PART III

PILOT PROJECT EXPERIMENT

13. INTERSECTION IMPROVEMENT

(1) Objective

The main objectives of the intersection improvement project as a Pilot Project are as follows:

- To examine effects and impacts of improving geometrical configurations of junctions as well as installation of signal system
- To feedback the above to the formulation of Master Plan as well as the Pre-Feasibility Study for priority projects to be selected in the Master Plan

(2) Selection of Junction

Advantage & Disadvantage

- Converting physical configuration of junctions from a particular type to another (i.e. R/A to I/S, or I/S to R/A) had been determined prior to the actual implementation of the Pilot Project in terms of advantage and disadvantage.

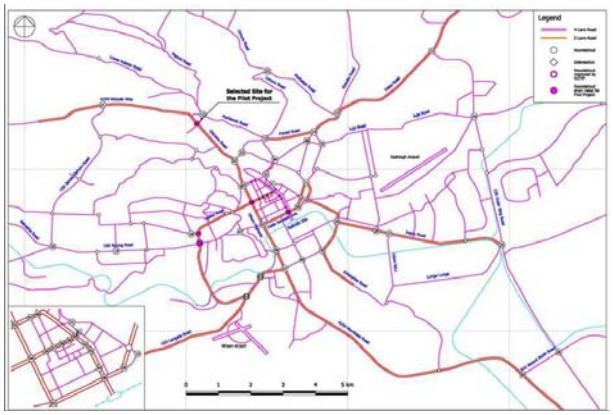
Advantage and Disadvantage of Improvement Works

Type of Junction		Non-Signalized Roundabouts*1	Signalized Roundabouts*2	Signalized Intersection*3
Civil Works	From Intersection	Maximum		Medium
	From Roundabout	Minimum	Minimum	Maximum
Signal System		Not Required	Required (at least 4-phase system)	Required (at least 2-phases system)
Reduction of Traffic Congestions		Medium to Minimum		Maximum to Medium
Reduction of Traffic Accidents		Medium	Maximum	Medium

Long List and Short List

- A total of 50 junctions in the City of Nairobi are selected as “Long List”, of which 21 junctions are selected as “Short List”.

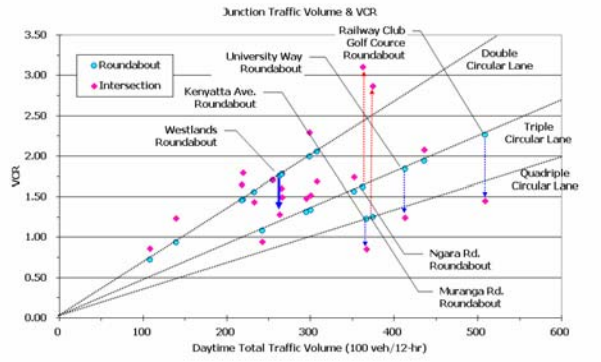
Major Bottle Neck Points in the City of Nairobi



Evaluation

- To evaluate “Short List”, Rough Volume-Capacity Ratio (VCR) Analysis was applied.
  - Assumed Peak Hour Factor: 0.10
  - Assumed Capacity: 1,500 veh/hr/lane

Effects of Geometric Conversion



Criteria

- To select a candidate site from the ‘Short List”, following criteria are applied;

Applied Criteria for Selection of Junction

Engineering Criteria	
- Effect (VCR Change):	>2.0=5, >1.75=4, >1.50=3, >1.25=2, >1.00=1
- Affect (Daytime Traffic Volume in Thousand):	<25.0=5, <50.0=4, <75.0=3, <100.0=2, >100.0=1
- Cost (Total Number of Lanes Merged):	<8=5, <12=4, <16=3, <20=2, >20=1
Environmental & Social Criteria	
- Regulation (RoW, PAP, Noise, Vibration, etc.):	Category-C=5, Category-B=3, Category-A=1
- Interview (include Residents / Shop Owner / Road Users / Operators):	Acceptable=5, Average=3, Not Acceptable=1
- Workshop (include GoK Officials, Experts from University, Donors, NGOs, Citizens, etc.):	Acceptable=5, Average=3, Not Acceptable=1
Other Criteria	
- Operation & Maintenance (Traffic Signal System, etc.):	Uncontrolled Roundabout = 5
	Uncontrolled Intersection = 5
	Controlled Intersection = 3
	Controlled Roundabout = 1
- Traffic Safety (Accident Rate, etc.):	Controlled Roundabout = 5
	Uncontrolled Roundabout = 3
	Controlled Intersection = 3
	Uncontrolled Intersection = 1

Selection

- As a result of applying the selection criteria Westlands Roundabout was selected as the implementation site of the Pilot Project, from the engineering, environmental and social, and other points of view.

Score of Candidate Sites

Category	Engineering			Environ & Social			Others		Total Score
Criteria / Jct. Name	Effect	Affect	Cost	Regulation	Public	Workshop	O & M	TrafficSafety	
Westlands	2	3	3	3	5	5	3	3	62
University Way	2	2	1	3	3	5	3	3	52
Kenyatta Av.	2	3	1	3	2	5	3	3	52
H. Selassie Av.	3	1	1	3	2	5	3	3	54
Weight	30	10	10	10	10	10	10	10	100

(3) Alternative Configuration

Alternative-1 (Conventional Intersection)

- Removal of the existing roundabout island and wide median along Waiyaki Way
- Enlargement of the curb of return and provision of the traffic islands at all four corners
- Provision of an exclusive right turn lane along Chiromo Road, Waiyaki Way, Ring Road Westlands and Rhapta Road
- Provision of exclusive left turn lane along Chiromo Road and Waiyaki Way

Alterantive-2 (Compromised Intersection)

- Extension of the existing median on Chiromo Road and Waiyaki Way up to the existing roundabout island
- Provision of the traffic channels for the right turner for all four roads inside the existing roundabout island
- Provision of a traffic channel for the through traffic for Ring Road Westlands and Rhapta Road inside the existing roundabout island

Alternative-3 (Modified Roundabout)

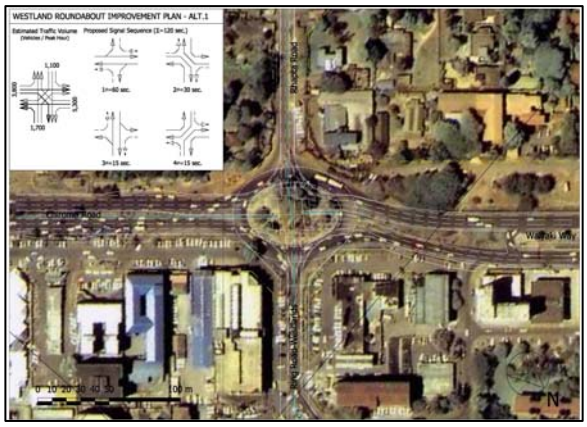
- Extension of the existing median on Chiromo Road and Waiyaki Way up to the existing roundabout island
- Reducing size of the existing oval shaped centre island by circle shaped island and provision of an extra circular lane along modified centre island

Common Works

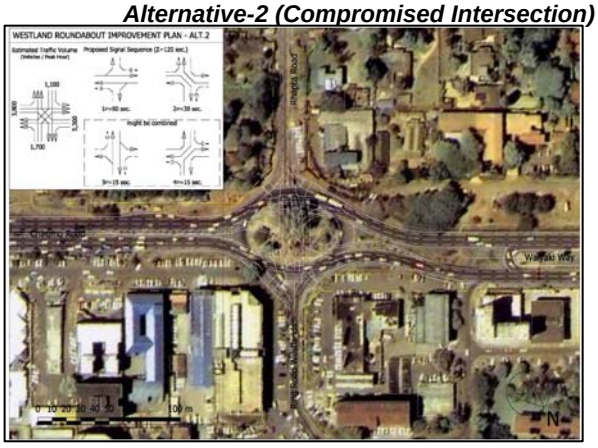
- Provision of signal system in accordance with junction's configuration
- Provision of sidewalks at all four corners and zebra crossings
- Provision of guard rails and/or guard posts along the carriageways
- Provision of lane markings and other traffic signboards
- Relocation of existing road furniture and/or service lines, if required
- Extension and/or cleaning of existing drainage system, if required

Alternative-3 was selected for the pilot experiment from traffic safety and operation points of view.

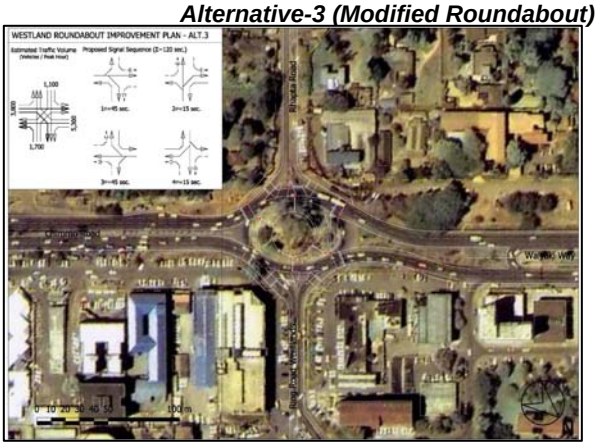
Alternative-1 (Conventional Intersection)



Alternative-2 (Compromised Intersection)



Alternative-3 (Modified Roundabout)



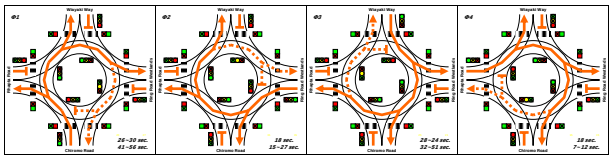
Advantage & Disadvantage of Alternatives

Contents		Alt.-1	Alt.-2	Alt.-3	Remarks
Civil Works		Large	Medium	Medium	Removal of Roundabout
Signal System	Vehicle	4 pcs	4 pcs	4 pcs	300 mm Heads for Arterials
	Vehicle	8 pcs	8 pcs	16 pcs	200mm Heads for Collectors, Exclusive Right & Left Turn Lanes, and Circular Lanes
	Pedestrian	16 pcs	28 pcs	16 pcs	200mm Heads
	Controller	6 phase	6 phase	8 phase	Minimum Requirement for Vehicle Control
Handling Capacity		High	Medium-	Medium	Vehicle Movements
Operational Restrictions		U-Turn Not Allowed	U-Turn Not Allowed	U-Turn Allowed	Especially Traffic from Chiromo Road
Traffic Conflicts	Vehicle vs. Vehicle	High	Medium	Low	Especially during Power Failure and/or Amber Blinking
	Vehicle vs. Pedestrian	High	Low	Medium	Crossing Length per Signal

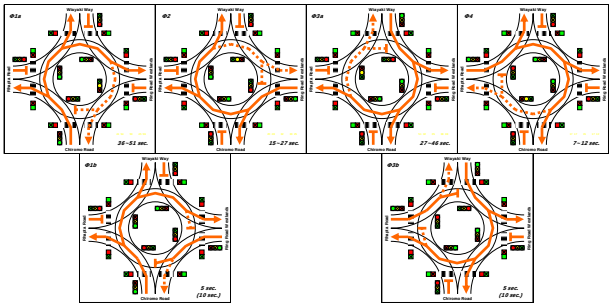
(4) Signal Settings

Counter clockwise operations as same manner as the other signalized roundabouts in the CBD were modified several times based on the traffic flow observations since first installation on February 2005, and finally 2-phase plus turning movement clearance setting has been introduced since June 2005 as a first attempt to the roundabout in Kenya.

