CHAPTER 29

TRAFFIC FLOW IMPROVEMENT PLAN IN CITY CENTRE

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29.1 PRESENT CONDITIONS AND ISSUES

(1) Present Conditions and Issues

The urban centre of Nairobi, which consists of the Central Business District (CBD) and extends to cover its vicinities, has political, institutional, commercial and business, cultural, and amusement activities that impact not only the Nairobi Metropolitan Area but also the whole of Kenya. It also plays an important role as a major trade, commercial and economic centre of the East Africa region. The urban centre of Nairobi is the busiest area in the Nairobi Metropolitan Area. It is also the area where most of major socio-economic activities are concentrated which generate and attract high volume of vehicle traffic.

Based on the assessment of traffic flow done for the Pre-Feasibility study, the present conditions including number of lanes and V/C ratios are shown in Table 29.1-1, and the problems associated with traffic flow in the urban centre are shown in Figure 29.1-1. The summary is enumerated below:

Road Network

- The functional hierarchy road network systems have not been well developed due to the topographical configuration including such features as the Nairobi River, Kenya Railway Station, Presidential Area, Golf Course, etc.
- The role of arterials, collectors and local streets are not clearly defined. For example, the simultaneous role of an urban highway as an international major arterial and/or a local street serving traffic accessing the CBD at the same time.
- The arterial road network connecting to the CBD does not function well, especially in the north-east area due to the complicated network and insufficient level of facilities.
- There seems to be some missing road links such as Missing Links 3, 6 and 7 traversing across the Nairobi River and some institutional / commercial areas as discussed in Chapter 28.

Traffic Flow inside the CBD

- Traffic Flow inside the CBD is quite congested due to the large pedestrian traffic boarding and alighting at terminals and stops, disorderly Matatu driver's behaviour, many illegal on street parking etc. Such streets include Tom Mboya, Ronald Ngala, etc.
- Major arterials play both the role of arterials and collectors. These include Haile Selassie Avenue, Moi Avenue, and University Way which should be improved to deal with the traffic demands. Particularly, revitalization of Moi Avenue is a key factor not only for

traffic flow improvement but also for purposes of upgrading the urban environment as a symbol of Nairobi.

- Double and triple car parking is a phenomenon often observed on streets inside the CBD. The policy on on-street parking needs to be urgently addressed as one of the easier options to implement as a traffic congestion mitigation measure inside the CBD.

Traffic Flow in Special Areas

- The traffic flow in some localized areas is heavily impeded and poorly distributed due to uncoordinated road geometry and insufficient road capacity, which cannot respond adequately to local traffic demand. Such areas mainly include the Westlands, Ngong Road, etc.

Road Condition

- Some arterials outside the CBD are currently congested beyond acceptable level due to the limited road capacity and poor state of facilities. These include Ngong Road, Thika Road, Juja Road, Landhies Road, Muranga Road, etc.
- There are few roads which have road facilities such as bus stops, space for non-motorized transport, drainage systems, traffic signs, etc.

Intersection Geometry

- The traffic flows are disturbed at intersections, especially at roundabout intersections, which are Pangani roundabout, Limuru Road with Forest Road junction, etc.

(2) Countermeasures

To improve the present conditions and issues as mentioned above, the following countermeasures and study are identified taking into account the funds required for immediate implementation:

Road Network Improvement

- Improvement of roads connecting to the CBD.

Traffic Flow Improvement

- Traffic flow improvement inside the CBD
- Car parking study in the CBD
- Revitalization of Moi Avenue

Traffic Flow improvement in Special Areas

- Traffic Flow improvement in Westlands

Road Condition

- Improvement of Ngong Road

Intersection Geometry Improvement

- Pangani roundabout, Limuru Road via Forest Road junction,

Table 29.1-1 ASSESSMENT OF PRESENT ROAD NETWORK TO CBD

Area	Road Name	Present No. of Lane	Capacity (PCU)	2004			2010		
				Traffic Volume (PCU)	V/C Ratio	Required No. of Lane	Traffic Volume (PCU)	V/C Ratio	Required No. of Lane
North	Muranga Road	4	50,000	50,068	1.00	4	63,632	1.27	6
	Limuru Road	2	20,000	15,460	0.77	2	20,331	1.02	2
North-East	Racecourse Road	4	50,000	34,576	0.69	4	45,174	0.90	4
	Ngara Road	2	20,000	17,883	0.89	2	23,774	1.19	2
	Park Road	2	20,000	16,793	0.84	2	18,648	0.93	2
South-East	Landhies Road	4	50,000	62,009	1.24	4	71,958	1.44	6
South	Uhuru Highway (S)	6	75,000	69,458	0.93	6	83,747	1.12	6
West	Valley Road	4	50,000	42,509	0.85	4	45,747	0.91	4
	Nyerere Road	2	20,000	7,001	0.35	2	7,534	0.38	2
	State House Road	2	20,000	16,005	0.80	2	19,215	0.96	2
North-West	Uhuru Highway (N)	6	75,000	70,932	0.93	6	86,868	1.20	6
Urban Area Total		-	450,000	402,694	0.89	-	486,628	1.08	-

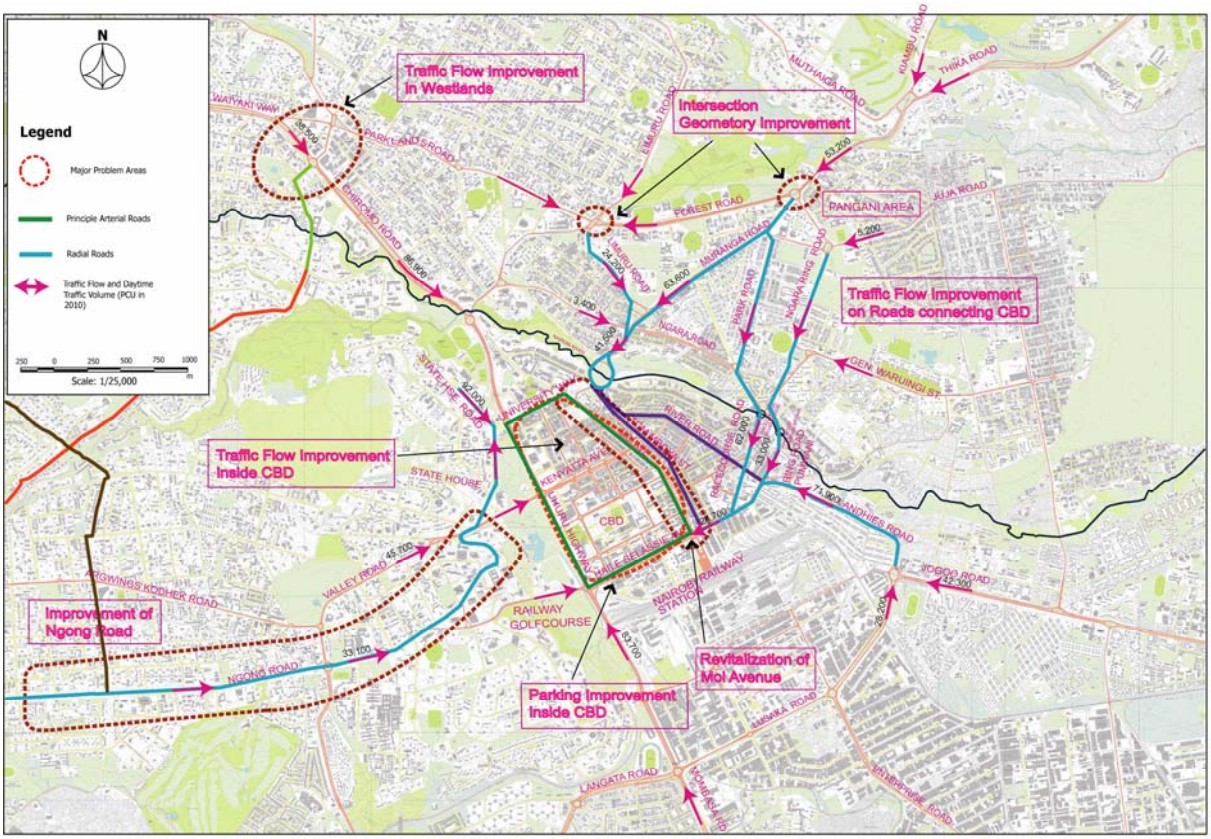


FIGURE 29.1-1 STUDY AREA FOR TRAFFIC FLOW IMPROVEMENT IN URBAN CENTRE

29.2 ROADS CONNECTING TO THE CBD

29.2.1 Study Approach

(1) Study Flow

The objective of this Study is to prepare a functional road system connecting the CBD and to provide effective facilities for the smooth inflow of traffic into and outflow from the CBD. The study approach for roads connecting the CBD is shown in Figure 29.2-1.

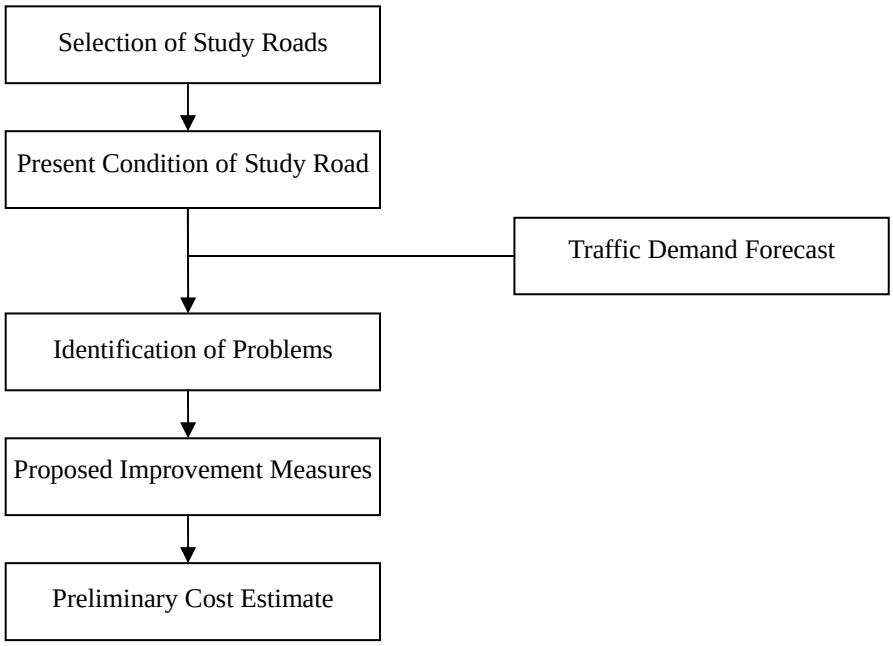


FIGURE 29.2-1 STUDY APPROACH

(2) Selection of Study Roads

The present major road network system connecting to the CBD is shown in Figure 29.2-2. Table 29.1-1 shows area comparison of degree of congestion and the major roads located in the North and North-East areas which have higher V/C ratio than ones in the other areas. Uhuru highway has also higher V/C ratio and is expected to be improved by the Northern Corridor Improvement Project of WB.

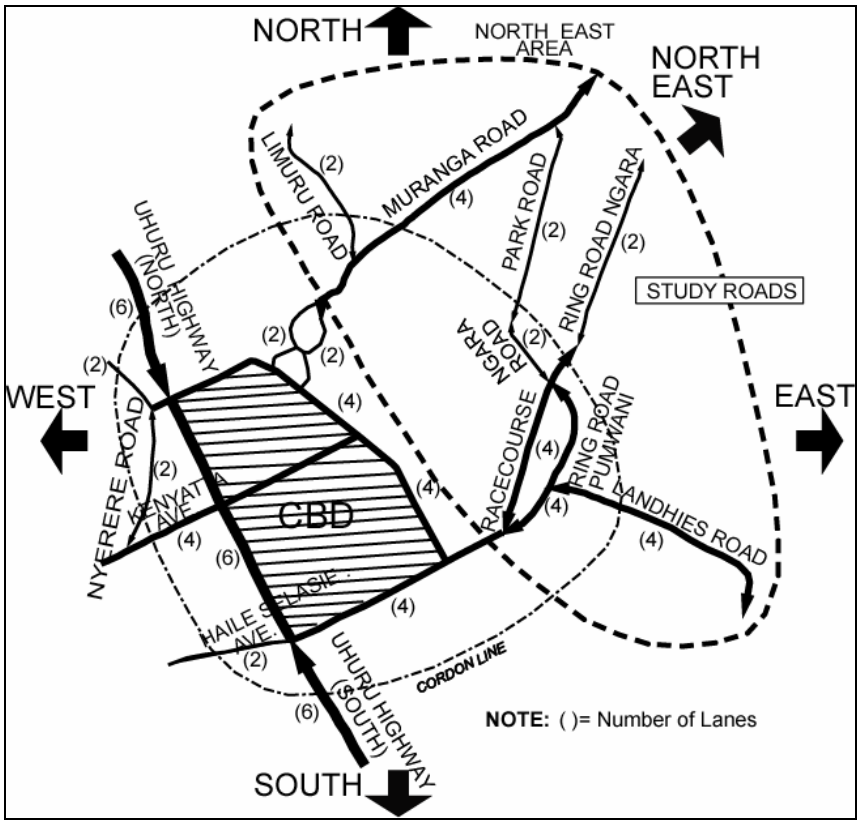


FIGURE 29.2-2 MAJOR ROADS CONNECTING TO THE CBD

Table 29.2-1 presents an assessment of demand/capacity ratio derived from the Vehicle/ Capacity ratio (VCR) determined in 2004 while Figure 29.2-3 shows the results of traffic flow simulation inside the CBD and its vicinity.

