DETAILED DISTRICT PHYSICAL PLANS
FOR KICUKIRO & GASABO
KIGALI, RWANDA

KIGALI CITY
TRANSPORTATION MASTER PLAN REPORT

MAY 2013

TASK ORDER 3: CONCEPT PLANNING

CITY OF KIGALI

DOCUMENT INFORMATION

Report Title:	**Kigali City Transport Master Plan Report**
Project Title:	**detailed physical plan for gasabo and kicukiro, kigali**
Project Ref No.:	**310-02-01-0002**
Client:	**City of Kigali**
Submission Date:	**31-05-2013**
File Name:	**RWF1101_KIGALI CITY TRANSPORT MASTER PLAN REPORT_03062013**

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Number of copies issued: 2

DOCUMENT STATUS

Version No.	Date Issued	Details	Approval for Issue
1	24-07-2012	draft 1	djoko prihanto
2	27-05-2013	Final	djoko prihanto
3			
4			
5			

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ACKNOWLEDGEMENT

We would like to acknowledge and thank the following individuals and organizations for their invaluable insights and contributions to the preparation of the "Detailed Physical Plan of Kicukiro and Gasabo."

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PREFACE

Project Background

The City of Kigali (CoK), one of the most active and progressive City Councils of Africa, aspires to see Kigali develop as a competitive, safe and clean modern city. In the recent past, the Government of Rwanda has undertaken the preparation of several urban development plans in the sectors of planning, transport, infrastructure, housing and environment for Kigali. Having completed the Kigali Conceptual Master Plan (2008) and Detailed Master Plans for Nyarugenge District as well as various other sub-areas of Kigali, the City now intends to develop Detailed Physical Plans for the other two Districts, namely, Gasabo and Kicukiro, so as to have an integrated detailed plan for the entire City.

Project Commissioning and Scope

In October 2011, through a public tender, the City of Kigali awarded the **'Design of Detailed District Physical Plans for Kicukiro & Gasabo'** to Surbana International Consultants, Singapore (Surbana).

This master planning project, in addition to the detailed planning of the two districts, has the following objectives:

- To review the planning direction and strategies for the entire City of Kigali, while integrating all the past planning and development initiatives undertaken.
- To prepare Conceptual Kigali Transportation Plan and Final Kigali Transport Master Plan. This would include the review and integration of existing plans, so as to make available a complete city wide transportation master plan for the whole of Kigali.
- To establish a GIS database for the entire City which has a coordinated base map, proposed land use plan & development control information for all areas of the City. This GIS system would form a part of the MIS system being put in place by the Government.
- To ensure participation of the various stakeholders in the development of the Master Plan so as to develop a plan that reflects the needs and aspirations of the City's residents.
- To ensure participation in the planning process as well as capacity building of the CoK staff through training programmes in Singapore and the Surbana project office in Kigali.

Project Organization & Schedule

The project is spread over one year and comprises of the following 6 task orders, each with a duration of 2-4 months:

Task Order 1: Start-up, Reconnaissance & Base-mapping

Task Order 2: Existing Conditions & Vision

Task Order 3: Conceptual District Plan

Task Order 4: Schematic District Plans

Task Order 5: Detailed Urban Design

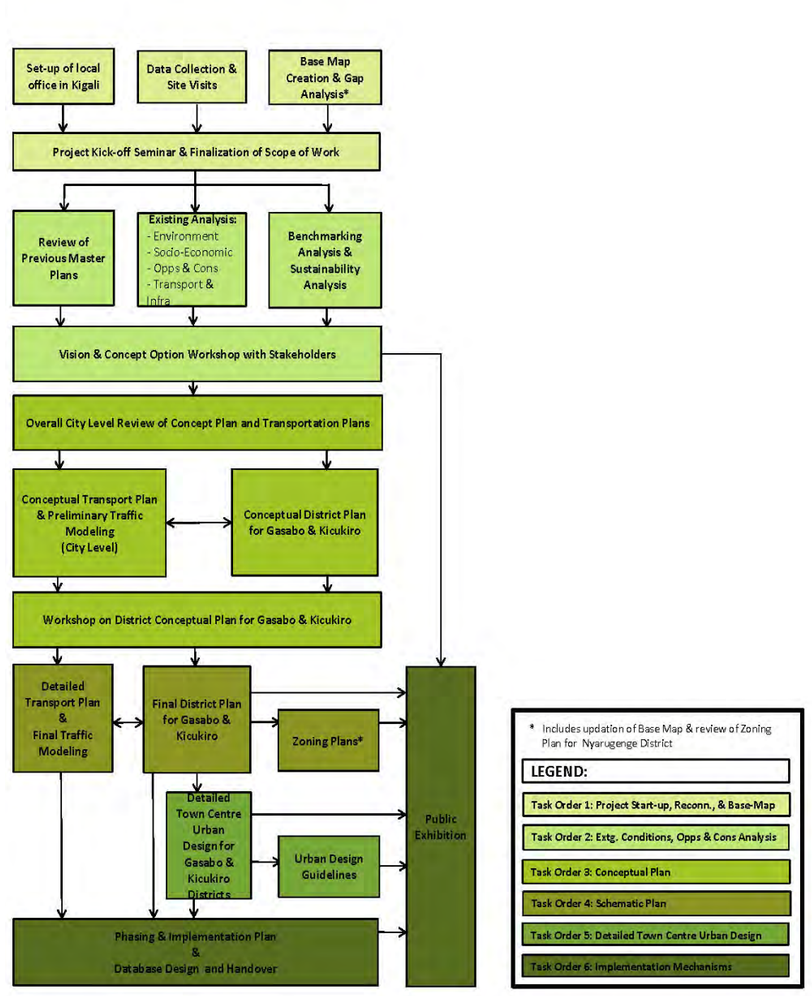
Task Order 6: Implementation Plans

Project Process

In line with the project scope discussed above, the process to be adopted for this project is as elaborated below:

- Establishment of a proper working base which incorporates all land use related information for developing the master plan.
- In-depth analysis of various existing issues facing the City and stock-taking and review of previous master plans and transportation planning initiative in the City in order to develop an integrated plan.
- Benchmarking with international best practices in city planning and management, determining the future growth scenario, and setting the development vision and the strategic growth direction for the city.
- Development of a conceptual transport plan and management strategy for the entire city followed by detailed integrated master plans, transport plan and urban design plans for two districts.

The planning process adopted for this project is further illustrated in the diagram.



Project Deliverables

Various reports, corresponding to the various task orders are to be submitted to the City of Kigali, which include:

Task Order 1:
- Inception Report

Task Order 2:
- Analysis, Benchmarking and Visioning Report

Task Order 3:
- Conceptual Kigali Transportation Plan report
- Gasabo Conceptual Plan Report
- Kicukiro Conceptual Plan Report

Task Order 4:
- Final Transportation Master Plan Report
- Final Gasabo Master Plan Report
- Final Kicukiro Master Plan Report
- Gasabo Zoning booklet
- Kicukiro Zoning booklet

Task Order 5:
- Gasabo Town Centre Urban Design report
- Kicukiro Town Centre Urban Design report
- Gasabo Town Centre Zoning booklet
- Kicukiro Town Centre Zoning booklet

Task Order 6:
- Implementation Report

Stakeholders' Participation & Capacity Building

A key component of the project would be to ensure adequate participation in the planning process from various stakeholders such as decision-makers, private sector focus groups, community organisations and various public interest groups. As such, numerous meetings, seminars and workshops are to be undertaken at all stages of the project. A long-term public exhibition of the master planning project is to be undertaken at the end of the project with an objective to launch and market the master plan.

In addition, a communication plan, executed through various print, broadcasting & online media would ensure participation and feedback from the wider public.
This plan preparation process would also be an opportunity for capacity building of CoK staff to further enhance their competency and capability of the staff to execute the master plan.

This comprehensive city wide plan, incorporating the detailed plans of the two districts as well as all the past planning initiatives would become the long term development framework for Kigali City, guiding it into an era of progressive and holistic city development.

1 INTRODUCTION TO THE TRANSPORTATION MASTER PLAN

1.1 INTRODUCTION

Population in Kigali has been growing steadily from six thousand in 1960 to over two hundred thousand in the early 1990s, and after a period of unrest in 1994, doubled to over six hundred thousand people in the year 2000. The increase in population was due to Rwandans returning from around the world after the 1994 genocide. They tended to settle in the capital where there was considerable security, which has led to spontaneous, uncontrolled growth in the City and resulted in inefficient land use and resources.

Today, the population of Kigali stands at 1.2 million and is expected to grow to between 4 to 5 million in the next twenty-five to thirty years.

Economic growth often follows intense growth in population, especially in developing countries, and Rwanda is expected to follow the same trend.

Transportation is an integral part of a city's growth. Its state directly impacts a city's economic viability and its condition affects the economic performance, safety and liveability of a city, in addition to strengthening resilience to climate change.

The road network in Kigali has begun to show signs of age, and while the overall condition of the network is healthy, it is expected to deteriorate further in the next 30 years, if a good maintenance regime is not put in place.

The transportation master plan is developed to ensure that Kigali is well-equipped to fulfil the transport requirements of a modern city while supporting a healthy economic growth and promoting a higher quality of life. It can help in mitigating the effects of climate change and provide sustainable measures to adapt to the changes.

1.1.1 THE NATIONAL PERSPECTIVE

The Republic of Rwanda has set a vision to transform itself from a low scale agrarian economy to an active player within the regional economy. The City of Kigali is the centre of transformation in Rwanda and is currently experiencing rapid economic growth. As a result of this growth, traffic in the City has similarly grown and is expected to grow at the same rate as the economy.

Planned growth is vital to ensure that preservation and improvement of the quality of life for the communities of Kigali. The Government of Rwanda has recently undertaken the preparation of several development plans in the sectors of urban planning, transport, infrastructure, housing and environment for Kigali.

1.1.2 THE VISION OF THE CITY OF KIGALI

In support of the national vision of the Republic of Rwanda, the City Council intends to make Kigali "a safer, cleaner, more competitive, modern city with expanding opportunity for sustainable development of its citizens and the country at large."

To achieve this, the City has identified several Pillars of the Vision as follows:-

- To be a modern city with expanding opportunity to grow;
- To act as an engine for national economic growth ;
- To be able to receive all the constituents of Rwanda as well as all visitors to Rwanda;
- To represent a good image of the country and strengthen both regional and international collaboration and partnership.

The vision for the City of Kigali is to be "**The Centre of Urban Excellence in Africa**".

The broad vision for the entire city is to be achieved through 6 critical goals set by the Detailed Master Plan. These are:-

1. City of Character, Vibrant Economy and Diversity
2. **City of Green Transport**
3. City of Affordable Homes
4. City of Enchanting Nature and Biodiversity
5. City of Endearing Character and Unique Local Identity
6. City of Sustainable Resource Management

The Transportation Master Plan is intended to set out a strategic vision for the City of Kigali in its pursuit to become a **City of Green Transport**. It will ensure that future transportation needs for the City such as integrated network of roads, rapid and non-motorised transit, and policies and guides can be planned and budgeted for as the City grows.

1.2 ABOUT THE TRANSPORTATION MASTER PLAN

1.2.1 THE RATIONALE FOR A TRANSPORTATION MASTER PLAN

The Government of Rwanda has previously commissioned a Kigali Conceptual Master Plan and Detailed Master Plans for Nyarugenge District as well as various other sub-areas of Kigali. The Kigali City Council now intends to develop Detailed Physical Plans for the other two Districts in Kigali, namely, Gasabo and Kicukiro, to achieve an integrated detailed plan for the entire City.

While the direction of the City of Kigali has been set through these Master Plans, the City does not have an integrated transportation master plan to direct development in terms of transport.

The Kigali Transportation Master Plan (TMP) intends to fulfil this role by providing a framework for the long-term development and expansion of existing transportation systems that will support the City of Kigali in an intelligent and a sustainable manner.

The Transportation Master Plan is intended as a long-term strategic planning document for transport-related issues. It should be recognised that the TMP is not intended to address site-specific or corridor-specific issues.

The TMP will evolve and expand to suit the community's requirements and needs as the City develops. As a live document, the TMP should be updated on a regular basis.

This TMP sets the planning horizon at 2040. By doing so, the TMP defines the City as it would look in 2040. However, as the City's growth is organic, it is difficult to foresee the City's developments as it matures. As such, implementation projects in this TMP is current for the years 2013-2020 and the TMP is to be updated approximately every five years by key stakeholders such as the City Council, the relevant Statutory Boards, Commissions and the Community.

Key implementation proposals, at both policy level and network improvement level, are provided in this document for the short-term as catalyst for future long term projects.

The package of actions presented, if implemented, are intended to achieve the Ultimate Goal of the TMP to make Kigali a "City of Green Transport".

Figure 1.1 Goals of the Transportation Master Plan

1.2.2 THE SPECIFIC GOALS OF THE TRANSPORTATION MASTER PLAN

As part of the Vision to become a City of Green Transport, the vision report identified several areas for improvement in terms of transport, namely:-

- An extensive New Road Network
- A comprehensive Public Transport Network
- Inclusion of Non-motorised Transit

Upon further study and discussions with members of MININFRA and the City Council, the areas of improvement have been further refined to become the following specific goals of the Transportation Master Plan as shown in Figure 1.1:-

1. To become a Transit-Oriented City
2. To establish a Complete Transport System
3. To create a Sustainable Transport Network

Achieving these three goals would help progress the City of Kigali towards becoming a City of Green Transport.

This overarching theme of goals forms the backbone and its characteristics serve as key principles in guiding the TMP process.

1.2.3 Preparation of the Transportation Master Plan

The TMP was prepared by Surbana International Consultants in association with the Surbana Urban Planning Group.

The preparation of the TMP consisted of the following major components:

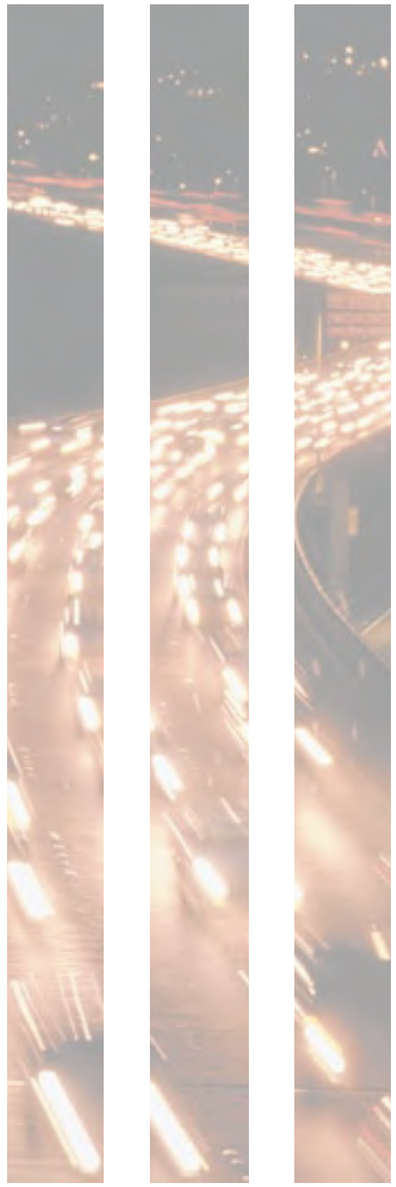
- Meetings with stakeholder groups in Kigali
- Public Consultation Activities
- Site Visits to the City of Kigali
- Review of the proposed land use master plans and existing transportation planning initiatives
- Preparation of a Geographic Information Systems (GIS) road alignment database
- Development of a macroscopic transport model
- Development of concept transport plans for implementation in Kigali
- Development of Implementation Plans

1.2.4 Implementation Mechanisms

As agreed with the City, the TMP would present long-term plans and proposals for the design horizon of 2040 while preparing interim designs for implementation in the short term.

The implementation plans presented in the TMP represents the mechanisms to be implemented by 2025, and will serve as the benchmark for progress on achievement of goals and objectives set by this document.

The results of the short-term implementation plans will then identify shortfalls of the current plans and allow for future amendments to the proposals to better suit the City.

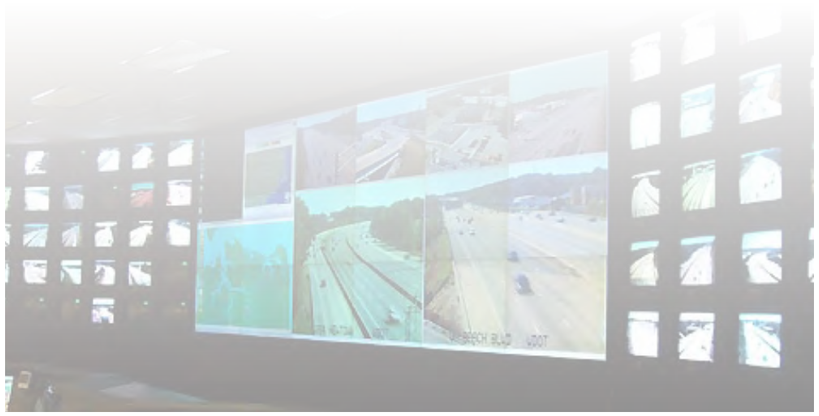


1.3 THE DELIVERABLES

The TMP provides guidance for the City to plan for its transportation needs. To aid the City in its transport network development process, the TMP will deliver the following:-

- Concept Transportation Plans
- Proposals for Institutional Setup, Development Policies and Asset Management
- A Schematic GIS database for use in the transport planning of the City
- A macro-level traffic model for use to analyse traffic along the major corridors and at critical junctions in the City

The Transportation Master Plan can be used as a catalyst to initiate changes to the existing transportation network in Kigali, using the above-said deliverables. The Development Plans and Implementation Proposals would guide the City in legislation and policy-making, while the GIS database can be used as a starting point for guiding road network development. This can be supported by the traffic model developed for the City, as the City can actively monitor traffic impacts of new developments on the proposed road network.



1.4 ORGANISATION OF THE REPORT

1.4.1 CHAPTER 1 INTRODUCTION

In this chapter, the City's need for a Transportation Master Plan has been identified, and the visions and goals introduced.

This chapter also discusses the process of preparing the TMP, and the outcomes of the TMP.

1.4.2 CHAPTER 2 CONTEXT, CONSTRAINTS AND OPPORTUNITIES

Kigali's position in context of the current and future challenges and opportunities for transportation is explained.

The chapter provides a holistic view on the existing and projected socio-economic aspects and describes in detail the existing transportation networks in Kigali and current proposals in place such as the new Bugesera International Airport and proposed rail connections to Tanzania.

Existing initiatives are identified with regard to rail and air, and current practices by institutions are identified.

The opportunities and challenges faced by the Transportation sector are also discussed.

1.4.3 CHAPTER 3 SPECIFIC GOALS, OBJECTIVES AND STRATEGIES

The objectives of the goals are explained in detail in this chapter (Figure 1.2). The strategies for each goal will be explained and elaborated in terms of their relevance to the Transportation Plans in Chapter 4.

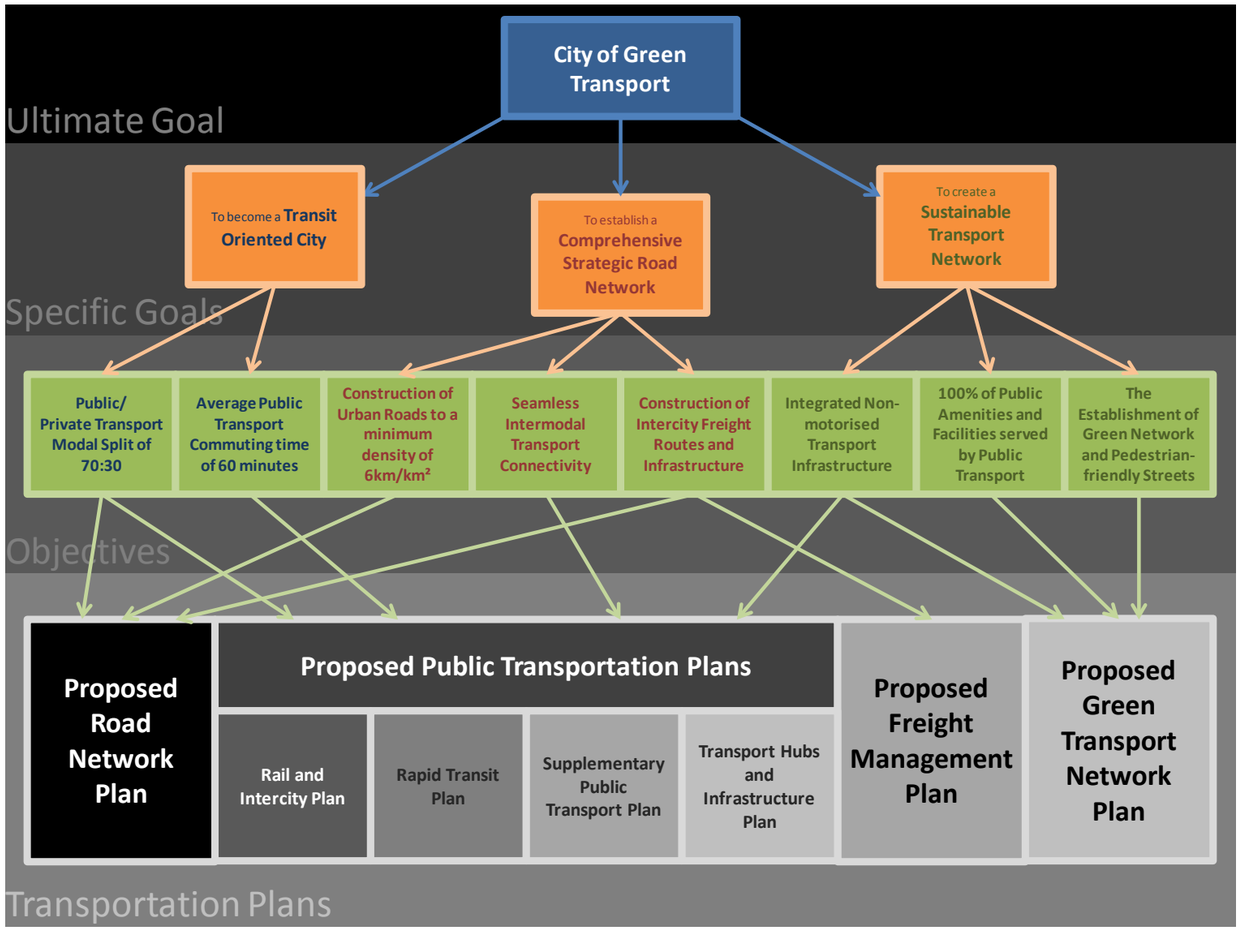


Figure 1.2 Goals and Objectives of the Transportation Master Plan

1.4.4 CHAPTER 4 KIGALI CONCEPT TRANSPORTATION DEVELOPMENT PLANS

Figure 1.3 shows the original conceptual plan of the City of Kigali with conceptual regional connectivity and regional centres. Sustainable transportation has been included in the design of the transport network.

Detailed proposals for the Transportation Plans are provided in this Chapter. The development strategies are further explained, and concepts and applications demonstrated.

In the preparation of the Master Plan, several development proposals were devised for improving the transportation network in Kigali.

Following modelling analysis and predicted projections for the population and employment of the City, several recommendations have been identified and formalised as Development Proposals for use in this Master Plan.

The Development Proposals are as follows:-

1. Proposed Road Network Plan
2. Proposed Public Transportation Plans, consisting of:-
   - Rail and Intercity Plan
   - Rapid Transit Plan
   - Supplementary Public Transport Plan
   - Transport Hubs and Infrastructure Plan
3. Proposed Freight Management Plan
4. Proposed Non-motorised Transport Network Plan

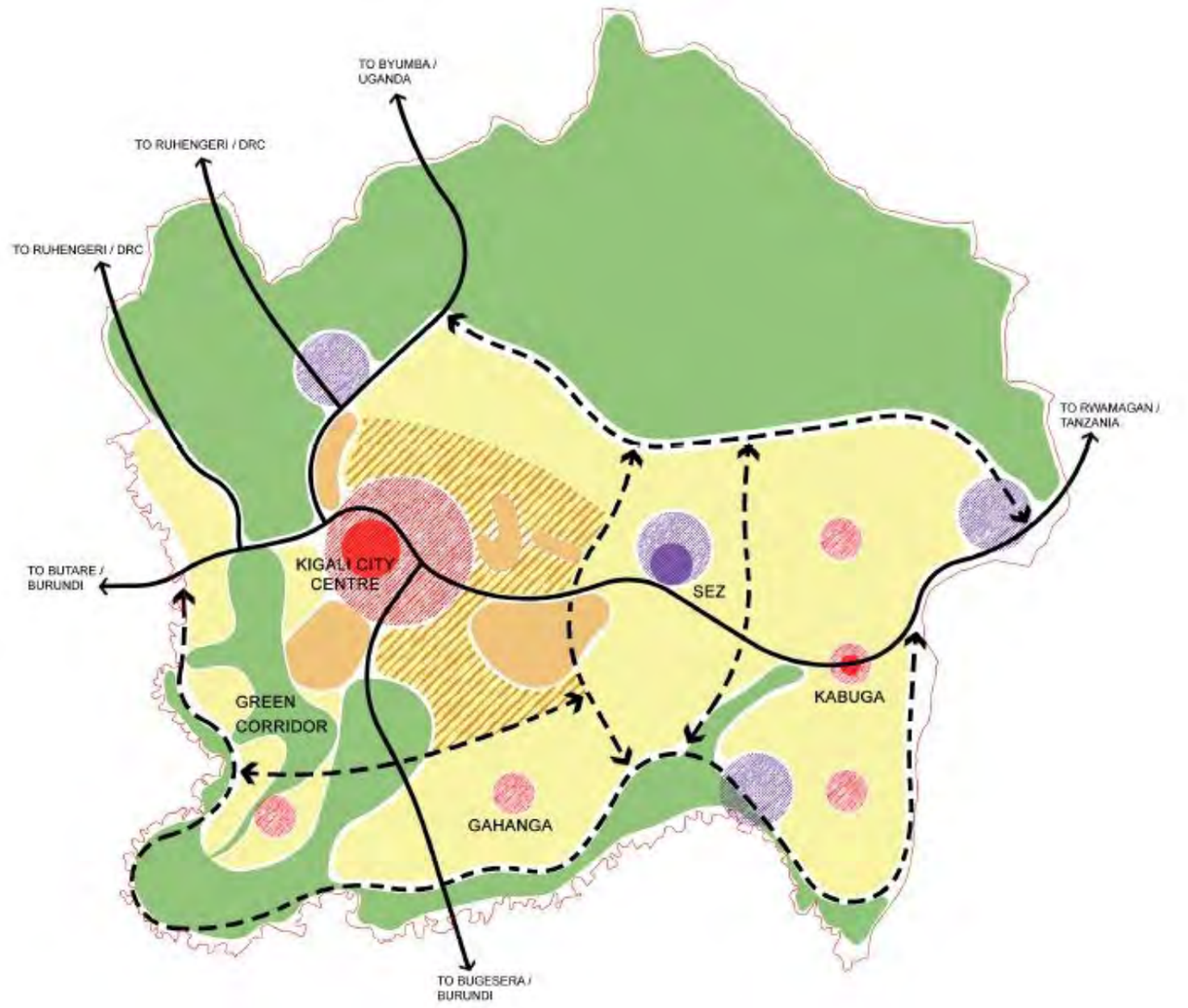


Figure 1.3 Conceptual Design of the City of Kigali, showing Connectivity and Decentralised Regional Centres

1.4.5 Chapter 5 Institutional Setup, Traffic Management and Policies

In Chapter 5, issues relating to the institutional setup, traffic management and policies are identified and addressed.

In regards to the institutional setup, the fragmented form of institutions involved in transportation matters and bureaucracy may affect the enabling of the projects identified in Chapter 4. A detailed proposal for establishing the Kigali Transport Authority (KTA) is provided in order to aid the implementation of this master plan.

Secondly, proposed guidelines are suggested for commission by the City to guide future development. Among these guidelines are road design standards, manuals for designing residential streets and the context sensitive design methods. These guidelines would form the policies which would be used to implement the proposed plans.

Thirdly, it is also recommended that traffic management becomes part of the legislation in the city. Several planning tools such as Transport Impact Assessments can be made a requisite for planning approvals, where traffic studies will guide the approval of projects within the city, and especially within the commercial core. In addition, by providing analysis on intersections' level of service and improvement needs, general traffic hazards, accidents, parking, environmental and aesthetic concerns, and funding, traffic impact such as congestion on urban centres may be alleviated. The application of Intelligent Transportation Systems are also discussed as a part of the traffic management process in Kigali.

1.4.6 Chapter 6 Implementation Projects and Proposals

The last chapter addresses the key Implementation Projects, and proposes demonstration projects and key studies in the short-term .

Short-term catalyst projects have been identified in discussions with Kigali City Council, and following site visits, some insight into how the short-term development of the transportation network in Kigali can be influential in the development of the City.

In addition to this, several projects may be implemented with the current institutional setup, for example a public transport study may be commissioned to investigate the feasibility of BRT proposals. Additionally the current institutional setup is able to commission an asset inventory exercise and prepare a street design manual based on proposals within this document.

2 CONTEXT, CONSTRAINTS AND OPPORTUNITIES

2.1 KIGALI: HISTORICAL AND GEOGRAPHICAL CONTEXT

2.1.1 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 transit centre with through-routes going to neighbouring countries through Kigali. It became Rwanda's capital when it gained independence in 1962 and since then it has become Rwanda's major economic, cultural and transport hub.

2.1.2 DEMOGRAPHICS

The population of Rwanda is relatively young compared to many countries. Rwanda has the highest population density in Africa, and the population is still growing at 2.8% per year. By 2050, Rwanda is estimated to have 26 million people, more than double its current population estimated at 11 million. 4 to 5 million of the population are expected to live in Kigali City in 2040, compared to the current population estimate of 1.2 million.

2.1.3 CLIMATE

The average temperature and precipitation of Kigali are shown in Figure 2.3. Kigali's average high temperature of between 25.9 and 28.2°C can be attributed to its location along the equator. The average yearly precipitation is 950.9mm. It rains throughout the year; however it peaks between March-April and October-November. It is significantly dry between June and August with less than 50mm of rain.

2.1.4 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.

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 (see Figure 2.2). Within Rwanda, the City of 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 .

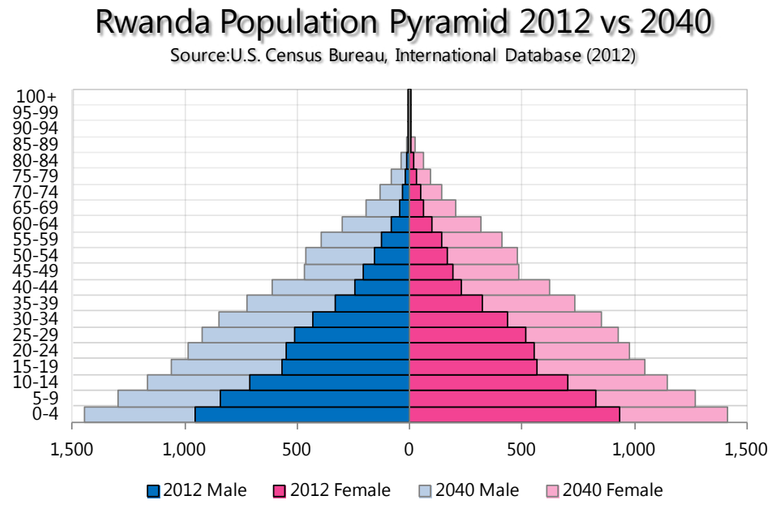


Figure 2.1 Rwanda Population Pyramid 2012 and 2040 (projected)

Figure 2.2 Map of Rwanda (about.com, 2012)

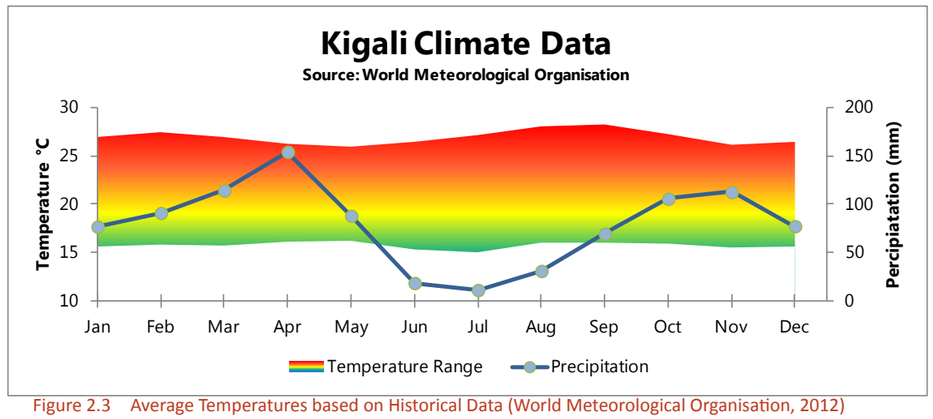


Figure 2.3 Average Temperatures based on Historical Data (World Meteorological Organisation, 2012)

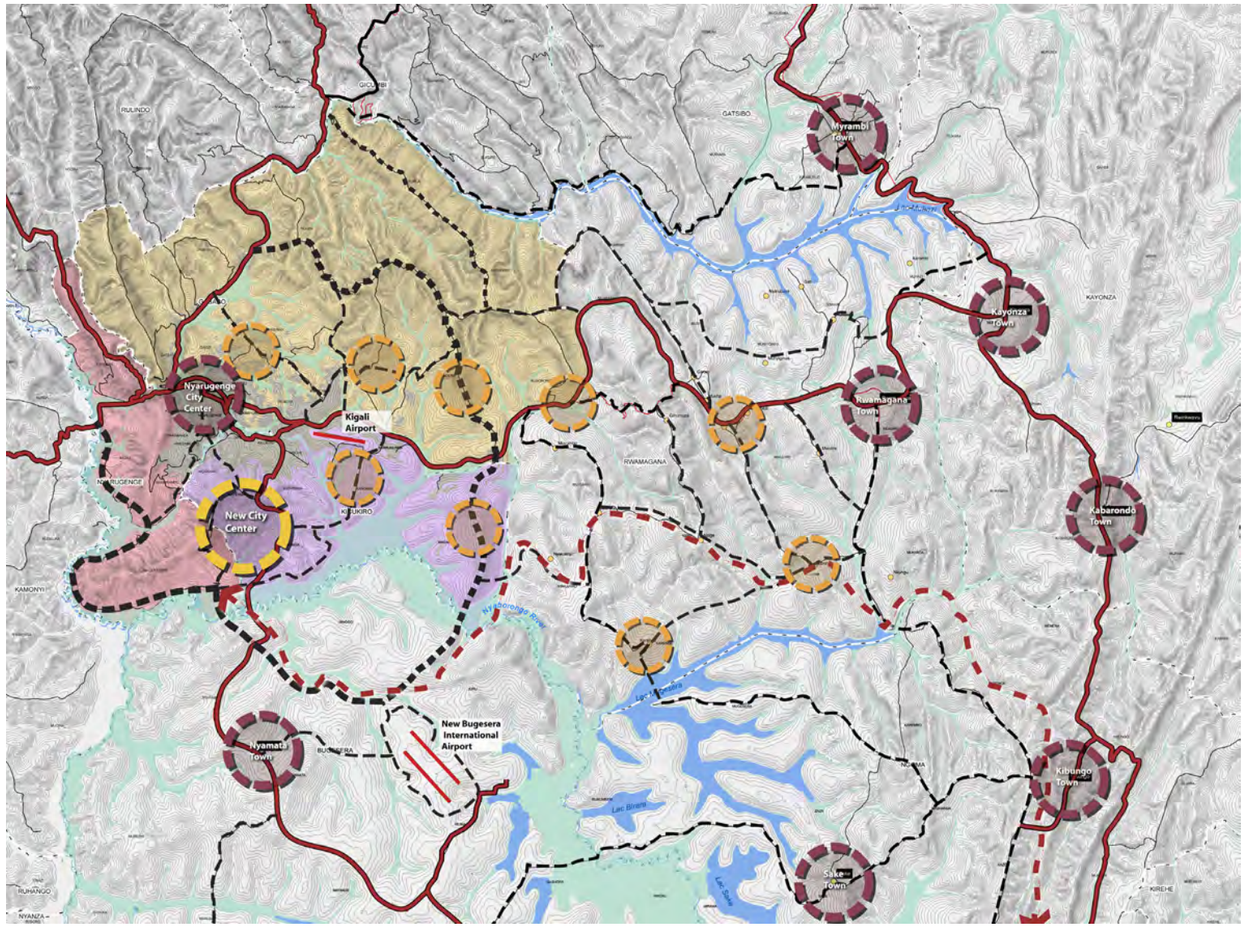


Figure 2.4 Kigali Regional Circulation Plan (OZ Architecture, 2007)

2.2 OVERVIEW OF THE TRANSPORT SECTOR IN RWANDA

The transport sector is considered a strategic sector for Rwanda given that high transport costs are currently regarded as a hindrance to the economic growth and development of the country.

MININFRA has prepared a Transport Sector Policy (2008) which defines the vision of the Government as well as its strategic orientations for the Transport Sector.

The transport infrastructure in Rwanda comprises:-

1. Road Transport, with a network of 14,000km, corresponding to a road density of 0.53km/km²
2. Air Transport, with two international airports and five aerodromes spread across the country. Work has begun on the eighth airport, Bugesera International Airport which would complement services from Kigali International Airport.
3. Lake Transport, which is limited to Lake Kivu. Other fluvial forms of transport are non-existent due to the more convenient
4. Rail Transport, which currently is not found in Rwanda. There are plans to build a railway between Rwanda and the port of Dar es Salaam in Tanzania

The transport services in Rwanda are provided by both the public and private sector, and includes bus, taxi and airline services.

The transport sector contributes considerably towards poverty reduction and economic growth, and serves as support to other economic sectors. It plays a fundamental role in the economy of Rwanda as it contributes about 7% to the GDP, and represents about 15% of total service delivery.

There has been a steady increase in the allocation of resources to the transport sector both from internal and external sources of finance, which is a clear demonstration of the importance that the Government of Rwanda places in the development of the sector.

2.2.1 Road Transport in Rwanda

Road Transport in Rwanda comprises a road network of 14,000km, giving a road density of 0.53km/km².

As shown in Figure 2.5 the road network extends into the neighbouring countries, namely Uganda, Burundi, Democratic Republic of Congo, and Tanzania.

The national roads (shown in yellow) continues and links into national roads in these adjacent countries.

Several major cities are located where these roads meet: for example, towards the Democratic Republic of Congo, the roads join onto each other at Goma and Bukavu.

Traffic going from DRC to Tanzania to the east would travel from either Goma and Bukavu, through Kigali and towards Bwamagana before splitting north or south.

These national roads are paved and provide a permeable network through Rwanda, although much of the traffic would travel through Kigali when travelling in an east-west direction.

Much of the traffic using these National Roads are commuters, however due to the lack of rail network in Rwanda, freight traffic forms a large proportion of traffic on these routes.

Figure 2.5 Primary Road Network in Rwanda (Google Maps, 2012)

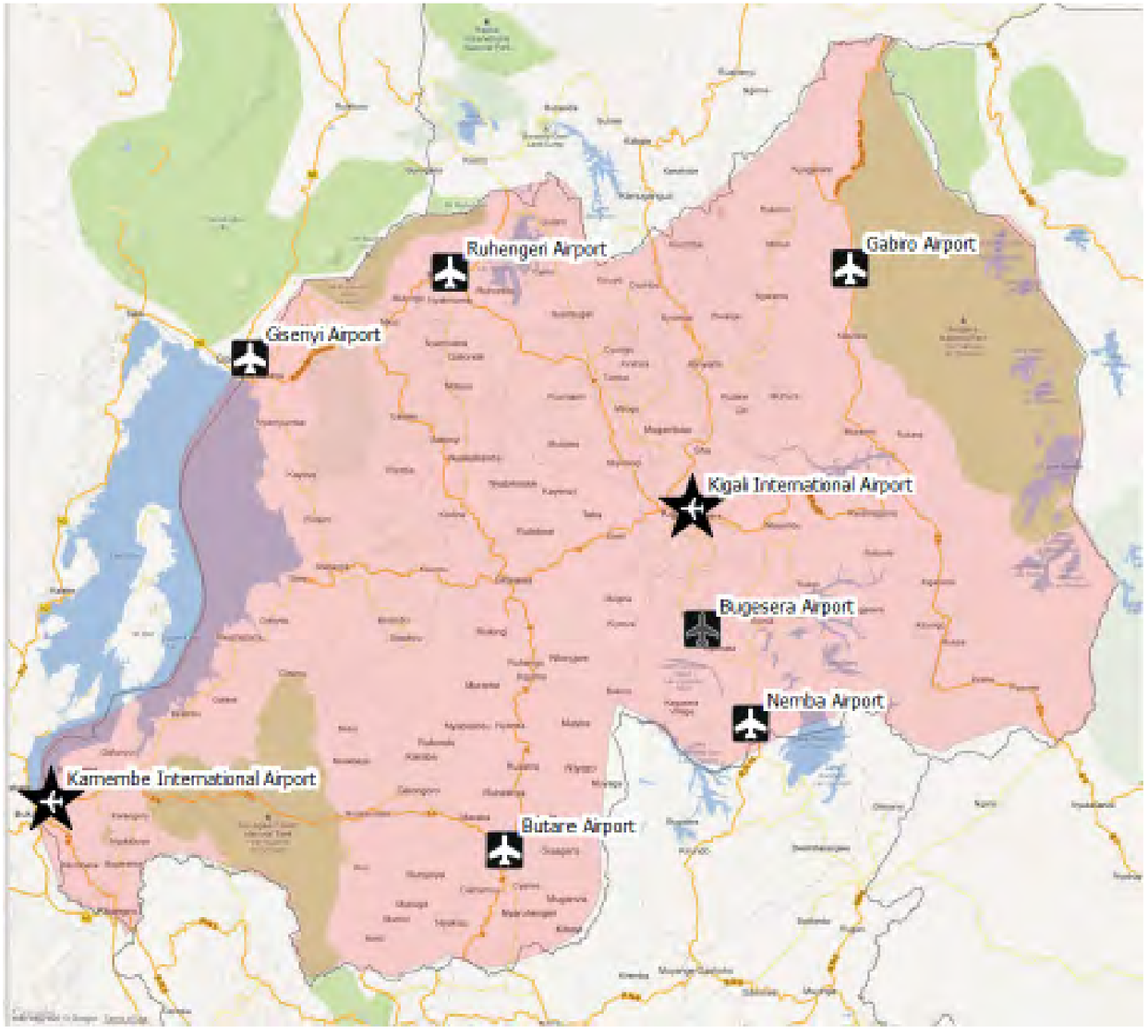


Figure 2.6 Air Transport in Rwanda

2.2.2 Air Transport in Rwanda

Rwanda has two international airports and five aerodromes spread across the country. Work has begun on the eighth airport, Bugesera International Airport which would complement services from Kigali International Airport.

The two International Airports in Rwanda are Kigali International Airport (also known as Kanombe International Airport) and Kamembe International Airport. The remaining airports are small aerodromes, which are in deplorable states, and would require rehabilitation and expansion of their basic infrastructure and navigational equipment.

Kigali International Airport is currently running at almost full capacity. The proposed Bugesera International Airport, which is located approximately 30km to the south of the City, is intended to supplement the Kigali International Airport.

Construction of the Bugesera Airport has begun, with an estimated completion date for the first Phase in 2016.

2.2.3 Water Transport in Rwanda

Water Transport in Rwanda is limited to lakes, in particular in Lake Kivu.

Due to the more prominent road network, water transport in Rwanda has not been developed further.

2.2.4 Rail Transport in Rwanda

There are currently no railways in Rwanda. The mountainous nature of the terrain in Rwanda makes the implementation of rail very challenging and potentially expensive.

Recent studies show that railway in Rwanda may be a means to stimulate trade of goods with partner countries of the East African Community.

Several schemes and initiatives have been proposed for Rwanda.

East African Rail Master Plan

As a member of The East African Community, Rwanda is part of the plans to connect to the East African region via rail. The East African Railway Master Plan is a proposal for rejuvenating the existing railways serving Tanzania, Kenya, Uganda and extending them into Rwanda and Burundi and ultimately to South Sudan, Ethiopia and beyond.

This plan (see Figure 2.7) has been carried out in cooperation with the Governments of Tanzania and Burundi. This is a comprehensive plan that goes as far as proposing stations at Kigali, Bugesera, Isaka and Gitega.

The capital cost to implement the plan is estimated at US$3.7 billion. Funding will be through the African Development Bank (AfDB).

Rwanda National Land Use Master Plan (RNLUMP)

This plan sets out extensive provision of rail for the entire country. The proposed rail alignment has connections to Tanzania, Uganda and Lake Kivu. The alignment being proposed is based on that proposed in the Feasibility Study project. However, it extends the rail alignment further north beyond Kigali. The alignment passes directly through Kigali City. This is clearly a concept as much of the terrain the alignment crosses is unsuitable for rail.

Strategic Transport Master Plan for Rwanda

This is a comprehensive transport master plan for the entire country. The section of rail to the north of Kigali is described as being a concept subject to the successful implementation of the southern section of rail. The northern section of rail links Kigali to Gisyeni.

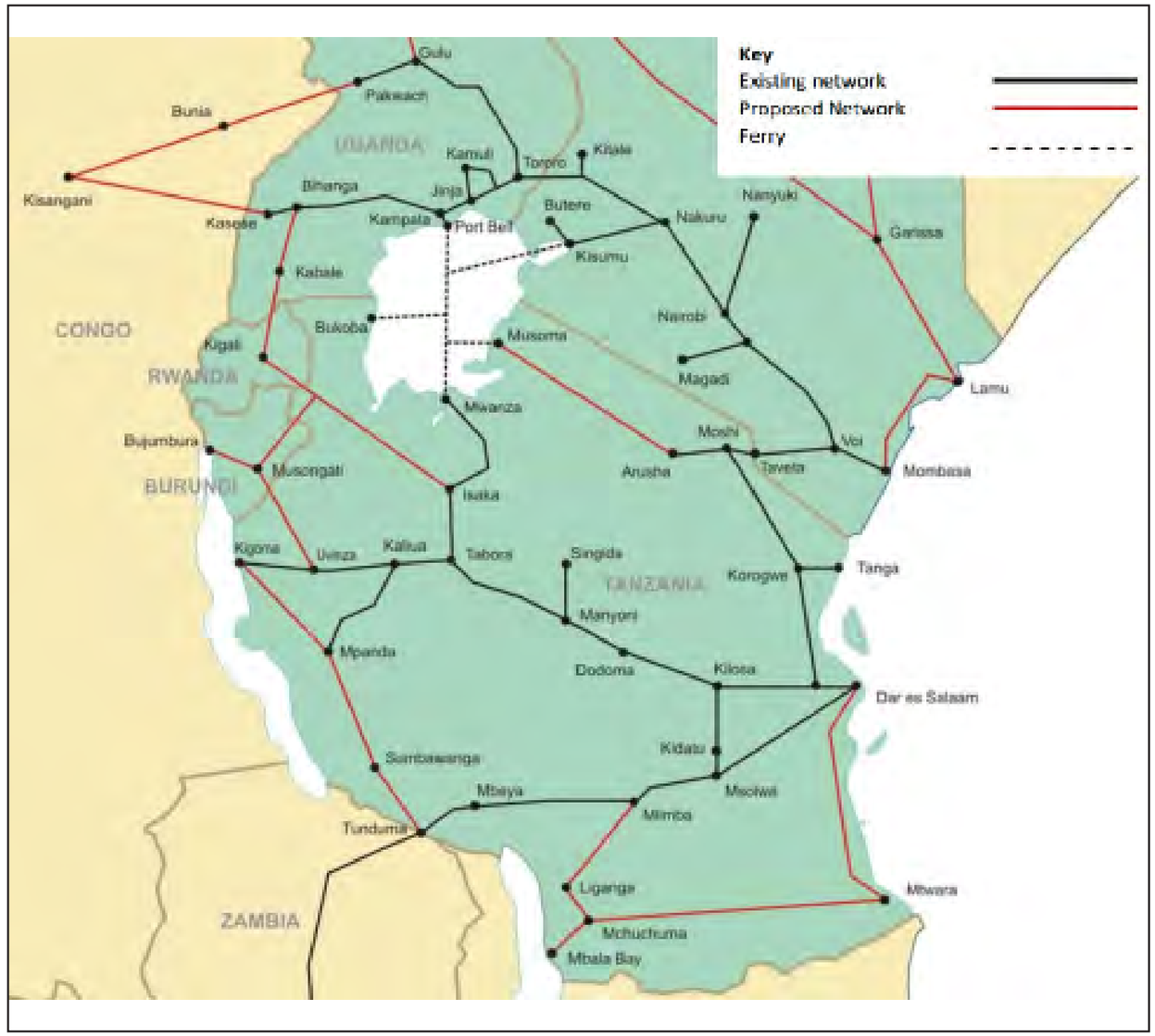


Figure 2.7 Extract of the Map of the Existing and Proposed Rail Network Links (East African Railways Master Plan, 2009)

Figure 2.8 Typical Unpaved Road

Figure 2.9 Public Bus Station

Figure 2.10 A Rural National Road in Kigali

Figure 2.11 Well-maintained National Road in City - Vers Kibungo

2.3 EXISTING TRANSPORTATION IN KIGALI

2.3.1 OVERVIEW OF ROAD, RAIL AND AIR TRANSPORTATION

The road network in the core of the City has received continuous improvement works, and has advanced the road infrastructure into a positive economic factor.

However, there are still improvements to be made to meet current needs in rural areas (see Figure 2.8). At the same time investments are directed into the construction of new paved roads at the expense of the maintenance of existing roads. As such. The existing road stock is aging and deteriorating.

Congestion has begun to emerge in the city areas, and has started to affect the City negatively. Congestion increases travel time, wastes fuel and cause air pollution, reduces businesses' attractiveness to both workers and consumers, and reduces safety and security due to its impedance to public services such as ambulances and fire trucks.

Public transportation infrastructure such bus stations (Figure 2.9) are well-developed and support free movement of people in the region, providing access to work opportunities, better communities to live in, while having access to basic utilities and civil facilities such as schools, parks and libraries. At the same time, business can rely on the network for timely shipments of goods.

Freight movement is sufficiently well-controlled in the City, with the traffic management currently controlled by the Rwandan police force. While freight movements are generally confined in the National Roads,

Much of the traffic management is still done manually, with fewer than 30 junctions being signalised in the City.

The City is in a good position to implement good traffic management principles and apply sensible transport solutions as it is still early in its development. It is therefore vital to obtain new revenue resources for the road maintenance, and at the same time, plan for the revitalisation of existing roads (see Figure 2.11).

In addition, future plans for rail are in place. The existing transportation networks do not yet support the development of rail in the City, and this needs to be accounted for when examining the road network.

Kigali International Airport is well-connected to the existing City core by road. However, the new Bugesera International Airport may not be well-linked to the City, hence examination of the existing network will need to consider these new developments.

2.3.2 Existing Road Network and Conditions

The current road network in Kigali City consists of 732 km of roads, of which only 14% is paved (see Figure 2.13).

Less than 1% of the roads constructed are with granite-pavers, and the rest is rough dirt (see Figure 2.12 and Figure 2.15). The surfacing materials for the paved roads can be either tarmac or cobblestone (see Figure 2.17). The construction of these paved roads is not consistent and these roads currently have no maintenance regime. Existing roads also do not have consistent road elements like standard kerb and verge dimensions.

Nationally, Kigali City is well-connected to other parts of Rwanda and beyond by a network of National Roads. The CBD forms the centre of a radial network of mostly paved roads, which connect Kigali to the neighbouring countries, e.g. the Democratic Republic of Congo (DRC), Burundi, Tanzania, and Uganda. Even though the roads are paved, they are not all well-maintained. Of these National Roads, the routes to Gitarama, Rwamagana, and Byumba are most widely used.

On the district level, roads within the Districts of Gasabo and Kicukiro are mostly unpaved single carriageways without uniform side tables and road furniture. These unpaved roads become water-logged during the wet season and dusty during the dry season. They are also vulnerable to erosion from surface runoff.

The major National Roads from Kigali City to other regions in Rwanda and beyond are listed below:

- Kigali – Gitarama – Butare – Akanyaru – Burundi (190 Km)
- Kigali – Kibungo – Rusumo –Tanzania (167 Km)
- Kigali – Kayonza – Kagitumba – Ouganda (191 Km)
- Kigali – Byumba – Gatuna – Ouganda (80 Km)
- Kigali – Ruhengeri – Gisenyi –DRC/ Goma (156 Km)
- Kigali – Butare – Cyangugu – Ruhwa – Bukavu (284 Km)
- Kigali – Butare – Cyangugu – Rugarama – Burundi (322 Km)

Figure 2.12 Example of Unpaved Road in Kigali

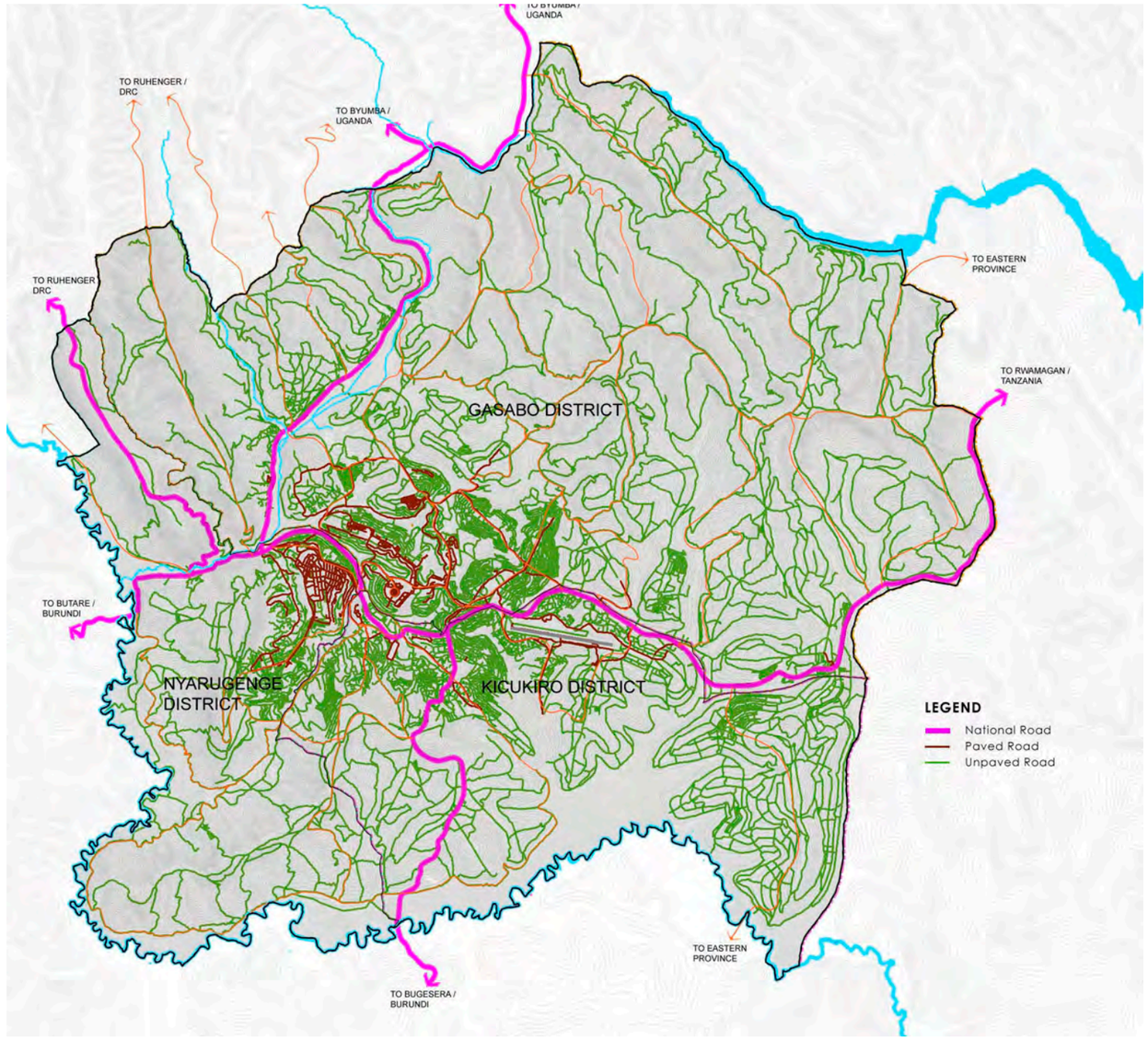


Figure 2.13 Existing Roads in Kigali (Red indicating paved)

Table 2.14 Summary of Official Gazette No. 04 of 23/01/2012 on Roads in Rwanda

Road Class	Definition[1]	Road Width (m)	Total Road Reserve (m)[4]
National Roads	International roads that link Rwanda with neighbouring countries;	3.52	44m
	Roads that link Districts or that link a District and the City of Kigali;		
	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 Roads	Roads linking different sector headquarters within the same District, or those roads that are used within the same sector.	3.52	44m
Districts and City of Kigali 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	24m
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.	-	-

1. Article 3 Classification

2. Article 15 Width of national roads, Districts, and City of Kigali roads and those of other urban areas - Class 1

3. Article 16 Width of national roads, Districts, and City of Kigali roads and those of other urban areas - Class 2

4. Article 22Road reserve for national roads, Districts and City of Kigali roads and those of other urban areas

EXISTING ROAD CLASSIFICATION

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

- National roads
  - National roads comprise the following categories:
  - International roads that link Rwanda with neighbouring countries;
  - Roads that link Districts or that link a District and Kigali City;
  - Roads that link areas of tourist significance and facilities of National or international importance such as ports and airports.
- Districts and Kigali City roads and that of other urban areas – Class 1
  - Class 1 Roads are roads linking different Sector's headquarters within the same District, or those roads that are used within the same Sector.
- Districts and Kigali City roads and that of other urban areas – Class 2
  - Class 2 Roads are arterial roads that connect Districts roads to rural community centres that are inhabited as an agglomeration.
- Specific roads
  - Specific roads are 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.

The gazette also stipulates road dimensions such as the minimum lane width, minimum carriageway width and road reserve. 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.

A summary of the gazette is shown in Table 2.14.

Within Kigali, other than the afore-mentioned routes, the road network is not extensive. Outside of the main urban areas, many of the major roads follow the topography and are located primarily on the ridges or in the valleys. The existing local road network has not been designed and built following any consistent hierarchy and construction methods.

In the last household survey it was found that 92% of people in Kigali use roads regularly (see Figure 2.18). However car ownership is low (Figure 2.16 and Figure 2.19), therefore suggesting that most of the people travel by public transport and are pedestrians or cyclists. Non-motorised transport infrastructure such as pedestrian walkways are present but not consistently constructed in Kigali. This poses a danger for pedestrians where these infrastructure are non-existent.

