

#### **(4) Road Network in the Study Area**

##### *a. Road Network Characteristics in the Study Area*

As shown in Figure 4.2-4, Nairobi Metropolitan Area is located in the centre of the Eastern region of Africa in terms of economic development and transportation. As for the road network, there are two international trunk roads. The first one is the Northern Corridor (A109/104) that includes Mombasa/ Uhuru Highway/ Chiromo Road/ Waiyaki Way/ Naivasha Road. It extends from Nairobi City Centre to the south direction to Athi River (and Mombasa, an international port) and to the north-west direction to Limuru (and Naivasha/Kisumu to Uganda and Sudan borders). The second international trunk road is Thika Road (A2) that runs to the north-east direction from Nairobi City Centre to Thika, Murang'a, Nanyuki, Embu, Meru to Ethiopia border after Garissa. Each of these roads run roughly parallel to the existing railways.

In addition to the above international roads, there are five important "Class C" radial roads: (1) Langata Road (C58) to the south-west direction, (2) Ngong Road (C60/61) to the west direction, (3) Limuru Road (C62) to the north-west direction, (4) Kiambu Road (C64) to the north direction, and Kiambu (Juja) Road (C98) to the eastern direction. To connect these radial roads, there are two ring roads; Outer Ring Road (C59), from Ruaraka in the north to the airport in the south, and Road (C63) linking Ruiru/ Kiambu/Kikuyu/Karen/Wilson Airport Roads that runs east to west to south across the northern and western sides of the city via Langata Road.

The road network is much affected by topographic features so the Study Area is geographically divided into four sub areas such as north, east, south and west. Geographical characteristics of the sub-areas and constraints for road network development are shown in Table 4.2-6 and Figure 4.2-5, respectively.

