2020 Edition

Transport Plan

Kigali Master Plan 2050

UMUJYI WA KIGALI

Serivisi zinoze kandi zinoze

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The Centre of Urban Excellence

Preface

The Transport Master Plan sets out a strategic vision for Kigali to meet the requirements of a ***City on the Move.*** It will help ensure that an integrated transport network, policies and guidelines can be planned and budgeted for as the City grows. This document is the 2018 update of the 2013 Transport Master Plan. It includes an update of the Road Network Strategy, Public Transport Strategy, Freight Management Strategy, Green Transport Network Strategy and Institutional Strategy.

The goals of the updated 2018 Transport Master Plan are:

- To become a Public transport-Orientated City
- To establish a complete Transport System
- To create a Sustainable Transport Network

Fig. i highlights the key changes to the 2018 Transport Master Plan from the 2013 version.

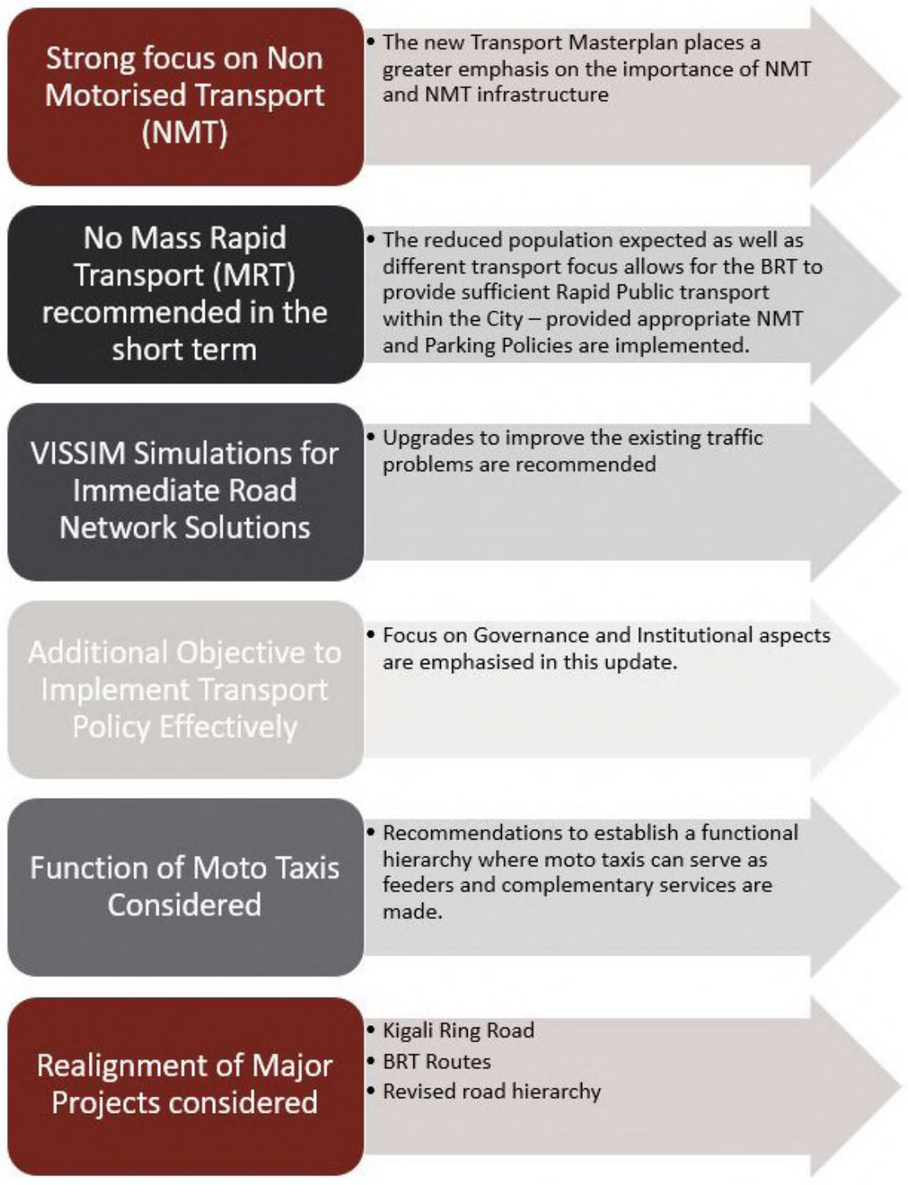

Fig. i: Key Changes from 2013 Transport Masterplan

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List of Items

°C – Degrees Celsius (Temperature)

ASL – Above Sea Level

BRT – Bus Rapid Public transport

centre- Central Business District

CoK – City of Kigali

Ha - Hectare

HCUR - High Capacity Urban Road

ITS - Intelligent Transport Systems

KCMP - Kigali Concept Master Plan

Kigali- City of Kigali

km – kilometres

km/h – kilometre per hour

LRT – Light Rail Public transport

LRV - Light Rail Vehicles

m – meters

min – minute

MININFRA - Ministry of Infrastructure

mm – millimetres

MP- Master Plan

NMT – Non-Motorised Transport

RHA- Rwanda Housing Authority

RURA – Rwanda Utilities Regulatory Authority

sqm – square meters

TMP- Transport Master Plan

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Acknowledgements

The City of Kigali would like to acknowledge and thank the following individuals and organizations for their invaluable insights and contributions to the preparation of the Kigali Master Plan Review.

City of Kigali (COK) - One Stop Centre, Infrastructure Department, Landscape Department
Nyarugenge, Gasabo, Kicukiro Districts
Ministry of Infrastructure (MININFRA)
Ministry of Agriculture and Animal Resources (MINAGRI)
Ministry of Environment (MoE)
Ministry of Lands and Forestry (MINILAF)
Rwanda Housing Authority (RHA)
Rwanda Agriculture Board (RAB)
Rwanda Water and Forestry Authority (RWFA)
Local Administrative Entities Development Agency (LODA)
Rwanda Environment Management Authority (REMA)
Rwanda Association of Local Government Authorities (RALGA)
Rwanda Land Management and Use Authority (RLMA)
Rwanda Development Board (RDB)
Rwanda Transport Development Agency (RTDA)
Rwanda Utilities Regulatory Authority (RURA)
Sector Executive Secretaries
Gasabo, Nyarugenge and Kicukiro Districts
Rwanda National Police (RNP)
Rwanda Defence Force (RDF)
Rwanda Women Network
Rwanda Institute of Architects (RIA)
Rwanda Civil Society Platform (RCSP)w
Rwanda Green Building Organization (RGBO)
Rwanda – National Climate and Environment Fund (FONERWA)
Rwanda Women Network
Broadband System Corporation (BSC)
Uwezo Youth Empowerment
SafeMotos
Care International Rwanda
Association of People with disabilities
Institute for Transportation and Development Policy (ITDP)
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Rwanda Association of Professional Environmental Practitioners (RAPEP)
Global Green Growth Institute (GGGI)
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Strawtec Building Solutions
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International Growth Centre (IGC)
Water and Sanitation Corporation (WASAC)
The Integrated Polytechnic Regional Centre (IPRC) Kigali
National Institute of Statistics Rwanda (NISR)
University of Rwanda (UR)
Moto Cooperative FERWACOTAMO
Institution of Engineers Rwanda
Rwanda Energy Group (REG)
Energy Development Corporation Limited (EDCL)
Development Bank of Rwanda (BRD)
Laterite Ltd.
Department for International Development (DFID) Rwanda
VNG International
World Bank Group
Rwanda Hospitality Association (RHA)
Nyamirambo Women's Center
Institution of National Museums of Rwanda
Youth Engagement in Agriculture Network (YEAN)
Rwanda Youth in Agribusiness Forum (RYAF)
Airtel
Zone Association
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Introduction

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1.3 Context and Perspective

1 Introduction

1.1 Project Background

The City of Kigali (CoK), one of the most active and progressive City Councils in Africa, has been working towards developing Kigali into a city with modern infrastructure and cost-effective quality services. Effective transport systems are critical to enable economic growth and development in a city. In 2013, Surbana Jurong- SMEC were responsible for developing a Transport Master Plan that was to be updated 5 years from its adoption. This document is the 2018 update of the 2013 Transport Master Plan.

1.2 Project Commissioning and Scope

In the beginning of 2018, Surbana Jurong Consultants (Pty) Ltd and SMEC International, were awarded the "Consulting Services for 2013 Kigali Master Plan Update". Surbana Jurong and SMEC (part of the Surbana Jurong Group) worked as one team to implement all technical activities. This Transport Master Plan was created in conjunction with the Kigali Master Plan to ensure integration between planning, transport and infrastructure services.

Project Name: Consultancy Services 2013 Kigali Master Plan Update
Client: City of Kigali, Rwanda
Location: Kigali, Rwanda
Site Area: 730 sqkm
Project Duration: 10 months

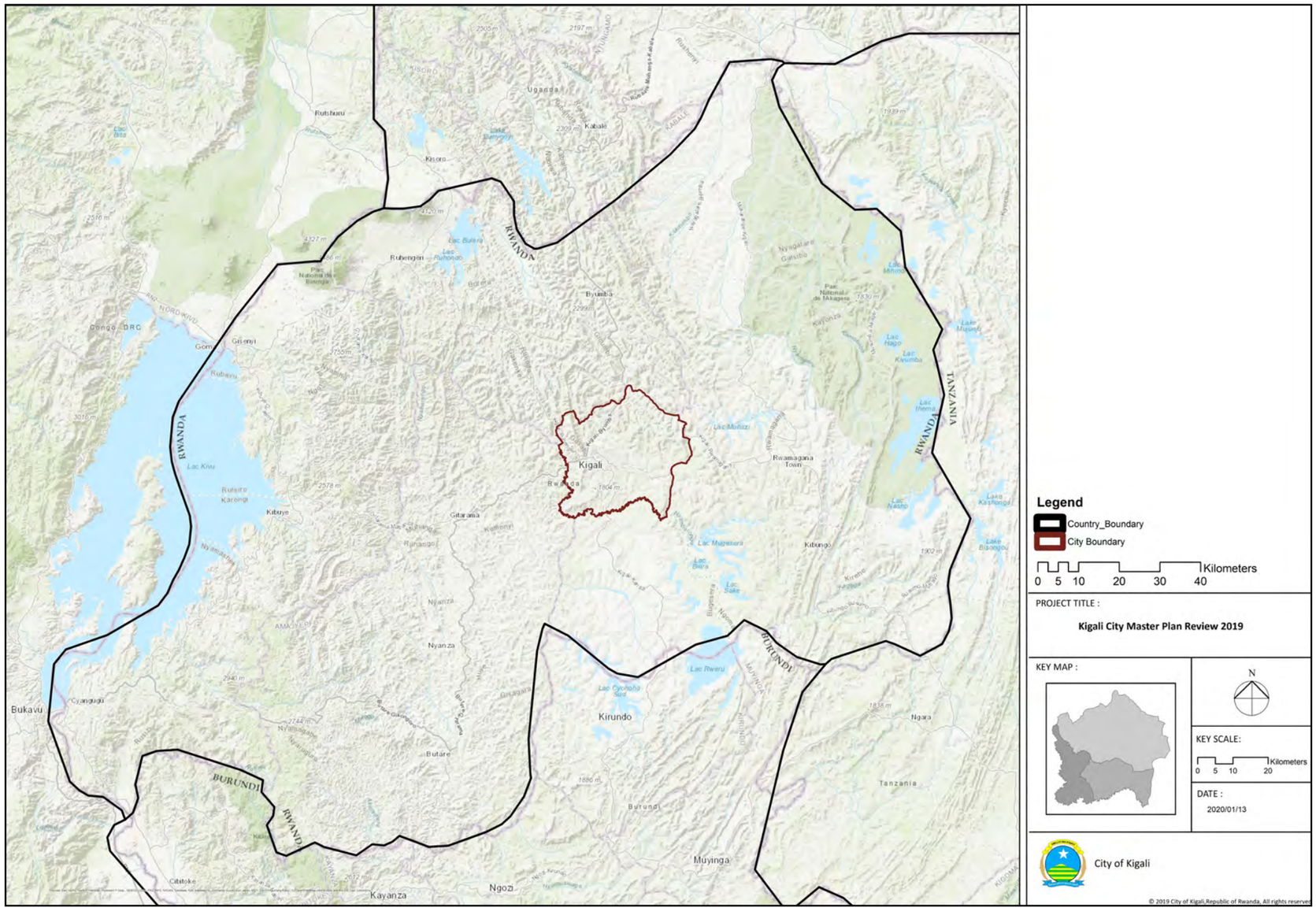

Figure.1.1 The City of Kigali, 2018

1.3 Context and Perspective

Location

Located amidst Central and East Africa, Rwanda is bordered to the north by Uganda, to the east by Tanzania, the south by Burundi and the west by the Democratic Republic of Congo. Kigali, located in the geographical centre of Rwanda is the administrative and commercial capital and the largest city of the country. Kigali is shown in Fig.1.1

Geographical

Kigali is located in the region of the Albertine Rift region, forming part of the watershed for the Nile. Hills with prominent ridges define its topography. Developments can be found mainly in the valleys. The tops of the ridges have an average elevation of 1 600 metres above sea level (ASL), while the valleys are around 1 300 metres ASL. Slopes are generally steep and most roads traverse along contours to ascend the slopes. The City is ringed towards the north and west by higher hills. The highest of these is Mt. Kigali, with an elevation of 1 850 metres ASL. The southern reaches of the district is defined by the Nyabarongo River, which forms the marshes of Kigali. Within Rwanda, Kigali province shares borders with three other provinces (East, North and South); the West province forms Rwanda's borders with Lake Kivu to the west and the North and South provinces to the east.

Historical

Kigali was founded in 1907 as the administrative centre of Rwanda and quickly developed into a major commercial centre primarily due to its central location. It gained importance as a public transport centre with through-routes going to neighbouring countries. Kigali became Rwanda's capital when it gained independence from Belgium in 1962 and since then it has become Rwanda's major economic, cultural and transport hub.

Climate

Kigali's average temperature is approximately 22°C with a low temperature of about 16°C and a high temperature of about 28°C. The moderate to high temperatures can be attributed to its location along the equator. The average annual precipitation is approximately 950 mm. It rains throughout the year; however it peaks between March-April and October- November. It is mostly dry between June and August with less than 50mm of rain.

National Transport Sector

The transport sector is considered a strategic sector for Rwanda given that high transport costs are regarded as a hindrance to the economic growth and development of a country. Although significant transport infrastructure developments have taken place, transport service and infrastructure still require improvements and upgrades to support the growing population and economy.

The transport infrastructure in Rwanda comprises:-

1. Passenger transport services in Rwanda are provided by both the public and private sector, and includes bus, taxi and airline services.
2. Road Transport: Length of National paved roads increased from 1 279 km in 2015 to 1 355 km in 2016 while the total cumulative number of registered vehicles in 2016 was 183 703 (Rwanda Statistical Yearbook, 2017).
3. Air Transport: According to Rwanda Airports Company (2019) there are two international airports (Kigali International and Kamembe International) and five other airports and airstrips spread across the country. Work has begun on the third international airport, Bugesera International Airport which will become the primary International Airport for Rwanda.
4. Lake Transport: Limited to Lake Kivu. Other fluvial forms of transport are limited to local boats due to more convenient alternatives.
5. Rail Transport: Not currently found in Rwanda. There are plans to build railways in Rwanda.

The transport sector is viewed as contributing considerably towards poverty reduction and economic growth, and serving as support to other economic sectors. It will continue to play a fundamental role in the economy of Rwanda.

Sectoral Context

Although Kigali has implemented many measures to address urban mobility issues since the 2013 Transport Master Plan, the steps required to ensure future mobility challenges are met are much bolder. Some future mobility challenges that are expected to accelerate in the future include:

- Increased average travel distances with urban expansion
- Increased car ownership and motorised trips
- Increased numbers of moto-taxis

These factors mean that without drastic measures such as improved public transport services and the prioritisation of non-motorised transport (NMT) and NMT infrastructure, the mobility levels of service within the City are likely to continue to deteriorate. Higher congestion and environmental pollution need to be avoided through the planning and implementation of larger scale public transport and non-motorised transport projects.

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2

Vision & Objectives

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2 Transport Vision and Objectives

2.1 Objective of Transport Master Plan Update

The core objective of this assignment was to update the 2013 Kigali Transport Master Plan with a new methodological approach based on two key elements:

1. An intense participatory process aimed at deeply involving a large base of stakeholders, capable of providing valued inputs and feedback during the update process.
2. Support this update with updated journey time survey data, traffic count survey data, and household travel survey data. This represented an opportunity to incorporate updated land use, population and employment forecasts (based on a supporting socio-economic analysis) and to update the existing road based transport model and 2013 Transport Master Plan.

2.2 Kigali Master Plan Update 2018

The broad Kigali Master Plan Update has 8 themes of development:

1. City of Excellence
2. City of Integrated Neighbourhood
3. City at Work
4. Green City
5. City on the Move
6. Efficient City
7. City for Citizens
8. Creative City

The Transport Master Plan sets out a strategic vision for Kigali to meet the requirements of a ***City on the Move***. It will help ensure that an integrated transport network, policies and guidelines can be planned and budgeted for as the City grows.

2.3 Transport Vision for Kigali- City on the Move

The goals of the updated 2018 Transport Master Plan are:

- To become a Public Transport-Orientated City
- To establish a complete Transport System
- To create a Sustainable Transport Network

These are shown in Fig.2.1 along with their related objectives.

Five enabling strategies were identified to help accomplish these goals and objectives, namely:

1. Road Network Plan (refer to Section 8)
2. Public Transport Plan (refer to Section 9)
3. Freight Management Plan (refer to Section 9.1)
4. Green Transport Plan (refer to Section 9.2)
5. Implement Transport Policy Effectively (refer to Section 9.3

The City of Kigali (CoK) is divided into three districts namely Nyarugenge, Kicukiro and Gasabo. The centre of Kigali is mostly located in the Nyarugenge district near the Kicukiro and Gasabo borders. The following section describes the existing transport environment based on the following sources of information obtained in 2018:

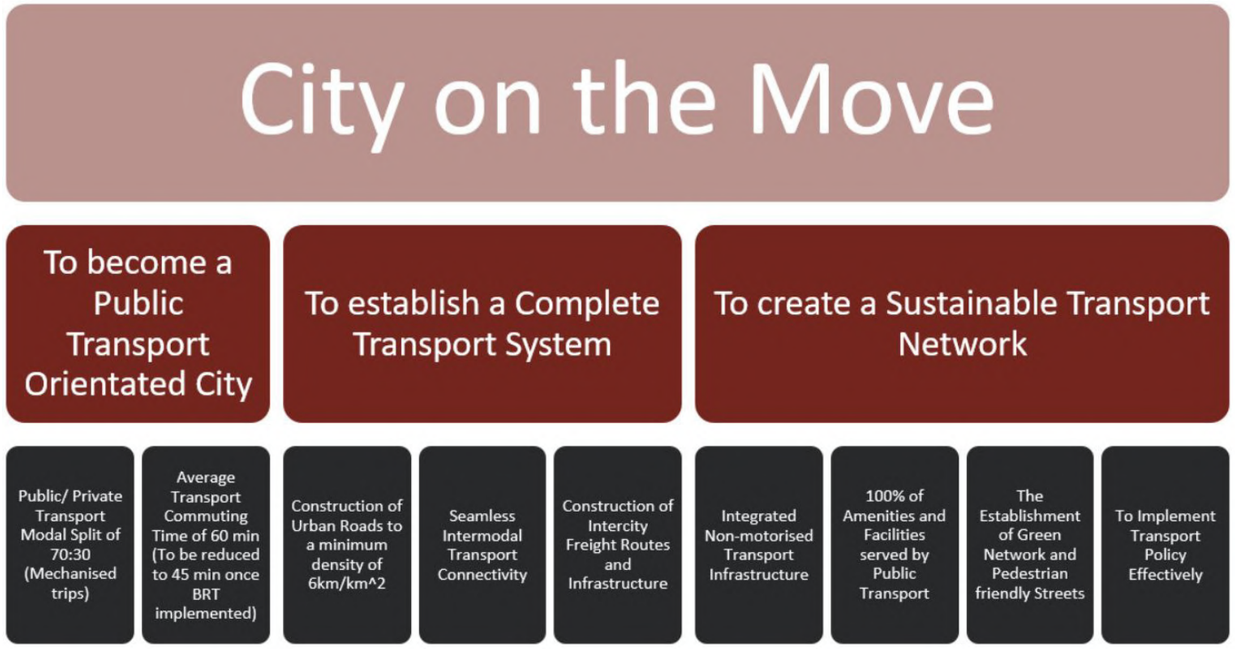

Figure 2.1 Transport Vision for the City of Kigali

- Household Travel Survey data
- Forecast population, employment and land use data
- Traffic Count Survey data
- Journey Time Survey data
- Desktop study of the existing transport network and transport policies (see Reference List provided in Section 11)
- Site visits
- Stakeholder consultation

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3

Exisiting Transport Environment

3.1. Household Travel Survey data
3.2. Intersection Traffic Count Survey Data
3.3. Journey Time Survey Data
3.4. Road Network
3.5. Public Transport Network
3.6. Freight Network
3.7. Green Transport Network
3.8. Transport Policy Implementation

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3 Existing Transport Environment

3.1 Household Travel Survey data

3.1.1 Population Density

The current (2018) population for Kigali is approximately 1.5 million and is forecasted to grow to approximately 3.8 million in 2050.

The 2018 population density (people per hectare) is illustrated in Fig.3.1. It can be concluded that the areas with the highest population density is in the centre of Kigali. The average population density for Kigali is approximately 25 people per Hectare.

The forecasted 2050 population density (people per hectare) is illustrated in Fig. 3.2 It can clearly be seen that the centre will become even more densely populated and other areas further away from the centre will also become more populated. The average density for Kigali is expected to reach a maximum of about 53 people/Ha in 2050.

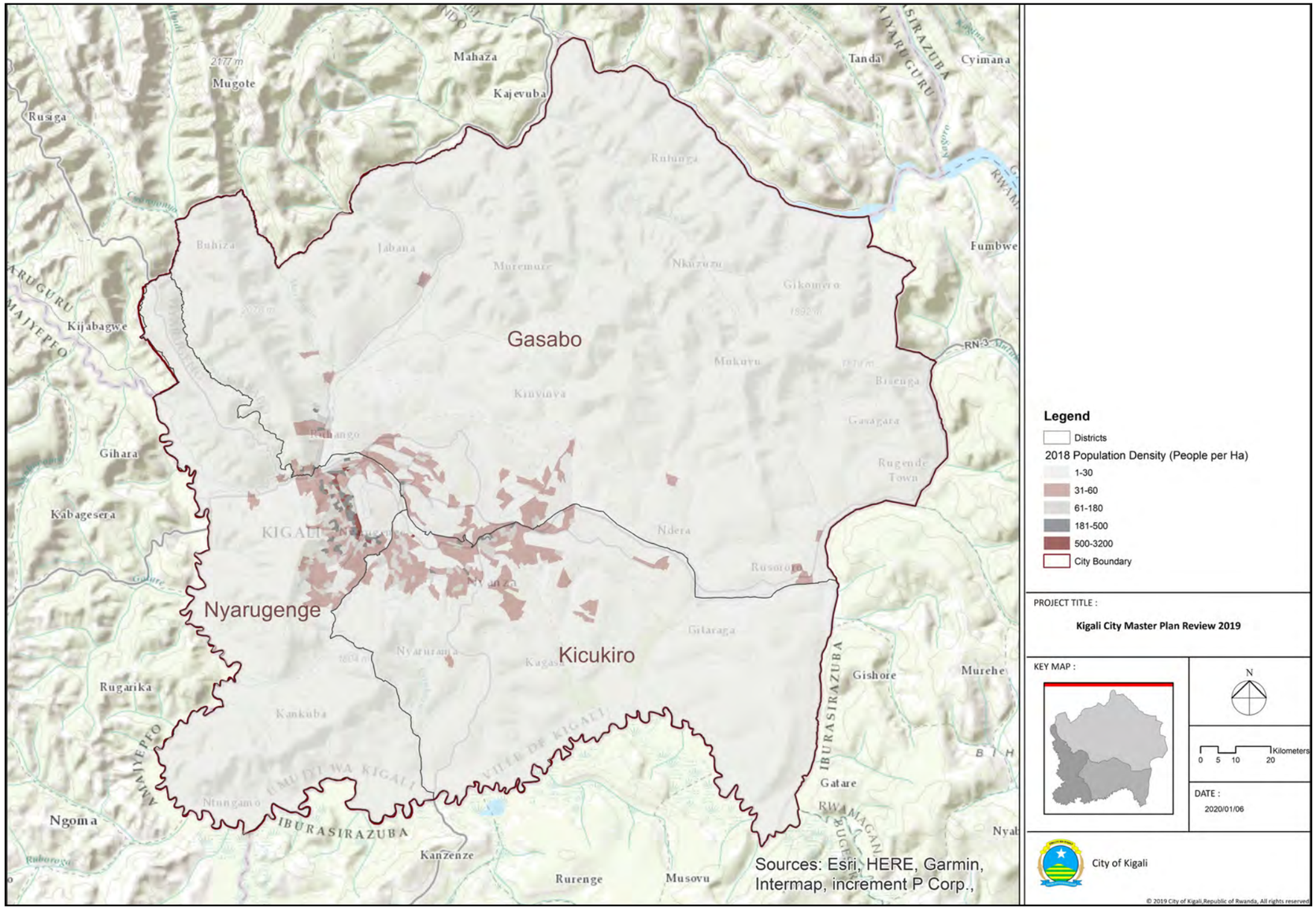


Figure 3.1 Population Density (People per Ha) in 2018

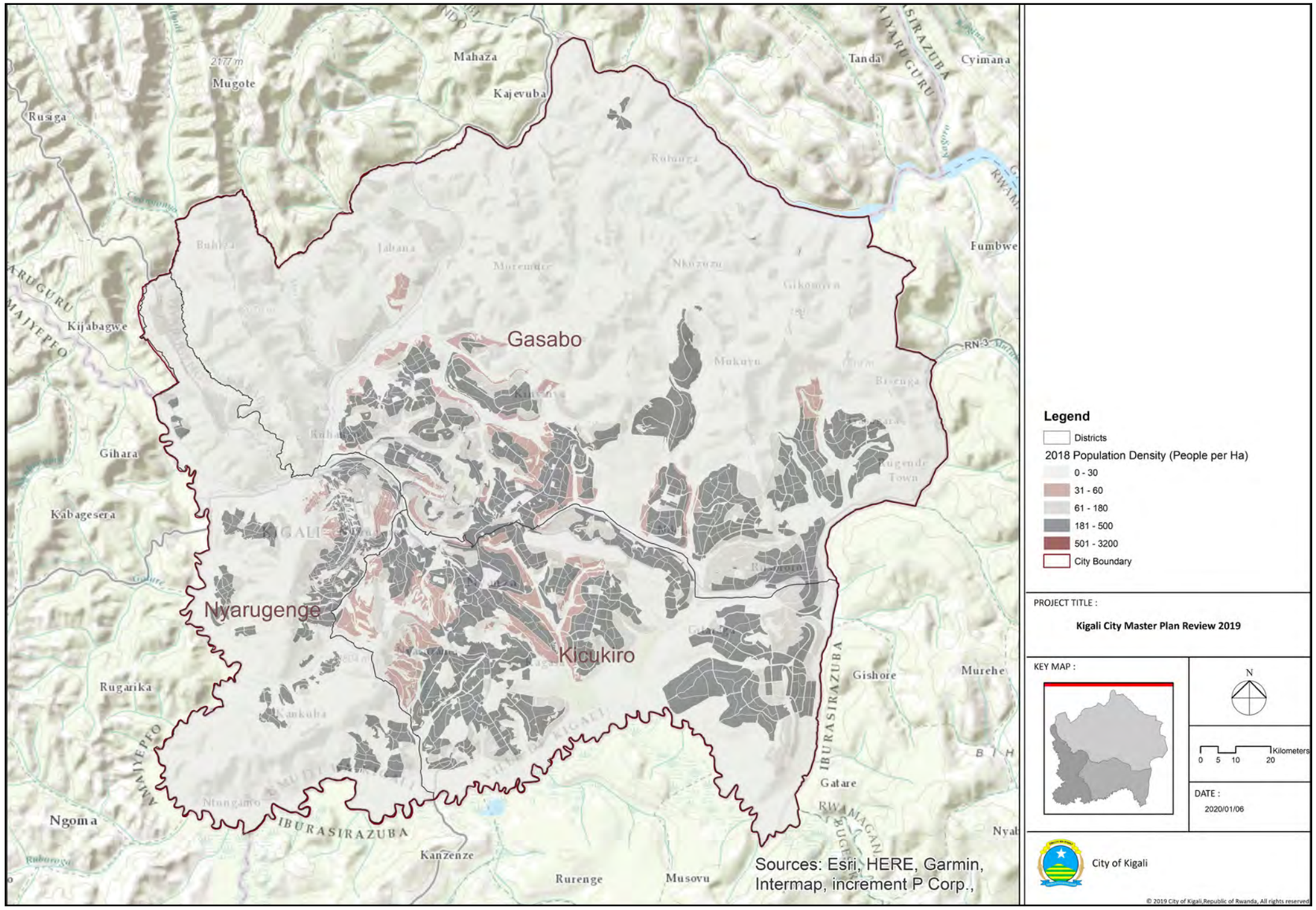


Figure 3.2 Poulation Density (People per Ha) forecasted for 2050

3.1.2 Monthly Household Income

The average household income is illustrated in Fig. 3.3 as the monthly household income per person in Rwandan Franc. This shows that people earning a higher income are located towards the centre of Kigali.

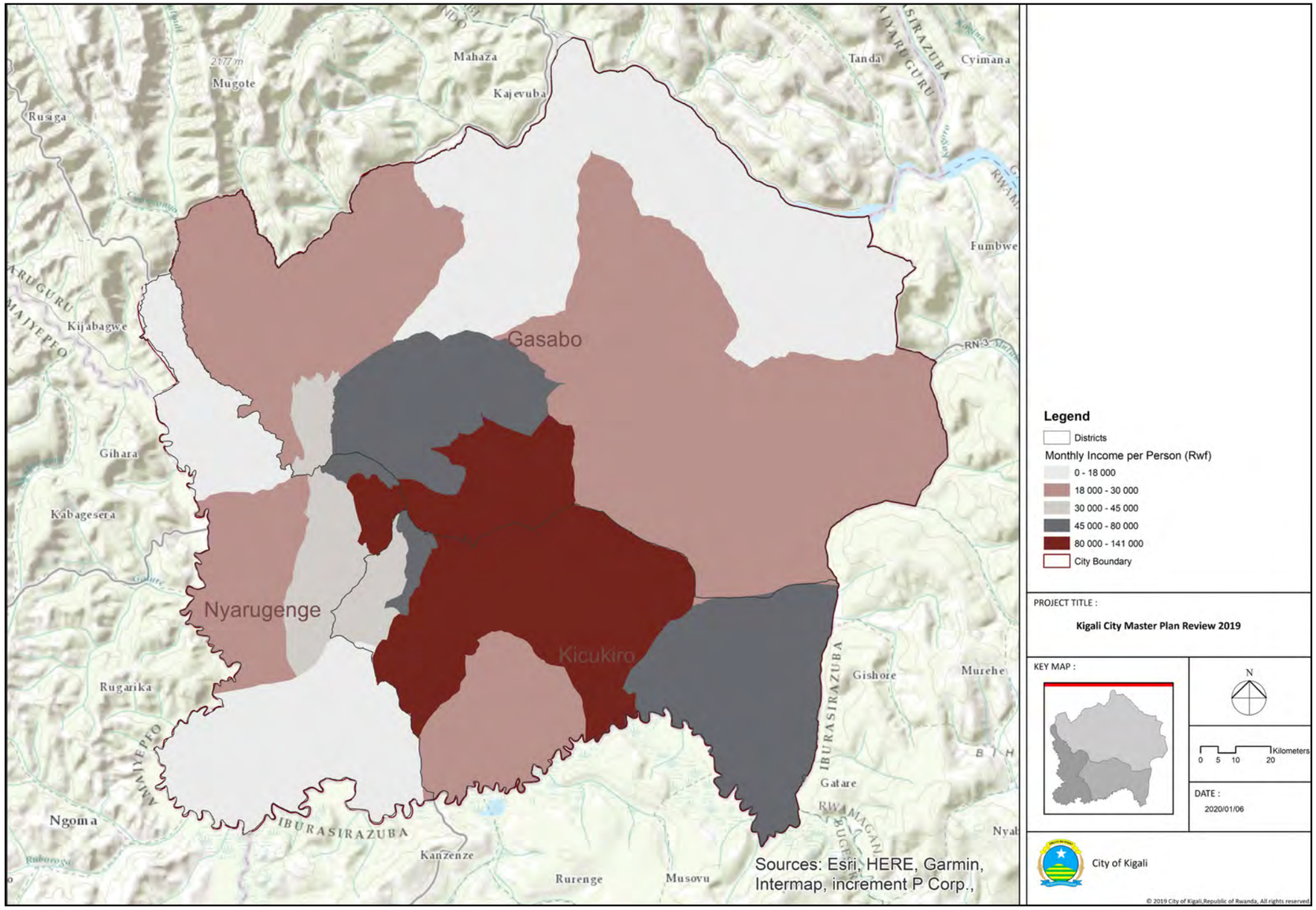


Figure 3.3 2018 Average Monthly Household Income per Person

3.1.3 Vehicle Ownership

Fig.3.4 illustrates the number of households within a sector which own at least one bicycle, at least one motorcycle and/ or at least one motor vehicle. For example, some households might own more than one bicycle/ motorcycle/motor vehicle. Also, one household might own both cars and bicycles.

When comparing average monthly household income per month per person to vehicle ownership per household, it can be concluded that the higher income areas are also areas with higher motor vehicle ownership and the lower income areas are also areas with high bicycle ownership. Motorcycle ownership is higher towards the centre and the Nyarugenge district.

According to the World Bank automobiles and motorcycles motorization rate is rapidly growing and, in the absence of sufficient public transport supply (only 55% of population and 24% of City of Kigali (CoK) territory is within 400 meters of a bus line) that can provide high quality services for the markets served, moto-taxis are taking over a significant share of the travel market (12% modal share) .
The level of motorization (number of vehicles per 1000 inhabitants, with different types of vehicles) should be surveyed as part of an ongoing survey programme.

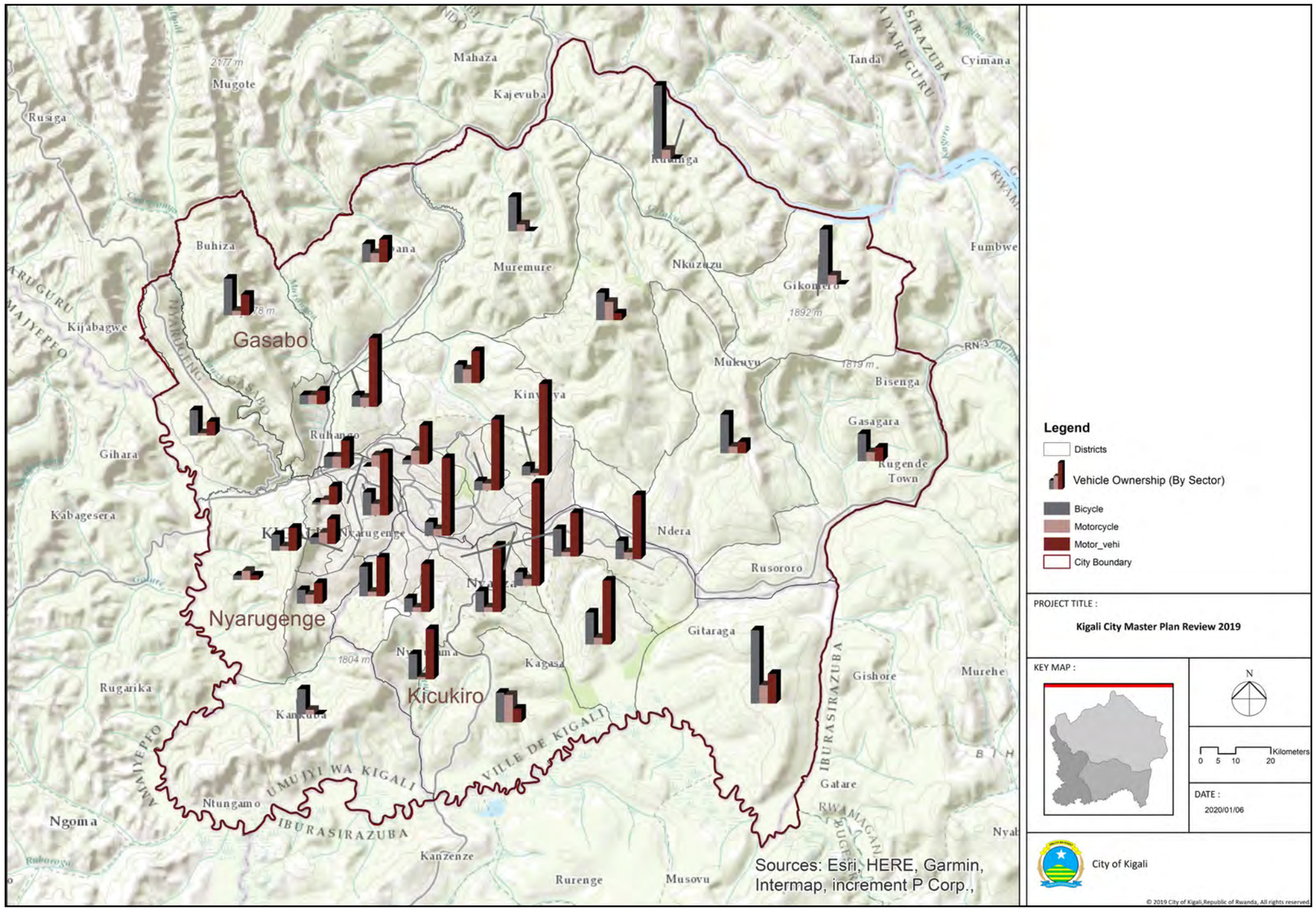


Figure 3.4 2018 Number of households per sector that own at least one bicycle, one motorcycle and/or one motor vehicle

3.1.4 Travel Distance from Residence to Place of Work

The average distance that residents of each respective sector travel to their place of work is illustrated in Figure 3.5. The chart only displays results for employed people. It can be noted that most people live within 2km of their place of work. Even in the case of remote areas such as the northern parts of Gasabo and the southern parts of Nyarugenge and Kicukiro it is noted that most people live within 2km of their place of work. This is an interesting finding seeing as Kigali is roughly 30km in width/length (from north to south and east to west). The data therefore shows that long distance commuting it not currently a major occurrence. The data also shows that most commuter trips are currently shorter than 5km which is considered an acceptable cycling distance and a relatively acceptable walking distance.

It can be concluded that on average, the majority of employed citizens live within 2 km from their place of work.

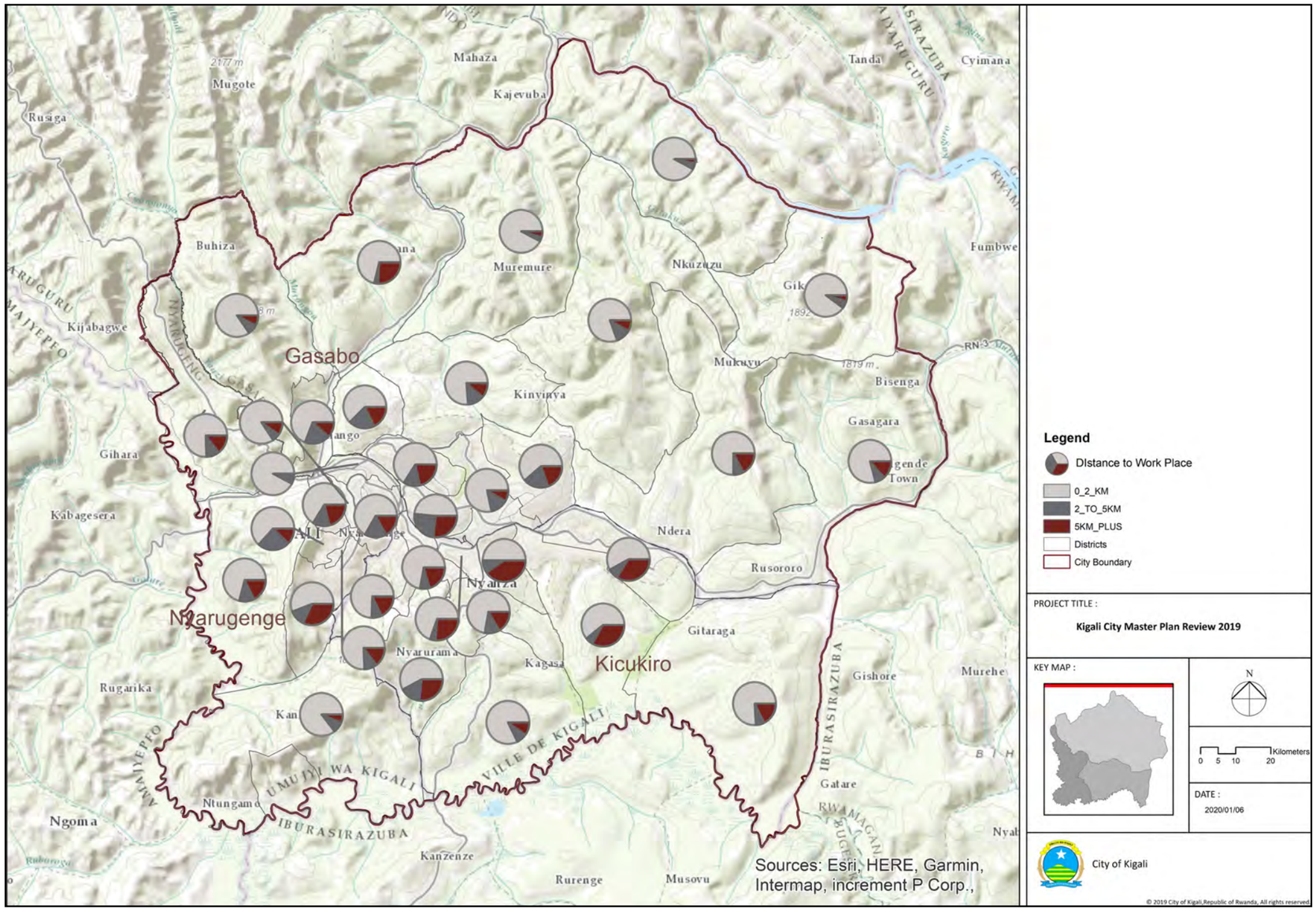


Figure 3.5 2018 Average Travel Distance from Residence to Place of Work

3.1.5 Mode of Travel to Place of Work

Fig 3.6 illustrates the modes of transport that is used by employed citizens as transport to their place of work. The chart only displays results for employed people.

It can be concluded that the majority of employed citizens use walking as a mode of transport to their place of work.

When comparing the mode of transport used to travel to work to the average monthly household income, it is clear that the areas where people earn a higher income are also the areas where the usage of private car travel is more common.

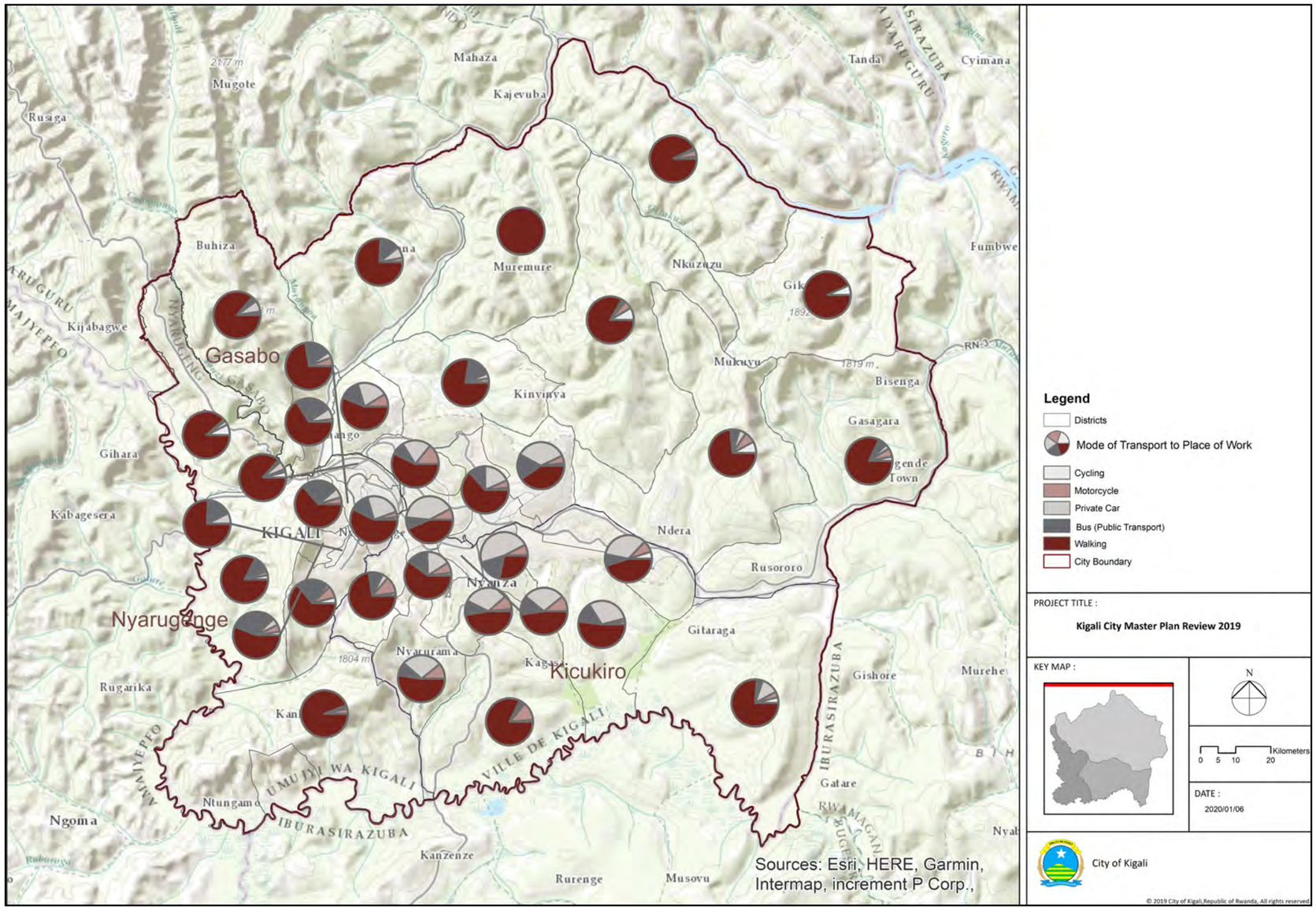


Figure 3.6 2018 Mode of Travel to Place of Work

3.1.6 Time of Day of Travelling to Work

The average time of day that employed citizens travel to work is illustrated in Fig.3.7. The chart only displays results for employed people.

It can be concluded that the most popular time of day for people to travel to work is between 06:00 and 09:00 in the morning.

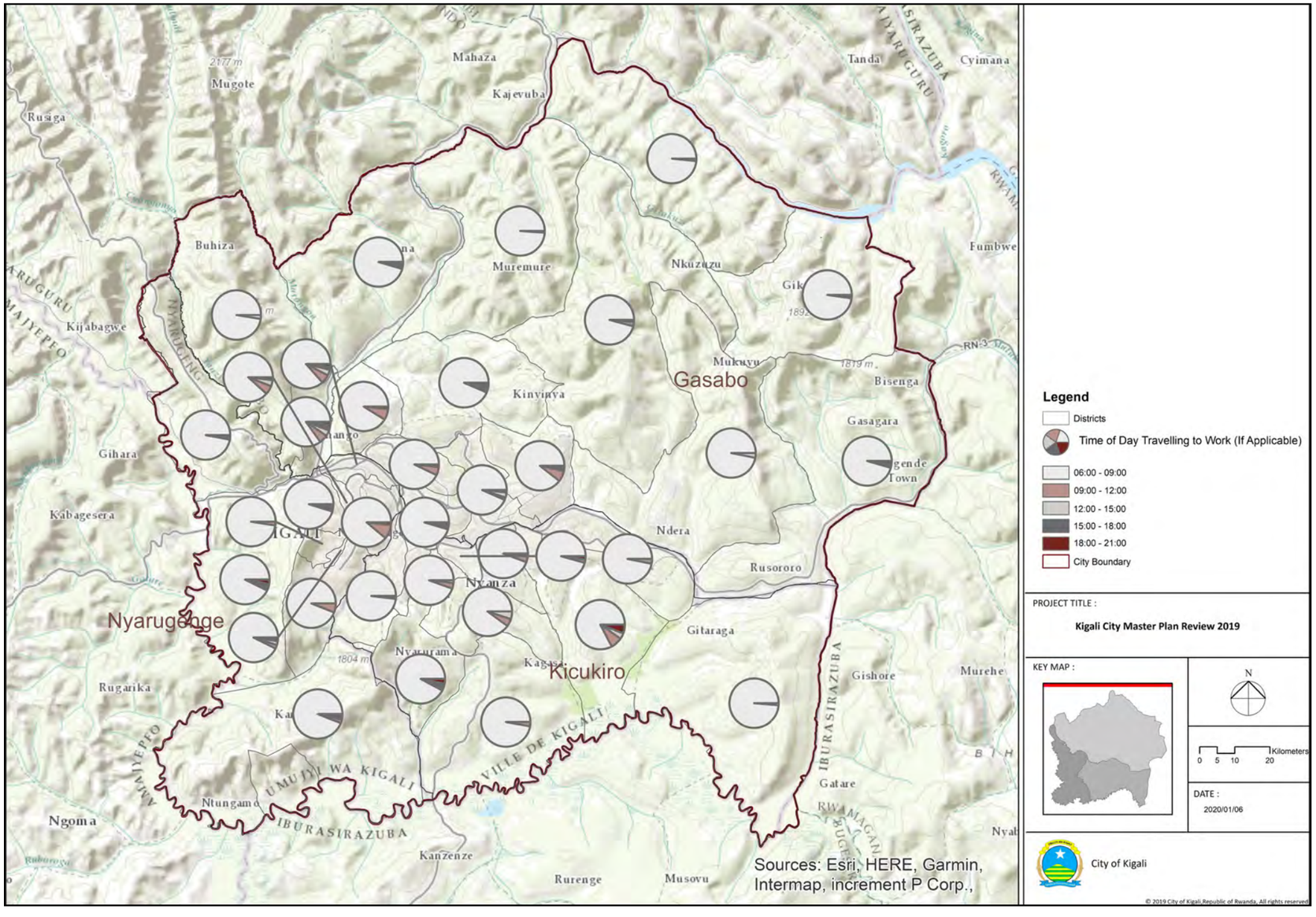


Figure 3.7 2018 Time of Day of Travelling to Work

3.1.7 Travel Distance from Residence to School

The average distance that residents of each respective sector lives to the nearest school is illustrated in Fig.3.8.

It can be concluded that on average, the majority of citizens live within 2 km of the nearest school.

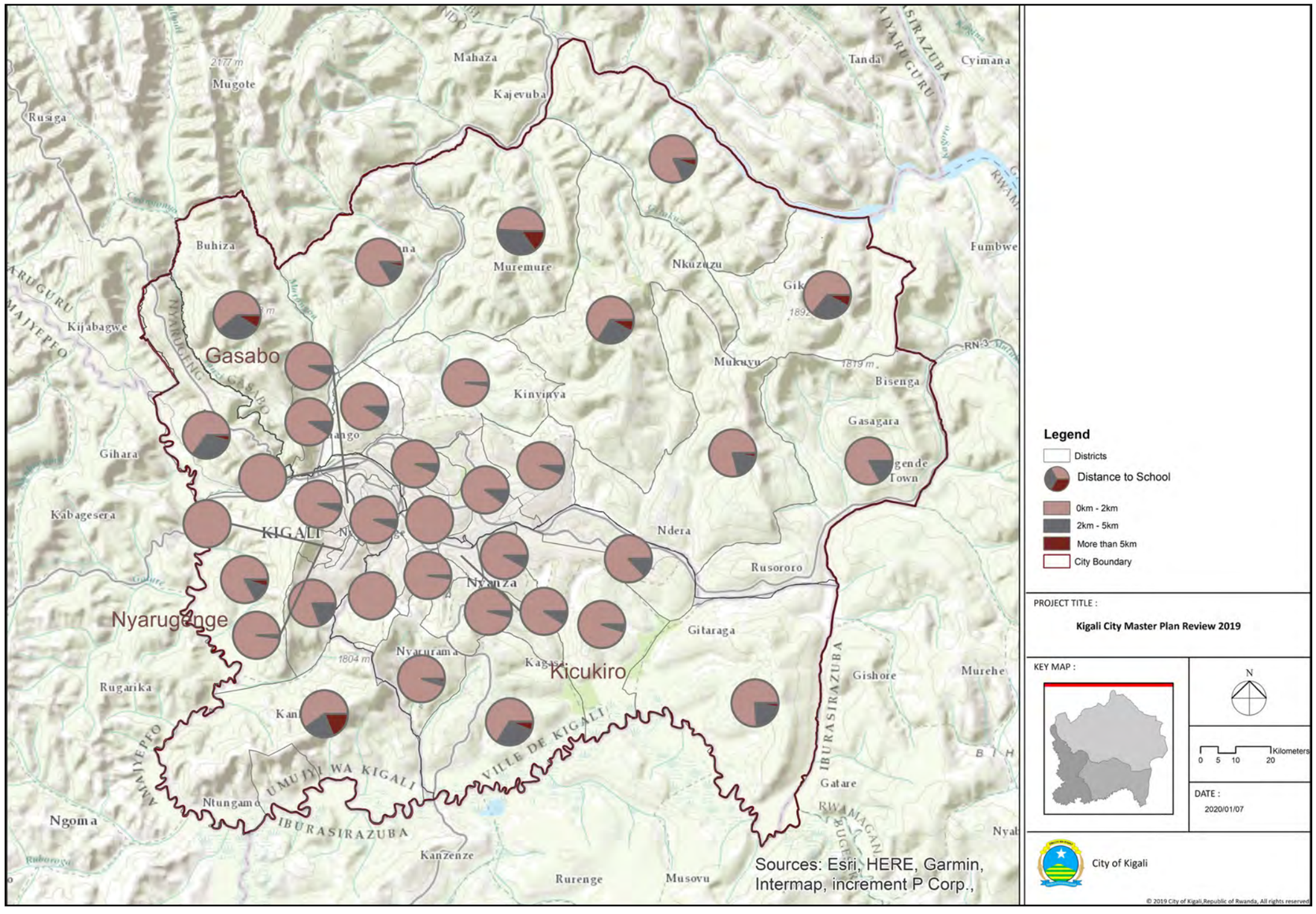


Figure 3.8 2018 Average Travel Distance from Residence to School

3.1.8 Mode of Travel to School

Fig.3.9 illustrates the modes of transport that is used by scholars as transport to their respective schools.

It can be concluded that walking is the most popular mode of transport for scholars travelling to school.

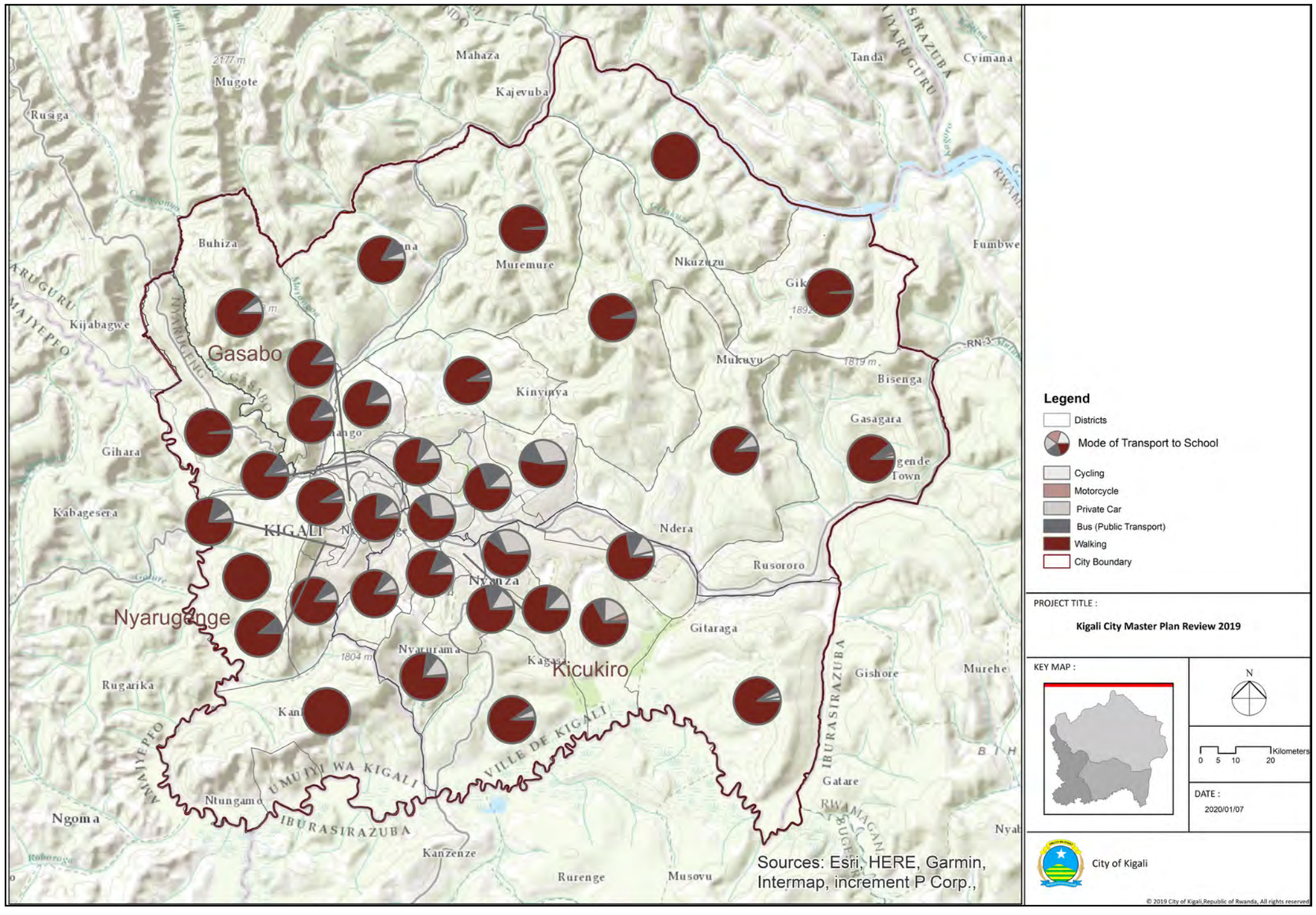


Figure 3.9 2018 Mode of Travel to School

3.1.9 Travel Distance from Residence to Healthcare Facility

The average distance that residents of each respective sector resides to the nearest dispensary or health centre is illus strated in Fig. 3.10

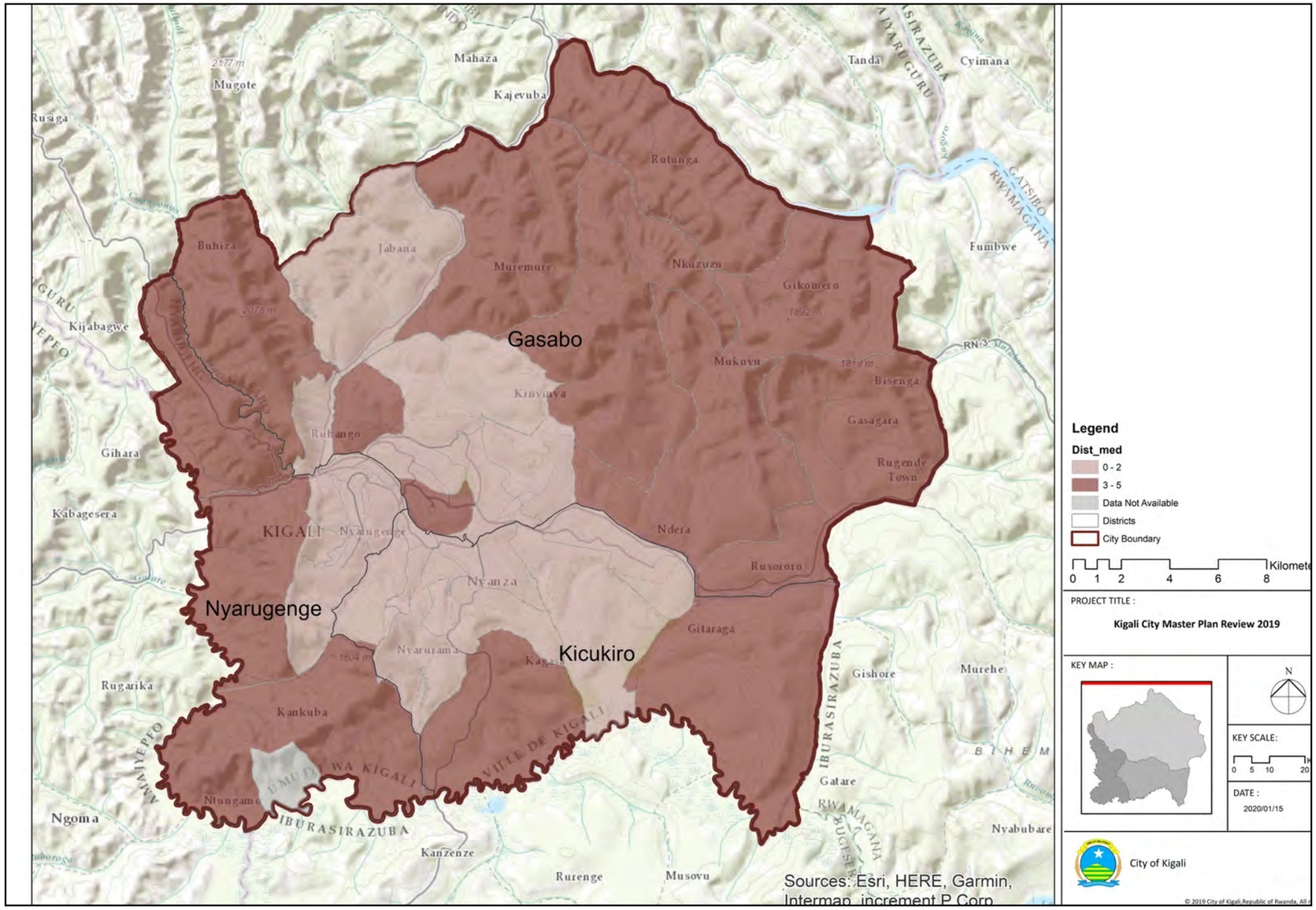


Figure 3.10 2018 Average Travel Distance from Residence to Healthcare Facilities

3.2 Intersection Traffic Count Survey Data

3.2.1 Road Intersection Traffic Counts

Classified intersection traffic count surveys were conducted at 30 intersections between 06:00 and 09:00 AM and between 15:00 and 18:00 PM between Tuesday 17 July 2018 and Thursday 19 July 2018. These surveys were conducted in 15-minute intervals for each intersection.