Figure 2.17 Different Pavement Types found in the City of Kigali

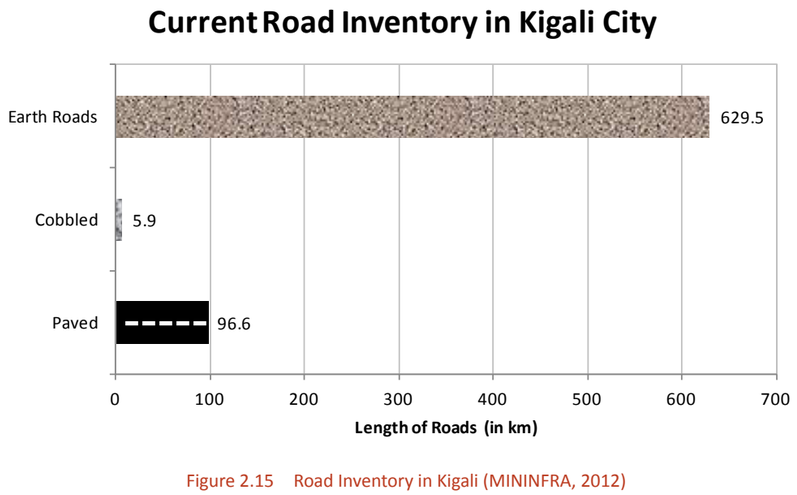


Figure 2.15 Road Inventory in Kigali (MININFRA, 2012)

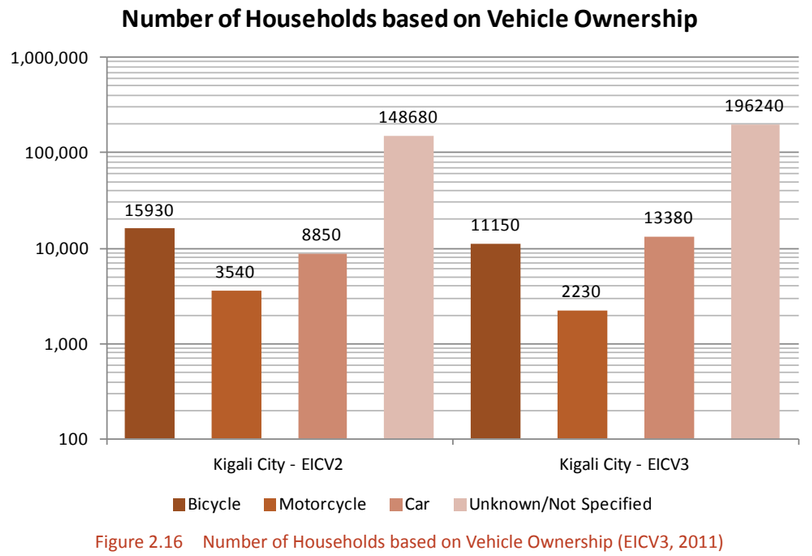


Figure 2.16 Number of Households based on Vehicle Ownership (EICV3, 2011)

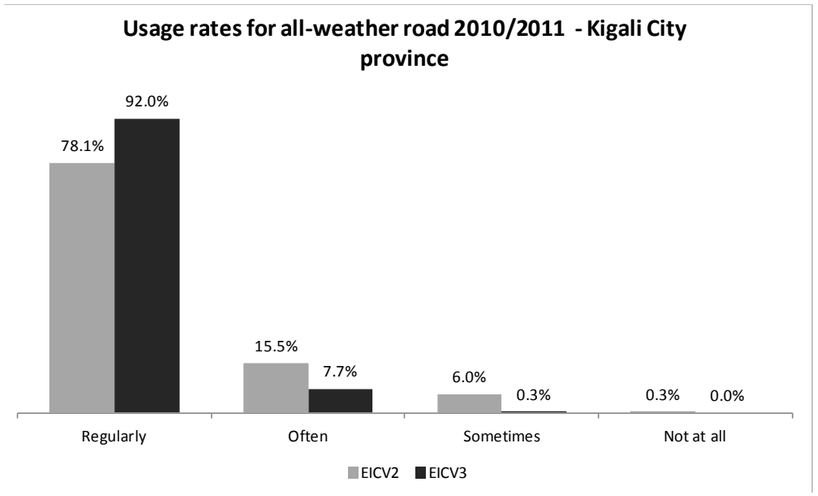


Figure 2.18 Road Usage in Kigali (Integrated Household Living Conditions Survey 3,EICV3, 2011)

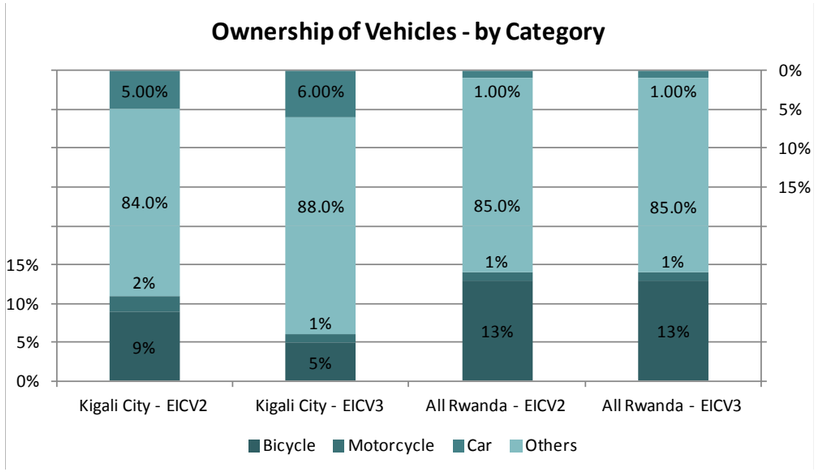


Figure 2.19 Vehicle Ownership by Category (EICV3, 2011)

Figure 2.20 Unregulated On-street Parking

Figure 2.21 Traffic Road Markings absent from Road in Kigali

Figure 2.22 Dual Carriageway with Median separating Traffic

2.3.3 Existing Traffic Management System

Currently, the majority of road intersections in the City of Kigali are unsignalised. Some traffic management systems such as traffic signals and roundabouts can be found in the urban areas, mainly in Nyarugenge District.

There are a total of 16 signalised junctions in the city, which operates on fixed timings (static settings). They are currently inefficient as the signals are not dynamically linked to traffic sensors and therefore are unable to respond to changing demand. In addition, the traffic lights are supplied by many different manufacturers and therefore complicates the maintenance regime of these signalised junctions.

The current traffic signals settings have not been optimised to current traffic demand, and additionally the traffic signals do not have any priority signs in case of malfunction. The City also lacks any specialist to optimize the signal timings for the traffic lights.

It is understood that the Kigali City Council intends to replace all the old traffic lights with new ones. This move may assist the standardisation of the traffic signals so that a centralized traffic light coordinating system could be used to optimize the performance of the junctions.

Normal traffic light operation is frequently interrupted by power outages and represents a significant road safety issue. The use of roundabouts in conjunction with the signalised junctions can help with alleviating congestion, while providing a solution that is cost-effective and relatively maintenance-free in the short term.

Traffic calming methods such as multiple speed-reducing humps are found on certain roads to reduce the speeds of vehicles especially in areas where there are tight corners and steep gradients. However, these are improperly designed and in many cases, not properly maintained.

Traffic markings are not commonly found on Kigali roads. Existing markings may not be fully maintained. There are no guidelines to standardize traffic markings in Rwanda which also leads to different marking schemes being observed across the city.

Safety

The urbanized areas of Kigali City experience higher accidents numbers; in general, approximately 79% of annual accidents occur in the City. This can be due to there being a higher number of motorized vehicles on the road in the City as compared to the rural areas.

There is currently no system identifying accident blackspots in the city, which means detailed assessments of the road accidents are not easily compiled.

Additionally the construction of roads are done in piecemeal form, which has resulted in inconsistent safety features in the road infrastructure. Road safety in designs are not reviewed in detail in the present planning approval stage for developments, resulting in a road network which would be considered unsafe once traffic volume increases.

Freight Traffic

A major border post is located in Gikondo, which regulates the goods going into and through Kigali City. Freight traffic is plying through the existing road network to reach the border post. Lorries have to park along the streets around border post to complete their customs clearance as there is insufficient parking space at the designated parking area within the enclosed area of the border post. Heavy trucks are prohibited in CBD during day time unless permission is given by traffic police. However, the trucks are allowed to use the roads at night.

This demonstrates some form of traffic control in Kigali which has been applied to some degrees of success.

Figure 2.23 shows how freight traffic utilises the National Road Network. The Rwanda Strategic Transport Master Plan (RSTMP) identifies three types of freight operations, namely: intra provincial, inter provincial and regional freight movements.

Much of this traffic travels through Kigali.

Existing Development Control Measures

The local government does not have expertise to assess transport impacts, and due to the institutional setup, cannot empower the local authority to decline development proposals on the grounds of negative traffic impacts. There is no local design manual or guidelines for roads and highways design, and the design for road construction depends on the contractor. The lack of standardisation in the City has made future maintenance more difficult and complex due to difference in design.

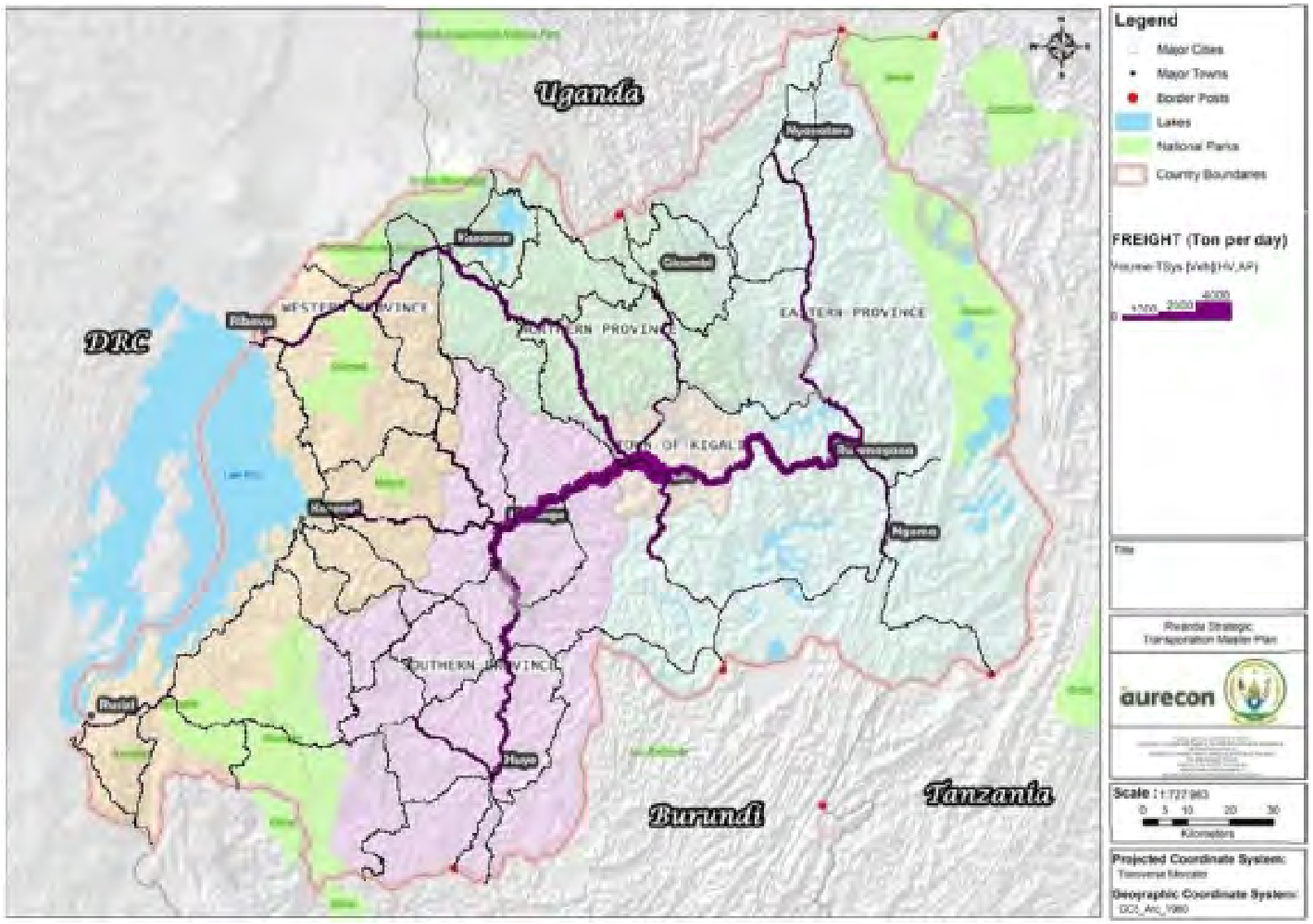


Figure 2.23 Freight Traffic Analysis in the Rwanda Strategic Transport Master Plan (Aurecon, 2012)

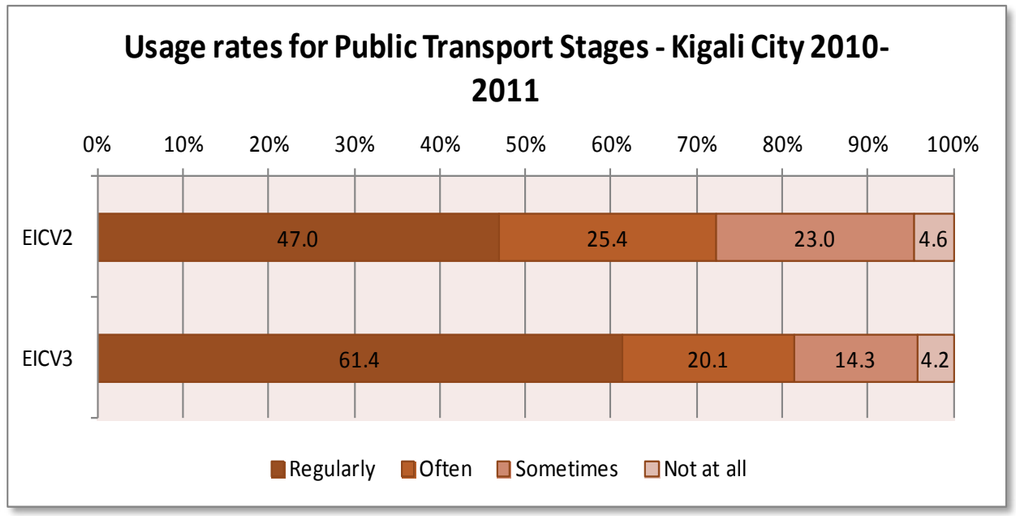


Figure 2.24 Usage Rates for Public Transport in Kigali (EICV3,2011)

Figure 2.25 Public Bus Station in Kigali

2.4 PUBLIC TRANSPORTATION IN KIGALI

MININFRA prepared a report on the Development of an Integrated Public Transport System for City of Kigali in March 2012.

In this document, MININFRA identified the state of public transport and provided recommendations for the improvement of public transport in the City.

2.4.1 Bus Services and Infrastructure

There are 5 bus terminals in the City currently. Gasabo District has 3 bus terminals – 2 are functioning and Kubuga Bus Terminal is under rehabilitation. The berthing, queuing and ticketing systems in the terminals and stops are haphazard. It is noted in the "Summary Report on Development of an Integrated Public Transport system for Kigali City" that there is congestion in existing bus terminals.

Some of the licensed bus operators are:

- Kigali Bus Service
- Onatracom
- Jaguar Bus Company

Kigali Bus Services operates the larger 80-seats buses. They are the first bus service provider to implement automated ticketing system by using contactless smart card. Other bus services hire bus conductor to collect payment from the passenger.

Bus Terminal Infrastructure

It is noted that there is a lack of pedestrian facilities within the bus terminal. Passengers have to enter the bus terminal with the same access as the buses. As shown in Figure 2.25 there are no crossings or linking facilities for the passengers to get from one bus waiting area to another. Pedestrian traffic and vehicular traffic circulation are not separated in bus terminal.

In Kicukiro District, Nyanza Bus Terminal was constructed in 2009 with the future vision of the bus terminal becoming more utilitised when developments in the area increase and the development of the new City Center in Gahanga. The land use around Nyanza Bus Terminal is planned to be mainly mixed commercial and residential.

Bus Stops Infrastructure

"Summary Report on Development of an Integrated Public Transport system for Kigali City" highlighted a lack of central planning or standardization used in the road and supplementary infrastructure which has a detrimental impact on transport vehicles and the efficient operating of traffic within the City.

Some bus stops have shelters, but few have a bus bay as shown in Figure 2.26. Minibuses stop outside the market in Kicukiro District, picking up passengers at the bus stop without both bus shelter and bus bay(see Figure 2.27). In the new townships that have been developed in Gasabo, the bus stops have bus bays but not shelters.

2.4.2 Taxi Services

There are 3 different types of taxi services operating within Kigali City –Taxi, Motorbike Taxi and Bicycle Taxi. To operate, taxi operators will have to register with RURA. These taxis service providers are under the umbrella of their own associations and only operate within their own sector.

Taxi

There are 370 registered taxis operating in Kigali City. However, there is also large number of unregistered taxi service operating in Kigali.

Motorcycle Taxi (Taximoto)

Another popular mode of transport, shown in Figure 2.28, is the motorcycle taxi which offers a quick and efficient way to travel, especially to rural areas with unpaved roads and steep slopes. There are approximately 7,000 motorcycle taxis operating in Kigali City and are managed by various private operators. However, there is significant number of motorcycle taxis that operate without license and permits in additional to the above-mentioned number.

Fares of these motorcycle taxis are loosely regulated. The fares typically range from 200-1000 Rwf. Registered motorcycle taxis operate only within the registered sector.

There is a lack of parking spaces for these taxi services. In February 2012, CoK allocated 53 motorcycle parking areas in major zones of the City to regulate parking of motorcycle taxis.

Bicycle Taxi

Bicycle taxis, as shown in Figure 2.29, are forbidden in the City area, but they can be found in the rural areas in Gasabo and Kicukiro District as an alternative mode of transport to motorcycle taxi. Similar to motorcycle taxi, registered bicycle taxi operators are only allowed to operate within their registered sector.

Figure 2.26 Typical Bus Stop in Urban Kigali

Figure 2.27 Informal Bus Stop next to Road

Figure 2.28 Taximotos in the City

Figure 2.29 Bicycle Taxis

Figure 2.30 Existing Rural Road without Pedestrian Walkways

Figure 2.31 Existing Urban Road without Pedestrian Walkways

2.4.3 Non-Motorised Transportation

Public transport and non-motorised transport go hand in hand as part of sustainable transportation, and therefore investment cannot be provided for public transport without including for non-motorised transport infrastructure such as pedestrian walkways and cycleways.

There are currently very few stretches of roads in Kigali that have formal pedestrian walkways.

Figure 2.30 and Figure 2.31 shows some existing roads without pedestrian infrastructure. As such, pedestrians are required to walk on the carriageways.

Figure 2.33 and Figure 2.32 show walkway provision on one side of the road. As it can be seen, pedestrians still walk on the carriageway due to convenience and lack of safety awareness. Figure 2.34 also shows that car owners do not respect the pedestrian domain by parking over walkways.

The report on the Development of an Integrated Public Transport System for City of Kigali identified several problems for non-motorised transportation in terms of public transport, most notably:-

- lack of well-designed pedestrian crossing facilities giving pedestrians and public transport more priority, and
- lack of pedestrian and NMT access to the terminals, which hinder the prospect of appropriate integration of PT and NMT

Figure 2.32 Pedestrians walking on Carriageway with disregard to Existing Infrastructure

Figure 2.33 One-sided Walkway Provision

Figure 2.34 Car parking on Existing Walkway

2.4.4 Existing Rail Network in Kigali

There are currently no railways in either Kigali or nationally in Rwanda. The mountainous nature of the terrain in Rwanda makes the implementation of rail very challenging and potentially expensive.

There have been numerous projects to try to connect Rwanda by rail none of which ave been realised to date.

2.4.5 Existing Air Transportation in Kigali

Kigali International Airport (KIA) shown in Figure 2.35 is one of 2 international airports in Rwanda. It is the principal passenger airport and the main entry point for international passenger services. It is managed and operated by the Rwanda Civil Aviation Authority (RCAA). The current location of the airport is to the East of the Central Business District (CBD), approximately 11km away by road. The airport is located on a flat area on top of a ridge. This topography precludes the possibility of further expansion of the airport as the current layout utilises all the available level ground.

The Route Nationale 3 passes by and forms the main access to the airport from the CBD. The road network leading to KIA experiences chronic congestion during peak period. With the planned increase in air travel demand, this situation will only be exacerbated.

Statistics released by RCAA show that in 2010, over 300,000 passengers used the airport. This demand is predicted to increase over the next decade with more than 1 million passengers per annum expected by 2025. Based on the observed past increase in cargo and passengers numbers and projected increase in Rwanda's GDP, it is expected that the current airport will be unable to meet future air travel demand.

The land use around the airport is a mix of commercial and mainly residential. The surrounding land use means that any safety incident such as a runway overrun would have serious consequences. However decommissioning the airport may be costly and unfeasible at this stage.

Figure 2.35 Existing Kigali Airport in the City Centre

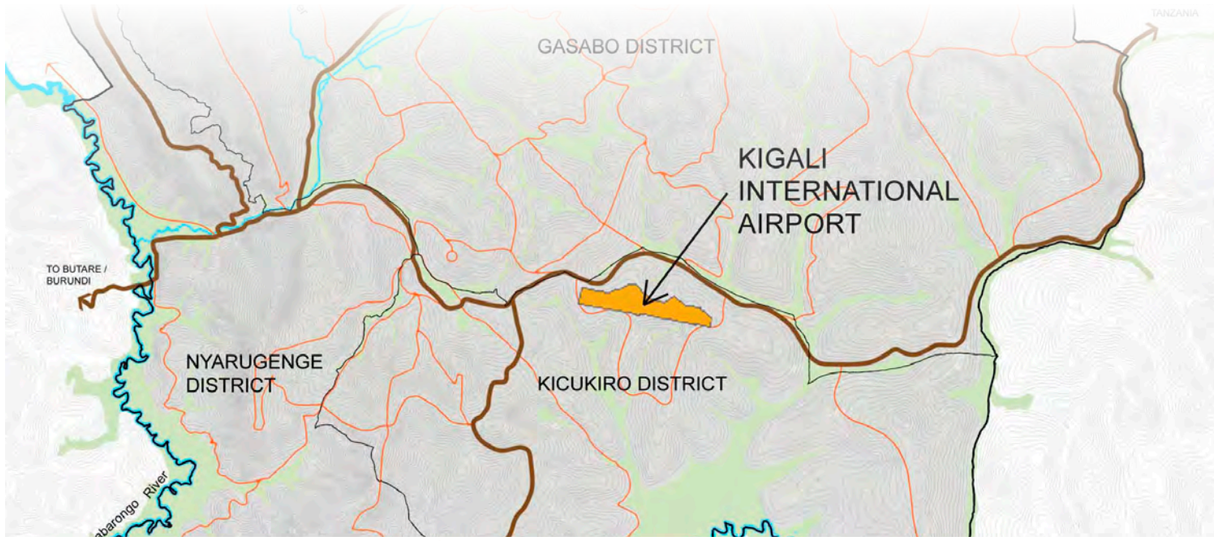


Figure 2.36 Location of the Proposed Bugesera International Airport in relation to Kigali

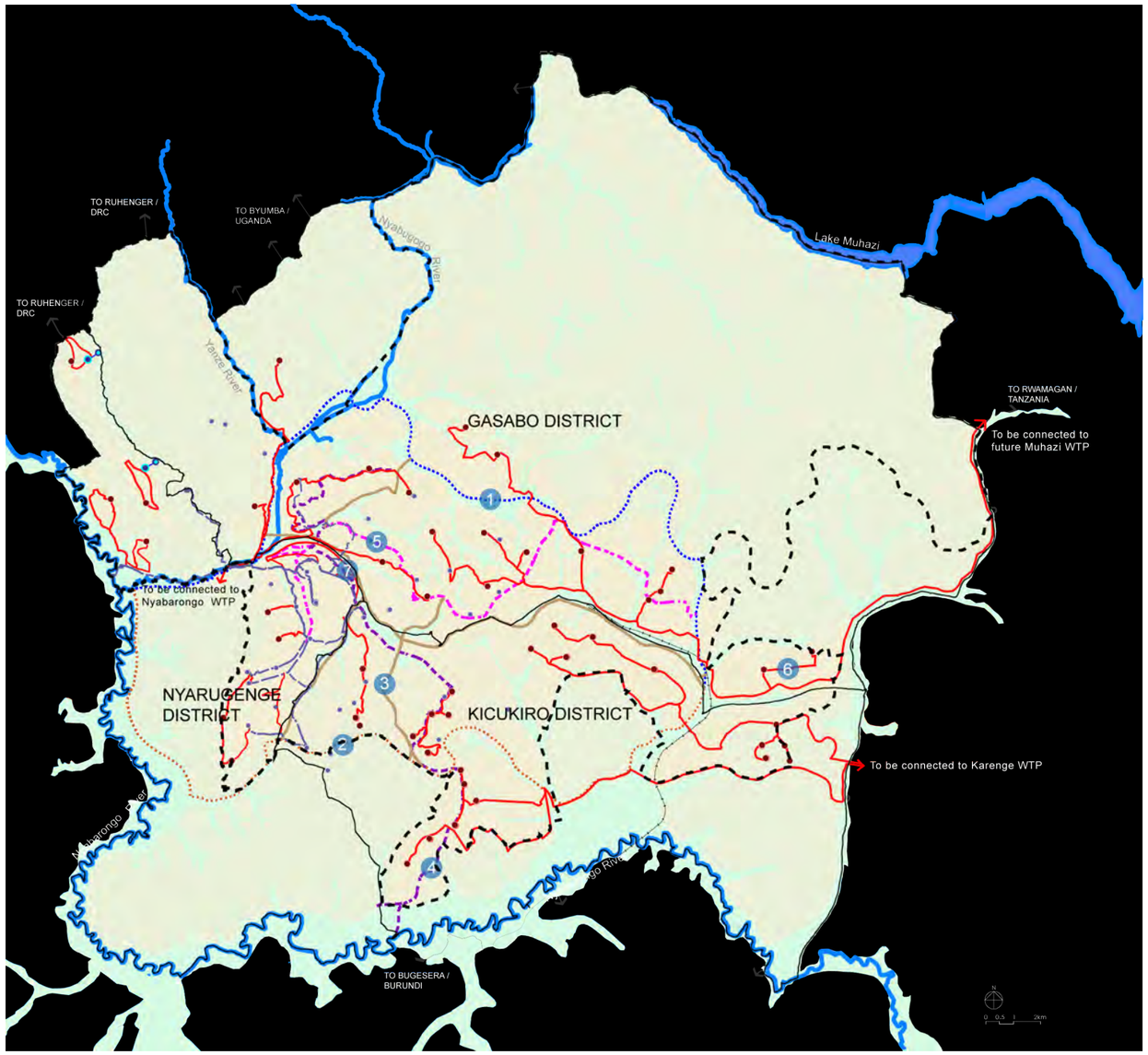


Figure 2.37 Current Road Network Initiatives

2.5 TRANSPORT MASTER PLAN AND OTHER INITIATIVES

STRATEGIC TRANSPORT MASTER PLAN FOR RWANDA

The Ministry of Infrastructure (MININFRA) initiated a strategic transport master plan for Rwanda in 2010 with the distinct purpose of formulating the detailed transport strategies for the short- and medium-term planning horizon (10- years).

The reports on the following specialised issues were produced while developing the strategic master plan:-

- Status of the Transport Sector in Rwanda
- Cross-Cutting Issues Impacting on the Transport Sector in Rwanda
- Calibration, Validation and Application of the Transport Model
- Recommendations to Improve Inter-City and Rural Public Transport Services
- Institutional Structure for the Transport Sector in Rwanda
- Appraisal of Transport Infrastructure and Transport Services Projects
- Appropriate Options for Public Private Partnerships
- Programming of the Master Plan

The KTMP was prepared bearing in mind some of these issues identified.

2.5.2 CURRENT ROAD NETWORK INITIATIVES

CURRENT ROAD IMPROVEMENT PROJECTS

There are many road improvement projects underway in Kigali. The following are the major projects being carried out:-

- The Feasibility of Widening of the Kigali-Ruhengeri Road
- Rehabilitation of 83.1km Kigali – Ruhengeri Road
- Rehabilitation of Kigali – Kayonza
- Development of 21 km Kicukiro – Kirundo (Kibugabuga – Ruhuha)
- Development of 21 km feeder roads between Bulinga – Remera
- Gitarama – Ngororero – Mukamira Road Project

Inventory is not currently done in Kigali, and no records of the conditions of roads exist. It is difficult to determine the conditions of a particular road or whether it needs maintenance work.

2.5.1 Current Rail Network Initiatives

As there are currently multiple options for the final rail alignment and the extent of the railway, a brief summary of the rail initiatives being proposed is presented in the following sections.

East African Rail Master Plan

As a member of The East African Community, Rwanda is part of the plans to connect the region via rail. The East African Railway Master Plan is a proposal for rejuvenating the existing railways serving Tanzania, Kenya, Uganda and extending them into Rwanda and Burundi and ultimately to South Sudan, Ethiopia and beyond. The cooperation and integration of the railways from the surrounding countries is essential to make the rail proposal viable.

One of the principal recommendations within the plan is to harmonise the different gauges in operation across the region. The surrounding countries utilise two gauges for rail; the 1,000mm and 1,067mm gauges.

The report suggests that rail should be used for passenger commuting if the extension across the country is realised.

This plan has been carried out in cooperation with the Governments of Tanzania and Burundi. This is a comprehensive plan that goes as far as proposing stations at Kigali, Bugesera, Isaka and Gitega.

The details of the proposed railway system in Rwanda are as follows:

- Branch line from Isaka to Kigali splits at Keza
- 494 km Isaka to Kigali
- 186 km Keza to Kigali
- 800 metre long trains with a top speed of 120 km/hr
- 3-4 Locomotives per train will be required to attain the carrying capacity and speeds required for the railway.

The capital cost to implement the plan is estimated at US$3.7 billion. Funding will be through the African Development Bank (AfDB).

Rwanda National Land Use Master Plan (RNLUMP)

This plan sets out extensive provision of rail for the entire country. The proposed rail alignment has connections to Tanzania, Uganda and Lake Kivu. The alignment being proposed is based on that proposed in the Feasibility Study project. However, it extends the rail alignment further north beyond Kigali. The alignment passes directly through Kigali City. Much of the terrain which the alignment crosses is unsuitable for rail. Therefore further study would be required to identify the best alignment for the rail.

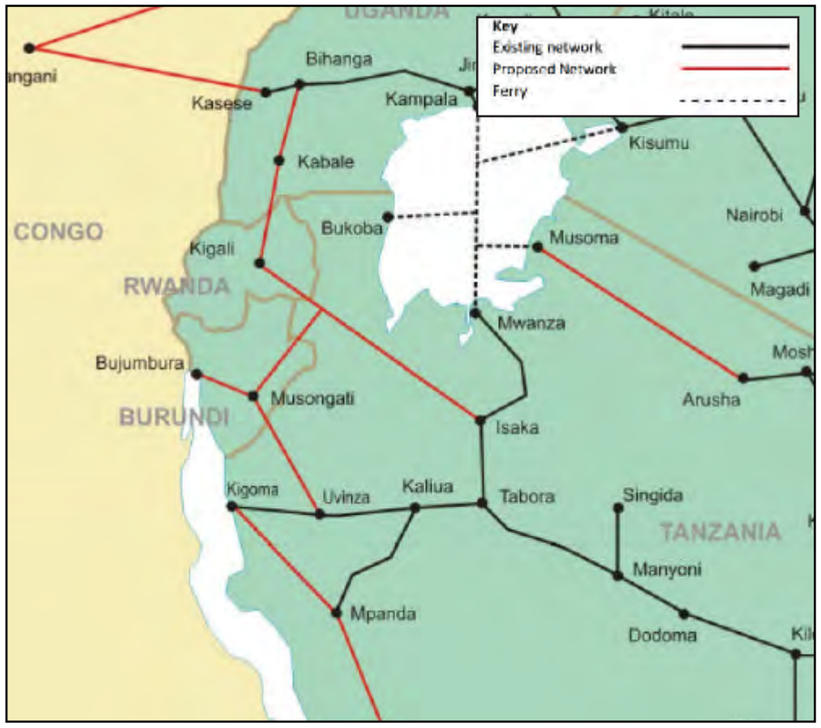


Figure 2.38 Extract of the Map of the Existing and Proposed Rail Network Links (East African Railways Master Plan, 2009)

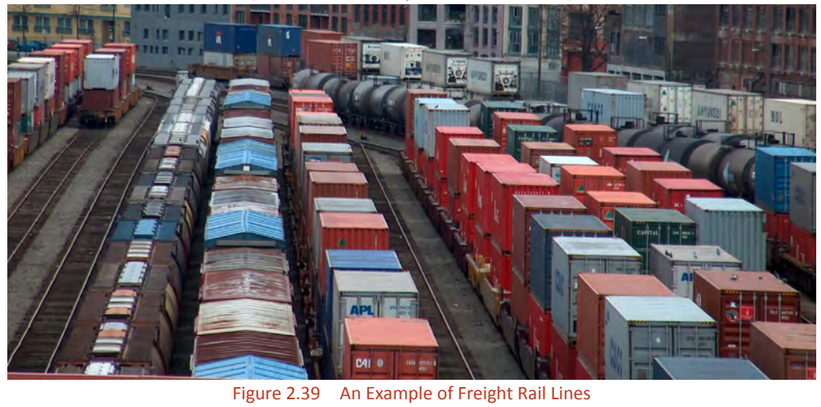


Figure 2.39 An Example of Freight Rail Lines

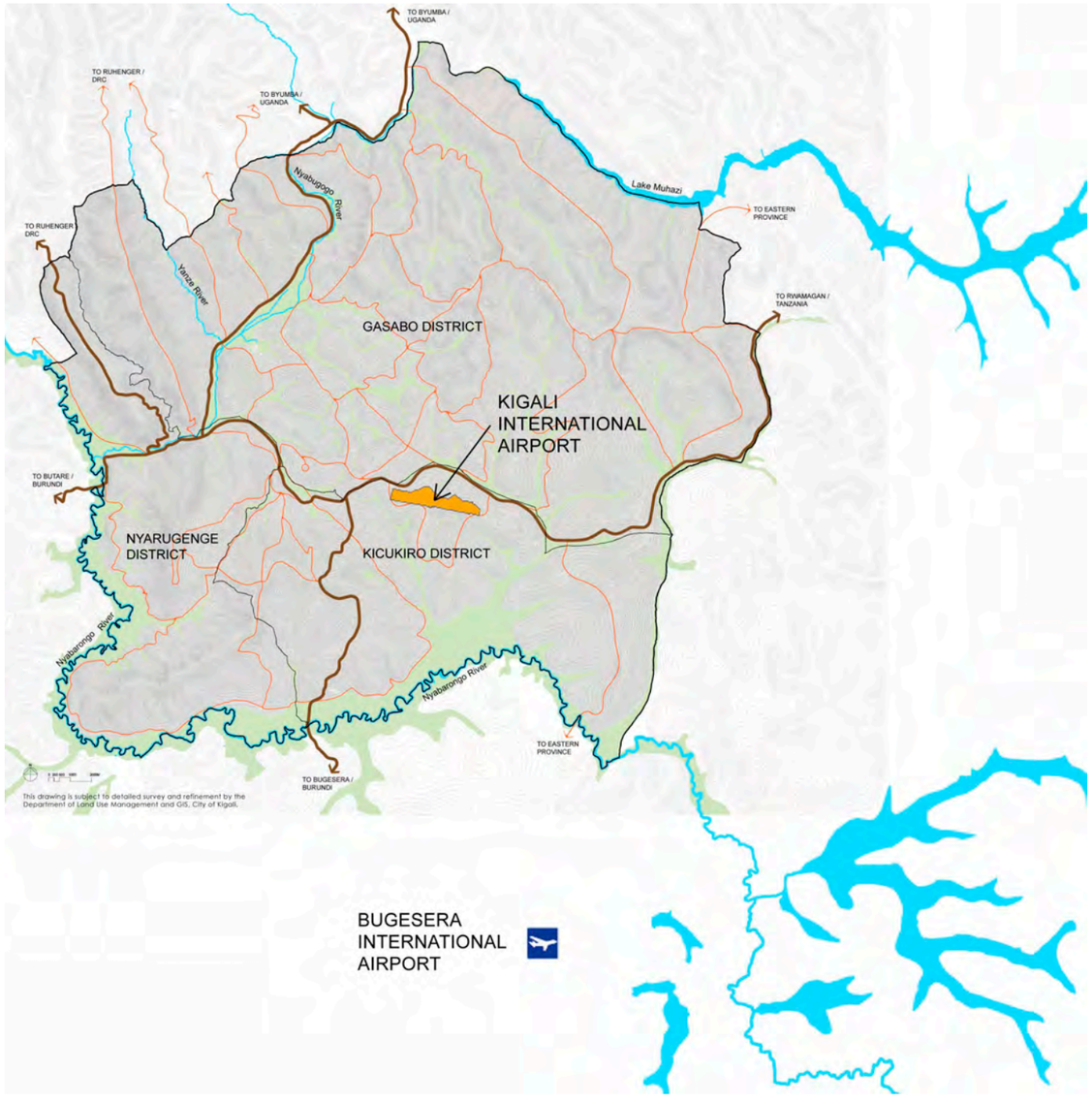


Figure 2.40 Location of the Proposed Bugesera International Airport in relation to Kigali

2.5.3 Current Air Transportation Initiatives

Construction of the Bugesera International Airport

Given the economic importance of air travel, plans have been made to supplement the capacity of the KIA with a new international airport being constructed at Bugesera, about 40km south-east of Kigali. The airport is initially expected to handle over 1 million passengers annually during its first phase. It will have the capacity to handle 15,500 tonnes of cargo annually. Further expansions to the airport can increase its capacity to up to 12 million passengers per annum.

The location of the new airport increases the travel time between the airport and Kigali CBD, and may be an issue in attracting air travel. It is vital to facilitate travel between the Bugesera Airport and the CBD. Unpredictable journey times or excessively long journeys will make the operation of the airport less effective, and may affect airline operators' choice of operating from the new airport.

There is a need to strengthen the transport links between the airport and Kigali CBD to promote air travel to the new airport. .

2.5.4 Proposed Public Transport Initiatives

Technical Report: Consulting Services for the Planning and Design of a Public Transport System for Kigali City

The afore-mentioned report discusses in detail the approach to providing an efficient public transport service to the people in Kigali.

In this report, the consulting engineers recommend the following workflow for the improvement of the city:-

1. Formalisation of the Existing Public Transport Services
2. Infrastructure Upgrades and Improvements
3. Construction of Long-distance Transit Services

while being supported by a series of institutional reform, particularly in

4. Reorganising the Public Transport Industry
5. New Institutional Structure and Regulatory Framework
6. Investment and Training in Personnel

For the purposes of the Kigali Transportation Master Plan, many of the road alignments are proposed to be altered and improved. While the proposals set in this document remains valid, they would need to be revised following the update of the proposed land use plan.

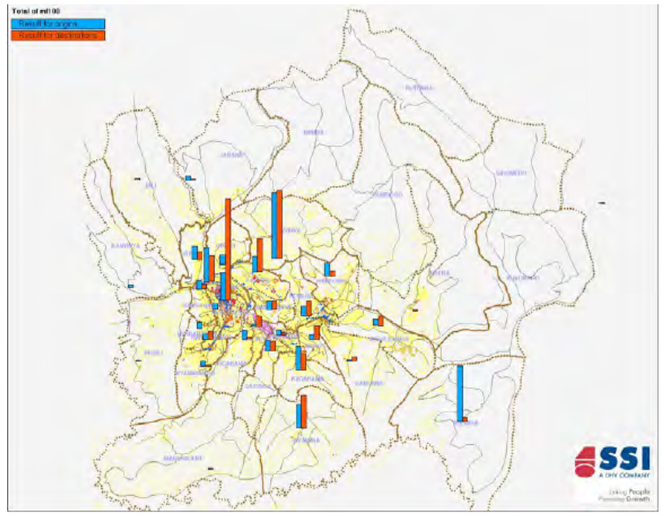


Figure 2.41 2032 Trip Generation and Attraction (SSI, 2012)

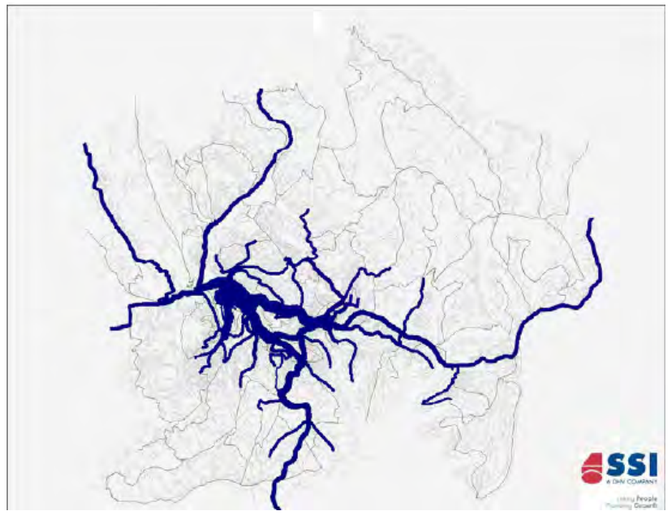


Figure 2.42 2032 Public Transport Routes (SSI, 2012)

2.5.5 Development Control Measures

Rwanda Strategic Transport Master Plan

This document has identified the need for an enhanced institutional setup to manage development control in Rwanda.

Due to separation of functions, the status of development control in Rwanda has not advanced. While the establishment of the Rwanda Transport Development Agency (RTDA) was well-received, its role in development control, particularly in Kigali is minimal.

Roads play an important part in managing traffic and providing safety to all its users. New development in Kigali would impact roads, and in turn, affect the safety of the roads.

At the same time, these developments can be viewed as an opportunity to enhance the city's roads.

While there are no development control measures in Kigali, the RSTMP has identified the need for such, in particular, traffic law enforcement, pedestrian safety, traffic information systems, safety engineering, road safety research, etc.

The Road Traffic and Road Safety Act (Draft) aims to improve road safety by means of vehicle road-worthiness and road design issues, which when gazetted would guide the development control measures in Kigali.

Rwanda's National Strategy for Climate Change and Low Carbon Development

Rwanda's National Strategy for Climate Change and Low Carbon Development suggests that for urban areas, they should be developed into high density walkable cities.

By working towards high density urban areas, urban sprawl will be limited, and the city would be less reliant on motorised transport. Designing high density cities with corridors for pedestrians and cyclists and green public spaces, would reduce the need for energy intensive transport, improve quality of life and reduce the risk of flooding.

The same document identifies the need for a robust road network. It is currently the main transportation mode, due to the lack of rail in the area, and all sectors – agriculture, mining, industry and services - relies heavily on this road network. The current network varies in quality and can have a detrimental effect on the economy; maintenance costs would be expensive, and development may be limited due to the provision of dirt tracks instead of paved roads. Additionally due to the inconsistency in road makeup, the majority of the network is also unprepared for current and future climate, for example weathering of the surface and road runoff drainage systems.

2.6 CHALLENGES AND OPPORTUNITIES IN TRANSPORT

Upon review of the current situation in Kigali and Rwanda in general, the opportunities and challenges facing the city have been identified.

The goals of the Master Plan are to create a Transit-oriented City with decentralised regional centres, supported by a sustainable transport network. To achieve these goals, key opportunities in Rwanda have been identified as:-

- Economic growth
- Greenfield City
- High Dependency and Fresh Perception on Public Transport
- Progressive, Strong and Good Governance
- Pro-sustainability Government
- Suitable Climate

On the other hand, key challenges have been identified as:-

- The rise of car-ownership
- Low Capacity in Institutional Setup
- Limited Funding for Transport Infrastructure
- Topography
- Narrow Roads in Existing Urban Areas
- Lack of Government Land Bank

2.6.1 Opportunities

Economic growth

Kigali's unprecedented economic growth in the past decade has shown that the city is resilient to short-term economic fluctuations. With such growth comes economic backing to invest in transport infrastructure.

Additionally with foreign investment in the City, the City Council would be able to request for contributions for infrastructure upgrades as part of their planning approval, which would ultimately benefit the city as a whole.

The availability of abundant local labour would enable the improvement of road infrastructure in rural areas, and would also contribute to a reduction in poverty.

Greenfield City

Much of Kigali is underdeveloped, or are still greenfield.

As such there is opportunity for the City to develop or redevelop the transport network in Kigali, especially in the areas where the road alignments are not suitable for major transit.

A large proportion of the rural areas in Kigali are low-income settlements. These informal settlements are not efficient in landuse and are ripe for redevelopment.

By progressively improving these areas, and ensuring these areas are well-served by public transport, the city can grow in a sustainable manner.

High Dependency and Fresh perception of Public Transport

Currently the City of Kigali has a high modal share of public transport which stands at around 80% of the total travel of the city.

Due to Kigali's stage of economic and social development, the population is more receptive to the use of public transportation as a means of getting around the City.

The Mayor of Bogota, Enrique Penalosa once said that a developed country is not a place where the poor have cars. It's where the rich use public transport.

Cities such as Paris, New York and London have very low car ownership rates within the cities due to the high penetration of public transport in these cities, and a good branding to support them. For example the most famous brand is the London Underground, which has been expanded to include above-ground public transport.

Progressive, Strong and Good Governance

Rwanda is one of the most progressive countries in Africa. It has strong and good governance to implement the necessary infrastructure projects, including transportation projects to support the population and economic growth.

The Government also encourages training at all levels, including language courses, and places technical training as a top priority. This will enable the country to acquire adequate human resources for the transport sector in the medium term at all levels.

Several public and private institutions of higher learning have been established in Rwanda and cooperation agreements have been negotiated with development partners to train Rwandans in technical studies in the field of infrastructure and transport services.

Pro-sustainability Government

The Government of Rwanda has acknowledged the importance of the transport network and has commissioned several environmental-friendly studies, such as public transport study in Kigali and a Transport Sector Strategic Plan. This shows a willingness on the government's behalf to improve it.

Suitable Climate

Kigali's moderate and relatively dry climate is suitable for pedestrians and cyclists, and should be included in the planning of the transportation system. While cycling is not readily adoptable in the City as the terrain is hilly, public transportation can be used to supplement any cycling networks/facilities.

2.6.2 Challenges

Rise of car ownership

One of the most critical challenges faced by Kigali is the rise of car ownership. In cities with poor public transportation options, the car tends to become the only mode of transport that can be conveniently used for day-to-day purposes.

The City has seen an increase of car ownership in the past few years, as identified by the household surveys conducted in Kigali.

While the number of vehicles in Kigali are still manageable at present, in the planning horizons of 2025 and 2040, if the vehicular growth is not managed, congestion would not only occur but will be difficult and expensive to rectify.

The transport master plan would need to actively promote the use of public transportation and non-motorised transportation as a good alternative to motorised vehicles such as cars .

Low Capacity in Institutional Setup

As shown in the previous sections the institutional setup for transportation in Rwanda is fragmented and may become a liability in the long run, possibly due to lengthy approval and processing periods, in addition to bureaucratic red-tape.

The main challenge would be to unify the transport functions of these institutions into one institution, such as a Transport Authority.

Limited Funding for Infrastructure

The costs of building new transport infrastructure will increase as time goes by, and even maintaining them would increase exponentially as the length of road networks increase. While there are road maintenance funds provided by the central government, the local authority would still need to obtain additional funds, not only for building infrastructure and maintenance, but upgrade facilities such as bus stops and bus stations.

In most developed countries, the planning approval procedure in the local planning team includes for traffic impact assessments to be done prior to the approval of a proposed development. Following this, a contribution to the maintenance of the network or even for improvement works may be required of the developer depending on the significance of the development on the road network.

In the current administration of the city, there are no such arrangements or requirements when giving planning approval. This is an opportunity for creating another source of funding for transport projects, but there is a need to clarify the proposed organisational structure before this can be efficiently done.

Public transport infrastructure requires a high level of investment to be able to support better transit initiatives.

Topography of Kigali

The road gradient for cycle paths should not be more than 5%. In view of the hilly terrain of Kigali, it will be a challenge to implement a comprehensive and continuous cycling network.

The City is built on ridges and valleys (see Figure 2.43) and traversing these may be difficult for bicycles especially if not well-integrated with the public transport.

Possible solutions include cycle racks on BRTs and provision of cycle routes only in valleys.

Narrow Roads in Existing Urban Areas

There is no continuity in pedestrian facilities from one development to other developments or commuter facilities. This will compromise on the safety of the pedestrian.

The existing urban areas are already very well built-up, and any upgrading or improvement works in the urban areas may be very cost-intensive.

There may also be issues with land boundaries (see following section) where land ownership may be prohibitive to future road expansion.

In such cases, the road networks in these particular areas would be improved with a separate framework specifically designed for the urban areas.

Lack of Government Land Bank

The City of Kigali does not have sufficient land bank on which transportation infrastructure can be developed or where road widening can be done easily.

The road network in the City has been developed ad-hoc. While in new developments, the road network is well-designed, the land-ownership is not always clear, and may result in legal problems.

Due to a fragmented institutional setup and a weak legal framework, maintenance of the roads drains funding, and reduces the funds for obtaining land.

There is need to identify future plans for the City so that land can be reserved for proposed plans.

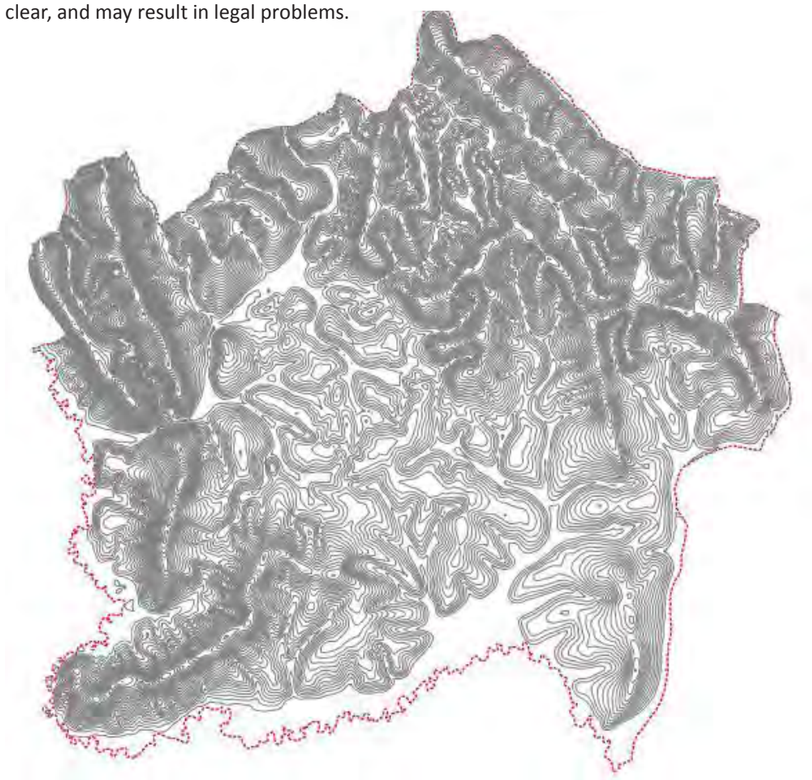
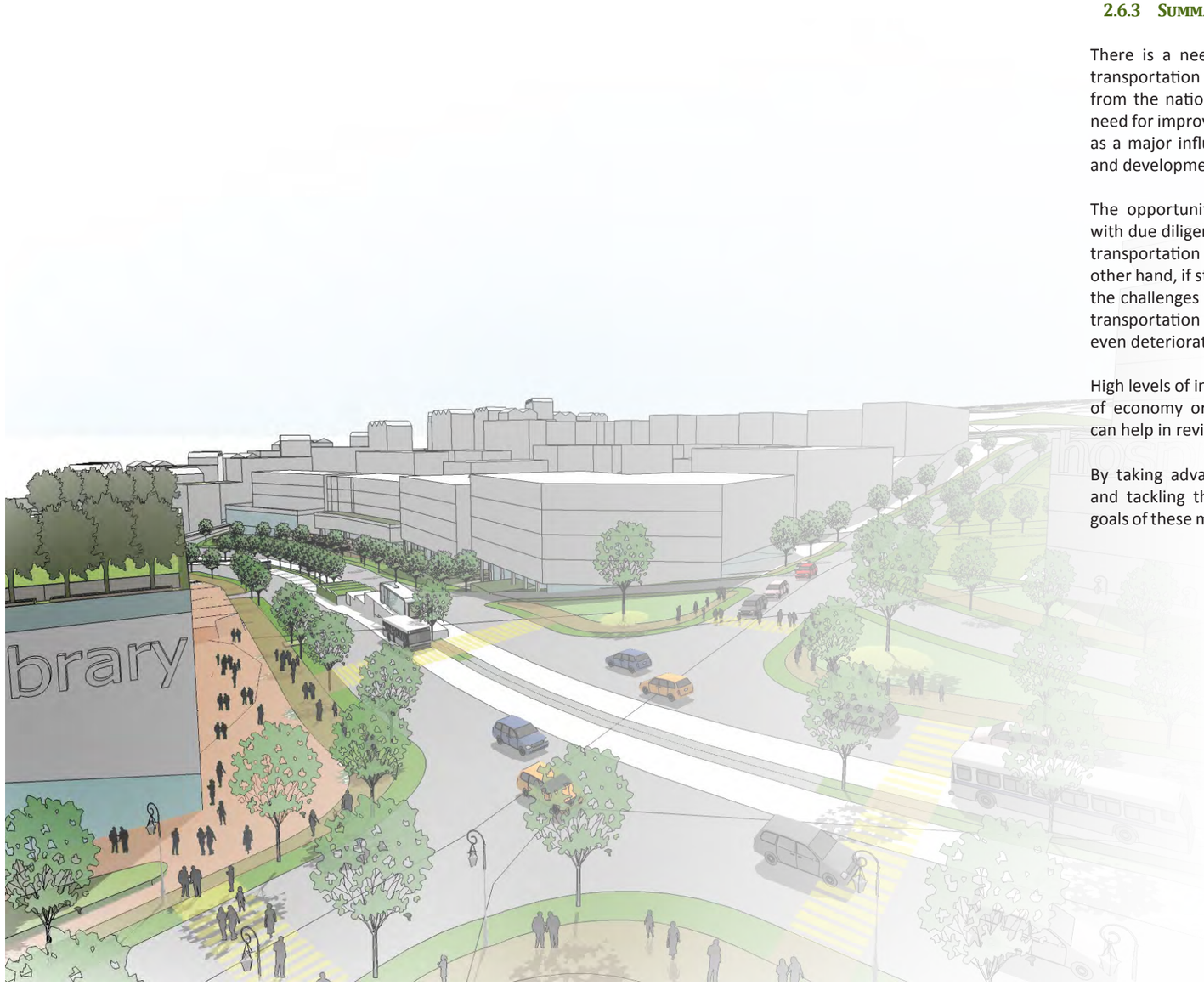


Figure 2.43 Undulating Topography in Kigali



2.6.3 Summary

There is a need for the improvement of transportation in Kigali. There is support from the national and local level, and the need for improvement has been recognised as a major influence for economic growth and development.

The opportunities in the City, if handled with due diligence, will greatly improve the transportation landscape in Kigali. On the other hand, if steps are not taken to resolve the challenges faced, the conditions of the transportation system may not improve or even deteriorate further.

High levels of investment, whether in terms of economy or infrastructure, in the City can help in revitalising the city's liveability.

By taking advantage of the opportunities and tackling the challenges early on, the goals of these master plan may be achieved.

The City needs to guide its inhabitants into a highly sustainable environment where the sustainable transport is integrated deeply into the City's day-to-day life.

Considering the progressive and strong government, it is likely that the government will provide full support in the comprehensive development of transport infrastructure in the City of Kigali in anticipation of future economic and population growth.

The pro-sustainability government is also more likely to support active traffic demand management, such as limiting the number of cars on the road and therefore slowing down the increase in the car ownership.

Due to economic and population growth, which is expected to reach 4 to 5 million in 2040, major expansion in the transport sector is crucial. This should include an comprehensive expansion of the road network and the introduction of an efficient, sustainable public transport system.

Considering the limited funding, lack of government land bank and the terrain in Kigali, a careful study on a cost effective proposal is needed for Kigali.

3 SPECIFIC GOALS, OBJECTIVES AND STRATEGIES

The Vision of the City is to become a Centre of Urban Excellence. To achieve this, the Transportation Master Plan intends to support one of the Key Goals of the vision, namely for the City to transform into a City of Green Transport.

The City of Green Transport is a city which puts emphasis on efficient, complete transit networks which can move high volumes of people quickly, in addition to supporting and integrating sustainable modes of transportation into the road networks.

As such it was determined that to achieve this, the following specific goals were defined for the City of Kigali:-

1. To become a Transit-oriented City
2. To establish a Comprehensive Transport System, and
3. To create a Sustainable Transport Network

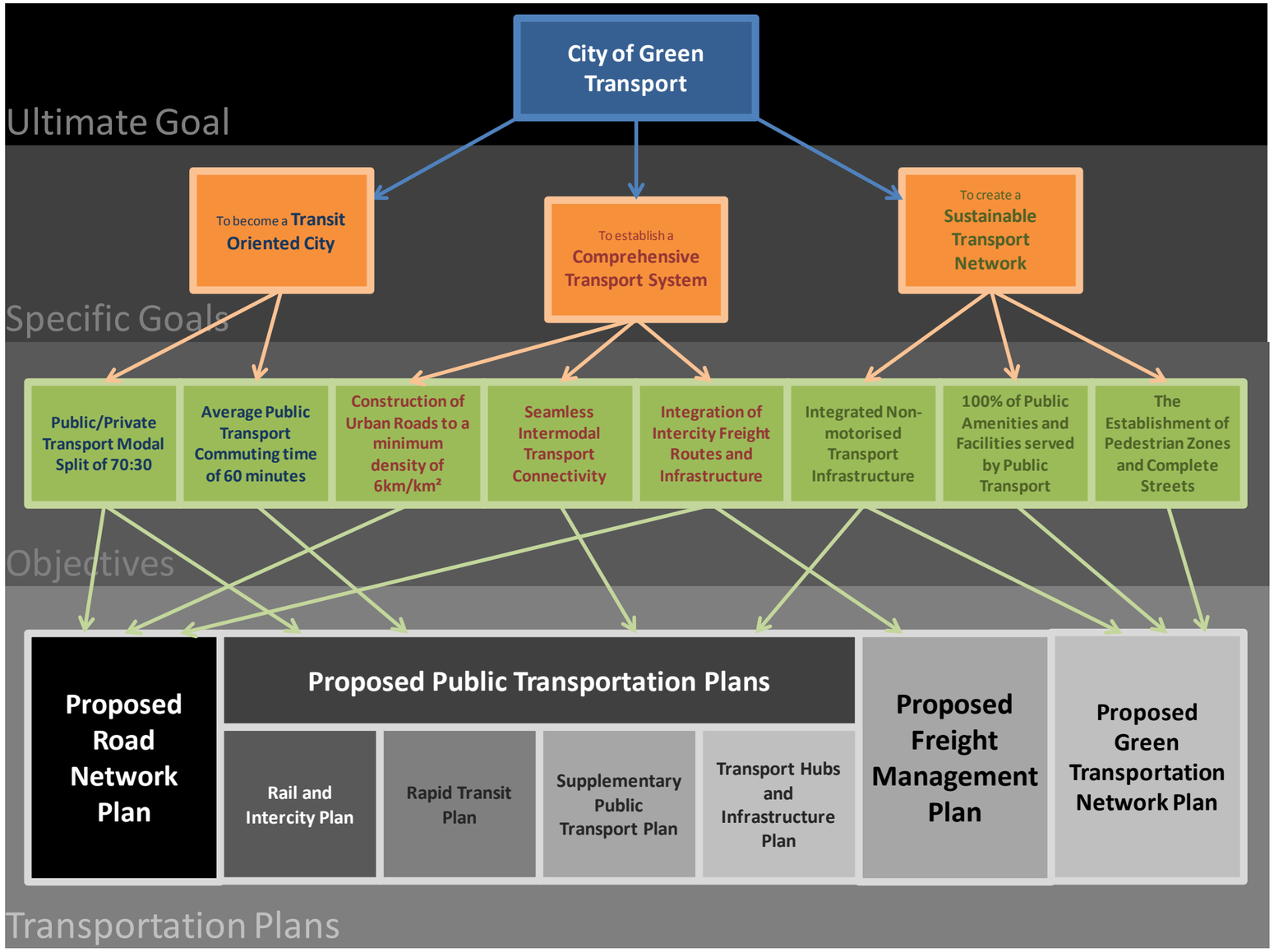


Figure 3.1 Goals and Objectives of the Transportation Master Plan

3.1 SPECIFIC GOAL 1: TO BECOME A TRANSIT-ORIENTED CITY

A transit-oriented city is a city that encourages transit ridership and maximise access to public transport.

