwards in peripheral areas and belt type development from west to northeast along Thika Road. (Belt Type-II)
- Transport Corridor Pattern:
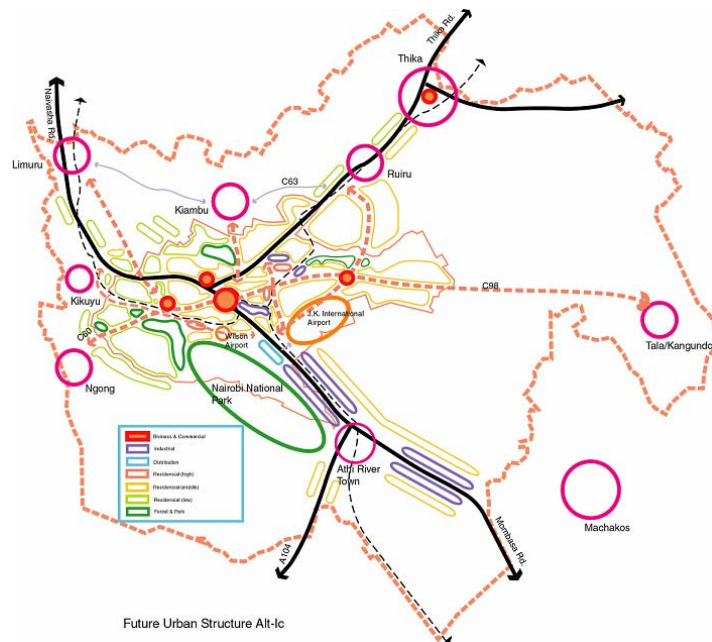 - Bypass roads, radial and belt type transport corridors (Belt Type-b)
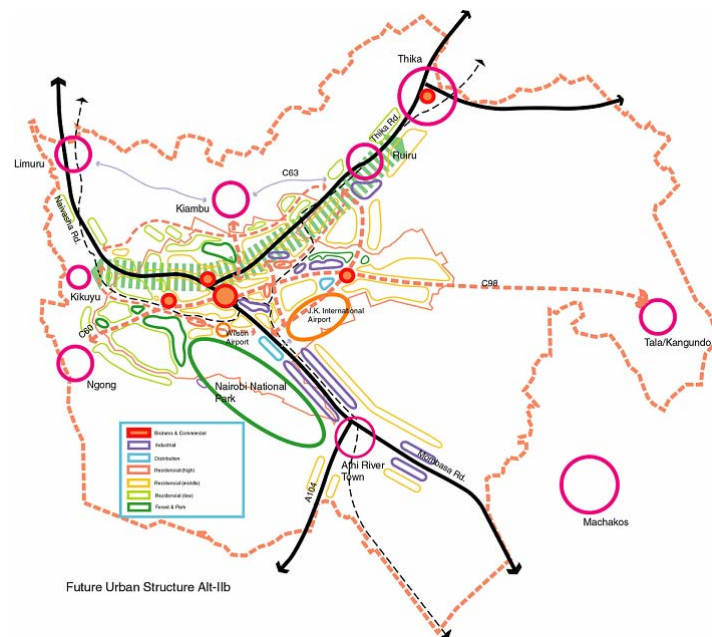
FIGURE 11.3-3 FUTURE URBAN STRUCTURE ALTERNATIVE-IIB

<u>Alternative-IIIa</u>
- Land Use Pattern:
  - Urbanization along trunk roads (Mombasa Road and Kangundo Road), expansion of built-up areas outwards in peripheral areas, belt type development from west to northeast along Thika Road and distribution of urban functions in circular direction (Circular Type-III)
- Transport Corridor Pattern:
  - Ring roads, radial and belt type transport corridors (Belt-Ring Type-a)
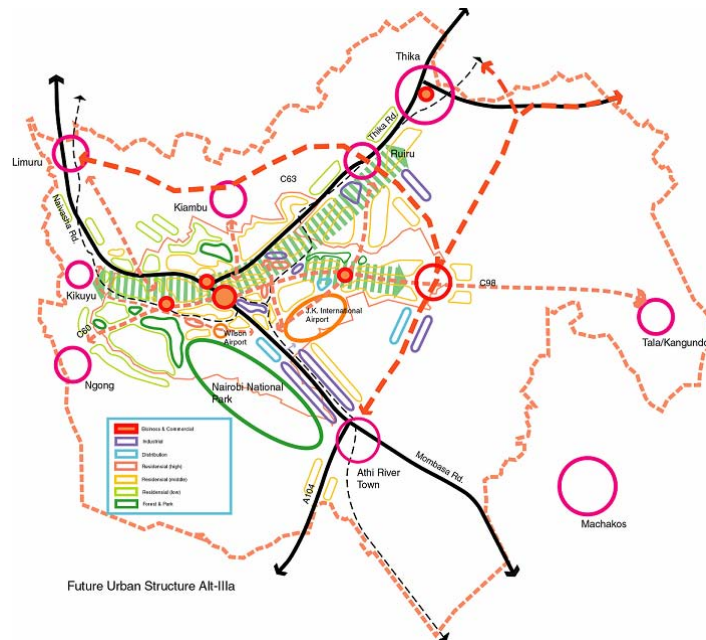
FIGURE 11.3-4 FUTURE URBAN STRUCTURE ALTERNATIVE-IIIA

11.3.3 Desirable Conceptual Urban Structure as the Base for Transport Master Plan

As already mentioned, redistribution of urban functions and workplaces should be aimed at paying attention to the current urbanization trend. Out of alternatives, **Alternative-IIIa** (Circular Type Development with Belt-Ring Type Transport Corridors) is recommendable based on the following merits.