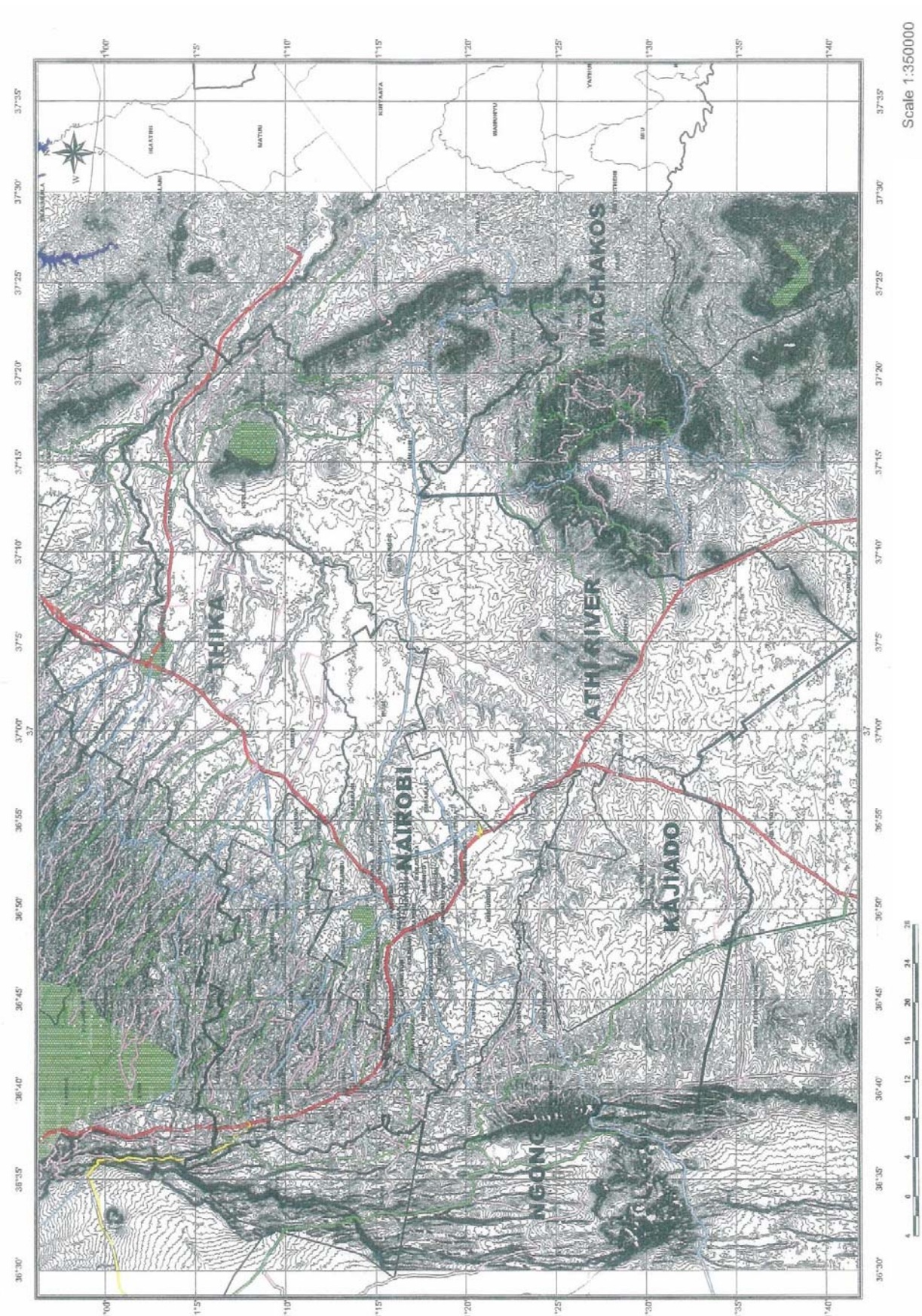


FIGURE 4.2-5 GEOLOGICAL CONSTRAINTS FOR ROAD NETWORK DEVELOPMENT

**TABLE 4.2-6 ROAD NETWORK BY SUB AREA**

Sub Area	Topography /Land Use	Road Networks
Northern Area : bounded by the north boundary, A104, D410 and influence area of Thika Road A2	<ul style="list-style-type: none"> <li>• Steep-sided valley running northwest to southeast.</li> <li>• Coffee and tea farm</li> <li>• Along Thika Road, towns are developed; Industry in Ruaraka and Dandora; Many universities along Thika Road, Jomo Kenyatta University, Kenyatta University, etc.</li> </ul>	<ul style="list-style-type: none"> <li>• Road network forms parallel to the ridge of Mount Kenya, in the north-west and south-east direction. The roads connect villages along the ridge. There are few minor roads linking these ridge roads over valleys.</li> <li>• Only one major road (C63) runs in the foot of a mountain area in the east and west direction.</li> <li>• North Bypass is planned in this area.</li> </ul>
Western Area : bounded by the west boundary, A104, Langata Road, and, the boundary of urban area	<ul style="list-style-type: none"> <li>• Ngong Hill</li> <li>• The Dagoretti and Embakasi Forest; the Olula Forest; and the Ngong Road Forest.</li> <li>• About half of the Karen- Langata area is a high income residential area with big plot sizes.</li> </ul>	<ul style="list-style-type: none"> <li>• Road network consist of radial roads; C60, C61 and C58, and part of ring road of C63.</li> <li>• The Ngong Hill restricts development.</li> <li>• A route of the Southern Bypass is planned in this area.</li> </ul>
Southern Area : bounded by west and south boundary, and Mombasa Highway (A104)	<ul style="list-style-type: none"> <li>• Nairobi National Game Park</li> <li>• Lower land for cattle range</li> <li>• Athi River town and EPZ</li> </ul>	<ul style="list-style-type: none"> <li>• In the south part of the Study area, Nairobi National Park restricts the development of the road.</li> <li>• Only the Mombasa road connects Athi River town and Nairobi city proper.</li> </ul>
Eastern Area : bounded by east and south boundary, Thika Road, National Park, Mombasa Road	<ul style="list-style-type: none"> <li>• Undeveloped.</li> <li>• Ranching and sisal farms.</li> </ul>	<ul style="list-style-type: none"> <li>• Less developed road network</li> <li>• Only the Komo Rock runs to Kangundo in the central part of this area, connecting with Outer Ring Road.</li> <li>• Eastern Bypass is planned.</li> </ul>

### ***b. Existing Road Network System***

As shown in Figure 4.2-6, the road network in the Study Area consists of radial roads and ring roads.

#### **Radial Roads**

- The road network in the study Area consists of seven major radial roads that handle mainly international and intercity traffic. There are two radial International Highways (A104 and A2) and five radial roads of Class C. All radial roads start from Nairobi CBD, through commercial and administration centres, to the suburbs and surrounding cities and towns. Table 4.2-7 presents the destinations at the major radial roads which are also depicted in Figure 4.2-6.