TABLE 29.2-1 ASSESSMENT OF VCR IN 2004

Direction		Road	Exist. Lanes	Traffic (2004)	VCR (2004)
North	Uhuru Highway (N)		6	70,932	0.95
South	Uhuru Highway (S)		6	69,458	0.93
West	1	Nyerere Road	2	7,001	0.35
	2	Kenyatta Avenue (W)	4	55,832	1.12
	3	Haile Selassie	2	12,218	0.61
	Average VCR				0.69
North-East	1	Landhies Road	4	62,009	1.24
	2	Ring Road Pumwani	4	21,913	0.44
	3	Ring Road Ngara	2	18,147	0.91
	4	Racecourse Road	4	34,576	0.69
	5	Ngara Road	2	17,883	0.89
	6	Park Road	2	16,793	0.84
	7	Muranga Road	4	50,068	1.00
	8	Limuru Road	2	15,460	0.77
	Average VCR				0.84

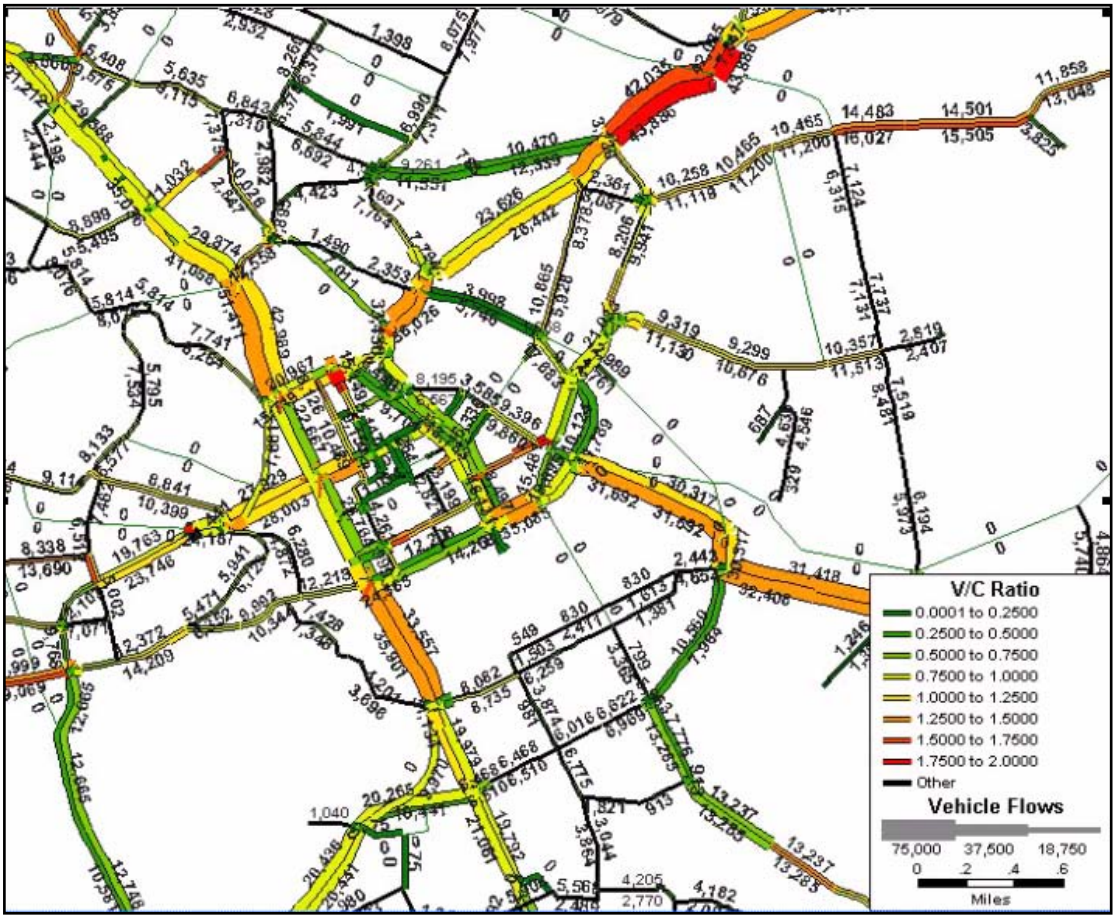


FIGURE 29.2-3 RESULTS OF TRAFFIC FLOW SIMULATION INSIDE THE CBD AND ITS VICINITY IN 2004

The following definition of Level of Service (LOS) in Table 29.2-2 is applied for assessment.

TABLE 29.2-2 DEFINITION OF LEVEL OF SERVICE

LOS	VCR	Traffic Conditions
C	< 1.0	No congestion during day time and virtually constant traffic flow. Serious delay due to congestion observed to be rare.
D	1.0 ~ 1.25	Possibly 1~2 hour- congestion at peak hours.
E	1.25 ~ 1.75 (Ave. 1.5)	Rapidly increasing congestion time around peak hours. Prolonged congestion around peak hours to all day.
F	> 1.75	All day heavy congestion

Note: Refer to Chapter 17.

Roads depicting VCRs exceeding 1.5 are anticipated to be constantly characterized by heavy congestion throughout the day. VCRs exceeding this level indicate that the road capacity needs to be increased by widening of the existing road or construction of new additional roads.

The VCR determined in 2004 for the North direction of Uhuru Highway is 0.95 and the South direction of Uhuru Highway is 0.92, while the VCR for the major roads in the West direction has an average of 0.69, while that of the North-East direction has an average of 0.92. The capacity of the road network in the North-East direction is the lowest except for Uhuru Highway. However, Uhuru Highway is expected to be improved under the World Bank's Northern Corridor Improvement Project. Consequently, the improvement of the major roads traversing the CBD in the North-Eastern direction needs to be addressed as a matter of urgency.

Criteria for Selection of Study Roads

Based on the assessment of the demand/capacity ratio of roads in the North-East direction, the road network in the north-east area is identified as the most congested and hence selected as high priority for the Pre-Feasibility Study. Table 29.2-3 presents the major roads selected in the north-east area.

TABLE 29.2-3 SELECTED MAJOR ROADS IN NORTH-EAST AREA

Road		From	To	Length (km)	Exist. Lane	Carriage Way Width (m)	Road Reserve (m)
1	Landhies Road	H. Selassie Avenue Jct.	Jogoo Road	1.30	4	18.05	32.95
2	Ring Road Pumwani	Landhies Road Jct.	Ngara Road Jct.	0.60	4	20.85	39.25
3	Ring Road Ngara	Ngara Road Jct.	Juja Road	1.07	2	7.25	22.55
4	Racecourse Road	H. Selassie Avenue Jct.	Ngara Road Jct.	0.75	4	13.85	29.70
5	Ngara Road	Racecourse Jct.	Park Road Jct.	0.35	2	7.25	18.33
6	Park Road	Ngara Road Jct.	Muranga Road	1.13	2	9.25	26.85
7	Muranga Road	Pangani R/A	Globe Cinema R/A	2.20	4	8.60	31.00
8	Limuru Road	Forest Road Jct.	Muranga Road	0.80	2	9.35	45.25
	Total			8.20			

29.2.2 Present Condition of Study Roads

(1) Road and Traffic Condition Survey

A Road condition survey was carried out by the Study Team. The major items identified for the road survey are road geometric conditions, road profile (carriageway, median, side walk and drainage), pavement, and road facilities such as street lights, etc. In addition, the traffic condition survey was conducted in reference to on-road parking, bus/matatu stops, as well as traffic control signs and signals. The results of the survey are summarized in the following sections.

(2) Study Roads Characteristics

Landhies Road

Landhies road originally starts from Jogoo Road Roundabout to Haile Selassie Roundabout. Based on the traffic flow characteristics of this road, it is identified as a primary road in the Master Plan Study. This is one of the most important roads connecting to the CBD from the South-East direction of Nairobi.

Ring Road Pumwani

Ring Road Pumwani starts from Haile Selassie Avenue to Racecourse Road. It is identified as a secondary road in the Master Plan Study and is one of the very important roads connecting to the CBD from the North Eastern Part of the City.

Ring Road Ngara

Ring Road Ngara starts from Muranga Road Jct. to Racecourse Jct. This road forms a ring road in the north eastern part of Nairobi. It is identified as a secondary road in the Master Plan Study. The section between Juja Road Roundabout and Racecourse is also one of the very important roads connecting to the CBD from the North Eastern Part of the City.

Racecourse Road

Racecourse Road branches off from Haile Selassie Avenue and merges into General Waruinge Street at Starehe Boys Centre. It is identified as a primary road in the Master Plan Study. The study section of the road is limited to the section between Haile Selassie Avenue and Ring Road Jct. due to the bottleneck nature of this section.

Ngara Road

Ngara Road originally starts from the Museum Hill Jct. to Racecourse Roundabout. It is identified as a secondary road in the Master Plan Study due to the fact that the road width is narrow in nature. However, the section between Park Road and Racecourse Roundabout is also one of the most important roads connecting the CBD to the North Eastern part of the City.

Park Road

Park Road diverges from Muranga Road, merges into Ngara Road and finally approaches the Racecourse Roundabout. This road is identified as a primary road in the Master Plan Study. It is also one of the very important roads connecting to the CBD from the North Eastern direction of Nairobi.

Muranga Road

Muranga road originally starts from the Thika Road Roundabout to Moi Avenue through Globe Cinema Roundabout. It is identified as a primary road in the Master Plan Study. This

road is one of the very important roads connecting the CBD from the North and East directions of Nairobi. In this Study, the study section of this road is limited only to that between Pangani Roundabout and Globe Cinema roundabout which become serious bottleneck.

Limuru Road

Limuru Road originally starts from Limuru to Muranga Road Jct. It is functionally identified as a primary road in the Master Plan Study. This road is one of the very important roads connecting the CBD from the North direction of Nairobi. In this Study, the study section of this road is limited only to Forest Road Jct. and Muranga Road Jct. The main reason for such selection is the prevalence of several bottlenecks within the road.

(3) Present Roads Conditions of the Study Roads

The present road conditions are summarized in Table 29.2-4.

TABLE 29.2-4 PRESENT ROAD CONDITIONS

Road Name	Carriageway	NMT	Pavement	Drainage	Remarks
1.Landhies Road	4-lane road (partly incomplete 6-lane carriageway)	2 to 4m for each Side, poor	Poor	Fair open (1.0m)	RR is 23m for one-way section.26.7 to 34m for others sect.
2.Ring Road Pumwani	6-lane road	1.8 to 14.5m at each side including open space	Poor	Open drains 1.5 to 2.2m Fair	RR is 36.8m
3.Ring Road Ngara	2-lane road. 7.3m to 10.3m wide.	2.2 to 5.8m, Poor	Poor	Open drains. 1.5 to 2.2m Fair	RR is 28.3m
4.Racecourse Road	3-lane road for one-way to Huruma RD, and 4-lane for two-way.	Sidewalk (12 to 18m in total). Poor	Fair	Underground but not functioning	RR is 30m.
5.Ngara Road	2-lane road, 7.25m-wide	2.4 and 7.0m, Poor	Poor	Open, 0.2 & 0.9m, poor	RR is 18.8m
6.Park Road	2-lane road; 9.25 to 9.85m-wide	Enough sidewalk (14 to 18m in total). Poor	Poor	Poor open drainage (2.0)	RR is 26m.
7.Muranga Road	2-lane road except 3-lane for one-way from Limuru and Ngara Jcts.	Both side has minimum 3m Poor	Poor	Poor open drainage (1 to 2m)	RR is 30m except one-way section (22m)
8.Limuru Road	2-lane road; 9.15 to 9.45m-wide	1.0m for each Side. Poor	Poor	Fair open drainage (1.0 to 2.0m)	RR is 26 to 45m.

(4) Present Traffic Facilities Conditions

The present traffic facilities conditions are summarized in Table 29.2-5.

TABLE 29.2-5 PRESENT TRAFFIC FACILITIES CONDITIONS

	Road Name	Roadside Activities (Zoning)	On Street Parking	Bus / Matatu Stops	Pavement Markings	Traffic Signs	Street Light
1	Landhies Road	Jua Kali Sheds (Mixed: Industrial & Commercial)	Illegal parking	Partly illegal	Poor	None	Damaged
2	Ring Road Pumwani	Hawking (Commercial)	No illegal parking	Few matatus stopping illegally	Poor	None	Damaged
3	Ring Road Ngara	Hawking Kiosks Tree nursery (Residential)	Few illegally parked vehicles	Few matatus stopping illegally	None	Few traffic sign	Damaged
4	Racecourse Road	Hawking (Commercial)	Few illegal Parking	Many illegally stopping	Poor	None	Damaged
5	Ngara Road	Kiosks Hawking (Mixed: Residential & Commercial)	No illegal Parking	A few illegally stopping	Poor	None	Damaged
6	Park Road	Kiosks (Mixed: Residential & Commercial)	No/few illegal Parking	Few matatu Illegally stopping	Poor	None	Damaged
7	Muranga Road	Tree nurseries Car dealers Hawking Kiosks (Residential)	Illegal Parking on Park Rd. to Ngara Rd.	Illegal Stopping On Limuru Rd to Globe Cinema	Poor	None	Damaged
8	Limuru Road	Hawking Kiosks (Residential)	Illegal parking on Makhan Singh Rd To RA	Many illegally stopping	Poor	None	Damaged

29.2.3 Traffic Demand Forecast

(1) Traffic Demand Forecast in 2010

In the Master Plan Study, the traffic demands in 2015 and 2025 were forecasted based on the person trip survey conducted. The detailed forecasted procedure was mentioned in Chapter 12.

In the Pre-feasibility Study, using the present vehicle OD matrix and the forecasted vehicle OD matrix in 2015, the vehicle OD matrix in 2010 is estimated by using interpolation method. These vehicle OD matrixes are assigned to the present road network and the road network in 2010 by using TRANS-CAD simulation model as shown in Table 29.2-4.

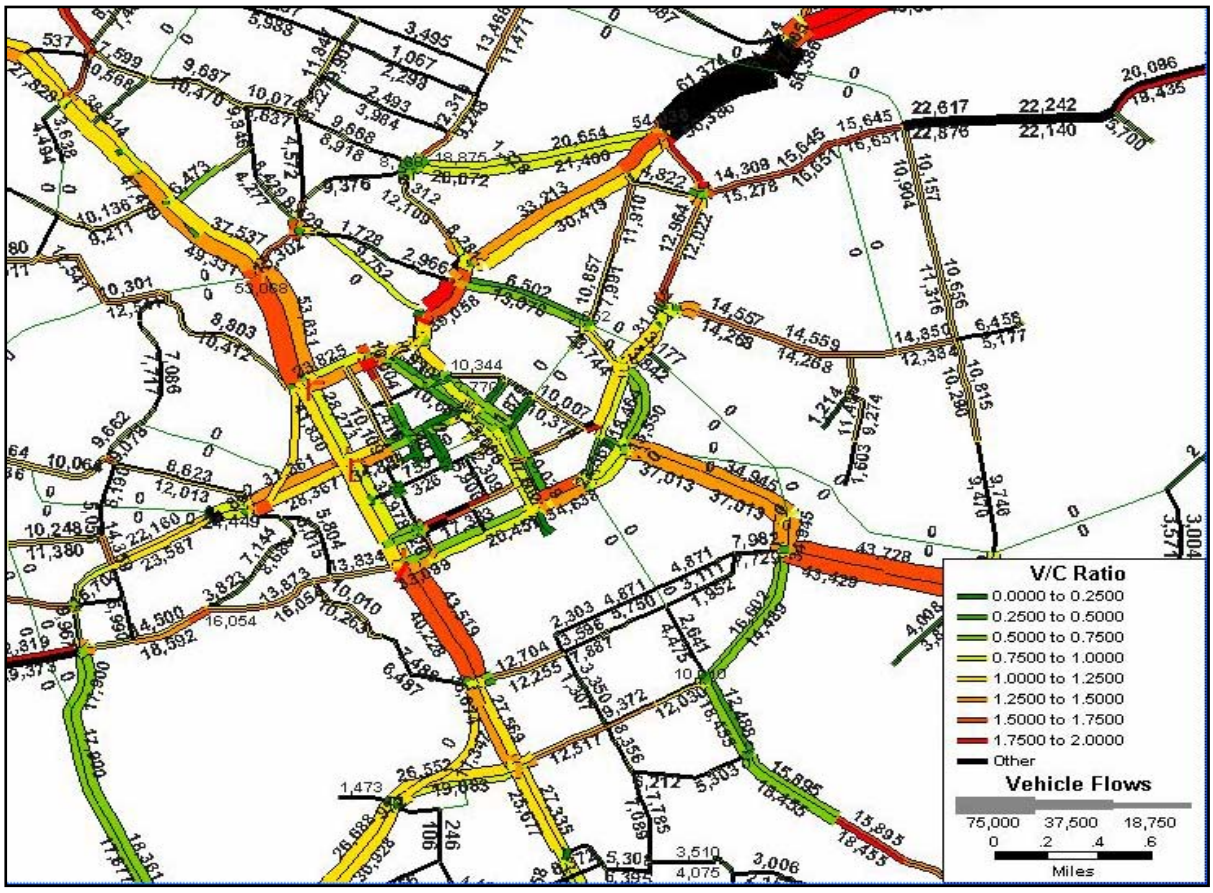


FIGURE 29.2-4 RESULTS OF TRAFFIC FLOW SIMULATION IN CBD AND ITS VICINITY IN 2010

(2) Assessment of Demand/ Capacity in 2010

Table 29.2-6 presents assessment of demand/capacity in terms of VCR in 2010.