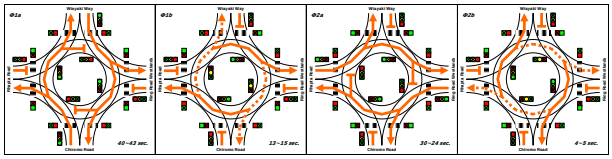
Original Counter Clockwise Setting



Modified Counter Clockwise Setting



Two-Phase + Turning Movement Clearance Setting



14. OUTCOMES AND PUBLIC OPINIONS

To evaluate the Pilot Project, a series of monitoring surveys, composition of traffic, environmental, and social condition surveys were conducted between August 2004 and July 2005.

Traffic Conditions

Sectional Vehicle Traffic Volume **(unit: pcu/12-hr)**

Stage	Waiyaki Way	Ring Road	Chiromo Road	Rhapta Road	Total
Before-1	18,329	7,036	29,713	4,671	59,749
Before-2	18,292	6,553	17,594	4,444	46,883
During-1	23,311	7,093	26,572	4,288	61,264
During-2	22,221	8,211	26,967	3,594	60,993
After-1	16,500	5,493	19,410	3,838	45,241
After-2	28,060	6,855	25,211	4,764	64,890

Maximum Queue Length **(unit: meters)**

Stage	Waiyaki Way	Ring Rd -In	Chiromo Road	Rhapta Road	Ring Rd -Out
Before-1	230	220	>500	260	n/a
Before-2	450	230	700	300	300
During	1,220	300	1,510	400	290
After-1	1,200	320	760	730	265
After-2	210	300	410	220	180

Crossing Pedestrian **(unit: persons/12-hr)**

Stage	Waiyaki Way	Ring Road	Chiromo Road	Rhapta Road	Total
After-2	1,764	4,327	15,865	3,273	25,238

Travel Speed & Level of Service **(unit: km/hr)**

Stage	Waiyaki Way		Ring Road Westlands		Chiromo Road		Rhapta Road	
Before	18.3 [E]	46.1 [B]	5.1 [F]	7.8 [F]	7.1 [F]	35.2 [C]	2.9 [F]	17.2 [D]
During	33.7 [C]	55.0 [A]	7.1 [F]	8.2 [F]	12.2 [F]	37.1 [C]	6.0 [F]	17.6 [D]
After-1	11.3 [F]	45.6 [B]	1.9 [F]	6.3 [F]	5.6 [F]	37.1 [C]	4.4 [F]	15.9 [D]
After-2	31.3 [C]	45.5 [B]	6.1 [F]	10.9 [E]	27.1 [D]	19.1 [E]	13.9 [E]	17.7 [D]

14.2 Environmental Conditions

Noise Level **(unit: dB)**

Stage	Waiyaki Way	Ring Road Westlands	Chiromo Road	Rhapta Road
Before	72.6~89.3	66.6~85.0	77.0~91.3	69.9~84.9
During	63.3~82.0	64.8~73.1	68.6~83.5	62.6~75.2
After-1	63.5~89.2	60.7~80.1	62.6~93.7	60.2~84.3
After-2	69.2~86.7	70.3~86.5	67.3~86.5	68.6~86.7

Particle Matters (Suspended Dust) **(unit: μg/m^3)**

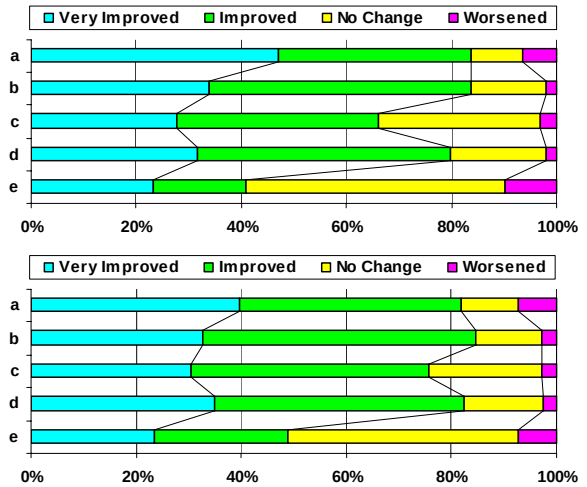
Stage	Coarse	Fine	Total
Before	367~845	260~666	650~1,105
During	111~133	16~26	137~150
After-1	77~351	17~39	114~369
After-2	143~268	61~143	286~329

Air Pollutants **(unit: ppb [NO/NOx/NO_2], ppm [CO])**

Stage	NO	NO_X	NO_2	CO
Before	2.0~25.0 (11.4)	5.0~29.0 (14.3)	0.0~11.5 (3.5)	2.8~4.3 (3.3)
During	2.0~15.0 (7.3)	1.0~32.0 (9.6)	0.0~20.0 (2.6)	3.0~3.5 (3.3)
After-1	4.0~38.0 (10.7)	8.0~42.0 (16.6)	0.0~26.0 (5.9)	2.5~5.0 (3.7)
After-2	5.0~35.0 (13.0)	6.0~50.0 (16.7)	1.0~18.0 (3.7)	2.5~4.0 (3.1)

Social Conditions

User's Observations **(Above: MT, Below: NMT)**



Note; a: Vehicle Waiting Time, b: Pedestrian Waiting Time, c: Safety [Vehicle vs. Vehicle], d: Safety [Vehicle vs. Pedestrian], e: Traffic Noise

15. MAJOR FINDINGS AND RECOMMENDATIONS

(1) Major Findings

Engineering View

- Conversion of Geometrical Configuration
  - Convert non-signalized intersection to non-signalized roundabout (Opt.-1)
  - Convert non-signalized intersection to signalized intersection (Opt.-2)
  - Convert non-signalized roundabout to signalized roundabout (Opt.-3)
  - Convert signalized roundabout to signalized intersection (Opt.-4)
  - Convert signalized intersection to grade separation (Opt.-5)
- Provision of NMT Facilities
  - Provision of Wide Enough (3 ~ 5 m in width) Paved Sidewalks
  - Provision of Clear Cross Walk Markings and/or Raised Cross Walks
- Provision of Traffic Safety Measures
  - Provision of Off-Street Type Bus and Matatu Stops
- Provision of Other Street Facilities

Education View

- Provision of Traffic Education
  - Provision of chance to learn about traffic rules and manner for all kinds of drivers as well as road users, such as pedestrians, bicyclists, and vendors

Enforcement View

- Provision of Disciplines for Traffic Management and Land Use
  - Provision of strong discipline for the traffic police officers, as well as local and central government officials to be able to take necessary counter actions against the traffic rule violators, illegal land usages, encroachments of road reserve, and so on.

Social and Environmental View

- Provision of Public Consent
  - Provision of chance to feedback Public opinion from all road users and Project Affected People.
  - Provision of monitoring surveys for air pollutants, noise level, suspended dust, traffic volume, queue length, travel speed.

Financial View

- Provision of Budget and Accountability

(2) Recommendations

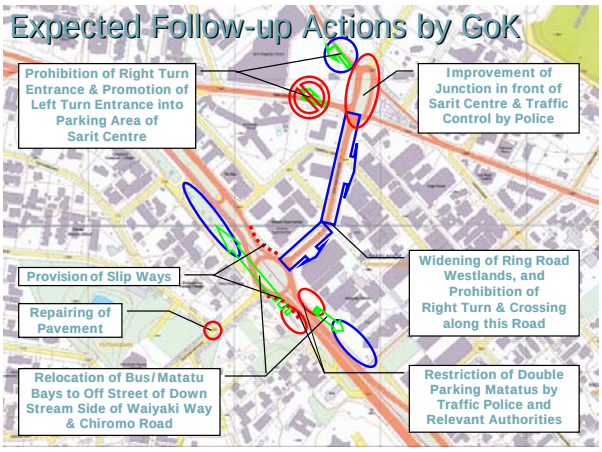
General

- The results of the Pilot Project Experiment reveal that motorists believe to own the absolute prerogative in using roads, neglecting the right of pedestrians to cross roads safely.
- This behaviour of motorists shall be addressed to use roads with the harmonized time sharing between pedestrians and motorists.
- Such policy shall be established by the Authority to provide road facilities of safety crossing for pedestrian as well as to maintain the urban amenity.
- For this purpose, the traffic safety education is mandatory. Accordingly, the enforcement of traffic rule and regulation shall be properly implemented.
- It shall, therefore, be emphasized that traffic issues can not be solved with engineering approach alone without education and enforcement.

Actions Required for Improvement of Westlands Roundabout

- Widening of Ring Road Westlands, and prohibition of right turn and crossing along this road
- Relocation of bus/matatu bays to off street of down stream side of Waiyaki Way and Chiromo Road
- Restriction of double parking of matatu by traffic police and relevant authorities
- Improvement of junction in front of Sarit Centre, and traffic control by police
- Prohibition of right turn entrance and promotion of left turn entrance into parking area of Sarit Centre
- Repairing of pavement on Rhapta Road
- Provision of Slip Way (together with widening of Ring Road Westlands and Rhapta Road)

Expected Follow-Up Actions by GOK



PART IV

PRE-FEASIBILITY STUDY

16. SELECTION OF PRE-FEASIBILITY STUDY PROJECT

The Plan incorporates various projects and measures in the field of urban transport sector with implementation plan of three (3) stages. Among the projects under the Short-Term, the following are selected for Pre-Feasibility Study to be implemented immediately with the following objectives.

1.Study on Construction of Missing Links No.3, No.6 and No.7

- Formation of R/C Round Network
- Encouragement of NMT
- Promotion of Area Development

2.Study on Traffic Improvement Plan in the City Centre

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

3.Study of Improvement of Bus and Matatu System

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

17. MISSING LINK NO.3, NO.6, AND NO.7

(1) Objectives of Missing Links

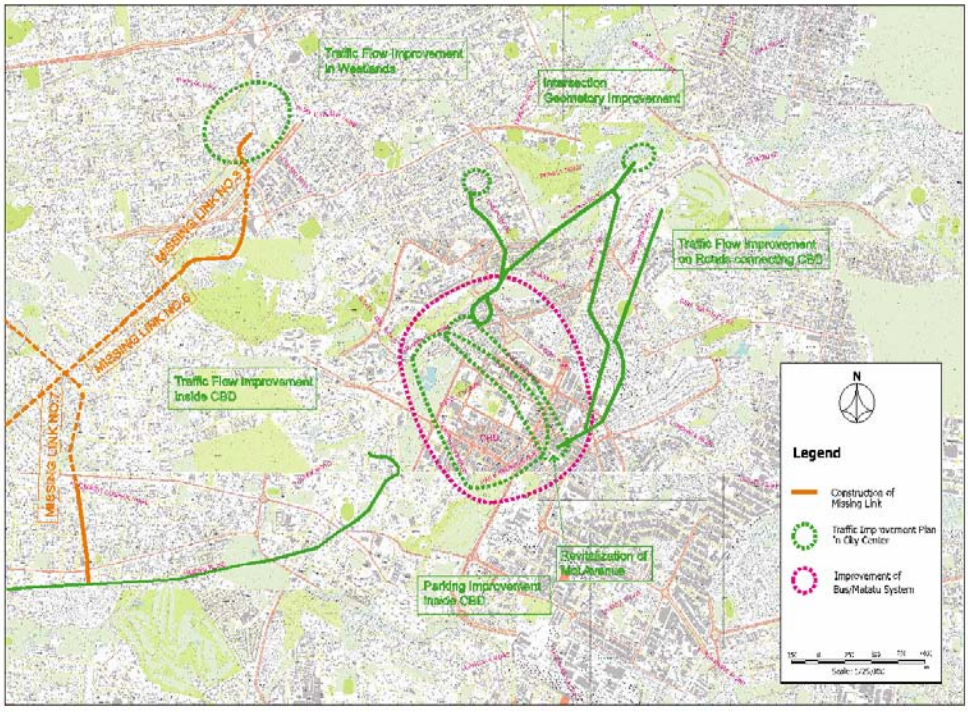
Missing Links impede daily socio-economic activities in the city centre and in the riverside communities. Missing Links have no bridges over rivers crossing such as Nairobi River, etc. The Study aims to construct Missing Links No.3, No.6, and No.7, to connect each separated residential zones and to form a western part of urban radial and circumferential network system (C3) which will increase accessibility for mitigating traffic congestions. This includes the construction of new paved roads and improvement of the existing roads mainly between Westlands Roundabout and Ngong Road, as well as the provision of NMT for pedestrians and cyclists to facilitate urban transport needs for low income people mainly in Kibera slum areas.