(1) Fostering Regional Growth Center

Enhancement of transport potential is indispensable to develop the fostering sub centers (regional growth center). In this regard, Alternative-IIIa has a relatively favorable condition because of the supporting transport corridors. Thika and Athi River towns will have higher transport potential to be provided with the incorporation of a new regional artery. Also, the potential of growth of Kiambu, Ruiru, Limuru as major centers will be enhanced by the improvement of the ring type artery. In addition, a new sub center can be formed at the Embakasi area.

(2) Enhancing Land Use Potential

Ring type transport corridor development can enhance the land use potential of feeder areas between radial arteries. Thus Alternative-IIa and -IIIa will have a higher potential for the total development comprising of industry and housing to diminish the transport demand in terms of person-kilometers.

(3) Guiding Current Urbanization Properly

The new regional artery between Athi River town and Thika can guide the current belt type urbanization that was originally proposed in the Metropolitan Growth Strategy in 1973.

(4) Mitigating Traffic Congestion on Radial Arteries

Ring-type transport corridor can contribute to the mitigation of the traffic congestion on radial arteries, because of the creation of access/egress points to/from the central area. This alternative further has the following strong points.

(5) Formulating New International and Regional Corridor

A new international and regional transport corridor will be formed by mutually connecting National Roads A2 and A3 to Ethiopia, National Road A104 to Tanzania and Uganda and Mombasa Road (National Road A109).

(6) Minimizing Conflict between Development and Wild Animals

As the development priority was put on Mavoko area out of the Nairobi Metropolitan Region with large future land development potential, minimization of the conflict between development and wild animals and their migration beyond the Nairobi National Park can be realized.

11.4   ECONOMIC FRAME

11.4.1 GDP (Gross Domestic Product)

Kenyan economic growth forecast with a long horizon was not officially available. As a consequence, the growth rates of GDP per capita were set after the examination of officially announced growth targets and recent economic trend. In this Study, the values shown in the "Kenya Transport Policy and Roads Sub-Sector Policy and Strategy", prepared for Kenyan Government and Kenya Roads Board, funded by European Union, December 2003 were adopted after the discussion with Kenyan side. And then, future real GDP and GDP growth rates were estimated based on the forecast population and GDP per capita (Table 11.4-1).

TABLE 11.4-1   ECONOMIC GROWTH ASSUMPTIONS (2004-2025)

		2000	2001	2002	2003	2004	2010	2015	2025
GDP	(bil.KSH)	685.4	767.4	850.0	968.4	1,036.2	1,335.9	1,687.3	2,643.7
(at current prices)		(Actual)	(Actual)	(Actual)	(Actual)	(Est.)	(Proj.)	(Proj.)	(Proj.)
GDP	(bil.KSH)	103.5	104.7	105.9	107.8	111.8	-	-	-
(at 1982 constant prices)		(Actual)	(Actual)	(Actual)	(Actual)	(Est.)			
Real GDP growth rate	(%)	-0.2	1.2	1.1	1.8	3.7	4.3	4.8	4.6
		(Actual)	(Actual)	(Actual)	(Actual)	(Est.)	(Proj.)	(Proj.)	(Proj.)
Population	(mil.)	30.2	30.9	31.5	32.2	32.8	36.5	39.7	46.3
		(Proj.)	(Proj.)	(Proj.)	(Proj.)	(Proj.)	(Proj.)	(Proj.)	(Proj.)
GDP per capita	(KSH)	22,700	24,900	27,000	30,100	31,600	36,600	42,500	57,100
(nominal)		(Actual)	(Actual)	(Actual)	(Actual)	(Est.)	(Proj.)	(Proj.)	(Proj.)
GDP per capita growth rate	(%)	-2.9	-0.8	-1.1	-0.4	1.8	2.5	3.0	3.0
(real)		(Actual)	(Actual)	(Actual)	(Actual)	(Est.)	(Proj.)	(Proj.)	(Proj.)

Source:Consultant's estimate based on the "Economic Survey 2004", 2004, Central Bureau of Statistics

Note:Exchange rates for years 2000, 2001, 2002 and 2003 werebased on the Statistical Bulletin by Central Bank of Kenya.

11.4.2 GRDP (Gross Regional Domestic Product)

No statistical data was available for the present GRDP. Through the discussion with staff members in the CBS, the concentration rate of working population in Nairobi Metropolitan Area and Nairobi City were applied to the GDP for retrieving estimate factors of the present GRDPs. The same growth rates of the GDP per capita were also employed to estimate future GRDP per capita.

11.5   POPULATION

11.5.1 Population

Future population was estimated based on the forecasted population by district under the influence of HIV/AIDS by CBS. As CBS's population forecasts were made up to 2020 for the whole country, the extrapolation method was applied to estimate the country's population in 2025. Then urbanization rate in terms of population was applied to estimate the total urban population in Kenya on condition that migration from the rural to the urban continues. The future concentration rate of population to Nairobi Metropolitan Area was set and applied to estimate population in Nairobi Metropolitan Area in 2025. Population of Nairobi City was also estimated by applying the concentration rate of urban population to Nairobi City.

The concentration rate of urban population to Nairobi City was set based on the fact that the rate is currently at a threshold to a decrease reflecting the low density urban sprawl, under the assumption that planned distribution of population takes place. The future population in surrounding areas was estimated in consideration of the recommended future urban structure (See Table 11.5-1).