TABLE 29.2-6 VC RATIO IN 2004 AND 2010

Road		Exist. Lane	Traffic (2010)	VCR (2010)	LOS
1	Landhies Road	4	71,958	1.44	E: Serious Congestion
2	Ring Road Pumwani	4	32,014	0.64	C: Free flow
3	Ring Road Ngara	2	24,986	1.25	D: Heavy congestion
4	Racecourse Road	4	45,174	0.90	C: Nearly saturation
5	Ngara Road.	2	23,774	1.19	D: Heavy congestion
6	Park Road	2	18,648	0.93	C: Nearly Saturation
7	Muranga Road	4	63,632	1.27	D: Heavy congestion
8	Limuru Road	2	20,331	1.02	D: Saturation
Average VCR				1.08	

The VCR of Landhies Road is anticipated to be 1.44 and the LOS at E, indicating the need to increase the roadway capacity. Widening can adequately be carried out within the present road reserve.

On the other hand, the VCR values of Ring Road Ngara, Ngara Road and Muranga Road will increase to 1.25, 1.19, and 1.27, respectively with the LOS at D. For these roads there is a need to rehabilitate the present roadway capacity to a recoverable design state. Overlay, minor geometrical improvement along the carriageway, provision of NMT facilities, drainage improvement, and landscaping need to be included.

The roads having VCR values less than or slightly greater than 1.0 are Ring Road Pumwani, Racecourse Road, Park Road, and Limuru Road with a LOS at C. No serious congestion is anticipated for these roads. The present physical conditions of the road need to be improved with the enhancement of traffic control by curtailing impediments to smooth traffic flow such as illegal parking and bus/matatu stops.

29.2.4 Identification of the Problems

The traffic problems and issues are identified in Table 29.2-7. Some of these problems can be best appreciated by looking at the photos in Figure 29.2-5.

TABLE 29.2-7 IDENTIFICATION OF THE PROBLEMS

Issues		Present Conditions	Future Problems
Level of Service			
	VCR	0.92 (Max 1.24)	1.07 (Max 1.44)
	Level of Service	C/D	E
Roadway Conditions			
	Number of lanes	Two lanes or four lanes	Capacity is less than traffic demand
	Lane width	3.0 to 3.5m	-
	Shoulder width	Narrow	Being traffic obstructions
	Lateral clearance	Narrow	Being traffic obstructions
	Road surface	Poor	Reduction of travel speed
	Horizontal and Vertical Alignment	No critical section	-
	Intersection	No exclusive turn lanes	Deceasing capacity
	NMT	No pavement, No maintenance	Lower LOS. Increasing of mixing traffic on carriageway
	Drainage	No function, poor maintenance	Road flooding causing congestions
	Street Light	No function	Serious security and safety
Traffic Conditions			
	Composition of heavy vehicles	Heavy vehicles at peak hour, No time and route limitation	Slower traveling speed and lower LOS. Serious congestion
	Composition of bus / matatu	Majority of vehicles stopping/ parking on side walk illegally	Slower travel speed and serious congestions due to blocking other traffic.
	Composition of NMT	Hand carts and bicycles on the carriageway	Slower travel speed of other traffic causing congestions and accidents.
	Directional distribution of traffic	High variation between the morning and evening peak hours	Increase in unbalanced traffic by lane at peak hours
	Fluctuation of traffic flow	High variation between peak hours and off-peak hours	Difficult traffic control
Traffic Control			
	Intersection	No two-way stop control sign at minor road	Reduced capacity
	Pedestrian crossing	No crossing facility	Accident black spots
	Right/left turning vehicles	No control and no turning lane	Reduction of the capacity
	Traffic control sign	Few and not systematic	Accident black spots
	Traffic regulation	Illegal stopping/parking	Reduced the capacity; Serious congestions

Direction of Traffic: Unbalanced Traffic by Lane

Street Light: Non-functional

NMT: No pavement. State of Negligence

NMT on Carriageway

Drainage: Mal-function and poor maintenance

Public Transport

NMT: No improvement. State of Negligence

Traffic Regulation: Parking on NMT

FIGURE 29.2-5 TRAFFIC PROBLEMS AND ISSUES

29.2.5 Proposed Improvement Measures

(1) Proposed Improvement Measures

The proposed improvement measures include works for (i) improvement to increase the road capacity, (ii) rehabilitation to recover the design road capacity, and (iii) repair to maintain the present road conditions. These works are applied to the Study roads based on the future demand/capacity ratio assessment as proposed in Table 29.2-8.

TABLE 29.2-8 PROPOSED IMPROVEMENT MEASURES

Road		VCR (2010)	Exist. No. of Lanes	Required No of Lanes	Proposed Measure
1	Landhies Road	1.44	4	6	Improvement
2	Ring Road Pumwani	0.64	4	4	Repair
3	Ring Road Ngara	1.25	2	2	Rehabilitation
4	Racecourse Road	0.90	4	4	Repair
5	Ngara Road.	1.19	2	2	Rehabilitation
6	Park Road	0.93	2	2	Repair
7	Muranga Road	1.27	4	4	Rehabilitation
8	Limuru Road	1.02	2	2	Rehabilitation

(2) Work Components

Work components of proposed improvement measures are presented in Table 29.2-9.

TABLE 29.2-9 PROPOSED MAJOR WORK COMPONENTS

Measures	Description	Major Work Component
1. Improvement	Widening of carriageway, NMT (W=5.0m), green belt, and drainage improvement within its road reserves.	1.1 New construction of additional lanes 1.2 Overlay of the existing carriageway. 1.3 NMT way construction 1.4 Pipe drainage 1.5 Landscaping
2. Rehabilitation	Overlay pavement of the present carriageway with minor modification of road profile for NMT.	2.1 AC Pavement (t=50mm)* 2.2 NMT way construction 2.3 Drainage improvement 2.4 Landscaping, preferable
3. Repair	Pavement repair and NMT	3.1 AC surfacing (t=30mm)** 3.2 NMT construction 3.3 Drainage improvement 3.4 Landscaping, preferable

Note: * and ** Pavement thickness is to be provided following the detailed present pavement survey.

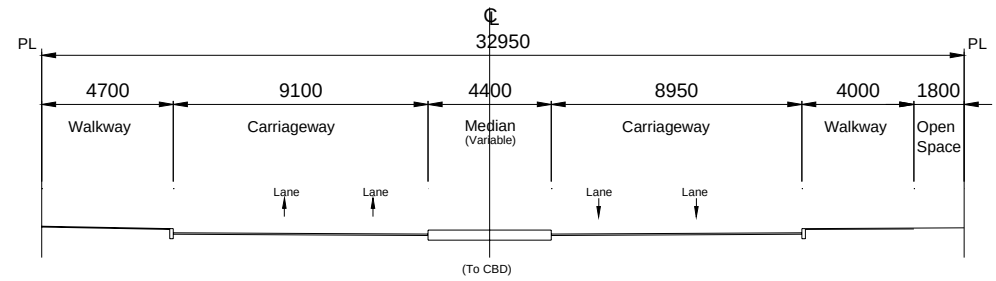
(3) Design Criteria and Proposed Cross Section

Design Criteria and Proposed Cross Section specifications are presented in Table 29.2-10.

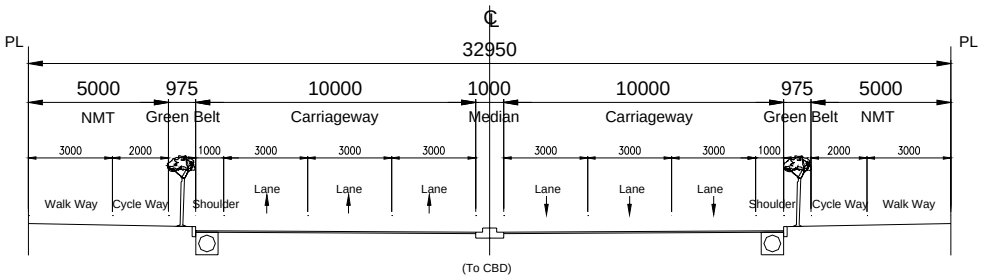
TABLE 29.2-10 DESIGN CRITERIA AND PROPOSED CROSS SECTION

Item	Unit	Specification
Design Speed	km/hr	50
Lane Width	m	3.0 – 3.5
Shoulder	m	1.0
Median	m	> 1.0 preferable
NMT	m	3.0 – 5.0
Green Belt	m	> 1.0 preferable

The road cross sections for the Improvement of Landhies Road and Rehabilitation of Muranga Road are proposed in Figure 29.2-6 and -7, respectively.



EXISTING: 3.5 M @ 4-LANE ROAD



PROPOSED: IMPROVEMENT 3.0 M @ 6-LANE DIVIDED ROAD WITH NMT (W = 5 M) AND GREEN BELT

1.0 LANDHIES ROAD

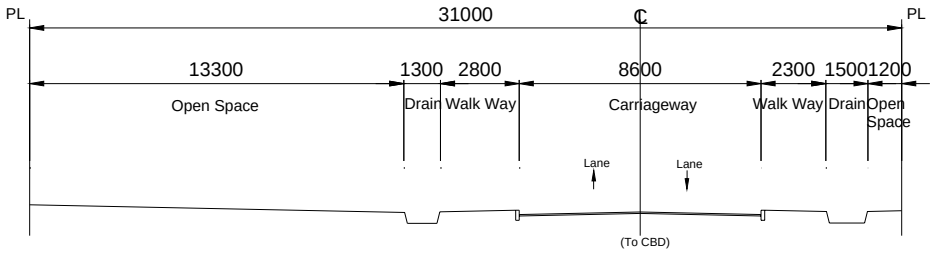
(APPROXIMATELY 700 M FROM JUNCTION OF HAILE SELLASIE AVENUE) L = 1.3 Km

Widening of carriageway, NMT, green belt, and drainage improvement within road reserves.
Proposed Work:
1. Widening: 2 lanes to 4 lanes: (1) carriageway (3m @ 3lanes, 1m @ 2 shoulders), (2) median (1.0m)
2. Overlay: AC surfacing (t=50mm)
3. NMT way construction: 2 @ 5.0m (3m walk way, 2m cycle way)
4. Pipe drainage:
5. Landscaping: Green Belt W= approx. 1.0 m

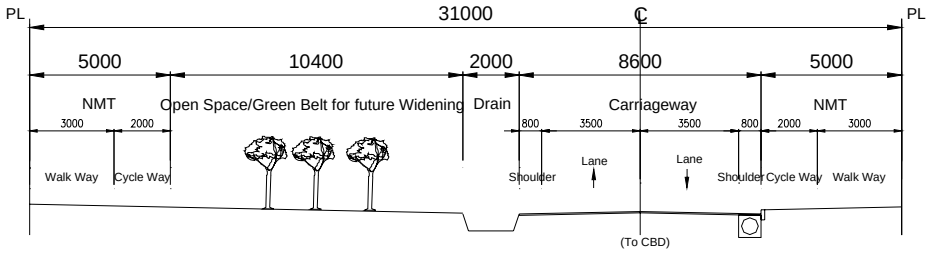
South Side

North Side

FIGURE 29.2-6 IMPROVEMENT OF LANDHIES ROAD



EXISTING :3.5M @ 2-LANE ROAD



PROPOSED: REHABILITATION WITH NMT W = 5.0m

7.0 MURANGA ROAD

(APPROXIMATELY 500M FROM JUNCTION OF RING ROAD NGARA AND FOREST ROAD) L = 2.2Km

Overly pavement, NMT, minor improvement (drainage, green belt) within road reserve.
Proposed Work:
1. AC pavement (t=50mm)
2. NMT way construction: 2 @ 5.0m (3m walk way, 2m cycle way)
4. Pipe drainage:
5. Open drainage
5. Landscaping: Open Space/ Green belt for future widening.

West Side

East Side

FIGURE 29.2-7 REHABILITATION OF MURANGA ROAD

29.2.6 Preliminary Cost Estimate

Preliminary cost estimate is presented in Table 29.2-11 while Work Quantity and Cost is available in Table 29.2-12.

