CHAPTER 30

IMPROVEMENT OF BUS/MATATU TRANSPORT SYSTEM

CHAPTER 30 IMPROVEMENT OF BUS/MATATU TRANSPORT SYSTEM

30.1 STUDY APPROACH

(1) Study Approach

Planning concept of the public transport plan in the Nairobi Transport Master Plan is explained this way: From the current limited modal choice develop the urban transport environment with wide variety of modal selection to the Nairobi Metropolitan citizens. Based on this, the public transport plan is to restructure the public transport system including the introduction of larger capacity public transport mode into the major roads, introduction of shuttle public transport system into the city center and shift the matatu to the suburban feeder system, etc. For the short term plan, the urgent, relatively small cost and effective countermeasure is taken into considerations such as bus/matatu corridor improvement and traffic management, and mode interchange area improvement. At the same time the traffic safety and regulation educations, and considerations of institutional and financial, and urban/social environmental aspects are also studied.

Working procedure of this study is shown in Figure 30.1-1. The study is divided into the following five sections:

1) Basic Considerations and Selected Studies/Projects（refer to Section 30.1）
2) Existing Analysis and Problems/Issues（refer to Section 30.2）
3) Studies of Small Scale Improvement/Management Measures (refer to Sections 30.3, 30.4, 30.5 and 30.6)
4) Study for the Cost Estimate, Economic and Financial Analysis and Implementation Schedule (refer to Section 30.7, 30.8 and 30.9)
5) Study for the Traffic Safety/Regulation Education of the Public Transport (refer to Section 30.10)
6) Study for the Urban/Social Environment, Institutional and Financial Considerations for the Implementation (refer to Section 30.11 and 30.12)

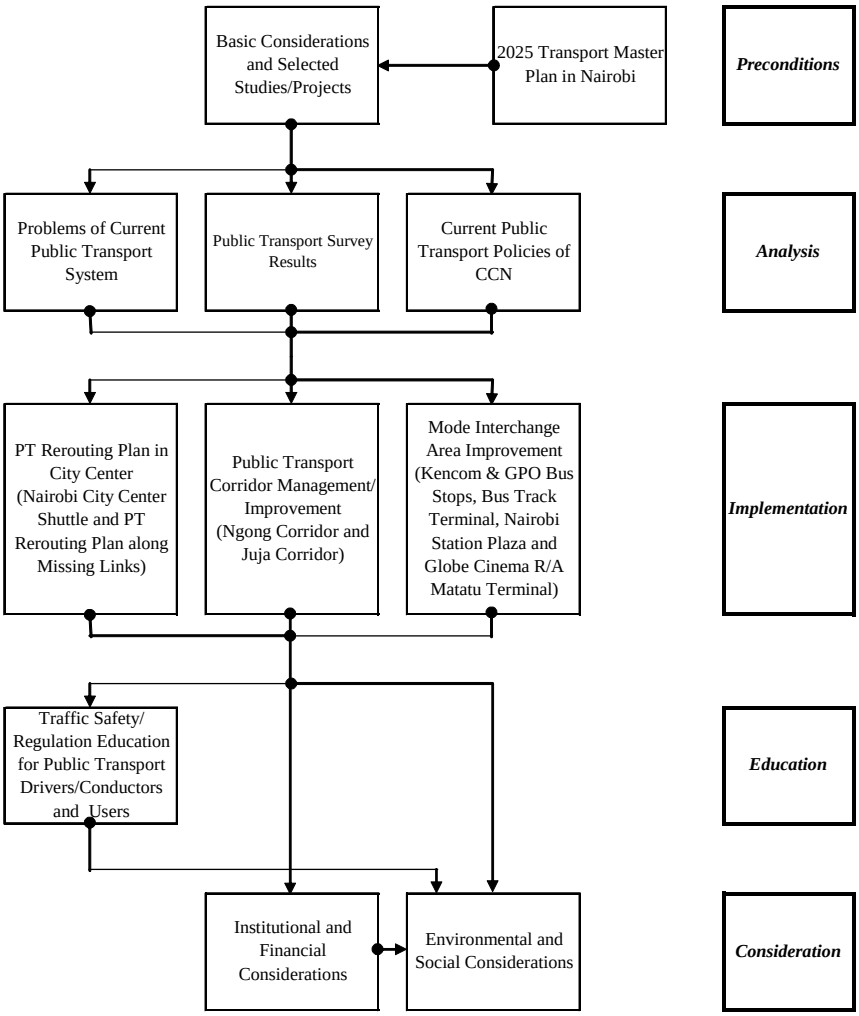


FIGURE 30.1-1 WORKING PROCEDURE AND STRUCTURE OF THE STUDY

(2) Selected Studies/Projects for the Second Phase of the Master Plan

Basic considerations of the Second Stage Study are as follows:

1) Second Stage Study is in line with the Master Plan
   - Improvement/management of public transport corridors
   - Introduction of larger size of public transport modes than matatus along major public transport corridors
   - Preparation of various kind of public transport modes such as shuttle bus in the city center
   - Introduction of new public transport routes into the newly constructed roads such as missing links
   - Strengthening the mode interchange area
   - Traffic safety/regulation education for drivers, conductors and users of the public transport

- Institutional, financial and environmental considerations for the implementation of the proposed measures of the public transport system improvement

2) Urgent, relatively small scale cost and direct-effect measures are selected
3) The outputs of the study are good lessons for capability-building of Kenyan planners and engineers

Based on above, the following studies/projects are selected in this study

1) Bus/Matatu Rerouting Plan in the City Center
   a) Proposed Shuttle Bus System in City Center
   b) Public Transport Rerouting Plan along Missing Links
2) Corridor Management/Improvement along Juja Corridor and Ngong Corridor
3) Mode Interchange Area (MIA) Improvement
   Study MIA: Nairobi Station, Bus Track Terminal, Kencom Bus Stop, GPO Bus Stop and Globe Cinema Terminal.
4) Traffic Safety/Regulation Education for Public Transport Drivers, Conductors and Users
5) Institutional, Financial and Environmental/Social Considerations

Location of selected projects is shown in Figure 30.1-2.

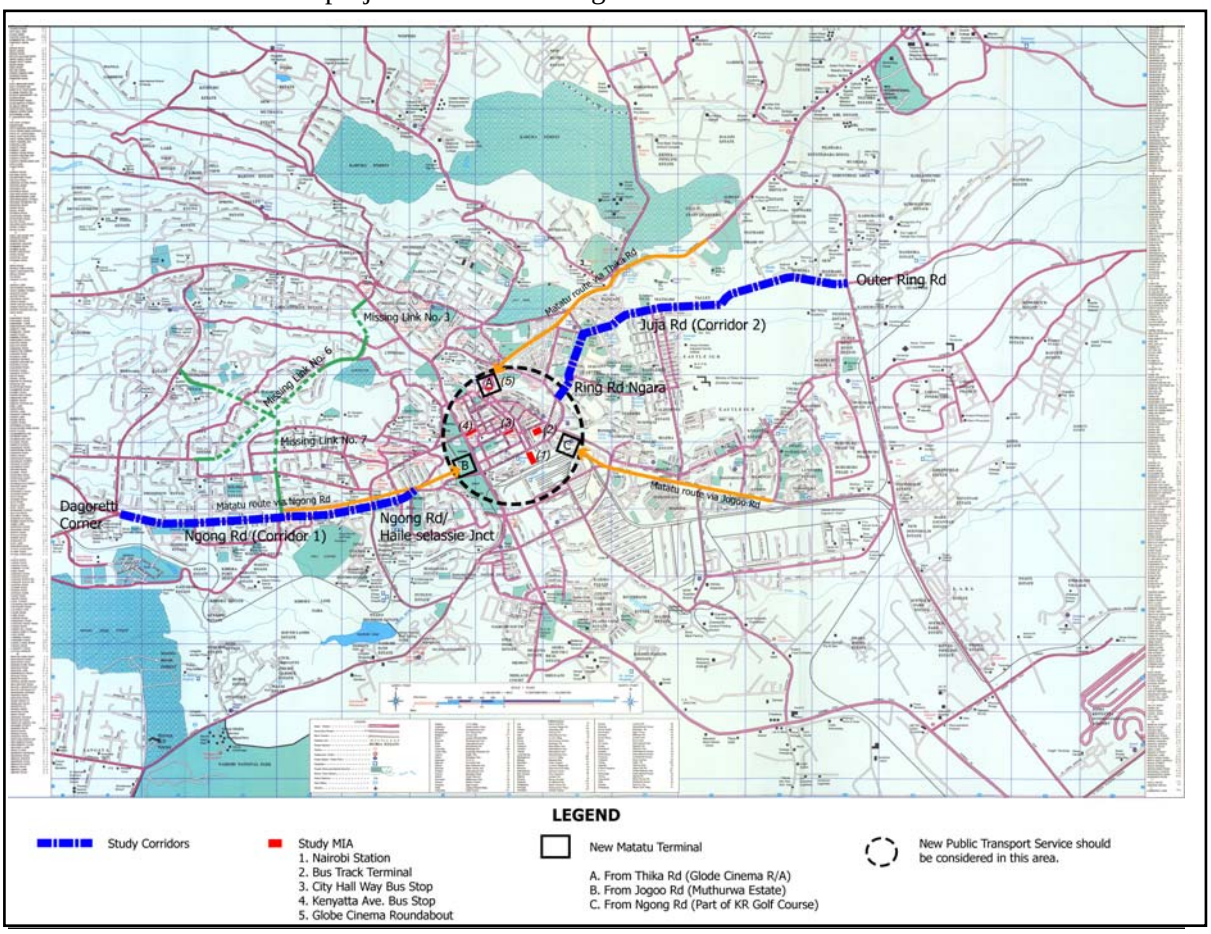


FIGURE 30.1-2 LOCATION OF SELECTED PROJECTS

30.2 PRESENT CONDITIONS AND PROBLEMS

30.2.1 From the Previous Year's Study

The existing problems and issues facing the Nairobi metropolitan area have been identified by the previous year's study as follows.

(1) Bus/matatu services are business-oriented operation considering that all of the operators are privately owned. There is no provision of basic public transport services, such as comfort, convenience and safety.

(2) Passengers passing through CBD by matatu need transfer, because most of the matatu routes have their origin/destination at CBD.

(3) More than 80% of total public transport along trunk roads consists of small matatu. This is not an effective use of the limited urban infrastructure and causes traffic congestion and traffic accidents.

(4) Public transport user's dissatisfaction (from a public transport user's interview)
   1) Bus (mainly Bus Track)
      - Lack of punctuality of operational schedule
      - Expensive fare
      - Air pollution
      - Noisy
      - Poor bus stop facility
   2) Matatu
      - Long travel time
      - Long waiting time at bus/matatu stop
      - Lack of punctuality of operational schedule
      - Late first matatu and early last matatu
      - Lack of safety at bus/matatu stop
      - Expensive fare
      - Poor feeder system
      - Noisy

30.2.2 Summary of the Public Transport Survey

Following are the Public Transport Surveys conducted to obtain useful data for the improvement of the public transport system.

(1) Analysis of the public transport route structure
(2) Public transport on-board survey
(3) Public transport operational survey
(4) Inventory survey of the public transport related facilities

Survey location is shown in Figure 30.2-1 and major findings from the survey results are as follows:

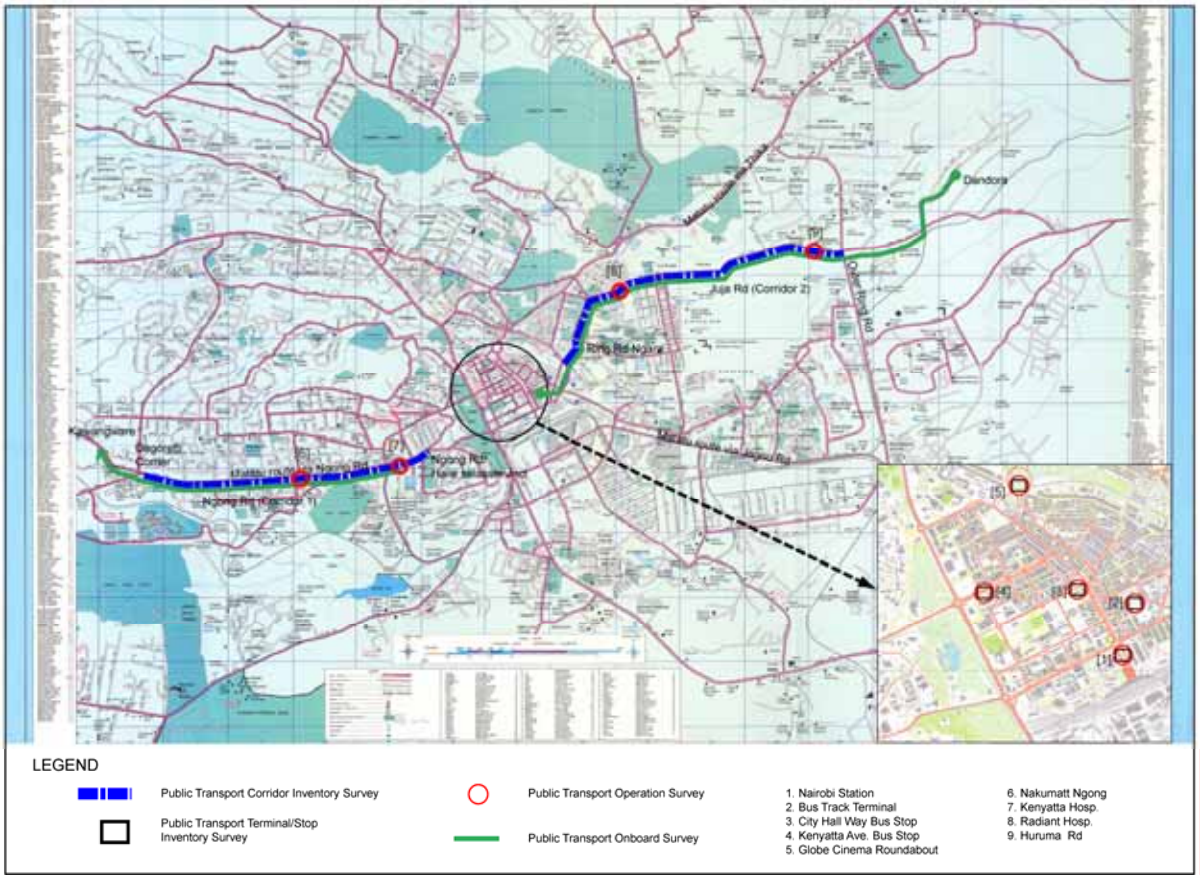


FIGURE 30.2-1 SURVEY LOCATION

(1) Analysis of the Public Transport Route Structure

The bus and matatu route structures have already been analyzed in the Master Plan stage. Main changes of the bus and matatu transport system in the past year are: 1) stop of operation of Metro Shuttle, 2) rapid growth of Citi Poppa buses which currently numbered to 100 from 4 last April 2004, and 3) matatu route along Thika Road was cut at the Globe Cinema Roundabout. However, basic route structure remains as it is. Buses have east-west routes and are radial, passing through the city center while matatu have a radial pattern route structure and its origin/destination is in the city center.

Bus and matatu route structures are shown in Figures 30.2-2 and 30.2-3, respectively.

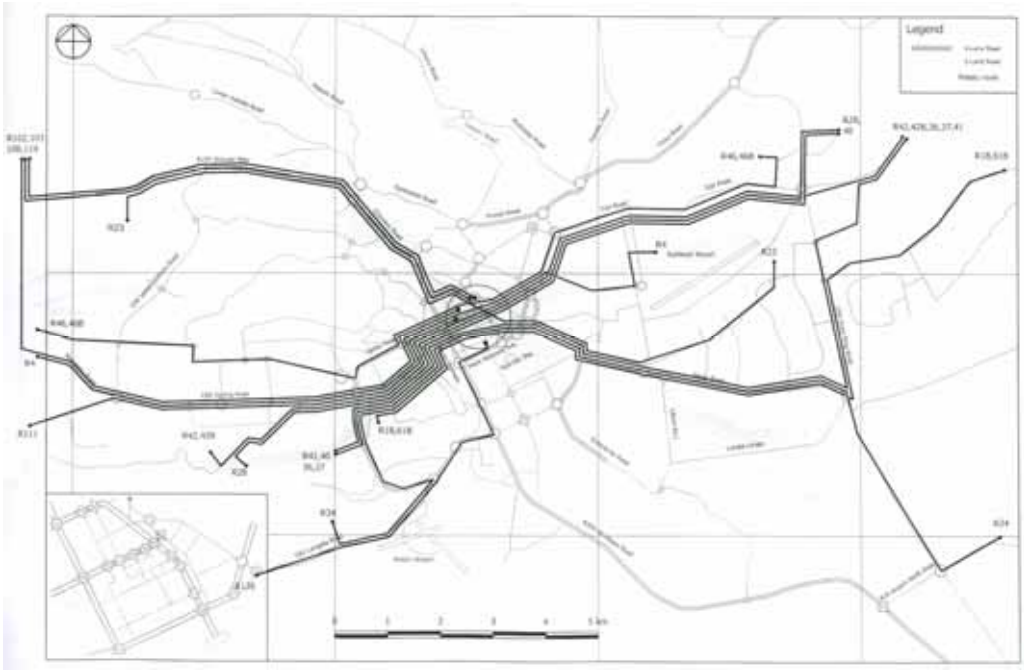


FIGURE 30.2-2 BUS ROUTE STRUCTURE

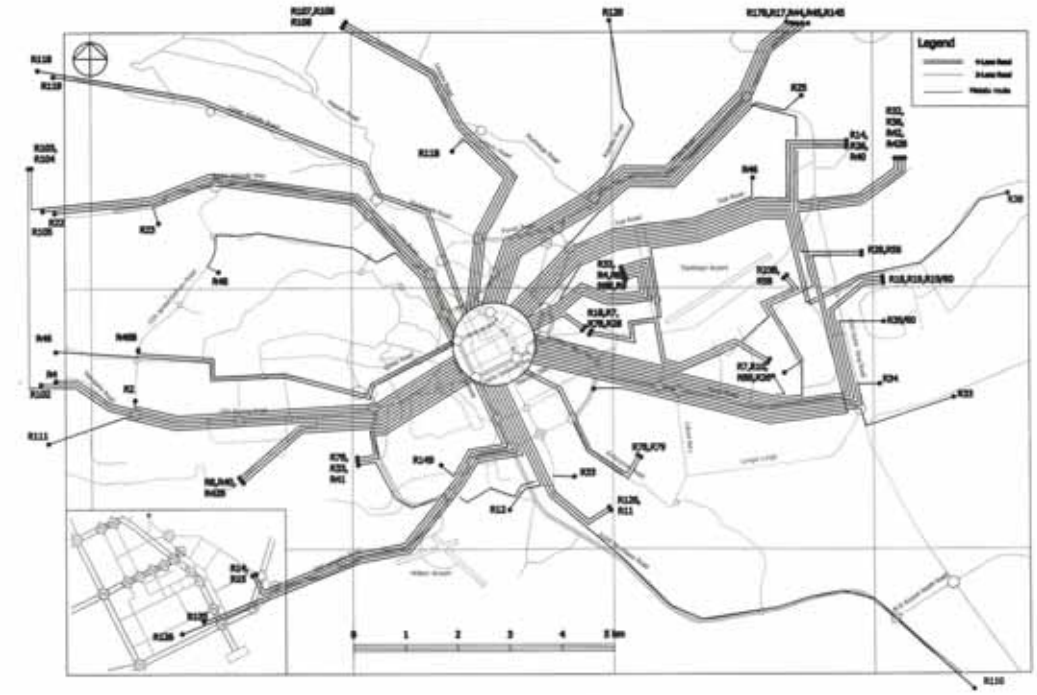


FIGURE 30.2-3 MATATU ROUTE STRUCTURE

(2) Terminal Traffic Count Survey

The purpose of this survey is to obtain the basic data for improvement plan of each terminal/stop based on the analysis of in and out flow traffic of these terminals/stops.
Survey method and surveyed terminals/stops are as follows:

1) Survey Method
   - 12-hour traffic count (6:30-18:30)
   - Maximum occupancy or maximum queue length
   - Average terminal time

2) Surveyed Terminal/stop
   - Nairobi Station
   - Bus Track Terminal
   - Kencom Bus Stop
   - GPO Bus Stop
   - Globe Cinema Roundabout Matatu Terminal

Survey results are summarized in Table 30.2-1 and major findings are as follows:

1) In and out traffic volume to/from Nairobi Station is 4,092 vehicles/12 hours and this volume is the largest among the 5 terminals/stops. The smallest is recorded at Bus Track Terminal (163 vehicles/12 hours).

2) Many illegal private cars at the bus bay can be seen at GPO Bus Stop (10% out of total stopping vehicles).
3) Maximum occupancy can be seen in Globe Cinema (94 vehicles).
4) Bus queue reaches a maximum of 23 buses, which are seen waiting at the vacant bus stop at Kencom Bus Stop along Moi Avenue. This largely affects the vehicular traffic along Moi Avenue.
5) Average terminal times are 1.6 – 5.8 minutes (peak hour) and 7.9 – 40 minutes (off-peak hour). Waiting time at off-peak hour tends to stretch longer than that at peak hour.

TABLE 30.2-1 TERMINAL TRAFFIC COUNT SUMMARY

Items		Unit	Nairobi Station		Bus Track		Kencom		GPO		Globe Cinema	
12-hour Traffic Volume		veh./12-hour	4,069	100.0%	159	100.0%	2,219	100.0%	1,513	100.0%	3,228	100.0%
By Type	Bus Track /Other Bus	veh./12-hour	24	0.6%	147	92.5%	1,569	70.7%	1,042	68.9%	0	0.0%
	Citi Hoppa	veh./12-hour	306	7.5%	0	0.0%	615	27.7%	331	21.9%	0	0.0%
	Big Matatu	veh./12-hour	861	21.2%	0	0.0%	0	0.0%	0	0.0%	1,212	37.5%
	Small Matatu	veh./12-hour	2,330	57.3%	0	0.0%	0	0.0%	0	0.0%	1,932	59.9%
	Others	veh./12-hour	548	13.5%	12	7.5%	35	1.6%	140	9.3%	84	2.6%
Inflow Peak Hour Traffic Volume		veh./hour	244		12		133		98		198	
Maximum Occupancy *1		veh.	**87**		**11**		**23**		**5**		**94**	
Average Terminal Time	Peak	min.	5.8		N.A.		4.4		1.6		5	
	Off-peak	min.	21.1		N.A.		16.2		7.9		40	

Note: *1 Figures in Kencom and GPO are number of queuing buses
N.A Not available

(3) Public Transport On-board Survey

To obtain the operational characteristics of buses and matatus, on-board survey was conducted along Ngong Road and Juja Road. The survey results are shown in Figures 30.2-4 and 30.2-5.

Many matatus stop at non-designated bus/matatu stops, especially along Juja Road, to allow passengers to board/alight. This causes the serious traffic congestions and poses risk to the safety of public transport users.

The average operating speed along surveyed corridors is approximately 24 km/hour (17 km/hour – 31 km/hour).

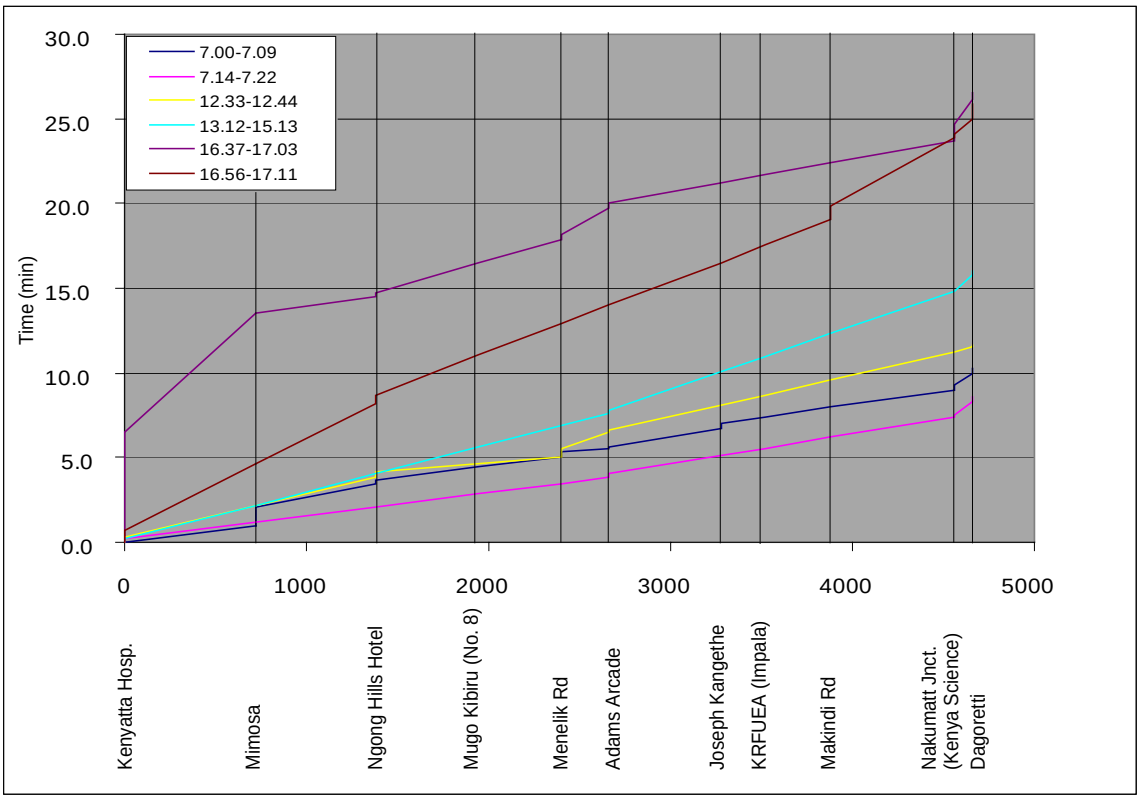


FIGURE 30.2-4 (1) ON-BOARD SURVEY RESULT (NGONG ROAD: FROM CITY CENTER TO NGONG)

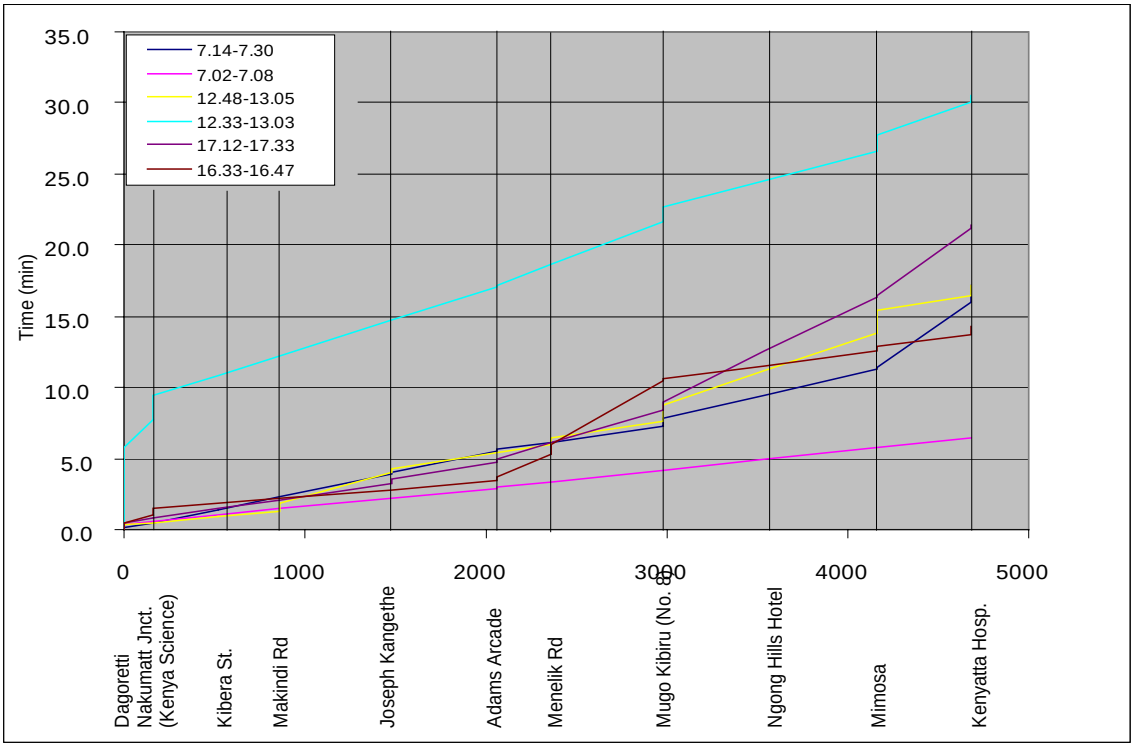


FIGURE 30.2-4 (2) ON-BOARD SURVEY RESULT (NGONG ROAD: FROM NGONG TO CITY CENTER)

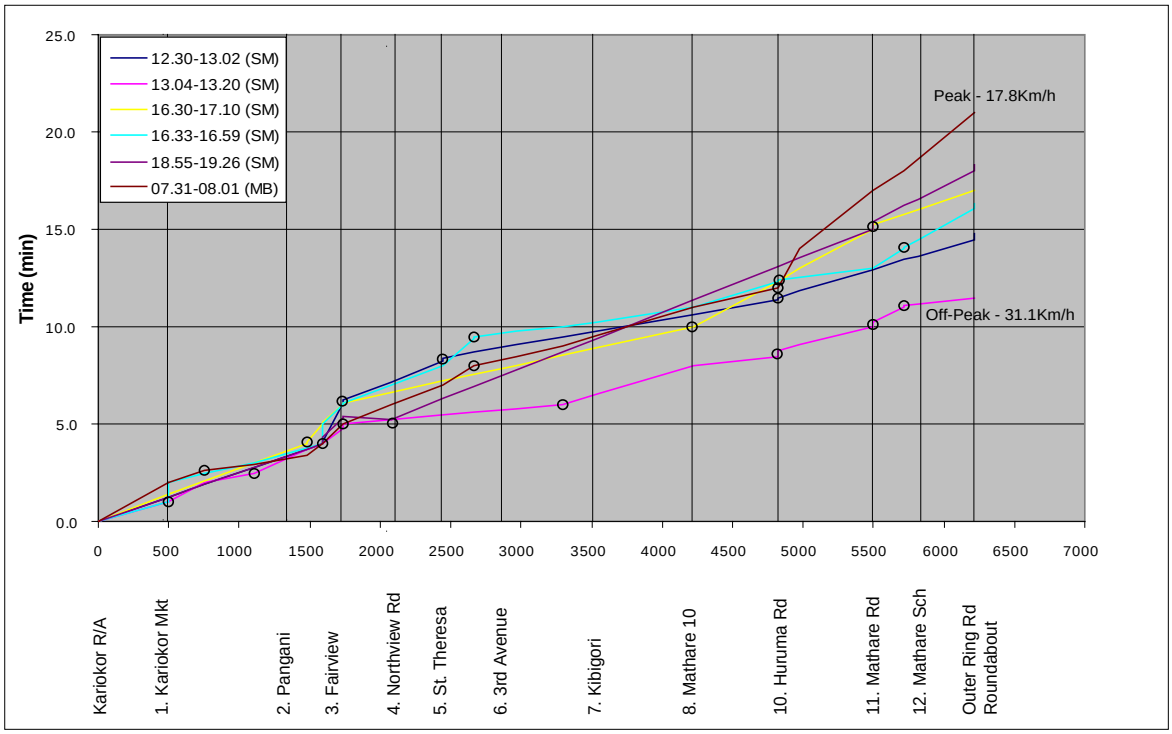


FIGURE 30.2-5 (1) ON-BOARD SURVEY RESULT (JUJA ROAD: FROM CITY CENTER TO DANDORA)

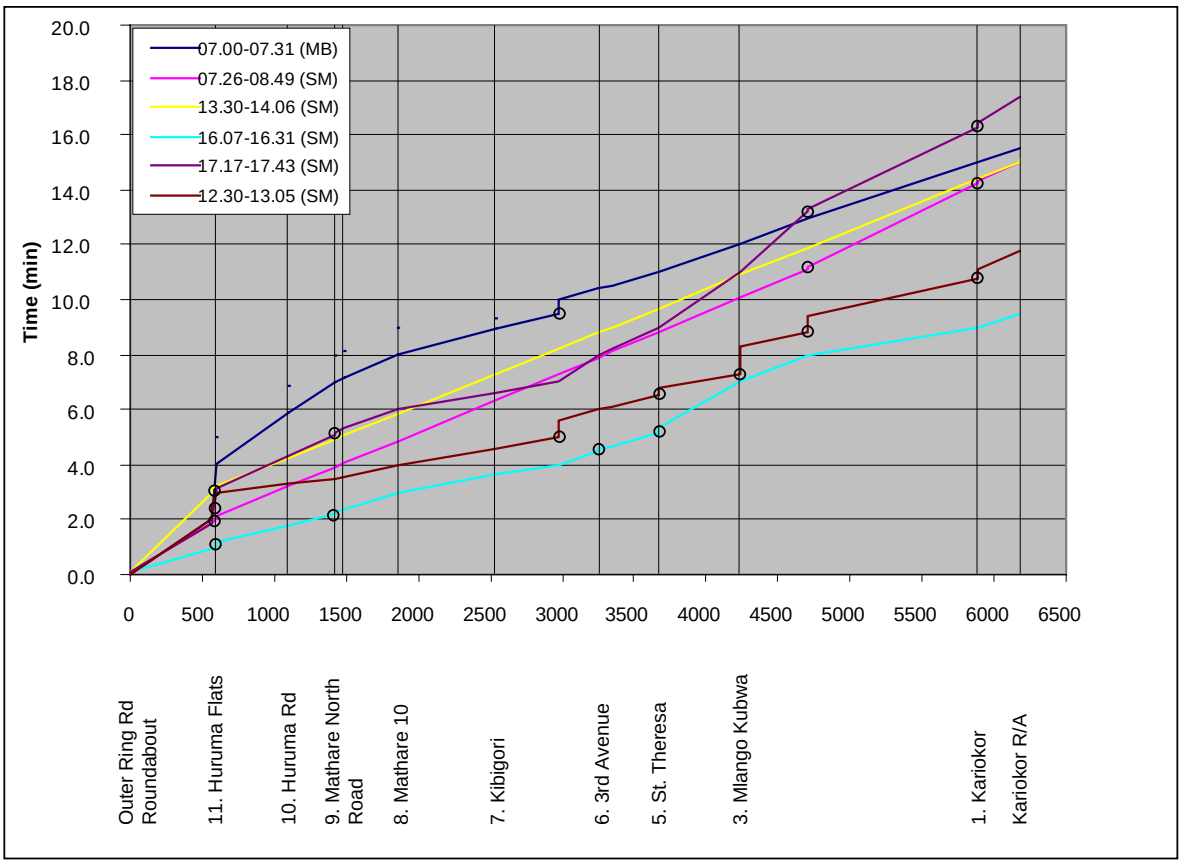


FIGURE 30.2-5 (2) ON-BOARD SURVEY RESULT (JUJA ROAD: FROM DANDORA TO CITY CENTER)

(4) Public Transport Operational Survey

The number of boarding/alighting passengers and the time it takes for them to board/alight were surveyed at major 4 bus/matatu stops along Ngong Road and Juja Road. Survey results are summarized in Tables 30.2-2 and 30.2-3.