TABLE 11.5-1 GRDP GROWTH ASSUMPTIONS (2004-2025)

		1999	2000	2001	2002	2003	2004	2010	2015	2025
Kenya	GDP (at current prices)	(bil.KSH)	639.1 (Actual)	685.4 (Actual)	767.4 (Actual)	850.0 (Actual)	968.4 (Actual)	1,036.2 (Est.)	1,335.9 (Proj.)	1,687.3 (Proj.)	2,643.7 (Proj.)
	Population	(thousands)	28,687 (Actual)	30,208 (Actual)	30,865 (Proj.)	31,517 (Proj.)	32,165 (Proj.)	32,808 (Proj.)	36,500 (Proj.)	39,700 (Proj.)	46,300 (Proj.)
	Earnings	(bil.KSH)	247.6 (Actual)	285.9	333.5	388.4	-	-	-	-	-
	GDP per capita (nominal)	(KSH)	21,700 (Actual)	22,700 (Actual)	24,900 (Actual)	27,000 (Actual)	30,100 (Actual)	31,600 (Actual)	36,600 (Proj.)	42,500 (Proj.)	57,100 (Proj.)
	GDP per capita growth rate (real)	(%)	-0.7 (Actual)	-2.9 (Actual)	-0.8 (Actual)	-1.1 (Actual)	-0.4 (Actual)	1.8 (Est.)	2.5 (Proj.)	3.0 (Proj.)	3.0 (Proj.)
Nairobi Metropolitan Area	GRDP (at current prices)	(bil.KSH)	276.0 (Est.)	224.4 (Est.)	250.9 (Est.)	271.6 (Est.)	309.5 (Est.)	331.2 (Est.)	450.0 (Proj.)	597.4 (Proj.)	1030.4 (Proj.)
	GRDP(Nairobi) (at current prices)	(bil.KSH)	263.6 (Est.)	211.0 (Est.)	236.2 (Est.)	255.7 (Est.)	291.3 (Est.)	311.7 (Est.)	418.8 (Proj.)	534.6 (Proj.)	885.2 (Proj.)
	Population	(thousands)	3,230 (Actual)	3,378 (Proj.)	3,533 (Proj.)	3,695 (Proj.)	3,865 (Proj.)	4,042 (Proj.)	4,736 (Proj.)	5,424 (Proj.)	6,961 (Proj.)
	Population(Nairobi)	(thousands)	2,143 (Actual)	2,290 (Proj.)	2,380 (Proj.)	2,471 (Proj.)	2,563 (Proj.)	2,657 (Proj.)	3,079 (Proj.)	3,390 (Proj.)	4,176 (Proj.)
	Earnings (NMA)	(bil.KSH)	107.0 (Actual)	93.6	109.0	124.1	-	-	-	-	-
	Nairobi	(bil.KSH)	102.1	88.0	102.7	116.8					
	Thika	(bil.KSH)	3.2	3.6	4.1	4.7					
	Kiambu	(bil.KSH)	0.6	0.7	0.8	0.9					
	Limuru	(bil.KSH)	0.7	0.8	0.9	1.0					
	Athi River	(bil.KSH)	0.4	0.5	0.6	0.7					
	NMA earnings/Total		43.2%	32.7%	32.7%	32.0%	32.0%	32.0%			
	GRDP per capita (at current prices)	(KSH)	85,470 (Est.)	66,440 (Est.)	71,010 (Est.)	73,520 (Est.)	80,090 (Est.)	81,930 (Est.)	95,020 (Proj.)	110,150 (Proj.)	148,030 (Proj.)
	GRDP per capita(Nairobi) (at current prices)	(KSH)	123,000 (Est.)	92,140 (Est.)	99,260 (Est.)	103,470 (Est.)	113,640 (Est.)	117,310 (Est.)	136,040 (Proj.)	157,710 (Proj.)	211,950 (Proj.)
	GRDP per capita (at 1982 constant prices)	(KSH)	13,870 (Est.)	10,030 (Est.)	9,690 (Est.)	9,160 (Est.)	8,920 (Est.)	8,840 (Est.)	10,250 (Proj.)	11,880 (Proj.)	15,970 (Proj.)
	GRDP per capita(Nairobi) (at 1982 constant prices)	(KSH)	19,960 (Est.)	14,950 (Est.)	16,110 (Est.)	16,790 (Est.)	18,440 (Est.)	19,040 (Est.)	22,080 (Proj.)	25,590 (Proj.)	34,390 (Proj.)
	GRDP per capita growth rate (real)	(%)	7.3 (Est.)	-27.7 (Est.)	-3.4 (Est.)	-5.5 (Est.)	-2.7 (Est.)	-0.9 (Est.)	2.5 (Proj.)	3.0 (Proj.)	3.0 (Proj.)

Source:Consultant's estimate based on the "Economic Survey 2004", 2004, Central Bureau of Statistics
Note:Exchange rates for years 2000, 2001, 2002 and 2003 were based on the Statistical Bulletin by Central Bank of Kenya.

Population at division level was estimated by assuming future population density of residential areas that was derived from the consideration of the correction between the current population density and future urban structure. In determining the present population densities of residential areas, GIS data analysis was applied. Population at district level was estimated by setting the population concentration rate to Nairobi City under the whole Nairobi Metropolitan Area population as control total.

Population itself and population break down to divisions were made basically by applying the interpolation method, with slight adjustments was made to reflect the current trend in population increase (See Table 11.5-2).

TABLE 11.5-2 POPULATION OF NAIROBI AND NAIROBI METROPOLITAN AREA (2004-2025)

	1979 Population	(%)	1989 Population	(%)	1999 Population	(%)	Growth rate p.a. 1989-1999
Kenya	15,327,061	100.0	21,443,636	100.0	28,686,607	100.0	3.0%
Urban	2,306,048	15.0	3,877,222	18.1	9,904,044	34.5	9.8%
Nairobi Metropolitan Area	1,360,496	8.9	2,062,014	9.6	3,229,624	11.3	4.6%
Urban	897,266	5.9	1,488,965	6.9	2,995,103	10.4	7.2%
Nairobi	827,775	5.4	1,324,570	6.2	2,143,254	7.5	4.9%
Nairobi pop./NMA pop.		60.8		64.2		66.4	
Others	532,721		737,444		1,086,370		

