DATE: 28 September 2012

Rwanda Transport Development Agency
Ministry of Infrastructure
MININFRA Building, 4th Floor
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Kigali
Republic of Rwanda

Att: Dr Elias Twagira

PREPARATION OF A STRATEGIC TRANSPORT MASTER PLAN FOR RWANDA: FINAL REPORT

It is with great pleasure that we hereby submit the Final Report as part of the Rwanda Strategic Transport Master Plan.

As per the Terms of Reference, the RTDA (along with other stakeholders) has had the opportunity to provide final contributions to the report for which we thank you. We have, where possible, included all comments received in the Final Report. Where such comments could not be included, separate communications and correspondence was provided.

We trust that our submission is to your approval.

Yours sincerely,

Dr Paul Lombard
For AURECON
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<td>EDPRS</td>
<td>Economic Development and Poverty Reduction Strategy</td>
</tr>
<tr>
<td>EAC</td>
<td>East Africa Community</td>
</tr>
<tr>
<td>MTEF</td>
<td>Medium Term Expenditure Framework</td>
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<td>NIS</td>
<td>National Investment Strategy</td>
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<tr>
<td>RSTMP</td>
<td>Rwanda Strategic Transport Master Plan</td>
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<td>Sub Saharan Africa Transport Policy</td>
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<td>CCTFA</td>
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</tr>
<tr>
<td>NCTTC</td>
<td>Northern Corridor Transit, Transport Coordination Agency</td>
</tr>
<tr>
<td>IRR</td>
<td>Internal Rate of Return</td>
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<tr>
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Chapter 1: Background, Context, Purpose and Vision of the RSTMP Report

Background and Planning Context to the RSTMP

- This report, the Rwanda Strategic Transport Master Plan (RSTMP) also referred to in this report as the Strategy, required a review of the status of the transport sector, data collection, and the development of the transport master plan which will provide guidance for the development of integrated medium and long term land transport programs for the next 10 years in conformity with Vision 2020 and the objectives of the Economic Development and Poverty Reduction Strategy (EDPRS).

- The transportation environment is basic economic interaction between supply and demand. A mature transportation system displays this interaction best. The area where the biggest demand exists, e.g. a densely populated urban area would typically have a dense road network and public transport infrastructure to serve the demand for transportation that exists there. In a developing environment though, the challenge is to use transportation interventions to have a catalytic effect to “create” a demand where, at present, it may not be to the extent that warrants the investment.

- The RSTMP development was undertaken within a defined planning context which informed the RSTMP with regards to the focus of the study, specifically with regards to the transport objectives of Rwanda. The planning context of Rwanda is defined by a number of national initiatives and guiding documents that informed the RSTMP, including, but not limited to, the following:
  - Vision 2020
  - Economic Development and Poverty Reduction Strategy (EDPRS)
  - Rwanda National Land-use and Development Master Plan
  - Rwanda Transport Sector Policy

Purpose of this Report

- The purpose of this document is to present the consolidated RSTMP report consisting of an executive summary, the RSTMP itself and the working papers and technical reports which served as input to the development of the RSTMP.

- This document is not merely a consolidation of the working papers and technical reports, but rather a synopsis of the salient themes of importance to the RSTMP. These salient themes will typically include:
  - The characteristics and status of transport sector elements (i.e. transport infrastructure, transport services etc.)
  - Issues and concerns pertaining to each transport sector element
  - An overview of master plan interventions required for the various transport sector elements (i.e. projects)
  - An intervention program indicating the sequence, resource requirements and timing of transport sector interventions / projects required to address the underlying issues and concerns.
The RSTMP Vision for Transport

- The RSTMP deals with the "strategic" layer of the transport system. The strategic transport system envisaged for Rwanda by the RSTMP is aligned with the visions and objectives of current transport policies of Rwanda (e.g. Transport Sector Policy, EDPRS, LUMP and Vision 2020).

- Based on and aligned with, the key policy vision pillars of current transport policies, the RSTMP Vision Pillars were developed:
  - Economic: Develop a Transport System that supports sustainable economic activity and value for money
  - Compliant: Develop a Transport System that complies with modern rules and standards, that is focused on safety and protecting the environment
  - Capacity: Develop a Transport System that is sufficient, optimal and timeous
  - Continuity: Develop a Transport System that is globally and regionally focused, integrated, stable, that improves mobility and provides access to economic activities and transport facilities
  - Choice: Develop a Transport system that enables universal and quality accessible options; that ensures social equity through providing affordable and reliable transport options and alternatives that enable equitable development and growth.

- The Vision Pillars of Rwanda also forms the basis for assessment criteria as part of the Multi-Criteria Analysis developed to assist with prioritizing projects identified for the RSTMP.

Chapter 2: Concepts Important to the Understanding of the Strategy (RSTMP)

Strategic Dimension and Composition of the Strategy

- The RSTMP considers transport system issues related to connectivity at the following levels:
  - Inter-Continental (e.g. Kigali and Europe). Defined in this context as the involvement of, and interaction between Rwanda and other nations.
  - Inter-Regional (e.g. Rwanda and Kenya). Defined in this context as the involvement of, and interaction between Rwanda and other regions – specifically neighbouring countries.
  - Inter-Provincial (e.g. Town of Kigali and Western Province). Defined in this context as the involvement of, and interaction between Provinces of Rwanda.
  - Kigali City and Important Nodes of Rwanda (e.g. Kigali and proposed Bugesera Airport). Defined in this context as the involvement of, and interaction between Kigali City and nodes of national importance to Rwanda.

- The following fall outside the scope and are not considered part of the Strategy:
  - Intra-Provincial (e.g. within the Northern Province) Defined in this context as interactions within a specific Province of Rwanda.
  - Inter-District (e.g. between Nyamasheke and Rusizi). Defined in this context as the involvement of, and interaction between Districts of Rwanda.

- Intra-District (e.g. within the Rusizi District). Defined in this context as interactions within a specific District of Rwanda.
Importance of Regional Corridors

- Rwanda is a member state of the East African Community (EAC) of which member states include Kenya, Uganda Burundi, and Tanzania. Rwanda is a landlocked country and far from the maritime ports of Kenya and Tanzania. The distance to the nearest port of Dar-Es-Salaam is approximately 1400 km.
- Rwanda is dependent on two main transport corridors for trade, namely the Northern Corridor and the Central Corridor. According to the 2009 Public Expenditure Review on the Transport Sector, about 70 percent of Rwanda’s external trade utilizes the Northern Corridor.
- In this study, the main principles established by the EAC to ensure regional connectivity and integration are adhered to, including, but not limited to: road classification; road standards (e.g. 100km/h design); support to regional overload control, and road transport de-regulation overseen at the regional level.
- The corridors traversing Rwanda both have their own managing agencies that are mandated to monitor corridor performance and to promote the corridors. For the Central Corridor the managing agency is the Central Corridor Transport Facilitation Agency (CCTFA) and for the Northern Corridor the managing agency is called the Northern Corridor Transit, Transport Coordination Agency (NCTTC).
Types of Transport Demand
- Transport on the strategic transport network conveys people and goods. The movement of people on the strategic transport network is focused between cities and across borders. Freight transport entails the long haul of different commodities (i.e. break-bulk, dry-bulk, containerized, liquid, etc.) including cross-border trade.
- The distinction between types of transport demand is important because different transport modes serve diverse transport demands over various distances more efficiently.

Transport Mode role Allocation
- Transport in Rwanda today is based on the road and aviation modes, with rail linkages, inland waterways, and pipeline modes being planned for the future.
- Road transport is efficient for local and medium haul distances. Rail comes into its own for large freight volumes over long distances. Air transport is efficient for passenger transport (or for low-weight, high-value commodities) over long distances. Inland waterways are efficient where rivers are non-seasonal, otherwise they serve localized needs only.

Institutional Transport Organisation
- The success and sustainability of the Strategic Transport Network is directly related to the strength of the institutions that oversee the sector. Institutions are the means by which policy decisions are made effectively. Policies without organisations capable and willing to implement them are not credible.
- The institutional structure of the Strategy covers all modes of transport (namely: Roads, Road Transport, Inland Waterways, Rail and Aviation) and is divided into the following:
  - Policy and Planning;
  - Safety Regulation;
  - Commercial Regulation;
  - Infrastructure Provision;
  - Infrastructure Funding; and
  - Services.
### Chapter 3: Strategic Transport Network

#### Introduction
- Transport is a strategic intervention area to enable the expanding of the Rwandan economic base from predominantly agriculture based into the secondary and the tertiary sectors. The rehabilitation and development of transport infrastructure is regarded as a crucial aspect to lower the costs of doing business in Rwanda.
- This section of the RSTMP is focused on the transport network (infrastructure) that falls within the scope of the RSTMP and therefore covers the transport networks of *roads*, *rail*, *airports*, *inland waterways*, *pipelines*, and *multi-modal facilities*. Each of the said transport modes are discussed in terms of the following general criteria (with additional criteria included where considered):
  - Classification;
  - Standards;
  - Network; and
  - Way Forward/Recommendations
- The following Sections provide a summary overview of each RSTMP transport network and the major issues and concerns identified.

#### RSTMP Road Network - Overview
- The purpose of any road network is to preserve and sustain social and economic development. To achieve this purpose and objective there is a need to ensure that the RSTMP road network is operating safely, efficiently and within its design capacity.
- In order to meet this mandate, specific factors need to be investigated. These factors/principles/concepts, crucial to the analysis of the RSTMP Road Network, include:
  - Classification
  - Access Management
  - Standards
  - RQMS/IRNMS
  - Overload Control
  - Road Safety
  - Road Capacity and Continuity Analysis
- The total road network of Rwanda consists of almost 14,000 km. However, only roads that fall within the scope of the RSTMP (i.e. of national and regional importance) were investigated.
- The RSTMP Road Network that was analyzed consists of approximately 2,837km (nearly 20% of the total road network) of which 1,171km are paved (40%) and 1,667km are unpaved/gravel roads (60%).
Road Network – Major Issues and Current Realities

- **Issues pertaining to Road Access Management and Road Classification in Rwanda:**
  - Incomplete Road Classification Process
  - Lack of Road Functionality Classification Standards
  - Lack of Minimum Road Access Standards

- **Main Issues Identified where Standards can Assist:**
  - Road access management along national roads that hampers the mobility function of the road,
  - Posted speed along national roads at 80km/h due to accidents and the location of settlements along these roads,
  - High number of accidents along classified road network,
  - Road signage and markings to warn drivers of limited sight distance change on posted speeds, passing opportunities.

- **Main Guideline Recommendations regarding Standards for Rwanda:**
  - Develop Geometric Design Standards for Roads;
  - Develop Standards for culvert and bridge design per road classification;
  - Develop Pavement Design Standards;
  - Develop Construction Best Practice;
  - Develop Road Signs and Markings Manual;
  - Develop Access Management Guideline;
  - Develop Road Safety Manual;
  - Develop Road Safety Audit Manual;
  - Develop Overload Control Policy and Standards.

- A road network in its entirety is an important asset that needs to be looked after (managed) and by disregarding its importance and upkeep will result in unnecessary and otherwise avoidable costs to a country’s economy. There are limited definitions specifically for defining an Integrated Road Network Management System (IRMS) due to the numerous systems that form part thereof (ranging from Pavement Management Systems, Asset Management Systems, Road Safety Management Systems, Bridge Management Systems, Congestion Management Systems, etc. An **Integrated Road Network Management System (IRNMS)** is therefore identified in the transport industry as the management system that brings all road management systems together and it is recommended that Rwanda develop its own IRNMS as a priority.

- **The following Overload Control (OLC) recommendations are identified specifically for Rwanda:**
  - Rwanda should align OLC with that of the EAC (i.e. harmonize axle load limits and vehicle dimension standards; guide registrations of new vehicles to eliminate variations over time);
  - Rwanda should commission and implement a country-specific Overload Control Strategy in order to ensure that the unique OLC situation prevalent in Rwanda and thereby identify associated requirements are identified and addressed;
  - Expedite the process of establishing agreements that will ensure smoother cross-border operations;
  - Expedite the process of standardizing OLC weighing equipment, procedures and interpretation of enforcement guidelines leading to integration of data collection and collective reporting.

- **Observations regarding Road Freight:**
  - Domestic distribution of crops at rural level needs transportation from small plots of farms to provincial intermediary warehouses.
Small pick-up trucks are the preferred mode of transport for movement of short distance delivery. For larger consignments transported from provincial intermediary warehouses to Kigali as well as from Kigali for exporting of goods, larger trucks are used for goods transportation.

- **Road Freight Constraints:**
  - The road-freight market in Rwanda is very small and there are few transport operators.
  - Rwanda is constrained from accessing global markets due to high transport costs as well as delays.
  - Rwanda depends on quality of transport and transport procedures on corridors. Optimising Road-Freight Operations

- **Road Based Border Posts:**
  - The concept of "One-Stop Border Post" has been identified at Rusumo, Akanyaru, Kagitumba and Gatuna. It is proposed that the remaining border posts be assessed in terms of upgrades required and the feasibility of upgrading to “One-Stop Border Post”.

- **Truck Stops / Roadside Stations:**
  - A Truck Stop / Roadside Station is an establishment, usually located near a busy road, with a large parking area for heavy vehicles. The stop usually offers a range of services for professional truck drivers to rest and refresh themselves, often with accommodation and other services available.
  - The following are minimum standards required at a Truck Stop:
    - Ample parking space for trucks and other heavy vehicles;
    - Accommodation facilities;
    - A place to purchase food and other refreshments; and,
    - Ablution facilities for those not making use of accommodation facilities.
  - Over and above the minimum requirements stipulated above, it is imperative for the Ministry of Transport to also consider the following:
    - There should be government legislation that forces drivers to stop between 11pm and 5am for compulsory rest.
    - More safe and clean truck stops / roadside stations are needed. Alternatively, along the route there should be lay-bys constructed with stadium lights and security so that drivers can sleep in relative safety.
    - Drivers need to attend regular driver training courses to improve their skill as well as stop complacency. Further, there should be relevant training courses for truck drivers that carry specialized/ dangerous goods e.g. chemicals.
    - The transfer of HIV/ Aids and sexually transmitted infections is a growing concern in the transport industry. These threats can only be addressed by way of the partnerships of society: government and the private sector; workers and management; transport operators and commuters. Truck stops / roadside stations can be an important part of the strategy to protect Truck Drivers against these and other illnesses and provide information on these risks.
  - Truck Stops / Roadside Station Studies are proposed as part of the RSTMP

- **Weighbridges:**
  - The overload control guidelines document, recently completed, provides comprehensive guidance that addresses infrastructural and operational requirements relating to weighbridges (refer to Section 3.2.6). A number of weighbridge locations are proposed in as part of the RSTMP.

- **By-Passes along Road Freight Network:**
  - The purpose of a road-freight by-pass is to restrict movement of freight vehicles by re-directing it from a focal point like a city centre. It is aimed at minimizing the need for a freight vehicle to travel through a focal point (such as a city centre) thereby optimizing the safety of a city centre as well as optimizing travel time (whereas travel time is minimized when travelling through
a city centre when freight is not destined for that city centre). There are three road-based by-passes/ring roads being proposed for Rwanda as follows:
- The City of Kigali
- Muhanga and Huye towns
- At the town of Musanze

### Envisioned Road Freight Operations:
- There are two primary corridors within Rwanda, which are aligned to the existing regional corridors (i.e. the Central as well as the Northern Corridor of the EAC). These primary corridors include:
  - The corridor from Rusomu border – Ngoma – Kanyonza – Kigali – Musanze – Nyundu – Gisenyi border is the first primary freight corridor.
  - The corridor from Katuna border – Gicumbi – Kigali – Muhanga – Huye – Akanyaro border is the second primary freight corridor.
- The profile of a primary freight corridor needs to include:
  - These corridors need to enhance regional connectivity. To achieve regional connectivity the corridors need to operate in an efficient manner. This includes provision of the necessary freight-based facilities proposed along each corridor as well as providing adequate capacity. Capacity can be enhanced by provision of climbing lanes where warranted as well as provision of ring-roads were proposed.
  - Traffic volumes carried by these corridors need to be of national as well as regional importance. The corridors need to have substantial truck ADT to substantiate the investment that will be made to ensure mobility.
  - Speed limits are in place that to support mobility.
  - Vehicular mix is mostly limited to motorised transport.
- The following corridors constitute secondary freight corridors:
  - Kagitumba border – Nyagatare – Kanyonza;
  - Kigali – Nyamata – Nemba border;
  - Musanze – Cyanika border;
  - Muhanga – Ngororero – RN4;
  - Muhanga – Karongi; and,
- The profile of a secondary freight corridor needs to include:
  - These corridors need to enhance provincial connectivity.
  - Traffic volumes carried by these corridors need to be of provincial importance.
  - Vehicular mix can include both motorised transport as well as non-motorised transport. It is therefore important that the accommodation of non-motorised transport is taken into account when designs are prepared.

### Road Safety:
- This section is aimed at establishing a foundation for Road Safety in Rwanda as part of the RSTMP, taking into account the latest road accident statistics as well as international best practices that relate to road safety in Rwanda. The outcome of this section is a proposed "High-Level" Road Safety Strategy for Rwanda and respective short-term implementation projects aimed at promoting a more functional and safer road network in the country. This section is therefore structured as follows:
  - Rwanda Road Safety Context provides the status quo of aspects that influence and determine the context in which road safety has to be managed in Rwanda, i.e. the location, the vehicle fleet as well as an overview of current road accident
The Road Accident Statistics Overview provides a brief overview of accident statistics worldwide and in Rwanda.

- The Rwanda Road Safety Environment sub-section contains information on the status of the road safety environment in Rwanda. It also highlights issues which have been identified during the course of the project and which need to be addressed in the Road Safety Strategy.
- The Incident Management System (IMS) sub-section provide an introduction to IMS and identifies what is involved and the prerequisites of an IMS in order to minimize the direct and secondary effects of accidents, as well as to restore normal capacity and safety levels to all affected road facilities as quickly and efficiently as possible;
- The proposed “High-Level” Road Safety Strategy sub-section proposes mitigating measures for the challenges identified in the previous sections, by using common interventions on road safety and road safety related infrastructure as well as education and communication strategies and programmes. These aspects, are addressed under the following Pillars, as per the UN Global Plan for the Decade Action for Road Safety 2011 - 2020:
  - Road Safety Management;
  - Safer Roads and Mobility;
  - Safer Vehicles;
  - Safer Road Users; and
  - Post-Crash Response or Emergency Services.
- Finally, the Way Forward summarizes the proposed “High-Level” Road Safety Strategy projects for the implementation of the Rwanda Strategic Transport Master Plan.

**Road Capacity and Continuity Analysis:**

- The road network of the RSTMP was analysed by way of assessing its operational capacity and strategic transport demand in order to determine and identify capacity and bottleneck improvement requirements that exist within the said road network.
- In order to analyse and assess the capacity and transport demand of the RSTMP road network, the following distinct but inter-related models were used and developed, namely:
  - **First Order Network Assessment (FONA)** – capacity assessment model;
  - **Highway Transport Model (HTM)** – capacity assessment model providing additional support to FONA; and
  - **VISUM Strategic Transport Demand Model** – multi-modal transport demand assessment model (given the nature and extent of the Strategic Transport Demand Model, a dedicated Chapter of the RSTMP Report provides specifics and conclusions).
- The Rwanda Network data was standardised in order to be applied in all three model platforms in order to provide consistent analysis input/output in terms of condition, traffic and capacity analysis. Therefore the data that was utilised for the HDM analysis was also utilised for the Transport Model as well as for FONA.
- The HTM model, VISUM and FONA were applied to determine traffic growth scenarios, assessment of the relationship between traffic and infrastructure capacity, i.e. identifying where actual or projected traffic does or is likely to exceed the infrastructure’s ability to process that traffic at an acceptable level of service, analysis of new road links.
based on land use and other socio-economic data utilized to generate traffic, a first-order estimate of the actual operating conditions on Rwanda’s major road network for the Rwanda Strategic Transport Road Master Plan. With regards to the above mentioned assessments, the following observations were made:

- The 2010 Base Year Scenario (40 & 60 km/h) shows that the Rwanda National Road Network is operating at undesirable levels with 11.1% and 88.9% of the total length of road network being analysed operating at a LOS E and F respectively. This is a clear indication of the impact operating speed (amongst others) has on the level of service.

- The FONA analysis model was developed to analyse road link capacity on a first order level. The HCM analysis method followed in the FONA model is primarily for two lane highway’s with speed limits between 70 and 100 km/h. In Rwanda the speed limits on the freeways vary between 40km/h in urban areas and 60km/h in rural areas. Taken these speed limits into account it is noted that the speed limits on freeways in Rwanda fall outside of the speed limits identified for the HCM method. The result of the speed limit not within the set parameters of HCM method is that the LOS modelled by FONA is far worse than experienced while driving along roads in Rwanda.

<table>
<thead>
<tr>
<th>Route Number</th>
<th>Total Route length</th>
<th>Km Climbing Lane Direction 1</th>
<th>Percentage Climbing Lane Direction 1</th>
<th>Km Climbing Lane Direction 2</th>
<th>Percentage Climbing Lane Direction 2</th>
<th>FONA Results Additional Lanes Required both directions</th>
</tr>
</thead>
<tbody>
<tr>
<td>RN 1</td>
<td>170.7</td>
<td>78.9</td>
<td>46%</td>
<td>78.48</td>
<td>46%</td>
<td>20% 80%</td>
</tr>
<tr>
<td>RN 2</td>
<td>78.9</td>
<td>47.14</td>
<td>60%</td>
<td>38.78</td>
<td>49%</td>
<td>0% 100%</td>
</tr>
<tr>
<td>RN 3</td>
<td>167</td>
<td>70.9</td>
<td>42%</td>
<td>60.26</td>
<td>36%</td>
<td>0% 100%</td>
</tr>
<tr>
<td>RN 4</td>
<td>149.3</td>
<td>80.82</td>
<td>54%</td>
<td>87.86</td>
<td>59%</td>
<td>0% 100%</td>
</tr>
<tr>
<td>RN 5</td>
<td>117.6</td>
<td>19.86</td>
<td>17%</td>
<td>17.94</td>
<td>15%</td>
<td>0% 100%</td>
</tr>
<tr>
<td>RN 6</td>
<td>151</td>
<td>41.96</td>
<td>28%</td>
<td>45.2</td>
<td>30%</td>
<td>39% 61%</td>
</tr>
<tr>
<td>RN 7</td>
<td>82.7</td>
<td>29.04</td>
<td>35%</td>
<td>23.18</td>
<td>28%</td>
<td>29% 71%</td>
</tr>
<tr>
<td>RN 8</td>
<td>25.1</td>
<td>9.48</td>
<td>38%</td>
<td>5.64</td>
<td>22%</td>
<td>0% 100%</td>
</tr>
<tr>
<td>RN 9</td>
<td>30.4</td>
<td>1.02</td>
<td>3%</td>
<td>13.38</td>
<td>44%</td>
<td>37% 63%</td>
</tr>
<tr>
<td>RN 10</td>
<td>7.7</td>
<td>1.98</td>
<td>26%</td>
<td>0.96</td>
<td>12%</td>
<td>44% 56%</td>
</tr>
</tbody>
</table>

HTM Results v/s FONA Results for base year 40km/h and 60km/h speed limits
Other Initiatives Supporting the Strategic Road Transport Network
This section identifies initiatives that fall outside the road transport network but play an important supporting role. These include the following and will be discussed in turn:

- **Alternative Project Appraisal Technique for Non-Classified Gravel Roads**
  - 9 302km of the road network is unclassified and unpaved roads and no standard capacity analysis methodology exists for these types of roads. The first step to improve capacity along a gravel road is to pave the road and thus increase the operating speed along the road. Several analysis techniques are found in the literature to evaluate when to pave a road and when not to do so.
  - Factors that influence the decision when to pave a road are:
    - After Developing a Road Management Program
    - When the Local Agency Is Committed to Excellence
    - When Traffic Demands It
    - After Standards Have Been Adopted
    - After Considering Safety and Design
    - After the Base and Drainage Are Improved
    - After Determining the Costs of Road Preparation
    - After Comparing Pavement Life and Maintenance Costs
    - After Comparing User Costs
    - After Weighing Public Opinion

  “Traffic is a primary factor in deciding to pave or not to pave. The Minnesota study found that gravel road maintenance costs per mile appear to increase considerably after an ADT level of 200 vehicles per day. On the other hand, the South Dakota study found that paved roads are most cost-effective at ADT levels above 150 vehicles per day. So, decisions can be made based on traffic data, local construction and maintenance costs, and area growth values to determine if and when a roadway should be paved.” (Minnesota Local Technical Assistance Program, 2006)

  - It can be concluded that the main consideration to pave or not to pave is not an easy decision and once a road is paved it does not mean that it disappears from the problem list it is added to the maintenance schedule and cost to public sector.

- **Regional Non-Tariff Barrier Programme**
  - Non-tariff barriers (NTBs) have gained prominence as alternative trade policy instruments for domestic industry protection or for regulating trade. NTBs are barriers to trade that are not tariffs and include both trade-restricting measures such as quotas, technical barriers, etc. and trade-promoting measures such as export subsidies etc. In their application, NTBs are increasingly raising market access concerns at both global and regional levels.
- On March 2, 2004, member states of the EAC signed a protocol for establishment of the East African Community Customs Union which Policy makers to eliminate NTBs.
- Such policy measures have a great potential of improving the welfare of people living in the EAC countries (including Rwanda).
- The following policy actions are proposed:
  - Streamline administrative requirements to improve on efficiency
  - Remove unnecessary barriers that contribute to increased transportation costs.
  - Removal or reduction of NTBs should be tackled as a group and not one-by-one
  - Since NTBs are similar across the region, a region-wide approach for tackling NTBs might be less costly and as effective as national-specific or sector-specific approaches.
  - Design and implement monitoring systems to provide feedbacks to the relevant authorities on the control of unnecessary barriers to trade in the EAC region.

- **Non-Motorised Transport**
  - The total transport system does not only comprise ‘formal’ modes of transport but also consist of ‘informal’ means of transport which is often referred to as ‘intermediate means of transport’ (IMT) or ‘non-motorised transport’ (NMT).
  - NMT/IMT should be encouraged not only by providing infrastructure but by ensuring that pedestrians and other NMT users feel safe and secure in their environment and that services and land use is orientated towards the NMT network.
  - The one disadvantage of NMT is that long distances can be exhausting and therefore planning should consider the proximity of services to homes and to one another.
  - NMT/IMT plays an integral part of road safety and is included under the proposed “High-Level” Road Safety Strategy for Rwanda.

- **Rural/District Roads Programme (ASSETIP)**
  - This is an agency set up as a private, non-profit association and pays no taxes. The agency works on behalf of local authorities who delegate certain functions to the agency. The local government usually reserves the right to select the projects and the agency then:
    - recruits consultants to carry out detailed engineering;
    - invites bids and awards contracts for supervision and works, manages the contracts, and pays the contractors directly from a special account opened in its own name.
    - The agency is subjected to a bi-monthly management and financial audit and an annual technical audit.
  - AGETIP/ASSETIP has a short term role to play, particularly in economies where the local consulting industry is relatively underdeveloped. However, in future ASSETIP could play a vital role on a District and Local level in terms of institutional support, capacity and skills transfer within the transport sector of Rwanda.

| RSTMP Rail Network - Overview | The rail mode comes into its own for longer-distance hauls of fairly large volumes of cargo and it is an important commuter carrier in dense urban areas. In a mature transport system with large passenger demand, rail is a viable long-distance (high-speed) passenger carrier. |
| RSTMP Rail Network – Current realities | Rail Network
  - Rwanda does not presently have a rail network. The rail systems of neighbouring countries extend towards but do not reach Rwanda:
  - The URC/RVR (Uganda) mainline from Mombasa goes as far as Kampala. The Kampala-Kasese branchline is not operational |
although RVR is investigating the feasibility of reopening it

- The TRL (Tanzania) mainline from Dar es Salaam reaches Mwanza and Kigoma. The Kigoma section especially is subject to service interruptions because of the poor state of repair. The plan to extend a branchline from Isaka to Kigali is well advanced
- The SNCC (DRC) system has a branchline from Kabalo to Kalemié. The SNCC system is in the process of being rehabilitated.

**Rail Classification**
- A formal classification system has also not been adopted as yet.
- In the absence of a rail system, the issue of network classification does not arise.
- Rail classification would be relevant when a hierarchy of rail applications start to emerge, e.g. urban rail, local freight rail, regional freight rail, etc.
- In Southern Africa where there is a broader rail network, the general classification merely differentiates between “mainline” and “branchline”.

**Rail Standards**
- There are no current rail standards
- Uniform rail standards can be adopted to ensure continuity of service and also have other benefits such as economies of scale in construction and operation. This is especially important for a landlocked country of which the rail system has to tie in with that of its neighbours.
- There are three main categories of standards that can be followed, i.e. track, equipment and operations standards:
  - **Track standards** are dominated by the question of gauge. Other track standards that are particularly important are:
    - Uniform general axle loads so that wagons and payloads can be standardised
    - Uniform track geometric standards to ensure sufficient speeds
  - **Key equipment standards** are:
    - Standardised mainline locomotive fleet allowing for ease of maintenance and improved availability and utilisation
    - Standard wagon, coupling and braking systems
    - Standardised maximum train lengths
  - **As regards operating standards**, these are clearly more important the busier the rail system is and the more operators require access to the lines. The operating interface between adjacent national railway systems is crucial, including the rules of whether locomotives may cross the border, how wagons are handed over from one operator to another, and where and how Customs duties are performed.
Other operating standards include:
- Uniform track maintenance procedures
- Scheduled train services around which shippers can plan.

**Rail Initiatives**
- In the region, there are two plans investigating possible future expansion of the rail system:
  - The EAC Rail Master Plan (EARM) proposed new links, including from Isaka (TRL) to Kigali with a branchline into Burundi, and from Kigali via Kabale to Bihanga/Kasese (URC/RVR).
  - The Great Lakes Railway Pre-feasibility Study has investigated links from Bukavu to Kigali, Bujumbura to Kigali and Gisenyi to Kigali.
  - The topography of the terrain along the Bujumbura-Kigali and Bukavu-Kigali sections is not conducive to a rail solution. Kigali-Kasese is feasible from a construction perspective.
  - The major rail initiative in Rwanda is the development of the Isaka-Kigali line, with a branch from Keza via Gitega to Musongati in Burundi. This development is seen as a strategic initiative to improve the freight link to the coast and a crucial platform for the industrialisation of the country.
- The line would extend 493km from Isaka to Kigali, with the Burundi section contributing a further 197km.