Major findings are as follows:

1) Average boarding/alighting time at normal bus stops such as Kenyatta Hospital (to town), Nakumatt Ngong (to town) and Radient Hospital (to/from town) is 2 – 6 seconds/ passenger.
2) Average boarding/alighting time at bus stops such as Kenyatta Hospital (from town), Nakumatt Ngong (from town) and Radient Hospital (to/from town) is relatively long. Because these bus stops are located near a large-scale development (supermarket) and at the interchange point with another route.
3) Boarding/alighting time during peak hour is shorter than off-peak hour's.

TABLE 30.2-2 BOARDING/ALIGHTING TIME AT BUS STOP (NGONG ROAD: KENYATTA HOSPITAL AND NGONG NAKUMATT)

Direction	Mode	Ngong Road											
		Kenyatta Hospital						Nakumatt Ngong					
		Peak			Off-peak			Peak			Off-peak		
		Ave. Stopping Time (sec.)	Ave. B/A Pax (persons)	Stop Time/ Pax (sec./ person)	Ave. Stopping Time (sec.)	Ave. B/A Pax (persons)	Stop Time/ Pax (sec./ person)	Ave. Stopping Time (sec.)	Ave. B/A Pax (persons)	Stop Time/ Pax (sec./ person)	Ave. Stopping Time (sec.)	Ave. B/A Pax (persons)	Stop Time/ Pax (sec./ person)
To Town	Bus	21.93	7.81	2.81	22.50	4.29	5.24	4.11	1.53	2.69	7.16	1.27	5.64
	Citi Poppa	21.99	6.33	3.47	23.68	4.63	5.11	13.63	2.60	5.24	9.70	1.50	6.47
	Metro Shuttle	18.70	7.08	2.64	25.46	3.79	6.72	38.40	1.00	38.40			
	Big Matatu	19.39	6.24	3.11	18.26	4.09	4.46	10.99	2.73	4.03	8.27	1.83	4.52
	Small Matatu	19.04	4.12	4.62	22.35	2.81	7.95	15.63	2.14	7.30	7.70	1.18	6.53
	Total Average	20.36	5.69	3.58	22.17	3.56	6.23	13.20	2.22	5.95	7.94	1.33	5.97
From Town	Bus	46.70	3.69	12.66	27.97	3.75	7.46						
	Citi Poppa	41.80	2.13	19.62	30.09	3.62	8.31						
	Metro Shuttle	46.00	2.00	23.00									
	Big Matatu	44.04	2.47	17.83	39.75	2.82	14.10						
	Small Matatu	31.54	2.80	11.26	36.10	2.42	14.92						
	Total Average	40.10	2.86	14.02	34.43	3.11	11.07	94.63	4.48	21.12	87.03	2.73	31.88

TABLE 30.2-3 BOARDING/ALIGHTING TIME AT BUS STOP (JUJA ROAD: RADIENT HOSPITAL AND HURUMA ROAD)

Direction	Mode	Juja Road											
		Radiant Hospital						Huruma Road					
		Peak			Off-peak			Peak			Off-peak		
		Ave. Stopping Time (sec.)	Ave. B/A Pax (persons)	Stop Time/ Pax (sec./ person)	Ave. Stopping Time (sec.)	Ave. B/A Pax (persons)	Stop Time/ Pax (sec./ person)	Ave. Stopping Time (sec.)	Ave. B/A Pax (persons)	Stop Time/ Pax (sec./ person)	Ave. Stopping Time (sec.)	Ave. B/A Pax (persons)	Stop Time/ Pax (sec./ person)
To Town	Bus				3.00	1.00	3.00	12.55	0.74	16.96	40.50	0.30	135.00
	Big Matatu	3.89	1.80	2.16	2.20	1.50	1.47	24.36	1.03	23.65	43.10	0.90	47.89
	Small Matatu	3.57	1.47	2.43	2.80	1.60	1.75	16.26	0.93	17.48	32.70	0.50	65.40
	Total Average	3.64	1.70	2.14	2.50	1.60	1.56	22.58	0.91	24.81	41.00	0.70	58.57
From Town	Bus	9.50	4.50	2.11				30.20	0.39	77.44	18.29	1.21	15.12
	Big Matatu	4.43	1.96	2.26	18.80	1.70	11.06	34.14	2.55	13.39	30.21	1.36	22.21
	Small Matatu	13.59	2.90	4.69	66.90	1.00	66.90	35.02	2.50	14.01	27.82	1.10	25.29
	Total Average	6.76	2.22	3.05	24.70	1.70	14.53	34.09	2.32	14.69	28.45	1.25	22.76

(5) Inventory Survey of the Public Transport Related Facilities

To obtain the existing conditions and characteristics as a mode interchange area, inventory survey of the selected 5 terminals/stops is conducted. Survey results are presented in Section 30.5.

30.2.3 Current Public Transport Policies of the City Council of Nairobi (CCN)

The implementation of matatu route-cut at the CBD fringe along the major public transport corridors such as Thika Road is started by the CCN because of the deterioration of not only the traffic conditions but also urban activities due to the rapid increase of the vehicular traffic and public transport demand. As a concrete step, it is proposed to develop three new matatu terminals at major public transport corridors and to cut the matatu routes at the CBD fringes as follows.

(1) Matatu terminal at Globe Cinema Roundabout and cut the matatu routes to/from Thika Road at this terminal (this has already been implemented and currently in operation).

(2) Matatu terminal is proposed at the Presidential Pavilion near Uhuru Park and cut the matatu routes to/from Ngong Road at this terminal. The site of this proposed terminal is owned by the central government. Therefore, coordination should be carefully considered with the Office of the President.

(3) Matatu terminal is proposed in the Muthurwa Estate and cut the matatu routes to/from Jogoo Road and Enterprise Road at this terminal. This proposed terminal locates in the Kenya Railways property. Therefore, coordination should be carefully considered with the Kenya Railways.

Location of new and proposed matatu terminals at the CBD fringe is illustrated in Figure 30.2-6.

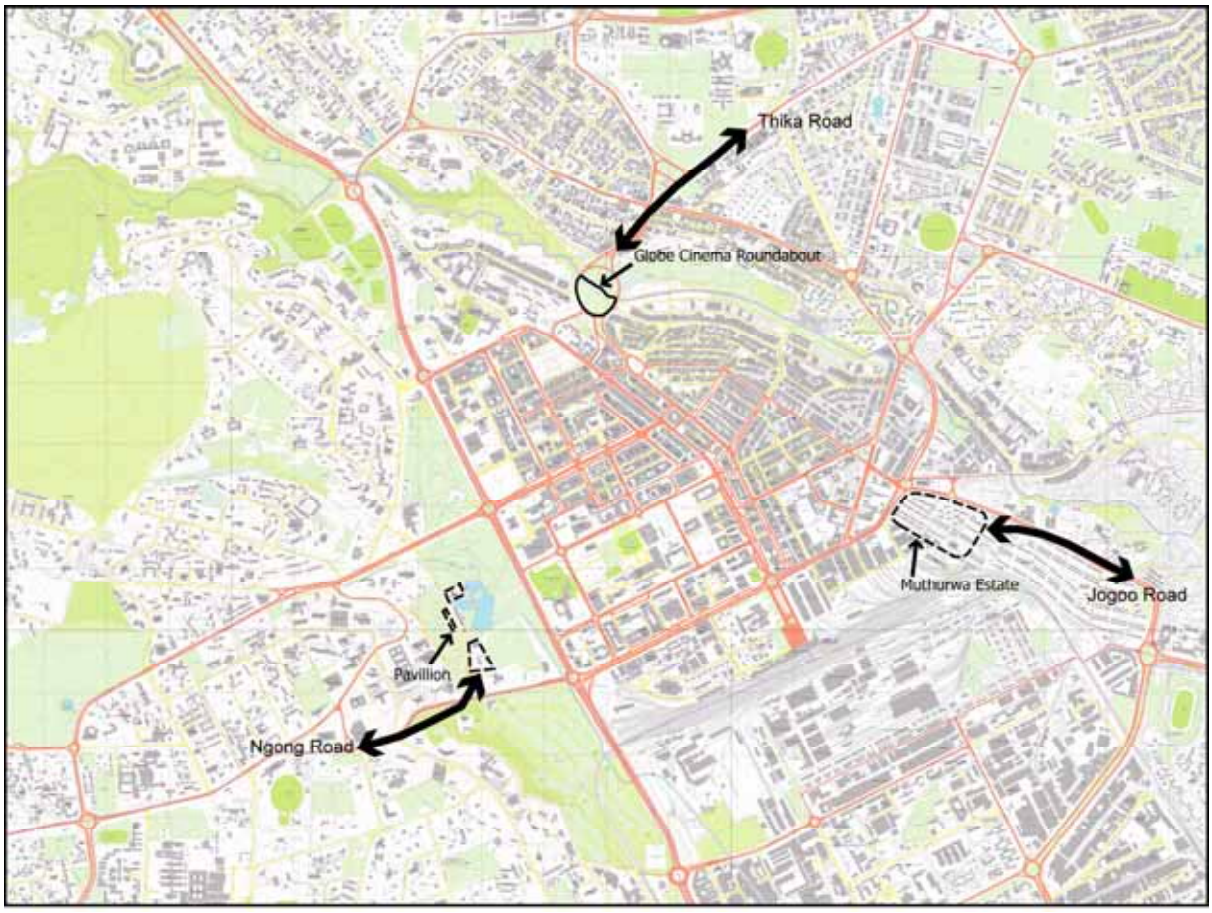


FIGURE 30.2-6 LOCATION OF NEW AND PROPOSED MATATU TERMINALS AT THE CBD FRINGE

30.3 PROPOSED SHUTTLE BUS SYSTEM IN THE CITY CENTRE

30.3.1 System

The new city shuttle bus system is operated by 3-minute interval during peak hours and 5-minute interval during off-peak hours, using minibus such as Metro Shuttle and City Hoppa considering the traffic congestions in the city center and limited urban road space. The objectives of the new shuttle bus system are:

- To secure the public transport service at the areas where the matatu routes cut in the city center because of the matatu route-cut policy of the CCN; and
- To improve the level of public transport service in the city center where usually a low level of service exists.

As mentioned previously, three new matatu terminals are proposed (refer to Figure 30.1-2):

a) Matatu routes to/from Thika Road: Globe Cinema Roundabout (already implemented)
b) Matatu routes to/from Ngong Road: Presidential Pavilion near Uhuru Park (proposed by CCN)
c) Matatu routes to/from Jogoo Road and Enterprise Road: Muthurwa Estate (proposed by CCN)

The new city shuttle bus system will cater to the above 3 terminals to serve as a connection between them. It is characterized as follows.

30.3.2 Route

Basic considerations for the route planning are as follows.

- Connect the three matatu terminals with minimum route length by 2 routes
- Connect not only the matatu terminals but also major facilities in the city center
- Include major roads in the city center such as Moi Avenue, Kenyatta Avenue and Haile Selassie Avenue in these routes but exclude the Uhuru Highway because of its large volume of through traffic with long trips
- Minimum route length of more than 10 km considering the cost performance and efficiency of fleet schedule

Considering the above conditions, 2 city shuttle bus routes which connect the matatu terminals and major facilities/areas with clockwise and counter clockwise movements are proposed, as shown in Figure 30.3-1.

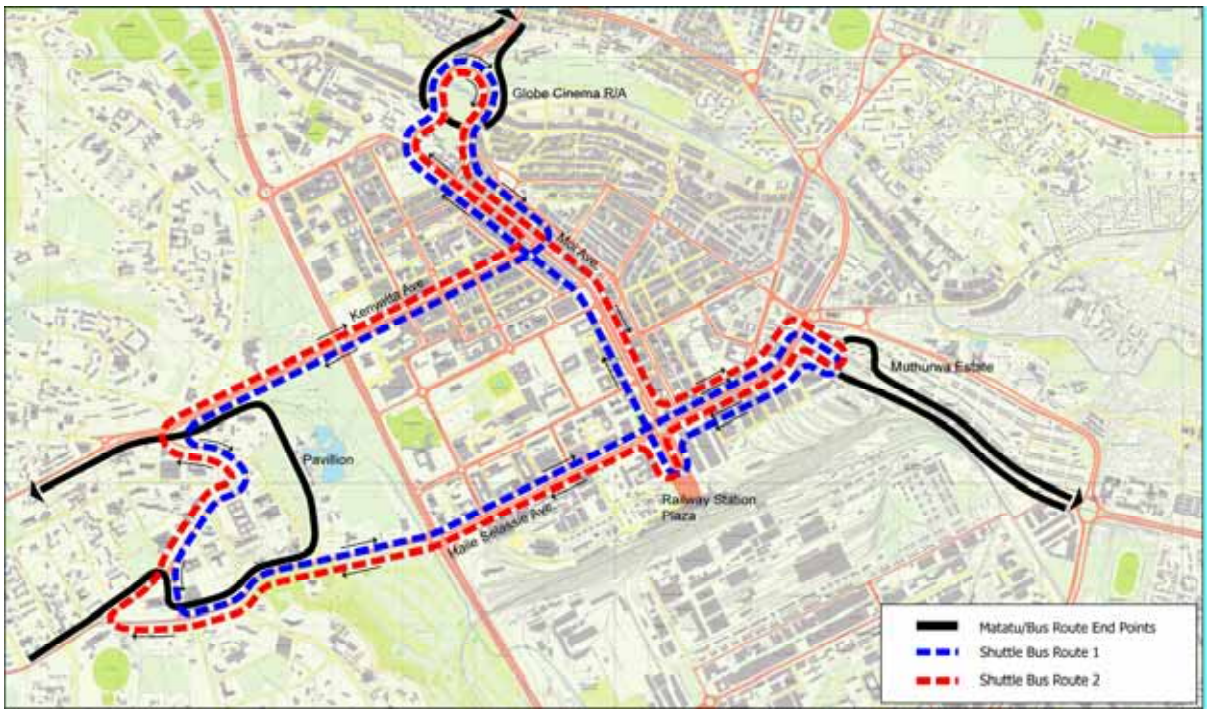


FIGURE 30.3-1 PROPOSED CITY SHUTTLE BUS ROUTE

30.3.3 Demand Forecast

Demand forecast of shuttle bus users in 2004 and 2010 are estimated based on the following factors:

(1) Development of an OD table for shuttle bus is based on the matatu OD table.
(2) Trips which have origin to/ destination from Thika Road, Jogoo Road and Ngong Road are selected.
(3) Average distance of walk trips between each terminal and CBD zone 1-6 made by public transport users is assumed to be approximately one km (see Figure 30.3-2).
(4) The part of walk trips between zone 75 (Ngong side matatu terminal) and CBD zones 1-6 is assumed to shift to shuttle bus.
(5) An OD in 2010 table is developed based on the increase rate of public transport from 2004 to 2010.

Based on the above factors, OD tables of shuttle bus users in 2004 and 2010 are shown in Table 30.3-1. From the table, it is seen that total daily shuttle bus users in 2004 and 2010 are 148,200 and 163,030, respectively. On the other hand, traffic assignments on the shuttle bus routes in 2004 and 2010 are illustrated in Figure 30.3-3 and Figure 30.3-4, respectively.

FIGURE 30.3-2 NEW MATATU TERMINALS, WALKING DISTANCE AND ZONES IN CBD

TABLE 30.3-1 OD TABLES OF SHUTTLE BUS USERS IN 2004 AND IN 2010

Circulate Bus 2004 — Public Transport Total 1,704,392

	CBD1	CBD2	CBD3	CBD4	CBD5	CBD6	Thika	Juja	Jogoo	Mombasa	Langata	Ngong	Waiyai	Limuru	WALK	Total
CBD1	0	0	0	0	0	0	750	0	7,060	0	0	1,490	0	0	500	9,800
CBD2	0	0	0	0	0	0	4,010	0	11,640	0	0	2,910	0	0	500	19,060
CBD3	0	0	0	0	0	0	4,730	0	3,930	0	0	6,380	0	0	500	15,540
CBD4	0	0	0	0	0	0	1,430	0	2,190	0	0	2,850	0	0	100	6,570
CBD5	0	0	0	0	0	0	440	0	1,890	0	0	4,170	0	0	100	6,600
CBD6	0	0	0	0	0	0	8,140	0	0	0	0	8,510	0	0	100	16,750
Thika	820	4,460	3,930	220	430	8,700	0	0	0	0	0	0	0	0	0	18,560
Juja	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jogoo	7,380	11,680	3,850	2,340	1,790	0	0	0	0	0	0	0	0	0	0	27,040
Mombasa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Langata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ngong	1,570	3,320	6,380	2,760	3,660	8,790	0	0	0	0	0	0	0	0	0	26,480
Waiyai	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Limuru	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WALK	500	500	500	100	100	100	0	0	0	0	0	0	0	0	0	1,800
Total	10,270	19,960	14,660	5,420	5,980	17,590	19,500	0	26,710	0	0	26,310	0	0	1,800	148,200

Circulate Bus 2010 — Public Transport Total 1,874,831 2,062,050 1.1

	CBD1	CBD2	CBD3	CBD4	CBD5	CBD6	Thika	Juja	Jogoo	Mombasa	Langata	Ngong	Waiyai	Limuru	WALK	Total
CBD1	0	0	0	0	0	0	830	0	7,770	0	0	1,640	0	0	550	10,790
CBD2	0	0	0	0	0	0	4,410	0	12,800	0	0	3,200	0	0	550	20,960
CBD3	0	0	0	0	0	0	5,200	0	4,320	0	0	7,020	0	0	550	17,090
CBD4	0	0	0	0	0	0	1,570	0	2,410	0	0	3,140	0	0	110	7,230
CBD5	0	0	0	0	0	0	480	0	2,080	0	0	4,590	0	0	110	7,260
CBD6	0	0	0	0	0	0	8,950	0	0	0	0	9,360	0	0	110	18,420
Thika	900	4,910	4,320	240	470	9,570	0	0	0	0	0	0	0	0	0	20,410
Juja	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jogoo	8,120	12,850	4,240	2,570	1,970	0	0	0	0	0	0	0	0	0	0	29,750
Mombasa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Langata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ngong	1,730	3,650	7,020	3,040	4,030	9,670	0	0	0	0	0	0	0	0	0	29,140
Waiyai	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Limuru	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WALK	550	550	550	110	110	110	0	0	0	0	0	0	0	0	0	1,980
Total	11,300	21,960	16,130	5,960	6,580	19,350	21,440	0	29,380	0	0	28,950	0	0	1,980	163,030

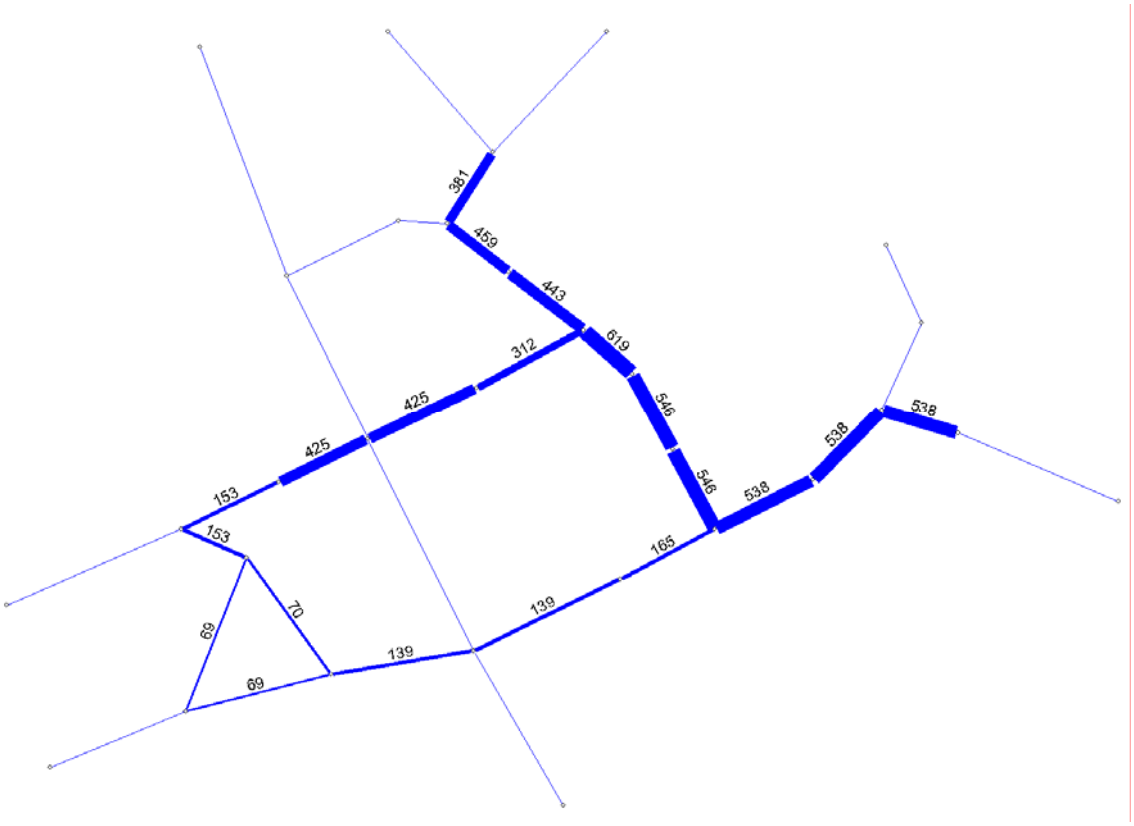


FIGURE 30.3-3 TRAFFIC ASSIGNMENT OF SHUTTLE BUS TRIPS ON THE ROUTE NETWORK IN 2004

(Unit: 00/day)

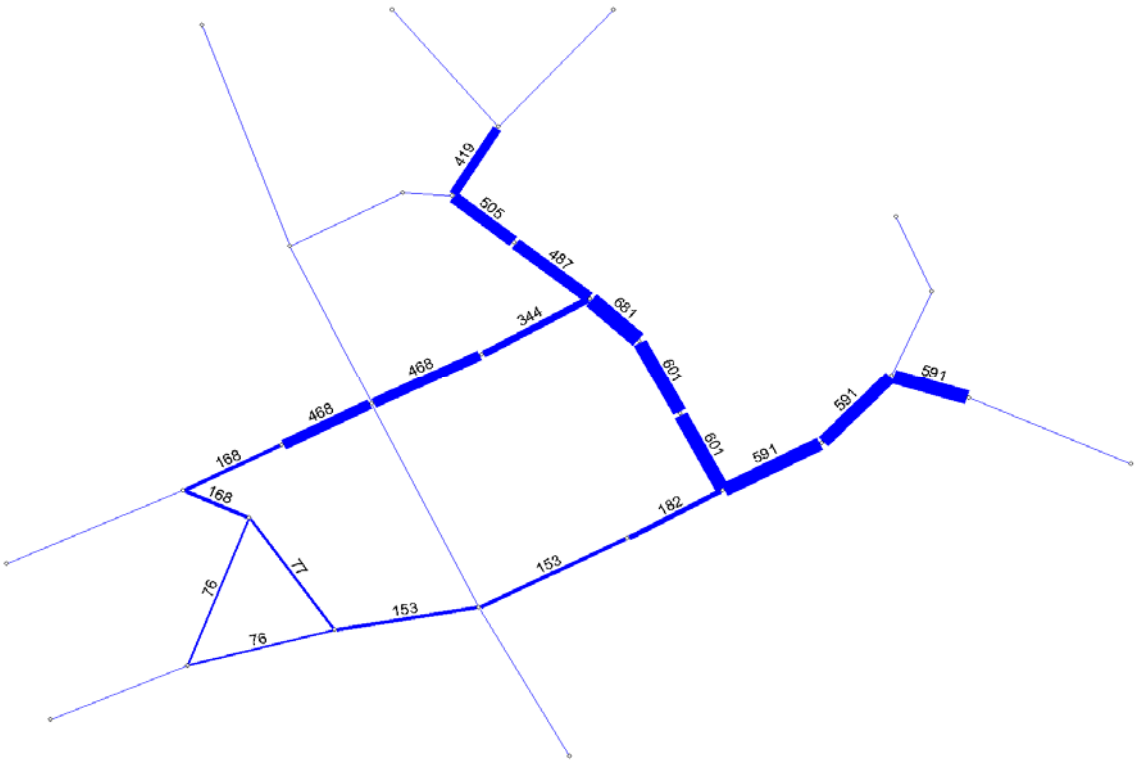


FIGURE 30.3-4 TRAFFIC ASSIGNMENT OF SHUTTLE BUS TRIPS ON THE ROUTE NETWORK IN 2010

(Unit: 00/day)

30.3.4 Proposed Plan

(1) Shuttle Bus Fleet Size

Based on the Master Plan policy, it is desirable that larger size shuttle bus fleet is introduced. However, considering the limited road space and traffic congestions in the CBD, it is preferable that the shuttle bus fleet comprise of 30 – 40 seat capacity such as those operated by Metro Shuttle and Citi Hoppa and allow standing passengers considering the average operational speed of public transport in the urbanized area (25 km/hour) and transport efficiency.

Based on the daily shuttle passengers, average daily passengers per shuttle bus and availability of buses, required bus fleet size is as follows:

168,030 passengers/day÷900 passengers/bus/day÷90%＝210 buses

(2) Terminal Facilities

Basically, shuttle bus system connects 3 matatu terminals and Nairobi Station. However, the shuttle bus does not enter the terminal at Ngong Road side (along Processional Way), therefore, Globe Cinema, Muthurwa and Nairobi Station are used as the shuttle bus terminals.

(3) New/improved Bus Stop

Basically, bus tops for shuttle bus use existing facilities except for the following 3 new bus stops and 1 existing bus stop to be relocated. Geometric design of bus stop adopts the design which is proposed in Section 30.4.