TABLE 29.2-11 THE PRELIMINARY CONSTRUCTION COST

Unit: Thousand Ksh

Road		Length (km)	Foreign Component (78%)	Local Component (22%)	Total
1	Landhies Road	1.30	102,900	29,000	131,900
2	Ring Road Pumwani	0.60	21,000	6,000	27,100
3	Ring Road Ngara	1.07	22,900	6,500	29,400
4	Racecourse Road	0.75	20,000	5,700	25,700
5	Ngara Road	0.35	7,100	2,000	9,100
6	Park Road	1.13	34,000	9,600	43,600
7	Muranga Road	2.20	70,500	19,800	90,300
8	Limuru Road	0.80	26,100	7,300	33,400
	Total	8.20	304,400	85,900	390,500

TABLE 29.2-12 WORK QUANTITIES AND COST

	Project Component	Unit	Unit Price	Q'ty	Amount	Remark
1	Landhies Road Improvement	1.3 km	Ksh		(x1000Ksh)	
1.1	Widening	m	12,468	1300	16,208	t=100mm
	Overlay	m	36,409	1300	47,332	t=50mm
	NMT Way Construction	m	16,901	1300	21,971	W=5.0mx2
	Drainage	m	4,653	1300	6,049	Open/Pipe
	Green Belt	m	500	1300	650	
	Road Furniture/ Bus Stops	LS	10%		9,200	
	Miscellaneous Work	LS	30%		30,490	
	Total				**131,900**	
2	Ring Road Pumwani Repair	0.6 km	Ksh			
	AC Surface	m	9,015	600	5,409	t=30mm
	NMT Way Construction	m	17,333	600	10,400	
	Drainage Improvement	m	4,653	600	2,791	Open/Pipe
	Landscaping	m	500	600	300	
	Road Furniture/ Bus Stops	LS	10%		1,900	
	Miscellaneous	LS	30%		6,300	
	Total				**27,100**	
3	Ring Road Ngara Rehabilitation	1.07 km	Ksh			
	AC Overlay	m	5,585	1070	5,976	t=50mm
	NMT Way Construction	m	11,688	1070	12,506	W=5m+3m
	Drainage Improvement	m	1,398	1070	1,496	Open
	Landscaping	m	500	1070	535	

(to be continued)

	Project Component	Unit	Unit Price	Q'ty	Amount	Remark
	Road Furniture/ Bus Stops	LS	10%		2,100	
	Miscellaneous	LS	30%		6,787	
	Total				**29,400**	
4	Racecourse Road Repair .	0.75 km	Ksh			
	AC Surface	m	7,091	750	5,318	t=30mm
	NMT Way Construction	m	11,688	750	8,766	W=5m+3m
	Drainage Improvement	m	4,653	750	3,490	
	Landscaping	m	500	750	375	
	Road Furniture/ Bus Stops	LS	10%		1,800	
	Miscellaneous	LS	30%		5,951	
	Total				**25,700**	
5	Ngara Road Rehabilitation	0.35 km	Ksh			
	Carriageway Improvement	m	2,926	350	1,024	
	AC Overlay	m	4,936	350	1,728	t=50mm
	NMT Way Construction	m	5,611	350	1,964	
	Drainage Improvement	m	4,326	350	1,514	
	Landscaping	m	500	350	175	
	Road Furniture/ Bus Stops	LS	10%		600	
	Miscellaneous	LS	30%		2,095	
	Total				**9,100**	
6	Park Road Repair	1.13 km	Ksh			
	AC Surface	m	3,999	1130	4,519	t=30mm
	NMT Way Construction	m	17,766	1130	20,076	
	Drainage Improvement	m	4,699	1130	5,310	Open/Pipe
	Landscaping	m	500	1130	565	
	Road Furniture/ Bus Stops	LS	10%		3,000	
	Miscellaneous	LS	30%		10,130	
	Total				**43,600**	
7	Muranga Road Rehabilitation	2.2 km	Ksh			
	AC Overlay	m	6,197	2200	13,633	t=50mm
	NMT Way Construction	m	17,333	2200	38,133	
	Drainage Improvement	m	4,699	2200	10,338	Open/Pipe
	Landscaping	m	500	2200	1,100	
	Road Furniture/ Bus Stops	LS	10%		6,300	
	Miscellaneous	LS	30%		20,796	
	Total				**90,300**	
8	Limuru Road Rehabilitation	0.8 km	Ksh			
	AC Overlay	m	6,738	800	5,390	t=50mm
	NMT Way Construction	m	17,333	800	13,866	
	Drainage Improvement	m	4,699	800	3,759	Open/Pipe
	Landscaping	m	500	800	400	
	Road Furniture/ Bus Stops	LS	10%		2,300	
	Miscellaneous	LS	30%		7,685	
	Total				**33,400**	
	Grand Total	**8.2**			**390,500**	

29.3 TRAFFIC FLOW IMPROVEMENT INSIDE THE CBD

29.3.1 Study Approach

(1) Study Flow

The Study approach for traffic flow improvement inside the CBD is illustrated in Figure 29.3-1. The primary objective of the Study is to examine and adopt appropriate measures for the problems inside the CBD.

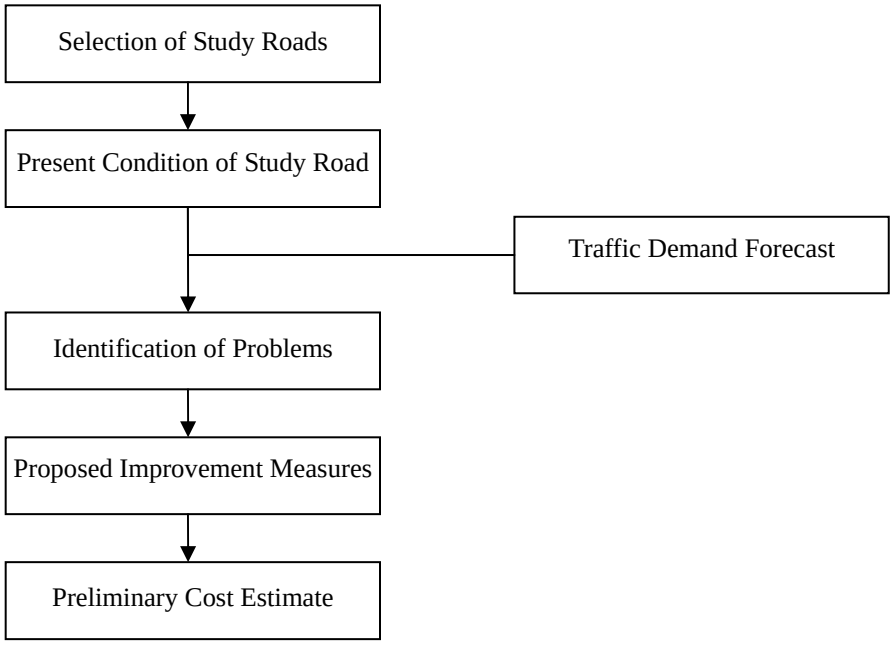


FIGURE 29.3-1 STUDY APPROACH FOR TRAFFIC FLOW IMPROVEMENT INSIDE THE CBD

(2) Selection of Study Roads

1) Road Network inside the CBD

Figure 29.3-2 shows the existing road network in the CBD of Nairobi. The road network in the CBD is comparatively developed as a grid type. The total length of the road network in the CBD is about 25.4 km, of which arterials cover about 6.0 km, collectors about 12.1 km and the remaining 7.3 km are local roads (see Table 29.3-1).

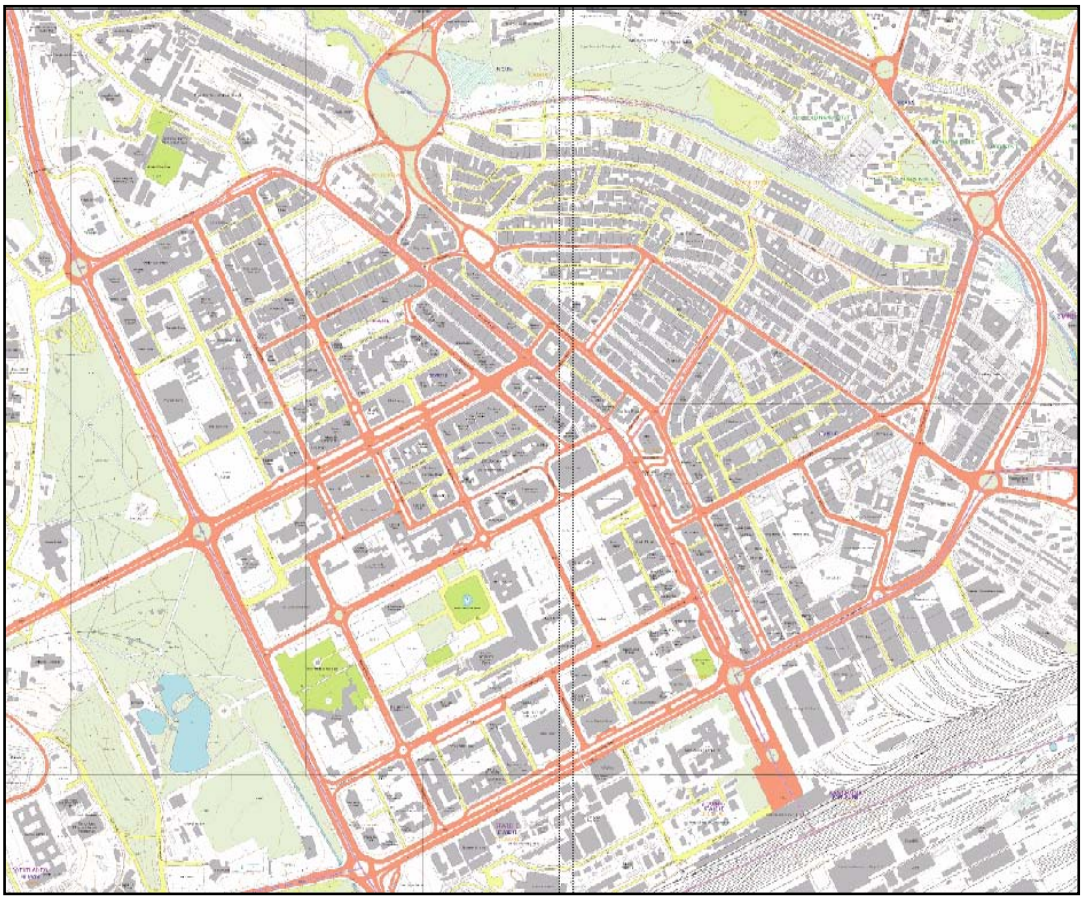


FIGURE 29.3-2 STUDY AREA FOR TRAFFIC FLOW IMPROVEMENT INSIDE THE CBD

TABLE 29.3-1 ROAD LENGTH BY TYPE

	Length (m)	%
Arterial Road	5,999	23.5
Collector Road	12,149	47.7
Local Road	7,335	28.8
Total	25,483	100.0

2) Selection of Roads to be studied

Results of the traffic survey are available in Table 29.3-2. This data set is utilized to analyze traffic congestion and determine level of service of the major roads in the CBD. Results of the analysis are given in Table 29.3-3 (traffic congestion and level of service of major roads in the CBD) and Table 29.3-4 (NMT traffic congestion).

TABLE 29.3-2 MAJOR ROADS INSIDE CBD

	Name of Road	A	B	Road Function	Length (m)	No. of Lanes
	CBD A					
East-West Direction						
1	University Way	Uhuru Highway	Moi Avenue	Arterial	470	4
2	Kenyattah Ave.	Uhuru Highway	Moi Avenue	Arterial	790	4
3	Haile Sellasie Ave	Uhuru Highway	Moi Ave.	Arterial	890	4
4	Biashara Street	Koinange Street	Moi Avenue	Collector	370	2
5	Post Road	Paliament Road	Muindi Mbingu St.	Collector	220	2
6	Mama Ngina Street	Muindi Mbingu St.	Moi Ave.	Collector	440	2
7	City Hall Way	Uhuru Highway	Moi Ave.	Collector	870	2
8	Harambee Avenue	Uhuru Highway	Moi Ave.	Collector	870	2
9	Monrovia Street	Loita Street	Moi Avenue	Local	445	2
10	Moktar Daddah Street	Uhuru Highway	Roundabout	Local	480	2
11	Tubman Road	Koinange Street	Moi Avenue	Local	390	2
12	Market Street	Uhuru Highway	Muindi Mbingu St.	Local	220	2
13	Banda Street	Loita Street	Kimathi Street	Local	460	2
14	Standard Street	Koinange Street	Kimathi Street	Local	435	2
15	Kaunda Street	Muindi Mbingu St.	Kimathi Street	Local	320	2
	S-Total				7,670	
North-South Direction						
1	Uhuru Highway	Haile Sellasie Ave	University Way	Arterial	1,140	4
2	Moi Avenue	University Way	Haile Sellasie Ave	Arterial	1,470	4
3	Koinange Street	University Way	Post Road	Collector	740	2
4	Muindi Mbingu St.	University Way	Mama Ngina Street	Collector	800	2
5	Kimathi Street	Tubman Road	Mama Ngina Street	Collector	460	2
6	Parliament Road	Post Road	Haile Sellasie Ave	Collector	634	2
7	Wabera Street	Banda Street	City Hall Way	Collector	380	2
8	Connecting Road	Mama Ngina Street	City Hall Way	Collector	60	2
9	Taifa Street	City hall Way	Harambee Avenue	Collector	280	2
10	Connecting Road	Harambee Avenue	Haile Sellasie Ave	Collector	135	2
11	Loita Street	Monrovia Street	Kenyattah Ave.	Local	470	2
	S-Total				6,569	
	Total				14,239	

	Name of Road	A	B	Road Function	Length (m)	No. of Lanes
	CBD B					
East-West Direction						
1	Slip Road	Global Cinema RA	Moi Avenue	Arterial	174	2
2	Muranga Road	Global Cinema RA	Moi Avenue	Arterial	195	2
3	Haile Sellasie Ave	Moi Avenue	River Road	Arterial	870	4
4	Latema Road	Global Cinema RA	Haile Sellasie Ave	Collector	230	2
5	ACCR Road	Koinange Street	Moi Avenue	Collector	370	2
6	Ronald Ngala Street	Uhuru Highway	Muindi Mbingu St.	Collector	220	4
7	Racecourse Road	Loita Street	Kimathi Street	Collector	460	4
8	Luthuli Avenue	Koinange Street	Moi Avenue	Local	390	2
9	Kilome St.	River road	Kirinyaga	Local	180	2
10	Mondolane St.	Moi Avenue	Tom Mboya St.	Local	790	2
11	Carbel St.	Moi Avenue	Tom Mboya St.	Local	435	2
12	Maragua St.	Moi Avenue	Tom Mboya St.	Local	220	2
13	Maragua Lane	Moi Avenue	Tom Mboya St.	Local	320	2
14	Bank Street	Moi Avenue	Tom Mboya St.	Local	440	2
15	Short St.	Moi Avenue	Tom Mboya St.	Local	870	2
	S-Total				6,164	
North-South Direction						
1	Tom Mboya St.	Roundabout	Haile Sellasie Ave	Collector	1,140	4
2	Uyoma Street	University Way	Post Road	Collector	740	2
3	Lagos Road	University Way	Bank Street	Collector	800	2
4	River Road	Tubman Road	Mama Ngina Street	Collector	460	2
5	Kirinyaga Road	University Way	Haile Sellasie Ave	Collector	1,470	2
6	Mfangano Street	Monrovia Street	Kenyattah Ave.	Local	470	2
	S-Total				5,080	
	Total				11,244	
	Grand Total				25,483	