At the same time, the city will need to integrate all forms of transit such as motorised transport and non-motorised transport to public transportation.

To be able to do so effectively, planning needs to start at the very basic level, in this case the road network.

There are two objectives set in order to achieve this specific goal:-

1. To ensure that a high public transport to private transport participation ratio of 70:30.
2. To provide a public transport network which provides an average public transport commuting time of 60 minutes or less within the City.

The Transportation Master Plan intends to support the achievement of these specific goals by means of two physical development plans, namely:-

- The Proposed Road Network Plan
- Proposed Public Transportation Plans

which in turn would be supported by proposed policies and institutional setup within the City Council.

Figure 3.2 Proposed Transit Oriented Developments in Kigali

3.1.1 OBJECTIVE 1: ENSURE A PUBLIC TRANSPORT TO PRIVATE TRANSPORT PARTICIPATION RATE OF 70:30

A high public transportation modal split is important for a transit-oriented city. A high rate means that transit ridership is high, and by association, revenue in transport would achieve critical mass and therefore be self-sustaining.

This can only be achieved in a city if the public transport infrastructure and services are sufficient and attractive to commuters.

An integrated mass-transit system, supported by a comprehensive supplementary feeder system is therefore crucial in achieving this objective.

One of the key proposals of the Transportation Master Plan is the provision of a mass transit to serve the city, in this case, a Bus Rapid Transit (BRT) system servicing the City. It is envisioned to be the primary transit backbone of the City, and be the mode of choice for long-distance travel. Current bus services are expected to integrate with this BRT system, acting as a feeder system for the BRT.

ENABLING STRATEGIES

- Develop a high quality mass-transit system which provides good coverage, and direct, fast and frequent services
- Develop a road network that supports mass transit systems
- Supplementary Public Transport/ Feeder Systems which work in conjunction with the mass-transit systems

3.1.2 OBJECTIVE 2: PROVIDE A PUBLIC TRANSPORT SYSTEM WITH AN AVERAGE COMMUTING TIME OF 60 MINUTES OR LESS

Travelling time is always a factor in modal choice between private and public transport.

Public transportation commuting times are almost always longer than private transport commuting times, especially in developing countries.

In order to build a transit-oriented city, public transportation would need to be a more attractive mode of choice for personal transport.

It is therefore important to develop a transit system which can reduce travel time within the City of Kigali.

To ensure that the average commuting time is met, the public transport network must be easily reached by walking from around the city.

ENABLING STRATEGIES

- Develop a high quality mass-transit system which is easily accessible and segregated from road traffic
- Develop a supplementary public transport system which maximises transit route coverage
- Adopt Intelligent Transportation Systems to enhance service reliability

3.2 SPECIFIC GOAL 2: TO ESTABLISH A COMPREHENSIVE TRANSPORT SYSTEM

The different transit systems in Kigali would need to be integrated into a comprehensive transport system so that all road users benefit from the improvements proposed in the City.

Due to the City's relatively undeveloped road network, there is scope for the City to revitalise the road network with optimised alignments and more permeable links.

In addition, the population growth has placed Kigali in a good position to implement mass transit systems to both cope with the growing population and also encourage economic growth.

There are three objectives set in order to achieve this specific goal:-

1. To construct urban roads to a minimum density of 6km per square kilometre
2. To provide seamless intermodal transport connectivity from all modes of transit, especially private vehicles to public transport, and
3. To construct intercity freight routes and infrastructure

The achievement of these specific goals may be supported by three physical development plans, which are:-

- The Proposed Road Network Plan
- Proposed Public Transportation Plans
- Proposed Freight Management Plan

3.2.1 OBJECTIVE 3: CONSTRUCT URBAN ROADS IN KIGALI TO A MINIMUM DENSITY OF 6KM/KM^2

In the current situation, most of the roads in Kigali are unpaved, and density of paved road network is not on par with international standards.

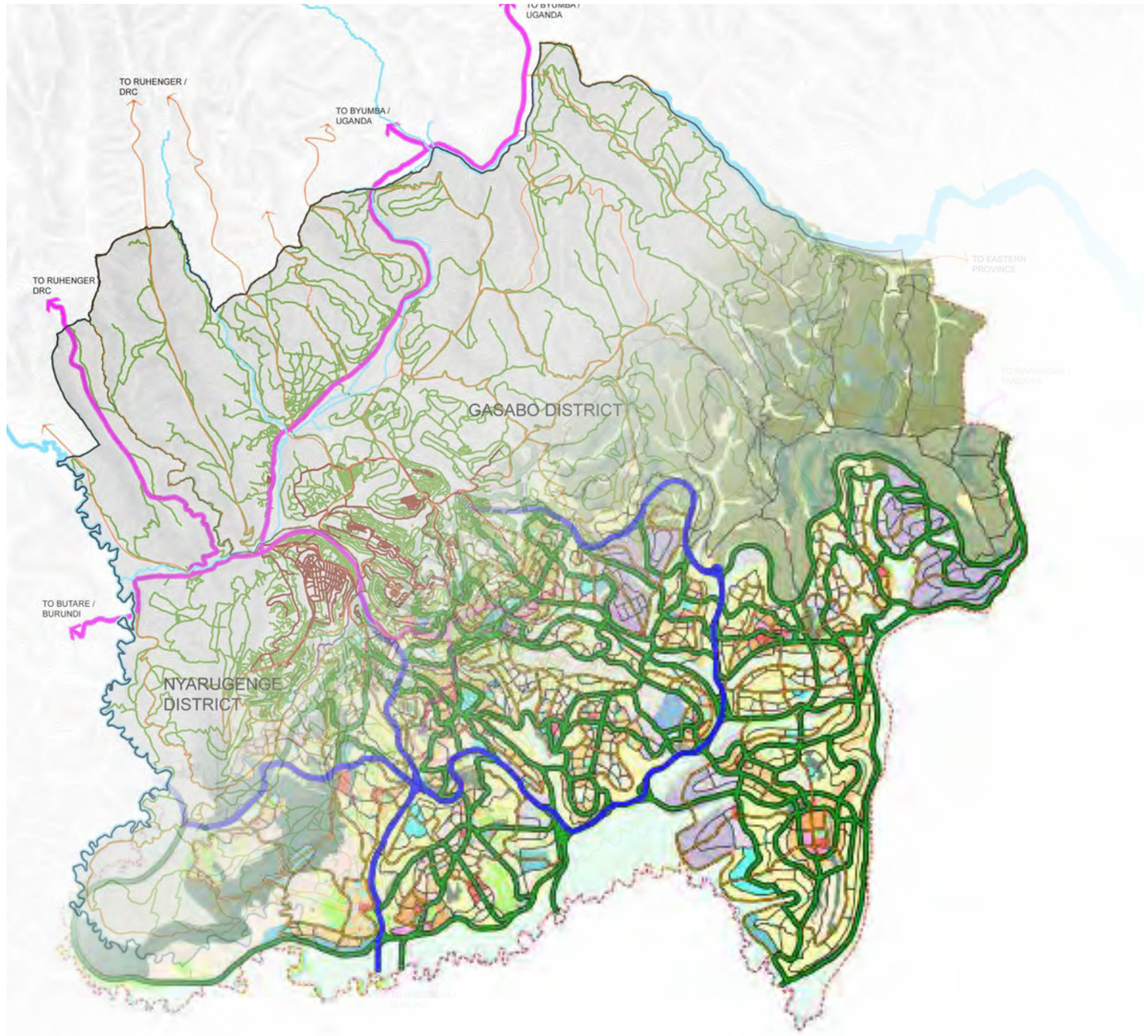
The construction of urban roads in Kigali would elevate the economic and social aspects in the City. Density of the urban roads normally correlate with a permeable and gridded network, which is ideal for a city. Many of the planned cities in United States are laid out in grid form, and are easily adaptable for public transit.

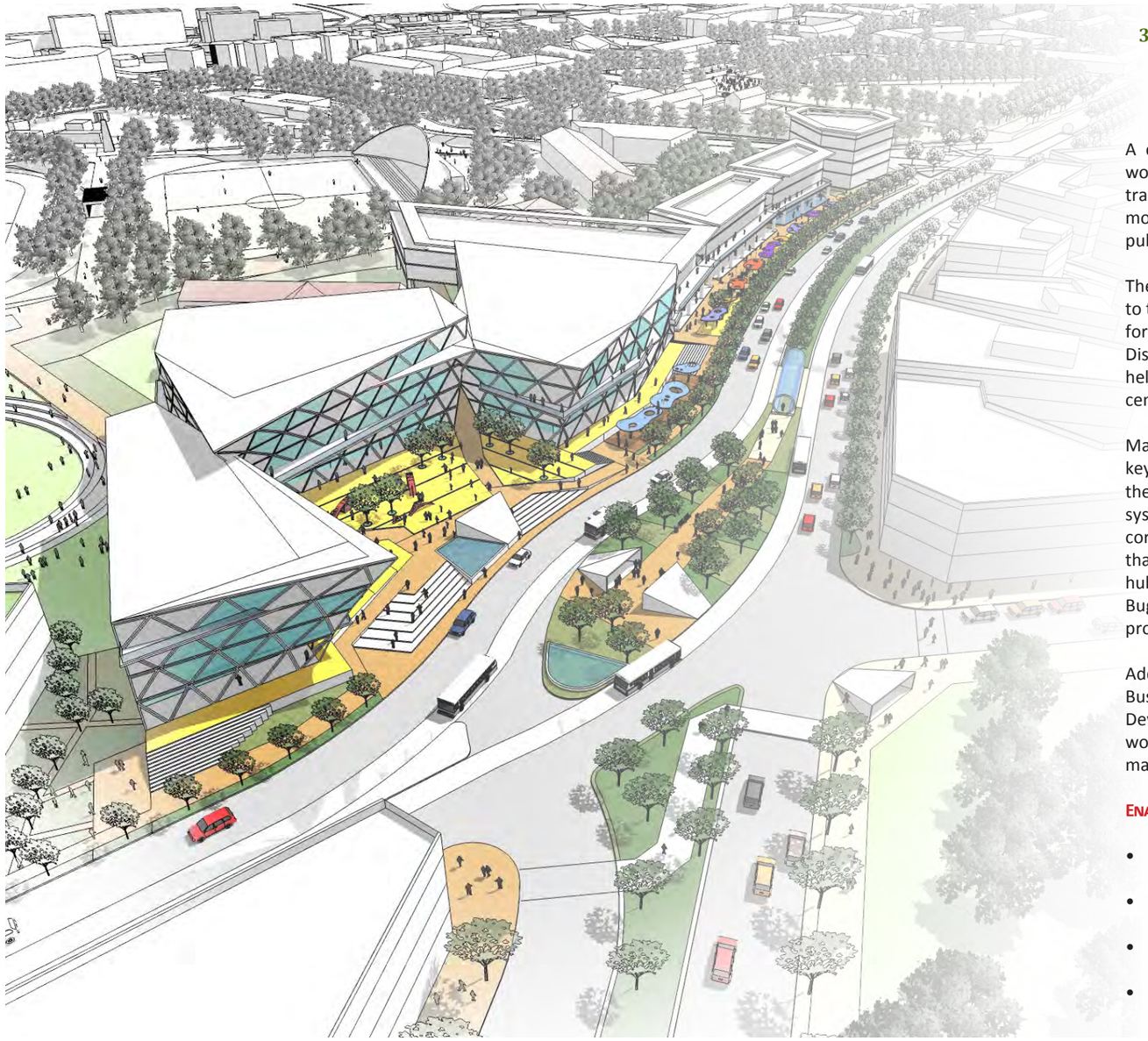
In the context of Kigali, the urban roads would be developed based on the hub-and-spoke model, and be designed to cope with road capacity issues.

As these roads would be newly paved, there is opportunity to ensure that during construction of these roads, non-motorised transport infrastructure is included.

ENABLING STRATEGIES

- Develop a ring and radial system of highways for Regional Travel
- Develop a High Capacity Urban Roads Network for high mobility within the City
- Provide a Non-motorised Transport Network along Arterial and Collector Roads





3.2.2 Objective 4 Provide Seamless Intermodal Transport Connectivity

A comprehensive strategic road network would aim to provide seamless intermodal transport connectivity between transit modes, particularly between private and public transport.

There is a need for private transport trips to transfer onto public transport, especially for trips heading into the Central Business District and Regional Centres. This would help alleviate congestion in the urban centres.

Mass Transport Corridors are one of the key features in the City, as they would form the backbone on which the mass transit systems (BRT or MRT) would travel. These corridors would be designed in such as way that they pass by rail and air transportation hubs such as the Kigali Airport, the new Bugesera International Airport and the proposed Rail Freight Terminal.

Additionally transport hubs such as Intercity Bus Interchanges and Transit-oriented Developments with public car parking would be built along these corridors to maximise their use as connecting stations.

Enabling Strategies

- Locate Transport Hubs along Major Arterial Roads with BRT
- Integrate Rail and Air Transport with the Road Network
- Connect Regional Centres with Mass Transport Corridors
- Connect Intercity Bus Interchanges with Public Transport and BRT

3.2.3 Objective 5: Integrate Intercity Freight Routes and Infrastructure

The use of the National Roads through Kigali for the purposes of freight would not be ideal in the urban centres.

This is because freight traffic are the primary cause of road deterioration which in turn increases maintenance costs.

The redirection of freight traffic onto a freight route/network which segregate freight traffic and city traffic is ideally the best arrangement for the City.

Several logistics hubs may be required as part of the Freight Management Plan for the City.

The Freight Management Plan can also identify the route for which freight traffic can travel into the city.

Enabling Strategies

- Locate Logistics Hubs in the fringes of the City
- Locate Intermodal Logistics Hubs where necessary
- Provide a High Capacity Urban Road Network around the City for through-freight and through-traffic

3.3 SPECIFIC GOAL 3: TO CREATE A SUSTAINABLE TRANSPORT NETWORK

A sustainable transport network is one which is efficient and effective especially when considering environmental impacts of the system.

In the context of Kigali, a sustainable transport network is one where the movement of people maximises the use of green trips, generally defined as walking and cycling trips. For medium to long distance trips, a sustainable network would encourage the use of public transport.

The sustainable network in Kigali would also be expected to serve the social aspects which would be required by the non-motorised transport networks, in the case where pedestrians are prioritised depending on the context of the roads.

To achieve this specific goal, it is envisioned that the City would:-

1. Ensure the provision of non-motorised transport infrastructure in the proposed road plans
2. Ensure that 100% of the public amenities and facilities in the City are served by Public Transport and/or Non-motorised Transport, and
3. Establish a Green Transportation Network and Pedestrian-friendly Streets in Kigali

This would be supported by two physical development plans, namely:-

- Proposed Public Transportation Plans
- Proposed Non-motorised Transport Network Plan

3.3.1 OBJECTIVE 6: INTEGRATE NON-MOTORISED TRANSPORT INFRASTRUCTURE INTO ROAD NETWORK

It has been identified in the previous chapter that non-motorised transport infrastructure are lacking in the City of Kigali especially in the rural areas.

The road cross-sections are not standardised and therefore a large number of the roads in Kigali do not have separate pedestrian and cycle paths.

In addition, there is no cycle network in the City. By inclusion of cycle network design in the road network, many of the longer trips made in Kigali can be replaced by bicycle trips.

There is a need to integrate public transit services with bike facilities so that cyclists can also consider public transit as an intermediate mode for connectivity.

ENABLING STRATEGIES

- Develop a city-wide NMT network which includes cycling and connectivity
- Include Pedestrian and Cycling in the Arterial and Collector Road Networks
- Develop a strategic approach to providing pedestrian amenities such as trees and street furniture
- Develop a pleasant streetscape especially along Green Transportation Network routes

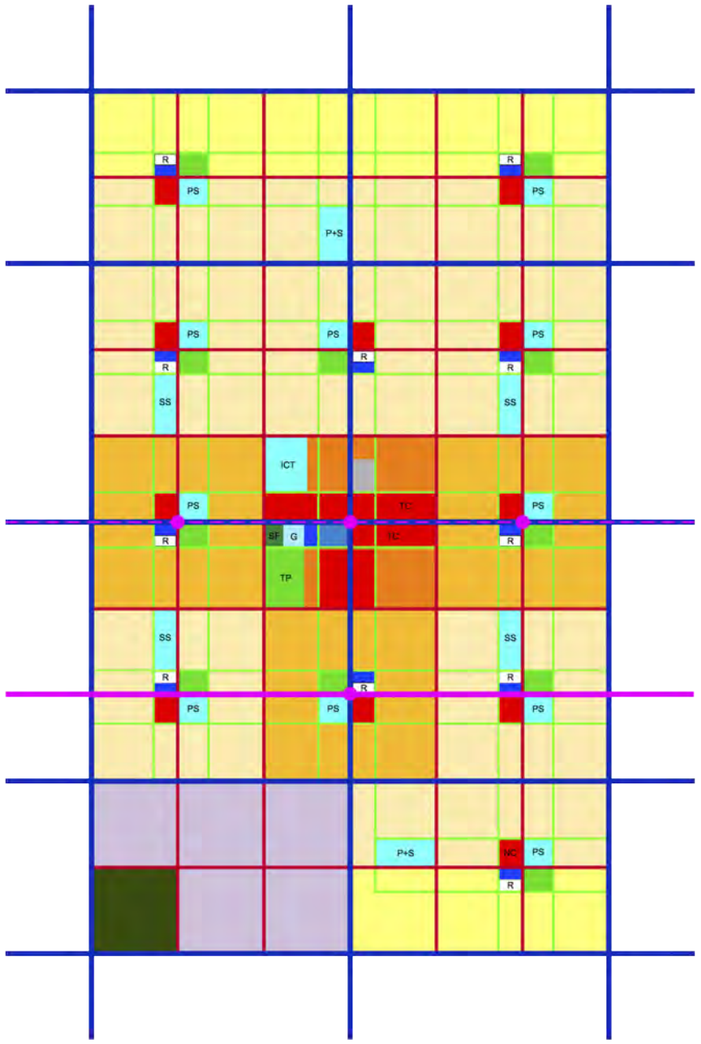


Figure 3.3 Concept Layout of Urban Land Use Plan

3.3.2 Objective 7: Ensure 100% of Public Amenities and Facilities to be served by Public Transport

This objective is to ensure that trips to public amenities and facilities such as schools can be made by public transport and green trips.

Non-motorised transport connectivity is essential from public transport nodes. For example, if the public facilities are located some distance away from the nearest bus stop or transport hub, a well-developed pedestrian link should be present to enable the travel mode transfer.

The public amenities and facilities should be well-served by the primary mass transit network, and where this is not possible, a clear link to the supplementary public transport must be present.

Enabling Strategies

- Develop a well-permeating public transport system into the urbanscape of Kigali
- The locations of public amenities and facilities to be located within regional centres which are well served by public transport

3.3.3 Objective 8: Establishment of Green Transportation Network and Pedestrian-Friendly Streets in Kigali

In addition to the pedestrian and cycling networks along the roads, a green transportation network should be present to connect the pedestrian and cycling networks together.

There are large swaths of forests and open spaces where cycle and pedestrian tracks can be provided, and therefore maintain connectivity between the regional pedestrian and cycle paths.

In the urban settings pedestrian friendly streets would also need to be provided. In these streets, which would mainly be found in the residential and commercial hubs, pedestrians would have priority over vehicles on the carriageway.

Enabling Strategies

- Develop a well-connected Green Transportation Network
- Develop a pedestrian-friendly street design guidance manual for use in residential and urban commercial settings
- Pedestrianise urban core centres where possible

3.4 BENCHMARKING

Performance benchmarks can be seen as an essential stepping stone to higher levels of accountability in the management and evolution of the transport system.

A number of cities with good transportation systems were selected as benchmark for the City of Kigali to identify gaps in the current transport system from Vision for transportation system (see Figure 3.4 and Table 3.5). These cities include Singapore for its world-class land transport system, Curitiba and Bogota for its efficient public transport system. As the vision for the City of Kigali is to become the Centre of Urban Excellence for Africa, Cape Town and London which are the main economic hubs of the sub-Sahara Africa and the world respectively are included in the benchmarking exercise.

These benchmarks can then be used to develop Key Performance Indicators which can subsequently determine the achievement of the TMP's proposed goals.

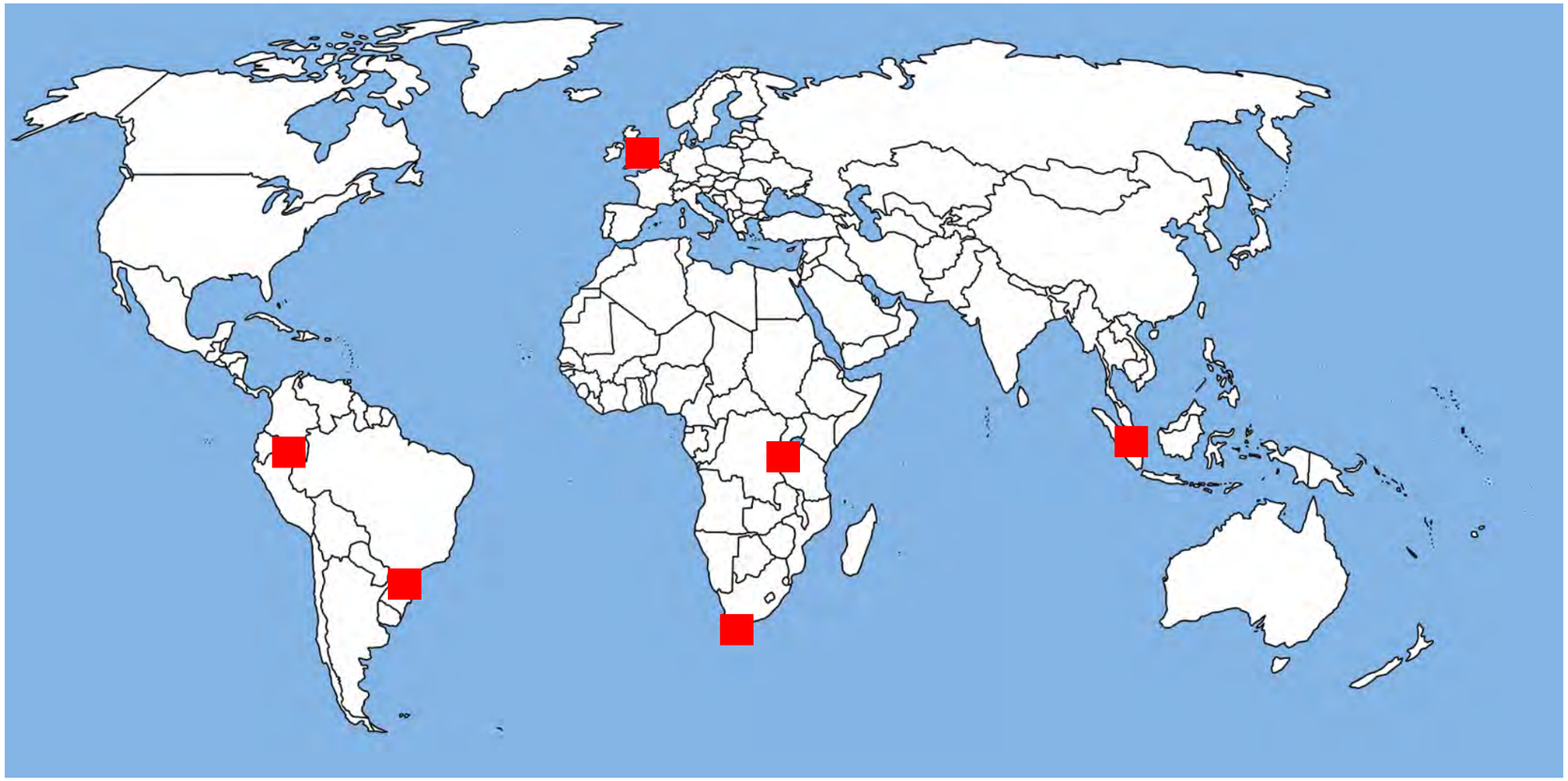


Figure 3.4 Goals of the Transportation Master Plan

Sources:
Airfrance. (n.d.). Bogotá Eldorado Int'l Airport (BOG) Guide | Air France. Retrieved May 15, 2012, from Air France - Destination guides: Welcome: http://travel-guide.airfrance.com/sisp/index.htm?fx=location.airport&loc_id=1065505
Bus lane. (n.d.). Retrieved May 15, 2012, from Wikipedia, the free encyclopedia: http://en.wikipedia.org/wiki/Bus_lane
City of Cape Town. (2011).City of Cape Town Annual Report 2010/11. Cape Town.
City of Cape Town. (2009). Integrated Transport Plan 2006-2011. Cape Town.
Estadísticas Generales. (n.d.). Retrieved May 15, 2012, from TRANSMILENIO S.A.: http://www.transmilenio.gov.co/WebSite/Contenido.aspx?ID=TransmilenioSA_TransmilenioEnCifras_EstadisticasGenerales
Global BRT Data. (n.d.). Retrieved May 15, 2012, from http://brtdata.org/
Karis, B., McCartney, K., Veilleux, J., and Yannes, C.. (2006). Curitiba, Brazil - Transportation Case Study. Hidalgo, D., and Facchini, D. (2010)
Lindau, L., Hidalgo, D., and Facchini. D.. (2010). Curitiba, the cradle of bus rapid transit. Built Environment 36 , 274-283.

Table 3.5 Table of Benchmark Cities (Surbana, 2013)

	Kigali City	Singapore	Cape Town	Curitiba	Bogota	London
Population	965,398 (2009)	5,183,700	City = 827,218	Municipality = 1,764,540	6,840,116	7,825,200
			Metro = 3,497,097	Metro = 3,209,980		
Area (km2)	730 (2009)	710	City = 496.7	Municipality = 430.9	1,587	1,570
			Metro = 2,454.72	Metro = 15,416.9		
Density (per km2)	1,165.80	7,315	City = 1,700	Municipality = 4,062	4,300	4,978
			Metro = 1,400	Metro = 210.9		
National GDP per capita (USD)	605	49,271	8,066	12,789	7,132	38,592
Urban Transport System						
Public : Private	80:20	59:41	48:52	61:39	75:25	57:43
Cars /1000 person	40	114	200	400	Not available	330
Length of Expressway (km)	0	161	Not available	Not available	Not available	60
Percentage of Paved Road	< 20%	100%	Not available	Not available	Not available	Not available
Connectivity from City to international transport terminal (e.g. Airport, international railway station) by driving (min)	Not available	20	20	Not available	40	30-45
Average Commute Time (min)	Not available	36	32	67	35	35 (2006)
Public Transport						
Spacing between bus stops (m)	Not available	400	Not available	880 – 1175	700	Not available
Length of Dedicated Bus Lane (km)	0	178	Not available	244	134	240
Non-motorised Transport						
Length of cycleways (km)	0	116	16	250	300	683
Provision of pedestrian walkway	Currently Ad Hoc	At all development-side of the road	NMT lanes, for both pedestrian and cyclist, run parallel to the new MyCiTi bus lanes	Pedestrian mall at transport hub	All development side of road, pedestrian streets and malls, overhead connection to BRT	At all development-side of the road
Safety						
Fatalities on the Road per 100,000 pop	27.7	3.8	37.8	5.1	7.1	1.6
Environmental						
Carbon Emission (carbon dioxide emission per capita)	1.6	7	City = 11.7	2.1	Not Available	9.6
			Metro = 5.8			

MyCiTi cycleways set new pace for bicycle commuting. (n.d.). Retrieved May 15, 2012, from City of Cape Town official website - local government services: http://www.capetown.gov.za/en/Pages/MyCiTIcyclewayssetnewpaceforbicyclecom.aspx
Nair, P., Kumar, D.. (2005). Transformation in Road Transport System in Bogota: An Overview. The ICFAI Journal of Infrastructure .
Sources (continued):
Transport for London and Camden. (2011). London Cycle Network Plus (LCN+) Annual Report 2009/10. London.
Transport for London. (n.d.). London Airport. Retrieved May 15, 2012, from Transport for London: www.tfl.gov.uk/gettingaround/2558.aspx
Urban Intersections Curitiba | Parking a bike in Curitiba. (n.d.). Retrieved May 15, 2012, from Cultural Library: http://culturallibrary.kisd.de/workshops-and-projects/urban-intersections-curitiba/parking-a-bike-in-curitiba/
Veolia Transportation. (n.d.). Veolia Transportation - Transit - Bus Rapid Transit - Key Contracts - Bogota. Retrieved May 15, 2012, from Veolia Transportation : http://www.veoliatransportation.com/transit/bus-rapid-transit/key-contracts/bogota
World Travel Guide : Official Destination Guides. (n.d.). Retrieved May 15, 2012, from Cape Town International

Table 3.6 Key Strategies and Performance Indicators

Specific Goals	Objectives	Key Strategies	Key Performance Indicators	Remarks
Goal 1: To become a Transit Oriented City	Public/Private Transport Modal Split of 70:30	Develop a high quality mass-transit system which provides good coverage, and direct, fast and frequent services	80% of Urban Areas to be within 2km (or 30 minutes walk) of the Mass Transit Lines	-
		Develop a road network that supports mass transit systems	Mass Transit Corridors to connect all major Regional Centres	-
		Supplementary Public Transport/Feeder Systems which work in conjunction with the mass-transit systems	100% of Urban areas to be within 500m (or 10 minutes walk) from Feeder Bus Systems	-
	Average Public Transport Commuting time of 60 minutes	Develop a high quality mass-transit system which is easily accessible and segregated from road traffic	Mass Transit Corridors to connect all major Regional Centres	-
		Develop a supplementary public transport system which maximises transit route coverage	100% of Urban areas to be within 500m (or 10 minutes walk) from Feeder Bus Systems	-
		Adopt Intelligent Transportation Systems to enhance service reliability	Adoption of ITS Technologies for use in Public Transport	-
Goal 2: To establish a Comprehensive Strategic Road Network	Construction of Urban Roads to a minimum density of 6km/km²	Develop a ring and radial system of highways	Urban Density of Major and Minor Arterial Roads to exceed 2km/km²	Average Arterial Road Density for 17 international cities of 2km/km² (Barter, 2000)
		Develop a High Capacity Urban Roads Network	5% of the Road Network to be High Capacity Urban Roads	Singapore's Ratio is 4.7%
		Provide a Non-motorised Transport Network along Arterial and Collector Roads	100% of Arterial and Collector Roads to have NMT infrastructure	-
	Seamless Intermodal Transport Connectivity	Locate Transport Hubs along Major Arterial Roads with BRT	Provision of Transport Hubs in Regional Centres	-
		Integrate Rail and Air Transport with the Road Network	Rail and Air Transport to be within 1km of BRT Network	-
		Connect Regional Centres with Mass Transport Corridors	Mass Transit Corridors to connect all major Regional Centres	-
		Connect Intercity Bus Interchanges with Public Transport and BRT	Provision of Transport Hubs at major Transit Intersections	-
	Construction of Intercity Freight Routes and Infrastructure	Locate Logistics Hubs in the fringes of the City	Logistics Hubs to be located near HCUR in edge of City	-
		Locate Intermodal Logistics Hubs where necessary	Intermodal Logistics Hubs to be located near Air and Rail Transit Links	-
		Provide a High Capacity Urban Road Network around the City for through-freight	Alignment of HCUR to suit through-freight routes	-

Table 3.7 Key Strategies and Performance Indicators (Continued)

Specific Goals	Objectives	Key Strategies	Key Performance Indicators	Remarks
Goal 3: To create a Sustainable Transport Network	Integrated Non-motorised Transport Infrastructure	Develop a city-wide NMT network which includes cycling and connectivity	Development of NMT Network and Cycle Network	-
		Include Pedestrian and Cycling in the Arterial and Collector Road Networks	Inclusion of NMT in Road Hierarchy Design	-
		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 Green Network routes	Inclusion of NMT Network along Green Connectors	-
	100% of Public Amenities and Facilities served by Public Transport	Develop a well-permeating public transport system into the urbanscape of Kigali	Reorganisation of the Public Transport Network	-
		The locations of public amenities and facilities to be located within regional centres which are well served by public transport	Mass Transit Corridors to connect all major Regional Centres	-
	The Establishment of Pedestrian Zones and Complete Streets	Develop a well-connected Green Transportation Network	Reservation of Green Connectors within City	-
		Develop a pedestrian-friendly street design guidance manual for use in residential and urban commercial settings	Commission of Road Design Manuals and Guidelines	-
		Pedestrianise urban core centres where possible	Commission of a Pedestrianisation Project in Kigali	-

Table 3.6 and Table 3.7 show the proposed KPIs and targets set for each goal discussed in Sections 3.1 to 3.3.

The KPIs are indicators showing the progress or performance of the transportation network compared to a target set by the City. The Transport Authority needs to investigate in detail the needs of the City so that the KPI targets are revised to more attainable levels.

For the purpose of this TMP, the proposed KPIs are based on the benchmark cities as identified.

Some of these objectives fulfil more than one of the goals of the Master Transport. To help with the formulation of strategies, the KPIs will be described in the strategies section.

The strategies formulated for each objective support the transportation plans in the next chapter.

Figure 2.23 illustrates how each objective influences the transportation plans in the TMP.

Table 3.8 Objectives to be achieved by Proposed Plans

Transportation Plans	Objective 1	Objective 2	Objective 3	Objective 4	Objective 5	Objective 6	Objective 7	Objective 8
	Public/ Private Transport Modal Split of 70:30	Average Public Transport Commuting time of 60 minutes	Construction of Urban Roads to a minimum density of 6km/km²	Seamless Intermodal Transport Connectivity	Construction of Intercity Freight Routes and Infrastructure	Integrated Non-motorised Transport Infrastructure	100% of Public Amenities and Facilities served by Public Transport	The Establishment of Pedestrian Zones and Complete Streets
Proposed Road Network Plan	✓		✓		✓			
Rail and Intercity Plan				✓				
Rapid Transit Plan	✓	✓	✓					
Supplementary Public Transport Plan	✓	✓				✓		
Transport Hubs and Infrastructure Plan	✓	✓		✓		✓		
Proposed Freight Management Plan					✓			
Proposed Green Network Plan				✓			✓	✓

3.5 APPLICATIONS OF STRATEGIES

The key strategies which have been laid out to assist in the achievements of the objectives have been identified in the previous section.

In this section the strategies are grouped according to the proposed transportation plans and applied accordingly.

There are four main sectors of improvement, namely:-

1. Proposed Road Network
2. Proposed Public Transportation
3. Proposed Freight Management and
4. Proposed Green Transportation Network

3.5.1 PROPOSED ROAD NETWORK STRATEGIES

- Develop a road network that supports mass transit systems
- Develop a ring and radial system of highways
- Develop a High Capacity Urban Roads Network
- Connect Regional Centres with Mass Transport Corridors

Three applications of the strategies were formulated:-

- Proposed Road Hierarchy Matrix
- Hub-and-Spoke Distribution System
- High Capacity Urban Road Network

PROPOSED ROAD HIERARCHY MATRIX

A road hierarchy matrix which supports different uses of roads is required. The Road Hierarchy would be applied to a proposed road network which supports the land use through the identification of Mass Transit Corridors between Regional Centres.

It is important to shift the focus of transportation from private transport, such as cars, towards public transportation, non-motorised and shared modes of travel such as buses, taxis, mass transit systems and a comprehensive pedestrianised and cycle network.

The classification of Gazette No. 4 defines four types of roads, which in this report has been assumed to define place functions:-

- National Roads
- Class 1 Roads
- Class 2 Roads
- Specific Roads

These roads are tabulated against four classes of roads based on the capacity as follows:-

- High Capacity Urban Roads
- Major Arterial
- Minor Arterial
- Collector Roads

A Place/Mobility Matrix is proposed for adoption by the City. Figure 3.9 shows the different types of Roads and where they fall within the Place/Mobility Matrix.

For the purposes of the initial Transportation Master Plan, the matrix identifies 8 general road uses which fall within the classification. The matrix is non-exhaustive, i.e. more road uses can be developed and adapted within this matrix.

The feasibility study has identified different road types to be adopted within Kigali. The number of road types can be increased to suit, and may be amended to suit the existing road reserve, or construction setting. Further information can be found in APPENDIX A.

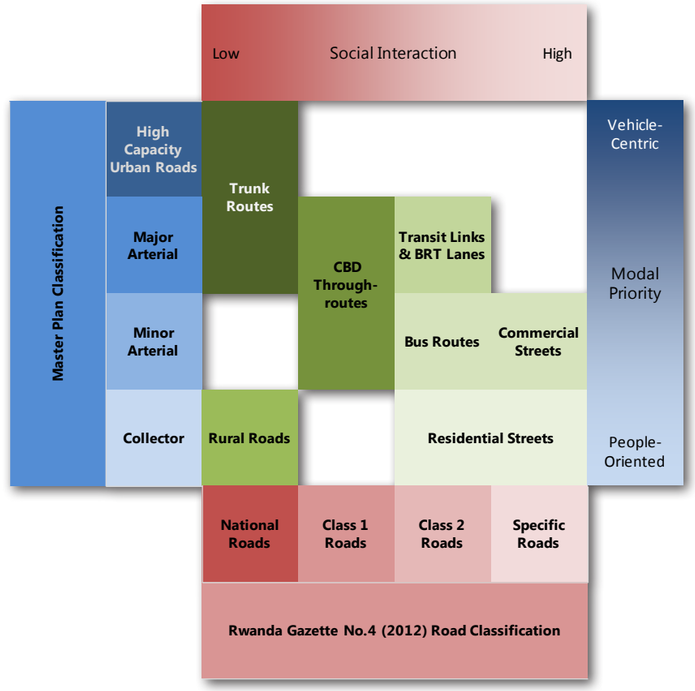


Figure 3.9 Proposed Road Hierarchy based on Rwanda Gazette and Master Plan Classification

High Capacity Urban Roads– Trunk Route

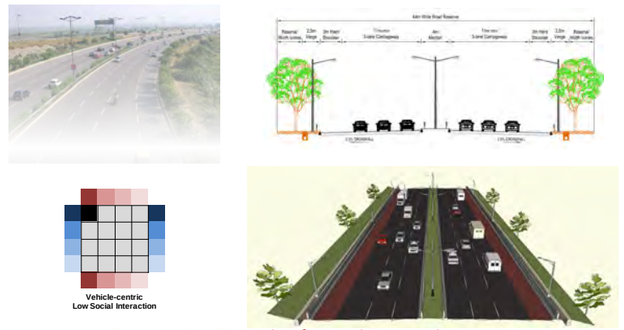


Figure 3.10 Example of a Road Type in the Matrix

HUB-AND-SPOKE DISTRIBUTION SYSTEM

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 CBD and other local urban centres can be represented by hubs, and connections between the surrounding areas and the hubs can be considered as the spokes.

Interurban Connectors can also originate from outside the City, and connect to the Urban Centres.

This system is designed to minimise the number of routes between key nodes and other hubs. This system is ideal especially in 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 maximising utility.

There are three levels of urban centres considered in the current master plan:-

- City Centre serving intra-CBD travel and inter-city travel
- Fringe Centres serving travel within fringe areas and to City Centre
- Regional Centres serving travel within suburban and rural areas and to City Centre

The area of influence of the hub, also known as the catchment area, is the region where the people or goods flow in and out of the hub. In Kigali, the inhabitants of the surrounding residential areas congregate around the urban centres before going to their destinations. The BRT lines shall be planned to ensure that these are linked in order to work more efficiently.

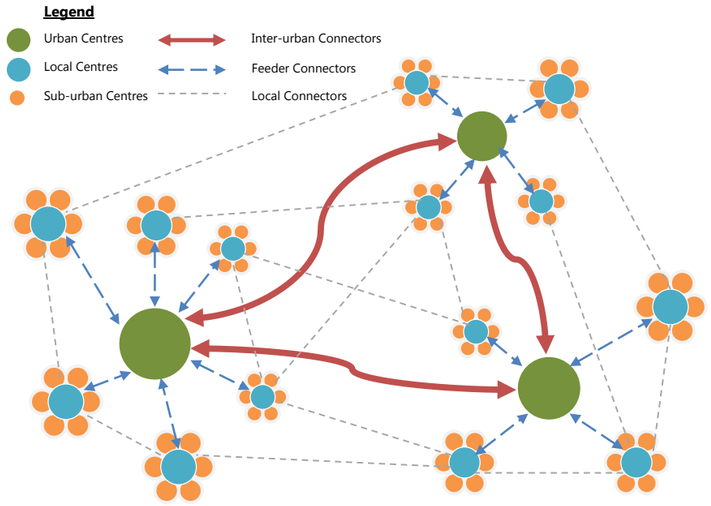


Figure 3.11 Hub and Spoke Mechanism

Figure 3.12 Linking Urban Centres with High Capacity Urban Roads

HIGH CAPACITY URBAN ROAD NETWORK

Inter-urban centre travel will need to be facilitated by both private and public transportation. The TMP identifies potential routes for connecting the Urban Centres and intends to develop these as part of the high capacity urban road network.

The High Capacity Urban Roads, or HCUR for short, are intended for use by motorised vehicles only, and serve a specific purpose of providing a high level of movement.

These routes would be suitable for international and regional freight, and at the same time, provide a high level of connectivity for inter-regional public transport, such as express buses from other cities or regional hubs.

Figure 3.13 Location of Proposed Rail Interchange and Existing Airport in Kigali in 2040

3.5.2 Proposed Public Transportation Strategies

- Develop a high quality mass-transit system which provides good coverage, with direct, fast and frequent services, and is easily accessible and segregated from road traffic
- Supplementary Public Transport/ Feeder Systems which work in conjunction with the mass-transit systems
- Develop a supplementary public transport system which maximises transit route coverage
- Locate Transport Hubs along Major Arterial Roads with BRT
- Integrate Rail and Air Transport with the Road Network
- Connect Intercity Bus Interchanges with Public Transport and BRT
- Develop a well-permeating public transport system into the urbanscape of Kigali
- The locations of public amenities and facilities to be located within regional centres which are well served by public transport

Four applications were formulated based on the above strategies, which are:-

- Rail and Intercity Connectivity
- Mass Transit Corridors
- Transport Hubs
- Good Coverage of Public Transport

Rail and Intercity Connectivity

Intermodal trip exchanges would be required for trips originating from outside the City, especially by rail, air or public transport.

It is therefore part of the strategy to ensure that rail and air intermodal connectivity is maintained in the City.

As part of the public transportation network, it is vital for the mass rapid transit and public transport systems to serve these intermode hubs.

Rail is expected to play a major part in freight transit in Kigali in the future, especially once the East African Railway Network is built. Due to its connectivity to a coastal port, it is therefore envisioned that the rail interchange would be a major industrial and logistic areas.

By ensuring that the mass transit system connects to the rail interchange, the workforce can therefore rely on public transport to get to their work place.

Similarly, by connecting the mass transit system to the existing and future airports, it provides a convenient and speedy mode of transport to and from the airports.

Mass Transit Corridors

Current applications and developments in public transport have identified Mass Transit systems to be efficient in use in cities with high density. Kigali's population of 5 million people in 2040 justifies the development and construction of a mass rapid transit system.

In this Master Plan, the use of Bus Rapid Transit and light rail Mass Rapid Transit was examined. It was determined that while both were viable options, the Bus Rapid Transit was more financially viable in the short to medium term. The MRT system option could be revisited once a BRT system is running and the demand for a MRT can be justified. In the land-use masterplan, reservation of land for use for the MRT will ensure the viability of the MRT project if it is required.

While an MRT system is ideal for transporting large numbers of passengers, an upgrade of the BRTs to trams should also be considered during the feasibility study. Trams are more efficient compared to BRTs as they are tracked, and can be automated with little difficulty. The automation can result in increased frequency, which increases capacity. While trams run slower than light rail systems, existing BRT lanes can be retrofitted for trams. The vertical alignments of trams and buses are similar, and in addition to that, buses can run in conjunction with trams on the same line. It is recommended that in the future upgrade phases, a tram system should be investigated alongside the MRT system.

Transport Hubs

Intermediate transport hubs with transit facilities such as BRT stations, bus stops, public parking and cycle parking would be required in the City of Kigali in the future to encourage intermodal trips.

These transport hubs can be built as stand-alone hubs, or can also be integrated into commercial and industrial complexes.

These hubs can then be further developed for intercity bus services or pedestrian-friendly links to urban areas, and can be seen to be a positive influence in public transport.

Good Coverage of Public Transport

In order to sustain demand for using public transport, accessibility should be made available across the City of Kigali via feeder systems, such as local buses, mototaxis etc which provide services to and from urban residential centres.

To some extent, the availability of these systems should be present at all times so that it can be a viable alternative to personal motorised transportation.

In addition to providing supplementary support to the Mass Transit systems, existing public transport such as mototaxis, can be accommodated as part of the supplementary system before being phased out. However, the phasing will need to take place in stages as they will need to supplement the proposed public transport.

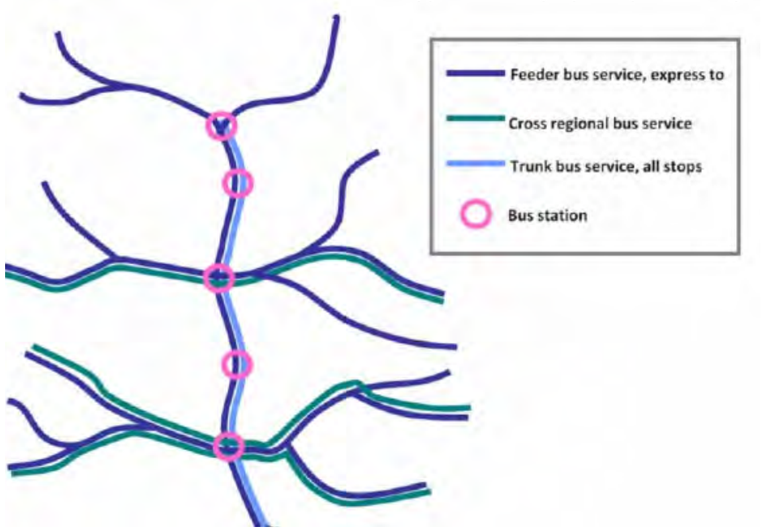


Figure 3.14 Example of how Feeder Buses provide continuity to BRT

Figure 3.15 Access onto Buses from BRT Boarding Stations in Curitiba, Brazil

3.5.3 Proposed Freight Management Strategy

- Locate Logistics Hubs in the fringes of the City
- Locate Intermodal Logistics Hubs near existing and proposed intermodal points of travel such as airports and rail stations
- Provide a High Capacity Urban Road Network around the City for through-freight traffic

In order to achieve the strategies listed above, a realignment of freight routes was developed in conjunction with the High Capacity Urban Road (HCUR) network in mind.

The plans were studied, and several locations for logistics hubs were identified.

Realignment of freight routes

The first exercise examined the existing freight routing in the City of Kigali, and determined the key routes that were greatly affected by through traffic.

The next exercise was to find alternative routes for these traffic movements. This was done at the same as the High Capacity Urban Road alignment exercise so that the routes can be used for freight with little impedance.

This also means that with the construction of the HCUR network, freight travel can also be improved at the same time.

Location of Logistics Hubs in the Fringe of City

After the realignment of freight routes, several locations for logistics hubs were identified.

These hubs not only include for road freight but also for internal modal freight, such as air and rail.

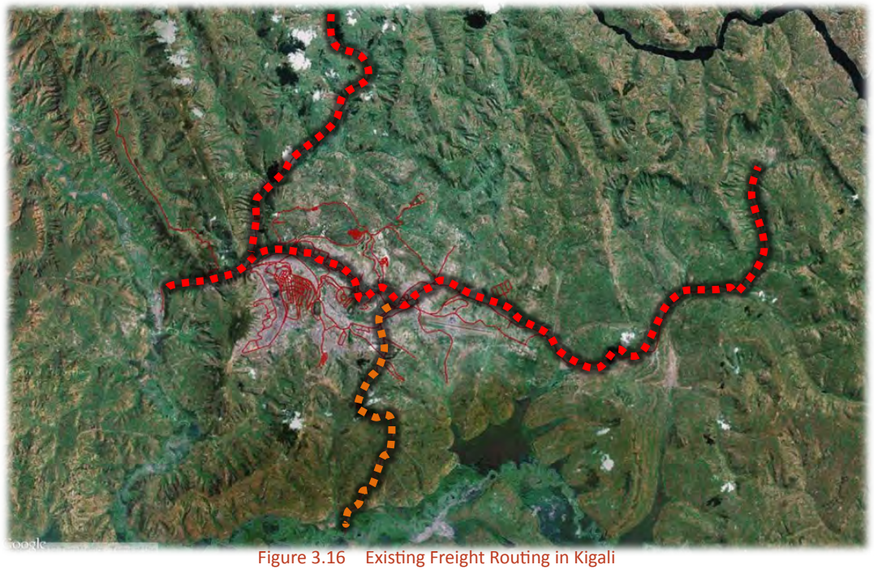


Figure 3.16 Existing Freight Routing in Kigali

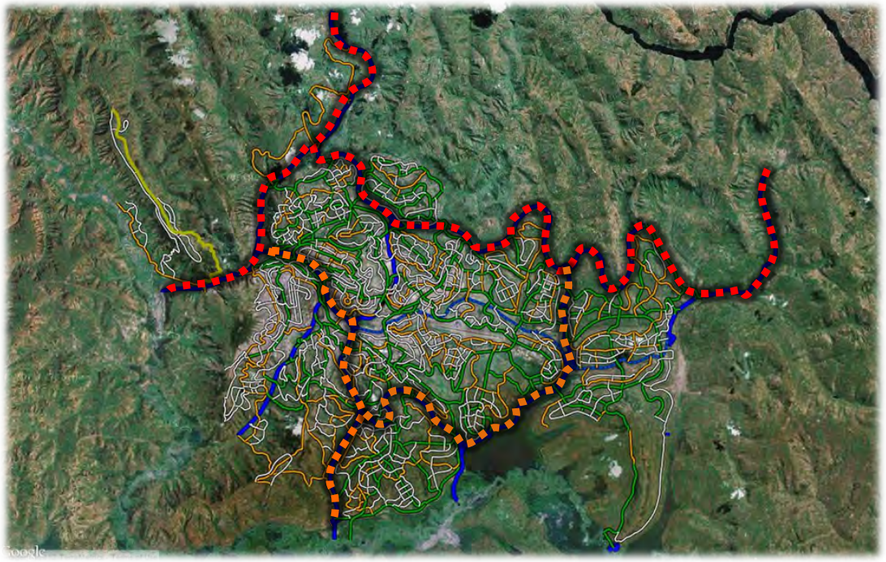


Figure 3.17 Proposed Freight Routing in Kigali in 2025 and beyond

3.5.4 Proposed Green Transportation Network Strategies

1. Provide a Non-motorised (Walking and Cycling) Transport Network along Arterial and Collector Roads
2. Develop a city-wide NMT network which includes cycling and connectivity
3. Develop a strategic approach to providing pedestrian amenities such as trees and street furniture
4. Develop a pleasant streetscape especially along Green Transportation Network routes
5. Develop a well-connected Green Transportation Network
6. Pedestrianise urban core centres where possible

The strategies are applied in the following actions:-

- Provision of a Green Transportation Network
- Integration of Non-motorised Transport infrastructure in Roads
- Streetscape Design Guides and Pedestrianisation

Provision of a Green Transportation Network

There are two primary forms of non-motorised transport – walking and cycling. They are the most common mode of transport in urban settings due to the high density of shops and services within walking and cycling distance.

Currently a significant proportion of daily travel in Kigali City is by foot and to a lesser extent by bicycle. A large proportion of the pedestrian traffic, especially in the AM peak period, is from school children. All motorised public transport users become pedestrians for a certain proportion of their daily journey. This is noticeable at the larger taxi parks in the City where hundreds if not thousands of pedestrians move around the public transport facilities during the peak periods.

A good walking/cycling environment can provide opportunities to practise and maintain a healthy lifestyle.

In a developing city like Kigali, obesity and inactivity are not problems faced by the residents, but may arise in the face of over-reliance on private transport modes. In the future, the provision of a walkable network in Kigali can promote this healthy mode of transport should be promoted where possible.

Figure 3.18 Proposed Cycle/Pedestrian Link Enhancements in Palo Alto, United States

Figure 3.19 Pedestrian and Cyclist Priority as the standard-de-facto in most the Urban Zones of Modern Cities

Integration of Non-motorised Transport infrastructure in Roads

To promote walking in the City of Kigali, pedestrian walkways need to be included in all new and upgraded roads. In addition where crossing occur, safety measures need to be provided to protect the pedestrians from vehicular traffic

Figure 3.19 shows how pedestrian and cyclist facilities have been provided in most of the modern cities. Due to low cost and high benefits, these facilities have become more prominent in the urban landscape.

Within the City of Kigali, cycle routes are to be planned for each urban area, and in the recreational parks in the city. The primary use of the cycle routes within the urban area can be focused on the internal traffic, both for leisure, and can be alternative to short-distance trips.

Due to the hilly topography of Kigali, inter-urban cycle routes are not planned as they can be difficult to manoeuvre. However cycle schemes for inter-urban cycling should not be discounted, and should be incorporated where possible.

In order to promote cycling as a main mode of transport, cycle parking and facilities such as public showers can be included in all new development as part of planning approval, and facilities need to be built to a certain standard to aid the modal choice.

Facilities for pedestrians are being provided with pedestrian footways built on most of the new main/arterial roads.

Ancillary Pedestrian Facilities are those facilities, buildings, or structures adjacent to or directly linked to BRT stations. They can also be stand-alone facilities or structures located within or adjacent to the right of way. These facilitate pedestrian movements.

They can include:

- Overpass or underpass structures, such as overhead pedestrian bridges
- Passenger shelter structures
- Park and Ride facilities (car parks etc)

Streetscape Design Guides and Pedestrianisation

Pedestrian safety is paramount where their movements interact with traffic. Pedestrians need to be greatly empowered in the urban centres. By pedestrianising commercial streets and reducing vehicular traffic in these centres the streets can then be regenerated for pedestrians only. Cars do not necessarily contribute to income generation for shops along the streets. Instead, by providing greenery and returning the road space for use by cafes, the economic benefits are greater.

The provision of non-motorised transport in the City of Kigali will help boost the use of public transport, hence provide support and much-needed funding for public transport systems.

The inclusion of non-motorised transport infrastructure as part of legislation will enable the city to become more pedestrian- and cyclist-friendly, which in turn will help with the ultimate goal of green and sustainable transport in the future.

The people of Kigali can benefit greatly from a healthy lifestyle, and at the same time enjoy a much better urban environment free of pollution and cars.

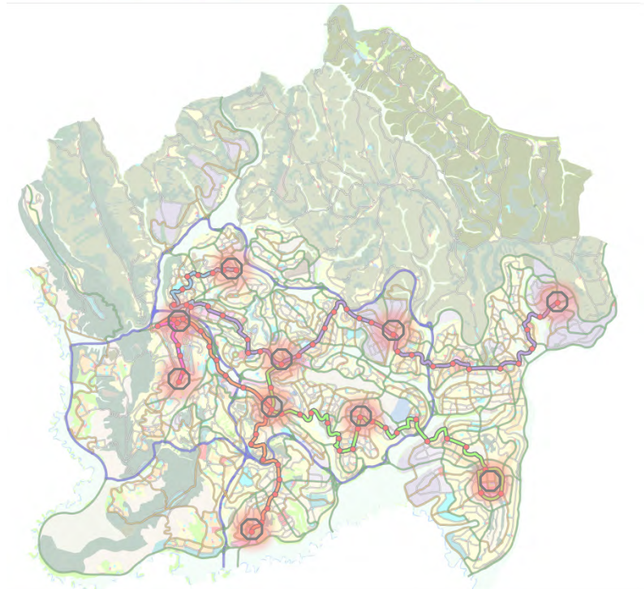
The recommended interim guidance for the urban road design is the Manual for Streets (DfT, 2007) and Manual for Streets 2 (DfT, 2010) which explain key design concepts in the provision of road space for non-motorised users and public transport users.

Figure 3.20 Pedestrian Crossing Enhancement at Oxford Circus, London

Figure 3.21 Creation of Cul-de-sacs by closing Roads

Figure 3.22 Pedestrianised Streets in City Centres

4 KIGALI CONCEPT TRANSPORTATION DEVELOPMENT PLANS



Following the strategies that have been formulated in Chapter 3, the transport plans for the City of Kigali were developed.

There are a total of seven physical transport plans proposed as a result of the strategies, namely:-

- Road Network Plan
- The Public Transportation Plans, consisting of:
  - Rail and Intercity Plan
  - Rapid Transit Plan
  - Supplementary Public Transport
  - Transport Hubs & Infrastructure Plan
- Freight Management Plan
- Green Transport Network Plan

The plans are inter-related with land-use planning, and are formed with the base land-use plan provided by the Master Plan 2040.

These plans are to be reviewed in the near future when conducting detailed studies. These plans are highly dependent on feasibility studies, and are presented in this report for reference only.

4.1 PROPOSED LAND USE MASTER PLAN 2040

4.1.1 POPULATION AND TRAFFIC GROWTH

The basis of this TMP is the Land Use Master Plan 2040 which identifies the use of land in the City by the year 2040.

In the Master Plan, land parcels have been classified into many uses, such as residential, commercial, industrial, and civic facilities. Based on this land use plan (Figure 3.1), the commercial urban and residential areas have been identified. These areas are considered transport 'zones', which means they would generate or attract trips, whether vehicular or otherwise, depending on the time of the day.

Having identified these zones, investment on the transit networks for key areas of Kigali can be sensibly appropriated.

For the development and assessment of the future road network, the commercial and industrial hubs are considered as employment centres, and residential zones considered as workforce generators.

4.1.2 PROPOSED BROAD LAND USE PLAN 2040

The socio-economic study projected the City's population at between 4 to 5 million by 2040. To meet this increasing demand for urbanization, the urban area within the City is proposed to be expanded by two and half folds based on the available developable land.

The broad land use plan for 2040 shows the ultimate development envisioned for the Kigali City. The key land use proposals are:

- To expand and strengthen the City Centre by allowing high density commercial and vibrant mixed use developments with premium office, retail, hotel and residential developments
- To introduce regional level commercial areas in the Fringe Towns and the new townships in suburban areas
- To safeguard land for consolidated Industrial Estates for general industries
- To establish an efficient highway grid and arterial system ensuring the long-term regional connectivity and internal linkages
- To redevelop existing dense unplanned settlements into medium-rise residential zones in the urban-fringe area
- To develop medium rise residential townships in sub-urban sectors with integrated public facilities and light industrial developments
- To conserve nature areas such as forests and wetlands, and protect steep slopes through afforestation
- To introduce iconic civic developments, entertainment venues, regional recreation and tourism destinations
- To provide land for farming in the unbuildable areas
- To develop key infrastructure and supporting facilities such as the Environmental Treatment Zones, cemetery, Bus Terminals, etc

Figure 4.1 Proposed 2040 Land Use Plan

PROPOSED DISTRIBUTION OF DENSITY

In the proposed land use plan, 43% of Kigali City's land is proposed to be urbanized in order to accommodate the long term population growth. Although, the amount of land consumption is multiple-fold compared to the present scenario, the urban land will fall short if the population densities remain mismanaged. Hence, taking a much compact and sustainable development approach, the average urban density for Kigali in 2040 is proposed to be at 16,000 persons/ sq km.

The density distribution plan (Figure 2.13) shows the different urban densities that are proposed for the three restructured urban areas.