**Aviation Network - Overview**
- Air transport is expected to play an important role in long-haul passenger transport, i.e. specifically to link Rwanda with neighbouring countries and the rest of the world.

**Aviation Network – Current Realities**
- There are seven functioning airfields in Rwanda at present. The main airport in Rwanda is Kigali International Airport which is located at Kanombe, which is about 10km from the city centre. This is the main international aviation gateway to the country.
- Kigali International has both terminal and airside capacity constraints. An interim terminal upgrade should to alleviate immediate landside pressure. The short, single runway is not designed to accommodate fully-laden wide body aircraft (necessary for long haul). However, it cannot be extended due to the terrain and the airport’s proximity to Kigali City.
- Due to the limited capacity of the current airport which is anticipated to be reached by 2015 and other limitations, a new international airport is being planned at Bugesera about 40km South-East of Kigali.
The future role of the KIA is currently not decided yet, although it is understood this role might entail use as a possible military asset.

- The other airports in the national airports network are Kamembe (Ruzizi), Gisenyi, Ruhengeri, Butare, Gabiro and Nemba. Karongi Airport has also recently been identified as having potential to serve as a Tourist Circuit Airport.

- **Airport Classification**
  - There is no formal airport classification system in place in Rwanda presently. However, such a system has been proposed for the EAC.
  - Various systems for airport classification are applied internationally. These systems are based on criteria such as function of the airport, level of traffic (passenger or cargo), design and safety criteria. The proposed EAC system is based on the Federal Aviation Administration (FAA) stratification categories, and the International Civil Aviation Organization (ICAO) reference codes.
  - The airport classification system proposed in the EAC is based on a distinction between four airport classes, as indicated on Table below:

<table>
<thead>
<tr>
<th>Airport Classification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>International Airport</td>
<td>Airports supplying a wide range and frequency of international services, including intercontinental services and a full range of domestic services. Flights can be scheduled or unscheduled, and the airport can accommodate large aircraft.</td>
</tr>
<tr>
<td>Regional Airport</td>
<td>Airports catering for the main air traffic demand of individual regions. They are concerned with the provision of domestic services, including links with gateway airports, a range of charter services, and may also provide short-haul international services. Flights can be scheduled or unscheduled. Aircraft are typically smaller than at International Airports.</td>
</tr>
<tr>
<td>Tourist Circuit</td>
<td>Airports specifically targeted at improving access for tourists, accommodating mostly charter or non-scheduled movements with fairly small aircraft.</td>
</tr>
<tr>
<td>Local Airport</td>
<td>All airports not falling under International, Regional or Tourist Circuit airports. These would typically cater for general aviation only.</td>
</tr>
</tbody>
</table>

- The EAC Master Plan previously proposed the following classifications for Rwandan airports:
  - International: Kigali International
  - Regional: Kamembe
  - Tourist Circuit: Gisenyi, Ruhengeri and Butare
  - Local: Nemba and Gabiro.
  - However, it is understood that Gisenyi, Ruhengeri, Butare and Gabiro might also in future fulfil the role of a regional airport in this classification and should be updated accordingly in time. Furthermore, a Tourist Circuit Airport has been identified at Karongi.

- **Airport Regional and National Standards:**
  - Aviation technical standards are generally regulated by the International Civil Aviation Organisation (ICAO) which is a specialized agency of the United Nations. The following ICAO standards are of specific relevance for the Rwanda Aviation Industry:
    - ICAO Annexure 11 – Air Traffic Services
- ICAO Annexure 14 – Aerodromes.
  - In addition, the existence of regionally accepted standards, under the ICAO Africa-Indian Ocean Regional Air Navigation (AFI-RAN) network also has a specific bearing on the Rwandan aviation sector.
  - Regarding these aviation standards, the following main issues should be noted:
    - The development and implementation of aviation standards should be discussed and agreed at a regional level
    - The current airport infrastructure in Rwanda needs to be evaluated against these standards, and remedial actions undertaken where required (and feasible)
    - The development of future airports, specifically the Bugesera airport, needs to be done in line with these standards.

### RSTMP Inland Waterways (IWW) Network - Overview

- The cost structure of marine transport is such that it has relatively high terminal costs and relatively low shipment cost compared to other modes, such as road transport.
- Short-haul lake transport will therefore be at a disadvantage if a trip is not long and if the lake transport portion of that trip is not large.
- Whereas inland waterways (IWW) were key to unlocking trade in the wider Great Lakes area, the importance of this mode has been overtaken by more flexible, lower-cost and higher capacity alternatives – especially roads.
- In the Transport Strategy, IWW is likely to fulfil a local, rather than national role.

### RSTMP Inland Waterways (IWW) Network – Current Realities

- **IWW Network**
  - IWW options in Rwanda relate primarily to Lake Kivu and the Akagera River (linked to Lake Victoria). The Rusizi River is generally acknowledged to be not navigable.
  - Lake Kivu:
    - has a surface area of 2 400km², which means that it is 50km wide on average.
    - In comparison, Lake Tanganyika is 673km long from end-to-end, and Lake Victoria 319 km (from Port Bell to Mwanza).
    - It is therefore not expected that Lake Kivu will play a major role in long-haul transport, especially as the other transport modes develop around it.
  - Akagera River:
    - flows into Lake Victoria at a point North of Bukoba.
    - Apart from the Rusumo Falls 60 km downstream from Lake Rweru at the confluence of the Kagera and Ruvubu rivers on the Rwanda-Tanzania border, the river is meandering with only a slight drop in elevation to Bukoba (1 150m), more than 360 km downstream from Rusumo.
    - The primary findings of the study on the navigability of Akagera river were that the existing hydro-meteorological data required for engineering designs is limited, specifically regarding spatial variation of water levels along the river; and
    - Although the volume of traffic that could be diverted to the river was estimated to be about 1Mtpa by 2020, the river project was likely to be overtaken by other initiatives in the rail and road sector and may therefore be difficult to justify.

- **IWW Port Classification**
  - Currently, there is no inland waterway infrastructure classification available or in use in Rwanda.
  - For the purposes of the RSTMP, the inland waterway infrastructure classification focuses primarily on the inland waterway nodes, namely the ports and terminals.
  - It is proposed that two levels of lake port be recognised:
    - Primary lake ports (or terminals) would be Rubavu, Karongi and Rusizi.
    - Secondary lake ports would be Nkora, Mugonero, Kirambo and Nyamirundi.
  - The Lake Kivu Water Transport Feasibility Study proposed that the port authority headquarters be located at Rubavu. This is
also likely where the main ship repair workshops would be based.

- In the case of the Akagera River, the primary ports would be Kagitumba and Bukoba/Kemondo Bay.

- **IWW Standards**
  - There are no formal national facility and equipment standards in place for IWW, but there are various regional and international norms that apply.
  - Trading on the inland lakes is considered to be international trade and thus, for many years in the past, international maritime rules and standards have applied.
  - There is need to review, rationalise and harmonise the existing water transport legislation and policies so as to promote consistency in the sector

![Akagera River Inland Waterway Transport Network](image)
Pipelines are the preferred, lowest-cost transport solution for liquid petroleum products and crude oil, except at fairly low levels of demand.

The regional pipeline network responds to the needs and requirements of the upstream (extraction and import/export) and midstream (refining and processing) sub-sectors.

Recent developments in Uganda could lead to the region becoming an oil producer and exporter.

Currently, land-locked countries of the East African Community (such as Uganda, Rwanda and Burundi) import all of their petroleum requirements by road and rail, through either the Port of Mombasa or Dar es Salaam.

**Pipeline Network**
- Currently Rwanda has no pipeline network in place and there are no immediate plans to implement a pipeline network.
- However, given the continuing demand for liquid petroleum products and crude oil and the economic growth trend of Rwanda, the viability of implementing a pipeline network will become a reality in future.

**Rwanda’s Integration with Planned Pipeline Initiatives**
- A number of pipeline initiatives are planned within the East African Community and there is potential for Rwanda to align and integrate with these initiatives in order to fast-track pipeline transportation as a mode option within the country.
- The Dar es Salaam-Mwanza Petroleum Products Pipeline was commissioned in 1997 transporting petroleum products by pipeline from Dar es Salaam to Mwanza and with storage depots located along the route. The objectives also included supply petroleum products to Uganda, Rwanda, Burundi and the DRC.
- Recent interest in building a similar pipeline between Dar es Salaam and Mwanza has been shown by the Qatari Noor Oil group and other parties. An important consideration from a regional perspective is how the potential of refining oil products in Uganda will play out and how this will affect the configuration of the Dar es Salaam-Mwanza pipeline.
- The Uganda-Kampala Pipeline link project was first conceived to link Uganda into the existing Mombasa-Eldoret pipeline. This would open the possibility of an extension to Rwanda and eventually onto Burundi.
- Additional Pipeline proposals that have come to light recently are:
  - New alignment of Kampala-Kigali Pipeline proposed: Kagitumba-along the border to Katuna-Gicumbi-Kigali.
  - Additional future pipeline link to Lake Kivu: Kigali-Muhanga-Ribavu
  - Additional future pipeline link to Lake Kivu: Huye-Rusizi (pipeline feeder branching from the Kigali to Bujumbura alignment)

Multi-modal transportation is the transportation of passengers or freight by means of more than one mode.

The use of more than one mode implies that some form of change-over is required between modes and between the trunk and feeder services.

Multi-modal transport is generally categorised in terms of the following:
- Long-haul (trunk) services, i.e. generally large-capacity services carrying large numbers of passengers or large volumes of goods over long distances on a relative simple route network, generally between major settlements or cities.
- Short-haul (distribution or feeder) services, i.e. generally smaller-capacity services carrying lower numbers of passengers or lower volumes of goods over shorter distances on a much more complicated distribution route network with the purpose of distribution passengers and freight within an urban context (within a city).
• **Intercity and Multimodal Infrastructure Network**
  - In the context of the Transport Strategy it is important to identify opportunities for modal transfer facilities stemming from the inter-city and inter-regional movement of passengers and goods.
  - It is necessary to seek alignment between the Rwanda National passengers and freight transport services and these multi-modal facilities within the Rwanda STMP.

• **Rwanda STMP-Kigali City Transport Integration**
  - Multi-modal facilities or terminals facilitate the modal change-over between long-haul and long-haul, or between long-haul and short-haul passenger and freight transport services.
  - These change-over positions should be located at the outskirts of the city, where long-distance high-order routes enter the city limits and the network changes to a more complicated distribution network.
  - Locating the multi-modal facilities on the city limits or outskirts prevents large capacity modes manoeuvring the geometrically constrained urban roads.
  - Long-haul transport services therefore take place on the outside of the city limits and short-haul (distribution) services take place within the city limits.
  - A central defining feature of the radial city multi-modal facility concept is the ring-road / ring-rail which connect the various multi-modal facilities.
  - The ultimate success of these multi-modal facilities rests on their inter-connectivity and accessibility to the core of the urban centre, therefore the existence or establishment of a ring-road and/or ring-rail connector is critical.
  - Most of the passenger and freight transport in Rwanda originates from, goes to or passes through the Kigali city because it is the capital city, the economic, cultural, and transport hub of the country.
  - Given that the transport system of Rwanda is a radial network originating from Kigali city centre, a similar approach to determining the multi-modal facility positions can be followed:

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**Proposed Kigali City Multi-Modal Facility Locations**
Free Trade Zone Multi-Modal Facility
- The Free Trade Zone is located approximately 11km east of Kigali city centre.
- The primary purpose of this facility will be the storage and redistribution of freight.
- It is envisaged that the Trade Free Zone will be served initially by road infrastructure and later by freight rail and pipeline infrastructure, as these modes become feasible in future.
- It is envisaged that the Trade Free Zone Multi-modal facility would contain warehouses and storage facilities, the fuel storage depot, container depot, rail sidings and a cargo handling terminal, and heavy vehicle parking, services and overnight facilities.
- The transhipment activities envisaged for the Trade Free Zone Multi-modal facility includes road-rail interface including load centre, and a road-road interface including trans-loading, cross-docking and warehousing.

Kigali International Airport Multi-Modal Facility
- The Kigali International Airport is located south-east of Kigali city centre.
- It is a medium sized international airport housing three terminals.
- The main terminal can accommodate six small to mid-size aircraft, but it can also accommodate a Boeing 747 jet.
- A cargo terminal is also located at the airport.
- The primary purpose of this facility is to serve the international, regional and domestic passenger and cargo markets. The airport is primarily served by road infrastructure.
- Although the facility should only accommodate road-based modes, different road-based modes - A public transport multimodal facility, private transport with dedicated parking areas for short-term and long-term parking, and road freight should be accommodated:

Bugesera International Airport Multi-Modal Facility
- The new Bugesera International Airport will be constructed in the Bugesera district, approximately 40km south of Kigali city centre.
- The airport will support up to 18 aircraft movements per hour (peak) and the terminal will have capacity for 450 enplaning and departing passengers per hour at peak times.
- Up to 1.8 million passengers can be served per year at IATA service standard C.
- The primary purpose of this facility is to serve the international, regional and domestic passenger and cargo markets.
- The airport is primarily served by road infrastructure, and this will continue for the foreseeable future.
- However, if the Rwanda rail infrastructure expands in future, a rail link between Kigali City and the airport may be considered.

  o Kicukiro Multi-Modal Facility
    - The proposed Kicukiro multi-modal facility is located approximately 8km south-east of Kigali City CBD.
    - The primary purpose of the Kicukiro Multi-modal facility is to facilitate the transfer of passengers between road-based public transport service modes, i.e. quality bus service, conventional bus, minibus taxis.
    - It is envisaged that the Kicukiro Multi-modal facility will be served initially and primarily by road infrastructure.
    - However, the Isaka-Kigali rail link would – for passenger transport purposes – land at Kicukiro as well.

  The design of the multi-modal facility will depend on whether it is a road-based multi-modal facility or a road-rail multi-modal facility.

  o Nyabugogo (Gatsata) Multi-Modal Facility
    - The proposed Nyabugogo (Gatsata) multi-modal facility is located approximately 3km north-west of Kigali City CBD.
    - Its primary purpose is to facilitate the transfer of passengers between road-based public transport service modes in the same manner as Kicukiro.
    - The typical road-based / road-rail multi-modal layout with multi-modal transfer facilities could be considered.
<table>
<thead>
<tr>
<th>Chapter 4: Transport Services (RSTMP)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Introduction</strong></td>
</tr>
<tr>
<td>- Transport services’ refers to the transport operations that make use of the transport infrastructure to move people and goods:</td>
</tr>
<tr>
<td>o The nature of transport operations is conducive to competition.</td>
</tr>
<tr>
<td>o This is true where the main goal is ‘mobility’, i.e. travel speed.</td>
</tr>
<tr>
<td>o Stops required for ‘access’ purposes reduce the overall speed.</td>
</tr>
<tr>
<td>o The transport system is a compromise between mobility and access requirements, with mobility services attracting a premium and therefore generally candidates for multiple service providers.</td>
</tr>
<tr>
<td>o Access services are provided where the benefits of transport outweigh the cost thereof and the ability of the market to pay for it.</td>
</tr>
<tr>
<td>o Such ‘social’ transport services may take the form of a mass transit service in an urban area, or a public bus service in a rural setting.</td>
</tr>
<tr>
<td>o A public transport service may start off as a social service, with insufficient demand to make the system pay for itself from the onset.</td>
</tr>
<tr>
<td>o Over time, though, because of the availability of the system, the numbers increase and the system becomes more financially viable.</td>
</tr>
<tr>
<td>o Mobility services naturally gravitate to the private sector and access service to the public sector.</td>
</tr>
<tr>
<td>o However, access (public) services should, even if it does not pay for itself financially – must be operated efficiently and cost-effectively.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RSTMP Road Transport Services – Current Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Road Services are split into three categories:</td>
</tr>
<tr>
<td>o Road Freight Services</td>
</tr>
<tr>
<td>- The domestic road freight industry is deregulated in the sense that there are no requirements for transport operators to be licensed to carry on their operations;</td>
</tr>
<tr>
<td>- RURA is investigating to formalise the industry.</td>
</tr>
<tr>
<td>- Road freight transport operations are all private, with rates made on a negotiated basis.</td>
</tr>
<tr>
<td>- Services are all non-scheduled, i.e. delivered on an as-required basis.</td>
</tr>
<tr>
<td>- At the regional level, cross-border road freight is governed by agreements with member states of the EAC.</td>
</tr>
<tr>
<td>- There is no formal bi-lateral agreement in place with the DRC.</td>
</tr>
<tr>
<td>o Road Passenger Transport Services</td>
</tr>
<tr>
<td>- Currently, road-based passenger services are provided by minibus taxis and buses, with both services covering short and long distance routes.</td>
</tr>
<tr>
<td>- The market is deregulated with RURA issuing service licences and setting fares ceilings.</td>
</tr>
<tr>
<td>- There are about 30 licensed operators that provide inter-city passenger transport in Rwanda.</td>
</tr>
<tr>
<td>- Regional transport follows the same pattern as for road freight transport.</td>
</tr>
<tr>
<td>- ONATRACOM is a government-owned road transporter, offering services between Kigali and the major towns, covering more than 80% of the national bus network.</td>
</tr>
<tr>
<td>- ONATRACOM buses also serve some remote areas along dirt roads not otherwise accessible by public transport.</td>
</tr>
<tr>
<td>o Quality Bus Corridor (QBC)</td>
</tr>
<tr>
<td>- The current road transport system is generally acknowledged to be inefficient and costly.</td>
</tr>
<tr>
<td>- Passenger transport services are uncoordinated.</td>
</tr>
<tr>
<td>- Most services emphasise access (multi-stops) at the cost of mobility.</td>
</tr>
</tbody>
</table>
The Land Use and Development Master Plan for Rwanda accordingly identified the concept of a QBC providing quality bus services between cities. The QBC would be a dedicated service on major roads linking important cities and nodes within Rwanda.

The advantages of a QBC system include:
- Improved passenger transport infrastructure;
- Traffic management and environmental improvements;
- Passenger transport service prioritisation and improvement;
- Enhancing integration with other modes of transport (i.e. cycle and pedestrian facilities);
- Improving information to the public on the passenger transport services provided; and
- Improved working environment between passenger transport operators.

The following QBCs were identified in the course of developing the Transport Strategy:

<table>
<thead>
<tr>
<th>Origin - Destination</th>
<th>Kigali – Gatsibo</th>
<th>Kigali – Bugesera</th>
<th>Kigali - Nyagatara</th>
<th>Kigali - Kamonyi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of Route (km)</td>
<td>Unknown</td>
<td>25</td>
<td>161</td>
<td>44</td>
</tr>
<tr>
<td>Current Patronage (pax/day)</td>
<td>1 200</td>
<td>1 400</td>
<td>1 000</td>
<td>800</td>
</tr>
<tr>
<td>Future Patronage (pax/day)</td>
<td>2 300</td>
<td>2 100</td>
<td>2 100</td>
<td>900</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of Route (km)</td>
<td>71</td>
<td>88</td>
<td>55</td>
<td>132</td>
</tr>
<tr>
<td>Current Patronage (pax/day)</td>
<td>1 200</td>
<td>700</td>
<td>900</td>
<td>700</td>
</tr>
<tr>
<td>Future Patronage (pax/day)</td>
<td>1 800</td>
<td>1 200</td>
<td>1 300</td>
<td>1 700</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Origin - Destination</th>
<th>Kigali – Rubavu</th>
<th>Kigali – Musanze</th>
<th>Kigali - Muhanga</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of Route (km)</td>
<td>156</td>
<td>92</td>
<td>65</td>
</tr>
<tr>
<td>Current Patronage (pax/day)</td>
<td>600</td>
<td>400</td>
<td>800</td>
</tr>
<tr>
<td>Future Patronage (pax/day)</td>
<td>1 700</td>
<td>1 200</td>
<td>1 000</td>
</tr>
</tbody>
</table>

Integration of QBS with other modes:
- The provision of a QBC service needs to take into consideration the operations of other modes of passenger transport within the same environment (i.e. roads) as well as across other mode of transport (i.e. rail, air, NMT).
- Minibuses and Taxi Minibuses should complement the bus service by focusing on settlements that are remote from bus services.
### Rail Transport Services – Current Status

- The decision on the optimal structuring of rail transport service provision will face Rwanda shortly with the construction of the Isaka-Kigali rail extension of the TRL system.
- The service will be dominated by long-haul trade freight with the potential of some more localised passenger services.
- Given the projected volumes, there will be a single operator.

### Air Transport Services – Current Status

- The main role of air transport is regional and international connectivity and mobility.
- RwandAir is the designated national carrier and provides services to the region (Bujumbura, Dar es Salaam, Entebbe/Kampala, Kilimanjaro, Mombasa, Nairobi), the rest of Africa (Addis Ababa, Brazzaville, Johannesburg, Libreville) and intercontinentally (Brussels and Dubai).
- Air services rights are negotiated bilaterally, with carriers of most of these countries also serving Kigali.
- RwandAir operates scheduled domestic services linking Kigali with Cyangugu/Kamembe and Gisenyi. There are at least two non-scheduled carriers registered in the country.
- Internationally, the trend remains that domestic air services (cabotage) remains reserved for carriers owned and registered in a country. Where regionalisation is advanced (e.g. the European Union) cabotage rights in a member state become available to carriers of other member states too. It is anticipated that this is the direction that will be taken in the EAC as well.
- In the meantime, it is proposed that Rwanda deregulate the domestic air services market so that there will not be an artificial limitation on air services responding to growing demand.

### Air Navigation Service Provision – Current Status

- Rwanda presently provides lower airspace (approach and aerodrome) control via the RCAA at Kigali International Airport.
- Upper airspace (area/overflight) control is provided by Tanzania through the TCAA.
- Before Rwanda takes a unilateral view on changing the current model for the provision of CNS/ATM, the investigations into an optimal regional model should be concluded at EAC level.

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**Bus Service between Bugesera Airport and Kigali**
### Inland Waterway Transport Services – Current Status

- **Lake Kivu Transport Services**
  - Lake transport services are presently provided on an ad hoc basis and outside any formal transport licensing regime. As per the Economic and Technical Feasibility Study for Water Transport on Lake Kivu, the intention is to formalise lake transport.
  - The service would entail a scheduled passenger and freight service operated with a fleet of two vessels.
  - The feasibility study proposed the following two route options, i.e. a local service stopping at all lake ferry terminals en-route, or an express service/local service overlap with one vessel operating a local service and the other an express service only stopping at major ports.
  - The projected demand (250 passengers and 15t to 20t cargo per day) is too low to sustain a commercially viable service and it is anticipated that a government subsidy would be required until the passenger volumes increase.
  - Future linkages with ports on the DRC side of the Lake (e.g. at Goma and Bukavu) is also being considered.
  - It is important to note that facilities (i.e. port and road links) at these locations are limited at this stage and would require upgrading should such linkages with the DRC on Lake Kivu be pursued.

- **Akagera River Transport Services**
  - Transport on the Akagera River, if proven to be technically feasible, will entail similarly limited passenger and cargo demand as on Lake Kivu.
  - If the Government of Rwanda wishes to support the development of the river as a transport route, river transport rights should be awarded to a single operator to maximise the commercial potential.
  - Otherwise, rights should be deregulated and local operators should be allowed to ply their trade on the river without economic limitation.

### Pipeline Transport Services – Current Status

- Pipeline infrastructure and services are generally operated as one business meaning that it is an integrated service whereby the entity who constructs the pipeline generally operates the services.
- Given the inherent difficulties of vertically separating infrastructure provision and transport services in the pipeline mode, it would be logical to subsume the pipeline transport services under the infrastructure provision responsibilities of the designated pipeline concessionaire.
- Third Party Access (TPA) will come into play after the infrastructure has been constructed and operated for a sustained period.
- A TPA policy requires owners of natural monopoly infrastructure facilities to grant access to those facilities to parties other than their own customers, usually competitors in the provision of the relevant services, on commercial terms comparable to those that would apply in a competitive market.

### Chapter 5: Strategic Transport Demand Model - VISUM (RSTMP)

#### Introduction

- The purpose of the model developed for the RSTMP is to provide assistance with regard to strategic transport decisions.
- Focus of the model is thus on the movement of persons and goods between major towns in Rwanda and between neighbouring countries.
- The majority of the road and rail network to be represented in the model are outside urban areas where the Average Daily Traffic (ADT) are more applicable than the peak hour traffic.
- The model was therefore developed to represent the ADT on the roads and other transport.
- The model followed the standard four step modelling process consisting of trip generation, trip distribution, modal split and assignment of vehicles on the representing road network.
- The model was developed in two separate components, a passenger component and a freight component, which was both assigned to the model network.
- The goal of this multimodal model was to identify the optimum modes and routes of transport for the estimated passenger and freight movements within the region, advising on appropriate transport investments for the future.
Besides the base year transport demand model (2010), a possible future scenario was also developed (2020).

The Rwanda National Land Use Development and Development Master Plan describe three future scenarios in terms of land use and development:

- Alternative Red (worse/critical) - if development continues in an uncontrolled, ad.hoc/laissez-faire mode.
- Alternative Yellow (fair/acceptable) - in this scenario we present the land-use scenario if development continues in a relatively managed and controlled way.
- Alternative Green (good/prosperous) - in this scenario we present the land-use scenario if development continues in a very controlled way.

Transport Network Data

- Looks at the network level of detail and therefore consisted mainly of national and other higher order roads and only those local roads providing links to activity nodes of strategic significance to the region as a whole. It was important to ensure that all zones are linked to one another via the represented network.
- The road network will be coded as two-way links.
- Mountain passes were represented in terms of distance and speed in the network.
- Air routes were represented by two-way links.

Transport Service Data

- Describes passenger and transport services in terms of parameters such as:
  - Mode
  - Origin
  - Destination
  - Frequency
  - Journey time

Demographic data

- Demographic data required per traffic zone includes aspects such as:
  - Total population
  - Employed (possibly in more detail categories)
  - Unemployed
  - Vehicle ownership
  - Where this data was not available, assumptions was made, based on national data.

Land Use and Production Commodity Data

- The land use data required is largely dependent on the trip purposes.
- The typical trip purposes associated with metropolitan or urban models are not applicable in this study.
- The majority of the road network represented in the model was outside urban areas where longer distance trips are more applicable than shorter trips.
- The main trip purposes were passenger and freight trips, with freight trips categorized per commodity.
- Data on mining, agriculture and production of goods etc per district is required to model freight trips.
Traffic Data
- Road traffic data was available on most major routes.
- No primary data collection took place; only secondary traffic data was used.
- Traffic data is classified in terms of motorcycle, car, bus, minibus taxi and heavy vehicle.
- The OD data was used for identifying trip making characteristics for trip generation and trip distribution.

Zone System
- The 30 districts in Rwanda formed the traffic zones for this model.
- Each zone was represented by a separate polygon. Zones connect like a puzzle and no islands were allowed.
- The three digit numbering system was used for internal zones.
- The first digit represents the province and the last two digits represent the district.
- The following numbers were used for each province:
  - 101 – 103: Town of Kigali
  - 201 – 208: Southern Province
  - 301 – 307: Western Province
  - 401 – 405: Northern Province
  - 501 – 507: Eastern Province
- The locations of the District Offices were used as centroids for the zones.
- Five external zones were created for:
  - Burundi
  - Tanzania
  - Kenya
  - Uganda
  - The Congo

Count Locations

Traffic Zoning System
• Trip Generation
  o Trip generation is the first step in the demand modelling process.
  o It involves forecasting the number of person trips that will start or end in a traffic zone.
  o To estimate the regression equations for passenger and freight trips multiple linear regression analyses was carried out in order to develop the equations needed for the estimation of trip attractions and trip productions. The regression analysis compared the trips from the OD Survey.
  o The freight commodities in the survey were aggregated into 6 categories, namely:
    o Agriculture
    o Building Material
    o Bulk Agriculture
    o Foodstuff
    o Household Goods
    o Mining
  o For mining trips, only districts with significant mineral deposits were used in the trip generation process.
  o Although population is a determining factor in trip generation and distribution of freight trips, freight is expected to grow at a higher rate than the population due to economic growth.

• Trip distribution
  o Trip distribution is where the origin-destination pattern of travel is determined.
  o The result of a trip distribution model is a trip matrix.
  o The model that was applied here are a synthetic (or gravity) model.
  o The gravity model was applied for each trip purpose and income combination, using the parameters determined during the calibration process.

• Modal Split
  o Modal split is a term used to allocate total person trips to the different modes of transport.
  o Modal split is done after the trip distribution phase.
  o The modal split modal take into account captive users for both person and freight trips.
  o Captive users are those that will not change to a different model no matter changes in the parameters used to apply the modal split.
  o The modal split for passenger trips was done in two phases:
    - A primary modal split where motorised trips are split between private and public trips
    - A secondary modal split where the public transport passenger trips were split into bus and taxi minibus modes.
  o Provision was also made for future modes such as passenger rail.
External Trips
- Two external vehicle matrices were developed for the base year.
- These matrices were however only partial due to the limited number of survey locations.
- The matrices were developed from the OD data in the National Land Use Master Plan.
- A matrix correction technique was used to produce complete matrices for passengers and freight, using traffic counts at or near border posts.

Base Year Model Demand
- It takes the following factors into account:
  - Base Year Road Based Traffic Demand
    - 97% of passenger transport is by public transport and only 3 per cent by private transport.
    - The split between bus and minibus taxi is 87% by taxi and 13% by bus. All freight is transported by road based transport.
  - Base Year Rail Demand
    - Currently there is no rail system in Rwanda
  - Base Year Inland Water Transport Demand
    - Lake Kivu is by far the largest of Rwanda's lakes forming the border with the DRC.
    - There are occasional boat services between the ports of Rusizi, Karongi and Giseny, but these do not run to a regular timetable and
often have to be chartered.  
- There are also boats used to ferry people to some of the islands in the lake, but these also do not run regularly.
- Therefore no demand matrices were developed for the base year.

**Base Year Air Transport Demand**
- A passenger air matrix was developed for the base year based on the EAC base year air passenger model (based on flight schedules) & Domestic flight schedules.
- For the base year there are 12 000 scheduled seats on international flights and 600 domestic scheduled seats per week to and from Kigali airport.
- Assuming 80 per cent occupancy there were just over half a million arrivals and departures at Kigali airport per annum in 2010.