2004 Population	(%)	2010 Population	(%)	2015 Population	(%)	2025 Population	(%)
32,808,000	100.0	36,500,000	100.0	39,700,000	100.0	46,300,000	100.0
12,535,800	38.2	15,560,300	42.6	18,387,200	46.3	24,855,900	53.7
4,041,868	12.3	4,736,200	13.0	5,423,800	13.7	6,960,700	15.0
3,849,035	11.7	4,573,450	12.5	5,305,905	13.4	6,960,700	15.0
2,656,997	8.1	3,078,500	8.4	3,389,900	8.5	4,176,400	9.0
	65.7		65.0		62.5		60.0
1,384,871		1,657,700		2,033,900		2,784,300	

TABLE 11.5-3 POPULATION IN NAIROBI METROPOLITAN AREA BY DIVISION (2004-2025)

	Population 2004	Land use Total (ha)	Residential	Pop.density 1999 (residential area)	Population 2010	2015	2025
Nairobi Metropolitan Area							
Nairobi	2,656,997	69,610	48,471	55	3,078,500	3,389,900	4,176,400
Central	366,239	1,060	873	444	357,300	346,000	340,000
Makadara	214,792	2,010	800	258	209,700	203,300	200,000
Kasarani	351,690	8,570	7,369	46	417,800	467,300	589,000
Embakasi	618,490	20,830	19,084	35	820,000	975,900	1,335,400
Pumwani	229,777	1,170	1,119	197	226,900	222,100	223,000
Westlands	262,267	9,760	8,857	28	312,300	349,900	442,000
Dagoretti	300,044	3,870	3,650	79	358,600	402,500	510,000
Kibera	313,699	22,340	6,719	45	375,900	422,800	537,000
Others	1,384,871				1,657,700	2,033,900	2,784,300
Kiambu	531,905	46,430	4,468	119	574,800	663,800	836,100
Kiambaa	227,162	19,050	1,408	161	245,500	283,500	357,100
Githunguri	13,505	1,070	0	-	14,600	16,800	21,200
Limuru	76,991	11,470	0	-	83,200	96,100	121,000
Kikuyu	214,247	14,840	3,060	70	231,500	267,400	336,800
Thika	363,986	80,840	29,000	13	483,900	626,000	913,500
Kakuzi	8,995	6,160	799	11	9,600	15,500	22,500
Municipality	133,115	22,020	5,632	24	177,000	228,900	334,100
Riuru	221,876	52,660	22,569	10	297,300	381,600	556,900
Machakos	283,601	176,950	66,299	4	377,000	487,800	711,800
Kangundo	99,115	17,820	2,701	37	131,800	170,500	248,800
Matunguru	109,049	63,430	6,719	16	144,100	187,600	273,700
Mavoko	75,437	95,700	56,879	1	101,100	129,700	189,300
Kajiado	205,378	73,840	5,085	40	222,000	256,300	322,900
Ngong	176,335	34,800	5,085	35	190,600	220,100	277,200
Central	29,043	39,040	0	-	31,400	36,200	45,700

11.5.2 Employment

The future working population was estimated by applying a participation ratio of work available to the workable population (15 to 64 years old). The workable population was estimated also based on the CBS's forecast result of population projections by age group. As CBS 's population forecast by age group was made up to 2010 for districts, the same constitution rates were applied for working population estimates by district in 2025.

Subsequently, the participation rate for work was assumed to increase judging from statistical data, and the determined participation rates were applied to estimate the working population in Nairobi Metropolitan Area.

Future concentration rate of working population in Nairobi City was set and applied to estimate work places in Nairobi City in 2025. The concentration rate of working population in Nairobi City was determined based on the fact that the rate is currently at the turning point to decrease and bound to reflect the industrial development along regional arteries, as well as the assumption that planned relocation of industry and/or business functions will take place.

The Future working population by industrial sector and type was estimated by applying a regression model with a fixed control total of working places in Nairobi City. Work places by division within Nairobi City were estimated in consideration of present work places by division and industry, which were derived from the Person Trip Survey and future urban structure (See Table 11.5-4).

TABLE 11.5-4 WAGE EMPLOYMENT IN NAIROBI METROPOLITAN AREA (2004-2025)