Objectives of Pre-Feasibility Study

- To formulate a radial and circumferential road network (C-3) in order to provide an effective and economical road transport.
- To encourage non-motorized transport by providing safe and comfortable facilities.
- To promote the area development and community cohesion by connecting zones divided by rivers.

For the above reasons, the Missing Links No.3, No.6 and No.7 are selected with high priority out of the main 16 candidate-missing links, and these links will form C3 that will handle high traffic volume.

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



(2) Existing Road Conditions

Study Missing Links

Section	Road Condition (Right of way)	Length (Km)
Missing Link No. 3		
1	Existing Road to be improved	0.950
2	ROW=30 m. New construction	0.810
Total		1.760
Missing Link No. 6		
1	Existing Road to be improved	0.450
2	ROW=24 m. New construction	1.050
3	ROW=30 m. New construction	1.350
Total		2.850
Missing Link No. 7		
1	Existing Road to be improved	0.750
2	ROW=30 m. New construction	2.200
3	Existing Road to be improved	0.800
Total		3.750
TOTAL LENGTH		8.360

- All existing roads are earth and gravel roads disconnected by rivers and stream crossings. Hence no vehicle can pass these roads except few sections that are approaching to some residential apartments. However, the whole Missing Link No.6 is practically passable by vehicles.
- Only a concrete foot bridge at Nairobi River on Missing Link No.3 is constructed for pedestrians. No bridges are constructed at Kirichwa Kubwa and Kirichwa Ndogo rivers and streams (Missing Link No.7). The present Missing Links are pedestrian routes that connect residential and working places. During rainy seasons, some areas become impassable due to muddy surface and flooding at the river crossings.
- Many temporary kiosks (licensed by the CCN) and open vendors occupy road reserves, in particular at the intersections, and encroachments are found along the missing links and the river reserves.
- Many utilities use the road reserves; such as high power electric lines, main water supply conduits, and telephone lines. In Missing Link No.7, clearance of the high power electric line is very low whilst crossings the road reserve.

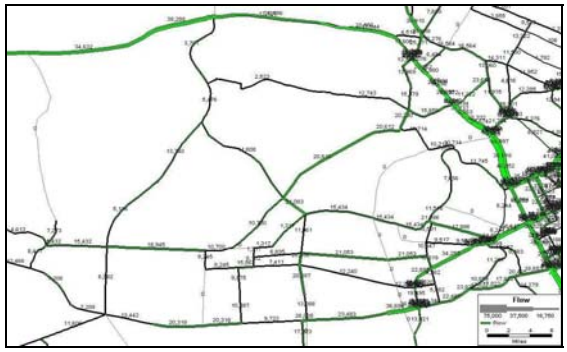
Existing Road Condition (No.6)

Kirichwa Kubwa River Crossing (No.7)

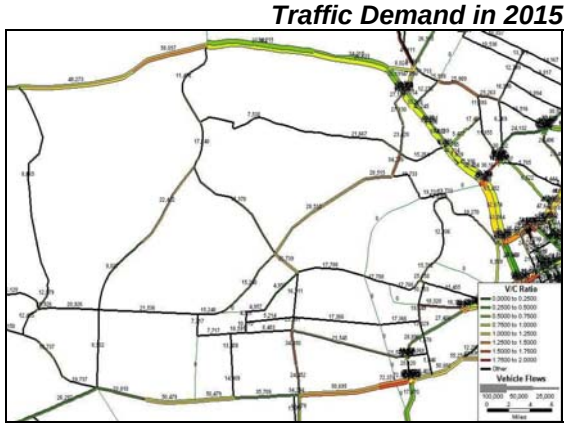
(3) Traffic Demand

The following figures present traffic demand in 2005 and 2015, respectively.

Traffic Demand in 2005



Traffic Demand in 2015

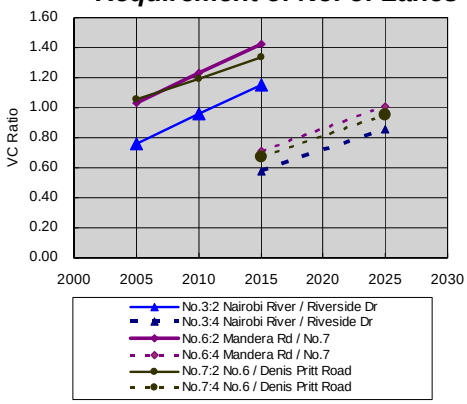


Congestion degree of both 2 and 4 lane roads are compared and shown below.

No.	No. of Lanes	2005	2015	2025
No.3	2-lane	0.76	1.16	1.71
	4-lane	0.38	0.58	0.86
No.6	2-lane	1.03	1.43	2.02
	4-lane	0.52	0.71	1.01
No.7	2-lane	1.05	1.34	1.91
	4-lane	0.53	0.67	0.95

VCR will exceed 1.2 and 1.4 in 2015, which is equivalent to Level of Service E. Thus widening to 4-lane is recommended by the year 2015.

Requirement of No. of Lanes



(4) Design Policy and Standards

Design Policy

- Introduction of stage construction;
- Maximum utilization of existing road reserves;
- Provision of Non Motorized Transport (NMT) with walk ways and cycle ways on one side;
- Introduction of barrier-free design for the Physically Challenged People;
- Provision of bus stops to harmonize development with public transport;
- Provision of access to the road side residents
- Provision of mitigation measures against negative natural environmental impacts; and
- Consideration of open spaces temporally for relocation and resettlement of the Project Affected People.

Standards

The following standards applicable in Kenya are adopted along with international design standards.

- Road Design Guidelines for Urban Roads (2nd Draft), MOLG, August 2001 (RDUG)
- Road Design Manuals, Road Department, Ministry of Transportation and Communication, Kenya, August 1987
- Standard Specification for Road and Bridge Construction, Roads Department, Ministry of Transport and Communication, Kenya, August 1986

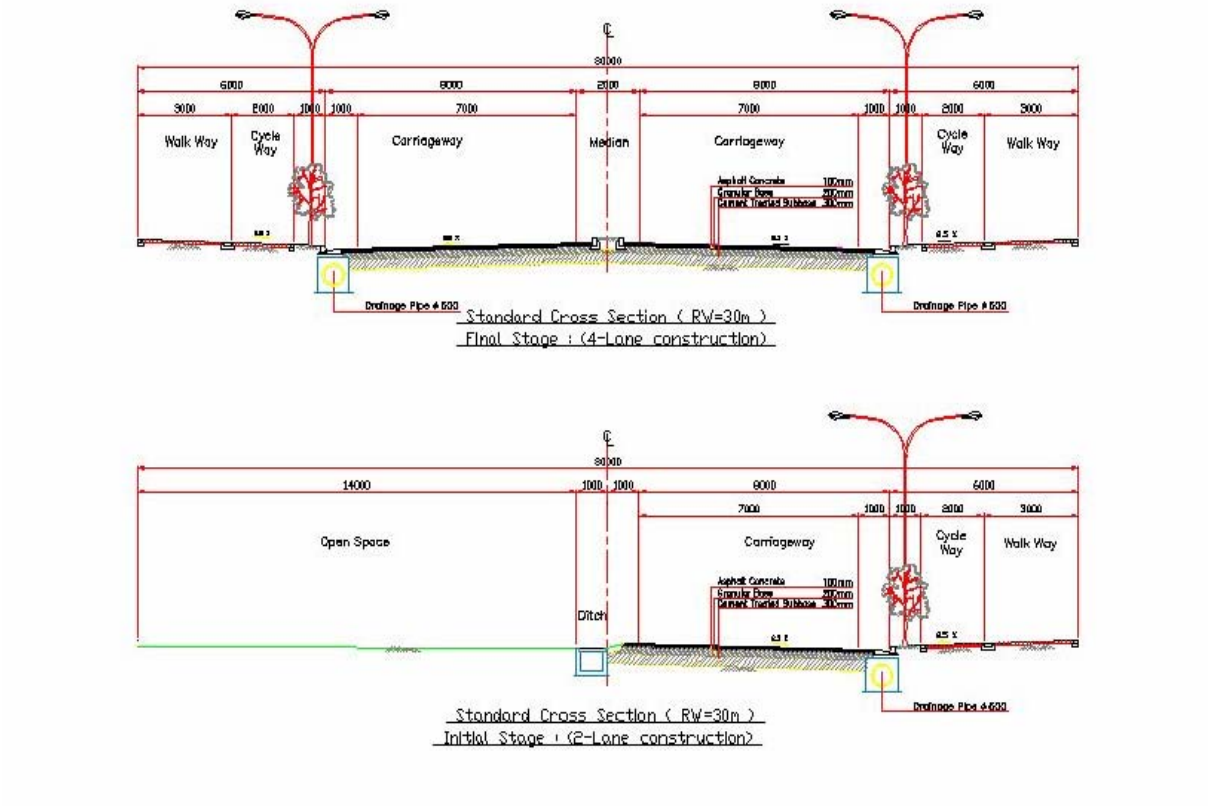
5) Preliminary Design

PROPOSED ROAD CROSS SECTION

Item	Unit	Cross Section Element	
RR=30m		Initial Stage	Ultimate Stage
Number of Lanes	No.	2	4
Carriageway	m	7.0	7.0 x 2 = 14.0
Lane Width	m	3.5	
Pavement Type		AC	
Median	m	-	2.0
Shoulder	m	1.0	1.0 x 2 =2.0
Green Belt	m	1.0	1.0 x 2 =2.0
Cycle Way	m	2.0	2.0 x 2= 2.0
Pavement Type		AC	
Walk Way	m	3.0	3.0 X 2 =6.0
Pavement Type		Interlocking	
Side Ditch (Open)	m	1.0	-
Surface Drainage (Drainage Pipe)	No.	(0.6 dia.)	(0.6 dia x 2)
Open Space	m	14.0	-
Street Lamp	No.	1	2

Note: NMT=3m for RR 24m

Standard Road Cross Section (RR=30m)



Bridge Design

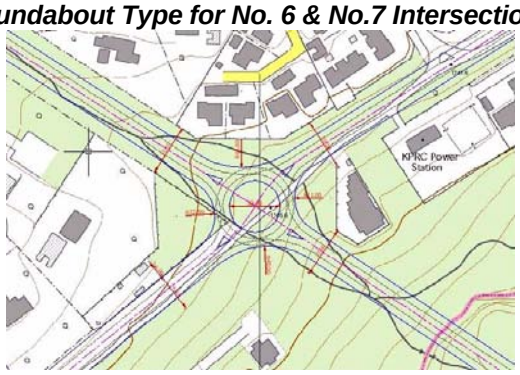
Three bridges are required at the river crossings: Nairobi River (No.3), Kirichwa Ndogo River (No.7a), and Kirichwa Kubwa River (No.7b). A 50-year return period of discharge and bridge length is determined by hydrological study. The length of bridge will be standardized for savings in cost and time. All bridges have 2-lane carriageway and 3-m NMT at the initial stage.