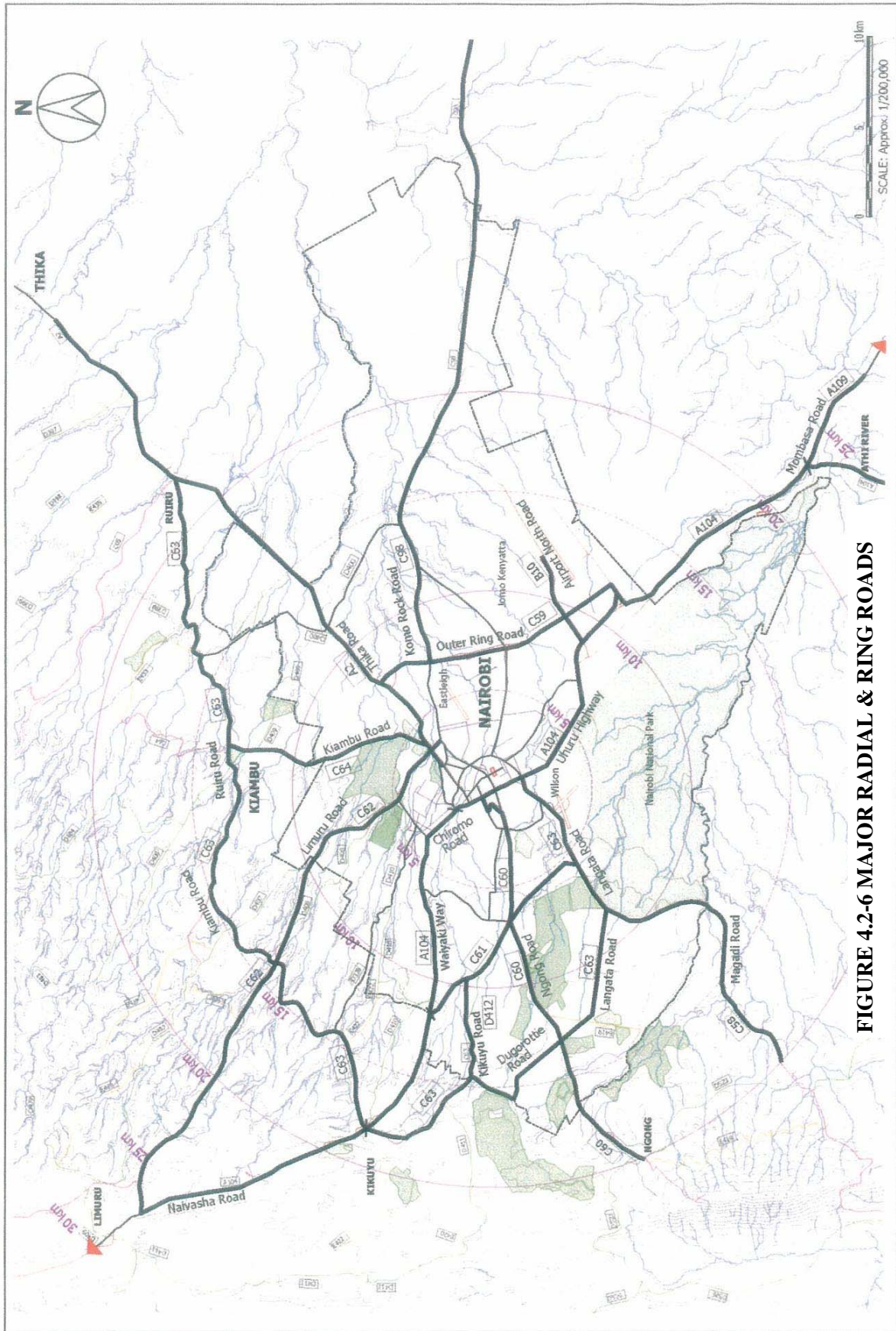


FIGURE 4.2-6 MAJOR RADIAL & RING ROADS

**TABLE 4.2-7 SUMMARY OF MAJOR RADIAL ROADS**

Class	Road Name	Direction from Nairobi	Connection
A104	Mombasa Road / Uhuru Highway Chiromo Road / Waiyaki Way / Naivasha Road	To south-east To north-west	Nairobi to Uganda / Nairobi to Mombasa / Sudan
A2	Thika Road	To north-east	Nairobi to Ruiru / Thika / Garissa / Ethiopia
C58	Langata Road	To south-west	Nairobi to Kajiado
C60	Ngong Road	To west	Nairobi to Ngong
C62	Limuru Road	To north-west	Nairobi to Limuru
C64	Kiambu Road	To north	Nairobi to Kiambu
C98	Komo Rock Road	To east	Nairobi to Kangundo

### Ring Roads

- There are two ring-formed roads in the study area. Table 4.2-8 presents the destinations of the two ring roads which are also depicted in Figure 4.2-6.