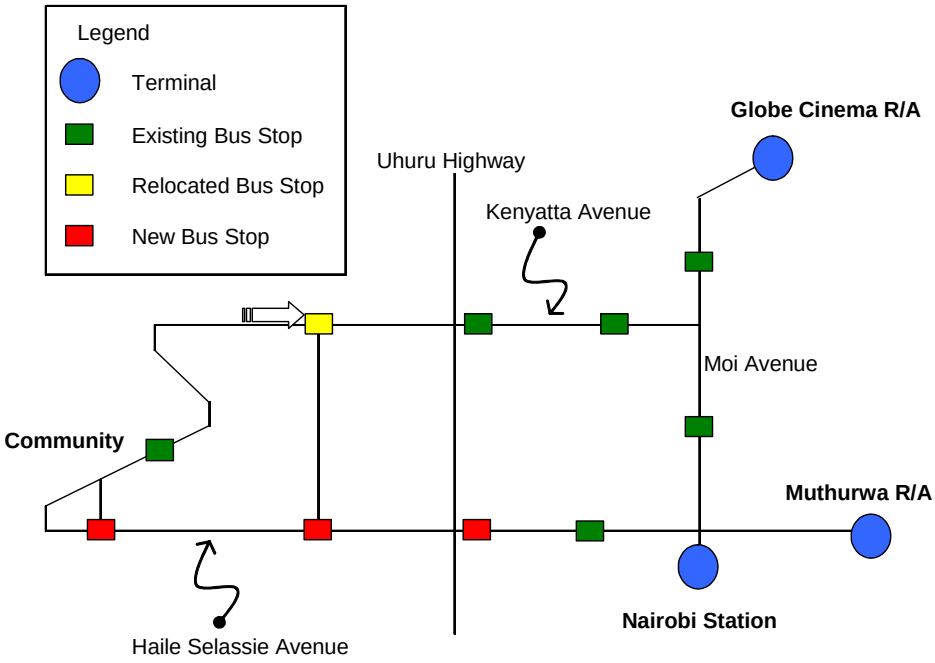


FIGURE 30.3-5 PROPOSED SHUTTLE BUS STOP

(4) Others (Fares and Route Map)

A flat fare of Kshs. 10 is proposed to introduce the private operation and to give economical (cheap) convenience to the users. Financial viability is assessed in (6) hereinafter. It is important to prepare the shuttle bus route maps and distribute them to not only Nairobi citizens but also travelers/visitors to show how the system works, how convenient it is, and encourage them to use it.

30.3.5 Effectivity Analysis

(1) Reduction of Public Transport Traffic Volume (from small matatus to shuttle buses in the CBD)

Based on the demand forecast of the shuttle bus system, the reduction of public transport traffic volume, that is, replacing small matatus with shuttle buses in the CBD, are summarized in Table 30.3-2.

The introduction of shuttle bus system will largely reduce the related traffic generated by the 3 matatu terminals, which is from 26,831veh.-km to 9,657veh.-km (reduction of 64%).

Preconditions of this assumption are as follows:

- All matatu passengers at new terminals transfer to shuttle bus or walk to their destination.
- Average occupancies of matatu and shuttle bus are 14.7 persons/vehicle (from person trip survey) and 40 persons/vehicle, respectively.
- Passenger car units (PCU) of matatu and shuttle bus are 1.5 and 2.0, respectively.

TABLE 30.3-2 REDUCTION OF PUBLIC TRANSPORT TRAFFIC VOLUME BY INTRODUCING THE SHUTTLE BUS IN CBD

Name of Terminal	At Terminal			At Terminal		Distance between Old and New Terminal (m)	**Matatu**	Ave. Trip Length of Shuttle (m)	**Shuttle**	
	Matatu Pax	Shuttle Pax		Matatu (veh.)	Shuttle (veh.)		**Veh.-km**		**Veh.-km**	
	A	B	C=B/A	D=A/14.7*1.5	E=B/40.0*2.0	F	**G=D*F/1000**	H	**I=E*H/1000**	J=I/G
Globe Cinema	95,726	41,850	0.44	9,768	2,093	625	**6,105**	1,050	**2,197**	
Muthuwa	150,874	59,130	0.39	15,395	2,956	750	**11,546**	1,150	**3,400**	
Processional Way	99,954	55,450	0.55	10,199	2,773	900	**9,179**	1,375	**3,812**	
Walk		3,960			198			1,250	**248**	
Total	346,554	160,390	0.46	35,363	8,020		**26,831**		**9,657**	0.36

(2) Preparation of the Convenient Public Transport System in the CBD

This shuttle bus system is introduced as the new public transport system in the Nairobi Metropolitan Area. It offers convenience for persons who move within the CBD and is seen to contribute to the decrease of traffic congestions in the CBD. Not only convenience but also safety is largely provided for the connection between eastern side (CBD) and western side (institutional) of Uhuru Highway.

30.4 PUBLIC TRANSPORT REROUTING PLAN ALONG MISSING LINKS

Construction of missing links in the urbanized area is intended to strengthen the urban road network in Nairobi and to alleviate the heavy traffic congestion in the adjoining roads of missing links. At the same time, the rerouting of the public transport routes to the missing links is seen to generate the public transport demand along the missing links and provide added convenience for public transport users especially those belonging to the low-income group. Moreover, this rerouting is expected to improve the urban environment and to revitalize the district activities along the missing links.

Figure 30.4-1 shows the location and typical cross sections of the missing links.

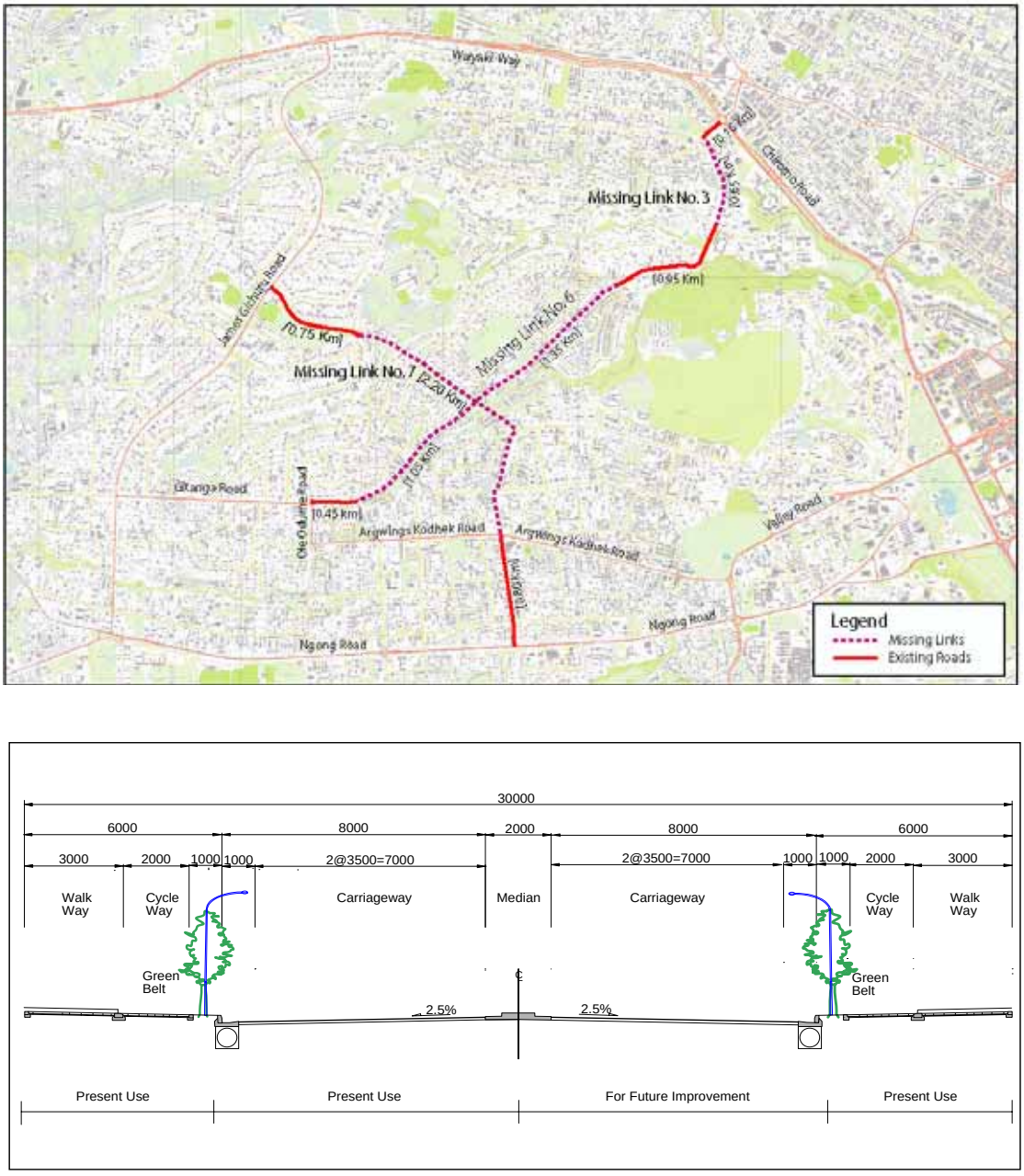


FIGURE 30.4-1 LOCATION AND TYPICAL CROSS SECTIONS OF THE MISSING LINKS

30.4.1 Analysis of Public Transport Route in the Vicinity of Missing Links

Figure 30.4-2 shows the bus/matatu routes in the area between Waiyaki Way and Ngong Road. Most of the matatu routes along Ngong Road have their origin/destination in the Nairobi Station and most of the matatu routes along Waiyaki Way have their origin/destination in and around Nation Roundabout.

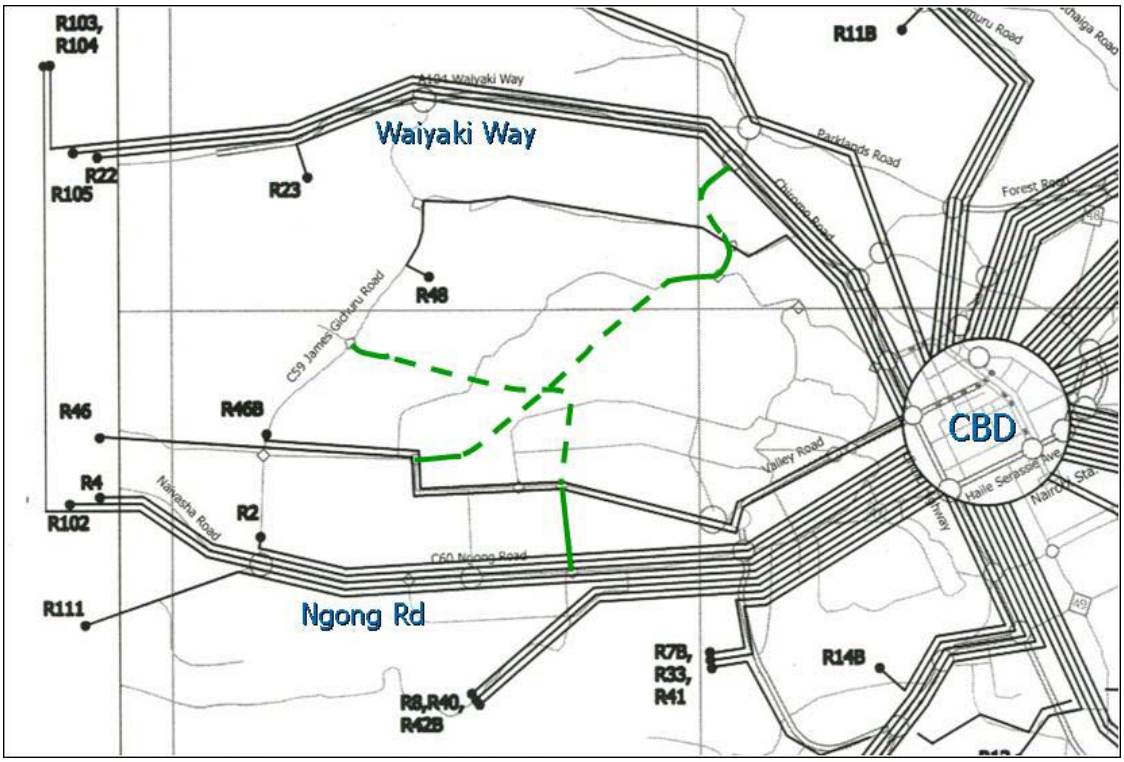


FIGURE 30.4-2 PUBLIC TRANSPORT ROUTES IN THE VICINITY OF MISSING LINKS

30.4.2 Public Transport Demand in Missing Links

On the other hand, Figure 30.4-3 shows the traffic assignment of public transport OD trips in 2004 on the missing links. The following traffic characteristics can be seen from these assignment results.

(1) It is estimated that the public transport demand along Missing Link Nos.3 and 6 is 58,300 trips/day in total. This shows that many public transport users will use the Ngong – Westlands corridor including Missing Link Nos. 3 and 6 if there is a public transport route on this new corridor.

(2) It is also estimated that the public transport demand along Missing Link No. 7 is 12,700 trips/day. This is relatively lower than that of Missing Link Nos. 3 and 6. However, it is observed that vital residential development converted from single units to apartments/ condominiums in Lavington Area. Therefore, it is expected that there will be more public transport demand between Lavington and CBD.

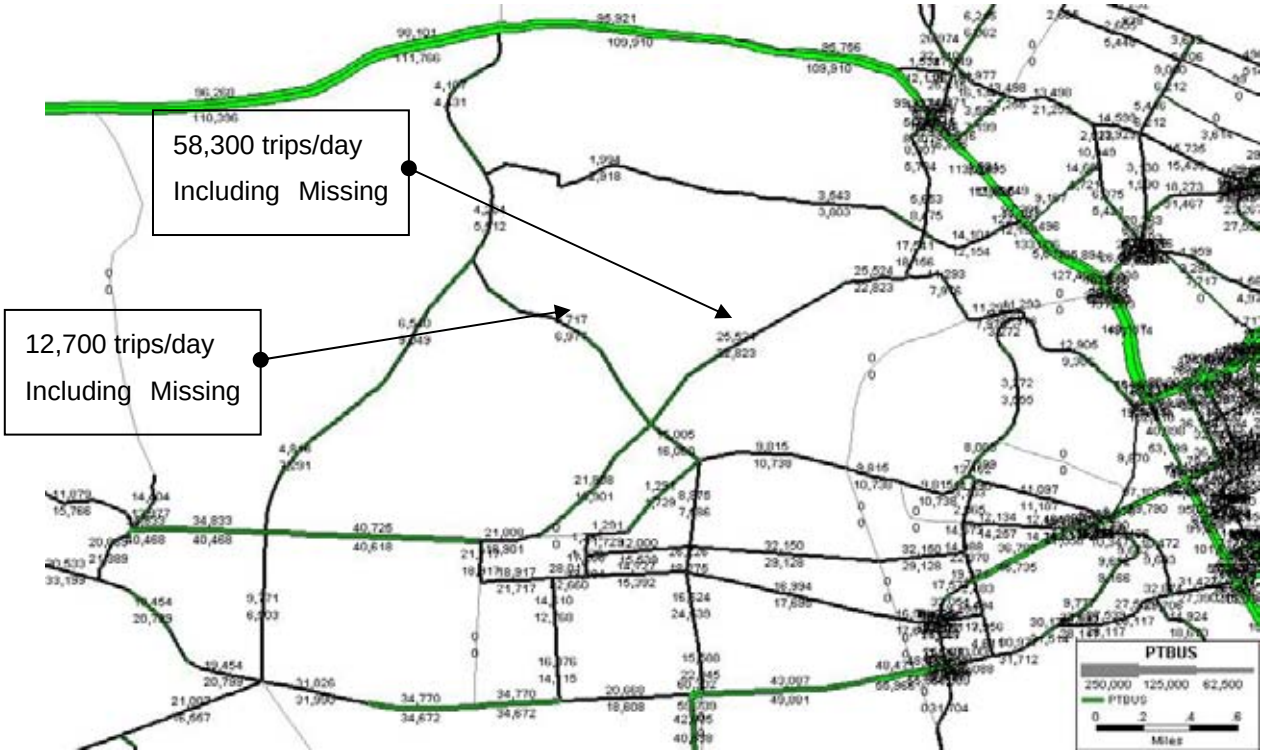


FIGURE 30.4-3 PUBLIC TRANSPORT DEMAND ASSIGNMENT ALONG AND IN THE VICINITY OF MISSING LINKS IN 2004

30.4.3 Basic Considerations for Rerouting of Public Transport along Missing Links

The following 3 items are the basic considerations for rerouting of public transport along Missing Links:

(1) The prepared plan should be a good manual for the introduction of new public transport route to the new area and/or new road.
(2) The new public transport route, especially inside urbanized area, should only allow a fleet of minibuses/buses with a seat capacity of 30 passengers or more.
(3) For the development of bus facilities, the convenience of public transport users should be the priority.

30.4.4 Bus/Matatu Rerouting Plan along Missing Links

Based on the current public transport route structure and demand characteristics in this area, a public transport rerouting plan is proposed to develop the proper public transport route network to cope with the public transport demand in this area, and to increase the public transport users living along the missing links.

Basic concepts of the rerouting plan are as follows:

(1) Missing Link Nos.3 and 6

The busiest matatu route between Ngong area and City Center is Route No.46 (Kawangware-Nairobi Station via Argwings Kodhek) where about 500 matatus ply. And a large volume of public transport demand is expected between Ngong area and Westlands via Missing Link Nos. 3 and 6. Therefore, it is proposed to pull out some of matatu units from Route 46, convert them into buses to be operated on the new route. The proposed bus route is starting from Kawangware then, via Missing Link Nos.3 and 6, connects to Westlands area where more public transport demand can be expected. After Westlands the proposed bus route continues to travel via Ring Road Parklands, which will expand from 2 to 4 lanes, and then via Parklands Road and Limuru Road connects to Globe Cinema Terminal, because it is difficult to develop the terminal in the limited Westlands area.

(2) Missing Link No.7

Currently, many single unit houses have been converted to apartments and condominiums in Lavington area. Therefore, public transport demand is expected to increase between Lavington, where housing development is booming, and City Center via Missing Link No.7.

Based on the above discussion, the proposed conceptual public transport route network along and in the vicinity of missing links is shown in Figure 30.4-4.

FIGURE 30.4-4 PROPOSED CONCEPTUAL PUBLIC TRANSPORT ROUTE NETWORK ALONG AND IN THE VICINITY OF MISSING LINKS

30.4.5 Facility Requirements/Planning Guidelines

(1) Fleet

It is proposed to introduce a fleet of minibuses/buses with a capacity of 30 passengers and more, to serve as the new public transport to the new routes on the missing links. Considerations are given to effectiveness of road usage, and safety and convenience of the passengers. Introduction of matatu to new public transport route is not permitted anymore.

(2) Bus Stop Spacing

Basically, bus stop spacing is 500m based on the survey and analysis of public transport corridors such as Ngong Road and Juja Road.

(3) Geometric Design of Bus Bay

Geometric design of bus bay is proposed in Section 30.5.

(4) Sidewalk Width

The typical cross section of the Missing Link is shown in Figure 30.4-1. Average width of sidewalk is 5.0 m (minimum requirement of sidewalk width in front of bus stop is 3.0 m), therefore there are no problems to install bus stop facilities such as bus shelter and passing through for pedestrians.

(5) Bus Stop Sign

There are various and different kinds of bus stop design in Nairobi area. It is proposed that the bus stop design be uniform for easy recognition of all users of public transport not only Nairobi citizens but also travelers and visitors. It is further proposed, if possible, that each bus stop name, fare system and operational duration be affixed on the bus stop sign.

(6) Bus Stop Shelter and Bench

Bus stop shelter for protection against sunshine and rain and bench for resting while waiting should be installed at all bus stops. These amenities will greatly encourage passengers to wait at bus stops instead of other places along the road.

(7) Others (Kiosk, Lighting, Bus Route Map, etc)

Business activity at bus stop is only for those with permits from CCN such as building kiosks which must be of same design to have uniformity. And uniformed designed kiosk will enhance the image of public transport and contribute to the activation of business activities of small communities around the bus stop. Lighting secures the nighttime safety of bus passengers and helps increase bus users because the lighting can extend the bus operation period until late at night. Distribution of convenient bus route maps to bus users, not only Nairobi citizens but also travelers and visitors, is to increase bus use convenience and bus passengers.

30.4.6 Effectivity Analysis

(1) Increase of Convenience of Public Transport Users Living along the Missing Links

By rerouting public transport route to Missing Links there will be expansion of the public transport service coverage in the influential area, consequently improving the convenience of public transport along and in the vicinity of Missing Links. The public transport service coverage embraced by Waiyaki Way, Uhuru Highway, Ngong Road and James Gichuru Road, increases to 88% from 70% after rerouting as shown in Figure 30.4-5.

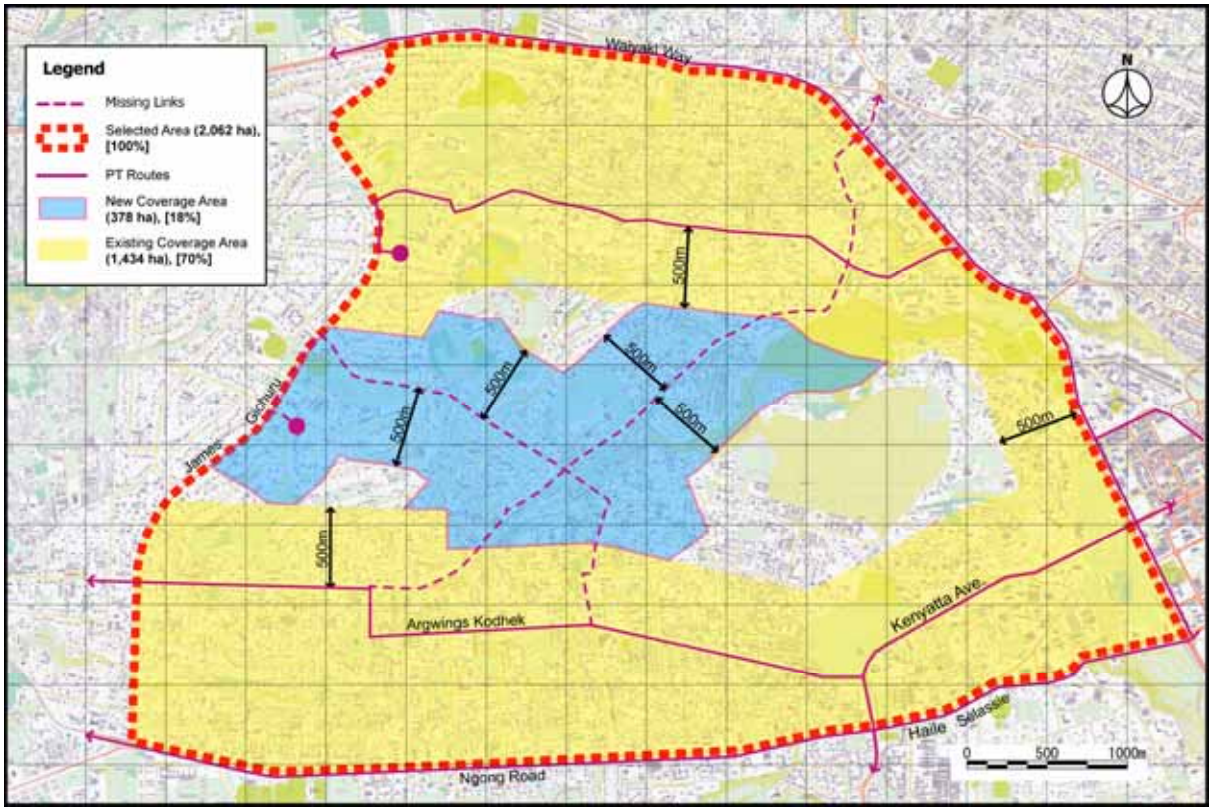


FIGURE 30.4-5 PUBLIC TRANSPORT SERVICE COVERAGE BEFORE AND AFTER REROUTING

(2) Decrease of Road Traffic along the Roads in the Vicinity of Missing Links

Another merit of rerouting of public transport to Missing Links is mitigation of the public transport demand from major public transport corridors. Along Ngong Road, public transport demand before rerouting is 108,400 trips/day and after the rerouting is 93,000 trips/day. This shows a 14% decrease of trips.

30.5 PUBLIC TRANSPORT CORRIDOR MANAGEMENT/IMPROVEMENT

The public transport plan in the transport master plan targeting the year 2025 proposed the introduction of larger capacity public transport modes in the major public transport corridors and the development of mode interchange areas at the urban fringe to promote and encourage the modal shift from private cars to public transport. The short-term actions along public transport corridors are to identify the problems and to propose small-scale improvement and/or traffic management under the current conditions for both public transport system and road infrastructure.

30.5.1 Selected Corridors

Two public transport corridors, namely Ngong Road and Juja Road, are selected for this study because of their different corridor characteristics of public transport users (Ngong Road: high and medium income level, and Juja Road: low income level) and ease of implementation, i.e. not much other issues present such as road encroachment.

FIGURE 30.5-1 SELECTED CORRIDORS

30.5.2 Present Conditions (including survey results)

Based on the ocular survey and public transport survey (on-board survey and operation survey), the present conditions of Ngong Road and Juja Road are as follows:

(1) Ngong Road

- Daily matatu and bus traffic volumes are 10,425 (82.5% of PT traffic) and 2,218 (17.5%), respectively. Percentage of public transport traffic out of total vehicular traffic (33,174) is 38.1%. This is one of the bus corridors.
- Poor traffic management between Haile Selassie Ave. and Valley Road causes serious traffic jams especially during peak hours.
- Most of bus stops along Ngong Road have shelters and bus stop signs; however, some bus stops such as 10A (refer to Figure 30.5-2) near Jamhuri Estate (near Kibera Railway Station) are poorly equipped with such facilities.
- 8A bus stop has not enough waiting space for public transport users.
- Matatu drivers wait for the passengers at bus/matatu stop.
- Disorderly stopping of bus/matatu at bus bay causes obstruction of through traffic.
- Need adequate lighting for the security of waiting passengers during the night.
- Not enough bus/matatu facilities for aged and disabled persons.

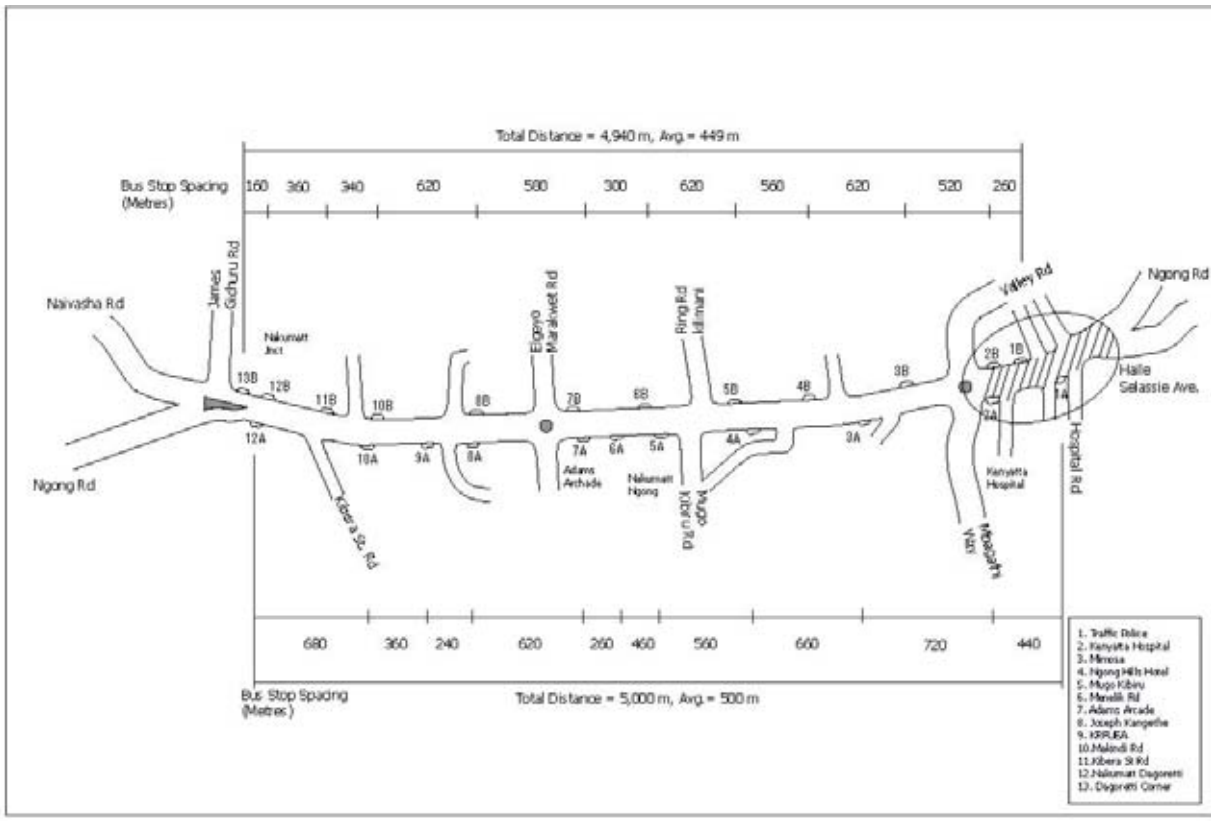


FIGURE 30.5-2 PRESENT CONDITIONS ON NGONG ROAD

(2) Juja Road

- Daily matatu and bus traffic volumes are 14,340 (92.1% of PT traffic) and 1,234 (7.9%), respectively. Percentage of public transport traffic out of total vehicular traffic (28,596) is 54.4%. This is the highest, not only in terms of matatu share but also public transport share, among 7 major public transport corridors in the Nairobi Metropolitan Area.
- Intersection at Juja Road/Outer Ring Road is one of the busiest transfer points between east-west and south-north public transport routes.
- Long distance between bus stops from Kariokor Market Roundabout and Pangani Roundabout.
- Poor bus stop facilities along Juja Road because most of bus stops have no shelters.
- Not enough waiting space for public transport users, such as 9B and 12A (refer to Figure 30.5-3).
- Disorderly business activities in the bus stop space, such as 5A and 10A (refer to Figure 30.5-3).
- Need adequate lighting for the security of waiting passengers during the night.
- Matatu drivers wait for the passengers at bus/matatu stop.
- Disorderly stopping of bus/matatu at bus bay causes obstruction of through traffic.
- Many passengers waiting for bus/matatu at the place where there is no bus/matatu stop.
- Not enough bus/matatu facilities for aged and disabled persons.