Length: L=30.8m, W=11.75m
Foundation: Spread foundation (No.3 and No.7b)
Shallow Pile (L=4.5m) (No.7a)
Super structure: Pre-cast post tension PC Girder
Vertical Clearance for maximum flow water level to lowest structure member: 2.0m

Intersection Design

There are eight intersections on Missing Link No.3, No.6, and No.7, including 6 conventional types, one signalized intersection (No.7 & Argwings Kodhek Road), and one roundabout (No.6 & No.7). The proposed design is shown below.

Roundabout Type for No. 6 & No.7 Intersection



Pavement Design

The Study compared pavement design methods based on Kenyan standards, Road Note, AASHTO and Japan Guidelines. Design life is 12 years. The following pavement structure is proposed.

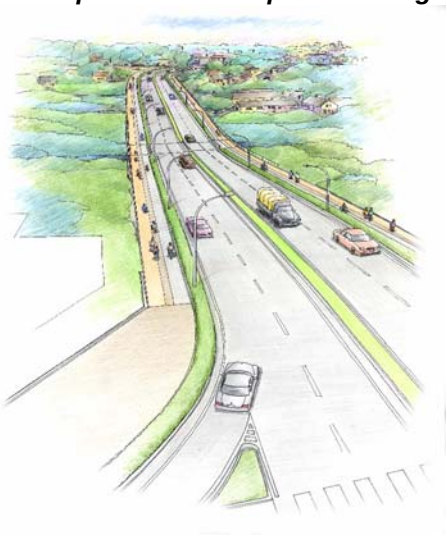
Carriageway pavement
Asphalt Wearing course: t1=3cm
Asphalt Binder course: t2=7cm
Base course (Crusher run): t3=20cm
Sub-base (Lime/Cement Stabilized): t4=30cm

NMT Pavement
Walk Way: Concrete Interlock w=3.0m,t=50mm
(1.0m asphalt surfacing for Wheel Chair h2=30mm, W=1000mm)
Cycle Way: Asphalt concrete w=2.0m, t=30mm

Drainage Design

Road side ditches of U-shaped concrete drainage (700mm x 700mm) and surface drainages of L-shaped gutter type with collecting pipe (dia. 600mm) are applied.

Perspective of Completion Bridge



(6) Environmental and Social Considerations

Stakeholder Meeting

Three stakeholder meetings were held during the Pre Feasibility Study.

Stakeholder meeting

No.	Date	Special Themes
4	27 May 2005	Outline of selected studies
5	26 July 2005	Anticipated problems in project implementation
6	23 August 2005	Recommended mitigation measures in project implementation

The Following issues were discussed.

Environmental Impact

- Noise and air pollution
- Relocation of temporary kiosks
- Environmental balance
- Land acquisition if required
- Demolition of buildings in case of encroachment into Road Reserve (RR)

Mitigation Measures for Natural Environment

- Green belt areas
- Harmonization of implementation with other projects within same areas
- Installation of noise barriers

Mitigation Measures for Social Impact

- Creation of shopping areas for traders
- Encroachment of private land in RR.
- Resettlement action plan is elaborated for those directly affected by the Project.
- Relocation site for the kiosk and garage owners could be allocated along the Missing Link No.6 and No.7, which a half of the width of road reserve would be made available.

(7) Economic Evaluation

Total benefits including vehicle-kilometers and vehicle-hours are calculated in the "without and with project" case for 2-lane construction. The following summarizes its results.

Estimation Of Benefit (MKsh/Year)

Year	Saving in VRC	Saving in VFC	Saving in VOC	Saving in TTC	Total Saving
2005	116.624	37.469	154.093	26.541	180.544
2010	231.734	93.048	324.782	65.685	390.467
2015	300.538	142.429	442.967	10.,545	543.512
2025	1,144.772	231.893	1,376.665	163.700	1,540.364

Note: VRC: Vehicle running cost; VFC: Vehicle fixed cost
VOC: Vehicle operating cost; TTC: Travel time cost

Analysing the project cost and benefits, economic evaluation was conducted for the following parameters.

NPV	Ksh 2,273 million
B/C	5.77
EIRR	40.1 %

Notes: 1) Project life is assumed to be 20 years.
2) Discount rate is assumed at 12%.

(8) Institution and Fund Arrangement

Since the Missing Link roads are classified as City Roads, the following arrangement is recommended.

- Implementation Agency: CCN and MOLG
- Road Management & Maintenance Body: CCN with KRB Budget
- Foreign component: funded by external finance resources

The following specific training needs are identified; (i) Construction planning and management; (ii) Road management and maintenance planning; (iii) Preparation and monitoring of RAP (Resettlement Action Plan); and (iv) Environment Management and Monitoring.

(9) Implementation

Based on traffic demand and required numbers of lanes, at the initial stage a 2-lane road will be constructed. From 2015, since VCR is envisioned to increase to nearly 1.5, widening of the 2-lane to a 4-lane road will be required. The following stage construction will be adopted for such implementation. This will save unnecessary amount of initial investment.

- Initial stage: 2-lane road: up to 2015
- Ultimate stage: 4- lane road from 2015

Construction and Project Cost Estimate

(MKsh)

Major Work Item	No.3	No.6	No.7	Total
1. Road				
(1) Improvement of existing road	16.48	7.81	26.89	51.18
(2) New Construction (RR=30m)	37.73	62.89	102.48	203.10
(3) New Construction (RR=24m)	0	37.20	0	37.20
2. Bridge	110.16	0	220.32	330.48
3. Roundabout	0	0	31.79	31.79
4. Signalized Intersection	0	0	6.06	6.06
5. Road Furniture /Bus Stops	49.31	1.62	81.38	132.31
6. Miscellaneous	41.94	1.52	64.42	107.88
Total	**255.62**	**111.04**	**533.34**	**900.00**

Note: 1US$ = 75Ksh = 112 Japanese Yen. 1Ksh = 1.50Yen

ROW acquisition and relocation/resettlement costs are estimated by surveying the number of Project Affected Peoples (PAP). The total amount is estimated at 9.0 million Ksh.

Cost of engineering services including detailed design and supervision is estimated at 36 million Ksh and 54 million Ksh, respectively.

The total project cost is estimated at 999 million Ksh.

Implementation Programe

Major Work	Cost (million Ksh)	Year (Cal.)	2006	2007	2008	2009	2010
		Year (Fiscal)	2006	2007	2008	2009	2010
Fund Preparation							
Consultant Selection							
Detailed Design/Tender Services	36			36			
ROW/Resettlement	9		9				
Contractor Tender							
Construction	900				450	450	
Construction Supervision	54				27	27	
Total	**999**		**9**	**36**	**477**	**477**	

Note: Fiscal year of GOK starts in July and end in June.

18. TRAFFIC FLOW IMPROVEMENT IN CITY CENTER

(1) Present Condition and Issues

- The urban center, which consists of the Central Business District (CBD) and extends to cover its vicinities, has political, commercial and business, cultural and amusement activities.
- The major problems in the City Center are identified as follows:
  - Not well functioned arterial road network connecting to CBD
  - Some missing links over the Nairobi River
  - Congestion on some arterials outside CBD and inside CBD
  - Double and triple illegal on-street parking
  - Heavily congested traffic flow in some localized areas
  - Not properly design of intersection geometry in some intersections and roundabouts.
- To solve these problems, the following tasks are selected for pre-feasibility study for immediate implementation;
  - Improvement of roads connecting to CBD in the north-east area
  - Traffic flow improvement inside CBD
  - Parking improvement inside CBD
  - Revitalization of Moi Avenue
  - Improvement of Ngong Road
  - Traffic Flow improvement in Westlands
  - Pangani roundabout, Limuru Road with Forest Road junction

(2) Roads Connecting to CBD

Present Condition and Issues

- Some arterials outside the CBD are presently congested whose level of service is below the acceptable level due to poor road condition and inadequate transport related facilities.

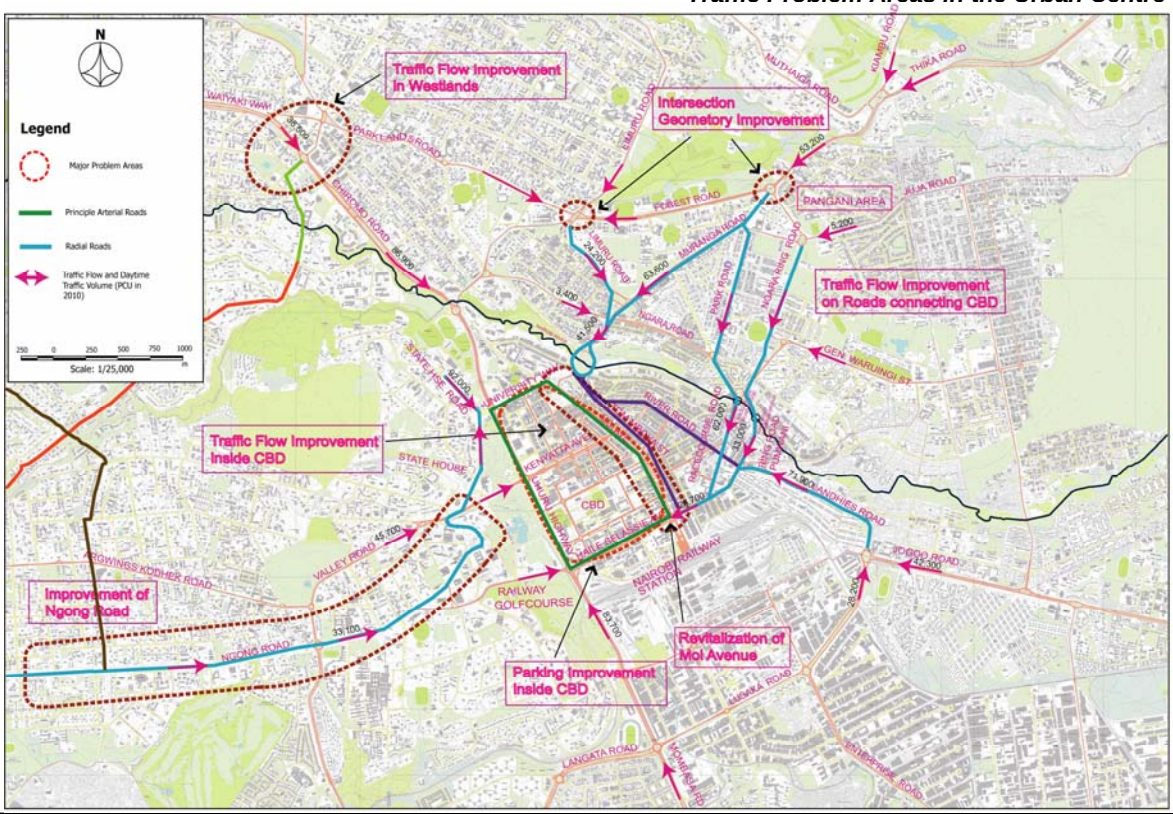
Traffic Congestion

Direction		Road	Exist. Lane	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	Hail Selassie Avenue	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	15,461	0.77
	Average VCR				**0.92**

Problem Areas

- In order to realize efficient flow of traffic, a number of problem areas which need to be addressed are identified and shown in the map below.