**TABLE 4.2-8 SUMMARY OF MAJOR RING ROADS**

Class	Road Name	Radius of the Centre	Connection
C59	Outer Ring Road Airport Road	7.5 km in the east side (Total length= 13.4km)	Thika (A2)/ C98/ JMT Airport / Mombasa (A104)
C63	Ruiru /Kiambu / Dagorretti	15-20km in the north to west side (Total length = 67.0km)	Thika(A2) /Kiambu(64) / Limuru (C62)/ Naivasha (A104)/ Ngong (C60)/ Langata Road (C58)

- The Outer Ring Roads connect Thika Road (A2), C98, Jomo Kenyatta International airport and Mombasa Road (A104). This road functions as a small eastern bypass, having a 7-km radius from the city centre, and carries the heavy traffic generated from Mombasa Road and to the east side of Nairobi City.
- The Ring Road linking Ruiru, Kiambu, and Dagorretti reaching Langata Road runs from north west with a 15 to 20km radius from the city centre. This road acts as a north-west-south ring road together with Langata Road.
- Due to lack of sufficient circumferential or ring-formed roads and bypasses, trips between edge towns have to pass through Nairobi City centre and to cross Uhuru Highway.
- The Outer Ring Road is congested in both directions as among the radial roads, Thika Road and Ngong Road handle heavy traffic at peak hours. In the morning peak, inbound traffic is heavy, and the traffic on the opposite direction is not heavy. However, in the evening peak, both directions are congested along the Outer Ring Road which carries heavy traffic from Thika to Mombasa Road.

### **(5) Road Network by District**

The data on road networks in the districts of Kiambu, Thika, Machakos, and Kajiado is shown in Appendix 4.

### **4.3 EXISTING ROAD CONDITIONS**

#### **4.3.1 Number of Lanes**

The number of lanes varies from 2 to 6 according to the road class and areas traversed. International roads such as A104 and A2 and urban primary arterials have 4 to 6-lane carriageway with nominal road reserves of 60m width. Most of 6-lane roads are located in the CBD such as Uhuru Highway (A014), Haile Selassie Road, Kenyatta Avenue, Jogoo Road, Mbagathi Road, etc. in the urbanised area. Other arterial roads have a 2-lane carriageway with a nominal road reserve of 30m wide. Some minor roads and local and access roads have only one-lane with 5 to 7m wide. Details are presented in Appendix 4.

#### **4.3.2 Typical Cross Sections**

The cross sections also vary according to road class. Major roads such as international roads (Class A) of MRPW and primary arterials in CCN have a 3.5m wide lane carriageway, wide median, shoulder (mostly unpaved) and side walk (in the city centre). Typical cross sections of major roads are shown in Figure 4.3-1.

#### **4.3.3 Pavement Types and Conditions**

The pavement types are bitumen (AC and DBST), Gravel and Earth (unpaved). Most of major arterials of national road (A, B, and C) are paved by bitumen with good and fair conditions, while about half of the secondary roads (D) are paved by bitumen with 70% in good or fair and 30% in bad conditions. Most minor and special purpose roads are gravel and unpaved roads in bad condition. In Nairobi City, about 80% of roads are bitumen paved roads in good or fair conditions. Details of pavement types and conditions are presented in Appendix 4.