The following vehicle classes were considered:

- Cars;
- Motorcycles (Moto-taxis);
- Buses; and
- Trucks.

Surveys were conducted for both the AM and PM periods at intersections as follows:

- Intersection 1: KK103 / KK5
- Intersection 2: KN3 / KN5
- Intersection 3: KN5 / KG109
- Intersection 4: KN5 / KN3
- Intersection 5: KG11 / KN5
- Intersection 6: KN5 / KG6
- Intersection 7: KN5 / KG501
- Intersection 8: KG644 Circle
- Intersection 9: KG2 Circle
- Intersection 10: KG7 / KG501
- Intersection 11: KG7 / KG694
- Intersection 12: KG7 / KG550
- Intersection 13: KG7 / KN8
- Intersection 14: KN8 / KG704
- Intersection 15: KN7 / Kigali Gatuna Road
- Intersection 16: KN7 / KN8 Interchange
- Intersection 17: KN7 / Kigali Gatuna Road

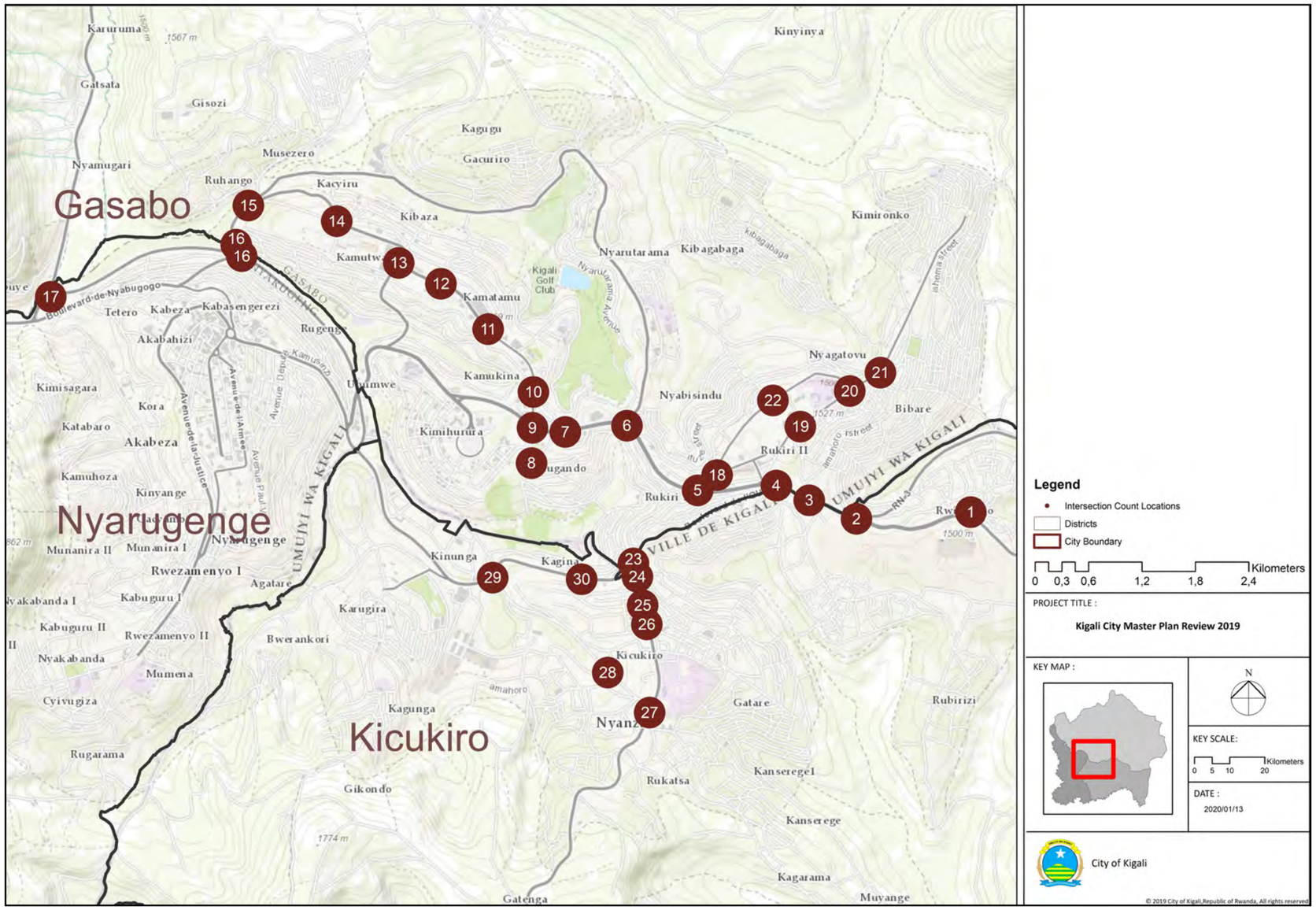


Figure 3.11 2018 Intersection Traffic Count Locations

- Intersection 18: KG11 / KG113
- Intersection 19: KG11 / KG13
- Intersection 20: KG11 / KG17
- Intersection 21: KG11 / KG19
- Intersection 22: KG11 / KG16
- Intersection 23: KN3 / KK15
- Intersection 24: KK19 / KK15
- Intersection 25: KK15 / KK10
- Intersection 26: KK15 / KK21
- Intersection 27: KK15 / KK8
- Intersection 28: KK8 / KK34
- Intersection 29: KK8 / KN3
- Intersection 30: KN3 / KK10

The locations of the intersection traffic count surveys are illustrated in Fig.3.11.

It was found that the peak hour for the AM period is 07:30 – 8:30 and the peak hour for the PM period is 17:00 – 18:00.

The average vehicular modal split for the AM peak hour is shown in Fig. 3.12.

The average vehicular modal split for the 2018 PM peak hour is shown in Figure 3.13.

It can be seen that in the majority of the cases, the largest part of the vehicular traffic can be attributed to motorcycles (moto-taxis) followed by private cars.

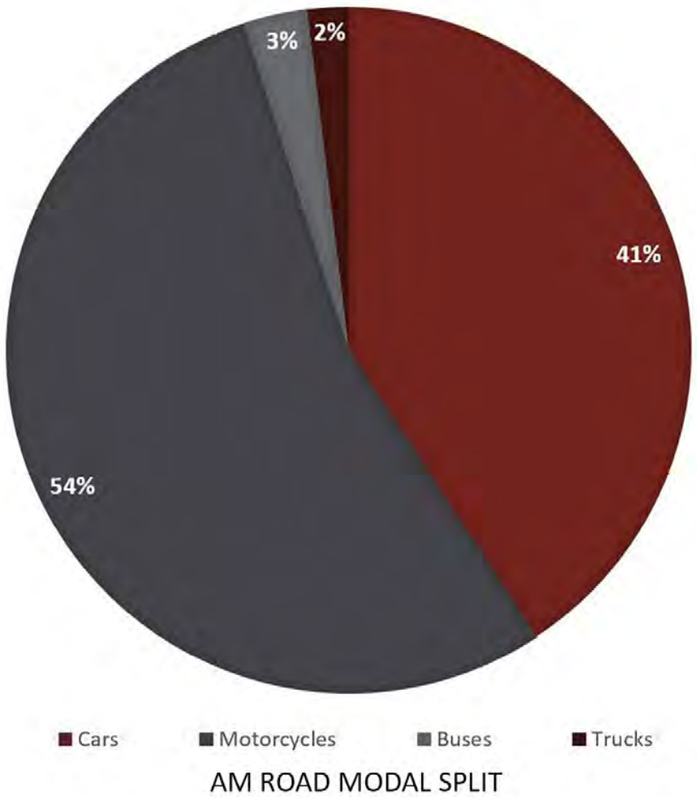


Figure 3.12 2018 AM Peak Hour Vehicular Mode Split based on Intersection Count Survey

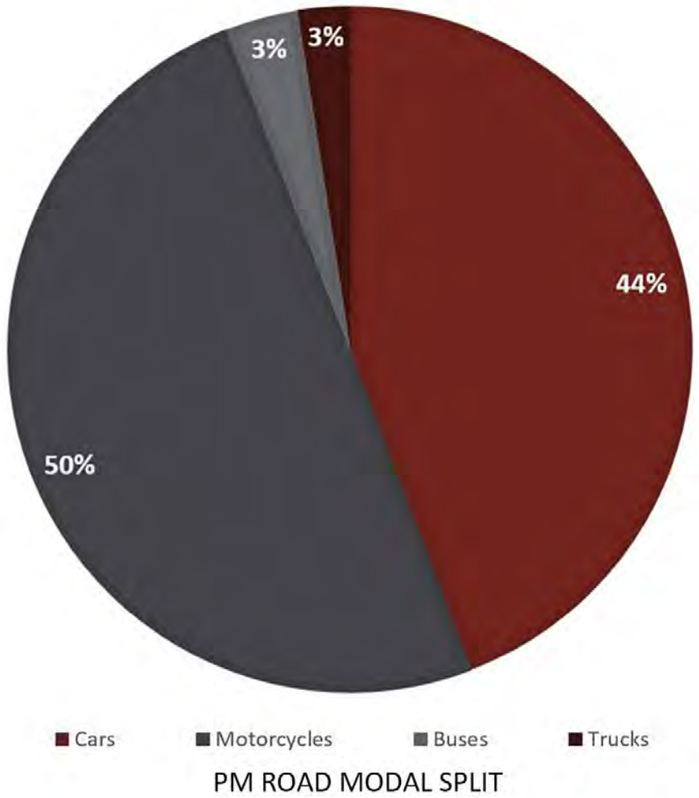


Figure 3.13 2018 PM Peak Hour Vehicular Modal Split based on Intersection Count Surveys

3.2.2 Link Traffic Count Survey Data

Classified link traffic count surveys were conducted at 30 locations along identified links between 06:00 and 09:00 AM. These counts were conducted in 15-minute intervals at each location.

The following vehicle classes were considered:
- Cars;
- Motorcycles (moto-taxis);
- Buses; and
- Trucks.

The major links providing access to/from the wider Kigali and three additional areas of interest were identified to be surveyed as illustrated in Fig.3.14. These were:

1. Entire Kigali Region (Link Counts 1, 2, 3, 4, 5, 6)
2. Airport (Intersection Count 2; Link Counts 7, 25, 27, 8)
3. CBD (Link Counts 22, 23, 16, 30)
4. Nyabugogo Taxi Rank (Intersection Count 10; Link Count 17)

The locations of the link traffic count surveys are illustrated in Fig.3.15.

These survey locations were:
- Link 1: RN 2 near Murambi
- Link 2: KK 3 Road near Nyagasamba
- Link 3: KK 15 Road near Kayumba
- Link 4: Unnamed Road
- Link 5: RN 4 near Shyorongi
- Link 6: KK 3 Road near Kamashashi
- Link 7: KK 15 Ave between KG 24 Street and KK 3 Road
- Link 8: KK 20 Ave between KK 7 Street and KK 142 Street

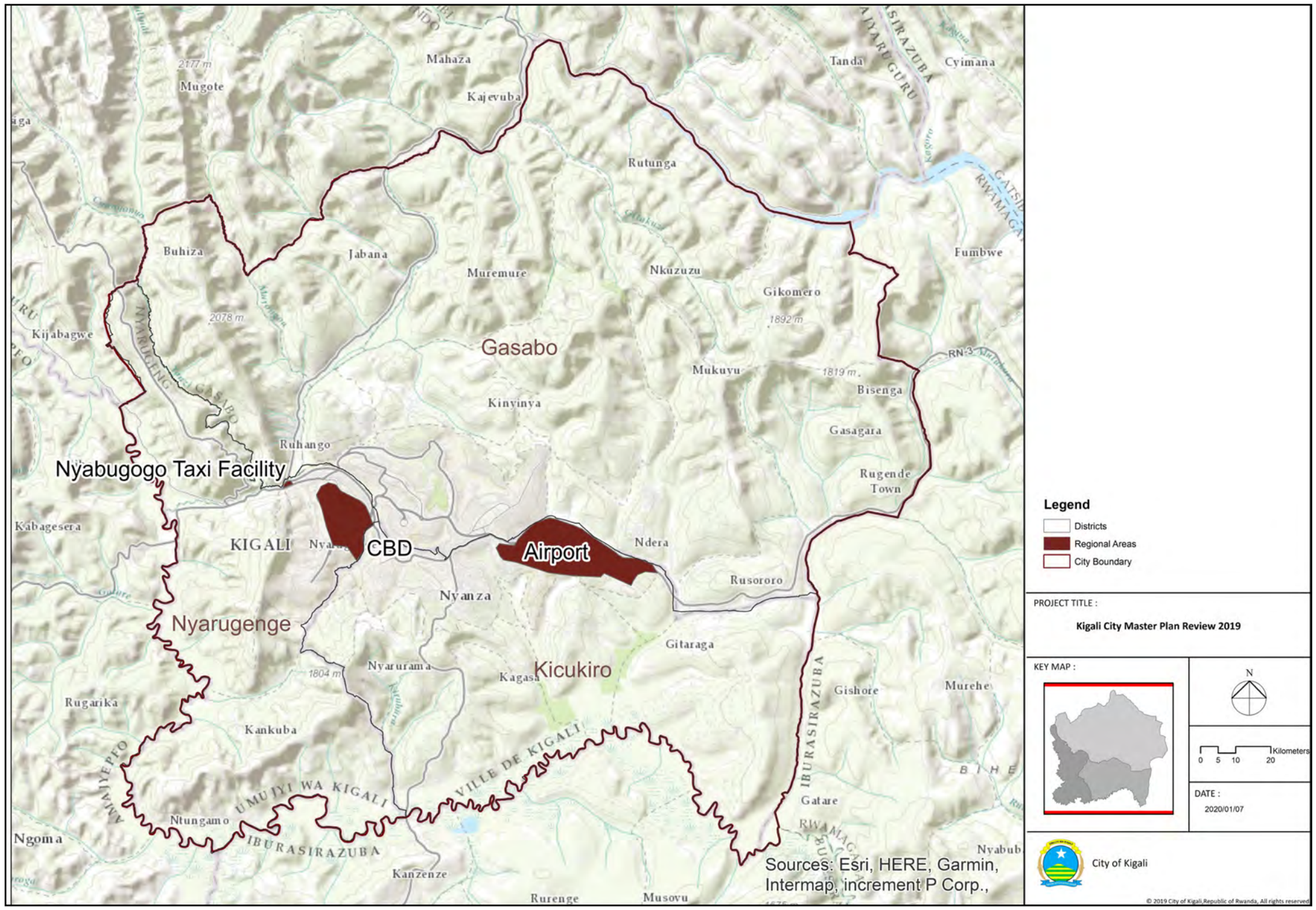


Figure 3.14 Surveyed Areas of Interest

- Link 9: KN 5 Road between KK 122 Street and KK 3 Road
- Link 10: KN 1 Road between KN 7 Road and RN 4
- Link 11: KG 9 Ave between KG 12 Ave and KG 15 Ave
- Link 12: KN 7 Road between Kigali-Gatuna Road and KN 8 Ave
- Link 13: KG 11 Ave between KG 27 Ave and Unnamed Road
- Link 14: KG 537 Street near KG 13 Ave
- Link 15: KN 3 Road between KK 697 and KK 4 Ave
- Link 16: KN 3 Road near KN 7 Road
- Link 17: RN 4 near KN 1 Road
- Link 18: KK 231 Street between KK 18 Ave and KK 160 Street
- Link 19: KG 14 Ave between KG 693 Street and KN 8 Ave
- Link 20: KG 33 Ave between KG 15 Ave and KG 693 Street
- Link 21: KG 15 Ave between KG 564 Street and KG 493 Street
- Link 22: KN 2 Ave between KN 170 Street and KN 168 Street
- Link 23: KK 2 Ave between KN 68 Street and KK 4 Ave
- Link 24: KN 7 Road between KN 14 Street and KN 8 Ave
- Link 25: KK 13 Ave between KG 196 Street and KK 3 Road
- Link 26: KK 15 Road between KK 30 Ave and KK 32 Ave
- Link 27: Unnamed Road near KK 3 Road and KK 22 Ave
- Link 28: Kigali- Gatuna Road (NR 3) near NR 2
- Link 29: Unnamed Road near KK 3 Road
- Link 30: KN 3 Road between KN 3 Street and KN 5 Street

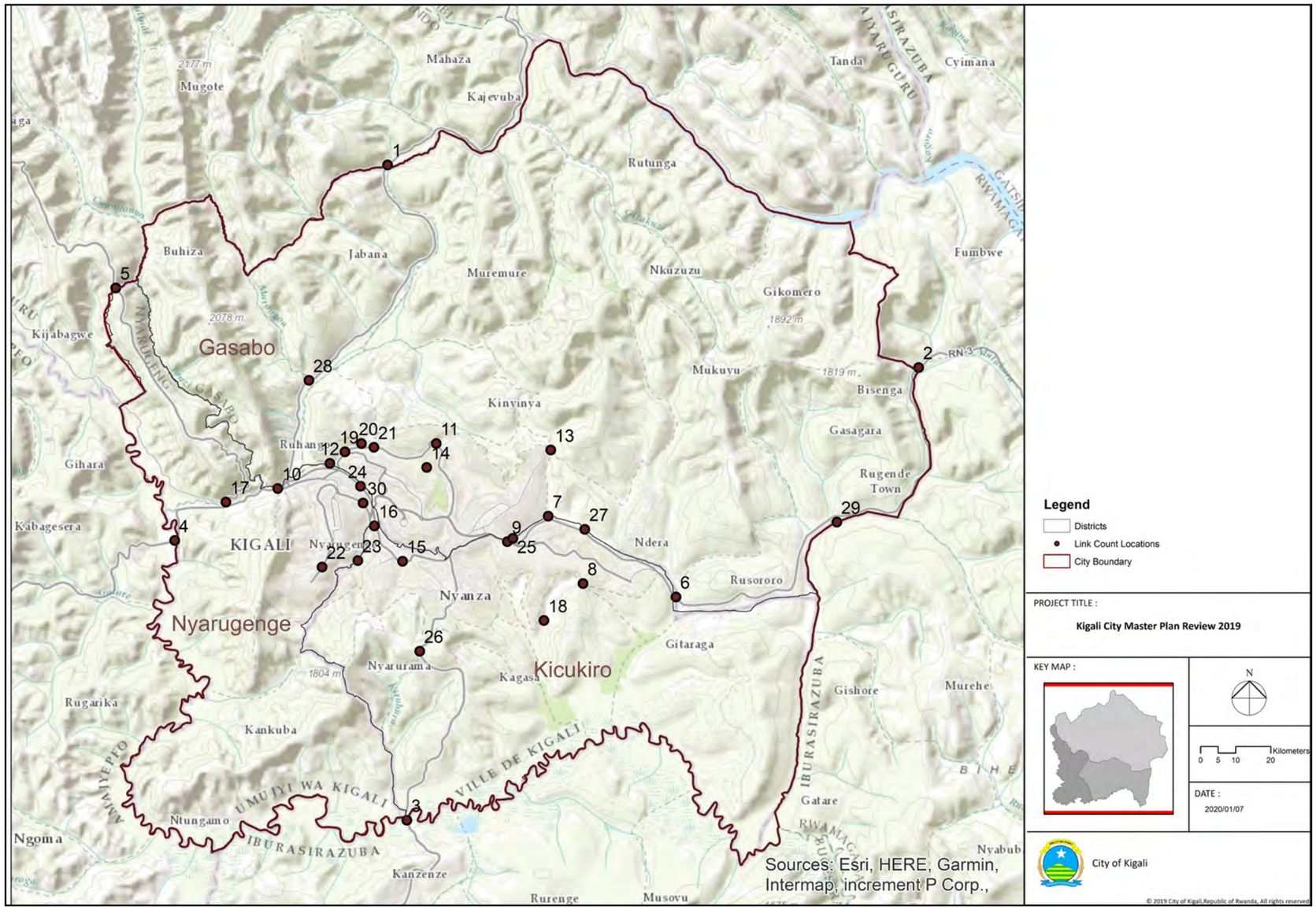


Figure 3.15 2018 Traffic Link Count Survey Locations

The 2018 AM peak period directional split for respective surveyed areas of interest is illustrated in Figure 3.16.

When analysing the entire network of observed link locations in the peak hour AM period, the vehicular modal split is illustrated in Figure 3.17. Vehicular traffic can mostly be attributed motorcycles (moto-taxis), followed by private cars. Non-motorised transport (NMT) was not surveyed as part of this exercise, but it's mode share was captured as part of the Household Travel Surveys and is reported on in Section 3.1.

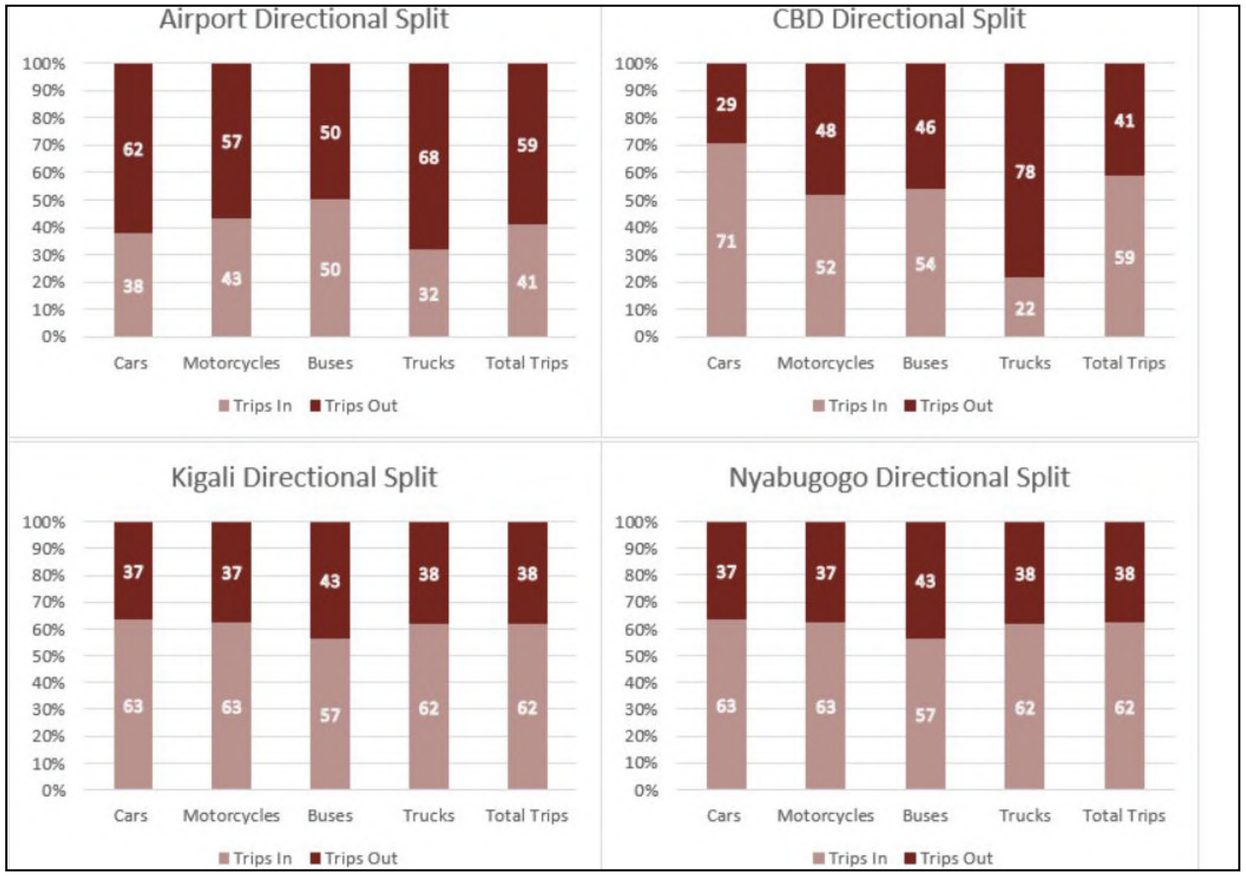


Figure 3.16 2018 AM Peak Hourly Directional Split

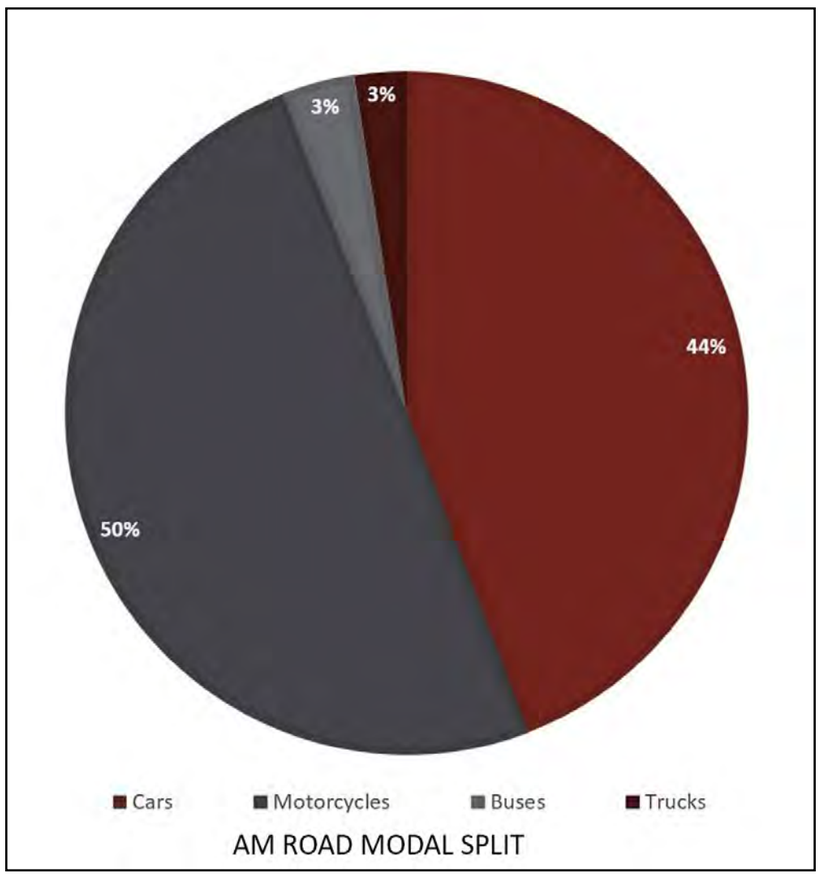


Figure 3.17 2018 AM peak hour Vehicular Modal Split According to Link Traffic Count Survey Data

3.3 Journey Time Survey Data

The routes indicated in Figure 3.18 were driven by car in the 3-hour AM period and the journey times recorded and verified against the predicted journey times provided by Google Maps.

The recorded journey times are listed in Table 3.1

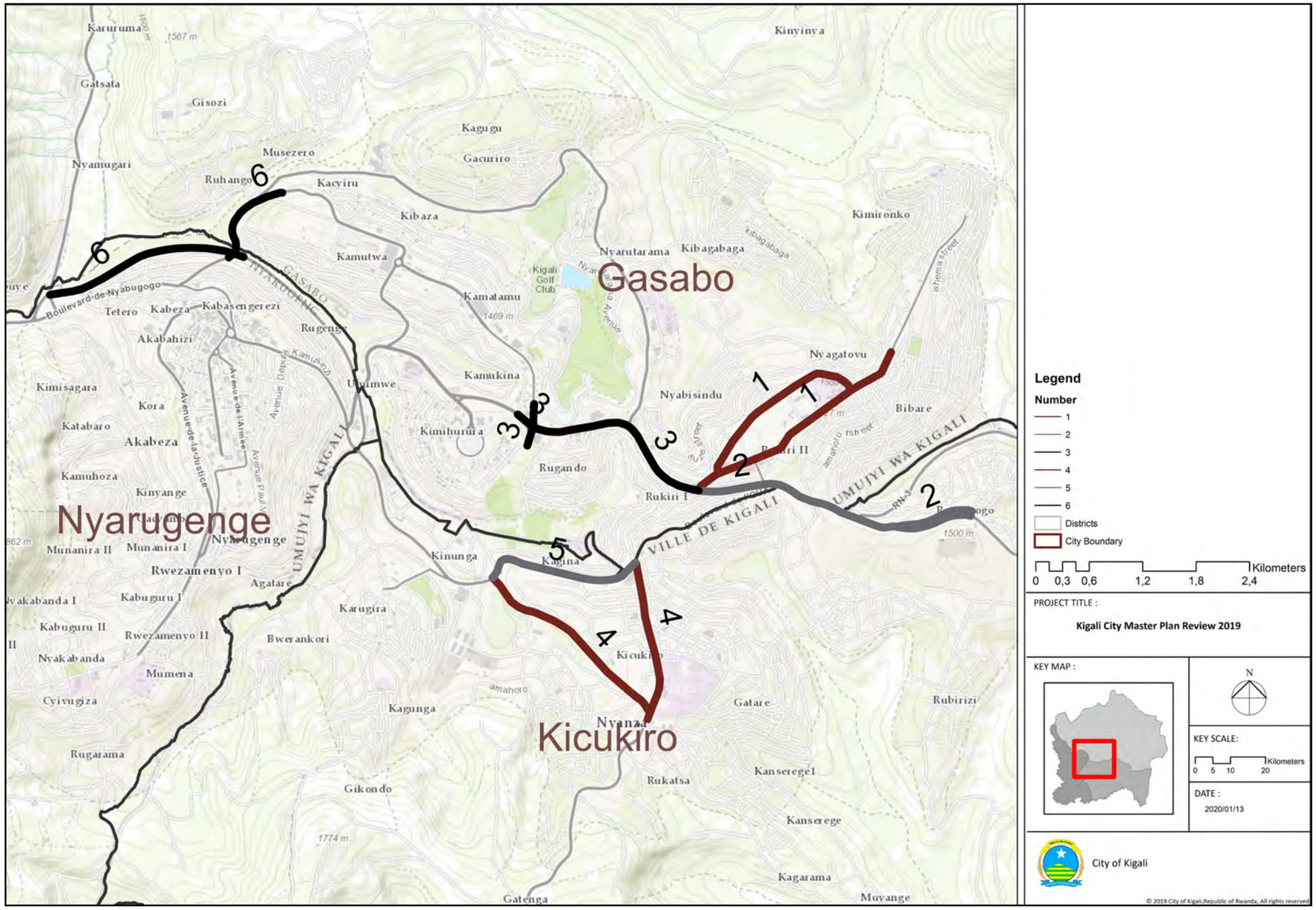


Figure 3.18 Corridor Journey Time- 2018 Survey Locations

Corridor Number	Description	Surveyed Travel Time (min)- West to East or Clockwise	Surveyed Travel Time Reverse (min)- East to West or Anti-Clockwise	Google Maps Travel Time (min)	Google Maps Travel Time Reverse (min)
Corridor 1	Stadium Link	11.5	N/A	12	12
Corridor 2	Airport Section	5	5.5	6 to 10	4 to 7
Corridor 3 + Link	Embassy Section	11	13	9 to 14	9 to 14
Corridor 4A-B	University Section	12	N/A	10	9
Corridor 5	Interchange Section	7	10	6 to 10	6 to 12

Table 3.1 2018 AM Peak Hour Corridor Journey Times

3.4 Road Network

3.4.1 Overview

Since adoption of the 2013 Transport Master Plan, many road infrastructure projects have been implemented in Kigali. The road network has been improved, upgraded and rehabilitated in the past five years. The city topography, consisting of mainly valley and hills, remains as a natural guide and restricting for the road network infrastructure development.

Congestion in the City is developing rapidly which wastes fuel, increases travel time, causes additional pollution and can reduce safety. Congestion is also an impedance to public service vehicles such as ambulances and trucks.

An all-weather road is a road that can be used in all weather conditions and that is not flooded by rain. This mostly means paved roads but could also mean well-maintained unpaved roads. According to the Fifth Integrated Household Living Conditions Survey (EICV 5) (2018), the percentage regular usage rates for all-weather roads for Kigali City decreased from 90.7% in 2013/14 to 86.8% in 2016/17, however the number of residents living within 19 minutes' walk of the nearest all-weather road increased from 97.5% to 98.8%. Fig.5.19 shows the percentage of people living different distances to all-weather roads in Kigali City in 2016/17. As can be seen in the chart, only 1% of Kigali City residents live more than 500m from an all-weather road.

The 2013 Kigali Transport Master Plan stated that only 14% of the 732km road network in Kigali was paved. The majority of roads in Rwanda are still unpaved. Major paved roads only occur in the urbanized areas of the City and most of the roads in the rural areas are in the form of mud tracks.

New housing projects have come with the development of roads, sidewalks and other street infrastructure. According to the Statistical Year Book 2017 for Rwanda, 22% of roads in Rwanda were paved in 2016. This is shown in Figure 3.20. There has been an increase in the number of roads that have been paved in Rwanda and this national trend is understood to be evident in Kigali as well.

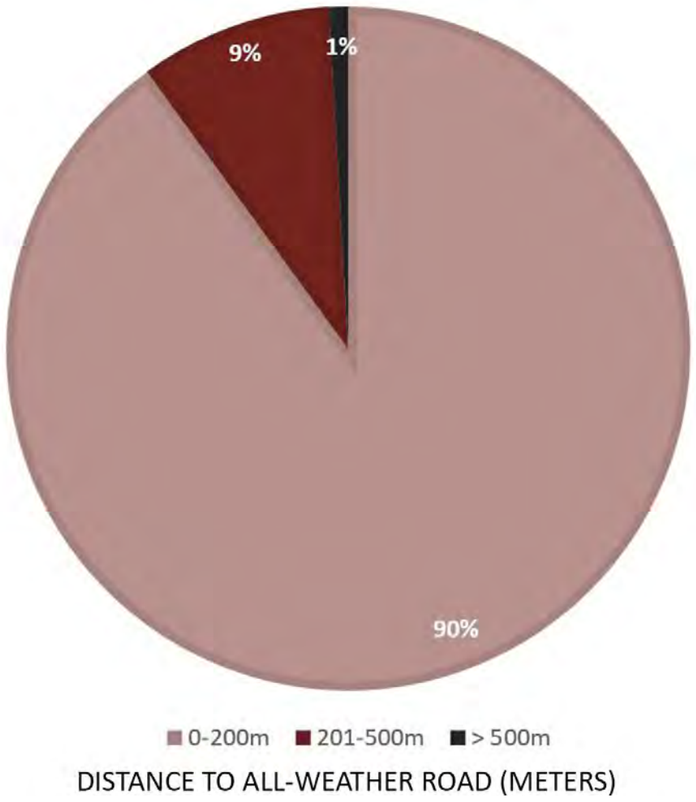


Figure 3.19 Distance to All-Weather Road (m) for Kigali City, 2018 (Source: EICV 5, 2018)

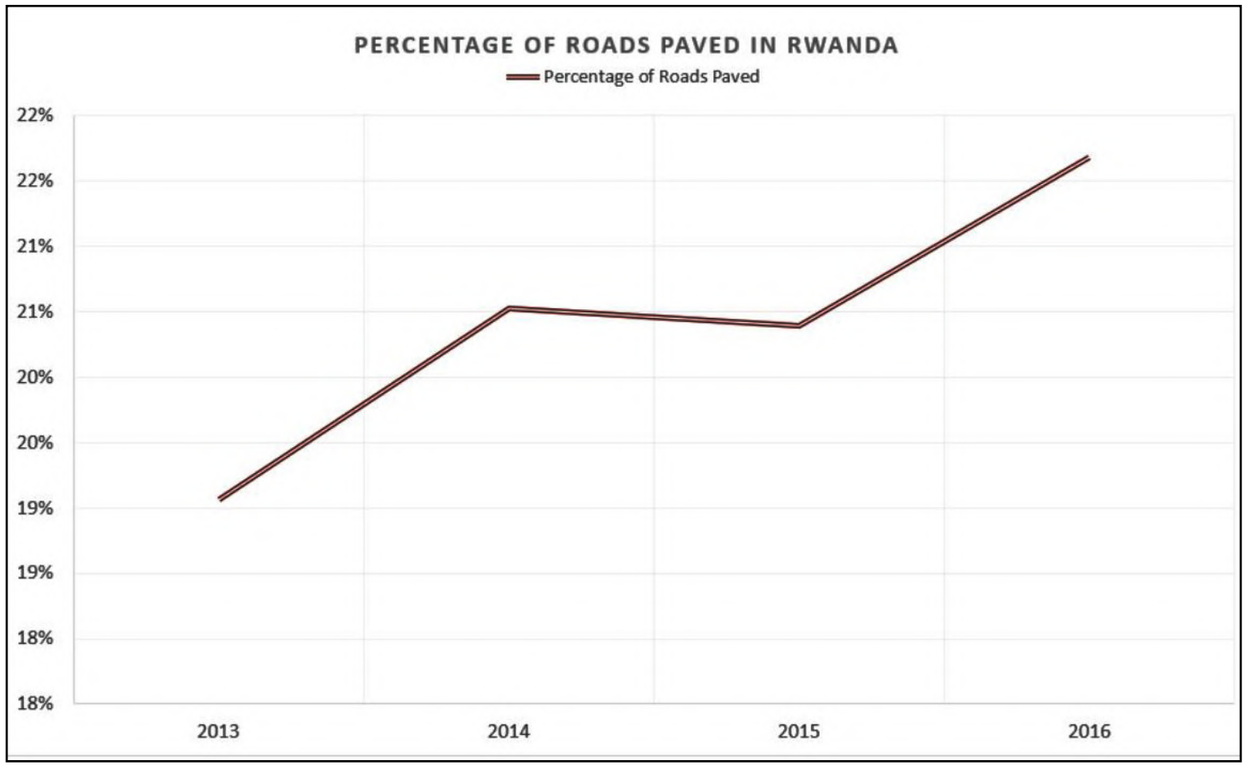


Figure 3.20 Percentage of Roads Paved in Rwanda- (Source: Statistical Yearbook for Rwanda 2017

The Figure 3.21 shows the Kigali City Road Network in 2018. The road classification in this figure shows that only major arterials and minor arterials can currently be identified in terms of observed speed, traffic volume, raod capacity and right of way. The road classification has been reviewed and updated as part of this Updated Transport Master Plan report, as discussed in Section 3.4.2.

Nationally, Kigali City is well-connected to other parts of Rwanda and beyond by the National Road network.

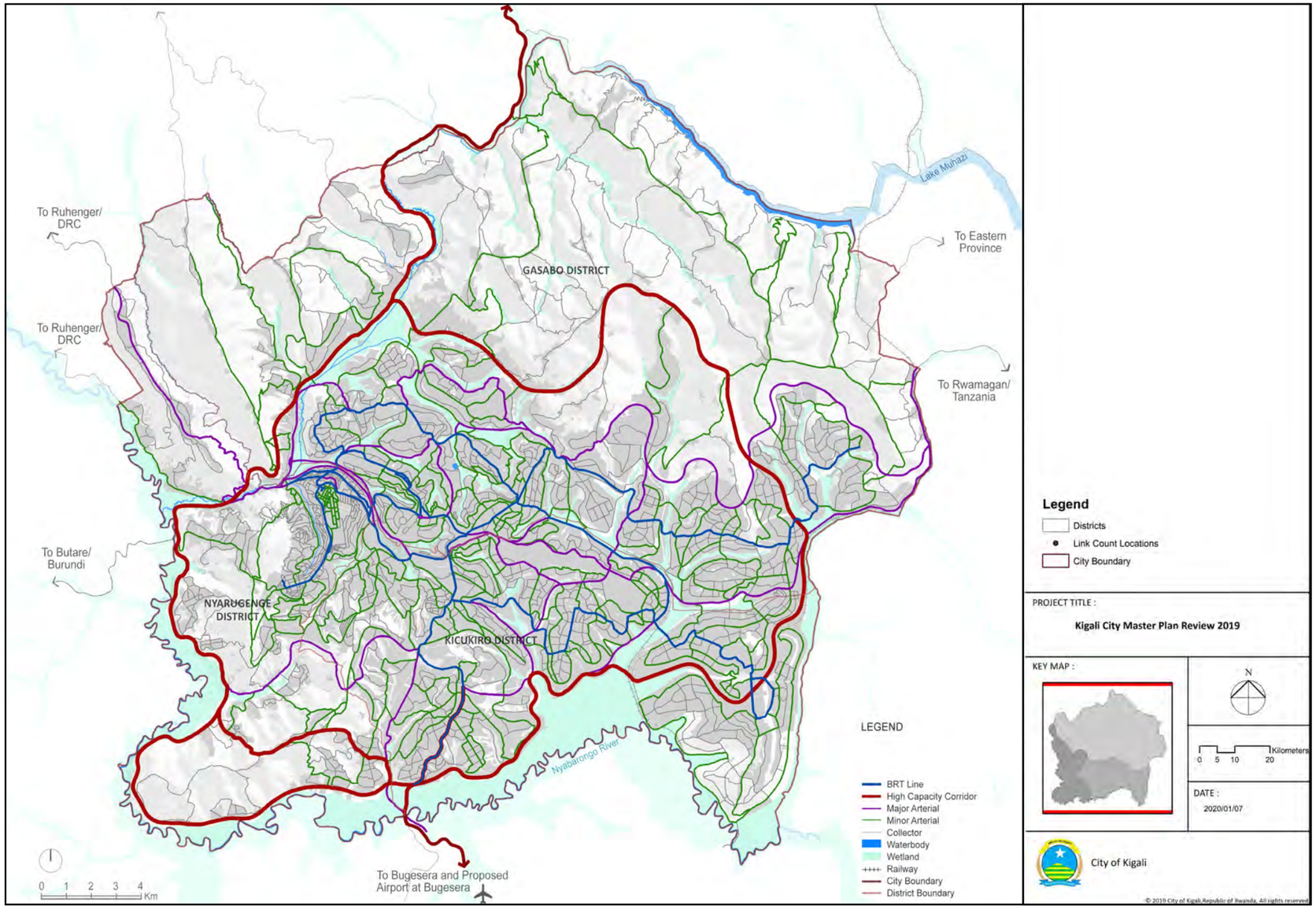


Figure 3.21 Road Network

3.4.2 Road Classification

The Rwandan government has published Official Gazette No. 04 of 23/01/2012 to establish the law governing the roads in Rwanda. The Official gazette states that public road network shall comprise the following classifications:

- **National roads:** National roads shall be those comprising the following categories:
  - o International roads that link Rwanda with neighbouring countries;
  - o Roads that link Districts or that link a District and the CoK;
  - o Roads that link areas of tourist significance and facilities of national or international importance such as ports and airports.
- **Districts and City of Kigali roads and that of other urban areas – Class 1**
  - o Class 1 shall be roads linking different Sectors' headquarters within the same District, or those roads that are used within the same Sector.
- **Districts and City of Kigali roads and that of other urban areas - Class 2**
  - o Districts and CoK roads and that of other urban areas - Class 2 shall be arterial roads that connect Districts roads to rural community centres that are inhabited as an agglomeration.
- **Specific roads**
  - o Specific roads shall be those specifically constructed to connect national roads or District roads to Kigali City and other urban areas to the centres for private sectors activities such agricultural production, natural resources processing or to tourist sites.

The gazette also stipulates road dimensions such as the minimum lane width, minimum carriageway width and road reserve. The Rwandan government has published a Special Official Gazette of 03/12/2015 to establish the law governing the road reserves in Rwanda. The road reserve includes embankments, edge areas, bollards, road lighting facilities, storm water drainage facilities, grassy strips, central median strips, hard and soft shoulders, fills, walls, stairs, bridges, tunnels, technological and artistic works, road signs and other elements related to road. This is shown in Table 3.2 (source: Transport Master Plan for the City of Kigali, Rwanda (2013)).

The official Gazette (03_12_2015) also states the following:

"However, the dimensions of the road reserve for the City of Kigali and other urban areas shall be determined in respect of provisions of the master plan of the City of Kigali or other urban area irrespective of the road classification".

Road Class	Definition	Lane Width (m)	Road Width (m)	Total Road Reserve (m)
National Roads	International roads that link Rwanda with neighbouring countries;	3.52 m	-	44 m
	Roads that link Districts or that link a District and the CoK;			
	Roads that link areas of tourist significance and facilities of national or international importance such as ports and airports			
Districts and CoK roads and that of other urban areas - Class 1 Roads	Roads linking different sector headquarters within the same District, or those roads that are used within the same sector.	3.52 m	-	44 m
Districts and CoK roads and that of other urban areas - Class 2 Roads	Arterial roads that connect Districts roads to rural community centres that are inhabited as an agglomeration.	-	6.03 m	24 m
Specific Roads	Roads specifically constructed to connect national roads or District roads to Kigali City and other urban areas to the centres for private sector's activities such agricultural production, natural resources processing or to tourist sites.	-	-	-

Table 3.2 National Road Classes

Table 3.3 shows the road reserves and other dimensions for roads within Kigali from the 2013 Kigali Transport Master Plan.

Types	High Capacity Urban Roads	Major Arterial Roads				Minor Arterial Roads			Collector Roads	
	Trunk Roads		Bus Rapid Transport	Link Roads	CBD Throughfare		Bus Routes	Commercial Streets	Residentail Streets	Rural Road
Design Speeds & Geometry										
Maximum Speed Limit	90-120 km/h	75 – 90km/h	40 – 75 km/h	75 – 90 km/h	40 – 75 km/h	40 – 75 km/h	30 – 60 km/h	30 – 40 km/h	30 – 40 km/h	75 – 90 km/h
Geometry Design to International Standards										
Street Dimensions										
Desirable Road Reserve Width	37 – 44 m	34 – 37 m	34-40m	34 – 37 m	28 – 37 m	22 – 27 m	27 m	27 m	18 – 22 m	18 – 22 m
Typical number of lanes per direction	2 – 5 lanes	2 – 4 lanes	2 – 3 lanes	2 – 3 lanes	2 – 3 lanes	1 – 2 lanes	1 – 2 lanes	1 – 2 lanes	1 – 2 lanes	1 – 2 lanes
Minimum Carriageway Width	3.5 m per lane	3.5 m per lane	3.5 m per lane	3.5 m per lane	3.5 m per lane	3.5 m per lane	3.5 m per lane	3.5 m per lane	3 m per lane	4 m per lane
Median Width	4 m	1 – 4 m	1 – 4 m	0.6 – 4 m	0.6 m	0.6 m	0.6 m	0.6 – 2 m	-	-
Hard Shoulder	3 m	-	-	-	-	-	-	-	-	-
Easement / Verge	2.5 – 6 m	2.5 – 6 m	-	-	-	-	-	-	-	2 – 3.5 m
Footway	-	-	1.5 m min	1.5 m min	1.5 m min	1.5 m min	2 m min	2 m min	1.5 m min	-
Cycleway	-	-	1.5 m min	1.5 m min	1.5 m min	1.5 m min	1.5 m min, or omit	1.5 m min, or omit	1.5 m min	-
Planting Strip	-	-	2 m	2 m	2 m	2 m	2 m	2 m	2 m	-
Vehicular Crossovers	No	No		No	No	No	Yes	Yes	Yes	Yes
Traffic Calming	No	No		No	No	No	Yes	Yes	Yes	-
On-street Car Parking	No	No		No	No	No	No	Short-term	Yes	-
Public Transport										
Bus Access	Not Recommended	Not Recommended	Not Recommended	Yes	Yes	Yes	Yes	Maybe	Maybe	Yes
Bus Stations				-	Maybe	Maybe	Yes	Maybe	Maybe	Yes

Table 3.3 Kigali Road Types (Kigali Transport Master Plan 2013)

The BRT sections are Major Arterial Roads as per the road types defined in Table 3.3. The BRT station cross-sections according to the BRT Feasibility Study and Preliminary Design (refer to Chapter 7.1.3), adheres to this road classification. Table 3.4 shows the classification and relative dimensions for BRT routes extracted from the BRT Feasibility Study and Preliminary Design Second Interim Report (2018).

3.4.3 Traffic Management Systems

Road intersections in Kigali consist of stop controlled intersections, signalized intersections and roundabouts. In the past 5 years, plans have been made to signalize previously stop controlled sections where the junctions warrant the upgrade because of the need to manage traffic flow. In some instances there are problems with ensuring the signals are operational. Signal optimization and synchronization is still a requirement for many of these intersections. The 2013 Transport Master Plan stated that there were 16 signalized intersections in the City. The International Journal of Computer Science Trends and Technology (Volume 6 Issue 3, 2018) count 15 traffic lights in the City. This number could not be confirmed but a decrease in traffic lights from 2013 is expected as some traffic lights were converted to roundabouts. These signalized intersections are not well coordinated and are often not in operation.

In efforts to control the unsafe high speeds in Kigali, the city introduced speed governors in 2016. These are set to a maximum of 60 km/h in public service

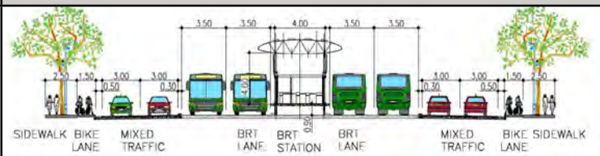
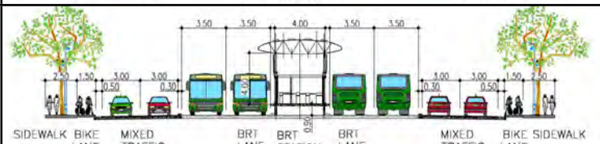
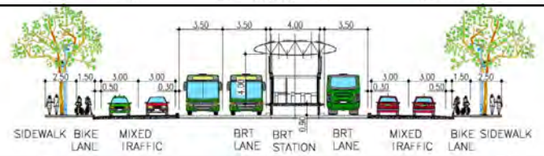
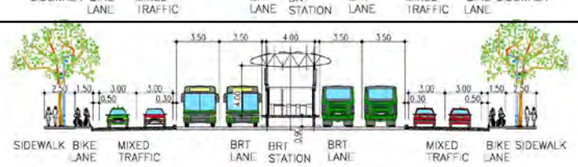
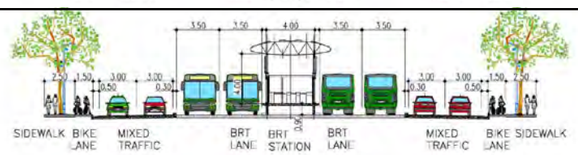
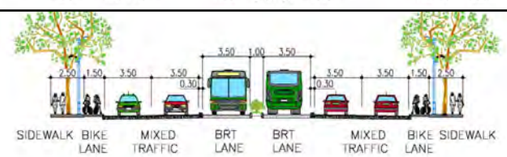
		Design Speed					
BRT infracture type	At station cross sections	Maximum Speed Limit	Desirable Road Reserve Width	Minimum Carriage Way	Vehicular Crossover	Traffice-Calmin	On-Street Parking
Type I Station		40-75 km/h	34-40 km/h	3.5 m/lane	No	No	No
Type II Station		40-75 km/h	34-40 km/h	3.5 m/lane	No	No	No
Type III Station		40-75 km/h	34-40 km/h	3.5 m/lane	No	No	No
Type IV Station		40-75 km/h	34-40 km/h	3.5 m/lane	No	No	No
Type V Station		40-75 km/h	34-40 km/h	3.5 m/lane	No	No	No
Type VI Station		40-75 km/h	34-40 km/h	3.5 m/lane	No	No	No

Table 3.4 BRT Cross Sections

vehicles and vehicles transporting goods. The project continues to face difficulties in implementation as some of the fleet have yet to install the governors and in others they are tampered with or removed. Vehicles that do not comply are stopped, suspended and face penalties. Speed governors have also been a part of the reason why public transport costs have risen early 2018. This seems to be due to an increase in stop-starting to adhere to speed limits, which in turn leads to an increase in fuel consumption.

In general traffic law enforcement officers are very visible and appear to maintain a good presence on the streets of Kigali.

3.4.4 Road Safety

According to police data, Kigali City road based accidents remain higher than the rest of Rwanda. In 2017, 71% of total registered road accidents involved motorcycles (moto-taxis), pedestrains and bicycles. The KN 7 road, the KN 5 Rroad and city circle juctions remain the hotspots for fatal accidents in Kigali as determined from a study done from the police database. The fatal accident hotspots of Kigali are represented in Figure 3.22. The information was extracted from the 2017 Rwanda Statistical Yearbook. No data was availble to distinguish between accidents involving pedestrian and cyclists.

The government has continued to implement safer road programs to educate road users on effective and safe usage of the road. In 2017 the government reviewed laws on road

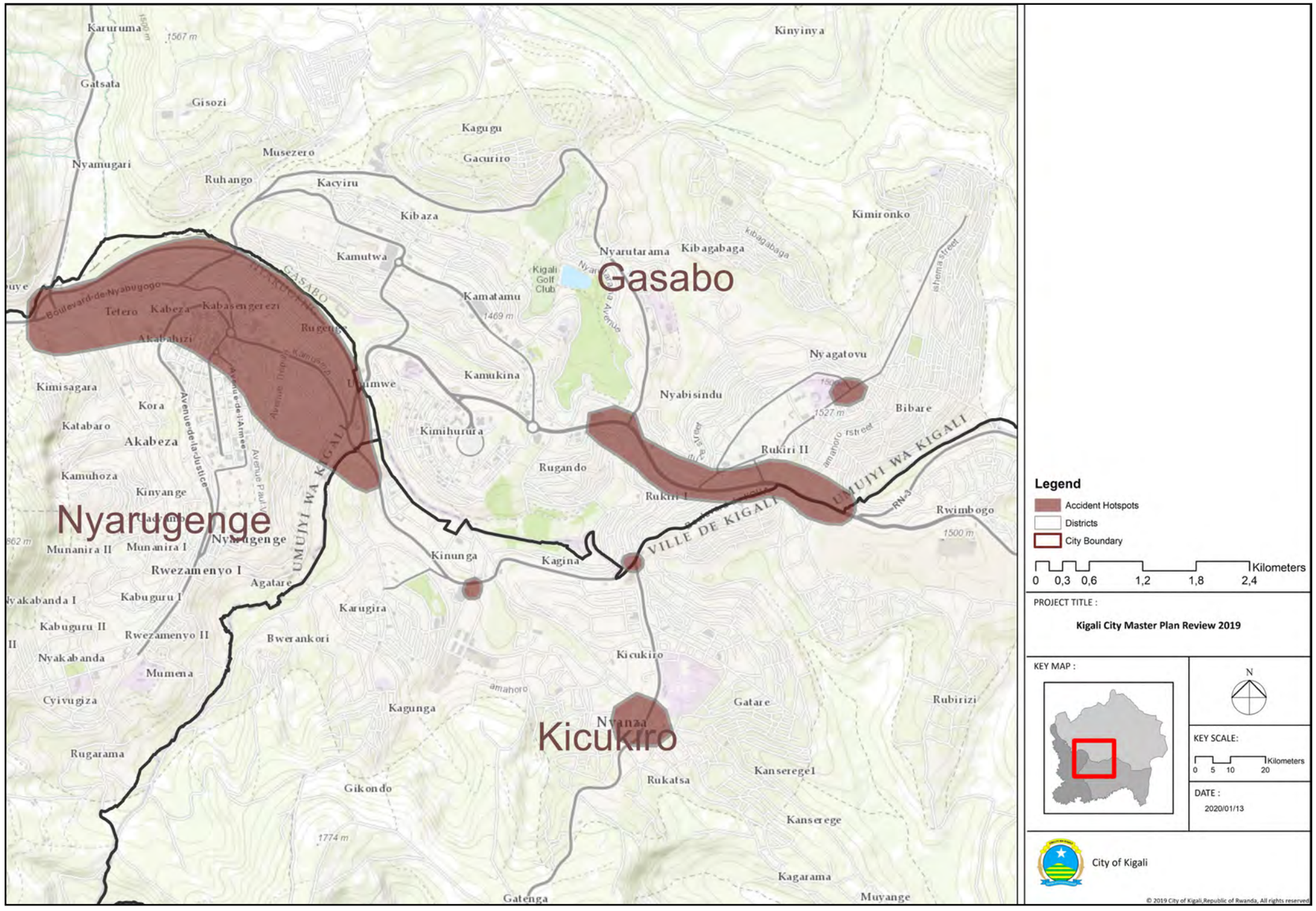


Figure 3.22 Fatal Accident Hotspots

safety to toughen penalties againts traffic offenders. They have also commited to implementing all possible strategies to enhance road safety measures as evident by a campaign launched by the Rwanda national police and minister of transport in 2017 to curb road accidents and promote road users respect road safety standards.

The police have been conducting road safety sessions among motorists, cyclists, members of the public and in schools from 21st May to 1st June 2018. Accident statistics are shown in Figure 3.23 and Figure 3.24.