**Traffic Assignment**
- The final stage in the four-step approach is the assignment of the trip demand onto the transport networks.
- This model uses the equilibrium assignment procedure for private transport.
- The equilibrium procedure distributes demand according to Wardrop’s first principle “every individual road user chooses his route in such a way that his trip takes the same time on all alternative routes and that switching routes would only increase personal journey time”.
- In the inner iteration step, two routes of a relation are brought into a state of equilibrium by shifting vehicles. The outer iteration step checks if new routes with lower impedance can be found as a result of the current network state. The main findings of this scenario include:
  - Kigali is the main trip generator and attractor for national trips.
  - The majority of passenger movement takes place along the RN 1 between Kigali and Gitarama and and Ruhango and on the RN 3 between Kigali and Rwamagana.
  - There is also notable passenger movement on the RN 4 between Gisenyi and Ruhengeri and Ruhengeri and Kigali as well as on the RN 1 between Gitarama and Butare.
  - The majority of freight movement takes place along the RN 1 between Kigali and Gitarama and and Ruhango and on the RN 3 between Kigali and Rwamagana.
  - There is also notable freight movement on the RN 4 between Gisenyi and Ruhengeri and Ruhengeri and Kigali as well as on the RN 1 between Gitarama and Butare.

**Model Validation**
- The final stage in the process is to assess the degree of correlation between the modelled assigned demand and the observed demand.
- There were 11 count locations on urban and semi-urban links, and they were on the following links:
  - RN15 on the section Kicukiro-Gahanga
  - RN15 on the section Nyamata-Gahembe
  - RN3 on the section Kigali-Kanombe
  - RN3 on the section Kanombe-Rugende
  - RN3 on the section Gishari-Rwamagana
  - RN1 on the section Butare-Mukoni
  - RN6 on the section Kadashya-Rusizi I
  - RN7 on the section Gitarama-Mero
  - RN2 on the section Gatsata-Nyacyonga
These counts were excluded from the comparison to exclude local trips since the focus of the model was on the movement of persons and goods between major towns in Rwanda and between neighbouring countries.

Observed and modelled demand was compared, using a measure such as the R2 statistic.

Additional validation criteria were applied using the GEH test on individual link flows.

### Validation Results

<table>
<thead>
<tr>
<th>Validation criteria</th>
<th>Freight</th>
<th>Additional validation criteria were applied using the GEH test on individual link flows.</th>
<th>Additional validation criteria were applied using the GEH test on individual link flows.</th>
<th>Additional validation criteria were applied using the GEH test on individual link flows.</th>
<th>Additional validation criteria were applied using the GEH test on individual link flows.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional validation criteria were applied using the GEH test on individual link flows.</td>
<td>Freight</td>
<td>Additional validation criteria were applied using the GEH test on individual link flows.</td>
<td>Additional validation criteria were applied using the GEH test on individual link flows.</td>
<td>Additional validation criteria were applied using the GEH test on individual link flows.</td>
<td>Additional validation criteria were applied using the GEH test on individual link flows.</td>
</tr>
<tr>
<td>Additional validation criteria were applied using the GEH test on individual link flows.</td>
<td>Additional validation criteria were applied using the GEH test on individual link flows.</td>
<td>0.83</td>
<td>0.92</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Additional validation criteria were applied using the GEH test on individual link flows.</td>
<td>Additional validation criteria were applied using the GEH test on individual link flows.</td>
<td>90% of individual links</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Model Use

- The model was developed as a national strategic model and should be used as such. The capabilities of the model include the following:
  - The impact of any new roads, road upgrades or road closures on:
    - modal split
    - congestion
    - route choice
  - Determining the impact on modal split of changes in public transport such as:
    - new or altered routes
    - changes in fares
    - changes in travel time
    - introduction of new modes such as rail
  - The model has the ability to evaluate the impact of:
    - increase / decrease in population
    - change in population and / or employment densities
    - change in vehicle ownership rate
    - change in international trade

### How to Improve the Model

- The following data or surveys could improve the existing national model:
  - Classified counts before and after each town, not in built up areas
  - Future counts also at existing count locations in order to create a history of counts for traffic growth
  - Vehicle occupancy surveys
  - OD surveys for freight transport using pre-coded origins and destinations
  - OD surveys specific for passenger transport using pre-coded origins and destinations
  - Travel time surveys
  - Detailed public transport information such as schedules or headways
  - Detailed land use information per traffic zone for the base year and target year
### Future Year Strategic Transport Demand Model Network Scenarios

- **Scenario 1**: Current network - is the network as is with no road upgrading and no rail network
- **Scenario 2**: Current network with Rail included for passengers & freight - a railway line is included as proposed in the *Rwanda National Land Use Development and Development Master Plan*. This railway line is to provide both passenger and freight transport
- **Scenario 3**: Current network with new and improved road links - the network is improved in terms of connectivity. The following links are upgraded to surfaced roads which can accommodate speeds of up to 60 km/hr:
  - RN 17 from RN 6 to RN 7
  - RN 7 from RN 17 to RN 16
  - RN 16 from RN 7 to RN 4
  - RN 42 from NYARUGURU to RN 24
  - RN 24 from RN 42 to RN 1
  - RN 19 from RN 1 to RN 41
  - RN 41 from RN 19 to GISAGARA
  - RN 29 from RN 1 to RN 15
  - RN 27 from RN 13 to RN 18
  - RN 18 from RN 27 to RN 20
  - RN 20 from RN 18 to new link
  - Local link with new link to connect the RN 20 to the RN 25
  - RN 25 from new link to local link
  - Local links
  - RN 31 between the RN4 and the RN 1
  - RN 20 linking up with the RN 4
- **Scenario 4**: Network with improved road links AND quality bus services on Quality Bus Corridors - The 10 origin-destination pairs with the highest passenger demand for 2020 was identified as the Quality Bus Corridors and they are:
  - Kigali – Gatsibo
  - Kigali – Bugesera
  - Kigali – Nyagatare
  - Kigali – Ruhango
  - Kigali – Huye
  - Kigali – Rubavu
  - Kigali – Gicumbi
  - Kigali – Nyanza
  - Kigali – Musanze
  - Kigali – Muhanga
- **Scenario 5**: Current network with proposed Inland Waterway Transport - includes inland waterway transport on Lake Kivu Feasibility Study as well as international links as per the Great Lakes Study. The possibility of the inland water transport
Future Transport Model Demand

- Future Passenger Demand
  - Passenger demand is expected to grow in relation to population growth.
  - The Green Scenario is aiming at a low population growth with a rate of 2.5% per annum. The worst case scenario - a higher population growth rate of 3.2% per annum was applied.
  - The private transport share would grow in relation to the growth in vehicle ownership.
  - The current growth rate in vehicle ownership is 2.3% per annum

- Future Freight Demand
  - Freight demand is expected to increase in relation to the projected growth rate per commodity or sector.

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Sector</th>
<th>Growth Rate per annum (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>Primary</td>
<td>8.63</td>
</tr>
<tr>
<td>Building Material</td>
<td>Secondary (Construction)</td>
<td>7.04</td>
</tr>
<tr>
<td>Bulk Agriculture</td>
<td>Primary</td>
<td>8.63</td>
</tr>
<tr>
<td>Foodstuff</td>
<td>Tertiary</td>
<td>9.83</td>
</tr>
<tr>
<td>Household Goods</td>
<td>Tertiary</td>
<td>9.83</td>
</tr>
<tr>
<td>Mining</td>
<td>Secondary (Mining)</td>
<td>11.77</td>
</tr>
</tbody>
</table>

- Future External Traffic
  - External traffic demand is expected to increase at 7.5% per annum as projected in the Feasibility Study for the Isaka - Kigali / Keza - Gitega - Musongati Railway Project

  - Future Rail Demand
    - The model predicts a significant change in mode should rail be introduced to the network as described in Scenario 4.
    - Around 11,300 tons per day could shift from road based transport to rail freight by 2020.
    - This will be largely due to a shift of 80 per cent of imports and exports to rail.
    - Large freight volumes are expected on the northern alignment from Kigali to Uganda with 6,800 tons per day.
    - By 2020 there will be passenger rail demand of 23,000 passengers per day for the entire rail network including the northern extension.
    - On the link between Tanzania to Kigali there will be passenger rail demand of 5,500 passenger per day.

  - Future Inland Waterway Transport Demand
    - The model estimates that 55 passengers per day will travel on water based transport on Lake Kivu.
    - Taking into account the possible demand as estimated in the great lakes study there is potential for 5540 tons of freight to be transported across Lake Kivu per day.

  - Future Air Transport Demand
    - For the target year of 2020 it is estimated that there will be 45,000 domestic travellers per annum and around 1.8 million international arrivals and departures.
- Of the international passengers, fifty per cent will be in transit.
- According to the RCAA, Air Traffic from Kigali airport is expected to reach 1.5 million by 2017 when the Bugusera International Airport is scheduled to open.
- By 2025 it is expected to hit the 3 million mark and by 2030 3.5 million.
- Fifty per cent of the traffic will be direct transit through the airport without entering Kigali city.
- This figure will grow to 70% after 2030 as the RwandAir route network expands.
- This is in line with developments in Kenya Airways and Ethiopian Airlines both of them are players in the same market.

**Guidelines for Determining the Type of Public Transport Infrastructure**
- It is recommended that the South African guidelines for determining the type of public transport infrastructure be applied here.
- South Africa has developed a broad set of guidelines for determining the type of public transport infrastructure which will be appropriate to each corridor.
- The guidelines are as follows:
  - High passenger-volume corridors with more than 40,000 passengers per direction per day will probably support a rail - or dedicated public transport road - infrastructure in congested areas.
  - Public transport nodes (stations and interchanges) in these high-ridership corridors will be supported by feeder services rendered by buses or minibus taxis.
  - Moderate-ridership corridors with 10,000 to 40,000 passengers per day per direction are likely to be served by a road infrastructure, with priority or dedicated lanes for public transport over parts of the corridor.
  - The line-haul services in these corridors will largely be provided by buses, supplemented by both buses and taxis at nodal public transport interchanges.
  - Low-ridership corridors will characteristically have fewer than about 10,000 passengers per day per direction, and are likely to have some road-based priority schemes.
  - Many of these low-ridership corridors will be feeder corridors.
  - All the roads can be expected to be paved and the line-haul function or feeder function will fall primarily to taxis or small road-based vehicles.

**RSTMP Economic Analysis of Transport Model Scenarios – Applied Factors**

**Methodology Adopted**
- When performing the economic analysis of the scenarios, the methodology as outlined below was adopted.
- Alternative Specification - different alternatives have to be specified to test for feasibility of the proposed project(s). To determine the feasibility of the scenarios, the following should be noted:
  - The Base Network Scenario or the status quo (i.e. the situation without any projects or improvements) was defined as Alternative 0 and the total transport costs of Alternative 0 was compared with the total transport cost of Alternative 1, 2, 3, 4 and 5.
  - Alternatives 1, 2, 3, 4 and 5 were formulated as Rail Scenario, Improved Road Links, Quality Bus Corridor, IWW Scenario and All Projects, respectively.
  - Alternative 5: All Projects, combines all projects (i.e. Rail Scenario, Improved Road Links, Quality Bus Corridor and IWW Scenario) as one project.
- Analysis Period
  - A 20-year analysis period was used for the economic assessment.
- Economic Costs and Benefits
  - All costs and benefits were expressed in economic costs or resource costs (i.e. excluding taxes and subsidies) and an
An economic cost factor of 0.82 as used by the African Development Bank was used to convert all the FinancialPrices pertaining to project implementation to Economic Costs.

- The benefits expressed in terms of vehicle operating cost savings and time savings as obtained from HDM-4 are in Economic Cost terms, as these have been obtained after deducting all taxes from the vehicle operating cost inputs.

- **Analysis Results**
  - The analysis results are presented in tables on the guideline document.
  - Economic Feasibility Indicators
  - The feasibility of each alternative was indicated in terms of the following economic indicators:
    - Internal Rate of Return (IRR);
    - Net Present Value (NPV); and
    - Benefit/Cost Ration (B/C Ratio)
  - All three criteria listed above give consistent results in this case, as is evident from the analysis results tables on the guideline document.
  - It is evident from the NPV, IRR and the B/C Ratio that:
    - Alternative 1, Alternative 3 and Alternative 5 are viable;
    - Alternative 2 and Alternative 4 are not considered viable as a result; however the overall viability is obtained through Alternative 5.
Chapter 6: Future Transport Network and Service Configuration (RSTMP)

Introduction/Overview

- The future Rwanda transport network is the spatial translation of transport network and transport services strategies developed as part of this Strategy, drawing from the vision, goals and development objectives of a number of strategic planning documents of the Rwanda Transport Sector.
- The following sketch planning initiatives stemming from the strategic transport master plan have been discussed in the preceding chapters:
  - New road links and road upgrades to improve network continuity
  - Planned railway network and services (including future network and services extensions)
  - Aviation classification and associated works for international, regional and local airports
  - Inland waterway ferry terminals and transport services
  - Freight network, weighbridges and truck stops / roadside stations
  - One-stop border posts upgrades and multi-modal transfer facility development
  - Planned pipeline network extension on the Uganda-Kampala Pipeline link
  - Planned public transport networks including a Quality bus service and an Airport flyer bus service.

*Future Rwanda Transport Network (Diagrammatic Representation)*
Chapter 7: Transport Institutional Arrangements (RSTMP)

Introduction
- Beyond the specific physical network and related transport services, the success and sustainability of the Rwanda Transport network is directly related to the strength of the institutions that oversee the sector. Institutions are the means by which policy decisions are made effective. Policies without organisations capable and willing to implement them are not credible.

RSTMP Guiding Principles
- Five main principles undergird the institutional development recommendations:
  - Separation of Functions;
  - With the potential for conflict of interest, policy formulation and strategic planning, provision of transport, and oversight and enforcement of the policy objectives should be separated from each other. Moreover, the owners and providers of transport infrastructure and services need to be independent from those that oversee these owners and providers.
  - Market-Based Solutions;
  - In line with international best practice, the transport sector should increasingly move towards solutions with great private sector involvement, except where services have clear strategic or monopolistic characteristics.
  - In the absence of market sources, there should be interventions by Government to support the market and protect the consumer.
  - Regional Integration;
  - The Master Plan needs to integrate to a larger regional institutional reality.
  - It is specifically important to recognise that various oversight and regulation functions will increasingly be moving to a regional (EAC) level.
  - Establishing Legal ‘Ownership’ of Transport Functions;
  - Legal ownership should be established by assigning primary responsibility for management of a specific transport related function to a particular entity or agency.
  - Customer Focus
  - The transport system should respond to customers’ (users’) requirements in terms of needs, efficiency and costs.

RSTMP Current Institutional Structure

Summary of Existing Institutional Structures

<table>
<thead>
<tr>
<th>Policy and Planning</th>
<th>Roads</th>
<th>Road Transport</th>
<th>Inland Waterways</th>
<th>Airports ,ANS &amp; Air Transport</th>
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<tr>
<td>MININFRA</td>
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<td>Safety Regulation</td>
<td>RURA/RNP</td>
<td>RURA</td>
<td>RCAA</td>
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<td>Private Sector</td>
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</tr>
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</table>

RSTMP Policy & Planning
- The parent Ministry responsible for transport in Rwanda is the Ministry of Infrastructure (MININFRA) which is also responsible for four other sub-sectors addressing Energy, Habitat and Urbanism, Water and Sanitation and Meteorology.
- The Ministry is responsible for overall transport policy and strategic planning, the creation of a transport enabling environment, and setting of transport rules, regulations and standards.
- The need to give due attention to the transport component of MININFRA’s ambit has been acknowledged by the recent establishment of a semi-autonomous agency, the Rwanda Transport Development Agency (RTDA).
The RTDA was established to assist the Ministry with the management and administration of the transport sector. However, the RTDA equally has infrastructure delivery obligations, mostly regarding roads, but also in relation to airports and rail. The RTDA should ideally focus either on strategic transport planning or infrastructure delivery.

### Roads and Transport
- The 'safety' aspect of roads and road transport include the configuration of the infrastructure, the traffic traversing the infrastructure and the interplay between infrastructure and traffic.
- Safety refers to all safety-promotion or risk-reduction measures taken with respect to transport infrastructure planning, development and operation as well as the delivery of transport services in the interest of persons that may be participating as passengers, operators or members of the public or property, who may be affected by transport activities involving accidents or incidents.
- ‘Security’, on the other hand, refers to threats to the transport system from outside the transport domain, i.e. the illegal interference against transport infrastructure, operations and services.
- Although transport role players must participate to ensure security, this area is primarily the domain of the Rwanda National Police (RNP) and not MININFRA.
- The anticipation of, and planning for, traffic is integral to the process of designing, operating and maintaining roads. In that sense, road safety is an RTDA responsibility. The standards that the RTDA must comply with should not be set by RTDA itself, but by MININFRA.
- From a regulatory perspective vehicle/driver/operations licensing should remain a function of RURA and where necessary the organisation should be further empowered to effectively fulfill these responsibilities.
- The institutional responsibility for road traffic management should be designated to an appropriate roads authority or agency to operate under the auspices of a Ministry responsible for transport – i.e. the RTDA.
- Notwithstanding the regulation of road infrastructure and vehicle standards, there remains a need to accentuate ‘road safety’ as a discipline in its own right - road safety programs.
- Even if parts of road safety work can be commercialised and financed by users’ fees, road safety must remain a government function. Either a lead Ministry or a National Road Safety Council (NRSC) or Commission should assume responsibility for the concerted effort.
- Road Safety can, however, not be the responsibility of government alone. The commercial sector, service organisations and non-governmental organisations (NGOs) play an important role in increasing road safety awareness.

### Functional Areas of Road Safety
- An approach to road safety strategy may involve accident prevention, injury reduction, knowledge base development and capacity building measures.
- The following list of areas where road safety initiatives could be active, is presented:
  - driver fitness (driver training and testing)
  - vehicle safety standards and testing
  - pedestrian safety
  - fleet operations management
  - human behaviour
  - fraud and corruption
  - traffic law enforcement
  - emergency medical services
- traffic information systems and analysis
- safety engineering
- road safety research
- children’s traffic education;
- road safety publicity;
- financing road safety

- Current Road Safety Legal Framework
  - In order to gain a proper understanding from an institutional perspective on the current legal arrangements addressing road safety, the following could be briefly reflected upon:
    - Accra Declaration (Ministerial Round Table: African Road Safety Conference, 2007)
      - Rwanda made a declaration, at the “Declaration of African Ministers responsible for Transport and Health” on 8 February 2007 in Accra, Ghana, committing to work together to stop the growing epidemic of death and injuries on our (Rwanda’s) roads.
      - The declaration commits Rwanda to implement and strengthen the required legislation, action and enforcement plans to ensure that measureable targets to reduce fatalities due to road accidents are met.
      - In this regard a target of halving fatalities by 2015 has been set.
    - Road Traffic and Road Safety Act (Draft) - This draft Act regulates:
      - Road Traffic and Road Safety;
      - the licensing of drivers and motor vehicles, and the compulsory requirements for minimum motor vehicle insurance;
      - the movement of pedestrians,
      - motorised and non-motorised vehicles,
      - loaded or mounted draught animals, and livestock on roads,
      - highways and public ways of the country; and
      - Provides for a road safety system and traffic management.
      - The Act makes provision for the establishment of an advisory National Road Safety Committee who should consult on matters such as:
        - Implementation and setting up laws relating to Road Traffic and Road Safety
        - Establishment of Vehicle Inspections and Testing centres
        - Establishment and the preparation of guidelines for the operation of Motor vehicle driving schools
        - Establishment of guidelines for Driving License Examination
        - Installation and rehabilitation of road signs and signals
        - Delineation of entrance and exit ways to or from different services for road users along the road.
      - Traffic Police and Road Traffic Act
      - Traffic Police and Road Traffic Act regulates traffic on the public highway, of pedestrians, of vehicles loaded or mounted draught animals and livestock.

- Aviation
  - In Rwanda, the Rwanda Civil Aviation Agency (RCAA) promotes the safe, regular, secure and efficient use and development of civil aviation in the country.
It is responsible for aviation safety and security, maintenance and management of the airport and aerodrome system, the provision of air traffic management services and the interaction with the international civil aviation community on behalf of the Government of Rwanda.

Clearly, the RCAA currently fulfils both the regulatory and service provision role in terms of aviation infrastructure and ANS. International best practice has increasingly moved toward a clear separation between these regulatory and services provision roles.

The main benefit of such separation is that it provides the opportunity for greater commercialisation of service delivery while ensuring service quality through regulatory independence and avoiding any possible conflicts of interest.

- **Railways**
  - Rail safety is not governed under international convention as is the case with aviation and maritime transport.
  - However, the same requirement for safety and (to a lesser extent) harmonised technical standards apply to this mode.
  - One initiative being addressed at the EAC level is the possible establishment of a regional railway safety regulator, working in liaison with the respective national railway safety regulators.
  - Such a national regulator does not formally exist in Rwanda at present, with this function nominally resorting under MININFRA.

- **Inland Waterways**
  - For inland waterways, the standards and specifications of vessel construction, fitments and qualifications of the crew are all set by IMO, including standards and rules for vessels operating on inland waterways.
  - In October 2009, the ministers responsible for maritime transport in Africa adopted the African Maritime Transport Charter - to promote the effective implementation of international maritime instruments to which member states are parties and to encourage the establishment and support of maritime and ports administrations.
  - Rwanda may consider establishing such a maritime authority to oversee the national sub-sector. However, initiatives in the EAC are towards establishing a regional maritime and inland waterway safety regulatory body.

- **Pipelines**
  - This area is not yet a target for regional oversight.
  - At the national level, the respective roles of the Ministry of Lands, Environment, Forestry and Mining and MININFRA will have to be clarified.

- **National Transport Safety Authority**
  - MININFRA or MOT could consider establishing a National Transport Safety Authority (NTSA).
  - This would be an entity that houses the non-roads safety oversight functions until such time that these bodies are created at the regional level. This entity would house the functions required with the development of the new rail, inland waterway and pipeline infrastructures and transport for which safety regulatory capacity needs to be created in any event.
  - Combining these sub-sectoral responsibilities under one agency should have some scale benefits not available if separate regulators were established for each of these fairly small industries.
  - It would probably be the least disruptive to retain the aviation safety oversight function in the already operational RCAA.

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**RSTMP Economic And Market Access Regulation : Role of RURA**

- The Rwanda Utilities Regulating Agency (RURA) is the economic regulator overseeing some aspects of the transport sector, specifically passenger road transport authorisation and tariffs.
- Tariffs for road freight transport, air transport and airports and ANS are not regulated at present. The authorisation of air transport services pertains to the RCAA.
- The transport tariff regulation function should not reside with agencies that are also involved in safety oversight or delivery.
- The present arrangement of airports and ANS tariffs being set by the delivery agency (RCAA) should therefore be unwound and this...
function moved to RURA.
- In future, rail and pipeline tariffs should equally be overseen by RURA.
- For market access, the RURA obligations should be extended so that the Agency has a formal obligation to coordinate cross-border transport rights for road and rail transport with neighbouring states.
- With regards to Road Safety, RURA should oversee all road safety strategies and initiatives in future until a National Road Safety Council or National Transport Safety Authority is in place.

### RSTMP Infrastructure

#### Roads

**Roads Hierarchy**
- The ‘National Road Network’ is made up of national roads:
  - District and City of Kigali Roads (category 1), and
  - District and City of Kigali Roads (category 2) as arterial roads linking District Roads (category 1) with community centres.
- The National Road Network Law aims at regulating the national road network and to determine its reserve and classification.

**Road Provision**
- The separation between the purchaser (the Road Fund) and the service providers (Road departments and Agencies) is fundamental when developing sound road sector reforms.
- The RTDA is responsible for the provision and maintenance of roads at the national level.
- In accordance with the decentralised policy of government, some road responsibilities have been transferred from the central government to the provincial governments and the districts within each province.
- The functions in respect of procurement, monitoring and evaluation (M & E) and contract management are all included as part of the roads directorate under the Managing Director.
- It can therefore be assumed that detail planning, design and construction and maintenance work will be performed by the private sector.
- This arrangement is aligned with best practice and should be maintained.
- Specific provision is made for axle load control as part of the RTDA’s functional responsibilities. The actual establishment of weighbridges and their operation should, however, be outsourced and even concessioned out.

**Road Funding**
- The National Road Fund (NRF or ‘Fonds d’Entretien Routier’ (FER)), previously the RMF, is the institution responsible for collection and disbursement of money intended for road maintenance.
- The Fund, as a legal entity with administrative and management autonomy, carries out revenue collection, payment of maintenance activities, monitoring and technical audits as well as financial audits.
- The REF is funded by monies from the public budget, Government or donor subsidies (grants), fuel levies, road toll on foreign vehicles and annual road tolls on local vehicles, overload and other fines, interest on its investments, and from other more incidental sources.
- Issues may be pointed where the FER’s legal mandate differs from other, similar road funds in Africa. Salient issues include:
  - There is no overriding statement of intent for the FER.
  - It is not clear how the annual public roads maintenance programme accounts for urban roads relative to non-urban roads.
  - The FER Act and Roads Act do not align well regarding the funding responsibilities for roads.
  - The FER reports to MININFRA, which is the same ministry that oversees the RTDA. The more typical model is to avoid
conflict of interest between managing roads and purchasing efficient roads outputs.

- The existence of a Board with back-to-back performance contracts is good practice.
- Tension should be encouraged between the roads provider (RTDA) and roads output purchaser (FER) to ensure that good value for money is attained.

  - **Rural Roads**
    - The provision of rural roads, i.e. category 1 and category 2 roads providing inter and intra-district connectivity, resorts with the Districts.
    - With respect to funding, it is important to note that the Government pays an amount of money not less than 10% of Government's annual revenue is paid into a Common Development Fund for the Districts and the City of Kigali in order to promote development and to strengthen the economic development of the Districts and the City of Kigali within the context of decentralisation.

  - **Aviation Infrastructure**
    - As discussed previously, there is a need to separate the obligation to develop and operate airports from their safety and technical regulation. Apart from potential conflicts of interest, such separation is also proposed due to the fact that it would open the possibility of increased private involvement.
    - The ATM service delivery function would follow airports institutionally.
    - However, the regional initiative to establish an upper airspace control centre (UACC) would imply that at least some ATM functions migrate to such regional body.
    - That would leave lower airspace functions in the airports and ANS authority.

  - **Rail Infrastructure**
    - The operational role that rail plays in Rwanda and in its neighbouring countries is primarily for the transport of cargo over long distances.
    - With this long distance, the planning, funding and implementation of rail should be coordinated regionally.
    - More specifically, as the Rwanda rail system will firstly be an extension of the TRL (Tanzania) system, the rail development and operating responsibility will have to be coordinated at least bilaterally.
    - It is recommended that a Rail Management Agency be developed.
    - Such an agency would be the agent of the MOT and will be tasked with overseeing the operations of rail services with good corporate governance and prudent financial management that is essential for the achievement of a strategic rail service in Rwanda.

  - **Inland Waterway Infrastructure**
    - It is expected that public support would therefore be required to unlock the IWW system, in the form of facilitating or even providing port infrastructure.
    - The actual operations – especially the types of vessels anticipated on Lake Kivu – may also require public backing.

  - **Pipelines**
    - The development of pipeline infrastructure into Rwanda will take place when the commercial logic dictates that a dedicated transport infrastructure is justified financially.
    - There will therefore be a tipping point when it becomes feasible to switch from more general transport modes (road, rail) to a dedicated pipeline.
    - The system will be an extension of the regional pipeline system.
    - Pipeline infrastructure provision will reside with the Energy Agency.
Multi-modal Facilities
- In the case of the Bugesera Airport multi-modal facility will be integral to the operation of the airport.
- It would therefore be developed and operated as part of the airport facility and under the concession agreement.
- The multi-modal long-short distance passenger interface facilities within Kigali will be developed under the auspices of Kigali City.

RSTMP Transport Services
- As noted previously, the base model for transport services is private provision in competition under open market access arrangements.
- The exceptions to this general rule would be some road passenger transport services, rail and IWW.
- It would be expected that the entity contracting/issuing market access licenses for transport would also be responsible to plan the public transport requirement and to contract service providers to perform public transport.
- Characteristics of Transport Services include:
  - The development of node identification and route plans;
  - Contract with service providers;
  - Contract to include specific public service obligations (PSO’s) and
  - Contract to include agreement on shadow tariffs for PSO’s.
- Road Passenger Transport Services
  - ONATRACOM presently operates on about 80% of the national bus route network and is the current inter-city public transport service in Rwanda.
  - At district level, District Councils are responsible for planning, integration and coordination of public transport within their areas of jurisdiction;
  - The private sector is responsible for the main form of public transport, i.e. the taxi or “twegerane” for providing a stopping taxi service, as well as an express service similar to a bus service for longer distances;
  - With the development of quality bus corridors and services, the bus transport level of service will be upgraded generally. However, there will be areas not served or not served properly by QBS. In these parts, ONATRACOM will remain the bus service operator of last resort.
- Rail Services
  - For some time, at least, the focus of rail operations would be to embed a proper service and to develop the rail market.
  - The rail operator would require some protection in the form of an exclusive operating arrangement.
  - In the near term, the issue of multiple, open access to the rail infrastructure would not arise.
- Inland Waterways
  - Similar to rail, the IWW operations on especially Lake Kivu where a not-insignificant initial capital layout is required, will require providing the operator sole operating rights.
  - In the case of the Kagera River, transport operations may be carried out over shorter distances and with smaller vessels, so that the transport service market could possibly be structured more atomistically.
Chapter 8: Implementation of the strategy (RSTMP)

Introduction/Overview

- A detailed review of the options for private participation in the Rwandan transport sector was developed in Working Paper 7 (WP7) of this project. This section serves to highlight salient aspects of this review, with specific focus on the actions required to stimulate and enable such private participation, as well as the possible projects that can be targeted in this regard.
- It should be noted that the focus here is on the specific actions required to move transportation Public Private Partnerships (PPPs) forward in Rwanda. The actions needed are discussed under the following headings:
  - PPP project opportunities; and
  - Institutional Implementation Issues.

PPP Project Opportunities

- Opportunities can be classified into three main functional spheres:
  - Transport infrastructure development;
  - Transport infrastructure operation and maintenance; and
  - Transport service provision.
- Each of the above spheres are discussed in the RSTMP...
Institutional Implementation Issues

- The implementation of transport PPPs in Rwanda will require some work at an institutional level. Specifically the following will need to be addressed:
  - Capacity building in RTDA;
  - Appointing the most appropriate project officer;
  - Early identification of feasible projects;
  - Managing the PPP project stream;
  - Engaging with experienced advisors;
  - Standardizing project documents; and
  - Addressing weaknesses in the institutional framework.

- In addition to these actions we also propose that the role of the PPP unit might be slightly adjusted from what is currently proposed in the PPP guidelines.