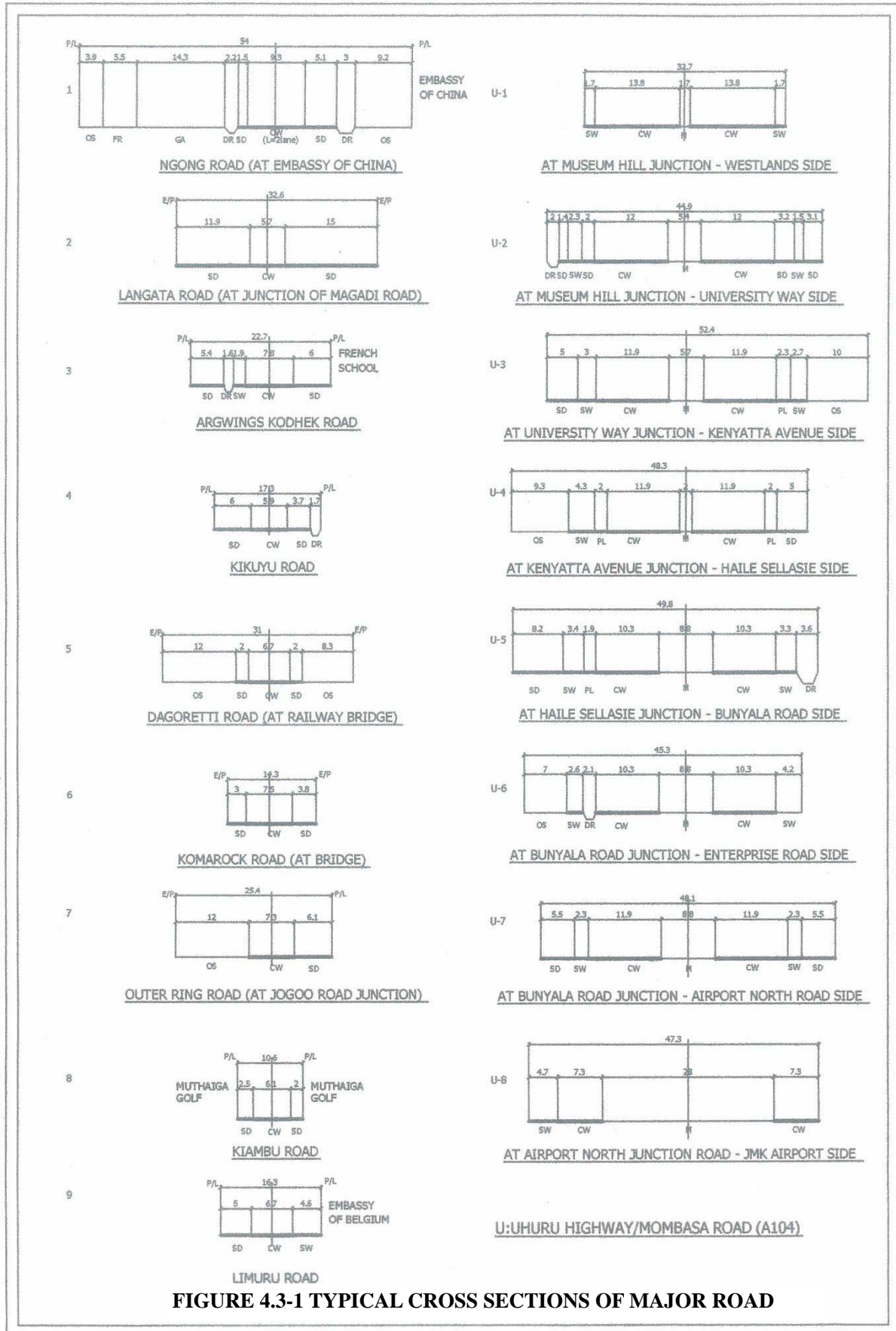


FIGURE 4.3-1 TYPICAL CROSS SECTIONS OF MAJOR ROAD

**TABLE 4.3-1 DETAILS OF NUMBER OF LANES OF MULTI-LANE ROADS IN NAIROBI CITY**

	Road Name	Start point	End point	No. of Carriage-ways	Lanes by Carriage-way	Total No. of Lanes
	<b>Nairobi CBD</b>					
1	Chiromo road	Museum hill	Waiyaki Way	2	3	6
2	City Hall way	Moi Avenue	Uhuru Highway	2	2	4
3	Haile Selassie	Landhies Road	Uhuru Highway	2	3	6
4	Haile Selassie	Uhuru Highway	Ngong road	2	2	4
5	Harambee Avenue	Moi Avenue	Uhuru Highway	2	2	4
6	Kenya Avenue	Moi Avenue	Posta Road	2	2	4
7	Kenya Avenue	Posta Road	Uhuru Highway	2	3	6
8	Kimathi Street	Mama Ngina street	Tubman road	2	2	4
9	Koinange street	University Way	Kenya Avenue	2	2	4
10	Landhies Rd	Jogoo Road	Haile Selassie	2	3	6
11	Loita Street	Kenya Avenue	Monrovia street	2	2	4
12	Moi Avenue	University Way	Haile Selassie	2	2	4
13	Parliament road	Haile Selassie	Kenya Avenue	2	2	4
14	Ronald Ngala	Moi Avenue	River road	2	2	4
15	Taifa Road	City Hall Way	Harambee Avenue	2	2	4
16	Uhuru Highway	Museum hill	Lusaka road	2	3	6
17	University Way	Uhuru Highway Junction	Slip road Junction	2	3	6
18	University Way	Slip road Junction	Miundi Mbingu	2	2	4
19	Racecourse Road	Haile Selassie	Waruingi street	2	2	4
	<b>Surrounding Areas including Urbanized Area</b>					