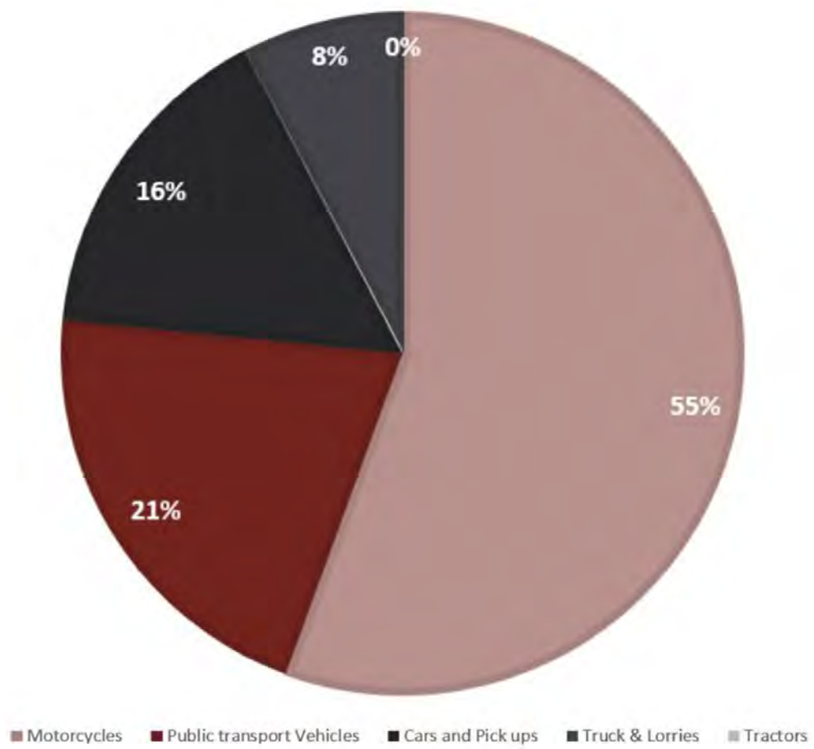


Figure 3.23 Rwanda: Percentage Mode Type for Injuries in Road Accidents, 2017

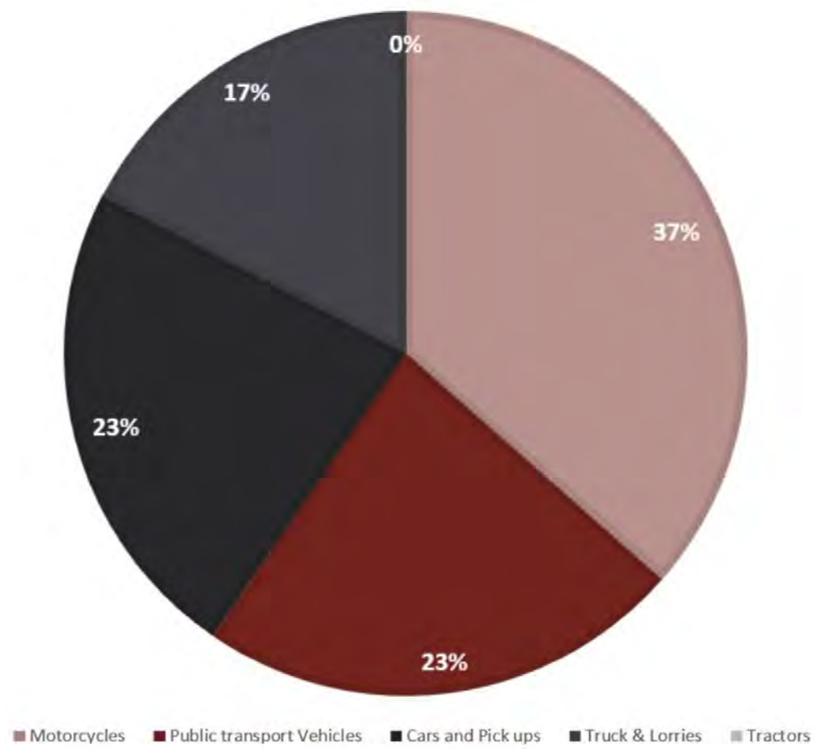


Figure 3.24 Rwanda Percentage Mode Type for Fatal Road Accidents.2017

3.5 Public Transport Network

3.5.1 Overview

The following public transport modes are currently (2018) available in Kigali. RURA fully regulates all motorised taxis. Public transport services can only be supplied by licensed operators:

5. Bus
6. Moto-Taxi
7. Car and Minibus Taxis
8. Bicycle Taxis
9. Air Transport

The graph in Figure 3.25 shows a comparison of Public Transport use in Kigali City between 2013/14 and 2016/17 according to the Fifth Integrated Household Living Conditions Survey (EICV 5) (2018). As shown in the graph, citizens of Kigali City are aware of public transport. The number of people who use public transport regularly or often has increased from 85.7% to 86.9%.

The pie chart in Figure 3.26 shows the 2016/17 walking time to public transport stages in Kigali City according to the EICV 5 (2018). About 40% of Kigali City residents have to walk more than 20 minutes to the nearest public transport stage.

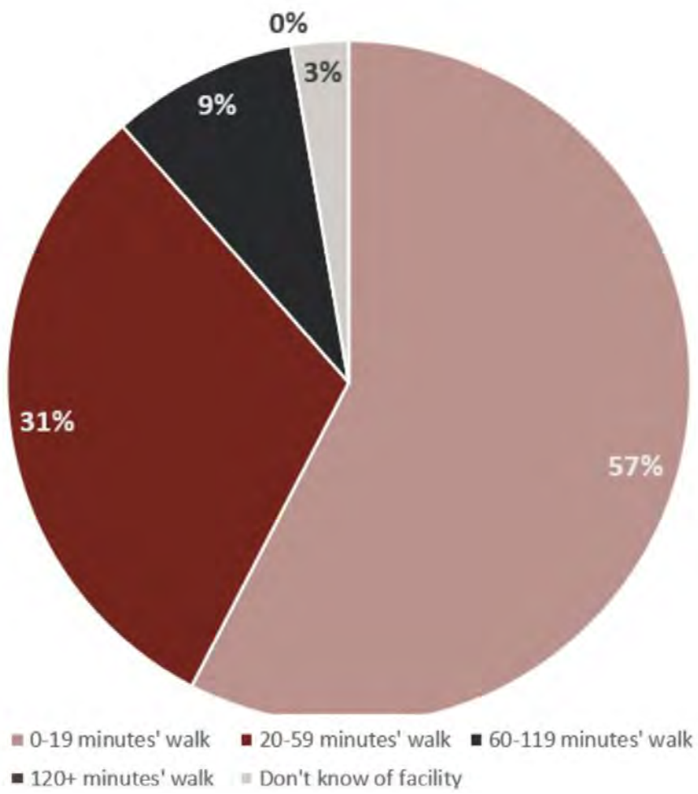
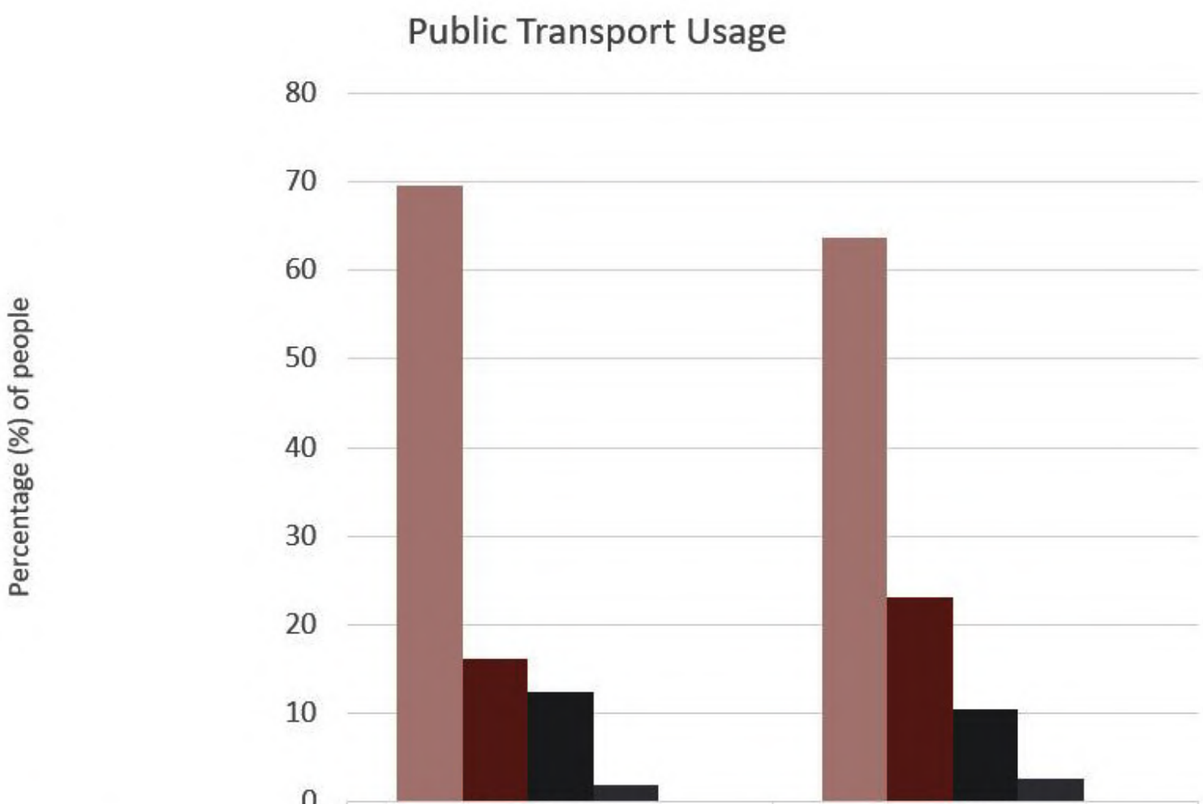


Figure 3.26 Walking Time to nearest Public Transport Stage (Source: EICV 5, 2018)



	2013/14	2016/17
Regularly	69,5	63,7
Often	16,2	23,2
Sometimes	12,4	10,5
Not at All	1,9	2,7
Don't know about this service	0,1	0

Figure 3.25 Public Transport Usage (Source EICV 5, 2018)

3.5.2 Buses

The RTDA Annual Report for 2016-2017 shows there were 865.5 km of scheduled bus routes in the City of Kigali which was much higher than the RTDA Annual Report target of 330km for 2017. The zones and bus routes are shown in Figure 3.27. These are operated by the following bus companies:

- Kigali Business Services (Zone I)
- Royal Express Limited (Zone II)
- Rwanda Federation of Transport Cooperatives (RFTC) (Zones III and IV)

Smartcard systems for the buses of the Kigali Bus Services and Royal Express Limited in Kigali have been adopted. Other bus companies are expected to adopt these systems in future.

The existing services have been seen as insufficient to deal with the increasing demand for public transport in the city and as a result, BRT is in the feasibility study and preliminary design phase.

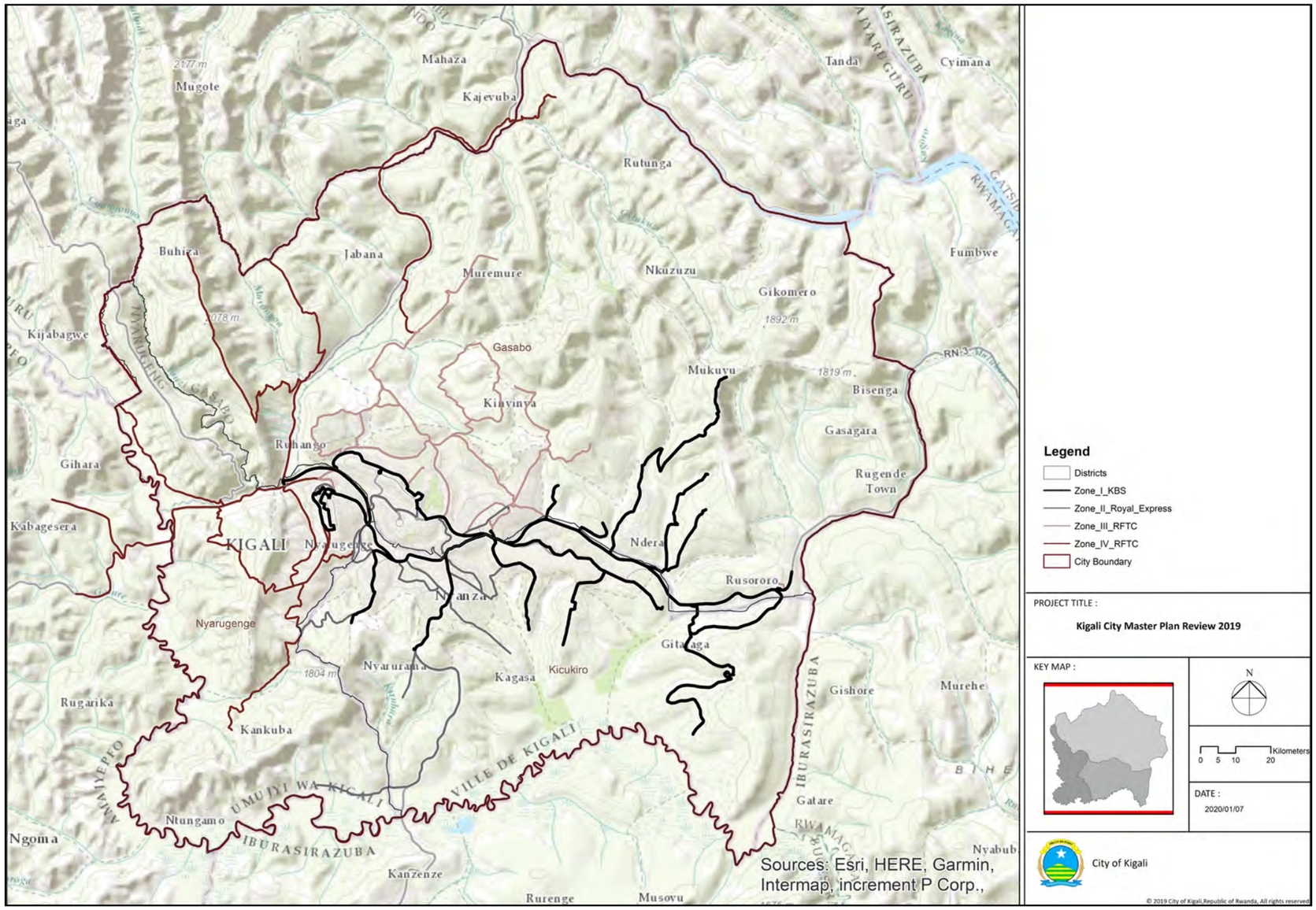


Figure 3.27 Existing (2018) Bus Routes in Kigali

The existing bus terminals are shown in Figure 3.28.

These bus terminals previously had no pedestrian facilities and pedestrians had to enter the bus terminals at the same vehicular access as the buses. Although some improvements have been implemented, additional pedestrian facilities at these terminals are still required.

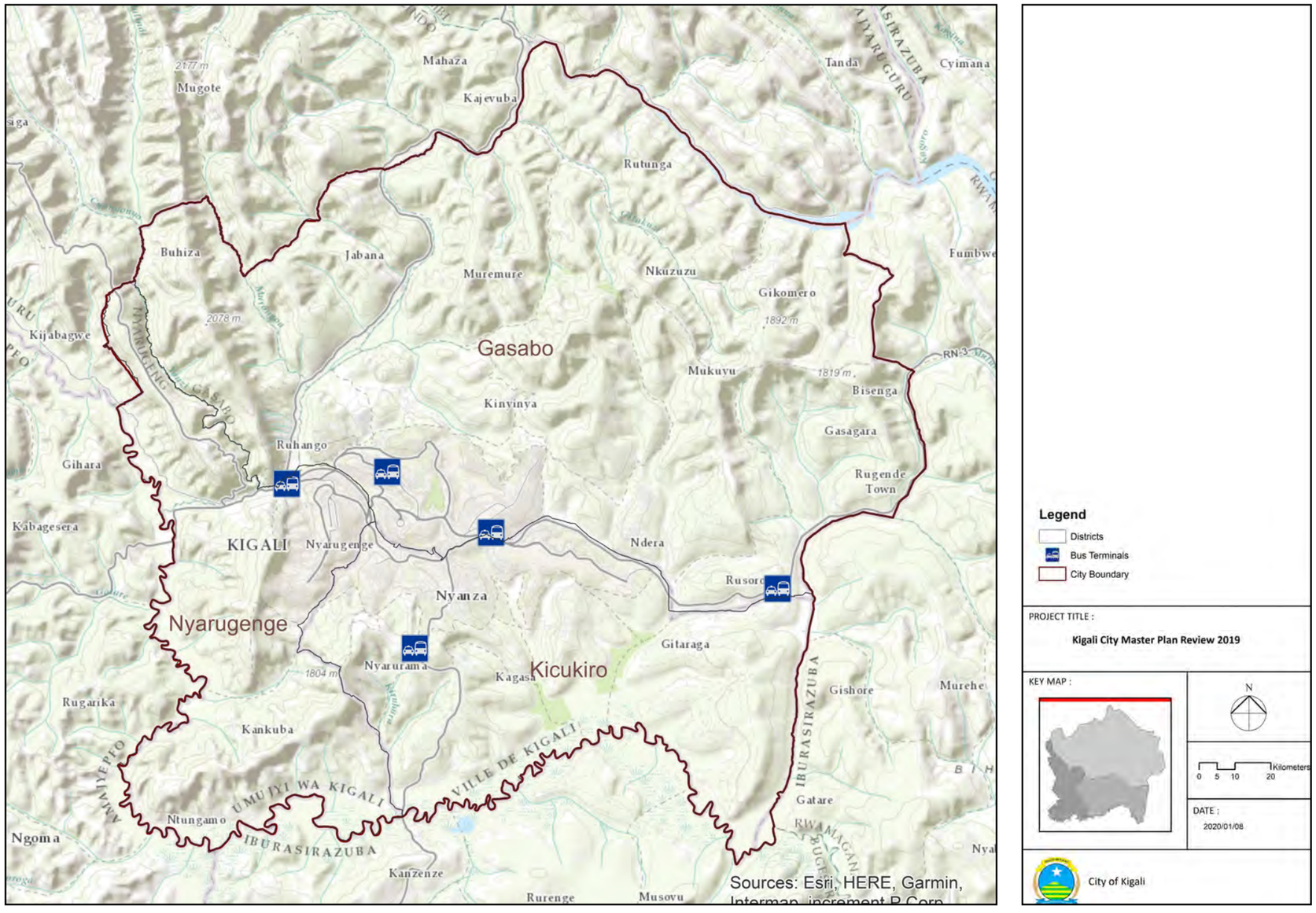


Figure 3.28 Bus Terminals, 2018

3.5.3 Motorcycles (Moto-taxis)

Moto-taxis are one of the main forms of transport in Kigali. Some moto-taxi operators have begun offering ride-hailing and an on demand services platform with cashless services.

The traffic count surveys done show that over 50% of vehicles on the road during peak hours are Moto-taxis. As can be seen in the graph in Figure 3.29, the number of licensed moto-taxis is increasing at a rate higher than that of other road vehicles. In 2017 around 70 000 moto-taxis were registered in Rwanda.

3.5.4 Air Transport

The Rwanda Civil Aviation Authority (RCAA) regulates and oversees civil aviation in Rwanda, including the Kigali International Airport. Kigali International Airport is one of two International Airports in Rwanda and is currently the principle passenger airport. It has one 3 500m x 45m runway. In recent years, the airport has undergone major upgrades, however the topography in the area limits the expansion of the airport and instead, a second airport outside the Kigali City (Bugesera International Airport) is being constructed to complement Kigali International Airport. Details of this project are included in Section 7.1.2.

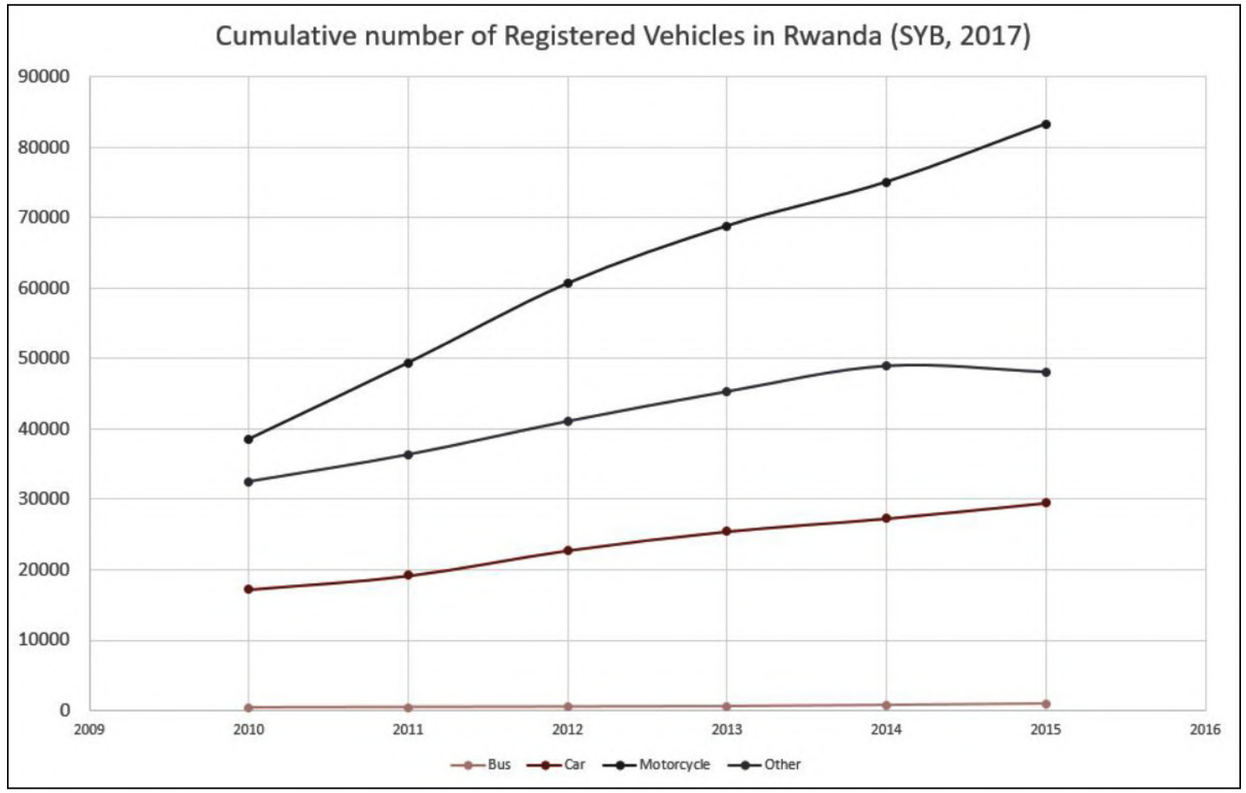


Figure 3.29 Number of Registered Vehicles in Rwanda, 2017

3.6 Freight Network

3.6.1 Road Freight Network

Kigali is located in the central of Rwanda, which places it in a good position as a stopping centre for freight travelling between international borders. Freight travel connectivity is shown in Figure 3.30. There are 5 points of entry into the City. The National Roads are well-developed in Rwanda, however at the moment runs through the City in an east-westerly direction. The National Route network is quite comprehensive and places Rwanda as collector point for goods in the surrounding areas.
A major border post in Gikondo, Kigali regulates the goods going into and through the city. Freight traffic travels through Kigali City. Heavy trucks are prohibited in the CBD during the day unless permission is given by traffic police.

The current Road Freight Network is shown in Figure 3.30.

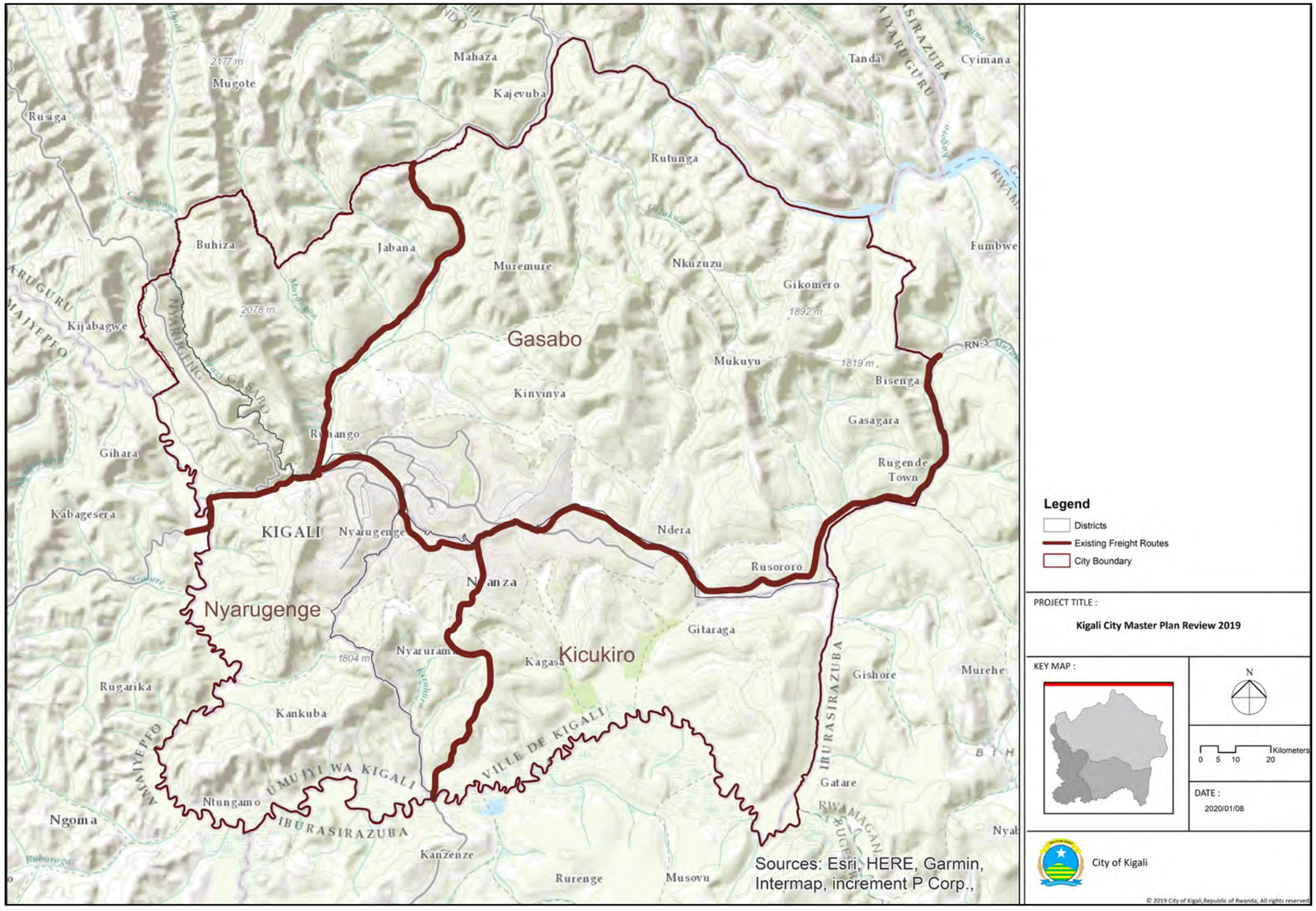


Figure 3.30 Existing Freight Routes in Kigali

The regional Northern Corridor comprises of the inter-country highway which connects Rwanda (Kigali) to Uganda (Kampala), and Kenya (Nairobi and Mombassa) as illustrated in Figure 3.31.

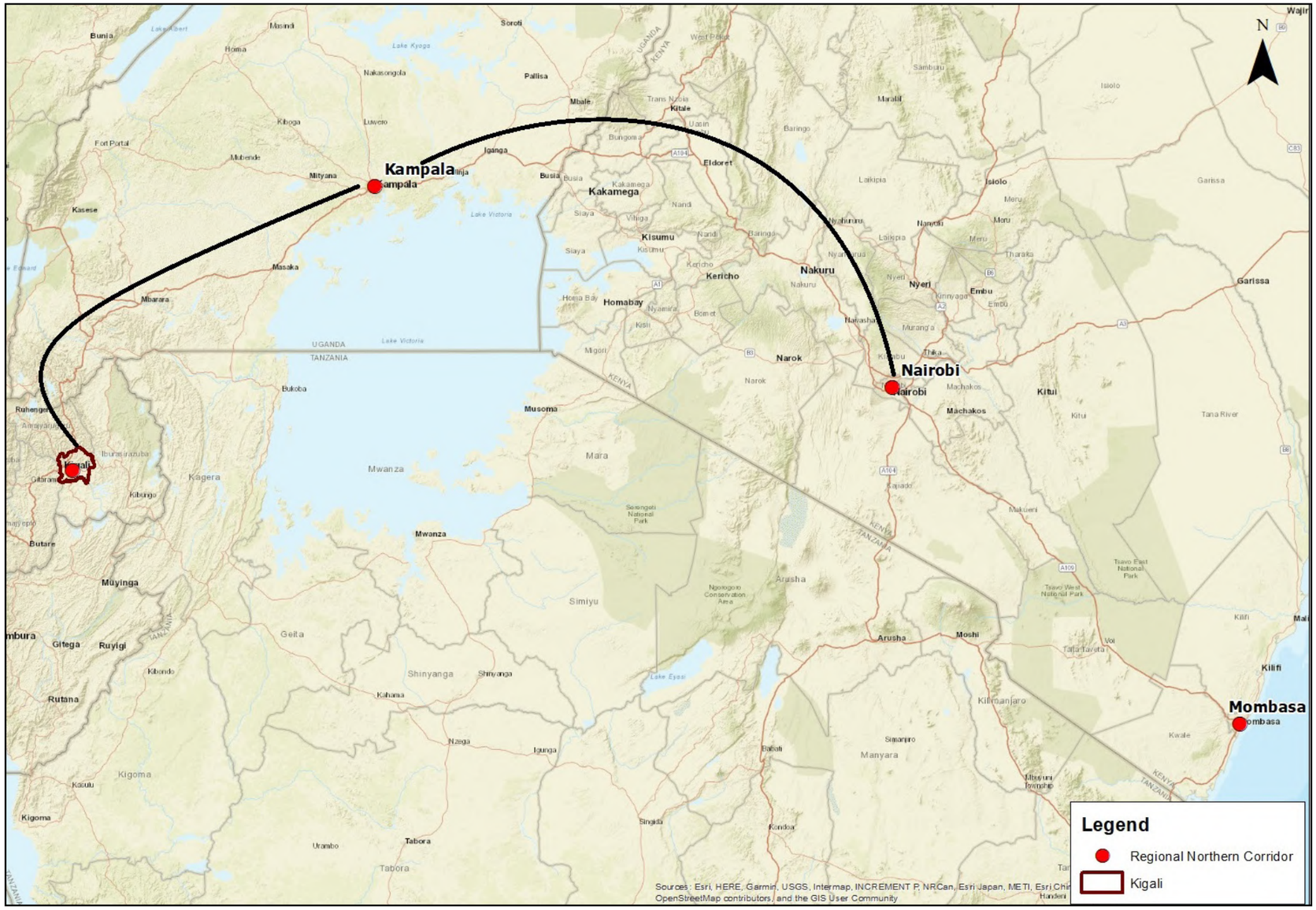


Figure 3.31 Regional Northern Corridor

The Central Highway corridor connects Rwanda (Kigali) to Tanzania (Dar-es-Salaam) and Burundi (Bujumbura) as illustrated in Figure 3.32.

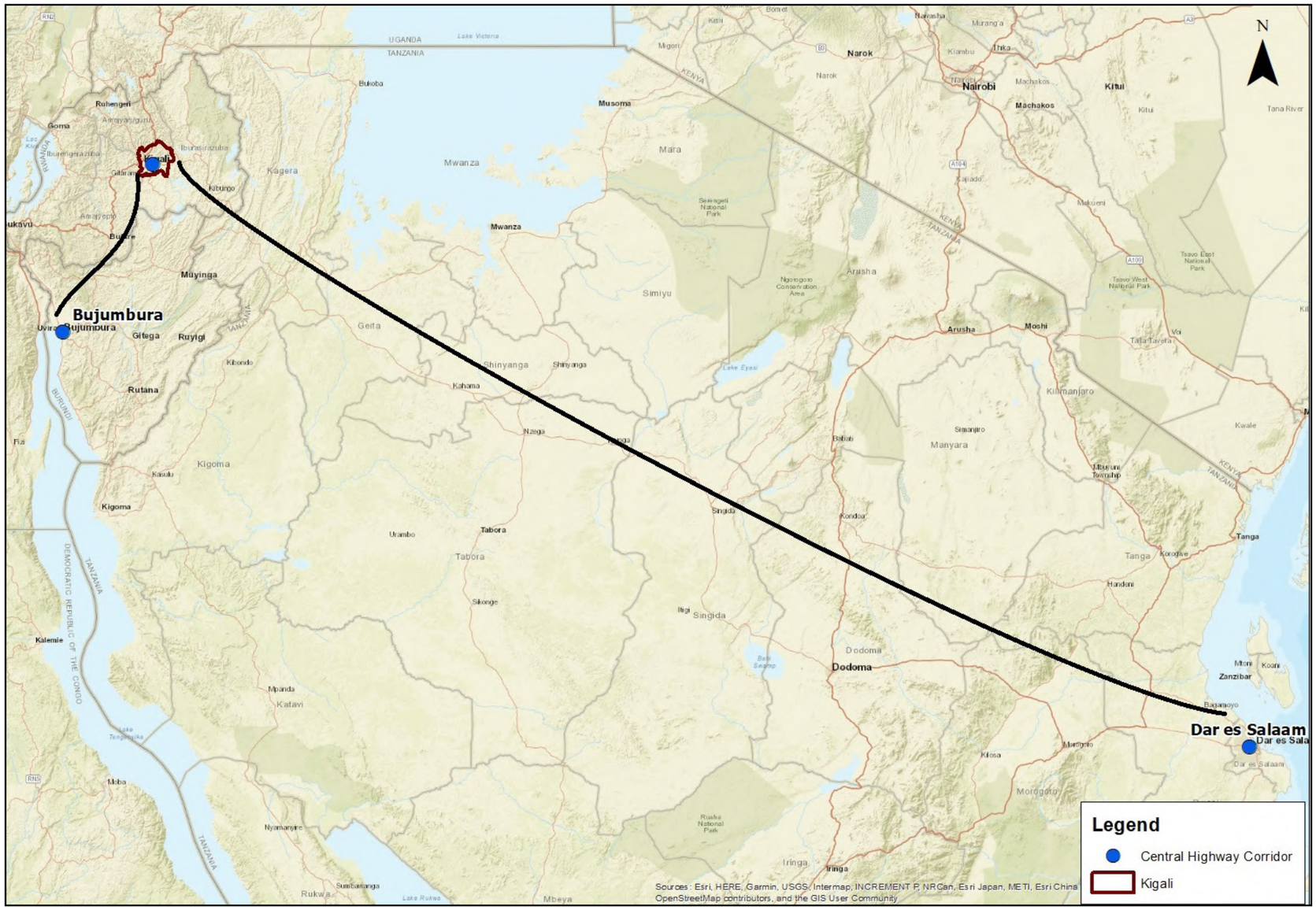


Figure 3.32 Central Highway Corridor

Kigali is globally connected by the existing Kigali International Airport which is situated in the heart of Kigali along the east-west national highway. This highway connects Kigali to the neighbouring towns of Rwamagana in east, and Gitarama in west, and to the other larger towns of Kibuye, Nyanza and Butare in Rwanda as illustrated in Figure 3.33

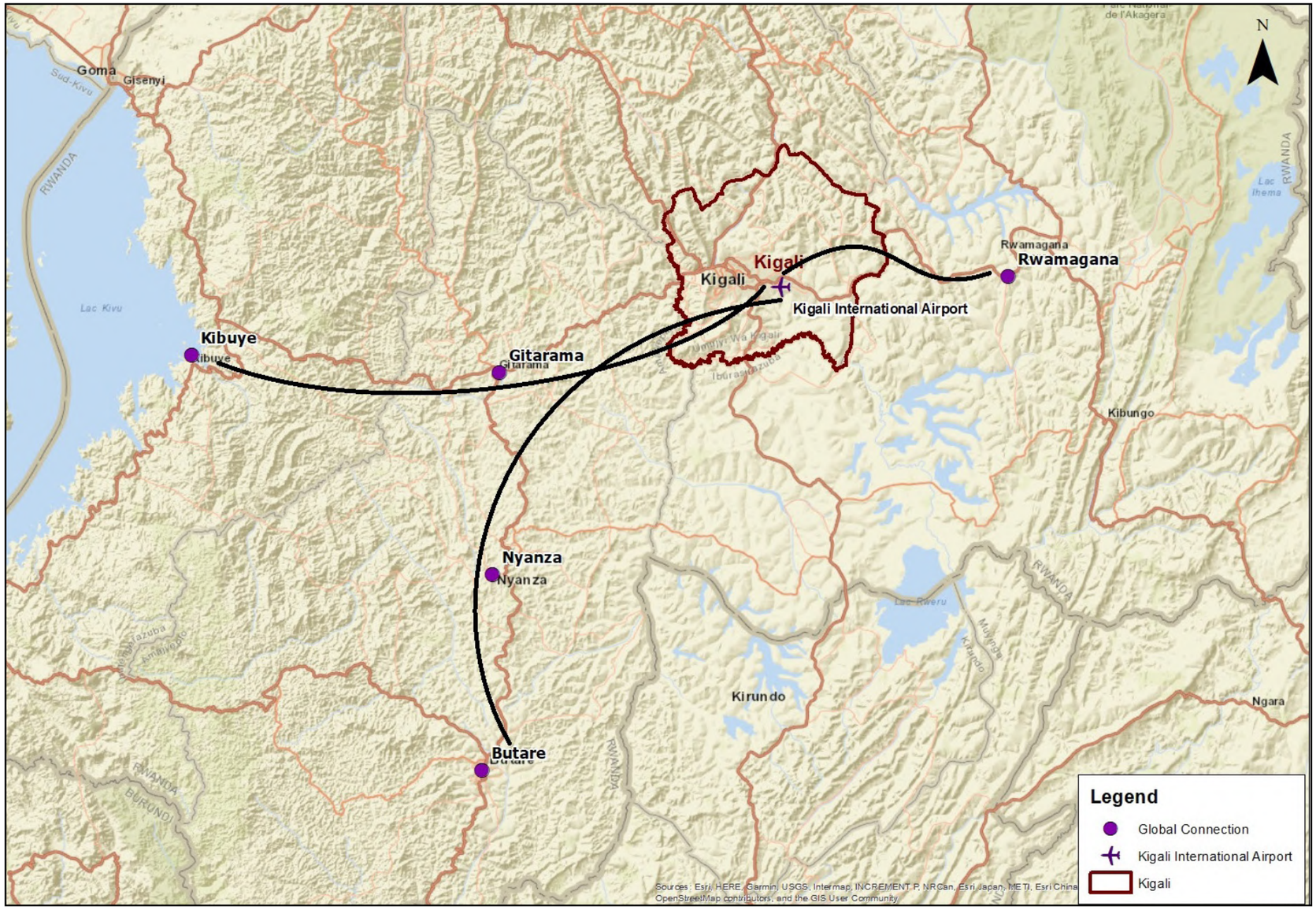


Figure 3.33 Connection between Kigali Airport to the Neighbouring Towns

The two northern highways that make up the Northern Corridor connect Kigali to Byumba in the north and the tourist destination -Ruhengiri in the northeast and Gisenyi in the far-east.

The two northern highways that make up the Northern Corridor connect Kigali to Byumba in the north and the tourist destination Ruhengiri in the northeast and Gisenyi in the far-east as illustrated in Figure 3.34.

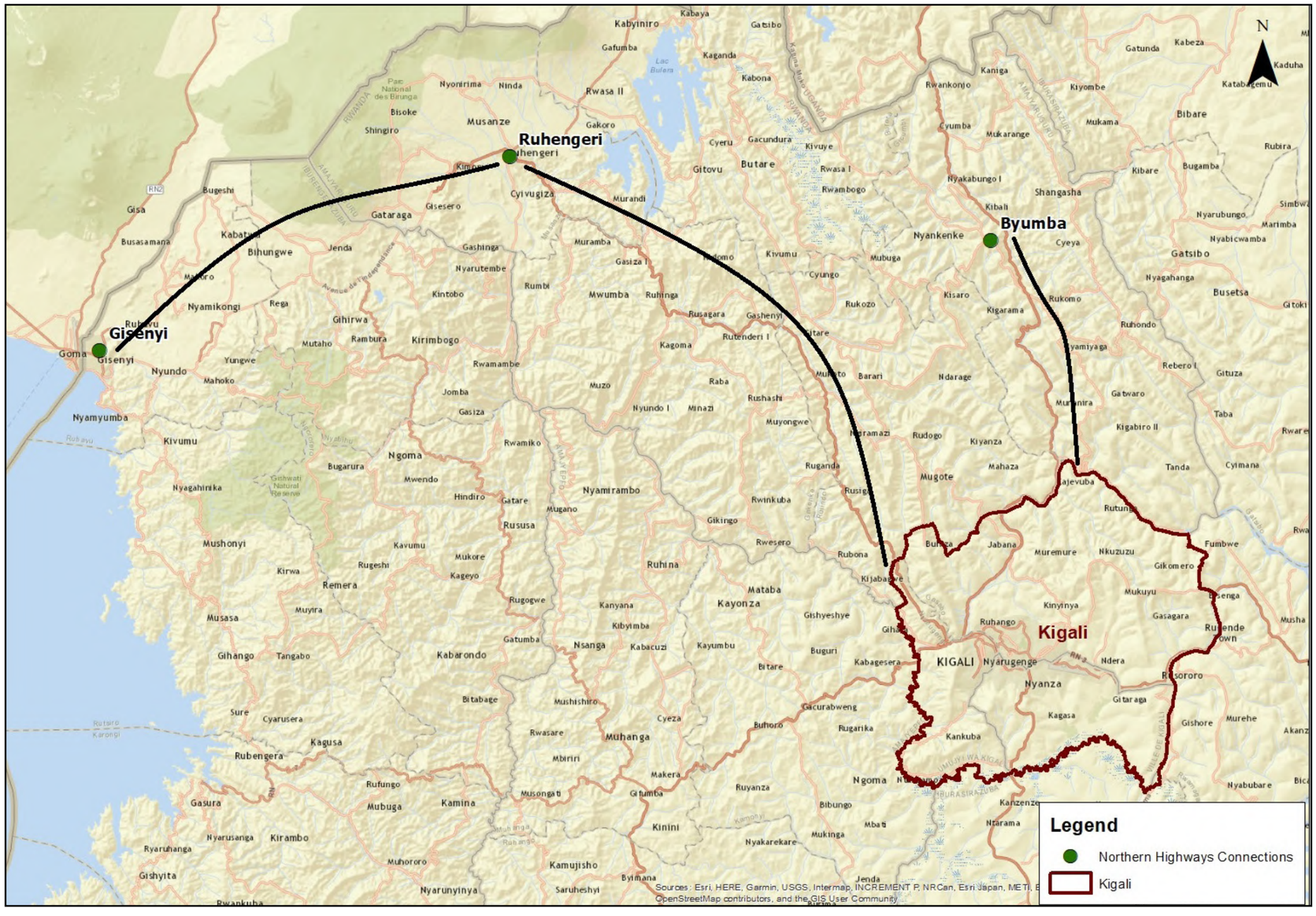


Figure 3.34 Northern Corridor Connections

In order to support the increasing air traffic, the new International Airport is proposed to be developed in Bugesera which lies about 26 km south-east of Kigali. Figure 3.35 shows the inter-country roads. This road is referred to as the “Airport Link Road “and also indicated on Figure 4.1.

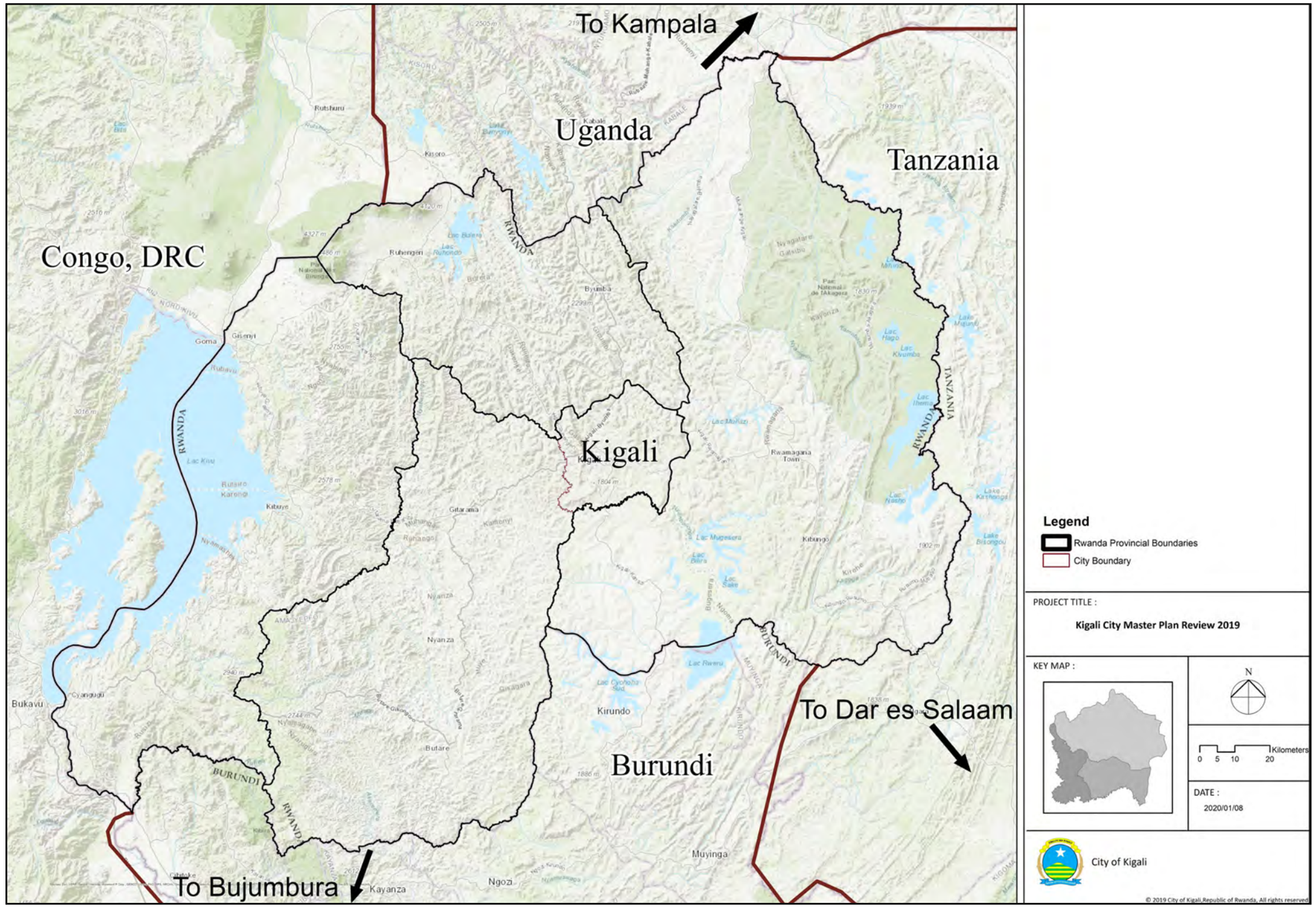


Figure 3.35 Inter-Country Roads and City Entry Points

3.6.2 Rail Network

There are no existing railway lines in Rwanda. Several schemes and initiatives have been proposed for Rwanda, despite the mountainous terrain. There are plans for rail connections with Tanzania and Uganda. There are also proposals for a rail link to the new international airport (Bugasera) to be located south of Kigali (refer to Section 3.5.4).

According to the RTDA 2016-2017 Annual Report there are currently two proposed rail projects for Rwanda. The central corridor will link Rwanda (Kigali) with Tanzania (Isaka / Dar-Es-Salaam) while the northern corridor will link Rwanda (Kigali) with Uganda (Kagitumba / Kampala).

Central Corridor: Rwanda (Kigali) - Tanzania (Isaka / Da- Es-Salaam

As part of efforts to stimulate the economy of the East African Community, Kigali and Rwanda are in plans to construct a new railway line between the Kigali and Isaka / Dar es Salaam. In spite of the challenges that the topography of Rwanda bring, the feasibility studies verified rail in Rwanda as a viable long distance transport option that would ease the transfer of goods. The proposed railway will be a single ballasted, standard gauge system with a maximum speed of 120 kph for passengers and 80 kph for freight. A conceptual layout for Kigali freight and passenger stations is illustrated in Figure 3.36.

Figure 3.36 Kigali freight and passenger stations (https://www.newtimes.co.rw/section/read/227911)

The Standard Gauge Railway phase which is approximately 500 km long was planned to be launched by October and expected operation in 2022. Figure 3.37 illustrates the planned alignment.

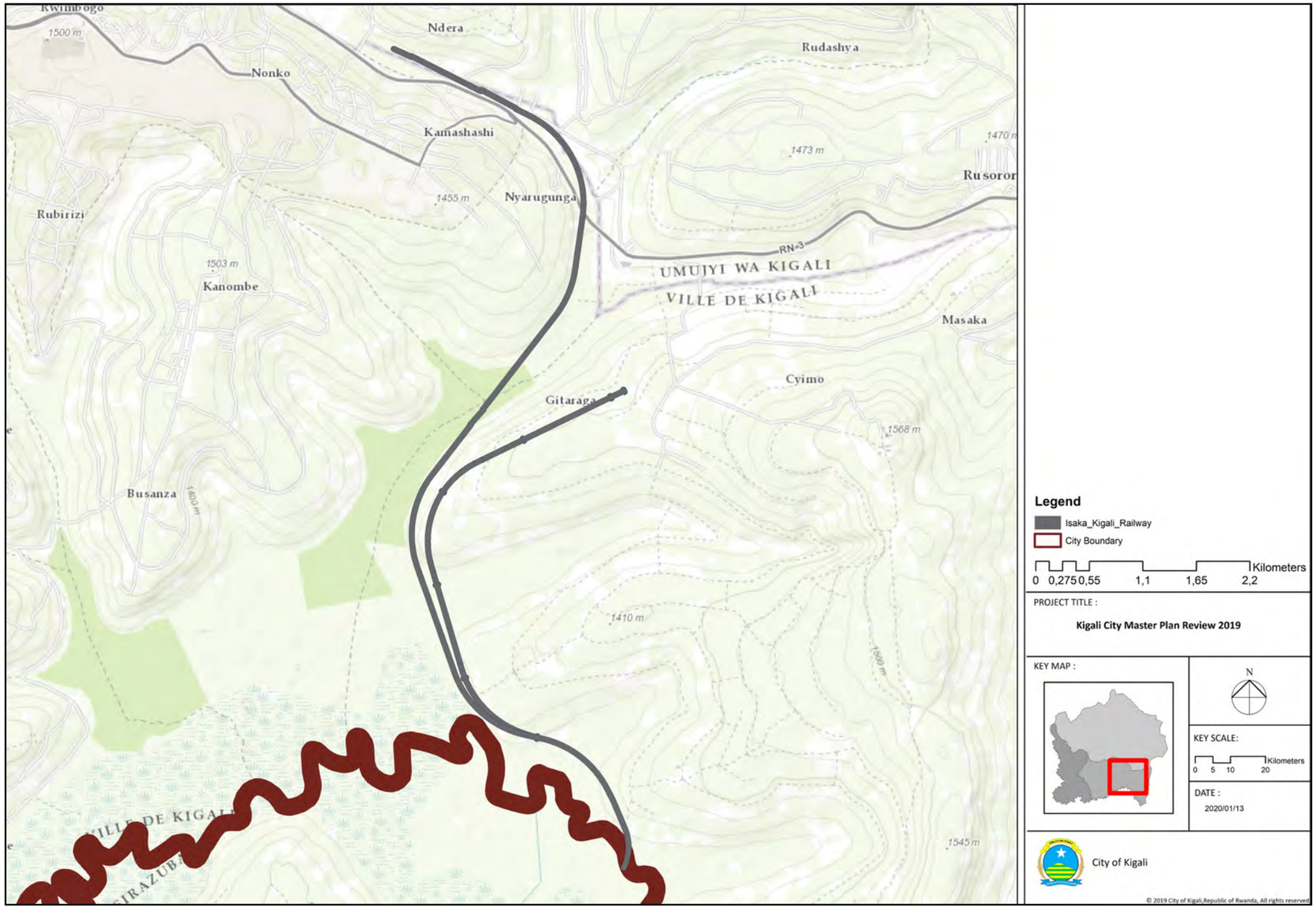


Figure 3.37 Kigali - Isaka Railway

Northern Corridor: Rwanda (Kigali) - Uganda (Kagitumba / Kampala)

Plans to construct a Standard Gauge Railway between Kigali and Kagitumba / Kampala have commenced, however these are currently on hold as priority has been given to different projects and the line's success is dependent on progress on the project in Uganda. The planned alignment is illustrated in Figure 3.38

These are discussed further in Section 4.1.

3.7 Green Transport Network

Through stakeholder consultation it has been communicated that there are some formal pedestrian walkways and cycle ways within Kigali. During consultation these routes have been criticized for being poorly positioned or discontinuous. It has been stated that in some areas it is necessary for pedestrians and cyclists to use roadways.

There is also a view that since the 2013 Master Plan was implemented, pedestrian crossings have become much safer due to supervision by traffic enforcement.

Stakeholders have indicated that there is little to no universal accessibility with regards to provision of non-motorised transport infrastructure.

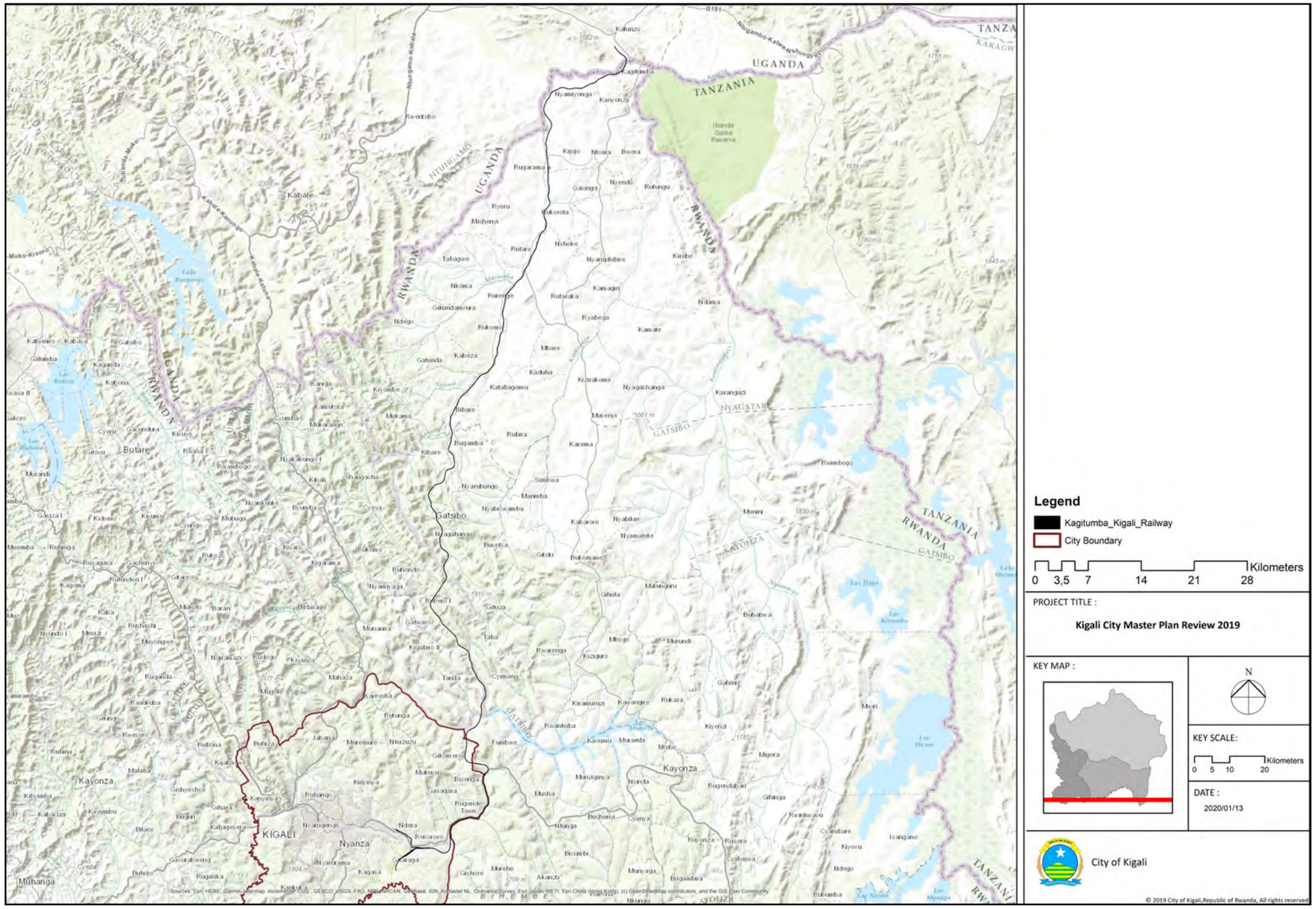


Figure 3.38 Kagitumba - Kigali Railway

3.8 Transport Policy Implementation: Transport Legislative and Governance Structure

Several different authorities are responsible for different transport functions. Table 3.5 shows a summary of transport authorities and their roles in Kigali according to their respective websites.

Authority	Description	Roles and Responsibilities
City of Kigali (CoK) (http://www.kigalicity.gov.rw)	The municipal government of Kigali which oversees all three districts (Nyarugenge, Kicukiro and Gasabo).	• The supervision of the implementation of national policies in Kigali. • The preparation the Master Plan of Kigali and specific master plans, the insurance of their execution through large-scale projects implemented at city level, and the follow up on the execution of specific master plans of the Districts. • The preparation the development plan of Kigali. • The guidance and coordination of planning activities of the Districts of Kigali. • To monitor activities and the functioning of the Districts of Kigali and the government institutions operating at its level and provide services that are not delivered by other administrative entities in Kigali. • The insurance of the safety of the people and property in Kigali. • The promotion of infrastructure in Kigali and guidance on its implementation. • Guidance on the infrastructure inspections that are carried out by other administrative entities of Kigali and carry out inspections of large-scale projects that are put in place at its level. • The development and implementation of the plan for transport in Kigali. • The mobilisation of resources and strategic planning for collection of taxes and charges in accordance with relevant laws. • To support the Districts of Kigali in terms of economic development. • The promotion and follow up of investment activities in Kigali.
Rwanda Regulatory Authority (RURA) (https://rura.rw/)	Rwanda Utilities Regulatory Authority (RURA) was created by law in 2001 with the mission to regulate and license certain public utilities including transport.	• To set up necessary guidelines in order to implement and enforce laws and regulations. • To ensure compliance by public utilities with the provisions of laws and regulations governing the regulated sectors in an objective, transparent and non-discriminatory manner. • To ensure the continuity of service delivery by the licensed or authorized service providers and the preservation of public interest. • To protect users' and operators' interests by taking measures likely to guarantee effective, sound and fair competition in the regulated sectors within the framework of applicable laws and regulations. • To protect and promote consumers' interests. • To promote the availability, accessibility and affordability of regulated services to all consumers including low income, rural and disadvantaged consumers. • To promote efficient development of regulated sectors in accordance with the Government economic and financial policy. • Promote and protect the rights and obligations of consumers and service providers. • Issuing permits, authorizations and licenses required for regulated sectors, in accordance with the relevant laws and regulations. • To monitor and ensure compliance by regulated network or service providers in line with their licenses, permits and concession obligations. • To ensure fair competition in all regulated sectors.