Chapter 9: RSTMP Projects and Programmes

Introduction/Overview

- The RSTMP takes a long-term view on the future and strategic transportation system of Rwanda and identifies programmes and projects that secure the integrity of the system today as well as laying the foundation for the future.
- The objective of this Chapter is to provide a process that would enable the successful appraisal and scheduling of projects and programmes that were identified as part of the RSTMP. This is specifically essential for projects that need to compete for funding from the same budget group.
- Prioritisation is essential for projects that need to compete against each other from the same budget group. All the projects from each category will be listed and ranked based on related criteria. The following comments apply to the projects from each category.
  - Road Infrastructure Projects
    - The road infrastructure projects resulted mainly from the transport model which included various capacity- and road safety analysis. These projects are therefore all warranted and already ranked according to the importance on the road network capacity and safety.
  - Other Transport Infrastructure Projects
    - Additional transport infrastructure projects and studies were identified by analysing the status quo of the transport services and identifying the gaps in order to provide fundamental services across all transport modes. These projects need to be prioritised as input into the final consolidated list of projects.
  - Institutional Projects and Studies
    - The transport institutional arrangements (infrastructure) were analysed and covered the transport institutions related to roads, rail, airports, inland waterways, pipelines, and multi-modal facilities. From this, institutional and policy related projects and studies were identified in order to address the shortfalls and to optimise existing
structures responsible for the implementation of transport infrastructure projects in Rwanda. Some of these projects need to compete for funding from the same budget group similar to other project categories and therefore also needs to be prioritised.

- In order to prioritise the identified projects and studies with a mix of both competing and aligned project objectives of transport into one unified list of projects, a project evaluation methodology was sought that could take into account a number of qualitative and quantitative aspects simultaneously, and which can accommodate changes in planning emphasis and project life-cycle implications over time.

- In order to evaluate/prioritise the RSTMP projects identified, appropriate evaluation criteria were identified. These criteria strive to advance regional integration through project implementation by fostering various outcomes such as the enhancement of competitiveness, development of human resources, reducing poverty, improving peace and security, and democratizing the state and society.

- Similarly the evaluation criteria was developed to align with the Vision Pillars identified as part of the RSTMP development process.

- The approach followed for the RSTMP project and programme scheduling is summarised in the steps illustrated in the adjacent figure.

### RSTMP Prioritized Projects and Programmes Results

- A prioritized project list was generated that reflect the priorities of the RSTMP based on the RSTMP Vision Pillars (refer to Chapter 9 for details).

- To assist with the implementation of the RSTMP, the prioritised projects are grouped in terms of the following RSTMP Programmes (in no particular order):
  - Strategic Road Infrastructure Development Programme;
  - Strategic Transport Development Programme (Aviation Infrastructure and Services);
  - Strategic Transport Development Programme (Inland Waterways Infrastructure and Services);
  - Strategic Transport Development Programme (Pipeline Infrastructure and Services);
  - Strategic Transport Development Programme (Rail Infrastructure and Services);
  - Strategic Transport Development Programme (Strategy, Policy and Institutional); and
  - Strategic Transport Development Programme (Surface Public Transport Infrastructure and Services).

- Refer to Chapter 9 of the main RSTMP report for details regarding the prioritized projects grouped in terms of the above project programmes.

A summary of the RSTMP Programmes identified. The summary includes the total cost per timeframe and the total cost per programme. It is important to note that the timeframes allow flexibility in that the programmes can be implemented within the timeframe and could then extend over the next timeframe. It is therefore critical that the RTDA further develop the proposed programmes as they see fit.
### Table RSTMP Strategic Project Programme Summary

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<tr>
<th>No.</th>
<th>RSTMP Project Programme</th>
<th>Short Term: Year 1 to 2 (USD Million)</th>
<th>Medium Term: Year 3 to 5 (USD Million)</th>
<th>Long Term: Year 6 to 10 (USD Million)</th>
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<td>7.0</td>
<td>Strategic Transport Development Programme (Surface Public Transport Infrastructure and Services)</td>
<td>14.15</td>
<td>55.90</td>
<td>23.10</td>
<td>93.15</td>
</tr>
<tr>
<td></td>
<td><strong>Grand Total</strong></td>
<td><strong>422.61</strong></td>
<td><strong>1,309.78</strong></td>
<td><strong>2,302.97</strong></td>
<td><strong>4,033.36</strong></td>
</tr>
</tbody>
</table>

### RSTMP Budget
- The parent Ministry responsible for transport (as well as its budgetary concerns) in Rwanda is the Ministry of Infrastructure (MININFRA). The need to give due attention to the transport component of MININFRA’s ambit has been acknowledged by the recent establishment of a semi-autonomous agency, the Rwanda Transport Development Agency (RTDA). The RTDA was established to assist the Ministry with the management and administration of the transport sector. The budget for transport resides with MININFRA and the RTDA with the following budgetary programmes currently in place (relevant to transport capacity expenditure):
  - Development of Infrastructure for Opening-Up Rwanda; and
  - Development and Maintenance of Road Transport Infrastructure.
- A summary of the current economic outlook of Rwanda is provided with details regarding the current budget (relating to transport) and guidelines in terms of the future budgetary requirements as it relates to the implementation of the RSTMP Project Programmes (refer to Chapter 9 for details)
1. Context and Purpose

1.1 The Strategy (Rwanda Strategic Transport Master Plan)

This Strategy, the Rwanda Strategic Transport Master Plan (RSTMP), provides the planning direction for transport issues of national importance, i.e. related to the backbone transport system that provides national and international access to major national centres. It covers the organisation of the transport sector as well as the delivery of transport infrastructure and services. The strategy takes a long-term view on the future transportation system and identifies programmes and projects that secure the integrity of the system today as well as laying the foundation for the future system. Programmes and projects are identified and scoped at the strategic level and these will be prepared in more detail by the nominated execution agencies.

The transportation environment is basic economic interaction between supply and demand. A mature transportation system displays this interaction best. The area where the biggest demand exists, e.g. a densely populated urban area would typically have a dense road network and public transport infrastructure to serve the demand for transportation that exists there. In a developing environment though, the challenge is to use transportation interventions to have a catalytic effect to “create” a demand where, at present, it may not be to the extent that warrants the investment.

A frequent mistake is to concentrate strategy and investment around the provision of capacity, whereas a more balanced approach should seek to manage both the demand and supply sides of the system. Demand can be managed in a number of ways – the spatial development frameworks and legislative frameworks start playing an important role here.

There is sufficient evidence internationally that it is impossible to invest in transport to the extent that it addresses capacity problems completely and sustainably. It is therefore important in the master planning process to focus on the management of transport demand as well. By considering both capacity and demand, the lifespan and utility of each investment can be maximised to its full potential.

1.1.1 Supply

1.1.1.1 Transportation Infrastructure

- Existing Transport Infrastructure
  
  Through the development of the status quo assessment, it became very clear that only some modes of transportation are established and available in Rwanda. These are motorised transport, non-motorised transport and air transport. The associated infrastructure supporting these modes is well developed in certain areas and to a lesser extent in other areas. Rail transport, on the other hand, does not exist in Rwanda currently, and there is no rail infrastructure anywhere in the country. There is very limited waterway transport across Lake Kivu and no pipeline transport.

- Classification of Transport Infrastructure
  
  The plan of transportation infrastructure requires a hierarchical approach. In the roads context, the need for mobility and connectivity should inform the planning and investment in high-level, national and regional roads (inter-regional). Intra-regional, the focus of lower order roads should aim at providing a balance between accessibility on the one hand and mobility on the other. The principle is illustrated by the adjacent figure.

  For airport infrastructure, the function of the specific facility providing for take offs and landings are usually easily discernible by the level of services and size of the facility provided. International airports have to comply with a set of requirements that necessitate the provision of certain key elements at such facilities. Smaller order, regional and local airfields and landing strips clearly provide for a different market and function within the bigger
transportation eco system.

- Capacity of Infrastructure
  
The capacity of the infrastructure that is available and of the infrastructure that is planned is important to understand. In the case of roadways the number of lanes, the topography, the operating speed and the width of the lanes all play important roles in the determination of actual capacity. With airport facilities, the number and length of the runways and the supporting services and technology available at such facilities all contribute towards capacity.

- Condition of infrastructure
  
The condition of infrastructure informs on the probable duration of sustained utility that can be gleaned from such infrastructure. The continuous availability of infrastructure, which is directly linked to rigorous maintenance plans and operational expenditure budgets, is extremely important to understand and take into account in the appraisal of any transport system. Unfortunately a condition assessment did not form part of the Terms of Reference (ToR) of the RSTMP.

1.1.1.2 Services

- Commuter Transport
  
The supply of public transport services as a means to facilitate the movement of people is commonplace in most urban areas. The supply of these services often requires the provision of a public subsidy in order to alleviate congestion on existing road-based infrastructure. Capacity is therefore provided through the supply of strategic services where the need for travel will make it most feasible to provide such services.

- Freight Transport
  
The transportation of freight is normally not incentivised if it is road-based. Similar though to the provision of public transportation, if the quantum of freight that needs to be conveyed reaches a certain threshold, investment into the provision of rail or water based transport needs to be considered. In this instance, capacity is therefore created through the investment of public funding. In some instances, this investment can also be made by the private sector.

1.1.2 Demand

1.1.2.1 Economic Drivers

An important part of master planning is the ability to look into the future and to make informed predictions about the potential growth in certain geographical areas but also, on a more global scale, within certain demographic categories.

The spatial planning and land development control mechanisms play an important role in the decision making process of where to invest in future transport infrastructure and also, in what kind of infrastructure to invest in. Ideally, by merely inspecting the transportation infrastructure provision within a country, region or city, one should be able to deduct where the important development nodes are, and what kind of nodes these probably are, e.g. commercial, minerals and resource, agricultural, industrial, commercial, rural or residential.

The underlying factors that would provide the funding for these strategic investments through various possible exclusive and/or complimentary avenues will be the socio-economic profile of the users, the number of travellers and the projected frequency of travel.

Of further importance to the economic modelling environment is the potential of economic development which can be unpacked in a variety of ways. That detail is not important in this section – it is however important to understand this very important rule in the future of transport master planning.
1.1.2.2 Legislative Drivers

Demand can be controlled rather effectively through legislation. This can, for instance, be done through the regulation and control of certain segments of the transport section.

The challenge in most cases is not to intervene too much to allow for market forces to determine the most feasible evolution of the system.

1.1.2.3 Incentive and Disincentive

Road user charging has become commonplace in most maturing transport systems as a means to manage the demand for travel. The implementation of road user charging is often controversial and unpopular, but demonstrating the value proposition of introducing this is key to ensure its eventual acceptance.

Rebates and waivers on rates and taxes is another means of incentivising investment with the focus around certain areas or corridors.

Bulk contribution policies as a requirement for the development, are used in a similar way to encourage development to take place responsibly and in line with development control principles.

1.2 Transport Policy Implementation Cascade

The Strategy is informed by a national policy and planning framework, which it applies to the transport sector. The strategy is realised in the form of projects, packaged into coherent programmes, which are in turn prioritised for implementation. This Strategy covers the “Strategy” to “Implementation” Steps highlighted in Figure 1-1.

*Figure 1-1: Overarching Cascade for Implementing Transport Policy*
1.3 Strategy Context

Key national policies and plans informing the Strategy were investigated and the salient points are discussed in the following sections.

1.3.1 Vision 2020

The long-term development of Rwanda, as it is elaborated in the Vision 2020, assigns fundamental importance to the development of the economic infrastructure of the country, and in particular transportation infrastructure. In dealing with transport infrastructure the Vision 2020 addresses strategies to overcome the negative impact Rwanda's landlocked status has on transport costs to the sea ports and the role regional rail transport can play to alleviate this situation. Closely associated with transport infrastructure is land use management and the need to ensure its optimal utilisation in urban and rural development as well as land for infrastructure. It also has to be recognized that Rwanda is currently characterized by low but accelerating urbanization and the role to be played by basic transport infrastructure. The following objectives are promoted by Vision 2020:

- Short-term: Promotion of a macro-economic stability and wealth creation to reduce aid dependency;
- Medium-term: Transforming from an agrarian to a knowledge-based economy;
- Long-term: Creating a productive middle class and fostering entrepreneurship.

1.3.2 Economic Development and Poverty Reduction Strategy (EDPRS)

The Economic Development and Poverty Reduction Strategy (EDPRS) aims at guiding Rwanda's medium-term objectives over the 2008 – 2012 period towards economic growth and improving the well-being of its citizens. The development of an effective transport network at national and at regional levels, the diversification of the modes of transport, and improvement in the quality of transport services on the transport corridors will certainly contribute to achieving these objectives. With regards to transport, the EDPRS is aimed at improving transport links, both nationally and internationally; reducing and regulating transport costs; improving the institutional framework and sector capacity; improving road safety; acquiring sustainable road maintenance funding; and promoting road maintenance and a generally improved paved road network.

1.3.3 National Land Use and Development Master Plan

The National Land Use and Development Master Plan (LUMP) 2010 for Rwanda is a collaborative approach that includes both transport and land use planning interventions and policies. The objective of integrated land use and transport planning, is to find a balance between land use decisions and transportation planning so that the economic, social, cultural and physical potential of the transport system, and society as a whole, can benefit optimally from planning and investment decisions. The LUMP describes three future scenarios in terms of land use and development:

- **Alternative Red (worse/critical)** the land-use scenario where development continues in an uncontrolled, *ad hoc / laissez-faire* mode. It is a ‘predictive’ scenario – extrapolation of currents trends and processes and business as-usual;
- **Alternative Yellow (fair/acceptable)** the land-use scenario where development continues in a relatively managed and controlled way. It is an ‘exploratory’ scenario – construction alternative, plausible futures;
- **Alternative Green (good/prosperous)** the land-use scenario where development continues in a very controlled way. It is a ‘normative’ scenario.

The LUMP was developed based on the Green Alternative Scenario and therefore the RSTMP is aligned accordingly. The LUMP is summarised in Figure 1-2, Figure 1-3, and Figure 1-4 with regards to land use, population density and the future planning as proposed by the LUMP. Figure 1-5 provides a gap analysis summary.
Currently the South of Kigali City and Ribavu have the highest concentration of people living within these urban areas.

Volcanoes are a tourist attraction.

The Kigali City has a larger increase in employment than other Provinces.

Concentration of a variety of resources suitable for mining.

Social Amenities/Facilities
- Health Care facilities are distributed throughout Rwanda, especially concentrated near the urban areas.
- The distribution of schools and educational facilities are also well distributed in Rwanda in relation with the population densities.
- Economic activities are centered around the urban areas, especially the City of Kigali.

Methane Gas
- Economic opportunity for people to relocate because of possible work within the Energy Sector.

Geothermal Resource
- Economic opportunity for people to relocate because of possible work.

Locations of tourist accommodation. Kigali City has the largest volume of tourist accommodations.

Observation
- Land uses are spread out. Nodes are mainly “single” activity nodes, such as “industrial”, “business”, “tourism” and “mining”.
- Mix land uses are observed in Kigali City and the area of Rabavu.

Transport Alignment
- In the case of Rwanda where land uses are spread across the country, transport-links are very important in connecting the different activities with each other and with the residential areas within each region.
- Good transport-linkages favour mobility between nodes and promote accessibility to the different activity nodes.

Figure 1-2: Transport Alignment based on Important Land Uses Identified by the LUMP, 2010
Density
- Most densely populated country in Africa.
- Average of 369 people/km² (2010).
- Population growth rate is 3.2% (2010).
- Population is 8.2 million people (National Census, 2002).
- Population according to demographic and housing surveys is 9.7 million (2010).
- Population in urban areas is 18% with an annual urban growth rate of 4.2% (2010).

Observation
- Population density is expected to become extremely high in Kigali City, with people/km² doubling in the southern parts of Kigali City by 2020.
- Ribavu and Rusizi are expected to grow into dense urban areas along the eastern border of Rwanda, with Risuzi located near Lake Kivu.

The rest of the Ribavu district is estimated to reach a population density of 1001-2000 people/km² by 2020.

The rest of Kigali City is estimated to reach 2001-5000 people/km² by 2020.

The South of Kigali City and Rabavu have the highest population estimated at 2001-5000 people/km² (2010).

The South of Kigali City is estimated to reach 5001-10000 people/km² by 2020.

The rest of the Rusizi district is estimated to reach a population/km² of 1001-2000 people by 2020.

Transport Alignment
- High population densities favour the implementation of a public transport system. Within an urban area, the public transport stops should ideally be 400m-800m apart, since an acceptable walking distance for bus/tram stops are 400m and 800m for a train station.
- Long distance commuter rail can be supported between two urban areas where the densities reach 1000 people/km².

Figure 1-3: Density Alignment based on the LUMP, 2010
Roads

- Travel pattern surveys showed that vehicle ownership is high, especially in Kigali (2009).
- There is a trend that traffic is growing quicker than both population and employment.
- Rwanda is heading towards a more car-dependent society, with public transport usage dropping.
- Currently, Rwanda does not have a commuter – or freight rail system in place.
- A *railway line* is proposed to link Rwanda with the port of Dar-es-Salaam.
- The section of the railway running through Kigali is proposed to be used for public transport as a Light Rail System during peak hours.

Transport Alignment

- The transport-linkages proposed between the urban areas expected to grow substantially should be supported.
- Accessibility gives people the opportunity to access daily activities such as school, work and health care facilities. Good transport links to these activities, promote social- and economical development.
- As discussed under density alignment, a railway line (commuter and freight) makes good transport sense in a country with such high population densities and that is land-locked.

**Figure 1-4: Future Planning Alignment based on the LUMP, 2010**
Transport Alignment
With the estimation that Rusizi, Ribavu and Musanze will become densely populated urban areas, the following are recommended:

- The *corridors* between Kigali City-Rubavu, Rubavu-Rusizi and Rusizi-Kigali City needs to be strengthened.
- The *road reserves* of the RN-roads which connect these major urban areas should be protected from unwanted settlement-sprawling along these corridors.
- The *railway line* will support sustainable transport within Kigali City where it will take on the function as a light rail system.
- The railway network has the opportunity to be supported by other modes of public transport such as busses and taxis. Intermodal transfer facilities could strengthen the transport system and create an environment where people can easily access a variety of different public transport modes.

*Figure 1-5: Recommendations based on the LUMP’s Green Scenario*
1.3.4 Rwandan National Transport Sector Policy

The Rwanda National Transport Sector Policy identifies the important role Transport plays in stimulating economic growth by increasing internal production and facilitating access to domestic and international markets while ensuring favourable conditions for provision and distribution of imported products within the country. The emphasis is placed on the development of transport infrastructure and services, in terms of construction, rehabilitation and maintenance of the transportation networks, aimed at growth and economic development in order to achieve the objectives set by Vision 2020. The Rwanda National Transport Policy identifies the need to reduce constraints to transport in order to promote sustainable economic growth and decrease poverty.

1.3.5 Key Transport Sector Focus Areas

Based on the problem statements of the Vision 2020, EDPRS, Land Use and Development Master Plan, and the National Transport Sector Policy, a number of key transport sector focus areas and concerns are summarised.

1.3.5.1 Transport Framework Focus Areas

The following focus areas have been identified that relate to improving the transport framework of Rwanda:

- Assuring a balance between the services offered by the public and private sector in order to ensure a minimum level of service in the interest of the public, which the private sector may not be able to provide in the transportation of passengers and goods due to economic infeasibility;
- Developing technical and professional expertise to allow the strengthening of the private sector in the provision of goods and passenger transport services;
- Developing Rwandan expertise within private sector companies in the disciplines related to transport (planning, design, construction and maintenance of infrastructure for all modes of transport);
- Establishing a urban transport system in Kigali City to reduce congestion, pollution and costs and increase mobility;
- Developing and creating intermediate means of transport, especially in the rural environment, and;
- The policy shall enable the development of regional integration models aimed at diversifying the modes of transport for both goods and passengers and the conveyance of supplies out of the country. In the medium and long term, road transport will not be the only mode for transporting Rwandan products at the national and international level.

1.3.5.2 Transport Safety Focus Area

The following focus areas have been identified that describes the need to improve transport safety in Rwanda:

- Introducing regulatory measures to enhance transport safety and law enforcement;
- Formulating and promoting road safety education and sensitization campaigns accessible to all;
- Identifying and rectifying problematic areas that might be potentially detrimental to transportation safety;
- Developing infrastructure that encourages better participation amongst its users;
- Updating the regulations related to transport safety;
- Establishing a permanent inspection and maintenance programme for vehicles and other equipment related to the transport sector;
- Harmonising the technical standards related to the transport sector with those of neighbouring countries within the context of regional integration; and
- Allocating transport safety responsibility among the role players appropriately.
1.3.5.3 Environmentally Sustainable Transport Focus Area

The following focus areas have been identified that describes the need to improve the environmental sustainability of transport in Rwanda:

- Promoting the use of intermediate means of transport and the most efficient vehicles in terms of environmental standards;
- Establishing regulations and tariffs against pollution emissions from vehicles;
- Establishing measures focusing on the reduction of the environmental impact of transport development projects; and
- Keeping the population informed and ensuring their participation in environmental management in the transport sector.

1.3.5.4 Human Resource Development Focus Area

The following focus areas have been identified that describes the need to improve the human resource development (transport) in Rwanda:

- Establishing an appropriate institutional framework for transportation which clarifies the roles and responsibilities of all stakeholders;
- Establishing effective and/or support execution structures to the sector in order to ensure the efficient implementation of the transport policy;
- Strengthening the institutional and human resource capacities of the sector; and
- Developing and promoting the use of ICT in the field of transportation.

1.3.5.5 Legislative and Regulatory Framework Focus Area

The following focus areas have been identified that describes the need to improve the legislative and regulatory framework of the Rwanda transport sector:

- Reviewing and updating where necessary the existing rules and regulations pertaining to the sector; and
- Elaborating on the regulations underlying the transport policy.

1.4 The RSTMP Vision for Transport

The RSTMP deals with the “strategic” layer of the transport system. The strategic transport system envisaged for Rwanda by the RSTMP is aligned with the visions and objectives of current transport policies of Rwanda (Transport Sector Policy, EDPRS, LUMP and Vision 2020) (refer to Figure 1-6). Key policy vision pillars adopted from current transport policies are grouped as follows

- **Economy**: To support sustainable economic activity and get good value for money
- **Environment**: To protect the built and natural environment
- **Safety**: To improve safety by reducing accidents and improve security
- **Mobility**: To improve generalised travel time
- **Accessibility**: To improve access to transport facilities
- **Integration**: To ensure that all decisions are taken in the context of Rwanda’s Integrated Transport Policy
- **Social Equity**: Ensure affordable and reliable transport options and alternatives for all

Based on and aligned with, the above key policy vision pillars, the RSTMP Vision Pillars are developed (refer to Figure 1-6):

- **Economic**: Develop a Transport System that supports sustainable economic activity and value for money
Compliant: Develop a Transport System that complies with modern rules and standards, that is focused on safety and protecting the environment

Capacity: Develop a Transport System that is sufficient, optimal and timeous

Continuity: Develop a Transport System that is globally and regionally focused, integrated, stable, that improves mobility and provides access to economic activities and transport facilities

Choice: Develop a Transport system that enables universal and quality accessible options; that ensures social equity through providing affordable and reliable transport options and alternatives that enable equitable development and growth.

The Vision Pillars of Rwanda also forms the basis for assessment criteria as part of the Multi-Criteria Analysis developed to assist with prioritizing projects identified for the RSTMP.
Rwanda Transport Policy Vision Pillars

- **Economy:**
  To support sustainable economic activity and get good value for money

- **Environment:**
  To protect the built and natural environment

- **Safety:**
  To improve safety by reducing accidents and improve security

- **Mobility:**
  To improve generalised travel time

- **Accessibility:**
  To improve access to transport facilities

- **Integration:**
  To ensure that all decisions are taken in the context of Rwanda’s Integrated Transport Policy

- **Social Equity:**
  Ensure affordable and reliable transport options and alternatives for all

RSTMP Vision Pillars Aligned with, and Based on Rwanda’s Transport Policies

- **Economic:**
  Develop a Transport System that supports sustainable economic activity and value for money

- **Compliant:**
  Develop a Transport System that complies with modern rules and standards, that is focused on safety and protecting the environment

- **Capacity:**
  Develop a Transport System that is sufficient, optimal and timeous

- **Continuity:**
  Develop a Transport System that is globally and regionally focused, integrated, stable, that improves mobility and provides access to economic activities and transport facilities

- **Choice:**
  Develop a Transport system that enables universal and quality accessible options; that ensures social equity through providing affordable and reliable transport options and alternatives that enable equitable development and growth

Figure 1-6: Diagrammatic Representation of the RSTMP’s Alignment with Rwanda’s Transport Vision Pillars
2. Concepts Important to the Understanding of the Strategy

2.1 Strategic Dimension and Composition of the Strategy

In light of the fact that the Strategy considers the strategic layer (dimension/hierarchy) of the transport system, it is necessary to define that dimension and hierarchy.

Rwanda is currently in a process of decentralisation, devolving political, economic, social, managerial/administrative and technical functions to local government.

Central Government is largely responsible for policy formulation, regulation and support to Local Governments through capacity building, financing and monitoring and evaluation. Local Government with its administrative entities are mainly in charge of implementation of government policies and service delivery, and to provide an avenue for the citizens’ voice and accountability.

The Province is responsible for coordinating district development planning of national policies and programs, and supervising implementation of the national policy in the Districts within a province. There are five administrative entities at provincial level, namely the City of Kigali and the Eastern, Northern, Western and Southern Provinces.

The local levels of government cascade from the District ('Akarere'); the Sector ('Umurenge'); the Cell ('Akagari'); and the Village ('Umudugudu').

The RSTMP considers transport issues at the top of this administrative hierarchy, i.e. transport system issues related to connectivity at the following levels:

- **Inter-Continental**;
- **Inter-Regional**;
- **Inter-Provincial**; and
- **Kigali and Important National Nodes**.

The Strategy's dimension/hierarchy principle components are defined below.

- **Inter-Continental** (e.g. Kigali and Europe – refer to Figure 2-1). Defined in this context as the involvement of, and interaction between Rwanda and other nations.
- **Inter-Regional** (e.g. Rwanda and Kenya – refer to Figure 2-1). Defined in this context as the involvement of, and interaction between Rwanda and other regions – specifically neighbouring countries.
- **Inter-Provincial** (e.g. Town of Kigali and Western Province – refer to Figure 2-2). Defined in this context as the involvement of, and interaction between Provinces of Rwanda.
- **Kigali City and Important Nodes of Rwanda** (e.g. Kigali and proposed Bugesera Airport – refer to Figure 2-2). Defined in this context as the involvement of, and interaction between Kigali City and nodes of national importance to Rwanda.

The following fall outside the scope and are not considered part of the Strategy:

- **Intra-Provincial** (e.g. within the Northern Province) Defined in this context as interactions within a specific Province of Rwanda.
- **Inter-District** (e.g. Nyamasheke and Rusizi – refer to Figure 2-3). Defined in this context as the involvement of, and interaction between Districts of Rwanda.
- **Intra-District** (e.g. within the Rusizi District – refer to Figure 2-3). Defined in this context as interactions within a specific District of Rwanda.

2.2 Importance of Regional Corridors

Rwanda is a member state of the East African Community (EAC) of which member states include Kenya, Uganda Burundi, and Tanzania. Rwanda is a landlocked country and far from the maritime ports of Kenya and Tanzania. The distance to the nearest port of Dar-Es-Salaam is approximately 1 400 km. The country lacks a link to regional railway networks, which means most trade is conducted by road. Consequently transport costs of imports and exports are high and this has a negative impact on the economic growth and
The transport sector is generally regarded as an important factor in economic and social progress of a country.

Rwanda is dependent on two main transport corridors for trade, namely the Northern Corridor and the Central. The Northern Corridor connects the landlocked countries of East and Central Africa, namely Burundi, Democratic Republic of Congo (DRC), Rwanda and Uganda to the Kenyan seaport of Mombasa. According to the 2009 Public Expenditure Review on the Transport Sector, about 70 percent of Rwanda's external trade utilizes this corridor. The Central Corridor links Rwanda to the Dar-Es-Salaam seaport. This corridor accommodates about 30 percent of the country's external trade.

In this study, the main principles established by the EAC to ensure regional connectivity and integration are adhered to, including, but not limited to: road classification; road standards (e.g. 100km/h design); support to regional overload control, and road transport de-regulation overseen at the regional level.

The regional corridors provide the scaffolding for economic development and it is anticipated that the government ministries / agencies promoting regional investment will promote corridors as investment destinations.

The corridors traversing Rwanda both have their own managing agencies that are mandated to monitor corridor performance and to promote the corridors. For the Central Corridor the managing agency is the Central Corridor Transport Facilitation Agency (CCTFA) and for the Northern Corridor the managing agency is called the Northern Corridor Transit, Transport Coordination Agency (NCTTC).
Figure 2-1: Inter-Continental and Inter-Regional
Figure 2-2: Inter-Provincial; Kigali and Important National Nodes
Figure 2-3: Inter-District and Intra-District
2.3 Types of Transport Demand

Transport on the strategic transport network conveys people and goods. The movement of people on the strategic transport network is between cities and across borders. Freight transport entails the long haul of different commodities (i.e. break-bulk, dry-bulk, containerised, liquid, etc.) including cross-border trade.

All freight transport is driven by economic and commercial considerations. Passenger transport may be purely for social reasons (e.g. school transport). However, the passenger traffic expected on the strategic transport network would typically be of a commercial nature.

The distinction between types of transport demand is important because different transport modes serve diverse transport demands over various distances more efficiently.

![Figure 2-4: Typical Passenger Transport Suitability for different Travel Tasks](image)

2.4 Transport Mode Role Allocation

Transport in Rwanda today is based on the road and aviation modes. In the near future a rail link will be constructed. There is potential for developing inland waterways as well as fuel pipelines. Road transport is efficient for local and medium haul distances. Rail comes into its own for large freight volumes over long distances. Air transport is efficient for passenger transport (or for low-weight, high-value commodities) over long distances. Inland waterways are efficient where rivers are non-seasonal, otherwise they serve localised needs only.

Schematically, the expected modal roles are as presented in Table 2-1.

<table>
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<th>Transport Linkages</th>
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<th>Road</th>
<th>IWW</th>
<th>Aviation</th>
<th>Pipeline</th>
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<td>P/F</td>
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<td>(F)</td>
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<td>Intra-District</td>
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</table>

Note:

F = Freight, (F) = Potential Freight, P = Passenger, (P) = Potential Passenger, P/F = Passenger and Freight, (P/F) = Potential Passenger and Freight
2.5 Institutional Transport Organisation

Beyond the specific physical network and related transport services, the success and sustainability of the Strategic Transport Network is directly related to the strength of the institutions that oversee the sector. Institutions are the means by which policy decisions are made effectively. Policies without organisations capable and willing to implement them are not credible.