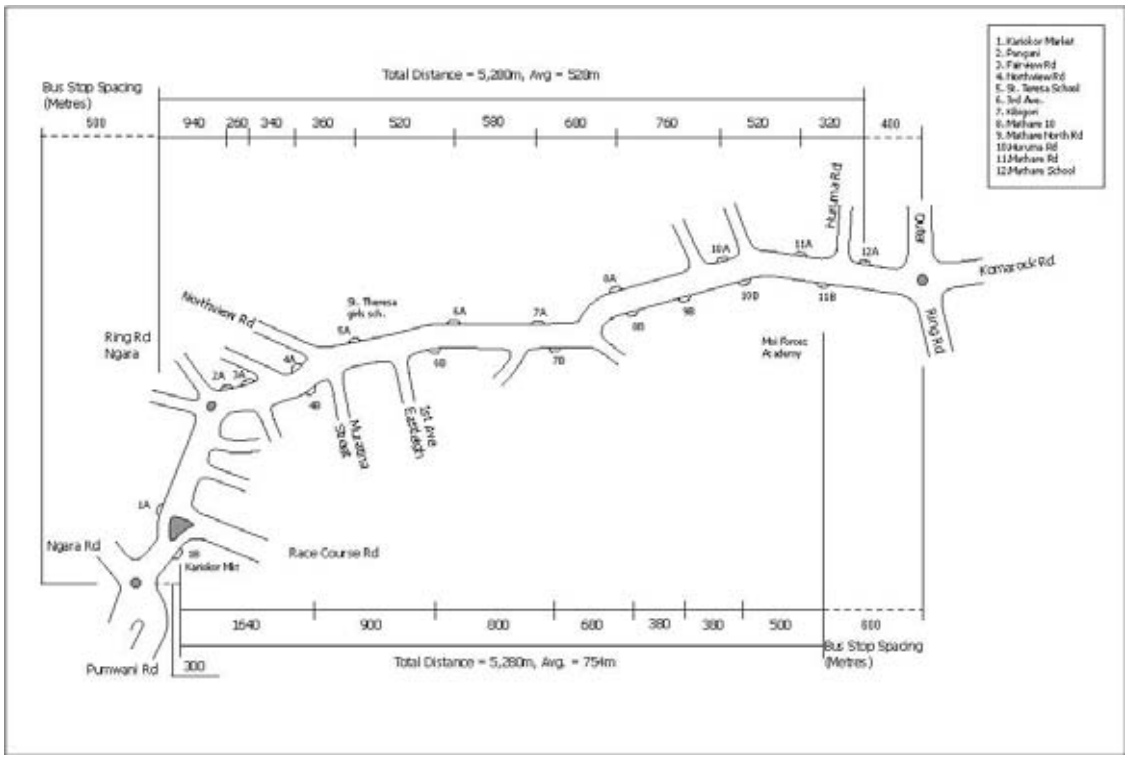


FIGURE 30.5-3 PRESENT CONDITIONS ON JUJA ROAD

30.5.3 Basic Considerations

The following are the basic considerations for corridor management/improvement:

(1) Keep in mind that the measures to be taken are to serve a public transport corridor; therefore, it is necessary to consider the urban/transport characteristics of the corridor.

(2) Basic considerations as a public transport corridor are as follows:

- Bus stop spacing

  Based on the person trip survey and inventory survey, it is proposed that the bus stop spacing be approximately 500 m.

- Geometric design of bus/matatu bay

  Based on the typical bus bay details by road design guidelines for urban roads (2nd draft, MOLG, August, 2001), and bus bay inventory along Ngong Road and Juja Road, the proposed geometric design of bus/matatu bay is shown in Figure 30.5-4.

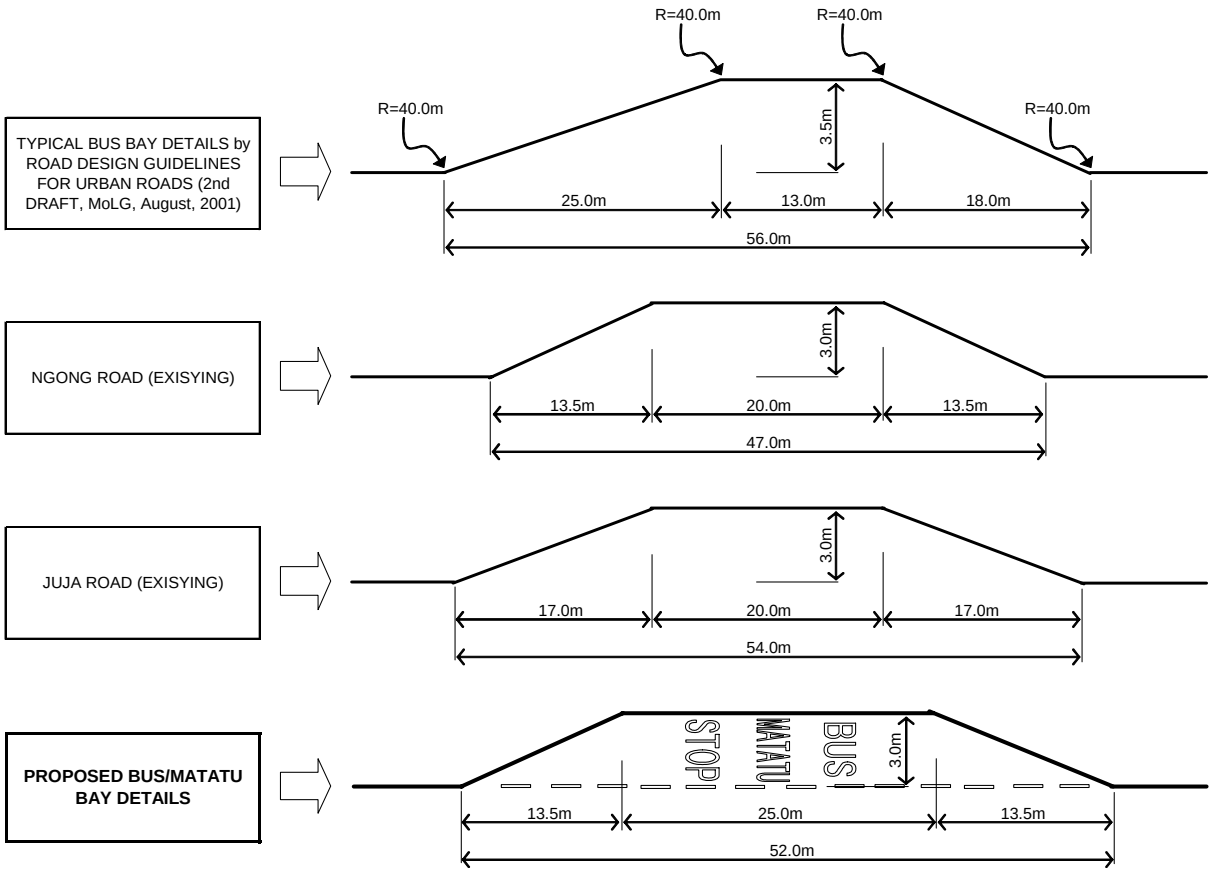


FIGURE 30.5-4 GEOMETRIC DESIGN OF BUS/MATATU BAY

- Sidewalk width

  Existing average sidewalk width of Ngong Road and Juja Road are 2.0 and 2.6, respectively. However, some bus stops can be observed as having poor waiting space. Based on existing data, pedestrian behavior and width of bus shelters, a minimum width of 2.0 m sidewalk should be required in front of bus/matatu.

- Bus stop sign

  There are various and different kinds of bus stop design in Nairobi area. It is proposed that the bus stop design be uniform for easy recognition of all users of public transport not only Nairobi citizens but also travelers and visitors. It is further proposed, if possible, that each bus stop name, fare system and operational duration be affixed on the bus stop sign.

- Bus stop shelter and bench

  Bus stop shelter for protection against sunshine and rain and bench for resting while waiting should be installed at all bus stops. These amenities will greatly encourage passengers to wait at bus stops instead of other places along the road.

- Others (Kiosk, Lighting, Bus route map, etc)

  Business activity at bus stop is only for those with permits from CCN such as building kiosks which must be of same design to have uniformity. And uniformed designed kiosk will enhance the image of public transport and contribute to the activation of business activities of small communities around the bus stop.

  Lighting secures the nighttime safety of bus passengers and helps increase bus users because the lighting can extend the bus operation period until late at night. Distribution of convenient bus route maps to bus users, not only Nairobi citizens but also travelers and visitors, is to increase bus use convenience and bus passengers.

- Measures for aged and disabled person

  For easy access to the bus stop by aged and disabled persons, preparation of continuous flat sidewalk is important. More importantly, preparation of space for wheelchairs in buses is also important for smooth trip by them. In the future, it is advisable to introduce low floor bus in the Nairobi Metropolitan Area.

- Bus/matatu traffic regulation

  Even if public transport facilities were completed, public transport operation would not work well without proper public transport operation regulations. This issues is tackled in Section 30.6.

(3) To understand the public transport corridor characteristics, the following are the important factors:
- Traffic volume and its composition along the corridor;
- Land use conditions along the corridor; and
- Existing conditions of bus/matatu related facilities.

(4) It is necessary to consider how the results of this study could easily to be used to the other corridors.

30.5.4 Proposed Corridor Management/Improvement Plan

(1) Ngong Road

Relatively high and mid-income level households reside alongside this corridor, which has the highest bus traffic share among 7 major public transport corridors in Nairobi Metropolitan Area. The traffic congestion here is more serious than in other corridors not only because of the increase of traffic in the 2-lane, 2-way road but also because of the disordered bus/matatu operation. In particular, the section between Valley Road and Haile Selassie Avenue is the most heavily congested section along Ngong Road, because many public transport routes concentrate to this narrow road section.

Most of bus/matatu stops are installed at 500 m interval and bus/matatu related facilities such as bus/matatu shelters are well maintained, but some bus/matatu stops need improvements. For instance, sidewalk widening and installation of shelters.

On the other hand, many matatus waiting for passengers can be observed at bus/matatu stops near large-scale developments such as supermarkets. This also causes traffic jams and measures should be put in place to counter this problem.

Considering the above conditions, the following proposals are given, and illustrated in Figures 30.5-5 and 30.5-6, for the corridor management/improvement along Ngong Road.

1) <u>Management/improvement plan including bus priority lane between Valley Road and Haile Selassie Avenue (refer Figure 30.5-6)</u>

Ngong Road between Valley Road and Haile Selassie Ave. has the highest public transport demand owing to the concentration of many bus/matatu routes and existence of large facilities such as Kenyatta Hospital along the said section. On the other hand, most sections of the road are narrow with 2 lanes: the width of the carriageway is 9.4 m to 11.0 m. The current traffic management along the section (w=11.0m) between Kenyatta Hospital and Valley Road is operating as a reversible lane using 3 lanes (2-lane to city

center during morning peak and 2-lane to Ngong during evening peak). However, the poor traffic management and regulation by the traffic police cause traffic congestions along this section. To cope with these problems, the traffic management plan including the introduction of bus priority lane with reversible lane is proposed as shown in Figure 30.5-6.

2) Regulation of the development of small matatu terminal (passenger waiting space) to a large-scale development

Many matatus are waiting for passengers at/around the bus/matatu stop in front of large-scale developments such as supermarkets. This causes traffic jams in this area. Therefore, it is proposed to regulate the development of small matatu terminal (passenger waiting space) to a large-scale development.

3) Improvement of bus/matatu related facilities

Basically, the facilities such as shelters and sidewalks are relatively well-maintained along this corridor, except for some area. Therefore, it is proposed that the passenger waiting space be improved (minimum width of 2.5 m) in the case of poor bus/matatu stops, especially bus stops at southern part between Adams Square and Kibera Station Road.

4) Installation of bus/matatu bay marking to all bus/matatu stops

Disorderly bus/matatu stopping at/around bus/matatu stop causes the traffic jams and puts passengers at risk. Therefore, the installation of bus bay marking, as shown in Figure 30.5-4, and regulation of proper stopping position are required at the minimum.

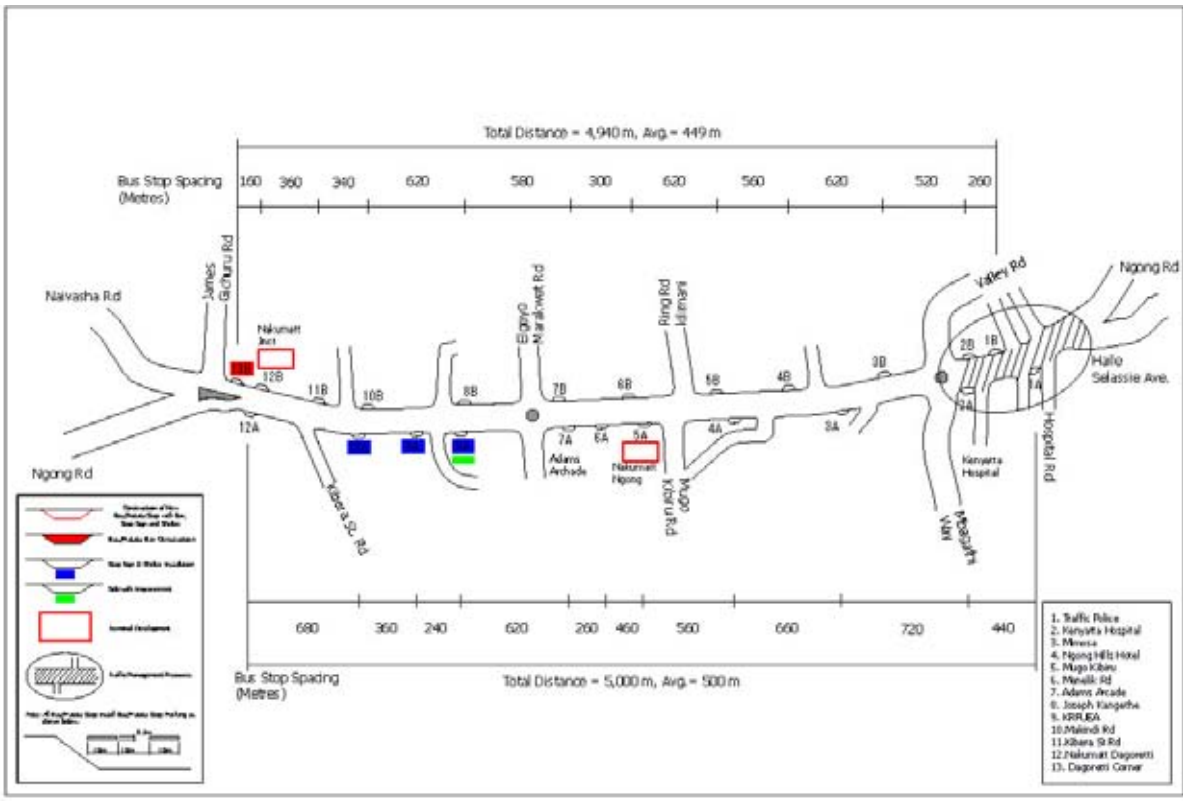


FIGURE 30.5-5 PROPOSED CORRIDOR MANAGEMENT/IMPROVEMENT PLAN ALONG NGONG ROAD

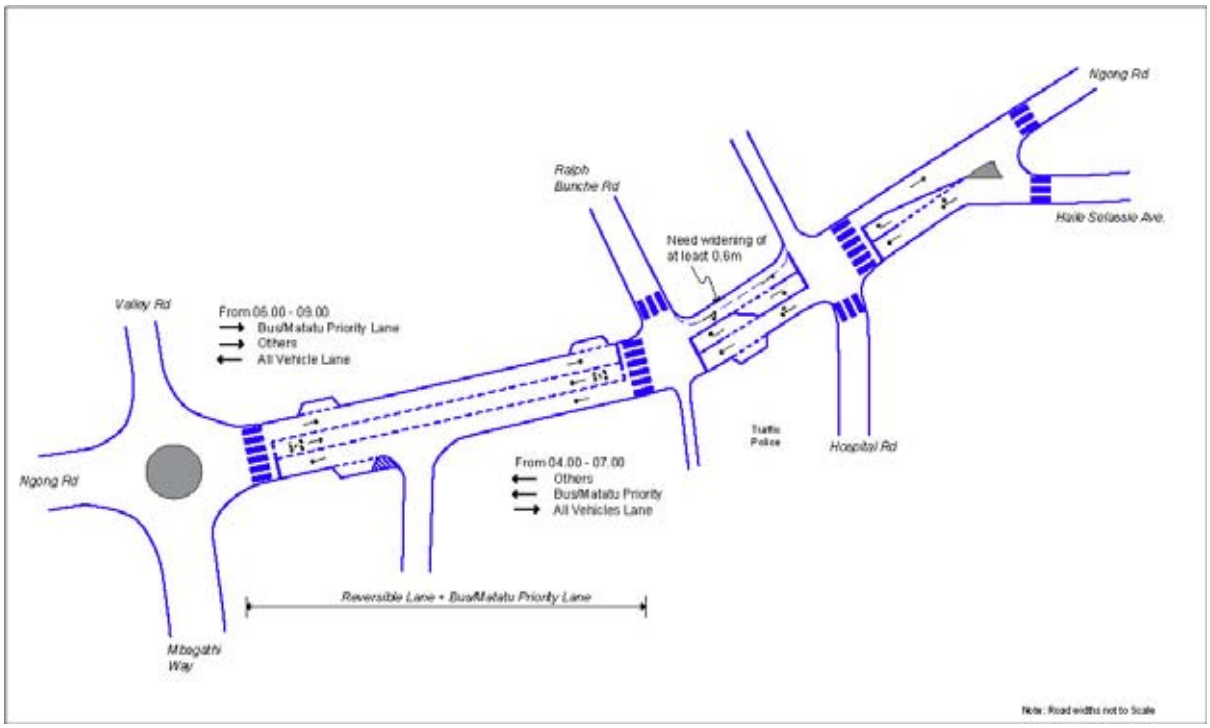


FIGURE 30.5-6 MANAGEMENT/IMPROVEMENT PLAN INCLUDING BUS PRIORITY LANE BETWEEN VALLEY ROAD AND HAILE SELASSIE AVENUE

(2) Juja Road

Percentage of matatu traffic out of total public transport traffic along Juja Road is the highest among the major public transport corridors in the Nairobi Metropolitan Area. Most residents along this corridor belong to the low-income group. Almost all bus/matatu stops have no bus/matatu stop signs and shelters. This forces many passengers to wait for matatus at the corner of side streets which leads to the traffic congestion along this corridor.

There are no bus/matatu stops between Kariokor Market and Pangani Roundabout, which is almost 1.5km apart. It is observed that the bus/matatu stops have limited width of sidewalk and illegal business activities at the bus/matatu stops. There is no bus stop at Juja Road/Outer Ring Road intersection, where can be observed many transfer passengers between east-west and south-north public transport routes.

Considering the above conditions, the following proposal are given, and illustrated in Figures 30.5-7, for the proposed corridor management/improvement along Juja Road.

1) Installation of new bus/matatu stops between Karikor Market and Pangani Roundabout
   New bus/matatu stops are proposed between Kariokor Market and Pangani roundabout (distance between 1.0km to 1.5km) based on the average bus/matau spacing of 500m.

2) Installation of bus/matatu stop signs and shelters at almost all stops
   Installation of shelter at bus stops is important not only for protection against sunshine and rain but also for preventing traffic jams and putting passengers at risk because most of the passengers waiting for a bus/matatu at the entrance of local road, if there is no shelter at bus stops.

3) Development of bus/matatu terminal at Juja Road and Outer Ring Road
   It is proposed to develop a bus/matatu terminal at Juja Road/Outer Ring Road intersection where many transfer passengers generate between north-south and east-west corridors. And there is no bus/matatu stop at this intersection, which causes traffic jams and puts waiting passengers at risk.

4) Improvement of bus/matatu related facilities
   It is necessary to improve the poor bus/matatu stop facilities, especially the sidewalks.

5) Installation of bus/matatu bay marking at all bus/matatu stops
   Disorderly bus/matatu stopping at/around bus/matatu stops cause the traffic jams and puts passengers at risk. Therefore, the installation of bus bay marking, as shown in Figure 30.5-4 and regulation of proper stopping position at the minimum.

6) Prohibition of illegal on-street business at the bus/matatu stop

Business activity at bus stop is only for those with permits from CCN such as building kiosks that must be of same design for uniformity, especially along this corridor. And uniformed designed kiosk will enhance the image of public transport and contribute to the activation of business activities of small communities around the bus stop.

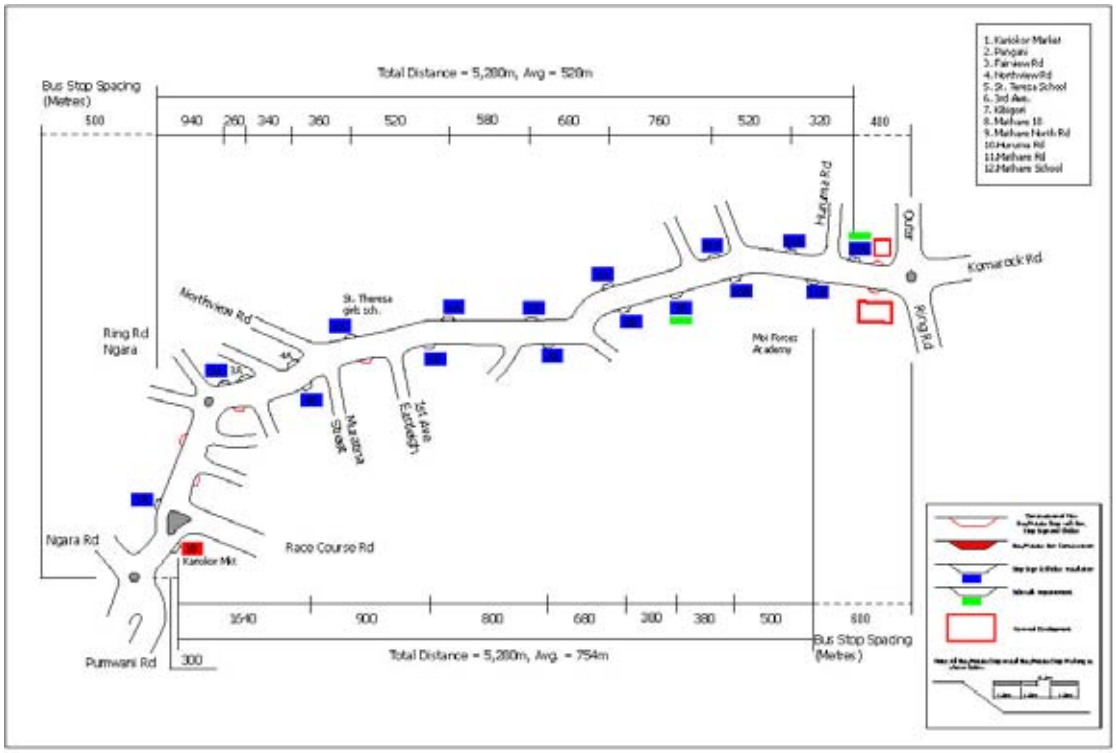


FIGURE 30.5-7 PROPOSED CORRIDOR MANAGEMENT/IMPROVEMENT PLAN ALONG JUJA ROAD

30.5.5 Effectivity Analysis

An analysis of the corridor management/improvement measures is made to determine their effectiveness in terms of:

(1) Improvement of safety conditions at bus stop

Because all bus stops are now equipped with bus stop signs and shelters.

(2) Improvement of convenience of public transport users

Because there are less complaints and people are satisfied with the service.

(3) Increase of travel speed along the corridors

Because there are no long queues of passengers waiting on the street.

(4) Decrease of road traffic accidents along the corridors

Because of the reduction of persons and vehicles crossing on the street.

30.6 MODE INTERCHANGE AREA IMPROVEMENT

30.6.1 Selected MIAs

The short-term improvement plan of selected mode interchange areas such as large scale bus/matatu terminals and stops, as listed below, which largely affect the traffic situation in the city center is proposed. The location of selected MIAs is shown in Figure 30.6-1.

(1) Nairobi Station Plaza
(2) Bus Track Terminal
(3) Kencom Bus Stop
(4) GPO Bus Stop
(5) Globe Cinema Roundabout Matatu Terminal

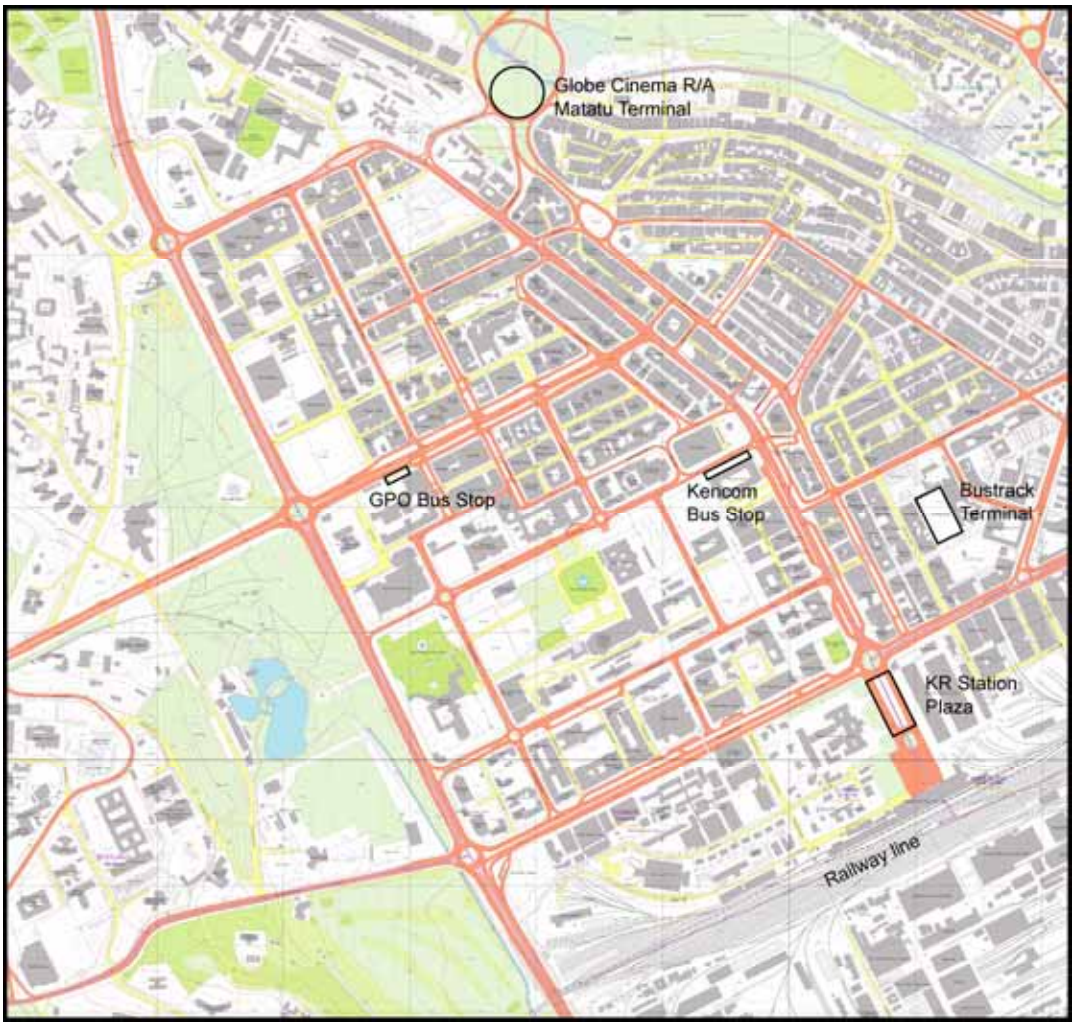


FIGURE 30.6-1 SELECTED MODE INTERCHANGE AREAS

30.6.2 Basic Considerations

Basic considerations for mode interchange area (MIA) planning are as follows:

- Improvement of convenience of transfer between modes;
- Improvement of comfort and safety while waiting for public transport modes;
- Improvement of efficiency of the existing mode interchange areas where lands are considered prime locations in the Nairobi Metropolitan Area; and
- Contribution of the urban environment and amenities by the improvement of MIAs.

30.6.3 Nairobi Station Plaza

(1) Existing Conditions

1) This MIA is the busiest and most varied in terms of modes using it, among the selected MIAs.
2) Total 12-hour traffic is more than 4,000 and consists of small matatus (57% of the total), big matatus (21%), Citi Poppas (7.5%), buses (1%) and others (13.5%), including private cars and taxis.
3) Maximum occupancy is 87 vehicles.
4) Daily railway passengers using Nairobi Station is approximately 16,000 (commuter passengers).
5) Station plaza utilization is shown in Figure 30.6-2. Matatu bays scatter all over the area.

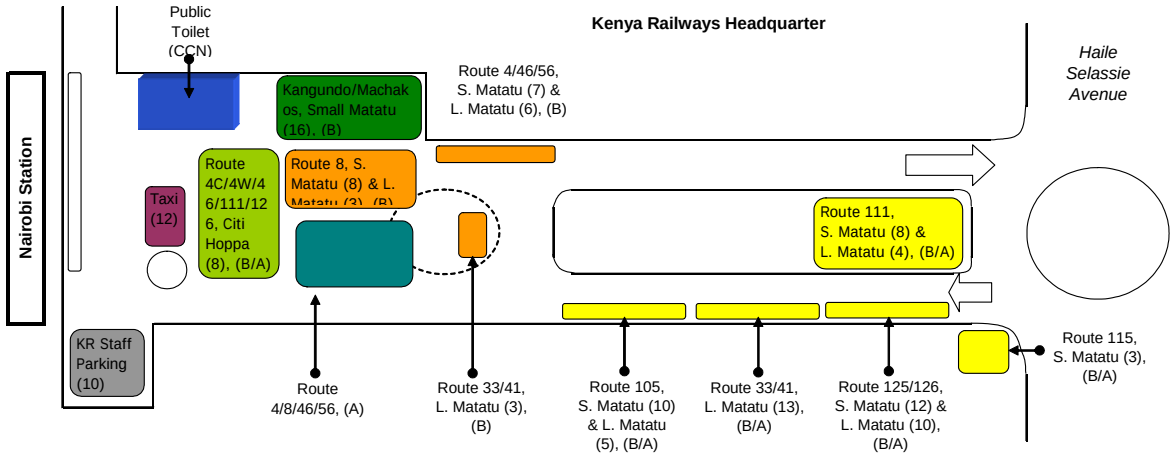


FIGURE 30.6-2 EXISTING CONDITIONS OF NAIROBI STATION PLAZA

6) Entrance/exit of Nairobi Station plaza is at one of the busiest roundabouts (Moi Avenue and Haile Selasseie Avenue intersection) in the CBD.
7) This was the origin of Nairobi city. It was the most beautiful landmark in the city.

(2) Planning Concept

Planning Concept for Nairobi Station Plaza improvement is as follows:

1) Revitalization as the most beautiful landmark in Nairobi city in the past years;
2) Improvement of function of transfer as a multi-modal interchange area; and
3) Preparation of newly proposed shuttle bus terminal instead of matatu boarding/alighting space, because almost all the matatus using this terminal will shift to Processional Way area in the near future.

(3) Proposed Plan

1) Planned modes

Based on the existing conditions and proposed shuttle bus system, the planned modes in Nairobi Station Plaza are as follows:

- Shuttle bus: a bus bay to accommodate 8 shuttle buses
- Standard Bus (intra-city): Bus track and other buses (8 buses)
- Standard Bus (inter-city): suburban routes such as Machakos and Kangundo (5 buses)
- Matatu: except for western routes (36 slots)
- Taxi: a taxi stand for 3 units and a taxi pool of 20 units are prepared
- Private car: 6-car loading/unloading bay including taxi unloading
- Bicycle: provide approximately 150 bicycle stands
- Pedestrian: develop a pedestrian network within the station plaza including pedestrian crossing

2) Other Facilities

Mode interchange areas (MIAs) such as station plaza are the place where many people are generated and attracted. Therefore, a mode interchange area has a great potential for commercial activities. A supermarket or shopping mall attached to a bus terminal or railway station is one of the most popular developments of modal interchange areas. Use of the mode interchange areas not only as commercial activities but also as public space is the trend in other countries. Branches of local government offices, galleries and libraries attached to the railway station are popular in Japan. This type of development may contribute not only to increase of public transport users but also to energize regional/community activities. This means that the mode interchange areas become the core of the community activities. In this study, the following are the candidates for attached facilities to the Nairobi Station Plaza:

- Commercial activities: Kiosks
- Other activities: CCN office branch, library, gallery and public open space

Examples of other facilities attached to railway stations in Japan are shown in Figure 30.6-3.