	1999	2002	2003	2004	2010	2015	2025
				(est.)			
Kenya							
Population	28,686,607	31,517,142	32,165,328	32,808,269	36,508,255	39,714,908	46,333,333
Labor force base population (15-64)	15,026,909	17,076,627	17,548,683	18,004,314	21,120,645	23,636,890	29,618,032
Labor force rate	0.524	0.542	0.546	0.549	0.579	0.595	0.639
Employment	5,492,600	6,851,500	7,338,600	7,922,906			
Wage employment	1,688,700	1,699,600	1,727,700	1,737,590	-	-	-
Informal sector	3,738,800	5,086,400	5,545,200	6,119,465	-	-	-
Self-employed and unpaid family workers	65,100	65,500	65,700	65,851	-	-	-
Employment rate to labor force	0.366	0.401	0.418	0.440	-	-	-
Nairobi Metropolitan Area	0.705	0.706	0.706	0.706	0.710	0.720	0.750
Population	3,229,624	3,694,963	3,864,524	4,041,868	4,904,900	5,683,400	6,960,700
Labor force base population (15-64) (a)	2,068,346	2,323,911	2,431,234	2,547,951	3,039,576	3,509,266	4,524,455
Employment (b)	1,473,945	1,854,201	1,999,203	2,167,210	2,887,600	3,333,800	4,072,000
Participation rate (b/a)	0.713	0.798	0.822	0.851	0.950	0.950	0.900
Nairobi							
Population	2,143,254	2,470,850	2,563,297	2,656,997	3,078,500	3,389,900	4,176,400
Labor force base population (15-64)	1,461,003	1,640,699	1,701,133	1,762,401	2,037,522	2,237,334	2,714,660
Employment at work place (c)	1,321,651	1,659,467	1,781,971	1,928,376	2,541,100	2,833,700	3,257,600
Wage employment	420,787	425,632	433,635	436,908	587,057	749,412	1,240,824
Agriculture	7,318	9,104	9,275	9,843	10,000	10,000	10,000
Manufacturing	116,645	116,124	118,151	118,548	154,376	177,353	238,165
Service	296,824	300,404	306,209	308,647	422,681	562,059	992,659
Informal sector	896,000	1,228,700	1,343,100	1,486,136	1,948,543	2,078,788	2,011,276
Self-employed and unpaid family workers	4,864	5,135	5,236	5,333	5,500	5,500	5,500
Concentration rate to Nairobi City (c/b)	0.897	0.895	0.891	0.890	0.880	0.850	0.800
Employment (residents in Nairobi)	876,353	1,096,782	1,176,111	1,258,802	1,475,600	1,639,349	2,035,305
Others							
Population	1,086,370	1,224,113	1,301,227	1,384,871	1,657,700	2,033,900	2,784,300
Labor force base population (15-64)	607,343	683,212	730,101	785,550	1,002,055	1,271,932	1,809,795
Employment at work place	152,294	194,734	217,232	238,834	346,500	500,100	814,400
Kiambu	0.214	0.252	0.262	0.159	0.242	0.312	0.450
Population	443,606	482,658	506,526	531,902	574,800	663,800	836,100
Labor force base population (15-64)	259,005	279,499	296,693	315,096	363,461	424,832	543,465
Employment at work place	55,366	70,524	77,666	84,838	115,800	158,700	244,600
Wage employment	10,399	10,444	10,459	10,474	0.269		
Informal sector	43,961	59,077	66,173	73,297			
Self-employed and unpaid family workers	1,007	1,003	1,035	1,068	1,100	1,100	1,100
Thika	0.366	0.377	0.378	0.222	0.287	0.341	0.450
Population	266,173	313,067	337,412	363,994	483,900	626,000	913,500
Labor force base population (15-64)	153,417	181,256	197,598	215,590	305,942	400,640	593,775
Employment at work place	56,210	68,323	74,598	80,829	120,400	170,400	267,200
Wage employment	29,229	29,353	29,829	29,981	0.375		
Informal sector	26,377	38,319	44,080	50,118			
Self-employed and unpaid family workers	604	651	689	731	750	750	750
Machokos	0.218	0.250	0.282	0.157	0.241	0.310	0.450
Population	239,905	258,143	270,366	283,599	377,000	487,800	711,800
Labor force base population (15-64)	123,157	138,866	142,506	150,712	210,140	292,680	462,670
Employment at work place	26,862	34,695	40,166	44,458	70,700	113,000	208,200
Wage employment	2,543	2,562	4,293	4,893	0.295		
Informal sector	23,774	31,597	35,321	38,995			
Self-employed and unpaid family workers	544	536	552	569	580	580	580
Kajiado	0.193	0.254	0.266	0.140	0.228	0.302	0.450
Population	136,686	170,245	186,923	205,376	222,000	256,300	322,900
Labor force base population (15-64)	71,764	83,591	93,304	104,152	122,511	153,780	209,885
Employment at work place	13,856	21,192	24,802	28,708	39,600	58,000	94,400
Wage employment	-	-	-		0.276		
Informal sector	13,545	20,838	24,420	28,296			
Self-employed and unpaid family workers	310	354	382	412	430	430	430

Working places in Nairobi City were estimated by setting a concentration rate and/or ratio of working population in Nairobi City to the working population in the whole Nairobi Metropolitan Area as a control total. The working population break down of work places to divisions for

intermediate years were made basically by the interpolation method, with some adjustment to comply with the total work places in Nairobi City (See Table 11.5-5).

TABLE 11.5-5 WAGE EMPLOYMENT BY DIVISION IN NAIROBI METROPOLITAN AREA (2004-2025)

	Population	Work population at work place									
	2000	2004				2010	2015	2025			
		Total	Manufacture	Service	Agriculture			Total	Manufacture	Service	Agriculture
	(pers.)	(pers.)	(pers.)	(pers.)	(pers.)						
Nairobi	2,656,997	1,928,376	295,230	1,623,146	10,000	2,541,100	2,833,700	3,257,600	641,520	2,606,080	10,000
Central	366,239	696,101	52,016	644,085	0	852,097	905,707	968,690	95,705	872,986	0
Makadara	214,792	219,697	104,380	115,317	0	282,336	309,953	348,347	192,048	156,300	0
Kasarani	351,690	179,565	49,076	128,776	1,713	225,047	243,060	266,548	90,294	174,541	1,713
Embakasi	618,490	208,115	45,519	160,122	2,473	347,622	437,751	584,855	182,078	400,304	2,473
Pumwani	229,777	140,120	7,796	130,819	1,505	170,945	181,277	193,160	14,345	177,310	1,505
Westlands	262,267	228,962	16,991	210,320	1,651	322,715	374,214	453,553	31,263	420,640	1,651
Dagoretti	300,044	146,799	10,027	135,329	1,442	206,831	239,788	290,550	18,450	270,658	1,442
Kibera	313,699	109,018	9,424	98,379	1,215	133,508	141,951	151,896	17,339	133,342	1,215
Others	1,384,871	238,834	-	-	-	346,500	500,100	814,400	-	-	-
Kiambu	531,905	84,838	-	-	-	115,800	158,700	244,600	-	-	-
Kiambaa	227,162	36,232	-	-	-	49,465	67,795	104,500	-	-	-
Githunguri	13,505	2,154	-	-	-	2,938	4,024	6,200	-	-	-
Limuru	76,991	12,280	-	-	-	16,760	22,969	35,400	-	-	-
Kikuyu	214,247	34,172	-	-	-	46,637	63,912	98,500	-	-	-
Thika	363,986	80,829	-	-	-	120,400	170,400	267,200	-	-	-
Kakuzi	8,995	1,998	-	-	-	2,975	4,210	6,600	-	-	-
Municipality	133,115	29,560	-	-	-	44,027	62,308	97,700	-	-	-
Riuru	221,876	49,271	-	-	-	73,398	103,882	162,900	-	-	-
Machakos	283,601	44,458	-	-	-	70,700	113,000	208,200	-	-	-
Kangundo	99,115	15,538	-	-	-	24,717	45,532	72,800	-	-	-
Matunguru	109,049	17,095	-	-	-	27,195	50,098	80,100	-	-	-
Mavoko	75,437	11,826	-	-	-	18,788	34,598	55,300	-	-	-
Kajiado	205,378	28,708	-	-	-	39,600	58,000	94,400	-	-	-
Ngong	176,335	24,649	-	-	-	33,988	54,166	81,000	-	-	-
Central	29,043	4,059	-	-	-	5,612	8,952	13,400	-	-	-