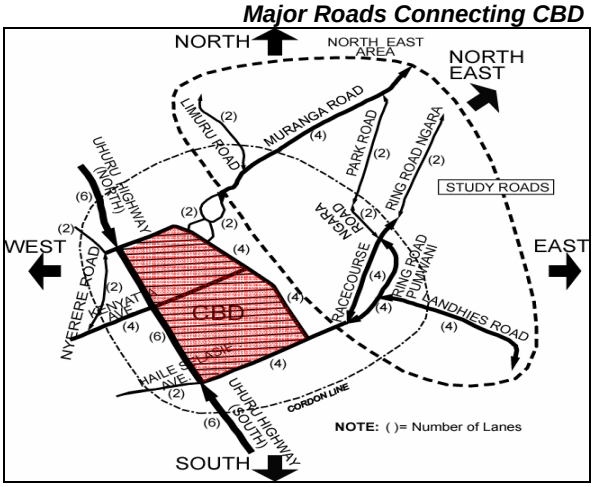
Traffic Problem Areas in the Urban Centre



Present Network

- The arterials road network connecting to CBD is not well functioning, especially in the north-east due to the complicated network and insufficient transport related facilities.

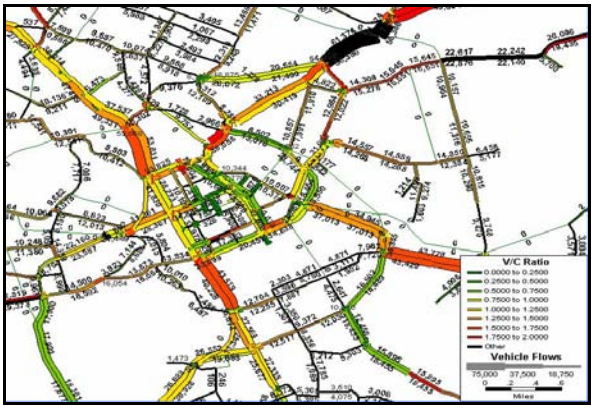
Major Roads Connecting CBD



Traffic Demand in 2010

- Traffic demand in the year 2010 is forecasted and shown below. Without any improvement measures to be taken, the traffic situation is expected to be worse than present.

Traffic Demand Forecast in 2010



Proposed Improvement Measures

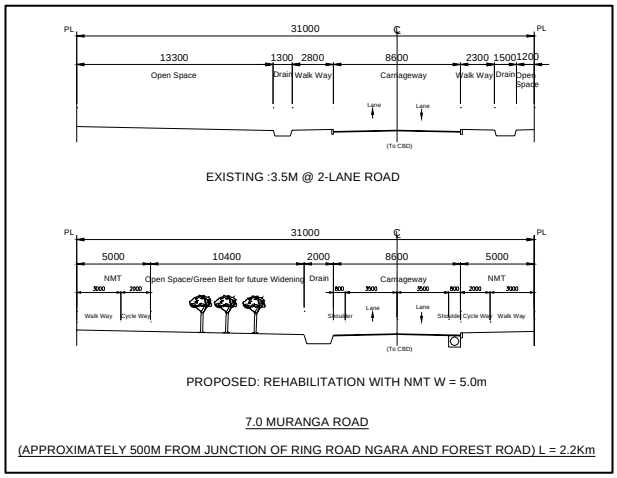
- Proposed improvement measures for each of the roads are shown below.

Recommended 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

- Based on the design criteria set up and the condition of the road, the following typical cross-section for Muranga Road is established:

Cross-Section of Muranga Road



Cost Estimates

- Based on the preliminary designs for the major roads and unit cost analyzed, the project cost for the roads connecting to CBD is estimated at KSh 390.5 million at 2005 prices.

Preliminary Cost Estimates (MKsh)

	Road	Length (km)	Foreign 78%	Local 22%	Total
1	Landhies Road	1.30	102.9	29.0	131.9
2	Ring Road Pumwani	0.60	21.1	6.0	27.1
3	Ring Road Ngara	1.07	22.9	6.5	29.4
4	Racecourse Road	0.75	20.9	5.7	25.7
5	Ngara Road.	0.35	7.1	2.0	9.1
6	Park Road	1.13	34.0	9.6	43.6
7	Muranga Road	2.20	70.5	19.8	90.3
8	Limuru Road	0.80	26.1	7.3	33.4
	Total	8.20	304.6	85.9	390.5

Implementing Agency

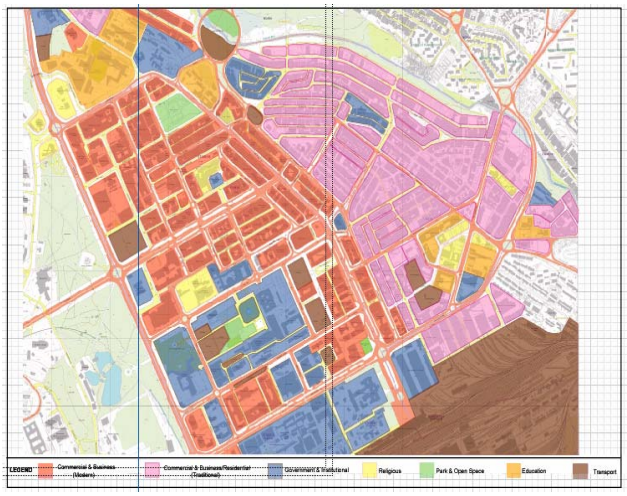
- Most of the roads which need to be improved to realize smooth flow of traffic are classified as national road thus the Ministry of Roads and Public Works (MRPW) should be the lead implementing agencies. These roads are parts of Radial Roads inside C3 in the Master Plan.

(3) Traffic Flow Improvement inside CBD

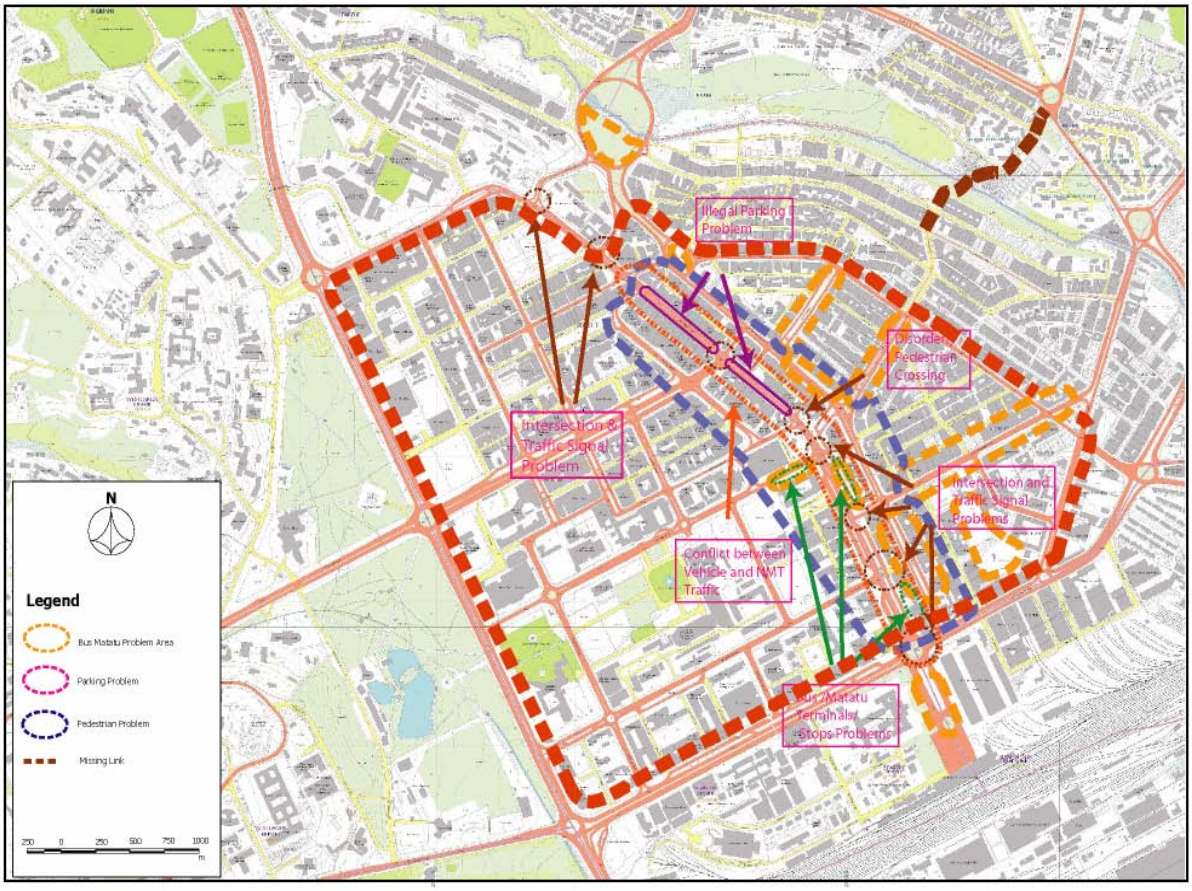
Present condition and Issues

- Based on analyses of the current land use, traffic flow, and present road conditions, the present conditions and issues can be identified;
  - Urban activities are too much concentrated to the CBD
  - Bus and Matatu terminals are also located inside CBD
  - There are some missing links over the Nairobi River
  - Poor level of services (LOS) of arterials and collectors
  - Insufficient sidewalk and poor pedestrian facilities of Moi Avenue, Tom Mboya Street, and Ronald Ngala Street
  - Illegal on-street parking and too much parking demand
  - Traffic management devices and equipment is not properly installed.
  - Very bad traffic security and safety
- CBD western area, located at the western part of Moi Avenue, is characterized as modern or formal business sector's land use, while CBD Area B, located at the eastern part, is traditional or informal business land use.