FIGURE 30.6-3 BEAUTIFUL STATION PLAZA DEVELOPMENT AT MARUGAME STATION IN JAPAN

3) Zoning

In accordance with the basic consideration and planned modes, zoning of Nairobi Station Plaza improvement is illustrated in Figure 30.6-4.

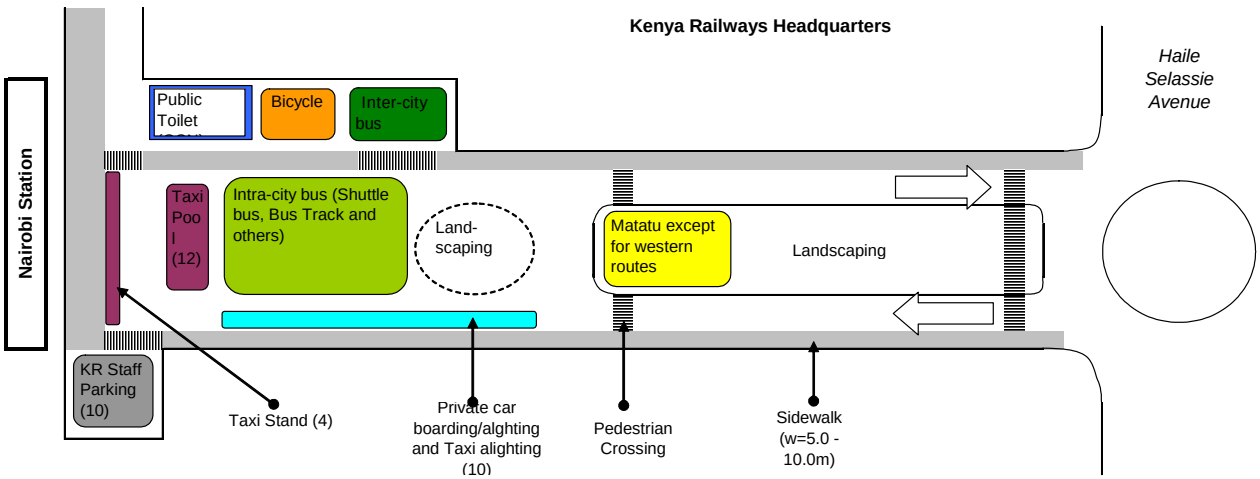


FIGURE 30.6-4 ZONING IN NAIROBI STATION PLAZA

4) Layout Plan

Based on the zoning, and configuration and unit standard, the proposed layout of Nairobi Station Plaza is shown in Figure 30.6-5.

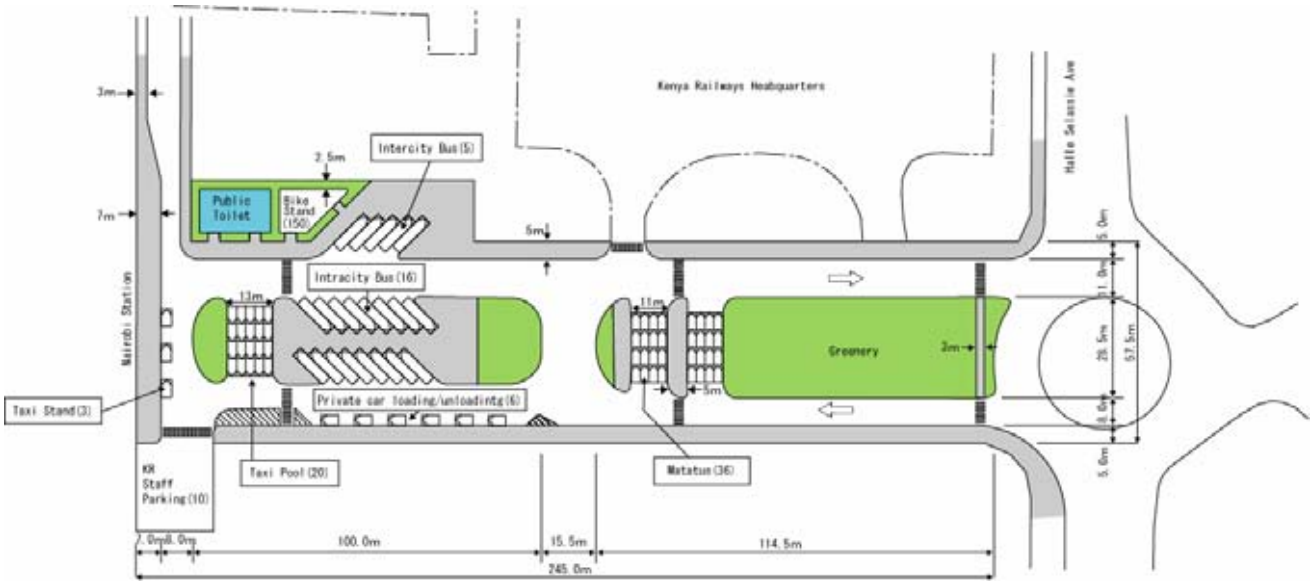


FIGURE 30.6-5 PROPOSED LAYOUT PLAN OF NAIROBI STATION PLAZA

30.6.4 Bus Track Terminal

(1) Existing Conditions

1) This terminal, which is used exclusively by Bus Track buses, measures 6,300m^2 and has 27 bus boarding/alighting berths located in the CBD where land commands high price.
2) Twelve-hour bus traffic is about 150 and maximum occupancy of buses is 11, which is less than half of capacity. The utilization of this terminal is extremely low.
3) Many matatus which wait for passengers block the entrance/exit of this terminal

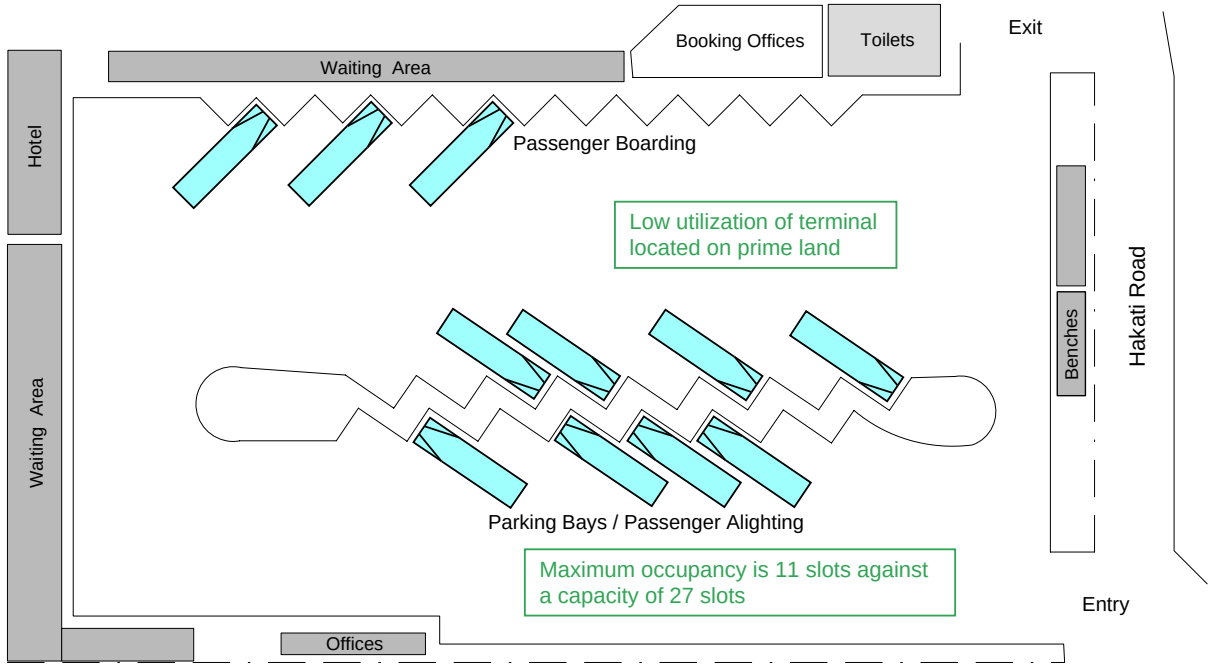


FIGURE 30.6-6 EXISTING CONDITIONS OF BUS TRACK TERMINAL

(2) Planning Concept

The planning concept of this terminal is to maximize use of valuable transport space located in the CBD not only for Bus Track but also for other public transport modes.

(3) Proposed Plan

Considering the number of peak hour incoming buses and average terminal time, required number of bus berths is 6 based on the following formula.

- Required number of bus/matatu berths (BB)

  BB= NB/2

  Where: NB: Peak hour number of arriving buses

  Terminal time at bus berth is 30 min. (Based on the average between Nairobi Station Plaza: 12 min. and Globe Cinema Terminal: 40 min.)

  12 buses/hour÷2buses/berth/hour= 6 berths

Therefore, it is proposed to put up 11 bus berths in the northern part of the terminal for exclusive use of Bus Track and 16 bus berths in the southern part which can be used by other public transport such as a depot of shuttle bus system.

30.6.5 Kencom Bus Stop

(1) Existing Conditions

1) All buses bound for western area in Nairobi use this bus stop. There are 7 routes including Ngong area. However, there is no bus stop sign including route and this causes inconvenience to waiting passengers.
2) The existing number of berths is limited. Most of the buses waiting for passengers wait a long time here resulting in a queue that reaches 23 buses in length (maximum) along Moi Avenue. This causes serious traffic jam along Moi Avenue.
3) Pavement surface at bus stop is deteriorated.

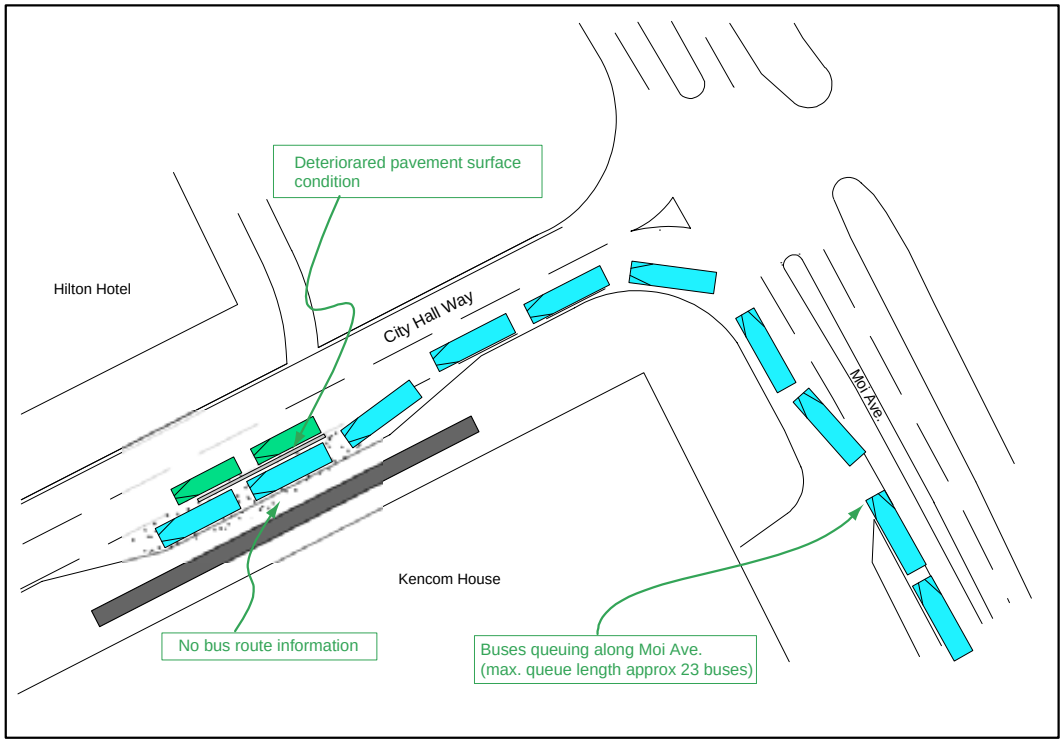


FIGURE 30.6-7 EXISTING CONDITIONS OF KENCOM BUS STOP

(2) Planning Concept

Planning concept of this bus stop is to minimize the traffic congestion of major road in Nairobi based on the proper bus bay space and to provide convenient bus stop facilities for the increase of convenience of bus users.

(3) Proposed Plan

1) To improve the bus users' convenience and to minimize the queue length of buses along Moi Avenue, it is proposed that 7 bus berths are prepared at Kencom Bus Stop.

Theoretically, if the proposed hourly number of handled at the bus stop is 140 (=7 berths × 60/3, assuming that the terminal time is 3 minutes, current terminal time at peak hour is 4.4 minutes), there is no bus queue any more, because peak hour arriving number of buses is 133 (terminal time: 4.4 minutes and peak hour number of buses: 133 refer to Table 30.2-1).

2) And, it is also proposed that all 7 bus berths be installed a bus stop sign indicating the route name to added to the convenience of bus users.

3) Pavement surface improvement at bus stop is necessary.

Proposed layout plan of Kencom Bus Stop is illustrated in Figure 30.6-8.

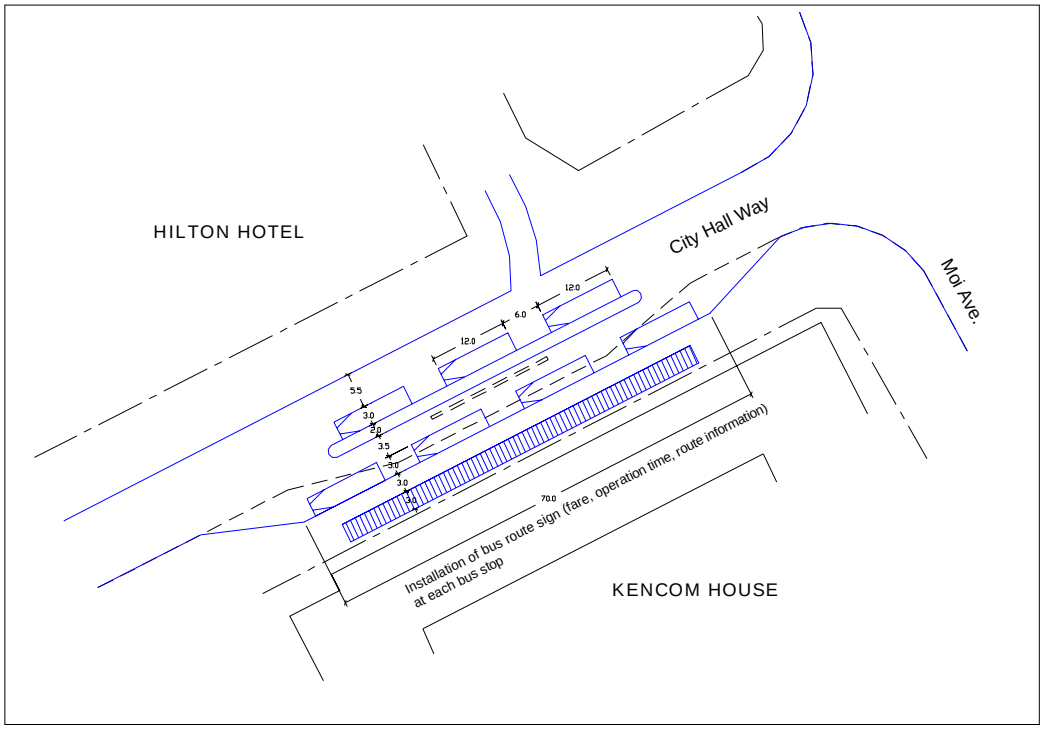


FIGURE 30.6-8 PROPOSED LAYOUT PLAN OF KENCOM BUS STOP

30.6.6 GPO Bus Stop

(1) Existing Conditions

1) Twelve-hour bus traffic is 1,373 (90% of total traffic use this bus stop); on the other hand, private car traffic is 140 veh/12-hour (about 10% of total traffic).
2) Currently this bus stop can accommodate 5 buses at the same time, however, many illegal private cars use the bus bay as on-street parking. Consequently, some buses, which could be as many as 5, are seen lining up before bus stop area.

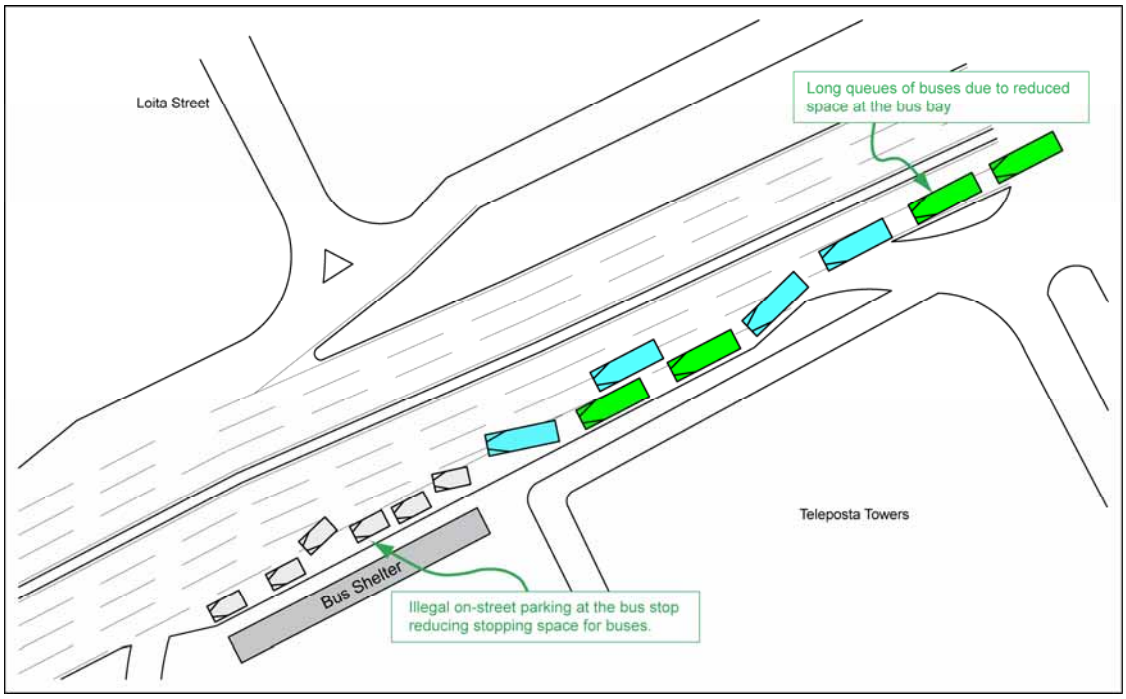


FIGURE 30.6-9 EXISTING CONDITIONS OF GPO BUS STOP

(2) Planning Concept

To minimize the traffic congestion and the risk of traffic accidents in and around GPO Bus Stop based on the proper use of bus stop space.

(3) Proposed Plan

Proposed plan of GPO Bus Stop is as follows:

1) To enforce the strict prohibition of on-street parking of private cars in this bus stop; and
2) To install the proper bus stop sign and marking at this bus stop.

30.6.7 Globe Cinema Terminal

(1) Existing Conditions

1) This MIA is newly developed to minimize the congestion in the CBD from heavy matatus traffic, i.e. matatus coming from Thika direction cutting their route at this terminal.
2) Total 12-hour traffic is 3,228 and consists of small matatus (60% of the total) and big matatus (40%).
3) Maximum occupancy is 94 matatus. This is the largest among the selected MIAs.
4) Crossing the busy circular roads is often a very risky situation for matatu users.
5) Existing conditions of this terminal is shown in Figure 30.6-10. Matatu bays scatter all over the area.

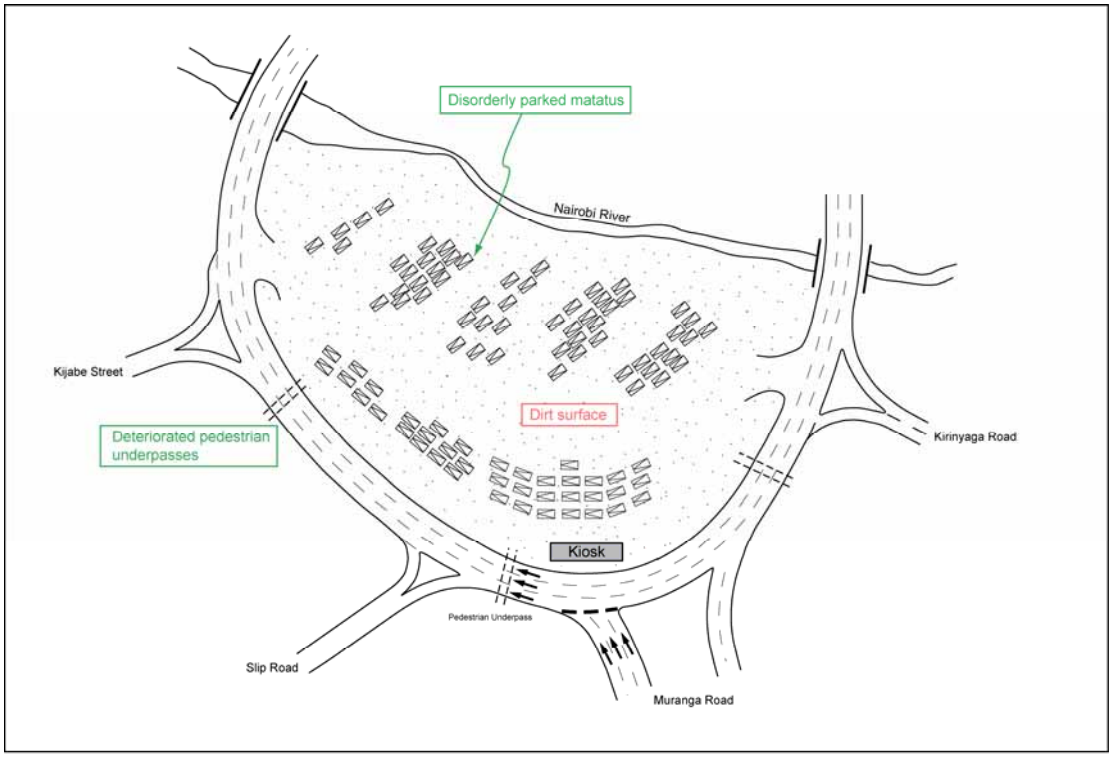


FIGURE 30.6-10 EXISTING CONDITIONS OF GLOBE CINEMA ROUNDABOUT TERMINAL

(2) Planning Concept

Planning Concept of Globe Cinema Roundabout is to develop the area as a multi-modal MIA consisting of matatus and other public transport modes such as the newly introduced shuttle buses.

(3) Proposed Plan

1) Basically, the matatu and shuttle bus boarding/alighting space is prepared at the initial

stage, to improve the convenience of public transport users, especially the matatu users using the Thika Road routes. And to minimize the congestion in this terminal, 34 matatu berths and 8 shuttle bus berths are proposed.

Theoretically, if the proposed hourly number of matatus handled at the matatu stop is 408 (=34 berths x 60/5, assuming that the terminal time is 5 minutes, based on the current terminal time at peak hour), there is no overflow matatus at this terminal, because peak hour arriving number of matatus is 198 (peak hour number of matatus: 198 refer to Table 30.2-1).

2) Eight shuttle bus stops are also proposed to increase convenience of public transport system in the CBD, as mentioned above.
3) And, it is also proposed that all matatu/shuttle bus berths be installed a bus/matatu stop sign indicating the route name to add to the convenience of bus/matatu users.
4) Deteriorated existing three pedestrian underpasses should be improved to secure the safety of terminal users and pedestrians in and around this terminal.
5) The multi-story commercial complex with car parking facilities will be developed on this terminal by PPP (public-private participation) scheme in the future as a northern new landmark in the CBD (southern landmark is Nairobi Station).

Proposed layout of Globe Cinema Roundabout is shown in Figure 30.6-11.

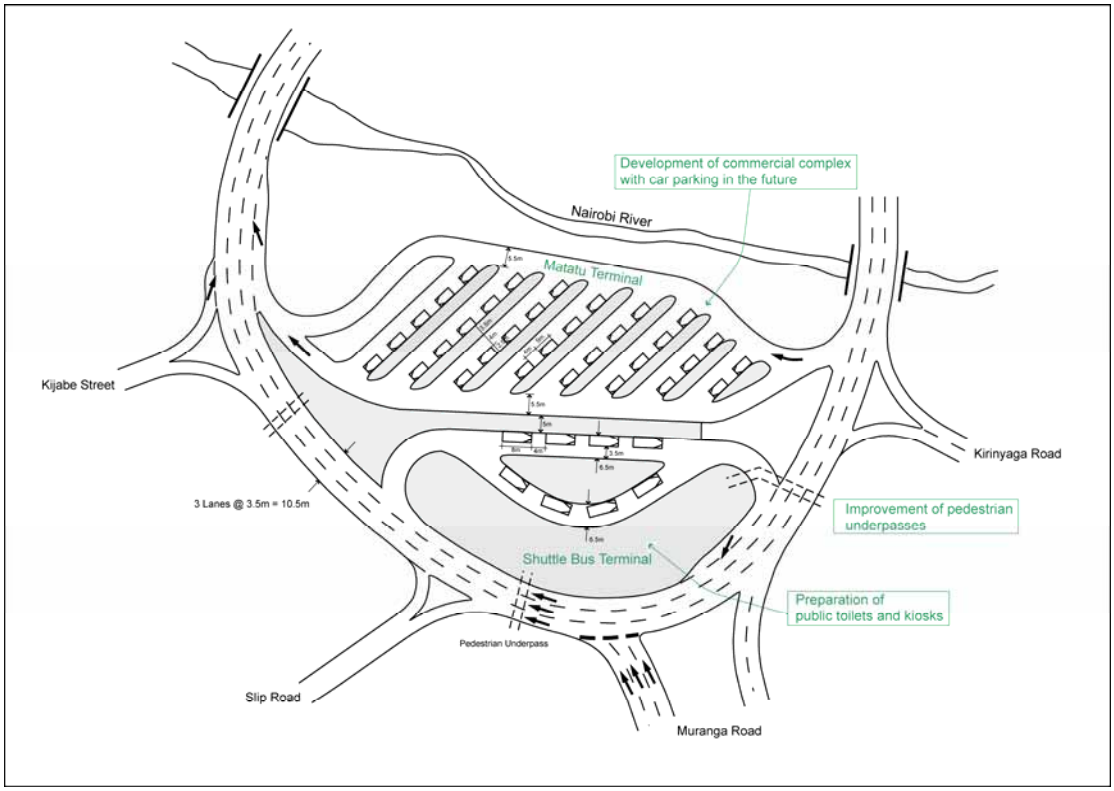
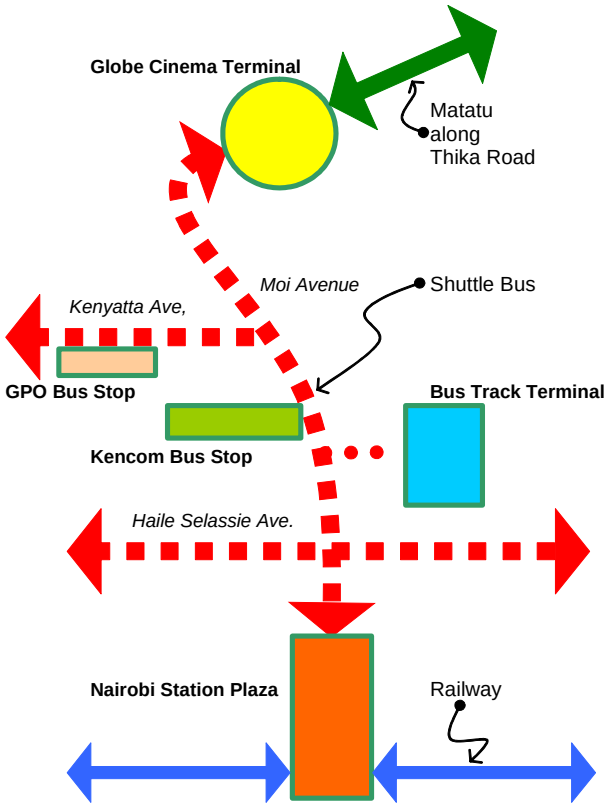


FIGURE 30.6-11 PROPOSED LAYOUT PLAN OF GLOBE CINEMA ROUNDABOUT

30.6.8 Effectivity Analysis

Mode interchange area improvement gives a great positive impact to the Nairobi Metropolitan Area. These are enumerated below and illustrated in Figure 30.6-12.

(1) Contribution of the urban amenities
(2) Decrease of traffic congestion
(3) Improvement of convenience of public transport users
(4) Improvement of safety
(5) Revitalization of the CBD
(6) Creation of landmark in Nairobi
(7) Effective utilization of under-utilized valuable land in the CBD



Effectivity / Name of MIA	Improvement of convenience of PT users	Decrease of traffic congestion	Improvement of safety	Contribution of the urban amenities	Revitalization of the CBD	Creation of landmark in Nairobi	Effective utilization of under-utilized valuable land in the CBD
Nairobi Station Plaza	✓			✓	✓	✓	
Bus Track Terminal	✓						✓
Kencom Bus Stop	✓	✓	✓				
GPO Bus Stop	✓	✓	✓				
Globe Cinema Terminal	✓	✓	✓	✓	✓	✓	✓

FIGURE 30.6-12 POSITIVE IMPACT OF MODE INTERCHANGE AREAS IMPROVEMENT

30.7 PRELIMINARY COST ESTIMATE

30.7.1 Proposed Shuttle Bus System

Based on the shuttle bus plan, cost is estimated as shown in Table 30.7-1.

TABLE 30.7-1 PRELIMINARY COST ESTIMATE

Unit: Thousand Ksh

No.	Description of Work	Unit	Unit Cost	Quantity	Cost	Remarks
1	Bus Fleet (51 seater)	Bus	3,967.00	210.00	833,070.00	Isuzu
2	Globe Cinema Terminal	m2				Not included. See MIA improvement
3	Muthurwa Terminal	m2				Not included
4	Processional Way Terminal	m2				Not included
5	Bus Bay	Nos	732.00	4.00	2,928.00	as per new sketch
6	Bus Shelter B	Nos	120.00	4.00	480.00	Size for Existing on Ngong Rd, 4.56㎡(3.8m x 1.2m)
7	Marking	m2	2.64	60.00	158.40	Use hot applied thermoplastic paint imported from South Africa or Dubai
	Sub Total 1				836,636.40	
8	Contingency	ls			125,495.46	15% of subtotal 1
	Sub Total 2				962,131.86	
9	Overhead	ls			240,532.97	25% of subtotal 2
	G.Total				1,202,664.83	

Note: all rates are excl.VAT, and reference only
assuming no soil replacement for black cotton soil

30.7.2 Public Transport Corridor Management/Improvement

The preliminary cost estimate is summarized in Table 30.7-2 based on the above discussions.