Table 3.5 Transport Authorities in Kigali

Authority	Description	Roles and Responsibilities
Rwanda Transport Development Agency (RTDA) (http://rtda.gov.rw)	Government institution affiliated to the Ministry of Infrastructure focussing on the national road and rail networks.	• Management and control of the national road network in an attempt to achieve road safety and ensure maintenance. • Management and control of waterways transport infrastructure with a view of ensuring their value added. • To develop railway infrastructure in Rwanda. • Promoting transport services.
RwandAir (https://www.rwandair.com/)	The national airline of Rwanda also handling ancillary activity at Kigali National Airport.	• To provide safe, secure and reliable air transport services on all our selected routes, thereby linking Rwanda with the rest of the world. • To operate with aircraft and other equipment that are maintained to the highest international standards. • To ensure that the Airline is well integrated in the industry • To serve customers warmly and efficiently, continuously benchmarking with the best-run competitors and globally. • To enhance shareholder value through profitability and capital growth. • To create and maintain a working environment that encourages employees to continuously improve their knowledge and exploit their full potential. • To encourage and participate in the promotion of the growth of the tourism in Rwanda. • To facilitate the movement of the people and goods for the promotion of trade and industry for the well-being of Rwanda.
Rwanda Civil Aviation Authority (RCAA) (http://www.mininfra.gov.rw/index.php?id=135)	The national aviation authority of the Republic of Rwanda. The RCAA is associated with the Ministry of Infrastructure and the focus of the RCAA is to regulate and oversee all aspects of civil aviation.	• To ensure the safe development of civil aviation in Rwanda. • To advise and assist the Government in its business with the International Civil Aviation Organization. • To represent Rwanda as the national authority in respect of matters relating to civil aviation on an international level. • To control and maintain airports associated with the RCAA and to provide the necessary services. • To provide air traffic control services, flight information services and Rwanda Aeronautical information services. • To provide and manage search and rescue services to aircraft in distress within Rwanda airspace. • To provide adequate emergency services and facilities to airports. • To collaborate with other government bodies in ensuring the safety of aircrafts and passengers
Republic of Rwanda Road Maintenance Fund (RMF) (http://www.fer.gov.rw/)	An institution established by law in order to ensure the collection and funding for maintenance services on the Rwanda road networks associated with the Ministry of Infrastructure.	• To receive, manage and disburse funds for the maintenance of Class 1 national, district and Kigali roads. • To integrate with other relevant bodies in the preparations of road maintenance programs as funded by the RMF. • To ensure that proposals and tender documents pertaining to road maintenance comply with the law before approval of funding. • To ensure that work is conducted according to plans and signed contracts. • To expropriate the public and compensate their damaged works in accordance with relevant legal provision.

Table 3.6 Transport Authorities in Kigali

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4

Implementation Status

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4 Transport Implementation Status Assessment Summary

4.9 Implementation Status of Major Projects

A detailed list of the relevant existing project status for capital improvement plan and catalytic projects can be found in the Implementation Status Report as submitted to the City of Kigali in 2018. Table 4.1 outlines some of the major projects being evaluated in this Interim Transport Master Plan Report and their current status. This information was developed from the City Development Strategy 2018-2024.

Sector	Project	Status	Comment
Road Network (Refer to Section 8.1 and Figure 4.1)	Major Arterial: Kigali Ring Road	5%	Major delay Revision of alignment and feasibility study ongoing
	High Capacity Urban Roads	30%	Some roads have been upgraded and some are upcoming as in the City Development Strategy
	Major Arterial: Airport Link Road	10%	Preliminary Design Complete
Public Transport Network (Refer to Section 7.1 and Figure 4.2)	Nyabugogo Transport Hub	15%	Concept Design Complete Major delay as no investment or developer for project
	Major Arterial: BRT- Corridor Reservation	10%	Delay due to high cost of land acquisition
	Major Arterial: BRT Lines	5%	Feasibility study and preliminary design ongoing
	Bugesera International Airport	60%	First Phase under construction to be completed in Dec 2020
Freight Network (Refer to Section 9.1 and Figure 4.3	Rwanda (Kigali) - Tanzania (Isaka / Dar Es Salaam) –Standard Gauge Railway	5%	Feasibility study complete Funding required
	Rwanda (Kigali) – Uganda (Kagitumba / Kampala) Railway	5%	Feasibility
	Freight Rail Connection to Bugesera Airport	0%	Bugesera Airport under construction
Green Transport Network (Refer to Section 9.2)	Pedestrian Links along BRT routes	10%	Delay due to high cost of land acquisition
Transport Policy (Refer to Section 9.3)	Development of a Kigali Transport Authority	0%	No existing progress

Table 4.1 Major Transport Projects

Figure 4.1 below illustrates the major remaining road network projects as outlined in Table 4.1. The High Capacity Urban Roads (HCUR) Network was included in the 2013 Transport Master Plan but have not yet been fully implemented. The 2018 Transport Master Plan still intends to develop these routes as part of the Major Arterial Network but as priority has shifted from the road network to NMT, the only remaining HCUR is the Kigali Ring Road.

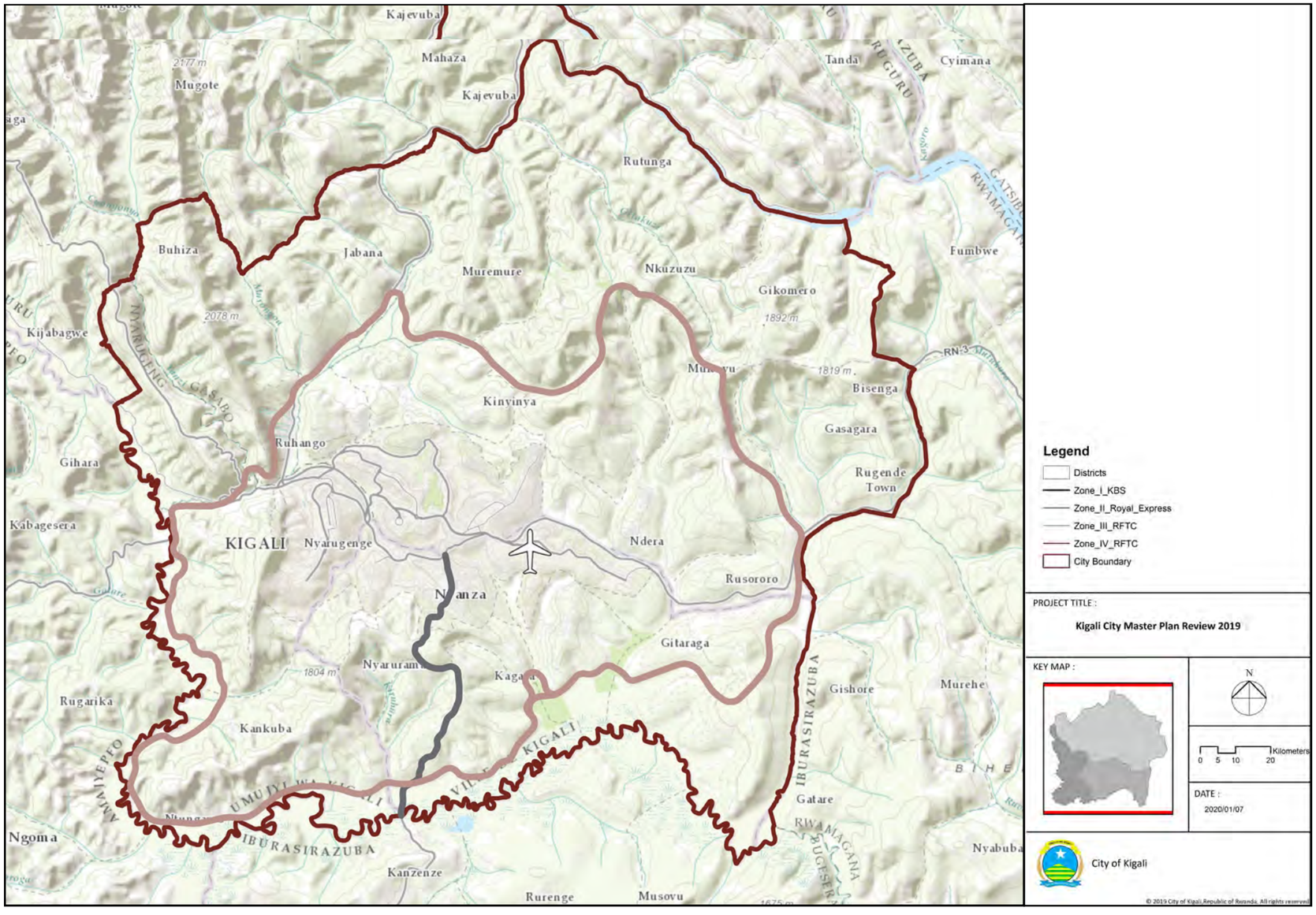

Figure 4.1 Major Road Network Projects

Figure 4.2 illustrates the major remaining public transport projects.

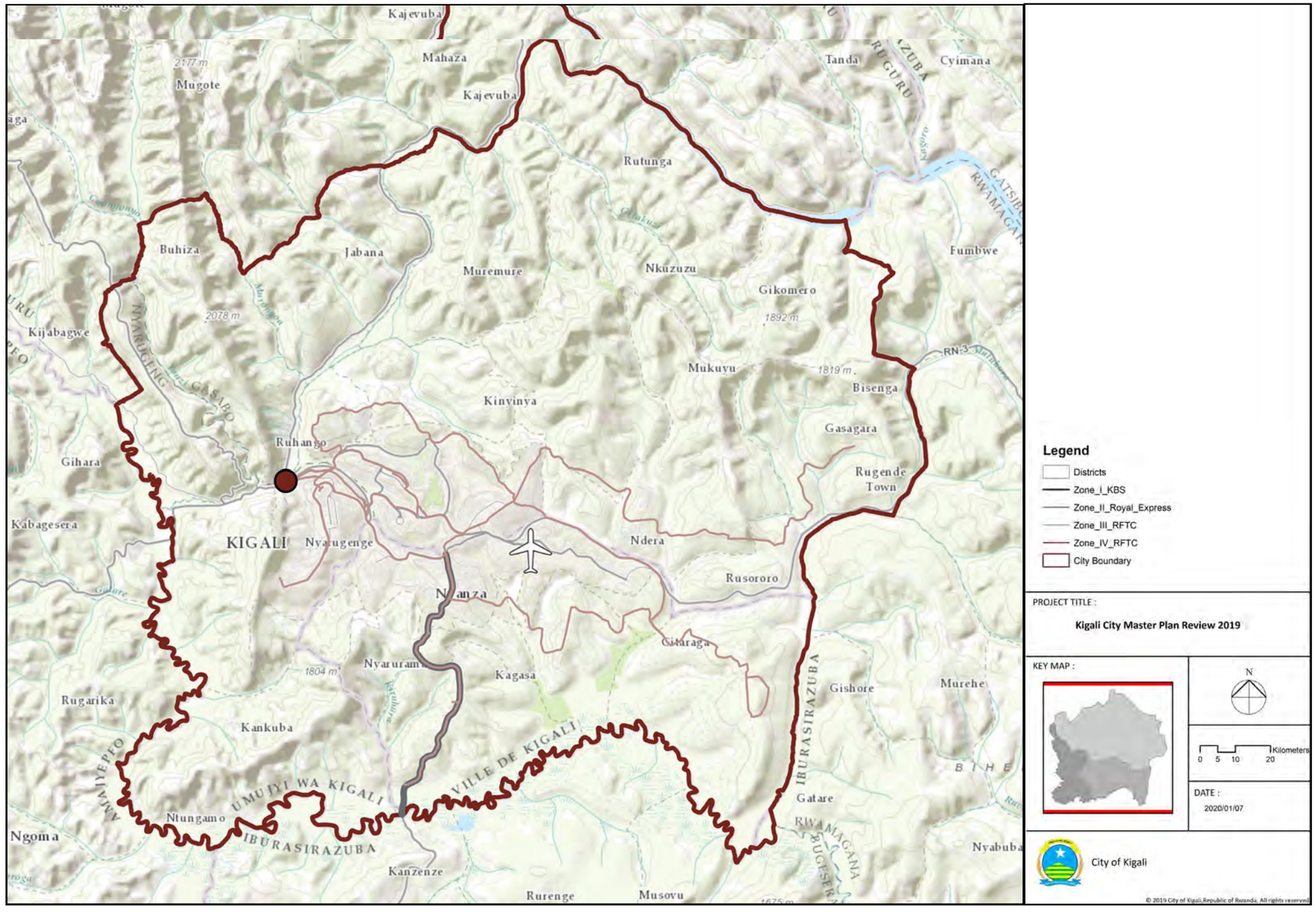

Figure 4.2 Major Public Transport Network Projects

Figure 4.3 illustrates the major remaining freight transport network projects

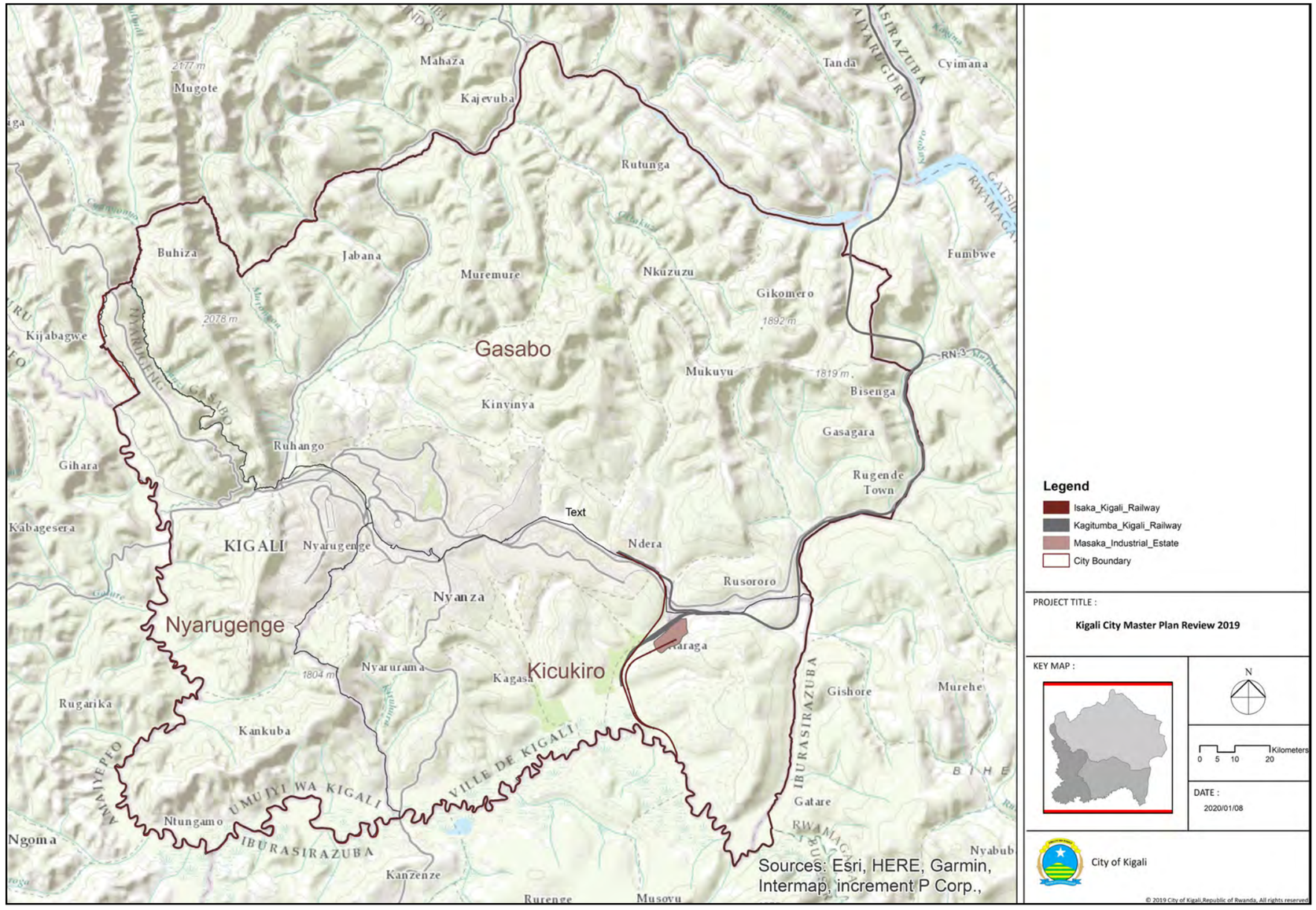

Figure 4.3 Major Freight Network Projects

Implementation Status of Additional Projects

Table 4.2 lists the implementation status of additional projects as per City officials and the City Development Strategy 2018-2024. No additional descriptions or details of the projects are available.

The Kagera River is discussed in Table 4.2 and the location illustrated in Figure 4.4.

Sector	Project	Status
Road Network	Maintaining all new and existing roads	100% completed
	Maintaining all new and existing roads till 2017 (281.4km)	100% completed
	43.3km of new asphalt roads constructed (2013-2018 projects)	86.6% complete
	100 km of stone paved road constructed (2013-2018 projects)	64.5% completed (included 3.6Km of stone paved roads)
	29.5km of asphalt roads rehabilitated (2013-2018 projects)	46.7% completed (13.8 km)
	6 major road junctions improved (interchanges, traffic light, roundabout)	30% (unknown locations) (KSEZ, Sonatubes and Nyabugogo underway)
	Rehabilitate 21.08km of asphalt roads between 2018 and 2024	Pre-feasibility study available
	Detailed study for different urban roads (98.2km) by 2024	Study for 48.2km ongoing
	120km of asphalt roads constructed by 2024 (Currently 398.9 km of asphalt road constructed)	0%
	All 528.9km of new and existing roads to be maintained till 2024 (398.9 km existing roads)	0%
	Upgrading 60km of urban roads from single to dual carriageway by 2024	Pre-feasibility
	Replacement of analogue traffic lights to digital traffic lights at 8 junctions by 2024 (unknown locations)	Pre-feasibility
	Installation of solar street lighting/ photovoltaic solar energy for electricity for 30km by 2024	Pre-feasibility
	Monitoring of Intelligent Street Light Systems (100km)	Pre-feasibility
	5 Major Road Junctions improved by 2024 (unknown locations)	Pre-feasibility
	Dedicated Transport Link between new Airport and City Centre (refer to Figure 4.1)	Pre-feasibility
	Links to secondary cities (refer to Figure 4.5)	Pre-feasibility

Table 4.2 Implementation Status of Additional Projects

Sector	Project	Status
Public Transport Network	17 km along the major public transport corridors expanded	80.2% completed
	Nyabugogo intercity bus terminal improved (refer to Figure 4.2)	15% Feasibility and Preliminary Design
	Bus Rapid Public transport Corridor constructed at main corridor (12.3km) by 2024 (refer to Figure4.2)	Feasibility study and Preliminary Design in Progress
	Extension of PT routes network to 300km and improvement of existing public transport services	Pre-feasibility
	Dedicated Bus Lanes (DBL) on expanded roads created	0%- Pre-feasibility
	Ferries along Kagera River (refer to Figure 4.4)	Pre-feasibility
	Cable Car Transport (refer to Figure 7.6)	Pre-feasibility
Freight Network	Standard Gauge Freight link with Tanzania (Could be extended with passenger services to new airport) (refer to Figure 4.3)	Feasibility Study Complete
Green Transport Network	3 pedestrian bridges erected (unknown locations)	0%
	Pedestrian corridor KN 4 Avenue developed by 2024	Detailed study completed
	4 pedestrian bridges erected (unknown locations)	Pre-feasibility
Implementation of Transport Policy	Adoption of Kigali Transport Master Plan 2013	Completed
	Adoption of Updated Kigali Transport Master Plan 2018	Updated Transport Master Plan 2018 is being compiled and should be approved and adopted by City of Kigali Council in 2019

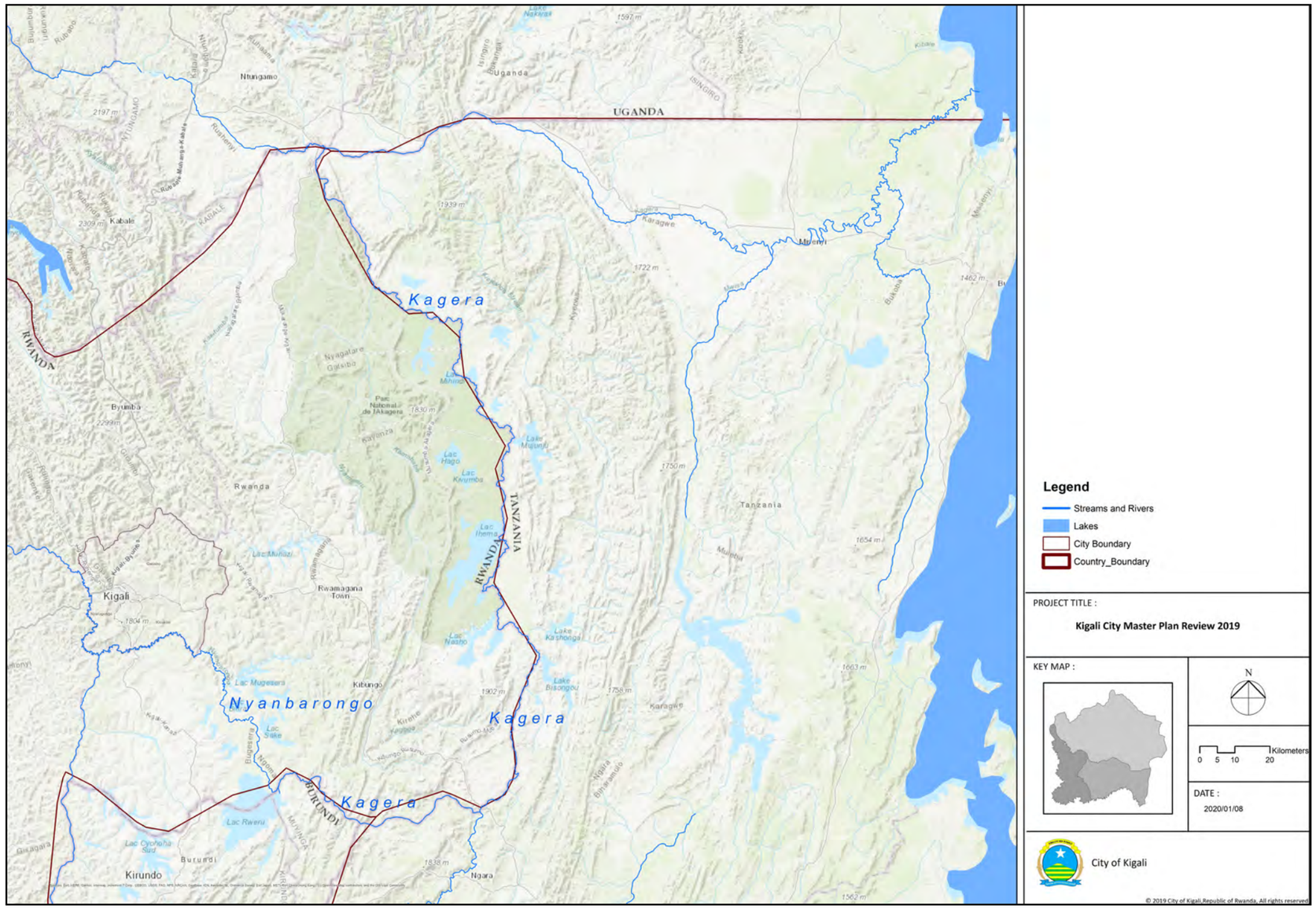

Figure 4.4 Kagera River

The Secondary Cities are discussed in Table 4.2 and the location illustrated in Figure 4.5.

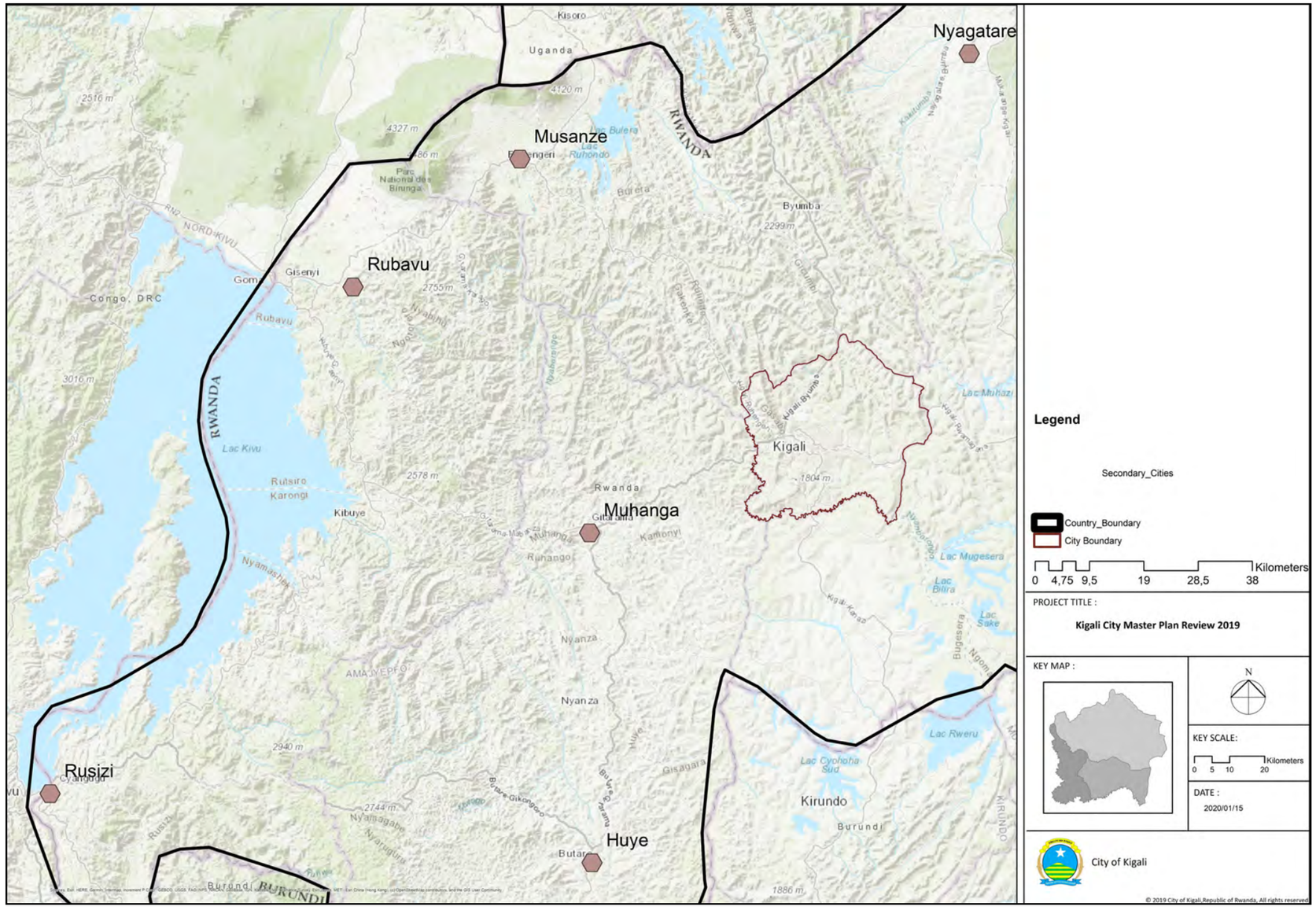

Figure 4.5 Locations of Secondary Cities

Some of the Primary roads rehabilitation development programs for Rwanda that improved Kigali's connectivity to the rest of the country, included the following projects:

- Kigali – Bugesera- Burundi: Paved;
- Kigali –Gicumbi- Gatuna: Rehabilitation work completed 2015;
- Kigali –Musanze- Rubavu: Rehabilitated; and
- Kigali- Rwamagana- Kayonza: Recently resurfaced, east from the capital.

These projects are illustrated Figure 4.6.

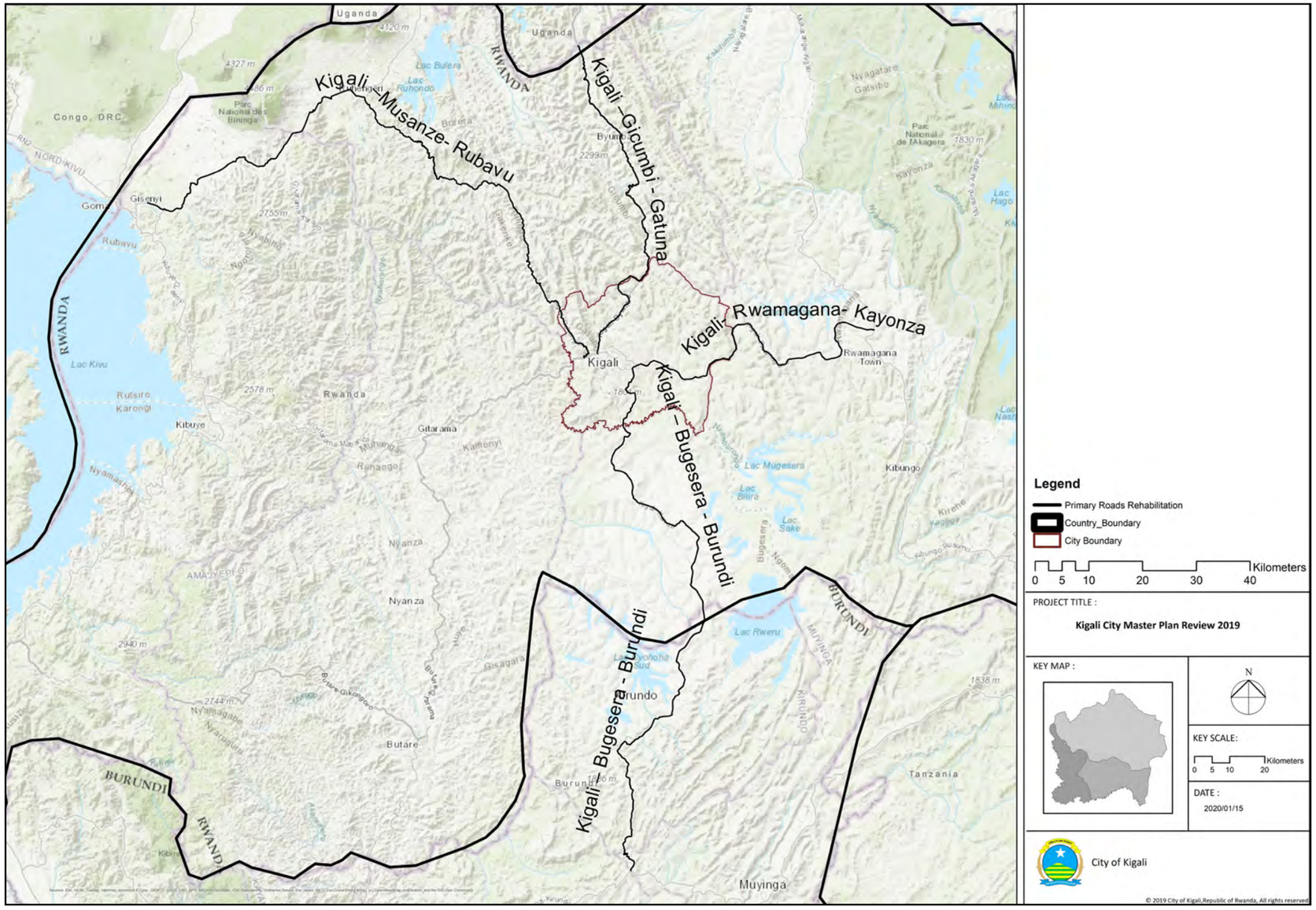

Figure 4.6 Primary Roads Rehabilitation Development Program

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5

Spatial Development Framework

5.1. Development strategies

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5 Spatial Development Framework

5.1 Development strategies

The overarching strategy for the Kigali Master Plan is development of "Centers" and "Corridors" within the City of Kigali where the centers are specialised clusters of high value economic activity, major shopping, civic and recreation connected via the economic corridors built along a backbone of transport infrastructure - the proposed public transport (BRT) that link these important economic activities in different centers planned throughout the city. The updated master plan for Kigali has the following key considerations:

- Strengthening and organizing the existing CBD in Nyarugenge;
- Acknowledging four self-sustaining centers with mixed use commercial for peri-urban growth supporting the CBD;
- Establishing four main self-sustaining Regional Centers with mixed use commercial as new growth areas and employment destinations in the sub-urban areas;
- Identified industrial clusters and SEZ to form consolidated and well-connected employment zones for manufacturing, logistics and warehousing;
- Improving connectivity and accessibility via transport corridors, with the proposed Bus Rapid Transport, spreading throughout the city;
- Mixed use residential and commercial zones spread at key locations along public transport corridor creating a well-knit and well-connected system of housing, jobs and public transport;
- Mixed use and mixed income, high-density, affordable and quality living environments in proximity to employment centers ;
- To redevelop existing unplanned settlements into higher density residential developments;
- To develop clusters of consolidated housing in the rural areas;
- To conserve nature areas such as forests, wetlands and water bodies. Also protect steep slopes (above 30%) in both urban and rural areas; and
- Conserving Kigali's rich nature, heritage and cultural areas;

The Master Plan proposes major employment distribution within mixed use commercial districts and industrial parks, planned as nodes along the BRT corridor. Higher density mixed use residential and commercial are planned at regional and commercial centres for larger employment and housing ratio to control urban sprawl. The mixed-use commercial zones including industrial nodes are proposed to be planned as integrated zones with affordable housing, social infrastructure and green open spaces.

The master plan advocates to develop mixed income, mixed use, higher density residential around employment centers and public transport corridors thus connecting different employment and residential areas by public transport across the city. The mix of uses and activity within residential area will not only help create a vibrant living environment within the city but will also support creation of more formal jobs in the market and to bring work closer to homes, thereby limiting the time and resources required for travels to work. This will also promote women into the workforce, with work place in proximity to home.

The master plan also proposes upgradation and renewal of unplanned settlements around the CBD and regional centers to accommodate higher density of population currently living in poor urban environment in the heart of the city. This mix of residential areas around the CBD shall bring vibrancy into the city centre. As the city expands in future, the increasing population in Kigali is proposed to be housed around regional centers in sub-urban areas.

There are currently about 1.5 million people living in Kigali and about 0.58 million employment opportunities. The following graph shows the projected growth in population for the City. The expected 2050 population for Demand Scenario B is approximately 3.8 million.

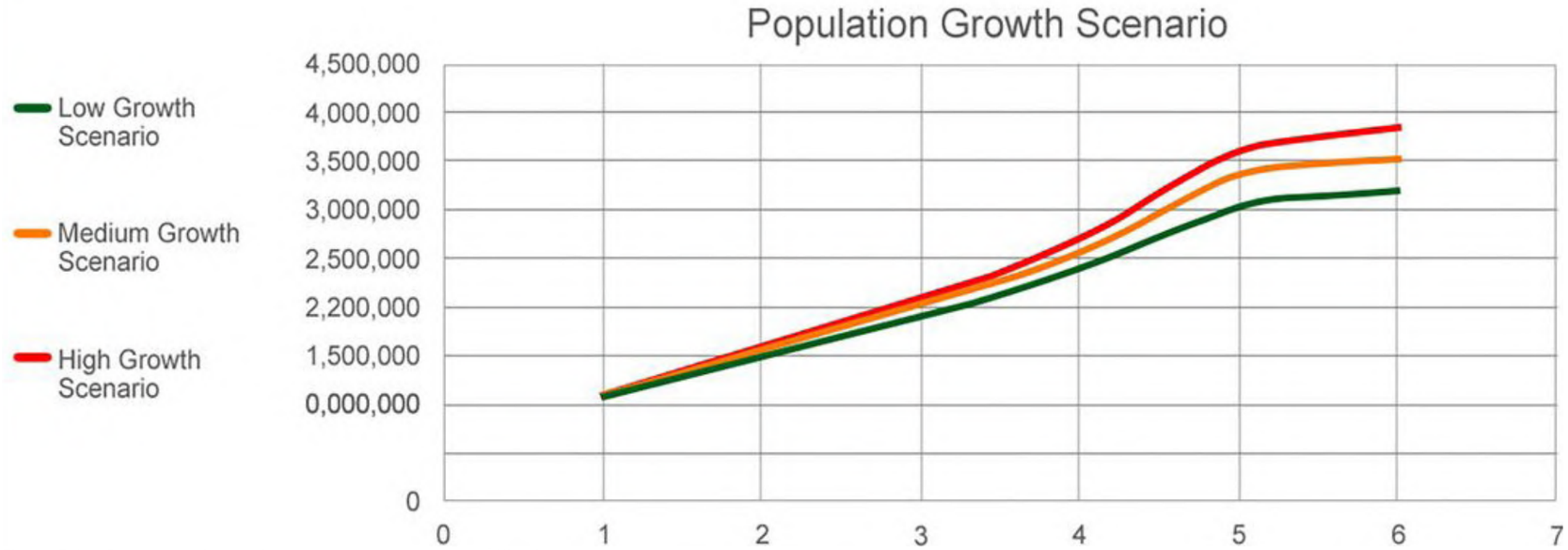

Figure 5.1 Graph showing projected population growth of Kigali

Figure 5.2 shows the projected growth of employment opportunities of different industries in Kigali. In 2050 Rwanda is projected to have approximately 1 880 000 employment opportunities, as per Demand Scenario B, about 530 000 of which in Agriculture that are not shown in the graph.

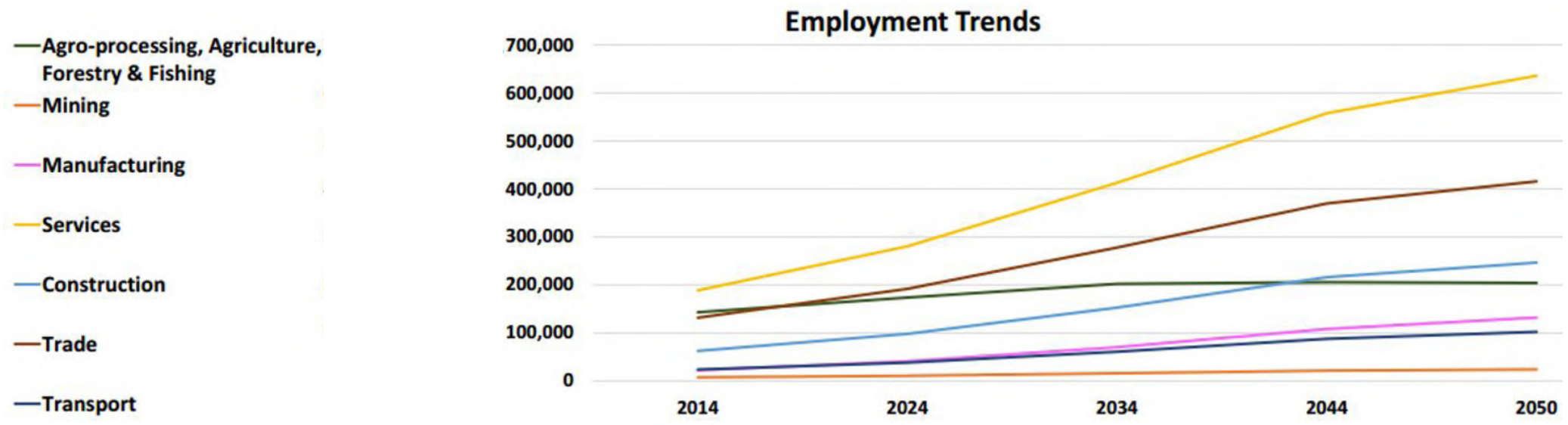

Figure 5.2 Projected Employment Growth in Various Sectors

The phasing of the Master Plan is shown in Figure 5.3.

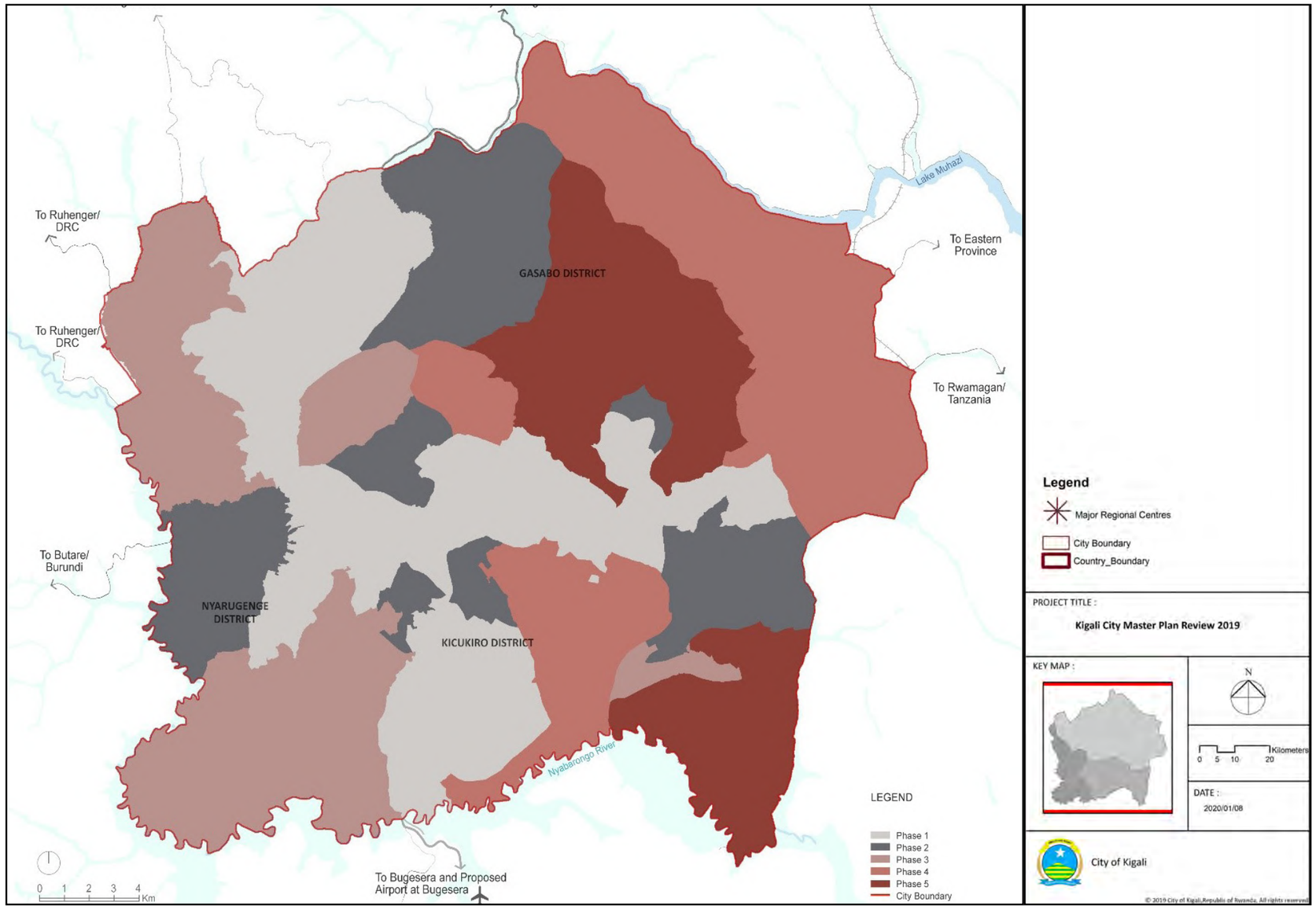

Figure 5.3 Phasing of Masterplan

The regional Centres are shown in Figure 5.4 Regional Centres.

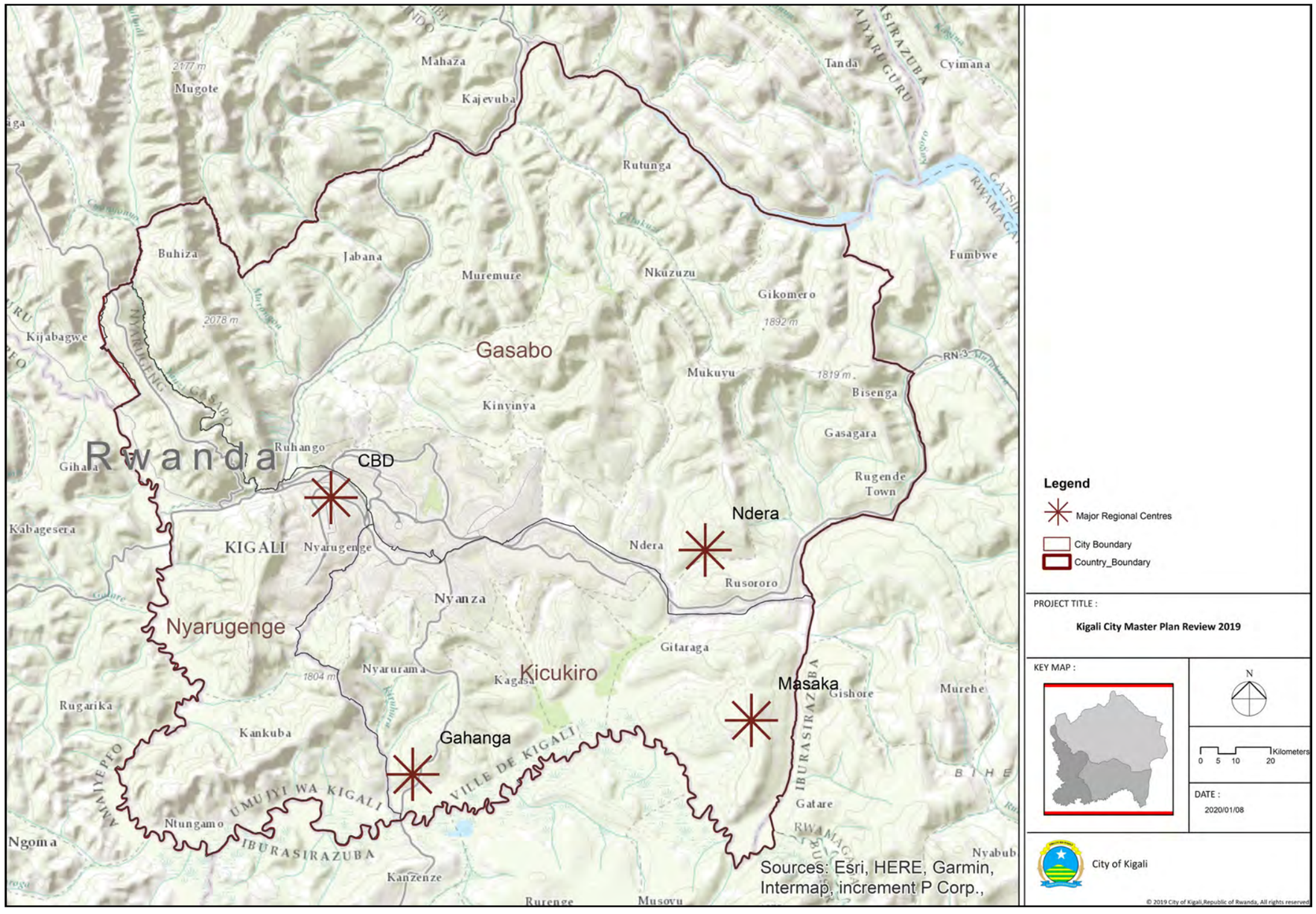

Figure 5.4 Located Regional Centres

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6

Transport Needs Assessment

6.1. Introduction
6.2. Key Issues
6.3. Present and future transport demand estimation
6.4. PTV Visum Macro Simulation Model Development

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6 Transport Needs Assessment

6.1 Introduction

This Chapter describes the transport requirements of the people in Kigali. Relevant issues from the previous transport Master Plan as well as new issues identified are highlighted in this chapter. The transport needs assessment was informed by a comprehensive literature review as well as an in depth stakeholder consultation process. The latter took place in 2018 and is documented in the Comments Collected Report of November 2018. The following meetings were held where comments and information were collected:

- Kick-off Presentation to Sector Secretaries, 26 July 2018
- City of Kigali, 17 July 2018 @ 10:30
- City of Kigali, 18 July 2018 @ 14:00
- RTDA, 17 July 2018 @ 14:30
- RTDA; 31 October 2018 @ 14:00
- RCCA, 17 July 2018 @ 15:30- Meeting Cancelled
- RURA, 18 July 2018 @ 15:30- Meeting Cancelled
- Focus Group Meeting for City on the Move, 31 October 2018 @ 09:00
- Overall for Project:
-
  - o 13 Focused groups discussions with Community and representatives
  - o 6 TAG meetings, 2 Stakeholders meetings
  - o More than 90 technical meetings
  - o Feedback received from Districts, Villages, SMS, WhatsApp, Facebook and Twitter

Table6.1 shows the documents that were considered in the compilation of this Masterplan.

No.	Document	Year	Authority or Author
1	Upgrading and preventing unplanned an underserviced settlements in Kigali City Rwanda	2017	UN Habitat
2	National Informal Urban Settlement Upgrading Strategy	2015	UN Habitat
3	Kigali Urban Sanitation Study- Vol 1: Synthesus Report	2017	UN Habitat
4	Kigali Urban Sanitation Study- Vol 2: Annexures	2017	UN Habitat
5	Smart City Rwanda Masterplan	2017	UN Habitat
6	Faster Urbanization, Greater Agglomeration	2009	
7	7 Years Government Programme: National Strategy for Transformation (NST 1)	2017	Republic of Rwanda
8	Kigali City Development Strategy (2018-2024)	2018	City of Kigali
9	Urban Planning and Building Audit Report for City of Kigali	2017	MININFRA
10	Introduction to Kigali State of Environment: Challenges and Opportunities	2013	GGGI Enviro
11	BRT Second Interim Report	2019	SPEA Engineering, Logit Transportation Engineers
12	Transport Master Plan for City of Kigali	2013	City of Kigali
13	Rwanda Vision 2020	2000	Ministry of Finance and Economic Planning

Table 6.1 Documents Considered in Compilation of Transport Master Plan

6.2 Key Issues

6.2.1 Road Network

The consultation and desktop review of the relevant documentation informed the review of the key issues identified in the 2013 Transport Master Plan. The following key issues were identified in terms of the Road Network for this update:

Issues related to systematic Transport Planning:
- Inconsistent road hierarchy, access and mobility function, and associated typologies / cross-sections.
- No classification system for local roads.
- Fragmented development.
- Many roads are not paved.
- There is road congestion along the road leading to the existing Kigali International Airport (KN5 Road).
- Limited road capacity.
- Hilly topography.

Issues related to systematic Traffic Engineering and Design:
- No formal guidelines to standardise the geometric design of roads (Rwanda forms part of the East African Community (EAC). However is left-hand drive and Rwanda is right-hand drive, which means it is not possible to apply EAC design standards directly to Rwandan roads).
- Various manufacturers of traffic signals cause problematic maintenance.
- Poor design of traffic calming measures.
- No formal guidelines to standardise road markings and signs specific to Rwanda.
- Inconsistent intersection control (only few traffic signals, signals are not optimised and often not operational).
- New land-use developments do not always consider the gradient when designing the access connection to the public road level.

Issues related to systematic Development Control:
- Parking provision is not systematically enforced throughout Kigali.
- Moto-taxi parking is not included in planning.

6.2.2 Public Transport Network

The consultation and desktop review of the relevant documentation informed the review of the key issues identified in the 2013 Transport Master Plan. The following key issues were identified in terms of the Public Transport Network for this update.

Issues related to systematic Transport Planning:
- Limited space and government owned land for public transport infrastructure.
- Limited integration between public transport modes.
- A high speed public transport link to new international airport (Bugesera) south of the Kigali centre is required. The recent BRT Second Interim Report is a comprehensive investigation into the provision and feasibility of this link. The public transport corridor space needs to be reserved for this link, however the current geometric design for this link only makes provision for two lanes per direction for general traffic and does not include additional right of way for the BRT.
- Unpaved roads and steep gradients limits bus accessibility.
- Limited spatial coverage of the bus network.
- Limited shelters.

Issues related to systematic Traffic Engineering and Design
- Limited consideration of universal accessibility in the design of public transport systems.

6.2.3 Freight Network

The consultation and desktop review of the relevant documentation informed the review of the key issues identified in the 2013 Transport Master Plan. The following key issues were identified in terms of the Freight Network for this update.

Issues related to systematic Transport Planning:
- Planning a rail line through the centre of the City will involve careful planning to ensure it does not sterilise large portions of land or form an additional physical barrier in the city.
- Freight movement by rail to airport may not be viable.
- Mountainous terrain makes implementation of rail complicated and expensive.
- Limited access for larger, heavier vehicles due to steep gradients.
- An increase in e-commerce will result in an increased number of heavy vehicles travelling in the City.

6.2.4 Green Transport Network

The following key issues have been identified from the 2013 Transport Master Plan and discussions with authorities:

Issues related to systematic Transport Planning:
- Dedicated pedestrian and cycle routes are only provided in the city centre.
- Lack of continuity: non-motorized transport routes are disconnected.
- Hilly terrain (more than 5%) presents a challenge to successfully implement cycling.

Issues related to systematic Traffic Engineering and Design:
- Special needs are not accommodated through universal access design.

6.2.5 Effective Transport Policy Implementation

The following key issues have been identified from the 2013 Transport Master Plan and discussions with authorities.

Issues related to systematic Transport Planning:
- Fragmentation of policy and responsibility.
- Gaps in responsibility.
- The lack of custodianship of the official multi-modal transport model for the city.
- Hierarchy of transport plans is unclear.
- There is no centralized transport database where all survey data is collated and regularly updated.

Issues related to systematic Traffic Engineering and Design:
- No specific guidelines for Traffic Impact Assessments for new developments.
- There are no thresholds and guidelines for pedestrian bridges.

Issues related to systematic Development Control:
- Buildings are approved in areas where space for transport systems are required.

6.3 Present and future transport demand estimation

6.3.1 Trip generation, trip distribution and mode choice sketch planning

A preliminary investigation was done to estimate the total person trips in Kigali and to help predict the type of measures that would be required by 2050 before more detailed planning was completed.

Some assumptions are made in this simple preliminary calculation:
- 10% of daily trips are made in the morning peak hour
- The analysis included in the BRT Feasibility and Preliminary Design Second Interim Report was based on a multi-modal transport demand model and supporting data surveys. The mode split information from this report was assumed in the demand estimation for the update of the transport master plan, as shown in Table 6.2:

- The average person makes 1.8 trips per day
- 2018 Population of Kigali: 1 500 000
- 2050 Population of Kigali: 3 800 000

The Table 6.3 shows the projected number of trips estimated.

There is a very large increase in number of road trips expected from around 75 000 to around 410 000. ***Even with a BRT system implemented, extensive road upgrades and extensive additional public transport solutions will be required to support Kigali's rapidly growing population.***

NMT trips will increase only slightly from around 150 000 to around 190 000 in 2050 when BRT is implemented. These types of trips are the most sustainable as they have low capital input requirements, no running costs and are less damaging to the environment. It is important that the City of Kigali enable non-motorised transport and make it as attractive as possible to decrease the number of road and public transport trips.

The required additional infrastructure upgrades is also dependent on average trip length. When mixed-use developments are implemented, trip lengths are shorter as people are able to commute by walking and cycling. Other journey purposes such as school trips and shopping trips also become shorter with mixed-use developments. Kigali is somewhat unique in the sense that trip lengths are already fairly short. If mixed-use developments are therefore implemented one could expect trip lengths to remain short on average going forward.

A desire line is the number of people that would like to travel between two particular zones. In a scenario where trip lengths are shorter, many intra-zonal trips will occur while in a scenario where trip lengths are longer, more infrastructure is required to facilitate more inter-zonal trips.
Where most trips are short, many trips happen within zones and can therefore easily take place via NMT. In a case where the trips are longer, many more people travel between zones and they travel further distances. It is important to note that the recommendations of this master plan is dependent on an assumption that trip length frequency will remain similar to what was observed as part of the surveys. This is discussed in more detail in Section 3.1.

6.3.2 Benchmarking / Case Studies

To understand international best practices, various leading examples have been studied based on selected criteria. The criteria for selecting benchmark cities are as below:

- Some of the Top Overall Transport Systems in the World
- Bus Rapid Public transport in other African Cities

Residential and Commercial Parking Standards were benchmarked in the BRT Feasibility Study and Preliminary Design Second Interim Report.
Table 6.4 and Table 6.5 list the examples used to understand international practices for overall transport systems and BRT respectively.

Mode Split Information	Non-motorised Transport	Car or Moto-Taxi	Public Transport
2017	52%	32%	16%
2050 Without BRT	21%	60%	19%
2050 With BRT	28%	52%	20%

Table 6.2 Modal Split Data (BRT Feasibility and Preliminary Design Second Interim Report)

No. of Peak Hour Trips	NMT	Car or Moto	PT	Total
2018	151 200	75 600	43 200	270 000
2050 Without BRT	143 640	410 400	129 960	684 000
2050 With BRT	191 520	355 680	136 800	684 000

Table 6.3 Estimated Projected Number of Person Trips

Countries/Locations	Singapore	Paris	Hong Kong	London	Madrid	Kigali
General Information						
Population (people)	5.6 million	7 million	3.3 million	8.4 million	3.2 million	1.5 million Planned: 3.8 million
Population Density (people per km2)	8 100	9 200	36 300	5 200	5 200	2 500 Planned: 5 200
National GDP per Capita (USD)	66 900	57 200	57 200	37 200	39 300	2 207
Transport System						
Public : Private	75 : 15	-	88 : 12	34 : 66 (Metro 2005) 55 : 45 (City 2005)	54 : 46 (Metro 2005) 66 : 34 (City 2005)	84:16
Cars / 1000 person	530	530	63	213	563	-
Percentage of Paved Road	100	100	100	100	99	14
Average Commute Time (min)	84	64	73	84	62	2km / 30 min
Average Waiting Time (min)	12	12	14	13	11	30
Walking Distance (km)	0.56	0.74	0.73	0.53	0.59	2km / 30 min Planned: KPI is 500m from PT service
Key Successes	Efficiency: Currently developing predictive maintenance system Affordability: Including discounts for low-wage workers; free travel for children and other concessions Convenience and flexibility of ticketing system	Developed roads with some being converted to accommodate more NMT High levels of safety (37% of roads limited to 30km/h) Real-time information screens	75% population and 95% work-places within 1km of metro station (37% of trips by heavy rail) Modern technology including card that works for transport payment, non-transport services, office access etc. Improved sustainability with electric vehicles	Success in public and private transport with efficient ITS driven systems and Transport for London focusing on reliable public transport Unified way finding system for multi-modal travel Safe transport	Metro system with good coverage Good public transport efficiency with improved maintenance, extended coverage, new infrastructure and increased workforce	There are currently a large number of commuter trips using Non-Motorised Transport.
Affordability of monthly public transport ticket compared to average income (%)			2.55%	6.14%		

Table 6.4 Transport Systems

Cities	Johannesburg	Cape Town	Pretoria	Lagos	Dar es Salaam	Kigali
Population	4.4 million	3.7 million	2.9 million	22 million	4.3 million	Planned: 3.8 million
Density (People/km2)	2 696	1 530	464 (Metro density)	7 759	3 100	Planned: 5 200
BRT Name	Rea Vaya	MyCiti	A Re Yeng	Lagos BRT	DART	-
Date Operational	2009	2011	2014	2008	2016	Planned: 2025
Length (km)	43.5	31	14	22	20.9	Planned: 109
No. of Stations	13	30	12	28	27	131
Position of Lanes	Median	Median	Median	Kerb	Median	Median
Fleet Size	277	-	30	220	177	Planned: Approximately 700
Commercial Speed	30	30	-	30	23	Planned: 25
Boarding Level	High	Low	Low	Low	High	
Passengers per Day	42 000	66 178	3 400	200 000	180 000	Planned: 145 000
Infrastructure Cost per km (USD)	11 980 (2013)	-	-	1 700 (2010)	8 130 (2018)	Planned:6280 (2050)

Table 6.5 Bus Rapid Public transport

6.3.3 Best Practices

Transport Network

There are various urban typologies. Centralized, decentralized and distributed are some examples of these. The existing and planned urban typology within Kigali suggests a decentralized pattern with four planned regional centers.

A City with an effective transport system is spatially integrated and unified. Different transport network models have different advantages and suit different areas. Some example networks are shown in Figure 6.1.

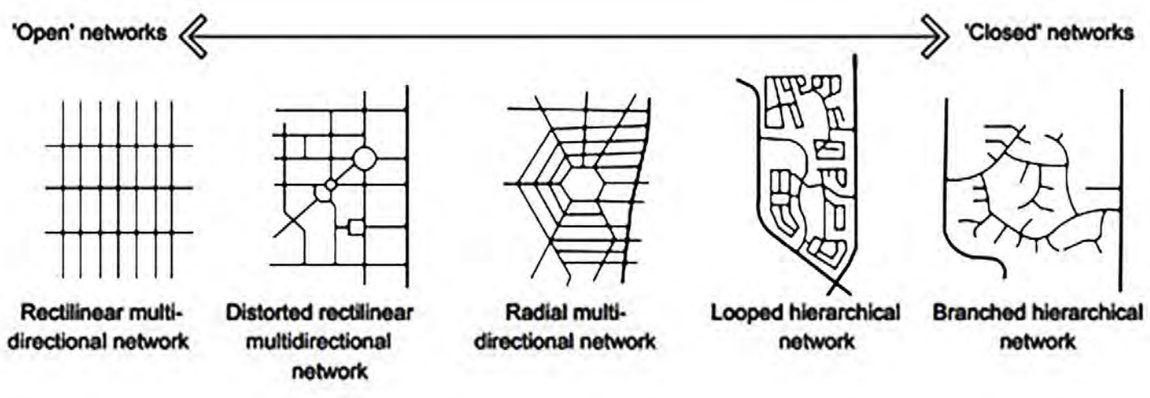

Figure 6.1 Examples of Generic Networks (Source: Guidelines for Human Settlement Planning and Design Volume 1, CSIR, 2000)

The existing road network in Kigali is very much a closed network mainly due to topographical challenges. The benefit of a closed network is that fast moving through traffic is limited and it therefore presents a safer environment than an open network. However, a movement towards a more open network in Kigali would be advantageous as one of the benefits of such a network is increased accessibility for all modes, including NMT.