City Centre

The City Centre area is the most strategic area and prime in terms of real estate value. While the City Centre will accommodate major regional level commercial uses and civic facilities; it is essential to encourage the high density residential development in the City Centre in order to provide homes close to the major job centre of the City. Hence, a higher urban density of 30,000 persons per sq. km is proposed for the City Centre Area. With this proposed density, the City Centre is able to accommodate 480,000 people, which is around 10% of the City's population.

Fringe Area

Being sited around the immediate vicinity of the City Centre, the urban fringe area will also remain as prime land for residential uses. The majority of Kigali's population is expected to live in the urban fringe and hence, the City's fringe density is proposed to be 22,000 persons/ sq km. The urban fringe is able to accommodate 1.4 million people which are almost a third of the total City's population.

Sub-urban Area

It is realized that the current trend of developments is quite low in density and with such low urban densities, it will not be possible to meet the City's future urban land demand. Hence, the developments in suburban areas are also proposed to be intensified and supported with integrated public facilities. The gross urban density proposed for the suburban areas is 18000 persons per sq km. With this density, 60% of City's population will be living in the suburban townships. The suburban areas will be organized as a series of high density townships. Various large employment nodes such as industries, regional centres will offer employment in these areas, thus reducing the need to commute to the City Centre for work.

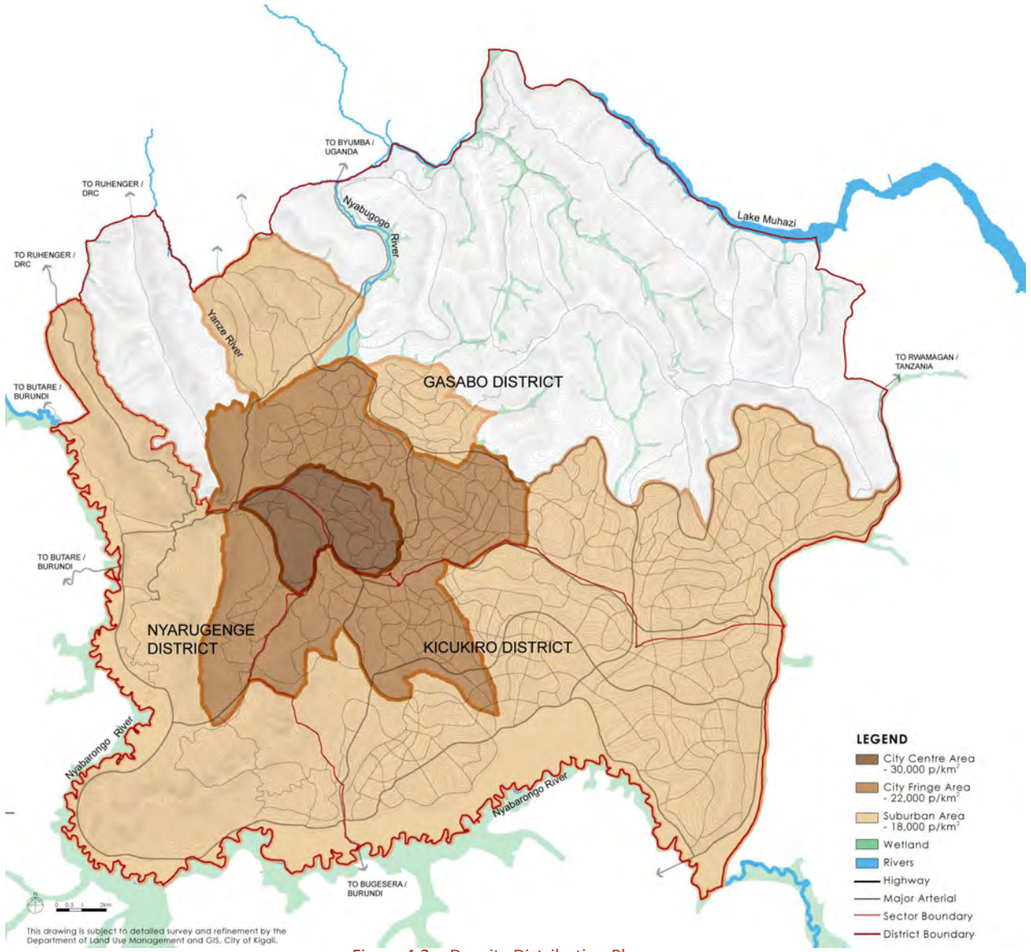


Figure 4.2 Density Distribution Plan

PROPOSED DISTRIBUTION OF TOWNSHIPS

The existing urban areas are largely spread over 17 sectors and almost half of the City's urbanized area is unplanned. While there are a few new development projects that are proposed as cluster housing development, majority of the developments are developed individually. To move away from such small-scale and individual-plot based developments, it is proposed to organise the existing and new growth areas as integrated townships with a range of comprehensive facilities.

Proposed Township Model

Kigali City is proposed to be restructured into twenty-four self-sufficient townships. The majority of these townships are proposed to be served by public transit corridor which is also the main structuring element of these townships. The typical township size proposed for Kigali is around 900 to 1000 hectares accommodating an average population of 200,000 residents each.

Generally the townships are organized along the topography and one to two hills constitutes one township entity. Arterial roads form the township boundary and BRT corridors define the main central spine. The central spine holds commercial uses and major facilities with maximum density.

The township model illustrates the key concept for typical new towns. The higher density residential neighbourhoods are proposed around the town centre and in areas around the walking distance of the public transit corridor. The density is proposed to gradually lower in the areas away from the transit corridor.

All the townships are proposed such that it ensures the walkability within its smallest neighborhood cells with key facilities such as neighbourhood centres, primary schools and local parks located within walking distance of the residents. Other than town level commercial needs, town facilities such as the Vocational Training Institute, Polyclinic, Bus Interchange, Sports Field, Town Park, Cemetery and Light Industrial Estate, etc are proposed to be safeguarded in each township. Low density residential areas are proposed at lower slopes, near the scenic wetlands with quick access to the highway network.

Proposed Township Boundaries

The township boundaries are determined based on the following criteria:

- The township boundaries are based on the natural boundaries and geographically conglomerated urban areas.
- The township boundaries follow the respective sector boundaries where possible.
- The developable urban areas are divided by the highway grids of 3-6 kilometres and major arterial roads spaced at 800 to 1200 meters. The township boundaries at some areas are influenced by these road networks

Proposed Distribution of Population

For the proposed density distribution, 95% of the projected population are to be redistributed amongst the City Centre and 25 urban townships in city fringe and suburban areas. The remaining population is expected to be distributed in the rural sectors of Kigali. The proposed population distribution by district is shown in Figure 4.4.

By population, the township size ranges from smaller townships of 80,000 to 100,000 people in Kanyinya (N1), Northern Mageragere (N4), Western Ndera (G5), Southern Gatenga (K2) and Northern Kanombe (K6); to larger townships such as the ones in Nyamirambo (N3), Kimironko (G4), Kicukiro (K3), Gahanga (K4) and Masaka (K11) which accommodates 200,000 to 350,000 population. These larger townships play a much larger role at regional level in terms of commercial distribution and hence, are substantiated with larger population catchments.

Proposed Distribution of Employment

Kigali City currently offers a total of 500,000 jobs in services, industrial and other sectoral employments. Majority of these jobs are around the City Centre with some employment in other scattered industrial and commercial areas. The proposed employment distribution by district is shown in Figure 4.5.

The socio-economic study projected that the labour participation in the City will be 46% in the year 2040. This requires the City to provide 2.3 million jobs in the long term based on a projected population of 5 million.

The Broad Land Use Plan proposes to cater for the projected job requirements through the establishment of well-distributed new employment nodes around the city in close proximity to townships.

20% of the City's service jobs are proposed to be provided within the City Centre. Additionally, 13% of the service and light industrial jobs are proposed to be provided in the surrounding Fringe Towns. The proposed general industrial estates are expected to provide 400,000 jobs in manufacturing and logistics industries.

Further to this, the new self-contained townships in the suburban areas are proposed to provide 36 % of the City's jobs, thus supporting a decentralized job distribution and ensuring significant local employment. Additional employment is also provided by several other commercial uses along the airport boulevard, resorts in Gahanga and Lake Muhazi, and Business Park at Gikondo.

Figure 4.3 Proposed Township Plan

Figure 4.4 Proposed Population Distribution by District

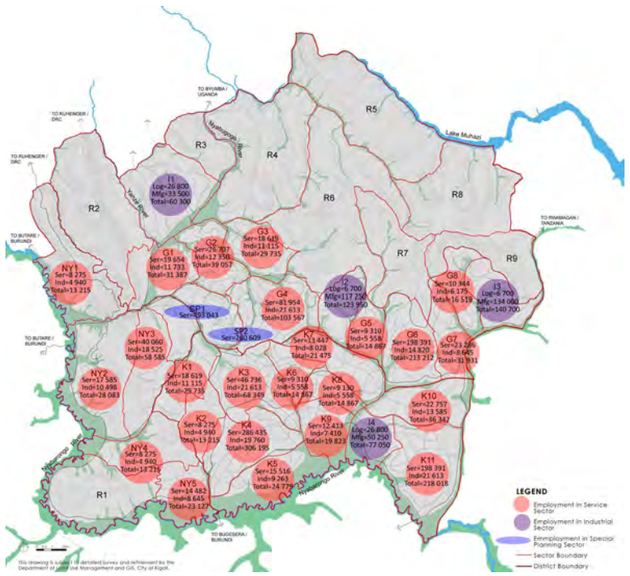


Figure 4.5 Proposed Employment Distribution by District

4.1.3 Proposed Broad Land Use Plan 2025

The socio-economic study projected the population of 2.9 million for Kigali in 2025. The proposed Broad Land Use Plan 2025 shown in Figure 4.6 is expected to cater for this population.

The broad land use plan 2025 is proposed mainly with an intention to direct the growth in the priority areas that are contiguous to the existing urban areas and areas with existing infrastructure in place.

This intermediate broad land use plan takes into account the major on-going and approved projects that are carving the City's peri-urban fabric. Some of these projects include large scale residential developments in Kinyinya, Gisozi and parts of Ndera and Gahanga; few commercial developments in Gatenga and Gahanga; and some development of facilities in Ndera, Kicukiro, Gatenga and Kagarama.

The urban sectors of Muhima, Nyarugenge, Kimisagara, Gitega, Nyakabanda, Rwezamenyo and Nyamirambo are identified as priority zones for the development in 2025 in Nyarugenge District. Similarly, the sectors of Gatsata, Gisozi, Kacyiru, Kimihurura, Remera, Kimironko, Kinyinya and parts of Ndera and Rusororo along the east-west corridor in Gasabo district are identified as priority development areas. In Kicukiro District, the sectors of Gikondo, Kigarama, Gatenga, Kicukiro, Niboye, Kagarama, and parts of Gahanga, Nyarugunga and Masaka are identified as the focus area for 2025.

While the land uses for the priority areas remains unchanged in the Year 2025 Land Use Plan, the key differences are:

- In terms of existing uses around the priority urban area, these may not all be redeveloped within this time frame as shown in the Broad Land Use Plan in 2025. However, development of large City level infrastructure is recommended to be focused in these priority urban areas.
- Development in future urban areas may be allowed as per the re-zoned future use on a case-by-case basis to be conditionally approved by the City.
- The existing or ongoing imudugudus in the future urban areas will remain within these areas until 2025.
- In terms of agricultural uses, it will allow farming within the buildable areas around the imudugudus and housing project sites in the future urban areas, although the lands are safeguarded and re-zoned as comprehensive residential townships in the future.

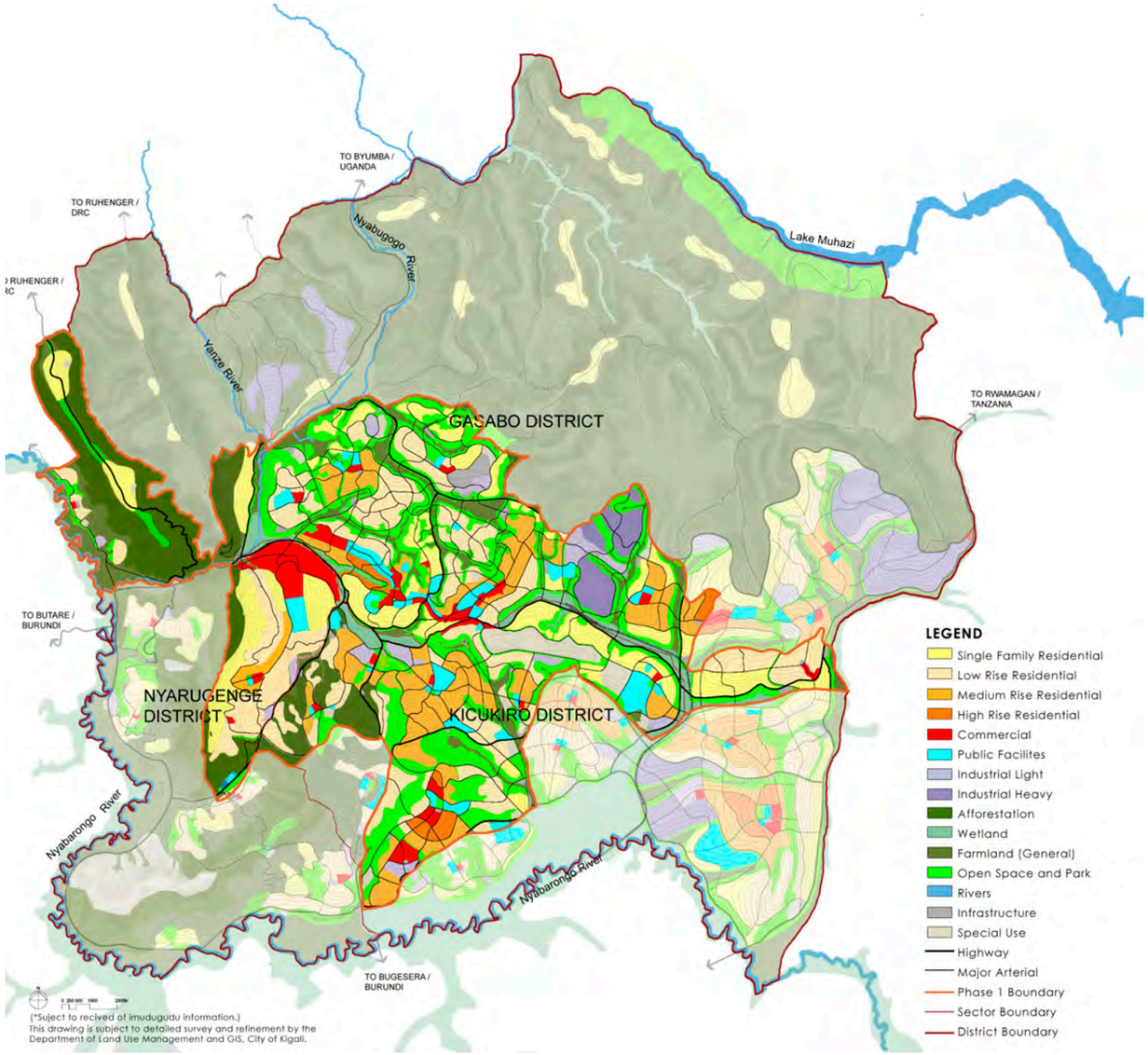


Figure 4.6 Proposed 2025 Land Use for City of Kigali

4.2 INTEGRATED LAND USE AND ROAD PLANNING

Transport and land-use are interrelated to each other. Land-use creates a specific activity in a specific location. Trip occurs when people need to engage in activities that are spatially separated from their current location.

When land-use planning allows urban sprawl, it also encourages car reliance. By planning a compact city served by public transport, it provides viable and sustainable alternatives to using cars. Land-use planning is therefore critical in managing travel demand through the placement of activity areas and providing for alternative transport choices.

Below are the principles adopted in the land use planning for managing travel demand:-

- Providing daily amenities within acceptable walking distance from home
  - Adequate facilities and amenities are provided within the townships and local neighbourhoods to meet the local needs of the population. By providing facilities and amenities within acceptable walking distance, it reduces the need for vehicle travel and encourages walking and cycling.
- Mix uses in town and neighbourhood centres
  - People travel when the activities they engage in sequentially are spatially separated. For example if shopping centres were in the city area and cinemas in the outskirts, a motorist would first need to drive to city for shopping, then again to the outskirts to watch a film. Compatible land-uses such as retail, food and beverage and recreation can be located within the same area to minimize the car trip generation and increase walking and cycling.
- High density developments around town and neighbourhood centres
  - When employment, housing, retail and leisure activities and services are concentrated in the same area, trip generation are more likely to be internal trips, which can normally be facilitated by walking or cycling.
- Align high density centres within major public transport nodes
  - By providing high density centres within the major public transport nodes, the need to travel using private transport can be drastically reduced. In most global cities public transport remains the most used mode of transport. However this only remains true as long as the destinations fall within walking distance of a public transport node. The catchment of the public transport can be extended by increasing the level of provision of public transport i.e. increased frequencies of feeder bus stops, integrated interchanges etc.

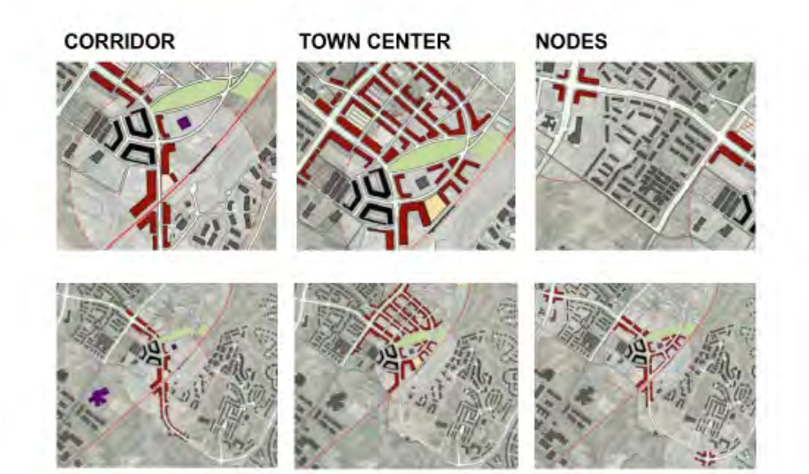


Figure 4.7 Different Scheme Applications of how Land Use and Transport Planning can be organised (Metropolitan Washington Council of Governments, 2010)

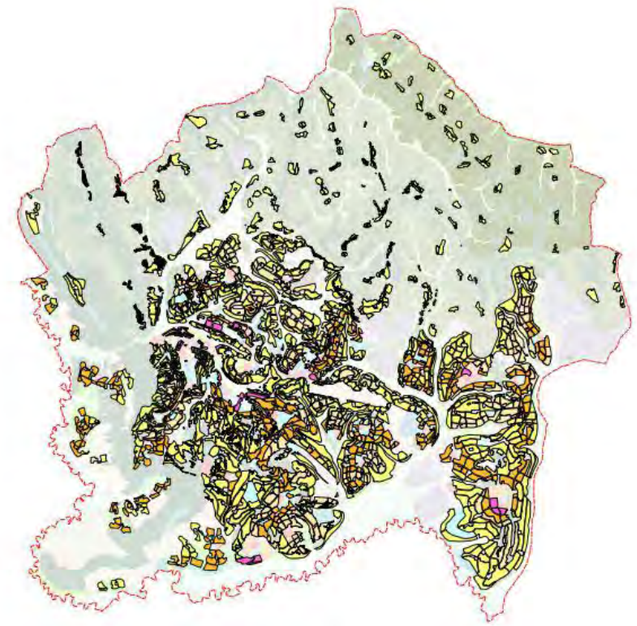
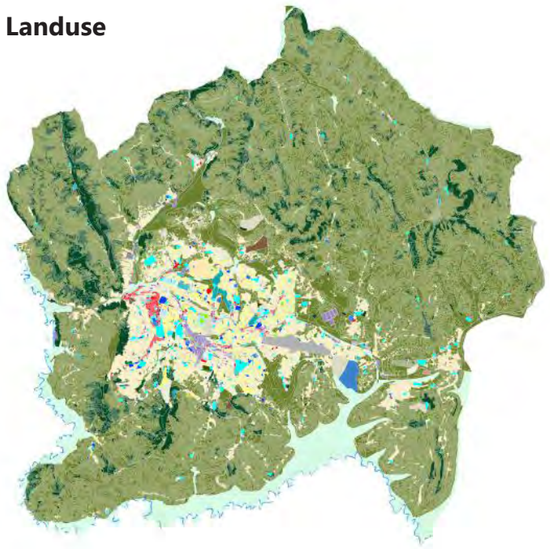
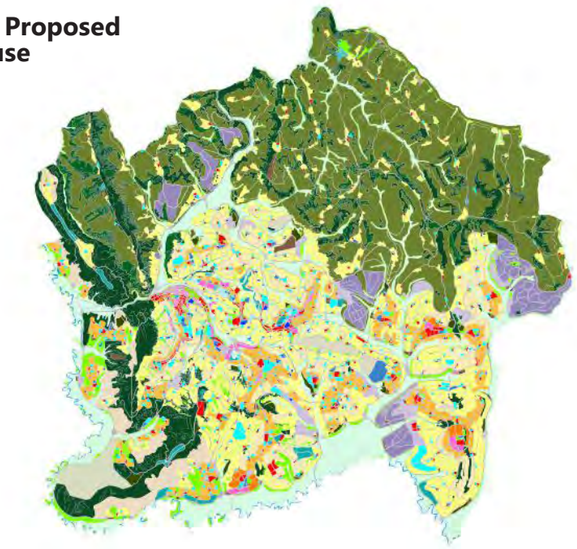


Figure 4.8 Proposed Residential Zones in the City

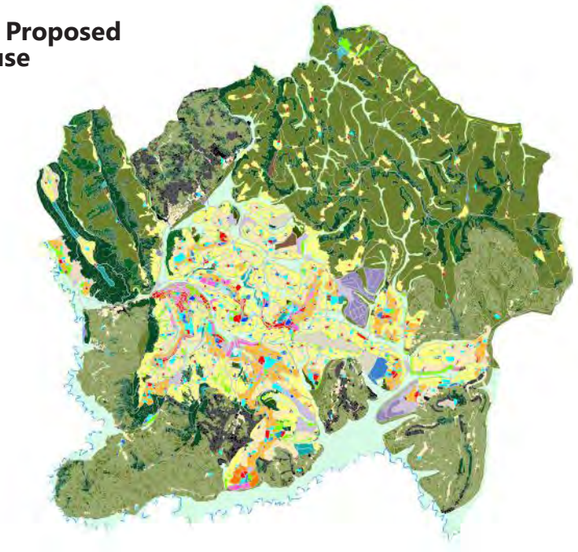
Existing Landuse



2040 Proposed Landuse



2025 Proposed Landuse



Proposed Land Use Distribution

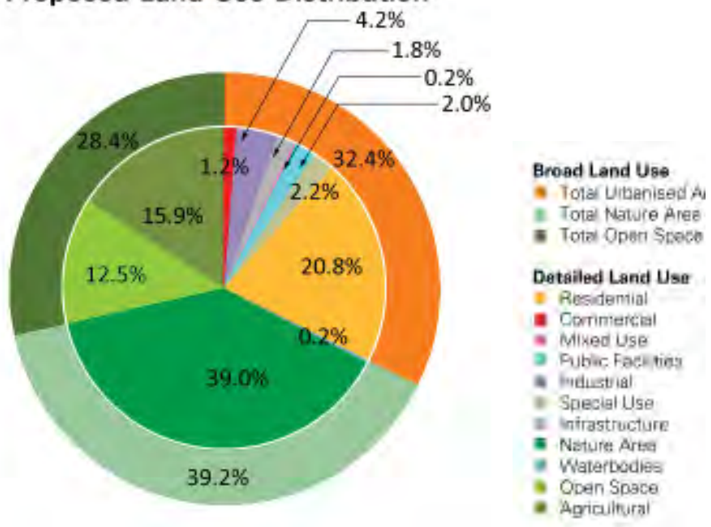


Figure 4.9 Evolution of Land Use from Existing 2012 to 2040

By planning ahead, transportation support for development of the city over the years can be accommodated by proper planning and land-use integration.

Maximising transport choices and managing travel demand by minimising the need of travel requires public transport infrastructure and services and land-use strategies to be harmonised in the planning exercise and implementation.

It is important to note that regional and urban policies and strategies can be ineffective when the local level does not have compatible land-use and design decisions. Integration at both regional and local level requires long-term commitment and communication at the broader level.

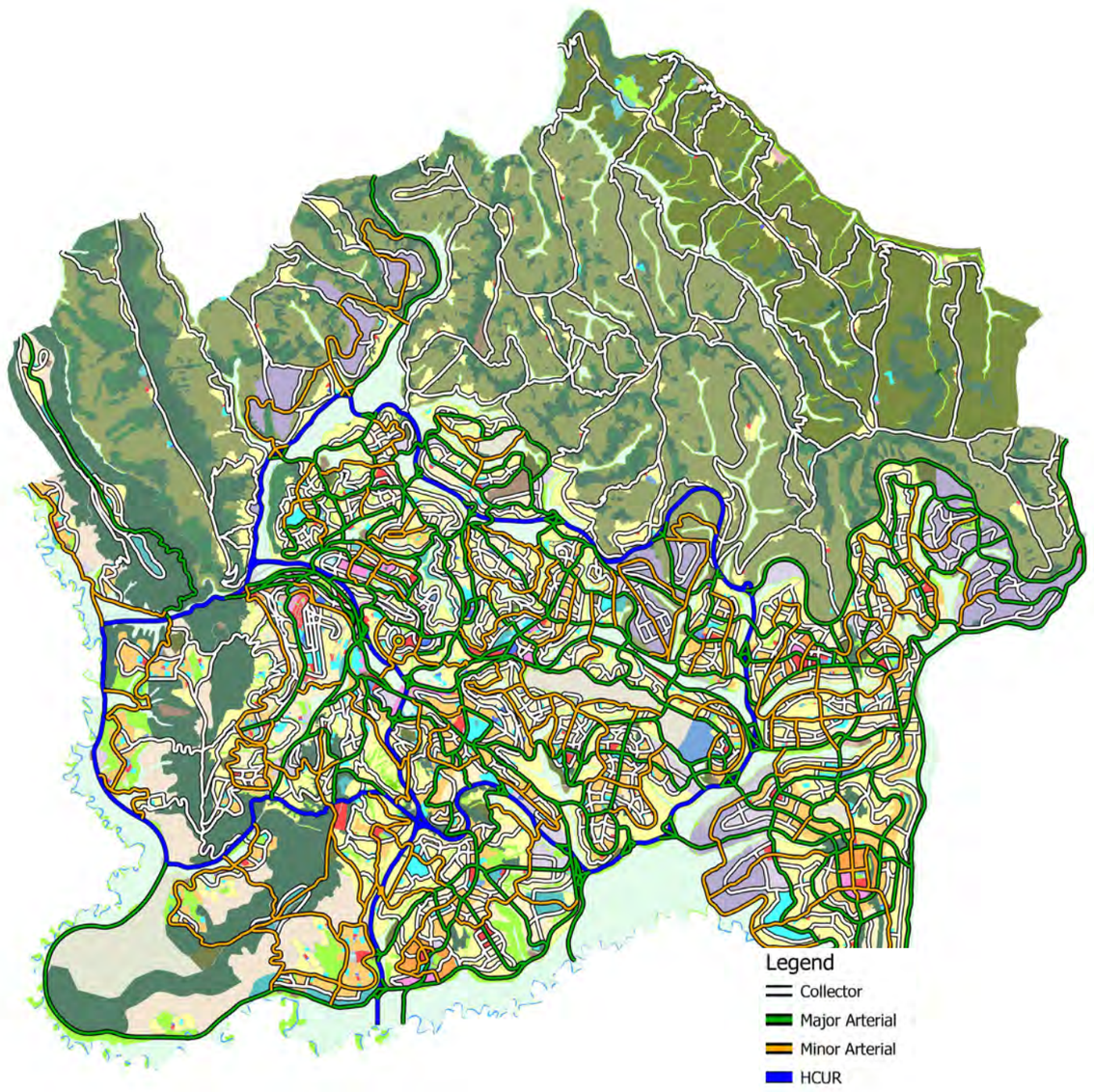


Figure 4.10 Proposed Road Network overlaying the 2040 Land Use Plan

4.3 THE PROPOSED ROAD NETWORK

A GIS database of the proposed road network for Kigali for the 2040 horizon was prepared, as shown in Figure 4.10. The road network has been developed based on the 2040 Master Plan. The resulting database can also be used in the modelling of the transit network using software such as VISSIM or VISUM. The schematic road network was prepared and analysed, and therefore be used as a starting point for future road development.

Analyses of capacities have been provided and included in this section. To take the results one step further, existing and proposed road classifications have been applied to these roads. Guidance for classifying these roads on the ground is provided in the following sections, and a context-sensitive solutions (CSS) methodology will be briefly explained for future preparation of road schemes and projects.

4.4 TRAFFIC MODELLING AND CAPACITY ANALYSIS

This section provides the network and corridor plans in context with the previous section. In the CSS approach, network planning:-

- Establishes a procedure for the design of the network
- Identifies road use such as freight and transit
- Distinguishes the individual road segments and functions

4.4.1 ESTABLISHING A TRANSPORT NETWORK

Using Geographic Information Systems software, the land-use plan can be mapped against the existing road network. The available information has enabled the preparation of the road network plan.

The following principles are observed in developing the road network plan:-

- Connect and provide access to and between communities, centres of activity and neighbourhoods of all types, as well as recreational and cultural facilities;
- Form a grid-like pattern of continuous thoroughfares except as precluded by topographic barriers;
- Conform with and follow natural topographic features and avoid adverse impacts to natural resource areas;
- Meet spacing and connectivity criteria;
- Have thoroughfares interconnected with specified distances between intersections to provide choices of routes to reduce travel distances; to promote use of transit, bicycles and walking; and to efficiently accommodate utility needs;
- Re-use existing road alignments to minimise impact on existing properties

Based on the first four principles, a grid-like network was identified for the City of Kigali. The network has been iteratively derived based on the above principles. The first step was to identify key arterial routes between urban centres and facilities, followed by the inclusion of internal grid-like patterns between arterials. After running the network in the modelling software based on the road capacity requirements, the arterial networks are re-adjusted. This is repeated until a satisfactory network is found.

Figure 4.11 Identification of the Road Network and the Ideal Alignments

Figure 4.12 Inclusion of Additional Connectors to the Grids and Proposed Public Transport links to Major Centres

4.4.2 Design Considerations

The following considerations were included during the preparation and modelling of the network:-

- Ring Road
  - In discussions with MININFRA, a Ring Road is proposed to provide a circular link around the CBD area. The Proposed Ring Road aims to divert through-traffic around the main City CBD so that demand on the roads in the CBD is reduced. The Ring Road will be used by freights and inter-district traffic as a by-pass route.
- Freight Routes
  - In addition to allowing freight on the Ring Road, additional freight routes leading into core urban centres and future industrial and logistics areas will also be necessary. Key Major Arterial Roads should be designed to take the axial load as part of the exercise to accommodate freight traffic.
- Road Capacities
  - The capacities of the roads have been obtained and interpolated from the UK Design Manual for Roads and Bridges document TA79/99 Traffic Capacity of Urban Roads. This assumption sets the basis for minimum lanes required.
- Street Patterns
  - The alignment of the existing road network is adopted where possible. Permeability in the city boundary cannot be readily modelled with the proposed model.
- Pedestrian Connectors
  - When modelling the public transport and pedestrian links, the connectors were generated linking the sites with their destinations. The model was run to simulate the pedestrian movements, utilising the public transports such as BRT lines, etc.
- Airport Link
  - The need to model a high-capacity urban road towards the new Bugesera International Airport was identified in the concept design stage. However due to the nature of an airport, the traffic generation from the airport does not peak in the AM or PM peak; instead it is highly dependent on the number of arrivals and departures. It was deemed for the report that the airport trips need not be simulated; however it is vital to include a route capable of a public transport link towards the airport as part of the design.

4.4.3 Analysing the Network

Methodology

The analysis of the road network utilises VISUM, a macroscopic strategic transportation modelling program. It was used for the production of both the Rwandan Strategic Transportation Master Plan (RSTMP) and for the Consulting Services for the Planning and Design of a Public Transport System for Kigali City (CSPDPTS). In view of this, a VISUM model was employed in this study to ensure compatibility between these studies.

Principally, for the design of road networks, the peak traffic hours are considered; for a service/industry-based economy, such as Kigali in 2040, the peak traffic hours are expected to be between 7.30-9.30am, from the home-to-work traffic, and 5.00-7.00pm which results from work-to-home trips.

Outputs

The aim of using VISUM as an analysis tool is to understand the impact of specific planning decisions on transportation infrastructure which in turn supports the decision makers in the land use planning process.

The key objectives are:-

- To ascertain the predicted peak travel demand and the expected impact of this on the Proposed Road Network
- To propose a Road Hierarchy for the Proposed Road Network based on the initial estimates of road capacity from the model
- To estimate the capacity and potential of the proposed BRT Network
- To identify future bus routes based on the demand.

Results

The VISUM analysis shows that by 2040, the network will be running above capacity in several major links. To compensate for the over-capacity, it is recommended that passive solutions be adopted to overcome the over-capacity.

These passive solutions include congestion pricing and charging for parking. The City of Kigali must also plan to invest in Mass Transit, which by 2040, may justify the inclusion of an MRT system as part of future developments. It must also implement land policies that discourage urban sprawl and reduce unnecessary driving.

The VISUM analysis has lead to a refinement of the initial arterial route network presented in the previous reports to one which is more suited for the weekday morning peak in 2040.

The final design for any transportation schemes shall be subject to detailed feasibility studies before implementation.

Figure 4.13 Refinement of Arterial Routes based on Density, Traffic Analysis and Pedestrian Routing

Figure 4.14 Proposed Road Network Capacity

4.4.4 Capacity Analysis

Based on the above assumptions, traffic impact of the developments on the city was also analysed.

Figure 4.14 shows the capacity of the roads during the AM Peak.

Figure 4.15 shows the same image but with the collector roads removed for clarity.

The colours Green, Orange and Red shows the vehicle capacity ratio of the roads at up to 85% of free flow, over 85% but less than 100% and more than 100% respectively.

When road usage exceeds 100% of free flow capacity, traffic slows down and congestion occurs.

It can be seen that most of the collector roads are within 85% of its expected capacity. A detailed look of the other roads show that in 2040, congestion may occur on the high capacity urban roads, in the city core area, and along BRT routes.

Most of the major arterial routes were underutilised in this scenario.

There are existing solutions to overcome this situation, namely the use of Intelligent Transport Systems, such as Variable Messaging Systems, which may alert drivers about potential congestion and to redirect drivers through the other underutilised arterial routes to avoid congestion from occurring.

Additionally, a congestion charge during peak periods when driving into the city core may alleviate the traffic condition in the City core.

Such techniques will be further explained in Chapter 5.

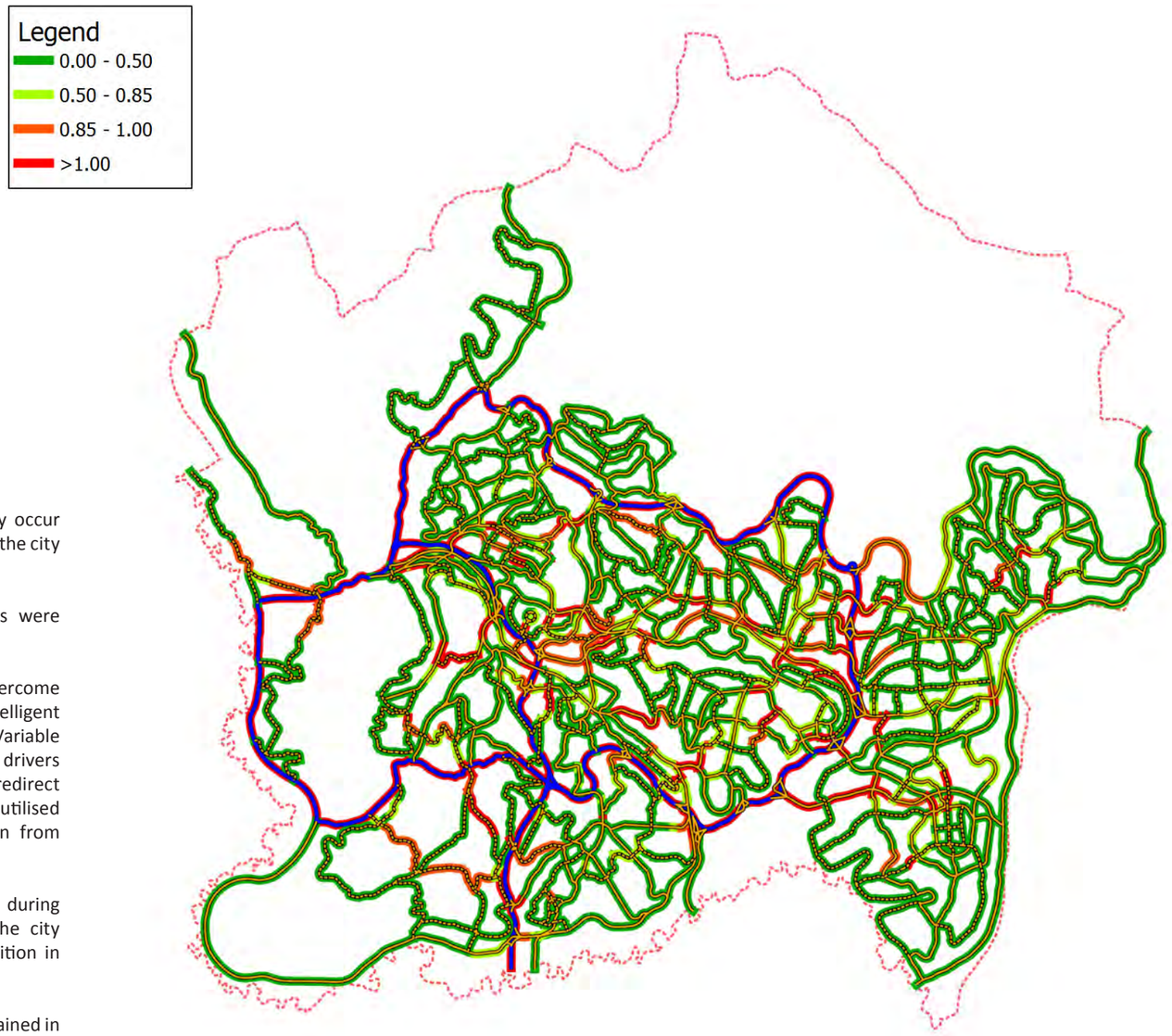


Figure 4.15 Proposed Road Network Capacity (Collector Roads omitted for clarity)

4.4.5 Coverage of Road Network

The provision of a well-defined road network which is classified according to the road context will ensure that the road network is not overdesigned and is suitable for the City of Kigali.

This plan accommodates a comprehensive public transportation network by identifying key alignments that can be used for the Mass Transit. In addition, by aiming for a high arterial road density in the City, this strategy ensures that buses are able to navigate through more roads then currently possible, therefore building on a very accessible public transport network that extends into all areas of the City.

Coverage of public transport can be ensured using the Geographic Information System tools. Over 80% of the City is within 2km (or 30 minutes of walking) of a proposed BRT station and 87% of the proposed built-up area of City is within 500m of major arterial routes.

Regional centres have been proposed in the Master Plan, and its public transport accessibility checked. All proposed regional centres are located within 2km of proposed BRT lines, and interconnectivity via major arterial roads between these regional centres is provided.

The proposed road hierarchy ensures that the 'Place' status of roads with low vehicle volumes is protected. This leads to an indirect provision of higher quality of life in these areas, in addition to fewer social ills such as decline in health due to pollution or road fatalities due to traffic accidents.

Figure 4.16 Classification of Roads based on Results from VISUM

4.4.6 Types of Roads

In the proposed road network, four types of roads have been proposed.

- High Capacity Urban Roads
- Major Arterial Roads
- Minor Arterial Roads
- Collector Roads

These roads are to be adopted by the City of Kigali upon construction and considered to be public roads.

In the VISUM analysis, the following assumptions were made for the following roads:-

<u>High Capacity Urban Roads</u>
Capacity: 7200 Vehicles per hour
Number of Lanes: 4
Proposed Speed Limit: 110kmh

<u>Major Arterial Roads</u>
Capacity: 5400 Vehicles per hour
Number of Lanes: 3
Proposed Speed Limit: 90kmh

<u>Minor Arterial Roads</u>
Capacity: 3600 Vehicles per hour
Number of Lanes: 2
Proposed Speed Limit: 70kmh

<u>Collector Roads</u>
Capacity: 1800 Vehicles per hour
Number of Lanes: 1
Proposed Speed Limit: 60kmh

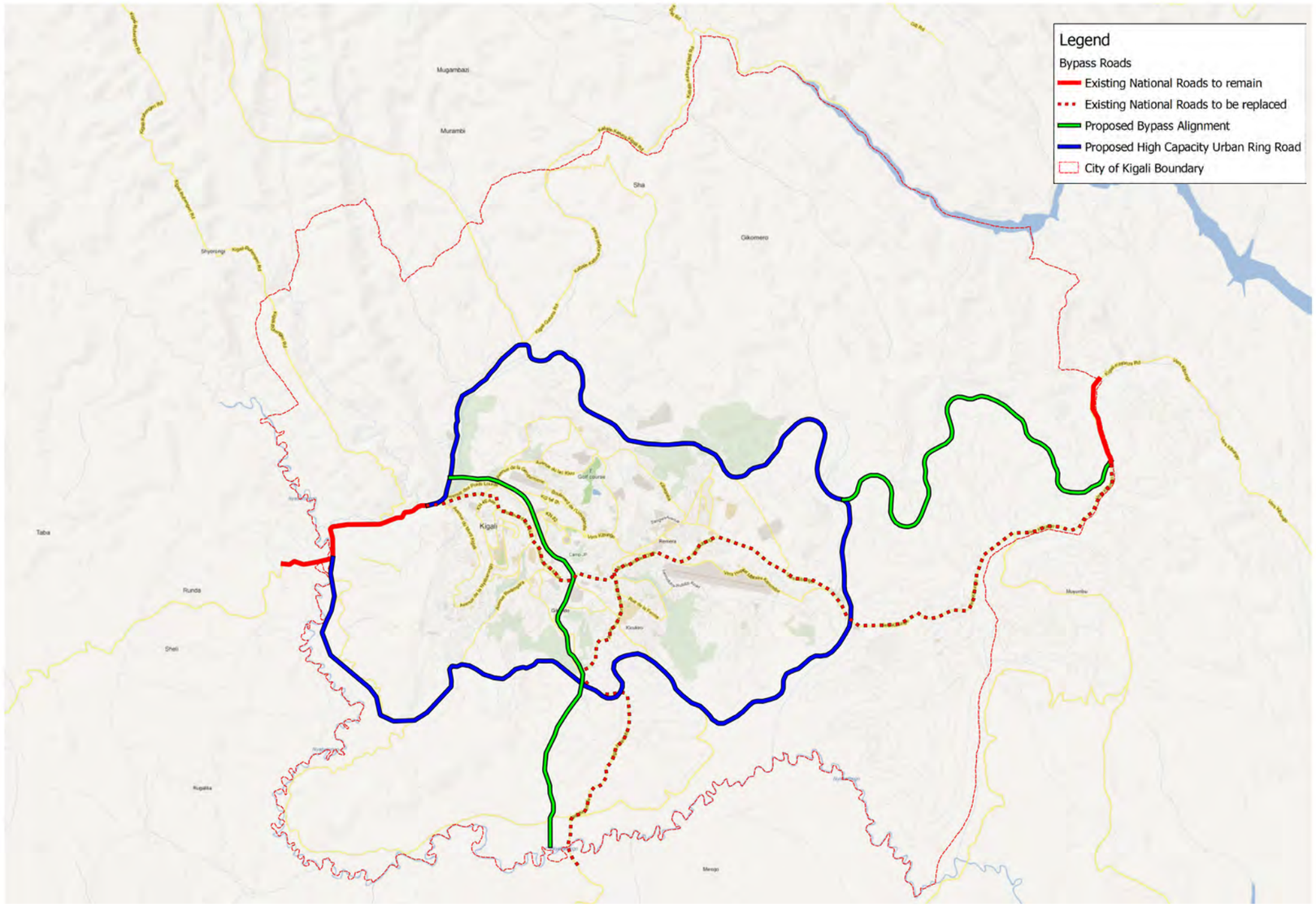


Figure 4.17 Proposed High Capacity Road Network to replace the Existing National Roads through Kigali

4.4.7 High Capacity Urban Roads

Detailed discussions with the City Council of Kigali and MININFRA identified the need for a ring-road in the City.

The proposed ring road needs to conform to the National Roads requirement and provide an alternative to the existing National Roads in Kigali.

Figure 4.17 shows the Proposed High Capacity Urban Network which would essentially allow through traffic to bypass the existing National Roads going through Kigali.

The existing National Roads (shown in solid red) cuts through the city core. The high amount of through traffic may not necessarily stop in Kigali and therefore should be effectively removed from the city centre.

It is proposed that the HCUR Ring Road (shown in blue) is to provide a circulating road for movement around the City, and also act as a distribution system for traffic travelling towards the north, south, east or west.

This would effectively replace the existing national roads cutting through the core of the city (shown in dotted red).

The High Capacity Urban Roads would be supplemented by two stretches of Bypass roads built to a minimum of Major Arterial standards, which would link the HCUR to the existing National Roads beyond the City boundary.

4.4.8 Coverage of Roads

In 2040, the estimated built-up area is 308 square kilometres, based on the proposed land use plan.

Assuming a 500m distance (10-minute walk) from any point of the Arterial Road Network shown in Figure 4.18, an estimated 87% (269km²) of the built-up areas (308km²) are accessible. This means that 87% of the city is accessible using public transport with a maximum of a 10-minute walk at the start and end of each journey.

The remaining 13% of the built-up areas are rural areas, but can still be accessible via the collector road network.

It is therefore essential to ensure that public transport infrastructure is built along all arterial roads where possible, and that a comprehensive and detailed bus plan and schedule is formed to accommodate this.

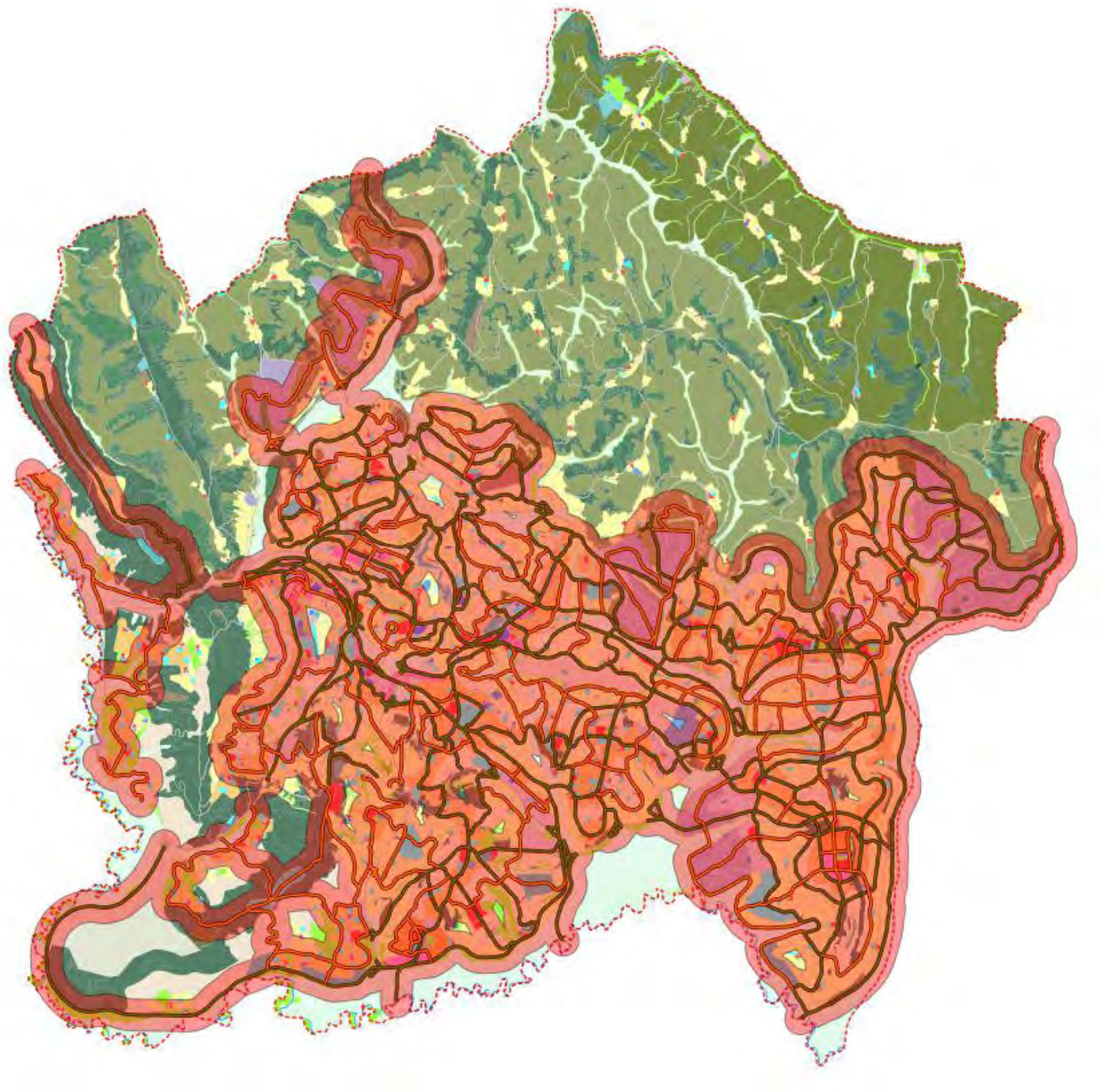


Figure 4.18 Coverage of Proposed Road Network

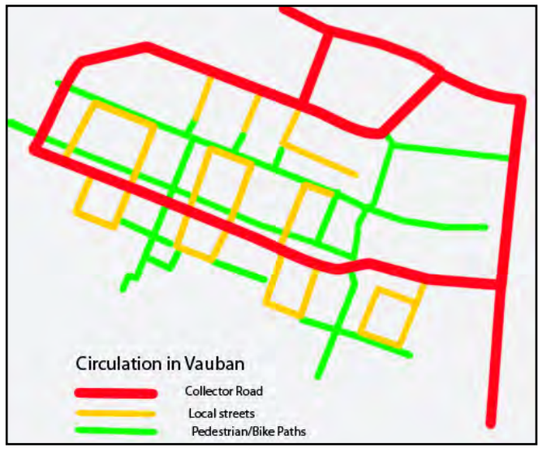


Figure 4.19 Example of an Internal Plot Circulation in Vauban,Germany

Figure 4.20 Example of an Access Development for a Township in Canada

Figure 4.21 Example of an Access Lane in Europe

4.4.9 Access Roads

The proposed road network has been defined to the Collector Road level, where this lowest category of roads 'collects' vehicles from adjacent developments onto the network.

The localised roads, also known as access roads, will have speeds no more than 30kmh, and are the primary roads of interaction. While the Transportation Master Plan aims to provide an overview of the road network in Kigali, it is important to stress that with proper design guidelines, the local zones can maintain an identity and proper integration with the community. In these zones, not only does the design of the roads matter, land use can also contribute to a complete streetscape.

Pedestrians are one of the main users of these access roads, and will be discussed in the following Non-motorised Transport section.

Figure 4.19 and Figure 4.20 shows how access roads can be formed and linked within plots with pedestrian paths.

These figures demonstrate a grid layout for access roads, which have few straight routes in and out of the township. The provision of turns and corners help with keeping speed down and therefore ensure pedestrians' safety.

Figure 4.21 is a prime example of an access lane that has a character of its own. The block paviors create a sense of class, and the one-way street arrangement frees up space for a cycling lane, and the lack of raised kerbs creates a pedestrianised feeling for drivers.

4.4.10 Standardised Road Design

One of the most important strategies that will help achieve the objectives and goals of the Transportation Master Plan is the standardisation of Road Design in Kigali.

There are two aspects of road design that is in grave need of improvement, which are the construction design of roads in the City, and the urban design of roads.

The construction design encompasses the physical design of roads; pavement thicknesses, kerb radii, superelevation and horizontal and vertical alignment to name a few. The physical design is important as these define the structural integrity and safety levels of roads.

The urban design of roads discuss broader design principles, which address usability concerns in addition to safety. The geometry of roads have been studied in detail in current international standards, namely the Design Manual for Roads and Bridges (UK) and Roadway Design Manual (US).

The purpose of these design manuals are to ensure that roads are built to a standard that will guarantee a level of safety and function, in addition to the reduction in maintenance due to proper installation or laying of roads.

The intention of this section is not to replicate the contents of these guidelines, but to draw attention to these for future reference.

The City needs to develop its own design standards to guide future developers in the preparation of road schemes.

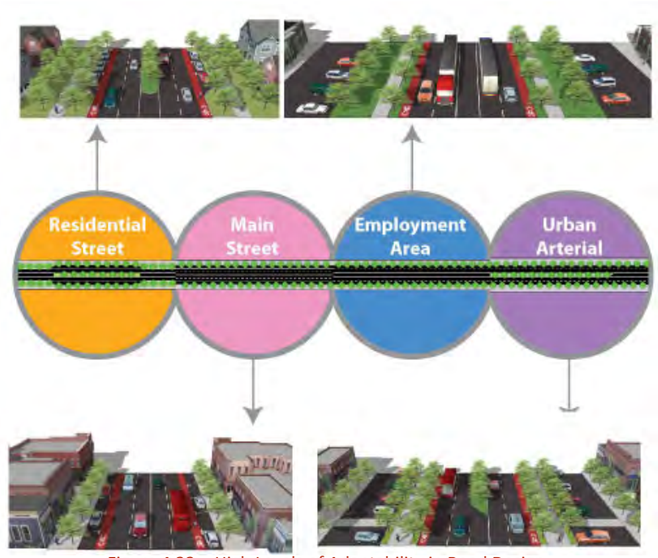
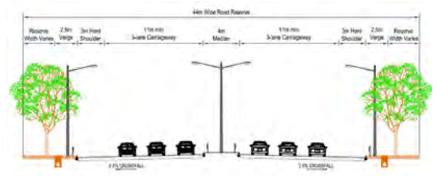


Figure 4.22 High Levels of Adaptability in Road Design

High Capacity Urban Roads– Trunk Route



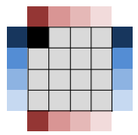


Figure 4.23 Example of Standardised Road Design

The streetscape of Kigali is not consistent and therefore may cause confusion to drivers, especially if the pedestrian and cyclist domains are not clearly laid out.

The TMP has prepared several preliminary road cross-section designs for the purposes of this report. The designs are proposed to be easily adaptable within a stretch of road, as shown in Figure 4.22.

Appendix B further expands on typical standard road designs that can be applied in Kigali.

In all cases, the design can deviate to accommodate any localised amendments, based on the context of the road at that location. The following page is an example of a Design Code Sheet for the Transit Links/BRT Lanes type. Additionally, the dimensions are for guidance only, and again can be amended to suit the situation.

Note that all reference to non-motorised transport infrastructure such as pedestrian and cyclist paths will be further discussed in the next section.

A detailed design guideline needs to be developed, expanding on these ideas introduced. With proper application, the road network in Kigali can be better managed.

Good Design Practice such as wider pedestrian paths can be accommodated in these guidelines.

Standard Cross-section Design Guidelines

In the design of a road scheme, the first step is to identify the alignment for the scheme. This has been done to some extent in this Transportation Master Plan. Key alignments have been identified to optimise the road network. Based on these preliminary alignments, the City should prepare a survey and set up a taskforce for the scheme.

The second step is to identify the scope or boundary of the project. Depending on the purpose of the scheme, land requisition requirements may vary. For example, for key urban roads the minimum right of way for procurement will be the carriageway width plus the minimum provision for pedestrians. However, in the commercial centres where vehicle access is limited, the carriageway may be converted to shared space for vehicles and pedestrians.

The road sections can be developed with the following facilities:-

- Median – The divider between opposing traffic lanes
- Carriageway – Traffic Lanes for all vehicular traffic
- BRT Lanes – Dedicated lanes for BRT lines
- Hard Shoulder – The emergency stop lane on high capacity urban roads
- On-street Parking – On-street parking where traffic movements are low or where speeds are inexcessive
- Easement/Verge – Easement space provided for utilities, maintaining visibility splays, or earthworks
- Planting Strips – For planters / greenery
- Footway – Pedestrian paths
- Cycleway – Cycle paths
- Multi-purpose walkways – Shared

4.5 PUBLIC TRANSPORTATION PLANS

There are four proposed public transportation plans for the City of Kigali.

The first is the Rail and Intercity Transportation plan, where transit between cities and international travel is accounted for in the City's transit plans.

The second is the Rapid Transit Plan, which discusses the application of rapid transit in the City.

The third plan is the Supplementary Public Transport Plan, where the implementation of the detailed proposals in the MINIFRA report "Development of an Integrated Public Transport System for the City of Kigali" is discussed.

Lastly, the Transport Hubs and Infrastructure plan discusses the proposed developments that can be provided along these public transport lines, including the mass transit corridors.

4.5.1 RAIL AND INTERCITY TRANSPORTATION PLAN

The Rail Transit is an important transportation aspect for the City of Kigali in the future.

By introducing rail transit to Kigali, time of travel for freight to the connecting cities, such as to the Dar Es Salaam Port in Tanzania, would be accelerated. Kigali can then play a role as a logistics hub for the City and the region.

Air connectivity is also vital for intercity transportation. The existing airport is suitably located within the City, however the proposed new airport is 30km from Kigali. It is important to ensure that this airport link is connected with public transport as well.

This would help make Kigali more attractive as a commercial district, and would attract international businesses.

Lastly road transport is the most common means of public travel between cities. This is the primary mode of transport for Rwandans travelling to the City, and requires a high level of investment and improvements, as identified in the previous public transport study.

The existing intercity bus stations in the City are to be upgraded to international standards.

A detailed route study would be required to determine the services, frequencies and fare levels for the intercity bus services.

Intercity Rail Transit and Connectivity

Kigali's land transport infrastructure is predominantly roads, and until recent times, has no rail.

The current East African Rail Corridor Proposal will link Rwanda to the coastal port of Dar Es Salaam by connecting to Tanzania. In addition, direct train connections would be made available to many cities in Burundi.

With the rail in place, Rwanda can be a logistics centre, bringing raw materials and freight from the surrounding regions to Kigali, then shipping them off to other industrial ports.

In addition, local industry may be boosted with more efficient and cheaper freight to the coastal port, hence providing an opportunity for international exposure for Rwandan products.

The rail link is not initially meant for passenger trips but may eventually be used for passenger transportation once it is economically viable.

The proposed rail station location however is well located along one of the proposed BRT lines. This ensures that connectivity from rail to the rest of the City via public transportation is maintained.