The parent Ministry responsible for transport in Rwanda is the Ministry of Infrastructure (MININFRA). The Ministry is responsible for overall transport policy and strategic planning, the creation of a transport enabling environment, and setting of transport rules, regulations and standards. Recently, Rwanda Transport Development Agency (RTDA) was established to assist the Ministry with the management and administration of the transport sector. The Rwanda Utilities Regulatory Agency (RURA) primarily ensures that utilities provide goods and services that meet the demand and needs of the users of such services. The Rwanda Civil Aviation Authority (RCAA) has been entrusted with the development, management and operation, and maintenance of all the services (except services handled in terms of a concession) associated with aviation.

The institutional structure of the Strategy covers all modes of transport (namely: Roads, Road Transport, Inland Waterways, Rail and Aviation) and is divided into the following:

- Policy and Planning;
- Safety Regulation;
- Commercial Regulation;
- Infrastructure Provision;
- Infrastructure Funding; and
- Services.
3. Strategic Transport Network

3.1 Introduction

Transport is a strategic intervention area to enable the expanding of the Rwandan economic base from predominantly agriculture based into the secondary and the tertiary sectors. The rehabilitation and development of transport infrastructure is regarded as a crucial aspect to lower the costs of doing business in Rwanda.

This section of the RSTMP is focused on the transport network (infrastructure) that falls within the scope of the RSTMP and therefore covers the transport networks of roads, rail, airports, inland waterways, pipelines, and multi-modal facilities. Each of the said transport modes are discussed in terms of the following general criteria (with additional criteria included where considered):

- Classification;
- Standards;
- Network; and
- Way Forward/Recommendations.

3.2 RSTMP Road Network

3.2.1 Introduction

The purpose of any road network is to preserve and sustain social and economic development. To achieve this purpose and objective there is a need to ensure that the RSTMP road network is operating safely, efficiently and within its design capacity.

In order to meet this mandate, specific factors need to be investigated. These factors/principles/concepts, crucial to the analysis of the RSTMP Road Network, include:

- Classification
- Access Management
- Standards
- RQMS/IRNMS
- Overload Control
- Road Safety
- Road Capacity and Continuity Analysis
The total road network of Rwanda consists of almost 14,000 km. However, only roads that fall within the scope of the RSTMP (i.e. of national and regional importance) were investigated. The following table presents the road network identified as roads of national importance to Rwanda and formed the basis for the RSTMP (refer to Table 3-1). The RSTMP Road Network that was analysed consists of approximately 2,837km (nearly 20% of the total road network) of which, 1,171km are paved (40%) and 1,667km are unpaved/gravel roads (60%).

**Table 3-1: The Rwanda Strategic Transport Master Plan Road Network**

<table>
<thead>
<tr>
<th>Route Number</th>
<th>Route Description</th>
<th>Paved (km)</th>
<th>Gravel (km)</th>
<th>Total (km)</th>
</tr>
</thead>
<tbody>
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<td>RN 1</td>
<td>Kigali-Butare-Akanyaru</td>
<td>158</td>
<td></td>
<td>158</td>
</tr>
<tr>
<td>RN 10</td>
<td>Bugarama-Ruhwa</td>
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<td></td>
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<td>RN 23</td>
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</table>
### Route Number | Route Description                        | Paved (km) | Gravel (km) | Total (km) |
<table>
<thead>
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<th></th>
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</thead>
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<td></td>
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<td>RN 27</td>
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<td>63</td>
<td>63</td>
<td></td>
</tr>
<tr>
<td>RN 28</td>
<td>Ruhengeri-Busogo-Kora-Kabuhanga</td>
<td>9</td>
<td>63</td>
<td>71</td>
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<tr>
<td>RN 29</td>
<td></td>
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<td>RN 3</td>
<td>Kigali-Kayonza-Rusumo</td>
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<td></td>
<td>166</td>
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<tr>
<td>RN 30</td>
<td></td>
<td>27</td>
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<td></td>
</tr>
<tr>
<td>RN 4</td>
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</tr>
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<td></td>
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<td>52</td>
<td>52</td>
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</tr>
<tr>
<td>RN 5</td>
<td>Kayonza-Kagitumba</td>
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<tr>
<td>RN 6</td>
<td>Butare-Cyangugu-Rusizi</td>
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<td>151</td>
<td></td>
</tr>
<tr>
<td>RN 7</td>
<td>Gitarama-Kibuye</td>
<td>83</td>
<td>83</td>
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<tr>
<td>RN 8</td>
<td>Ruhengeri-Cyanika</td>
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</tr>
<tr>
<td>RN 9</td>
<td>Cyangugu-Bugarama</td>
<td>31</td>
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<tr>
<td><strong>Total</strong></td>
<td></td>
<td>1,171</td>
<td>1,667</td>
<td><strong>2,837</strong></td>
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<tr>
<td><strong>%</strong></td>
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<td><strong>41%</strong></td>
<td><strong>59%</strong></td>
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</tbody>
</table>

#### 3.2.2 Road Classification and Access Management

#### 3.2.2.1 Role of Road Classification

Functional road classification is an indispensable tool for rational assessment and assignment of responsibilities in the road sector. Road functionality is an important concept that governs road access management. Functional road classification is an international practice, whereby a road is classified in accordance to the current and/or immediate future function it provides to all road users including direct communities.

Functional classification is usually the basis for other dimensions and can be defined in various ways. The road network is divided into separate (hierarchical) classes each with a distinct function. The following definition derives from the World Bank’s Highway Functional Classification Study Guidelines:

*Functional classification is based on the perceived structure and activities of society and its character. It categorises the roads by their primary function from serving traffic to serving land use that generates the*
traffic. Functional classification has become the major management tool and is used in virtually all aspects of decision-making regarding roads: transport system and economic planning, standards for design and maintenance, access management, data classification, resource allocation, road agency commercialisation, intermodalism and the size of the network. “- (World Bank, 1995).

The administrative dimension concerns the ownership of or responsibility for the road and it is usually linked closely to the functional classification. Functional road classification is basically a tool for road management. Classification is linked to many aspects regarding the organisation and management of the road sector as indicated in Figure 3-3 below.

Figure 3-2: Linkages between Classification and Road Sector Organisational and Management Aspects

There are numerous methods of classifying roads and they include:

- **Administrative classification**, which classifies roads in accordance to the authority responsible for them;
- **Route number classification** does not necessarily identify the authority responsible for the roads but provides a numbering system to the road network;
- **Geometric classification** uses the road geometry to provide a hierarchy for the road network;
- **Naming hierarchy** is another form of road classification, which classifies roads in accordance with their name (e.g. Avenue, Lane, Boulevard);
- **Traffic volume classification** is based on the average daily traffic that is carried by a road; it is also a good indication of the importance of a road;
- Another approach includes the use of **design speed** as a criterion to classify a road network;
- There is also the classification of roads system through the use of their **functionality** (which we will use in this instance); and
- A network can also be classified in terms of:
  - **Public transport** (i.e. strategic public transport routes to local distribution routes);
  - **Hazardous material** (Hazmat) routes;
- Pavement management systems; and
- Bridge flood designing processes.

In most countries road classification generally serves an administration and functional purpose. For administration purposes countries organize their roads into hierarchical networks in accordance to the road’s purpose, e.g. national roads for roads linking the capital to provincial centres, principal cities and other centres of national importance; urban roads for roads and streets serving transport demands within cities and towns; and, rural roads for local transport demands in rural areas.

Functional classification is the process by which roads are grouped into classes by the service they provide. Basic to this process is the recognition that a trip involves movement through a network of roads. A functionally classified road network assigns each road link a role that channels trips through a network efficiently. The basic concepts of functional classification are applicable, regardless of the nature or level of development of the economy or mix of traffic.

Allied to the idea of road classification is the dual role the road network plays in providing access to property and in travel mobility (refer to Figure 3-3). Access is a fixed requirement, necessary at both ends of any trip. Mobility along the path of such trips is defined in terms of "level of service". It can incorporate a wide range of indicators such as: road condition, travel speed, degree of congestion, etc.

As illustrated in Figure 3-3, local streets and collectors emphasize the land access function and arterials and freeways emphasize the mobility function; a compromise between both functions is provided where collectors/arterials meet. Consequently, arterials and freeways should have the highest traffic volumes, the greatest amount of commercial traffic, and the longest average trip lengths. Collectors should have intermediate values for these factors, and local streets the lowest values. Also, the longest trips should have the highest percentage of their trips on arterials and freeways, and the shortest trips should be concentrated on local streets.

The most important purposes and applications of functional road classification include:

- Delineation of public responsibilities in the provision and standard of public roads;
- Assignment of a road's ownership and responsibility for its management and financing;
- System planning for the road using travel modes, including non-motorized traffic; access management (access control); and, coordination with other modes of transport;
- Assistance to road users for selecting a travel route from origin to destination;
- Assignment of (uniform) minimum standards, including permissible vehicle axle loads, weights and dimensions
3.2.2.2 Regional or Inter-State Road Network Classification – International Best Practice

The following sections highlight international best practice examples in terms of providing a unified road network across country/state borders.

America

The National Highway System (NHS) of the United States comprises approximately 160 000 miles (256 000 km) of roadway, including the Interstate Highway System and other roads, which are important to the nation's economy, defence and mobility (refer to Figure 3-4). The NHS was developed by the United States Department of Transportation in cooperation with the states, local officials, and metropolitan planning organisations. Its main purpose is to coordinate federal funding as most of the roads (including the Interstates) are maintained by the federal states.

Establishment of the NHS encourages states to focus on a limited number of high-priority routes and to concentrate on improving them with federal-aid funds. At the same time, these states can incorporate design and construction improvements that address their traffic needs safely and efficiently. States can make operational changes, such as a program to locate and remove stalled vehicles that are impeding smooth traffic flow. States can employ available technological improvements, such as Intelligent Transportation Systems, which are intended to help reduce congestion and keep traffic moving without major roadway expansion.

NHS is intended to be a unified system where each mode complements the other. Increasingly, intermodal carriers rely on all forms of transportation to deliver goods and services to consumers in the most efficient manner possible. NHS supports this goal by serving 198 ports, 207 airports, 67 Amtrak stations, 190 rail/truck terminals, 82 intercity bus terminals, 307 public transit stations, 37 ferry terminals, 58 pipeline terminals, and 20 multipurpose passenger terminals.
Europe

The international E-Road Network (Euro-Route) is a numbering system for roads in Europe, developed by the United Nations Economic Commission for Europe (UNECE) (refer to Figure 3-5). The network is numbered from E1 up and its roads cross national borders. It also reaches Central Asian countries like Kyrgyzstan, since they are members of the UNECE.

In most countries, roads carry the European route designation beside national road numbers. Other countries like Belgium, Denmark, Norway and Sweden have roads with exclusive European route signage (examples are the E18 and E6).

**Road Design Standards of E-Road Network:**

The following design standards are applied to Euro-Routes, unless there are exceptional circumstances (e.g. mountain passes, etc.):

- Built-up areas shall be by-passed if they constitute a hindrance or a danger;
- The roads should preferably be motorways or express roads (unless traffic density is low so that there is no congestion on an ordinary road);
- They should be homogeneous and be designed for speeds of at least 80 km/h (very exceptionally 60 km/h), with motorways designed for at least 100 km/h;
- Gradients should not exceed 8% on roads designed for 60 km/h, decreasing to 4% on roads designed for 120 km/h;
- The radius of curved sections of road should not exceed 120 m on roads designed for 60 km/h rising to 1 000 m on roads designed for 140 km/h;
- "Stopping distance visibility" should be at least 70 m on roads designed for 60 km/h, rising to 300 m on roads designed for 140 km/h;
- Lane width should be at least 3,5 m on straight sections of road;
- The shoulder is recommended to be at least 2,5 m on ordinary roads and 3,25 m on motorways;
- Central reservations should be at least 3 m unless there is a barrier between the two carriageways;
- Overhead clearance should be not less than 4,5 m;
- Railway intersections should be at different levels.
Figure 3-4: National Highway System of the United States of America


Figure 3-5: E-Road Network of Europe

The Trans-African Highway Network comprises transcontinental road projects in Africa being developed by the United Nations Economic Commission for Africa (UNECA), the African Development Bank (AfDB), and the African Union in conjunction with regional economic communities (refer to Figure 3-5). They aim to promote trade and alleviate poverty in Africa through highway infrastructure development and the management of road-based trade corridors. The total length of the nine highways in the network is about 57 000 km.

In some documents the highways are referred to as "Trans-African Corridors" or "Road Corridors" rather than highways. The name Trans-African Highway and its variants are not widely used outside of planning and development circles, and currently one does not see them signposted as such or labelled on maps, except in Kenya and Uganda where the Mombasa-Nairobi-Kampala-Fort Portal section (or the Kampala-Kigali feeder road) of Trans-African Highway 8 is sometimes referred to as the "Trans-Africa Highway".

The network as planned reaches all the continental African nations except Burundi, Eritrea, Somalia, Equatorial Guinea (Rio Muni), Lesotho, Malawi, Rwanda and Swaziland. Of these, Malawi, Lesotho and Swaziland have paved highways connecting to the network, and the network reaches almost to the border of the others.

The agencies developing the highway network subscribe to the understanding that road infrastructure stimulates trade and thus alleviates poverty, as well as benefiting health and education, since they allow medical and educational services to be distributed to previously inaccessible areas.
SADC Road Classification Policy, Regional Trunk Road Network and Numbering

All roads in the SADC (Southern African Development Community) countries investigated were categorised according to a classification system. South Africa has a three-tier management system (three levels of government involved in management of the road network), while most of the other countries investigated adopted a two-tier management system (only two levels of government involved). The road classes adopted by the various countries are indicated in Table 3-2 below, which also shows the frequency of each road network class.

Two main configurations of road network classes are indicated in the table, namely:

- Trunk, main/regional, district, urban and rural/community roads, and
- Primary, secondary, tertiary, urban and rural/community roads

Regardless of the specific terminology, it is evident that road hierarchies are in place and are classified by functional characteristics and institutional responsibility.

### Table 3-2: Type and Frequency of Road Network Classes

<table>
<thead>
<tr>
<th>Road class</th>
<th>South Africa</th>
<th>Namibia</th>
<th>Botswana</th>
<th>Swaziland</th>
<th>Lesotho</th>
<th>Zimbabwe</th>
<th>Tanzania</th>
<th>Uganda</th>
<th>Malawi</th>
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<td>National</td>
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</table>

* Further classified into e.g. main, district and local, but varies per province.

The SADC policy regarding road infrastructure, as described in the SADC Protocol on Transport, Communications and Meteorology (August 1996), specifies objectives of member states regarding the road infrastructure of their countries. The following articles from this policy are relevant.

### Article 4.1

According to Article 4.1 of the protocol, member states agree to ensure and sustain the development of an adequate roads network in support of regional socio-economic growth by providing, maintaining and improving all roads including primary, secondary, tertiary and urban roads and including those segments which collectively constitute the Regional Trunk Road Network (RTRN) in order to:

- Ensure access to major centres of population and economic activity;
- Ensure access between ports of entry between member states and harbours of importance to the region;
- Minimise total road transport costs;
- Preserve assets vested in road infrastructure; and
Minimise detrimental impacts to the environment.

Article 4.2

According to Article 4.2, and in order to attain the road infrastructure objectives, member states agree to develop a harmonised regional road infrastructure policy aimed at:

- Monitoring the adequacy and quality of the regional road infrastructure and the need to mobilise resources to meet the developmental objectives contemplated in Article 4.1;
- Introducing commercial management practices to foster institutional, economic and technical efficiency in their national road sectors;
- Supporting, nurturing and coordinating their national roads activities to the benefit of the region as a whole;
- Developing complementary strategies to reduce the cost of constructing and maintaining their respective road networks, including consideration of the potential for reducing road financing needs by contracting out all types of road construction and maintenance activities; and
- Acknowledging the need of the region for a vibrant, capable, varied and geographically extensive contracting and consulting industry and endeavouring to define and develop the optimal environment for development of the regional contracting industry.

Article 4.3

Article 4.3 of the SADC Protocol on Transport, Communications and Meteorology stipulates that “Member States shall adopt a common definition of the Regional Trunk Road Network (RTRN) and common route numbers, which shall serve as a basis for a co-ordinated plan for the construction and development of roads of regional and continental importance which they intend to undertake within the framework of their national programmes”. Furthermore it stipulates that “Member States agree that the definition of the RTRN will be revised annually”.

The historical development of the RTRN can be summarised as follows:

- The RTRN was first defined in a working paper entitled *International Road Transport in the SADC Region*, dated 5 April 1990. This paper was prepared in connection with the Sixth Joint Meeting of the SATCC Working Groups on Road Infrastructure and Road Traffic and Transport that was held in Mbabane, (8-11 May 1990);
- Original definition of RTRN (1991): Length = 30,132 km. The original definition of the RTRN (1991) was based on the existing corridors in the SADC region. The objective was to ensure provision of effective road infrastructure to serve the transportation needs of the region along the defined corridors. These corridors gave access to the main ports and were served by a multi-modal transport system comprising mainly roads and railways. The 1991 defined RTRN did not include the countries of South Africa and the DRC;
- Expansion of RTRN to include South Africa (1995): Length = 46,303 km. Following South Africa’s membership of the Southern African Development Community (SADC) in 1994, the RTRN was expanded to include a number of major routes. The criteria used for determination of these routes were as follows:
  - Existing national (primary) routes in South Africa;
  - Fixed SADC routes in neighbouring countries;
  - To link the capital cities of at least two SADC member states with each other;
  - To link SADC member states with the major ports of the region.
- Revision of the RTRN (1998): Length = 46,080 km. The 1995 RTRN was revised in 1998 and details of the RTRN routes were published in Annexure I of the SADC Protocol on Transport, Communications and Meteorology. This revision resulted in a small decrease in total length due to the omission of a route in Namibia;
- Expansion of RTRN to include the DRC (2001): Length = 53,616 km. Following the DRC’s membership of SADC in 2000, three routes and associated link roads with a total length of about 8 000 km were identified and subsequently included in the RTRN;
Definition of RTRN as defined by Member States during the 2007 RUC Study (2006/07): Length = 52,246 km. During the preparation of the SADC study on The Implementation of Harmonised Road User Charges System in the SADC Region, SADC Member states were required to verify the extent of the RTRN in their countries. This verification exercise resulted in a slight decrease in the total length of the RTRN;

Revision of the RTRN (2008): Length = 62,674 km.

As indicated above, the length of the RTRN has increased significantly in length from 30,132 km in 1991 to 62,674 km in 2009. This inevitable increase reflects the additional road capacity required to accommodate the economic and other developments in road transport that have taken place over the intervening 17-year period both within the SADC region and elsewhere in Africa.

Article 4.4

Article 4.4 covers national road authorities and specifies that the member states agree to establish autonomous accountable national roads authorities, which are representative of the public and private sector, and which have clearly defined responsibilities, including reviewing the classification of national roads systems and the definition of the RTRN.

Numbering System

The SADC RTRN is constituted mainly of paved roads having a general north-south and west-east orientation (referred to as reference roads). It includes intermediate roads located between the reference roads, as well as branch, link and connecting roads.

The reference roads and the intermediate roads are recognized by two-figure numbers, whereas branch, link and connecting roads are recognized by three-figure numbers.

The numbering system for reference and intermediate roads are as follows:

- Reference roads and intermediate roads are recognized by two-figure numbers;
- The north-south orientated reference roads are recognized by two-figure odd numbers ending with five (5), increasing from west towards east;
- East-west oriented reference roads are recognized by two-figure even numbers ending with a zero (0) and increasing from north towards south; and
- Intermediate roads are recognized by two-figure odd and two-figure even numbers respectively, in the range between the numbers of the two reference roads they connect.

The numbering system for branch, link and connecting roads are as follows:

- Branch, link and connecting roads are recognized by three-figure numbers;
- The first figure refers to the nearest reference road to the north;
- The second figure refers to the nearest reference road to the west; and
- The third figure is a serial number.

The 2009 revision of the RTRN is shown in Map 3-1. In acknowledgement of the RTRN numbering system and as Tanzania forms part of the SADC agreement, an attempt to determine the route numbers for EAC corridors to extend the RTRN into Uganda, Kenya, Burundi and Rwanda is shown in Map 3-2. This is a proposal and will be tested in the next revision of the RTRN.
Map 3-1: SADC Regional Trunk Road Network, 2009
Map 3-2: EAC Corridors numbered to align with SADC RTRN 2009 numbering
3.2.2.3 Status of Road Classification in Rwanda

It is evident from Map 3-3 that:

- The road network is currently classified into two classes, namely the national roads (RN-class) and the district roads (RD-class);
- According to the decree relating to the Regulation of the National Road Network (2008), the road classification is made in accordance to the destination and significance of these public roads; and
- There are other classes of roads that have not been proclaimed and are not captured in Map 3-3, namely rural feeder roads; specific roads and urban road network.

Table 3-3 shows the characteristics of the different road classes in Rwanda.

**Table 3-3: Current Road Classification in Rwanda**

<table>
<thead>
<tr>
<th>Class</th>
<th>Category</th>
<th>Road Ownership</th>
<th>Distinction</th>
<th>Minimum Road Width (m)</th>
<th>Total Length (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RN</td>
<td>National Road</td>
<td>Ministry of Infrastructure</td>
<td>• Connect Rwanda with neighbouring state or between urban communities; &lt;br&gt; • Access to facilities of national or international importance; &lt;br&gt; • Tourism significance</td>
<td>6</td>
<td>2,859</td>
</tr>
<tr>
<td>RD</td>
<td>District Road</td>
<td>Districts</td>
<td>Connect headquarters of sectors within the same district</td>
<td>4</td>
<td>1,838</td>
</tr>
<tr>
<td>Rural Feeder</td>
<td></td>
<td>Districts</td>
<td>Connects district roads to centres of rural communities</td>
<td>Not stipulated</td>
<td>Not stipulated</td>
</tr>
<tr>
<td>Specific road</td>
<td>Centres for agricultural production, for harnessing of natural resources, or tourist sites</td>
<td>Connects national roads/district roads to centres of agricultural production, tourist sites and natural resources</td>
<td>Not stipulated</td>
<td>Not stipulated</td>
<td></td>
</tr>
<tr>
<td>Urban Roads</td>
<td>Kigali City or District in which urban centre is located</td>
<td>Connects sites within urban centres</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td>14,000</td>
<td></td>
</tr>
</tbody>
</table>

Source: Rwanda Road Classification Act of 2008; Road Inventory dated May 2006.

In 2009 Rwanda drafted a Law entitled the “Draft Law Regulating National Road Network (2009)” which was promulgated in 2011 entitled the Rwanda Road Act, 2011. The said Law states that the Road Network of Rwanda shall be classified as follows:

**Table 3-4: Road Classes Identified in the Road Act, 2011 to Regulate the National Road Network**

<table>
<thead>
<tr>
<th>Class</th>
<th>Description</th>
<th>Minimum Road Width (m)</th>
<th>Minimum Road Reserve Width (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Roads</td>
<td>These are: &lt;br&gt; 1. International roads that links Rwanda with a neighbouring state; &lt;br&gt; or &lt;br&gt; 2. Roads that link Districts or a District and the City of Kigali. &lt;br&gt; 3. Roads that link areas of tourist significance and facilities of national or international importance such as ports or airports.</td>
<td>The minimum viable widths of roads, the District and City of Kigali Roads not including the side drains and embankments shall be 7 meters.</td>
<td>The road reserve on which run National roads, District and City of Kigali roads-category 1, is delimited by two parallel lines at twenty two (22) meters on each side of the centre line of the road.</td>
</tr>
<tr>
<td>District and City of Kigali Roads – Category 1</td>
<td>These are roads with a local significance linking different headquarters of Sectors within the same District, or within the same Sector.</td>
<td>The minimum viable widths of roads, the District and City of Kigali Roads not including the side drains and embankments shall be 7</td>
<td></td>
</tr>
<tr>
<td>Class</td>
<td>Description</td>
<td>Minimum Road Width (m)</td>
<td>Minimum Road Reserve Width (m)</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>-----------------------------------------------------------------------------------------------</td>
<td>------------------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td>District and City of Kigali Roads – Category 2</td>
<td>These are arterial roads that connect District Roads category 1 to community centres.</td>
<td>The minimum width of District and City of Kigali Roads Category 2 of shall be 5 meters. Around and at the entrances of towns, communities or villages, the width of roads should be increased as the need shall be. Over and above this width, each road should have the necessary land extension for drainage ditches, embankments, and areas for storage of materials and, if there is space for sidewalks, which constitute integral part of the road.</td>
<td>The public reserve on which run District and City of Kigali Roads -Category 2 shall be of not less than 12 meters on each side from the centre line of the road.</td>
</tr>
<tr>
<td>Specific road</td>
<td>These are roads specifically constructed to connect National Roads and District Roads to the centres of agricultural production, natural resources or to tourist sites that ensure linkages within the City of Kigali.</td>
<td>Not specified.</td>
<td>Not specified.</td>
</tr>
</tbody>
</table>

**Source: Rwanda Road Act of 2011.**

### 3.2.2.4 Current Road Access Provision in Rwanda

There are three distinct human occupations in Rwanda, namely:

- **Urban dwellings**, which refers to dwellings found in an urbanised area (e.g. Kigali City, Musanze, Rubavu, Karongi, etc). The urban dwellings typically receive access to the primary network through access roads that are spaced at relatively acceptable spacing.

  ![Source: Google Map (July 2011)](image)

- **Settlements** refer to linear dwellings located along the classified road network. The settlement dwellings tend to have direct access to the primary network.

  ![Source: Google Map (July 2011)](image)
• **Rural dwellings** refer to dwellings found in rural areas. The rural dwellings tend to be located far from the primary road network. They tend to access the primary network through a single entry/exit access road.

![](source: Google Map (July 2011))

The extent of settlement patterns along the proclaimed road network is shown in Map 3-4.

The summary of the features of the settlement patterns presented in Map 3-4 are presented in Table 3-5.

**Table 3-5: Features of the Three Distinct Access Types found in Rwanda**

<table>
<thead>
<tr>
<th>Type of Access</th>
<th>Extent of Road Network</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of Links</td>
</tr>
<tr>
<td>Urban</td>
<td>200</td>
</tr>
<tr>
<td>Settlement</td>
<td>1,649</td>
</tr>
<tr>
<td>Rural</td>
<td>153</td>
</tr>
</tbody>
</table>

It is evident from Map 3-4 and Table 3-5 that:

• Majority of the classified road network in Rwanda has settlements located in the vicinity of its reserve, providing the following with respect to road operations in Rwanda:
  o Poor level of service;
  o Reduced road safety; and
  o Impaired land use and transport integration; amongst others.

• Rural areas are mostly found in the Southern and Western Provinces along these roads: RN7; RN17; RN23, RN26 and RN33.

• Urban areas are located along roads that are found in majority of towns and cities in Rwanda. The significant roads include:
  o The RN16 in the vicinity of Ribavu;
  o The RN31 and the RN20 in the Northern Province, in the vicinity of Nyarulo;
  o The RN31 in the vicinity of the City of Kigali;
  o The RN40 in the vicinity of Ngoma;
  o Sections of the RN5; and
  o The RN2 and RN20 in the vicinity of Gicumbi.

The roads in the vicinity of Huye, Karongi, Rusizi, Muhanga, Musanze and Nyagatare do not have such significant urban areas along their roads.

Table 3-6, supported by Map 3-5 shows the level of access per kilometre.
Table 3-6: Level of Accesses per Kilometre on the Rwanda National Road Network Assessed

<table>
<thead>
<tr>
<th>Level of Access</th>
<th>Extent of Road Network</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of Links</td>
<td>Total Length (km)</td>
</tr>
<tr>
<td>0-1 access per km</td>
<td>1,502</td>
<td>2,252.0</td>
</tr>
<tr>
<td>2-7 accesses per km</td>
<td>482</td>
<td>571.8</td>
</tr>
<tr>
<td>More than 8 accesses per km</td>
<td>18</td>
<td>13.3</td>
</tr>
</tbody>
</table>

The following observations are made from Table 3-6 and Map 3-5:

- Majority of the primary network in Rwanda has an access every 1 kilometre (75% of 0 – 1 accesses per kilometre). This is observed in the Southern, Northern as well as the Western Provinces;
- The Eastern Province is characterized by provision of 2 – 7 accesses per kilometre;
- Roads with over eight accesses per kilometre include:
  - The RN15 in the vicinity of Kigali;
  - The RN33 in the vicinity of Mashyuza; and
  - The RN34 in the vicinity of Rubona; Kanazi as well as Rango.
Map 3-3: Road Network in Rwanda
Map 3-4: Settlement Patterns along the Primary Network (Urban, Rural, Settlement)
Map 3-5: Access Spacing on Rwanda’s Road Network
Map 3-6: Impact of Topography on access to roads in Rwanda
3.2.2.5 Identification of Issues pertaining to Road Access Provision in Rwanda

The following section provides a summary of observed road access issues that require intervention.

Incomplete Road Classification Process

Currently Rwanda has proclaimed and classified two classes of roads, namely the national and district roads. There are three classes that still need to be classified, namely the rural feeder roads, the specific roads and the urban road network.

Further to the above, Rwanda has subdivided its primary road network (i.e. national and district roads) according to “their destinations and their significances” rather than their functionality.

Lack of Road Functionality Standards

Functionality standards are ideal for insurance of absolute minimum level of traffic safety and operations. The lack of road functionality standards in Rwanda has the following negative impacts:

- Lack of proper connectivity between different areas;
- Reduction in operational speed;
- Increase in traffic operation interferences; and
- Increase in traffic conflict - a major source of traffic accidents; among others.

Lack of Minimum Road Access Standards

The concept of access classification and their management has been provided in this Section. The following gaps have been identified with respect to access management practices in Rwanda:

- Inadequate Access Spacing
  
  Lack of adequate separation between adjacent accesses can impact negatively on the functional area of each access.

- Lack of Movement Separation at Accesses
  
  It is also good engineering practice to accommodate all traffic movements at an intersection for all road users. Furthermore, where traffic movement separation is warranted, they need to be provided as well. There are three type of access that can be permitted onto any public road. They include:
  
  - Full intersection, where all movements are allowed;
  - A partial access, where only right-in, right-out and left-in movements are allowable; and
  - A marginal access, where right-in and right-out movements are permissible.