20	Enterprise road	Lusaka road	Funzi road	2	2	4
21	Forest Road	Limuru road	Muranga road	2	3	6
22	Jogoo Road	Landhies Road	Likoni Road Junction	2	3	6
23	Jogoo Road	Likoni Road Junction	Outer Ring road	2	2	4
24	Juja road	Ring road Ngara	Muratina street	2	2	4
25	Langata Road	Uhuru Highway Junction	Kungu Karumba Junction	2	2	4
26	Lusaka Road	Jogoo Road	Enterprise road	2	3	6
27	Mbagathi way	Langata road	Ngong road	2	3	6
28	Mombasa Road	Lusaka road	JKIA	2	2	4
29	Muranga road	Moi Avenue	Ring road Ngara	2	2	4
30	Muranga road	Ring road Ngara	Thika road	2	3	6
31	Ngara road	Museum hill	Racecourse Road	2	2	4
32	Ngong road (town bound)	Third Ngong Avenue	Fifth Ngong Avenue	1	3	3
33	Ring Road Pumwani	Racecourse Road	Landhies Road	2	3	6
34	Thika road	Muranga road	Metro Boundary	2	2	4
35	Valley Road	Milimani Road	Argwings Kodhek	2	2	4
36	Waiyaki Way	Ring Road Westlands	Metro Boundary	2	3	6

Source: MRPW



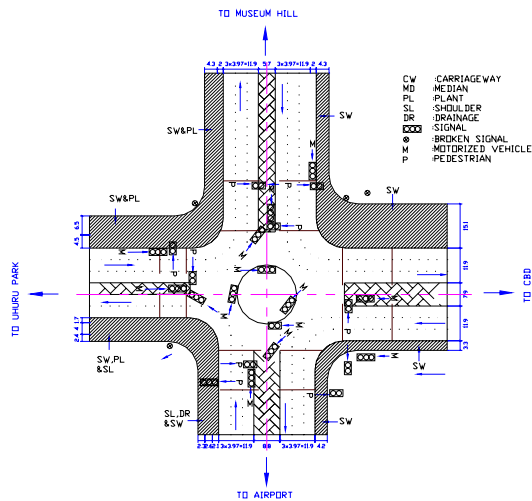
#### 4.4 EXISTING INTERSECTION CONDITIONS

The present intersection conditions are shown in Table 4.4-1. These intersections are selected as bottlenecks that need improvement by CCN. Typical intersections are shown in Figure 4.4-1.

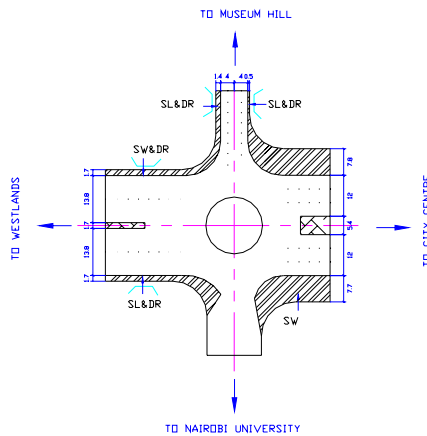
**TABLE 4.4-1 MAJOR INTERSECTION CONDITIONS**