Present Land Use



Traffic Problems Area inside CBD



- Based on the traffic survey and road inventory survey, present traffic congestion of major roads inside CBD is analyzed as shown below:

Present Congestion Degree

Road Name	No. of Lanes	Traffic Volume in 2005	V/C Ratio in 2005
Harambee Avenue	2	13,419	0.96
Parliament Road	2	7,235	0.52
Koinange Street	4	21,695	0.78
City Hall Way	4	13,419	0.48
River Road	2	13,395	0.96
Tom Mboya Street-S	4	24,025	0.86
Tom Mboya Street-N	4	27,417	0.98
Ronald Ngala Street	4	36,274	1.29
Kenyatta Avenue	6	59,367	1.10
Slip Road	2	19,738	1.40
Muranga Road	2	8,950	0.64

Improvement Measures

- The following improvement measures are recommended to the major roads inside CBD.
  - Improvement of carriageway
  - Prohibition and limitation of on-street parking
  - Improvement of bus / matatu terminals and stops
  - Improvement and widening of sidewalk and pedestrian crossing
  - Improvement of intersections and installation of traffic signals and CCTV
  - Pavement marking and traffic control signs
  - Tree planting

Recommended Improvement Measures

Road	VCR (2010)	Exist. No. of Lanes	Required No of Lanes	Proposed Measure
Harambee Avenue	1.46	2	4	W
Parliament Road	0.76	2	2	R
Koinange Street	1.06	4	4	R
City Hall Way	0.73	4	4	R
River Road	0.96	2	2	GI
Tom Mboya Street-S	1,10	4	4	GI
Tom Mboya Street-N	1.29	4	4	GI
Ronald Ngala Street	1.36	4	4	GI
Kenyatta Avenue*	1.16	6	6	GI
Slip Road	1.50	2	4	W
Muranga Road	0.99	2	2	R

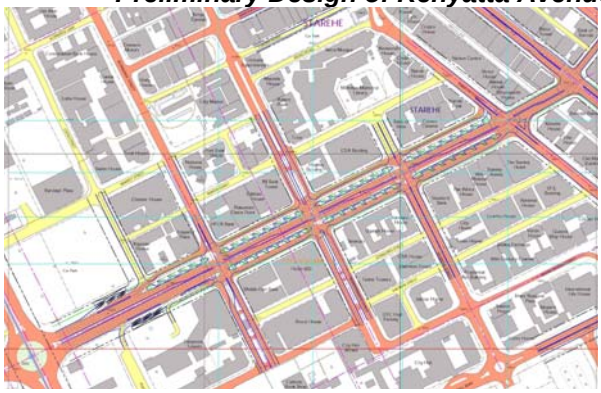
Note; W: Widening, R: Repair, GI: Geometrical Improvement

Preliminary Design

- Based on the road design elements, the typical cross section is prepared. The typical cross section of Kenyatta Avenue is shown below:

Typical Cross Section

Preliminary Design of Kenyatta Avenue



Cost Estimates

- The total estimated cost to all measures to improve traffic flow in the CBD is Ksh 549 million and the breakdown cost to each project is available in the table below.

Project Cost Estimate (MKsh)

	Road	Length (km)	Foreign Com.	Local Com.	Total
1	Harambee Av	0.9	136.5	38.5	175.0
2	Parliament Rd	0.6	12.1	3.4	15.5
3	Koinange St	0.7	42.3	11.9	54.2
4	City Hall Way	0.9	38.2	10.8	49.0
5	River Road	1.1	18.9	5.3	24.2
6	Tom Mboya St	1.1	85.8	24.2	110.0
7	Ronald Ngala St	0.6	31.9	9.0	40.9
8	Kenyatta Av	0.5	22.4	6.3	28.7
9	Slip Road	0.2	14.4	4.1	18.5
10	Muranga Rd	2.4	25.6	7.2	32.8
	Total	9.0	428.1	120.7	548.8

Note: No.8, 9, and 10 are under MRPW fund.

Implementing Agency

- Most of the above roads are classified as City Roads thus CCN and MOLG are the leading implementing agencies. Road improvement No.8, 9, and 10 will be made by MRPW because of the importance of these roads in the national road network.

(4) Revitalization of Moi Avenue

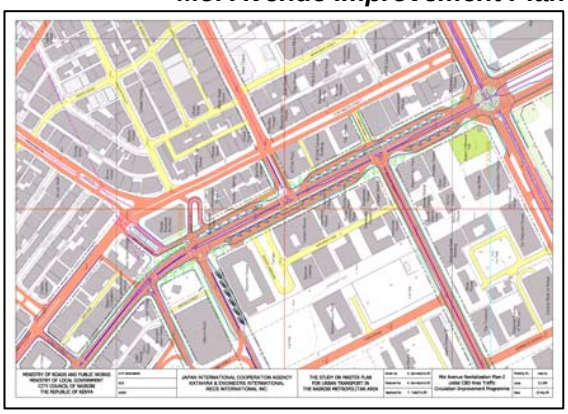
- When completed in early 20th century, Moi Avenue was the most beautiful street in Nairobi. However, due to lack of proper maintenance and repair works of roads inside CBD, Moi Avenue has deteriorated.
- Moi Avenue is just located at the boundary of modern and formal commercial and business area and traditional and informal area. Revitalization of the Moi Avenue will bring great impacts to the stagnated area.

Traffic Congestion and Level of Service

Road Name	Direct.	Cap. / 15 Min	Peak 15 Min Volume	VCR	LOS
Muranga Rd - Kenyatta Av	South	175	234	1.34	F
	North	175	295	1.68	F
Kenyatta Av - City Hall Way	South	175	306	1.75	F
	North	175	255	1.46	F
City Hall Way – R. Ngala St	South	350	306	0.87	E
	North	350	244	0.70	D
R. Ngala St - Harambee Av	South	350	248	0.71	D
	North	350	244	0.70	D

- In order to revitalize the Moi Avenue, improvement measures are established as:
  - Improvement of carriageway
  - Control of on-street parking
  - Improvement of Bus / Matatu terminals and stops
  - Improvement and widening of sidewalk and pedestrian crossing
  - Improvement of intersections and installation of traffic signals and CCTV
  - Pavement marking and traffic control signs
  - Tree planting

Moi Avenue Improvement Plan



(5) Car Parking Study

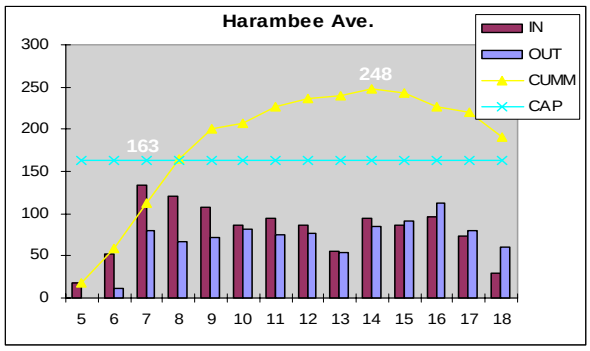
Present Condition and Issues

- The functions of the CBD are undermined by the inefficient use of road space such as illegal on-street parking, the lack of convenient public transport system and the low parking fees in CBD.
- Based on previous year's study and car parking surveys conducted in this stage, counter-measures that could adequately cope with the parking demand are proposed.

Parking Demand and Supply

- Three car parking surveys namely, car parking counts, interviews and inventory surveys were conducted. A sample of the in/out traffic volume by time and maximum occupancy of on-street parking is shown below.

Supply and Demand on Harambee Ave.



Existing balance and future demand

- The existing balance and future demand (year 2010) is shown below.

Demand and capacity

	Total	On-street	Off-street	Building
Capacity	14,864	3,941	3,834	7,089
Demand	13,000			
Possible Usage		100%	95%	80%
	13,255	3,941	3,642	5,671

Recommended Measures

- The following measures are established to improve the parking problems:
  - Increase of parking fee
  - Car parking Scheme
  - Flexible usage of car parking spaces of large-scale development such as Supermarkets.
  - Introduction of parking guide system
  - Improvement of PT system

(6) Westlands Area Improvement Plan

The following key countermeasures to alleviate traffic problems in Westlands shall be carried out;

- Widening of Ring Road Westlands between Missing Link No.3 (extension of Ring Road Kileleshwa) and Lower Kabete Road with NMT facilities.
- Relocation of existing bus/matatu bays on Chiromo Road to down stream side of Waiyaki Way and Chiromo Road reserves (outside carriageway)

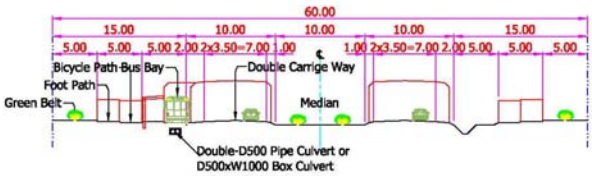
Westlands Area Improvement Plan

(7) Major Arterial Roads Improvement Plan

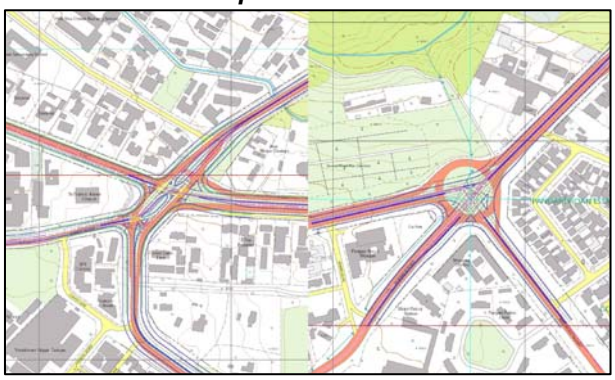
The following key countermeasures to improve traffic conditions along major arterial roads (i.e. Ngong Rd, Limuru Rd, Muranga Rd, etc.) shall be carried out;

- Widening of existing undivided 2-lane road to divided 4-lane road with NMT facilities.
- Geometrical improvement of existing roundabout & intersection with traffic signal installation

Typical Cross Section of Widening



Geometrical Improvement Plan of Junctions



(8) Environmental and Social Consideration

Both Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) are carried out in this study, with the following results:

- Since all the projects are located in the urban center of Nairobi, there is no significant natural environment.
- The following types of impacts are taken in the IEE and EIA.
  - Impact on social environment
  - Traffic safety
  - Air pollution and vibration
  - Landscaping
  - Disruption of traffic during construction period
- Although disruption of traffic during construction period is expected, there are many favorable effects by the projects.
- Environmental management and monitoring plan should be established.

(9) Economic Analysis

- The benefit-cost analysis of the traffic flow improvement in city center is shown below. The results show that the project is highly economical feasible from view point of national economy of Kenya.

Economic Indicators of Benefit Cost Analysis

NPV (KSh million)	1,851
B/C Ratio	3.49
EIRR (%)	45.8

Notes: 1) Service life of the project is 10 years
2) Discount rate is assumed to be 12 % in M/P.

(10) Implementation Schedule of Pre-Feasibility Study Projects

- Implementation schedule was planned within the affordable government financial framework.

Implementation Schedule

		Project Cost (Ksh million)	2006	2007	2008	2009	2010
1	Improvement of road connecting to CBD	390	■	■	■		
2	Traffic Flow Improvement in CBD	549	■	■	■	■	
3	Revitalization of Moi Avenue	84		■			
4	Parking Improvement in CBD	150	■	■			
5	Traffic Flow Improvement in Westlands	29	■				
Total		1,202	426	303	313	160	

Note: 2 is divided by 80 MKsh of MRPW and 469 MKsh of CCN.

19. IMPROVEMENT OF BUS/MATATU TRANSPORT SYSTEM

(1) Study Approach

- The established Master Plan aims to restructure the public transport (PT) system including the introduction of larger capacity public transport mode into the major roads, introduction of shuttle public transport system into the city centre and shift the matatu to the suburban feeder system.
- For the short-term plan, which is in-line with the Master Plan, urgent, low-cost and effective countermeasures is taken into consideration such as bus/matatu corridor management improvement and traffic management.