11.5.3 Enrolment

As shown in Table 11.5-6 educational enrollment was estimated by applying enrollment rates to age groups (6 to 14 years old, 15 to 18 years old, and 19 to 22 years old). Population by each age group was estimated also based on the CBS's forecast results of population projections by age group. As CBS's population forecast by age group was made only up to 2010 for district level, the same constitution rates were applied to estimate the population by age group and by district up to 2025.

Future educational enrollment rates were assumed to increase judging from statistical data. As enrollment rates considerably differ by district, level future enrollment was estimated by applying a regression model.

TABLE 11.5-6 ENROLMENT IN NAIROBI METROPOLITAN AREA (2004-2025)

	1999	2002	2003	2004 (est.)	2010	2015	2025
Kenya							
Population	28,686,607	31,517,142	32,165,328	32,808,269	36,508,255	39,714,908	46,333,333
Educational base population	12,182,409	13,232,699	13,446,773	13,656,313	14,853,111	15,583,897	17,361,717
Age (a)	7,153,216	7,666,823	7,773,342	7,876,572	8,249,808	8,683,413	9,540,671
Age group (15-18) (b)	2,684,613	2,921,722	2,964,350	3,005,775	3,495,590	3,466,817	4,061,807
Age group (19-22) (c)	2,344,580	2,644,154	2,709,080	2,773,965	3,107,712	3,433,667	3,759,239
Enrolment	6,838,749	7,018,949	8,138,565				
Primary school (d)	6,064,100	6,131,000	7,208,100	7,325,200	7,754,800	8,249,200	9,159,000
Enrolment rate to educational base population (d/a)	0.848	0.800	0.927	0.930	0.940	0.950	0.960
Secondary school (e)	724,758	819,227	862,907	881,200	1,125,600	1,199,700	1,600,800
Enrolment rate to educational base population (e/b)	0.270	0.280	0.291	0.293	0.322	0.346	0.394
University (f)	49,891	68,722	67,558	75,100	105,700	136,600	192,900
Enrolment rate to educational base population (f/c)	0.021	0.026	0.025	0.027	0.034	0.040	0.051
Nairobi Metropolitan Area							
Population	3,229,624	3,694,963	3,864,524	4,041,868	4,736,200	5,423,800	6,960,700
Educational base population	1,193,889	1,399,313	1,466,168	1,532,195	1,776,100	2,013,900	2,568,600
Age group (6-14)	579,128	702,454	735,720	768,230	879,800	981,000	1,246,000
Age group (15-18)	274,021	316,701	332,927	349,077	412,700	456,600	584,700
Age group (19-22)	340,741	380,157	397,521	414,888	483,600	576,300	737,900
Enrolment	609,139	701,749	832,576	873,270	1,035,000	1,187,400	1,581,474
Primary school	490,952	561,738	682,222	714,454	827,000	931,900	1,196,100
Secondary school	73,977	88,800	96,913	102,333	132,900	158,000	230,474
University and other institutions	44,210	51,211	53,441	56,483	75,100	97,500	154,900
Nairobi							
Population	2,143,254	2,470,850	2,563,297	2,656,997	3,078,500	3,389,900	4,176,400
Educational base population	746,836	877,901	910,466	943,408	1,089,700	1,203,400	1,482,600
Age group (6-14)	328,450	405,709	421,095	436,652	506,000	559,300	689,100
Age group (15-18)	172,453	195,229	202,750	210,377	245,100	271,200	334,100
Age group (19-22)	245,934	276,964	286,622	296,378	338,600	372,900	459,400
Enrolment	365,173	425,024	497,403	517,825	619,700	706,400	919,474
Primary school	278,441	324,437	390,474	406,087	475,600	531,300	661,500
Secondary school	46,557	54,741	59,019	61,673	78,900	93,800	131,674
University and other institutions	40,175	45,846	47,910	50,065	65,200	81,300	126,300
(outflow of trainees and students from Nairobi City)				(7,666)			(26,300)
Others							
Population	1,086,370	1,224,113	1,301,227	1,384,871	1,657,700	2,033,900	2,784,300
Educational base population	447,053	521,412	555,702	588,787	686,400	810,500	1,086,000
Age group (6-14)	250,678	296,746	314,625	331,577	373,800	421,700	556,900
Age group (15-18)	101,568	121,472	130,177	138,700	167,600	185,400	250,600
Age group (19-22)	94,807	103,194	110,899	118,510	145,000	203,400	278,500
Enrolment	243,966	276,725	335,172	355,445	415,300	481,000	662,000
Primary school	212,511	237,302	291,747	308,367	351,400	400,600	534,600
Secondary school	27,420	34,060	37,894	40,660	54,000	64,200	98,800
University and other institutions	4,035	5,364	5,531	6,418	9,900	16,200	28,600
Kiambu							
Population	443,606	482,658	506,526	531,902	574,800	663,800	836,100
Educational base population	175,008	201,546	210,383	219,737	229,700	258,900	326,000
Age group (6-14)	94,750	112,357	116,548	120,955	121,400	132,800	167,200
Age group (15-18)	40,487	47,693	50,084	52,627	57,100	59,700	75,200
Age group (19-22)	39,771	41,497	43,751	46,155	51,200	66,400	83,600
Enrolment	92,947	105,379	124,834	130,416	136,000	152,200	198,700
Primary school	80,324	89,849	108,073	112,488	114,100	126,200	160,500
Secondary school	10,930	13,373	14,579	15,428	18,400	20,700	29,600
University and other institutions	1,693	2,157	2,182	2,499	3,500	5,300	8,600
Thika							
Population	266,173	313,067	337,412	363,994	483,900	626,000	913,500
Educational base population	108,791	130,778	140,198	150,432	193,500	244,100	356,300
Age group (6-14)	59,886	72,922	77,685	82,826	102,300	125,200	182,700
Age group (15-18)	24,453	30,946	33,375	36,028	48,100	56,300	82,200
Age group (19-22)	24,451	26,910	29,137	31,578	43,100	62,600	91,400
Enrolment	58,410	68,390	83,205	89,300	114,600	143,400	217,200
Primary school	50,768	58,314	72,036	77,028	96,200	118,900	175,400
Secondary school	6,602	8,677	9,715	10,562	15,500	19,500	32,400
University and other institutions	1,041	1,399	1,453	1,710	2,900	5,000	9,400
Machokos							
Population	239,905	258,143	270,366	283,599	377,000	487,800	711,800
Educational base population	106,107	110,964	120,153	126,131	168,500	202,400	277,700
Age group (6-14)	62,548	65,506	70,582	73,771	96,000	107,300	142,400
Age group (15-18)	24,538	25,524	27,802	29,354	40,600	46,300	64,100
Age group (19-22)	19,021	19,933	21,770	23,005	31,900	48,800	71,200
Enrolment	60,459	60,577	74,628	78,458	105,500	121,800	169,300
Primary school	53,025	52,384	65,449	68,607	90,200	101,900	136,700
Secondary school	6,624	7,157	8,093	8,605	13,100	16,000	25,300
University and other institutions	810	1,036	1,086	1,246	2,200	3,900	7,300
Kajiado							
Population	136,686	170,245	186,923	205,376	222,000	256,300	322,900
Educational base population	57,148	78,124	84,969	92,487	94,700	105,100	126,000
Age group (6-14)	33,494	45,961	49,810	54,026	54,100	56,400	64,600
Age group (15-18)	12,090	17,310	18,917	20,690	21,800	23,100	29,100
Age group (19-22)	11,564	14,853	16,241	17,772	18,800	25,600	32,300
Enrolment	32,150	42,380	52,505	57,272	59,200	63,600	76,800
Primary school	28,394	36,754	46,188	50,244	50,900	53,600	62,000
Secondary school	3,264	4,854	5,507	6,065	7,000	8,000	11,500
University and other institutions	492	772	810	962	1,300	2,000	3,300