Code	Junction Name (Name of Roads Intersected)	Location On Road	No. of Legs*	Conditions
JC-1	Waiyaki Way Junction (Uhuru Highway Corridor-1)	A104	4	Roundabout Pilot project (Roundabout with Signal)
JC-2	Museum Hill Junction (Uhuru Highway Corridor-2)	A104	3	Roundabout/ No signal
JC-3	University Way Junction (Uhuru Highway Corridor-3)	A104	4	Roundabout with signals
JC-4	Kenyatta Avenue Junction (Uhuru Highway Corridor-4)	A104	4	Roundabout with signals
JC-5	Haile Selassie Avenue Junction (Uhuru Highway Corridor-5)	A104	4	Roundabout/No signal
JC-6	Bunyala Road Junction (Uhuru Highway Corridor-6)	A014	5	Roundabout/ No signal
JC-7	Likoni Road Extension Junction (Uhuru Highway Corridor-7)	A104	4	Roundabout/ No signal
JC-8	Airport North Road Junction (Uhuru Highway Corridor-8)	A104	4	Roundabout/ No signal
JC-9	Elgeyo Markwet Junction (Ngong Rd Corridor-1)	C58	4	Roundabout/ No signal
JC-10	Ring Road Kilimani Junction (Ngong Rd Corridor-2)	C58	2-lane (2-lane)	T-Junction. (Improvement with Missing Link No.12)
JC-11	Valley Road Junction (Ngong Rd Corridor-3)	C58	4	Roundabout/ No signal
JC-12	Kenyatta Avenue Junction (Ngong Rd Corridor-4)	C58	4-lane (2-lane)	Intersection with signals
JC-13	Riverside Drive/Ring Road Kileleshwa Jct.	-	2-lane/ 2-lane	T-Junction. (Improvement with Missing Link No.3)
JC-14	Limuru Road / Forest Road Junction	C62	4	Roundabout/ No signal
JC-15	Thika Road / Muthaiga Road Junction	A2	4	Roundabout/ No signal
JC-16	Thika Road / Forest Road Junction	A2	4	Roundabout/ No signal
JC-17	Thika Road / Outer Ring Road Junction	A2/ C59	3	Roundabout /No signal
JC-18	Outer Ring Road / Juja Road Junction	C59/ C98	4	Roundabout /No signal

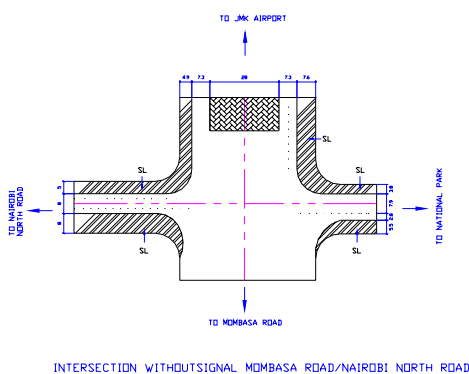
Note: No. of legs for roundabout, no. of lanes for intersection.



Roundabout with Signal: JC-4 Kenyatta Avenue Junction (Uhuru Highway A104 Corridor)



Roundabout without Signal: JC-2 Museum Hill Junction (Uhuru Highway A104)



Normal Junction: JC-8 Airport North Road Junction (Mombasa Road A104 )

**FIGURE 4.4-1 TYPICAL INTERSECTIONS**

#### 4.5 NON-MOTORISED TRANSPORT (NMT)

Non-Motorised Transport includes pedestrians, bicycles, and hand carts. Except for roads in the CBD and City Centre, there are no sufficient facilities for NMT such as walk ways (pedestrian way) and cyclist paths.

#### 4.6 PRESENT LEVEL-OF-SERVICE OF MAJOR ARTERIALS

##### 4.6.1 Major Arterials

Most of major arterials are evaluated at C Level-of-service, except B for Langata Road that was improved to a 4-lane highway recently. Jogoo Road is rated D and Juja Road is F. Juja Road is currently being upgraded to a 4-lane road.

##### 4.6.2 Uhuru Highway

Detailed LOS of Uhuru Highway is shown in Figure 4.6-1. Average LOS on the section of Uhuru Highway and the section between Mombasa and Naivasha Roads is rated at C. This LOS decreases to D and E at the intersections, particularly between Kenyatta Avenue, Haile Selassie, Bunyala, Langata Roundabouts in the CBD and the City Centre.

**TABLE 4.6-1 LOS OF MAJOR ARTERIALS**

Class	Road Name	No. of Lane.	ADT (1000xpcu)	Travel Speed (km/hr)	VCR	Level-of-service
A104	Mombasa	4-divided	46.0	35.0	0.92	C
A104	Uhuru Highway	6-divided	83.6	34.8	1.12	D
	-ditto-	4-divided	40.8	35.0	0.82	C
A104	Waiyaki Way	4-divided	60.6	36.5	1.22	C
A104	Naivasha Road	4-divided	49.6	64.9	1.00	A
A2	Thika Road	4-divided	58.6	34.7	1.17	D
C98	Komo Rock Road	2	19.1	39.5	0.96	C
C64	Kiambu Road	2	18.8	39.7	0.94	C
C62	Limuru Road	2	20.9	35.5	1.05	C
C60/61	Ngong Road	2	27.5	28.9	1.38	C
C58	Langata Road	4-divided	44.4	46.7	0.88	B
C59	Outer Ring Road	2	25.5	31.6	1.28	D
C63	Kikuyu/ Karen / Wilson Airport Roads (Nairobi City only )	2	5.7	44.8	0.29	C
P(CCN)	Jogoo Road	4-divided	53.4	27.0	1.06	D
P(CCN)	Juja Road	2	27.1	22.2	1.36	E