TABLE 30.7-2 PRELIMINARY COST ESTIMATE

Ngong Road

Unit: Thousand Ksh

No.	Description of Work	Unit	Unit Cost	Quantity	Cost	Remarks
1	Bus Bay	Nos	732.00	1.00	732.00	as per new sketch
2	Bus Shelter	Nos	120.00	3.00	360.00	as per existing metal stand on Ngong Rd
3	Bus Bay Marking	Nos	39.60	23.00	910.80	Use hot applied thermoplastic paint imported from South Africa or Dubai, assuming 15㎡/bay
4	Sidewalk Improvement	m2	2.47	50.00	123.50	t-200 bc, t-60 paving blocks
5	Dagoretti Corner Terminal	m2	7.48	500.00	3,740.00	t-300 sb, t-200 bc, t-50 ab, t-50 as, tc, pc
6	Mugo Kibiru Terminal	m2	7.48	500.00	3,740.00	t-300 sb, t-200 bc, t-50 ab, t-50 as, tc, pc
7	Marking for Bus/Matatu Priority Lane	m2	2.64	63.30	167.11	Use hot applied thermoplastic paint imported from South Africa or Dubai
8	Marking for Traffic Management	m2	2.64	139.50	368.28	Use hot applied thermoplastic paint imported from South Africa or Dubai
9	Marking for Pedestrian Crossing	m2	2.64	78.75	207.90	
10	Carriageway Improvement	m2	3.07		0.00	Excav. Dp 100mm,
11	Traffic Sign Post	Nos	40.00	2.00	80.00	
	Sub Total 1				10,429.59	
12	Contingency	ls			1,564.44	15% of subtotal 1
	Sub Total 2				11,994.03	
			OH(25%)		2,998.51	25% of subtotal 2
	G.Total				14,992.54	

Juja Road

Unit: Thousand Ksh

No.	Description of Work	Unit	Unit Cost	Quantity	Cost	
1	Bus Bay	Nos	732.00	7.00	5,124.00	as per new sketch
2	Bus Shelter	Nos	120.00	22.00	2,640.00	as per existing metal stand on Ngong Rd
3	Bus Bay Marking	Nos	39.60	25.00	990.00	Use hot applied thermoplastic paint imported from South Africa or Dubai, assuming 15㎡/bay
4	Sidewalk Improvement	m2	2.47	100.00	247.00	t-200 bc, t-60 paving blocks
5	ORR Corner South Terminal	m2	7.48	1,000.00	7,480.00	t-300 sb, t-200 bc, t-50 ab, t-50 as, tc, pc
6	ORR Corner North Terminal	m2	7.48	500.00	3,740.00	t-300 sb, t-200 bc, t-50 ab, t-50 as, tc, pc
	Sub Total 1				20,221.00	
7	Contingency	ls			3,033.15	15% of subtotal 1
	Sub Total 2				23,254.15	
			OH(25%)		5,813.54	25% of subtotal 2
	G.Total				29,067.69	

Note: all rates are excl.VAT, and reference only
assuming no soil replacement for black cotton soil

30.7.3 MIA Improvement

Preliminary cost estimate of the improvement of mode interchange areas is summarized in Table 30.7-3. Bus Track Terminal and GPO Bus Stop are not included in this cost estimate, because the measures of these MIAs are mainly traffic management.

TABLE 30.7-3 PRELIMINARY COST ESTIMATE

Nairobi Station

Unit: Thousand Ksh

No.	Description of Work	Unit	Unit Cost	Quantity	Cost	Remarks
1	Road Pavement	m2	7.48	10,109.00	75,615.32	t-300 sb, t-200 bc, t-50 ab, t-50 as, tc, pc
2	Sidewalk Pavement	m2	2.47	3,263.00	8,059.61	t-200 bc, t-60 paving blocks
3	Landscaping	m2	0.35	2,986.00	1,039.13	
4	Bus Shelter	Nos	1,900.80	3.00	5,702.40	Size for Kencom Bus stop, 144㎡ (36m x 4m)
5	Road Marking	m2	2.64	500.00	1,320.00	Use hot applied thermoplastic paint imported from South Africa or Dubai
6	Traffic Sign	Nos	36.00	1.00	36.00	
7	Street Light	Nos	317.25	12.00	3,807.00	
	Sub Total 1				95,579.46	
8	Contingency	ls			14,336.92	15% of subtotal 1
	Sub Total 2				109,916.38	
9	Overhead	ls			27,479.09	25% of subtotal 2
	G.Total				137,395.47	

Kencom Bus Stop

Unit: Thousand Ksh

No.	Description of Work	Unit	Unit Cost	Quantity	Cost	Remarks
1	Road Pavement	m2	7.48	870.00	6,507.60	t-300 sb, t-200 bc, t-50 ab, t-50 as, tc, pc
2	Sidewalk Pavement	m2	2.47	563.00	1,390.61	t-200 bc, t-60 paving blocks
3	Bus Shelter	Nos	1,900.80	2.00	3,801.60	Size for Kencom Bus stop, 144㎡ (36m x 4m)
4	Road Marking	m2	2.64	45.00	118.80	Use hot applied thermoplastic paint imported from South Africa or Dubai
	Sub Total 1				11,818.61	
5	Contingency	ls			1,772.79	15% of subtotal 1
	Sub Total 2				13,591.40	
6	Overhead	ls			3,397.85	25% of subtotal 2
	G.Total				16,989.25	

Globe Cinema Terminal

Unit: Thousand Ksh

No.	Description of Work	Unit	Unit Cost	Quantity	Cost	Remarks
1	Bus Shelter	Nos	1,900.80	10.00	19,008.00	Size for Kencom Bus stop, 144㎡ (36m x 4m)
2	Sidewalk Improvement	m2	2.47	4,083.00	10,085.01	t-200 bc, t-60 paving blocks
3	Road Pavement	m2	7.48	5,347.00	39,995.56	t-300 sb, t-200 bc, t-50 ab, t-50 as, tc, pc
4	Landscaping	m2	0.35	4,092.00	1,424.02	
5	Road Marking	m2	2.64	676.00	1,784.64	Use hot applied thermoplastic paint imported from South Africa or Dubai
6	Traffic Sign	Nos	36.00	1.00	36.00	
7	Street Light	Nos	317.25	10.00	3,172.50	
8	Underground Passage	m	195.00	10.00	1,950.00	
9	Kiosk	Nos	320.00	8.00	2,560.00	
10	Public Toilet	Nos	2,800.00	1.00	2,800.00	
	Sub Total 1				82,815.73	
11	Contingency	ls			12,422.36	15% of subtotal 1
	Sub Total 2				95,238.08	
12	Overhead	ls			23,809.52	25% of subtotal 2
	G.Total				119,047.61	

Note: all rates are excl.VAT, and reference only
assuming no soil replacement for black cotton soil

30.8 ECONOMIC AND FINANCIAL ANALYSIS

Based on the characteristics of the projects, the following economic and financial analysis is examined.

TABLE 30.8-1 PROJECTS AND ECONOMIC/FINANCIAL ANALYSIS MATRIX

Project	Economic Analysis	Financial Analysis
Proposed Shuttle Bus System	○	○
PT Corridor Management/Improvement	○	
MIA Improvement (Nairobi Station and Globe Cinema R/A)	○	○

30.8.1 Proposed Shuttle Bus System

(1) Economic Evaluation

1) Assumptions of Economic Analysis

The economic evaluation is carried out from view of whether or not the investment for the Shuttle Bus Introduction Project will be feasible in terms of national economy by the benefit-cost analysis.

Prior to carry out the economic analysis, the following presumptions are set up:

Evaluation Period

The evaluation period is assumed to be 10 years from 2010 to 2019 taking into account the nature of the Shuttle Bus Introduction Project. This period includes the construction period.

Implementation Schedule

The implementation schedule is assumed as follows:

- 2006 Implementation
- 2007 Open to the public

"With" and "Without" the Project

Economic benefits are calculated as differences between "With the Project" and "Without the project". For the calculation of economic befits, the situation of "Without the Project" is defined as "Do Nothing" is made, while "With the Project" is defined as the proposed Shuttle Bus Introduction Project is implemented.

Economic Benefits

Economic benefits in the economic analysis are assumed to be the following three:

- Vehicle operating cost
  - Vehicle running cost (VRC) (distance related running cost)
  - Vehicle fixed cost (VFC) (time related running cost)
- Travel time cost (TTC) by vehicle users

Economic Cost

The economic costs of the Project can be calculated from the financial costs deducting transfer elements such as import duties, taxes and tariffs, subsidies and other price distortion to trade. According to the recent feasibility study of Northern Corridor Transport project, the transfer element was calculated at 22 % to the total construction and maintenance cost. In this study therefore, it is assumed that the economic costs are calculated to deduct 22 % of the financial costs.

Economic Indicators

The economic evaluation method is principally employed benefit cost analysis. The economic indicators used in this study are as follows:

- Net Present Value (NPV)
- Benefit Cost Ratio, (BCR), and
- Economic Internal Rate of Return (EIRR)

2) Traffic Demand Forecast

Future traffic demand forecasted in a form of OD matrix (years 2010, 2015 and 2025) was assigned on the road network to estimate traffic volume in the city center. The estimated vehicle kilometers and vehicle hours of the road network in Nairobi for the case of "with" and "without" the project is summarized in Table 30.8-2.

TABLE 30.8-2 TOTAL VEHICLE KILOMETERS IN NAIROBI WITH AND WITHOUT SHUTTLE BUS INTRODUCTION PROJECT

Unit: '000 PCU Km/day

	W/O Project	W/ Project	W/O – W/
2010	14,192.3	14,109.0	83.2
2015	17,864.7	17,767.1	97.5
2025	28,080.7	27,709.2	371.5

Note: All traffic flow implementation measures are implemented by 2008

TABLE 30.8-3 TOTAL VEHICLE HOURS IN NAIROBI WITH AND WITHOUT SHUTTLE BUS INTRODUCTION PROJECT

Unit: Thousand PCU Hour/Day

	W/O Project	W/ Project	W/O – W/
2010	513.4	502.4	11.0
2015	814.4	797.5	16.8
2025	2,180.8	2,153.4	27.4

Note: Same notes as in Table 30.8-2

3) Estimation of Benefit

a) Basic Vehicle Operating Cost

The basic vehicle operating cost (BVOC) was estimated in the master plan stage. (See Table 30.8-4)

TABLE 30.8-4 BASIC VEHICLE OPERATING COST (EXCLUDING TAX)

Vehicle Type	Running (Ksh/km)	Fixed (Ksh/Hour)	Time (Ksh/Hour)
Car	7.3	27.2	33.1
Matatu	10.7	66.3	25.3
Bus	22.4	86.8	83.2
Medium Truck	19.2	65.3	0.0
Heavy Truck	28.3	83.1	0.0

Note: All costs are expressed as 2004 prices

b) Estimation of Benefits

The saving in vehicle operating costs and travel time cost were estimated and are shown in Table 30.8-5.

TABLE 30.8-5 ESTIMATION OF BENEFITS

Unit: Thousand Ksh/Year

Year	Saving in VRC	Saving in VFC	Saving in VOC	Saving in TTC	Total Saving
2010	242,813	73,920	316,733	79,926	396,659
2015	314,853	113,190	428,043	122,430	550,473
2020	614,241	137,583	751,824	148,814	900,639

Note: Same notes as in Table 30.8-4

4) Economic Cost Estimate

The project cost, which was already calculated in the previous section, is expressed as the financial cost. It is therefore to convert from financial cost to economic cost. In this study

the economic cost was estimated to deduct from financial cost to government taxes and shadow prices of unskilled labor is shown in Table 30.8-6.

TABLE 30.8-6 ECONOMIC COST ESTIMATE

Unit: Thousand Ksh

Description		Economic Cost	Financial Cost
1	Bus Fleet (51 seater)	649,795	833,070
2	Bus Bay	2,284	2,928
3	Bus Shelter	374	480
4	Road Marking	123	158
5	Contingency / Overhead	285,502	366,028
	Total	938,079	1,202,665

Maintenance Cost

The estimated maintenance cost, which consists of routine maintenance, is converted to the economic cost and shown in Table 30.8-7.

TABLE 30.8-7 ECONOMIC MAINTENANCE COST ESTIMATE

Unit: Thousand Ksh

	Economic Cost	Financial Cost
Routine maintenance Cost	18,762	24,054

5) Economic Evaluation

Benefit Cost Analysis

Based on the above mentioned benefits and cost estimates, the economic analysis of the Project was made. Table 30.8-8 shows the benefit – cost analysis of Shuttle Bus Introduction Project during project life period of 10 years and Table 30.8-9 shows the benefit cost stream. The results of the economic analysis show that a Net Present Value (NPV) of Ksh 652 million and BCR of 1.80 over 10 years life of the road using a discount date of 12% which is designated by the Ministry of Planning and Economic Development. The Economic Internal Rate of Return (EIRR) was compiled at 24.7 %.

TABLE 30.8-8 ECONOMIC INDICATIONS OF BENEFIT COST ANALYSIS

Net Present Value	Ksh 651.8 million
BCR	1.80
EIRR	24.7%

Notes: 1) Project life is assumed to be 10 years
2) Discount rate is 12%

TABLE 30.8-9 BENEFIT - COST STREAM OF SHUTTLE BUS PROJECT

Undiscounted BenefiT Cost Stream

Unit: Thousand Ksh

Sq	Year	Construction Cost	O & M Cost	Cost Total	VOC	TTC	Benefit	Cost-Benefit
1	2004	0	0	0			0	0
2	2005	0	0	0			0	0
3	2006	938,079	0	938,079			0	-938,079
4	2007	0	18,762	18,762	56,980	12,660	69,639	50,878
5	2008	0	18,762	18,762	130,452	29,472	159,924	141,163
6	2009	0	18,762	18,762	176,463	47,551	224,014	205,252
7	2010	0	18,762	18,762	316,733	79,926	396,659	377,897
8	2011	0	18,762	18,762	312,454	87,052	399,506	380,744
9	2012	0	18,762	18,762	330,558	94,799	425,357	406,595
10	2013	0	18,762	18,762	350,562	103,236	453,798	435,037
11	2014	0	18,762	18,762	372,743	112,424	485,167	466,405
12	2015	0	18,762	18,762	428,043	122,430	550,473	531,711
13	2016	0	18,762	18,762	473,067	122,430	595,497	576,735
Residual value		-83,307	0	-83,307	0	0	0	83,307
Total		854,772	187,616	1,042,387	2,948,054	811,980	3,760,034	2,717,647

Discounted Benefit Cost Stream

Unit: Thousand Ksh

Sq	Year	Discounted	Cost Total	Benefit	Cost-Benefit
1	2004	1.000	0	0	0
2	2005	1.120	0	0	0
3	2006	1.254	747,831	0	-747,831
4	2007	1.405	13,354	49,568	36,214
5	2008	1.574	11,923	101,635	89,712
6	2009	1.762	10,646	127,112	116,466
7	2010	1.974	9,505	200,960	191,455
8	2011	2.211	8,487	180,716	172,229
9	2012	2.476	7,578	171,795	164,217
10	2013	2.773	6,766	163,644	156,879
11	2014	3.106	6,041	156,211	150,170
12	2015	3.479	5,394	158,248	152,854
13	2016	3.896	4,816	152,849	148,034
Residual value		3.896	-21,383	0	21,383
Total			810,956	1,462,737	651,781

NPV (KSh Million)	651.8
B/C Ratio	1.80

6) Sensitivity Analysis

The sensitivity analysis is conducted under a worse case scenario incorporating increase and/or decrease of the estimation of costs and benefits. Table 30.8-10 shows the results of the sensitivity analysis.

TABLE 30.8-10 SENSITIVITY ANALYSIS REGARDING COSTS AND BENEFITS OF SHUTTLE BUS INTRODUCTION PROJECT

		Indicator	Benefits		
			20% down	Base Case	20% up
Costs	20% down	NPV (Million Ksh)	526	818	1,111
		B/C Ratio	1.82	2.27	2.72
		EIRR (%)	24.7	30.7	35.8
	Base Case	NPV (Million Ksh)	359	652	944
		B/C Ratio	1.44	1.80	2.16
		EIRR (%)	19.6	24.7	29.5
	20% up	NPV (Million Ksh)	193	485	778
		B/C Ratio	1.20	1.50	1.80
		EIRR (%)	15.6	20.5	24.7

Note: Project life of the project is assumed to be 10 years

7) Summary of Economic Analysis

The implementation of the Shuttle Bus Introduction Project in City Center can be justified from view of national economic point since the economic indicators of all cases are more than the over cut-off level which can be considered as 12% of EIRR in Kenya.

(2) Financial Analysis of Shuttle Bus System

The shuttle bus introduction project is evaluated from the financial view point in this section.

1) Assumptions

In order to evaluate financially, the following assumptions are employed in this study;

- The financial costs are estimated at mid-2005 constant prices, as shown in previous section.
- Regarding to the implementation schedule, the following implementation schedule is assumed;
  - Start of the project: 2006
  - Open to public: 2007
- The evaluation period is assumed to be 10 years of a period between 2006 and 2016.

A flat fare system is adopted based on the present fare level, that is, a Ksh 10. The increment of fare during 10 year period will not be considered in the financial analysis.

- Number of passengers used for the shuttle bus is forecasted to be 160,000 passengers / day in 2007 and there is no increment during 10 year period.
- Residual value of buses is assumed to be 10 % of initial bus fleet cost.
- Based on the actual operating and management costs of Metro Bus Service in the Kenya Bus Company, which is the similar bus service of the proposed Shuttle Bus, the unit bus operating and management costs are assumed to be Ksh 30 / km.

2) Operating Characteristics of the Shuttle Bus

The operating characteristics of the shuttle bus are shown in Table 30.8-11.

TABLE 30.8-11 (1) OPERATING CHARACTERISTICS (1)

Item	Value
A. Operating Distance (km)	7.80
B. No. of Stations	13.00
C. Scheduled Speed (km/h)	20.00
A. Potential Demand (000 Pax/day)	160.00
D. Peak-Hr Traffic (000/hr, both directions)	19.20
E. Aver. Trip Length (pax-km)	4.00
F. Capacity per bus (pass.)	50.00
G. No. of bus at peak	192.00
H. One-Way Travel Time (mins.)	23.25
I. Dwell Time at Terminal (mins.)	6.75
J. No. of spared bus	19.00
K. No of fleet required	210.00

TABLE 30.8-11(2) OPERATING CHARACTERISTICS (2)

Operating Parameters	Value
A. Potential Demand (000 Pax/day)	160.00
B. Pk-Hr Traffic (000/hr, both directions)	19.20
C. One-Way Travel Time (mins.)	23.25
D. Dwell Time at Terminal (mins.)	6.75
E. No. of Fleet required	211.00
F. Total Bus-km per Day	17,856.00
G. Unit Bus Operating and Management Cost (KSh / km)	30.00
H. Annual Bus Operating and Management Cost (Ksh Million)	176.80

3) Financial Analysis

The results of the financial analysis are summarized in Table 30.8-12. The FIRR for the shuttle Bus Project is computed at 25.4 % in case of unit bus operating and management cost being Ksh 30 /km, which implies that the project will be highly viable from the financial point of view.

TABLE 30.8-12 FINANCIAL INDICATORS OF SHUTTLE BUS PROJECT

FIRR	25.39 %
B/C Ratio	1.44
NPV	Ksh 771.3 million

TABLE 30.8-13 CASH FLOW OF THE SHUTTLE BUS PROJECT

Unit: Million Ksh

Year	Investment	O&M (incremental)	Total Out-Flow	Revenue (incremental)	Net Cash Flow	Discount Cash Flow(at 12%)		
						Out-Flow	In-Flow	Net
	(1)	(2)	(3)=1+2	(4)	(5)=4-3	(6)	(7)	(8)=7-6
2005	0					0.0		
2006	1,202.7		1,202.7		-1,202.7	1,045.8		-1,045.8
2007	0	176.8	176.8	528.0	351.2	133.7	420.9	287.3
2008	0	176.8	176.8	528.0	351.2	116.2	375.8	259.6
2009	0	176.8	176.8	528.0	351.2	101.1	335.6	234.5
2010	0	176.8	176.8	528.0	351.2	87.9	299.6	211.7
2011		176.8	176.8	528.0	351.2	76.4	267.5	191.1
2012		176.8	176.8	528.0	351.2	66.5	238.8	172.4
2013		176.8	176.8	528.0	351.2	57.8	213.3	155.5
2014		176.8	176.8	528.0	351.2	50.3	190.4	140.2
2015		176.8	176.8	528.0	351.2	43.7	170.0	126.3
Residual	-120.3	0.0	-120.3		120.3	-38.7	0.0	38.7
Total	1,082.4	1,591.0	2,673.4	4,752.0	2,078.6	1,740.5	2,511.9	771.3

4) Sensitivity Analysis

The sensitivity analysis of the Shuttle Bus Project is made by changing investment cost, operating and management cost and / or fair revenues. Table 30.8-14 (1) and (2) shows the results of the sensitivity analysis. These tables show that if fair revenue will be able to obtain the original estimation, that is, number of passenger will be able to ensure, the project will be financially feasible.

TABLE 30.8-14 (1) SENSITIVITY ANALYSIS OF THE PROJECT (FIRR)

		Operating & Management Cost		
		0.8	1.0	1.2
Revenue	0.8	18.2	14.3	10.2
	1.0	28.9	25.4	21.8
	1.2	38.8	35.5	32.2

Note: Investment cost is assumed to be no-change.

TABLE 30.8-14 (2) SENSITIVITY ANALYSIS OF THE PROJECT (FIRR)

		Investment Cost		
		0.8	1.0	1.2
Revenue	0.8	20.9	14.3	9.5
	1.0	33.9	25.4	19.4
	1.2	45.9	35.5	28.3

Note: Operating and management cost is assumed to be no-change.

30.8.2 Public Transport Corridor Management/Improvement

(1) Economic Evaluation

1) Assumptions of Economic Analysis

The economic evaluation is carried out from view of whether or not the investment for the Public Transport Corridor Improvement Project will be feasible in terms of national economy by the benefit-cost analysis.

Prior to carry out the economic analysis, the following presumptions are set up:

a) Evaluation Period

The evaluation period is assumed to be 10 years from 2010 to 2019 taking into account the nature of the Public Transport Corridor Improvement Project. This period includes the construction period.

b) Implementation Schedule

The implementation schedule is assumed as follows:

- 2006 - 2010 Implementation
- 20011 Open to the public

c) “With” and “Without” the Project

Economic benefits are calculated as differences between “With the Project” and “Without the project”. For the calculation of economic befits, the situation of “Without the Project” is defined as “Do Nothing” is made, while “With the Project” is defined as the proposed Public Transport Corridor Improvement Project is implemented.

d) Economic Benefits

Economic benefits in the economic analysis are assumed to be the following three:

- Vehicle operating cost
  - Vehicle running cost (VRC) (distance related running cost)
  - Vehicle fixed cost (VFC) (time related running cost)

- Travel time cost (VTTC) by vehicle users

However, due to the nature of the Public Transport Corridor Improvement Project, saving in vehicle fixed cost and travel time cost is considered in this study.

e) Economic cost

The economic costs of the Project can be calculated from the financial costs deducting transfer elements such as import duties, taxes and tariffs, subsidies and other price distortion to trade. According to the recent feasibility study of Northern Corridor Transport project, the transfer element was calculated at 22 % to the total construction and maintenance cost. In this study therefore, it is assumed that the economic costs are calculated to deduct 22 % of the financial costs.

f) Economic Indicators

The economic evaluation method is principally employed benefit cost analysis. The economic indicators used in this study are as follows:

- Net Present Value (NPV)
- Benefit Cost Ratio, (BCR), and
- Economic Internal Rate of Return (EIRR)

2) Traffic Demand Forecast

Future traffic demand forecasted in a form of OD matrix (years 2010, 2015 and 2025) was assigned on the road network to estimate traffic volume in the NMA. The estimated vehicle kilometers and vehicle hours on Ngong and Juja Roads is calculated in Table 30.8-15.

TABLE 30.8-15 VEHICLE KILOMETERS ON NGONG AND JUJA ROADS

Unit: Thousand PCU Km/day

	Ngong Road	Juja Road	Total
2010	128,999	133,890	262,888
2015	217,578	199,589	417,168
2025	336,362	278,374	614,736

Note: All traffic flow implementation measures are implemented by 2008

TABLE 30.8-16 VEHICLE HOURS ON NGONG AND JUJA ROADS

Unit: Thousand PCU Hour/day

	Ngong Road	Juja Road	Total
2010	6,418	5,261	11,679
2015	10,825	7,842	18,667
2025	16,734	10,938	27,673

Note: Same notes as in Table 30.8-15

3) Estimation of Benefit

Basic Vehicle Operating Cost

The basic vehicle operating cost (BVOC) was estimated in the master plan stage. (See Table 30.8-16)

Estimation of Benefits

The savings in vehicle operating cost and travel time cost were estimated and are shown in Table 30.8-17.

TABLE 30.8-17 ESTIMATION OF BENEFITS

Unit:Thousand Ksh/Year

Year	Saving in VRC	Saving in VFC	Saving in VOC	Saving in TCC	Total Saving
2004	0	6,338	6,338	4,473	10,811
2010	0	10,130	10,130	7,150	17,280
2015	0	15,017	15,017	10,600	25,616

Note: VRC is assumed to be 0 due to very small amounts of saving in VRC.

4) Economic Cost Estimate

Economic Cost

The project cost, which was already calculated in the previous section, is expressed as the financial cost. It is therefore to convert from financial cost to economic cost. In this study the economic cost was estimated to deduct from financial cost to government taxes and shadow prices of unskilled labor is shown in Table 30.8-18.

TABLE 30.8-18 ECONOMIC COST ESTIMATE

Unit: Thousand Ksh

Description		Economic Cost	Financial Cost
1	Ngong Road	11,695	14,993
2	Juja Road	22,673	29,068
	Total	34,368	44,060

Maintenance Cost

The maintenance cost, which consists of routine maintenance, is converted to the economic cost and shown in Table 30.8-19.

TABLE 30.8-19 ECONOMIC COST ESTIMATE

Unit: Thousand Ksh

	Economic Cost	Financial Cost
Routine maintenance Cost	687.3	881.2

5) Economic Evaluation

Benefit Cost Analysis

Based on the above mentioned benefits and cost estimates, the economic analysis of the Project was made. Table 30.8-20 shows the benefit – cost analysis of Public Transport Corridor Improvement Project during project life period of 20 years and Table 30.8-21 shows the benefit cost stream. The results of the economic analysis show that a Net Present Value (NPV) of Ksh 53.7 million and BCR of 2.77 over 10 years life of the road using a discount rate of 12% which is designated by the Ministry of Planning and Economic Development. The Economic Internal Rate of Return (EIRR) was compiled at about 40.0 %.

TABLE 30.8-20 ECONOMIC INDICATIONS OF BENEFIT COST ANALYSIS

NPV	Ksh 53.7 million
B/C	2.77
EIRR	36.4 %

Notes: 1) Project life is assumed to be 10 years
2) Discount rate is 12%

TABLE 30.8-21 BENEFIT COST-STREAM OF PUBIC TRANSPORT CORRIDOR IMPROVEMENT PROJECT

Unit: Thousand Ksh

Year	Investment	O&M	Total Out-Flow	Benefit	Net Benefit Flow	Discount Cash Flow(at 12%)		
						Cost	Benefit	Net
	(1)	(2)	(3)=1+2	(4)	(5)=4-3	(6)	(7)	(8)=7-6
2005	0					0.0		
2006	11,455.7		11,455.7		-11,455.7	10,228.3		-10,228.3
2007	11,455.7		11,455.7		-11,455.7	9,132.4	0.0	-9,132.4
2008	11,455.7		11,455.7		-11,455.7	8,153.9	0.0	-8,153.9
2009		687.3	687.3	15,985.4	15,298.1	436.8	10,159.0	9,722.2
2010		687.3	687.3	17,280.2	16,592.9	390.0	9,805.3	9,415.3
2011		687.3	687.3	18,679.9	17,992.6	348.2	9,463.8	9,115.6
2012		687.3	687.3	20,193.0	19,505.7	310.9	9,134.3	8,823.4
2013		687.3	687.3	21,828.6	21,141.3	277.6	8,816.2	8,538.6
2014		687.3	687.3	23,596.8	22,909.4	247.9	8,509.2	8,261.4
2015		687.3	687.3	25,616.5	24,929.1	221.3	8,247.8	8,026.5
2016		687.3	687.3	25,616.5	24,929.1	197.6	7,364.1	7,166.5
2017		687.3	687.3	25,616.5	24,929.1	176.4	6,575.1	6,398.7
2018		687.3	687.3	25,616.5	24,929.1	157.5	5,870.6	5,713.1
Total	34,367.0	4,811.4	39,178.4	143,180.4	104,002.1	30,278.8	83,945.5	53,666.7

Sensitivity Analysis

The sensitivity analysis is conducted under a worse case scenario incorporating increase and/or decrease of the estimation of costs and benefits. Table 30.8-22 shows the results of the sensitivity analysis.

TABLE 30.8-22 SENSITIVITY ANALYSIS REGARDING COSTS AND BENEFITS OF PUBIC TRANSPORT CORRIDOR IMPROVEMENT PROJECT

		Indicator	Benefits		
			20% down	Base Case	20% up
Costs	20% down	NPV (Million Ksh)	42.9	59.7	78.5
		B/C Ratio	2.7	3.47	4.16
		EIRR (%)	36.4	43.2	49.3
	Base Case	NPV (Million Ksh)	36.9	53.7	70.5
		B/C Ratio	2.22	2.77	3.33
		EIRR (%)	30.3	36.4	41.9
	20% up	NPV (Million Ksh)	30.8	47.6	64.4
		B/C Ratio	1.85	2.31	2.77
		EIRR (%)	25.6	31.3	36.4

Note: Project life of the project is assumed to be 10 years

6) Summary of Economic Analysis

The implementation of the Public Transport Corridor Improvement Project can be justified from view of national economic point since the economic indicators of all cases are more than the over cut-off level which can be considered as 12% of EIRR in Kenya.

30.8.3 MIA Improvement

(1) Economic Evaluation

1) Assumptions of Economic Analysis

The economic evaluation is carried out from view of whether or not the investment for the Public Mode Interchange Area (MIA) Improvement Project will be feasible in terms of national economy by the benefit-cost analysis.

Prior to carry out the economic analysis, the following presumptions are set up:

a) Evaluation Period

The evaluation period is assumed to be 11 years from 2011 to 2020 taking into account the nature of the MIA Improvement Project.

b) Implementation Schedule

The implementation schedule is assumed as follows:

- 2006 - 2010 Implementation
- 2011 Open to the public

c) "With" and "Without" the Project

Economic benefits are calculated as differences between "With the Project" and "Without the project".

d) Economic Benefits

Economic benefits in the economic analysis are assumed to be the following three:

- Vehicle operating cost
  - Vehicle running cost (VRC) (distance related running cost)
  - Vehicle fixed cost (VFC) (time related running cost)
- Travel time cost (TTC) by vehicle users

However, due to the nature of the MIA project, saving in vehicle fixed cost and travel time cost is considered in this study.

e) Economic Cost

As mentioned in the previous section, it is assumed that the economic costs are calculated to deduct 22 % of the financial costs.

f) Economic Indicators

The economic evaluation method is principally employed benefit cost analysis. The economic indicators used in this study are as follows:

- Net Present Value (NPV)
- Benefit Cost Ratio, (BCR), and
- Economic Internal Rate of Return (EIRR)

2) Traffic Demand Forecast

Future traffic demand forecasted in a form of OD matrix (years 2010, 2015 and 2025) was assigned on the road network to estimate traffic volume in the NMA. The estimated vehicle and vehicle hours used for Nairobi Station and Glove Cinema terminals is calculated in Table 30.8-23.