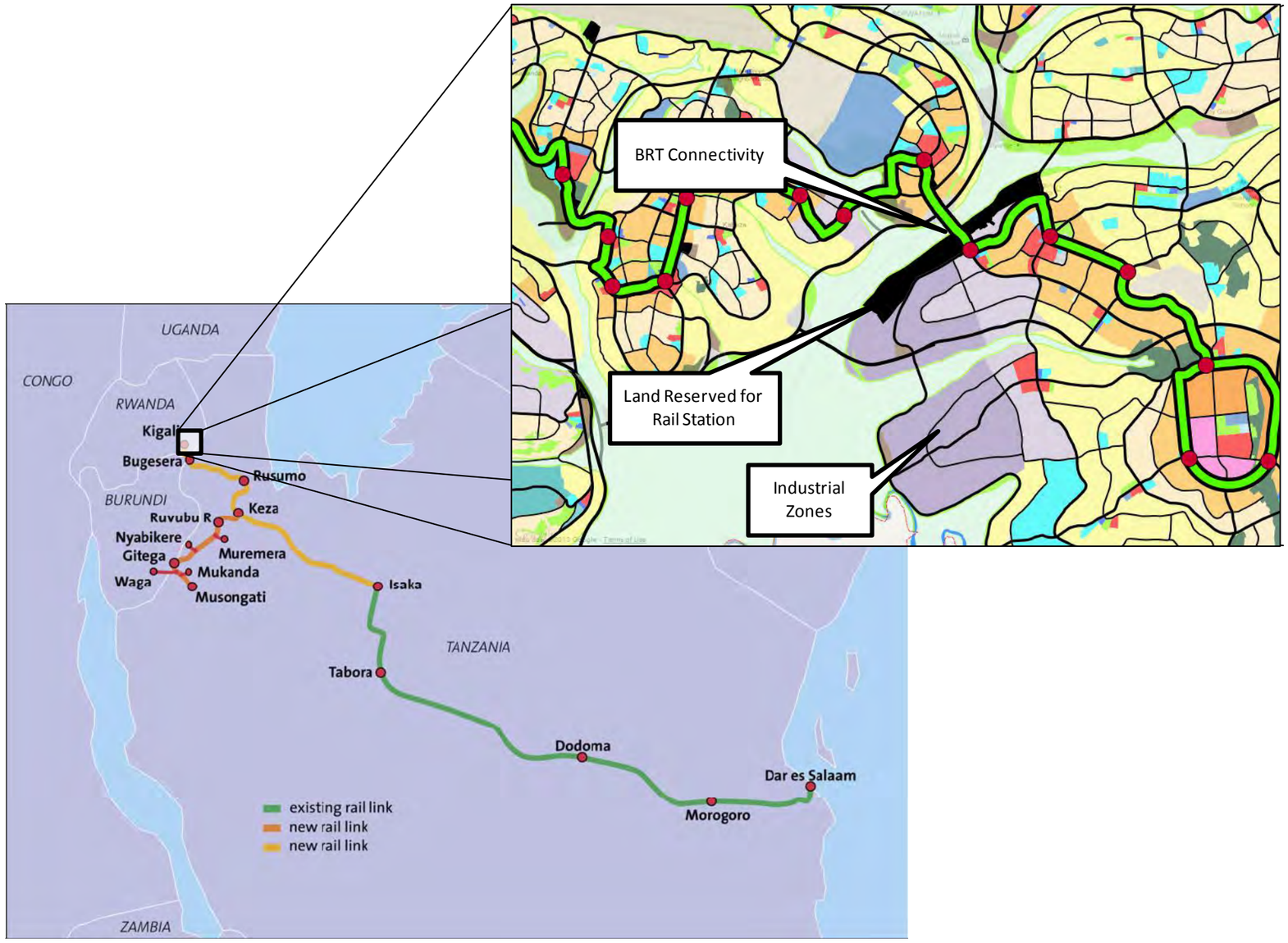


Figure 4.24 Proposed Rail Station in Kigali in 2040

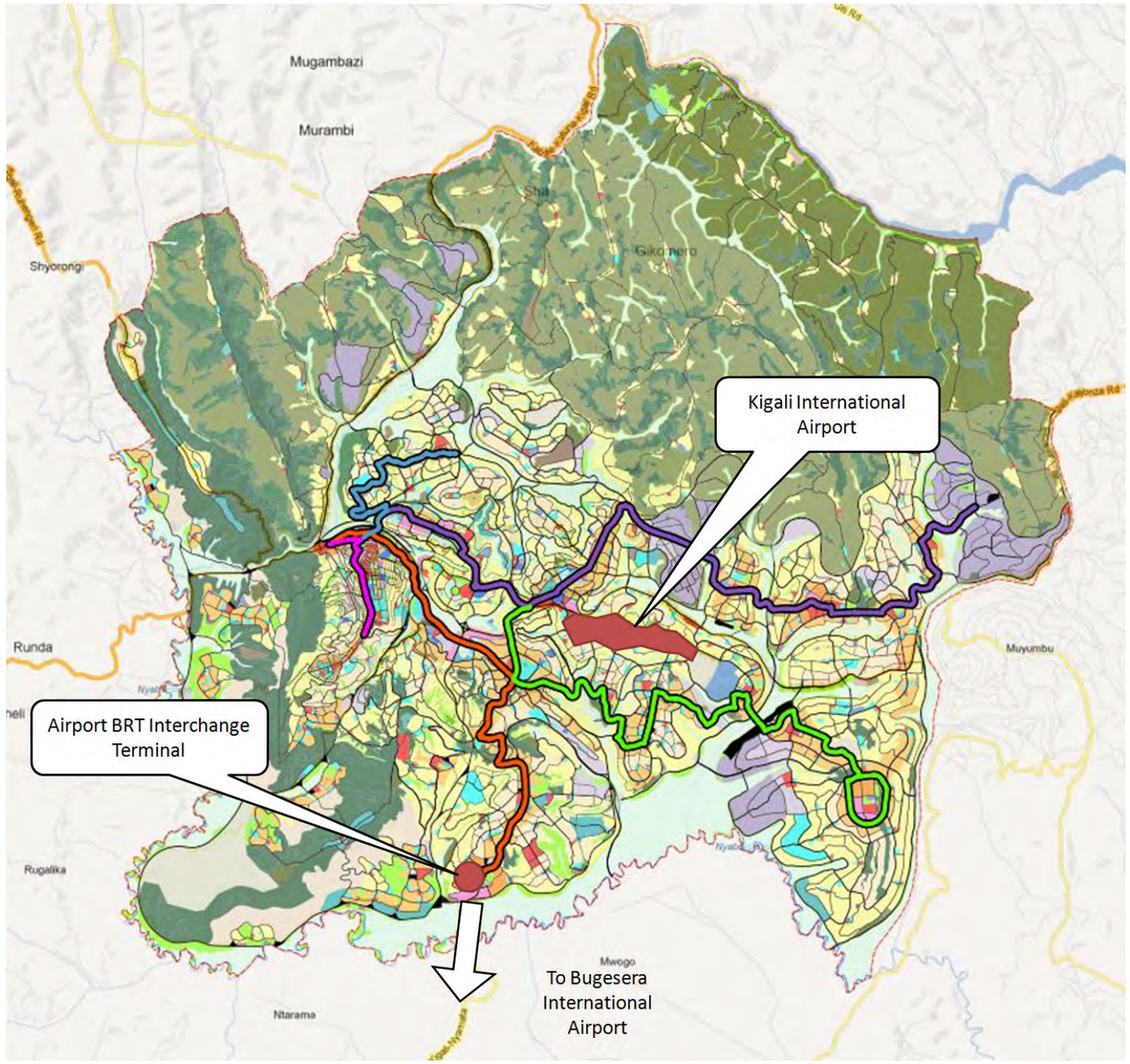


Figure 4.25 Location of Air Transit Connectivity in Kigali in 2040

Air Transit and Connectivity

The proposed Mass Transit lines will serve the existing Kigali International Airport in the City.

The Mass Transit Lines will extend to the gateway district of Gahanga south of Kigali.

From here, it is envisioned that the City will link Gahanga to the new proposed Bugesera International Airport by means of express buses in the interim, and with further expansion of the city, by means of mass transit.

The Mass Transit System is designed such that there would be a direct BRT line from Gahanga District to the CBD. This would suit business travellers to the City.

Kigali International Airport's location means it is well connected to the Mass Transit system. Feeder bus services would connect the airport to the surrounding BRT stations as required, and local public transport services would also help in the distribution of passenger traffic into the City.

Intercity Bus Systems

Intercity and international travel by express buses is currently served by the Nyabugogo Bus Terminal to the west of the CBD.

The Terminal has experienced congestion in recent years due to increased demand. The lack of land and the increase in commercial activities in the surroundings has made expansion plans difficult.

While there may be scope to ease congestion in the short-term using measures such as adopting proper bus scheduling and imposing parking bans in the surrounding area, the area may not be able to sustain vehicular growth.

It is recommended that intercity bus interchanges be provided at the fringes of the City and where possible, with direct connection to the mass transit system in the City.

By planning ahead, the easing of congestion in the City would be supported by the City during its natural progression in development.

In the interim, 3 public transport interchanges are proposed by this TMP to support the establishment of a comprehensive transport system: the Upgrade of the existing Nyabugogo Bus Terminal, the construction of a Bus Terminal in Gahanga, and the Ndera Integrated Township.

Nyabugogo Bus Terminal would be slightly relieved of some of the services from the east and south, which would mean that it would be able to streamline and better manage traffic from its catchment.

The Gahanga Interchange would work as an interchange between the new airport and the BRT lines.

Ndera, as the northeastern-most regional centre, is also suited as an intercity transit hub due to its location on the mass transit lines.

By integrating the intercity bus services to these transit hubs, and supported by the mass transit lines, intercity and international express bus travel can be streamlined and made more efficient.

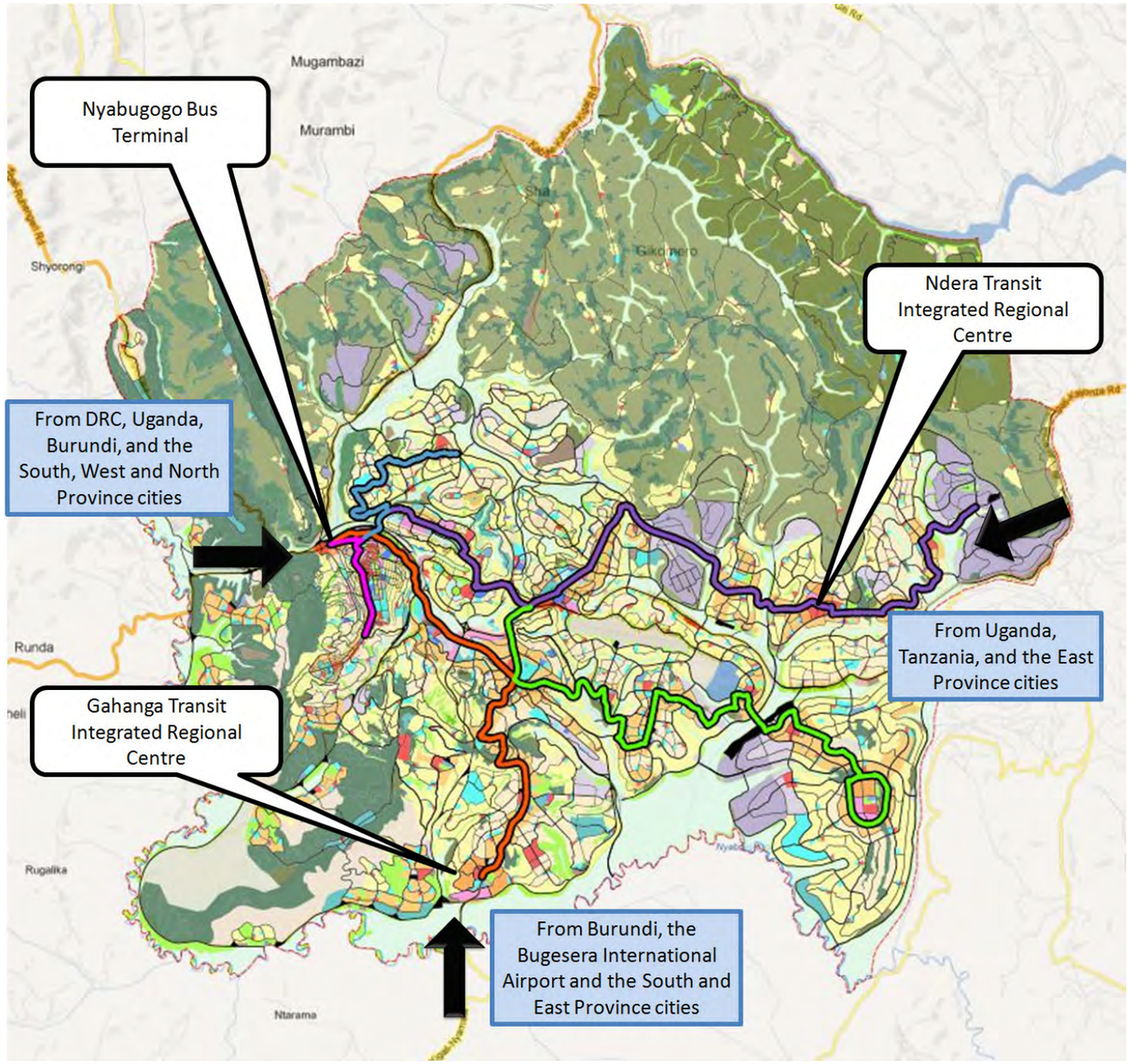


Figure 4.26 Location of Public Transit Connectivity in Kigali in 2040

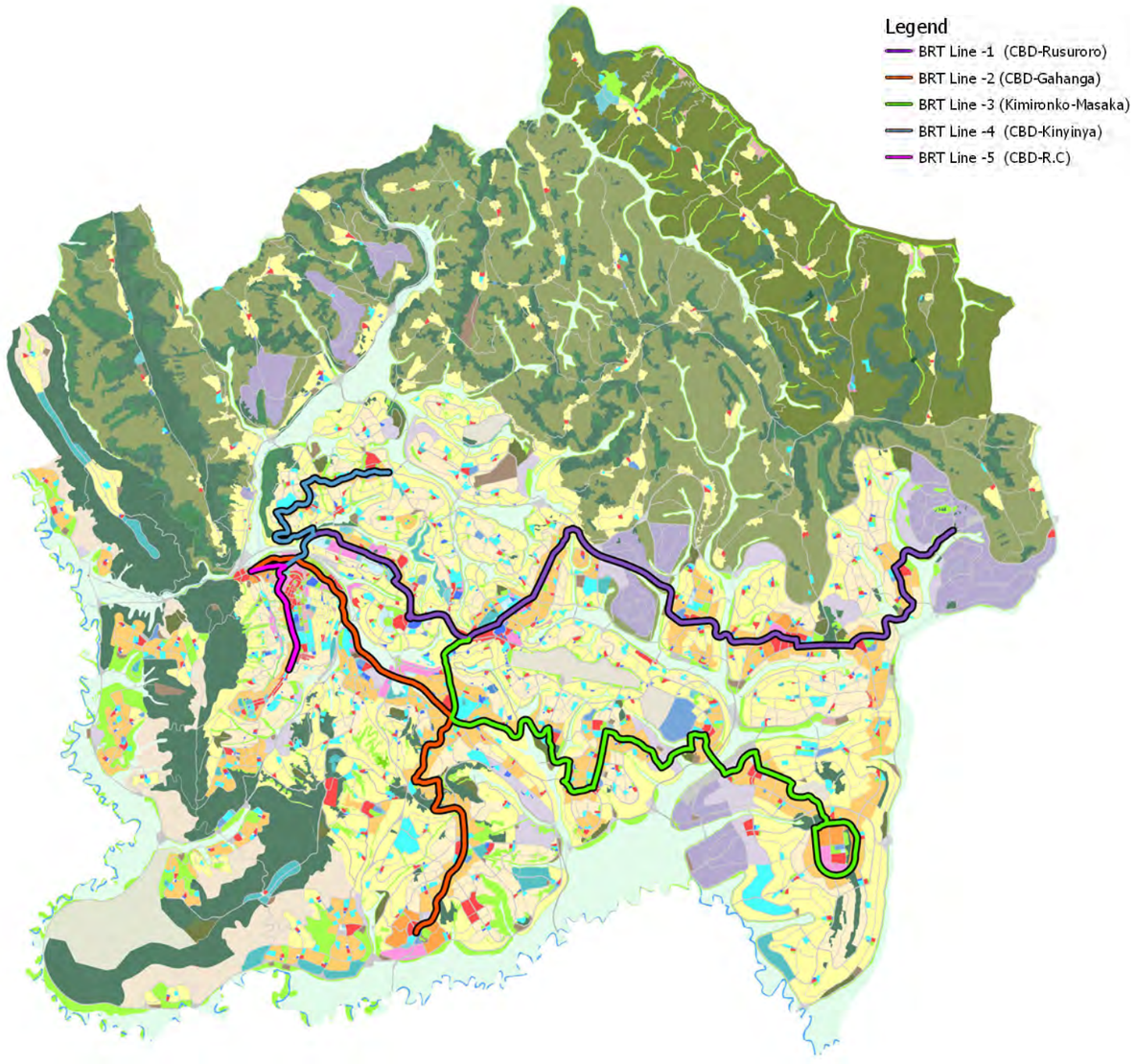


Figure 4.27 Proposed BRT Trunk Routes

4.5.2 The Mass Transit Network

Based on the Land Use Plan, the road analysis and existing facilities, the proposed BRT network as shown in Figure 4.27 was prepared.

A preliminary demand model provided the proposed routes as shown in this figure.

Based on the demand model, the optimum route was selected so that the BRT lines would serve the regional centres.

The BRT lines is expected to provide a comprehensive level of service to the city.

As it can be seen, the developments in the CBD, Rusuroro, Gahanga, Kimironko, Masaka, and Kinyinya would be very well-connected by the proposed BRT lines.

Continuity is maintained through several hubs for trip transfer, as can be seen in the diagram Figure 4.28 shown below.

A total of 92km of BRT lines are proposed for the year 2040. The longest line is 30km long, and is expected to complete a journey in an hour.

The creation of regional centres would mean that journey times on the BRT would not exceed an hour, and inter-regional trips can be made with no dependence on private transport.

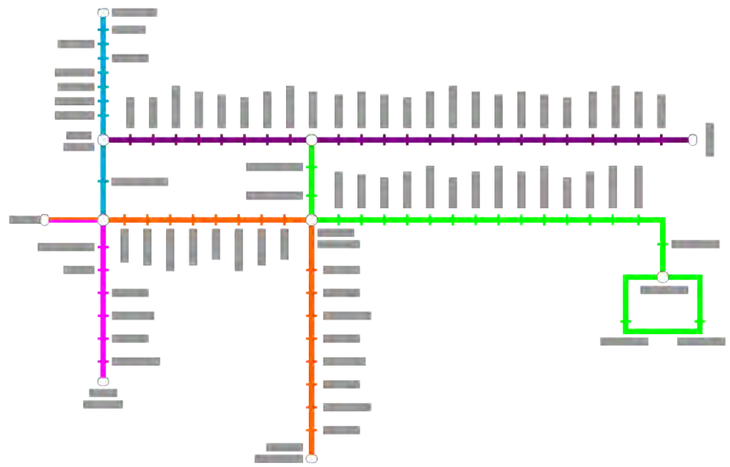


Figure 4.28 Possible BRT Schematic Map for Kigali

PROPOSED BRT SERVICE COVERAGE

Three main BRT services make up the trunk of the BRT lines, namely:-

- BRT1 CBD-Rusuroro (CBD to Northeast Kigali) – 30.5km
- BRT2 CBD-Gahanga (CBD to South Kigali towards Airport) – 19.0km
- BRT3 Kimironko-Masaka (Primary East-West Line) – 28.3km

Two lines serve the CBD:-

- BRT4 CBD-Kinyinya (CBD to north of CBD) – 8.9km
- BRT5 CBD-R.C (CBD throughroute) – 4.7km

BRT Line 2 is proposed to stop at the Gahanga township, but may be extended via express buses or special services toward the new airport south of the City.

Figure 4.29 shows the coverage of the BRT lines by foot. An estimated 225km² of the proposed 308km² built-up area falls within 2km radius of the BRT stations. The 2km catchment means that pedestrians would need to walk up to 30 minutes to go to places located within this zone. This means approximately 73% of the city would be accessible by BRT and a maximum of half-hour's walk at each end of the journey.

In such cases, regular bus services should be provided. A bus service would take about 10 minutes to travel that distance. By providing bus services to supplement the BRT lines, the remaining 27% of the journeys can be easily linked to public transport.

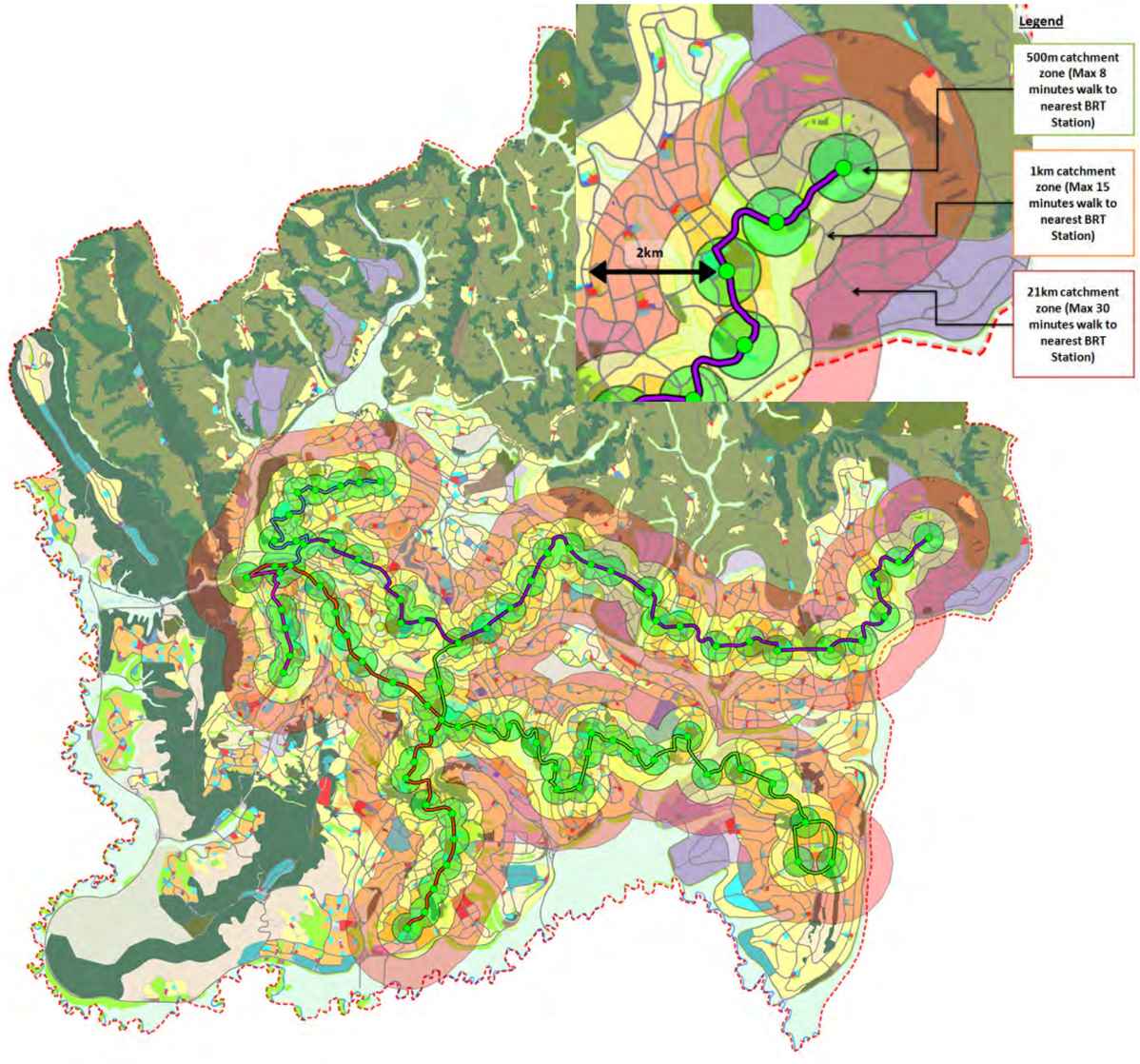


Figure 4.29 Catchment of BRTs

PLANNING FOR BRT

Figure 4.31 shows the overview of the BRT Planning Process, as shown in the Bus Rapid Transit Planning Guide, published by the Institute of Transportation and Development Policy, 2007.

A Bus Rapid Transit system works best as a profit-oriented company so that efficient services can be provided.

They would need to be regulated and monitored.

As such the BRT systems can be planned for different operators but built to the same standards and guidelines in order to ensure compliance to an adopted standard.

A regulatory body is envisioned to manage these operators and set policies, along with the initial planning, implementation and management.

SERVICE IMPROVEMENT

The services of the BRT and public buses would also need to be improved in conjunction with the infrastructure as they would be expected to be self-funding by 2040.

BRT lines are required to run through main routes of the City, serving all the proposed townships in order to ensure that connectivity between these townships are maintained.

The BRT system will have a significant impact on the existing public transport services. However, by properly restructuring, these existing public buses and mototaxis can act as feeder traffic into the primary BRT lines.

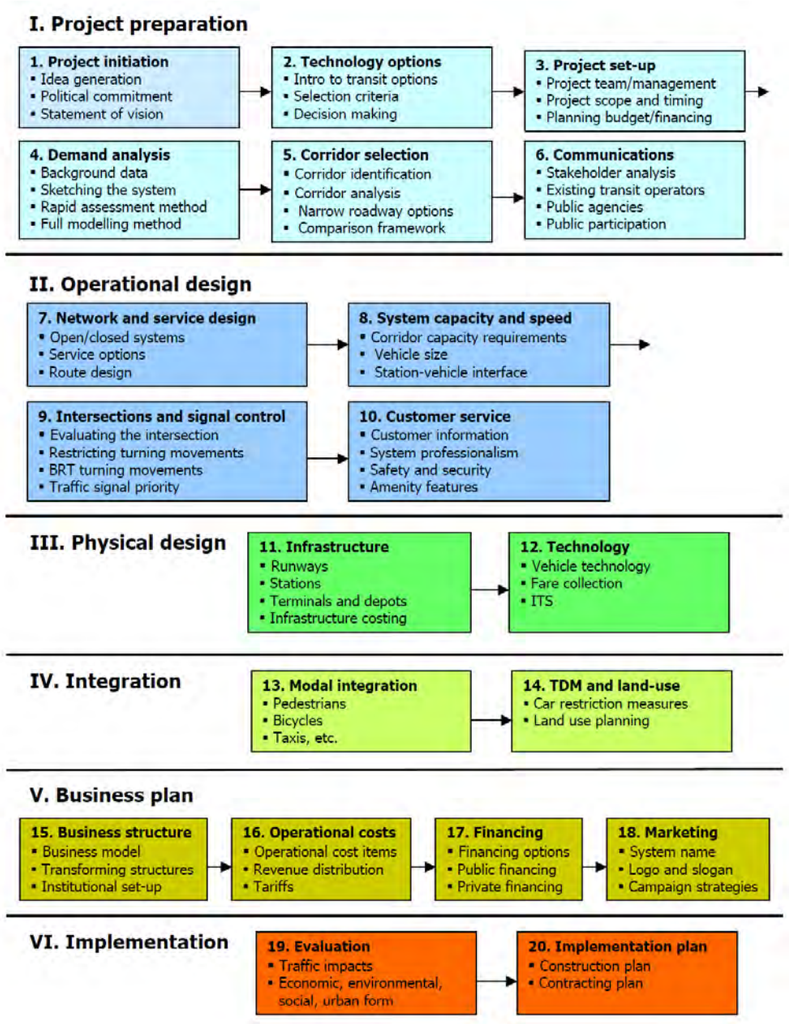


Figure 4.31 Overview of the BRT Planning Process (ITDP, 2007)

It is recommended that all feeder services terminate or provides connection to BRT stations as far as possible. Feeder services can also work as a local distributor service as well, and may run in parallel to BRT lines.

The anticipated passenger demand does not exceed 20,000 PPHPD along all corridors in the next ten years. As such Bus Rapid Transit is recommended for implementation in the short- to medium-term. Additionally, a plan to incorporate/phase out mototaxis and public buses will be required when planning the feeder services for the BRT lines.

A feasibility study will need to be done to design the optimum routing, taking into account land acquisition, geometric design, and capacity in terms of fleet and frequency.

In Singapore, the MRT system (4 MRT lines) is complemented by some three hundred bus services, many of which serve multiple MRT stations or run parallel to the MRT lines with more than four thousand buses in service in 2012. The bus services account for 85% of the ridership, nearly five and a half times the ridership of the MRT lines.

The BRT lines in Kigali are expected to provide similar levels of ridership, and therefore by 2040, an extensive feeder and local bus network should be in place to support the BRT lines.

The fleet needs to be well-integrated with the stations to ensure that service frequencies can be met. Boarding stations such as those in Curitiba (see Figure 4.30) have helped enable the BRT fleet to achieve passenger movements of 2.3 million trips per day.

Figure 4.30 Boarding Stations in Curitiba, Brazil

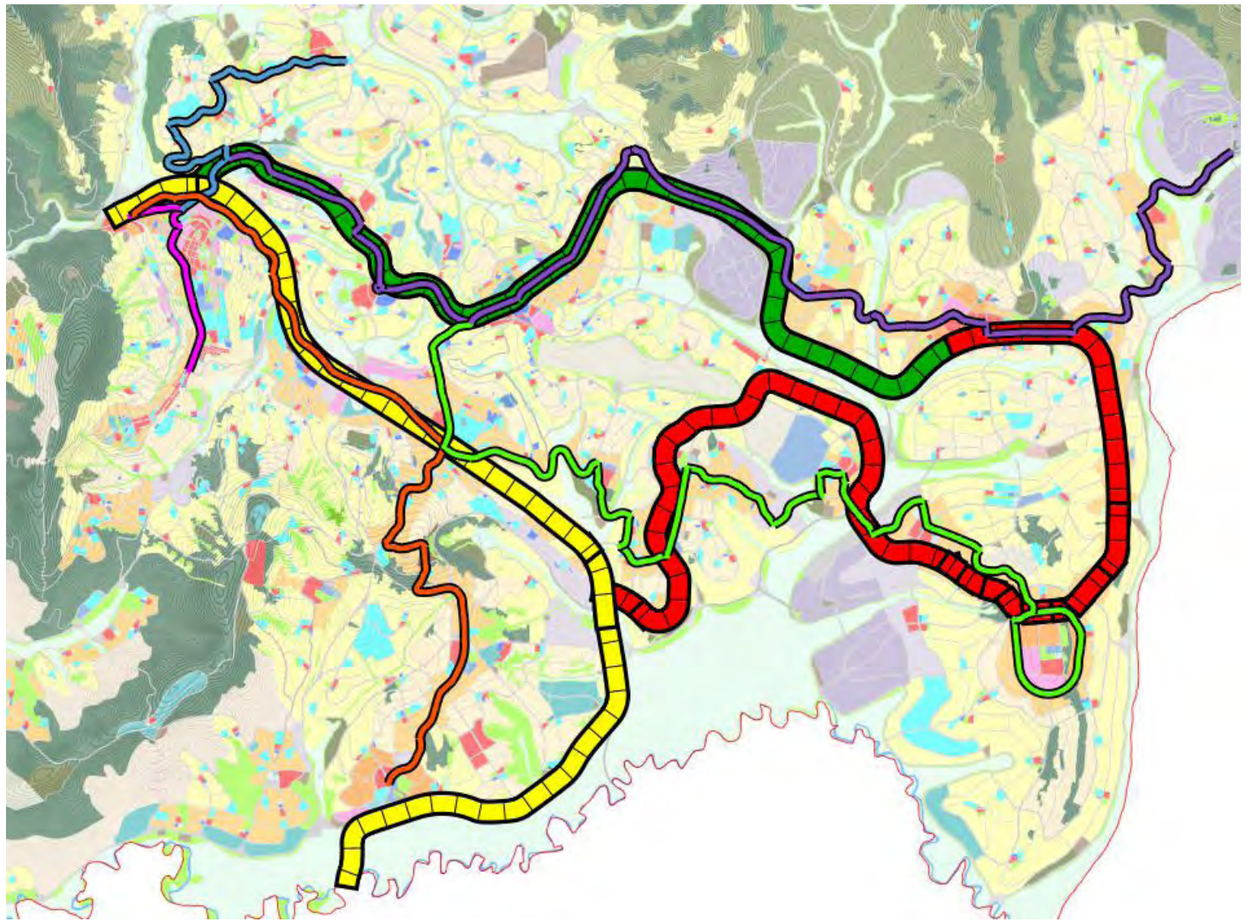


Figure 4.32 Proposed Light Rail Transit and BRT Routes

Feasibility of Light Rail Transit in Kigali

Light Rail Transit may not be a cost-effective solution in Kigali due to its undulating terrain and high costs involved in elevating platforms or tunnelling to achieve the necessary gradient and alignments.

While that is true in 2012, in the design horizon year of 2040, building technologies may have advanced to a stage where construction is cheap and ridership demand may justify it.

As such it is recommended that land be reserved along some of the alignments so that LRT may be built with little pressure on acquiring land for the development of the LRT.

Three preliminary alignments were found to be ideal for the purpose of this mode of public transport.

The Yellow line is proposed to be a link from the CBD to the airport.

The Green and Red lines would provide connectivity to the Yellow Line, and at the same time, due to the unique topography of Kigali, provide interconnectivity to one another through a transport hub. These lines would essentially link the north and the south of Kigali, and would complement the BRT lines to collect and distribute trips.

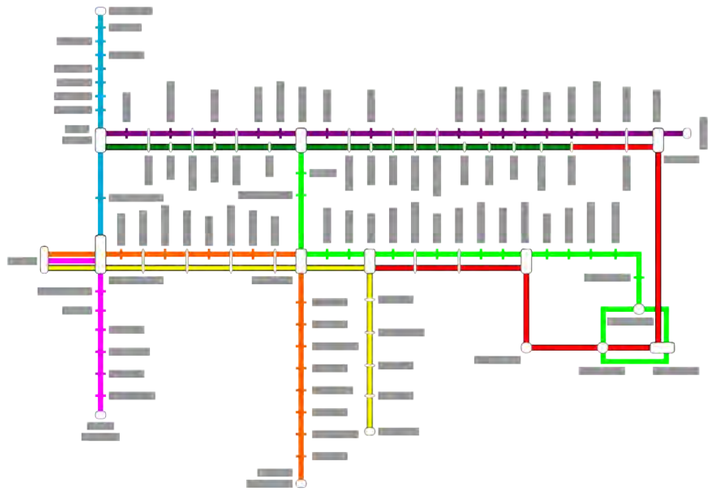
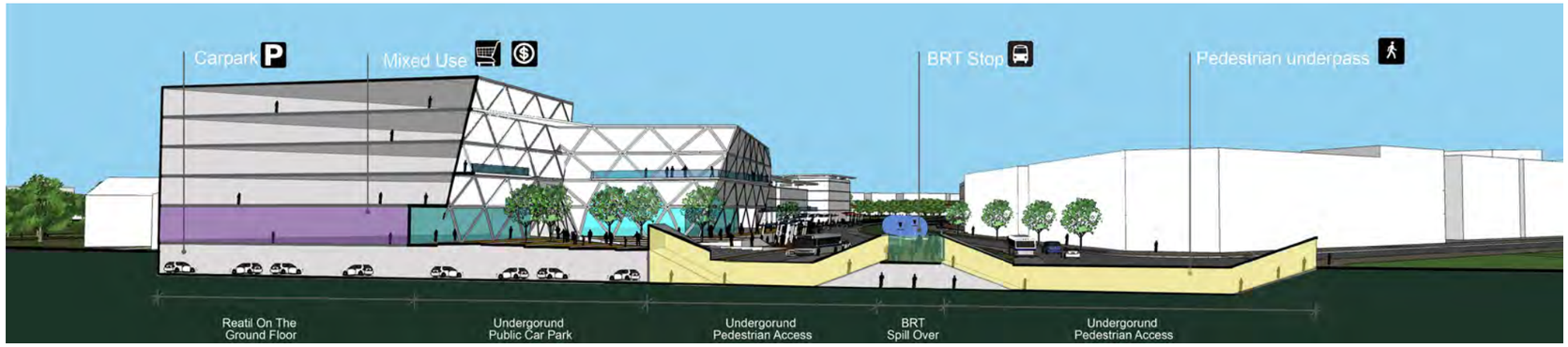


Figure 4.33 A Possible Integrated BRT/LRT Map for Kigali



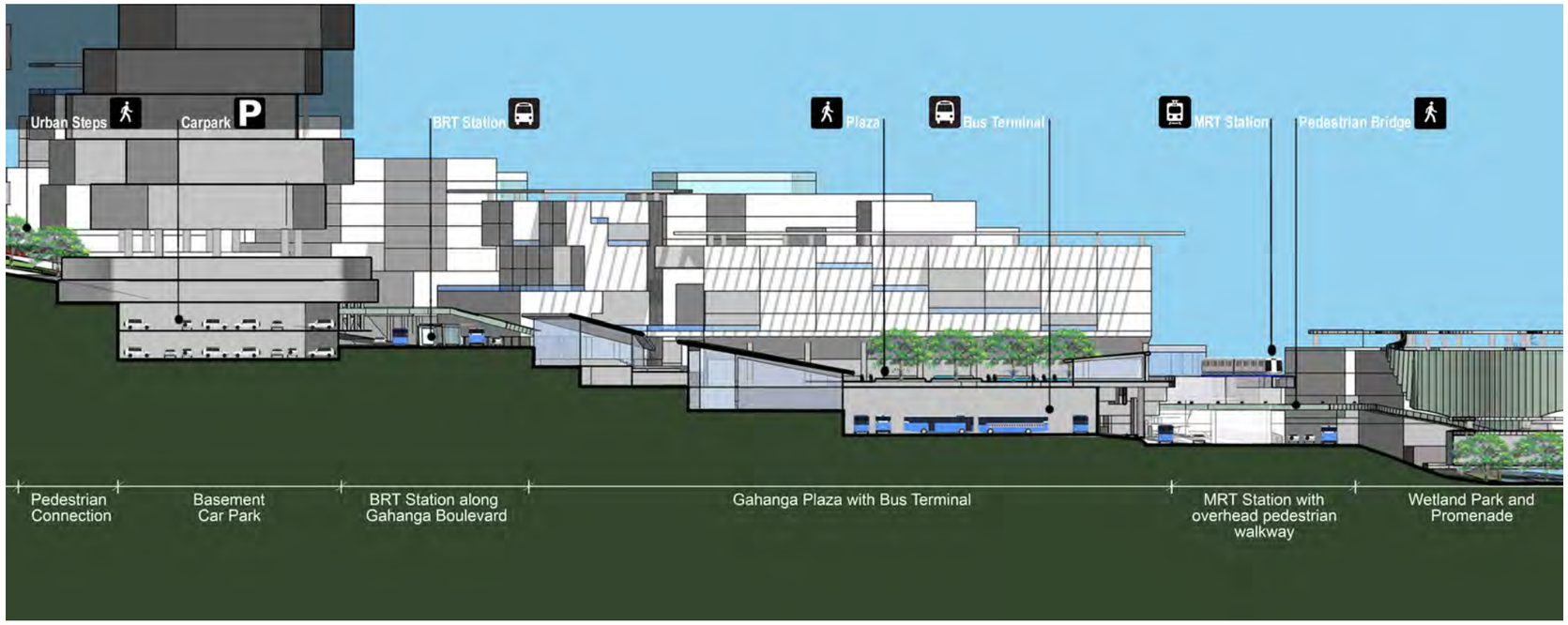


Figure 4.34 Transit Oriented Developments with Integrated Car Parks

Park and Ride Infrastructure

Park-and-ride (or incentive parking) facilities are car parks with connections to public transport that allow commuters and other people headed to city centres to leave their vehicles and transfer to a bus, rail system (rapid transit, light rail, or commuter rail), or carpool for the remainder of the journey. The vehicle is parked in the car park during the day and retrieved when the owner returns. Park-and-rides are generally located in the suburbs of metropolitan areas or on the outer edges of large cities.

Figure 4.34 shows several arrangements of a multistorey carpark along a bus or BRT route as designed for the City. Adjacent to these are commercial and residential developments which may utilise the car parks in addition to creating attraction for surrounding trips.

4.5.3 Supplementary Public Transportation Plan

Buses not only can fit in minor roads, but also effectively return road space to the pedestrians (see Figure 4.35).

A bus can effectively carry the equivalent of 60 cars worth of people, and as shown in the figure, the road space becomes very much permeable due to the reduction of cars.

This is the envisaged model in cities, where space is a constraint.

Figure 4.36 shows the hierarchy of travel from the village level to the city. The supplementary public transport systems should service all levels of the City, such that they work as distributor and collector systems from these villages to the town hubs.

In the future, the proposed travel between regional centres would be mainly provided by the BRT, and can be supplemented by regular bus services where necessary.

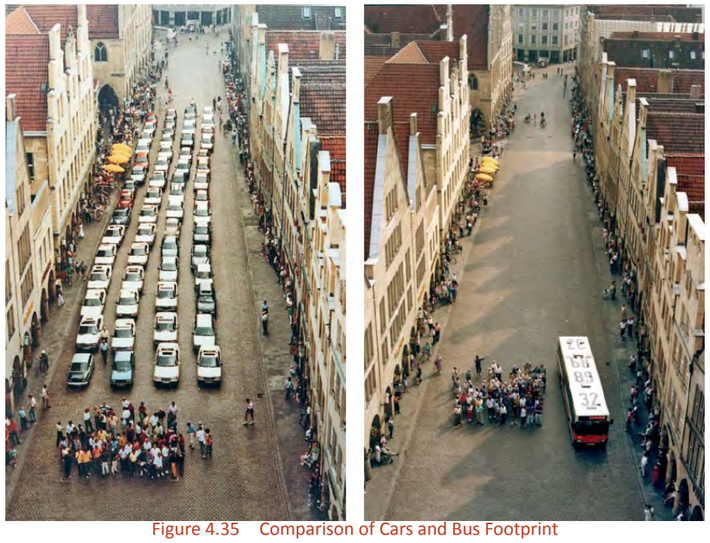


Figure 4.35 Comparison of Cars and Bus Footprint

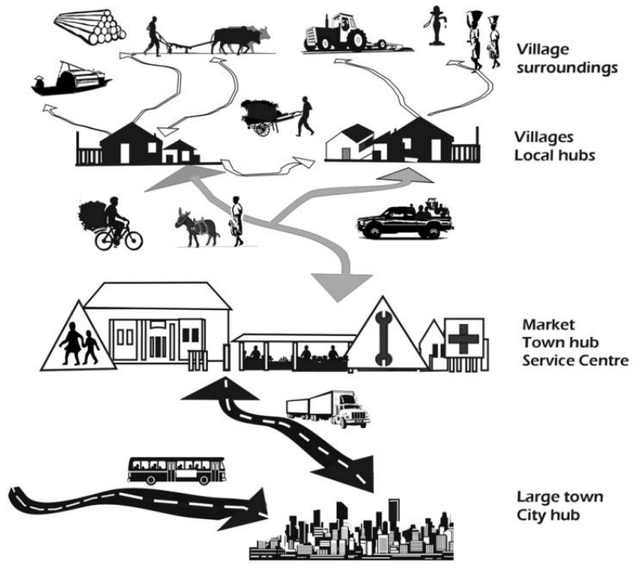


Figure 4.36 Hierarchy of Travel from Village to City

Development of an Integrated Public Transport System for Kigali

MININFRA's March 2012 report details many proposals which can be implemented in Kigali for the near future, in addition to long-term plans.

This document provides a comprehensive implementation plan for public transport in the City of Kigali, and is recommended for implementation due to its level of detail in study.

Figure 4.37 shows the high volume routes identified by the report where public transport services can be provided.

The document separates the development of public transport in three phases.

Phase I

- Development of Standard Bus Routes and Schedules
- Introduction of Standards for Public Transport Vehicles and Operators
- Provide tax holidays for the Importation of Standard and Large Buses for the Kigali City Bus Services
- Metering of all licences taxis
- Initiate Standard and Large Bus Pilot Demonstration Project
- Development of Standards and Specifications for Implementation of a Smart Integrated Ticketing System for Kigali Bus Services
- Implementation of a Hybrid Manual and Automatic Integrated Ticketing Strategy
- Development of an optimised bus service for school going children
- Initiation of Public Transport Sector Reforms

Phase II

- Upgrading and development of New Public Transport Infrastructures for Kigali City
- Construction/Reconstruction of Bus terminals/stops
- Identification and Construction Proper Bus-stops
- Implementation of an Smart and Integrated Ticketing System in the Kigali City
- Development of a smart and Integrated taxi service
- Integration of NMT, Motorcycle and public transport
- Development of Parking Policy and Strategy for Kigali City

Phase III

- Development of a Medium Level Bus Rapid Transit System for Kigali City for Main Bus Corridors
- Implementation of an Smart and Integrated Ticketing System for the Public Transport System in the Kigali City
- Demand management / traffic restraint
- Involving existing minibus operators in the new system
- Setting up an Unitary/Single Authority for the Transport system of Kigali City
- Summary of Cost Estimates for all Three Phases

The recommendations of the Report are in line with the recommendations of this TMP and should be accommodated where possible in the Implementation projects proposed by the TMP.

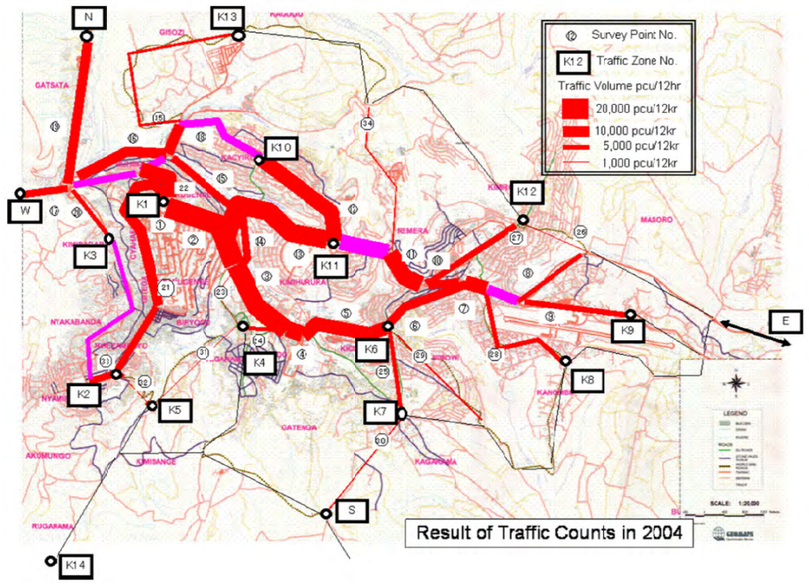


Figure 4.37 Qualitative and Quantitative Representation of Traffic Flows in different Routes of the City (MININFRA, 2012)

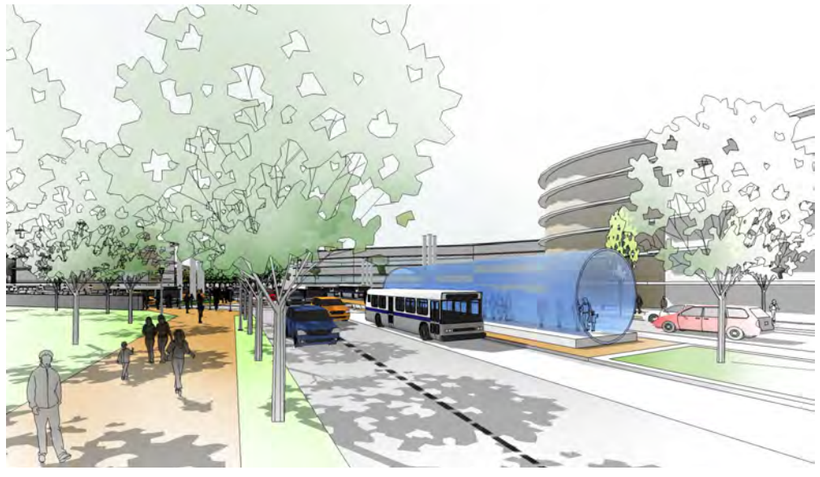


Figure 4.38 Integration of NMT and Public Transport

Figure 4.39 Example Components of Bus Stops (Translink, 2012)

Public Transport Infrastructure

Public transport infrastructure plays a vital part in the operation and function of an efficient, convenient and safe public transport system. Appropriate implementation would create a better customer experience and help make public transport a viable, competitive alternative to private transport travel. For example, inclusion of NMT infrastructure and well-designed bus stops (Figure 4.38 and Figure 4.39) can enhance the public transport experience.

In this document, key planning concepts are introduced to assist in the future development of public transport infrastructure in Kigali.

There are several issues related to public transport infrastructure that needs to be assessed for the City, namely:-

- Bus Stop Planning and Design
- Supporting Access Infrastructure
- Branding, Theming and Signage

While designing for these, several principles need to be adhered to, so that the ultimate goals of the TMP is achieved:-

- Disability access provision
- Environmental sustainability
- Human factors
- Consistent branding

4.5.4 Transport Hubs and Infrastructure Plan

The provision of transport hubs are necessary to supplement the economic growth and to provide better integration of the various modes of transport, both public and private.

Figure 4.40 shows an example of how the car park can be integrated into a transport hub, which can link directly to the adjacent BRT systems.

These transport hubs can be major economic centres with integrated commercial and retail, which can attract sufficient ridership demand for the BRTs during the off peak hours of operation.

The integrated car parks can also encourage drivers to park at these transport hubs before continuing their journey using the BRT.

By building these along the BRT lines, it could be another way of reducing congestion on roads.

Major transport hubs may be located in intersections of different BRTs and at the end of BRT lines, as identified in Figure 4.41.

Transport hubs in these locations tend to attract more footfall, making them ideal locations for commercial and retail centres.

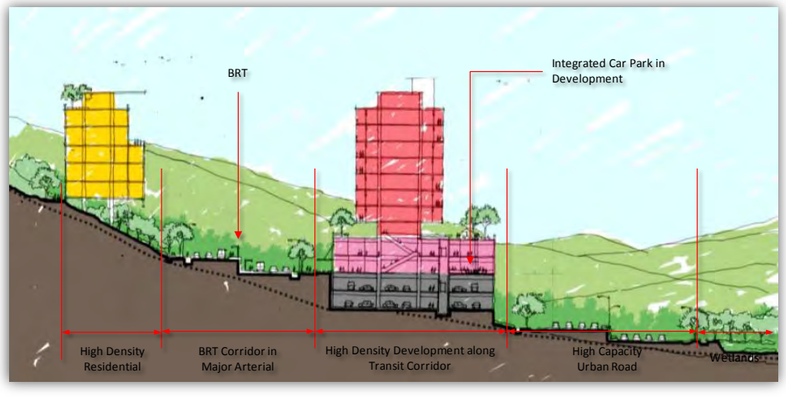


Figure 4.40 Example of a Transport Hub with Integrated Car Parks adjacent to BRT Station

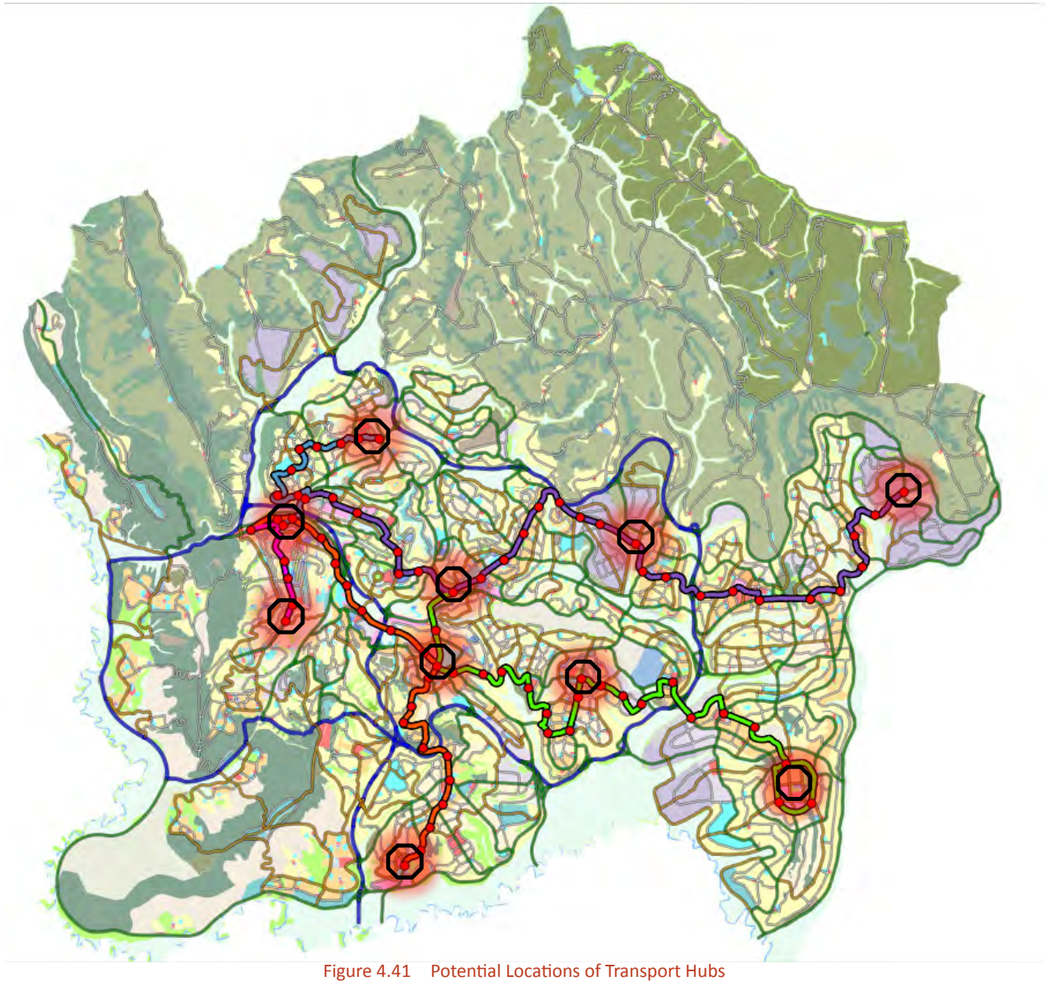


Figure 4.41 Potential Locations of Transport Hubs

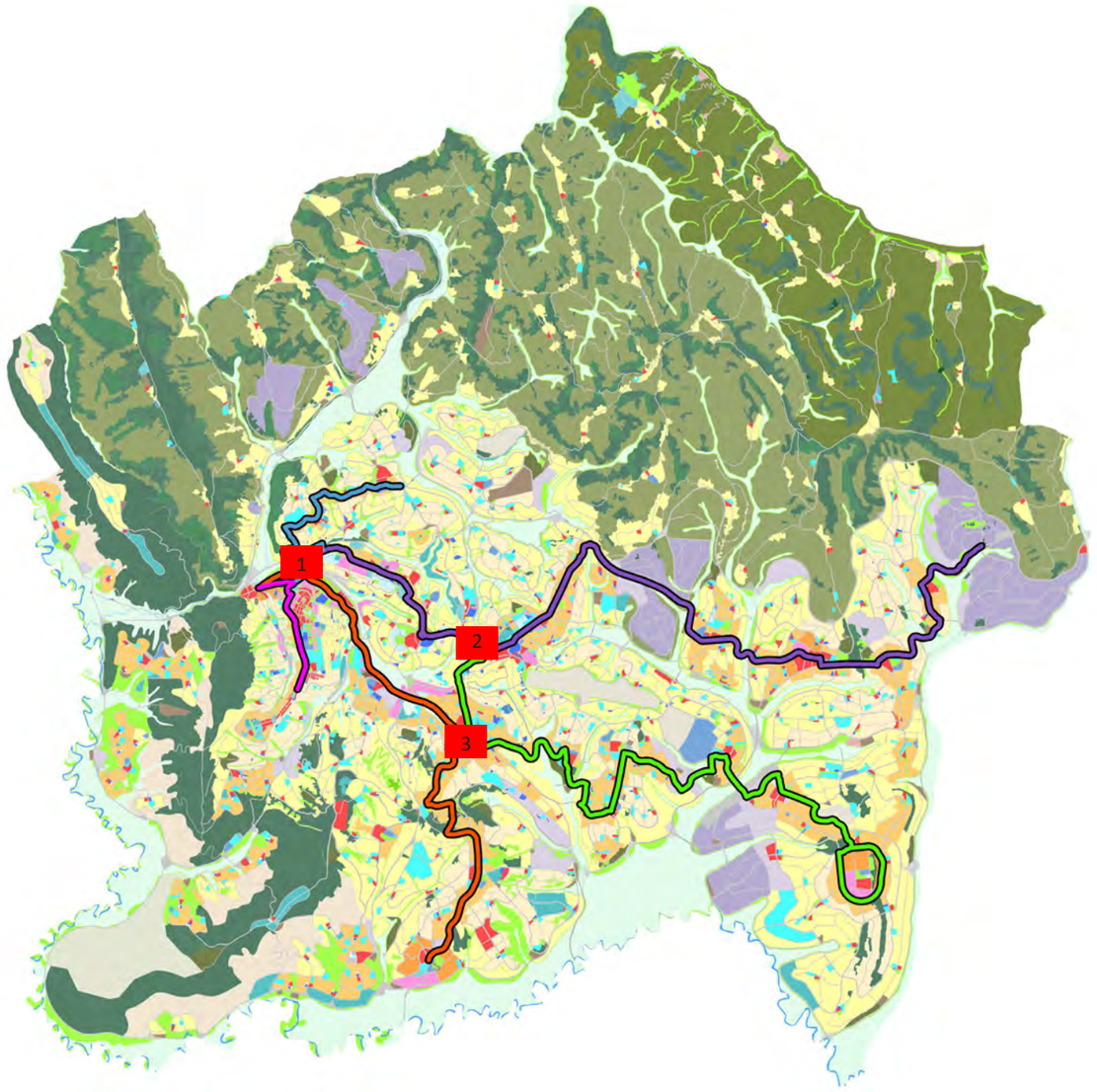


Figure 4.42 Proposed Interchange Transport Hubs

Transport Hub Location and Design

Transport Hubs are key infrastructure for large and highly populated catchments, where transfer from one mode of transport or interchange between transport modes are required.

These hubs serve key catchments such as commercial and business districts and may host a large variety of public transport infrastructure, for example park-and-ride schemes, cycle parking, taxi stands, bus stops etc (see Figure 4.43).

Interchange Transport Hubs

The interchange transport hubs are most suited for commercial use. These are located where two or more transport services meet, and therefore attract the most ridership. Their unique positioning in the city is therefore suitable for retail, and food and beverage centres, and can become a major destination for riders travelling to and from work.

3 such interchange locations have been identified in the TMP. The first is located in the Nyarungenge District and is well-placed between four of the proposed BRT lines.

The second is located in the existing Kimihurura town centre. The proposed regional centre is well-located in the heart of Kigali on the main east-west BRT line. It is also located conveniently on the Green line, which also connects to the southeast of the city.

The third interchange location is located at the meeting point of two proposed BRT lines just south of the second interchange. The link between the second and third interchanges would be attractive as commercial centres as they are easily reachable by both interchanges.

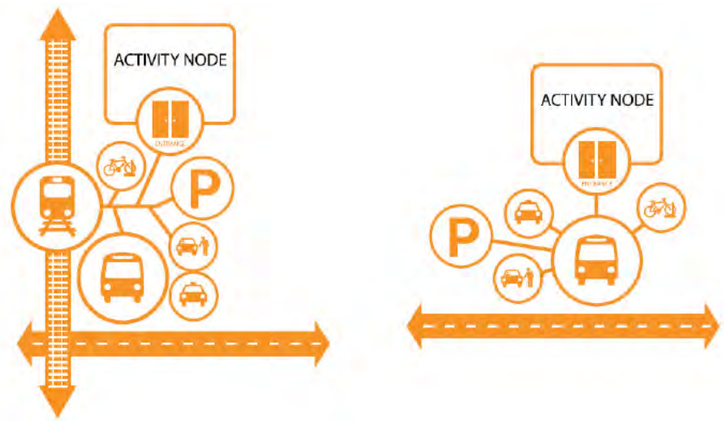


Figure 4.43 Locality Guidance for Station Facilities (Translink 2012)

End Terminal Transport Hubs

End terminals are crucial for maintenance and overnight parking purposes of the BRT. The bus fleet will need to have constant maintenance, and such service hubs should be located close to or at the terminus of bus routes.