TABLE 29.3-3 TRAFFIC CONGESTION OF MAJOR ROADS INSIDE THE CBD IN 2005

St. No	Road Name	Direction	Capacity / 15 Min	Peak 15 Min TrafficVolume	V/C Ratio	LOS
RS1	Harambee Avenue	East Bound	350	495	1.41	F
		West Bound	350	318	0.91	E
RS2	Parliament Road	South Bound	350	299	0.85	E
		North Bound	350	239	0.68	D
RS3	Taifa Road	South Bound	350	186	0.53	C
		North Bound	350	185	0.53	C
RS4	City Hall Way	East Bound	350	174	0.50	D
		West Bound	350	296	0.85	E
RS5	Koinange Street	South Bound	350	258	0.74	D
		North Bound	350	210	0.60	D
RS6	River Road	South Bound	350	131	0.37	B
		North Bound	350	75	0.21	B
RS7	Tom Mboya Street	South Bound	350	230	0.66	D
		North Bound	350	248	0.71	D
RS8	Latema Road	South Bound	350	304	0.87	E
		North Bound	350	205	0.59	C
RS9	Accra Road	South Bound	350	133	0.38	B
		North Bound	350	152	0.43	C
RS10	Ronald Ngala Street	East Bound	350	283	0.81	E
		West Bound	350	342	0.98	E
RS11	Tom Mboya Street	South Bound	350	535	1.53	F
		North Bound	350	315	0.90	E

Source: Traffic volume obtained from traffic survey conducted in this Study

TABLE 29.3-4 NMT TRAFFIC CONGESTION ANALYSIS INSIDE THE CBD IN 2005

St. No	Road Name	Direction	NMT Traffic / 15 Min	Sidewalk (m)	Capacity	V/C	LOS
RS1	Harambee Avenue	East Bound	324	2.2	688	0.471	C
		West Bound	455	3.6	1,125	0.404	C
RS2	Parliament Road	South Bound	468	3.6	1,125	0.416	C
		North Bound	294	4.2	1,313	0.224	B
RS3	Taifa Road	South Bound	376	3.2	1,000	0.376	B
		North Bound	398	2.7	844	0.472	C
RS4	City Hall Way	East Bound	344	2.2	688	0.500	C
		West Bound	332	3.4	1,063	0.312	B
RS5	Koinange Street	South Bound	527	3.8	1,188	0.444	C
		North Bound	505	3.0	938	0.539	C
RS6	River Road	South Bound	580	3.6	1,125	0.516	C
		North Bound	916	3.4	1,063	0.862	E
RS7	Tom Mboya Street	South Bound	1,572	3.7	1,156	1.360	F
		North Bound	2,928	3.7	1,156	2.532	F
RS8	Latema Road	South Bound	369	2.7	828	0.446	C
		North Bound	773	3.7	1,156	0.669	D
RS9	Accra Road	South Bound	705	3.6	1,125	0.627	D
		North Bound	689	4.0	1,250	0.551	C
RS10	Ronald Ngala Street	East Bound	837	3.2	1,000	0.837	E
		West Bound	540	2.2	688	0.785	E
RS11	Tom Mboya Street	South Bound	1,204	3.8	1,188	1.014	F
		North Bound	978	3.6	1,125	0.869	E

Source: NMT Traffic volume obtained from traffic survey conducted in this Study

3) Selection of Study Roads

Based on the assessment of the demand/capacity ratio of the carriageway and sidewalk of major roads inside the CBD, the following roads are identified as the most heavily congested roads, and therefore selected for Pre-Feasibility Study.

- Harambee Avenue
- Parliament Road
- Koinange Street
- City Hall Way
- River Road
- Tom Mboya Street
- Ronald Ngala Street
- Kenyatta Avenue
- Slip Road / Murang'a Road

29.3.2 Present Condition of the Study Roads

(1) Traffic Conditions

In order to grasp the traffic flow conditions inside the CBD, a traffic survey, consisting of traffic count survey and traffic movement survey, was conducted in this Study. The results of the survey are presented in the form of tables and graphs and discussed below.

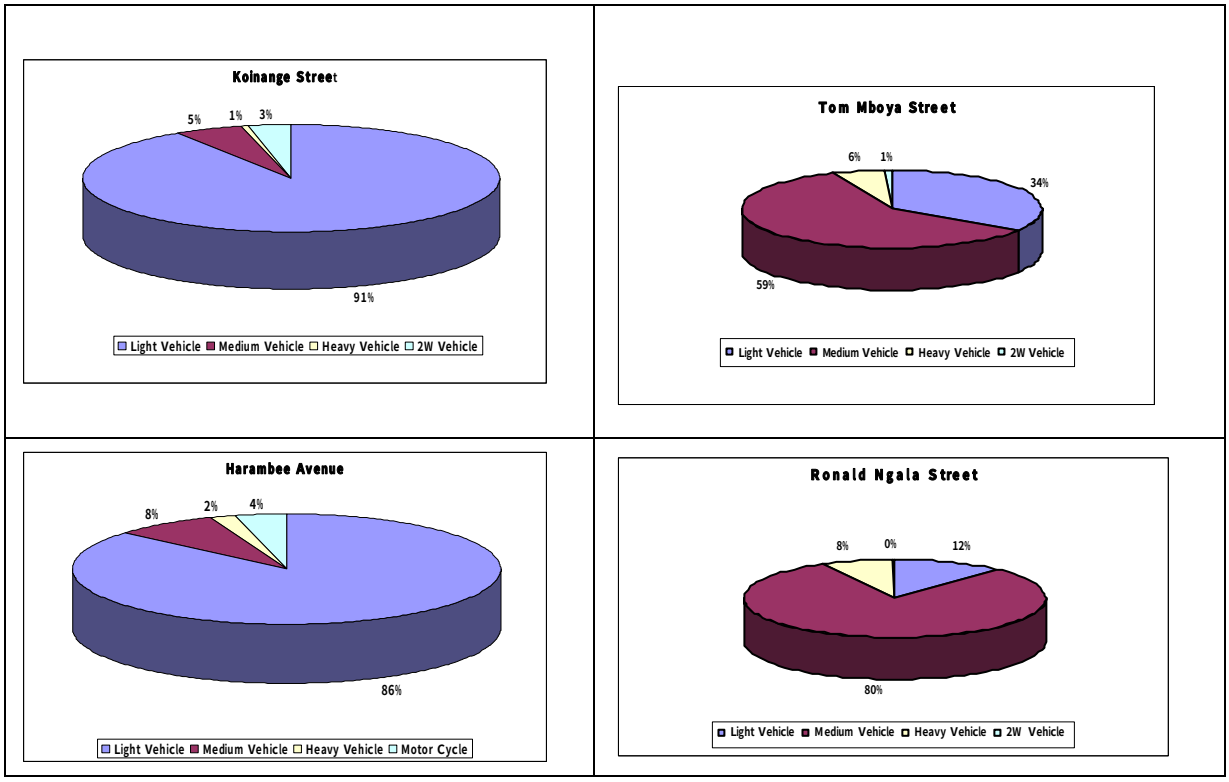
Table 29.3-5 depicts traffic volume for both directions along the major roads inside the CBD. The traffic volume on the major and secondary roads is in the range of 6,300 to 19,900 vehicles per 12 hours.

The vehicles involved in the counts are originally classified into 12 types. In the analysis, however these are re-classified into four major types: 1) light vehicles, 2) medium vehicles, 3) heavy vehicles, and 4) motor-cycles.

TABLE 29.3-5 TRAFFIC VOLUMES ON THE MAJOR ROADS INSIDE THE CBD

		Light Vehicle	Medium Vehicle	Heavy Vehicle	Motor Cycle	Total	
						Vehicles	PCU
RS1	Harambee Avenue	17,051	1,551	388	751	19,741	20,566
RS2	Parliament Road	14,021	909	90	766	15,786	15,959
RS3	Taifa Road	10,095	538	101	353	11,087	11,395
RS4	City Hall Way	11,947	1,240	685	391	14,263	15,329
RS5	Koinange Street	9,964	850	91	292	11,197	11,522
RS6	River Road	3,257	2,692	260	112	6,321	7,907
RS7	Tom Mboya Street	5,372	9,308	888	113	15,681	21,183
RS8	Latema Road	3,754	5,360	979	113	10,206	16,903
RS9	Accra Road	1,882	4,340	69	91	6,382	10,017
RS10	Ronald Ngala Street	2,113	13,783	1,211	53	17,160	28,331

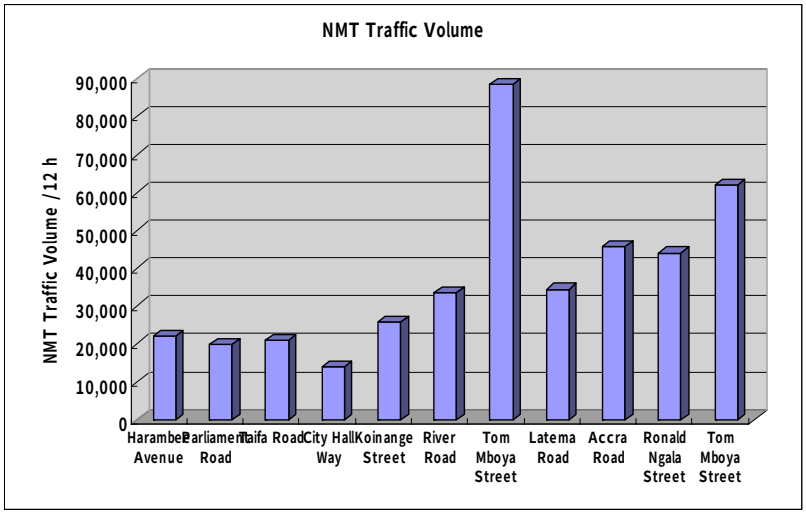
Source: Traffic survey conducted in this Study



Source: Traffic survey conducted in this Study

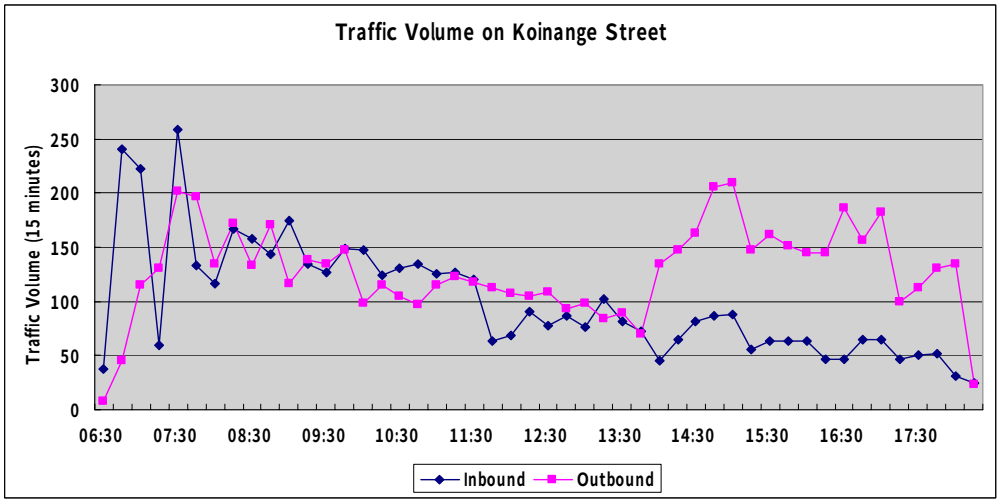
FIGURE 29.3-3 VEHICLE COMPOSITION ON MAJOR ROADS IN THE CBD

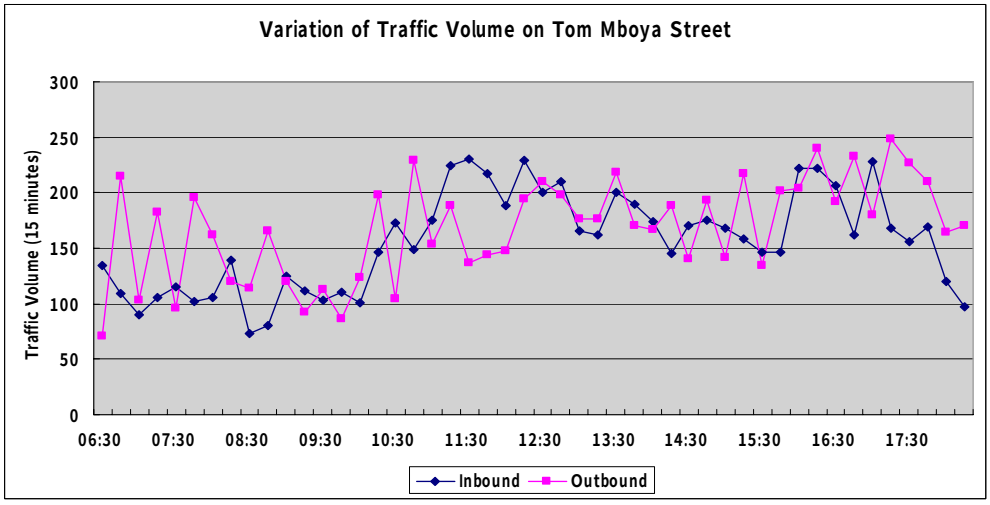
Figure 29.3-3 shows the vehicle composition on Koinange Street, Harambee Avenue, Tom Mboya Street and Ronald Ngala Street. Figure 29.3-4 shows NMT traffic volume inside the CBD, while Figure 29.3-5 shows the variation of traffic volume of Koinange Street and Tom Mboya Street.



Source: Traffic survey conducted in this Study

FIGURE 29.3-4 NMT TRAFFIC VOLUME





Source: Traffic survey conducted in this Study

FIGURE 29.3-5 15-MINUTE INTERVAL TRAFFIC VOLUME FLUCTUATION ON KOINANGE ST. AND TOM MBOYA ST.

(2) Road Condition

Based on the road condition survey conducted and the Master Plan Study results, the road conditions are described below.

Harambee Avenue

Harambee Avenue originally starts from Uhuru Highway to Moi Avenue. This road is identified as a collector in the Master Plan Study. This is one of the most important collector roads to distribute/collect traffic from primary roads to its own corridor.

Parliament Road

Parliament Road starts from Haile Selassie Avenue to Posta Road. It is identified as a collector road in the Master Plan Study and is one of the very important roads as a symbol of Kenya from the international and political perspectives.

City Hall Way

City Hall Way, which runs parallel to the Harambee Avenue, originally starts from Uhuru Highway and terminates at Moi Avenue. This road is identified as a collector in the Master Plan Study. This is one of the very important collector roads that distribute/collect traffic from primary roads to its own corridor.

Koinange Street

Koinange Street originally starts from University Way and terminates at Posta Road. This road is identified as a collector in the Master Plan Study. This road is also one of the very important collector roads that distribute/collect traffic from primary roads to its own corridor.

River Road

River Road starts from Globe Cinema roundabout and terminates at Racecourse Road. Although this road is identified as a collector road, it is a very important road since it serves Matatu routes to the north and north-east directions of Nairobi.

Tom Mboya Street

Tom Mboya Street, which runs parallel to Moi Avenue, starts from Globe Cinema roundabout and terminates at Haile Selassie Avenue. Although this road is identified as a collector road, it is very important as a Matatu route connecting from the north, north-east and east directions of Nairobi.