TABLE 30.8-23 NUMBER OF VEHICLES USED FOR NAIROBI AND GLOVE CINEMA PUBLIC MODE INTERCHANGES AREA

Unit: Thousand Vehicle/Day

	Nairobi Station	Glove Cinema	Total
2004	3,521	3,114	6,635
2010	3,965	3,507	7,472
2015	4,378	3,872	8,250

Note: All traffic flow implementation measures are implemented by 2008

TABLE 30.8-24 TERMINAL TIME OF NAIROBI AND GLOVE CINEMA PUBLIC MODE INTERCHANGES AREA

Unit: Thousand Vehicle/Day

	Nairobi Station	Glove Cinema	Total
2004	290,483	256,905	547,388
2010	327,131	289,316	616,448
2015	361,179	319,428	680,607

Note: Same notes as in Table 30.8-23

3) Estimation of Benefit

Basic Vehicle Operating Cost

The basic vehicle operating cost (BVOC) was estimated in the master plan stage. (See Table 30.8-25)

Estimation of Benefits

The saving in vehicle operating costs and travel time cost were estimated and are shown in Table 30.8-25.

TABLE 30.8-25 ESTIMATION OF BENEFITS

Unit: Thousand Ksh/Year

Year	Saving in VRC	Saving in VFC	Saving in VOC	Saving in TCC	Total Saving
2004	0	40,424	40,424	25,507	65,931
2010	0	45,524	45,524	28,725	74,249
2015	0	50,262	50,262	31,715	81,976

Note: VRC is assumed to be 0 due to very small amounts of saving in VRC.

4) Economic Cost Estimate

a) Economic Cost

The project cost, which was already calculated in the previous section, is expressed as the financial cost. It is therefore to convert from financial cost to economic cost. In this study the economic cost was estimated to deduct from financial cost to government taxes and shadow prices of unskilled labor is shown in Table 30.8-26.

TABLE 30.8-26 ECONOMIC COST ESTIMATE

Unit: Thousand Ksh

Description		Economic Cost	Financial Cost
1	Nairobi Station	107,168	137,395
2	Glove Cinema	92,857	119,048
	Total	200,025	256,443

b) Maintenance Cost

The maintenance cost, which consists of routine maintenance, was estimated in 30.8-27. The maintenance cost is converted to the economic cost as follows:

TABLE 30.8-27 ECONOMIC COST ESTIMATE

Unit: Thousand Ksh

	Economic Cost	Financial Cost
Routine maintenance Cost	687.3	881.2

5) Economic Evaluation

a) Benefit Cost Analysis

Based on the above mentioned benefits and cost estimates, the economic analysis of the Project was made. Table 30.8-28 shows the benefit – cost analysis of Traffic Flow Improvement Project in CBD Construction Project during project life period of 20 years and Table 30.8-29 shows the benefit cost stream. The results of the economic analysis show that a Net Present Value (NPV) of Ksh 195.8 million and BCR of 2.21 over 10 years life of the terminals using a discount date of 12% which is designated by the Ministry of Planning and Economic Development. The Economic Internal Rate of Return (EIRR) was compiled at about 36 %.

TABLE 30.8-28 ECONOMIC INDICATIONS OF BENEFIT COST ANALYSIS

NPV	Ksh 195.8 million
B/C	2.21
EIRR	35.9 %

Notes: 1) Project life is assumed to be 10 years
2) Discount rate is 12%

b) Sensitivity Analysis

The sensitivity analysis is conducted under a worse case scenario incorporating increase and/or decrease of the estimation of costs and benefits. Table 30.8-30 shows the results of the sensitivity analysis.

TABLE 30.8-29 BENEFIT COST-STREAM OF MIA PROJECT

Unit: Million Ksh

Year	Investment	O&M	Total Cost	Benefit	Net Cash Flow	Discount Cash Flow(at 12%)		
						Cost	Benefit	Net
	(1)	(2)	(3)=1+2	(4)	(5)=4-3	(6)	(7)	(8)=7-6
2005	0					0.0		
2006	40.0		40.0		-40.0	35.7		-35.7
2007	40.0	0.8	40.8	15.1	-25.7	32.5	12.1	-20.5
2008	40.0	1.6	41.6	30.3	-11.3	29.6	21.6	-8.1
2009	40.0	2.4	42.4	45.4	3.0	26.9	28.9	1.9
2010	40.0	3.2	43.2	60.6	17.4	24.5	34.4	9.9
2011		4.0	4.0	75.7	71.7	2.0	38.4	36.3
2012		4.0	4.0	77.2	73.2	1.8	34.9	33.1
2013		4.0	4.0	78.8	74.8	1.6	31.8	30.2
2014		4.0	4.0	80.4	76.4	1.4	29.0	27.5
2015		4.0	4.0	82.0	78.0	1.3	26.4	25.1
2016		4.0	4.0	83.6	79.6	1.2	24.0	22.9
2017		4.0	4.0	85.3	81.3	1.0	21.9	20.9
2018		4.0	4.0	87.0	83.0	0.9	19.9	19.0
2019		4.0	4.0	88.7	84.7	0.8	18.2	17.3
2020		4.0	4.0	90.5	86.5	0.7	16.5	15.8
Total	200.0	48.0	248.0	980.7	732.7	162.2	358.0	195.8

NPV(Mill. Ksh	195.8
B/C	2.21
FIRR(%)	35.89

TABLE 30.8-30 SENSITIVITY ANALYSIS REGARDING COSTS AND BENEFITS OF MIA PROJECT

		Indicator	Benefits		
			20% down	Base Case	20% up
Costs	20% down	NPV (Million Ksh)	157	228	300
		B/C Ratio	2.21	2.76	3.31
		EIRR (%)	35.9	45.7	56.2
	Base Case	NPV (Million Ksh)	124	196	267
		B/C Ratio	1.77	2.21	265
		EIRR (%)	27.8	35.9	43.7
	20% up	NPV (Million Ksh)	92	163	235
		B/C Ratio	1.47	1.84	221
		EIRR (%)	22.1	29.2	35.9

Note: Project life of the project is assumed to be 10 years

c) Summary of Economic Analysis

The implementation of the MIA Project can be justified from view of national economic point since the economic indicators of all cases are more than the over cut-off level which can be considered as 12% of EIRR in Kenya.

(2) Financial Analysis for MIA Project

The MIA Project is evaluated from the financial view point in this section.

1) Assumptions

In order to evaluate financially, the following assumptions are employed in this study;

- The financial costs are estimated at mid-2005 constant prices, as shown in previous section.

- Regarding to the implementation schedule, the following implementation schedule is assumed;
  - Start of the project: 2006
  - Completion of the project: 2010
  - Open to public: 2011
- The evaluation period is assumed to be 10 years between 2011 and 2020.
- A terminal charge is adopted to be the same as present level, that is, Ksh 70. The increment of fare during 10 year period will not be considered in the financial analysis.
- Residual value of terminal is not considered in this study.

2) Operating Characteristics of the MIA Terminals

The operating characteristics of the MIA terminals are shown in Table 30.8-31.

TABLE 30.8-31 OPERATING CHARACTERISTICS

Item	Nairobi Sta. Terminal	Glove Bus Terminal	Total
A. Number of Bus/Matatu in 2004	3,521	3,114	6,635
B. Terminal Fee (Ksh)	70	70	70
C. Day to Year Multiplier	330	330	330
D. Present Terminal Time (min/veh)	30	30	30
E. Saving in Terminal Time	15	15	15
F. Total Saving in Terminal Time (vehi-hour/year)	290,483	256,905	547,388
G Financial Revenue (Ksh'000/year)	290,483	256,905	547,388
G. Traffic Growth Rate (%)	1.02	1.02	1.02

3) Financial Analysis

The results of the financial analysis are summarized in Table 30.8-32. The FIRR for the MIA Project is computed at 4.0 %, which implies that the project will be highly viable from the financial point of view.

TABLE 30.8-32 FINANCIAL INDICATORS OF SHUTTLE BUS PROJECT

NPV	Ksh 425.0 million
B/C Ratio	2.52
EIRR	43.0 %

30.9 IMPLEMENTATION SCHEDULE

Taking into consideration the preparatory works and resources required, the implementation schedule is proposed as shown in Table 30.9-1.

TABLE 30.9-1 IMPLEMENTATION SCHEDULE

Project	Quantity	Cost (Kshs. Mil.)	Implementation Schedule				
			2006	2007	2008	2009	2010
1. Introduction of Shuttle Bus System in the CBD	LS	1,203					
2. Corridor Management/Improvement	LS	44					
3. Mode Interchange Areas Improvement	LS	273					

Note: Cost of public transport rerouting along Missing Links is included in Chapter 28.

30.10 TRAFFIC SAFETY EDUCATION AND REGULATION

Traffic safety education and regulation for public transport related persons, such as drivers, conductors and users, is one of the most important measures to prepare the convenient public transport system in Nairobi Metropolitan Area.

Even if excellent physical development is implemented, the facilities can not be adequately and fully used without proper traffic safety education/regulation. Lack of proper traffic safety/regulation education is one of the serious problems in the transport sector not only in Nairobi but in other areas of country as well.

On the other hand, the SIDA/GOK initiative named “Kenya Road Safety Action Plan (2005–2010)” is on going. This Action Plan discusses and recommends the comprehensive national road safety issues based on 14 sectors. ‘Public Transport Regulations and Compliance’ is one of the 14 sectors of this Action Plan. The objective and key implementation points of this sector are as follows:

Objective: Improve public transport operations and safety standards as a result of better legislation, self-regulation in the industry, government & industry partnership, improved awareness of compliance requirements and corrective enforcement.

Key implementation Points:

- Review the law and introduce new legislation, ensuring harmonization with national policy & the institutional set-up;
- Transport associations and investors shall be involved by the Government in formulating policy developments and interventions to provide safe public transport;
- Transport operators should be encouraged to emphasize self-regulation by strengthening the capacity of transport associations and their membership to regulate their own business and follow the law;
- There is a need to upgrade the requirements, skills and competence of public service vehicle (PSV) drivers and improve passenger safety;
- There should be financial incentives for smaller operators to invest in bigger capacity vehicles to ease congestion and improve management in the sector;
- There is need to provide easy access to clear information for potential investors in the sector;
- Commuters should be educated and empowered to bring improvements to public transport operations;
- Strengthen law enforcement officers' knowledge and skills in dealing with public transport operators to achieve traffic regulation compliance by corrective rather than punitive measures;
- Reorganize and improve the management of bus/matatu terminal to be safe, efficient transit points for commuters;
- Improve the provision of infrastructure especially adequate bus/matatu stops and terminals;
- Establish a clear public transport policy and emphasize on prioritizing mass public transport compared to private car users.

In this section, considering the points laid out in "Kenya Road Safety Action Plan (2005–2010)", more concrete safety measures could be recommended. These are as follows:

Recommendations for traffic safety education and traffic regulation

- For the bus/matatu drivers/conductors
  - Do not wait for passengers at bus/matatu stop (bus/matatu stop is the place for passenger loading/unloading)
  - Bus/matatu should stop at proper position in the bus bay
- For the bus/matatu passengers
  - Bus/matatu passenger should not cross the road just in front and back of bus/matatu
  - Passengers should form a line when waiting to board a bus/matatu, especially at terminals and major bus stops.
  - Give priority for alighting passengers

- Give priority for disabled, aged and small children

・Others

- Private cars should not drive along bus/matatu priority lane

30.11 ENVIRONMENT AND SOCIAL CONSIDERATIONS

30.11.1 Major Environmental Impacts

(1) Improvement of Public Transportation System

1) Improvement of Matatu Terminals Around CBD

Anticipated areas of the improvement of matatu terminals are: 1) Roundabout at Globe Cinema at Murang Road; 2) Muthurwa Estate to the northeast of Nairobi Railway Station on Muthurwa Road; and 3) Kenya Railway's property at Uhuru Park on Haile Selassie Avenue. As explained in the above sections, these three terminals would serve as the terminals for changing sub-urban public transportation of matatu to shuttle bus services, which this study team would like to suggest. Details of the component of Project are shown in Figure 30.3-1. From the environmental point of views, the following is noted:

<u>Anticipated Environmental Impacts</u>

- Natural Environment

i. Roundabout at Globe Cinema at Murang Road

- Upon construction of terminal buildings for shopping mall sewage discharge from the terminal building would contaminate the water in Nairobi River. Thus, appropriate size of sewage treatment system should be installed.
- Number of trees damaged as a result of matatu bay and terminal building construction works would have to be compensated by planting appropriate number of trees in the surrounding areas.
- Noise, vibration and air pollution within the roundabout are expected to increase to some extent.
- Since the riparian environment along Nairobi River has been deteriorated during the past decades, Naivasha Thorn tree which would extend branches for shading, Nandi Flame tree which blossom with red flowers, or Jacaranda which would blossom with purple flowers might be planted in and around the terminal area.

ii. Muthurwa Estate to the northeast of Nairobi Railway Station on Muthurwa Road

- Trees lining the area are lost to some extent and that the compensating tree planting is encouraged to implement.
- Noise, vibration and air pollution within the terminal are expected to increase to some extent.
- Naivasha Thorn tree which would extend branches for shading, Nandi Flame tree which blossom with red flowers, or Jacaranda which would blossom with purple flowers might be planted in and around the terminal area in order to enhance urban amenity.

iii. Kenya Railway's Property at Uhuru Park on Haile Selassie Avenue

- Noise, vibration and air pollution within the terminal are expected to increase to some extent.
- Trees in Uhuru Park would not be cut down although there are no rare species adjacent to the area for propose terminal. Instead, Naivasha Thorn tree which would extend branches for shading, Nandi Flame tree which blossom with red flowers, or Jacaranda which would blossom with purple flowers might be planted in and around the terminal area.

- Social Environment

i. Roundabout at Globe Cinema at Murang Road

- As matatu terminals are developed, passenger services such as kiosks, food stalls, and a large number of vendors as well as passengers would flock around the terminal area. This would generate a large amount of solid waste as well as sewage discharge to the near-by Nairobi River.
- Depending on the way the terminal is developed for the use of passengers and vendors, a large number of kiosk owners and Jua Kali Project operators of small scale artisan shops scattered throughout the city would probably be greatly benefit if they could be housed in the terminal building built partly or whole of it as hawker's market. Such market place would greatly benefit both vendors and passengers who would purchase their daily needs on the way back home.
- Uniformly designed kiosk would be placed for vending news papers and snacks in order to serve the daily needs of the commuters.

ii. Muthurwa Estate to the northeast of Nairobi Railway station on Muthurwa Road

- There are a number of relatively high income resident subject to resettlement. Because of relatively wealthy families are living in a relatively large size estate houses built in Muthurwa Estate, the cost of resettlement would run as high as Ksh. 2-3 million per household although it is a very rough estimation.

Detailed cost of resettlement and overall resettlement action plan is subject to further study.

- In conjunction with the introduction of shuttle bus services, there would be very significant commercial activities developed in this area. Thereby vitalization of the local economy is expected to a large extent.
- Uniformly designed kiosk would be placed for vending news papers and snacks in order to serve the daily needs of the commuters.

iii. Kenya Railway's Property at Uhuru Park on Haile Selassie Avenue

- Convenience for visiting these areas would increase to some extent because of improved public transportation system.
- In conjunction with the introduction of shuttle bus services, there would be very significant commercial activities developed in this area. Thereby vitalization of the local economy is expected to a large extent.
- Uniformly designed kiosk would be placed for vending news papers and snacks in order to serve the daily needs of the commuters.

2) Introduction of Shuttle Bus System around CBD

Details of the introduction of shuttle bus services of the Project are shown in Figure 30.3-1. From the environmental point of views, the following is noted:

Anticipated Environmental Impacts

- Natural Environment
  - As a large number of bus/mataru entering CBD are replaced by shuttle buses, noise, vibration and air pollution are reduced in this particular area to some extent. Details of the factors on noise, vibration and air pollution are subject to further study.

- Social Environment
  - Introduction of modern shuttle bus should greatly reduce the traffic volume of matatu entering the CBD area. Depending on the way it is operated, it should attract private car owners and that it should contribute to reduce overall volume of traffic in CBD.
  - Modern shuttle bus service should introduce comfortable bus riding, which would be mentally and physically comfortable. It would also be relatively fast to go to work and that the mental and physical comfortableness of passengers would create positive attitude among the workforce.

(2) Public Transport Corridor Management

1) Improvement of Bus Route on Ngong Road

Details of the improvement of bus route on Ngong Road of the Project are shown in Figure 30.5-5 and 30.5-6. From the environmental point of views, the following is noted:

Anticipated Environmental Impacts

- Social Environment
  - There is a large number of bus/matatu bays improved along Ngong Road as a result of this particular component of the Project. Thus, efficiency of the public transportation system should be greatly improved.
  - A couple of bus/matatu stops are planned to create at large shopping centres along the road. Thus convenience to the shoppers, particularly for those of low income families, should be improved to a large extent.

2) Improvement of Bus Route on Juja Road and Ring Road Ngara

Details of the improvement of bus route on Juja Road to Ring Road Ngara of the Project are shown in Figure 30.5-7. From the environmental point of views, the following is noted:

Anticipated Environmental Impacts

- Social Environment
  - Because of the large number of bus/matatu stops constructed along the road, the behavior of waiting passengers to occupy portion of the road will be avoided. This would greatly reduce the risk on traffic safety.

(3) Improvement of Mode Interchange Area

1) Improvement of Nairobi Station Plaza

Details of the improvement of Nairobi Station Plaza are shown in Figure 30.6-5. From the environmental point of views, the following is noted:

Anticipated Environmental Impacts

- Natural Environment
  - As a part of environmental mitigation measures for the Project as a whole, tree planting for the Nairobi Station Plaza will have to be implemented in order to rejuvenate the station plaza as a landmark of downtown Nairobi. Indigenous trees such as Naivasha Thorn tree which would extend branches for shading, Nandi Flame tree which blossom with red flowers, or Jacaranda which would blossom

with purple flowers might be planted in and around the terminal area. Naivasha thorn tree would extend branches for shading while Nandi flame tree would blossom with red flowers. Jacaranda would blossom with purple flowers and probably the most beautiful trees in Africa.

- Social Environment
  - Re-organizing of the railway station square should reduce congestion of the vehicles and commuters to a great extent.
  - With consolidation of the bus/matatu stops, flow of commuters and vehicles would be controlled which would improve traffic safety.
  - Uniformly designed kiosk would be placed for vending news papers and snacks in order to serve the daily needs of the commuters.
  - Statues of wildlife crafted locally made out of scrap metals, such as elephants, giraffes and other mammals as well as birds, would be placed as the land mark of the station plaza.

2) Improvement of Bus Stops within CBD

Details of the improvement of bus stops within CBD are shown in Figure 30.6-8. From the environmental point of views, the following is noted:

Anticipated Environmental Impacts

- Social Environment
  - Improvement of public transport service should become psychologically and physically comfortable to the commuters and shoppers. The commuters should feel that it becomes relatively fast to go to work or shopping and that the mental comfortableness of passengers would create positive attitude among the workforce.

30.11.2 Effects of the Project to the Psycho-physical Conditions of Commuters

As a result of the improvement of public transportation system, the following is noted in terms of behavioral changes and economic productivity as a whole.

Psycho-physical Comfortableness

- Controlled flow of public transportation at improved roundabouts and signalized intersections would mean that not only the drivers but also passengers would feel psycho-physical comfortableness during the riding hours. Thus, smooth flow of traffic would affect psychological attitude to a more positive side and in return it would affect physical comfortableness of the passengers.

Increase of Economic Productivity

- As irritating traffic congestion is reduced at various points in the city centre of Nairobi, general travelling time of goods and passengers would be reduced to a large extent i.e. economic productivity over time would be improved.
- Continuous slow movement of vehicular traffic at roundabouts and signalized intersections do not require overly long time of stop-and-go of the public transportation system i.e. not only noise and vibration emanated from vehicles entering the roundabouts and signalized intersections are reduced but also consumes less fuel than they are at present. In view of increasing number of not-so-well serviced vehicles and higher fuel cost in the future in Kenya, improved traffic flow would contribute to prevent it from increasing air pollution and the cost of fuel.

30.12 INSTITUTIONAL AND FINANCIAL CONSIDERATIONS

30.12.1 Current Situation

(1) Relating Entities for the Schemes

The above stated plans of “Bus/ Matau Rerouting Plan in the City Center,” “Public Transport Corridor Management/ Improvement,” and “Mode Interchange Area (MIA) Improvement” are all related to the road based public transport service i.e. bus/ matatu services. Table 30.12-1 shows players of the sector in NMA of which details are described in Chapter 7 and Appendix 7.

TABLE 30.12-1 PLAYERS OF PT SECTOR IN NMA

Entity/Function	Facility	Legislative	Licensing	Education/ Publicity	Law Enforce.	PT Service
MOT	-	R	-	(R)	-	-
TLB	-	-	R	(R)	-	-
CCN	R	-	-	(R)	-	-
MOLG/ UDD	(R)	-	-	(R)	-	-
MRPW	R	-	-	-	-	-
Traffic Police	-	-	-	(R)	R	-
Education Entities	-	-	-	R	-	-
Publicizing Entities	-	-	-	R	-	-
KBS	-	-	-	-	-	P
Matatus	-	-	-	-	-	P
New Bus Companies	-	-	-	-	-	P

R: Responsible

(R): Partly Responsible

P: Providing

For the schemes, most of facilities provision, and operation and maintenance for PT such and bus/ matatu terminals and stops are under responsibility of CCN while MRPW is responsible for bus/ matatu stop facility for the roads under their jurisdiction.

Bus/ matatu licensing is under TLB and legislation regarding PT is managed by MOT. Traffic Police is in charge of law enforcement and direct traffic flow control. Education and publicity regarding PT are handled by education and publicizing entities with information/ contents provided by CCN, MOT, TLB, and Traffic Police.

PT service providers are KBS, matatu operators and emerging bus companies.

This study for institutional and financial consideration puts focus on bus/ matatu facility provision, legislative control, bus/ matatu licensing, and service providers as shown in Figure 30.12-1.

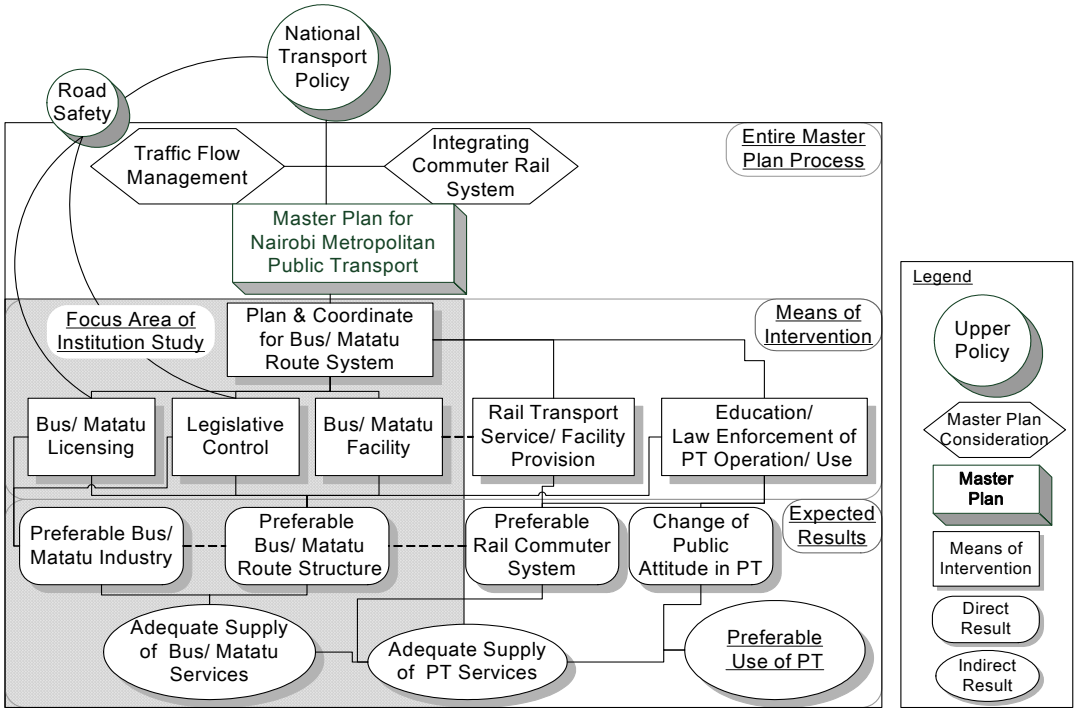


FIGURE 30.12-1 FOCUS AREA OF INSTITUTION AND FINANCING STUDY FOR THE SCHEMES

It has to be noted, as stated in detail in Chapter 7 and Appendix 7, that these functions and activities in the NMA's public transport sector are discretely conducted without explicit common direction for its preferable future. Public transport service itself is provided by the business or profit oriented operators with almost no intervention from the public interest point of view.

(2) Means of Intervention and Tool for Materialization of the Schemes

For materialization of the short term schemes, there are 3 utilizable means of intervention in focus area:

1) Provision, operation and maintenance of bus/ matatu facilities – CCN in basic,
2) Legislative Control - MOT, and
3) Bus/ Matatu Licensing - TLB.

Each one of these means of intervention is able to have at least 2 tools as follows:

1) Facility Provision
   a) Bus/ matatu stop facility provision, operation and maintenance
   b) Mode Interchange Terminal provision, operation and maintenance
2) Legislative Control
   a) Regulation for facility use to eliminate traffic flow impediment
   b) Deregulation for standing passenger to increase carrying capacity of city center bus

3) Bus Matatu Licensing
   a) Licensing based on criteria and incentive/ condition
   b) Support for bus company formulation as operators for particular routes

At present, all the above promising intervention tools are not utilized intentionally for materialization of preferable state of the public transport and most of them are not in use.

Table 30.12-2 summarizes the above discussions. All the means of intervention are functioning in certain degree while some of intervention tools are not in existence.

TABLE 30.12-2 RESPONSIBLE ORGANIZATION AND INTERVENTION MEANS AND TOOLS

Agency	Means of Intervention	Intervention Tool
CCN	Bus/ Matatu Facility Provision	Stop Facility Mode Interchange Terminal
MOT	Legislative Control	Regulation for Facility Use Deregulation for Standing Passenger
TLB	Bus/ Matatu Licensing	Licensing Based on Criteria Support for Bus Company Formulation

The above mentioned tools have to be utilized in harmonized manner for the materialization of the schemes. Combinations of tools for a particular scheme are shown in Table 30.12-3.

TABLE 30.12-3 COMBINATION OF INTERVENTION TOOLS AND SCHEMES

Scheme	Agency	Intervention Tool	Role
Selected Route PT Corridor Management	CCN	Stop Facility	Main
	MOT	Regulation for Facility Use	Main
Selected Mode Interchange Area Improvement	CCN	Mode Interchange Terminal	Main
	MOT	Regulation for Facility Use	Sub
	MOT	Deregulation for Standing Passenger	Sub
Shuttle Bus System in CBD	TLB	Licensing Based on Criteria	Main
	MOT	Deregulation for Standing Passenger	Main
	CCN	Mode Interchange Terminal	Main
	CCN	Stop Facility	Sub
	MOT	Regulation for Facility Use	Sub
	TLB	Support for Bus Company Formulation	Sub
Public Transport along Missing Link	TLB	Licensing Based on Criteria	Main
	CCN	Stop Facility	Sub
	TLB	Support for Bus Company Formulation	Sub

The Corridor Management Schemes are expected to be materialized by appropriate stop facility provision/ maintenance and proper rules and regulations preparation aside from education/ training and enforcement.

The Mode Interchange Area Improvement Schemes are basically facility provision, operation and maintenance type project which are supported by proper rules and regulations, and deregulation of standing passenger in the city centre since effects of the schemes shall be substantially enhanced by other measures like the Shuttle Bus System in CBD.

The scheme for Shuttle Bus System in CBD requires complex interventions of intentional licensing, deregulation of standing passenger for the shuttle bus as well as mode interchange terminal provision/ operation. The intentional licensing must be based on articulated and publicized criteria enabling selection of appropriate operators for the licensing. Stop facility provision/ improvement and supporting instrument such as official credit guarantee for fostering preferable bus industry for service provision to the system supports the success of the scheme.

For providing desirable public transport system along the newly constructing Missing Link Roads, guided induction of preferable public transport service provider through licensing is a main instrument for materialization. Appropriate stop facilities have to be properly incorporated in the road construction and fostering preferable bus industry may help the materialization.

It has to be noted that the above combinations can effectively work for the materialization when plan and action for coordination in accordance with the Master Plan PT concept are successfully practiced. Figure 30.12-2 shows the relationship of the above discussions.

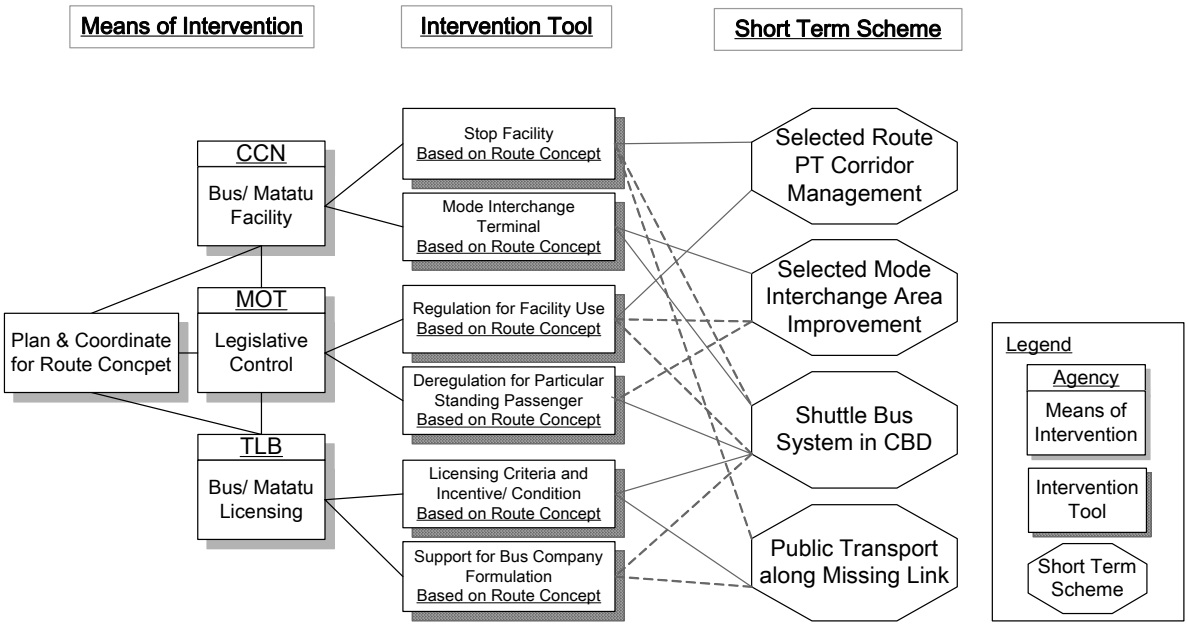


FIGURE 30.12-2 RELATIONSHIPS OF INTERVENTION MEANS AND TOOL, AND THE SCHEME

(3) Issues for Materialization of the Schemes

The issues are discussed in two aspects: service providers which are intervened side and public sector which is intervening side.