- Inadequate Sight Distance
  
  Three sight distances need to be met to ensure safe operations at accesses. They include:
  
  - Stopping sight distance is required to allow road users accessing an intersection or those on a public road to stop adequate once a hazardous incident has been spotted;
  - Decision sight distance is required, especially at accesses that are controlled by traffic signals; and
  - Gap acceptance sight distance allows those road users who want to join a stream of traffic on the public road to do so safely and with limited disruption to flow of traffic on the public road.

Further to the three sight distances required at an access, sufficient sight distances needs to be provided on the different topography to allow safe operations at accesses provided on either vertical and horizontal curves. Map 3-6 provides a snapshot view of impact of the topography on road access.

The following observations are provided from Map 3-6:
• The Northern, Southern and Western Provinces have mountainous area. Provision of adequate sight distance in these regions need great care as both vertical and horizontal curves will be necessary to navigate roads found in the area. Care should be taken to allow adequate manoeuvring at horizontal curves;

• Rolling sections are found throughout the network. They impact stopping sight and gap acceptance sight distances more than the decision sight distance. Care should be taken to provide controlling elements like limiting access on very steep gradients; and

• The requirement of Road Access Management Administration

An efficient road access administration system will be required to complement the road access management and its implementation. Road access management involves various tasks like (1) record keeping of road accesses; processing of access applications and issuing of road access permits; and (2) inspection of accesses and enforcement of standards and requirements.

To address road classification and access management issues identified, the following mitigation measures are proposed:

**Table 3-7: Mitigation Measures to ensure Road Classification and Access Management in Rwanda**

<table>
<thead>
<tr>
<th>Project</th>
<th>Project Objective</th>
<th>Proposed Implementation Timeframe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rwanda Road Classification</td>
<td>The purpose of this project would be the following:</td>
<td>Short-Term</td>
</tr>
<tr>
<td></td>
<td>• Approach for access application;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Approach to issuing of access permits;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Approach to inspection and monitoring of accesses; and</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Development of the appropriate administration body to manage all access management mandates.</td>
<td></td>
</tr>
<tr>
<td>Development of a Road Access Management System for Rwanda</td>
<td>The purpose of this project would be to develop a systematic approach to control of location, spacing, design and operations at accesses.</td>
<td>Medium-Term</td>
</tr>
<tr>
<td>Development of Rwanda’s Road Access Management Administration</td>
<td>The purpose of this project would be to complement the management and administration of the proposed Roads Access Management System for Rwanda. Aspects included in this project should include:</td>
<td>Medium-Term</td>
</tr>
<tr>
<td></td>
<td>• The optimum administration structure to management and implement the road access management system;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Appropriate approach to access application;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Appropriate approach to issuing of access permits; and</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Appropriate approach to inspection and monitoring of accesses.</td>
<td></td>
</tr>
</tbody>
</table>

3.2.2.6 Recommended Strategy

The methodology to be followed to classify the road network on a strategic level will involve the inclusion of primary - and secondary roads. The process to be followed to arrive at a conclusion is summarised in Figure 3-7.
The existing road classification, the classification in the act and the available data of the road network needs to align in order to provide an effective and workable classified road network that can be linked to standards and specifications for roads that the Rwanda government can afford and implement in the foreseeable future, which are:

- Currently the only road network indicates three classes, namely primary, secondary and tertiary roads with no formal functional definition or characteristics.
- The 2008 Road Classification Act defined the road classes as described in Table 3-3
- The 2011 Road Act regulates the National Road Network and gives road classes with characteristics and/or definitions that must be taken into account (Refer to Table 3-8).

**Table 3-8: Road Classes Identified in the Road Act, 2011 to Regulate the National Road Network**

<table>
<thead>
<tr>
<th>Class</th>
<th>Description</th>
<th>Minimum Road Width (m)</th>
<th>Minimum Road Reserve Width (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>National Roads</strong></td>
<td>These are:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. International roads that links Rwanda with a neighbouring state;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>or</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Roads that link Districts or a District and the City of Kigali.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Roads that link areas of tourist significance and facilities of national</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>or international importance such as ports or airports.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The minimum viable widths of roads, the District and City of Kigali Roads</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>not including the side drains and embankments shall be 7 meters.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The road reserve on which run National roads, District and City of Kigali</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>roads -category 1, is delimited by two parallel lines at twenty two (22)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>meters on each side of the centre line of the road.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>District and City of Kigali Roads – Category 1</strong></td>
<td>These are roads with a local significance linking different headquarters of Sectors within the same District, or within the same Sector.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The minimum viable widths of roads, the District and City of Kigali Roads</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>not including the side drains and embankments shall be 7 meters.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The public reserve on which run District and City of Kigali roads -category 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>shall be of not less than 12 meters on each side from the centre line of the road.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>District and City of Kigali Roads – Category 2</strong></td>
<td>These are arterial roads that connect District Roads category 1 to community centres.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The minimum width of District and City of Kigali Roads Category 2 of shall be 5 meters.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Around and at the entrances of towns, communities or villages, the width of roads should be increased as the need shall be.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Over and above this width, each road should have the necessary land extension for drainage ditches, embankments, and areas for</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The public reserve on which run District and City of Kigali roads -category 2 shall be of not less than 12 meters on each side from the centre line of the road.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Class | Description | Minimum Road Width (m) | Minimum Road Reserve Width (m)
--- | --- | --- | ---

storage of materials and, if there is space for sidewalks, which constitute integral part of the road.

Specific road | These are roads specifically constructed to connect National Roads and District Roads to the centres of agricultural production, natural resources or to tourist sites that ensure linkages within the City of Kigali. | Not specified. | Not specified.

For the purpose of this national strategic document, only national and district roads will be dealt with as this fall within the scope of the RSTMP. According to the descriptions in Table 3-8, this will include the National Roads and the District and City of Kigali Roads – Category 1 which are indicated in Map 3-9.

As can be seen the primary roads align perfectly with the National Roads, whilst the secondary roads align perfectly with the District and City of Kigali Roads – Category 1 (from hereon to be referred to as Category 1 roads).

The National and Category 1 Roads, as per the newly defined road classes of the Road Act 2011, as shown on Map 3-9 align perfectly with the initial primary and secondary roads. Furthermore, taken additional known characteristics of the Rwanda road network into account (refer to Map 3-7 and Map 3-8) and linking the importance of these characteristics back to the classified roads of Map 3-9, it is clear that the classification of National and Category 1 roads also aligns.
Map 3-7: Public Transport Routes and International Corridors
Map 3-8: Traffic Volumes, Freight Volumes and Existing Road Class (Primary and Secondary)
Map 3-9: Road Network According to the Classes of the Road Act 2011
3.2.3 Regional and National Standards

Road transport plays a fundamental role in the social and economic development of Rwanda and its neighbouring countries. In most of the countries in Africa it provides the dominant mode of freight and passenger transport and carries a large portion of the continent's total trade in goods, passengers and other services.

The primary objective of any transport system is to transport people and freight safely and efficiently from the place of origin to a destination of choice utilizing a specific mode of transport and in some instances more than one mode. The functions and activities necessary to perform this primary task collectively constitute the transport system. The transport system represents the derived demand for the conveyance of passengers and freight utilizing various modes of transport and hence the reason for the system's existence.

As depicted in Figure 3-8 below and to perform the transport function, any mode-specific transport system requires two major sub-systems:

- the **infrastructure sub-system** providing all the physical facilities (including functional operation) to accommodate the safe and efficient operation of transport facilities;
- the **operations sub-system**, comprising all transport service delivery functions involved to ensure a safe and efficient movement of passengers and freight between points A and B while utilizing associated transport infrastructure.

The two sub-systems operate within a **transport environment** which comprises road, rail, maritime, inland waterways, aviation and pipelines. Governing these systems are **laws, regulations, standards and procedures**.

**Government authorities** will be responsible for the enabling framework consisting of policy, legal and institutional frameworks and affect the necessary oversight to ensure that requirements are achieved.

---

**Figure 3-8: The Transport System**

*Source: EAC Transport Strategy and Road Sector Development Program*

Each of the dimensions depicted in Figure 3-8 were evaluated in different working papers as part of the Rwanda Strategic Road Master Plan. However, the implementation of road standards, regulations and the enforcement thereof, needs to be considered based on the main issues identified in the analysis of the infrastructure and operations.
The main issues identified during the development of the master plan where standards can assist in the correcting of these issues are:

**Main Issues Identified where Standards can Assist:**

- Road access management along national roads that hampers the mobility function of the road,
- Posted speed along national roads at 80km/h due to accidents and the location of settlements along these roads,
- High number of accidents along classified road network,
- Road signage and markings to warn drivers of limited sight distance change on posted speeds, passing opportunities.

The identification of the institutional responsible department, the law that will govern the institution, and the legal set of regulations; first needs to be determined given the current regulation and institutional arrangements in Rwanda. The analysis methodology applied comprises an investigation into the:

- Vision of transport, set in the transport policy;
- Institutional arrangement – the implementation agencies and there powers;
- Current laws governing road transport;
- Standards and best practice currently implemented in Rwanda and in neighbouring countries; and
- Regional integration and harmonisation.

The following actions are required:

- Promulgate the National Road Network Law to be used to declare standards;
- Amend Road Traffic and Road Safety Act to include road safety strategy for Rwanda;
- Appoint service provider to investigate current best practice available in the EAC, COMESA and SADC to develop guidelines for the following areas (refer to Table 3-9):

**Table 3-9: Recommendations regarding Standards and Guidelines for Rwanda**

<table>
<thead>
<tr>
<th>Guideline Standard</th>
<th>Law / Act</th>
<th>Implementation Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geometric Design Standards for National and District Roads</td>
<td>National Road Network Law</td>
<td></td>
</tr>
<tr>
<td>Geometric Design Standards for unclassified roads and local streets,</td>
<td>National Road Network Law</td>
<td></td>
</tr>
<tr>
<td>Standards for culvert and bridge design per road classification</td>
<td>National Road Network Law</td>
<td></td>
</tr>
<tr>
<td>Pavement Design standards</td>
<td>National Road Network Law</td>
<td></td>
</tr>
<tr>
<td>Construction best practice including labour</td>
<td>National Road Network Law</td>
<td></td>
</tr>
<tr>
<td>Road Signs and Marking Manual</td>
<td>Road Traffic and Road Safety Act</td>
<td></td>
</tr>
<tr>
<td>Access Management Guideline</td>
<td>National Road Network Law</td>
<td></td>
</tr>
<tr>
<td>Road Safety Manual</td>
<td>Road Traffic and Road Safety Act</td>
<td></td>
</tr>
<tr>
<td>Road Safety Audit Manual</td>
<td>Road Traffic and Road Safety Act</td>
<td></td>
</tr>
<tr>
<td>Overload Control Policy and Standards</td>
<td>National Road Network Law</td>
<td></td>
</tr>
</tbody>
</table>
3.2.4 Rwanda Transport Policy Review

The Rwanda Transport Policy is aligned with its 2020 Millennium Vision which, inter alia, provides for modern transport infrastructure and cost effective and quality services with due regard to safety and environmental concerns. Infrastructure should be developed in a sustainable manner to support economic growth of the country, mobility of the population and serve as a “pivot” for exchange of goods and services at national and regional level.

Among the key objectives contained in the policy, the following are relevant in respect of regional integration:

- strengthen the institutional framework and capacity of transport institutions and stakeholders in the planning and management of the sector;
- reduce and control transport costs;
- assure the durability and quality of the rural, urban and international transport network;
- improve safety for goods and passengers in the principle modes of transport;
- increase mobility of the population in order to improve access to essential transport services;
- establish a system to ensure sustainable financing of road maintenance; and
- enhance Rwanda's integration into the regional economy and to make Rwanda a regional trade and transit centre.

The Policy provides for principle “strategic axes” to guide the actions that will be necessary to give effect to the objectives. Strategic axes of importance to regional integration are:

- private sector to play a more important role in developing infrastructure;
- participation of local communities in maintenance of roads;
- support from decentralized entities that can assume their responsibilities in the management of the sector within the framework of established policies;
- taking into account regional dimensions and processes of integration currently in progress in order to develop a transport sector that will benefit from opportunities offered and which respond to the challenges of the regional context; and
- reinforcement of the human resource capacities to build a viable transport sector.

The policy implementation strategies and programmes are motivated by principle planning instruments that will guide the medium and long-term development of the transport sector. Definitive priority actions have been defined in respect of the development and improvement of economic infrastructure, enhancement of transport safety, sustainable development and consultation with partners and the associated allocation of roles and responsibilities.

As discussed in Working Paper 01, the law required for the implementation and enforcement of road design and maintenance standards already exist in Rwanda. These laws need to be finalised, updated and amended per indication and promulgated in order to ensure effective enforcement and possible prosecution of non-compliers.

3.2.5 Road Quality Management System / Integrated Road Network Management Systems

A road network in its entirety is an important asset that needs to be looked after (managed) and by disregarding its importance and upkeep will result in unnecessary and otherwise avoidable costs to a country's economy due to increased vehicle operating costs, higher accident rates, longer travel times, transport damage, etc.

Management and specifically a Management Framework is very important and enable management decisions to be made in a structured manner that is logical and consistent. It provides guidance on the type of decisions that must to be made, the purpose of those decisions, who needs to make them, when must they be made, the information needed to make the decisions, etc. A Management Framework, when looking at roads, can therefore assist in improving the quality of decision-making, and can result in greater effectiveness and efficiency for both customers of the road network and the road administration (Robinson, 2000).

An idealised Management Hierarchy can be demonstrated as follows:
There are limited definitions specifically for defining an Integrated Road Network Management System (IRMS) due to the numerous systems that form part thereof (ranging from Pavement Management Systems, Asset Management Systems, Road Safety Management Systems, Bridge Management Systems, Congestion Management Systems, etc.

An Integrated Road Network Management System (IRNMS) is therefore identified in the transport industry as the management system that brings all road management systems together, and can be defined as:

‘An all-encompassing framework, including both information processing and human resources, for the integrated management of the road network, including the determination and optimisation of the economically warranted projects, programmes, strategies and budgets, for both development and maintenance.’ – (Tekie, 2005)

An IRNMS is therefore an essential component of a country’s road network and a crucial tool that allows decisive decisions to be made based on accurate information.

Integrated Road Network Management requires a comprehensive understanding of all elements involved in the roadway environment and the users interacting with this environment.

This section aims to provide a broad description of an IRNMS and its important components. Furthermore, this section will identify key Management Systems (as part of the IRNMS) that are required urgently to be implemented within Rwanda in order to provide a sound foundation that will enable decision makers to manage the Rwanda Road Network effectively and efficiently.

An IRNMS is broadly structured around two (2) imperative systems or components, namely:

- Information System: An Information System collects, organises and stores data about the Road Network.
- Decision-Support Systems: Decision-Support Systems comprise of application modules that enable the processing of the data and provide the information on which decisions can be based and, ultimately, implemented. Decision-Support Systems are generally defined further in terms of the following:
  - Planning;
  - Programming;
  - Preparation; and
  - Operations.

---

1 It is important to note that an Information System caters specifically for a specific organization that deals with a specific road network of a country. For example the South African Roads Agency Limited (SANRAL) as per their mandate is only concerned with the National Roads of South Africa and therefore their Information System collects, stores, and organizes information regarding all National Roads of South Africa. In the case of the RSTMP therefore, such a Road Network Information System would contain information with regards to the EAC Road Corridors and Corridor Feeders located in Rwanda as well as National Roads of Rwanda.
Based on the above, an IRNMS is therefore founded on the following management levels or functions (refer to Figure 3-9):

- Road Network Information;
- Planning;
- Programming;
- Preparation; and
- Operations

**Figure 3-9: An IRNMS Management Structure**

With regards to Figure 3-9 above, the following detail is provided:

- **Road Network Information**
  
  A Road Network Information System, as defined above, containing data about the Rwanda Road Network and is central to Management Systems that form part of an IRNMS such as, but not limited to, for example, Pavement Management Systems, Bridge Management Systems, Traffic Management Systems, Road Safety Management Systems, etc.

- **Planning**
  
  Decision-support system for strategic planning undertaken to develop long term plans for the Rwanda Road Network as a whole; planning time horizons typically of five years or more; undertaken to determine what are the implications resulting from meeting objectives in terms of future budget needs, consequential pavement conditions, user costs, etc.

- **Programming**
  
  Decision-support system for tactical planning or programming concerned with determining need in the budget year; planning time horizons of one to three years; including identification of links or sections
from the network which require treatment and the timing of treatments, possibly in conjunction with a rolling programme; cost estimating, prioritisation, budgeting, monitoring.

- **Preparation**
  Decision-support system for project preparation, including project formation and design, costing, works order or contract preparation and issue.

- **Operations**
  Decision-support system for the management of operations on a daily or weekly basis, including defining work to be carried out, developing appropriate costs for this in terms of labour, equipment and materials, and making arrangements for carrying out the work by force account or by contract, the recording of work accomplishment, and the use of this information for monitoring and control.

### 3.2.6 Overload Control Programme

Road transport plays a fundamental role in the social and economic development of many developing countries. In the EAC region and in the individual member states, it provides the dominant mode of freight and passenger movements and carries between eighty and ninety percent of the region’s total trade in goods and services. **In Rwanda freight movements alone account for approximately 7,100 tons per day by road.**

Therefore, in order to attain acceptable levels of road transport efficiency, the management and maintenance of road infrastructure and assets form an important part of development programmes.

Road infrastructure represents huge investments for any country. To protect these assets against misuse and damage, individual countries have promulgated Road Traffic Acts that stipulate permissible axle load, axle group combinations and vehicle dimensions. These limits are meant to ensure that roads last for their full design life with normal maintenance expenditures. In addition, control of axle loads to prescribed limits can be justified for the following reasons:

- ensuring a level playing field between transporters
- limiting the extent of road maintenance required
- improving road safety

Laws and regulations to control overloading have been in existence in Sub Sahara African countries for more than 40 years, and have been changed and updated over the years to reflect the changing circumstances of the road transport industry. During the same period the road transport vehicles have grown in size and road transport has increased with the removal of the protection of railways in some countries and the liberalisation of the economies.

A gradual but marked shift from rail to road in the 1980s became more rapid in the nineties and into the current century. Smaller trucks were substituted with today’s interlinks and super-links. Axle load control and enforcement of legal loads have only in very few of the Sub Sahara African countries kept pace with this development of road transport.

Most road pavements are designed to carry a range of ‘standard’ (8.2 tonne) axles over a period of time. The number of ‘Equivalent Standard Axles’ (ESAs) is determined with respect to the type of traffic expected to use the road over its design life. The AASHO road tests established that the life of a given road is approximately proportional to the fourth power of the axle load for the same number of passes.
Table 3-10 illustrates the effect of Axle Load on the design life of a pavement that is loaded above a limit of 10 tonnes for varying power exponents.

Table 3-10: Effect of Axle Loads on Pavement Life

<table>
<thead>
<tr>
<th>Design Axle Load (Tonnes)</th>
<th>Carried Axle Load (Tonnes)</th>
<th>Equivalence Factor</th>
<th>Pavement Life (years) for Varying Power Exponent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>n = 4.0</td>
<td>n = 4.5</td>
</tr>
<tr>
<td>10.0</td>
<td>10.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>10.0</td>
<td>11.0</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>10.0</td>
<td>12.0</td>
<td>2.1</td>
<td>2.3</td>
</tr>
<tr>
<td>10.0</td>
<td>13.0</td>
<td>2.9</td>
<td>3.3</td>
</tr>
<tr>
<td>10.0</td>
<td>15.0</td>
<td>5.1</td>
<td>6.2</td>
</tr>
</tbody>
</table>

Source: EAC Transport Strategy and Regional Roads Sector Development Program, Africon, 2010

The above table indicates, for example, that a single axle that is overloaded by just 20% over a limit of 10 tonnes, i.e. loaded to 12 tonnes, with an assumed power exponent of 4.0, has just over twice the damaging effect (equivalence factor = 2.1) as a legally loaded vehicle. Moreover, if the pavement were to be continually subjected to such overloading, its life would be reduced from 20 years to just less than 10 years! It is noteworthy that the effect of the Fourth Power Law on weak pavements can be catastrophic, whilst the effect does not apply significantly to over-designed pavements or gross vehicle mass.

The effect of the exponential relationship is that most road wear is caused by vehicles with more heavily laden axles; (refer to Figure 3-11) and a disproportionate share of road wear will be caused by overloaded vehicles.
As the size of a load approaches the design strength of a pavement or bridge, the effects of the load will be more significant. In these cases, a small number of passages of the load can cause significant structural damage. In an extreme case, a single passage of a grossly overloaded vehicle could cause catastrophic failure.

The marginal cost associated with an overloaded vehicle on a road comprises three main components:

- The increase in transport cost to other vehicles as a consequence of the overloading. This increase in transport cost reflects that the deterioration caused and results in increased costs for operating the vehicle and lower speeds, resulting in higher time costs. This increase is due to higher time cost incurred as a result of lower operating speeds necessitated by deteriorating roads.
- Assuming that routine maintenance actions are condition responsive, overloaded vehicles on a road would lead to earlier and more frequent routine maintenance interventions.
- Overloading will lead to the road authority remedying the damage by way of periodic maintenance actions or reconstruction at an earlier date than would have been the case without the additional vehicle.

The Overload Guidelines Document (Synthesis Report and Guidelines on Vehicle Overload Control in Eastern and Southern Africa, SSATP, March 2010), provide comprehensive guidance to practitioners and officials tasked with Overload Control in the region to enable them to address most infrastructural and operational issues relating to weighbridges in particular and overload control in general.

In summary, the guidelines cover aspects such as:

- Selection, installation and operation of weighbridges
- Data collection, analysis and reporting
- Private sector involvement and financing mechanisms
- Cross border overload control, and
- Training of weighbridge personnel.
The above guidelines, as distinct from manuals, are of a generic nature in that they provide guidance to practitioners on the various aspects of overload control indicated above. Such guidance will need to be customised to the specific environment in which it is being applied and which will vary significantly between the various member countries of the EAC.

In order to expedite the harmonisation of axle load limits and vehicle dimensions, this section gives some comparison of the status quo, explains some of the most important work done to optimise limits in the SADC region and recommends limits to be adopted.

The recommended axle load and gross combination mass limits for the SADC Regional Trunk Road Network (RTRN) are based on a study for Southern Africa which was carried out in 1993 to determine the optimum axle load limits, i.e. such axle loads and weights that will minimise the total transport cost on a regional basis in the SADC region. This concept is illustrated in Figure 3-12 which shows the various inter-acting elements in relation to the derivation of the optimum axle load limits.

![Figure 3-12: The concept of the Economic Axle Load Limit](image)

Source: EAC Transport Strategy and Regional Roads Sector Development Program, Africon, 2010

The important assumption used in the SADC study is that axle load regulations should be based on a trade-off between road haulage cost and costs related to road and bridge wear. Simply stated, this means that axle loads and gross vehicle weights should be increased to the point where the savings to the hauls affected from a further increase is less than the increase in costs due to the additional wear on roads and bridges. The analysis was undertaken using the World Bank’s Highway Design and Maintenance Standards Model (HDM-III).

Based on the outcome of the HDM-III analyses, the regional optimum single axle load limit was determined as 13.0 tonnes. However, based on consideration of the axle load Economic Efficiency Frontier, in terms of the benefits versus costs of increasing from the prevailing limits to the optimum limit (refer to Figure 3-13 and Table 3-11), the harmonised limits recommended for the region were less than the optimum limits, as shown in Table 3-11.
In addition to axle load economic efficiency considerations, there were a number of other reasons for recommending limits which were less than the optimum limits. These included the large proportion of sub-standard pavements, a significant amount of backlog maintenance and concern over the adequacy of future maintenance funding. In the event, the recommended regional axle load and gross combination mass limits for the SADC region are as follows:

**Table 3-12: SADC recommended harmonised axle load limits**

<table>
<thead>
<tr>
<th>Maximum Axle Load Limits (Tonnes)</th>
<th>Gross Combination Mass (GCM) (Tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Steering</td>
<td>Tandem</td>
</tr>
<tr>
<td>7.7</td>
<td>10</td>
</tr>
</tbody>
</table>

### 3.2.6.1 Summary of EAC Recommendations and the Way Forward

As could be seen from the above, there are many issues surrounding the topic of Overload Control; some are multifaceted. This section seeks to prioritise and summarise the recommendations in a manner to guide decision makers as to the short and medium term programme priorities.

As a first priority the EAC region and each member state should respectively commission the compilation of an OLC strategy. The EAC region needs to have an overarching regional Overload Control strategy based...
on the work done and reported above. Each country should commission and implement a country specific Overload Control strategy. The reason for each country needing to do this separately, is to ensure that each country identifies and addresses the unique situation prevalent in the country, e.g. some countries need to make legislative changes and others not, some need to establish new institutional vehicles and others not, and different countries need to make different changes to policies to fall into a harmonised whole. These policies will guide the actions that follow.

The second priority, flowing from the first, should be the harmonisation of axle load limits and vehicle dimension standards. Some proposals with the rationale behind them are included above. Furthermore, there is a great variation in vehicle types in use in the region. This makes it extremely difficult to design scales and software to handle all possible options. A logical consequence of the above would thus be to guide the registrations of new vehicles to eliminate too many variations over time.

A third priority should be agreements to establish smoother cross-border operations in order to reduce the OLC effort required at border posts.

A further priority should be the standardisation of weighing equipment, procedures and interpretation of enforcement guidelines leading to integration of data collection and collective reporting. This cannot be done without training according to region-wide standardised training programmes. An economy of scale is then also possible for proper preventative maintenance regimes, calibration requirements and human resources resulting in lower life cycle costs.

Other priorities to establish a stable and sustainable solution include the adoption of innovative contractual arrangements to involve private sector in the appropriate areas of the OLC initiative. Areas such as maintenance management, data collection and reporting are typical areas where private sector has proved to be beneficial and cost effective.

An aspect not to be under-estimated, is the value that public awareness adds to the whole initiative. It entails the education and encouragement of all the parties involved in the freight industry to see the benefits and to contribute to a better future that is sustainable, fair and more cost effective for all.

Lastly there are a number of other technical issues that are of a lesser importance to gain momentum, but are important in the long term sustainability of the initiative, such as: policies on excess cargo imports, abnormal loads, licensing of transporter associations, the use of unconventional technology for the detection of overloading and weight distance charging.

3.2.6.2 Overload Control Recommendations Specific to Rwanda

Given the EAC recommendations and proposals identified in the previous section, the following OLC recommendations are identified specifically for Rwanda:

- Rwanda should align OLC with that of the EAC (i.e. harmonise axle load limits and vehicle dimension standards; guide registrations of new vehicles to eliminate variations over time);
- Rwanda should commission and implement a country-specific Overload Control Strategy in order to ensure that the unique OLC situation prevalent in Rwanda and thereby identify associated requirements are identified and addressed;
- Expedite the process of establishing agreements that will ensure smoother cross-border operations;
- Expedite the process of standardising OLC weighing equipment, procedures and interpretation of enforcement guidelines leading to integration of data collection and collective reporting.

3.2.7 Road Freight

The Rwanda Road Freight Network can be classified into two types that operate within the country – domestic goods or localised freight (refer to Table 3-13) as well as exporting goods or long haulage freight transport (refer to Table 3-14).

Table 3-13: Illustration of Domestic Goods Freight

<table>
<thead>
<tr>
<th>Domestic distribution of goods is characterised as follows:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Small plots farms, with the capacity to produce small quantities of crops, make use of middle-men transporting goods from farms to markets. Potential mode of heavy vehicle used includes pick-up trucks.</td>
</tr>
<tr>
<td>• For farmers who cannot afford middle-men services, loads are transported by head loading or non-</td>
</tr>
</tbody>
</table>
motorised transport. Potential mode of transport used in these instances includes animal drawn carts as well as hand-held carts.

**Table 3-14: Illustration of Long Distance Haulage Freight**

With respect to distribution of goods destined for long-distance haulage the following are observed:

- Produce destined for exporting are brought into regional intermediary warehouses for preparation by the middle-men or a third party.
- Larger shipments are transported further to Kigali for transportation to markets external to Rwanda.

The following observations are made:

- Domestic distribution of crops at rural level needs transportation from small plots of farms to provincial intermediary warehouses.
- Small pick-up trucks are the preferred mode of transport for movement of short distance delivery.
- For larger consignments transported from provincial intermediary warehouses to Kigali as well as from Kigali for exporting of goods, larger trucks are used for goods transportation.

With regards to the current road freight network, the following are observed (refer also to Chapter 5: Transport Demand Model):

- Primary freight movement is observed on the RN1 (Huye – Muhanga – Kigali) as well as the RN3 (Kigali to Rwamagana).
- Secondary movement of freight is observed as follows:
  - The RN5 from Nyagatare to Kanyonza as well as from Kanyonza to Ngoma;
  - The RN2 from Kigali to Gicumbi;
  - The RN31 from Kigali to Musanze and the RN4 from Musanze to Ribavu;
  - The RN11 from Muhanga to Ngororero;
  - The RN7 from Muhanga to Karongi;
  - The RN15 from Kigali to Nyamata; and
  - The RN6 to Huye.

According to Rwanda's Diagnostic Integration Study (2005, p.28 - 31) road-freight operations have the following constraints:

- The road-freight market in Rwanda is very small and there are few transport operators.
- Rwanda is constrained from accessing global markets due to high transport costs as well as delays.
- Rwanda depends on quality of transport and transport procedures on corridors. Optimising Road-Freight Operations

The observations from current freight movement show three broad road-based freight operations, namely **intra provincial freight movement** (i.e. short-haulage); **inter-provincial freight movement** (i.e. intermediate-haulage) and **regional freight movement** (i.e. long-distance haulage from Rwanda to other regional centres in neighbouring countries).

### 3.2.7.1.1 The Freight Activity Nodes

Observed road-based freight operations within Rwanda (also captured in Working Paper 03: Calibration, Validation and Application of the Transport Model) depicts the following economic centres; which will constitute freight activity nodes within Rwanda:

<table>
<thead>
<tr>
<th>Region</th>
<th>Eastern Province</th>
<th>Southern Province</th>
<th>Western Province</th>
<th>Northern Province</th>
<th>Town of Kigali</th>
</tr>
</thead>
</table>

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Over and above these economic centres the following specific freight zones are anticipated within the jurisdiction of the Town of Kigali as well as the Eastern and Western Provinces:

- The Free Zone (Town of Kigali Province);
- The Kigali International Airport (Town of Kigali Province);
- The Bugusera International Airport (Eastern Province);
- Kagitumba Maritime Zone (Eastern Province);
- Karongi Maritime Zone (Western Province);
- Rubavu Maritime Zone (Western Province); and,
- Rusizi Maritime Zone (Western Province).