TABLE 11.5-7 ENROLMENT BY DIVISION IN NAIROBI METROPOLITAN AREA (2004-2025)

Population 2004 Pupils/students at study place

	Population 2004 (pers.)	2004 Total (pers.)	2010 Total	2010 Primary	2010 Secondary	2010 University/ others	2015 Total	2015 Primary	2015 Secondary	2015 University/ others	2025 Total	2025 Primary	2025 Secondary	2025 University/ others
Nairobi (residents only)	2,656,997	517,825	619,700	475,600	78,900	65,200	706,400	531,300	93,800	81,300	919,474	661,500	131,674	100,000
Central	366,239	109,835		55,200				54,200				53,900		
Makadara	214,792	43,062		32,400				31,900				31,700		
Kasarani	351,690	82,626		64,500				73,200				93,300		
Embakasi	618,490	76,033		126,700				153,000				211,500		
Pumwani	229,777	44,207		35,100				34,800				35,300		
Westlands	262,267	55,878		48,200				54,800				70,000		
Dagoretti	300,044	53,826		55,400				63,100				80,800		
Kibera	313,699	52,357		58,100				66,300				85,100		
Others	1,384,871													
Kiambu	531,905	130,416	136,000	114,100	18,400	3,500	152,200	126,200	20,700	5,300	198,700	160,500	29,600	8,600
Kiambaa	227,162			48,700				53,900				68,500		
Githunguri	13,505			2,900				3,200				4,100		
Limuru	76,991			16,500				18,300				23,200		
Kikuyu	214,247			46,000				50,800				64,700		
Thika	363,986	89,300	114,600	96,200	15,500	2,900	143,400	118,900	19,500	5,000	217,200	175,400	32,400	9,400
Kakuzi	8,995			1,900				2,900				4,300		
Municipality	133,115			35,200				43,500				64,200		
Riuru	221,876			59,100				72,500				106,900		
Machakos	283,601	78,458	105,500	90,200	13,100	2,200	121,800	101,900	16,000	3,900	169,300	136,700	25,300	7,300
Kangundo	99,115			31,500				35,600				50,000		
Matunguru	109,049			34,500				39,200				50,000		
Mavoko	75,437			24,200				27,100				40,000		
Kajiado	205,378	57,272	59,200	50,900	7,000	1,300	63,600	53,600	8,000	2,000	76,800	62,000	11,500	3,300
Ngong	176,335			43,700				46,000				53,200		
Central	29,043			7,200				7,600				8,800		

Enrollment by division within Nairobi City was estimated by considering the present enrollment by division, which was derived from the Person Trip Survey and future urban structure under total enrollment in Nairobi City as a control total, as well as future location of educational facilities in the surrounding districts (See Table 11.5-6).