Kigali, because of the terrain and urban design, is best suited towards a decentralized system where multiple centers have high accessibility and represents the dominant areas of the network. This is also sometimes referred to as a hub-and spoke style distribution system and is represented in Figure 6.2.

A hub and spoke distribution system allows people or goods to converge in a ring and radiate from a central hub. In a city, the center and other local urban centers can be represented by hubs and connections between the surrounding areas while the connections can be considered as spokes.
Interurban connectors can also originate from outside the city, and connect to the regional centers. This system is designed to minimize the number
of routes between key nodes and other hubs. This system is ideal especially for public transport where feeder systems provide traffic to key hubs, which in turn distribute traffic along the key transport corridors. The hub-and-spoke model is considered very efficient in keeping costs and inventory down while maximizing utility.

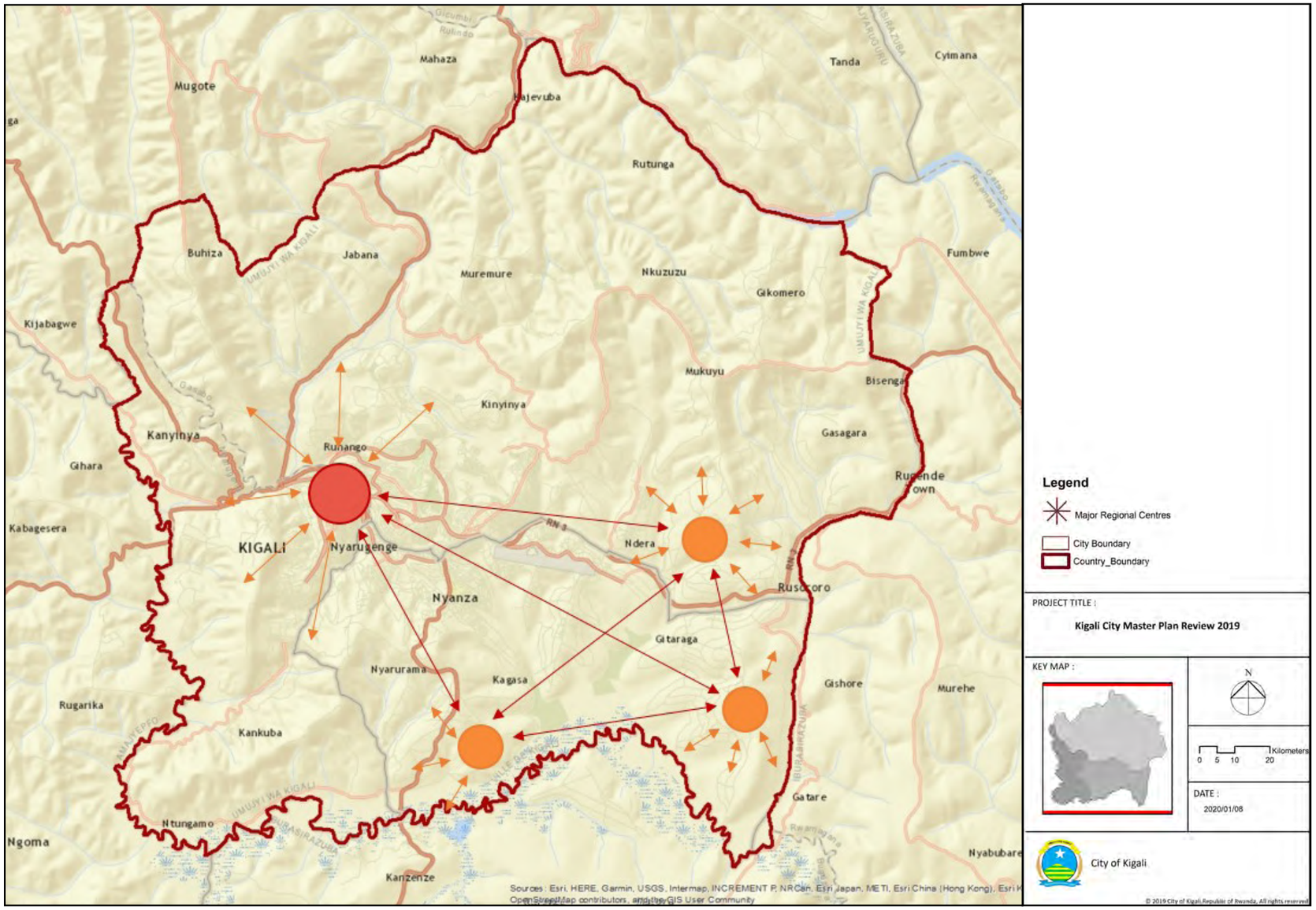

Figure 6.2 Hub and Spoke Distribution System highlighting Planned Regional Centres

Road Network

Road hierarchy planning is an urban planning method where the different roads are differently designed to prioritise their purpose. The two main distinguishing purposes are mobility and access. Roads are then categorized and specifications for road types such as speed and intersection spacing can be specified.

Larger roads are used to carry through traffic longer distances while smaller streets provide access to local properties and areas. These roads may be given different names but follow the principles that major roads follow strategic routes allowing for heavier traffic and higher design speeds while minor roads are designed to allow for many access points with light traffic and lower design speeds.This road hierarchy planning illustration is shown in Figure 6.3.

The objective of road hierarchy planning is to allow authorities to group roads in a manner that allows for easy adoption of appropriate standards for construction, upgrade, maintenance and development.

A hierarchy plan should:

- Direct long distance flow into less sensitive locations.
- Separate high speed and volume traffic from areas where this may be dangerous.
- Preserve areas where through-traffic is discouraged.
- Ensure development can be given sufficient space where access is more critical than mobility

An example of road hierarchy planning is illustrated in Figure 6.4.

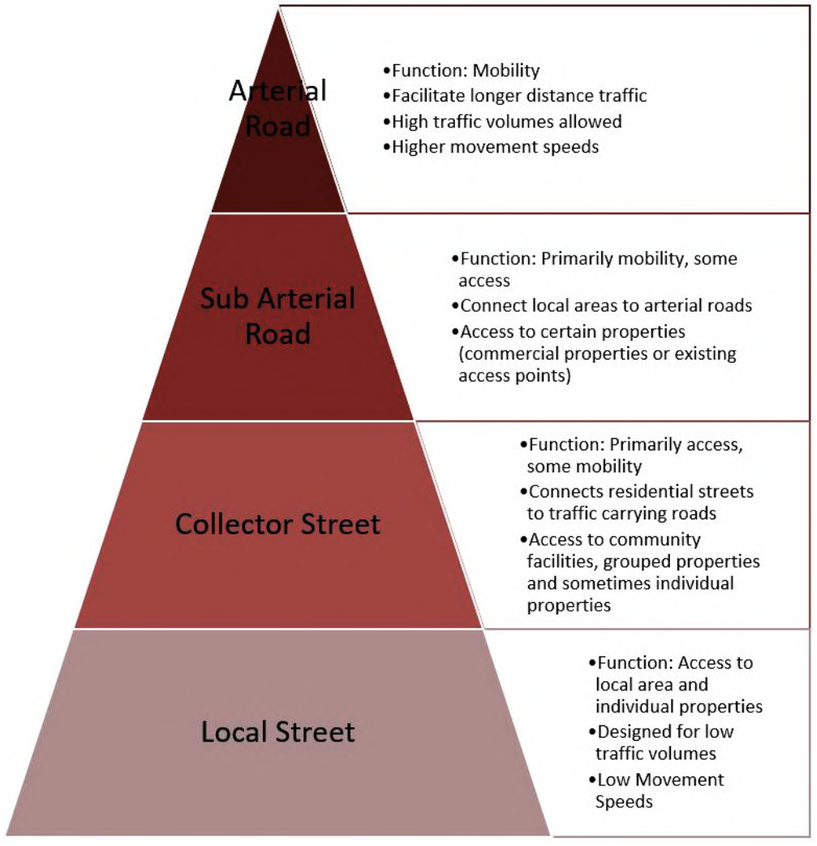

Figure 6.4 Road Hierarchy Planning

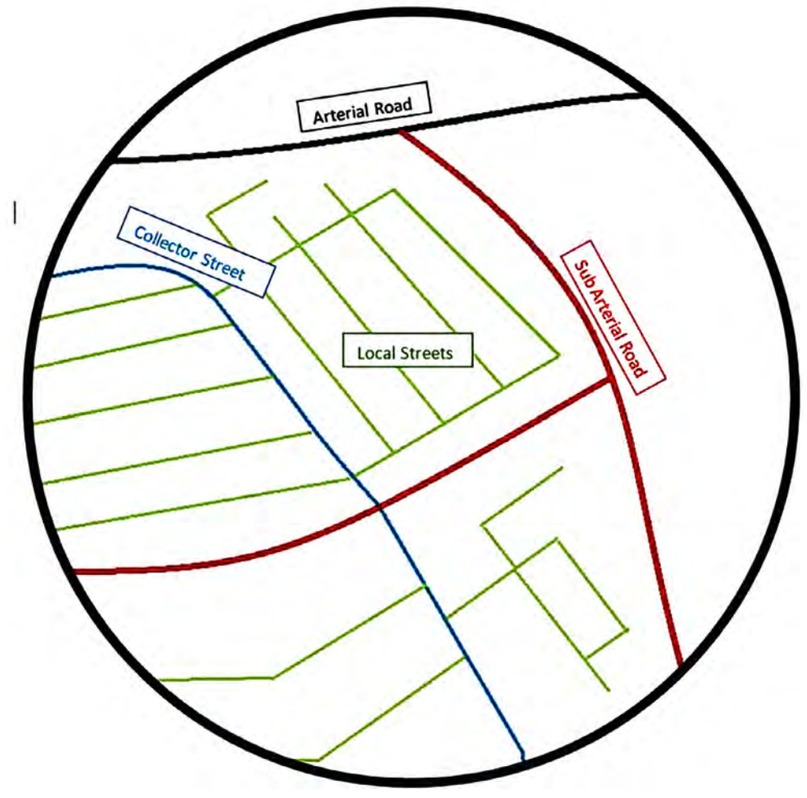

Figure 6.3 Example Road Hierarchy Plan

Although in this example only four levels of road were used, for specific areas more can be used as required by the specific region. Another example of roar hierarchy plan is illustrated in Figure 6.5.

Higher class roads can be used to separate different or incompatible areas but should not become a barrier within a development. Generally roads should only intersect with their own class of road or one class above or below the same class. In open networks this may be problematic, in which case consideration should be given to limit certain roads to specific modes of transport, to improve safety.

While a traffic analysis and simulation are relevant for vehicular traffic, vehicular capacity expansion should not be considered in isolation. Recommendations of road capacity expansion should be done as part of a integrated transport system approach taking into consideration public transport increased capacity (BRT), parking management and NMT infrastructure that would alleviate needs for vehicular capacity expansion.

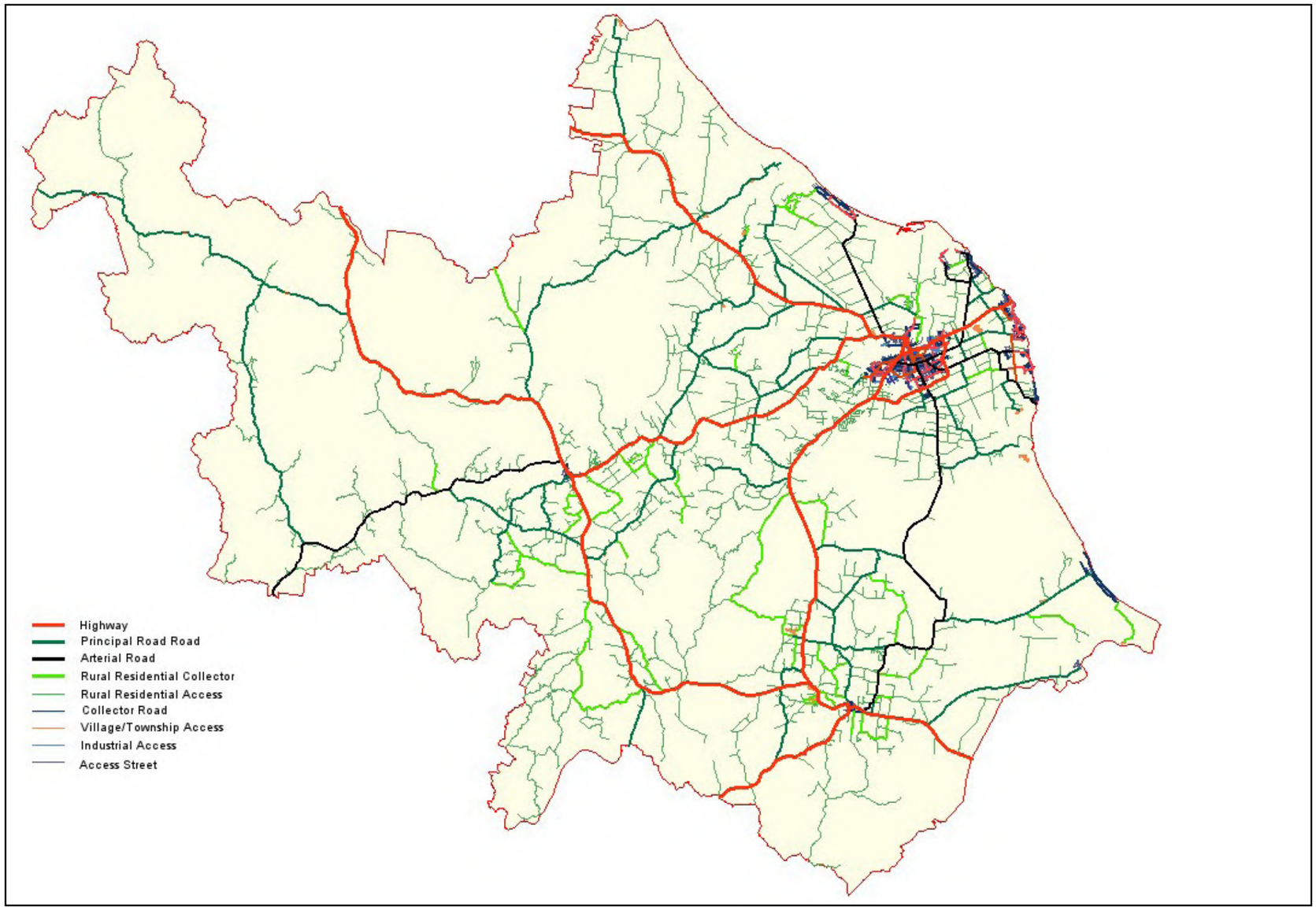

Figure 6.5 Example Road Hierarchy Plan (Source: http://lgam.wdfiles.com/local--files/road-hierarchy/BRC-Road-Hierarchy-Plan.png)

Public Transport Network

Traditional public transport hierarchy planning provides higher speed public transport services with infrequent stops along high demand routes between communities or larger areas; low speed medium sized vehicles within a sub-area and more private variable services over localized shorter distances.

This is to ensure that transport modes minimize travel times for the average user while still providing them with a service that gets the individual user very close to the destination. Costs of trips for longer distances are split between many users while modes such as taxis allow users better access locally.

This method of planning has received some criticism as it can result in people having to do multiple transfers between routes and modes. An excessive amount of transfers discourages people from using transport services. With autonomous vehicles and e-haling services likely becoming more prevalent in future hierarchical public transport planning should be done in a way that minimizes transfers where possible and in ways that can be adapted or will complement autonomous and e-haling services.

The chart in Figure 6.6 shows a breakdown of transport modes and gives some operating details.
One method that helps minimize the negative effects of transfers is an integrated network where departure times are coordinated between modes. Another method of improving public transport services is to ensure there is a unified payment system or integrated ticketing.

A good public transport system has the following characteristics:

- Readily available (where and when)
- High Frequency Services
- Good travel speeds
- Reliable
- Short boarding times
- Safe and secure
- Affordable
- Integrated
- Comfortable
- Accessible
- Good accommodation of users with specific needs
- Good attractiveness and marketing

As no individual mode is currently able to provide all of the above qualities, specific qualities are prioritized for different modes in an integrated system to provide for user needs for each portion of the trip. For example while a taxi provides good accessibility it is often less affordable than a BRT which provides good mobility but is not a door-to-door service.

Heavy Rail	•Large, high speed trains with very high capacity •Separate rights of way •Infrequent stops
Light Rail Public Transport	• Moderate size, medium speed trains • Mainly separate rights of way • Variable distance between stops
Trams/ Street Cars	• Small, low speed trains • Primarily on urban streets • Short distance between stops
Bus Rapid Public transport	• Medium to large buses with medium capacity • Mainly separate rights of way • Medium to high speeds
Express Bus	• Bus on scheduled routes • Usually no separate rights of way • Medium speeds • Infrequent stops
Fixed Route Bus Service	• Bus on scheduled routes • Usually no separate rights of way • Low to medium speeds • Frequent stops
Ferry Services	• Boats used to transport therefore often default rights of way • Low to medium speed • Variable stops
Parapublic Transport	• Small bus/ van with low capacity • Demand- responsive service • Low speed • Stops as required
Personal Rapid Public Transport	• Small automated vehicles on track • Demand responsive service
Ride Share	• Vans or taxis carrying multiple people
Taxi	• Conventional taxi service with very low capacity

Figure 6.6 Transport Modes and Operating Details

Freight Network

Freight is required for delivery of goods but as freight is the primary cause of road deterioration it is ideal for freight to be separated from regular road traffic either through the use of rail or through separate freight roads.

As separate freight roads are usually not possible it is important that freight routes are prescribed to major roads and roads outside urban areas as far as possible as these are better designed for the wear caused by heavy vehicles.

Freight is more dangerous on local roads and access to local roads especially during peak hours should be minimized to lessen the negative effects on traffic and road user safety.

Logistic hubs are critical to ensure the freight is effectively managed.

Green Transport Network

A Green Transport Networks design approach requires streets to be planned, designed, operated, and maintained to enable safe, convenient and comfortable travel and access for users of all ages and abilities especially if their chosen mode of transport is non-motorised. Design should allow for safe travel by those walking, cycling, and using alternative non-motorised transport modes.

As green transport networks have very low negative effects on the environment with relatively low infrastructure and user costs it is a preferred mode of transport. As movement is slow it is critical that land-use planning supports short trip distances to enable users to use this mode of transport. Non-motorised transport networks should also support public transport networks in their design.

A good non-motorised transport network should be continuous and connected in order to be useful. It should also be properly designed and maintained with safe and secure crossings and protection from dangerous or high-speed traffic.
NMT modes are very affected by hilly topography and routes should follow less steep inclines if possible. Seating or rest points could be provided in these areas to improve attractiveness.
Safety for NMT users is also a concern and so good lighting, security and other safety measures against crime should be in place.
Weather affects user ability to use NMT services and shade or shelter at points along routes may improve the attractiveness of this green mode of transport.

Transport Policy Implementation

In order to implement Transport Policy effectively a well-developed Legislative framework is required, which should be supported by the appropriate Governance / Institutional structures.

- Clear distribution of authority
- Good integration and communication between various authorities
- A holistic vision with supporting guidelines and legal backing
- Knowledgeable and experienced staff

An effective method to ensure that transport policy is well planned, implemented and does not allow for gaps in responsibility or duplicated contradictory work is to have a single corporate body to manage planning and design. The authority's functions can then be audited by independent bodies.

6.4 PTV Visum Macro Simulation Model Development

6.4.1 Overview

A PTV VISUM macro-simulation model was used to assess the road-based AM peak hour vehicular travel demand throughout Kigali and to help make informed strategic transport decisions in terms of future road infrastructure requirements. Public transport person demand and infrastructure and services capacity were considered in a separate high level spreadsheet model. The impact of public transport provision on road-based vehicular demand was determined through this parallel spreadsheet model and taken into account in the PTV macro-simulation model.

PTV VISUM is comprehensive transport modelling software and was used with a standard four step modelling process consisting of trip generation, trip distribution, modal choice and trip assignment.

Classified link traffic count surveys were used to derive revised travel demand patterns for each of the external roads entering and exiting the study area. A process of matrix estimation was used to revise the existing VISUM model to establish an updated base year model. A full network audit took place and edits and revisions were made to take account of new developments since 2013. The macro demand model was validated for the 2018 AM peak hour.

Accurate and comprehensive data was critical to calibrate the model. The data for input into the AM peak hour model included:

- 30 classified link traffic surveys during the 2018 weekday AM peak hour, as per Section 3.2.2.
- Journey time surveys along 5 routes during the 2018 weekday AM peak hour, as per Section 3.3.
- 30 classified intersection traffic surveys during the weekday AM peak hour, as per Section 3.2.1.
- Results from household travel surveys (approximately 3500 surveys in 2018), as per Section 3.1.
- Population and employment numbers from 2018 Master Plan Review, as per Section 7.
- Existing (2018) Land-Use from 2018 Master Plan Review, as per Section 5.
- Proposed 2050 Land-Use from 2018 Master Plan Review, as per Section 5.
- 2050 Mode split from BRT Feasibility and Preliminary Design, Second Interim Report, as per Section 1.3.1.

6.4.2 Model development

From the traffic count survey data the morning peak hour was taken as 07:30 to 08:30 AM in Kigali. Trip generation was estimated using the existing and projected population information. Trip distribution was determined using the existing and planned land-use and employment data. Mode split was taken from traffic count data and from the 2019 BRT Feasibility and Preliminary Design Second Interim Report.

Model Calibration

The model was calibrated and validated to an acceptable level using the traffic intersection and link count survey data collected in the data collection process. Table 6.6 shows the model validation measure and goal, which is inherent to PTV Visum, as well as the final model validation value for the four-step strategic model.

Model Structure

The demand strata in the model included private vehicles, Moto-Taxis and heavy vehicles. No public Transport operations were included in the Road Network model.

6.4.3 SCENARIO DEVELOPMENT

Various scenarios were developed to evaluate projects and best practice approaches suggested in Section 6 and 8.3.3. These included supply changes such as infrastructure upgrades to the road network as well as demand changes for example different mode splits in the case of BRT being implemented.

Table 6.7 shows a summary of the tests of the impact of different scenarios on the road network. Details on projects are included in Chapters 9 and 10. The road network upgrades were modelled by increasing the capacity and lanes along relevant roads. The 2050 base demand was based on population and employment growth projections as explained in Chapter 7.

Demand changes were incorporated by reducing the demand on the network to account for either a network wide mode shift or a decrease in road-based vehicle trips between specific zones.

- In this scenario the number of trips are grown based on an increase in population but no adjustments have been made to account for growth in vehicle ownership
- In this scenario vehicle ownership has resulted in a higher number of private car vehicle trips with no BRT implemented. This vehicle ownership growth was based on BRT Feasibility and Preliminary Design Second Interim Report.
- In this scenario vehicle ownership growth as well as an operational BRT system have been accounted for and is based on the BRT Feasibility and Preliminary Design Second Interim Report.

Measure	Goal	Final Model
R^2	>0.85	0.855
Slope	0.9-1.1	0.925
GEH for individual link roads <10%	85%	85.84%

Table 6.6 Calibration Criteria and Results

Tests	Demand Scenarios				Supply Scenarios				
					Road Infrastructure Upgrades				
	2018 Calibrated Demand	2050 Demand based on Population Growth1	2050 Demand with Population Growth and an increase in Car Ownership2	2050 Demand with Population Growth, and increase in Car Ownership and BRT Operational	Airport Link Road	Kigali Ring Road	High Capacity Urban Roads (excluding Kigali Ring Road)	2 Private Vehicle Lanes along BRT Routes	Final Proposed 2050 Road Network
1	■								
2		■							
3			■						
4				■					
5	■							■	
6	■				■			■	
7	■					■		■	
8	■						■	■	
9	■				■	■	■	■	
10				■				■	
11				■				■	
12				■				■	
13				■				■	
14				■	■	■	■	■	
15	■				■				
16	■					■			
17	■						■		
18	■				■	■	■		
19				■	■				
20				■		■			
21				■			■		
22				■	■	■	■		
23				■	■	■	■	■	■

Table 6.7 Model Demand and Supply Tests

6.3.5 Transport Demand

2018 AM Peak Hour

Figure 6.7 shows the Private vehicle assignment for 2018. Figure 6.8 shows the Volume/Capacity Ratios on different roads. Additional existing problem areas may not be highlighted as these are caused by intersection problems rather than road capacity issues. These are addressed by a Microsimulation model and accompanying report.

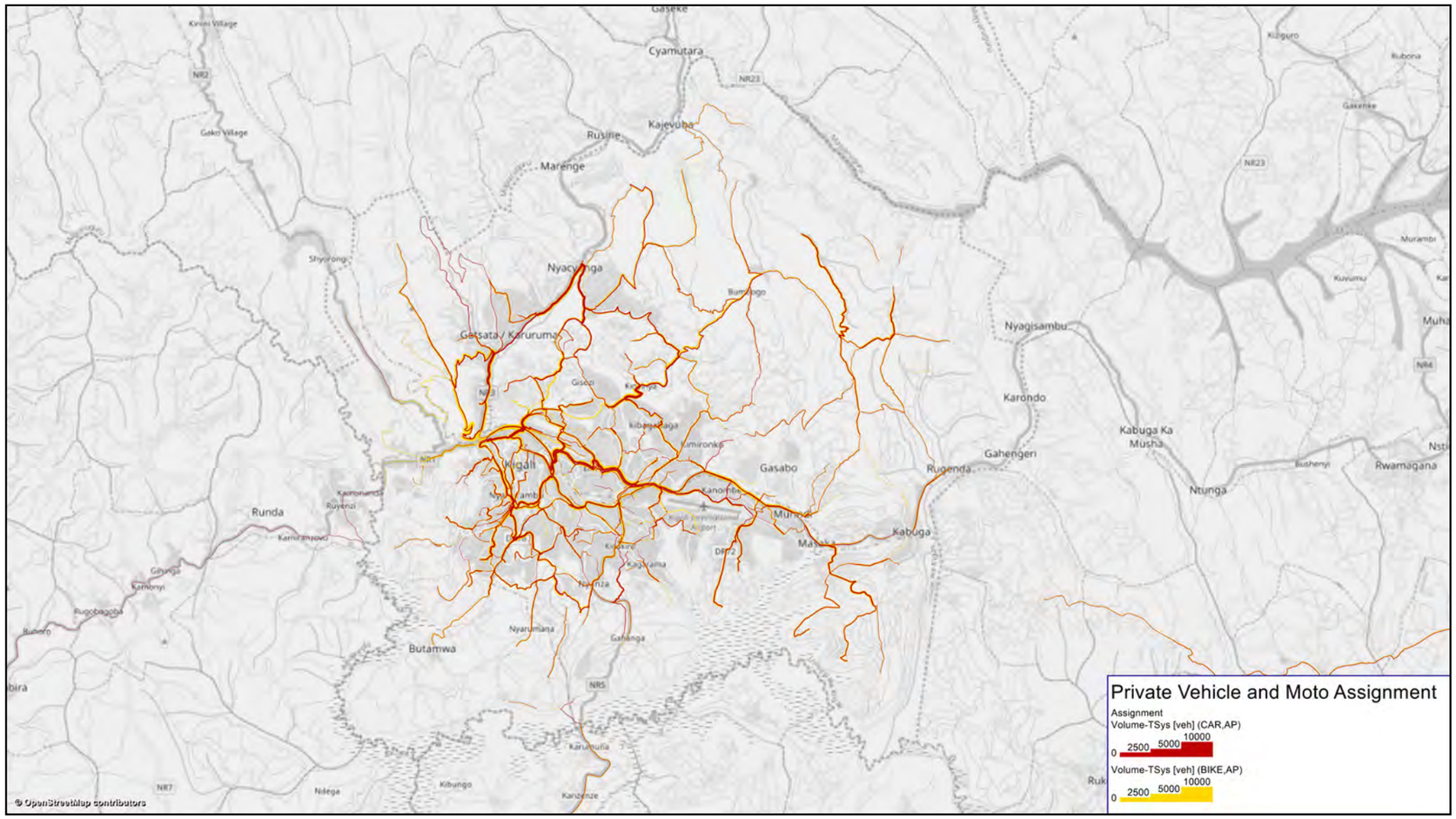

Figure 6.7 2018 Private Vehicle and Moto Assignment (Scenario 1)

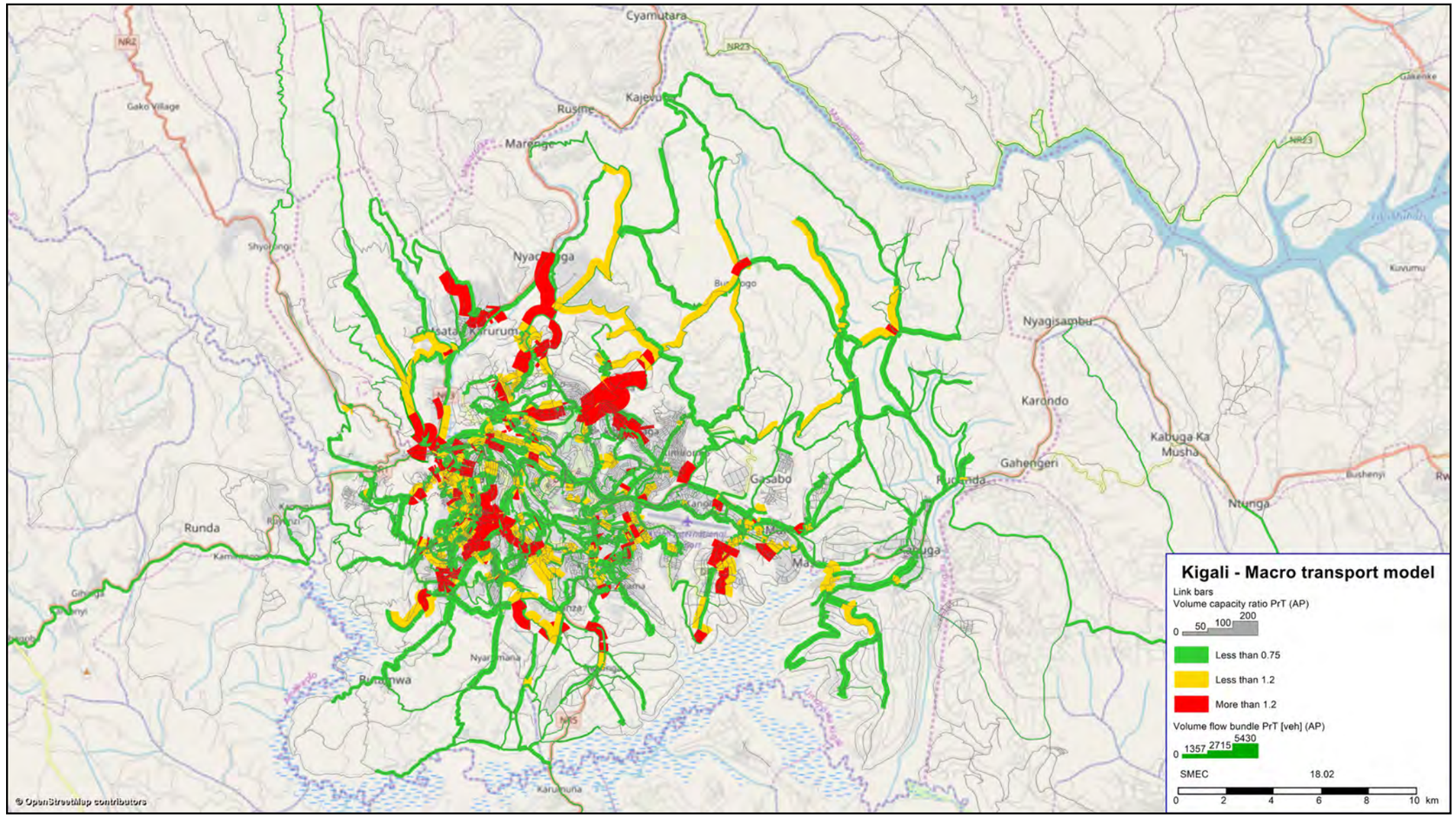

Figure 6.8 2018 Volume/Capacity Ratios (Scenario 1)

2050 AM Peak Hour

Figure 6.9 shows the 2050 vehicle assignment. This standard scenario assumes the BRT system has been implemented and there are reduced private vehicle trips but no road network upgrades have been implemented.

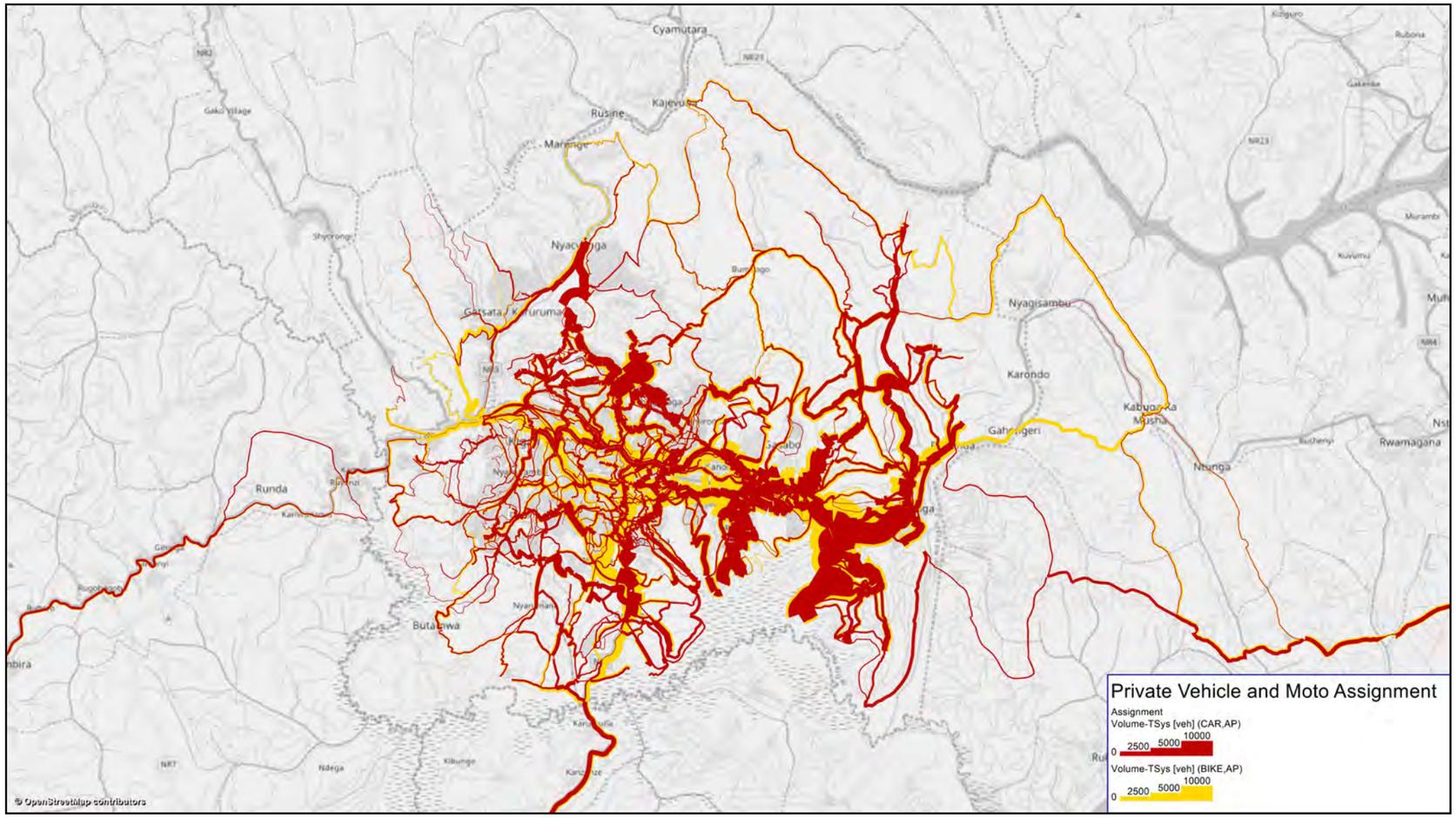

Figure 6.9 Private Vehicle and Moto-Taxi Vehicle Assignment for 2050 including growth in private vehicle ownership and assuming operational BRT (Scenario 4)

Figure 6.10 shows the Volume/Capacity ratios expected in 2050 with no Road Network Upgrades.

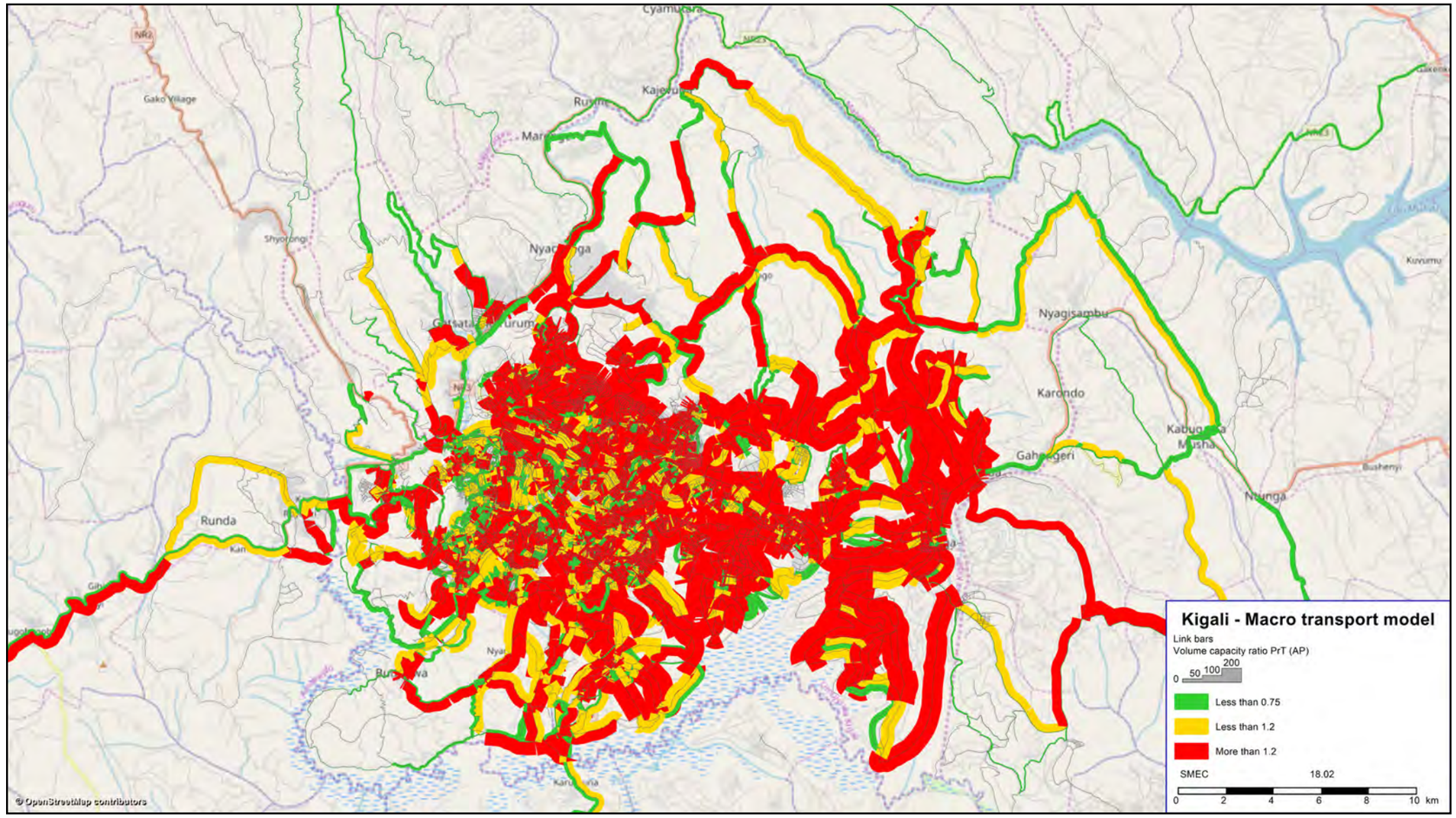

Figure 6.10 2050 Volume/Capacity Ratios for Road Network with No Road Upgrades Implemented (Scenario 4)

Compare 2015 TO 2018

Figure 6.11 shows the increase in traffic between 2018 and 2050.

The demand assessment show that a significant increase in vehicle-hours and delay can be expected by 2050, assuming the BRT is operational, coupled with an increase in car ownership and an increase in population from 1.5 million to 3.8 million. Transport strategies to mitigate against the impact are outlined in Chapter 7, 8 and 9.

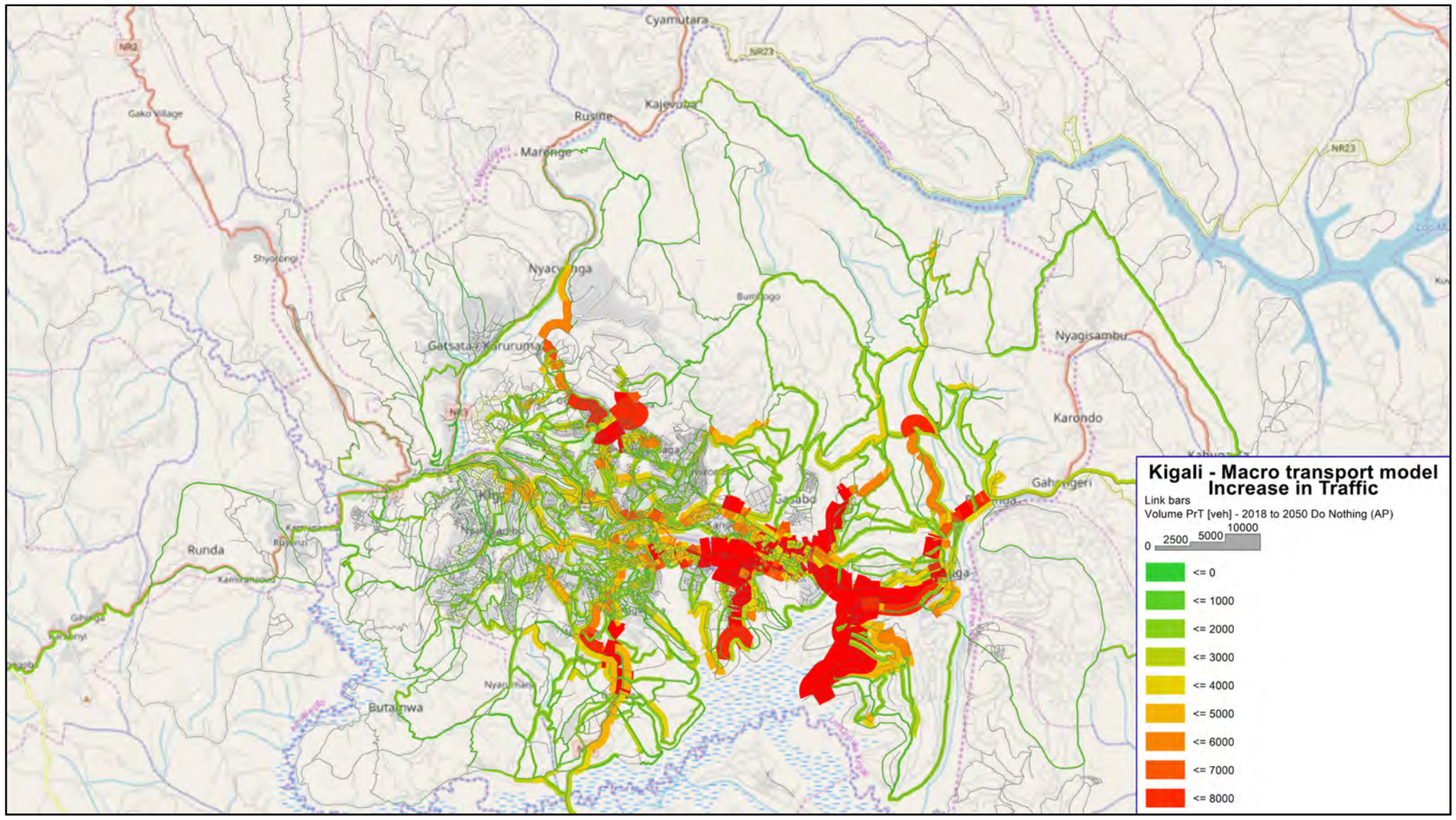

Figure 6.11 AM peak hour vehicular demand increase from 2018 to 2050 (Scenario 1 to Scenario 4)

	Network Travel Time (Vehicle Hours)	Network Distance (Vehicle Kilometres)	Population (million)
2018 Demand (Scenario 1)	26 628	993 634	1.5
2050 Demand (Scenario 4)	365 384	4 804 021	3.8
% increase per annum	8.5%	5%	2.9%

Figure 6.12 VISUM Model results Scenario 1 and 4

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7

Public Transport Strategy

7.1 Remaining Major Public Transport Projects
7.2 Public Transport Demand
7.3 Public Transport Recommendations and Requirements

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7 Public Transport Strategy

7.1 Remaining Major Public Transport Projects

Table 7.1 lists the key strategies of the Public Transport Plan.

Public Transport Plan – Key Strategies	Key Performance Indicators
Develop a high-quality public transport system which provides good coverage, and direct, fast and frequent services.	80% of urban areas to be within 500m (or 10 min walk) of public transport services.
Develop a road network that supports the public transport system.	Public transport services to connect all major regional centers.
Develop a supplementary feeder system which works in conjunction with the public transport system.	100% of urban areas to be within 500m (or 10 min walk) from the feeder system.
Develop a high-quality public transport system which is easily accessible and segregated from private road-based traffic.	Public transport services to connect all major regional centers.
Develop a supplementary feeder system which maximizes public transport coverage.	100% of urban areas to be within 500m (or 10 min walk) from the feeder system.
Adopt Intelligent Transport Systems (ITS) to enhance service reliability.	Adopt ITS technologies for use in public transport service design.
Locate road-based public transport stations, stops or interchanges along major arterial roads.	Provision of road-based public transport access points along major arterial roads in regional centers.
Integrate non-road-based public transport services (rail and air transport) with road – based public transport services.	Rail and air transport to be within 1km of road-based public transport services.
Connect regional centers with public transport services.	Public transport services to connect all major regional centers.
Integrate all road-based public transport services.	Provision of intermodal interchanges at major public transport intersections.
Develop a city-wide NMT network which supports the public transport system and utilizes open spaces.	Development of an NMT network.
Develop a Non-Motorised Transport (NMT) network along arterial and collector roads.	Inclusion of NMT in road hierarchy and cross-sections.
Develop a strategic approach to providing pedestrian amenities such as trees and street furniture.	Commission of road design manual and guidelines.
Develop a pleasant streetscape especially along the NMT network.	Inclusion of NMT in road hierarchy and cross-sections.

Table 7.1 Key Strategies of Public Transport Plan

7.1.1 Nyabugogo Transport Hub

The preliminary designs for the Nyabugogo Bus Terminus is complete. The design proposes local buses, BRT buses and buses to secondary cities and neighbouring countries are serviced within the hub. This hub will become a central point for public transport within the CoK as well as transport to nearby cities and countries. The location of the proposed Nyabugogo Transport Hub is illustrated in Figure 7.1.

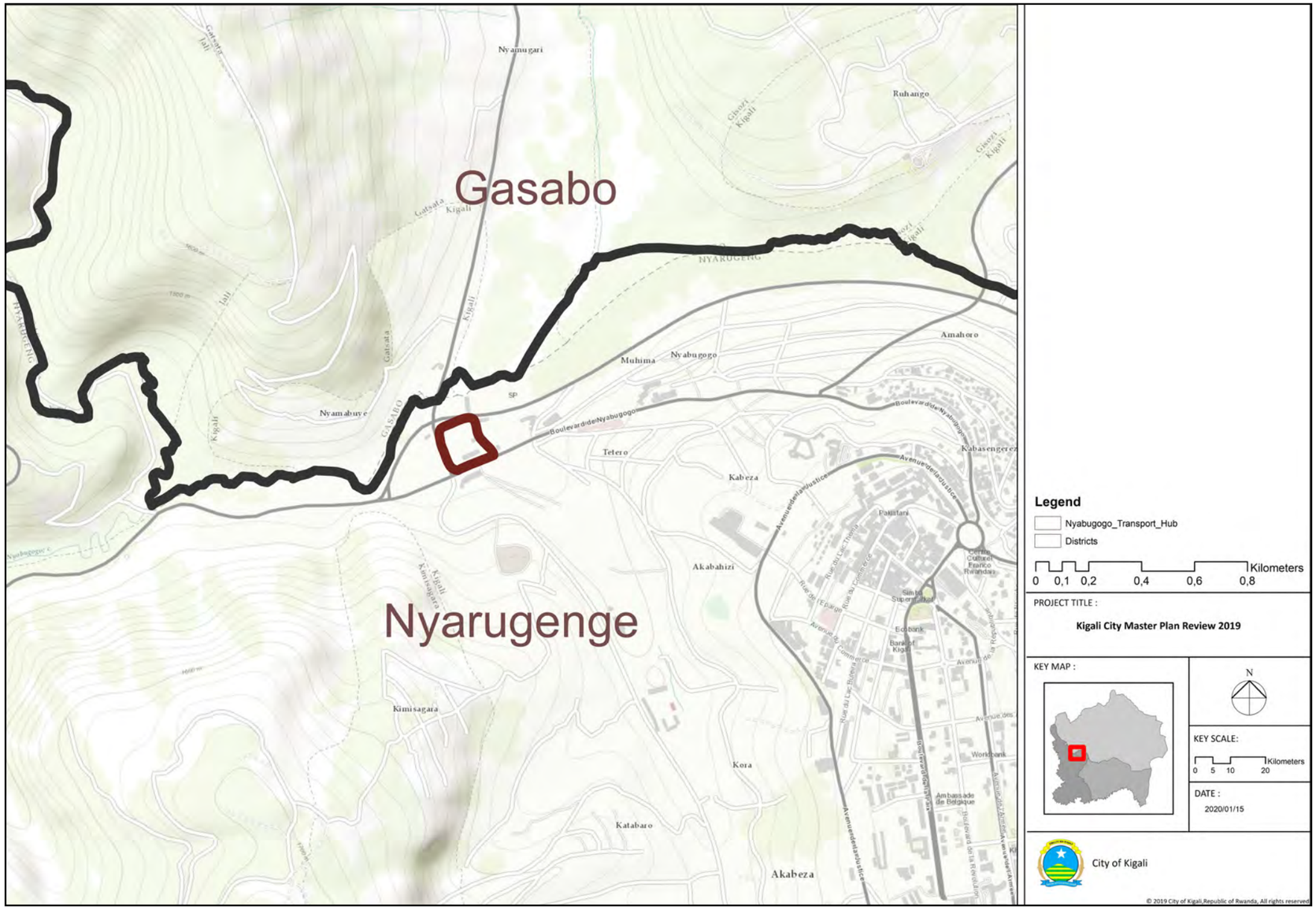

Figure 7.1 Proposed location for Nyabugogo Transport Hub

7.1.2 Bugesera International Airport

Bugesera International Airport is under construction and has been planned to have construction completed by December 2020. It is set to become Rwanda's largest International Airport with one 4 500m runway and an ultimate capacity of 4.5 million people trips per year. Figure 7.2 shows an aerial view of the airport under construction and Figure 7.3 shows a conceptual layout of the airport.

7.1.3 BRT Feasibility and Preliminary Design (Second Interim Report, 2019)

In 2013 the CoK undertook a project to conduct a Transport Master Plan in efforts to fulfil CoK's vision to be a City of Green Transport. The Master Plan included a strategic proposal for the development of a BRT network. A BRT feasibility and preliminary design was then completed in 2018 which was a more detailed study and refined some of the BRT details. This Transport Master Plan works on the assumption that the recommendations made in the BRT Feasibility and Preliminary Design Second Interim Report in terms of BRT infrastructure and operations as well as BRT corridor road network upgrades will be completed. In case population numbers increase at faster rates than predicted in the BRT Feasibility and Preliminary Design Second Interim Report, allowance should be made to implement the BRT sooner than previously proposed.

Figure 7.2 Aerial view of Construction of Bugesera International Airport

The objectives of the BRT project were to:

- Improve access to public transport
- Reduce travel time
- Reduce pollution
- Improve reliability, comfort and safety
- Capacitate a group of people able to continue/correct the Project

These objectives are in support of the *City on the Move* goals of the CoK.

In order to determine the feasibility of a BRT system in the CoK, a travel demand and forecasting model as well as a land-use model were developed using TRANUS and R software.

The transport model included:

- A Travel Demand and Mobility Model, which derives the demand for travel based on the socioeconomic and land use scenarios;
- A Mode and Destination Choice Model, which based on travellers' demand and preferences estimate the mode and destination of the trips originated in each zone;
- A Route Choice Model, which based on travellers' demand and preferences estimates the vehicle and passenger flows on the road and public transport network.

The land use model is composed of two sub-models:

- An Accessibility Model that estimates the accessibility of the different zones of the CoK based on the outcomes of the transport model;
- A Location Model that distributes the residential population on the available land for development and provide an estimate of the impact of travel accessibility on land prices.

Figure 7.3 Planned Bugesera International Airport (https://www.archdaily.com/911624/rwandas-bugesera-international-airport-to-set-records-for-sustainability/5c68d9e4284dd151290000ba-rwandas-bugesera-international-airport-to-set-records-for-sustainability-photo)

Figure 7.4 shows the final BRT route alignments determined from the models as well as discussion with relevant stakeholders in the CoK.

In terms of feasibility the following evaluations were completed:

- Economic Feasibility Study: The objectives of this portion of the evaluation was to evaluate the potential costs, revenues and subsidy requirements of the BRT system and this was done from an investor's perspective where non-financial benefits such as reduced pollution and improved time savings were not considered.
- Environment Safety and Social Impact Assessment: This assessment were used to identify and determine the urban impacts of the proposed BRT system for example its compatibility with urban projects and the resolution of expropriations.
- Sensitivity and Risk Analysis.

The following designs were completed as part of the preliminary design for the project:

- Public Involvement and Communication Plans
- Brand Concept
- Preliminary Traffic Management Plan for the construction period
- BRT Road Conceptual Design
- Terminal Design
- Bus Depot Design
- Traffic Engineering Improvements

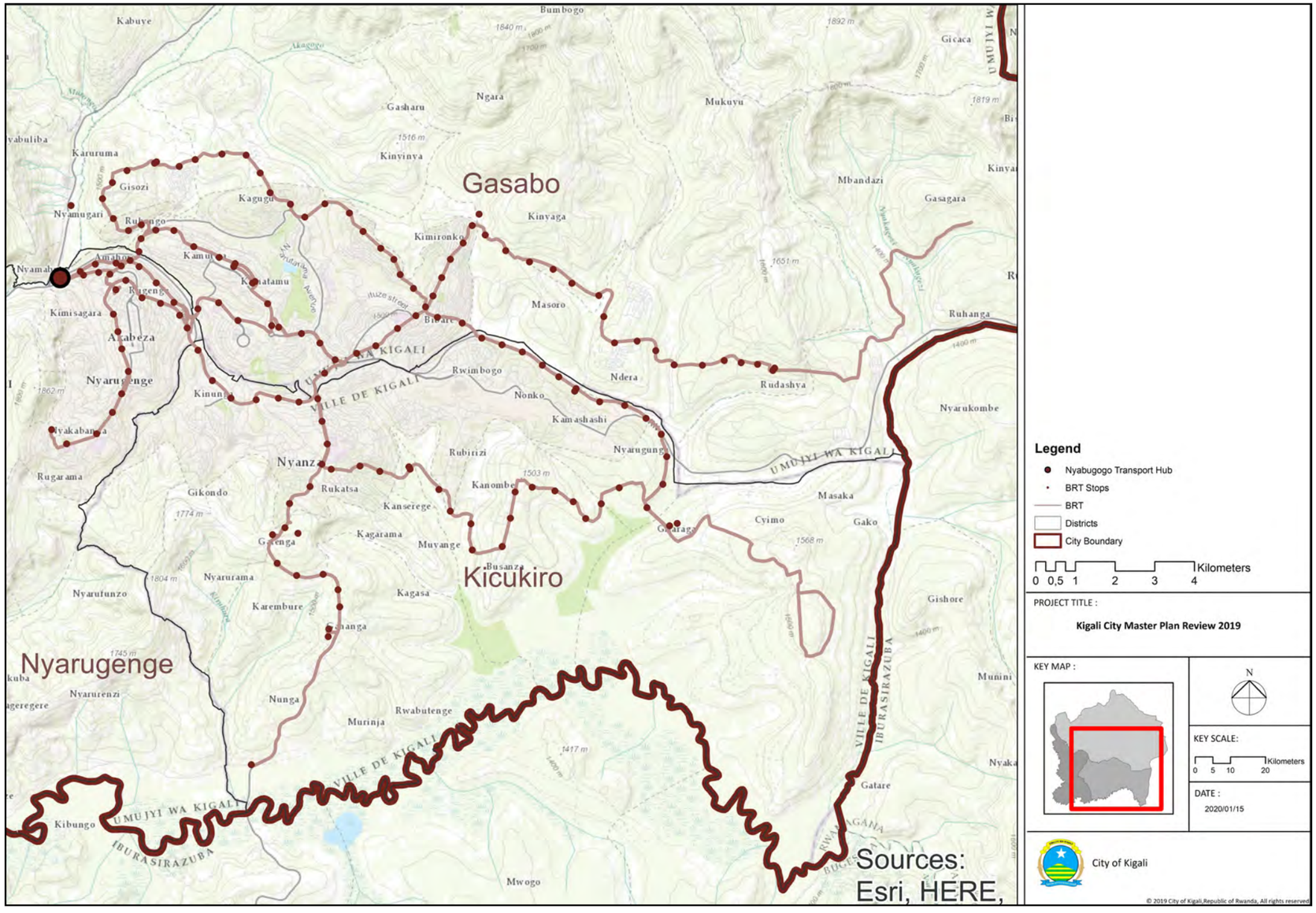

Figure 7.4 BRT Preliminary Design Alignment

This Feasibility and Preliminary Design of the BRT was developed with the perspective that the following developments would also be completed: The construction of a new international airport in Bugesera;

- The construction of an expressway connecting the new Bugesera Airport to the CoK up to the Kigali Convention Centre – this expressway is referred to as the Airport Link Road;
- The future planned Ring Road for Kigali, and in particular the first section, connecting the new Bugesera Expressway (Airport Link Road) to the new the City;
- The construction of logistic and industrial hubs around the outskirts of Kigali;
- The development of the so-called "by-pass", and related upgraded intersections, which will cross the CoK and constitute the infrastructural spine for private traffic which should not bisect, but put the CoK together, (as envisaged in the recent Nyabugogo Catchment Study).

Figure 7.5 shows the proposed phasing for the BRT lanes. The BRT is planned to be implemented along High Capacity Urban Roads and/or Major Arterial Roads as trunk routes with median boarding.