### 3.2.7.1.2 Freight Transport Supporting Infrastructure

There are three types of road-based freight transport infrastructure that greatly impact road freight transport services, namely cross-border posts; weighbridges and truck stops / roadside stations.

#### Road-Based Border Posts

Currently there are seven road-based border posts in Rwanda as follows:

<table>
<thead>
<tr>
<th>Border Post</th>
<th>Province</th>
<th>Neighbouring Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rusumo</td>
<td>Eastern Province</td>
<td>Tanzania</td>
</tr>
<tr>
<td>Nemba</td>
<td>Eastern Province</td>
<td>Burundi</td>
</tr>
<tr>
<td>Kagitumba</td>
<td></td>
<td>Uganda</td>
</tr>
<tr>
<td>Gatuna</td>
<td>Northern Province</td>
<td>Uganda</td>
</tr>
<tr>
<td>Cyanika</td>
<td></td>
<td>Uganda</td>
</tr>
<tr>
<td>Gisenyi</td>
<td>Western Province</td>
<td>DRC</td>
</tr>
<tr>
<td>Cyangugu/Rusizi</td>
<td>Western Province</td>
<td>Burundi/DRC</td>
</tr>
<tr>
<td>Akanyaro</td>
<td>Western Province</td>
<td>Burundi</td>
</tr>
</tbody>
</table>

The concept of “One-Stop Border Post” has been identified at Rusumo, Akanyaru, Kagitumba and Gatuna. It is proposed that the remaining border posts be assessed in terms of upgrades required and the feasibility of upgrading to “One-Stop Border Post”.

The minimum standards stipulated in the East African Community’s proposed One Stop Border Post Bill of 2010 should be adhered to.

#### Truck Stops / Roadside Stations

A Truck Stop is an establishment, usually located near a busy road, with a large parking area for trucks and other heavy vehicles. The stop usually offers a range of services for professional truck drivers to rest and refresh themselves, often with accommodation and other services available. The traffic model developed for Rwanda indicated the following with respect to road-based freight traffic:

- There are currently about 660 trucks moving along the road network on a daily basis, with the 50% increase expected in ten years.
The population of trucks sold in Rwanda in the six years spanning from 1995 to 2000 was just over 39,000 trucks (refer to Table 3-16 below).

### Table 3-16: Registered Heavy Vehicles in Rwanda (1995-2000)

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pick-up Truck</td>
<td>9,722</td>
<td>7,825</td>
<td>4,996</td>
<td>9,118</td>
<td>1,209</td>
<td>443</td>
<td>33,313</td>
</tr>
<tr>
<td>Trucks</td>
<td>164</td>
<td>407</td>
<td>738</td>
<td>927</td>
<td>1,025</td>
<td>1,116</td>
<td>4,377</td>
</tr>
<tr>
<td>Trailer / Lorry</td>
<td>67</td>
<td>164</td>
<td>266</td>
<td>355</td>
<td>397</td>
<td>464</td>
<td>1,713</td>
</tr>
<tr>
<td>Total</td>
<td>9,953</td>
<td>8,396</td>
<td>6,000</td>
<td>10,400</td>
<td>2,631</td>
<td>2,023</td>
<td>39,403</td>
</tr>
</tbody>
</table>

Source: Ministry of Finance and Economic Planning 2003

The rate of accidents that involve trucks in Rwanda is not known. However the number of accidents has been increasing since 1996 (refer to table below). One of the factors that have been identified as contributing to accidents involving heavy vehicles worldwide include the problem of fatigue, especially for truckers that travel long distances to transport goods.

### Table 3-17: Number of Traffic Accidents and Fatalities (1996-2002)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Accidents</td>
<td>1,624</td>
<td>2,795</td>
<td>3,181</td>
<td>3,824</td>
<td>3,490</td>
<td>3,780</td>
<td>4,344</td>
</tr>
<tr>
<td>Injuries</td>
<td>766</td>
<td>2,319</td>
<td>2,091</td>
<td>2,863</td>
<td>2,787</td>
<td>2,846</td>
<td>3,474</td>
</tr>
<tr>
<td>Deaths</td>
<td>96</td>
<td>574</td>
<td>562</td>
<td>437</td>
<td>401</td>
<td>393</td>
<td>451</td>
</tr>
<tr>
<td>Total</td>
<td>2,486</td>
<td>5,688</td>
<td>5,834</td>
<td>7,124</td>
<td>6,678</td>
<td>7,019</td>
<td>8,269</td>
</tr>
</tbody>
</table>

Source: Ministry of Finance, 2003

There is therefore a need for convenient, safe and comfortable truck stops / roadside stations on all major road freight routes around Rwanda.

The following are minimum standards required at a Truck Stop:
- Ample parking space for trucks and other heavy vehicles;
- Accommodation facilities;
- A place to purchase food and other refreshments; and,
- Ablution facilities for those not making use of accommodation facilities.

Over and above the minimum requirements stipulated above, it is imperative for the Ministry of Transport to also consider the following:
- There should be government legislation that forces drivers to stop between 11pm and 5am for compulsory rest.
- More safe and clean truck stops / roadside stations are needed. Alternatively, along the route there should be lay-bys constructed with stadium lights and security so that drivers can sleep in relative safety.
- Drivers need to attend regular driver training courses to improve their skill as well as stop complacency. Further, there should be relevant training courses for truck drivers that carry specialized/ dangerous goods e.g. chemicals.
- The transfer of HIV/ Aids and sexually transmitted infections is a growing concern in the transport industry. These threats can only be addressed by way of the partnerships of society: government and
the private sector; workers and management; transport operators and commuters. Truck stops / roadside stations can be an important part of the strategy to protect Truck Drivers against these and other illnesses and provide information on these risks.

Truck Stops / Roadside Station Studies are proposed at the following locations:

- At, or in close proximity to Rusizi and Cyangugu;
- At, or in close proximity to Huye;
- At, or in close proximity to Muhanga;
- At, or in close proximity to Gisenyi;
- At, or in close proximity to Musanze;
- At, or in close proximity to Gicumbi;
- At, or in close proximity to Nyagatare;
- At, or in close proximity to Kayonza;
- At, or in close proximity to Ngoma.

**Weighbridges**

The overload control guidelines document, recently completed, provides comprehensive guidance that addresses infrastructural and operational requirements relating to weighbridges (refer to Section 3.2.6). The following locations are proposed for Weighbridges:

- At, or in close proximity to, Katuna/Gatuna Border Post in the Northern Province;
- At, or in close proximity to, Cyanika Border Post in the Northern Province;
- At, or in close proximity to, Gisenyi Border Post in the Western Province;
- At, or in close proximity to, Cyangugu Border Post in the Western Province;
- At, or in close proximity to, Akanyaro Border Post in the Western Province;
- At, or in close proximity to, Rusumo Border Post in the Eastern Province;
- At, or in close proximity to, Kagitumba Border Post in the Eastern Province;
- At, or in close proximity to, Nemba Border Post in the Eastern Province;
- On the RN11 north of Muhanga at border of Southern and Western Province;
- On the RN3 at Kayonza in the Eastern Province;
- In close proximity to Rusizi and the industrial activities in the area.

For weighbridges located at or close to the proximity of One Stop Border Posts a concept of a separate freight facility coupled with a weighbridge facility needs to be considered. This can be supported by freight by-passes at the one stop border post facility.
By-Passes along Road Freight Network

The purpose of a road-freight by-pass is to restrict movement of freight vehicles by re-directing it from a focal point like a city centre. It is aimed at minimizing the need for a freight vehicle to travel through a focal point (such as a city centre) thereby optimizing the safety of a city centre as well as optimizing travel time (whereas travel time is minimized when travelling through a city centre when freight is not destined for that city centre). There are three road-based ring roads being proposed for Rwanda as follows:

- **Within the Town of Kigali Province:** a ring road around the City of Kigali is being proposed to allow movement of freight outside the jurisdiction of the city. The ring road needs to connect the Freight Trade Zone as well as other proposed freight facilities (i.e. truck stop; Kigali International airport and the proposed Bugesera International Airport) to the main freight corridors.

- **Within the Southern Province:** a bypass is proposed in the proximity of Muhanga and Huye towns to divert heavy vehicle traffic from the area of influence of the towns. The bypasses need to connect the proposed freight facilities (i.e. weighbridges and truck stops / roadside stations) to the main freight corridors.

- **Within the Northern Province:** a bypass is proposed at the town of Musanze in order to bypass heavy vehicle traffic from the influence area of the town.

### 3.2.7.2 Envisioned Road-Freight Operations

The following elements of the road freight system need to be observed:

- **There are two primary corridors within Rwanda, which are aligned to the existing regional corridors (i.e. the Central as well as the Northern Corridor of the EAC).** These primary corridors include:
  - The corridor from Rusomu border – Ngoma – Kanyonza – Kigali – Musanze – Nyundu – Gisenyi border is the first primary freight corridor.
  - The corridor from Katuna border – Gicumbi – Kigali – Muhanga – Huye – Akanyaro border is the second primary freight corridor.

- **The profile of a primary freight corridor needs to include:**
  - These corridors need to enhance regional connectivity. To achieve regional connectivity the corridors need to operate in an efficient manner. This includes provision of the necessary freight-based facilities proposed along each corridor as well as providing adequate capacity. Capacity can
be enhanced by provision of climbing lanes where warranted as well as provision of ring-roads were proposed.

- Traffic volumes carried by these corridors need to be of national as well as regional importance. The corridors need to have substantial truck ADT to substantiate the investment that will be made to ensure mobility.
- Speed limits are in place that to support mobility.
- Vehicular mix is mostly limited to motorised transport.

- Motorised vehicles allowed on a primary freight corridor include abnormal vehicles\(^2\); heavy vehicles\(^3\); light vehicles\(^4\); and, trailers\(^5\). Examples of these are shown below:

\[\text{Table 3-18: Illustration of Different Road Freight Vehicles}\]

<table>
<thead>
<tr>
<th>Heavy Vehicle</th>
<th>Light Vehicle</th>
<th>Trailers</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="https://example.com/image1.png" alt="Image" /></td>
<td><img src="https://example.com/image2.png" alt="Image" /></td>
<td><img src="https://example.com/image3.png" alt="Image" /></td>
</tr>
</tbody>
</table>

Source: Continuing Survey of International Road Haulage by UK Registered Vehicles

- The following corridors constitute secondary freight corridors:
  - Kagitumba border – Nyagatare – Kanyonza;
  - Kigali – Nyamata – Nemba border;
  - Musanze – Cyanika border;
  - Muhanga – Ngororero – RN4;
  - Muhanga – Karongi; and,

- The profile of a secondary freight corridor needs to include:
  - These corridors need to enhance provincial connectivity.
  - Traffic volumes carried by these corridors need to be of provincial importance.
  - Vehicular mix can include both motorised transport as well as non-motorised transport. It is therefore important that the accommodation of non-motorised transport is taken into account when designs are prepared.

- Motorised vehicles allowed on a secondary freight corridor include light delivery and trailers.

3.2.7.3 Freight Transport Service Integration

The proposed road-based freight transport system in Rwanda needs to be integrated with other four modes of freight transport, as follows:

- The envisaged rail line needs to be integrated with the road-based freight network. It has been further observed that a branch line might be required to connect road-based freight transport with rail-based freight movement at the Free Trade Zone;
- The envisaged air cargo services at both Kigali International and the proposed Bugesera International Airports;

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\(^2\) A motor vehicle that exceeds the legal dimensions.
\(^3\) A motor vehicle with at least one heavy axle (i.e. vehicles fitted with tyres of size greater than 406.4 millimetres).
\(^4\) A motor vehicle designed or adapted for conveyance of freight without no heavy axle.
\(^5\) A vehicle which is not self-propelled and which is designed or adapted to be drawn by a vehicle.
Waterway freight services at Lake Kivu (at Ribavu, Karongi and Rusizi) and the proposed Akagera River; and,

The proposed petroleum pipeline to the Free trade Zone.

Factors that impact freight transport services integration amongst different modes include:

- Facilities at nodes have to be standardised to provide efficient services;
- Accessibility to these nodes has to be developed or improved and transportation systems have to be integrated to attain inter-modality; and,
- The missing links connecting the nodal points to form the integrated freight transport system need to be confirmed and agreed to prior to development of the inter-modal nodes.

Rwanda is in need of a multimodal freight classification system that describes the design and function of freight routes and other freight facilities. The freight system for Rwanda needs to take into consideration road, rail lines, and freight facilities that include lake terminals, intermodal rail yards, airports, and pipeline terminals.

### 3.2.8 Road Safety

This section is aimed at establishing a foundation for Road Safety in Rwanda as part of the RSTMP, taking into account the latest road accident statistics as well as international best practices that relate to road safety in Rwanda. The outcome of this section is a proposed “High-Level” Road Safety Strategy for Rwanda and respective short-term implementation projects aimed at promoting a more functional and safer road network in the country. This section is therefore structured as follows:

- **Rwanda Road Safety Context** provides the status quo of aspects that influence and determine the context in which road safety has to be managed in Rwanda, i.e. the location, the vehicle fleet as well as an overview of current road accident rates in Rwanda and in neighbouring countries.
- **The Road Accident Statistics Overview** provides a brief overview of accident statistics worldwide and in Rwanda.
- **The Rwanda Road Safety Environment** sub-section contains information on the status of the road safety environment in Rwanda. It also highlights issues which have been identified during the course of the project and which need to be addressed in the Road Safety Strategy.
- **The Incident Management System (IMS)** sub-section provide an introduction to IMS and identifies what is involved and the prerequisites of an IMS in order to minimize the direct and secondary effects of accidents, as well as to restore normal capacity and safety levels to all affected road facilities as quickly and efficiently as possible;
- **The proposed “High-Level” Road Safety Strategy** sub-section proposes mitigating measures for the challenges identified in the previous sections, by using common interventions on road safety and road safety related infrastructure as well as education and communication strategies and programmes. These aspects, are addressed under the following Pillars, as per the **UN Global Plan for the Decade Action for Road Safety 2011 - 2020**:
  - Road Safety Management;
  - Safer Roads and Mobility;
  - Safer Vehicles;
  - Safer Road Users; and
  - Post-Crash Response or Emergency Services.
- Finally, the **Way Forward** summarises the proposed “High-Level” Road Safety Strategy projects for the implementation of the Rwanda Strategic Transport Master Plan.

### 3.2.8.1 Rwanda Road Safety Context

#### 3.2.8.1.1 Gross National Income (GNI)

When accident statistics are evaluated, the tendency is usually to compare a country’s statistics to those of neighbouring countries. Although it is often reasonable to do so, a factor which needs to be taken into...
account is Gross National Income (GNI). GNI provides an indication of a country’s income level and is therefore a reasonable indication of vehicle population and car ownership. Figure 3-15 compares Rwanda’s GNI to those of other low income countries. It shows that Zimbabwe and Niger have income levels comparable to that of Rwanda. Therefore, when accident rates are evaluated, it would be more meaningful to do a comparison of accident rates between these three countries (Rwanda, Niger and Zimbabwe).

Figure 3-15: Gross National Income – Low Income Countries, 2009
Source: World Health Organization (WHO)

3.2.8.1.2 Vehicle Fleet

Rwanda Revenue Authority has the mandate to register all vehicles in Rwanda. Since there is no manufacturing or assembling plant in the country, all vehicles were imported until 2004. An information system to record the registration of vehicles in the country was introduced in 2003. Prior to that, most data is outdated and should therefore be considered merely indicative of the evident vehicle population growth. More recent data could not be sourced at the time of this report.

The figures in Table 7-21 and figure are outdated and should therefore be considered merely indicative of the evident vehicle population growth. More recent data could not be sourced at the time of this report.
obtainable in hardcopy files only. Additionally, as of 2003, a new number plate system was introduced in Rwanda, which meant that all vehicles registered prior to that year, had to be re-registered. This process ran parallel with new vehicle registrations.

Since it was not possible to obtain data on the number of registered vehicles in Rwanda from local authorities, this section is based on data obtained from desktop research; therefore, for purposes of acceptability, all sources will be referenced accordingly.

Table 3-19 provides the number of vehicles registered in Rwanda between 1995 and 2000. From the data, it is evident that while fairly low, the vehicle fleet in the country has been increasing significantly from over 3,000 vehicles in 1995 to over 27,000 vehicles in 2000. This is a growth of 23,761 vehicles in five years. The latter could have been the immediate result of the end of the 1994 civil war and genocide and resultant rapid urbanization in the country since then.

**Table 3-19: Number of Vehicles registered in Rwanda, 1995 - 2000**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Taxi</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minibus</td>
<td>462</td>
<td>1,256</td>
<td>2,467</td>
<td>3,141</td>
<td>4,054</td>
<td>5,269</td>
</tr>
<tr>
<td>Pickup Truck</td>
<td>972</td>
<td>2,782</td>
<td>5,499</td>
<td>6,911</td>
<td>8,120</td>
<td>9,443</td>
</tr>
<tr>
<td>Truck</td>
<td>164</td>
<td>407</td>
<td>738</td>
<td>927</td>
<td>1,025</td>
<td>1,116</td>
</tr>
<tr>
<td>Trailer/Lorry</td>
<td>67</td>
<td>164</td>
<td>266</td>
<td>355</td>
<td>397</td>
<td>464</td>
</tr>
<tr>
<td>Personal Car</td>
<td>1,233</td>
<td>3,136</td>
<td>5,788</td>
<td>7,558</td>
<td>8,986</td>
<td>10,521</td>
</tr>
<tr>
<td>Project Vehicle</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>872</td>
</tr>
<tr>
<td>Official Vehicle</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2,059</td>
</tr>
<tr>
<td>Temporary Immatriculation</td>
<td>298</td>
<td>1,406</td>
<td>2,121</td>
<td>2,447</td>
<td>2,583</td>
<td>2,583</td>
</tr>
<tr>
<td>Diplomatic Corps</td>
<td>61</td>
<td>181</td>
<td>337</td>
<td>406</td>
<td>451</td>
<td>451</td>
</tr>
<tr>
<td>Special Engines (Tractor, Bulldozer, Construction equipment, etc.)</td>
<td>32</td>
<td>75</td>
<td>204</td>
<td>228</td>
<td>242</td>
<td>242</td>
</tr>
<tr>
<td>Total (excl. Special Engines)</td>
<td>3,257</td>
<td>9,355</td>
<td>17,268</td>
<td>21,843</td>
<td>28,720</td>
<td>27,018</td>
</tr>
</tbody>
</table>

**Source:** Hoffmann, 2004

The lower number of registered vehicles in 2000, compared to 1999, is because only taxis, minibuses, trucks, trailers/lorries and personal cars were accounted for in that year.

Figure 3-16 further indicates that from the vehicles registered in 2000 in Rwanda; almost 39 per cent were personal (private) cars and 35 per cent pickup trucks, while almost 20 per cent were minibuses.
Table 3-20 presents the number of registered vehicles in Rwanda by category between 2005 and 2008. The data has been extracted from the National Institute of Statistics of Rwanda (NISR) 2009 Statistical Year Book and illustrates the following:

- Motorcycles account for the highest vehicle registrations. Similarly, the number of registered motorcycles increased from almost 4,900 in 2005 to over 7,730 in 2008;
- There were significant registrations of cars, jeeps and pickups;
- There was a major decrease in the total number of registered vehicles in 2006, compared to other years. This was as a result of a decrease in imported vehicles in Rwanda after the banning of the import of Right-Hand-Drive vehicles, as well as the generally higher cost of Left-Hand-Drive vehicles; and
- Based on the NISR’s total annual number of registered vehicles, an increase of over 2,200 vehicles is evident between 2005 and 2008. Nonetheless, this figure does not represent the total sum of the categories presented. The actual totals have been calculated and highlighted in red. While it was not possible to get clarity on NISR’s calculations, the consultant concluded that this difference (highlighted in blue) might be because the NISR totals account for both vehicle registration and re-registrations, which was initiated in 2003 due to the introduction of new number plates in the country.

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus</td>
<td>15</td>
<td>15</td>
<td>46</td>
<td>91</td>
</tr>
<tr>
<td>Car</td>
<td>1,796</td>
<td>889</td>
<td>1,805</td>
<td>1,922</td>
</tr>
<tr>
<td>Half-Trailer</td>
<td>13</td>
<td>12</td>
<td>12</td>
<td>23</td>
</tr>
<tr>
<td>Jeep</td>
<td>1,793</td>
<td>676</td>
<td>1,032</td>
<td>1,327</td>
</tr>
<tr>
<td>Microbus</td>
<td>7</td>
<td>2</td>
<td>13</td>
<td>15</td>
</tr>
<tr>
<td>Minibus</td>
<td>724</td>
<td>279</td>
<td>212</td>
<td>657</td>
</tr>
<tr>
<td>Motorcycle</td>
<td>4,893</td>
<td>3,347</td>
<td>5,115</td>
<td>7,735</td>
</tr>
<tr>
<td>Pickup</td>
<td>1,497</td>
<td>859</td>
<td>1,290</td>
<td>1,225</td>
</tr>
<tr>
<td>Special Engine</td>
<td>26</td>
<td>14</td>
<td>83</td>
<td>62</td>
</tr>
<tr>
<td>Trailer</td>
<td>56</td>
<td>68</td>
<td>120</td>
<td>49</td>
</tr>
<tr>
<td>Truck</td>
<td>276</td>
<td>171</td>
<td>301</td>
<td>198</td>
</tr>
<tr>
<td>Unknown</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total (Calculated)</strong></td>
<td><strong>1,117</strong></td>
<td><strong>2,986</strong></td>
<td><strong>2,593</strong></td>
<td><strong>1,096</strong></td>
</tr>
<tr>
<td><strong>Total (NISR Year Book)</strong></td>
<td><strong>11,096</strong></td>
<td><strong>6,333</strong></td>
<td><strong>10,030</strong></td>
<td><strong>13,305</strong></td>
</tr>
<tr>
<td><strong>Difference</strong></td>
<td><strong>9,979</strong></td>
<td><strong>3,347</strong></td>
<td><strong>7,437</strong></td>
<td><strong>12,209</strong></td>
</tr>
</tbody>
</table>

Source: NISR, 2009

3.2.8.1.3 Comparison of Central African Countries’ Road Accident Fatalities

According to the WHO (2011) mortality estimates for member states for the year 2008, Rwanda recorded the second lowest road accident fatalities relative to other Central African neighbouring countries i.e. Burundi, Central African Republic (CAR), Chad and the Democratic Republic of Congo (DRC). Figure 3-17 and Figure

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8 Presidential Order No. 40/01 of 2005 and Presidential Order No. 85/01 of 2002, which regulate general traffic police and road traffic (NSIR, 2004)
3-18 show the number of road accident-related fatalities for different Central African countries by gender and age respectively. From the graphs presented, it is evident that in 2008, males were the main victims of road-related fatalities and the most vulnerable age group was between 15 and 59 years of age. Given the fact that this group is made up of the economically active members of these societies, this poses a major cost to society. Research conducted by the Transport Research Laboratory (TRL) in Bangladesh and Bangalore (India) in 2004, established that road-related accidents and injuries drive many households into poverty because household breadwinners\(^9\) of poorer communities (both urban and rural) are the most vulnerable road users (Commission for Global Road Safety, 2006).

![Figure 3-17: Deaths by Road Accidents per Country by Gender, 2008](source: WHO)

![Figure 3-18: Deaths by Road Accidents per Country by Age, 2008](source: WHO)

The figures above should be considered indicative only because while evident that DRC registered the highest number of road accidents, the population and vehicle size has not been considered. Should it be accounted for, then it becomes evident that the Central African Republic (CAR) registered the highest accident number per person and Rwanda the lowest at 1 accident for every 5,934\(^10\) people. Table 3-21 summarises this.

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>BURUNDI</th>
<th>CAR</th>
<th>CHAD</th>
<th>DRC</th>
<th>RWANDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RWANDA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^9\) “In Bangalore 71 per cent (urban) and 53 per cent (rural) of poor households were not poor before the fatal crash. In Bangladesh the figures were 33 per cent (urban) and 49 per cent (rural) for bereaved households” (Commission for Global Road Safety, 2006:9).

\(^10\) Vehicle population has not been considered.
Based on the analyses conducted, the following can be concluded:

- Compared to the other countries in the region, Rwanda’s road-related fatalities are minor; nonetheless, on a national level, the numbers are still high and the issue should be addressed.
- Motorcycle is the most registered type of vehicle in Rwanda.
- There is a need for more clarity on the data on number of registered vehicles in Rwanda.
- Some work will be required to improve the data integrity (i.e. correct inaccuracies).

**3.2.8.2 Road Accident Statistics Overview**

**3.2.8.2.1 International Accident Analysis**

Worldwide over 1.2 million people die each year from road traffic accidents and between 20 and 50 million suffer non-fatal injuries. The World Health Organisation (WHO) published two important road safety documents which provides recommendations for a comprehensive approach to improve road safety (WHO, 2004) and makes a global assessment of the status of road safety (WHO, 2009). This is summarised in Table 3-22.


<table>
<thead>
<tr>
<th>RANK</th>
<th>LEADING CAUSE 2004</th>
<th>%</th>
<th>RANK</th>
<th>LEADING CAUSE 2030</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ischemic heart disease</td>
<td>12.2</td>
<td>1</td>
<td>Ischemic heart disease</td>
<td>12.2</td>
</tr>
<tr>
<td>2</td>
<td>Cerebrovascular disease</td>
<td>9.7</td>
<td>2</td>
<td>Cerebrovascular disease</td>
<td>9.7</td>
</tr>
<tr>
<td>3</td>
<td>Lower respiratory infections</td>
<td>7.0</td>
<td>3</td>
<td>Chronic obstructive pulmonary disease</td>
<td>7.0</td>
</tr>
<tr>
<td>4</td>
<td>Chronic obstructive pulmonary disease</td>
<td>5.1</td>
<td>4</td>
<td>Lower respiratory infections</td>
<td>5.1</td>
</tr>
<tr>
<td>5</td>
<td>Diarroheal diseases</td>
<td>3.6</td>
<td>5</td>
<td>Road traffic injuries</td>
<td>3.6</td>
</tr>
<tr>
<td>6</td>
<td>HIV/AIDS</td>
<td>3.5</td>
<td>6</td>
<td>Trachea, bronchus, lung cancers</td>
<td>3.5</td>
</tr>
<tr>
<td>7</td>
<td>Tuberculosis</td>
<td>2.5</td>
<td>7</td>
<td>Diabetes mellitus</td>
<td>2.5</td>
</tr>
<tr>
<td>8</td>
<td>Trachea, bronchus, lung cancers</td>
<td>2.3</td>
<td>8</td>
<td>Hypertensive heart disease</td>
<td>2.3</td>
</tr>
<tr>
<td>9</td>
<td>Road traffic injuries</td>
<td>2.2</td>
<td>9</td>
<td>Stomach cancer</td>
<td>2.2</td>
</tr>
<tr>
<td>10</td>
<td>Prematurity and low birth weight</td>
<td>2.0</td>
<td>10</td>
<td>HIV/AIDS</td>
<td>2.0</td>
</tr>
<tr>
<td>11</td>
<td>Neonatal infections</td>
<td>1.9</td>
<td>11</td>
<td>Nephritis and nephrosis</td>
<td>1.9</td>
</tr>
<tr>
<td>12</td>
<td>Diabetes mellitus</td>
<td>1.9</td>
<td>12</td>
<td>Self-inflicted injuries</td>
<td>1.9</td>
</tr>
<tr>
<td>13</td>
<td>Malaria</td>
<td>1.7</td>
<td>13</td>
<td>Liver cancer</td>
<td>1.7</td>
</tr>
<tr>
<td>14</td>
<td>Hypertensive heart disease</td>
<td>1.7</td>
<td>14</td>
<td>Colon and rectum cancer</td>
<td>1.7</td>
</tr>
<tr>
<td>15</td>
<td>Birth asphyxia and birth trauma</td>
<td>1.5</td>
<td>15</td>
<td>Oesophagus cancer</td>
<td>1.7</td>
</tr>
<tr>
<td>16</td>
<td>Self-inflicted injuries</td>
<td>1.4</td>
<td>16</td>
<td>Violence</td>
<td>1.4</td>
</tr>
<tr>
<td>17</td>
<td>Stomach cancer</td>
<td>1.4</td>
<td>17</td>
<td>Alzheimer and other dementias</td>
<td>1.4</td>
</tr>
<tr>
<td>18</td>
<td>Cirrhosis of the liver</td>
<td>1.3</td>
<td>18</td>
<td>Cirrhosis of the liver</td>
<td>1.3</td>
</tr>
<tr>
<td>19</td>
<td>Nephritis and nephrosis</td>
<td>1.3</td>
<td>19</td>
<td>Breast cancer</td>
<td>1.3</td>
</tr>
<tr>
<td>20</td>
<td>Colon and rectum cancers</td>
<td>1.1</td>
<td>20</td>
<td>Tuberculosis</td>
<td>1.1</td>
</tr>
</tbody>
</table>

The *Global Status Report on Road Safety* modelled road traffic injury fatality rates per 100,000 population by WHO region and income group (refer to Table 3-23) and established the following:

- Low income and middle income countries have higher road traffic fatality rates (21.5 and 19.5, respectively per 100,000 population) compared to high income countries (10.3 per 100,000 population);
- Over 90 per cent of the world’s road traffic fatalities occur in low and middle income countries, which have only 48 per cent of the world’s registered vehicles;
- Almost half of those who die in road traffic crashes are pedestrians, cyclists or users of two-wheelers (i.e. vulnerable road users) and this proportion is higher in poorer economies;
- Only 15 per cent of countries have comprehensive traffic laws (defined in relation to speed, drunk-driving, use of helmets, seat belts and child restraints);
- Only 49 per cent of countries stipulate a legal blood alcohol limit of less than or equal to 0.05 grams per decilitre (which is recommended by the WHO report on injury prevention);
- 90 per cent of high income countries have a law requiring young children in cars to be restrained appropriately; only 20 per cent of low income countries have similar requirements;
- Enforcement for the identified risk factors is generally low; and
- Only one third of countries had a national road safety strategy that is endorsed by the government, includes specific targets and has funding allocated for its implementation.