Enrollment itself and the break down of divisions by age group for intermediate years were made basically by an interpolation method between 2004 and 2025 with the total enrollment in Nairobi City by age group as a control total (See Table 11.5-7).

11.6   HOUSEHOLD INCOME AND VEHICLE OWNERSHIP

11.6.1 Household Income

Household income in Nairobi City was estimated to be 1.81 times larger than that for 2025 as shown in Section 11.4. Past data revealed that car ownership has increased proportionally to the population increase in Nairobi City, the fact that real household income increase at constant price basis was almost nil. It means that the conventional elasticity method is not applicable for future car ownership forecast. Consequently, the cross sectional analysis of car ownership by income level derived from Person Trip Survey was applied for future car ownership forecast.

11.6.2 Household Car Ownership Rate

(1) Modelling Household Car Ownership Rate

Household car ownership correlates highly with household income in this case. Based on the Person Trip Survey data, the average household car ownership rate in 2004 was 23.3%, while the average household income was Ksh 32,600 per month.
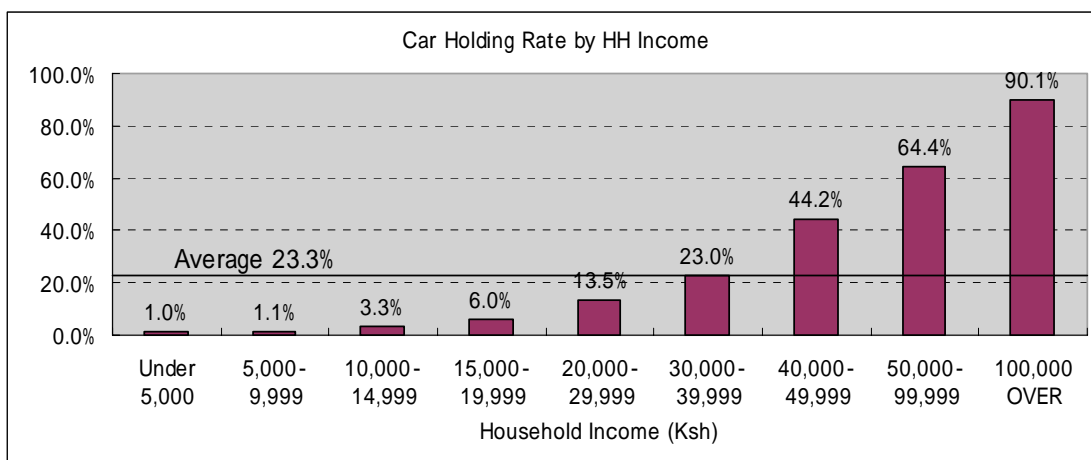

FIGURE 11.6-1 CAR OWNERSHIP RATE BY HOUSEHOLD INCOME

The relationship between household car ownership and income is shown in Figure 11.6-2. The model is express in the following function:

Rate_Car = 0.0202 * Income^2 – 0.0944 * Income + 0.1067

Where,

       Rate_Car: Household Car Ownership Rate

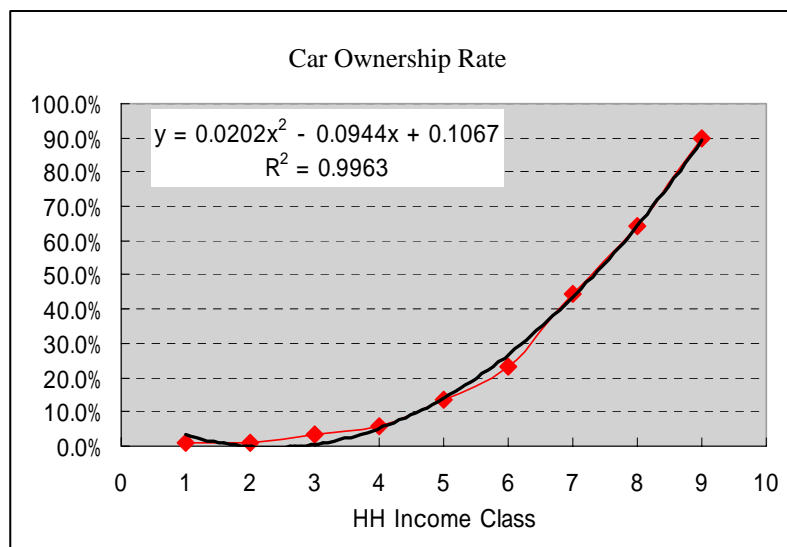   Income: Household Income Class

FIGURE 11.6-2 HOUSEHOLD CAR OWNERSHIP RATE MODEL

(2) Forecasting Future Household Car Ownership Rate

As shown in Table 11.6-1, forecasting the future household car ownership rate using the above function and the future household income indicates a steady increase from 23.3% in 2004, to 31.1% in 2010, 41.3% in 2015, and 49.2% in 2025, the target year of the Master Plan.

TABLE 11.6-1 FUTUTE HOUSEHOLD CAR OWNERSHIP RATE

	Year 2004	Year 2010	Year 2015	Year 2025
GRDP per Capita (Nairobi)	19,040	22,080	25,590	34,390
(at 1982 Constant Prices)	(1.00)	(1.16)	(1.34)	(1.81)
GRDP per Household (Nairobi)	32,600	37,805	43,815	58,882
(at 2004 Constant Prices)	(1.00)	(1.16)	(1.34)	(1.81)
Population Age 5 & Above	2,143,254	2,540,716	2,834,559	3,507,666
Number of Household	889,317	1,054,239	1,176,166	1,455,463
Car Ownership Rate per Household	23.3%	31.1%	41.3%	49.2%
Number of Private Car	207,339	327,366	486,207	716,138
	(1.00)	(1.58)	(2.35)	(3.45)