These service hubs may be used not only by the BRT fleet but also for public bus services.

Five terminals have been identified for use in the TMP.

The locations of these terminals may be near industrial zones, which would be compatible in terms of landuse.

These hubs will still need to play their part to become collector hubs. Hubs 3, 4 and 5 are suitable for collecting trips coming from the south and east of the City due to their locations in the urban fringes. These hubs are expected to draw a large amount of private traffic from surrounding rural areas and therefore are suitable for providing park-and-ride facilities.

Additionally they are ideal for out-of-city bus terminals, especially for intercity transport.

Figure 4.44 Example of a Transport Hub

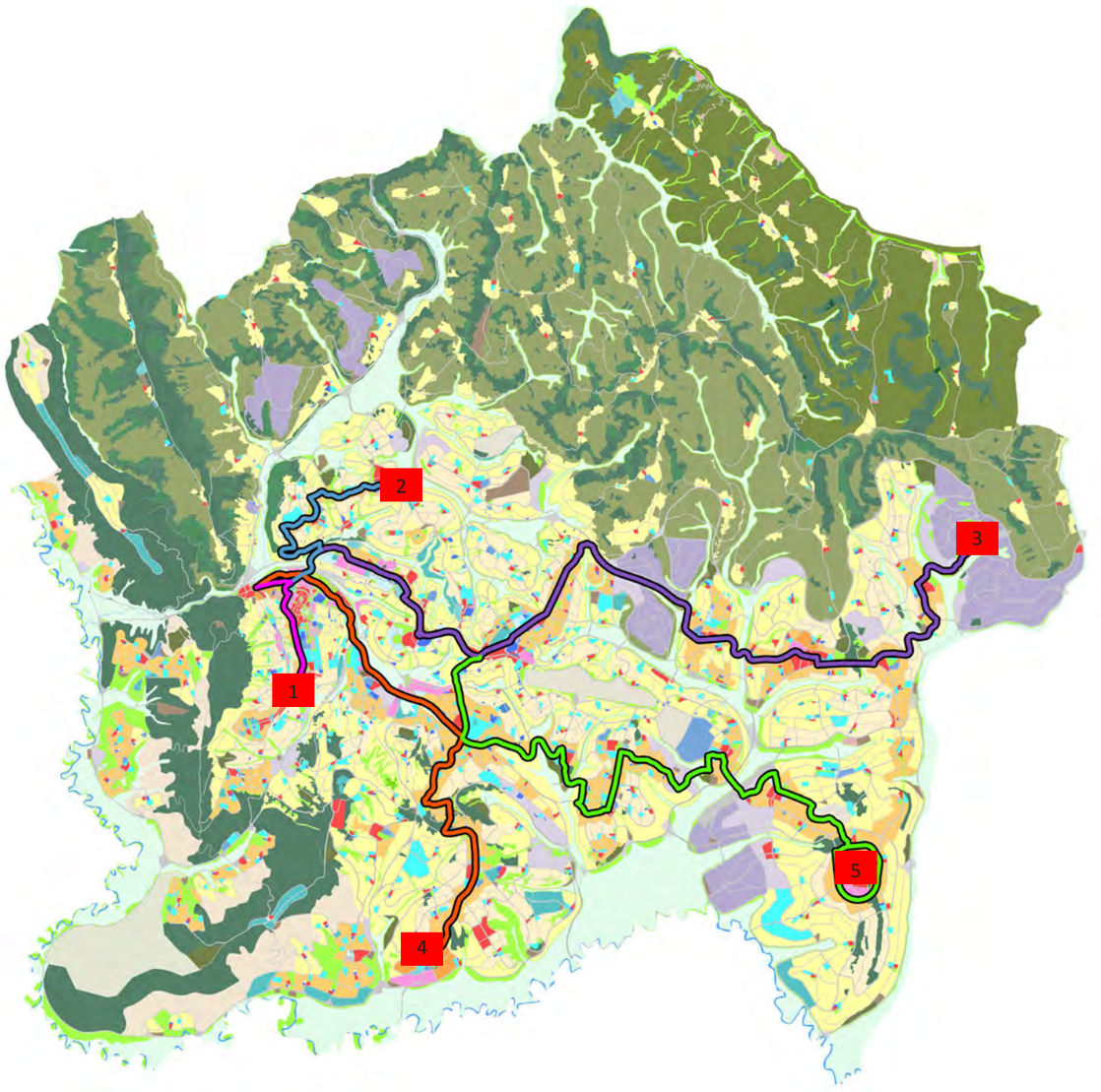


Figure 4.45 Proposed End Terminal Transport Hubs

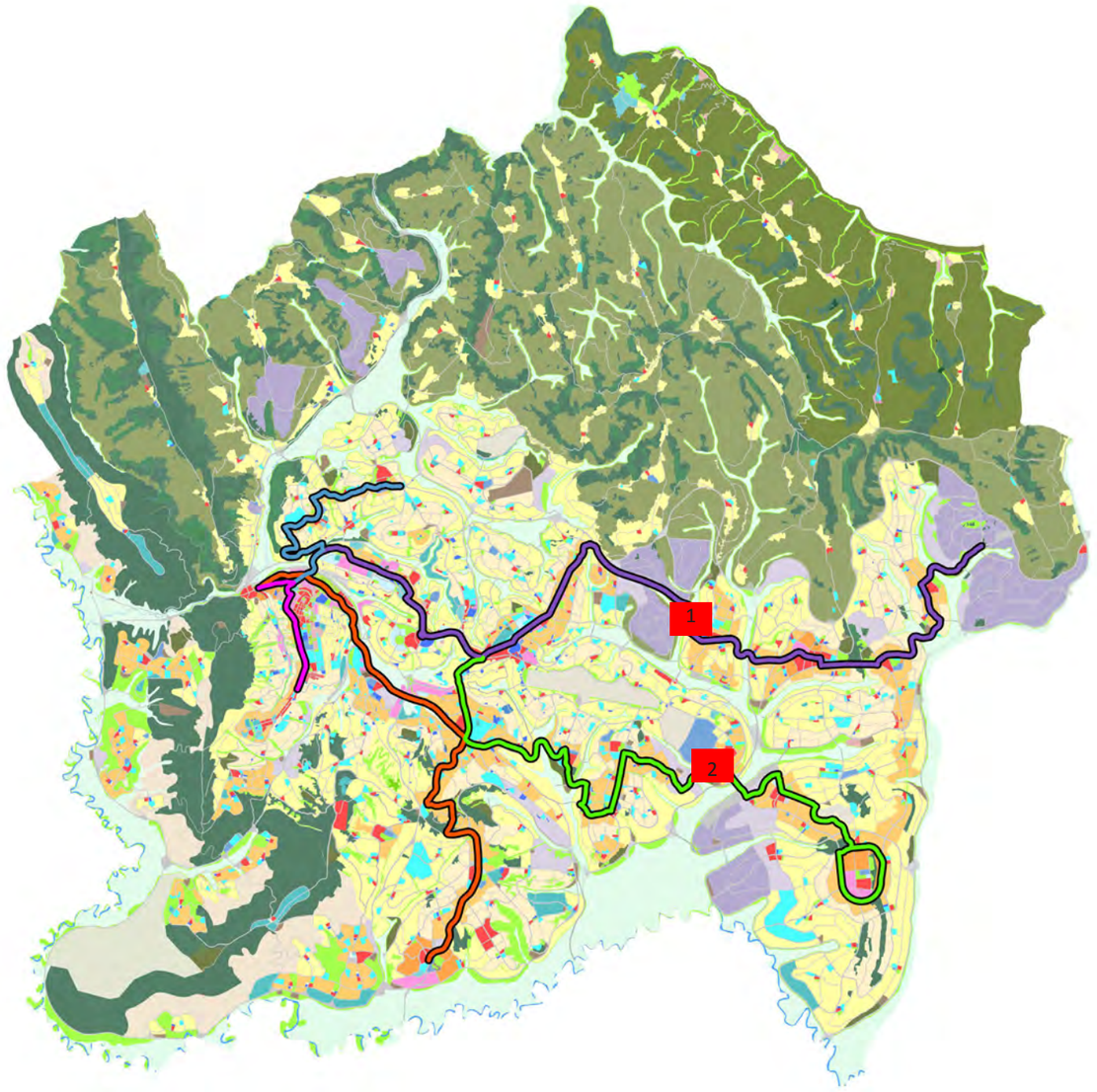


Figure 4.46 Proposed Interchange Transport Hubs

Intermediate Transport Hubs

Intermediate transport hubs can be located along long stretches of BRT lines.

In this TMP, two such hubs have been identified on the longer BRT Lines. As these hubs are located centrally, they are also ideal as collector hubs for pedestrians and cyclists travelling to other parts of the City.

The first intermediate hub shown in Figure 4.46 is located in the proposed Ndera Free Trade Zone. This hub is expected to be busy due to its location close to two different types of commercial zones.

The second intermediate hub identified is located directly south of the Ndera Free Trade Zone in the proposed Nyarugunga commercial hub. It is envisioned that these hubs would be linked by public transport in the short term to aid the movement of trips from the north to the south of site.

These intermediate transport hubs will have less need for parking due to their central locations, but would ideally be promoted as high density commercial centres such as shopping hubs and cinema complexes.

Figure 4.47 Preston Bus Station, UK, with Car Parking Facilities

Integration of Developments in Transport Hubs

Figure 4.48 and Figure 4.49 shows development concepts initially used to plan for the City Regional Centres. These have been further developed and can be seen in the Development Plans. An example of the application can be seen in Figure 4.50.

BRT stations or transport hubs would be situated within walking distance from the centre. Facilities would be situated within these areas to minimise walking transit distances.

Car Parking Provision

The construction of car parking in transport hubs in the fringes of the City can help in removing vehicles from travelling into the urban centres during peak hours.

The integration of mixed use development and multi-storey car parking in the City as shown in Figure 4.48 and Figure 4.49, would enable transit users move from all forms of transit (BRT, MRT or private vehicles) to another, in addition to the ease of access to facilities located within the high density urban developments. The location of the urban developments sandwiched between the urban roads, BRT corridors and future MRT lines would also mean that all facilities can be conveniently located within these developments.

Residential developments may be located along the ridges of the hills fronting the BRT mass corridors, therefore enabling easy access from these homes to workplaces in other regional centres.

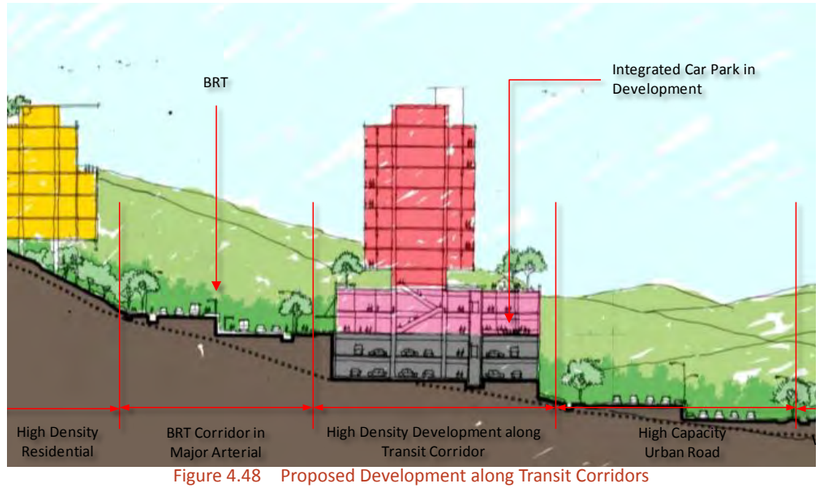


Figure 4.48 Proposed Development along Transit Corridors

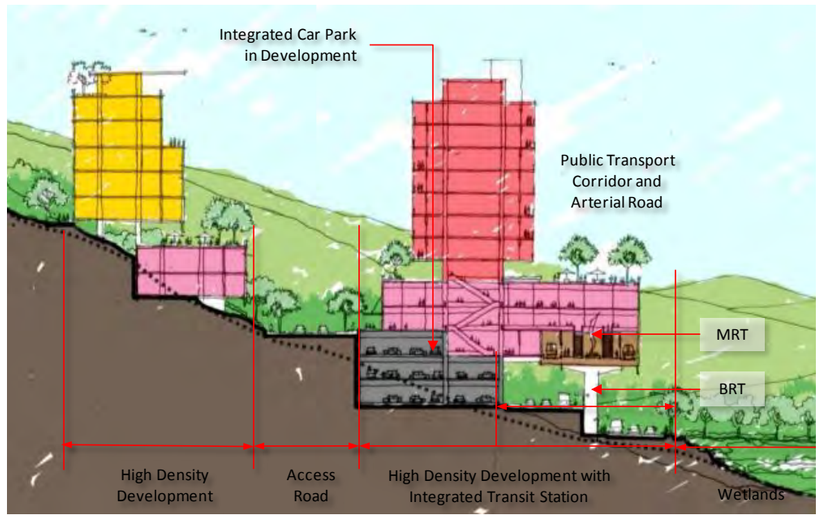


Figure 4.49 Proposed Development along Transit Stations, including MRT

Figure 4.50 Detailed Developments Plan for Kimironko, Kigali

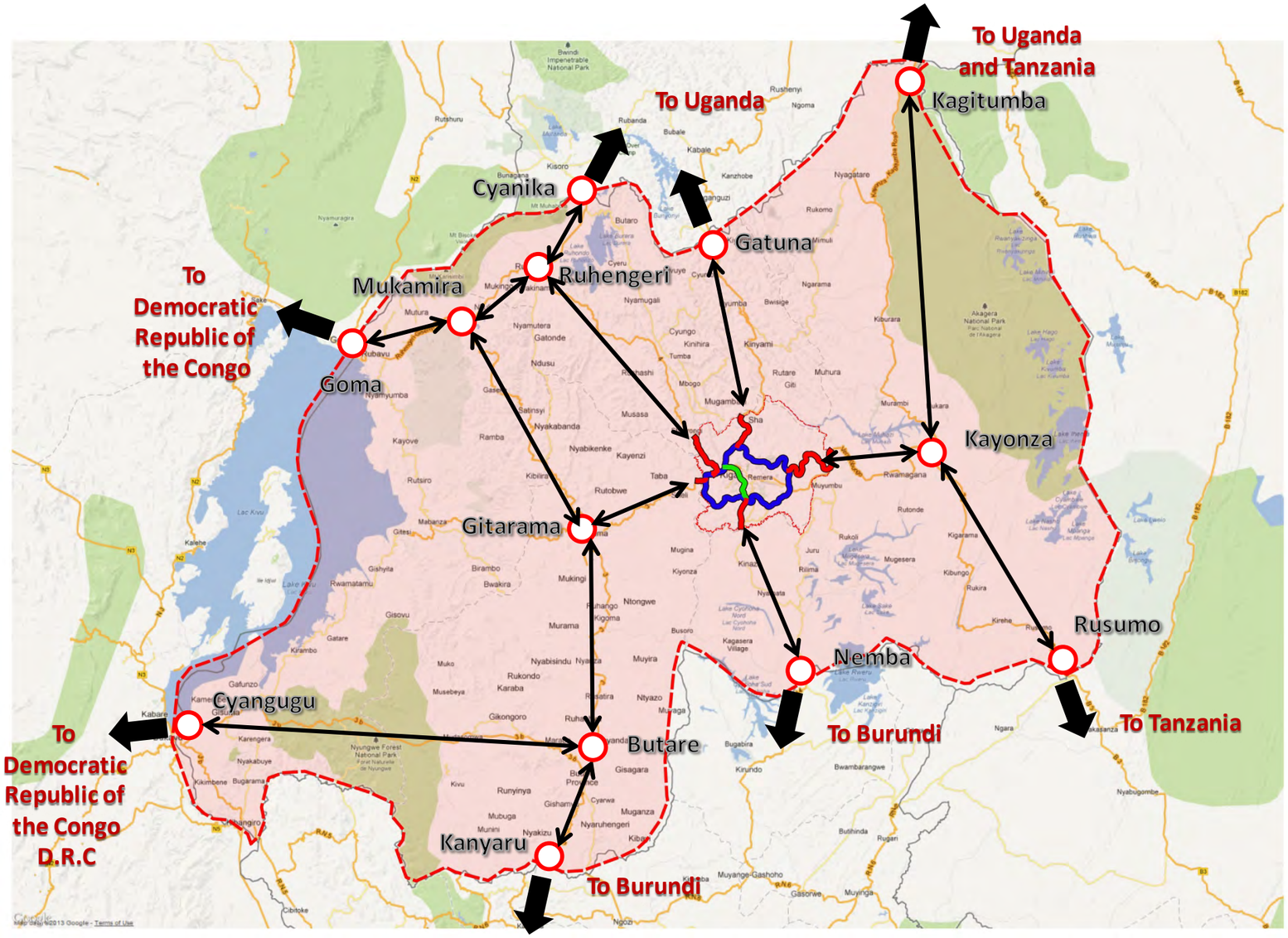


Figure 4.51 International and Regional Connectivity to Kigali

4.6 FREIGHT MANAGEMENT PLAN

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 4.51. 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.

Once the Rail Network connection is complete, it would strengthen Kigali's position as a logistics hub to the East coast.

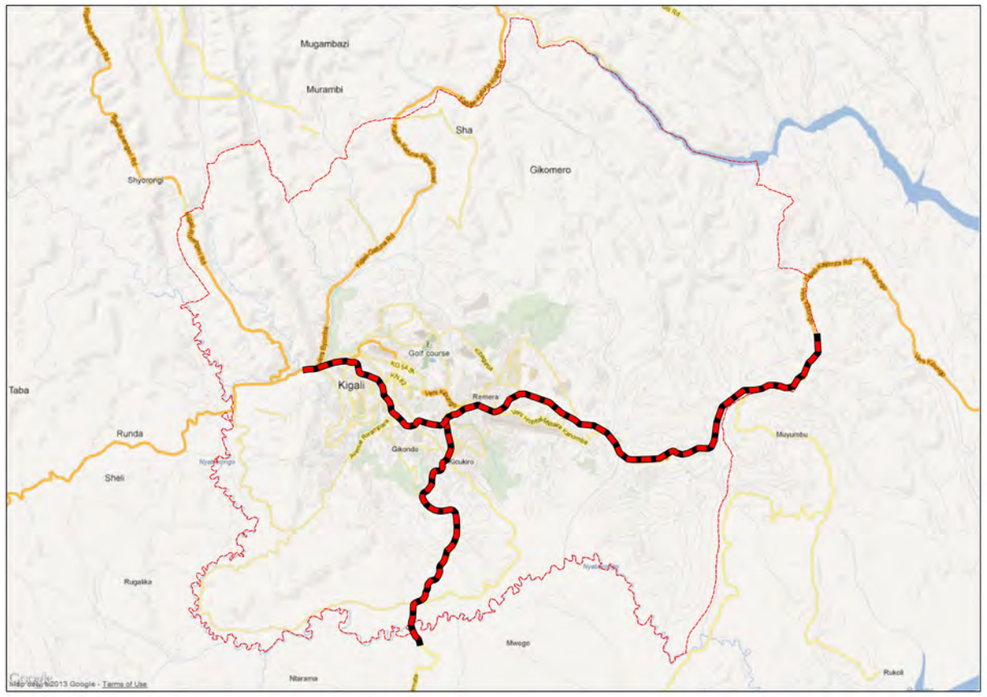


Figure 4.52 Existing Freight Route through Kigali

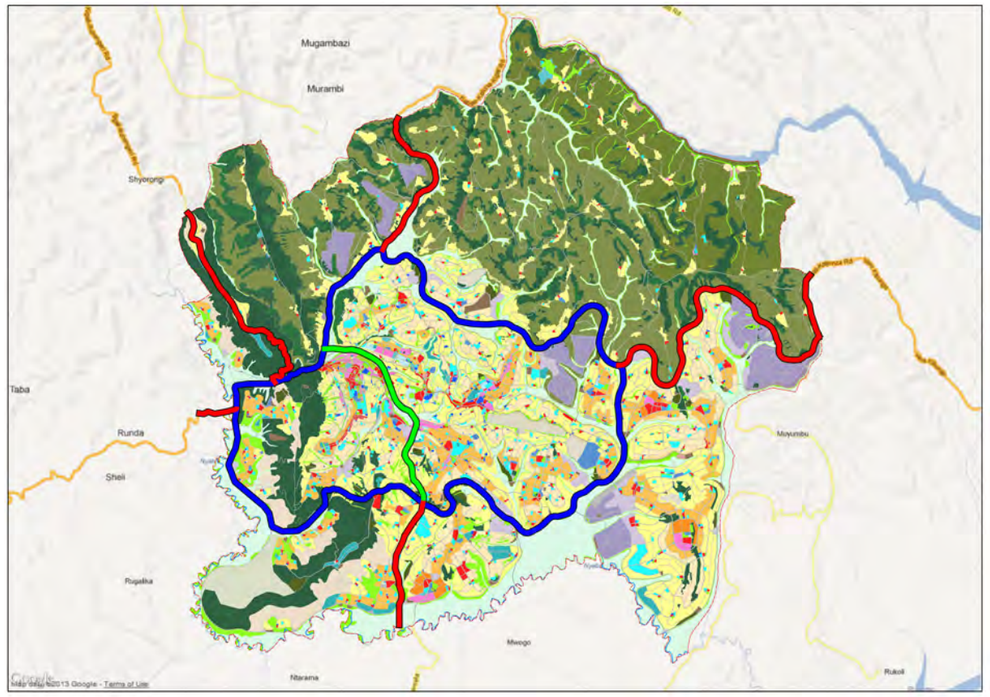


Figure 4.53 Proposed Freight Route in 2040

4.6.1 Realignment and Integration of Freight Routes and High Capacity Urban Roads

Currently, freight traffic travels in a east-west direction, as shown in Figure 4.52. This alignment brings through-freight traffic into the City, which is very undesirable. A Ring Road is proposed for use by the City to divert the through-traffic to the fringes of the City.

The High Capacity Urban Road network (Figure 4.53) can be utilised by freight traffic for this purpose.

The HCUR network circles around the City, and provides connections to all the industrial zones in the City.

There is scope for providing logistics hubs in the fringes of the City and within the industrial estates so that freight traffic movements are kept to its purpose.

Disruptive freight movements which do not need to enter the City and Regional Centres would also increase road maintenance costs, as freight traffic movements are the most destructive for paved roads.

Separation of such traffic would reduce maintenance costs for the City.

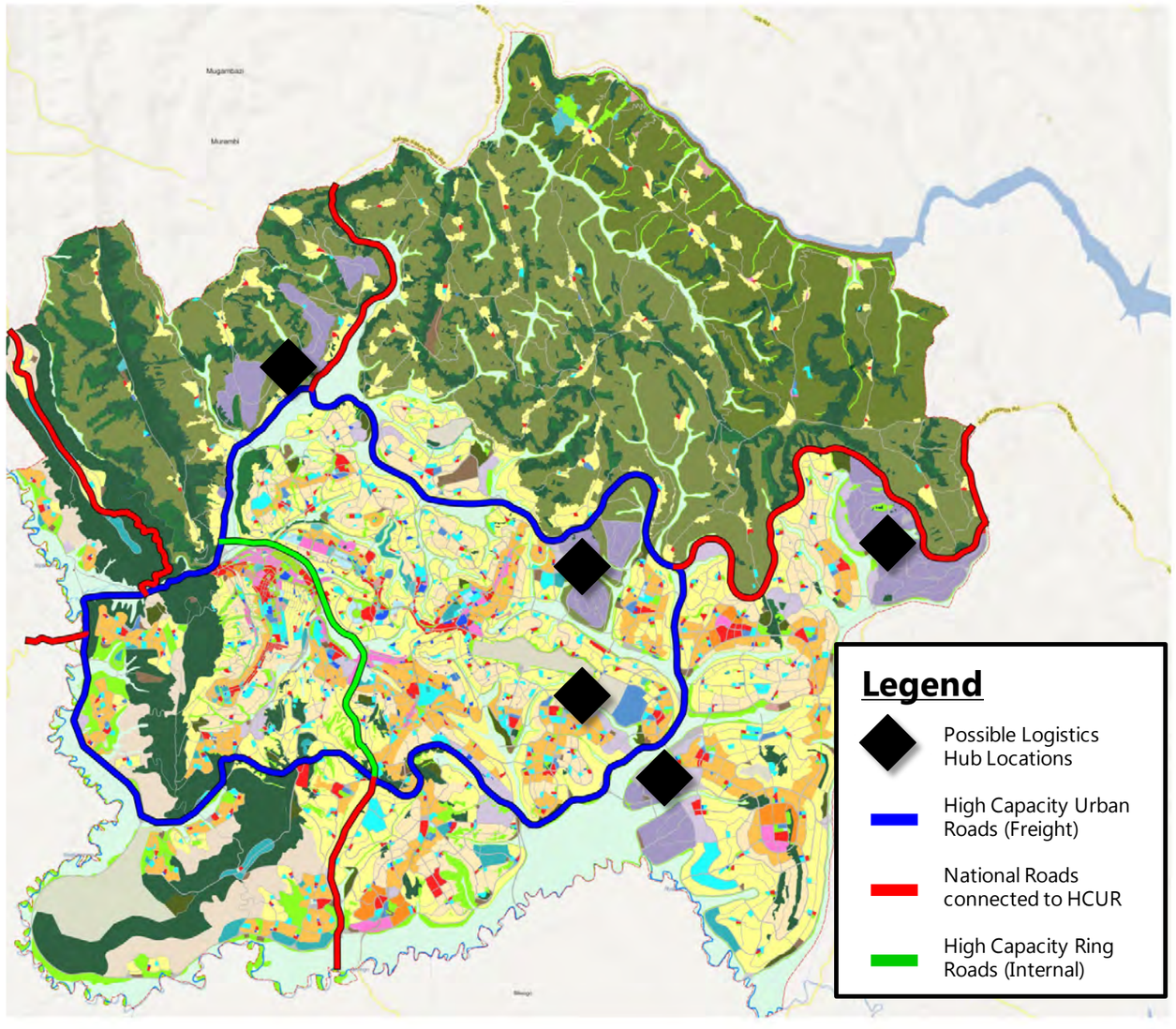


Figure 4.54 Possible Locations for Logistics Hubs

4.6.2 Possible Locations for Logistics Hubs

Figure 4.54 shows several locations where logistics hubs can be located.

The logistics hubs are proposed at these locations so that freight movements are be kept within the HCUR and National Road network, segregated from the City traffic.

The freight traffic should also be confined to industrial areas where possible.

There is also need to provide a logistics hub for the intermodal travel such as rail and air as discussed in Section 4.4.1 earlier.

4.7 GREEN TRANSPORTATION NETWORK PLAN

The Green Transporation Network Plan consists of the provision of Non-motorised Transport Infrastructure in the Land Use Plan.In addition to the provision of pedestrian footways and cycleways on roads where possible, the Green Transportation Network includes the provision of Major Green Connectors and Local Area Connectors where pedestrians and cyclists are given the priority.

These Connectors would be vehicle-free where possible, and provide a well-integrated NMT infrastructure in the fabric of the City.

The NMT network is also given a high priority along mass transit corridors, where the interaction between pedestrians and rapid transit is high.

In these cases, the NMT infrastructure would be provided to support the increase in pedestrian footfall.

Lastly, cycle corridors are provided within each regional centre where possible. There are many constraints to providing cycle corridors, such as steep slopes and narrow lanes. The cycle corridors identified are subject to further study before implementation.

Further to the Green Transport Plan is the pedestrianisation of urban centres. This introduces the pedestrian priority concept, which is prevalent in many modern cities.

It is envisioned that the sustainable transit would be well-supported by the proposed Green Transportation Network plan.

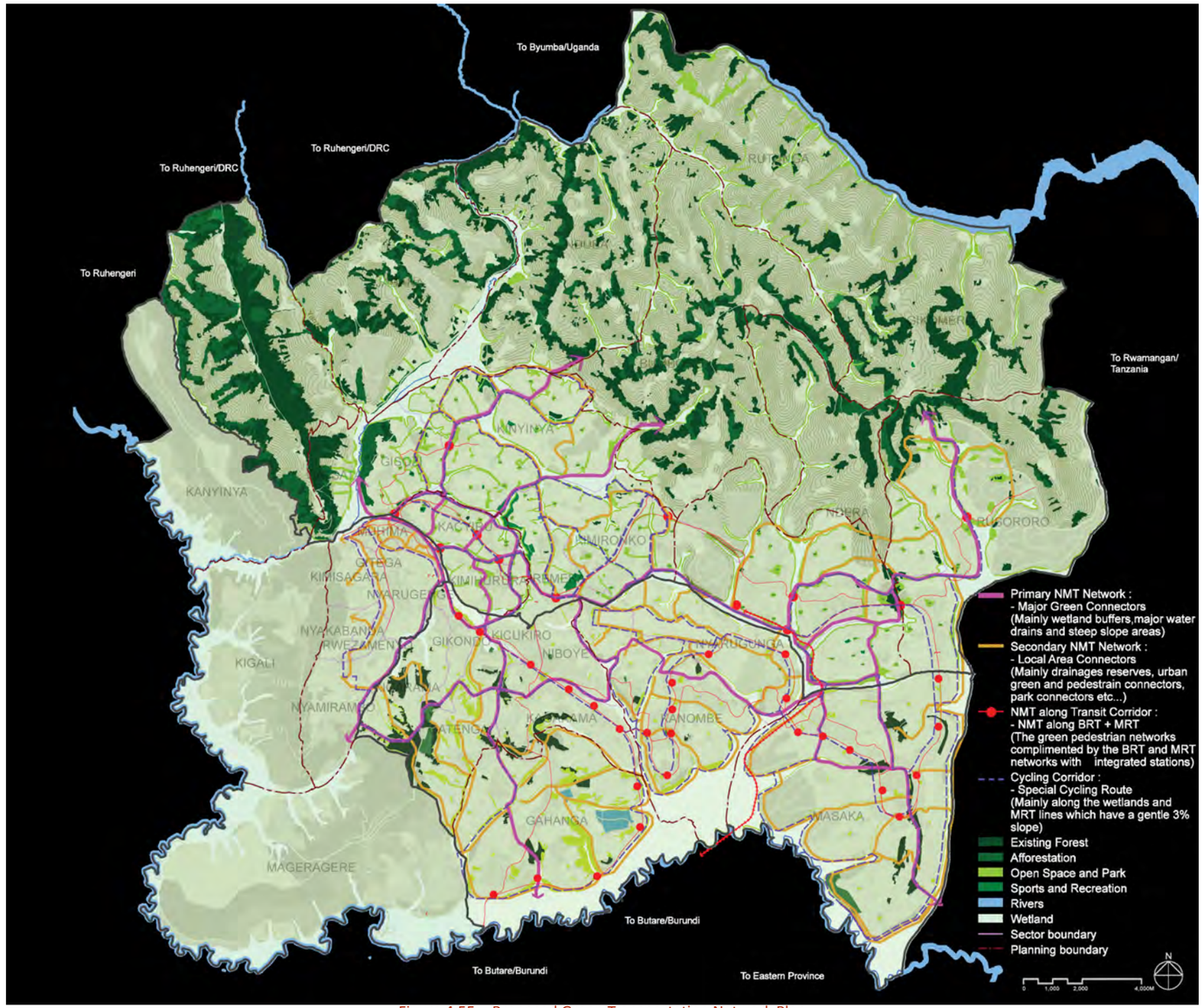


Figure 4.55 Proposed Green Transportation Network Plan

4.7.1 Major Green and Local Area Connectors

The pedestrian environment can dominate green and local area connectors where the presence of vehicles are minimal.

By providing pedestrian links between wetland buffers and steep areas where vehicles cannot gain access, the land use is maximised with little wastage while providing a comfortable environment for pedestrian permeability.

In local areas such as residential developments and parks, pedestrian infrastructure can be built along with other features such as drainage or public amenities.

Figure 4.56 Ecological Features along Green Connectors

While these environments cannot be totally vehicle-free due to the need for maintenance vehicles etc, the priority can be given to the pedestrians.

Figure 4.56 and Figure 4.57 shows examples of how green connectors can be designed to accommodate ecological features while providing access for vehicles.

These examples show a priority of pedestrians in the green space.

Figure 4.57 Well-integrated Pedestrian Facilities in a Shared Surface Green Space in Vancouver, Canada

4.7.2 Supporting NMT Infrastructure

The NMT infrastructure needs to provide support in terms of accessibility, efficient movement and safety.

This encompasses supporting components such as pedestrian infrastructure, lighting, integrated pedestrian networks and shelters.

The two main NMT infrastructure are discussed in the following sections.

Pedestrian Infrastructure

Pedestrian infrastructure is highly affects the road network due to its role as a social catalyst.

Movement of people needs to be supported by a series of interconnected pavements which can facilitate pedestrian movements.

Connections should be accessible, convenient, direct and legible. Elements for consideration are:-

- Intermodal conflicts - pedestrian crossings
- Kerb Ramps - connection, provision, quality and configuration
- Path width, grade, continuity and alternative paths
- Placement of other pedestrian infrastructure—rest points, railings, street furniture
- Pedestrian walkway and waiting shade cover for sun and weather protection

The most important infrastructure is the provision of the walkway. Based on the standard road designs proposed, walkways would be provided on all types of roads except the high capacity urban roads.

Pedestrian networks should be well-integrated with public transport networks, and walk-up catchments for bus stops should be between 400-800m, or 800-1200m for BRT stations.

Typical utilities required for pedestrian infrastructure are:-

- Shelter from rain, sun and wind
- Rubbish bins
- Seating
- Non-public transport information points
- Lighting

The installation of these infrastructure should not intrude into the pedestrian space. Planter boxes and other street furniture should be kept from interfering with path lines.

In roads where vehicle movements remain a high priority, pedestrian walkways should still be installed, but care should be taken so that conflicts are reduced.

However, where pedestrian movements are more prominent, such as in city centres, roads can be designed so that they are more pedestrian-oriented (see Figure 4.58). Dedicated pedestrian links may also be included in new developments so that land parcels remain permeable to pedestrians. Transit oriented developments may allow for pedestrian thoroughfare throughout the day to ensure that pedestrian connectivity is not broken (Figure 4.59).

Figure 4.58 Pedestrian-friendly Streets provide Accessibility to all Levels and Modes of Transport

Figure 4.59 Transit Oriented Developments with Focus on Pedestrian Connectivity

Figure 4.60 On-street Cycle Lanes

Figure 4.61 Integration of On-street and Separated Cycleways

Figure 4.62 Provision of Cycle Storage on Buses

Figure 4.63 Typical Cycle Parking

Cycle Infrastructure

Cycle Infrastructure are not different from pedestrian infrastructure requirements, with the exception of parking and specialised cycling lanes.

Due to the topography of the City of Kigali, it is also recommended that the public transport in the City provide additional service infrastructure to cyclists.

Cycle catchments for bus stops should be no more than 2.5km or 10 minutes' ride to all bus stops or BRT stations.

Where possible, end-trip amenities such as showers and gear storage should be provided. This can be required in the planning stage for any new commercial or retail development.

The proposed cycling infrastructure for the City of Kigali are:-

- dedicated cycling lanes
- cycle parking
- cycle storage on buses

Figure 4.60 to Figure 4.63 shows how these infrastructure can be implemented.

4.7.3 Pedestrian Zones and Complete Streets

In order to promote walking and to improve the overall walking environment, an pedestrian-friendly approach is required to manage traffic and transport matters and put more emphasis on the interests of pedestrians. In the last decade pedestrian schemes have been implemented all over the world with the following objectives:

- To improve pedestrian safety and mobility
- To promote walking as a transport mode
- To discourage access for non-essential vehicles
- To reduce air pollution
- To improve overall pedestrian environment

There are a few types of pedestrian schemes, namely:-

- Full-time pedestrian streets where pedestrians have full priority and vehicle access is only limited to service and emergency vehicles
- Part-time pedestrian streets where vehicular access is allowed in certain periods, but no parking spaces are provided
- Traffic-calming streets where pedestrian footpaths are widened and buildouts are common, to slow vehicles and discourage through-traffic, although vehicle movements are not banned

Whilst pedestrianisation is desirable from the pedestrian and environment standpoint, if not well-planned, may have a detrimental effect to roads in the vicinity.

Pedestrianisation of commercial zones have been found to increase footfall and attract more people to these zones, which also increases economic activity.

In residential areas traffic-calming measures reduce speeds and therefore create a safer and more conducive environment for family life.

Pedestrianisation is not intended for entire cities, as vehicular access still play a large part of cities. However, the intention on this section is to introduce the concept to the City of Kigali for trial, so that design for pedestrian zones can be systematically developed.

The closing of the roads for pedestrianisation can be beneficial after a detailed study for the scheme is done.

Pedestrianisation schemes should be accommodated for places where there are pedestrian capacity or safety problems. These schemes would need to look into the following:-

- Public demand and land use, e.g. are there shops or places of interest which would attract pedestrians and tourists to the area?
- Environmental and amenity considerations
- Impact of pedestrianisation on vehicular traffic in the vicinity and the servicing of buildings

Commercial Pedestrian Zone

Figure 1.2 shows a commercial pedestrian street in China. Its location in the heart of Guangzhou has made it a popular destination for tourists and attracts high levels of pedestrian footfall, boosting the local economy. Shops are serviced by delivery vehicles according to schedule which does not coincide with the pedestrian peak hours.

It is proposed that a similar pedestrian street be trialed in the City of Kigali. Additionally in new proposed regional centres, the development of pedestrian zones can be accommodated where possible, especially in the commercial hearts. Traffic issues which normally plague unplanned cities can therefore be designed out, for example, by providing car parking spaces at each end of the commercial street to encourage change of mode from driving to walking.

In the City of Kigali, several options were investigated. It was found that the most suitable site for pedestrianisation is Nyarugenge Market and its vicinity.

While the traffic is considered light, haphazard parking has made the road space difficult to manoeuvre. The pedestrianisation of the roads near the market (wider footpaths, no on-street parking, and narrower roads) would create a more pleasant shopping environment near the market, while still allowing through traffic. The traffic-calming street scheme can also extend to nearby attractions such as the cafe and market nearby, and along the commercial road on the east (see Figure 4.65).

Figure 4.64 Shangxiajiu Pedestrian Street in Guangzhou, China

Figure 4.65 Example of Pedestrian Schematic Plan for Nyarugenge Market

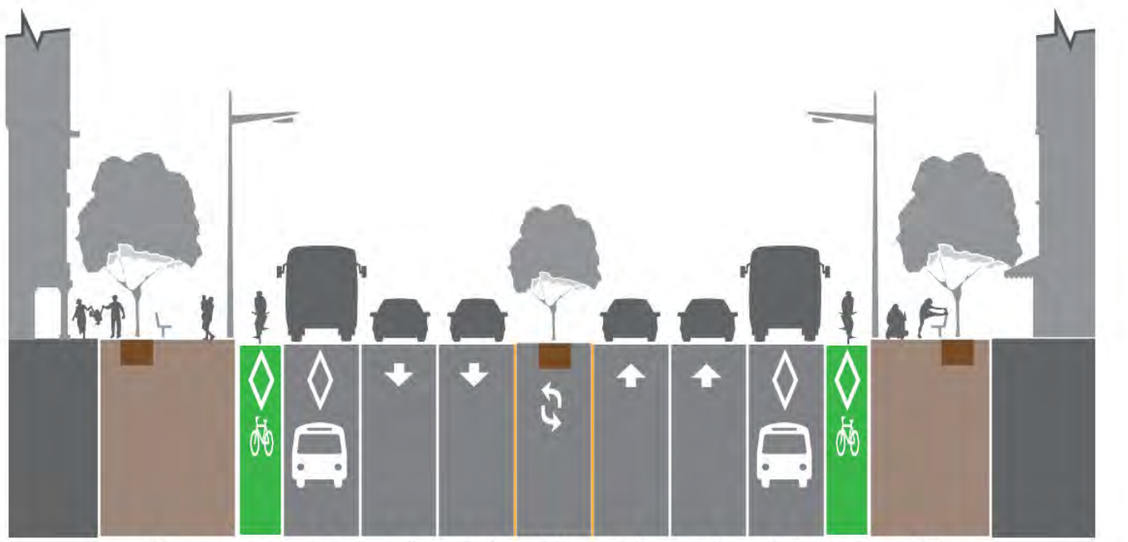


Figure 4.66 An Urban Complete Street in Canada


Figure 4.67 Proposed Complete Street Scheme at Eglinton Avenue East, Toronto: Before and After

COMPLETE STREETS

Complete Streets is a transportation policy and design approach that 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 regardless of their mode of transportation. Complete Streets allow for safe travel by those walking, cycling, driving automobiles, riding public transportation, or delivering goods (See Figure 4.66).

Complete street design should include principles and methods that can be applied all over the City to increase the quality of life of the City while benefitting the environment.

Liveable communities can be created. By extending public spaces in the urban street right-of-way, the opportunity is given to the City to greatly enhance sustainability by means of urban street projects.

Complete streets play a strong role in determining how society functions. They reverse the trend of isolated communities found in most urban cities today.

Complete streets avoid the segregation of communities due to the high permeability of such streets. Figure 4.67 shows an example of how applying the complete street principles on existing roads can transform the roads on a pedestrian level.

By implementing the Complete Streets approach, the City of Kigali can create more livable communities.

This supports the proposal to create regional centres for commercial and residential development, which means amenities and attractions would be more closely located. The knock-on effect is that people would more likely walk, cycle or take public transit which leads to improved population health and cleaner environment.

Developing baseline guidance for street design and incorporating sustainability as a key aspect in new development and redevelopment will promote positive changes for the people of the City.

The focus of this TMP is from the transport aspect. However, in the future studies on pedestrian zones and complete streets, it is recommended that the study takes into account all the potential aspects of sustainable design in road design, including energy consumption, source of construction materials and impacts to environmental resources.

5 INSTITUTIONAL SETUP, TRAFFIC MANAGEMENT AND POLICIES

5.1 EXISTING INSTITUTIONAL SETUP AND ISSUES

Integrating and Unifying Local and National Governance to coordinate efforts in implementation of good transportation systems

5.1.1 Background

This Master Plan is part of a comprehensive approach to address the needs of an integrated urban transport policy for the City of Kigali. Having a defined policy helps to smoothen and enhance the coordination efforts of all the players. This highlights the need for an active and objective-based strategic policy, where policy defines outcomes and success can be measured.

The challenges in implementing policy to get the intended results require some attention to the framework and also to the establishments responsible for execution. With capable and coordinated management, policies can be translated into strategic initiatives and tactical action to ensure delivery.

The Government of Rwanda is pursuing a policy of decentralization (Rwanda Decentralization Strategic Framework, 2007) which will increase local governments' responsibilities with regard to land use and transportation policy matters. The guiding statutory documents for the urban plan in the City of Kigali are the respective plans established by each District which define long-term land use and transportation plans. The crucial issue is how to ensure that the strategies and policies stipulated based on these individual spatial plans are mutually consistent and well-coordinated at the metropolitan level.

Problems and Issues in Urban Transport Management

The management of urban transport as a single function is almost nonexistent in the City of Kigali specifically due to:

- The weak institutional capacity and lack of adequate qualitative and quantitative human resources, thereby giving responsible agencies little guidance
- Too many stakeholders involved across the spectrum of urban transport - between municipalities and also national authorities cross-cutting into local affairs, which has resulted in a fragmented planning process and lack of coordination, vertically and horizontally between different levels of government and departments

Responsibility of Organizations

The current system delegating responsibility and authority to each of the national, city and municipal public authorities is inconsistent. All these authorities have their particular area of influence and control, with little effective coordination between them. The disintegrated institutional collaboration is one of the major causes of problems in the transport planning and management in Kigali today. Clear distinction of tasks has not been defined between the organisations, causing important traffic maintenance and management work to be overlooked, and in some cases, experience major resource shortfalls in carrying out the tasks.

The following have been identified as the key issues:-

- Fragmentation of policy and responsibility
  - Different and multiple agency involvement will cause dysfunctional ties with little incentive for 'ownership'
  - Divided responsibility of the City road network between MININFRA (national) and Municipalities
  - Division of public transport management for minibuses (ATRACO) and proposed BRT services (ONATRACOM – RPTA)
- Gaps in responsibility:
  - Numerous uncertainties in responsibility
  - Lack of integrated planning (between agencies/ functions and between transport and land use)

Potential Role and Function of Kigali City Council

Integration and coordination is a key issue identified in the Transport Sector Policy (2008). It is typical for the local authority to coordinate efforts and integrate the available resources to better maintain the City's transportation networks.

However the role of Kigali City Council (KCC) in achieving this is currently undermined, and can be attributed to a mix of centralization and decentralization approach of the national ministries and local municipalities. KCC is required to concede authority to national ministries for local issues, but has to implement the functions as the local municipality. In addition to this, a key mode of transport (BRT) for the city will be run by a national agency, which may affect transport integration efforts.

The fragmented urban planning and management function will hamper KCC in its essential integrating and coordinating role. While the RPTA's role is to establish and control the BRT systems, KCC will need to integrate it with the city-wide transit network. Without authority over the transit systems in Kigali, the decision-making, investments, system management, and traffic control for KCC are made significantly more complicated. To effectively manage the transport network, KCC requires major coordination and participation by all organisations both vertically and horizontally, which at present is weak or totally absent.

The role of the KCC should be recognized and strengthened to improve effective coordination of local government functions.

Role and Function of RURA (Rwanda Regulatory Agency)

RURA has taken a default role in managing the public transport services. The logistics in regulating public transport services is a daunting task and RURA's regulations and enforcement have a limited capacity to control actual services.

Route licensing in Rwanda is currently undefined. At present, RURA assigns routes to licenses. However, it is viewed that the planning of routes should be by the Municipality. Fares are currently self-regulated by market forces, and RURA's role in increasing fares is not well-defined.

Its role in Kigali is vital to structure the fare pricing of public transport, and therefore will need to be involved in the policy making.

Urban Transport Policy

The strategic policy direction to establish a Transport Authority in City of Kigali (SSI, 2012) is a good step for urban transport development but needs to be developed as part of an integrated Urban Transport Policy. Ultimately, it is the role of City Council to set out a holistic vision for the city's transport and development and this Master Plan is a good platform to build on this vision and policy.

There needs to be integration and coordination between the organizations responsible to implement, manage and control the process. As the sphere of urban transport is a complex set of issues and sectoral interests, it is recommended that a Kigali Transport Authority (KTA) be established with the purposes of integrating and coordinating efforts between the multiple players and to extend this into cohesive planning carried out by professionals within the Authority.

KTA will be the facilitator of the strategic policy set by the central government, translating it into a set of coordinated policies across the sectoral agencies that relate to urban transport and across the considerations of economic, social and environmental factors. It will provide a lean and efficient umbrella organization to coordinate the implementing agencies. The establishment of KTA will bring cohesion to the planning and execution process, and leads to a discussion of the nature of the execution agencies that deliver services at ground level. Unless there is a significant change in the way these agencies operate, the KTA will make little real difference at service level.

KTA would require a wide representation of stakeholders through a Board of Management so all vested interests are taken into accounts and the will to cooperate is fostered through a joint ownership of programs and a single line of accountability to the authority.

Coordination Among Local Government in Transport System Development

For a conurbation like the City of Kigali, where trade and public services flourish, there is a strong need to strengthen the transportation system through a coordinated manner. The development of transportation plan will involve many agencies at local and central government level and thus close cooperation will be required.

Urban transportation and land use development problems often spread beyond the boundaries of the City or Districts into the neighbouring local authorities. Therefore, transportation planning cannot be confined within the administrative boundary of a particular City or Districts. Overlapping or unconnected transportation network plans are consequences of a too inward-looking planning approach.

Formal arrangements to coordinate the transportation development planning through the formation of conurbation planning coordination committees are therefore required. One way of doing so could be by developing the "single corporate body".

Almost all Districts in the City of Kigali have included some sort of road development in their land use plan. The proposals from Districts should carefully be examined for their:-

- Consistency with the overall road network system
- Function and importance within the city's public transportation system
- Viability of constructing the proposed roads

Particularly with regard to bus transportation, it is necessary to foster better coordination to improve the efficiency of bus services as a whole. There is a need to re-examine the basic route network especially for the border routes and review the role and location of bus terminals.

The location and function of bus terminals should be reviewed as part of the process of defining the overall public transportation network, so that they correspond more closely to the pattern of passenger movements. This should make journeys more convenient for passengers and reduce total transportation costs.

Coordination Between Central Government and Provincial Government

With regard to the institutional aspect of transportation management in the City of Kigali, it is anticipated to clearly define the rationale of the establishment and conceptual structure of a transportation authority in accordance with the forthcoming need of metropolitan-wide transportation management to deal with an integrated transportation master plan. There are various alternatives to set up such institutions, such as

1) establishing a metropolitan-wide transportation authority, and

2) establishing a metropolitan region transportation planning commission.

The first alternative is to establish a new institution, namely, a Kigali Transport Authority, as discussed earlier, embracing all local governments, to manage transportation as a whole, including policymaking, fund raising, physical infrastructure development, operation & maintenance and transportation management. In such case, various transportation policies could be executed metropolitan-wide, such as road pricing, an earmarked fuel tax and reciprocal transportation system. The second alternative is to establish a metropolitan-wide transportation planning commission, whose main functions are to expedite metropolitan transportation planning, i.e. planning, research and coordination consisting of the central and local governments, academic institutes, transportation society, etc.

5.2 ESTABLISHMENT OF KIGALI TRANSPORT AUTHORITY

5.2.1 Review of Current Institutional Structure

Rwanda is currently composed of two layers of government: the central and local. Under the Rwanda Decentralization Strategic Framework (2007) the mainland of the Republic of Rwanda is divided into 5 regions. They are the Northern Province, Southern Province, Eastern Province, Western Province, and the City of Kigali.

As a result of the decentralization policy, the administrative structure of Rwanda has changed from Prefectures to Provinces and from Communes to Districts. The constitution of Rwanda provides for decentralization by empowering Districts as local tiers of the governance system. It also provides for the distribution of power and responsibilities between the central government and the districts.

In the Province of Kigali, the highest level of local government is the district. Each district is further subdivided into Sectors (Umurenge). The sectors are sub-divided into Cells (Akagari) and these are further subdivided into villages (Umudugudu). The sectors are the focal points of service delivery and are key in mobilizing communities to participate in development projects. They are also responsible for data collection and information gathering. The Cells are in charge of needs assessment and prioritization of service while the villages are the centres for community solidarity and self-help projects.

Central government in Rwanda is largely responsible for policy formulation, regulation and support to Local Government through capacity building, financing and monitoring and evaluation. This is done through public institutions such as Rwanda Transport Development Agency, which manages day-to-day aspects of transportation in Rwanda.

Local government with its administrative entities is mainly in charge of implementation of government policies and service delivery, and to provide an avenue for public feedback and accountability.

5.2.2 Institutional Development: Coordination

The foremost institutional issue in the transportation sector is insufficient coordination and communication between central ministries and local government agencies. Not only is there vertical discrepancy, the lack of consensus on regional planning across each local government's jurisdiction makes it more difficult to formulate an integrated transportation system development plan in the region.

Kigali City Council (KCC) should be the main player to coordinate among local administrations; however, inadequate resources and overlapping responsibilities with central agencies make it difficult for KCC to perform its duties effectively. The founding of a separate, legally and administratively independent and more flexible institution should be considered.

In this respect, the establishment of Kigali Transport Authority is strongly recommended to take charge of the creation and the management of a metropolitan-wide transportation development plan and to manage transportation in the region.

While it is important to establish a transportation authority for the region as part of the master plan implementation, it takes time to establish such a new agency. Hence, a planning commission should be established first in order to pursue the tasks in the short term.

5.2.3 Review of Transportation Authority in Other Metropolitan Areas

A variety of metropolitan-wide transportation organizations have been established in other countries, ranging from self-governing bodies which not only sets transport policies but also plan and operate transit systems, to policy-setting institutions which regulate and plan transit operations and allow the private sector to operate the transit systems.

An example of the latter is Transport for London (TfL), a governmental body whose role is implementing strategy and managing transport services in London. TfL is responsible for running the primary Underground network, but manages the maintenance by the private sector through contracts. TfL operates some of the major transit hubs, such as Victoria Coach Station, but coordinates operations for other hubs such as Waterloo Rail Station, which interfaces with the Underground.

The latter can be exemplified by the Public Transport Council (PTC) in Singapore, which deals with regulation, bus operation planning, and bus fare policy. Buses are operated by private companies through open contract tender.

In the context for the City of Kigali, the PTC model is more appropriate as it involves the private sector, which provides a trickle-down effect on the city's economy. Additionally KTA can focus on its role of policy making, planning and regulating the transportation services. By leaving operations to the private sector, competitive forces can ensure that the operational costs can be kept low through the tender process.

5.2.4 Establishment of Transportation Authority in City of Kigali

As previously identified, a single corporate body is recommended to manage traffic, design an integrated infrastructure development plan and provide a stable, reliable and safe public transit network to all citizens in the City of Kigali.

The establishment of a new transport authority can effectively and efficiently control transportation issues which may arise from the complex interactions between the jurisdictional areas of the Districts and the involvement of the central government. In this matter, there will be conflicts of interest, particularly regarding the use of existing institutions or capacities of existing agencies at the central and local governments. To resolve this, it is recommended to incorporate anticipated duties into KCC's. It can be made through granting adequate legal authority, which is superior to provincial and local governments' authorities, to some extent, and to create a mechanism to make sufficient revenue to carry out its duties, and to empower its personnel.

Kigali's status as the capital city of the nation also subjects it to more involvement by groups with vested interest in transportation. The institution will need to be effectively equipped with tangible transportation policy and instrument to manage the different interests.

The application of KCC to take the role as a transportation authority, which has extensive authority for planning, executing and monitoring all transportation affairs in the region, is not suitable for several reasons. The main reasons against the utilization of the City Council can be summarized as follows:

- Considering the KCC and its setup, it is still within the framework of public sector. A transportation authority needs to be independent from the public sector in the sense of institutional set-up, finance and human resources.
- The institution needs to be independent from governmental bureaucracy, interest groups, and should have a commercial-minded management. The institution should become an intermediate public transportation provider and run the business to deliver sustainable and reliable services to the region.

In view of the above, the establishment of a new transportation authority is therefore recommended. The reasons given below are derived from the lessons learned from the issues faced by the Kigali City Council, which is currently taking a fundamental role to facilitate an integrated spatial plan for the City of Kigali region and to harmonize infrastructure development plans among Kigali districts.

- The demarcation of roles and responsibilities do not depend on the administrative boundary or vertical ministerial delimitation of the central government; the authority could carry out its duties more systematically by setting up integrated transportation development systems. Because all facility, instrument and implementation are under one roof, it would need less efforts and time for the coordination.
- Once established, the authority would be the sole agent to formulate a transportation development plan for the City, so it will be one tangible integrated transportation development plan to be referred to by the respective provincial and local governments. It will also be the single actor to map out region-wide transportation management, including public transportation services.
- One of the key constraints is how to raise sufficient revenue to be a sustainable and self-reliant institution. The recommendation is to apply a new traffic management policy, TDM, and generate incomes from that source as well as from earmarked fuel tax, which can also be called as road fund.
- The new transportation authority would possess a discretionary power on funds, i.e. fundraising instrument, budgeting and capital management, so it would be less dependent on the revenue and budgeting of the central and local governments.
- Since the representatives of central ministries and related agencies would become the members of board of the authority, it is envisaged that inconsistent practices on transportation management would be minimized.
- Overlapping functions and role-sharing among agencies are observed in the current government systems; yet, this issue is expected to be resolved to some extent, since most functions, i.e. licensing, guiding and budgeting would be delegated to the new authority. The functions and duties would become clearer under one management. In particular, although central ministries will remain the supervisory organization to oversee the transportation policy, development plan and the implementation of the authority, it is envisaged that the ministries become more like an advisor instead of giving direct instructions regarding the authority's work.
- Under the transportation authority's framework, the integration of regional transportation planning will be coordinated by the board and its subsidiary committee, to ascertain full incorporation of respective regional plans.

Issues to be Considered for the Establishment of Transportation 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 Transportation 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 transportation 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 transit 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 transportation 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 transportation 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 Transportation 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 transportation 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 transportation 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 5.1 illustrates several aspects of the proposed institution to manage transport administration in the City of Kigali. The Study Team recommends to establish a transportation authority for the region with in the master plan period. To prepare for the establishment of the transportation 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					■	■	■

Figure 5.1 Proposed Timeline for the Establishment of the Kigali Transport Authority

Table 5.2 Institutional Development Process - Phase 1

Function	Persons	Remarks	Origin
Board of Management	10	Each existing transport-related agency identified Administration will have 1 representative on the Body, preferably a Senior Manager from the respective agencies	Public Authorities
Secretariat	2	Responsible for Minutes of Meetings of the Body and other secretarial duties, these 2 persons can be found within the large pool of administrative government workers.	Administration
Task Force	10	Seven experts is the minimum required for the unit to efficiently execute its works. One expert should be selected from respectively KCC, RURA, RTDA, RPTA, and the three Municipalities. The three remaining experts could deal with all other urban transport issues. These three experts do not necessarily need to come from within the public Administration but can also be academic or private consultants.	Stakeholders/ Experts

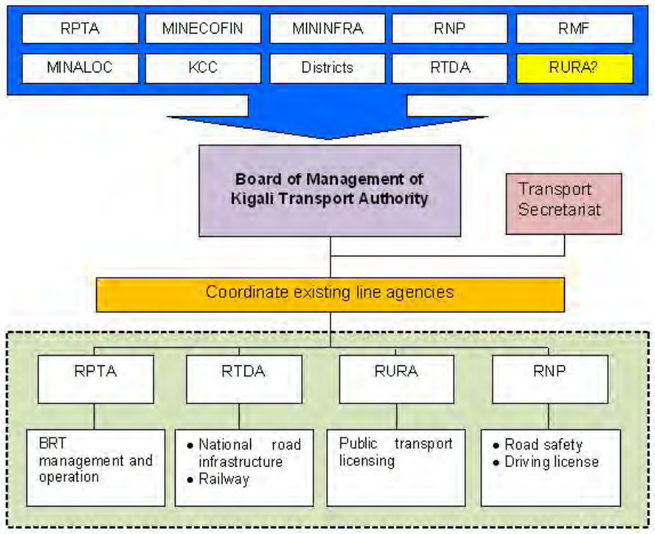


Figure 5.3 Structure of Transport Commission

5.2.5 Institutional Development Process

This section will present the development process of the proposed Kigali Transport Authority (KTA), based upon the analyses and concept detailed in the previous section.

Phase 1: City of Kigali Transport Planning Commission

Organizational Changes

Since it seems difficult to establish a new transportation authority in a short term, a City of Kigali transportation planning commission should be established in the interim to examine structure of the proposed organisation, functions, role sharing with the existing government agencies and for preparation of the authority to pursue the tasks in short term.

A Transport Planning Commission is to be set up under the supervision of the central government (MININFRA), consisting of transport-related personnel from local governments or districts and transport related government agency. The proposed Transport Planning Commission should consist of representatives from the following stakeholders:-

- Ministry of Infrastructure
- Ministry of Finance and Economic Planning
- Ministry of Local Government
- Kigali City Council
- Representatives from the Kicukiro, Gasabo, Nyarugenge District Councils
- Public Transport Authority
- Rwanda Utilities Regulatory Agency
- Rwanda Transport Development Agency
- Rwanda National Police
- Rwanda Road Maintenance Fund

The main functions of the Transport Planning Commission are to:-

1. establish Board of Management and Secretariat,
2. set strategic policy and define level of responsibilities,
3. coordinate respective land use planning at local governments into an integrated regional transportation plan,
4. conduct research and survey for transportation planning,
5. coordinate studies in the region to be utilized for an integrated transportation planning, and
6. manage the data collected through the study and survey to be used for academic research, planning purpose, and so on.

A secretariat is established to support the commission and carry out daily operations. Funding of the committee and secretariat shall be in form of contribution by the members or directly from the central government.