Ronald Ngala Street

Ronald Ngala Street originally starts from Moi Avenue and terminates at the merging point of Racecourse Road and is functionally identified as a collector road in the Master Plan Study. However, this road is very important and connects to the East direction of Nairobi as a Matatu

route. The eastern part of this road is operated as a one-way street.

Kenyatta Avenue

Kenyatta Avenue originally starts from Valley Road to Moi Avenue Junction. Its function is identified as a primary road in the Master Plan Study. This road is one of the very important roads inside the CBD. In this Study, the Study section of this road is only limited to that section between Uhuru Highway Junction and Moi Avenue Junction since this is where the bottleneck is prevalent which hampered efficient flow of traffic.

Slip Road / Muranga Road

Slip Road and Muranga Road are just short stretches connecting Globe Cinema to Moi Avenue. Although these roads are short stretches, they are important connections as primary roads.

The Present conditions of the selected roads are summarized in Table 29.3-6.

TABLE 29.3-6 PRESENT ROADS CONDITIONS

Road Name	Carriageway	NMT	Pavement	Drainage	Remarks
Harambee Avenue	2-lane road 9.75 m w/ curb-side parking lane	3.6 to 3.7 m for each Side, fair	Fair	Underground, fair	Road reserve 26 m
Parliament Road	2-lane road 13.75 m	3.4 to 4.75 m for each Side, fair	Fair	Underground, fair	Road reserve 25 m
Koinange Street	4-lane road 11.00 m w/ curb-side parking lane	5.1 to 6.8 m for each Side, fair	Fair	Underground, fair	Road reserve 30 m
City Hall Way	4-lane road 13.30 m w/ curb-side parking lane	3.4 to 4.75 m for each Side, fair	Fair	Underground, fair	Road reserve 32 m Partially one-way street
River Road	2-lane road 11.05 m	3.45 to 3.7 m for each Side, poor	Poor	Underground, but not functioning well	Road reserve 25 m
Tom Mboya Street (Accra – Ronald Ngala Street)	4-lane road 17.75 m	3.4 to 6.30 m for each Side, poor	Poor	Underground, but not functioning well	Road reserve 28 m
Tom Mboya Street (River Road – Accra Road)	2-lane road 12.85 m	4.2 to 3.5 m for each Side, poor	Poor	Underground, but not functioning well	Road reserve 28 m
Ronald Ngala Street	4-lane road 18.05 m	3.8 to 4.50 m for each Side, poor	Poor	Underground, but not functioning well	Road reserve 28 m
Kenyatta Avenue	4-lane road 18.05 m	3.8 to 4.50 m for each Side, poor	Poor	Underground, but not functioning well	Road reserve 28 m
Slip Road	2-lane road	No sidewalk Poor	Poor	Poor	Road reserve
Muranga Road (Globe Cinema – Moi Avenue)	2-lane road	2.5 to 4.0 m sidewalk, poor	Poor	Poor	Road reserve One-way street

29.3.3 Traffic Demand Forecast

In the Master Plan Study, the traffic demands in the years 2015 and 2025 were forecasted based on the person trip survey conducted. The detailed forecast procedure is discussed in Chapter 12.

In the Pre-Feasibility study, using the present vehicle OD matrix and the forecasted vehicle OD matrix in 2015, the vehicle OD matrix in 2010 is estimated using the interpolation method. The vehicle OD matrix in 2010 is assigned to the present road network and the road network in 2010 by using the TRANS-CAD simulation model.

Table 29.3-7 and 29.3-8 show the vehicle traffic congestion of the Study roads, together with the results of the traffic flow simulation that are depicted in Figure 29.3-6 and Figure 29.3-7.

TABLE 29.3-7 TRAFFIC CONGESTION USING TRAFFIC ASSIGNMENT MODEL

Road Name	No. of Lanes	Capacity (PCU)	Traffic Volume in 2004	V/C Ratio in 2004	Traffic Volume in 2010	V/C Ratio in 2010
Harambee Avenue	2	14,000	13,419	0.96	20,445	1.46
Parliament Road	2	14,000	7,235	0.52	10,646	0.76
Koinange Street	4	28,000	21,695	0.78	29,656	1.06
City Hall Way	4	28,000	13,419	0.48	20,445	0.73
River Road	2	14,000	13,395	0.96	20,381	1.46
Tom Mboya Street (Accra –Ronald Ngala Street)	4	28,000	24,025	0.86	30,843	1,10
Tom Mboya Street (River Road – Accra Road)	4	28,000	27,417	0.98	36,069	1.29
Ronald Ngala Street	4	28,000	36,274	1.29	38,174	1.36
Kenyatta Avenue*	6	54,000	59,367	1,10	62,650	1.16
Slip Road	2	14,000	19,738	1.40	21,063	1.50
Muranga Road (Globe Cinema RA – Moi Avenue)	2	14,000	8,950	0.64	13,800	0.99

Note: including service road

Table 29.3-8 shows the pedestrian traffic congestion based on growth rate of person trip in 2010.

TABLE 29.3-8 PEDESTRIAN TRAFFIC CONGESTION

Road Name	Direction	Width of Sidewalk (m)	Capacity (Pass)	Passenger Volume in 2004	V/C Ratio in 2004	Passenger Volume in 2010	V/C Ratio in 2010
Harambee Avenue	East	2.2	660	324	0.491	399	0.604
	West	3.6	1,080	455	0.421	560	0.518
Parliament Road	South	3.6	1,080	468	0.433	576	0.533
	North	4.2	1,260	294	0.233	362	0.287
Koinange Street	South	3.2	960	376	0.392	462	0.482
	North	2.7	810	398	0.491	490	0.604
City Hall Way	East	2.2	660	344	0.521	423	0.641
	West	3.4	1,020	332	0.325	408	0.400
River Road	South	3.8	1,140	527	0.462	648	0.569
	North	3.0	900	505	0.561	621	0.690
Tom Mboya St. (Accra –Ronald Ngala Street)	South	3.6	1,080	580	0.537	713	0.661
	North	3.4	1,020	916	0.898	1,127	1.105
Tom Mboya Street (River Road – Accra Road)	South	3.7	1,110	1,572	1.416	1,934	1.742
	North	3.7	1,110	2,928	2.638	3,601	3.245
Ronald Ngala Street	South	2.7	795	369	0.464	454	0.571
	North	3.7	1,110	773	0.696	951	0.857
Kenyatta Avenue*	South	3.6	1,080	705	0.653	867	0.803
	North	4.0	1,200	689	0.574	847	0.706

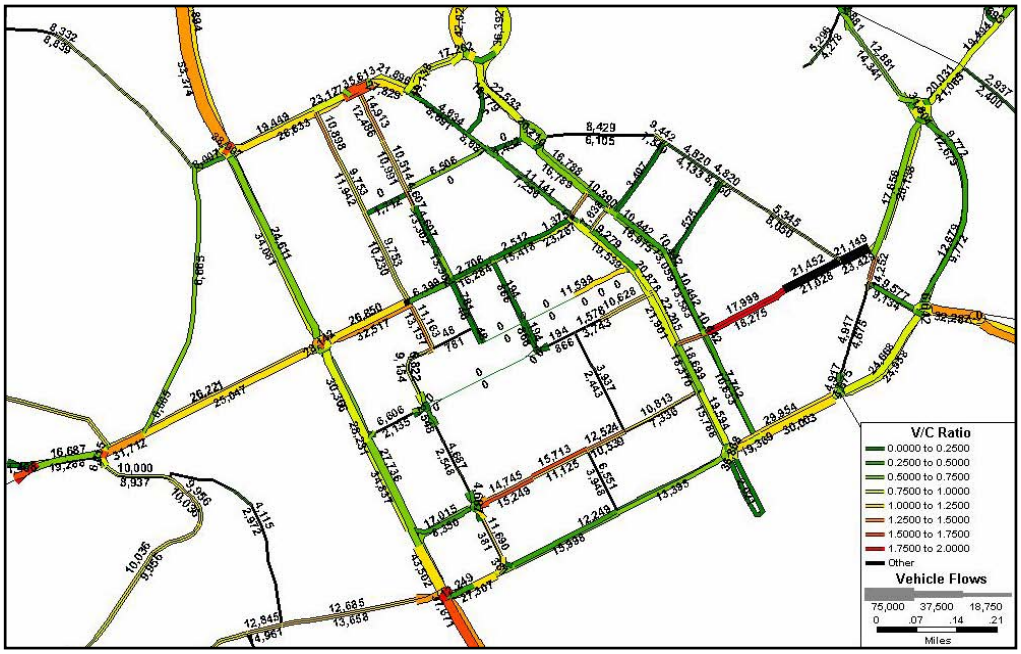


FIGURE 29.3-6 RESULTS OF TRAFFIC FLOW SIMULATION INSIDE THE CBD IN 2004

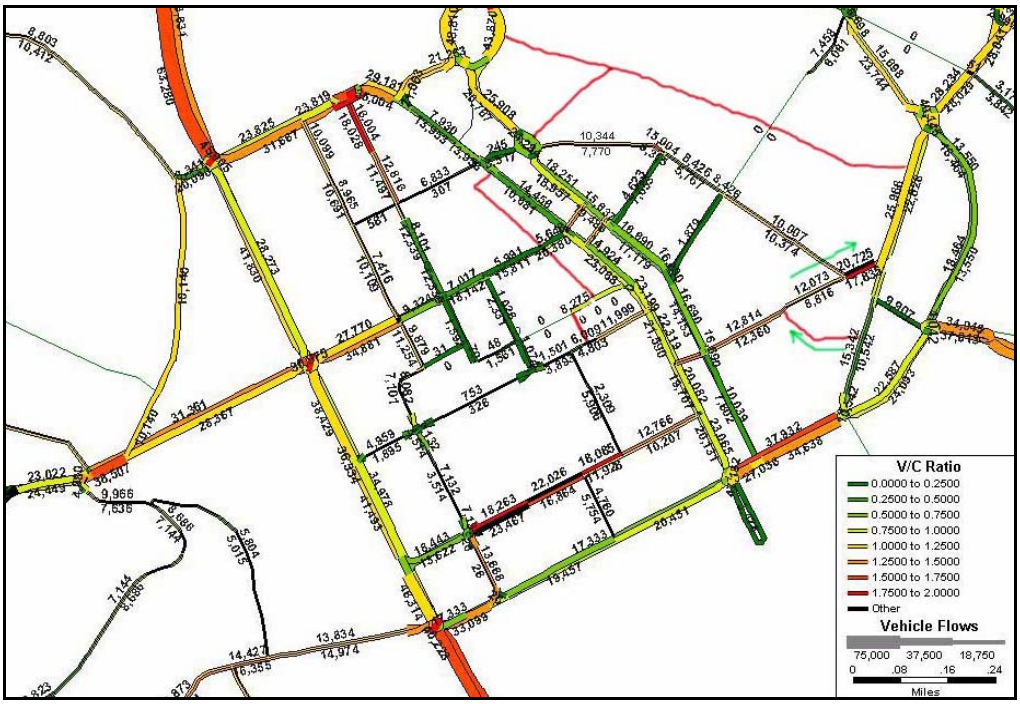


FIGURE 29.3-7 RESULTS OF TRAFFIC FLOW SIMULATION INSIDE THE CBD IN 2010

29.3.4 Identification of Problems

Based on the analyses of the current traffic flow and the existing road conditions, same problems and issues were identified.

(1) Urban Structure

Urban activities only concentrate inside the CBD where traffic congestion is serious. In addition to the urban activities, bus and matatu terminals and stops are heavily concentrated inside the CBD area. Obviously, inefficient and ineffective road network would slow down economic development.

(2) Road Network and Conditions

Although the road network inside the CBD is relatively developed, the hierarchy of road network or hierarchical usage of the road network has neither developed well nor put to proper use. There are some Missing Links crossing the Nairobi River between the CBD and the eastern part of Nairobi. Traffic congestion and poor level of service (LOS) of arterials and collectors due to various disturbances of vehicle traffic by Bus / Matatu and significant NMT traffic has been observed.

(3) Traffic Management

Disorderly traffic flow mainly caused by matatus can be seen along the matatu routes of Tom Mboya and Ronald Ngala Streets. Although many passengers boarding and alighting from buses/matatus concentrate along Tom Mboya and Ronald Ngala Streets, sufficient sidewalks and pedestrian facilities have not been provided. Illegal on-street parking can be observed inside the CBD. Traffic management devices and equipment have not been properly installed or well maintained. Traffic security and safety has not been secured, especially in the eastern part of Moi Avenue.

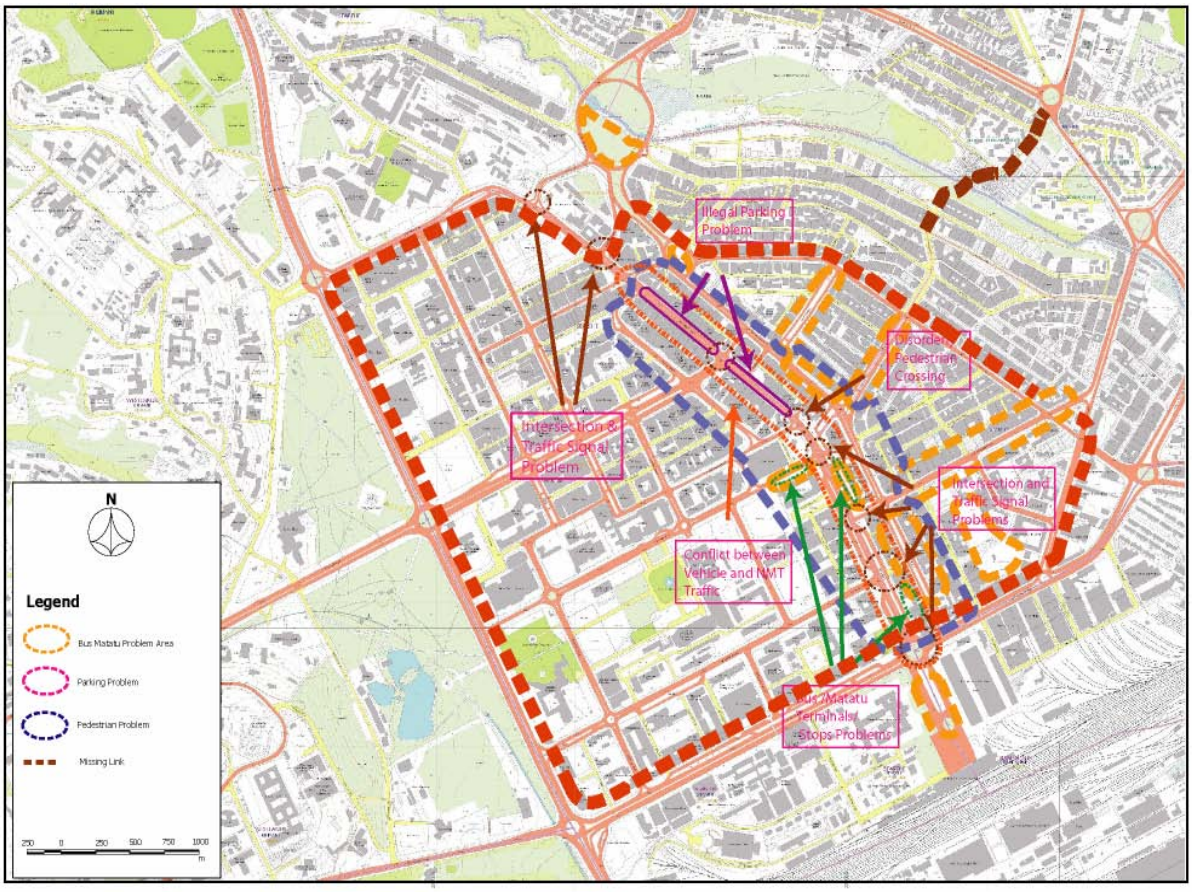


FIGURE 29.3-8 PROBLEM AREAS INSIDE THE CBD

29.3.5 Proposed Improvement Measures

(1) Basic Planning Policy

As pointed out in the analysis of the previous section, the road and traffic management problems and issues were identified.