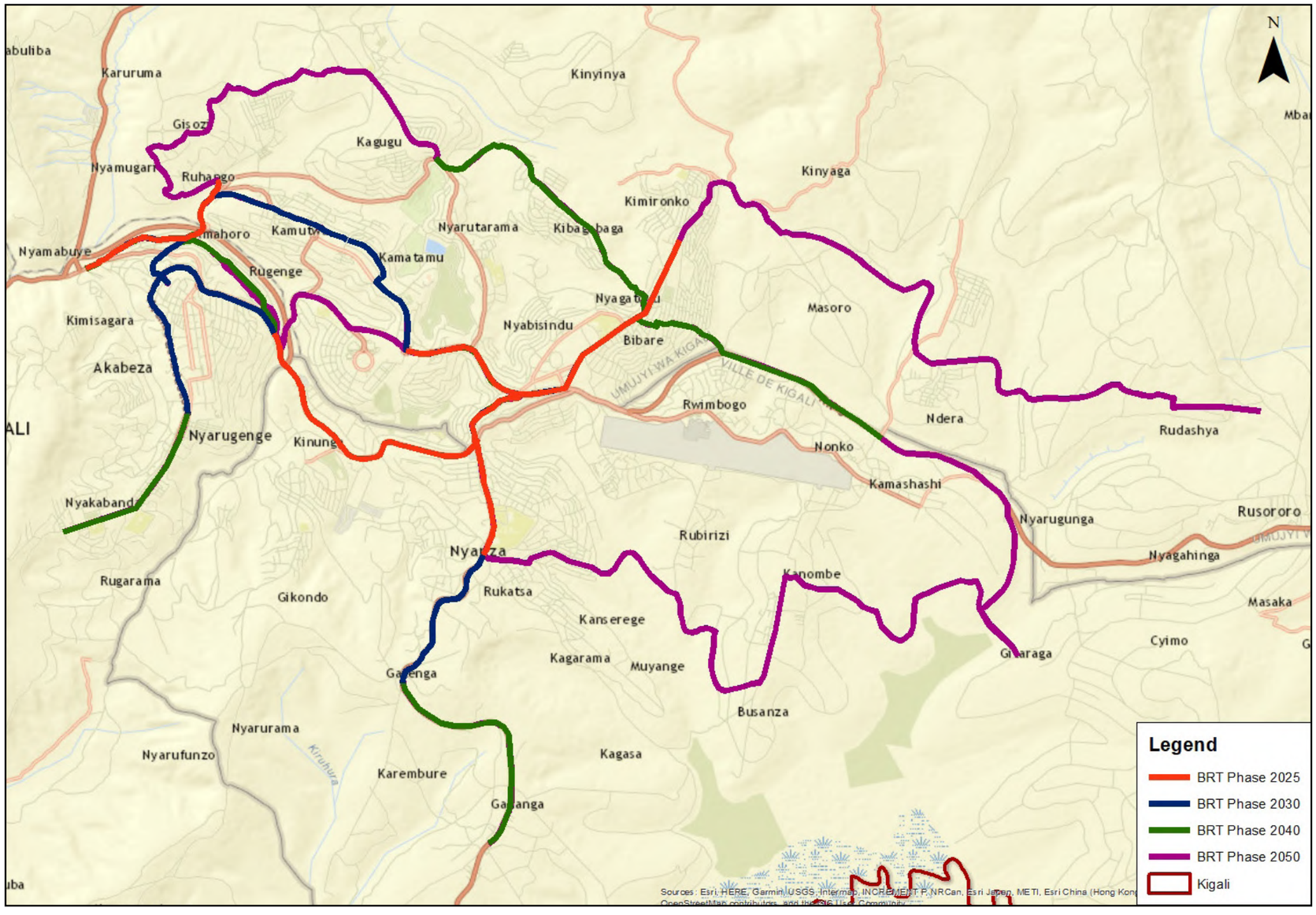

Figure 7.5 BRT Phasing

7.1.4 Cable Car

A cable car has been suggested between Nyabugogo and the centre of Kigali. If this is to be implemented a feasibility study will be required. Cable cars have the potential to act as feeder networks from inaccessible networks, to connect people between high risk zones in the City or for tourism purposes. The areas that the proposed route would connect, if found to be feasible, is shown in Figure 7.6. It should be noted that this is a strategic and conceptual design and the exact layout of the cable car line has not been approved.

Although the cable car was evaluated in the transport model, it has minimal effects on the road network and is best implemented to support non-motorised transport trips and to promote tourism. A feasibility study should be completed prior to its design and implementation.

7.1.5 Additional Projects

The following additional projects currently remain incomplete:

- 17 km along the major public transport corridors expanded.
- Extension of PT routes network to 300km and improvement of existing public transport services.
- Ferries along Kagera River (refer to Figure 4.4).

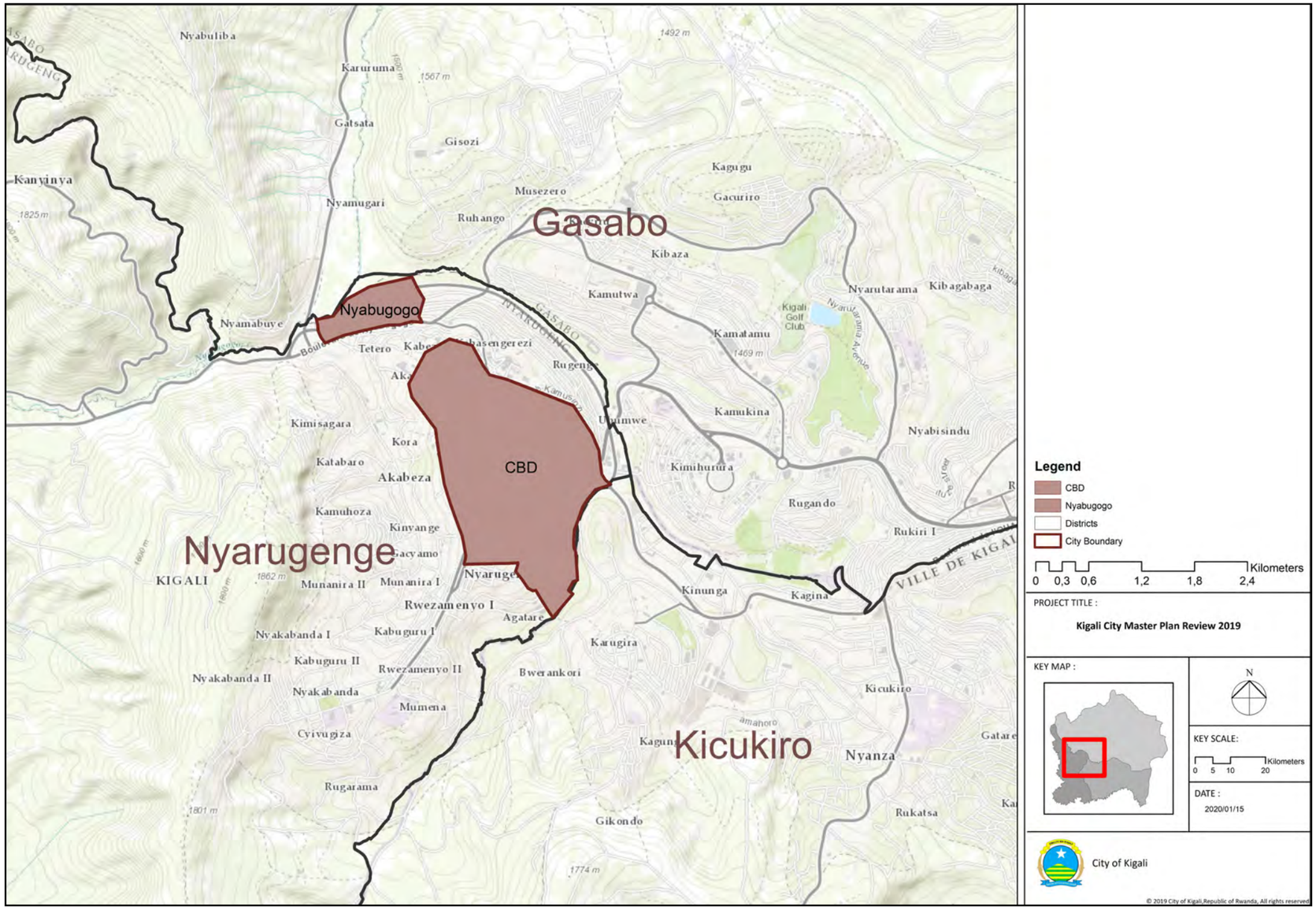

Figure 7.6 Cable Car Potential Locations

7.2 Public Transport Demand

With the BRT implemented, it is expected that 136 800 public transport trips will occur during the 2050 AM peak hour with modal split as determined by the BRT Feasibility and Preliminary Design Second Interim Report. In order to meet this demand a BRT system and a feeder system are required. According to the BRT Feasibility and Preliminary Design Second Interim Report it is expected that these systems will accommodate at least 105 000 trips.

According to the 2013 Transport Master Plan other bus services will be able to accommodate at least 70 000 trips.

As shown in Figure 7.7, the planned population and employment locations are well distributed around the City with many mixed-use areas. This will promote shorter trip lengths. Additionally, longer trips will be made from a range of sources towards the regional centres. Public transport corridor demand is unlikely to exceed more than 20 000 passengers per hour per direction in the 2050 AM Peak Hour, and therefore it is not currently foreseen that a rail solution would be required in 2050 (LRT, Commuter Rail or Metro Rail), however, with higher population and employment growth rates these solutions should be further investigated.

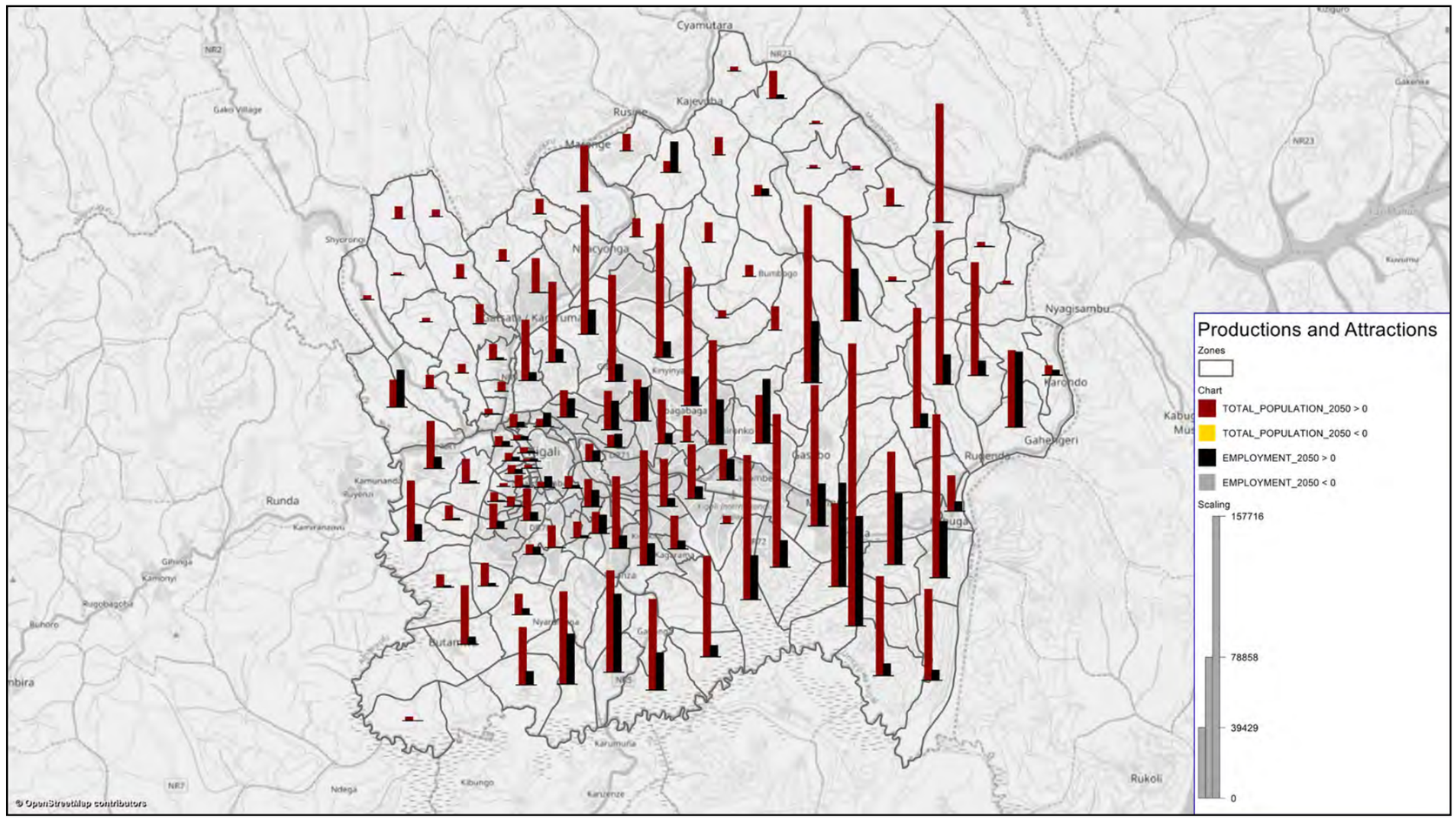

Figure 7.7 Population and Employment Distribution

7.3 Public Transport Recommendations and Requirements

In order to align with the transport goals and objectives, the following key strategies and key performance indicators were developed for the public transport enabling stategy (refer to Chapter 2):

The following proposed strategic, tactical and operational projects align to the suggested key strategies:

1. Development of a strategic level Integrated Public Transport Plan which will address public transport hierarchy and function. The plan should detail aspects such as the integration of the Moto-Taxis and Other Bus Services with other forms of Rapid Public Transport (for example BRT). The role of moto-taxis should be regulated to ensure they complement public transport systems or act as feeders in neighbourhoods with low densities unable to use alternative modes. Some modes could act as feeder services rather than competitive modes. These modes could include pre-feasibility studies for e-bikes and shared mobility. Park and Ride facilities near PT terminals should also be investigated The plan should also identify passenger access typologies, for example stops, shelters, open stations, closed stations and interchanges and make recommendations on the appropriate level of demand and public transport mode for each. Such a plan should also include an investigation into the feasibility of the extension of a high speed public transport link to new the international airport (Bugesera). In addition the plan should investigate the potential introduction of regional passenger rail connections at the planned freight rail link connection at the Bugasera airport. Such a plan should be supported by a multi-modal transport demand model.
2. Development of tactical level detailed feasibility studies for projects identified and prioritised in the Integrated Public Transport Plan should be commissioned, for example:
   - Bus Rapid Transport and associated feeder network feasibility study and operational business plan (refer to Section 9.1.3).
   - Cable car feasibility study and operational business plan (refer to Section 9.1.4).
   - Nyabugogo Transport Hub conceptual design (refer to Section 9.1.1).
3. Development of operational level assessments and designs:
   - Due diligence study to inform the reservation, zoning and accessibility of land for public transport terminals and depots.
   - nvestigation into the application of ITS technologies for certain identified solutions.
   - Development of universal access design guidelines for public transport and non-motorised transport access.
   - Development of monitoring mechanisms to survey and report on the achievement of the key performance indicators.
   - Develop a rationalisation plan for public transport operating licences.
   - Electronic Ticketing for All Public Transport in Kigali
   - Develop a Public transport fare policy (for all public transport modes including taxis and shared mobility) for Kigali to be approved and updated on an as-needed basis.

Figure 7.8 shows the proposed locations of BRT and bus depots and terminals as per the latest 2019 BRT Feasibility

Public Transport Plan – Key Strategies	Key Performance Indicators
Develop a high-quality public transport system which provides good coverage, and direct, fast and frequent services.	80% of urban areas to be within 500m (or 10 min walk) of public transport services.
Develop a road network that supports the public transport system.	Public transport services to connect all major regional centers.
Develop a supplementary feeder system which works in conjunction with the public transport system.	100% of urban areas to be within 500m (or 10 min walk) from the feeder system.
Develop a high-quality public transport system which is easily accessible and segregated from private road-based traffic.	Public transport services to connect all major regional centers.
Develop a supplementary feeder system which maximizes public transport coverage.	100% of urban areas to be within 500m (or 10 min walk) from the feeder system.
Adopt Intelligent Transport Systems (ITS) to enhance service reliability.	Adopt ITS technologies for use in public transport service design.
Locate road-based public transport stations, stops or interchanges along major arterial roads.	Provision of road-based public transport access points along major arterial roads in regional centers.
Integrate non-road-based public transport services (rail and air transport) with road – based public transport services.	Rail and air transport to be within 1km of road-based public transport services.
Connect regional centers with public transport services.	Public transport services to connect all major regional centers.
Integrate all road-based public transport services.	Provision of intermodal interchanges at major public transport intersections.
Develop a city-wide NMT network which supports the public transport system and utilizes open spaces.	Development of an NMT network.
Develop a Non-Motorised Transport (NMT) network along arterial and collector roads.	Inclusion of NMT in road hierarchy and cross-sections.
Develop a strategic approach to providing pedestrian amenities such as trees and street furniture.	Commission of road design manual and guidelines.
Develop a pleasant streetscape especially along the NMT network.	Inclusion of NMT in road hierarchy and cross-sections.

Table 7.2 Key Strategies of Public Transport Plan

and Preliminary Design Second Interim Report as well as potential Bus Depots and Terminals as included in the Master Plan.

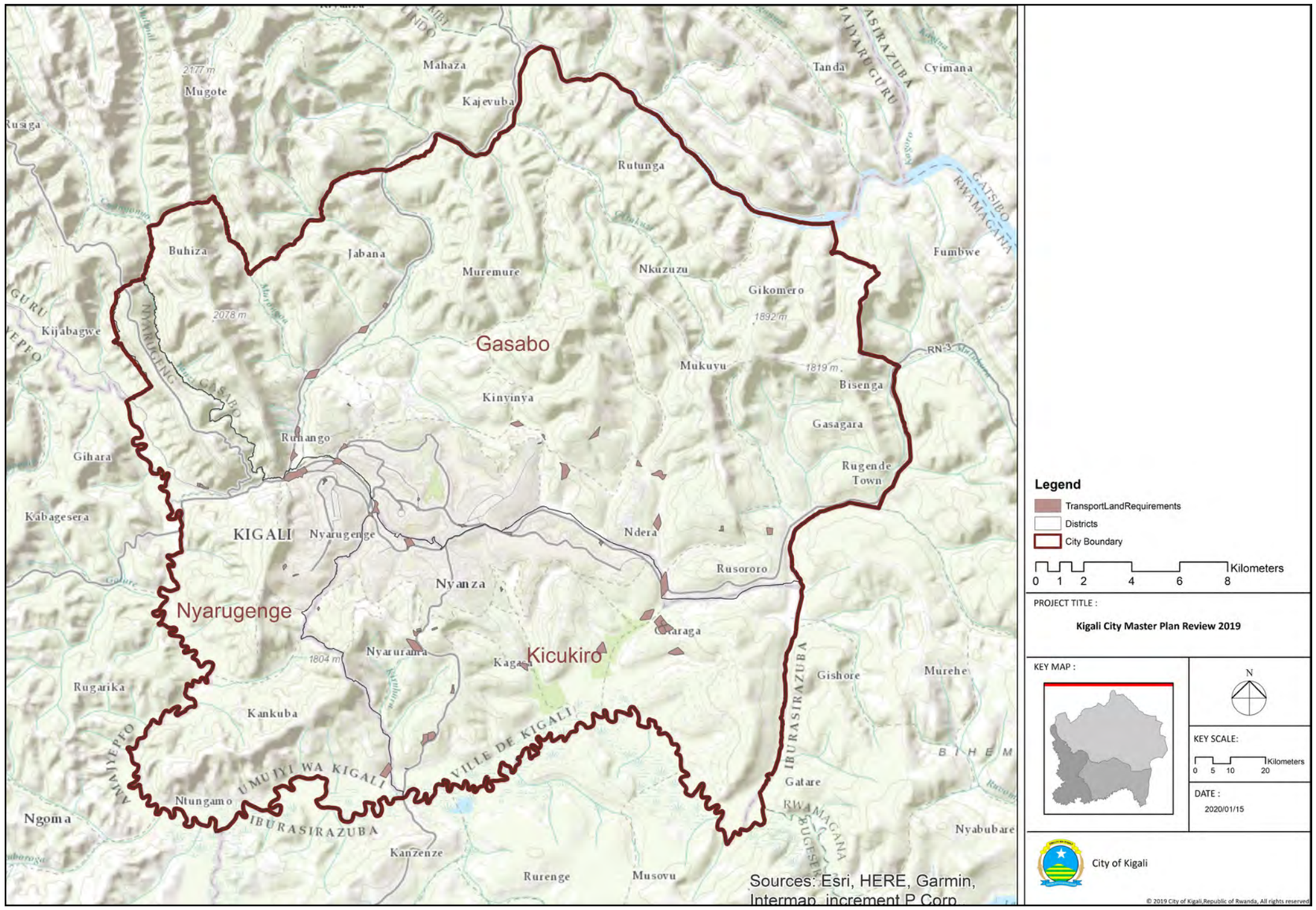

Figure 7.8 Locations of Depots and Terminals

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8

Road Network Strategy

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8 Road Network Strategy

8.1 Remaining Major Road Network Projects

8.1.1 Kigali Ring Road

In the 2013 Transport Master Plan, the Kigali Ring Road was classified as a High Capacity Urban Road (refer to Section 5.4.2). The 2013 plan proposed this road around the CoK with an aim to divert through-traffic around the main city and reduce traffic within the CoK. According to the 2013 plan, the Kigali Ring Road will be used by freight, inter-district traffic and as a by-pass route.

A feasibility study for the Kigali Ring Road is currently (2020) being completed. Due to geometrical complications, the latest proposal from this feasibility study is for the road to be realigned to further outside the built-up area of the City. As it would no longer be an urban road it is therefore proposed that its classification will be changed to a High Capacity Road.

There are two possible alignments proposed for Kigali Ring Road as shown in Figure 8.1.

The final Kigali Ring Road alignment has not been approved and decisions as to whether or not to toll the ring road have not been made. The existing feasibility study did not consider tolling and if the road is to be tolled, a toll feasibility study should be completed before further design.

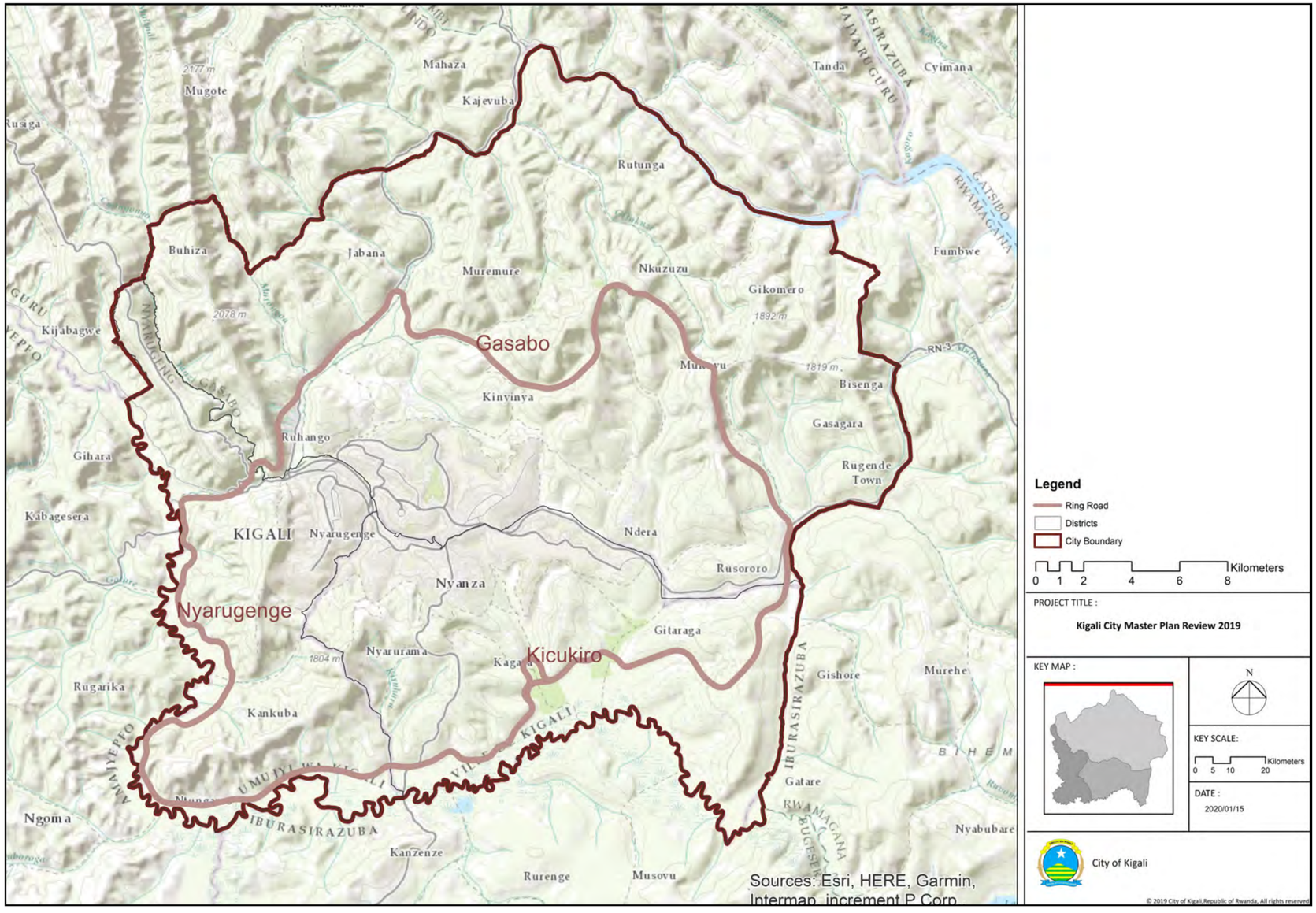

Figure 8.1 Kigali Ring Road Approved Alignment, 2019

No direct property access should be given along the Kigali Ring Road as this could cause safety concerns and will decrease the capacity of the road required to provide mobility around the City.

The Kigali Ring Road is scheduled to be completed by 2050.

8.1.2 Airport Link Road

The airport link road is classified as a Major Arterial (refer to Section 3.4.2) from Kigali towards the new Bugesera International Airport. The road is also known as the Sonatube- Gahanga- Akagera Bridge Road and is shown in Figure 8.2.

The airport link road is being financed by China and the alignment has been finalised. The preliminary design is also complete, however there is no special allowance made for public transport along this link such as BRT lanes. 2019 BRT Feasibility and Preliminary Design Second Interim Report indicates the requirement for dedicated trunk routes along a portion of this road (refer to Figure 7.4). The first phase of the project for the Sonatube- Gahanga- Akagera Bridge Road was scheduled for completion by December 2019. Future upgrades to this road may be required to accommodate BRT or alternative public transport systems.

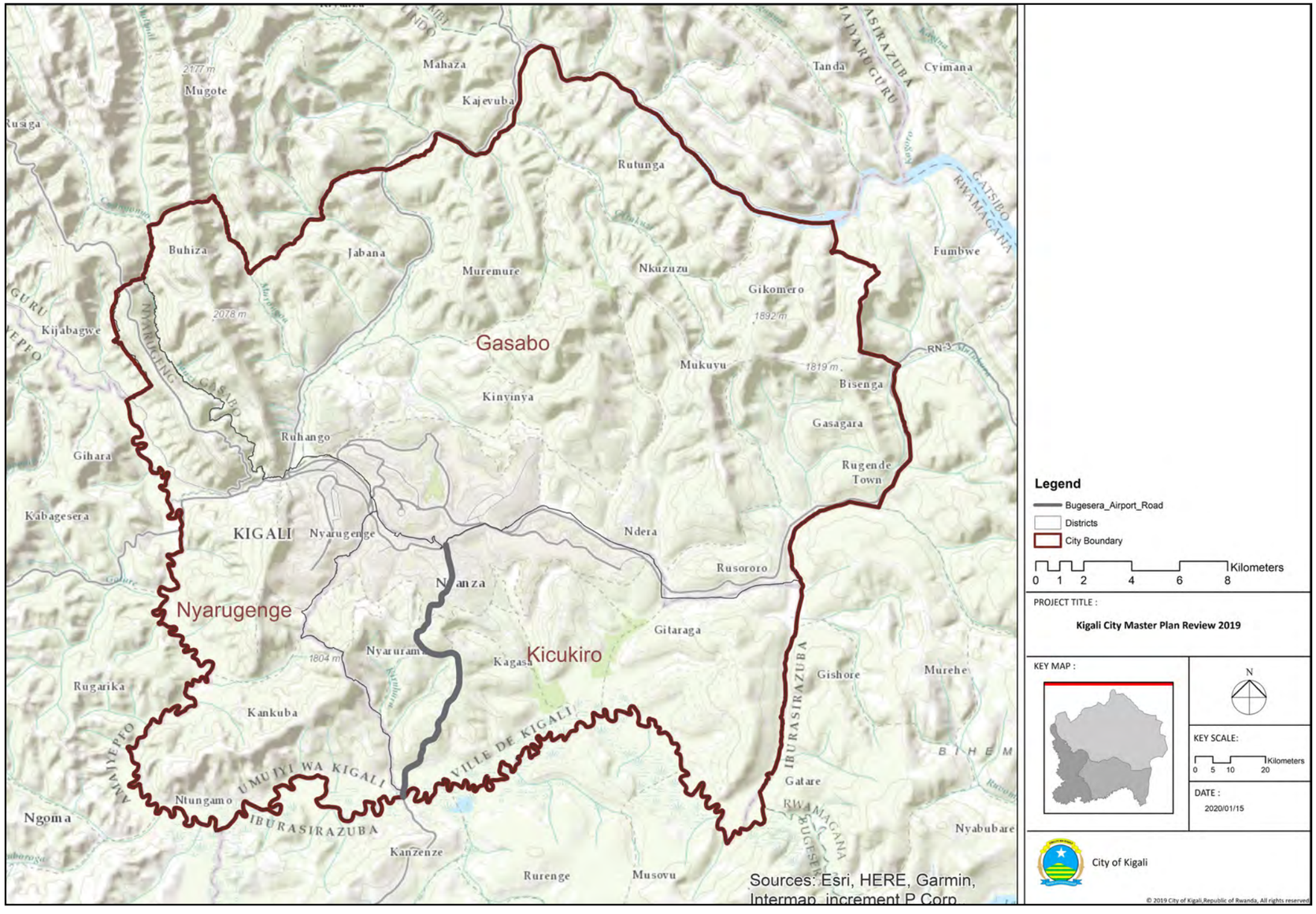

Figure 8.2 Airport Link Road (Sonatube- Gahanga- Akagera Bridge Road)

8.1.3 High Capacity Urban Roads

Travel between major urban centres will be supported by private transport as well as public transport. Potential routes for connecting these urban centres have been identified as part of the High Capacity Urban Roads (HCUR) Network by the 2013 Transport Master Plan but have not yet been implemented.

The 2018 Transport Master Plan still intends to develop these routes as part of the Major Arterial Network. The Network will consist of short roads, intended for use by motorised transport only and will serve the specific purpose of providing a high level of mobility. In areas where the suggested alignment are within areas with other approved projects, the exact alignment of these roads will require adjustment. It is however critical to ensure that these links still provide the same speed and capacity between two different areas if they are realigned.

The routes would will also serve international and regional freight vehicle movement as well as provide a high level of connectivity for inter-regional public transport modes such as express buses.

Figure 8.3 shows the layout of the proposed HCUR Network and original Ring Road from 2013.

The Kigali Ring Road proposed has now been realigned and is much further outside the City. The 2013 Ring Road alignment has been reclassified as a Major Arterial Road while the new Ring Road alignment is classified as a HCUR.

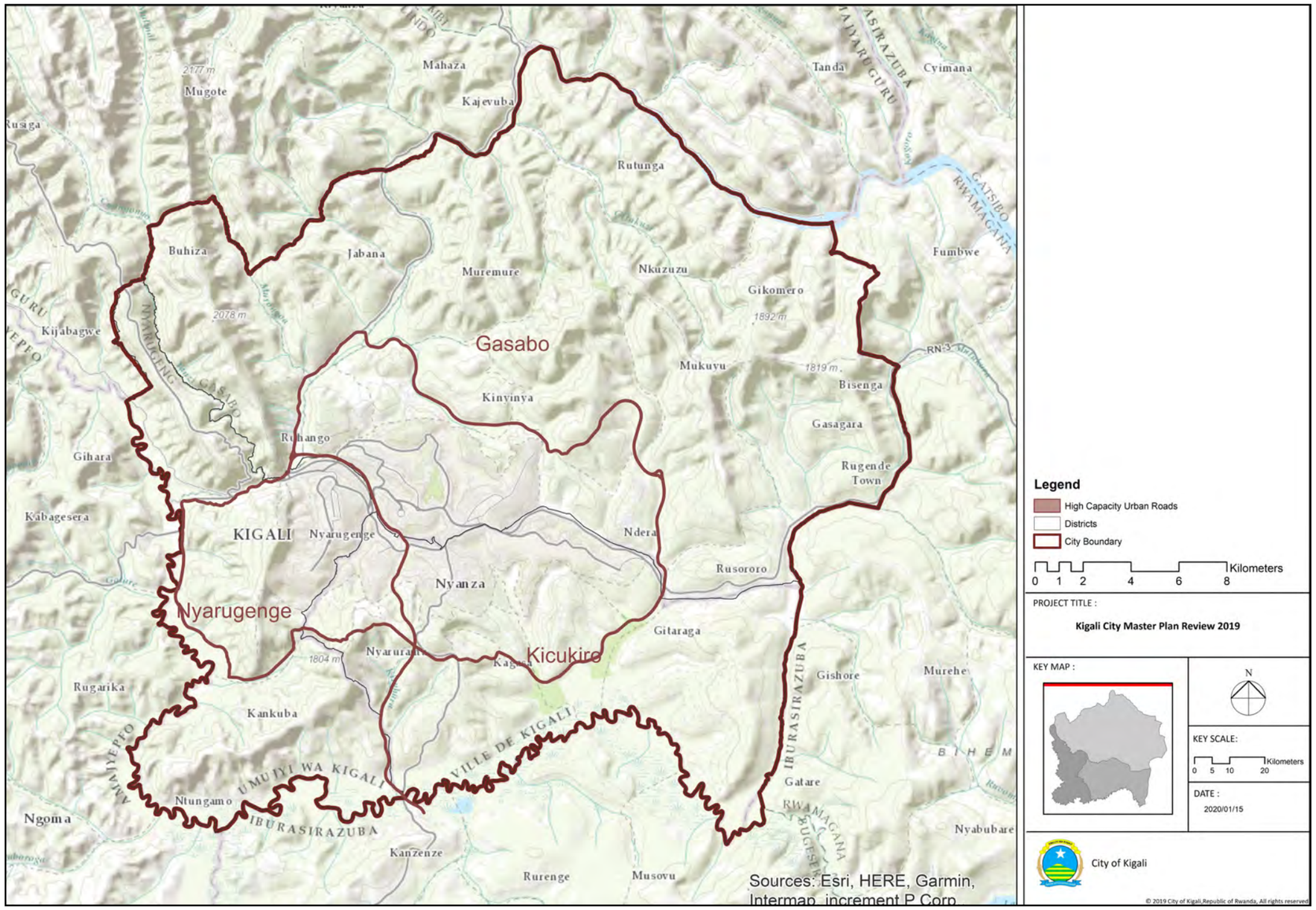

Figure 8.3 Proposed High Capacity Urban Roads Network from 2013 Master Plan

8.2 Model Results

8.2.1 Impact of Road Traffic Demand Increase

In this section an analyses of the impact of different demand assumptions relating to population growth, car ownership and the implementation of the BRT, should no additional road infrastructure be implemented (Scenario 1, 2, 3 and 4) is provided. The map illustrated in Figure 8.4 shows the expected traffic volume increase on roads between 2018 and 2050 due to expected population growth and an increase in car ownership (Scenario 1 vs Scenario 3). Although there is significant increase expected all over the Kigali network, many new trips are concentrated in the southeast of Kigali and the north of Kigali.

This demand increase is for the maximum estimated population in 2050 (increase from 1.5 million to 3.8 million). According to the model, the total demand for peak hour car trips increases from 88 397 in 2018 to 342 552 trips in 2050 and moto-taxi trips increase from 47 162 trips in 2018 to 111 179 trips in 2050. Scenario 2 takes into account the 2019 BRT Feasibility and Preliminary Design Second Interim Report's estimate that private vehicle car trips will increase from 28% to 44% if BRT is not implemented. The model results vary from the Preliminary Calculation in Section 8.3.1 because the trip generation was based on existing trip generation calculated in the model rather than an assumption of 1.8 trips per person per day, however the total trips remain in-line with expected results.

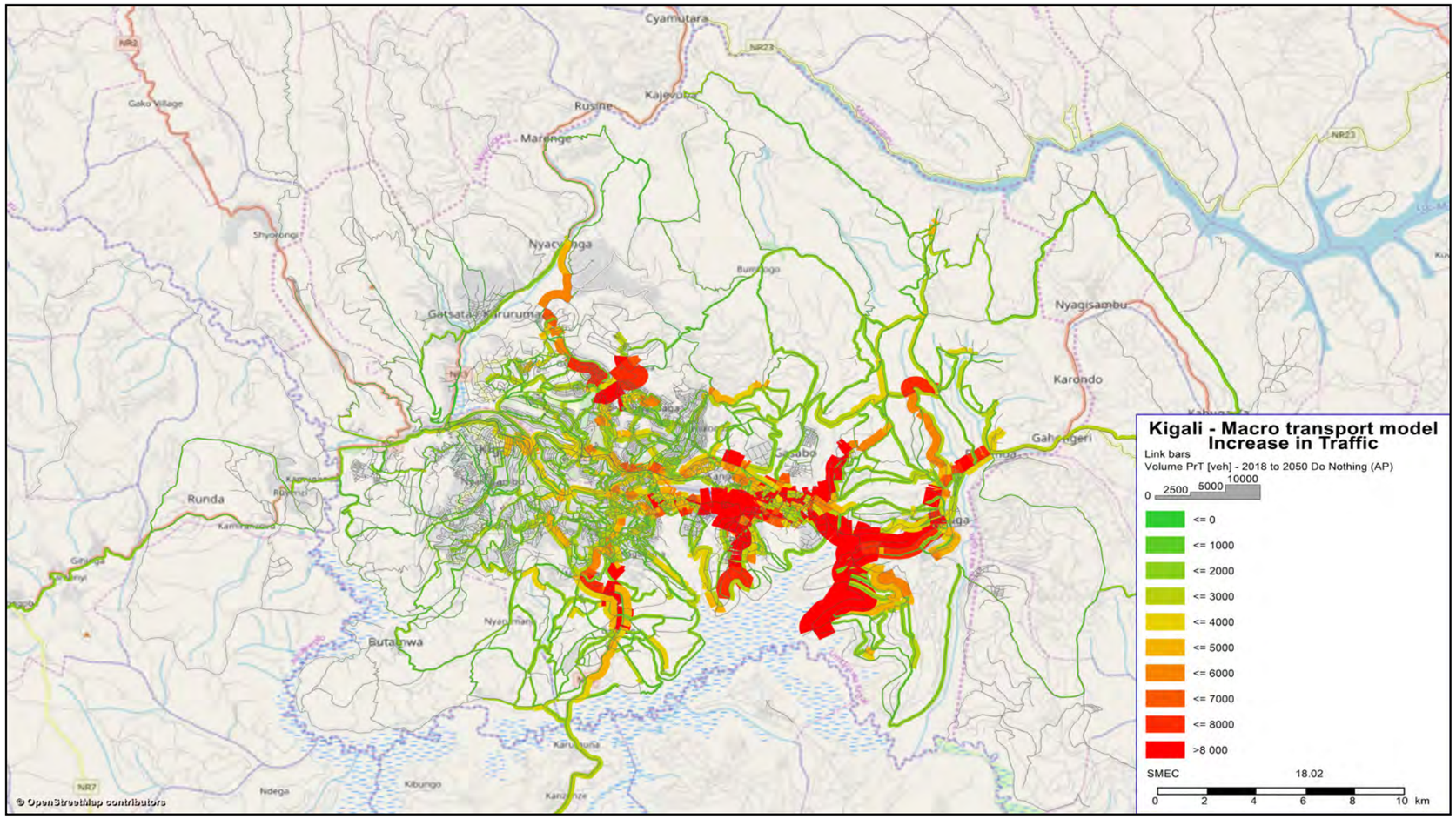

Figure 8.4 AM peak hour vehicular demand increase from 2018 to 2050 (Scenario 1 to Scenario 3)

Figure 8.5 and Figure 8.6 show the highest 100 vehicular desire lines for road transport trips in 2018 and 2050 respectively (Scenario 1 and 3).

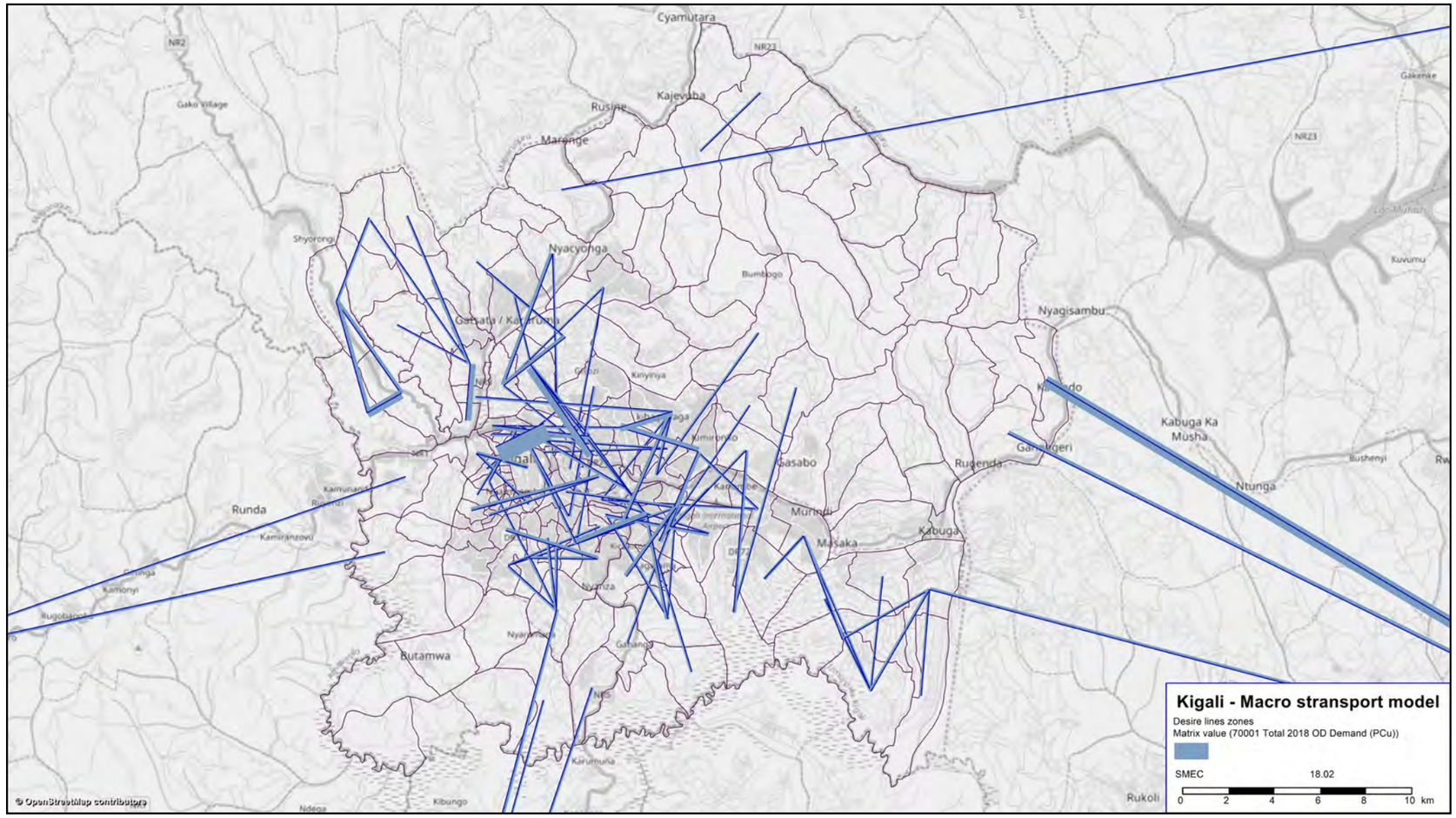

Figure 8.5 2018 AM peak hour Vehicular Desire Lines (Scenario 1: Highest 100)

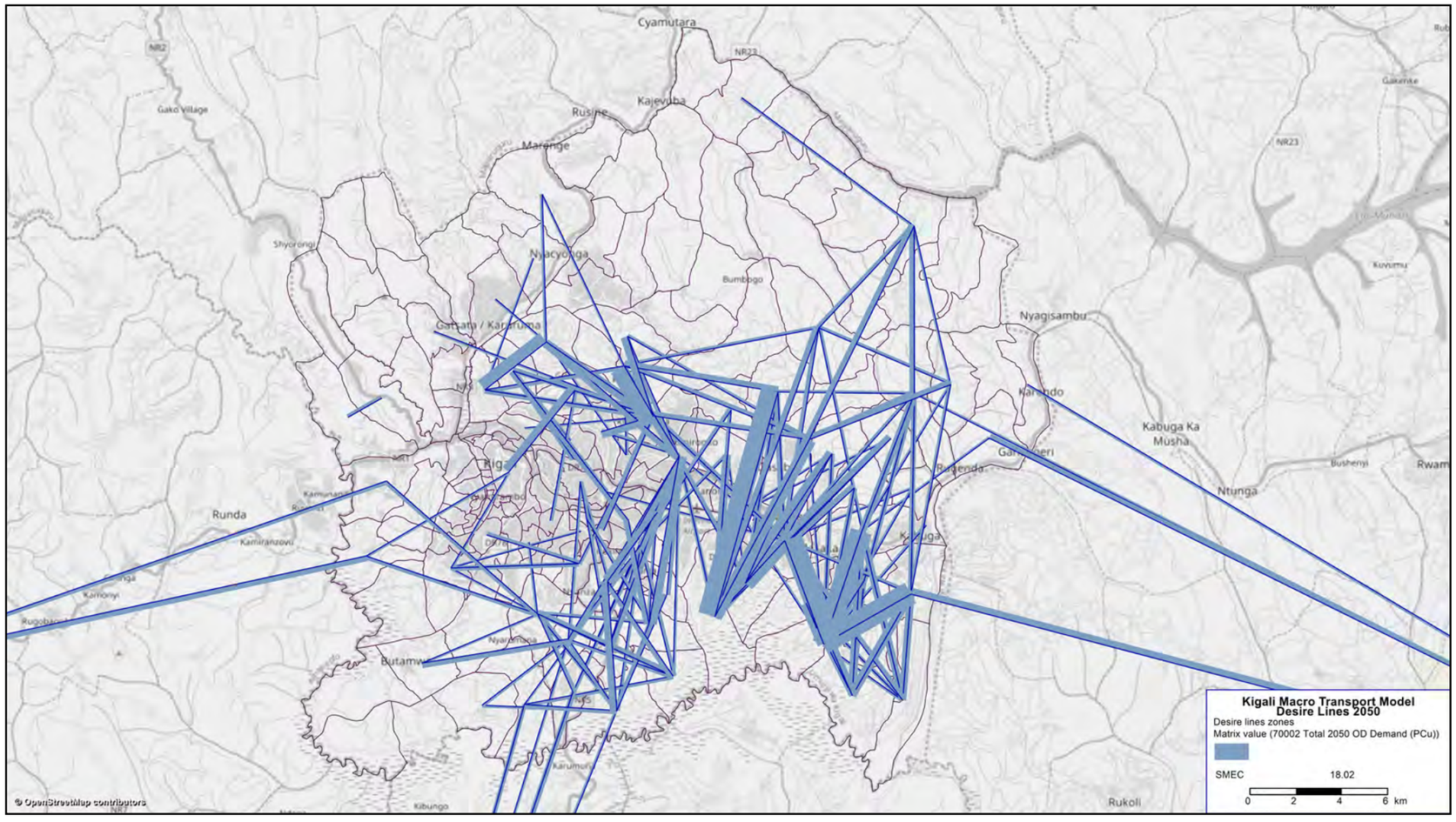

Figure 8.6 2050 AM peak hour Vehicular Desire Lines (Scenario 3: Highest 100)

Figure 8.7 shows the car and Moto-Taxi vehicle assignment for 2050 (Scenario 2). An increase in car ownership is not assumed in this case.

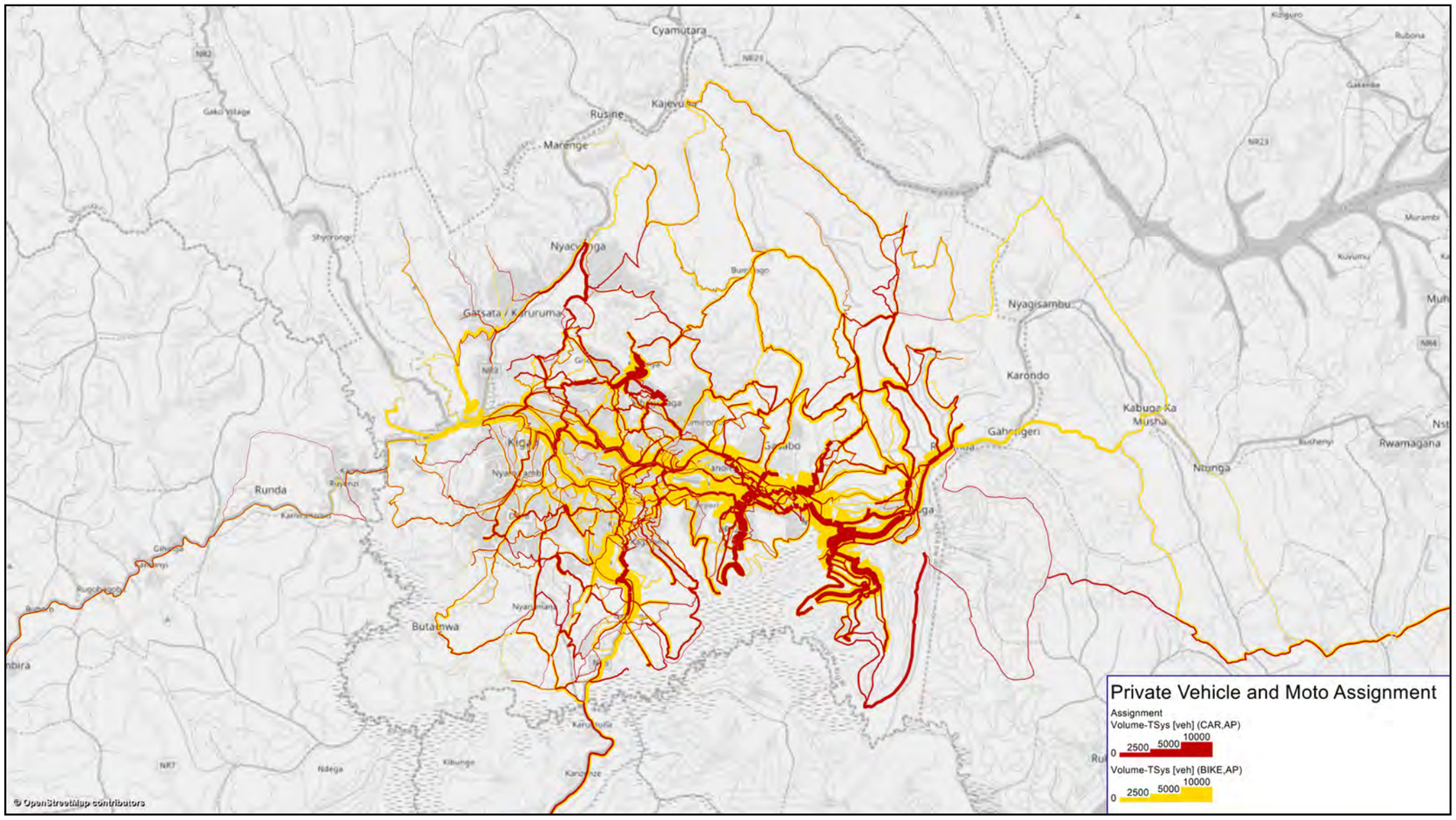

Figure 8.7 Private Vehicle and Moto-Taxi Vehicle Assignment for 2050 assuming no growth in private vehicle ownership (Scenario 2)

Figure 8.8 shows the car and Moto-Taxi vehicle assignment for 2050 (Scenario 3). An increase in car ownership is assumed in this case. This private vehicle car trip growth is due to expected population growth and Scenario 2 and 3 takes into account the 2019 BRT Feasibility and Preliminary Design Second Interim Report's estimate that private vehicle car trips will increase further from 28% to 44%, if BRT is not implemented.

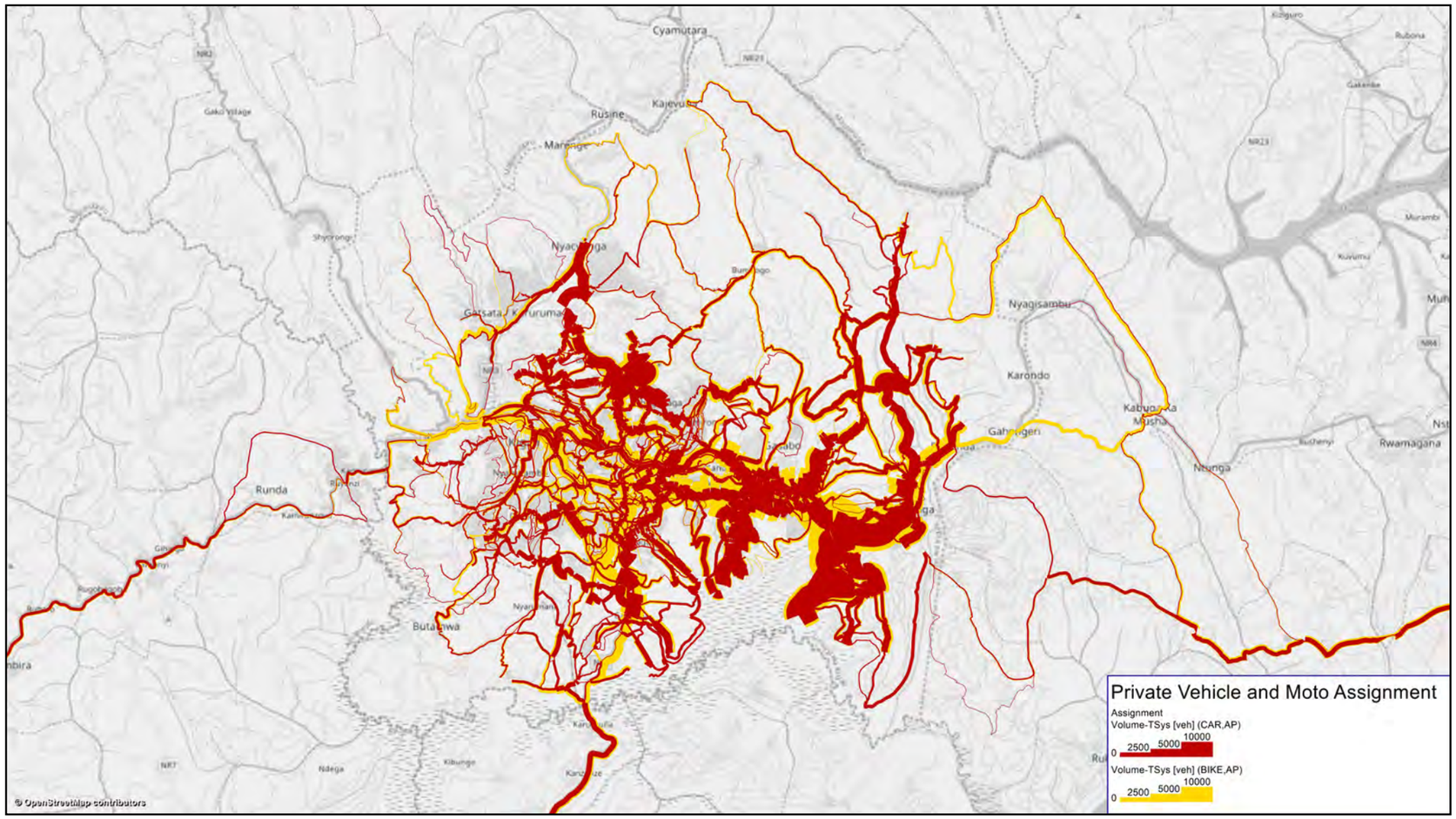

Figure 8.8 Private Vehicle and Moto-Taxi Vehicle Assignment for 2050 including growth in private vehicle ownership (Scenario 3)

8.2.2 Impact of BRT Infrastructure

In this section an analyses of the impact of providing an operational BRT service and/or 2 private vehicle lanes along the BRT trunk routes are provided, (Scenario 4 and 10).

Figure 8.9 shows the vehicle assignment for Scenario 4. As can be seen when comparing Figure 8.8 (Scenario 3) and Figure 8.9 (Scenario 4), there is only a small shift from cars to BRT. According to the 2019 BRT Feasibility and Preliminary Design Second Interim Report, if BRT is implemented, the expected modal split of cars is expected to increase only from 28% in 2018 to 52% in 2050, instead of to 60% in the case where no BRT is implemented.

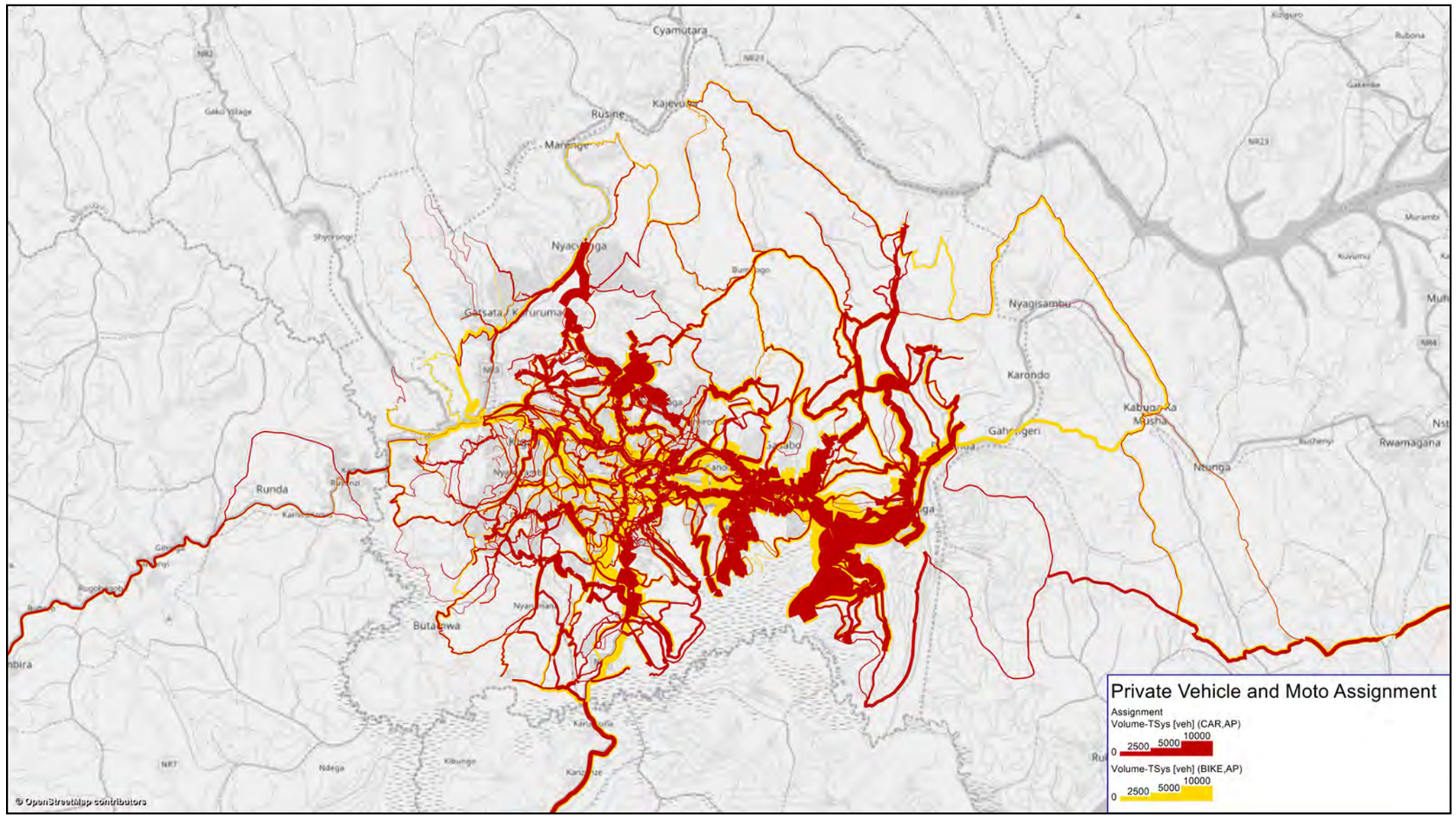

Figure 8.9 Private Vehicle and Moto-Taxi Vehicle Assignment for 2050 including growth in private vehicle ownership and assuming operational BRT (Scenario 4)

Figure 8.10 shows the road network assignment with the two private vehicle lanes per direction along BRT route upgrades also in place (Scenario 10).