1) Bus/ Matatu Licensing and Support for Proper Development of the Industry

Current controversial prevalence of the matatus in the road based public transport providers are mainly due to the followings two factors:

- Licensing bestowal without considering eligibility as a public transport provider to eliminate inappropriate operators, and
- Absence route structure plan and officially arranged routes, and criteria for distributing appropriate operating vehicles in particular routes for licensing.

To solve these problems, the latter one requires technical capacity building regarding particular planning and criteria preparation which takes long time, while the former can be done immediately. As a measure for the short term the licensing with the consideration of the eligibility is appropriate and applicable immediately.

The eligibility for the licensing consideration involves wide varieties of issues starting from legitimate payment of taxes and duties, transparent accounting, legitimate employment practices, explicit fare structures, observation of licensed route operations, scheduled operations, and so on. It is recommended to apply these aspects with explicit criteria for licensing.

Applying these criteria for licensing practice has to be conducted in incremental manner starting from the basic requirement to an applicant to be a formal legal person such as legitimate payment of taxes and duties considering the present licensing practice. The licenses are basically bestowed when an applicant possesses legitimate ownership of the subject vehicle which is qualified in terms of safety standards.

At the same time it is recommended to licensing agency to arrange rendering services necessary for potential applicants to develop themselves to satisfy the criteria. If it is possible subsidised fund procurement assistance to the current matatu operators to unite as a legitimate company for upgraded operations.

2) Lack of Coordinated Activity

The other important problematic issue for the materialization aside from the financial issue is the lack of coordinated activity in the sector in general. As explained in previous part (1) in this Section, functions and activities relating to the public transport sector are discretely conducted.

These disintegrated activities in the sector are considered to be caused by lack of a coordinating, initiating, or leading entity as shown in Figure 30.12-3. Planning and coordinating functions to guide or direct relating entities for intended direction are crucial for integrated efforts for creation of preferable public transport condition.

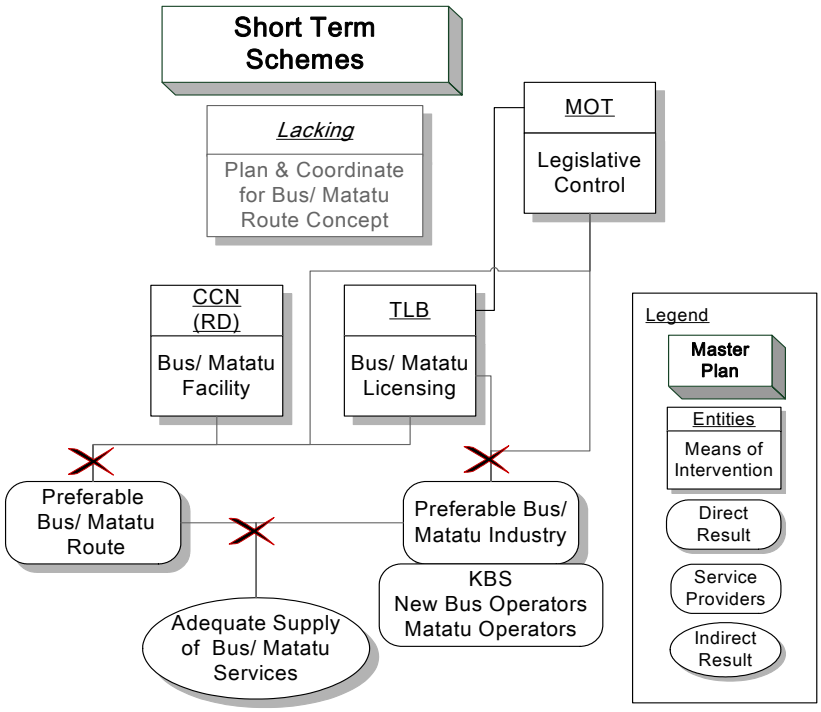


FIGURE 30.12-3 CURRENT ORGANIZATIONAL ARRANGEMENT

30.12.2 Ideal Institutional Arrangement and Kenyan Efforts

(1) Ideal Institutional Arrangement

Ideal institutional arrangement for the public transport sector in NMA is to establish a leading agency which executes not only planning and coordinating functions but also enjoys certain authority to mobilize relating entities for harmonized actions to materialize preferred condition of the sector. The leading agency has to hold fund channelling and procurement capabilities with its own implementation capacity for physical development and operation schemes as well as comprehensive planning ability. Licensing capability in bus/ matatu operations is recommended to be held by the agency for assuring the bus/ matatu route management by an effective tool of the licensing.

Since traffic management involves identical entities with the public transport sector except for the rail transport, the institutional arrangement for the public transport sector can naturally be expanded to entire transport management, called like the Nairobi Metropolitan

Transport Authority, including wider sense of traffic management which contains roads development as shown in Figure 30.12-4. As physical planning activities are conducted by LAs, significance of interrelated planning between transport and land use described in Chapter 21 is not stated here. It has to be mentioned, however, preparation or revision of the Master Plan requires involvement of MOLG.

Although details are not mentioned here importance of law enforcement, driver education and training, public education, publicity, rail transport has to be noted. The said Authority has to plan and coordinate these activities with relating entities with contents and materials if they are necessary.

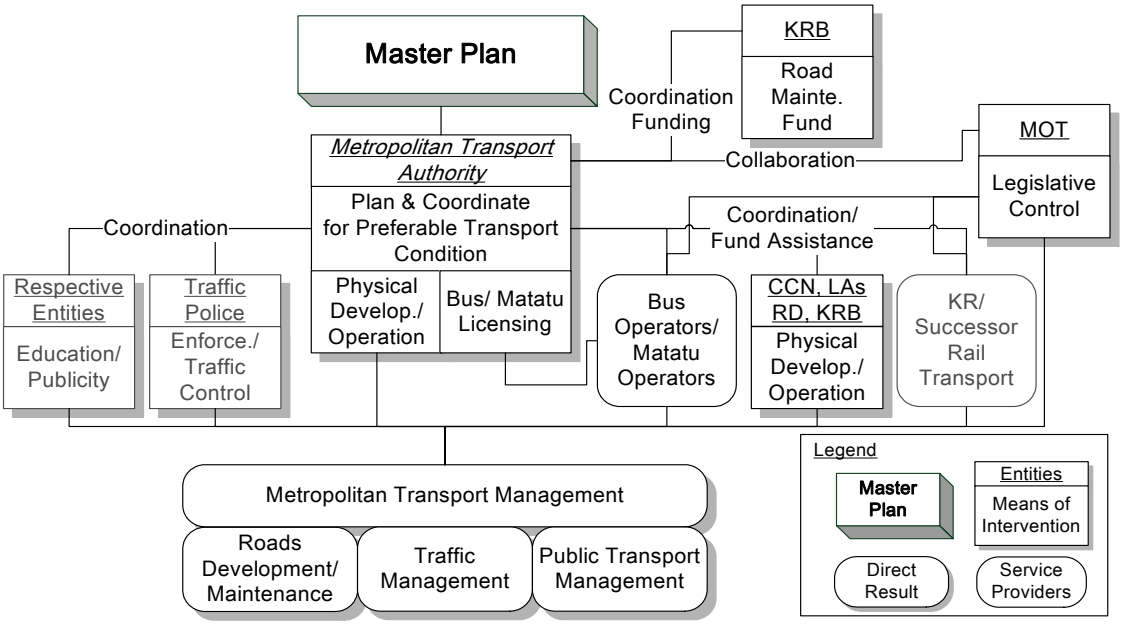


FIGURE 30.12-4 IDEAL INSTITUTIONAL ARRANGEMENT FOR NMA TRANSPORT MANAGEMENT

(2) Kenyan Efforts

As already stated in Chapter 21 GOK is now considering the establishment of the Nairobi Metropolitan Authority which has capability to execute comprehensive activities of regional physical development planning, implementation coordination including funding, and direct implementation and operation. The above mentioned organizational arrangement is not contradictory one with the Nairobi Metropolitan Authority, but its function is able to be placed as a component of the Nairobi Metropolitan Authority.

Recently advocating activity to establish Nairobi Metropolitan Public Transport Authority which regulates city's public transport sector and facilitates climate friendly investments in the sector has been performed in the society. Uniqueness of this is to link the city's public transport sector upgrading with the clean development mechanism to generate carbon

credits and to attract relating investments for necessary funding. The Authority envisaged in this concept is limited to public transport sector without other transport sector management.

In the case that the Nairobi Metropolitan Public Transport Authority is established, an agency like the Nairobi Metropolitan Authority or the Nairobi Metropolitan Transport Authority is necessary to integrate the metropolitan public transport sector adequately in the transport sector in NMA. Absence of this upper coordinating agency results most probably in low efficiency of the transport sector activities in general.

30.12.3 Recommended Transitory Institutional Arrangement

Since creation of a new permanent organisation takes long time to be materialized, it is recommended to establish ad-hoc temporary organisation as a committee named like the Metropolitan Transport Committee for immediate requirement of the transport sector planning and coordination. The committee's function is preferably to cover the entire transport sector as the same area of activities as the ideal organisation stated in the previous Section 30.12.2 as shown in Figure 30.12-5.

The committee is recommended to be organised by UDD of MOLG, since coordination of relating Local Authorities (LAs) including CCN is essential for development planning of the sector and involvement of the central governmental organisation is indispensable. CCN shall be a major planning force for the committee considering the capability of relating organisation especially in limitation of human resources.

Due to its temporally status, the expected capability of the committee in planning is not so high enough as the Authority to be established, the planning and coordinate function of the committee must be limited for the short term schemes in accordance with the Master Plan concepts.

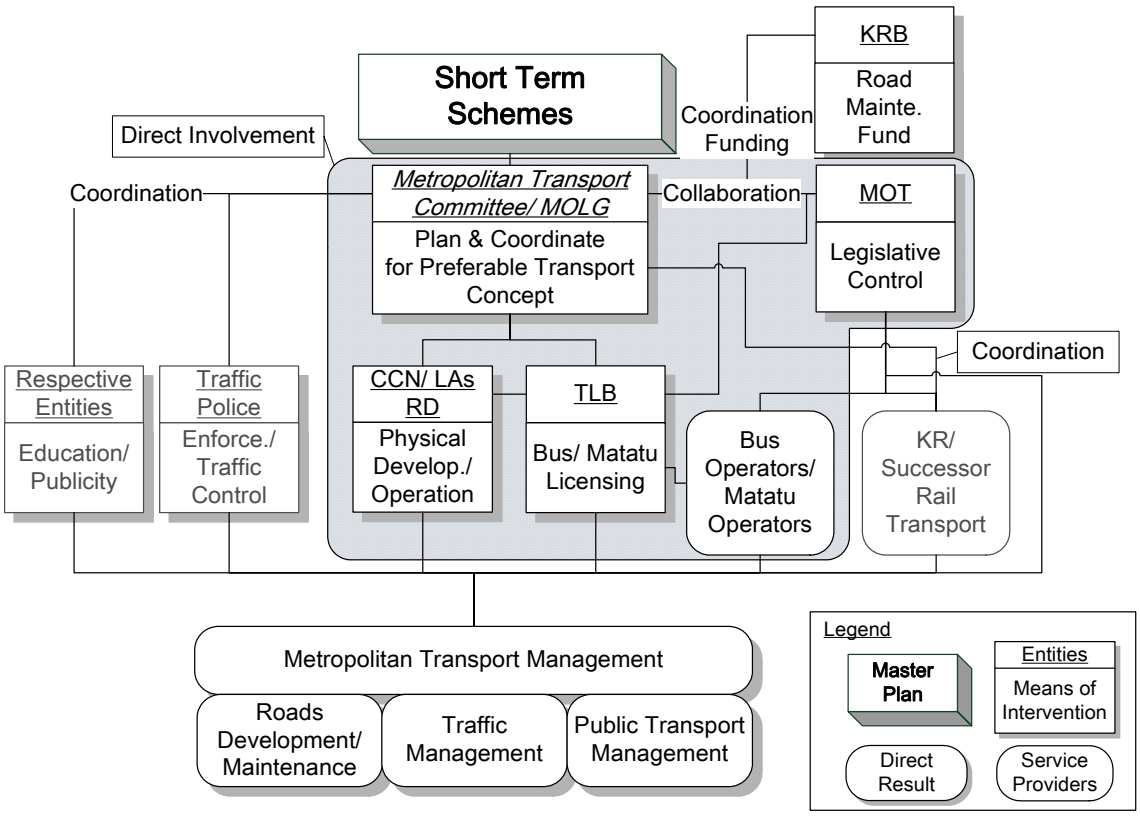


FIGURE 30.12-5 TRANSITORY INSTITUTIONAL ARRANGEMENT FOR SHORT TERM SCHEMES

30.12.4 Recommended PPP Schemes

Among the intervention tools described in 30.12.1 (2), schemes suitable for PPP or Public Private Partnership are only 2 under the CCN's facility provision category which are 1) bus/ matatu stop facility provision, operation and maintenance, and 2) Mode Interchange Terminal provision, operation and maintenance. As the selected short term schemes, they are concessions for 1) the Corridor Management Schemes, and 2) the Mode Interchange Area Improvement Schemes.

Revenue sources of both types of PPP schemes are 1) using fees for the facilities and 2) privilege of facility spaces for commercial purpose. Using fees are simple and straight forward while the privilege of facility spaces involves several aspects. Examples of the facility space uses follow:

- Operating retail shops within the facility space taking advantage of facility feature as a gathering place of people, bus/ matatu users, and
- Rent the spaces for advertisement.

Former one can be expanded to a terminal shopping building concept for the Mode Interchange Area Improvement Schemes.

As explained in 30.12.1 (2) both PPP schemes are supported by other intervention tools under the jurisdiction of MOT and TLB. The concept is shown in Figure 30.12-6.

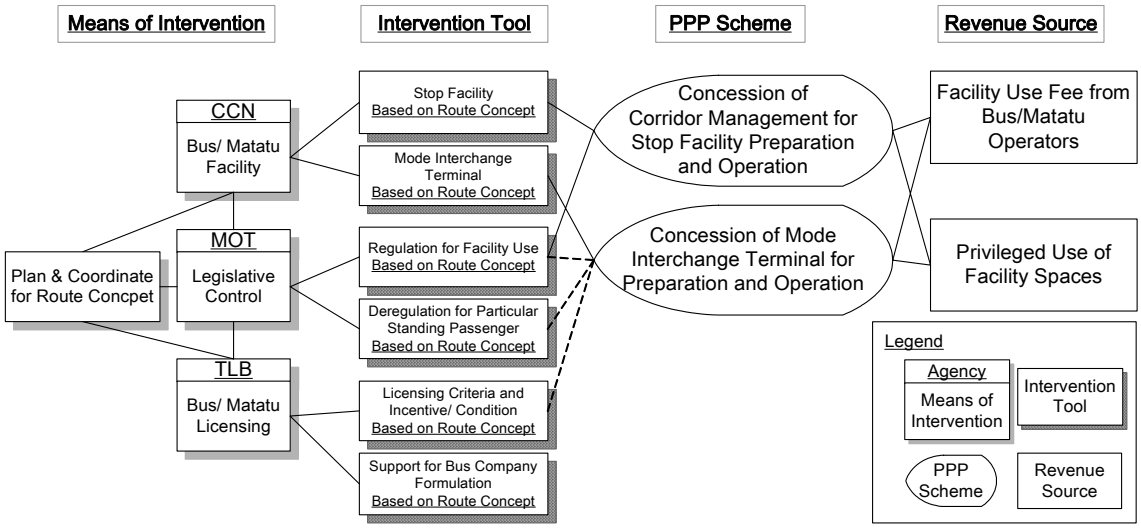


FIGURE 30.12-6 CONCEPT OF THE PPP SCHEMES

Among abundant configuration of PPP schemes, the following is a favourable example configuration of the Corridor Management Schemes considering the nature rather small initial investment cost and importance of the maintenance:

- CCN bears space, initial investment cost, and construct the stop facilities or provide design drawings with places of stops (facilities may include standardized retail shops), and
- The private participants construct or receive stop facilities, and operate and maintain stop facilities while they conduct sales, advertising and other revenue generating activities utilizing stop facilities.

An example for the Mode Interchange Area Improvement Schemes envisaging the future large scale terminal shopping building concept:

- CCN offers a concession for the use of space in the terminals and provides basic conditions as an appropriate terminal facilities with design supervision, and
- The private participants procure funds, design and construct terminal facilities, and operate and maintain the facilities.

In the case of the terminal building, competition for a design of a project is applicable.

Participants from the private sector are preferably joint ventures of a one with real estate management/ operation capability and one with experience in bus/ matatu operations.

CHAPTER 31

CONCLUSIONS AND RECOMMENDATIONS

CHAPTER 31 CONCLUSIONS AND RECOMMENDATIONS

31.1 CONCLUSIONS

31.1.1 Urban Transport Master Plan

(1) Plan Justification

The Master Plan for Urban Transport in the Nairobi Metropolitan Area is formulated in a comprehensive and systematic manner to cope with present and future transport requirements and to support the national socio-economic development of the area.

The Plan requires the following investment and time frame:

- Short Term (2006-2010)	;	7.9 BKsh
- Long Term (2011-2015)	;	10.8 BKsh
- Long Term (2016-2025)	;	24.7 BKsh
Total		43.4 BKsh

The Plan is justified to be technically and economically feasible and acceptable from the environmental and social viewpoint with the following economic indicators:

- BCR ; 2.34
- EIRR ; 39.4%
- NPV ; 10.35 BKsh

(2) Plan Components

The Plan involves a number of projects and measures with the following main components:

- Road Improvement
  - Formulation of Ring Roads and Circumferential Roads (8 roads)
  - Construction of Bypass and Link Roads (5 roads)
  - Connection of Missing Links (16 roads)
  - Provision of Non-Motorized Transport (18 routes)
  - Intersections improvement and signalization (48 locations)
- Traffic Management
  - Provision of parking facilities in the CBD
  - Establishment and enforcement of practical traffic rules and regulations

  - Practice of traffic safety education
  - Enforcement of traffic demand management
- Traffic Institution
  - Establishment of Nairobi Metropolitan Authority
  - Capacity development of transport administration and professionals
- Financing
  - Encouragement of Public-Private Partnership (PPP)
  - Study on increase of levy

31.1.2 Pre-Feasibility Study Projects

(1) Project Selection

The projects for Pre-Feasibility Study are selected among the projects under the Short-Term plan with the intention of achieving urgency, small-scale and low costs in terms of implementation, among others.

(2) Project Justification

The selected projects are justified for immediate implementation from technical and economic viewpoint and environmental and social aspects. The following economic indicators are presented incase of Traffic Flow Improvement Plan in City Centre for example:

- BCR; 3.49
- EIRR; 45.8%
- NPV; 1,851 M Ksh

(3) Project Implementation

The Projects are proposed for immediate implementation with the use of local funds and financial assistance from international lending institutes.

The projects require the following investment and time frame:

- 2006; 515M Kshs
- 2007; 1,117M Kshs
- 2008; 1,330 M Kshs
- 2009; 579 M Kshs
- 2010; 180 M Kshs
- Total; 3,721 M Kshs

(4) Project Components

The main components of the projects are as follows:

- Construction of Missing Links

  - Road Length: No 3; 1.76 km
    No 6; 2.85km
    No 7; 3.75 km

- Traffic Flow Improvement Plan in City Centre

  - Roads connecting to the CBD
  - Traffic flow improvement in CBD
  - Revitalization of Moi Avenue
  - Traffic flow improvement in Westlands
  - Parking improvement inside the CBD

- Improvement of Bus/Matatu Transport System

  - Shuttle bus
  - Corridor improvement
  - Mode interchange area improvement

31.2 RECOMMENDATIONS

(1) Plan Authorization

The Master Plan authorization is vital for systematic implementation of the recommended projects under the authorized ministries, authorities and agencies, so that all efforts can be integrated toward the same targets at the optimum timing.

Projects in the Master Plan should be included in the National Development Plan to secure required funds and to assure the development of the urban transport based on the established schedule for the smooth implementation and maximum efficiency.

(2) Plan Premise

The future land use pattern or urban structure is presumed in the Study focusing on the future transport patterns, since there is no official land use plan or urban structure plan. Therefore, modification of the plan may be required in accordance with the development of land use and urban structure in the future.

Main prerequisite conditions or future socio-economic framework for the Study was assumed based on an average growth rate of 4.6% of the GDP of Kenya and 2.1% of annual growth rate of population (4.0 million in 2004 to 6.9 million in 2025) estimated in the Study with reference to the CBS project. The Plan shall be adjusted according to any change in the future.

(3) Plan Implementation

The implementation program of the Plan is formulated based on a comprehensive prioritization in consideration of the technical urgency, budgetary limitations and other factors. When supplemental funds are available, for example, by PPP financing schemes, such projects of private sector interest are recommended to be implemented at the earlier stage.

To implement projects as scheduled, feasibility studies and detail engineering studies should be conducted a few years before the project schedule in order to secure the required fund and to avoid delay. Major projects and other large-scale projects will require a comprehensive study that includes engineering study, environmental impact assessment as well as technical, economic and financial analysis, with fund planning.

(4) Key Transport Issues

The Plan recognizes the real key issues in the transport sector when the sector is considered as a facilitator of rapid economic growth and reconstruction, poverty eradication and wealth creation for the country as stated in the National Transport Policy. The identified real key issues in the Plan are the following:

- Revitalization of Moi Avenue as the symbol of historical Nairobi
- Improvement of Uhuru Highway to foster the new image of a modern capital city
- Change of driving manners and motorist behavior
- Promotion of bus and matatu operation
- Establishment of parking policy on on-street parking

The Plan discusses the above key issues at the Pre-Feasibility Study.

The Pilot Project Experiment of intersection geometry improvement and traffic signal installation in Westlands roundabout reveals the phenomenon that drivers believe to own the absolute prerogative in using roads, while pedestrians are neglected. It is suggested that a policy be established so that roads be used with the harmonized time sharing betweens pedestrian and drivers. When a change in the manner of drivers is realized, then pedestrians can cross roads safely and the traffic rules will be observed with discipline.

(5) Traffic Safety Education and Enforcement

The traffic accident survey reveals the fact that a number of traffic accidents have been rapidly increasing in recent years, and private cars are the biggest source followed by matatus.

Traffic safety education should be emphasized on all road users with particular attention to the drivers of private cars and matatus. An education system should be established involving education in schools and periodic education of drivers prior to license renewal whenever practicable.

Strengthening of traffic enforcement is also indispensable not only for strict adherence to traffic rules but also for maintaining urban activities of the people and trust of the citizens.

(6) Institution and Organization

The Plan includes a large number of transport projects embracing road improvement, public transport, and traffic management, which require large investment and implementation

capacity. An effective organization for systematical implementation approach is the vital key for the successful realization of the Plan.

The establishment of a new organization, namely the Nairobi Metropolitan Authority, is expected. The Authority should be capable of taking the responsibility of coordination of comprehensive development planning and plan implementation for the Nairobi Metropolitan Area.

(7) Management and Maintenance

The large investments to be spent in implementing the Plan shall require proper maintenance and management in order to optimize the investment. The re-organization of authorities concerned is expected.

Human capacity development programs for management and maintenance engineers, as well as for other fields, is a major task that should be strongly established to develop the required experience through on-the-job training and other systemized training programs.

(8) Fund Preparation Measures

The fund required for implementation of the Plan is estimated to be nearly sufficient by the National Road Development Fund based on the assumption of a national economic growth of 4.6% per year.

Attraction of private participation is recommended to encourage private sector involvement in executing projects in which reasonable commercial return is expected including the following:

- Northern Bypass - Eastern Bypass
- Link Roads - Uhum Highway
- Parking Facilities in CBD
- Shuttle Buses in CBD
- Mode Interchange Area Development

To introduce new concepts in transport financing, management, and operation (including toll collection and roadside land development schemes), it is required to establish a legislation system that can attract private sector investments and provide a high level of service for facility users.

(9) Social Consideration

The Plan projects aim to minimize any negative impact on both natural and social environmental conditions, and propose mitigation measures wherever necessary.

The problem areas in acquiring road reserve spaces, however, are identified, particularly in forming the radial and circumferential road network.

Environmental Impact Assessment (EIA) will be required for major projects and it should be prepared in advance during the design stage of each project.

When implementing such projects in problem areas where land acquisition is required, resettlement action plan (RAP) should be prepared in early stages together with the allocation of required funds.

Public consultation or stakeholder meetings on proposed projects, particularly those in problem areas are strongly recommended to be held at proper timings to build public consensus through a professional and transparent manner.

(10) Study Intention

The Study established a set of measures to solve the present transport issues and formulates a practical, functional and economical transport system for the target year 2025. The outputs of the Study are expected to contribute to the development of the urban transport system in the Nairobi Metropolitan Area.

The actual commencement of problem solution measures shall start at the end of the Study with the joint efforts of the government and private sector. Such joint efforts and cooperation between the two sectors, public and private, shall be initiated effectively under the guidance and direction of the government.

To this end, thoughtful understanding and unprejudiced support of the Plan by policy makers and budgeting agencies are indispensable for the successful implementation of the Plan.

A comprehensive land use plan based on integrated growth strategy for the Nairobi Metropolitan Area should be prepared to offer a framework to guide development within the region.

(11) Programmes for Immediate Implementation

Among the projects under the Short Term Plan, the followings are selected for immediate Pre-Feasibility Study. The criterion in selection is urgency and small-scale with low costs, among others. The immediate plan components and costs are summarized in Table 31.2-1 below with recommend implementation method.

Construction of Missing Links No. 3, No. 6 and No. 7

- Formation of R/C Road Network
- Encouragement of NMT
- Promotion of area development

Traffic Flow Improvement Plan in the City Centre

- Improvement of traffic flow and circulation in the city centre, particularly in CBD
- Improvement of traffic flow on major arterials
- Improvement of traffic flow in special commercial area
- Improvement of car parking system inside CBD

Improvement of Bus/Matatu Transport System

- Restructuring of public transport system, particularly rerouting of Bus/Matatu Routes
- Introduction of Shuttle Bus

TABLE 31.2-1 MAJOR COMPONENTS AND COST OF URGENT PROJECTS

Unit:Million Ksh

	Quantity (km)	Total Cost MKsh	2006	2007	2008	2009	2010	Recommend Implementation Method
(1) Missing Links No.3, 6, and 7		999	9	274	477	239		Foreign Fund
Sub Total	8.4	999	9	274	477	239		
(2) Traffic Flow Improvement Plan in City Centre								
- Road connecting to CBD	8.2	390	132	120	138			MRPW
- Traffic Flow Improvement in CBD (NR)	3.1	80	80					MRPW: National Roads
- Traffic Flow Improvement in CBD (CR)	6.0	469	110	24	175	160		CCN: City Roads
- Revitalization of Moi Avenue	0.7	84		84				CCN
- Traffic Flow Improvement in Westlands	0.4	29	29					CCN
- Parking Improvement inside CBD	LS	150	75	75				PPP
Sub Total		1,202	426	303	313	160		
(3) Improvement of Bus/Matatu System								
- Shuttle Bus	1 set	1,203	53	425	425	150	150	PPP
- Corridor Improvement	1 set	44	14	15	15			CCN
- Mode Interchange area Improvement	1 set	273	13	100	100	30	30	PPP
Sub Total		1,520	80	540	540	180	180	
Total		**3,721**	**515**	**1,117**	**1,330**	**579**	**180**	
By Fund								
Foreign Fund		999	9	274	477	239		
MRPW		470	212	120	138			
CCN		626	153	123	190	160		
PPP		1,626	141	600	525	180	180	
Total		**3,721**	**515**	**1,117**	**1,330**	**579**	**180**	

(12) Capacity Building for Improvement and Management of Urban Traffic Flow Measures

To implement the above immediate programmes for traffic flow improvement plan in the City Centre, capacity buildings of relevant implementing agencies such as CCN under MOLG are required. A framework of the capacity building for improvement and management of urban traffic flow measures is listed below.

Background of the Project

- The present supply to transport is inadequate to meet the increase in traffic demand, in particular in the Nairobi Metropolitan Area. An inadequate supply of the road capacity, road structure and traffic management measures have been causing heavy traffic congestion and traffic accidents. Hence, there is an urgent need to increase the transport supply accordingly, in order to alleviate this situation, improvement of road structures/facilities and traffic management measures are required. Accordingly, and in line with the Government's sectoral development policy emphasizing safe and efficient transportation, the Republic of Kenya requested the Government of Japan the technical assistance to conduct the Study on Master Plan for Urban Transport in the Nairobi Metropolitan Area in the Republic of Kenya, with a time horizon of 2025.

- The Master Plan identified a number of projects and measures covering the transport sectors of road development, public transport and traffic management and institution and classified these into short, medium and long term.

- Among the short term projects, the urgent projects particularly those in the City Centre were selected and recommended for the immediate implementation with justification based on technical, economical, and environmental and social view points covering the following

(i) Traffic Flow Improvement Plan in City Centre

- Road connecting to the CBD
- Traffic flow improvement inside the CBD
- Parking improvement inside the CBD
- Revitalization of Moi Avenue
- Traffic flow improvement in Westlands

(ii) Improvement of Bus/Matatu System

- Shuttle bus
- Corridor improvement
- Mode interchange area improvement

Outline of the Project

Overall Goal

- Improvement of urban scenery, amenity and security

Project Purpose

- Traffic improvement in the City Centre

Outputs

- Traffic and safety improvement plan in the City Centre

Project Activities

Activities (1)

- Improvement of traffic flow and circulation in the city centre, particularly in the CBD
- Improvement of major arterials for traffic and urban scenery
- Improvement of traffic flow in special commercial areas
- Improvement of the parking system inside the CBD

Activities (2)

- Restructuring of public transport system, particularly rerouting of Bus/Matatu route
- Improvement of small-scale facilities for effective public transport operation

Activities (3)

- Engineering advise and guidance for detailed design, cost estimate, and contract document
- Engineering advise and supervision for construction
- Formulation of PPP mechanism

Input from the Japanese Government

- 1 – Traffic Engineer ; 3 years
- 1 – Highway Engineer ; 3 years
- 1 – PPP (Public Private Partnership) Specialist ; 1 year

Implementation Schedule

April 2006 ～ March 2009