From the viewpoint of traffic flow improvement inside the CBD for both vehicle and pedestrian traffic, four (4) planning policies are envisioned and highlighted:

- to alleviate traffic congestion and to promote orderly and smooth traffic flow inside the CBD;
- to provide comfort and safer Non-Motorized Transport (NMT);
- to enhance transport security and safety; and
- to emphasize on environmental and social considerations.

(2) Possible Measures for Traffic Flow Improvement inside the CBD

The possible measures that can be taken are summarized below.

- Policy measures
  - Policy for on-street parking
  - Policy for Bus / Matatu terminals and routes
  - Policy for NMT traffic

- Infrastructure measures
  - Improvement of roads
  - Rehabilitation and widening of sidewalks
  - Rehabilitation of roadside drainage
  - Rehabilitation of median

- Traffic management measures
  - One-way traffic circulation
  - Traffic safety devices
  - Rehabilitation of street lighting
  - Installation of traffic signals and Closed Circuit Television (CCTV) Systems
  - On-street parking control
  - Strengthening of traffic rules enforcement

(3) Project Components for Traffic Flow Improvement inside the CBD

In order to address the policy and measures of the traffic engineering and management program in the CBD presented in the previous sections, the following project components are formulated and summarized in Table 29.3-9.

- Improvement of road infrastructure
- Improvement of NMT systems
- Geometric improvement of intersections
- Restoration and installation of traffic signals and CCTV systems
- Installation of traffic safety devices (Traffic signs and pavement markings)
- Construction of missing links

In addition to the above mentioned project, the parking study is discussed in Section 29.4 and, the bus/matatu terminals and routes are discussed in Chapter 30.

TABLE 29.3-9 MEASURES FOR PROBLEMS AND ISSUES INSIDE THE CBD

Problems and Issues	Measures	Areas to be Adopted
Urban Structure		
Concentration of urban activities in the CBD	Dispersal policy for urban activities to sub-urban center	NMA
Concentration of Bus/Matatu Terminals	Bus/Matatu terminal relocation policy Restructuring of Bus / Matatu routes	Eastern part of the CBD
Constraints of economic development	Improvement of traffic congestion	Whole CBD area
Road Network and Conditions		
Establishment of road network hierarchy	Improvement of arterials and collectors	Arterials and collectors
Missing Links	Construction of Missing Links	Extension of Accra road
Traffic congestion and poor LOS	Improvement of carriageway Improvement of intersection Improvement of sidewalks Improvement of roadside drainage	Whole CBD area
Traffic Management		
Disorderly traffic flow	Education of Bus/Matatu drivers	Tom Mboya Street and Ronald Ngala Street etc
Insufficient pedestrian facilities	Widening of pedestrian facilities Proper planning of NMT routes	Tom Mboya Street and Ronald Ngala Street etc
Illegal parking	Policy for on-street parking Enforcement of illegal parking Control of on-street parking Construction of off-street parking	Whole CBD area
Poor traffic devices	Improvement of traffic signal system Installation of traffic devices Proper maintenance	Whole CBD area
Others		
Traffic security	CCTV system introduction Street lighting	Strategic places

(4) Improvement of Roads, Intersections and Sidewalks

Improvement Measures

Proposed improvement measures include a) increase of the road capacity by widening (V/C ratio<=1.50), b) increase of the road capacity by geometric improvement (1.25<=V/C<1.50) ratio, c) recovery of the road capacity by rehabilitation (1.00<=V/C<1.25), and d) repair of the present road conditions (V/C<1.00). These works are applied to the study road based on the future demand/capacity ratio assessment as proposed in Table 29.3-10 and Table 29.3-11.

TABLE 29.3-10 PROPOSED IMPROVEMENT MEASURES

Road		VCR (2010)	Existing No. of Lanes	Required No of Lanes	Proposed Measure
1	Harambee Avenue	1.46	2	4	Geometric Improvement
2	Parliament Road	0.76	2	2	Repair
3	Koinange Street	1.06	4	4	Rehabilitation
4	City Hall Way	0.73	4	4	Repair
5	River Road	1.46	2	4	Geometric Improvement
6	Tom Mboya Street (Accra –Ronald Ngala Road)	1,10	4	4	Rehabilitation
7	Tom Mboya Street (River Road – Accra Road)	1.29	4	4	Geometric Improvement
8	Ronald Ngala Street	1.36	4	4	Geometric Improvement
9	Kenyatta Avenue	1.16	6	6	Rehabilitation
10	Slip Road	1.50	2	2	Widening
11	Muranga Road (Glove Cinema RA – Moi Avenue)	0.99	2	2	Repair

TABLE 29.3-11 PROPOSED IMPROVEMENT OF SIDEWALK

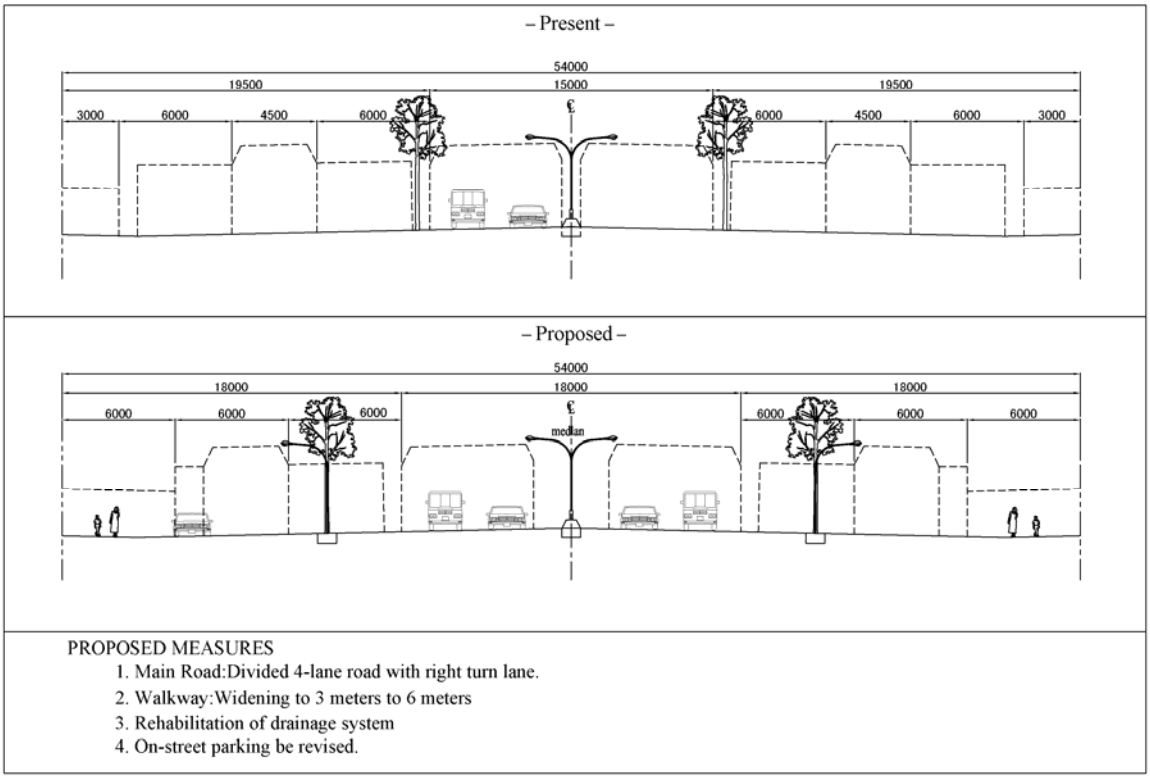
	Road Name	Direction	V/C Ratio in 2010	Existing Width of Sidewalk (m)	Required Width of Sidewalk (m)	Proposed Measure
1	Harambee Avenue	East Bound	0.604	2.2	2.2	Repair
		West Bound	0.518	3.6	3.6	Repair
2	Parliament Road	South Bound	0.533	3.6	3.6	Repair
		North Bound	0.287	4.2	4.2	Repair
3	Koinange Street	South Bound	0.482	3.2	3.2	Repair
		North Bound	0.604	2.7	2.7	Repair
4	City Hall Way	East Bound	0.641	2.2	2.2	Repair
		West Bound	0.400	3.4	3.4	Repair
5	River Road	South Bound	0.569	3.8	3.8	Repair
		North Bound	0.690	3.0	3.0	Repair
6	Tom Mboya St. (Accra - Ronald Ngala St.)	South Bound	0.661	3.6	3.6	Repair
		North Bound	1.105	3.4	4.0	Repair
7	Tom Mboya St. (River Road - Accra Road)	South Bound	1.742	3.7	6.0	Widening
		North Bound	3.245	3.7	10.0	Widening
8	Ronald Ngala Street	South Bound	0.571	2.7	2.7	Repair
		North Bound	0.857	3.7	3.7	Repair
9	Kenyatta Avenue*	East Bound	0.803	3.0	6.0	Widening
		West Bound	0.706	3.0	6.0	Widening

Typical Cross-sections

Based on the criteria established in Chapter 18, the existing and proposed typical cross-sections of Kenyatta Avenue and Tom Mboya Street are illustrated in Figure 29.3-9 and Figure 29.3-10, respectively.

Conceptual Plan

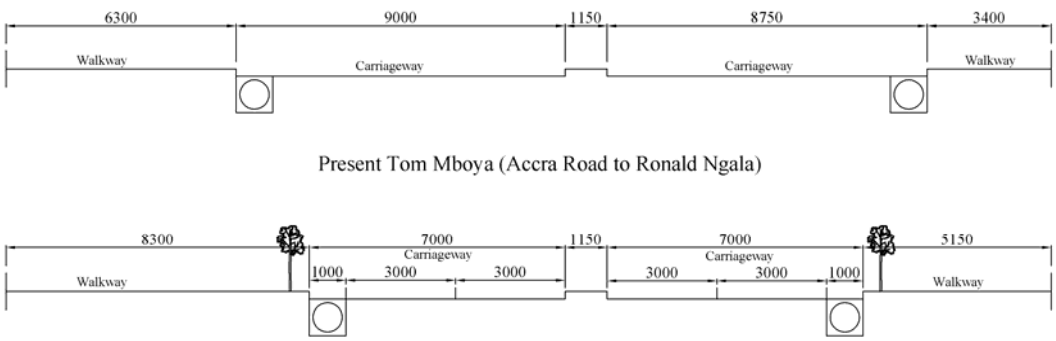
Based on the typical cross-section, the conceptual plan for Kenyatta Avenue Revitalization is shown in Figure 29.3-11.



PROPOSED MEASURES

1. Main Road:Divided 4-lane road with right turn lane.
2. Walkway:Widening to 3 meters to 6 meters
3. Rehabilitation of drainage system
4. On-street parking be revised.

FIGURE 29.3-9 TYPICAL CROSS SECTION OF KENYATTA AVENUE



Present Tom Mboya (Accra Road to Ronald Ngala)

Proposed Tom Mboya (Accra Road to Ronald Ngala)

PROPOSED MEASURES

1. Carriageway: Divided 4-Lane
2. Walkway: To Globe Cinema-Widening from 6.00m to 10.00m
   To Haile Selasie AVenue-Widening from 3.40m to 5.15m
3. Rehabilitation of drainage system
4. Prohibition of on-strrt parking
5. Landscaping: Greenbelt W=Approx.1.00m

FIGURE 29.3-10 TYPICAL CROSS SECTION OF TOM MBOYA STREET

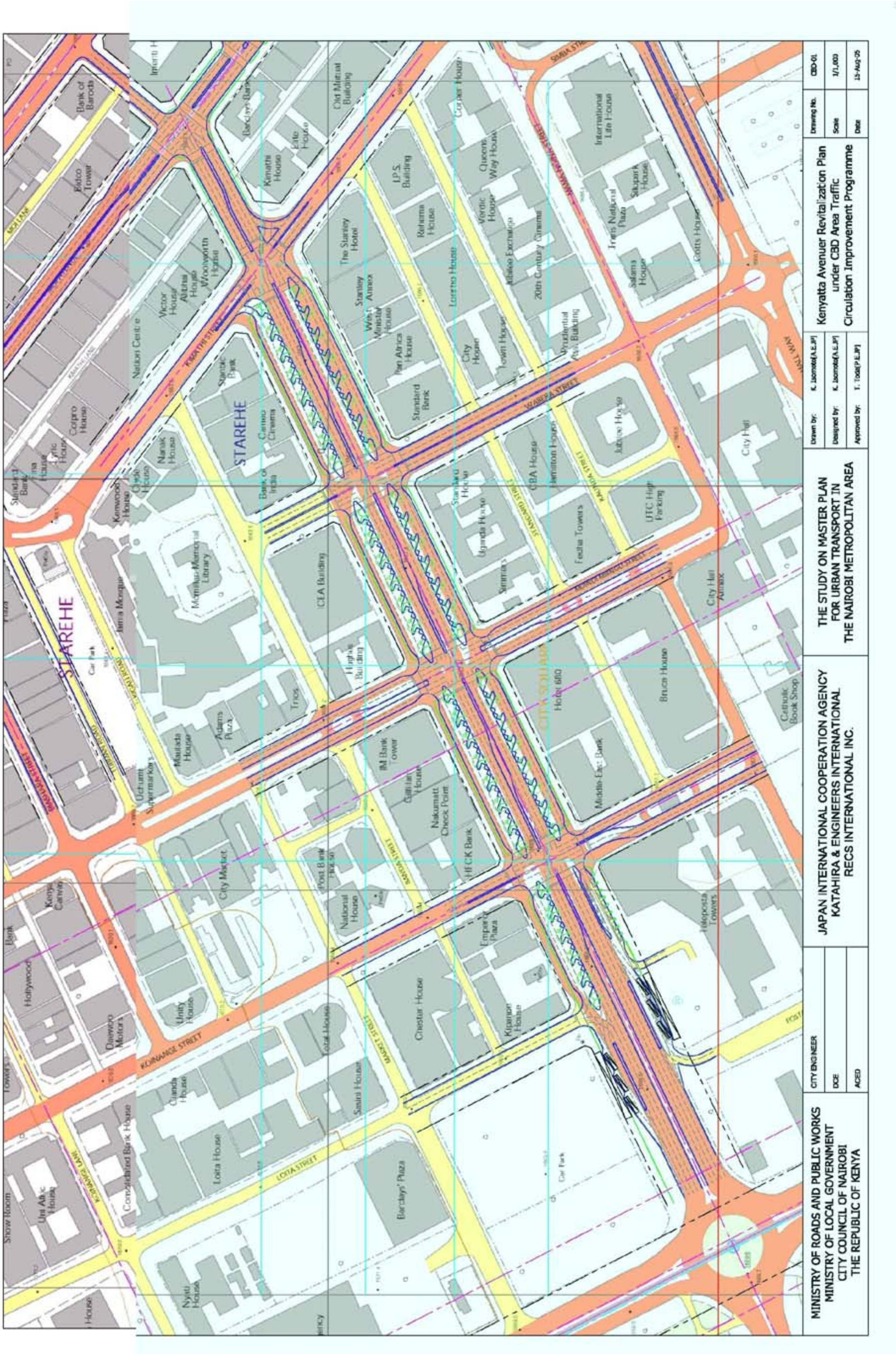


FIGURE 29.3-11 CONCEPTUAL PLAN FOR KENYATTA AVENUE REVITALIZATION

(5) Traffic Management Measures

Basic Considerations

A traffic management plan that takes into account the following basic considerations, based on these issues, is envisioned for the CBD.