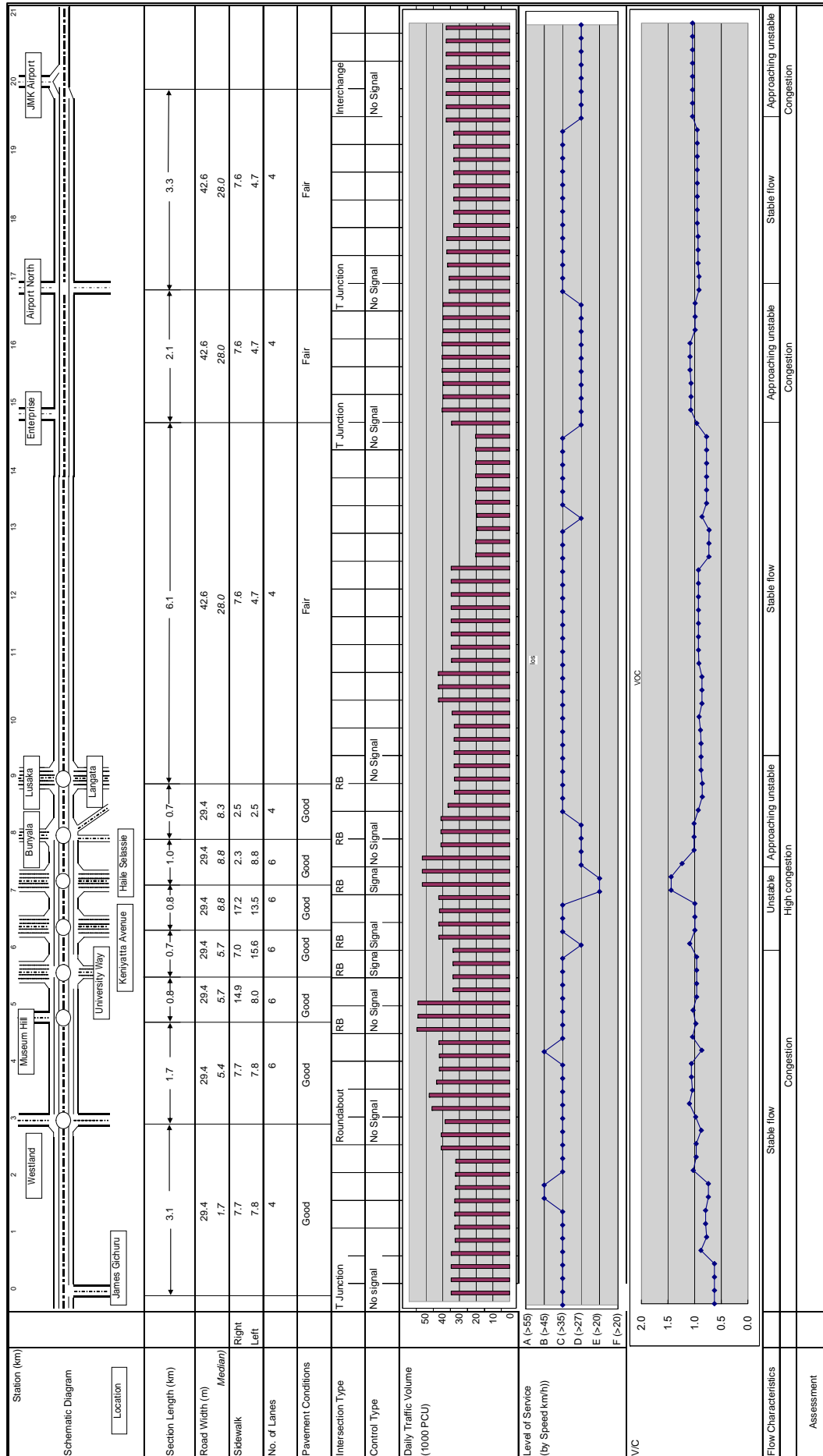


FIGURE 4.6-1 EVALUATION OF UHURU HIGHWAY (A104)