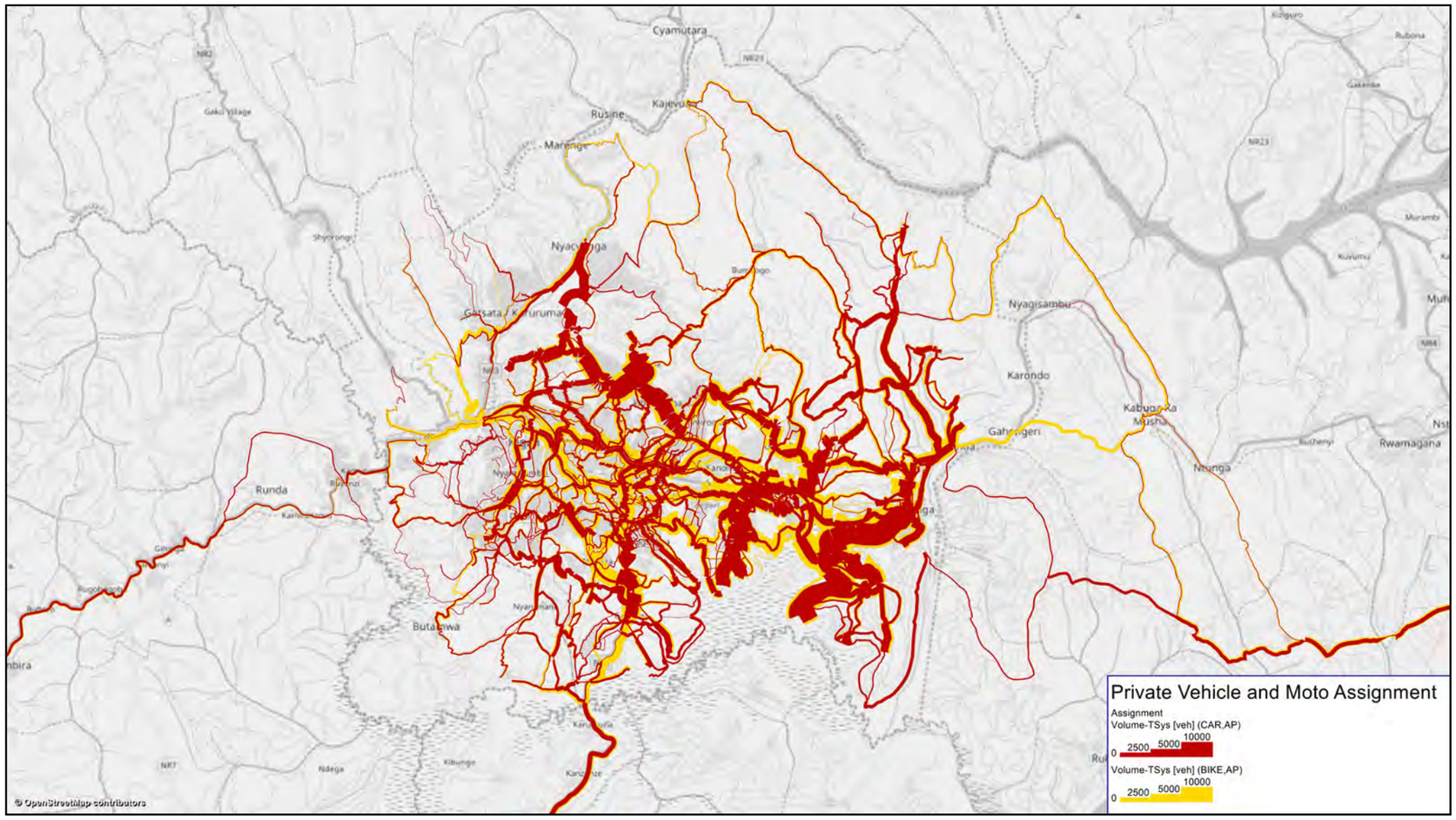

Figure 8.10 Private Vehicle and Moto-Taxi Vehicle Assignment for 2050 including growth in private vehicle ownership, operational BRT and improved road network along BRT lanes (Scenario 10

Figure 8.11 shows the v/c ratio for the road network with an operational BRT service and 2 private vehicle lanes along the BRT trunk routes implemented. As can be seen in the image, there are still congestion issues network-wide and many more road network upgrades are required to acceptably service road users.

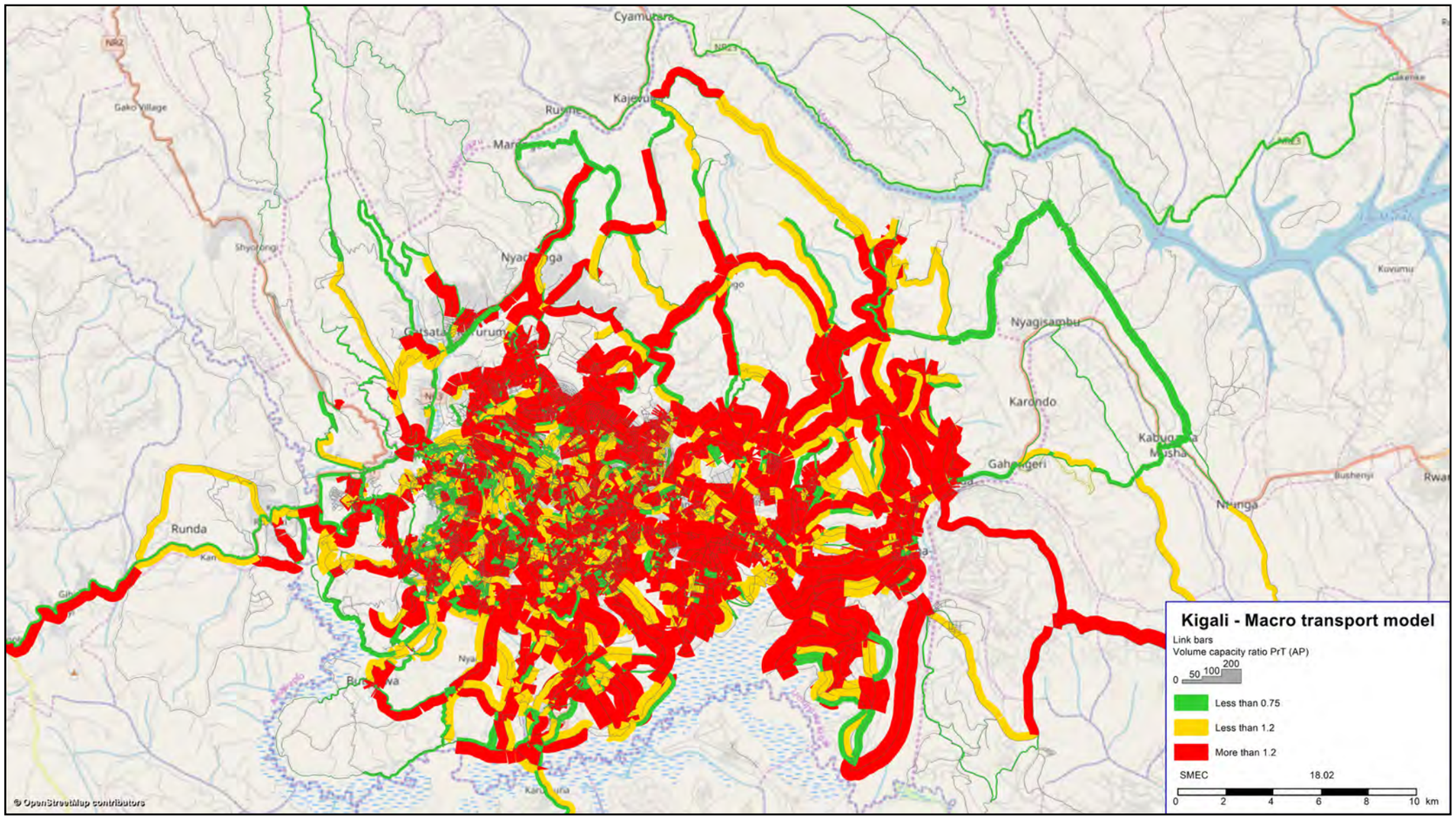

Figure 8.11 2050 Volume/Capacity Ratios for Road Network with BRT Operational and Associated Road Network Upgrades Implemented (Scenario 10)

8.2.3 Remaining Major Recommended Road Network Upgrades

This section presents an analyses of the impact of different major road network projects, namely the Airport Link Road, High Capacity Urban Roads and the Kigali Ring Road.

The following road network upgrades that were suggested in the 2013 Transport Master Plan and other studies were evaluated using the PTV VISUM Model:

- High Capacity Urban Roads, refer to Section 4.1
- Major Arterial: Airport Link Road, refer to Section 4.1
- Major Arterial: Kigali Ring Road
- Major Arterial: 2 Private Vehicle lanes along the BRT trunk routes (as included in BRT Preliminary Design, refer to Section 4.1)

The graph in Figure 8.12 shows the percentage of time saved and the percentage distance saved across the entire network in 2050 in relation to the existing road network (Scenario 4) with different upgrades in place. In cases where the distance saving is negative, vehicles are travelling longer routes to travel faster. The first case is where the BRT system is implemented, which decreases car demand as well as improves the car road network along BRT routes through the provision of 2 private vehicle lanes along the BRT trunk route (Scenario 10). The second case also assumes the BRT system is implemented. In addition the Airport Link Road, Kigali Ring Road and High Capacity Urban Roads are also assumed in the second case (Scenario 14). The final case ignores the BRT system and shows the effect of the road network upgrades (Airport Link Road, Kigali Ring Road and High Capacity Urban Roads) on its own (Scenario 22).

As can be seen in the graphs, the increase of road capacity along all the BRT routes has a significant effect on the increase in travel time and distance savings (21.94% and 2.88%). While the Airport Link Road, Kigali Ring Road and High Capacity Urban Road combination results in an increase in travel time savings (6.17%), detours to these major routes result in a decrease in travel distance savings (-8.6%).

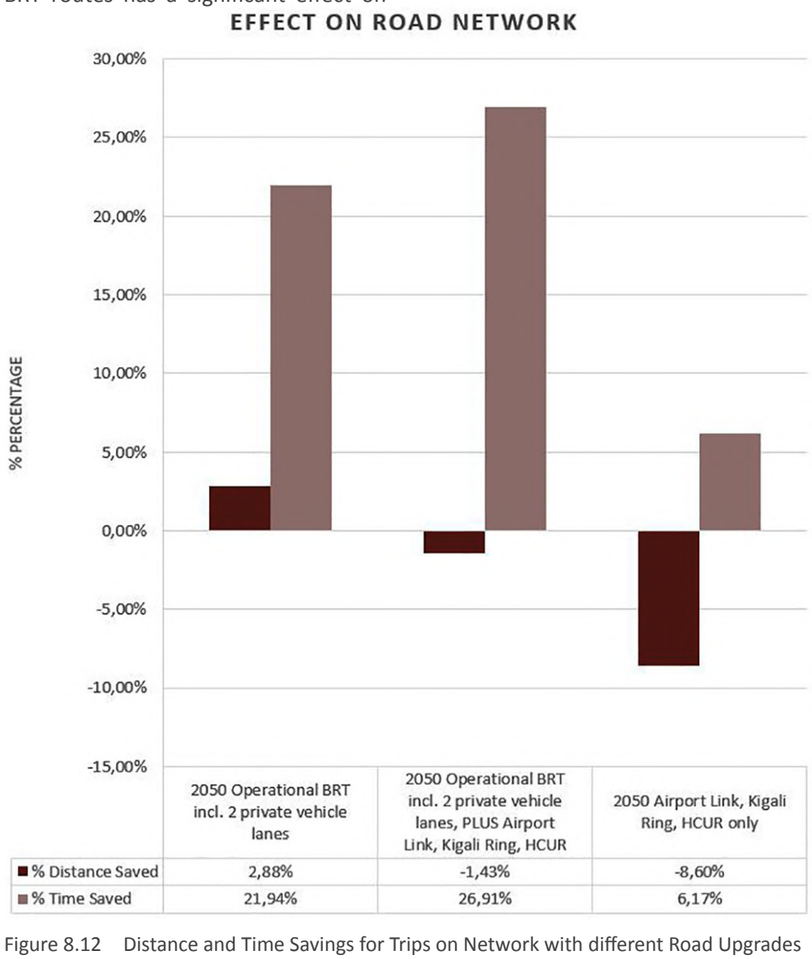

Figure 8.12 Distance and Time Savings for Trips on Network with different Road Upgrades (Scenario 10, Scenario 14 and Scenario 22 compared to Scenario 4)

The graph in Figure 8.13 compares each road upgrade and their individual effects on vehicle travel time and distance.

As can be seen in the graphs, the Kigali Ring Road significantly increases the travel time savings in the network (3.6%) but detours to this road also result in a large decrease in travel distance savings (-1.71%). The Airport Link road and High Capacity Urban Roads result in a smaller increase in travel time savings (0.95% and 2.2%) but also result in an increase in travel distance savings (2.96% and 3.45%).

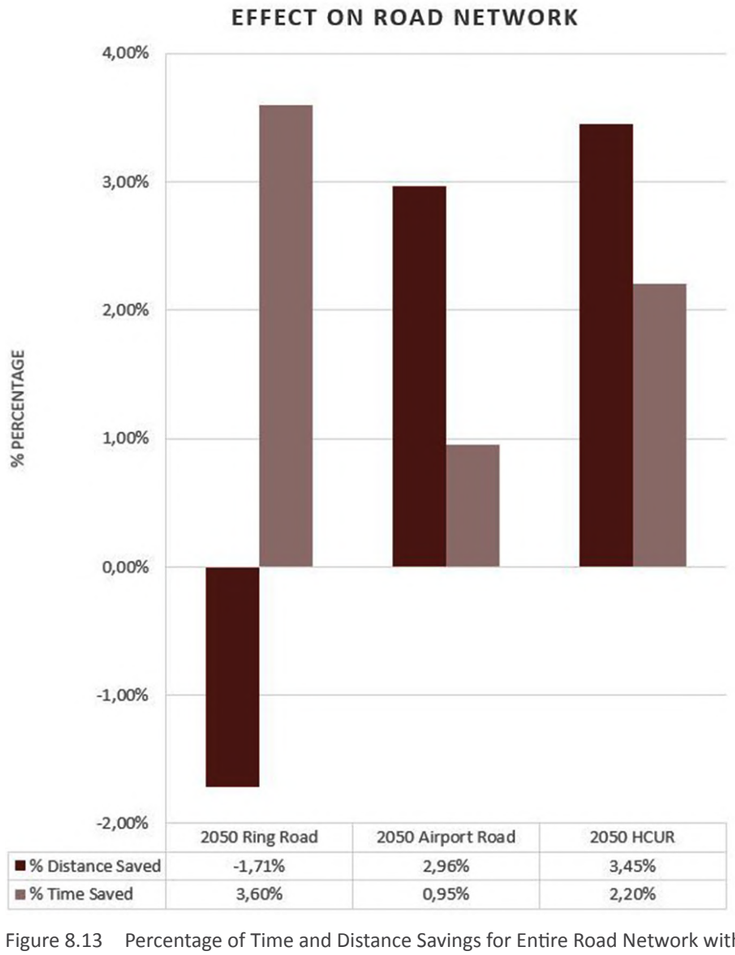

Figure 8.13 Percentage of Time and Distance Savings for Entire Road Network with Different Road Upgrades (Scenario 20, Scenario 19 and Scenario 21 compared to Scenario 4)

Figure 8.14 shows the V/C ratio for a scenario (Scenario 4) where no road upgrades are implemented but the BRT is operational.

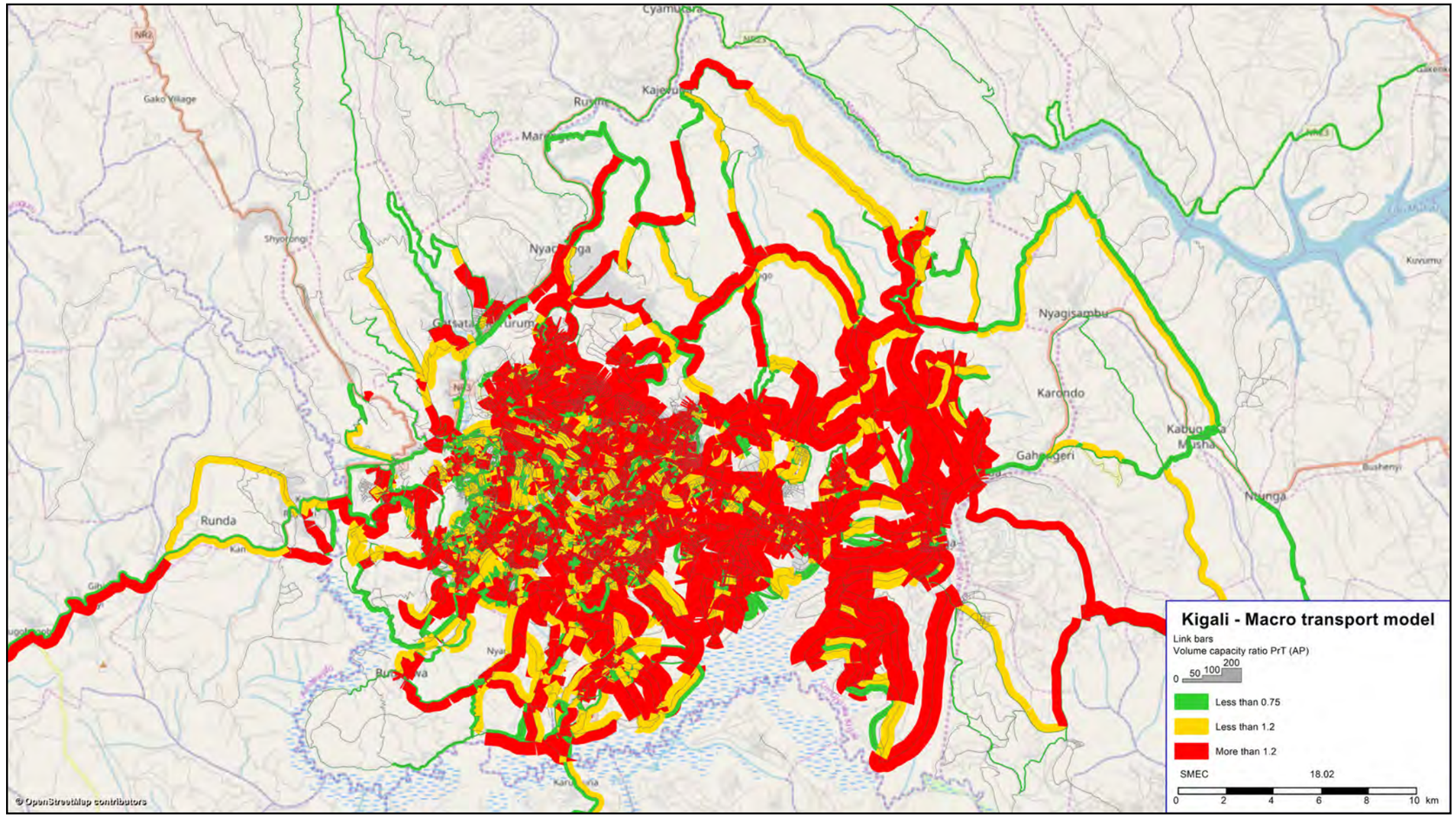

Figure 8.14 Volume/ Capacity Ratio with No Road Upgrades Implemented (Scenario 4)

Figure 8.15 shows private vehicle volume comparison on the system between a scenario where no upgrades are implemented (Scenario 4) to a scenario (Scenario 14) where all major road projects are implemented. As can be seen in the figure, small, internal City roads experience fewer vehicles while larger roads such as the Kigali Ring Road carry more traffic.

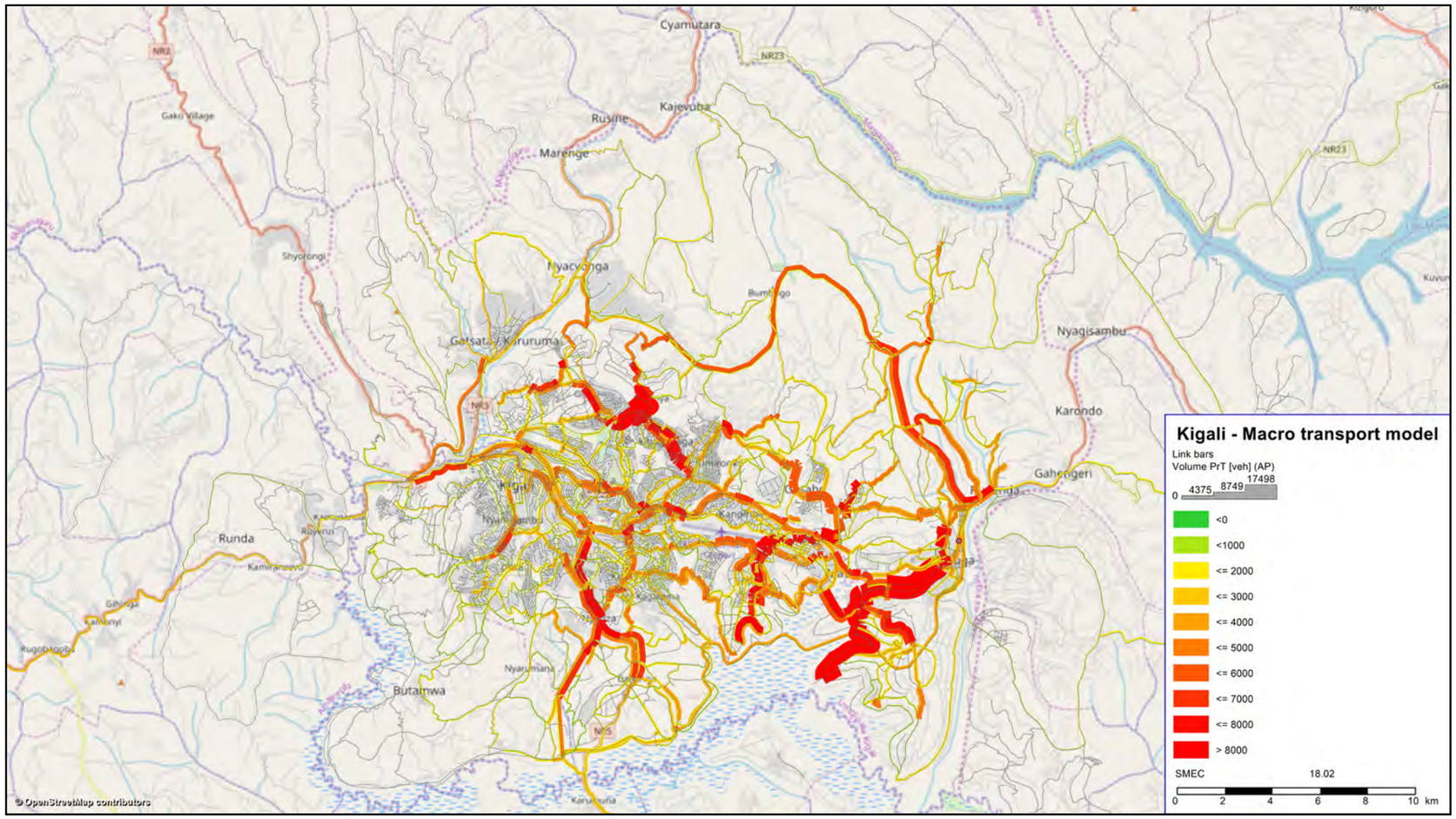

Figure 8.15 Private Vehicle Assignment Change- No Road Upgrades (Scenario 4) to All Major Road Projects Implemented (Scenario 14)

Figure 8.16 shows the V/C ratio for a scenario (Scenario 14) where all major road projects are implemented.

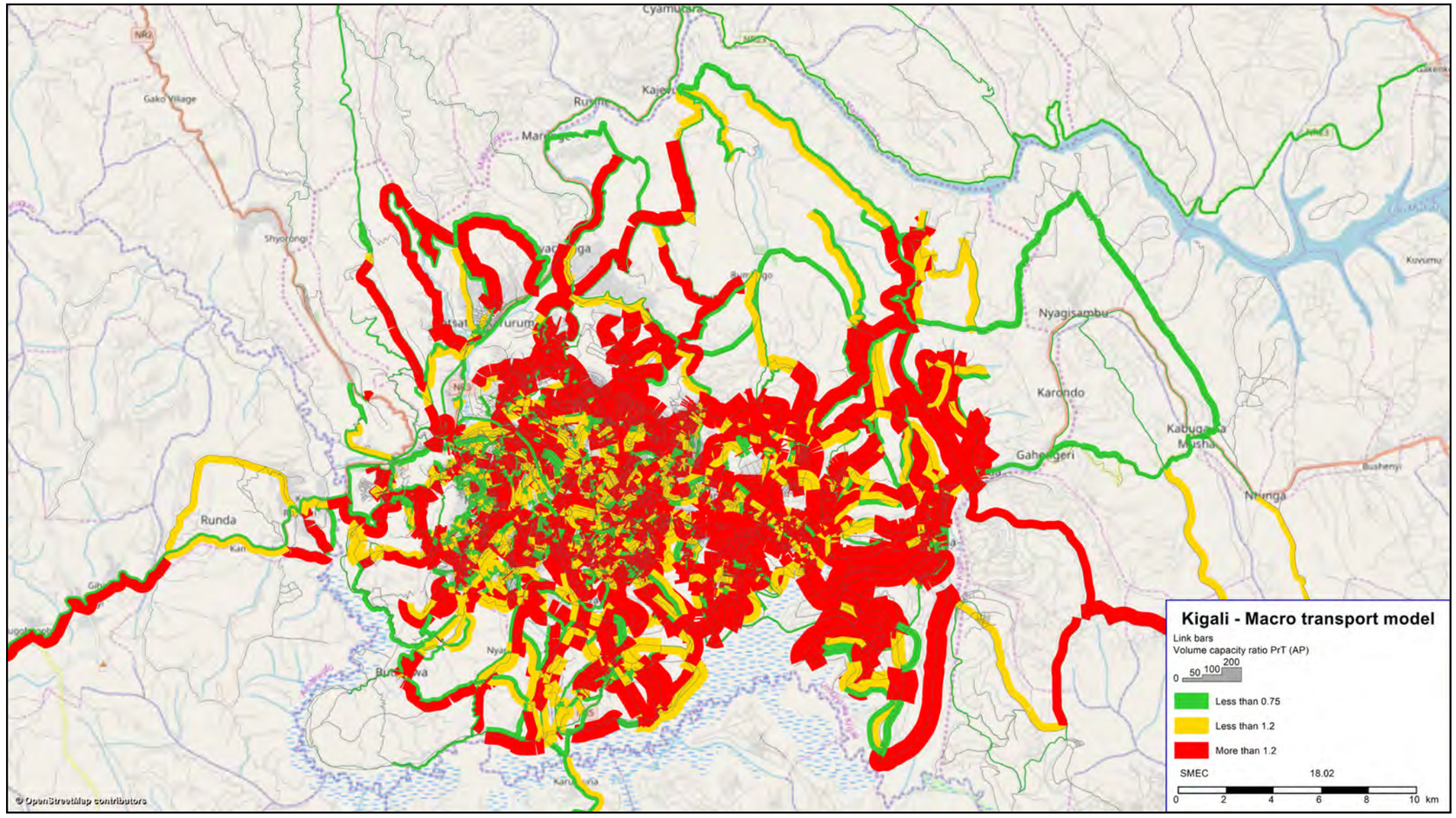

Figure 8.16 Volume/ Capacity Ratio with Road Upgrades Implemented (Scenario 14)

8.2.4 Proposed Road Network

Improvements to the High Capacity Urban Roads and Major Arterial Roads were proposed and tested (Section 8.2.2). However capacity upgrades are also required to establish Minor Arterial Roads, Collector Roads and additional Major Arterial Roads.

The road network designed for this is shown in Figure 8.17. This is the proposed road network for Kigali for 2050.

The recommended road widths for planning purposes must be seen as a guideline to achieve the system capacity required. Local challenges may require some more in depth investigation (area specific precinct master planning) to ensure the capacity needs are met as best possible, within practical limitations.

The recommended capacity upgrades are provided for RoW planning purposes. The capacity recommendations do not take into consideration detailed intersection capacity restrictions, queueing, intersection control, etc. The exact capacity requirement can only be confirmed through a more detailed capacity assessment (meso-scopic and micro-scopic modelling) and will also ensure that over-design of infrastructure is limited.

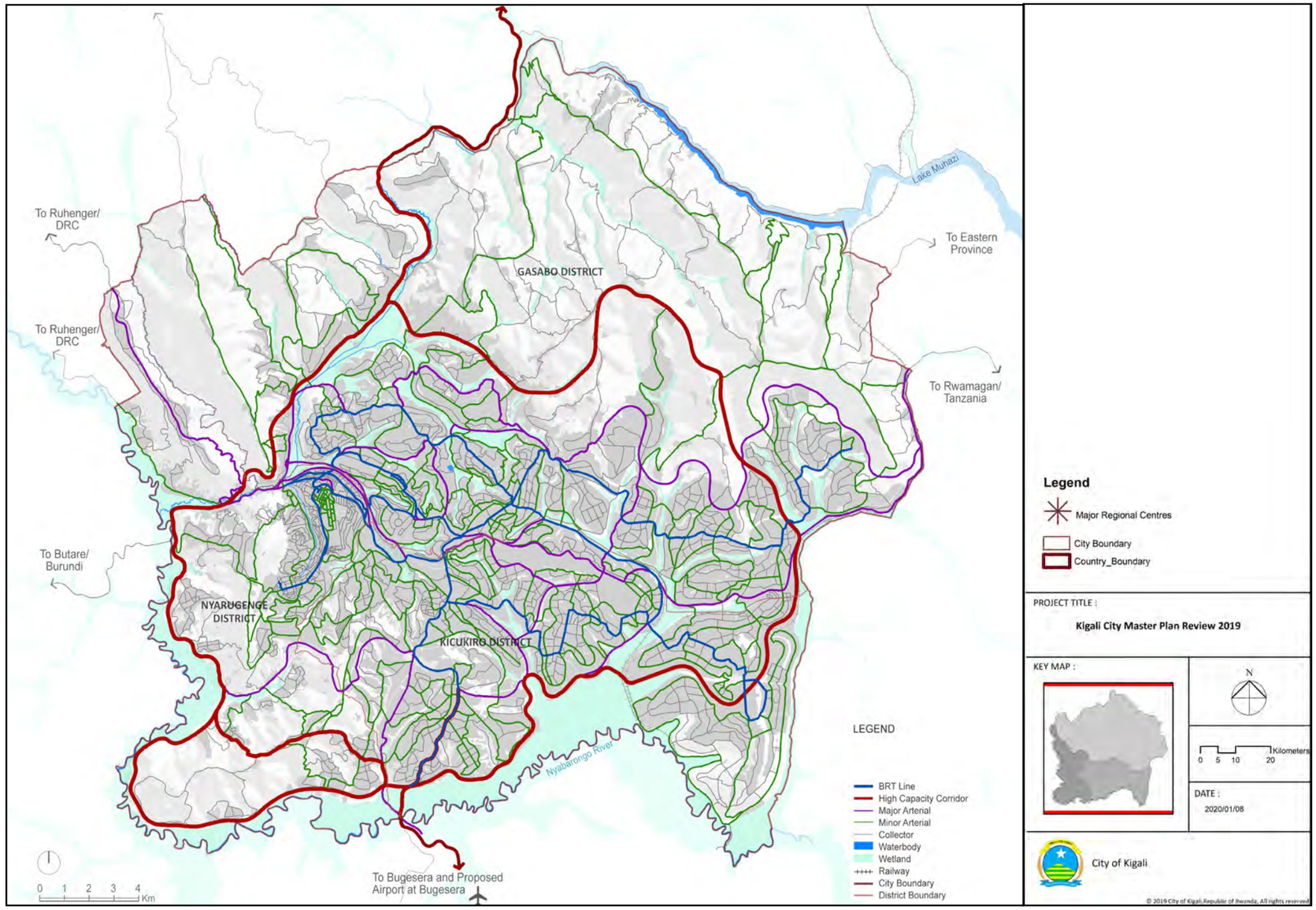

Figure 8.17 2050 Proposed Road Network and Classification

The recommended road alignments are provided for land use planning purposes. The alignments are based on the existing road alignments as far as possible, as requested. The alignments do not take into consideration an in depth assessment of topographical challenges and horizontal or vertical geometric design considerations. The exact alignment is therefore likely to change once the detailed design of the roads commence, based on the design solutions that will be recommended and budget availability. This can only be assessed and confirmed during the detailed planning and design processes. Large interchanges and some roads were removed from the proposed network (based on comments received). This will result in additional capacity restrictions that will be worse than those illustrated in the Updated Transport Master Plan. Due to the absence of a multi-modal transport demand model, we can only assume that the limited road capacity will result in more trips taking place via public transport and NMT.

Figure 8.18 shows the V/C results for this proposed network. As shown in the image there are still some problem areas. Under 7% of roads in terms of distance have a Volume/Capacity Ratio of over 1.2. Approximately 11% of roads in terms of distance have a Volume/ Capacity Ratio over 1. Only 7% of HCUR have a V/C Ratio above 1. The proposal is therefore to prevent and mitigate against this potential over-congestion through the implementation of the additional strategies as documented in this report.

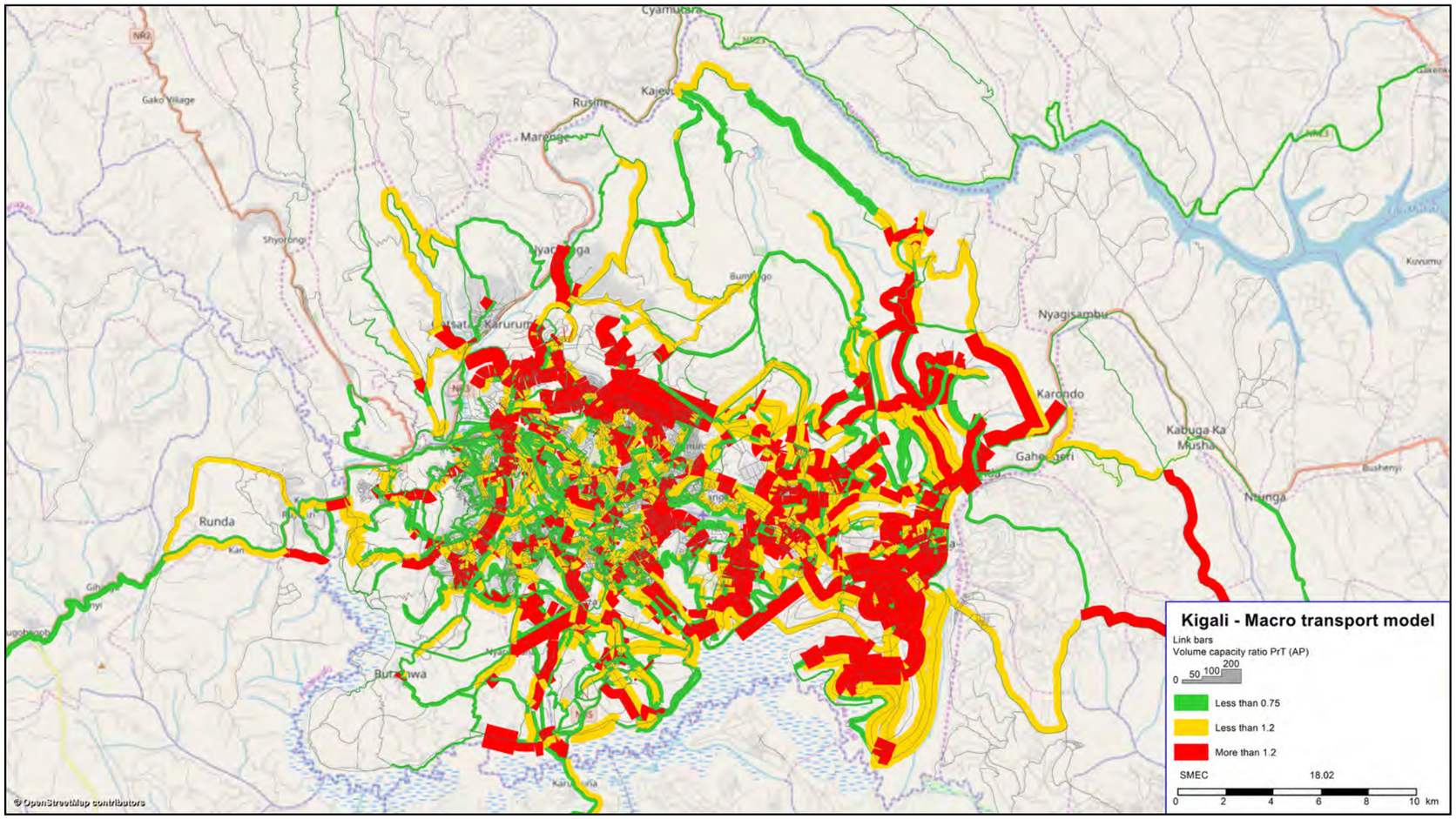

Figure 8.18 Volume/ Capacity for 2050 Road Network (Scenario 23)

As can be seen in the results the 2013 Transport Master Plan previous Ring Road (now downgraded to major arterial) carries a large demand. The capacity of this road should not be increased as this will only attract more vehicles and the outer ring road will go unused.

The other issue with the road network is the south eastern corner of Kigali where the Kigali Ring Road cuts through this regional node. In order for the regional node to remain as it is, public transport and non-motorised transport will need to be encouraged here even more than in other areas.

Urban areas are considered to be all areas not zoned to be agricultural or rural (refer to Figure 8.19).

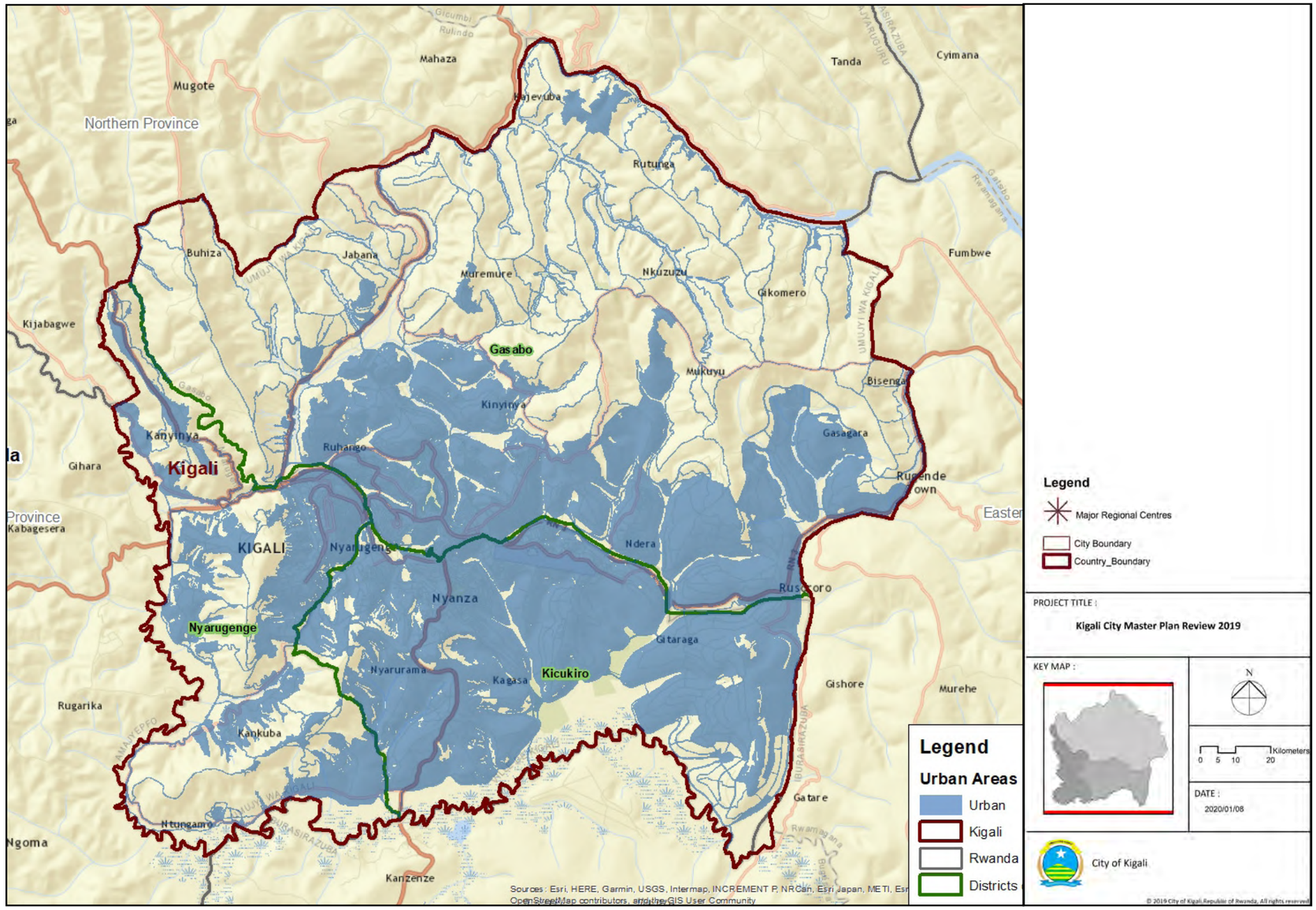

Figure 8.19 2018 existing and 2050 planned Kigali Urban Areas

Figure 8.20 illustrates the major regional centres.

The following road network upgrades are proposed:

- Upgrades along BRT routes to 2 lanes per direction.
- Airport Link Road Upgrades.
- Kigali Ring Road.
- Arterial routes for Kigali in 2050 that will require construction or upgrades to 2 lanes per direction if not already in place. These alignments can be adjusted as required during detail design periods and the shown route alignment is only an indication of where the road is required to help meet demand.
- Reduce flyovers and vehicle priority measures.

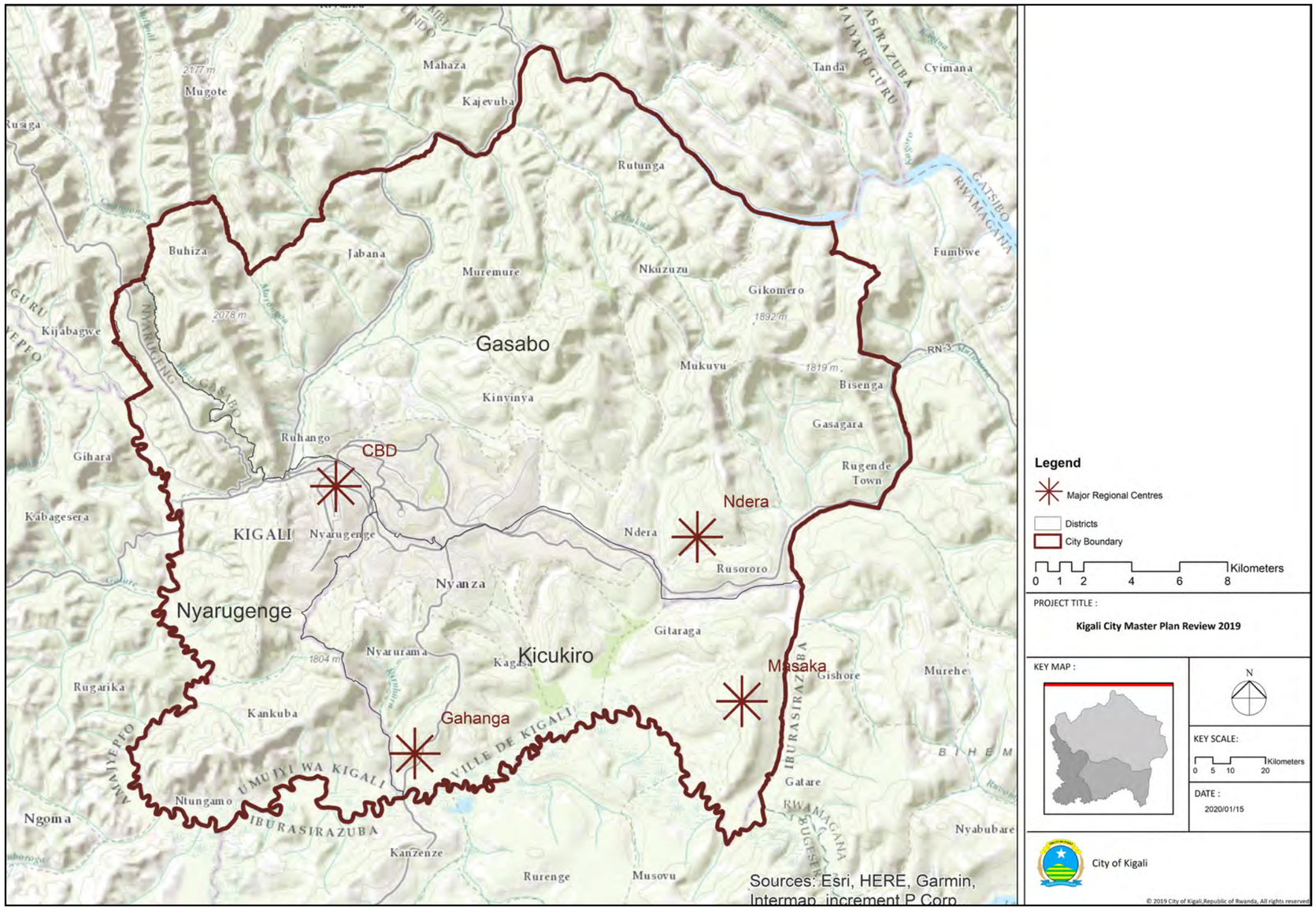

Figure 8.20 2018 existing and 2050 planned Major Regional Centres

Model Run	Demand Scenarios				Supply Changes					Demand Sensitivities				
					Road Network Upgrades									
	2018 Calibrated Demand	2050 Demand based on Population Growth	2050 Demand with Population Growth and an increase in Car Ownership2	2050 Demand with Population Growth, an increase in Car Ownership and BRT Operational3	Airport Link Road	Kigali Ring Road	High Capacity Urban Roads (Excluding Kigali Ring Road)	2 Private Vehicle Lanes along BRT Routes	Final Proposed 2050 Road Network	Cable Car	0% Motos; 0% to PT 100% to Cars	0% Motos; 50% to PT 50% to Cars	50% Motos; 100% shifted to cars	50% Motos; 50% to PT and 50% to cars
24	■				■	■	■	■		■				
25				■	■	■	■	■		■				
26	■				■	■	■	■			■			
27	■				■	■	■	■				■		
28	■				■	■	■	■					■	
29	■				■	■	■	■						■
30				■	■	■	■	■			■			
31				■	■	■	■	■				■		
32				■	■	■	■	■					■	
33				■	■	■	■	■						■

Table 8.1 Model Demand and Supply Sensitivity Tests

8.3 Sensitivity Checks

In addition to the primary model scenario tests discussed in Sections 6.4.3 and 6.4.4, a number of sensitivity scenario tests were carried out. Table 8.1 shows a summary of the sensitivity tests of the impact of different scenarios on the road network. These were related to a potential change in demand as a result of the implementation of a Cable Car and/or the a change in demand as a result of a change in the future function and hierarchy of Moto-Taxis. The 2050 base demand was based on population and employment growth projections as per Scenario B as explained in Chapter 5.

8.3.1 Moto-Taxi Options Analysis

Moto-taxis are a form of transport that creates many jobs and provides more affordable road transport alternatives to cars. They also take up less road space than a car. Unfortunately motorcycles do not provide the same safety as cars. In order to determine the impact on the road network should the Moto-Taxi industry continue to grow with the population or should the Moto-Taxi industry be limited, model demand scenarios were developed.

Scenario 30: 0% Moto-Taxis, 0% PT or NMT, 100% Cars – 100% of the Moto-Taxi vehicle trips are decommissioned as they become redundant as a result of car ownership increase – these trips all become Car trips.

Scenario 31: 0% Moto-Taxis, 50% PT or NMT, 50% Cars – assume 100% of Moto-Taxi vehicle trips are decommissioned as they become redundant and their function is replaced by another PT mode such as BRT, and the other 50% of the Moto-Taxi vehicle trips are decommissioned as they become redundant as a result of car ownership increase – these trips become Car trips.
Scenario 32: 50% Moto-Taxis, 0% PT or NMT, 50% Cars – 50% of the Moto-Taxi vehicle trips are decommissioned as they become redundant as a result of car ownership increase – these trips all become Car trips.

Scenario 33: 50% Moto-Taxis, 25% PT, 25% Cars - assume 50% of Moto-Taxi vehicle trips are decommissioned as they become redundant and their function is replaced by another PT mode such as BRT, and the other 50% of the Moto-Taxi vehicle trips are decommissioned as they become redundant as a result of car ownership increase – these trips become Car trips.

These results are shown in Figure 8.21.

As shown in the figure, the vehicle hours travelled on the road network are significantly affected by the number of Moto-Taxis on the road. A decrease in the number of Moto-Taxis means there will be additional capacity for cars, however if all Moto-Taxi users move to Public Transport or NMT, there is a positive effect on the road network.

In a scenario where the number of Moto-Taxis is limited, it should be ensured that additional public transport solutions are attractive.
For the purpose of this Masterplan it was assumed that the use of Moto-Taxis will continue to increase with population from 47 162 trips in 2018 to 111 179 trips in 2050.

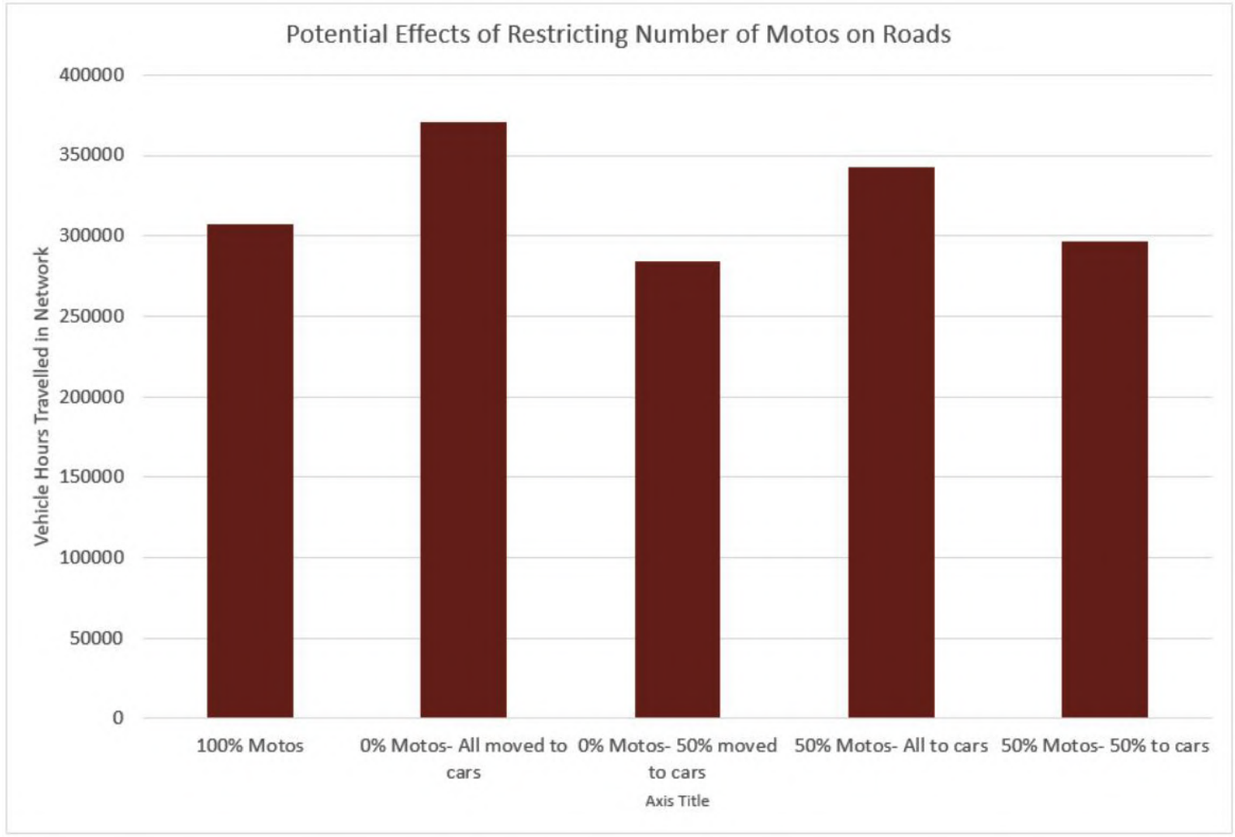

Figure 8.21 Effect of Restricting Moto-Taxis on Road-Based Travel Time (Scenario 4, Scenario 30, Scenario 31, Scenario 32 and Scenario 33)

8.3.2 Cable Car Analysis

The potential change in demand as a result of the implementation of a proposed cable car between the centre of Kigali and Nyabugogo was modelled in Scenarios 24 and 25 (refer to Figure 7.6: Cable Car Potential Locations. The impact on the road capacity and demand for road-based travel were regarded as negligible. The small-scale project cannot be accurately evaluated using the road network macro demand model.

A detailed feasibility study for the cable car project is required. As the cable car will only travel a short distance it is likely to attract most trips from the existing non-motorised transport commuter sector or from tourist trip purpose sector and will not have a significant impact on the road network capacity and demand other than reducing some of the car trips between the CBD and Nyabugogo. A stated preference survey and associated mode choice demand forecast model would be required to determine the extent of this.

8.4 Refined Road Classification

The road classification is a guideline that should be used in combination with Road Design Guidelines and good practice principles to ensure a safe and efficient road network is constructed in Kigali. The purpose of the road classification is to achieve a balance between the mobility and accessibility functions of the roads. Although recommendations are made, detail designs need to ensure that the people and vehicles using the roads are safe. Recommendations can be made to work outside these standards by professional road designers if properly justified.

Cross-sections can be developed based on the Right of Way classification in this document to form part of Road Design Guidelines.

Revisions to the 2013 Road Classification were made in consultation with the City of Kigali and ITDP to ensure coherence with Road Design Standards. The following notable revisions were made to the 2013 Road Classification:

- An additional category for “Local Roads” was added. This was to give guideline standards allow local access roads to be constructed as required even though these types of roads are not included in the Master Plan network.
- The class of CBD thoroughfare roads were removed and absorbed into other categories.
- Minimum RoW and Max Row were given for Brown Field and Green Field areas
- “Maximum speed limits” were replaced with Design Speeds as a guideline for geometric design purposes. The operating speed limits of roads can be done on a detail design level but an additional category notes allowance of low speed limits as preferred by the City. Actual design speed will depend on topographical limitations.
- The typical number of lanes per direction was reduced in some road classes. The goal of this was to discourage very large multiple lane roads and to rather prioritise NMT infrastructure.
- A note was added about BRT medians that states the median can be removed based on site conditions. If the median is removed the designers need to justify its removal and the detail design needs to ensure that safety risks are mitigated.
- Footpaths and cycle lanes were added to all classes of roads to help support NMT movements. Suitable safety barriers need to be implemented especially in areas with higher speed limits to ensure the safety of pedestrians and cyclists is not compromised.
- Pedestrian crossing recommendations were added. These are not exclusive and a detailed analysis of crossings is required to ensure safety standards are met.
- Lane widths for vehicles were minimised. Lane width should be based on traffic volume, vehicle type and speed. Higher speeds require wider lanes but lanes can be narrowed to encourage lower speeds. If a route is used by buses, the narrowest road lane should be 3,1m (Guidelines for Human Settlement Planning and Design, CSIR, 2000). Detail designs need to ensure lane widths will allow for large articulated vehicles to manoeuvre if required. If high numbers of large vehicles use a road (e.g. more than 8%), these should be used as the detail design vehicle.

Types	High Capacity Roads	Major Arterial Roads			Minor Arterial		Collector Roads		Local Roads	
	Trunk Roads		Mass Transport / Bus Rapid Transport	Link Roads	Main Bus Routes	Commercial Streets	Populated / Developed / Urban Road	Unpopulated / Undeveloped / Rural Road	Residential Street	NMT Route Greenway/ Multi-Use Pathway
Description										
Design Speeds & Geometry										
Design Speed to achieve required capacity and mobility	90 - 120kph	75 - 90kph	40 - 75kph	75 - 90kph	30 – 60 kph	30 – 40 kph	30 – 40 kph	50 - 60 kph	10 – 30 km/h	-
Speed Limit (applicable in specific conditions)	Can be reduced to 40kph due to geometric challenges or to improve safety	Can be reduced to 40kph due to geometric challenges or to improve safety	Can be reduced to 40kph due to geometric challenges or to improve safety	Can be reduced to 40kph due to geometric challenges or to improve safety	Can be reduced to 30kph due to geometric challenges or to improve safety	Can be reduced to 30kph due to geometric challenges or to improve safety	Can be reduced to 30kph due to geometric challenges or to improve safety	Can be reduced to 30kph due to geometric challenges or to improve safety	Can be reduced to 10kph due to geometric challenges or to improve safety	
Geometry Design to International Standards										
Street Dimensions										
Min ROW (Brown Field)	38,0	27,0	29,4	21,6	15,0	15,0	15,0	21,0	8,0	4,0
Max ROW (Green Field)	64,0	58,0	53,4	37,5	27,6	26,6	26,0	37,0	12,5	10,0
Typical number of lanes per direction	2 – 3 lanes plus service lanes	2 – 3 lanes	2 – 3 lanes	2 – 3 lanes	1 – 2 lanes	1 – 2 lanes	1 – 2 lanes	1 – 2 lanes	1 lane	-
Minimum Carriageway Width	3.5 m per lane	3 - 3.5 m per lane	3 - 3.5m per lane	3- 3.25 m per lane	3- 3.25 m per lane	3 m per lane	3 m per lane	4 m per lane	3- 3.25 m per lane	-
Median Width	4 m	1 – 4 m	1 – 4 m (may be removed based on site conditions)	0.6 – 4 m	0.6 m (only if 2 lanes per direction are provided)	0.6 m (only if 2 lanes per direction are provided)	-	-	-	-

Table 8.2 Refined Road Classification

Types	High Capacity Roads	Major Arterial Roads		Minor Arterial		Collector Roads		Local Roads	
	Trunk Roads		Mass Transport / Bus Rapid Transport	Link Roads	Main Bus Routes	Commercial Streets	Populated / Developed / Urban Road	Unpopulated / Undeveloped / Rural Road	Residential Street	NMT Route Greenway/ Multi-Use Pathway
Description										
Geometry Design to International Standards										
Street Dimensions										
Hard Shoulder per direction	3 m	-		-	-	-	-	-	-	-
Sideway Easement / Verge per direction	2.5 – 6 m	2.5 – 6 m	-	-	-	-	-	2 – 3.5 m	-	-
Footpath width per direction	2 m min (must be separated from motorised vehicles by buffer)	2 m min (must be separated from motorised vehicles by buffer)	2 m min (must be separated from motorised vehicles by buffer)	2 m min (must be separated from motorised vehicles by buffer)	2 m min	2 m min	2 m min	2 m min	-	-
Footpath furniture / Tree pits per direction	1m - 3m	1m - 3m	1m - 3m	1m - 3m	1m - 3m	1m - 3m	1m - 3m	1m - 3m	1m - 3m	1m - 3m
Cycle track width	One-directional: 2m min	1 – 4 m	1 – 4 m (may be removed based on site conditions)	0.6 – 4 m	0.6 m (only if 2 lanes per direction are provided)	0.6 m (only if 2 lanes per direction are provided)	-	-	-	-
Pedestrian Crossings (if warranted)	Separated Grade or Signalised	Preferably Signalised; Traffic Calming if required	Preferably Signalised; Traffic Calming if required	Preferably Signalised; Traffic Calming if required	Signalised/ Traffic Calming	Signalised/ Traffic Calming	Signalised/ Traffic Calming	Signalised/ Traffic Calming	Signalised/ Traffic Calming	-
Traffic Calming	No	Not recommended	Yes (not on BRT lanes)	Not recommended	Yes	Yes	Yes	-	Yes	Yes
On-street Car Parking	No	No	No	No	No	Short-term (Optional)	Yes	-	Yes	No

Types	High Capacity Roads	Major Arterial Roads			Minor Arterial		Collector Roads		Local Roads	
	Trunk Roads		Mass Transport / Bus Rapid Transport	Link Roads	Main Bus Routes	Commercial Streets	Populated / Developed / Urban Road	Unpopulated / Undeveloped / Rural Road	Residential Street	NMT Route Greenway/ Multi-Use Pathway
Description										
Public Transport										
Bus Access	When required	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Bus Stops	Only along service lane	Yes, with safe pedestrian crossing	Yes, with safe pedestrian crossing	Yes, with safe pedestrian crossing	Yes, with safe pedestrian crossing	Yes, with safe pedestrian crossing	Yes, with safe pedestrian crossing	Yes, with safe pedestrian crossing	Yes, with safe pedestrian crossing	No
Bus Shelter Width	2m min	2m min	2m min	2m min	2m min	2m min	2m min	2m min	2m min	
BRT Lanes per direction	-	-	1 - 2 lanes	-	-	-	-	-	-	-
Width of BRT lane	-	-	3.5 m min	-	-	-	-	-	-	-
BRT Station Width	-	-	4 m min	-	-	-	-	-	-	-
Public Transport										
Statutory Services	In Roadside Verge	In Roadside Verge	In Planting Strip	In Planting Strip	In Planting Strip	In Planting Strip	In Planting Strip	In Roadside Verge	In Planting Strip	-
Lighting Required	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional buffers	-	-	Approximately 0.2 between BRT lane and mixed traffic lanes (Semi-Traversable)	-	-	-	-	-	-	-

Note: These are generic best practice guidelines which can be adapted to suit a specific localised geometric design challenge or safety concern

8.5 Road Safety

Road Safety is fundamental to ensure that unnecessary injuries and deaths don't occur. Improved road safety also reduces repair costs to damaged infrastructure. Road safety is multi-faceted and there are a range of factors from various sectors that contribute towards road safety. Some of these key aspects are shown in Figure 8.22.