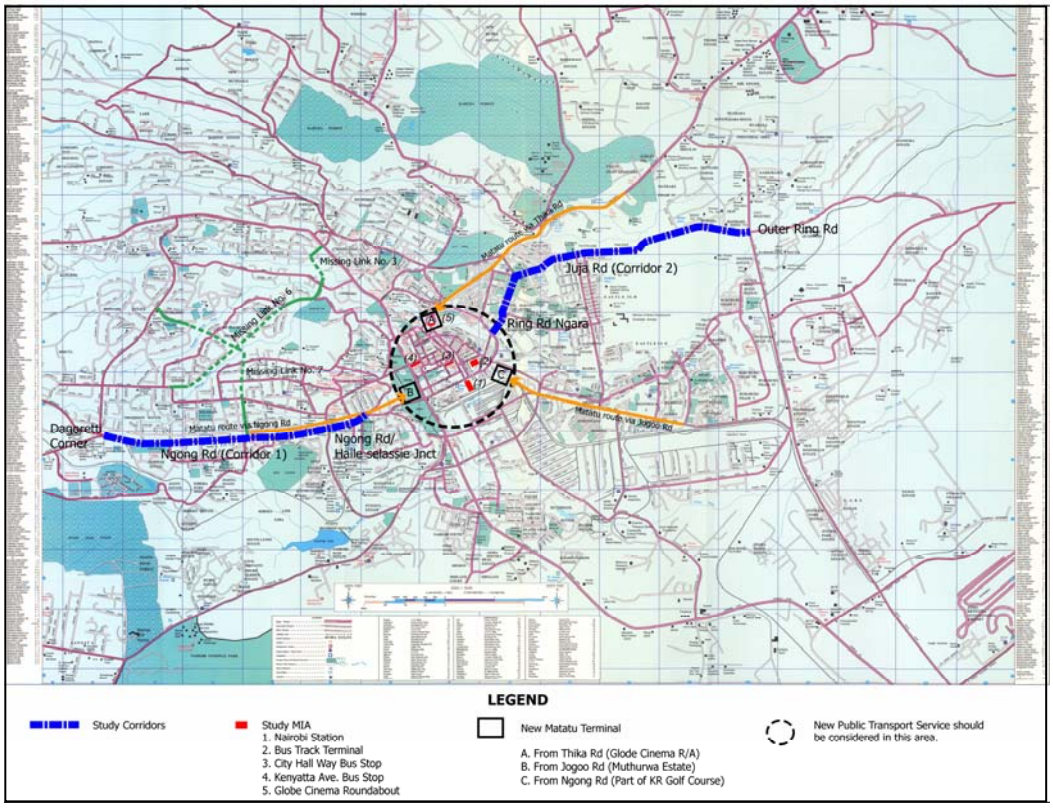
Selected Projects

- The selected studies are;
  - Bus/matatu rerouting plan
  - Corridor management/improvement along Juja and Ngong Corridors.
  - Mode interchange area improvement
  - Traffic safety regulation/education for public transport drivers, conductors and users
  - Institutional, financial and environmental/ social consideration.

(2) Present Conditions and Problems

- The existing problems and issues facing the Nairobi metropolitan area have been identified as follows:
  - Bus/matatu services are business oriented; therefore there is no provision for services such as comfort, convenience and safety.
  - Passengers passing through CBD by matatu need transfer, because most of the matatu routes have their destination in CBD.
  - More than 80% of total public transport along trunk roads consist of small matatus. This is not an effective use of the limited urban infrastructure and causes congestion.
  - Public transport user's dissatisfaction.
    - For bus; Lack of punctuality, expensive fare (relative to service), air pollution, noise, poor bus stop facility
    - For matatu; Long waiting time, lack of punctuality of operational schedule, late first matatu and early last matatu, lack of safety, expensive fare, poor feeder system.
- PT surveys were conducted to obtain useful data for improvement of PT system.

Survey Locations



(3) Proposed Shuttle Bus System in the City Centre

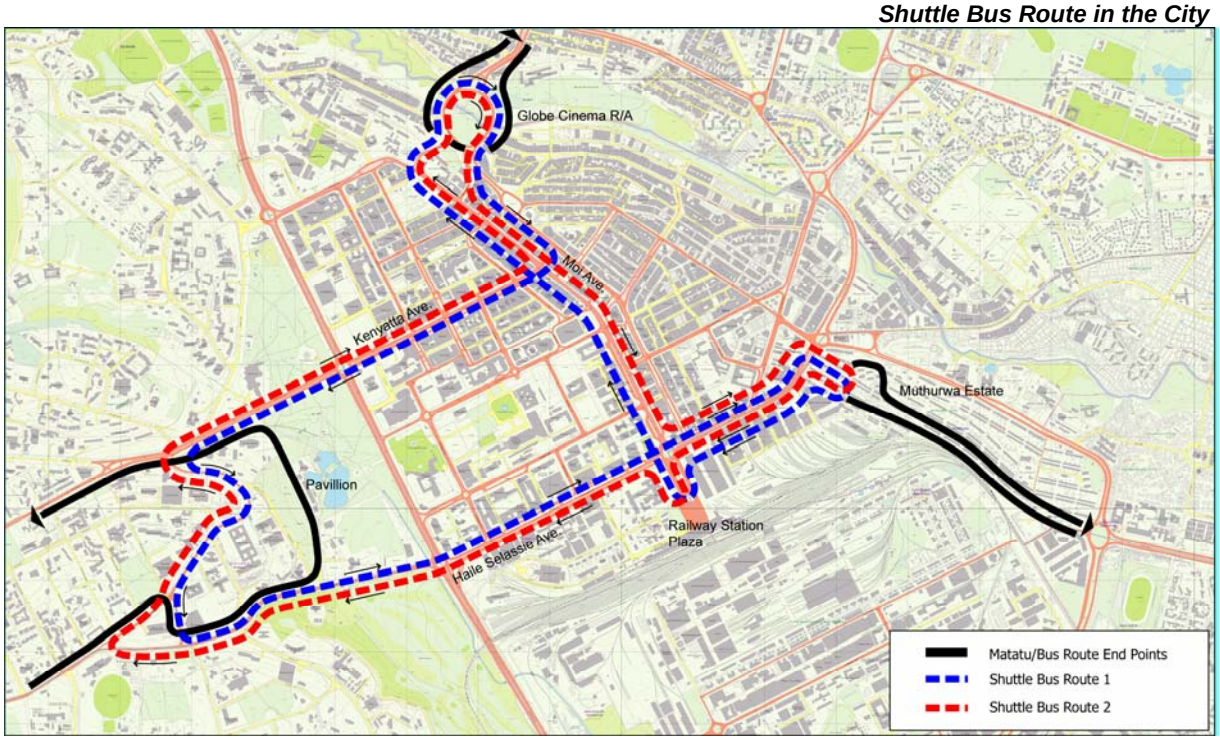
- A new shuttle bus system in the Nairobi CBD is proposed in order to attain the following objectives.
  - To secure the public transport services at the areas where the matatu routes-cut, due to CCN policy, in the city centre based on the three newly proposed matatu terminals namely;
    - Globe Cinema Roundabout (routes from Thika road),
    - Presidential Pavilion near Uhuru Park (routes from Ngong road),
    - Muthurwa state (routes from Jogoo road),
  - To improve the level of public transport service in the city centre where usually a low level of service exists.

- The new shuttle system will cater for the above 3 terminals to serve as a connection between them. It is characterized by the followings;
  - System:
    Route length – 7.8 km,
    Operation schedule (3-minutes peak and 5-minutes off-peak),
    Number of passengers – 163,000/day,
    Fare – 10Kshs. flat
  - Route:
    Connect the 3 matatu terminals with minimum route length by 2 routes and also major facilities in the CBD utilizing the major roads.

(4) Public Transport Rerouting 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 serious traffic congestion in the adjoining roads of missing links.
- Based on the current PT route structure and demand characteristics in this area, a public transport rerouting plan is established to develop a proper PT route network to cope with the demand in this area.
- Basic considerations for rerouting of public transport along missing links are;
  - Prepared plan should form a best practice for introduction of new public transport routes.
  - The new public transport route, especially in the urbanized area, should only allow a fleet of minibuses with a seating capacity of 30 passengers or more.
  - Convenience of public transport users should be the priority.
- Effects of PT rerouting along missing links include;
  - Increase of convenience for PT users living along the missing links (PT service coverage increases to 88% from 70%)
  - Decrease of road traffic in the vicinity of missing links. Along Ngong Road, public transport demand reduces from 108,400 trips/day to 93,000 trips/day. This is a decrease of 14%.

Shuttle Bus Route in the City



(5) Corridor Management/Improvement

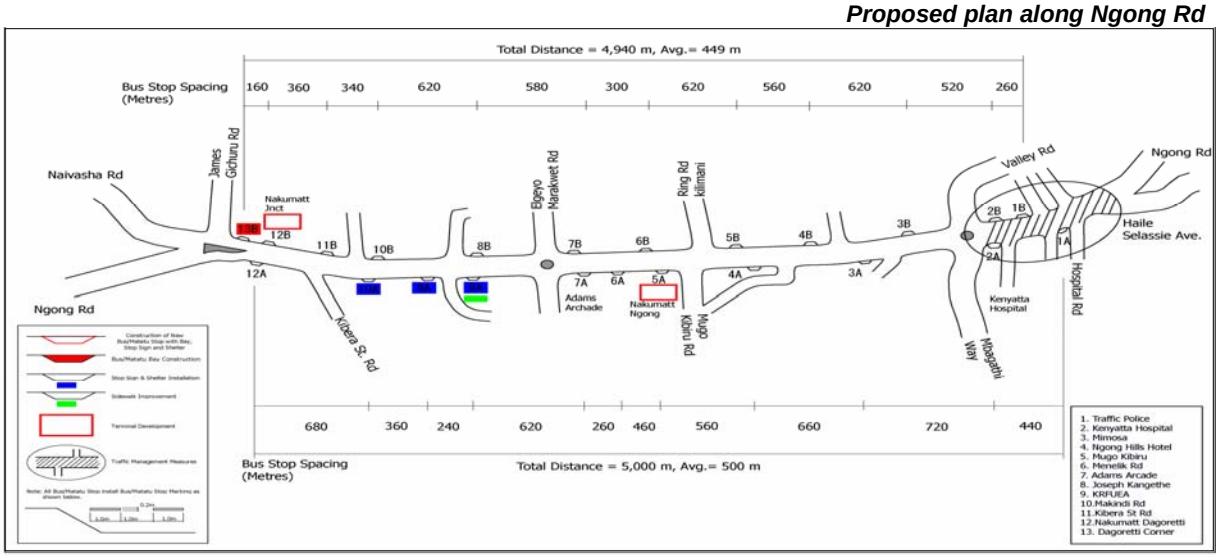
1. Ngong Road Corridor

- Relatively high and mid-income level households reside along this corridor, which has the highest bus traffic share among 7 major public transport corridors.
- Traffic congestion is more serious not only because of the great volume of passengers but also because of the disorderly bus/matatu operation.
- The section between Ngong Rd and Haile Selassie Ave. has the heaviest congestion because many public transport routes concentrate on this narrow road section.
- Most of the public transport related facilities are well maintained but some require improvement.
- Proposals for corridor management along Ngong Road are given as follows:
  - Management/improvement plan including bus priority lane between Valley road and Haile Selassie Ave.
  - Regulation of the development of small matatu terminal to large scale development.
  - Improvement of bus/matatu facilities
  - Installation of bus/matatu bay marking.