The establishment of the KTA Board of Management (see Figure 5.3) is the first step to improve the level of coordination among all stakeholders. The commission will further the research into the state of transport in Kigali, and sets the direction of the initial policy. The commission can also centralise and distribute research and study efforts and provide an insight for the integration of transportation and land planning.

Operation

The principal activity of the Board of Management consists of streamlining, coordinating, and integrating, by means of policy, the following:-

- Regulatory framework for transport in the City of Kigali;
- Strategic policy of the different stakeholders, in particular related to transport;
- Investment planning for upgrading of existing or development of new transport infrastructures;
- Maintenance of infrastructures, including the budgeting of the maintenance programs; and
- Control and enforcement, in particular procedures related to licensing, permits, policing of traffic, safety standards, and other transport-related issues.

At this stage in the development of KTA, the role of the Board of Management remains limited to a consultative role, focusing on follow-up and steering of policy-making and activities. A task force to prepare the Kigali Transport Authority will be set up as well under the direction of Board of Management. The task force is to consult ministries and draft necessary regulations for the establishment of the Authority. It will also prepare the action plan for the fund raising mechanism, i.e. road pricing and fuel tax, and facilitate the realization of the transportation master plan proposed by the Study Team.

Resources

At this initial stage of the KTA creation process, only human resources are needed in the planning commission, with consultancy assistance.

PHASE 2: TRANSFORMATION PHASE

Organizational Changes

The efforts in the Transformation Phase focus on expanding the role of KTA into a functional Authority that will take over the responsibility for urban transport in the City of Kigali parallel to the gradual introduction of functional and operational administrative structures.

KTA will execute the decisions made by the Board of Management previously established. The role of KTA will be to:-

- Create the management organization within the authority;
- Establish the administration;
- Commence reassignment of responsibility and creation of agencies;
- Develop policies for each agency within the overall strategic policy; and
- Develop budget plans.

The transformation of the KTA is particularly difficult because it requires combining the present process of simultaneous centralization in favour of the national government and decentralization in favour of the three districts in the City of Kigali to achieve centralization in favour of the city. The secretariat should help ease the transition due to efforts in the first phase.

The proposed organizational structure, characterises the urban transport system in the City of Kigali. It is important to note that the success of the Phase 2 process does not exclusively depend upon the work inside KTA. The successful implementation will also depend on the acknowledgement that institutional reorganization is needed for the line agencies with the objective of introducing structure and coherence that facilitates the functioning of KTA.

Operation

During the second phase, the Kigali Transport Authority is formally established under the supervision and control of the KTA Board of Management. This process involves the transformation of the Task Force into a more comprehensive and structured organization.

The principal task should be to internally organise the Authority and lay out in detail, the framework and functioning of the proposed Divisions, a task which should be completed before commencing Phase 3.

The administrative Secretariat, added to the organization during the first phase, should continue to function. However, it will now reports directly to KTA and not to the Board of Management. Its original function of writing and distributing meeting minutes and other small administrative functions will gradually expand in line with the expected growth of KTA' activities.

The experts in each proposed Division will determine the internal organization of each Division in creating different departments dealing with the responsibilities assigned, and the relationship with the line agencies. It is expected that all these will take place before the transfer of responsibility.

Resources

At this transformation stage, the human resources need to be expanded to ensure sufficient workforce is available when implementing the proposed works and administrative functions.

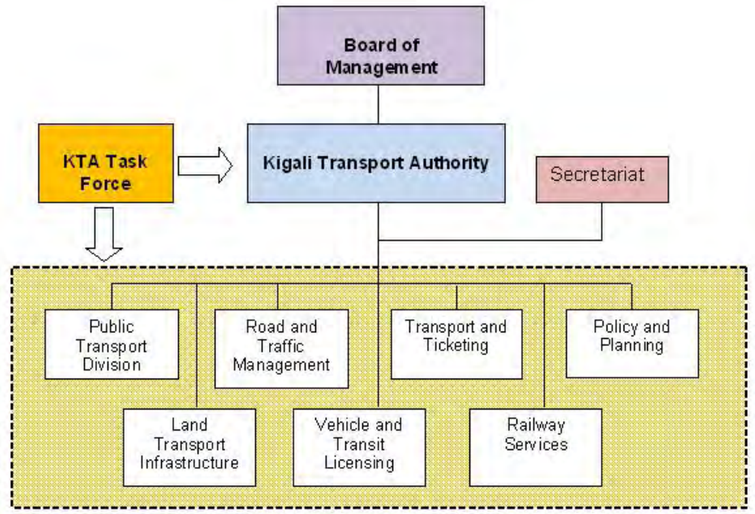


Figure 5.5 Proposed Establishment of Organizational Structure for Phase 2

Table 5.4 Institutional Development Process - Phase 2

Function	Persons	Remarks	Origin
Board of Management	10	No change from the Phase 1	Public Authorities
Secretariat	4	With the repositioning of the Secretariat under KTA, the responsibilities expand as the Secretariat will also have to take on the secretarial and administrative responsibilities for the Urban Transport Authority in addition to the responsibilities already assigned to it in Phase 1.	Administration
KTA	14	It is suggested that during the second phase, 2 experts are initially assigned to each of the 7 proposed divisions. They will have the explicit assignment to finalize the development of the divisions during Phase 3. One "coordinator" is added during the entire duration of Phase 2, bringing the total number of persons in the Kigali Transport Authority to 14 experts.	Stakeholders/Experts

PHASE 3: KIGALI TRANSPORT AUTHORITY (KTA)

Organizational Structure and Responsibilities

Phase 3 is the final stage in establishing the KTA. The main objective is to finalise the organizational structure of KTA, in particular the divisions under the control of the General Manager, and to complete the reorganization of the line agencies, as presented in Figure 5.6.

Three organizational issues of particular importance during Phase 3 are:-

- Introduction of an Advisory Board
  - The Advisory Board incorporates experts which are not directly attached to KTA but have existing roles in urban transport in City of Kigali. Members of the Advisory Board are proposed by each of the interested parties and their appointment is approved by the Board of Management.
- Departmentalizing the Secretariat
  - This involves separating respective responsibilities for the administrative tasks of the Secretariat, such as dealing with the staff of KTA and managing financial issues
- Completion of Reassignment of Responsibilities
  - Responsibilities of the proposed divisions and the line agencies are finalised.

With the completion of Phase 3, a fully-functional and well-structured authority will be responsible for all aspects of CoK transport system. At that time, KTA will have positioned itself as the coordinating intermediary between all stakeholders and the city's transport system.

KTA will relay the needs of the City's transport system to the national government and implement the national (urban) transport policy into concrete actions on the ground. An important part of its intermediate responsibilities is ensuring accountability of the line agencies and other executors and guaranteeing transparency on investment priorities to ensure coherent and sustainable development of the urban transport system.

KTA will be established as an independent public corporation, which is accountable not only to the central and local governments, but most of all, to the public. The Authority would be endorsed by either presidential decree or government law to stand as an independent public corporation. It shall oversee all land transportation issues and be responsible mainly for the following:

- To implement national policy
- To formulate integrated transportation planning, including road network development, BRT development, traffic management and public transportation system management
- To implement integrated transportation planning and programmes
- To issue licenses and control public transportation with bus route license, public transport business license, bus terminal development permission, etc
- To manage public transport registration operation and taxation
- To manage on-street parking operation
- To plan public transport services, such as trunk bus, minibuses, BRT, Taxi and
- To carry out traffic management measures, such as, road pricing, pedestrianisation and park and ride scheme.

Operational

The first duty of KTA, and its particular divisions, is to finalize the external restructuring of the line agencies. The final layout of the line agencies will in turn determine the final structure of the different divisions that deal with the control and coordination of the line agencies' activities.

The second duty will be to complete the internal organization of the divisions according to sectoral responsibility and the line agencies under its purview. Various smaller departments can be established under each division as is required according to the fields of responsibility.

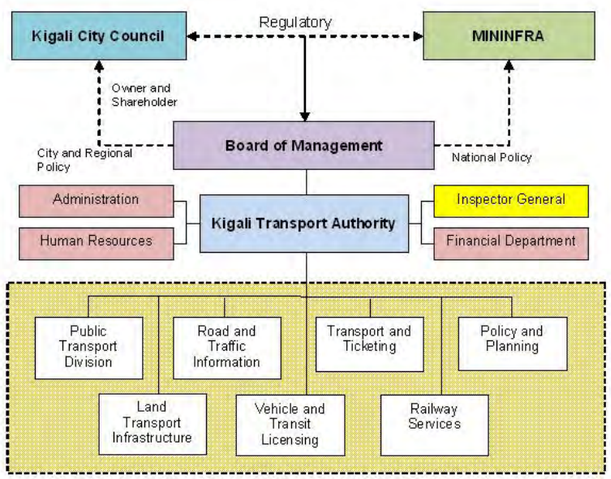


Figure 5.6 Final Organizational Structure for KTA

The authority would be operated by the revenue from public transportation business (bus, railway and bus terminal) and financial contribution or subsidy from the central and local governments. As an independent corporation, however, its primary goal is to be financially independent. It should be underlined that a disclosure of financial status is one of the most important aspects to secure its position as a public corporation offering public services to users in the City.

At the end of Phase 3, KTA will be fully operational and will require the necessary administrative, financial, and secretarial support. The role of the existing Secretariat will therefore be limited to traditional secretarial services while administration and legal affairs and financial affairs will each be assigned to a dedicated Department. An inspector-general will also be installed to ensure transparency and accountability within KTA.

Resources

The final number of staff for KTA can only be determined during the execution of Phase 3 and will be defined by the final setup of KTA. However, based upon the above basic structure, some indications can be given on the minimal number of staff required for operating efficiently. This is shown in Table 5.7.

Table 5.7 Institutional Development Process - Phase 3

Function	Persons	Remarks	Origin
Board of Management	10	No change from the Phase 2	Public Authorities
Advisory Board	Defined later	Assembles a relevant selection of public and private stakeholders to advise the Board of Management.	Stakeholders
Office of General Manager	Defined later	With the establishment of the different Divisions and Departments, supervision becomes imperative. A General Manager and an Assistant General Manager will be appointed by the Board of Management to take executive responsibility for KTA.	Stakeholders
Secretariat	4	Secretariat works	Administration
Administrative	5	An Administrative Manager (Department Head) will be assigned to supervise all administrative activities. However, in line with the gradual increase of responsibilities of KTA, the number of administrative staff might increase.	Public
		The Administrative Manager should be assigned from the administrative government workers, preferably originating from city-level administration.	Administration
Financial Department	4	A Financial Manager (Department Head) will be assigned. The selected persons should have the necessary financial knowledge and preferably reassigned from within the existing Public Administration.	Public
			Administration or outside contracts
Human Resource Department	5	Three persons would be assigned to managing the staff, while by the time Phase 3 is completed, another person will organize and coordinate staff training and capacity building for the efficient working of KTA.	Public
			Administration
KTA	14	No change from the Phase 2	Stakeholders/Experts

5.2.6 Proposed KTA Roles and Responsibilities

Reporting Structure

As KTA will be established as an independent public corporation, the shareholder of KTA will be under the framework of the Kigali City Council. For city transport management and its functional capacity it liaises directly with the national ministries, particularly the Ministry of Infrastructure, as shown in Figure 5.6.

The Kigali Transport Authority has 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 will include representatives of each of the principal public authorities and the General Manager (GM) of the KTA shall be a full time member of the Board. However, given the GM is accountable for executing the Board's strategy; he 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 is selected from the Members of the Board to preside over the meetings of the Board of Management. His selection will be for a pre-defined period of time, for example a year.

The decision-making procedure in the Board includes 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 are 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 will be under the responsibility of the General Manager. KTA will implement the strategic policy of the Board of Management as operational initiatives. They will 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 can 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 is 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 is 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 will be developed to coordinate their efforts.

Monitoring

The Board will 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 will 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.

Overall proposed functionality of the Transport Planning Commission and Kigali Transport Authorities can be seen in Table 5.8 and Table 5.9.

Table 5.8 Transportation Management for City of Kigali

	City of Kigali Transport Planning Commission	City of Kigali Transport Authority (KTA)
Major Missions	Promote urban transport planning	Provide integrated and efficient land transport system: planning, public transport services & traffic management
	Coordinate among the central and local governments	Develop selected transportation infrastructure
Transportation mode (to be responsible or in its consideration)	Bus, BRT, MRT, railway, minibuses and other land transportation modes	Bus, BRT, MRT, railway, minibuses and other land transportation modes
Operation of public transportation (as subsidiary corporation)	Not applicable	Bus, BRT
		Railway
Activity	Research	Policy implementation
	Coordinate urban planning and data	Planning on transport systems
	Manage studied data	Public transport licensing
	Coordinate existing line agencies	Traffic management
		Setting guidelines and enforcing standards
		Infrastructure development
		Public transport registration
Infrastructure development	Not Applicable	Road network
		Bridge, flyover
		BRT
		Bus terminal
Legal basis	Memorandum of Understanding	Joint agreement/Presidential decree/Government law
Institutional Setup	Member of commission	Statutory board
Position of institution	Under the supervision of central ministries	Independent
Form of institution	N.A	Public body
Member of institution	Central and local government	Local government and central government as board member
Member of institution outside government sector	Academic institute, civil society, private sector & NGO	Public service provider, civil society as Advisory Board
Constitution of staff	From public servant	Direct employment
Direct supervisory institution at central ministries	MININFRA	None
Financial framework	Funded from respective administrations	Urban development tax (property tax)
		Parking tax
		Tax share
		Public transport route licensing
		Road pricing
		Transit revenue
		Bond
		Borrowing
		Subsidy from governments

Table 5.9 Major Outlines of Proposed Institutions

	Tasks	Transport Commission	Kigali Transport Authority
Institutional Problems	Demarcation of role and responsibility	B	A
	Consistency with assignment and financial support	N.A	A
	Integrated transportation management and infrastructure planning	A	A
	Inconsistent practice among central ministries	A	A
	Financial constraint at the central and local government	N.A	A
	Discrepancy in financial and human resources between province and LG	N.A	N.A
	Institutional problems in coordination	B	A
	Insufficient function in transportation planning (information/data)	B	A
	Overlap functions and responsibilities among central ministries	B	A
Local Government Perspectives	Autonomy in terms of planning, budgeting and implementation of designated road network	Unchanged	Transfer to KTA
	Autonomy in terms of planning, budgeting and implementation of road network under its jurisdiction	Unchanged	Unchanged
	Autonomy on regional infrastructure planning and development of all transportation related programs	Unchanged	Unchanged
	Licensing: public transport business and route of inter-regional public transportation	N.A	Transfer to KTA
	Licensing: public transport business and route of inter-regional public transportation under its jurisdiction	N.A	Unchanged
	Effects on tax and charge revenues related to transportation	N.A	Partially transfer to KTA
	Loss of opportunity to generate new tax or charge related to transportation sector	N.A	Partially positive
	Financial burden derived from the contribution or subsidy to support the institution	N.A	Positive
	Restructuring of existing agencies and reshuffling personnel who work at transport related agency	N.A	Positive
	Collaboration with other local government in infrastructure development	Unchanged	Partially under KTA
Central Government Perspectives	Autonomy in terms of planning, budgeting and implementation of transportation sector program in the region	Unchanged	Transferred to KTA
	Authority to supervise and control sectoral program and urban planning in the region	Unchanged	Partially transferred to KTA
	Licensing: public transport business and route of inter-regional public transportation	Unchanged	Transfer to KTA
	Loss of opportunity to generate new tax or charge related to transportation sector	Unchanged	Possibly positive
	Financial burden derived from the contribution or subsidy to support the institution	Partially positive	Positive
	Restructuring of existing agencies and reshuffling personnel who work at transport related agency	Unchanged	Positive

A= Solved
B = Partially solved

5.3 REFORMING OF GENERAL BUS MANAGEMENT SYSTEM

In this section, the institutional aspects of public transport administration are examined and viable solutions suggested. There are four variable instruments for improving public transport service delivery, namely standardizing and enforcing minimum service standards, rejuvenating bus fleets, restructuring general bus license system and capacity development.

5.3.1 STANDARDIZING MINIMUM SERVICE STANDARDS (QUALITY OF SERVICE)

Indicators for minimum service standards of public transport services should be measurable and also defined from the passengers' viewpoint. Items that are important for passengers are accessibility, cleanness, convenience, comfort, frequency, reliability, safety, security, customer service quality, and equality.

Minimum service standards (Quality of Service of Public Transport) shall be developed by Kigali Transport Authority as a guideline and contain standard indicators and the means of verification, instead of tangible numerical criteria. Indicators and minimum quality assurance standards must be tangible and clear, while evaluation criteria should be customized according to various factors, i.e. population size, service coverage area, public transport characteristics, mode and so on. Means of verification and monitoring schemes should be explicitly indicated in the minimum service standards, so that national evaluation standard will be established, and later on will be able to use for collecting data and statistical analysis nationwide.

Minimum service standards will provide appropriate benchmarks to ensure the minimum quality of service to be delivered to passengers and public transport users. It should be noted that punitive measures to enforce the minimum service standards may be ineffective if the underlying causes of poor performance are not addressed. Therefore, minimum service standards should be incorporated under performance-based contracts which are financially able to promote the desired quality standard.

As a baseline, it is recommended that the City of Kigali adopt the 'Public Transport Council of Singapore, Quality of Services of Public Transport' as their QoS guideline.

5.3.2 Rejuvenation of Bus Fleets

One of major problems in the public transport operation is the aging and under-maintained bus fleets. All stakeholders, including bus operators, realise that old bus fleets must be replaced by new, more comfortable and safer fleets.

Some considerable instruments to encourage bus fleet rejuvenation are to reform periodic vehicle inspection, restrict the age of operational fleet, introduce financial incentives and improvements to the existing business models, and strengthening law enforcement.

Periodic Motor Vehicle Inspection

The periodic motor vehicle inspection (PMVI) can be used to improve public transport service level; however this would likely fail if operated separately from other measures. For instance, by associating the inspection with tax payments and vehicle registration, the renewal of the business permit and/or route license can be rejected if the bus fleet is not roadworthy.

Fleet Age Restriction Measures

Taking the current situations such declining market share and insufficient capital, bus companies and owners face difficulty in replacing their aging fleets. In the past, the Government provided financial support to bus companies through purchasing buses for them (ONATRACOM). Although Government provides no direct operating subsidy to general bus business, operators benefit financially from being able to purchase fuel at subsidized prices.

The issue of bus fleet renewal is not an isolated matter; it is closely tied to a viable business model, the financial mechanisms and institutional structures. When these issues are addressed, bus replacement issues will be resolved. Some possible measures combining the periodic motor vehicle inspection are:-

- Subsidy, loan (special loan period and/or interest rate), buyouts (old bus fleets will be exchanged for a new bus fleet down payment)
- Discount for the inspection payment and/or longer inspection interval, i.e. 6 months to 1 year
- Impose stiff penalties for violators; not only to ban bus fleets, but also to apply administrative sanctions to bus operators

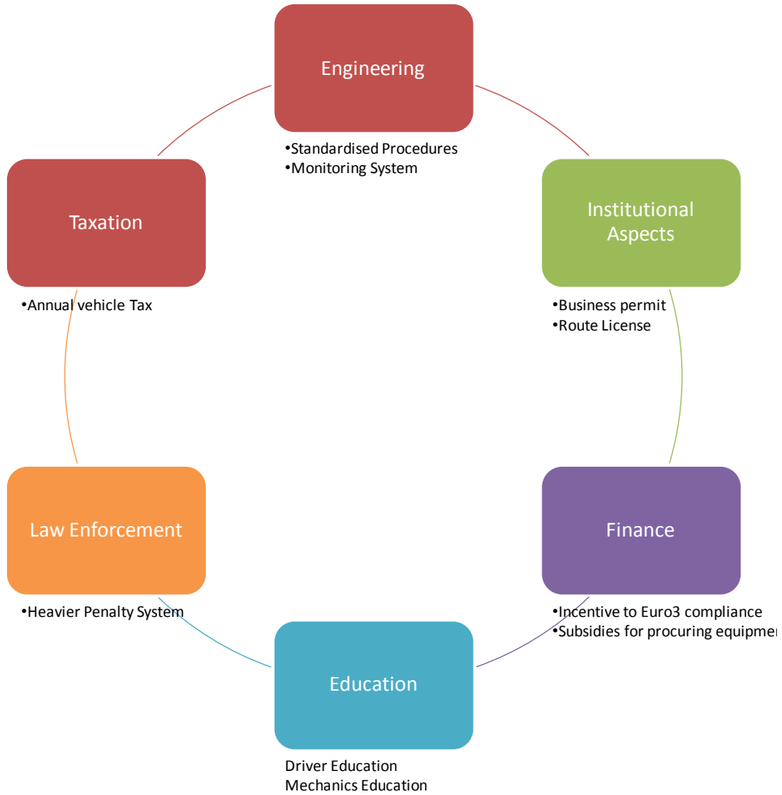


Figure 5.10 Mechanisms for managing Public Transport Fleets

Role-sharing and Law Enforcement

In the case of City of Kigali the transportation agency will be responsible for overseeing public transport administration and operations in the City, but it does not have the power to enforce laws and regulation, except in certain cases. The agency has to rely on the National Police as the enforcement agency, even to conduct road inspections. The following shows the likely role sharing among the agencies.

- Rwanda Ministry of Trade and Industry (MINICOM): workshop and mechanic accreditation, administrative direction to automobile industry to accelerate Euro 3 and 4 adaptation and technology adaptation for cost and energy effective vehicles
- Rwanda Ministry of Finance and Economic Planning (MINECOFIN): tax incentive and tax relief policies
- Rwanda Ministry of Natural Resources (MINIRENA): sustainable Compressed Natural Gas (CNG) and clean diesel supply policy, CNG station development, GHG emission policy and fuel quality monitoring.
- Rwanda National Police (RNP): Law enforcement

Role sharing and law enforcement among public transport administration should be defined clearly by function, and at the same time improve coordination and policy synchronization for public transport administration.

5.3.3 Restructuring General Bus License System

Typically, general bus operators are governed under a license or route permit system. However, this is a weak mechanism for the regulators to control the operators as operators carry the business risk. This system can work well if the operator has a sound business and a long term perspective for the business. For struggling operators their survival instinct is a stronger force than the regulations designed to control them. This can lead to poor behaviour and poor service standards.

The following sections outlines a number of approaches in incorporating incumbent operators into the system network, with services designated as:

- BRT trunk operations being the trunk route operation, with a high level of infrastructure;
- Intermediate bus routes, acting as cross-suburb routes and feeder to the BRT and fully integrated with BRT via fare integration, and connecting to BRT shelter platforms
- Local feeder and community services not fare integrated but serving local communities to provide local services and access to the BRT.

Contracting Large Bus Operators into the System Network

Generally, with the introduction of a BRT there is a program to 'migrate' large bus operators into the system as contracted service providers. What this achieves is the sharing of risk between the system manager and the operators where the risk is assigned where it can be best managed.

Under the institutional amendments, the proposed KTA will manage political risk, the Public Transport Executive will manage management (business) risk and contracted bus operators will bear the operational risks. The Public Transport Executive will manage the contracts between KTA and the bus operators. Contracting operators into the system will require appropriately sized contract packages to be developed and having affected operators form companies to bid for, or negotiate to operate these contracts. The benefits of this arrangement are:-

- Business permission, rules and conditions, and operations are packaged as one function under the contract which clearly outlines the responsibility of both KTA and the bus operator.
- The bus operator will have a strong hand in guaranteeing service quality.
- The bus operator does need to negotiate amongst route operators as it has the control of routes and can assign operators according to demand (operators have guaranteed kilometers, so can be assigned those kilometers wherever demand exists).
- Bus operators and employees have formal employment with more stable income and benefits.
- Routes can be reinforced and protected from errant private transport operators due to empowerment of law.

Managing Transition Process

An atmosphere of change often causes concern and uncertainty amongst bus operators, who see themselves as independent operators protected by a bus operating license. Managing the transition therefore requires the authorities to take on a consultative role and work to create the incentives and a sound business model to manage the transition to an integrated system.

The Authority's decision to expand the integrated bus system will result in the cancellation of individual route licenses, to be replaced by performance-based contracts. This action creates uncertainty for operators who may not wish to cooperate initially. On the other hand, KTA is offering viable and profitable bus operating contracts to provide services to the system under a business model which has minimal risk for the operator.

Contracts can be offered through competitive tender or negotiated contract basis and under the latter, operators are assigned company stock according to their level of entitlement (as a form of compensation). While negotiated contracts are not a competitive form of tender, it is a transparent process that manages the transition more smoothly. It avoids the complication of managing losers, who are likely then to allege that the competitive tender process was not transparent.

Incorporation of operators into companies also needs to recognize that bus owners presently earn a daily income and company ownership may only pay an annual dividend. A scheme to provide an advance on profit dividend may help ease this concern. Such a transition process for existing operators will require a committed negotiation process with the bus owners association or representatives nominated by the industry.

Worldwide experience has shown that as long as government is prepared to address the legitimate concerns of operators, successful outcomes can be achieved.

As these contracts are expanded across routes that are part of the integrated system, all buses that operate as intermediate or feeder services will be fitted with ticketing equipment so all passengers in the system can pay for distance travelled regardless of transfers made.

Under the current system, bus operations are somehow functionally classified but operationally unclear in its service delivery. Under the new arrangements, BRT and the intermediate bus routes will serve as the bus system network under the management of Public Transport Executive, with full fare integration and with bus operations provided under a performance-based contract.

Figure 5.12 shows the change in organization from the present license system to a classified contract system.

Table 5.11 shows the comparison between the responsibility of BRT/Intermediate routes, to more local area service types designed to serve local communities. For the local area services it may be possible to contract Minibuses services to act as feeders to the BRT stations.

Contracting Minibuses as Feeder to the BRT System

There is a scope for local government to engage more closely with the Public Transport Executive, i.e. the Public Transport Executive contracts the minibuses to provide feeder services to the BRT. Instead of migrating operators into formal business, minibuses can be organized as formal feeder services to the BRT, thereby creating a business for displaced operators. Such a partnership would include:

- Mutual benefits as feeder operators have a viable business associated by branding with the trunk line
- Mutual obligations within the partnership – operators keep minimum standards and the Agency assists with brand identification, creating space and suitable conditions for interchanging passengers
- Non-fare integration. Operators collect a fare off passengers with the possible level of cross-subsidy (top up fare) if required from the trunk operator (who benefits from additional passengers.

Such a partnership utilizes the existing abilities of paratransit, minibuses, taximoto and taxis to serve the local communities. Effectively, the smaller feeder operators will be organized at the 'macro' level of a defined scope of business and minimum standards to keep.

Table 5.11 Comparison of Responsibility of BRT and Intermediate Routes

	BRT	Intermediate	Local
Strategic Network Planning	KTA	KTA	LG / RTDA
Contract and Permit Approval	KTA	KTA	RURA
Performance-based Contract	Yes	Yes	No
• **Form of license**	-	-	Area
Regulatory Authority	KTA	KTA	RURA
Fare Setting and Approval	KTA	KTA	RURA
Integrated Fare System (smart card, etc)	Yes	Yes	No
Infrastructure Development	KTA	KTA	LG / RTDA
Fleet Size	Large	Mid and Large	Small

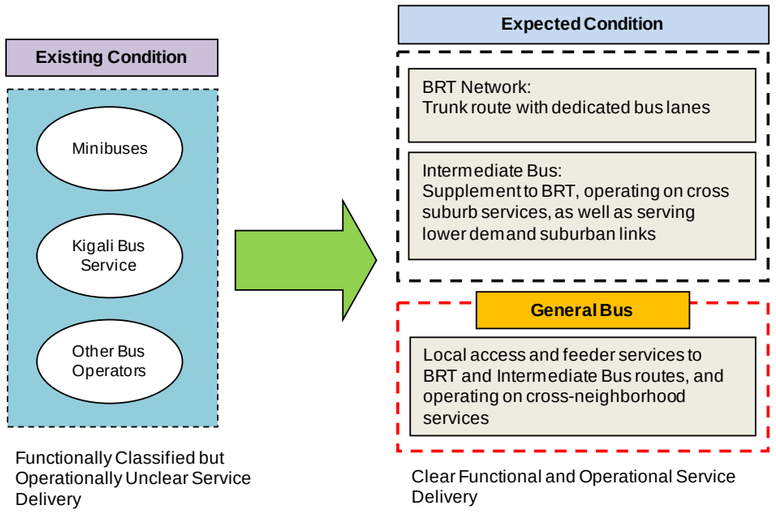


Figure 5.12 Concept of Mixed License to Classified Contract System

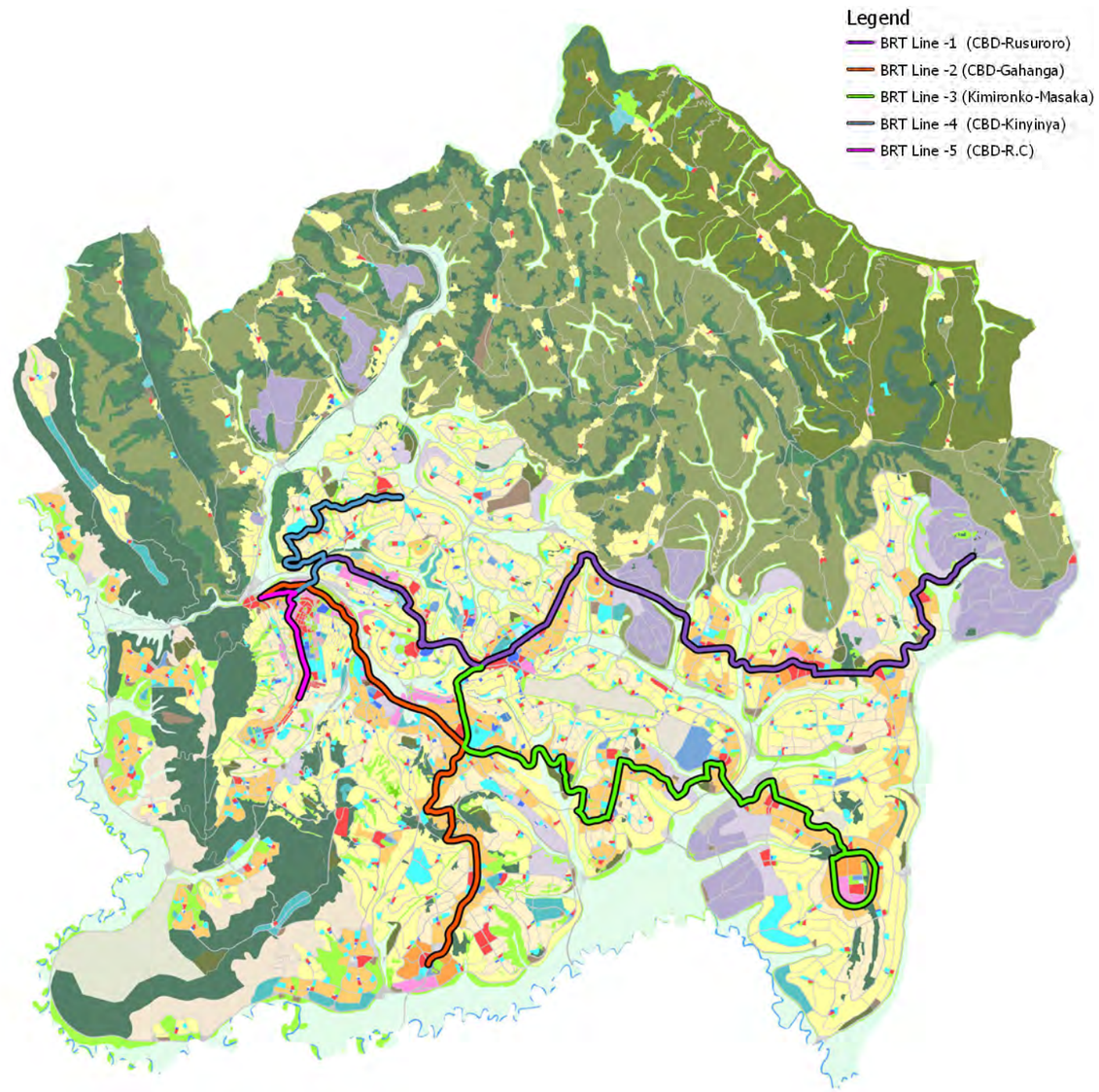


Figure 5.13 Proposed BRT Trunk Routes

5.4 MANAGE TRANSPORT ASSETS

The road furniture and Intelligent Transport Systems in a city manage the traffic flow and maintain a pleasant environment for all road users such as motorists, cyclist and pedestrians. These assets fall within the domain of the transportation network and therefore a management plan should be adapted to ensure their effectiveness. It is important to think of everything within the right-of-way as being an asset including the right-of-way itself. This means that a strategy to construct, upgrade, replace and maintain road assets should be developed.

The domain of the transportation network should encompass all aspects of the road use, which should also include providing parking for both cyclists and vehicle users, in addition to street furniture and utilities placed within the road right-of-way, while ensuring that the drainage of highways, roads and streets function properly.

Other assets include traffic signals, ITS signboards, road signs, road lighting etc. The maintenance of these assets ensures that the road network functions properly. It is also necessary to repave roads as these tend to deteriorate over time.

It is also the onus of the highway authorities to ensure that noise pollution from the roads is not excessive. Freight routes need to be identified and maintained as higher axle loadings cause more damage to sub-standard roads and therefore need to be repaved more frequently.

Assets Inventory

To best maintain all of the City's transport assets, it is first necessary to document the assets that the City owns. The following is a typical example of a list of transport assets taken from a UK City local transport plan.

- 838 km roads, 1300 km footways, 65 km rights of way
- 294 highway structures
- 8 car parks accommodating 1900 parking spaces and 1 bus station
- 43,000 street lights and illuminated sign units
- 356 traffic signal sets
- 21,000 highway trees and 138 hectares of highway verges
- Winter Service depot and 6 grit spreading vehicles
- Variety of street furniture

This list is not exhaustive, and needs to be extended in detail. The city needs to know, using a database, their assets within the road Right-of-Way, their conditions and statuses, and specifications so that they can plan for their maintenance. Additionally, this helps the city to manage the road environment for both pedestrians and motorists.

All of this information allows for comprehensive planning of the management of these assets. Understanding the assets is of particular importance as each individual item carries with it a long term financial burden. The actual purchase of an asset is normally the smaller cost as maintenance can cost up to 150% of the capital cost of the asset. Therefore, it is essential to understand the number and scale of assets held by the city in order to understand the future revenue required to cover the maintenance of these assets. As the number of these assets increases so does the future burden on the City's budgets. Therefore long term planning is required in order to financially service all of the assets held.

The Transport Research Laboratory UK (TRL) report TRL535 discusses footway maintenance management; however it contains examples of asset management that can be applied to all transport assets. When discussing the maintenance strategy, the importance of preventative maintenance is highlighted.

It also shows that if the condition is allowed to deteriorate too far then maintenance will not be sufficient to bring the asset back to a good condition. As a result the cost of repair ends up to be much higher than the work that would be required if preventative maintenance were carried. Overall costs can be reduced through timely intervention, which can only take place if the City has a full understanding of all transport assets held.

Training is also required for staff who would be managing the signal timings for the traffic signals.

Guidance and Management Plans

To manage the transport assets, the City of Kigali has to prepare guidance or management plans for the following:-

- Road Construction and Maintenance, including drainage and lighting
- Road Safety Measures
- Geometric Design
- Footways and Cycle-ways
- Maintenance and Stock Records for Intelligent Transport Systems
- Integrated Parking Management
- Traffic Signs
- Public Utilities Installation within Road Reserves
- Special Routes i.e. Freight and Bus Rapid Transit routes

To support the management of these assets, the use of a database is recommended. The database should contain a list of all assets, with comprehensive information such as purchase date, current conditions, specification/make, contractual obligations such as warranties, etc.

It is vital for assets to be managed in a strategic fashion rather than reactively.

The City of Kigali can gain more benefits by adopting the following:-

- Strategic Approach - A systematic process that takes a long-term view
- Lifecycle – The lifecycle of an asset is considered, from purchase to useful life to planned obsolescence
- Optimisation - Maximising benefits by balancing competing demands
- Resource Allocation - Allocation of resources based on assessed needs

Best Practices

It is recommended that:-

- A GIS database is prepared to manage assets
- Guidance and Management Plans be prepared for the road assets e.g.
  - Streetscape Design Manual
  - Parking Design and Management
  - Pedestrian and Cyclist Design Guidelines
  - Freight Management Plan

A more comprehensive list of guidance and management plans should be prepared by the proposed Transport Authority of the City depending on needs. By formalising these requirements, methods for protecting the transport assets can be enforced and managed.

Figure 5.14 Maintenance Regime will be required for Road Structures such as Bridges

Figure 5.15 Road Furniture such as Street Lighting and Cycle Racks within Right-of-Way shall be the purview of the Transport Authority

5.5 DEVELOPMENT OF TRANSPORTATION GUIDELINES AND MANUALS

This section has generally introduced the needs of detailed guidelines for transport ranging from car parking to traffic management to asset maintenance.

Development of these guidelines should be done in a systematic manner, and therefore provision of funding in the initial years should include the commissioning of research teams and transport professionals to further develop these guidelines specifically for the City of Kigali. These guidelines should then be maintained by the Transport Development team, and updated as frequent as necessary to include latest technological innovations in the transport industry.

The following list shows the guidelines proposed within this Transportation Master Plan, and while not comprehensive, should be considered the starting point:-

- Guidance to Road Design and Maintenance
- Informational Guide to GIS and Transportation in Kigali
- Streetscape Manual for Kigali
- Guidance to Intelligent Transport Systems
- Design and Maintenance Guidelines for Highways Structures
- Car Park Design and Strategy in Kigali

Guidelines should be prepared as and when necessary as the needs for these documents are contextual and depends highly on the needs of the City as it grows.

Road Construction and Asset Management Strategy

Kigali has not previously been able to allocate sufficient resources to the maintenance of the roads in the City. Figure 5.16 shows how deterioration coccurs. By providing timely maintenance, costs can be kept to a minimum.

In this section, a brief discussion on road capacity, road construction, recommended parking guidelines and alignment design will be given.

In this section, a holistic approach to asset management is also provided. Traffic management methods such as Intelligent Transport Systems (ITS), Traffic Safety Education and Traffic Management Administration are discussed and identified. These methods should be adopted in the framework to identify the capacities of the roads, managing traffic flow, urban car parks, environmental and serviceability levels of the transit network and the dispersion and diversion of road traffic to alleviate congestion.

It is recognised that the Transportation Master Plan is to give recommendations and while these guidelines are being prepared, the TMP will provide suggestions on the maintenance of the road network, including street furniture design. Following the Design of Road Network in the previous section, Appendix A shows how the context-sensitive solutions can be applied for the construction and maintenance.

The methods are discussed in this strategy and are not comprehensive; detailed guidance will need to be provided by the City as it is a case-to-case analysis. However by identifying methods such as Transport Impact Assessments and Travel Plans they can be used to help with the traffic situation in Kigali.

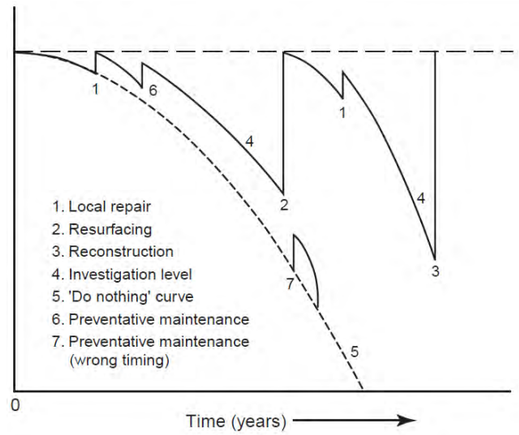


Figure 5.16 Typical Deterioration Curves

5.5.1 Road Construction Strategy

In this section, the importance of having a standardised road construction setup is explained. A framework for executing the strategy is discussed. The science behind the concepts is briefly explained, and key requirements are provided for development of the local road construction standards.

Proposed Framework for Constructing Roads

The construction of roads, if built to internationally recognised standards, will ensure the roads serve its intended life without failure. To ensure that the roads are built as required and at a timely progress, the Land Transport Infrastructure division of the Kigali Transport Authority needs to monitor, set goals, determine schemes and construct these roads. Their role is to manage the project, starting from the scheme evaluation all the way to implementation and monitoring.

The basis of the proposed road network is the GIS database prepared for this purpose. In this, the proposed Land Transport Infrastructure division can prepare a list of schemes that are either essential or non-essential. They will then need to discuss this further with potential stakeholders, for example RTDA and RMF, who may provide funding. By determining sources of funding and getting approval for the conceptual schemes, these may then be progressed to the next stage.

At the feasibility stage, the proposed Land Transport Infrastructure Division will need to progress with feasibility studies, which investigates the alignments, possible benefits and liabilities which may occur from these alignments. They will also need to investigate costs, and possible construction methodologies, etc. At this stage, public consultation is necessary to determine the impact of the scheme on the people. The results of the feasibility study will form the basis for approving the proposed road scheme, which will be funded by the stakeholders, the City, and potentially from the private sector. There are opportunities for build-operate-transfer (BOT) setups for major roads such as the high urban capacity roads to minimise risks associated with the construction of highways and roads.

In the detailed design stage, the proposed Land Transport Infrastructure Division will be in charge of the tender, awarding of contract, and execution of scheme. In this role, they will either design the road scheme in-house, or appoint an external consultant. It is recommended that the roads be designed to international standards (further explained in this section), so that any construction of new roads will be able to last longer with little maintenance. It is important that proposed Land Transport Infrastructure division maintains a team that ensures that road quality is built to a minimum standard. The same team can be an in-house design team, and continue with developing road standards for the City.

In the final process, a Road Maintenance team working under the Land Transport Infrastructure Division will take over the built roads into their purview. Their role is to maintain the roads, street furniture, and traffic systems during their proposed life cycle and to replace them where necessary.

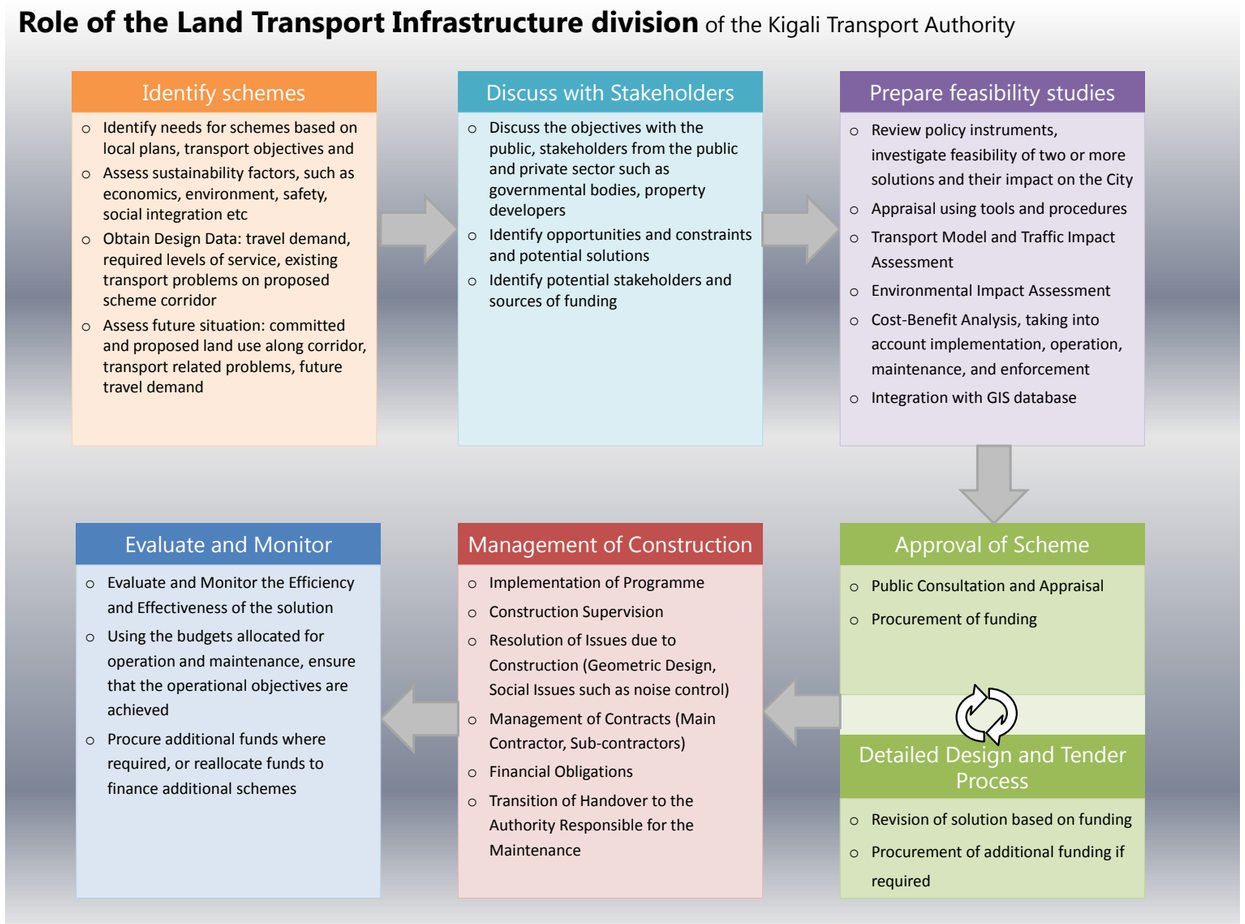


Figure 5.17 Proposed Role of the Land Transport Infrastructure Division of KTA

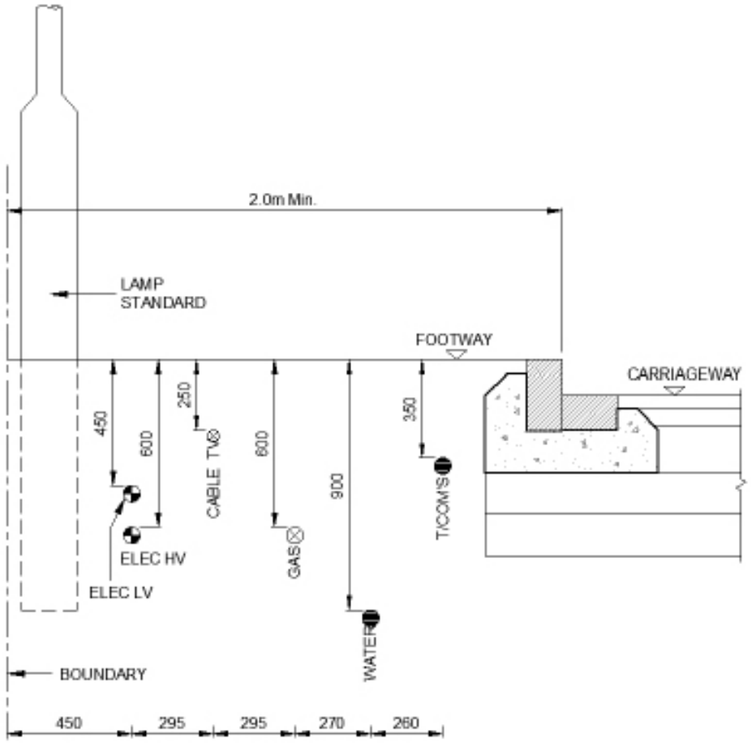


Figure 5.18 Example of Utilities and their Location in Pavement

Streetscape Design Manual

A street scene design manual is recommended for a consistent street construction within Kigali. Visual richness and diversity of street characters can create a very walkable environment. By standardising its design, the character of the City can be preserved throughout and reduce construction costs by selecting from a strict set of palettes.

A streetscape design manual should be prepared by landscape architects, with significant inputs from traffic consultants.

The design of a street should be all-encompassing, from the selection of material for surfaces to street furniture to pedestrian crossings. Without careful planning, a street may end up with significant clutter and unnecessary overdesign.

The production of a streetscape manual is necessary but not critical. Where possible, the existing guidelines on streetscape should be used and adopted with the view that a localised version using locally available materials be prepared. A taskforce needs to be set up to decide the direction of design, and apply this in Kigali.

The use of roadside furniture such as benches, plantings, etc play an important part in the urbanised areas, as they can help shield the pedestrians from traffic, and therefore indirectly lower vehicular speeds.

As previously discussed, the speed of the vehicle is primarily influenced by visibility, rather than set limit. For example, in the UK, it was found that where forward visibility was reduced, the average vehicle speeds reduced as well. This is particularly desirable in areas with high pedestrian content, as it means that vehicles will naturally adapt to its environment, creating safer urban roads.

The example shows how vehicular speed is affected by lower visibility splays by means of using street furniture. The examples can be easily adapted in many different ways, which, in addition to providing aesthetics, provide directional guidance to traffic flowing in the carriageway, the BRT vehicles in the dedicated lanes, pedestrians along footpaths, bicyclists on the track, and street vendors to conduct a safe operating environment.

Street lighting works to provide a safer environment for both pedestrians and vehicles. It illuminates the road rights-of-way, which first and foremost alerts drivers of obstructions, pedestrians and vehicles in the road. Its second most important use is to provide a safer and more secure environment for pedestrians at night, as fewer crimes occur in well-lit areas.

Improper lighting design in cities are detrimental, and therefore a lighting specialist is required in the infrastructure team to advise on the basic design parameters of luminous intensity, the contrast, glare, light uniformity over the pavements and aesthetics. The placement of street lighting is also critical. In general, a guideline that is proposed for the corridors based on the level of clarity and visibility required is a minimum illumination of 18 LUX with an average of 35 LUX at any point on the corridor. This increases in areas of higher accident records or with high pedestrian footfall and at intersections with high levels of pedestrian-vehicle conflicts.

In the interest of managing these assets, it is important to have a functional database which records the existing street furniture, as mentioned above. This can then be expanded to include every new build, for example if a new stretch of road is lighted, the make, installation date, contractor involved and status need to be recorded for maintenance purposes. While it is not necessary to take into account existing street furniture such as bins, it may be useful to record any new ones to aid the collection of rubbish by the contractors.

5.6 TRAFFIC IMPACT ASSESSMENT

A traffic impact assessment (TIA) is a study which analyses the effects of a particular development's traffic on the surrounding transportation network. They are important in assisting public agencies in making land use decisions and evaluate whether the development is appropriate for a site and what type of transportation improvements may be necessary.

Traffic impact assessments are only one aspect of transport planning.

Traffic impact studies should be used as one piece of several kinds of information to judge the suitability of development from a transportation standpoint.

It is recommended that traffic impact assessments should accompany developments which have the potential to impact the transportation network.

Figure 5.19 shows the proposed framework for the Traffic Impact Assessment.

When a Planning Application is submitted to the City, the planners determine whether a traffic impact assessment is required. If one is required, the planners car refer to the KTA Transport Planning Team, who would then discuss the scope of works with the Developer's Traffic Consultants.

After the analyses are completed, the consultants submit the TIA to the Transport Planning Team, where the TIA would be reviewed. Comments on the content are provided, and the TIA is reviewed based on the comments. During this period, monetary contributions to the KTA roads improvement funds are discussed. The larger the impact of the development on the road network, the more contributions would be expected. At this stage, the size and type of the development would be refined so that detrimental effects of the development can be minimised, and where necessary, upgrade works for the road network identified to accommodate the increase in traffic.

Once the traffic analyses are completed and planning conditions set, KTA can approve the planning application from the transportation standpoint. SImilarly if the traffic analyses are not suitable, or if conditions cannot be agreed, and an objection can be made on the grounds that traffic conditions would be worse.

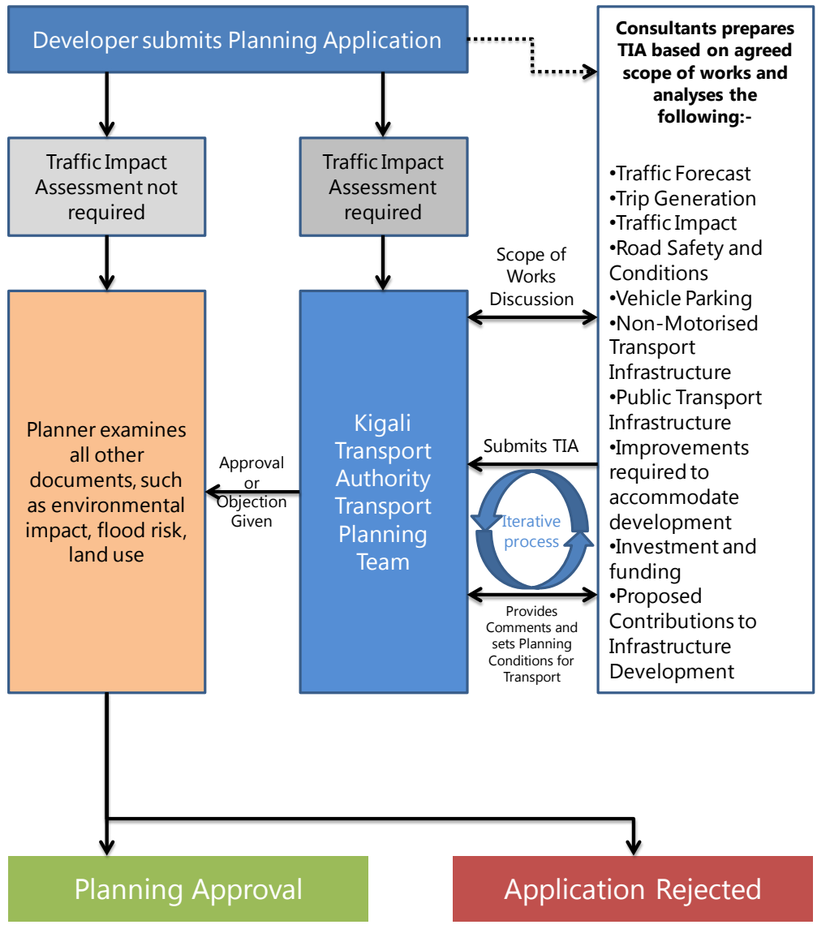


Figure 5.19 Proposed Framework for Traffic Impact Assessments

5.7 INTELLIGENT TRANSPORTATION SYSTEMS

Intelligent transport systems (ITS) are advanced applications which aims to provide innovative services relating to transport and traffic management and enable road users to be better informed and make better, smarter uses of transport networks.

Road users do not normally have perfect information regarding the traffic conditions of the road network, for example, if there is congestion in the roads.

To implement ITS in the City, a traffic control centre would first need to be set-up to overlook the city's traffic via remote cameras and sensors. Figure 5.20 shows an example of the traffic control centre in Singapore. The centre obtains traffic camera feeds from all over Singapore and constantly monitors the traffic situation especially during peak hours.

In the event of an accident, or congestion on roads, road users would be alerted using a Variable Messaging System (VMS, shown in Figure 5.21) which could redirect drivers to take alternative routes.

With the implementation of ITS in the City of Kigali, several aspects of roads can also be controlled by the traffic control centre, for example traffic lights timings, which could be altered depending on the situation to ease traffic conditions (Figure 5.22).

There are many other aspects of ITS that can be implemented in Kigali, and would require a detailed study as different cities require different approaches to ITS.

Figure 5.20 Intelligent Transport Systems Centre in Singapore

Figure 5.21 A Variable Messaging System in Use

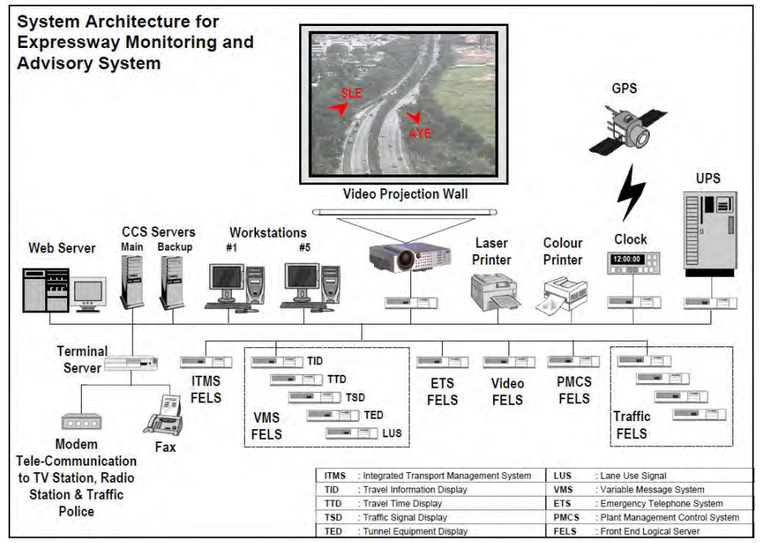


Figure 5.22 Signal Architecture for Expressway Monitoring and Advisory System

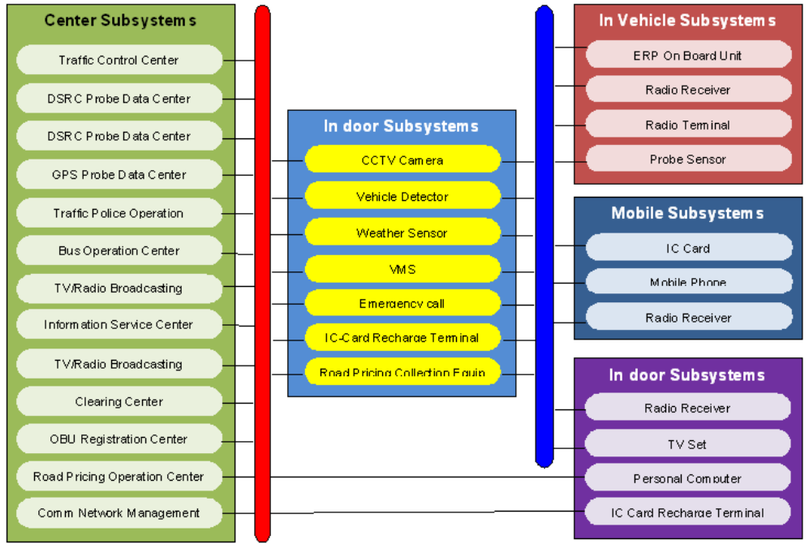


Figure 5.23 Subsystems that can integrate with the Intelligent Transport Systems

6 IMPLEMENTATION PROJECTS AND PROPOSALS

As discussed in the previous chapters, Kigali is in a good position to prepare the transportation systems to meet the future population and economic growth in the City.

To kick-start the process of modernising the transport systems in the City of Kigali, several catalyst projects have been identified. Catalyst projects are the Public or Private Projects to stimulate urban growth and development in key focus areas of the City.

6.1 DEVELOPMENT PHASING

The development phasing of the catalyst transport projects shall be in alignment with the development phasing plans proposed in the Master Plan as follows:

- In the short-term (2017), the focus of the City shall be to attract investment to kick-start quality growth in the City. The target areas for development are the City Centre and the City Fringe areas
- In the medium term (2025), the focus will be to meet the current housing backlog and to provide and improve basic quality-of-life services for the growing population. The target area for development are the suburban townships in the immediate vicinity of the City Fringe
- In the long term (2040), the focus will be on launching Kigali as the centre of Urban Excellence in Africa. The target area for development are the suburban areas

Figure 6.1 shows the catalyst development projects which are to be implemented in the short to medium terms.