Some of the aspects contributing towards road safety fall outside the scope of the Transport Master Plan and it is therefore recommended that a Road Safety Strategy for Kigali be completed and regularly updated. This plan should ensure all aspects surrounding road safety are adequately addressed.

8.5.1 Road Network Recommendations and Requirements

In order to align with the transport goals and objectives, the following key strategies and key performance indicators were developed for the road network enabling strategy (refer to Chapter 4):

The following proposed strategic, tactical and operational projects align to the suggested key strategies:

On a strategic level this updated Transport Master Plan represents a plan to guide the development of a road network with a consistent hierarchy, access and mobility functions and associated typologies and cross-sections. This plan also includes a classification system for local roads.

On a tactical level the following projects should be initiated:

- Feasibility study for the tolling of the Kigali Ring Road (including investigation into tunnelling and bridges).
- Feasibility study for the Airport Link Road and the extension of BRT services to Bugasera Airport.
- Feasibility study for High Capacity Urban Road (including investigation into tunnelling and bridges).
- Transport Master Plans for specific areas of interest for example the existing Kigali International Airport precinct, the three districts of Kigali, the four planned Regional Centres, etc.
- Traffic Management Plans for specific areas of interest for example Emergency (Police) Road Closures.
- Develop a Road Safety Strategy for Kigali.
- Feasibility for a Traffic Control Centre.

On an operational the following is recommended:

- Development of a Road Access Management Strategy for Kigali.
- Development of standardised geometric design guidelines including traffic calming measures. This should take into account PT and NMT requirements of the City.
- Development of standardised specifications for the design, procurement and installation of traffic signals. This should take into account PT and NMT requirements of the City.
- Development of a Road Sign and Marking Manual for Kigali. This should take into account PT and NMT requirements of the City.
- Development of a Parking Policy and Design Manual for Kigali.
- Development of monitoring mechanisms to survey and report on the achievement of the key performance indicators.

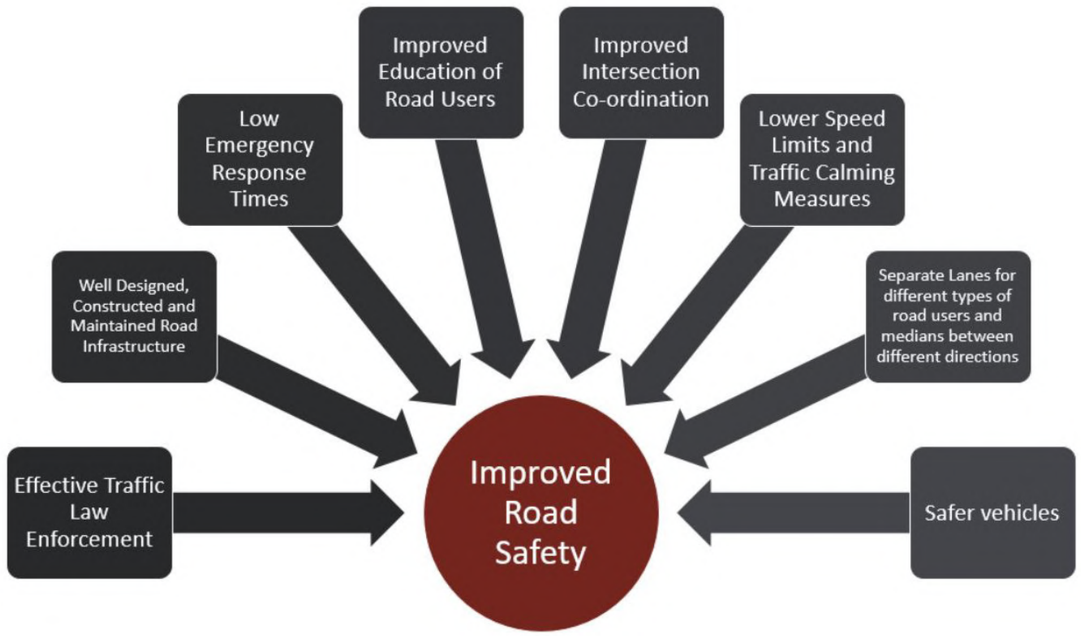

Figure 8.22 Some Aspects Contributing to Improved Road Safety

Road Network Plan – Key Strategies	Key Performance Indicators
Develop a road network that supports the public transport system.	Public transport services to connect all major regional centers (as shown in Figure 10 20).
Develop a ring and radial system of highways.	The density of major and minor arterial roads should exceed 2km/sqm in urban areas.
Develop a High Capacity Urban Roads (HCUR) Network.	5% of the road network should be HCUR.
Provide a Non-Motorised Transport (NMT) network along arterial roads.	100% of the major and minor arterial roads should have NMT infrastructure.
Provide a High Capacity Urban Road (HCUR) around the City for freight.	Alignment of HCUR to accommodate through movement of freight.
Develop a road hierarchy and associated mobility and accessibility functions, access management and cross-sections.	Commission of road design manual and guidelines.

Table 8.3 Key Strategies of Road Network Plan

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9

Other Transport Strategies

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9 Other Transport Strategies Required

9.1 Freight Management Strategy

In order to align with the transport goals and objectives, the following key strategies and key performance indicators were developed for the freight management enabling strategy (refer to Chapter 2):

The following proposed strategic, tactical and operational projects align to the suggested key strategies:

On a strategic level:

- The existing Road Freight Network is discussed in Section 5.6.1. The status of the Rail Network is discussed in Sections 5.6.2 and 6.1. The proposed road network (refer to Section 10.4) and Kigali Ring Road specifically will allow freight traffic passing the city to pass around it without adding to the internal heavy vehicle traffic.
- Provide input into the development of a national rail master plan that should determine the status of the planned rail connections to Uganda, Tanzania and Bugasera Airport. This plan should take account of the fact that these rail connections would strengthen Kigali's position as a logistics hub to the East coast.
- Logistic hubs should be located on the outskirts of the City to allow transfer to smaller trucks within the City. They should also be near rail, major roads and industrial areas. Possible areas where a logistic hub should be located are shown in Figure 9.1. A high level due diligence study should be carried out to determine the most appropriate locations for future logistic hubs.

On a tactical level:

- Develop freight management plans for specific areas of interest, for example the 4 planned regional centres. Such plans should identify locations for weigh bridges, inter-modal facilities, loading zones, truck stops, service facilities, dedicated routes, charging stations and restrictions. The plan should take account of on-street parking and the provision of NMT infrastructure.

On an operational level:

- Develop a guideline for the management of construction traffic.

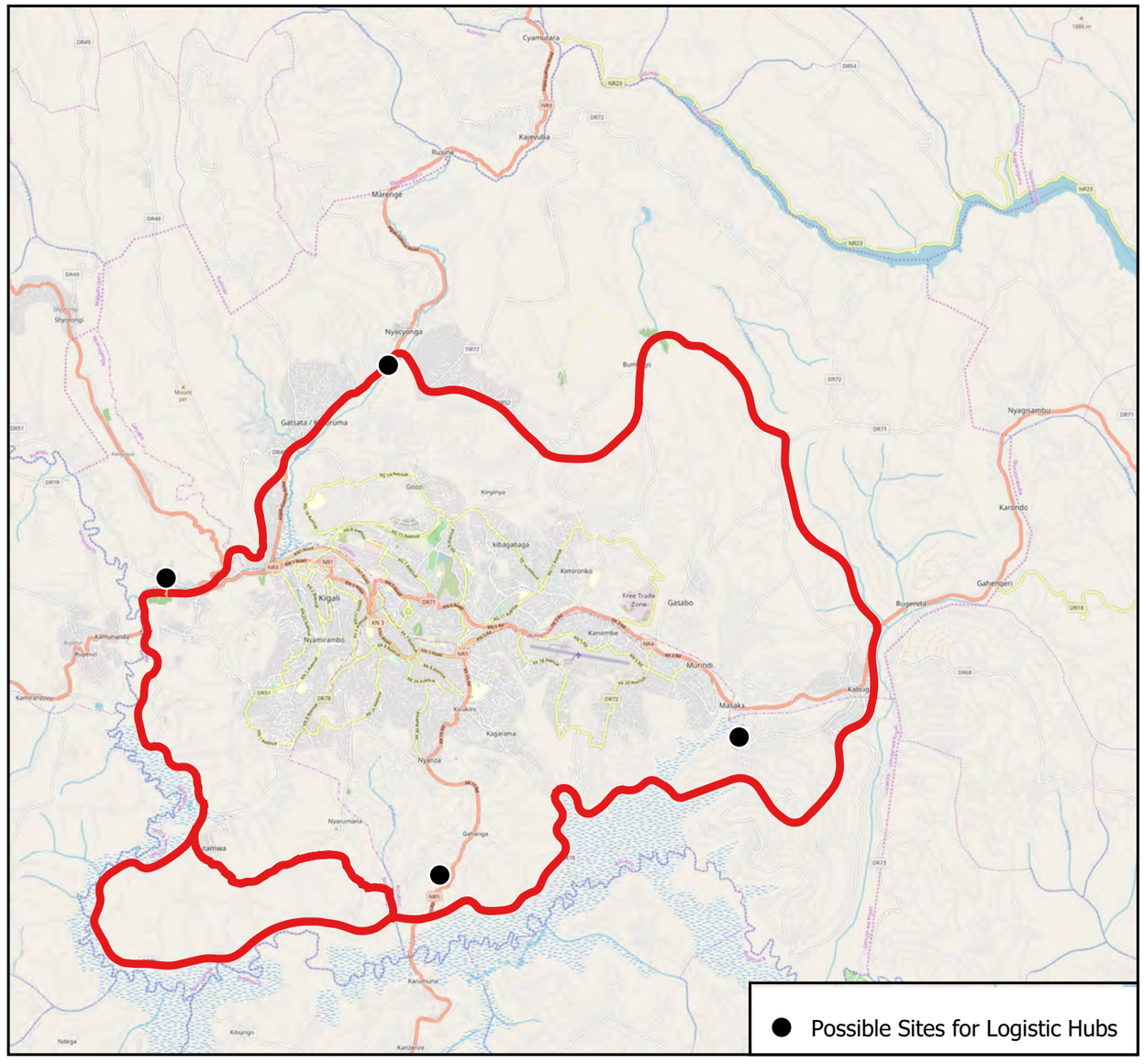


Figure 9.1 Possible Locations for Logistics Hubs

9.2 Green Transport Network Strategies

In order to align with the transport goals and objectives, the following key strategies and key performance indicators were developed for the green transport enabling strategy (refer to Chapter 2).

Green Transport Plan – Key Strategies	Key Performance Indicators
Develop a city-wide NMT network which supports the public transport system.	Development of an NMT network.
Develop a Non-Motorised Transport (NMT) network along arterial and collector roads.	Inclusion of NMT in road hierarchy and cross-sections
Develop a strategic approach to providing pedestrian amenities such as trees and street furniture.	Commission of road design manuals and guidelines.
Develop a pleasant streetscape especially along the NMT network.	Inclusion of NMT in road hierarchy and cross-sections.
Develop a well-connected NMT network that utilizes open spaces and the road network.	Reservation of servitudes.
Develop a pedestrian-friendly street design guidance manual for use in residential and urban commercial settings.	Commission of road design manuals, transport legislation and guidelines.
Pedestrianize regional centers where possible	Commission of pedestrianisation projects in regional centers.

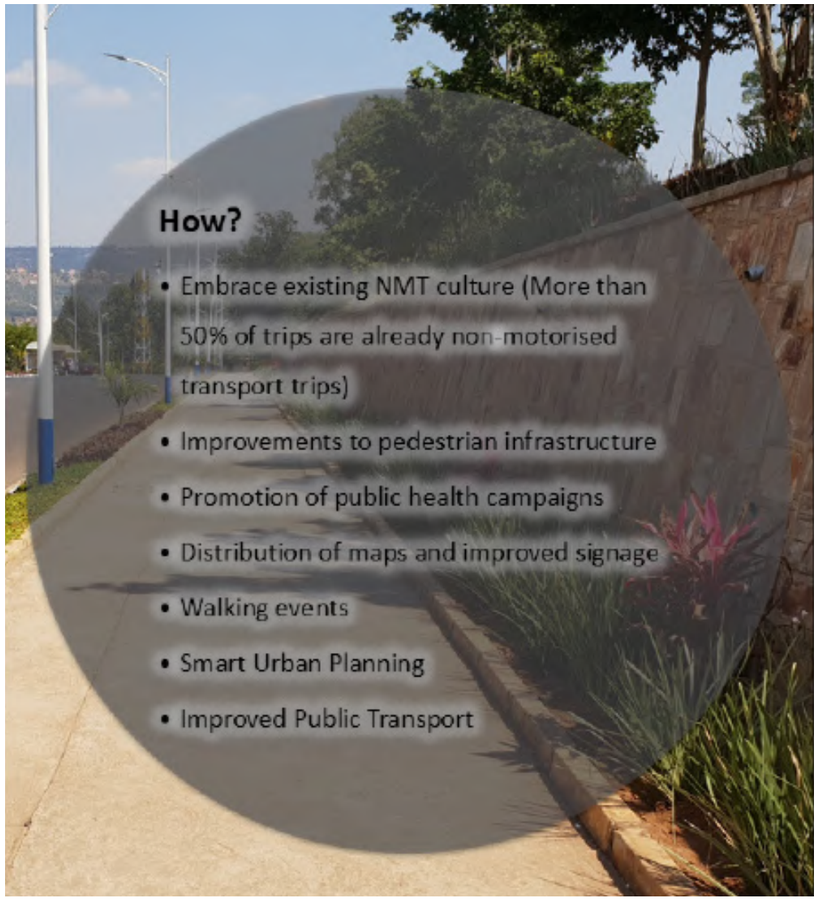
Table 9.1 Key Strategies of Green Transport Plan

9.2.1 Non-Motorised Transport Network

Green Transport Network Strategies consist of the provision of NMT infrastructure and the promotion of the use of NMT. This strategy should support the public transport systems but also provide an independent transport system that is comfortable and safe to encourage walking and cycling within the City.

Attractive green transport infrastructure encourages more people to walk which will decrease pressure on the road network, it often improves the health of citizens who use the network, it has low capital investment required and very low operation and maintenance costs and it has minimal impacts on the environment. The importance of this type of transport and ensuring people continue to embrace a lifestyle with NMT is often underestimated and yet is critical to the successful development and sustainable growth of Kigali.

NMT can also be encouraged during detailed NMT design and in smart urban planning guidelines. Short blocks, the reduction of front yard parking, building frontage design guidelines and other measures can be used to increase the walkability of an area outside the scope of this Transport Master Plan.



The following map in Figure 9.2 shows the primary and secondary NMT routes proposed. In order to reduce costs of the primary and secondary network and to ensure all regional centres are connected, the Pedestrian and Cycle routes follow the same paths. The primary pedestrian routes follow the planned BRT routes and should have sidewalks with a minimum total width of 2m in each direction as stipulated in the BRT Feasibility and Preliminary Design Second Interim Report. The secondary NMT routes require sidewalks with a minimum width of 2m in each direction as per the refined Road Classification (refer to Section 8.4). The primary and secondary cycle networks should, where possible have 2m cycle lanes per direction. If space constraints are an issue, dual direction 3m lanes can be constructed along secondary NMT routes as stipulated in Section 8.4.

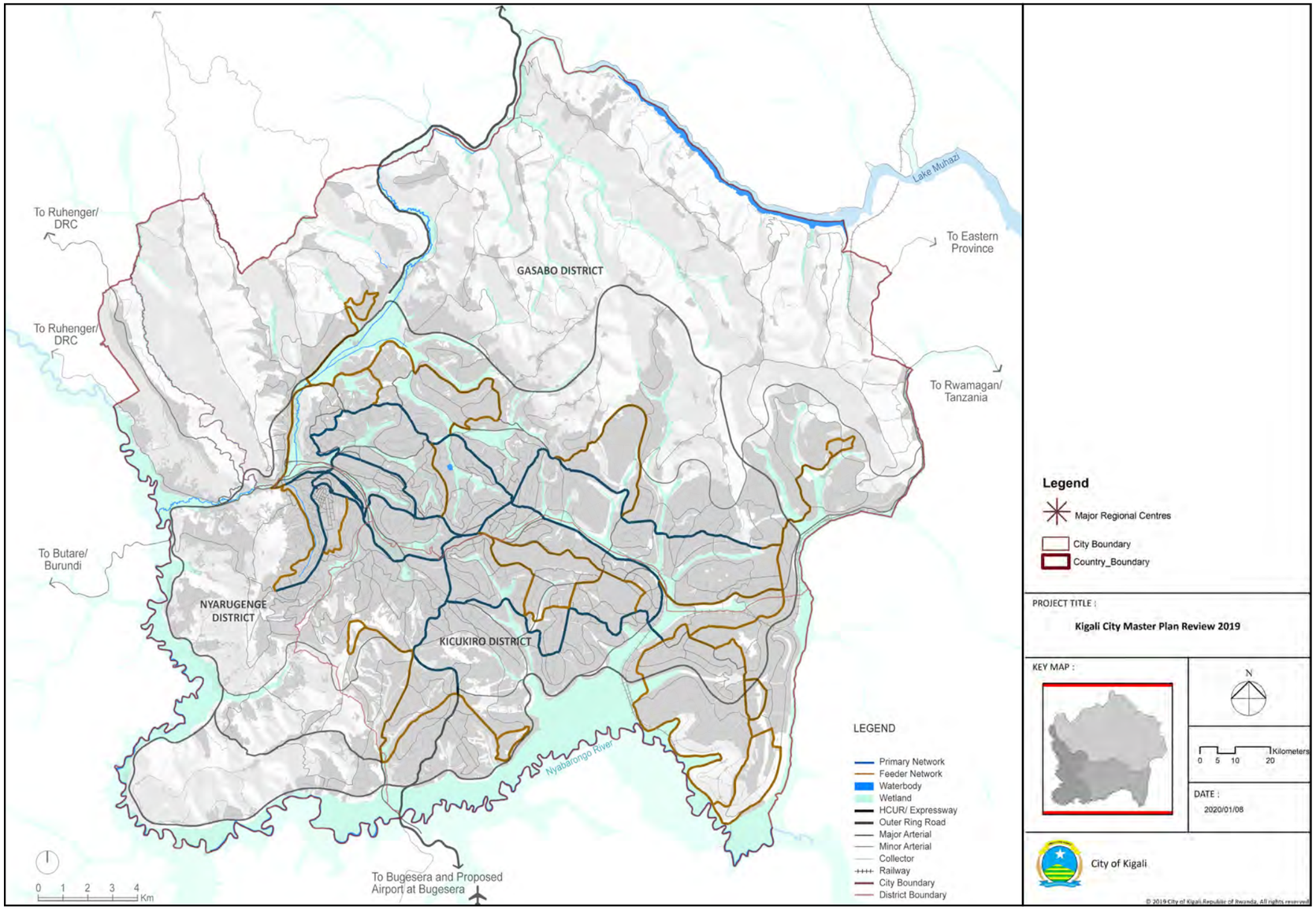


Figure 9.2 Proposed Primary and Feeder NMT Routes

The map in Figure 9.3 highlights areas where detailed NMT plans will be required. The CBD and Kacuyiru area requires an NMT plan immediately. The Gahanga sector will require a similar plan by 2024. The Masaka area will only require a similar plan by 2031.

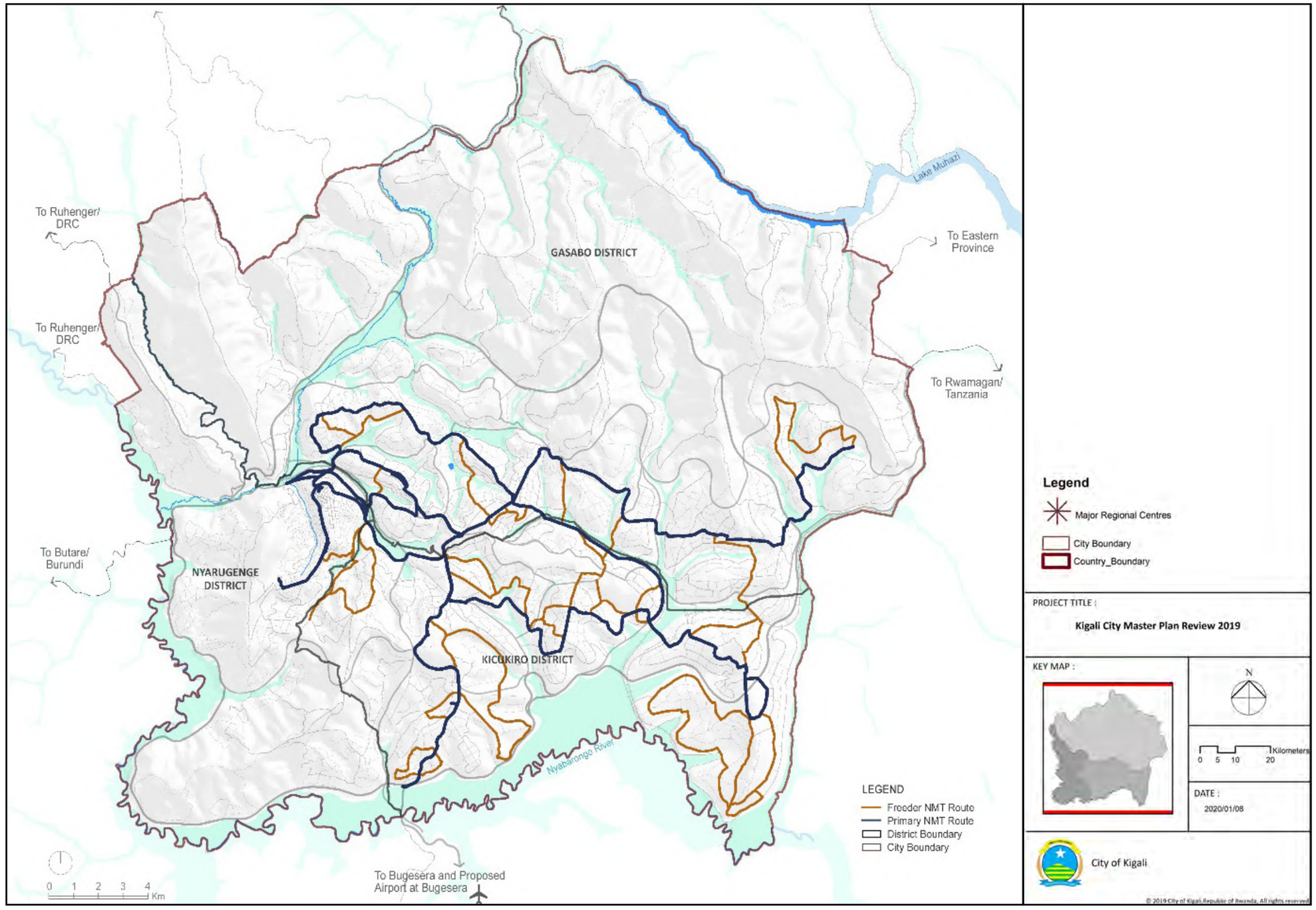


Figure 9.3 Areas requiring dedicated NMT plans

It is recommended that all roads within 500m of the BRT or Primary NMT routes be made a priority for upgrade in terms of NMT infrastructure. This should be completed with similar phasing to that of the BRT infrastructure. This is illustrated in Figure 9.4.

Warrant requirements for pedestrian bridges should be developed and these should be erected where appropriate. Pedestrian bridges should only be built in areas where there is limited gradient change then required for pedestrians (where the bridge minimises pedestrian gradient changes), where there are pedestrian safety concerns or where there are high volumes of pedestrians.

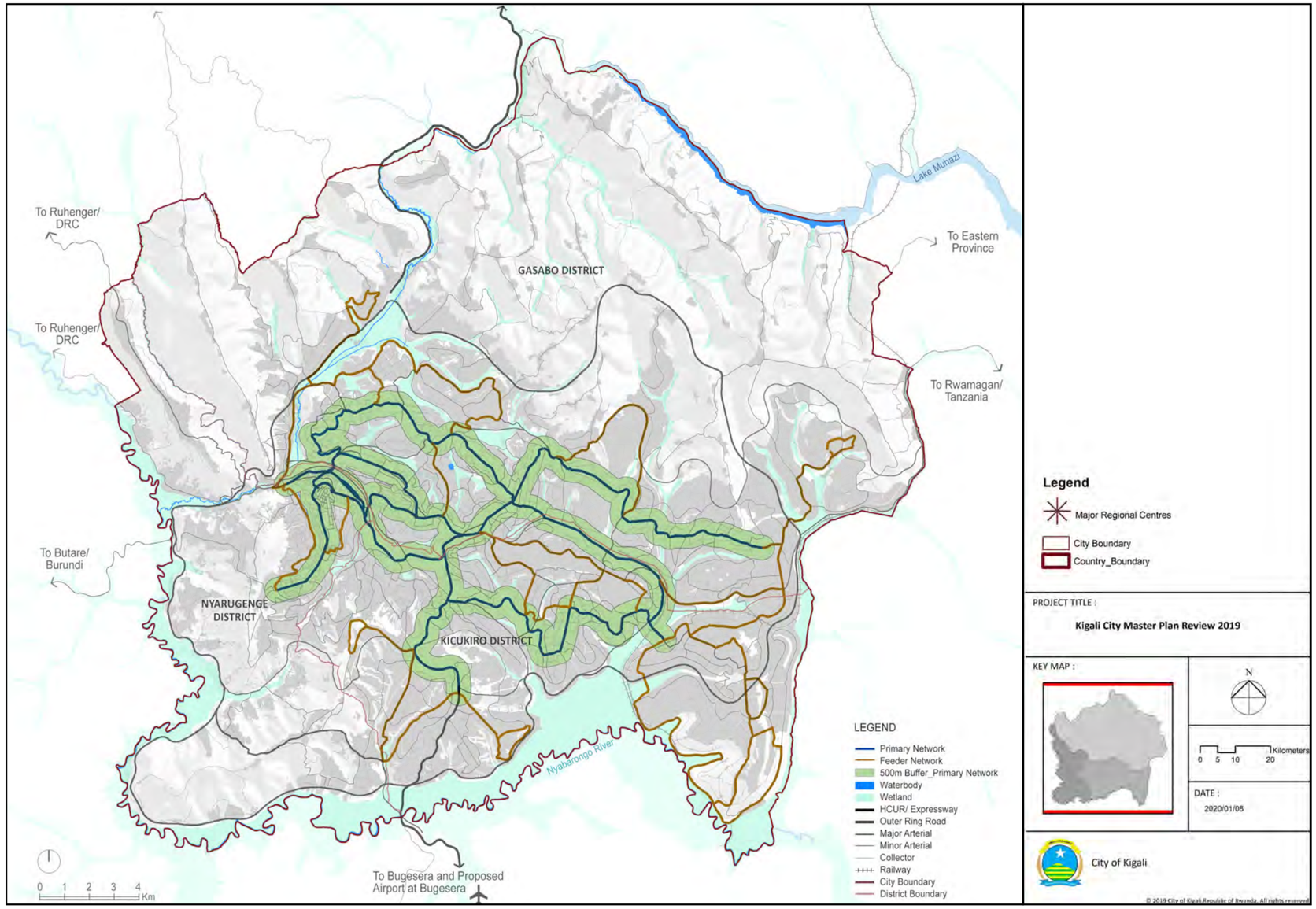


Figure 9.4 Primary and Feeder Cycle Network

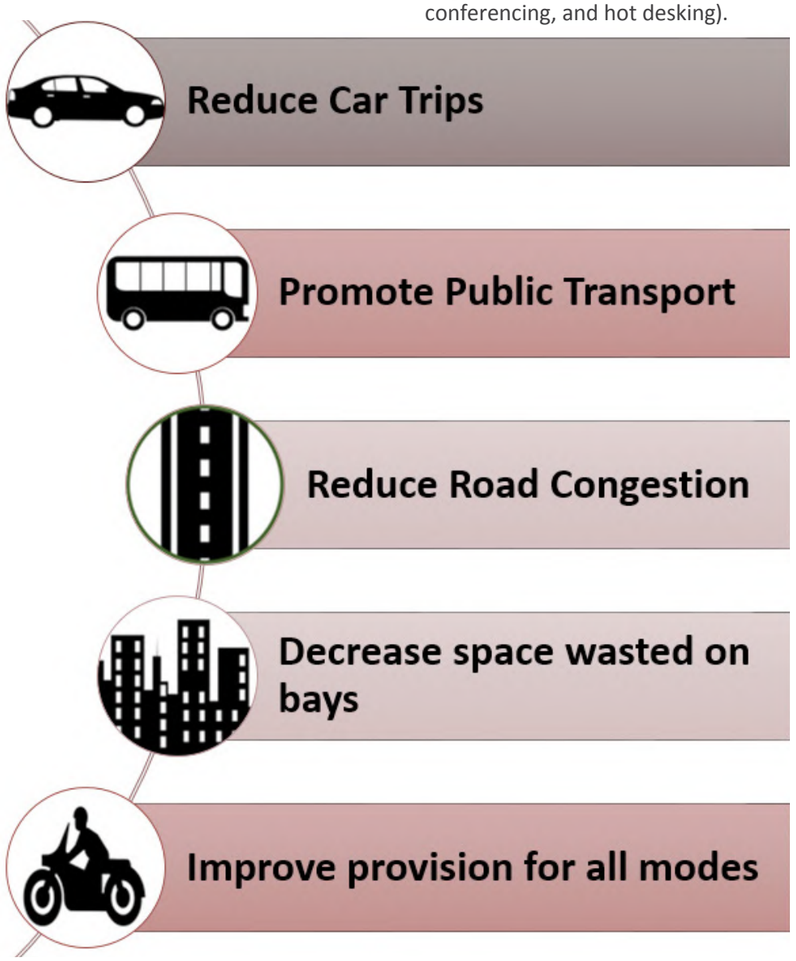
9.2.2 Green Transport Promotion Strategies

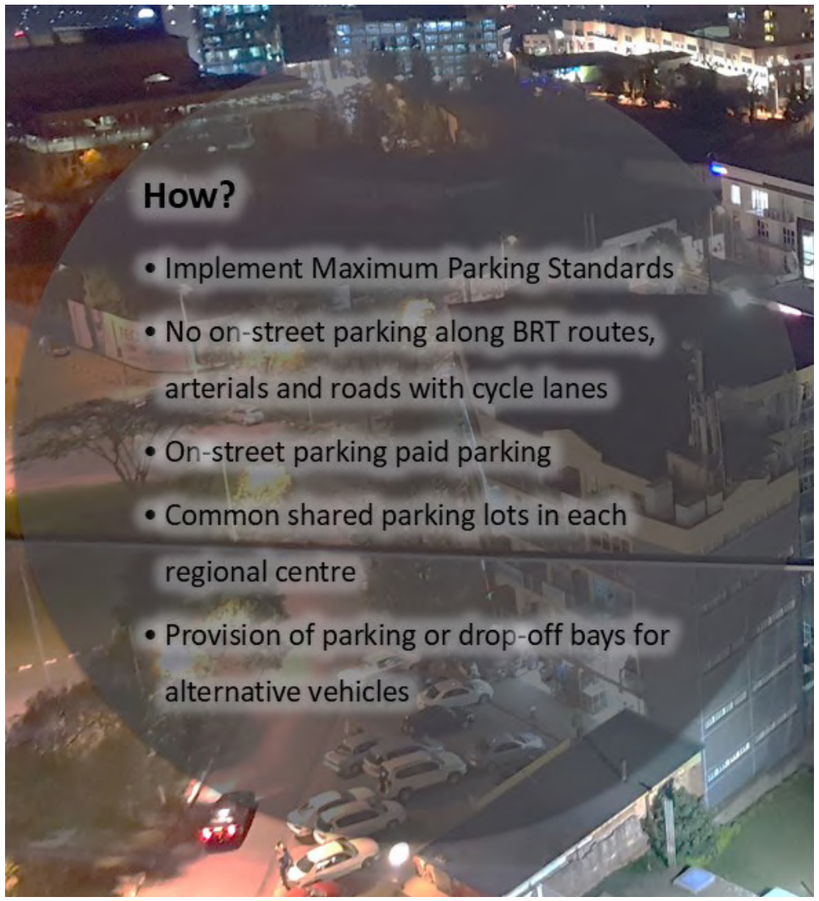
The BRT Feasibility and Preliminary Design Second Interim Report states that there will be a large mode shift from non-motorised transport to alternative modes. In order to ensure Kigali has a sustainable transport system, the existing culture of walking and cycling as a form of transport in the City needs to be maintained and further encouraged. Some techniques in order to do this are:

- Promotion of public health campaigns encouraging walking and cycling.
- Distribution of maps showing safe and convenient local walking routes to services.
- Provision of signage/wayfinding.
- Improvements to pedestrian access/ quality (e.g. safe crossings, tactile paving, dropped kerbs, disabled access, CCTV, lighting).
- Walking events such as led walks at lunchtime or after work, pedometer challenges.
- Ensure NMT priority at intersections
- Consider NMT only areas within CBD and other focussed areas
- Provision of appropriate numbers, type and location of cycle parking facilities (e.g. covered and secure).
- Availability of supporting facilities for staff (e.g. showers, lockers).
- Provision of cycle tracks or dedicated segregated infrastructure, where appropriate.
- Discounts or loans for purchase of equipment (e.g. cycle loan, tax free scheme to employees, vouchers).
- Advice or training on riding skills, use of bike buddies.
- On-site bicycle repair service.
- Cycle maintenance classes.
- Pool bikes and cycle clubs.
- Regular cycling promotion days.
- Provision of information on local cycle routes.
- Promotion of cycle hire schemes and cycle superhighways.
- Implementation of Bikeshare programmes.
- Promotion of e-bikes.

The only option with a smaller impact on the environment than non-motorised transport is to minimise the number of trips or need to travel. Some strategies to do this are:

- Introduce policy on flexible working (e.g. teleworking, home working and flexitime).
- Adoption of 'smart' working practices (e.g. teleconferencing, audio conferencing, and hot desking).
- Local recruitment strategy and incentives for staff to relocate closer to work.
- On-site services for employees (e.g. cafe, crèche, shop).
- Web access and provision of office space in homes.
- Home delivery drop-off points.





9.2.3 Parking Strategy

The main objective of this parking strategy is to reduce parking demand and not to accommodate the expected growth in parking demand. Meanwhile, the parking strategy must also ensure adequate accessibility for the support of businesses and the economy. A parking management plan should be developed.

On-street Parking

The following strategies are recommended:

- On-street parking to be allowed in accordance with the refined road classification system (refer to Section 10.4) but should be avoided along Public Transport corridors where possible and should be minimised or correctly priced to discourage private vehicle use.
- A research project be carried out to develop a policy and methodology for the payment of on-street parking, including pricing levels, parking bans, technology, enforcement mechanisms, legislation, parking design, revenue sharing models, etc.

Under the parking strategy (p. 79), on- and off-street parking along public transport corridors should be limited. Specifically, off-street parking policies should be related to the concept of TOD and efficiency goals of the visioning report (p.151). The plan should recommend adequate policies update to limit off-street parking in the BRT station areas.

Off-street Parking

- Identify areas where shared parking lots can be developed for special zones, including regional centres. This should inform the precinct master planning for these areas. The plan should also consider urban design principles to remove and/or ban setback parking (between the privately owned building and the public road space), which obstructs pedestrian movements.
- Conduct a research project to establish maximum parking standards for special zones, including regional centres. The project should include a benchmarking exercise as well as parking utilisation surveys. Although minimum parking standards are in place, these should be negotiable with developers in areas with good PT and NMT access after a transport impact assessment has been completed for any proposed development.
- Identify land parcels suitable for the development of park and ride facilities particularly close to public transport systems. These park and ride facilities will generally be located in the suburbs of metropolitan areas and on the outer edges of the larger cities.
- Off-street parking provision and moto-taxi parking should be tackled in a way that does not comprise a sustainable urban mobility trajectory and a shift to public transport and NMT usage. The parking management system should seek to minimise car usage in commercial centres and avoid off-street parking facilities along public transport corridors. For the case of moto-taxi parking, this should be avoided where possible. Incentives are needed for moto-taxis to act as feeders to public transport and not as a competing mode. Adequate policy updates are receommended to limit off-street parking in the BRT station areas.

9.2.4 Environmental Requirements

Poor air quality is an environmental health risk and the Inventory of Sources of Air Pollution in Rwanda (REMA, 2018) states that road traffic is a large contributor to air pollution. Green House Gases (GHG) also require reduction to ensure long-term environmental safety. Private road vehicles are a large contributor to GHG. Possible recommendations for the reduction of air pollution include restrictions around importing older vehicles, investing in public transport systems and reducing emissions from bus fleets. Some of these measures are outside the scope of this Transport Master Plan but more targeted studies to reduce GHG emissions and improve air quality have been conducted.

The following strategic measures should be implemented to help reduce air pollution and carbon emissions in Kigali using the Transport Master Plan:

- Invest in Public Transport systems as described in Section 9: Public Transport Strategy.
- Promote NMT and invest in NMT infrastructure as described in Section 9.2.1: Non-Motorised Transport Network.
- Relieve traffic congestion by implemented the Road Network Strategy as described in Section 10: Road Network Strategy.
- Invest in the Kigali Ring Road to reduce the number of heavy goods vehicles travelling within the Kigali City Centre as proposed in Section 9.1: Freight Management Strategy.
- Promote incentives to renew the bus fleet and include hybrid vehicles.
- Encourage the use of newer, fuel efficient or hybrid vehicles.
- Implement Electric Charging stations at existing fuel stations around the City.

Implement Transport policy Effectively – Key Strategies	Key Performance Indicators
Effectively implement the updated Kigali Transport Master Plan 2018	Establish a Transport Authority for Kigali
Authorities, roles and responsibilities clearly defined	Develop transport legislative environment
Develop a hierarchy of transport plans – policy/ strategy, tactical and operational level	Develop transport governance structure

Table 9.2 Key Strategies to Implement Transport Policy Effectively

9.3 Effective Transport Policy Implementation

In order to align with the transport goals and objectives, the following key strategies and key performance indicators were developed for the effective transport policy implementation through the strengthening of policies to institutional capacity. (refer to Chapter 4):

The following strategies are recommended:

- Establish the Kigali Transport Authority.
- Compile a Transport Information Register: A detailed Transport Inventory is required for the City. This should be updated every 5 years prior to the commencement of the Transport Master Plan Update and should include details on infrastructure, operations and vehicles. City-wide origin/destination surveys should be done with this.
- Develop Transport Assessment Guidelines and Manuals.
- Develop Traffic Impact Assessment and Development Application Standard Operating Procedures.
- Develop monitoring mechanisms to measure KPIs.
- Develop a multi-modal transport demand model to inform all planning for the City. Identify a custodian for the model has to be identified to protect its integrity and to ensure the "agreed demand and supply scenario" is utilised in all planning matters. The custodian should keep the model accessible to third parties for planning purposes and ensure the model is regularly updated and maintained.

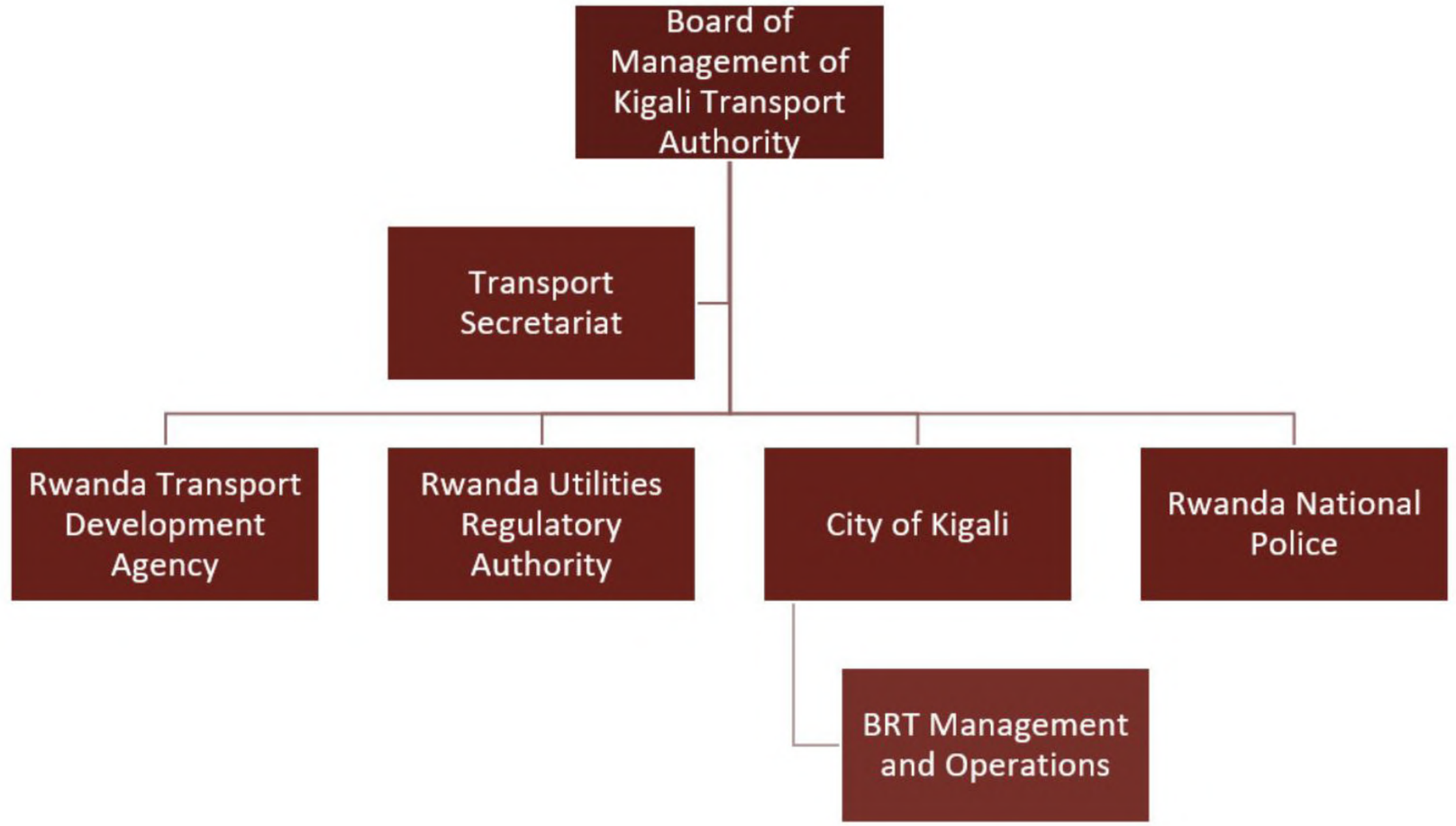


Figure 9.5 Proposed Structure of Transport Authorities in Kigali

9.3.1 Institutional Arrangement Proposed

An organogram showing the proposed Institutional arrangement is shown in 9.5 and information is sourced from the 2013 Transport Master Plan.

9.3.2 Kigali Transport Authority

This subsection describes important aspects to be considered when establishing a new institution to solve various issues encountered and to be anticipated in order to pursue the implementation of the Integrated Transport Master Plan for the City of Kigali. The actual process is broken into phases in appreciation of the complexities that will be faced.

Legal ground

Tangible legal framework needs to be given to the new transport authority. It is strongly suggested to establish an authority endorsed by state law or by presidential decree to give higher credibility and authority to carry out its duties effectively.

Institutional set-up

The authority should be an independent public body, with some functions can be contracted out to the private sector. It should be kept free from governmental and private sector influence, and focuses on the efficiency and effectiveness of the public transport in Kigali. In this way the organisation is guided by policies at national and local levels rather than receiving direct instructions.

Financial Resources

Funds required for running the transport authority should initially be provided by the government. Subsequent funds required can be obtained from private investors, such as implementation of Intelligent Transport Systems, as part of planning conditions.

Human Resources

The employees should be hired by the Authority directly to work for the Authority, instead of transferred employees from provincial or local governments, except the members of the board. They should not have dual identities, such as being the staff of authority and at the same time holding a position at a private company or at governments. Employment of permanent staff exclusively for the authority is highly recommended. Taking the above into consideration, the following illustrates the overall framework of the prospective transport institution.

Mission of the Prospective Metropolitan Governance

The mission of the prospective institution is to carry out the policies and programs indicated in the “Integrated Transport Master Plan for City of Kigali”, in order to provide commuters with highly efficient, comfortable and convenient transport systems, and public transport system will be the vital component of the system.

Vision

The vision of the institution is to deliver transport services that meet the demands of a dynamic and growing region with a population that will increasingly expect high standards in service and infrastructure. The institution offers various transport options to meet individual preferences of commuters, and the transport services to be provided will be of high quality, convenient, accessible, comfortable, safe, and affordable to the people living in the City of Kigali. Figure 9.5 illustrates several aspects of the proposed institution to manage transport administration in the City of Kigali. The Study Team recommends to establish a transport authority for the region with in the master plan period. To prepare for the establishment of the transport authority, it is recommended to set up a task force in the transport committee to target the establishment in 2017. 2013 2014 2015 2016 2017 2025 2040 Reformation of Local Government Strengthening of Local Government Establishment of Transport Planning Commission Kigali Transport Authority (KTA) preparation task force Establishment of KTA.

9.3.3 Proposed KTA Roles and Responsibilities

Reporting Structure

As KTA will be established as an independent public corporation, the shareholder of KTA could be under the framework of the Kigali City Council. For city transport management and its functional capacity it would liaise directly with the national ministries, particularly the Ministry of Infrastructure. The Kigali Transport Authority could have multiple reporting structures, both to national ministries under the national policy framework and also to the KCC as the owner.

Board of Management

The Board of Management could include representatives of each of the principal public authorities and the General Manager (GM) of the KTA is likely to be a full time member of the Board. However, given the GM is accountable for executing the Board’s strategy; he or she will have no voting power in the Board and is therefore incapable of influencing decision-making processes. The General Manager will be appointed by the Board and the appointment has to be approved by the KCC. The Chairman of the Board could be selected from the Members of the Board to preside over the meetings of the Board of Management. His or her selection would be for a pre-defined period of time, for example a year.

The decision-making procedure in the Board would include general decisions and strategic decisions. The former relate to day-by-day aspects of KTA activities and requires a simple majority (50%+1 vote).

The latter relates to critical decisions and include, but are not limited to, the selection of the Chairman of the Board, the appointment of the General Manager, the annual operating budget, approval of the auditor’s report, investments recommended to the Kigali City Council for financing, and approval of the evolving Transport Strategy. For critical decisions, either an absolute majority (100%) or a consensus vote (75%) can be considered.

General Manager

The daily operations of KTA should be under the responsibility of the General Manager.

KTA would implement the strategic policy of the Board of Management as operational initiatives. They would report at regular intervals to the Board regarding activities for management decisions. In the case where the Board disagrees with the way of the General Manager executing the tasks, an extraordinary meeting of the Board could decide to terminate the appointment. However, it is strongly recommended that this option be considered and used sparingly as it is disruptive and disturbs the smooth and continued functioning of the organisation.

The Advisory Board

An Advisory Board for the Board of Management is recommended to be made up of all other public and private service providers, operators and of the transport users. The principal objective of the Advisory Board would be to protect the rights of operators, service providers, and transport users by monitoring the working and decisions of the Board of Management. They should also have a role in formulating recommendations and suggestions to the Board of Management. The Advisory Board

should internally organize its structure and functions. It is recommended that an official representative is selected, e.g., Chairman of the Advisory Board, who will attend all meetings of the Board of Management as a non-voting member, championing the interests of the Advisory Board and reporting the results of board meetings to the representatives in the Advisory Board.

Setting Strategic Policy

The principal assignment of the Board of Management would be to develop a transport strategy for the City in line with the City's goals and guided by national transport policies. Under this strategy, policies for each line agency should be developed to coordinate their efforts.

Monitoring

The Board would also, through the Divisions, monitor the transport system and collect operational information to assess the quality of the delivery of services. The collected information will allow the Board to adjust standing transport strategy and make regulatory, institutional, managerial recommendations to the KCC, as well as drawing up investment budgets for infrastructure and transport service maintenance and development.

Financing

One important aspect is the financial responsibility of KTA. At its full completion in Phase 3 and after starting privately operated BRT and bus feeder services in the City of Kigali, KTA would receive financial revenues from these services. In practice, the revenues will be collected by BRT agency who will also be the final beneficiary of possible subsidies.

The Authority should have financial authority and, to the extent possible, depend on predictable funding sources (e.g. fuel taxes, government subsidies if needed, etc.) and not on annual budgetary commitments only.

9.4 Universal Access

In order to ensure that people are afforded equal opportunities, transport needs to be available to citizens with special needs or vulnerable users. People with disabilities, the elderly and the very young should be considered when planning and designing transport infrastructure and services to ensure mobility solutions for all.

Universal access relates to the ease with which all people can access transport-related activities especially NMT infrastructure and PT services. Universal access aims to ensure that users are able to move around a city without significant difficulty caused by physical barriers. There is currently no Universal Access Policy for Kigali to provide planning and design principles to guide the design of transport elements to accessibility for users with special needs.

The following recommendation is made:

- Incorporate Universal Access Design Principles into NMT and PT design.
- Compile a Universal Access Policy for the City of Kigali.

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10

Implementation

10.1. Multi-Criteria Analysis

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10 Implementation

10.1 Multi-Criteria Analysis

10.1.1 Overview

Multi-Criteria Analysis is a tool that can be used for decision making when multiple criteria need to be considered and a range of goals need to be met. Multi-criteria analysis is able to consider qualitative, quantitative and financial effects simultaneously. In order to ensure that the projects recommended for implementation in this plan would help support the vision of Kigali City, a multi-criteria analysis was completed on previously recommended projects as well as projects recommended by this report to determine which projects should be prioritised. This process was completed as an indicator to ensure recommended projects are in line with the Transport Visions and Objectives of the City.

It should be noted that multi-criteria analysis remains subjective and even though it does provide a framework to combine expert judgement as well as stakeholder preference while considering quantitative and qualitative data, giving consistent scores can be difficult. With this in mind, the priority of projects may change in time and with the changing needs of the CoK.

City of Kigali
Better Service Delivery

2013 Kigali Master Plan Update

Focus Group Meeting

City on the Move

MININFRA, 31 October 2018

Contact Details

Name: _____

Position: _____

Company/ Organisation: _____

Email: _____

Tel: _____

Any Additional Documents to be considered for Masterplan:

_____
_____
_____

Please Rate the following (Give a percentage score adding up to 100% for each question rating which you think are most important e.g. 33%, 33%, 34% = 100%):

4.1

To become a Transit Orientated City	To establish a Comprehensive Strategic Road Network	To create a Sustainable Transport Network
_____%?	_____%?	_____%?

4.2.1

Public/ Private Transport Modal Split of 70:30	Average Transport Commuting Time of 60 min
_____%?	_____%?

Figure 10.1 Page Two Questionnaire

City of Kigali
Better Service Delivery

4.2.2

Construction of Urban Roads to a minimum density of 6km/km^2	Seamless Intermodal Transport Connectivity	Construction of Intercity Freight Routes and Infrastructure
_____%?	_____%?	_____%?

4.2.3

Integrated Non-motorised Transport Infrastructure	100% of Amenities and Facilities served by Public Transport	The Establishment of Green Network and Pedestrian friendly Streets	To Implement Transport Policy Effectively
_____%?	_____%?	_____%?	_____%?

Additional Notes and Comments:

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Figure 10.2 Page One Questionnaire

10.1.2 Weighting of Objectives

The specific goals and objectives of the CoK were selected as the objectives for the multi-criteria analysis. The preliminary determination of the weight of objectives was completed at the Focus Group Meeting on 31 October 2018. The meeting was attended by representatives from the CoK, MININFRA and transport industry operators. The form given for meeting attendees is shown in Figure 10.1 and Figure 10.2. Attendees were asked to stipulate how important they thought the different objectives are relative to one another.

The results of the weighting exercise were broken down into the weightings determined by authority officials and the weightings of objectives determined by all the meeting attendees. The results as well as the recommended weightings of the objectives are shown in Figure 10.3 and Figure 10.4 respectively.

From this exercise it was concluded that the following objectives were deemed to be most important:

- Public/Private Modal Split of 70:30.
- Seamless Intermodal Transport Connectivity.
- Integrated Non-Motorised Transport Infrastructure.

Projects identified as part of the Road Network Strategy (Chapter 8) and the Green Transport Network Strategy (Chapter 9.2) were therefore emphasised. According to the results from the multi-criteria analysis, Effective Transport Policy Implementation (Chapter 9.3) is not prioritised. However it should be noted that in many cases, prioritising institutional policies enables the effective implementation of other strategies.emphasised. According to the results from the multi-criteria analysis, Effective Transport Policy Implementation (Chapter 9.3) is not prioritised. However it should be noted that in many cases, prioritising institutional policies enables the effective implementation of other strategies.

For the purpose of this report the recommended weightings were used to determine an implementation plan.

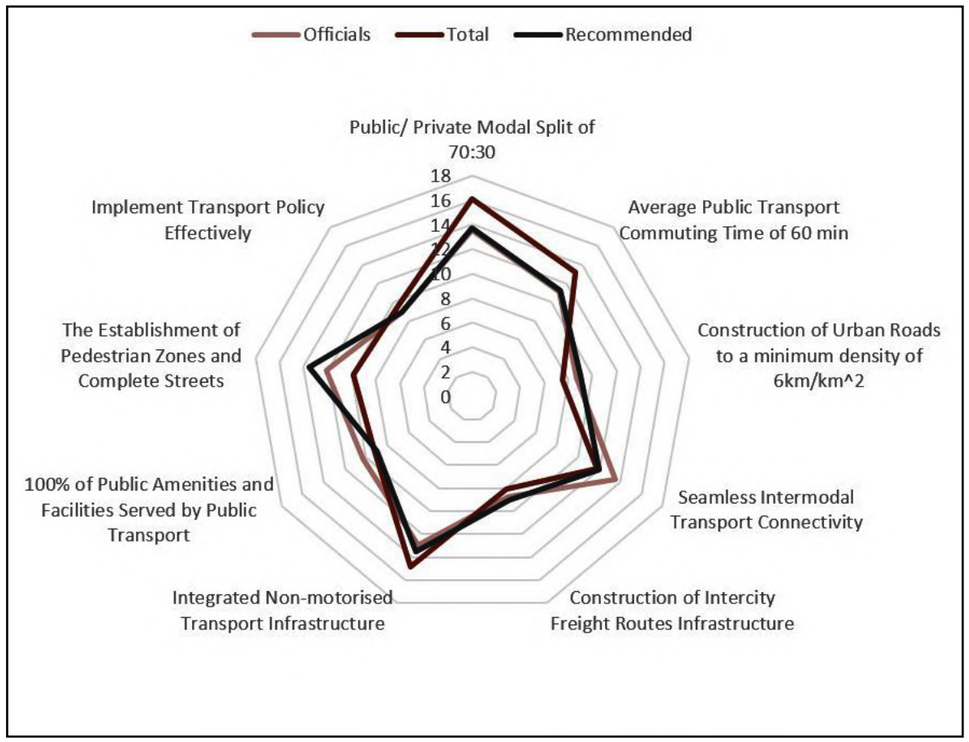

Figure 10.3 Results of Objective Weighting Exercise for MCA (%)

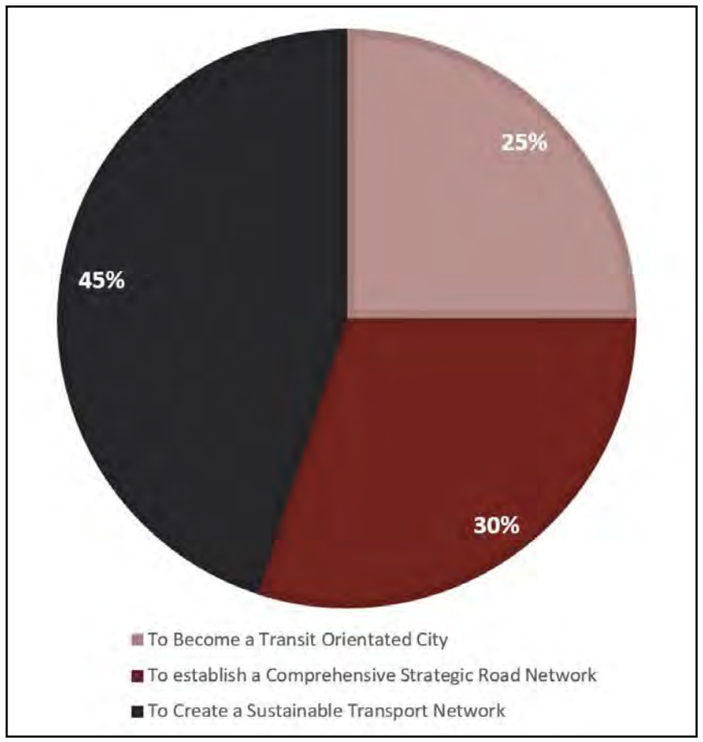

Figure 10.4 Recommended Weighting for Goals (%)

10.1.3 Results

Projects were identified from a list of existing suggested projects. The results from various professionals were combined to find the top 5 critical projects according to the multi-criteria analysis and these are listed in Table 10.1.

Some additional notes and observations from the Multi-Criteria Analysis:

- Cable Car Transport as an option scored in the top 10 results. This does not take into account the proposed line for a cable car is short and will only have a very localised impact.
- Guidelines and institutional requirements scored very low but many of these are required in order to implement bigger infrastructure projects effectively.
- Construction of the Kigali Ring Road was the road upgrade with no large NMT focus with the highest score.

Ranking	Project	Score
1.	BRT Design and Construction (Including NMT infrastructure)- Section 9.1.3	52%
2.	Extension of PT routes network to 300km and improvement of existing PT services- City Development Strategy Project	49%
3.	Detailed Study for Different Urban Roads (to include NMT) - City Development Strategy Project	45%
4.	Standard Gauge Freight link with Tanzania- Section 5.6.2.1	34%
5.	Pedestrian Corridors and Bridges Erected- City Development Strategy Project	31%

Table 10.1 List of Prioritised Projects according to MCA

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11

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