- In order to increase the road capacity, on-street parking is to be controlled on some of the arterials and collectors inside the CBD. Three (3) kinds of parking control measures will be recommended:
  - prohibition of on-street parking
  - employment of on-street parking ticket system
  - employment of parallel parking type instead of the 45 degree parking system.

- In order to increase the road capacity, vehicle and pedestrian traffic must be segregated as much as possible

- A traffic signal system can be effectively operated as a traffic management tool. It is recommended that many damaged traffic signals be restored in order to control both motor vehicles and pedestrian traffic effectively.

- Some of the Matatu terminals around Tom Mboya Street and Bus terminals near Ronald Ngala Street must be relocated to the fringe of the CBD as proposed in Chapter 30.

- Since the facilities for pedestrians going to/coming from Bus / Matatu terminals / stops are comparatively narrow, it is necessary to widen Tom Mboya Street and connecting roads between Moi Avenue and Tom Mboya Street.

- Traffic safety facilities, such as sidewalks and pedestrian crossings are not sufficient in number. The widening of sidewalks, pedestrian crossings, pedestrian fences, and other safety facilities must be improved to ensure pedestrian safety and to rectify the current disorderly pedestrian movement.

Improvement Plan

Based on the above-mentioned considerations, the plan of the traffic management on Moi Avenue is shown in Table 29.3-12. The locations for traffic management improvement are determined based on the road condition surveys and traffic analysis.

TABLE 29.3-12 TRAFFIC MANAGEMENT PLAN ON MOI AVENUE

	On-street Parking system	Pedestrian Facilities	Traffic Signal with Intersection Improvement	Bus/Matatu Terminals / Stops
Harambee Avenue	Allowed only at designated on-street parking space	Rehabilitation of sidewalk	Moi Avenue intersection	No Bus / Matatu
Parliament Road	Allowed only at designated on-street parking space	Rehabilitation of sidewalk	No traffic signal	No Bus / Matatu
Koinange Street	Allowed only at designated on-street parking space	Rehabilitation of sidewalk	University Way intersection Kenyatta Avenue	No Bus / Matatu
City Hall Way	Allowed only at designated on-street parking space	Rehabilitation of sidewalk	No traffic signal	Improvement of bus stops
River Road	Principally Prohibited on-street parking Allowed only at designated on-street parking space	Rehabilitation of sidewalk	Ronald Ngala Street intersection	Improvement of Matatu routes
Tom Mboya Street (Accra –Ronald Ngala Street)	Principally Prohibited on-street parking Allowed only at designated on-street parking space	Widening of sidewalk	Harambee Avenue intersection Haile Selassie Intersection	Improvement of Matatu stops / routes
Tom Mboya Street (River Road – Accra Road)	Principally Prohibited on-street parking Allowed only at designated on-street parking space	Widening of sidewalk	Ronald Ngala Street intersection	Improvement of Matatu stops / routes
Ronald Ngala Street	Principally Prohibited on-street parking Allowed only at designated on-street parking space	Widening of sidewalk	Tom Mboya Street	Improvement of Matatu stops / routes
Kenyatta Avenue	Allowed only at designated on-street parking in service road	Widening of sidewalk	Uhuru highway Koinange Street Muindi Mbingu Street Wabera Street Kimathi Street Moi Avenue	No improvement
Slip Road	Prohibited on-street parking	Widening of sidewalk	Moi Avenue	No improvement
Muranga Road (Globe Cinema RA – Moi Avenue)	Prohibited on-street parking	Widening of sidewalk	Moi Avenue	No improvement

(6) Installation of Traffic Safety Devices

Present Conditions of Traffic Safety Devices

The inventory survey for present conditions of traffic safety devices was carried out inside the CBD. Traffic safety suffers from the shortage of traffic signs and the standard of road marking inside the CBD is way below the requirements. The followings are summary of the present conditions of traffic signs and pavement markings.

Traffic Signs

Warning, regulatory and informatory signs are three major sign types that must be considered. The inventory survey shows that the system of the traffic signs in the CBD of Nairobi are too poor. The improvement of the traffic signs with road markings for the NMT are to be implemented from the basic level.

For the CBD area under the traffic flow improvement project, the estimated numbers of the required signs during the short term implementation period are shown in Table 29.3-13.

TABLE 29.3-13 TRAFFIC SIGNS REQUIREMENTS

Sign Type	Required Number
Warning	240
Regulatory	120
Informatory	240

Pavement Marking

There are pavement markings in the CBD area. Because the maintenance is poor, currently most of the pavement markings have disappeared.

For pavement markings, the following marking types have been considered:

- Lane marking
- Cross-walk marking
- On-street parking
- Off-street parking
- Channelization

Table 29.3-14 shows the estimated number of required road marking to sufficiently serve the CBD during the short-term period.

TABLE 29.3-14 ROAD MARKING REQUIREMENTS

Type of Marking	Required Number
Lanes	4,000
Cross-walks	3,000
Edges	4,000
On-Street parking	4,000

(7) Restoration and Installation of Traffic Signal

Present Condition of Traffic Signal Systems

Presently, there are eighteen traffic (18) signals in the Nairobi City Area, of which eight (8) signals are located in the CBD. Some of them are damaged, while some are partially damaged. The remaining few are partially operational. Due to lack of proper maintenance or absolutely no maintenance at all, these traffic signals have not been restored. CCN plans to restore or rehabilitate these traffic signals, but so far this has not been implemented yet.

Problems and Issues

Based on the field survey made, the following problems are identified.

a) Inadequacy and insufficiency of traffic control signals
b) Inadequacy in the method of traffic signal control
c) Lack of appropriate and adequate maintenance and repair

Proposed Traffic Signal Systems

It is necessary to restore and rehabilitate the traffic signal systems urgently. It is not necessary to install high level traffic signal systems within a short term period, but to replace the existing ones with local controllers. They are to be updated with the required functions in the future.

- Minimum functions required for local controllers
  The following functions are a pre-requisite for the new controllers:
  - Time-of-day
  - Number of signal phases
  - Coordinated functions
  - Function of operation with emergency signal timing during malfunction
- Location of signal lights and other control devices

(8) Introduction of Closed Circuit Television (CCTV)

At present, automatically or manually, no traffic monitoring systems have been introduced for the CBD. When heavy traffic congestion or accidents occur somewhere inside the CBD, the traffic administrator does not take any action due to lack of traffic monitoring systems. In order to provide counter measures to solve traffic congestion and traffic safety promptly, it is necessary to introduce traffic monitoring systems.

The CCTV system transmits the still and motion pictures, taken by CCTV cameras, in digital form through lines to the Control Centre. These pictures which can capture not only traffic volume but also vehicle or pedestrian traffic accidents, are of high resolution and are well processed that illegally parked vehicles and other abnormal situations can be detected and captured.

In the CBD area, it is recommended that CCTV Cameras are installed at eight (8) signal controlled intersections as follows.

TABLE 29.3-15 PROPOSED LOCATION FOR CCTV

	Cross Road	
1.	University Way	Koinange Street
2.	Moi Avenue	Muranga Road
3.	City Hall Way	Taita Road
4.	Moi Avenue	Ronald Ngala Road
5.	Harambee Avenue	Moi Avenue
6.	Uhuru Highway	Haile Selassie Avenue
7.	Ring Road Pumwani	River Road
8.	Valley Road / Kenyatta Avenue	Ngong Road / State House Avenue

29.3.6 Preliminary Cost Estimate

Preliminary cost estimate is presented in Table 29.3-16 while Work Quantity and Cost is given in Table 29.3-17.

TABLE 29.3-16 PRELIMINARY COST ESTIMATE

Unit: Thousand Ksh

Road		Length (km)	Foreign Component (78%)	Local Component (22%)	Total
1	Haranbee Avenue	0.87	136,548	38,514	175,062
2	Parliament Road	0.63	12,082	3,408	15,490
3	Koinange Street	0.74	42,294	11,929	54,224
4	City Hall Way	0.87	38,237	10,785	49,022
5	River Road	1.13	18,921	5,337	24,258
6/7	Tom Mboya Street	1.14	85,771	24,192	109,963
8	Ronald Ngala Road	0.60	31,865	8,988	40,853
9	Kenyatta Avenue	0.50	22,381	6,313	28,694
10	Slip Road	0.18	14,426	4,069	18,495
11	Muranga Road	2.40	25,598	7,220	32,818
	Total	9.05	428,125	120,753	548,878

TABLE 29.3-17 WORK QUANTITY AND COST

	Project Component	**Unit**	**Unit Price (Ksh)**	**Q'ty**	**Amount (x1000Ksh)**	**Remark**
1	Harambee Avenue	0.87 km				
	Pavement Improvement	m	76,767	870	66,787	t=100mm
	NMT Way Construction	m	5,611	870	4,882	W: AC(t=30mm)
	Drainage Repair	m	1,000	870	870	
	Landscaping	m	500	870	435	
	Road Furniture/ Bus Stops	LS	10%	-	7,300	
	Miscellaneous Work	LS	-	-	94,788	Inc. beautification
	Total				**175,062**	
2	Parliament Road	0.634 km				
	AC Overlay	m	9,908	634	6,282	t=50mm
	NMT Way Construction	m	5,611	634	3,557	W: Interlocking
	Drainage Repair	m	1,000	634	634	
	Landscaping	m	500	634	317	
	Road Furniture/ Bus Stops	LS	10%	-	1,100	
	Miscellaneous	LS	30%	-	3,600	
	Total				**15,490**	
3	Koinange Street	0.74 km				
	AC Improvement	m	26,950	740	19,943	t=100mm
	NMT Way Construction	m	22,798	740	16,871	W: Interlocking
	Drainage Repair	m	1,000	740	740	
	Landscaping	m	500	740	370	
	Road Furniture/ Bus Stops	LS	10%	-	3,800	
	Miscellaneous	LS	30%	-	12,500	
	Total				**54,224**	
4	City Hall Way	0.87 km				
	AC Overlay	m	19,210	870	16,713	t=50mm
	NMT Way Construction	m	18,740	870	16,304	W: Interlocking

	Project Component	Unit	Unit Price (Ksh)	Q'ty	Amount (x1000Ksh)	Remark
	Drainage Repair	m	1,000	870	870	
	Landscaping	m	500	870	435	
	Road Furniture/ Bus Stops	LS	10%	-	3,400	
	Miscellaneous	LS	30%	-	11,300	
	Total				**49,022**	
5	River Road	1.125 km				
	AC Overlay	m	7,963	1125	8,958	
	NMT Way Construction	m	5,611	1125	6,312	t=50mm
	Drainage Repair	m	1,000	1125	1,125	W:AC(t=30mm)
	Landscaping	m	500	1125	563	
	Road Furniture/ Bus Stops	LS	10%	-	1,700	
	Miscellaneous	LS	30%	-	5,600	
	Total				**24,258**	
6/7	Tom Mboya Street	1.14 km				
	Carriageway Improvement	m	35,559	1140	40,537	t=1000mm
	NMT Way Construction	m	30,365	1140	34,616	W:Interlocking
	Drainage Repair	m	1,000	1140	1,140	
	Landscaping	m	500	1140	570	
	Road Furniture/ Bus Stops	LS	10%	-	7,700	
	Miscellaneous	LS	30%	-	25,400	
	Total				**109,963**	
8	Ronald Ngala Road	0.6 km				
	Carriageway Improvement	m	23,290	600	13,974	t=1000mm
	NMT Way Construction	m	22,798	600	13,679	W:Interlocking
	Drainage Repair	m	1,000	600	600	
	Landscaping	m	500	600	300	
	Road Furniture/ Bus Stops	LS	10%	-	2,900	
	Miscellaneous	LS	30%	-	9,400	
	Total				**40,853**	
9	Kenyatta Avenue	0.5 km				
	Carriageway Improvement	m	33,077	500	16,539	t=50mm
	NMT Way Construction	m	5,611	500	2,806	W:Interlocking
	Drainage Repair	m	1,000	500	500	
	Landscaping	m	500	500	250	
	Road Furniture/ Bus Stops	LS	10%	-	2,000	
	Miscellaneous	LS	30%	-	6,600	
	Total				**28,694**	
10	Slip Road	0.176 km				
	New Construction	m	66,154	176	11,643	t=100mm
	NMT Way Construction	m	5,611	176	988	W:AC(t=30mm)
	Drainage Repair	m	1,000	176	176	
	Landscaping	m	500	176	88	
	Road Furniture/ Bus Stops	LS	10%	-	1,300	
	Miscellaneous Work	LS	30%	-	4,300	
	Total				**18,495**	
11	Muranga Road	2.396 km				
	AC Overly	m	4,324	2396	10,360	t=50mm
	NMT Way Construction	m	3,741	2396	8,963	W:AC(t=30mm)
	Drainage Repair	m	1,000	2396	2,396	
	Landscaping	m	500	2396	1,198	
	Road Furniture/ Bus Stops	LS	10%	-	2,300	
	Miscellaneous	LS	30%	-	7,600	
	Total				**32,818**	
	Grand Total				**548,878**	

Note: Road furniture include costs of traffic signs, road marking, and miscellaneous cost which covers restoration and installation of traffic signals.