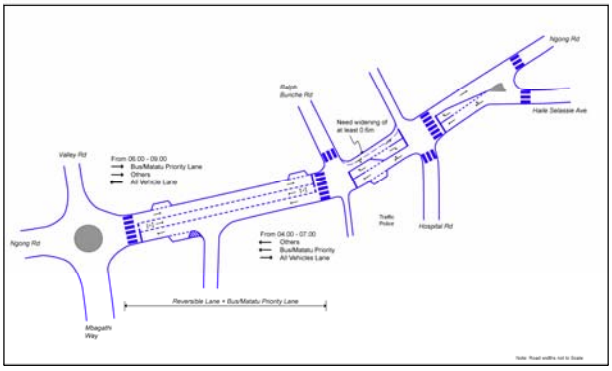
2. Juja Road Corridor

- Percentage of traffic out of public transport 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 signs and shelters. This forces many passengers to wait for matatu at the corner of side streets which leads to traffic congestion along this corridor.
- There are no bus/matatu stops between Kariokor market and Pangani Roundabout, which is 1.5 Km apart.
- It is observed that the bus/matatu stops have limited side walk width.
- Considering the above conditions, the following proposals are given for corridor management/improvement.
  - Installation of new bus/matatu stops between Kariokor market and Pangani Roundabout.
  - Installation of bus/matatu signs and shelters on almost all stops.
  - Development of bus/matatu terminal at Juja Road and Outer Ring Road.
  - Improvement of bus/matatu related facilities.

Proposed plan along Ngong Rd



Proposed bus priority lane along Ngong Rd



3. Effectivity Analysis

- An effectivity analysis shows the effectiveness of the proposed measures in terms of:
  - Improvement of safety conditions at bus stops
  - Improvement of convenience for public transport users
  - Increase of travel speeds
  - Decrease of road traffic accidents.

(6) Mode Interchange Area (MIA) Improvement

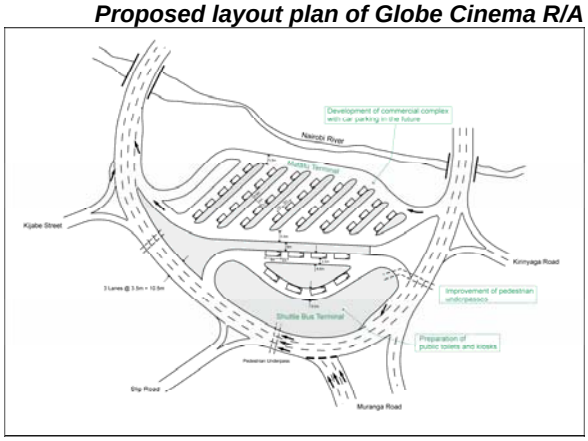
1. Selected MIAs
   - Nairobi Station Plaza
   - Bus Track Terminal
   - Kencom Bus Stop
   - GPO Bus Stop
   - Globe Cinema Roundabout

2. Basic Concept for MIA Planning
   - Increasing of convenience of transfer between modes
   - Enhancement of comfort and safety
   - Improvement of efficiency of existing MIAs located on prime land
   - Contribution to urban environment and amenities by improvement of MIAs

3. Nairobi Station Plaza
- This is the origin of Nairobi city. This MIA is the busiest and most varied in terms of modes using it among the MIAs. The total 12-hour traffic is more than 4000, 57% of which are matatus. Daily railway passengers using Nairobi Station is approximately 16,000 commuters.
- Proposed plan
  - Planned modes include: shuttle bus, standard (intra-city & inter-city) bus, matatu, taxi, private car and NMT.
  - Other facilities including commercial developments such as supermarkets to help energize community activities.
  - Facilities such as public open space should also be considered.
- In accordance with the basic consideration and planned modes, zoning of Nairobi Station Plaza improvement is illustrated below.

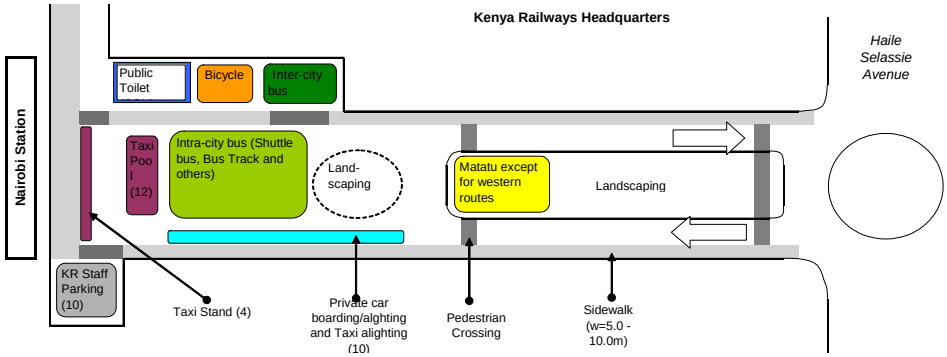
4. Globe Cinema Roundabout
- This MIA has been newly developed to reduce congestion in the CBD from heavy matatu traffic. The total 12-hour traffic is 3,228 and consists of 60% small matatus and 40% big matatus. Maximum occupancy is 94 matatus. Crossing the busy circular roads is often very risky for commuters.
- Proposed plan
  - The matatu and shuttle bus boarding/ alighting space is prepared in the initial stage. Theoretically, the proposed number of matatus to handle is 408 per hour assuming a terminal time of 5 minutes.
  - Eight shuttle bus services are proposed
  - Bus stop signs indicating the route name should be installed in all matatu/shuttle berths to enhance convenience.
  - Improve the existing pedestrian under-passes
  - Develop multi-story commercial complex with car parking facilities using Public Private Partnerships (PPP).

Proposed layout plan of Globe Cinema R/A



5. Effectivity Analysis
- Mode interchange area improvement gives a great positive impact to the Nairobi Metropolitan Area.
  - Contribution of the urban amenities
  - Decrease of traffic congestion
  - Improvement of convenience and safety of public transport users
  - Revitalization of the CBD
  - Creation of landmark in Nairobi
  - Effective utilization of under-utilized valuable land in the CBD.

Zoning in Nairobi Station Plaza



(7) Implementation Schedule

Implementation Schedule

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

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

(8) Traffic Safety Education and Regulation for Public Transport Drivers/Conductors and Users

- 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 convenient transport system in Nairobi Metropolitan Area.
- Lack of proper traffic safety/regulation education is one of the serious problems in the transport sector.
- Recommendations for traffic safety education and regulation include:
  - No waiting for passengers at bus/matatu stops
  - Bus/matatu should stop at proper positions in the bus bays
  - Give priority to alighting passengers
  - Give priority to disabled persons
  - Passengers should queue when boarding bus/matatus
  - Private cars should not drive along bus priority lanes

(9) Environment and Social Considerations

- Anticipated environmental impacts include:
  - Reallocation of a number of trees as a result of the developments
  - Generation of a large volume of solid waste because of attraction of business activities close to the new developments
  - Revitalization of the local economies close to the new developments
  - Reduction in traffic volumes in the CBD and therefore reduced congestion
  - Improved traffic safety for commuters and pedestrians
  - Psycho-physical comfortableness for drivers and passengers because of improved traffic flow
  - Reduction in noise, vibration and air pollution in the CBD as a result of reduction in large number of buses entering the CBD
  - Modern shuttle bus service should introduce comfortable bus riding, which would be mentally and physically comfortable
  - Introduction of shopping centres at MIAs would increase convenience for shoppers
  - Uniformly designed kiosk would be placed for vending news papers and snacks in order to serve the daily needs of commuters.

(10) Institutional and Financial Considerations

1. Current Situation

- Most of the facility provisions, operation and maintenance for PT such as bus/matatu terminals and stops are under the responsibility of CCN while MORPW is responsible for bus/matatu stop facilities for the roads under there jurisdiction.
- Bus/matatu licensing is under TLB and legislation regarding public transport is managed by MOT. Traffic police is in-charge of law enforcement and direct traffic control. Education and publicity regarding PT is handled by education and publicizing entities with information provided by CCN, MOT, TLB and traffic police.
- Public transport service providers are KBS, Matatu operators and emerging bus companies.

2. Means of Intervention and Tools for Materialization of the Schemes

- There are 3 utilizable means of intervention:
  - Provision, operation and maintenance of bus/matatu facilities – CCN
  - Legislative control – MOT, and
  - Bus/matatu licensing – TLB
- Possible Fund Arrangement
  - Shuttle bus; Public-Private Partnership
  - Corridor Management/improvement; CCN
  - Mode Interchange Area Improvement; Public Private Partnership.

3. Ideal Institutional Arrangement

- The ideal institutional arrangement for public transport sector in NMA is to establish a leading agency which executes not only planning and coordination functions but also has certain authority to mobilize related entities for harmonized actions to materialize preferred conditions of the sector.

CONCLUSIONS

AND

RECOMMENDATIONS

CONCLUSIONS

URBAN TRANSPORT MASTER PLAN

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.
- 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

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 CBD
  - Establishment and enforcement of practicable 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

PRE-FEASIBILITY STUDY PROJECTS

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.

Project Justification

- The selected projects are justified for immediate implementation from the viewpoint of technical, economic and the environmental and social aspects, with the following economic indicators that show incase of Traffic Flow Improvement Plan in City Centre.
  - B/C ; 3.49
  - EIRR ; 45.8%
  - NPV ; 1,851 M Kshs

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

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 CBD
  - Traffic flow improvement in CBD
  - Revitalization of Moi Avenue
  - Traffic flow improvement in Westlands
  - Parking improvement inside CBD

- Improvement of Bus/Matatu Transport System

  - Shuttle bus
  - Corridor improvement
  - Mode interchange area improvement

RECOMMENDATIONS

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.

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 GPD 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.

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.

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, as follows:

  - 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 level.

- The Pilot Project Experiment of intersection geometry improvement and traffic signal installation in Westlands roundabout reveals the phenomenon that drivers believe to own 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.

Traffic Safety Education and Enforcement

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

- The need of traffic safety education should be emphasized to all motorist particularly 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.

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

Institution and Organization

- The Plan includes a large number of transport projects embracing road improvement, public transport, and traffic management, which require large investments 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.

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.

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.

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.

Study Intention

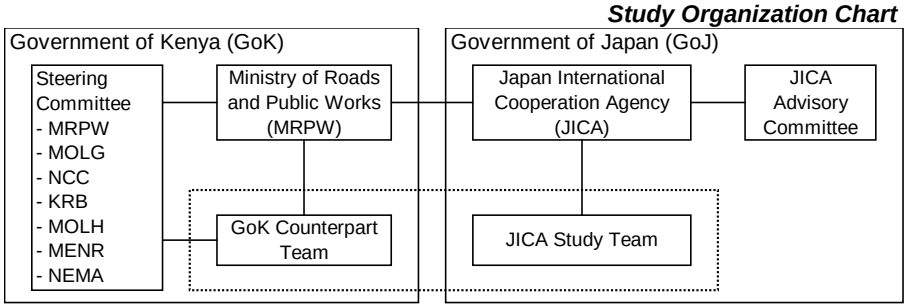
- The Study established a set of measures to solve the present transport issues and formulates a practical, functional and economical transport system for the target year 2025. The outputs of the Study are expected to contribute to the development of the urban transport system in the Nairobi Metropolitan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

Study Organization Chart



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