	Short Term (2017)	Medium Term (2025)	Long Term (2040)
EMPLOYMENT	• Development of Kigali CBD- Phase 1 • Development of Gahanga Sports Hub • Development of Airport Boulevard • Kigali SEZ - Phase 2 • Light Industrial Estate at Gahanga	• New CBD Core Development • Nyamirambo Fringe Centre • Gahanga Regional Centre - Phase 1 (Expo and Business Park) • Kicukiro Fringe Centre • Kinyinya Fringe Centre • Kigali SEZ - Phase 3 • Gikondo Regeneration (Mixed-Use) • Kimironko Redevelopment	• Gahanga Regional Centre Subsequent Phase • Kimironko Stadium Redevelopment • Ndera Regional Centre • Masaka Regional Centre • Rusororo Industrial Estate • Masaka Industrial Estate
HOUSING	• Development of affordable housing at Akuminigo and Rugarama • Upgradation of unplanned neighborhood at Kimironko • Development of Affordable Housing at Kinyinya (OZ Subarea) • Upgradation of unplanned neighborhood at Kicukiro • Redevelopment of unplanned area in Kimisagara and Gitega • RSSB affordable Housing Development	• Incremental Housing in unplanned neighborhood at Kimironko • Development of Affordable Housing at Kinyinya - Phase 1 • Incremental Housing in unplanned neighborhood at Kicukiro • Development of Affordable Housing at Gahanga- Phase 1 • Development of Affordable Housing at Ndera	• Redevelopment of unplanned neighborhood at Kimironko • Redevelopment of unplanned neighborhood at Kicukiro • Development of Affordable Housing at Masaka • Development of Affordable Housing at Gahanga- Phase 2
INFRASTRUCTURE	• Nyabugogo Transport Hub • Reservation for BRT Corridor • Development of STP in Gitikinyoni and Gikondo • Development of Landfill in Nyarugenge	• Nyamirambo - Nyabugogo - Ndera BRT (Line 1) • Nyabugogo- Gahanga BRT Line (Line2)	• Extension of BRT Line 1 to Rusororo Industrial Estate • Nyabugogo - Kinyinya BRT Line (Line 3) • Kicukiro - Masaka BRT Line (Line 4) • New MRT Lines
RECREATION AND TOURISM	• Nyarugenge Heritage Village • Lake Muhazi Development - Phase 1 • Pottery Village • Kigali Cultural Village	• Kigali CBD Wetland Park and Kimicanga Entertainment District - Phase 1 • Agro Tourism Valley • Wetland Biodiversity Park - Phase 1	• Lake Muhazi Adventure Theme Park • Kigali CBD Wetland Park - Phase 2 • Wetland Biodiversity ParkPhase 2 • Flower Valley

Figure 6.1 Catalyst Development Projects (Short to Medium Term)

Figure 6.2 Proposed Implementation Project - High Capacity Urban Roads and Ring Roads Scheme

6.2 CONSTRUCTION OF KEY ROAD AND MASS TRANSIT INFRASTRUCTURE

To support the catalyst development projects, the following new roads or road improvement projects are to be implemented in the short to medium terms:

1. Kimironko Regeneration - 3 km + 2.5 km street improvement
2. Gikondo Regeneration – 2 km of street improvement
3. Gahanga Integrated Township – 21 km of new roads
4. Ndera Integrated Township – 22 km of new roads

In addition to the above road projects, the key roads and mass transit infrastructure projects identified in this Transportation Master Plan for implementation in the next 5 to 10 years are discussed in the following sections.

6.2.1 RING ROAD (NORTH)

The Ring Road project is proposed to be built in three stages, namely the North Ring Road, the South Ring Road, and the Central High Capacity Urban Road scheme running through and beyond the Ring Roads.

The objective of the Ring Road (North) project is to improve local / peripheral and east west connectivity within the City.

The project scope covers the construction of about 36.7 km of 6-lane dual carriageway ring road, to be built at a cost of USD 112 million.

This key road will be a public project funded by the government either as a Built-Transfer project or a Build-Operate-Transfer project.

6.2.2 RING ROAD (SOUTH)

The scope of the Ring Road (South) project is essentially the same as Ring Road (North). The project involves the construction of about 33.2 km of 6-lane dual carriageway Ring Road, to be built at a cost of USD 101 million.

6.2.3 HIGH CAPACITY URBAN ROADS

The scope of the construction of the proposed High Capacity Urban Roads project is essentially the same as the Ring Road. The project involves the construction of about 45.8 km of 6-lane dual carriageway road, to be built at a cost of USD 214 million.

6.2.4 Implementation Study of Bus Rapid Transit Lines and Transport Hub Infrastructure

BRT Line Implementation Study

There are two proposed BRT Lines (refer to Fig. 6.8) in the Transportation Master Plan identified for construction in the short to medium terms. The two BRT lines are:-

- Nyabugogo-Gahanga Line
- Nyamirambo - Nyabugogo - Ndera Line

The Nyabugogo-Gahanga Line is 19 km long, and is estimated to cost USD 272 million. The Nyamirambo - Nyabugogo - Ndera Line is 26.2km long, and is estimated to cost USD 230 million.

A proposed link is to be constructed at the Amahoro stadium connecting to the Nyabugogo-Gahanga Line. In the future, this link will form part of the Kimironko-Masaka Line.

These proposed BRT lines are potential Public- Private Partnership projects, where the public sector would construct the infrastructure for the BRT lines including providing the BRT buses, and a private consortium or company would be given concession by the government to operate the BRT system.

Public Parking Provision and Removal of On-street Parking

An initiative to remove on-street parking along these BRT lines would be implemented.

This is in line with the proposal to provide off-street public parking in transport hubs.

The BRT feasibility study will include a detailed traffic study to determine the best locations for public parking so that interfacing between the private transport and public transport is maintained.

Transport Hubs

During the initial operation of the BRT system, four transport hubs would be sufficient to service the BRT lines for the time being.

The central hubs are required as they would be good locations for commercial zones.

There would also need to be a hub at the CBD zone.

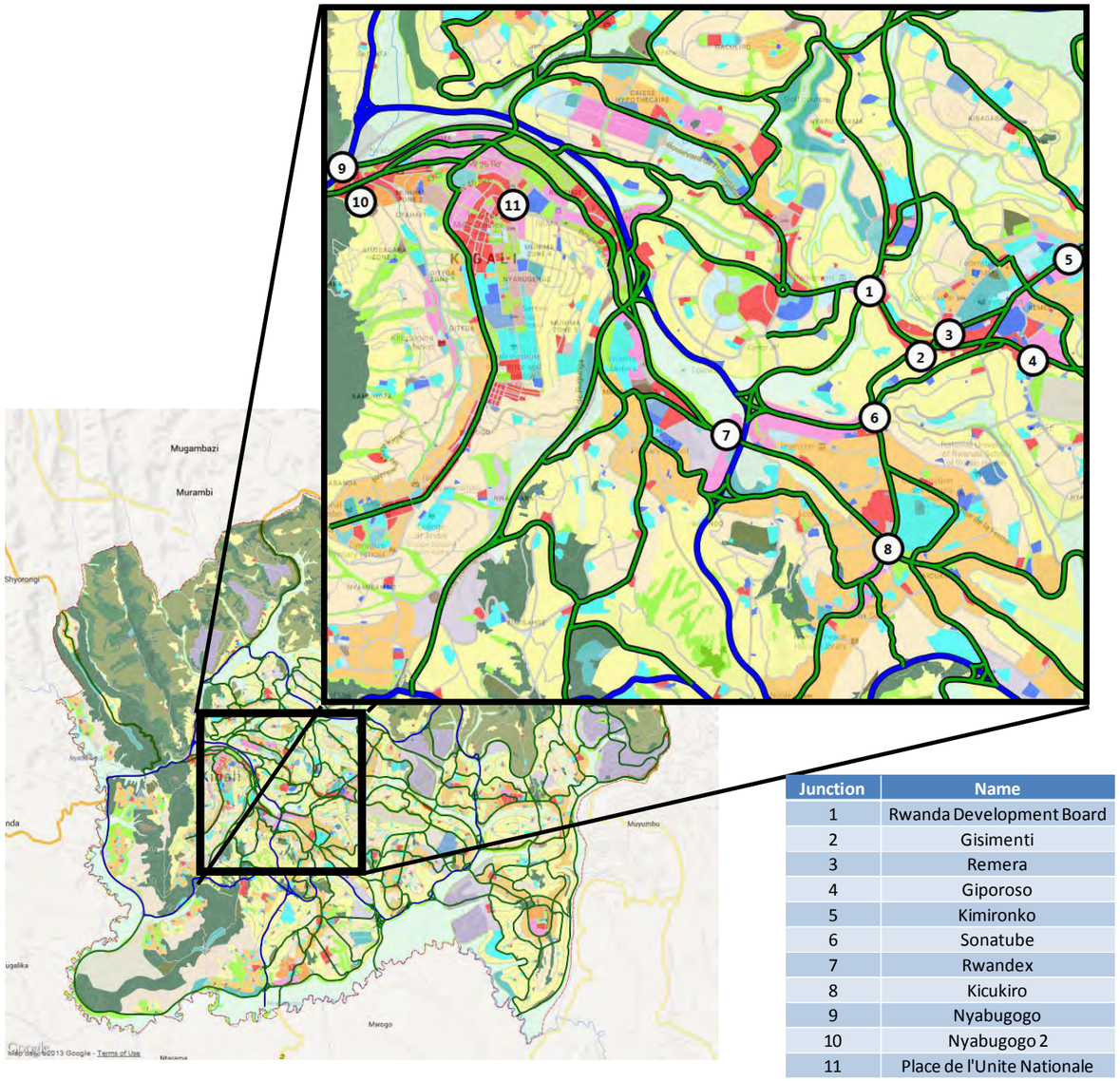
Lastly, one hub would be required in an industrial zone to serve as the maintenance and service hub, and in this case, it would be located on the CBD-Rusuroro line.

At the CBD, it is proposed that the existing Nyabugogo bus terminal be re-develop into an integrated regional transit hub. This presents an opportunity for the developers and designers to do a first integrated transit hub in Kigali.

The scope of the Nyabugogo redevelopment project will involves the re-development of a 2.4 ha site into an integrated Transit Hub with a basic inter-city bus terminal and integrated BRT Interchange.

The project is estimated to cost USD 3.05 million, and can be implemented as a public project or via a public/ private partnership.

Figure 6.3 Proposed Implementation Project - Bus Rapid Transit Scheme



Junction	Name
1	Rwanda Development Board
2	Gisimenti
3	Remera
4	Giporoso
5	Kimironko
6	Sonatube
7	Rwandex
8	Kicukiro
9	Nyabugogo
10	Nyabugogo 2
11	Place de l'Unite Nationale

Figure 6.4 Locations for Junctions earmarked for Improvements

6.2.5 Junction Improvement and Development Programme

The Master Plan requires many new junctions to be constructed as part of the upgrading and improvement of the overall road network. The current situation regarding junction design is that there are no standards to follow or capacity analysis carried out. This situation will cause long-lasting problems if allowed to continue when such wide spread expansion of the road network is planned for.

Whilst some of the critical junctions have been identified no actual solutions are being proposed as part of this master plan. Instead what is being proposed is that further studies are undertaken. These projects would have a much wider scope than simply solving the traffic problems at specific locations. Instead they should be projects to further the design standards used in Kigali for developing junctions. They should give guidelines on low cost design solutions applicable for Kigali.

Many of the standard design solutions employed in other Countries such as Singapore and wider Europe are can not be directly applied to Kigali due to infrastructure demand and cost.

These projects should be part of an ongoing program to improve the roads in Kigali. An example of the benefits of having these projects as part of an ongoing program can be seen in the implementation of Intelligent Transport Systems. Whilst several locations have had ITS equipment installed in Kigali currently this has not been carried out as part of a wider strategy as it uses bespoke technology which will limit future development particularly in terms of systems integration.

Low cost solutions will likely improve the current situation at many junctions and ultimately produce a set of design standards to follow for the continuing expansion of the road network.

Figure 6.4 identifies several locations for junctions that require some immediate improvement. These would be good locations to start this programme, as traffic improvement at these locations would greatly help the city. These would form demonstration projects for initiating the programme of improvement of junction design in the city.

Many new junctions such as mini- and small roundabouts and teardrop roundabouts (Figure 6.5 and Figure 6.6) have now been implemented extensively in Europe and United States and found to have a low accident incident rate, while maintaining road capacity. As part of the improvement projects a development team should be set up to oversee installing such junctions and monitor the demonstration projects to determine the effectiveness.

It is important to note that the process should have immediate start, as the time to obtain and examine the results of the junctions are a minimum of 6 months, with data collection continuing at least 3 to 5 years after construction.

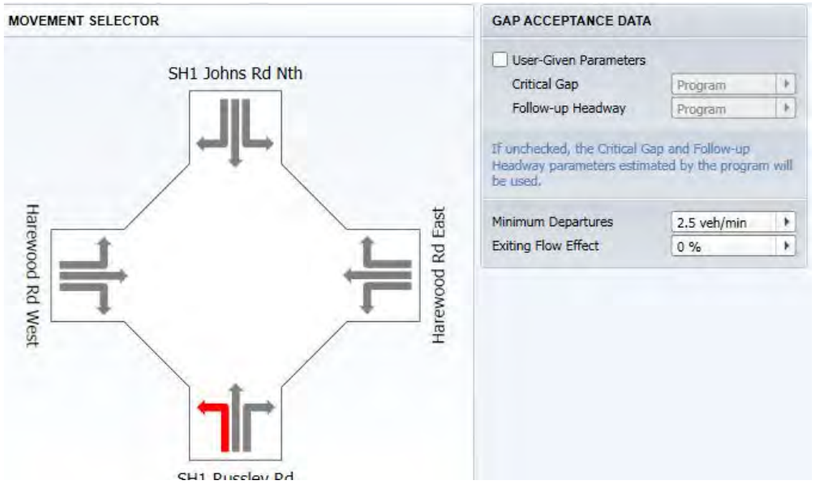
In conjunction with this programme of projects a project to explore setting up an ITS Centre in the City should be initiated. This will to regulate the traffic flow and monitor the signal timings at all the signalised junctions in the City to improve traffic circulation and the level of services of these junctions especially during the morning and evening peak hours.

Figure 6.5 Mini-roundabout in the Lurgan, Northern Ireland

Figure 6.6 Double Teardrop Roundabout Proposal, Keystone Parkway, United States

Figure 6.7 Proposed Gisimenti Gateway Junction

Figure 6.8 Proposed Gisimenti Gateway Junction (different perspective)



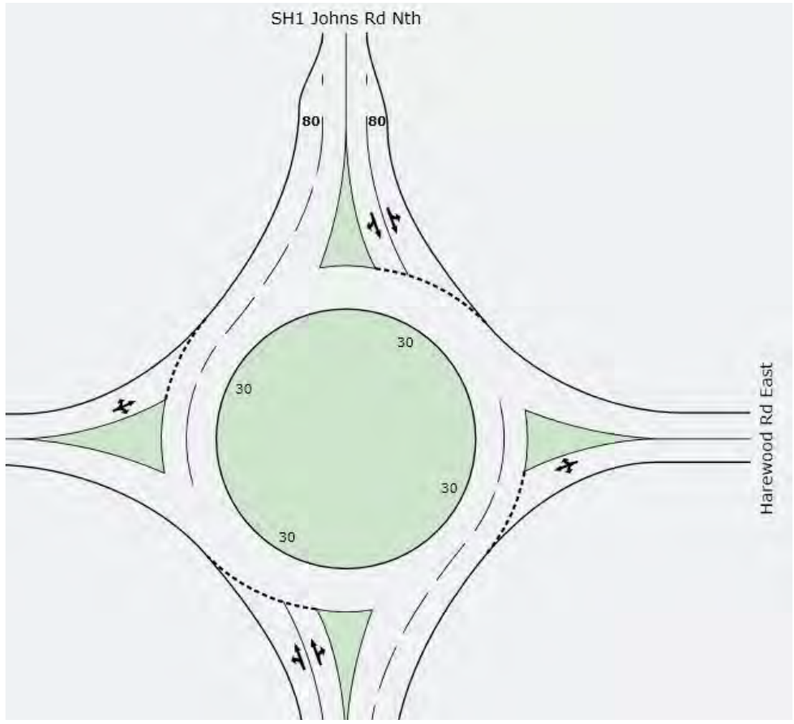


Figure 6.9 SIDRA Junction Capacity Analysis for use in Traffic Impact Assessment

Implementation of a Traffic Impact Process

From the process of developing this Master Plan it is clear that currently no planning conditions are being tied to developments in terms of road improvements. Due to the fast pace of development in Kigali many new projects are being initiated and approved every month. Recommendations have been made else where in this report with regards to setting up a long term process for the development of a TIA procedure however it is clear that some action is required in the interim. Development projects are being approved without any direct involvement from RTDA or the Ministry of Transport. This could lead situation where through lack of coordination that development projects are approved where infrastructure projects are planned, or vice versa.

Beginning the process of TIA could be used as a tool to catalyse the cross co-ordination between the various stake holding authorities. The development of this process is in the best interest of all parties as there are potential direct benefits for all involved.

The final structure and work flow for the procedure should be developed as part of a specific project to develop the TIA procedure. It is important that this is developed as a joint project with RTDA and the Ministry of Transport to enure that all parties will give their buy in. A direct benefit for the One Stop Centre is that the traffic assessment could be reviewed by engineers from RTDA reducing the man power requirements and work pressures.

Additional information on TIAs can be found in Appendix C.

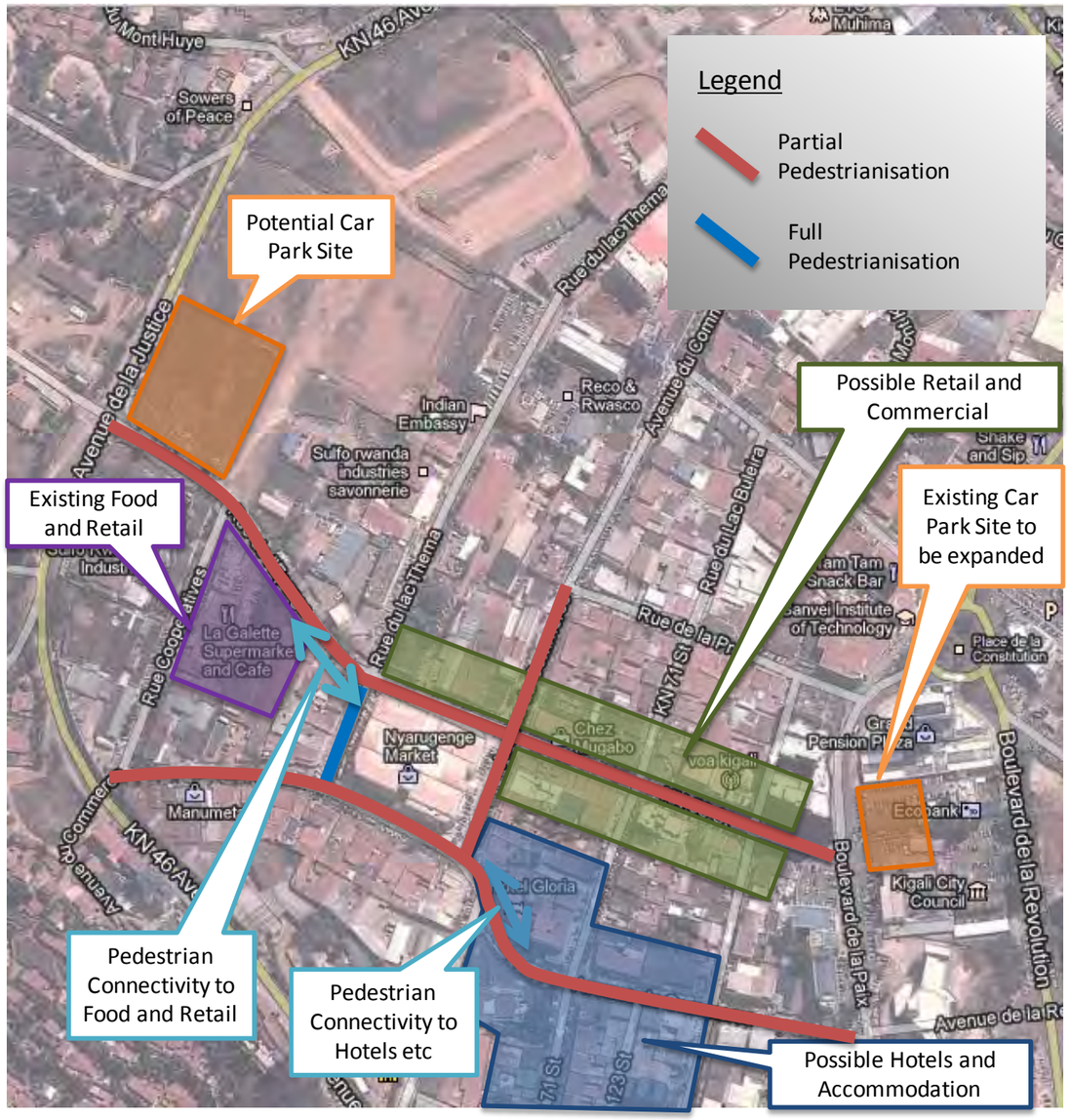


Figure 6.10 Example Schematic for Pedestrianisation of Nyarugenge Market

6.2.6 PEDESTRIANISATION

New Urbanist movements in US and Europe have pushed for the pedestrianisation of commercial areas in cities. The driving force behind this is the importance of people in these centres instead of cars, which contribute little to the cityscape.

It is clear when examining the transport statistics for Kigali that walking is by far the most common form of transport. Therefore pedestrian facilities should be prioritised in the city. In Kigali, the Nyarugenge Market has been identified as the ideal location for pedestrianisation, due to its heavy footfall and its location near the commercial centre.

A Pedestrianisation plan will need to be prepared to accommodate all the needs of the residents and commercial tenants there, for example, while closing the street to cars is a simple idea, goods delivery to the market place would still need to take place, and can be maintained if good enforcement is provided (i.e. delivery vehicles with stickers may enter the pedestrian zone, or cul-de-sac road arrangements to deter rat-runs).

Fig. 6.13 shows an example of how the pedestrianisation of Nyarugenge Market can be done.

Car parking sites are provided on both ends of the pedestrianised streets. The partial pedestrianisation would still allow vehicles to travel down these routes but all car parking spaces would be removed from these stretches. The full pedestrianised street would ban all vehicle movements and create a street that would be conducive for street commercial efforts, such as an open square with food stalls and tourist shops.

Pleasant pedestrian connectivity would be provided between the market and places of interest, for example the existing Le Galette Supermarket and Cafe west of the site, or the hotels to the southeast of the Market.

The pedestrianisation of the streets would also allow regeneration of the existing retail and commercial buildings, for example renovations to accommodate more shops and restaurants

For the wider improvement of facilities for pedestrians across Kigali, efforts should not solely focus on pedestrianisation. The provision of proper walking and crossing facilities in concert with some control on kerb side parking would give a vast improvement for pedestrians without the need for large scale investment. However many of the potential hurdles for improving and implementing such schemes are not simply construction, they are political and legal.

6.3 REORGANISATION OF THE PUBLIC TRANSPORT INSTITUTIONS AND MANAGEMENT

The establishment of the Kigali Transport Authority is crucial to spearhead the implementation of the catalyst transport projects in the short to medium terms. This has been emphasized and discussed at length in the previous chapter.

The key responsibilities of the Public Transport Authority are summarized below:-

- Formulate regional transportation policy
- Formulate integrated transportation planning, including road network development, railway (mrt) development, traffic management and public transportation system management
- Implement integrated transportation planning and programs
- Issue licenses and control public transportation with bus route license, public transport business license, bus terminal development permission, and so on
- Manage vehicle registration operation and taxation
- Manage on-street parking operation
- Provide public transport services, such as trunk bus, minibuses, railway, mrt, brt
- Carry out traffic management measures, such as, road pricing, park and ride, and park and bus ride.

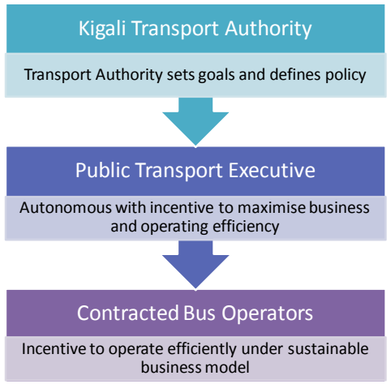


Figure 6.11 Conceptual Framework of BRT Management and Operation

In the interim, the establishment of a Public Transport System Manager will assist in the development and reorganisation of the public transport system, which is required prior to the development of the mass transit corridors.

The following section discusses how the establishment of a Public Transport Systems Manager can be implemented in the interim as part of the short-term plans for the City.

6.3.1 ESTABLISHMENT OF PUBLIC TRANSPORT EXECUTIVE

PROPOSED FUNCTIONS AND ORGANIZATIONS

As discussed in Chapter 5, a regional Public Transport Executive is a vital factor to expedite and improve public bus transport services across the City of Kigali. The Public Transport Executive will be under the structure of the KTA. It will be established as autonomous statutory agency to plan, manage and control the delivery of bus services across the City of Kigali, including the BRT network.

The KTA sets the Urban Transport Policy (UTP) across the region and execute programs and projects in the Kigali Transportation Master Plan. Strategic policy guides the Public Transport Executive in its operation and determines the strategic network development plan and business operation plan. The Public Transport Executive will manage and enforce bus operator contracts. Contracted bus operators will hire drivers and run buses; the Executive itself does not directly carry out bus or public transport operations.

The Public Transport Executive would also act as the system manager of the proposed BRT system (including intermediate and connected feeder routes) and functions commercially with the following responsibilities:-

- Control and deliver services, including intermediate and connected feeder bus routes
- Ensure smooth operation of BRT systems across districts
- Incentivise services to maximize business and operating efficiency
- No operation loss-compensating subsidy, while a “user-subsidy” can exist in a commercial operation as it recognises the commercial cost of carrying the passenger

By operating commercially, the Executive can aim to be financially independent, and at the same time ensure that operations can run efficiently and effectively to achieve profitability. By identifying its roles in the managing public transport, the Executive can better plan its works:-

Role of the Public Transport Executive

- Plan route network development
- Generate patronage and build revenue
- Ensure financial performance
- Manage system efficiency and costs
- Manage fare collection and implement fare policy
- Manage and enforce bus operator contracts
- Be responsible for customer service
- Manage PR, marketing and promotion

Table 6.2 summarizes the functions of the KTA, PT Executive and the central and local governments.

The role of the PTE is carried out through the following functions:-

1. Develop and implement the Revenue and Marketing Plan
2. Financial and Administrative Management
3. Benchmarking system cost recovery
4. Maintain infrastructure and systems
5. Assess /analyze & manage risk
6. Manage bus operator contracts

Physical infrastructure development included in the Kigali Transportation Master Plan will be financed through the KTA. However, the detailed engineering design, procurement of contractors, construction supervision will remain under the responsibilities of respective central and local government agencies.

Table 6.12 Functions of KTA, BRT agency and Governments

Sector	Sub-sector	Bus Rapid Transit (BRT)		General Bus Transport	
		BRT	Intermediate bus connecting BRT	Inter-city between Province Bus Services in Kigali	Intra-city Bus Service (General)
Planning	Strategic transport & urban development planning	KTA	KTA	CG/KTA	LG/KTA
	Planning route networks and development services	KBA	KBA	LG	LG
	Strategic service planning, bus/railway integration	KTA	KTA	CG/KTA	LG
	Planning Public Transport Infrastructure Development	KTA	KTA	CG/KTA	LG
Regulation	License and permit approval	KTA	KTA	CG/RURA	LG/RURA
	Administrative & Technical Standards, Minimum Service Standards and Guidelines	CG/KBA	CG/KBA	CG	LG/CG
	Fare policy	KTA	KTA	CG/RURA	LG/RURA
Finance	Financial Arrangement for Business Operation (facilitate loan, subsidy)	KTA	-	-	-
	Financing bus fleet procurement	KTA	LG/KTA	CG/LG	CG/LG
Fare/ Marketing	Development of Fare Collection System (ticketing system)	KTA	KTA	CG/LG	LG
	Marketing/Promoting Public Transportation Services	KBA	KBA	Operator	Operator
Infrastructure Development	Financial planning, budgeting and procurement (Procurement can be delegated to L/G and/or KTA)	KTA	KTA	KTA	LG
	Infrastructure Development (Construction) (Construction can be delegated to L/G and/or KTA)	KTA	KTA	CG/LG	CG/LG
	Construction Supervision & Technical Inspection(Supervision and inspection delegated to KTA and/or LG)	CG/KTA	CG/KTA	LG	LG
Asset Management	Land	LG	LG	LG	LG
	Base infrastructure	LG	LG	LG	LG
	Upper infrastructure (facility) (bus terminal, bus station)	KBA	KBA	LG	LG
	Fleets and equipment	KBA	KBA	LG	LG
Contract	Procurement (contract with bus operator)	KBA	KBA	-	-
Operation and Maintenance	Operation and Maintenance of the Infrastructure constructed by KTA			LG	LG
	Truck (routine/periodic maintenance, rehabilitation), barrier, marking	KBA	-	-	-
	Bus station (access pedestrian bridge)	KBA	-	-	-
	Control center (intelligent transportation system)	KBA	-	-	-
	Operation and Maintenance/Management of Facilities and Equipments			LG	LG
	Fleet maintenance	KBA	Operator	Operator	Operator
	ITS (bus location system, etc)	KBA	-	-	-
Business Operation	Business Operation	KBA	KBA	Operator	Operator
	Fare collection	KBA	KBA	Operator	Operator
	Revenue management	KBA	KBA		
	Fleet operation: operating bus	Operator	Operator	Operator	Operator
Evaluation	Business operation and performance evaluation	KTA	KBA	CG/LG	LG
Law	Law enforcement	Police	Police	Police	Police

6.4 THE WAY FORWARD

There are many potential issues and challenges faced by the City of Kigali in the implementation of the Transportation Master Plan to support the catalyst projects and other long term development projects proposed in the Land Use Master Plan in the short, medium and long terms. Some of the existing Issues and challenges are as follows:

- Need to effectively and efficiently control transportation issues in the three Districts, namely Nyarugenge, Gasabo and Kicukiru Districts
- Need to have a well-co-ordinated and well functioning institution effectively equipped with tangible transportation policy and instruments
- Need to acquire land to carry out road widening projects to meet the future traffic demand
- Need to secure funding to implement the catalyst transport projects
- Need to build capacity of the City Officials in implement the catalyst transport projects
- Lack of clear design standards to follow

It is important that the implementation of the transport catalyst projects is carried out according to the development phasing plan in a achievable way, especially in terms of land acquisition. All the proposed new roads and road widening projects from this Transportation Master Plan must be subject to detailed alignment study to comply with the road geometry design and safety standards, while minimising the land take and the need for land acquisition as far as practicable.

While it seems daunting to clear all the above mentioned hurdles in the short term, the City of Kigali is blessed with the backing of a transparent government with strong governance and political will to move the country forward.

With the right institutional set-up, government/private funding, trained City officials and strong support of the Master Plan from the people from the three Districts, the City of Kigali is well positioned to be able to implement the catalyst developments including the transport projects which will move the City ahead of other African countries and achieve the vision and goals set out in the Master Plan in the long term.

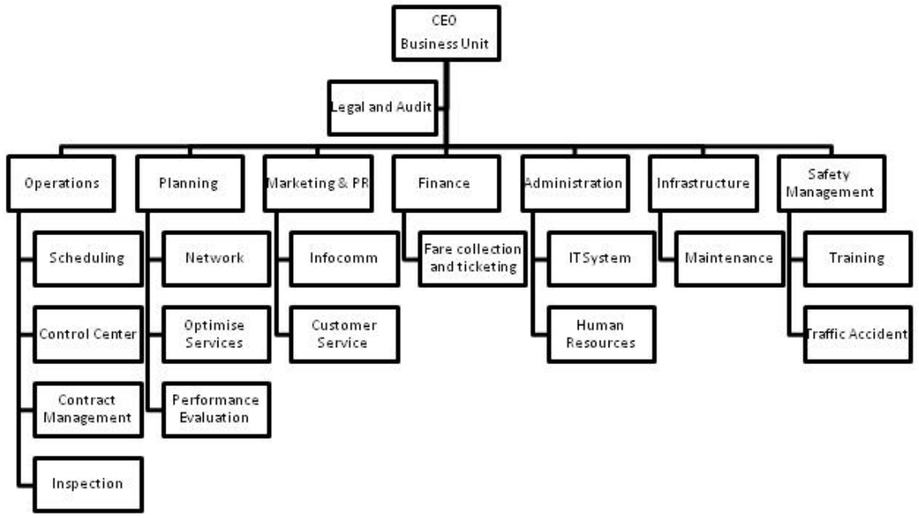


Figure 6.13 Proposed Organizational Structure of Public Transport Executive

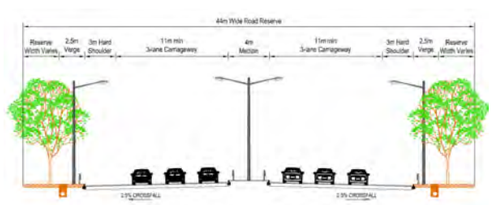
A PROPOSED ROAD CROSS-SECTIONS AND DESIGN DIMENSIONS

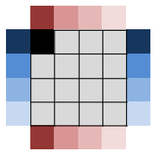
Types	High Capacity Urban Roads	Major Arterial Roads				Minor Arterial Roads			Collector Roads	
	Trunk Roads		Bus Rapid Transit	Link Roads	CBD Thoroughfare		Bus Routes	Commercial Streets	Residential Streets	Rural Road
Description										
Design Speeds & Geometry										
Maximum Speed Limit	90-120kmh	75-90kmh	40-75kmh	75-90kmh	40-75kmh	40-75kmh	30-60kmh	30-40kmh	30-40kmh	75-90kmh
Geometry Design to International Standards										
Street Dimensions										
Desirable Road Reserve Width	37-44m	34-37m	34-40m	34-37m	28-37m	22-27m	27m	27m	18-22m	18-22m
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	3.5m per lane	3.5m per lane	3.5m per lane	3.5m per lane	3.5m per lane	3.5m per lane	3.5m per lane	3.5m per lane	3m per lane	4m per lane
Median Width	4m	1-4m	1-4m, 7 @ station	0.6-4m	0.6m	0.6m	0.6m	0.6-2m	-	-
Hard Shoulder	3m	-	-	-	-	-	-	-	-	-
Easement / Verge	2.5-6m	2.5-6m	-	-	-	-	-	-	-	2-3.5m
Footway	-	-	1.5m min	1.5m min	1.5m min	1.5m min	2m min	2m min	1.5m min	-
Cycleway	-	-	1.5m min	1.5m min	1.5m min	1.5m min	1.5m min, or omit	1.5m min, or omit	1.5m min	-
Planting Strip	-	-	2m	2m	2m	2m	2m	2m	2m	-
Vehicular Crossovers	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Traffic Calming	No	No	No	No	No	No	Yes	Yes	Yes	-
On-street Car Parking	No	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
Bus Rapid Transit Lanes	-	-	Yes	-	-	-	-	-	-	-
Bus Rapid Transit Stations	-	-	Yes	-	-	-	-	-	-	-
Mass Rapid Transit	-	-	Yes	-	-	-	-	-	-	-
Other Information										
Statutory Services	In Verge	In Verge	In Planting Strip	In Planting Strip	In Planting Strip	In Planting Strip	In Planting Strip	In Planting Strip	In Planting Strip	In Verge
Lighting Required	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	

Table A.1 Proposed Design Guide (to be adapted by Local Transport Engineer)

Table A.1 shows the application of these facilities for different cross-sections. Additional cross-sections may be developed to suit a particular situation, for example dedicated BRT lanes only.

High Capacity Urban Roads– Trunk Route

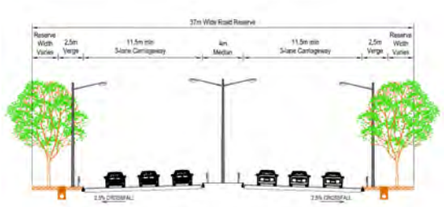


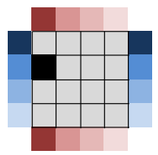


Vehicle-centric
Low Social Interaction

Fig. A.2 High Capacity Urban Roads - Trunk Route

Major Arterial– Trunk Route

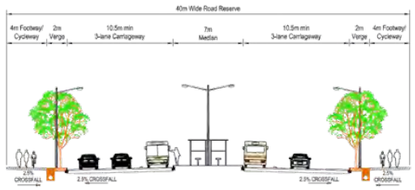


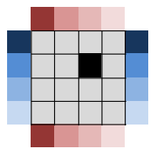


Vehicle-centric
Low Social Interaction

Fig. A.3 High Major Arterial - Trunk Route

Major Arterial– BRT link

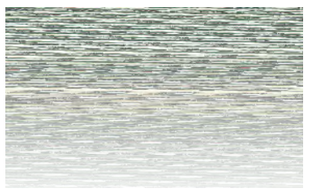


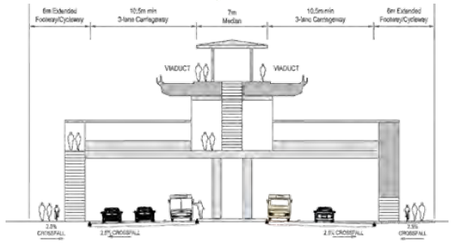


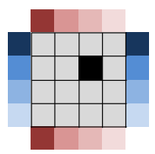
Vehicle-centric
Med Social Interaction

Fig. A.4 Major Arterial - BRT Link

Major Arterial– MRT



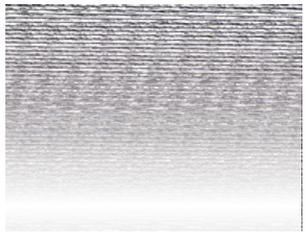


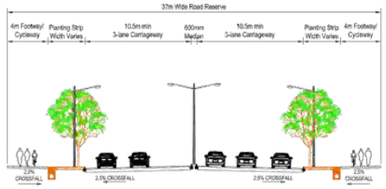


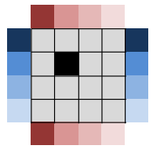
Vehicle-centric
Med Social Interaction

Fig. A.5 Major Arterial - MRT Link

Major Arterial– CBD Throughroutes



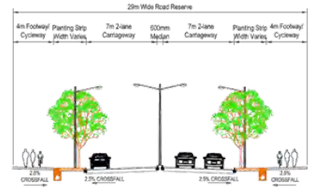


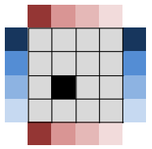


Vehicle-centric
Med Social Interaction

Fig. A.6 Major Arterial - CBD Through Routes

Minor Arterial– CBD Throughroutes

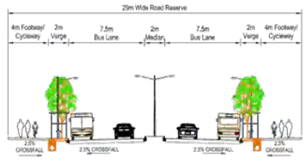


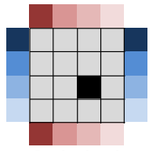


People-oriented
Med Social Interaction

Fig. A.7 Minor Arterial - CBD Through Routes

Minor Arterial– Bus Routes

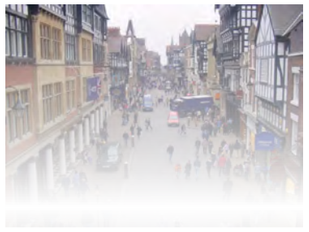


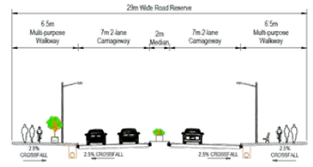


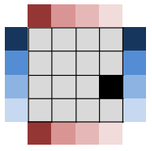
People-oriented
Med Social Interaction

Fig. A.8 Minor Arterial - Bus Routes

Minor Arterial– Commercial Roads







People-oriented
High Social Interaction

Fig. A.9 Minor Arterial - Commercial Roads

Collector– Residential Streets

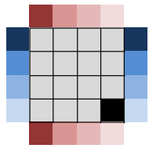
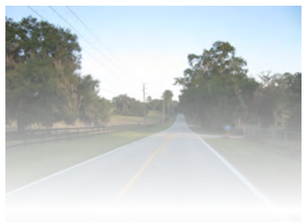
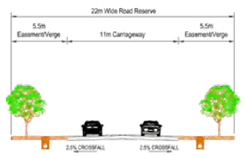


Fig. A.10 Collector Road - Residential Streets

Collector– Rural Roads





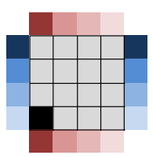


Fig. A.11 Collector Road - Rural Roads

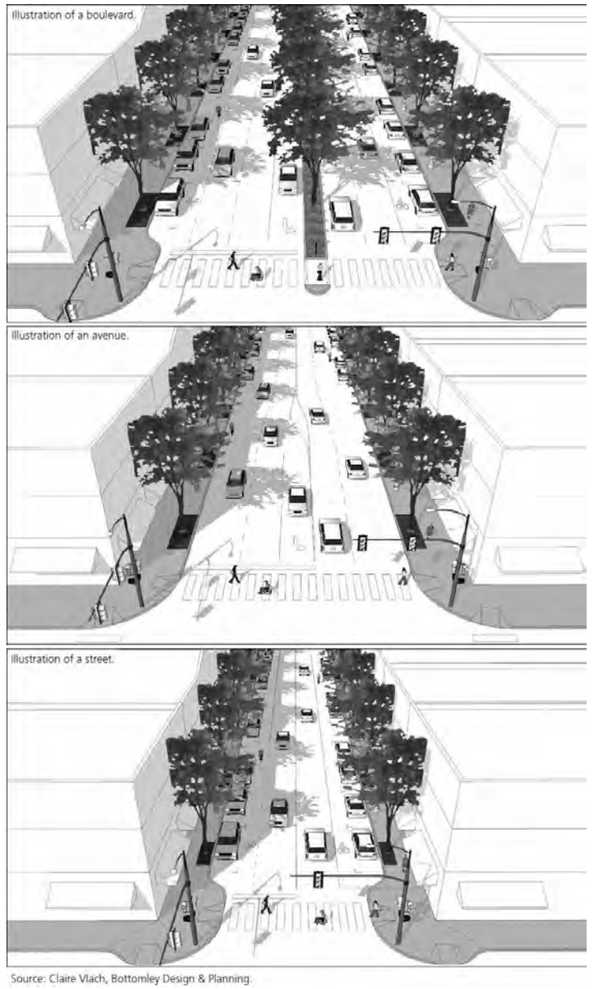


Fig. A.12 Example of Context-specific Solutions to Streetscape (Bottomley Design and Planning)

B ROAD DESIGN CONSIDERATIONS

Pavement Maintenance

The Road Gazette document identified the responsibilities, management, maintenance, financing and roads development for the National Roads.

Article 6 states that the management and maintenance of the National Roads shall be under the jurisdiction of the Rwanda Transport Development Agency, and works meant for national roads maintenance and development shall be funded by the Government. City of Kigali has the responsibilities as regards to the routine maintenance of the part of the national road passing over it and its surroundings.

From the above, CoK is responsible for maintaining the national roads within Kigali and its surroundings. The surroundings have not been defined and need to be determined. Additionally, the Government will fund the maintenance works. CoK and the Rwanda Transport Development Agency will need to liaise with one another to standardise and coordinate work.

Article 7 defines the capacity of the Government to request construction of roads by private entities. This is in line with many government laws where private developers are to upgrade/build roads for their development to ensure that the roads are to acceptable standards based on the estimated level of use of the particular roads.

Article 8 explains that the District Roads are under the purview of City of Kigali. Management and maintenance of the Class One roads will be part of the CoK's jurisdiction.

The Road Maintenance Fund will fund the maintenance work, and the Government will fund the development works for Class One roads.

The Class Two roads within the Districts and City of Kigali will be managed, rehabilitated, maintained and developed by the Districts and City of Kigali themselves using the funds allocated to them.

Article 9 describes the arrangement for the management, rehabilitation, maintenance and development of specific roads. The jurisdiction of these roads fall to those in charge of their management, and these may make special agreements with 'special companies' (undefined) charged with the maintenance of the road (or part of it).

Article 11 discusses the means of providing technical and service standards for Rwanda via a Ministerial. Article 13 states that any person responsible for supervising road works may delegate part or whole of his/her powers in accordance with legal provisions and regulations governing public works supervision.

Based on the above, it can be seen that the law has made provisions to delegate responsibility and funding via a legal mechanism. In this Master Plan the proposal is for the Land Transport Infrastructure division of Kigali Urban Transport Development to manage the roads as per Article 8. They will then need to liaise with RTDA. As outlined earlier in the first section, the funding of roads may be provided by private entities/developers as defined in Article 7.

It is therefore important that the road database includes for the road construction, conditions and dimensions of roads as this will help guide the Land Transport Infrastructure division to better manage the roads.

Structural Road Design/Pavement Design

Roads in the modern sense are paved roads. The typical pavement construction is as shown in Fig. A.1.

The pavement structure depends on the geotechnical conditions of the road, its life expectancy, and the design traffic quantum. The thicknesses of the base and sub-base normally relate to the quality of the underlying ground, as their primary function is to spread the load from traffic into the ground.

The surface course is the interface between the vehicles and the road. It provides friction, which keeps vehicles on the road, and protects the underlying binder and base courses. However, due to its role, it is constantly subject to wear and tear, and weather, which eventually wears it out. The surface course requires constant maintenance, and if properly designed and built, maintenance needs only take place in ten-year intervals or more.

Due to the surface course's role, it is subject to constant replacement. The binder course supports the surface course and transmits loads into the base course. As tarmac roads are flexible, the surface and binder courses are subject to cracking under pressure. The thickness of the binder course is therefore subject to both the life expectancy and design traffic quantum of the road.

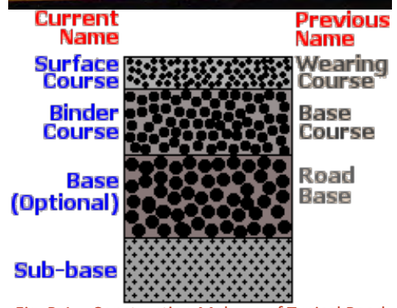


Fig. B.1 Construction Makeup of Typical Road

Geotechnics and Drainage Considerations

Article 28 of the Rwanda gazette discusses the water drainage system in the roads. Generally the drainage flow should be designed in such a way that:-

- Flowing of the water should not be impeded by overland obstructions.
- Any water that flows on the road must be routed through well built conduits.
- Authorization from local authority is required for new underground pipes/ suspended services.
- Rainwater on roads should be collected by using drainage channels and pipes
- Water/waste water from households must not be directed to public roads
- Private/public fountains should be placed at least 1.8m from edge of roads where possible

Drainage can be achieved in a number of ways: covered or open channels, buried pipes and manholes, and French drains. The choice of drainage depends on the context: in high capacity roads with little pedestrian movements, French drains are suitable both as a soakaway and as a generic way of storing and discharging rain water.

In some situations, the highways drainage systems are used to discharge surface water from adjacent properties; in this case the buried pipes and manholes solution is more suitable as they are purpose-built and therefore can function well with little maintenance. This solution is more expensive than the open channel one, however it can be built below the carriageway, therefore reducing land acquisition and maximising surface usage.

Alternatively, covers can be provided to the open channels, and made to be pedestrian lanes. This however increases the cost greatly, and may not be cost-efficient. The options are provided and it should down to the engineer to select a solution based on needs and cost.

In terms of geotechnics, Article 29 intends to keep the roads free from objects that may damage roads, in addition to ensuring that free passage of the roads by all members of the public is possible. Article 30 sets a minimum slope of 45° for upper and lower slopes of road embankments unless they are made of rock, or if landslides and fall of materials are impossible.

In standard practice, if the ground conditions below the road are sub-standard, a thicker road base needs to be laid so that the road does not sink/settle. This is normally the cause of potholes, where the supporting base of the road is not enough to accommodate for the washing away of soils below the road, causing cracks and other problems.

Cut and fill exercises can help with the geotechnical aspects of highways, and with proper design can ensure that the roads are structurally stable.

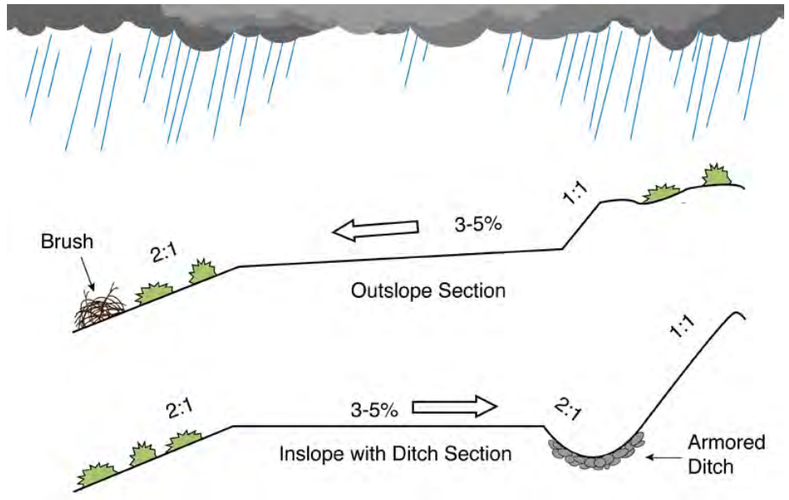


Fig. B.2 Drainage Considerations for Road Cross-sections

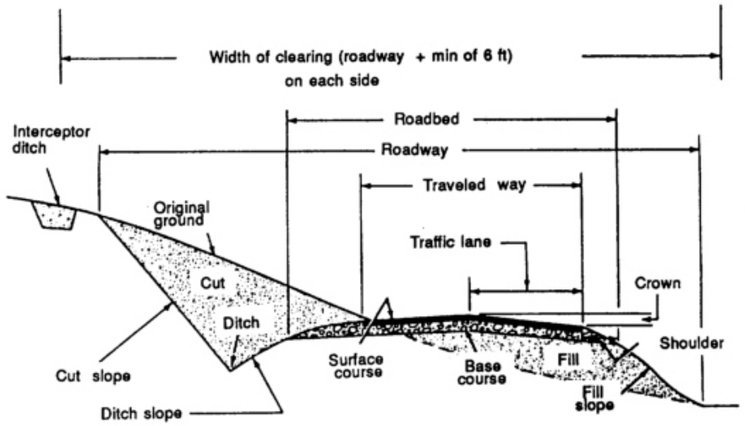


Figure 9-2. Road cross section and nomenclature

Fig. B.3 Examples of Earthworks Consideration during Geometric Design

Geometric Standards and Pavement Construction (AASHTO)

The existing road network is guided by the existing terrain. Some local earth roads are steep and would not meet international standards for acceptable road gradients. This being said, geometric design is one of the key factors that affect road safety.

There are currently no formal Rwandan guidelines to standardise the geometric design of the roads. MININFRA has an intention to adopt American Association of State Highway and Transportation Officials (AASHTO) standards as an interim measure before Rwandan geometric design guidelines are formalised.

Based on the Official Gazette No. 04 of 23/01/2012, it is stated that "A Ministerial shall define the technical and service standards for roads based on the study and research conducted by experts on the entire road network of Rwanda in general." Hence, it is under the purview of the MININFRA to develop technical and service standards for roads.

In the absence of such technical documents we recommend that the AASHTO design guidelines are used in the interim as per MININFRA's intentions. Where AASHTO guidelines are difficult to achieve due to topographic constraints, guidance from Transport Research Library (TRL) UK may be used. They have developed more international guidelines compared to AASHTO which may in time be more applicable.

Generally, road geometry involves designing to suit the topography. The design process is iterative. The first step is to select a design speed for the road. In general, 90kph for high capacity roads, 70kph for arterial roads and 40kph for collector roads are applicable. Based on this, the minimum sight distance or visibility i.e. the forward sight of which the road can be seen, is determined. Similarly, the minimum horizontal and vertical radii for the roads can be determined. Using these numbers obtained from design charts, the alignment is checked for compliance.

Where the road is not compliant, the designer can either reduce the speed limit (and ensuring compliance using road signs) or redesign the layout where possible to the proposed standards.

Intersection geometry is equally important, and while it shares many of the key considerations of roads, intersection geometry is highly influential to its capacity and should be designed to international standards.

The designer needs to bear in mind road cambers, superelevation, and road widths, including widening at curves and minimum widths for Rwandan vehicles.

For example, roads need to be laid with a slight gradient (between 2.5-3.0% along roads to ensure that they get drained constantly. This way, puddles will not accumulate and pose a hazard for road users.

Superelevation works in conjunction with road roughness to keep cars on roads and to avoid slippage. The figure shows how superelevation affects a moving vehicle at a bend (see Fig. 4.29)

Similarly, the road widths at curves have minimum radii, which are normally identified in international standards.

These are examples of how road geometry works to keep road users safe. The list is not comprehensive and therefore it is crucial for the City and the Government to establish a standard as soon as possible.

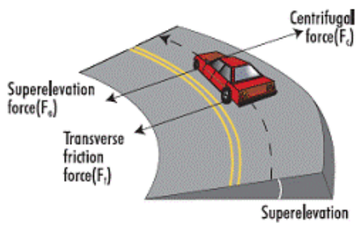


Fig. B.4 Superelevation in Rods

Utility Services

Due to the realignment, some widening, and new lane demarcation, the underground and overhead utilities will be relocated. These utilities include telephone poles, electric poles, transformers, underground cables, water drains, sewage pipelines etc.

It is necessary for the Transport Authority to make records and track all existing utilities and services in their jurisdiction. For example, they will need to liaise with the water authority to identify all existing drains and sewage that pass through public roads, as it may be possible that in future upgrade works, the services may be compromised unknowingly.

At this stage, it is recommended that the proposed one-stop centre make provisions for tracking and recording utilities and services as part of their job scope. This can then assist the LTS in ensuring that the road maintenance would not jeopardise existing services.

Street Furniture, Road Markings, Traffic Signs and Lighting

One of the key components of road maintenance is the street furniture, which help drivers identify roads and road regulations, and at the same time provide a safer and more comfortable environment for the pedestrians and cyclists.

Street furniture most commonly consists of:-

- Traffic Signals – with the ability to upgrade for transit signal priority
- Traffic signs – speed limits, stations, yields, one-way etc
- Pavement Markings – for lane separation, directional separation, stop markings etc
- Landscaping – Plantings along roadside where space is available
- Stand for Auto Rickshaw and non-motorized vehicles – for access to riders of the transit system
- Garbage cans – to provide an opportunity for people to dispose waste
- Railings / guardrails, channelisers, tree guards etc.

Road markings and traffic signals are key street furniture which are absolutely necessary in any streetscape. However, this does not mean that they cannot be designed to a better standard. For example, the figure shows a very cluttered streetscape which was designed solely according to standards in the UK. The decluttering of the road shown in the following figure shows a cleaner, more understandable and friendlier road, which still complies with standards.

C TRAFFIC IMPACT ASSESSMENT

C.1 TRAFFIC IMPACT ASSESSMENT

A traffic impact assessment (TIA) is a study which analyses the effects of a particular development's traffic on the transportation network. They are important in assisting public agencies in making land use decisions and evaluate whether the development is appropriate for a site and what type of transportation improvements may be necessary.

TIAs help development planners to:-

- Forecast additional traffic associated with new development,
- Determine the improvements that are necessary to accommodate the new development, such as road widening, construction of a new roundabout, etc.
- Assist in land use decision making.
- Assist in allocating scarce resources to areas which need improvements
- Identify potential problems with the proposed development which may influence the developer's decision to pursue it, for example inadequate road infrastructure for a stadium development,
- Allow the community to assess the impacts that a proposed development may have.
- Help to ensure safe and reasonable traffic conditions on roads after the development is complete.
- Reduce the negative impacts created by developments by helping to ensure that the transportation network can accommodate the development.
- Provide direction to community decision makers and developers of expected impacts.
- Protect the substantial community investment in the road system.

Traffic impact assessments are only one aspect of transport planning.

The one stop centre, which has a database of the proposed and existing networks, need to utilise this for the purpose of analysing the road network using traffic software such as VISUM and TRANSYT, and at the same time, provide feedback to the planning and development team of the City.

Road development shapes community growth patterns. If there is a lack of understanding of what may happen, the growth of the community may be undermined by unforeseen effects. For example, while expressways were seen as the way of the future, the difficulty for pedestrians to cross expressways have resulted in the division of cities and communities.

Good community growth may therefore be undermined by highway expansion or realignment decisions made at state or federal levels, unless a detailed study is prepared. Traffic impact assessments are focused on the effects of a particular set of developments, but may also provide information relevant to these broader plans and decisions.

In this situation, the TIA studies need to actively involve the proposed one-stop centre and provide feedback and analysis to the city-wide traffic model.

Traffic impact studies should be used as one piece of several kinds of information to judge the suitability of development from a transportation standpoint.

It is recommended that traffic impact assessments should accompany developments which have the potential to impact the transportation network.

Fig. A.1 shows the proposed framework for the Traffic Impact Assessment.

When a Planning Application is submitted, the planners determine whether a traffic impact assessment is required. If one is required, the planners refer to the KTA Transport Planning Team, who would then discuss the scope of works with the Developer's Traffic Consultants.

After the analyses are completed, the consultants submit the TIA to the Transport Planning Team, where the TIA would be reviewed. Comments on the content are provided, and the TIA is reviewed based on the comments. During this period, monetary contributions to the KTA roads improvement funds are discussed. The larger the impact of the development on the road network, the more contributions would be expected. At this stage, the size and type of the development would be refined so that detrimental effects of the development can be minimised, and where necessary, upgrade works for the road network identified to accommodate the increase in traffic.

Once the traffic analyses are completed and planning conditions set, KTA can approve the planning application from the transportation standpoint. Similarly if the traffic analyses are not suitable, or if conditions cannot be agreed, and an objection can be made on the grounds that traffic conditions would be worse.

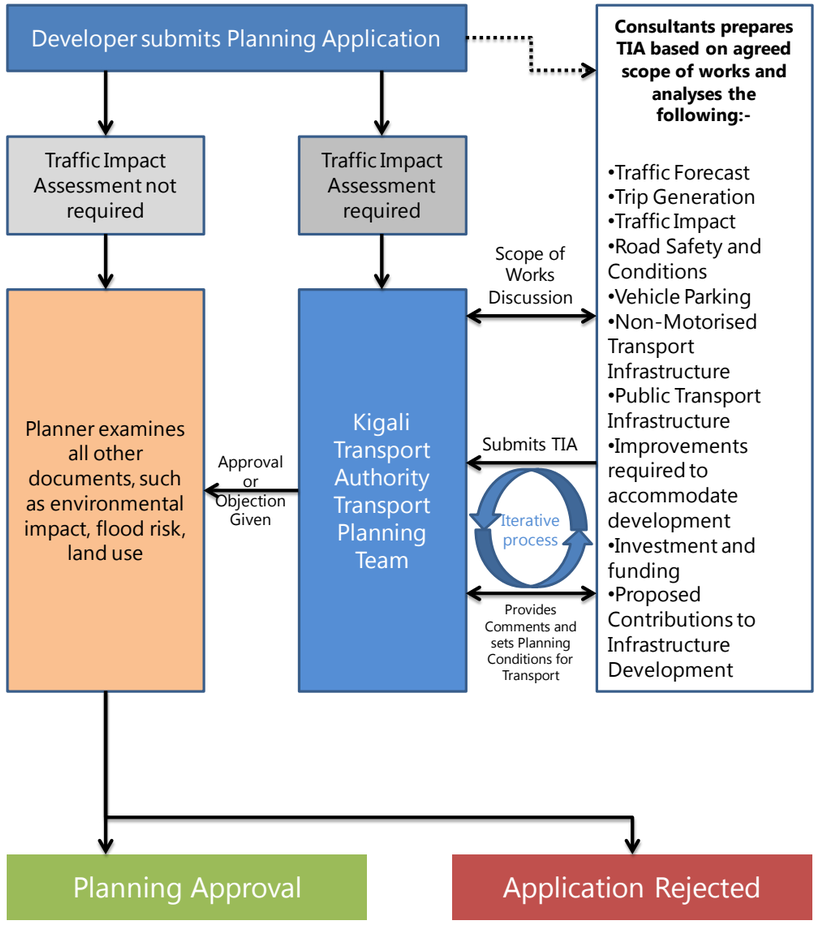


Fig. C.1 Proposed Framework for Traffic Impact Assessments

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