### Table 3-23: Modelled Road Traffic Injury Fatality Rates per 100 000 Population by WHO Region and Income Group

<table>
<thead>
<tr>
<th>REGION</th>
<th>HIGH-INCOME</th>
<th>MIDDLE-INCOME</th>
<th>LOW-INCOME</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td></td>
<td>32.2</td>
<td>32.3</td>
<td>32.2</td>
</tr>
<tr>
<td>Americas</td>
<td>13.4</td>
<td>17.3</td>
<td></td>
<td>15.8</td>
</tr>
<tr>
<td>South East Asia</td>
<td></td>
<td>16.7</td>
<td>16.5</td>
<td>16.6</td>
</tr>
<tr>
<td>East Mediterranean</td>
<td>28.5</td>
<td>35.8</td>
<td>27.5</td>
<td>32.2</td>
</tr>
<tr>
<td>European</td>
<td>7.9</td>
<td>19.3</td>
<td>12.2</td>
<td>13.4</td>
</tr>
<tr>
<td>Western Pacific</td>
<td>7.2</td>
<td>16.9</td>
<td>15.6</td>
<td>15.6</td>
</tr>
<tr>
<td>GLOBAL</td>
<td>10.3</td>
<td>19.5</td>
<td>21.5</td>
<td>18.8</td>
</tr>
</tbody>
</table>

#### 3.2.8.2.2 Rwanda Accident Analysis

Road traffic accident statistics in Rwanda are collected by the police. Recently, this data was also made available to Rwanda Transport Development Agency (RTDA). Previously it was sent to the Ministry of Infrastructure (MININFRA). In interviews with RTDA and MININFRA, it was established that Rwanda does not have a good data record. Presently, RTDA has very accurate data for year 2010 only. This can be because roles and responsibilities for road safety are neither clearly stipulated nor enforced. The section that follows, presents the road accident environment in Rwanda, based on the available data.

According to MININFRA, there were 2,398 road accidents and over 2,400 injuries in Rwanda in 2007. Figure 3-19 presents the number of road accidents in the country by province for 2007 and 2010. Map 3-10 illustrates the number of road accidents per district in 2010. In light of this, the following conclusions can be drawn:

- The City of Kigali experienced most accidents, i.e. 53 per cent in 2007 and 79 per cent in 2010;
- Southern, Eastern and Northern provinces experienced a decrease in total road accidents between 2007 and 2010. The Southern province recorded the highest decrease (123) and the Northern the least (14); and
- The lowest number of accidents occurred in the Western province (203) in 2007 and in the Northern Province (226) in 2010.
Figure 3-19: Number of Road Accidents in Rwanda by Province, 2007 and 2010

Source: MININFRA

Table 3-24 present the highest accident zones in Rwanda based on 2010 accident statistics. From the table, it is evident that Nyarugenge in Kigali recorded the highest accident rates in the country. Similarly, the districts of Ruhango, Rubavu, Rwamagana and Musanze recorded the highest rates in the Southern, Western, Eastern and Northern provinces respectively.

Table 3-24: Highest Accidents Zones

<table>
<thead>
<tr>
<th>HIERARCHY</th>
<th>LOCATION AND PRIORITY BREAKDOWN</th>
<th>NUMBER OF ACCIDENTS IN 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>National/Provincial Level</td>
<td>City of Kigali</td>
<td>3,851</td>
</tr>
<tr>
<td></td>
<td>Southern Province</td>
<td>270</td>
</tr>
<tr>
<td></td>
<td>Western Province</td>
<td>261</td>
</tr>
<tr>
<td></td>
<td>Eastern Province</td>
<td>261</td>
</tr>
<tr>
<td></td>
<td>Northern Province</td>
<td>242</td>
</tr>
<tr>
<td>District Level (Top 3 priorities per province)</td>
<td>Kigali Nyarugenge Gasabo Kicukiro</td>
<td>1,738 1,619 494</td>
</tr>
<tr>
<td></td>
<td>Southern Ruhango Huye Kamonyi</td>
<td>60 49 35</td>
</tr>
<tr>
<td></td>
<td>Western Rubavu Rusizi Ngororero</td>
<td>49 48 40</td>
</tr>
<tr>
<td></td>
<td>Eastern Rwamagana Gatsibo Bugesera</td>
<td>55 53 38</td>
</tr>
<tr>
<td></td>
<td>Northern Musanze Gakenke Gicumbi</td>
<td>66 55 48</td>
</tr>
</tbody>
</table>

Source: RTDA

This map illustrates that in 2010, the highest Average Daily Traffic (ADT) was registered in Kigali and Rwamagana (2,500 – 4,300). Ruhango and Musanze ADT vary between 1,000 and 1,500 vehicles per day. Huye ADT varies between 100 and 1,000 vehicles per day. Rwamagana ADT varies between 500 and 1,000 vehicles per day.

11Accident statistics were only available at National and District Levels.
The high accident periods in Rwanda are November, December, April and September respectively. Figure 3-20 plots the road accidents in Rwanda per month during 2010. Based on the graph, it is clear that most road accidents in Rwanda occur during the wet seasons, i.e. mid-March to mid-May (long rain period) and mid-October – mid-December (short rain period).

![Figure 3-20: Road Accidents in Rwanda per Month, 2010](image)

**Source:** RTDA

The high rate of accidents experienced in Kigali, in relation to the other provinces can be justified by the fact that more than 70 per cent of the registered vehicles in the country are found in the City of Kigali (Asiimwe, 2011).

Figure 3-21 presents road accidents in Rwanda by vehicle type from 2002 to 2005, and 2010. From the graph presented, the following is evident:

- Minibuses, pickups, 4x4’s, cars and motorcycles are the main types of vehicles involved in accidents, collectively accounting for 75, 71, 71, 66 and 84 per cent in 2002, 2003, 2004, 2005 and 2010, respectively.
- In 2010, pickups accounted for 1,944 accidents. Cars and motorcycles accounted for 1,684 and 1,442 accidents respectively. Similarly wheelbarrows were involved in 44 road accidents and pedestrians in 628.
- Bicycles, animals, and others related accidents increased over the period between 2002 and 2005, however, there was a major decrease in 2010.
- In 2003, 2004 and 2010 many pedestrians were involved in accidents, 888, 904 and 628, respectively.
- 2010 recorded the highest accident rates compared to the other years. Pickups had the most accidents.
- In 2002 and 2005, 4x4’s had the highest number of accidents (1,269 and 1,854 respectively) and pedestrians the lowest (3 and 17 respectively).
Map 3-10: Number of Accidents per District per year, 2010

Source: RTDA
The total number of road accidents between 2007 and 2010 more than doubled (increased by 2,486 accidents). Nonetheless, the percentage of severe accidents decreased from almost 32 per cent to almost 26 per cent. In 2007 and 2010, there were almost 760 and 1,170 severe accidents in Rwanda respectively, as indicated in Figure 3-22. MININFRA and RTDA also estimated a total of 308 and 445 road-related deaths in 2007 and 2010 respectively.

Map 3-11 illustrates the number of minor accidents per district in 2010. From Map 3-11 it is evident that most minor accidents occurred in the districts of Nyarugenge, Gasabo and Kicuriko in Kigali. Kicukiro recorded between 39 and 561 minor injuries. The least minor injuries occurred in the districts of Rutsiro, Kamonyi, Nyaruguru, Gisagara, Kayonza and Kirehe. Map 3-12 shows the distribution of the major injuries per district in 2010. Nyarugenge District (between 136 and 342), Gasabo District (between 136 and 342) and Kicuriko District (between 43 and 135) recorded the highest number of injuries.

In 2010, the Eastern Province experienced the highest number of accidents (131), followed by the Southern Province (106). Almost 80 per cent of the road accidents in the country occurred in the City of Kigali; a total of 69 led to fatalities. Map 3-13 and Figure 3-23 illustrate that in 2010, pickups were involved in most road-related fatalities (108) followed by pedestrians, which accounted for 110 road accidents in Rwanda.

The latter is an indication that through road safety education, road-related deaths can be prevented.
Map 3-11: Distribution of Minor Accidents per District, 2010

Source: RTDA
Map 3-12: Distribution of Major Accidents per District, 2010

Source: RTDA
Map 3-13: Number of Fatalities per District, 2010

Source: RTDA
Figure 3-23: Accident Fatalities by Vehicle Type, 2010

Source: RTDA

Figure 3-24 and Map 3-14 illustrate that negligence was the major cause of road accidents. It caused almost 58 per cent of the road-related accidents in the country. Bad manoeuvres and excess speed accounted for the second and third most common cause of accidents, 20.3 and 8.1 per cent respectively. Similarly, road condition, rain and road signage collectively contributed to less than 1.5 per cent of road accidents in the country. This is an indication that harsher policies to obtain driver’s licenses and law enforcement are feasible short-term attempts to reduce road-related accidents in Rwanda.

Figure 3-24: Causes of Accidents, 2010

Source: MININFRA and RTDA
Map 3-14: Causes of Accidents

Source: RTDA
Therefore it can be deduced that even though most accidents in the country occurred during wet seasons, rain only accounted for 0.3 per cent of the total road accidents in the country, which means that it was not a major cause of accidents. Nonetheless, the high accident rates during these periods could be because of the festive seasons, i.e. Christmas, New Year and Easter.

Figure 3-25 presents a breakdown of road accidents by vehicle ownership in 2010. From the graph it is clear that almost 90 per cent of the road accidents in Rwanda involve private vehicles, while only 11 per cent account for the remainder. In this breakdown, other vehicles include government, diplomatic, police, foreign-owned vehicles, etc. In 2010, about 229 accidents involved police vehicles and 139 accidents involved foreign-owned vehicles; both accounted for the first and second highest within the category “others”.

![Figure 3-25: Road Accidents by Vehicle Ownership, 2010](image)

**Figure 3-25: Road Accidents by Vehicle Ownership, 2010**  
*Source: RTDA*

Figure 3-26 and Map 3-15 present the occurrence of road accidents according to the time of day. From the graph and map presented, it is noticeable that in 2010, most accidents (68 per cent) in Rwanda (all provinces) occurred during the day. Day accidents occurring between 12:00 and 18:00 accounted for 53 per cent of the total day accidents (period between 06:00 and 18:00). About 9 per cent of the day accidents occurred between 11:00 and 12:00, while 11 per cent occurred between 17:00 and 18:00.

![Figure 3-26: Time of Accidents, 2010](image)

**Figure 3-26: Time of Accidents, 2010**  
*Note: July 2010 information was not available*  
*Source: RTDA*
Map 3-15: Time of Accidents
Note: July 2010 record was not available Source: RTDA
During the night period, i.e. 18:00 to 06:00, about 1,420 accidents occurred, 57 per cent of these occurred between 18:00 and 21:00. Of the 57 per cent, 306 accidents were between 19:00 and 20:00.

Figure 3-27 provides an indication of the ages of the drivers involved in road accidents in Rwanda in 2010. In essence about 48 per cent of the drivers fell in the age groups 25 to 35 years. About 995 accidents were linked to drivers aged between 40 and 50 years and only 16 were linked to drivers aged 70 to 85 years. From the graph, it is clear that the high risk population group is the economically active age group.

![Figure 3-27: Age of Drivers involved in Road Accidents, 2010](image)

**Source:** RTDA

In 2010 there were 167 road accidents (4 per cent of the total accidents in that year) involving drivers not carrying a drivers’ license. Figure 3-28 illustrates that of this group, a total of 110 drivers, (66 per cent) were motorcycle drivers. Similarly, minibuses and pickup drivers collectively accounted for 17 per cent.

![Figure 3-28: Accidents Involving Drivers without a Driver's License, 2010](image)

**Source:** RTDA

About 53 per cent of the road accidents in 2010 occurred in the first half of each month, i.e. between the 1st and 15th. Figure 3-29 illustrates that in 2010, the days of most accidents were (in descending order): 12th, 23rd, 19th; recording 215, 203 and 201 accidents respectively.
Moving away from a national level, a study conducted on the injury profile of patients admitted over a 9-month period to the emergency department of the Central Hospital (CHUK) in Kigali, Rwanda, established the following findings (refer to Table 3-25 and Table 3-26):

- 52 per cent of the incidents leading to injury were due to road collisions;
- 46 per cent of the road collision victims were passengers and 37 per cent pedestrians. Drivers and cyclists accounted for 17 per cent;
- 34 per cent of the road collisions involved motorcycles, 33 per cent bicycles and public transport (minibuses) 27 per cent;
- 64 per cent of the victims were male; and
- 48 per cent of the male population were between 16 and 30 years old.

Table 3-25: Cause of Injury by Gender

<table>
<thead>
<tr>
<th>CAUSE OF INJURY</th>
<th>NORTHERN</th>
<th>WESTERN</th>
<th>EASTERN</th>
<th>SOUTHERN</th>
<th>CITY OF KIGALI</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road Traffic Collision</td>
<td>17</td>
<td>19</td>
<td>16</td>
<td>17</td>
<td>82</td>
<td>151</td>
</tr>
<tr>
<td>Firearm</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>9</td>
<td>16</td>
</tr>
<tr>
<td>Stab Injury</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td>0</td>
<td>9</td>
<td>20</td>
</tr>
<tr>
<td>Falls</td>
<td>5</td>
<td>6</td>
<td>5</td>
<td>5</td>
<td>23</td>
<td>44</td>
</tr>
<tr>
<td>Burns</td>
<td>4</td>
<td>9</td>
<td>3</td>
<td>7</td>
<td>19</td>
<td>42</td>
</tr>
<tr>
<td>Others</td>
<td>7</td>
<td>3</td>
<td>4</td>
<td>0</td>
<td>8</td>
<td>22</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>37</strong></td>
<td><strong>44</strong></td>
<td><strong>35</strong></td>
<td><strong>29</strong></td>
<td><strong>150</strong></td>
<td><strong>295</strong></td>
</tr>
</tbody>
</table>

Source: Nsereko, Curationis and Brysiewicz, 2010

Table 3-26: Injury Victims by Cause of Injury and Province

<table>
<thead>
<tr>
<th>CAUSE OF INJURY</th>
<th>NORTHERN</th>
<th>WESTERN</th>
<th>EASTERN</th>
<th>SOUTHERN</th>
<th>CITY OF KIGALI</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road Traffic Collision</td>
<td>17</td>
<td>19</td>
<td>16</td>
<td>17</td>
<td>82</td>
<td>151</td>
</tr>
<tr>
<td>Firearm</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>9</td>
<td>16</td>
</tr>
<tr>
<td>Stab Injury</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td>0</td>
<td>9</td>
<td>20</td>
</tr>
<tr>
<td>Falls</td>
<td>5</td>
<td>6</td>
<td>5</td>
<td>5</td>
<td>23</td>
<td>44</td>
</tr>
<tr>
<td>Burns</td>
<td>4</td>
<td>9</td>
<td>3</td>
<td>7</td>
<td>19</td>
<td>42</td>
</tr>
<tr>
<td>Others</td>
<td>7</td>
<td>3</td>
<td>4</td>
<td>0</td>
<td>8</td>
<td>22</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>37</strong></td>
<td><strong>44</strong></td>
<td><strong>35</strong></td>
<td><strong>29</strong></td>
<td><strong>150</strong></td>
<td><strong>295</strong></td>
</tr>
</tbody>
</table>

Source: Nsereko, Curationis and Brysiewicz, 2010

3.2.8.2.3 Road Accident Analysis Conclusion

Based on the accident analyses which were conducted, it can be concluded that:
• The City of Kigali experiences most of the accidents in the country.
• Negligence is the main cause of road accidents, followed by bad manoeuvres and excessive speeding. 4 per cent of road accidents involved drivers without licenses, of which 110 (66 per cent) drove motorcycles.
• Pickups were involved in most road-related accidents and fatalities in 2010.
• 89 per cent of road accidents in 2010 involved privately owned vehicles.
• 69 per cent of road accidents in 2010 occurred between 06:00 and 18:00.
• 89 per cent of drivers involved in road accidents in 2010 were aged between 25 and 60 years.
• Pedestrian and passengers are the main victims of road accidents.
• In general the quality of the data in the Rwanda Road Accident Database is not up to standard, because there is no national database providing historical figures of road accident occurrence. Nonetheless, it was possible to obtain (incomplete) monthly data for 2010 from RTDA.
• Some work will be required to improve the data integrity (correct errors, especially on the historical data); therefore a national database must be created.
• There is not sufficient road accident data available to enable the future development of strategies to address accidents and their causes, as well as road safety campaigns, at a district or station level.

3.2.8.3 Rwanda Road Safety Environment

3.2.8.3.1 Road Safety Issues
The reality of road traffic injuries and accidents in low and middle income countries is that while the prevailing number of accidents is alarming, most of them go undetected firstly, because they involve scattered individuals of the poorer clusters in society, and secondly because of poor recording and data monitoring. Amongst other reasons for underestimating the problem are (Commission for Global Road Safety, 2006):
• The definition of a death in a road accident is not consistent with international practice, which records any death occurring within 30 days after a road accident as a road accident death. Some countries might consider a smaller gap, or even only consider death at the scene;
• The real cost to society of road traffic injuries and deaths, which is overlooked by both governments and donors;
• The lack of skilled professionals, i.e. road safety specialists, which creates a challenge for governments to develop good policies and strategies; and
• Corruption by enforcement authorities, which promotes weak governance.

3.2.8.3.2 The Case of Rwanda
With most of the country’s road network in poor condition and due to increasing urbanization, Rwanda’s transport network sustainability is questionable. Amongst other issues, the roads generally lack maintenance and rehabilitation. Their condition degenerates further due to poor storm drains and sewers. On an institutional level, Rwanda’s transport industry is faced with a shortage of skilled professionals and lacks an adequate monetary system, characterised by low tax revenue. While motorcycles, bicycles and walking are increasing as a means of transport for many residents, this reality is yet to be reflected in transport planning and management as most (if not all) of the roads in the country do not have formal Non-Motorised Transport (NMT) facilities. As a result, road-related fatalities are very common, thus making road safety a major problem for the nation (Kumar and Barrett, 2008).

While road safety has already been identified as a problem in Rwanda, only recently has a road safety expert been appointed in MININFRA. Similarly, there is currently no clear road safety structure in Rwanda. As it stands, road safety is a shared responsibility of MININFRA, RTDA and the police. No clear roles and responsibilities of these three institutions could be established. Therefore, for the purposes of developing a National Road Safety Strategy, more in-depth research is required to establish how the road safety environment operates in the country.

Nonetheless, the Government of Rwanda has embarked in some actions to regulate road safety in the country. According to MININFRA 2010 Annual Report, the following studies have either been completed or are under way:
Study | Status
--- | ---
Study for rehabilitation and modernisation of road signs | Completed. Now awaits execution
Study of the incremental impacts of accidents due to driving vehicles with opposite-site steering control | Completed
Study to assess the effectiveness of the existing vehicle inspection system and to recommend measures to strengthen the system if found inadequate | On-going

Source: MININFRA, 2011

3.2.8.3.3 Conclusion

Very little information on road safety was available when this report was compiled. This led to the following conclusions:

- Rwanda has no institutional structure for road safety – currently MININFRA, Police and RTDA share responsibility; and
- No policy/legislation stipulates roles and responsibilities; currently this is a grey area. Nonetheless, the Road Traffic and Road Safety (Draft) Act makes provision for the establishment of an advisory National Road Safety Committee.
### Table 3-27: Accra Declaration by African Ministers Responsible for Transport and Health

<table>
<thead>
<tr>
<th>Accra Declaration of African Ministers Responsible for Transport &amp; Health (At the African Road Safety Conference in Accra, Ghana – 8 February, 2007)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>We the Ministers responsible for Transport &amp; Health, meeting at the African Road Safety Conference in Accra, Ghana on 8th February 2007 on the importance of road safety;</strong></td>
</tr>
<tr>
<td><strong>HEREBY RESOLVE to undertake the following:</strong></td>
</tr>
<tr>
<td>1. <strong>Work together to stop the growing epidemic of deaths and injuries on our roads.</strong></td>
</tr>
<tr>
<td>2. <strong>Promote road safety as a health, transportation, law enforcement, education, and development priority for our nations.</strong></td>
</tr>
<tr>
<td>3. <strong>Set and achieve measurable national targets for road safety and traffic-injury prevention in all Member States to contribute to the achievement of Africa’s overall targets to reduce accidents fatalities by half by 2015.</strong> In this regard, <strong>Member States should designate a lead agency, with legal backing and adequate and sustainable financial resources, to ensure the achievement of the targets.</strong></td>
</tr>
<tr>
<td>4. <strong>Take necessary steps to source sustainable funding for development and management of transport infrastructure and services with work with multilateral and bilateral donors to develop road safety projects and programmes to build national road safety management capacity.</strong></td>
</tr>
<tr>
<td>5. <strong>Strengthen pre-hospital and emergency services in order to provide timely and appropriate care to road traffic-injured patients to minimize their effects and long term disability.</strong></td>
</tr>
<tr>
<td>6. <strong>Mainstream road safety into new and existing road infrastructure development programmes.</strong> In this regard, <strong>convince governments to devote a percentage of their investment in infrastructure development to road safety programmes.</strong></td>
</tr>
<tr>
<td>7. <strong>Improve the collection, management and use of data on road deaths and injuries so as to formulate evidence-based policies.</strong> In this regard, efforts would be made to address the non-reporting of accidents, and to harmonise data that originate from different sources.</td>
</tr>
<tr>
<td>8. <strong>Ensure the enactment and enforcement of laws associated with driving under the influence of alcohol and drugs; inappropriate and excessive speeding; non-use of helmets; driver licensing; road-worthy vehicles; and the use of mobile phones.</strong></td>
</tr>
<tr>
<td>9. <strong>Implement specific education programmes among drivers with regard to safe driving, particularly with issues associated with speed.</strong> In this regard, <strong>promote road safety initiatives at the local, municipal and national levels, for children and other road users.</strong></td>
</tr>
<tr>
<td>10. <strong>Urge African countries to pay special attention to rural transport.</strong> In this regard, <strong>ensure that adequate resources are provided for studies on rural dimensions of road safety and the implementation of their outcome.</strong></td>
</tr>
<tr>
<td>11. <strong>Encourage African countries to ratify and adhere to international treaties and conventions such as the Vienna Conventions on road traffic and road signs and signals.</strong></td>
</tr>
</tbody>
</table>

**Recommendations:**

**Member States should:**

1. Designate a lead agency that has proper legal backing, empowered and supported by adequate financial and human resources.
2. Ensure “reliable” data collection and to harmonise data that originate from different sources.
3. Improve road safety management on the continent by referring to good practices examples in Africa.
4. Harmonize national policies and action plans at sub-regional level (databases, regulations, infrastructure and equipment standards).
5. Encourage African countries to enforce road safety legislation, particularly related to speed control, use of helmets, alcohol control, strengthening emergency trauma care and enhancing visibility.
6. Strengthen partnership and collaboration at sub-regional, regional and global level.
7. Commemorate the first UN Global Road Safety Week by organizing activities at the national level and participating at the Youth Forum in Geneva in April 2007.
8. Mainstream road safety in national transport policies, including rural road safety.
9. Commit to educating and training the general public on road safety matters.
10. Set and monitor measurable targets to contribute to achieving the goal of reducing accident fatalities by half by 2015.

**Done in Accra on 8 February 2007**
3.2.8.4 Incident Management System (IMS)

“Incident Management is the process whereby a set of co-ordinated activities is initiated when an incident occurs on a major road in order to minimize the direct and secondary effects of the incident, as well as to restore normal capacity and safety levels to all affected road facilities as quickly and efficiently as possible.” (SANRAL, 2003) An incident can be defined as “An incident is any extraordinary condition or event that creates a safety hazard for other road users, and/or which reduces the capacity of the road, e.g. an accident (minor or major), a shoulder/lane blockage, spilled load, a construction area or a special event (such as a marathon).” (SANRAL, 2003)

To achieve the above several resources are needed to manage and clear the incident. These resources are grouped as follows:

- **Human** (fireman, call centre operators, emergency services)
- **Mechanical** (Emergency vehicles, Special equipment jaws-of-life)
- **Electronically** (ramp metering, VMS, communication network, computer software)

An Incident Management Systems takes into account the processes that need to be followed to clear incidents effectively and efficiently to restore normal traffic flow. These processes are captured in an Incident Management Plan as well as operational manuals and standard operating procedures (SOP’s) are detailed.

To develop an Incident Management Plan four factors need to be investigated:

- **Emergency Factors**: The quick reaction of emergency service to an incident on the freeway system can minimise secondary incidents and lead to the restoring of normal capacity on the system. It is of essence that the communication lines between the managing body and the emergency services are established and maintained.
- **Resources Factors**: An inventory of the local services and their capacity need to be established to ensure that the correct unit for the specific incident is dispatch.
- **Jurisdictional Factors**: Areas of jurisdiction along the freeways are a sensitive issue and not always clear which emergency service need to respond and which can attend to the incident in the shortest span of time. No legislation preludes agreements between the IMS managers and the local authority to clarify areas of jurisdiction and currently agreements are reached to ensure quick response times.
- **Management Factors**: The nature of an incident indicates that in any circumstance that the emergency service works under crisis conditions. Roles and responsibilities need to be clearly indicated in standard operating procedures and on scene management manuals.

3.2.8.4.1 What is involved in Incident Management

In the guideline for the development of an Incident Management System the following issues or factors which are as crucial to implement an IMS. These factors were also identified by the employees of the NMC during the past two years since the NMC is in operation. These factors are:

- Incidents should be detected accurately and rapidly,
- Nature of the incident should be determined rapidly,
- Information regarding the incident need to be collected and passed on to the appropriated agencies,
- The roles and responsibilities of the various agencies should be specified, understood and agreed upon,
- Responses to incident should be appropriate effective and co-ordinated,
- Quick clearing of both major and minor incidents needs to take place,
- Traffic management measures need to be applied for the duration of the incident,
- Alternative routes should be pre-planned and documented, and also show manpower requirements for diverting of traffic onto these routes,
- Information on traffic conditions and alternative routes needs to be conveyed to motorists,
- Traffic management plans for planned incidents (E.g. maintenance of road or road side furniture) need to be developed and implemented.
These factors can be categorised into 5 main groups which form the Incident Management Process. The 5 Steps are illustrated in the figure above.

The successful implementation of IMS is dependent on the support and response from the following role-players:

- Emergency services: Fire, Ambulance, Traffic, Police,
- Specialist agencies: Crane hires operators, pollution experts, chemical waste response, traffic engineers, road maintenance, mortuary and pathology.
- Private emergency agencies: private ambulance, Private fire departments,
- Private essential services: Towing companies,
- Road Authorities,
- Associations and institutes; Automobile Association, Road freight Associations, Security companies.

3.2.8.4.2 Key Prerequisites

Six prerequisites can be defined for the successful implementation of IMS and these needs to be kept in mind when developing an IMS for the roads within Rwanda. These are:

- Cognisance has to be taken of the autonomy of all agencies involved.
- The unique characteristics of each operational area have to be identified and addressed.
- The participants should have ownership or stake in the process.
- Sufficient time should be allowed for dynamic interaction between participating agencies,
- The Incident Management System should be realistic, workable and achievable,
- Existing resources should be utilized as far as possible, rather than creating new resources in order to minimize the cost implications of implementation.

It is important to note that while an effective IMS will assist with the response and recovery of an incident, the information that is gathered is just as valuable. This information then forms the basis for future planning and improved preparation in terms of response and recovery as well as the motivation for future initiatives which can assist in achieving Rwanda’s objectives. IM is not a specialist line function but rather a co-ordinating role which must align to the business requirements.
Figure 3-31: Typical IMS Information Flow between Participants

In the figure to the right the IMS and the information flow between participants to the IMS is shown. In this example the traffic management center (TMC) form the center point of communication. This center does not necessarily have to be a technological center but can be a Centre where different emergency service and role players meet and coordinate the response to incidents.

3.2.8.4.3 IMS Conclusion

It is recommended that Rwanda prepare tenders for companies that previously developed IMS for other countries to compile a country specific Incident Management System that take into account the above sections but have a knowledge of the medical system and emergency service available in Rwanda and the challenges relating to the national and district roads in Rwanda.
3.2.8.5 Proposed “High-Level” Road Safety Strategy

According to Grimm and Treibich (2010), road traffic accident fatalities could become the third major cause of death in low to middle income countries like Rwanda. With very limited data available and in an attempt to improve the current road safety environment in Rwanda, this sub-section proposes a “High-Level” Road Safety Strategy\(^\text{12}\), based on the challenges identified in the country and world best practices on road safety.

3.2.8.5.1 “High-Level” Road Safety Strategy

The proposed “High-Level” Road Safety Strategy consists of the following pillars, as illustrated in Figure 3-32: road safety management, safer roads and mobility, safer vehicles, safer road users, and post-crash response or emergency services.

![Figure 3-32: Road Safety Strategy Pillars](source)

These are discussed below, with emphasis on the main aspects of each pillar.

- **Road Safety Agency**: Promote the creation of a Multi-Sectoral Road Safety Agency to develop and monitor national road safety programmes.

- **National Strategy**: In coordination with the Road Safety Agency, develop a National Road Safety Strategy at a cabinet or ministerial level. This strategy should highlight long term priorities and implementation projects, stipulate roles and responsibilities, promote road safety management initiatives and develop and monitor a data collection system overlooking road traffic injuries and fatalities.

- **Realistic Long Term Targets**: National long term goals should be realistic and based on current national road traffic and respective available data.

- **Adequate Funding**: Ensure sufficient funding for road safety-related activities and programs through campaigns and a search for private sector donors. Ensure that annual and medium-term budgetary targets are recommended and alternative/innovative sources of funding investigated. Apply or secure a 10 per cent of the infrastructure investment in road safety.

- **Monitoring and Evaluation**: Establish information systems for on-going monitoring and evaluation of road traffic accidents, injuries and fatalities, as well as monitoring and evaluation of road safety interventions towards reducing these figures (i.e. moderating average speed, seat belt wearing, etc.), and respective economic impacts at national, provincial and local levels.

Ownership and Accountability: Governments and Road Authorities should assume road safety ownership and accountability and set a target to eliminate high risk roads by 2020 and allocate 10 per cent of road budget to road safety programmes. Road Authorities should report annual road safety status and proposed cost-effective solutions. Similarly, a road safety unit should be established to monitor this process and its performance.

Road User Needs and Sustainable Urban Development: Urban planning, transport demand and land use management should all be informed by road user needs, including safe mobility for all. Safety impact assessments and development control procedures should also be in place to ensure safe developments.

Road Maintenance: Safe operations and road maintenance of existing road infrastructure should be promoted. In this regard, road authorities should identify and monitor high accident, injury and fatality locations and type of accidents; conduct road safety assessments and proposed mitigating measures for accident reduction, and promote speed management through monitored speed limits and/or design on the road network.

Adequate Road Design: Develop a Road Design Manual, based on world best practices for multi-modal transport systems, to inform the construction of all new road infrastructure. Promote independent road safety assessments and audits and their respective implementation and enforcement.

Capacity Building and Knowledge Transfer: Promote knowledge transfer through partnerships (with civil societies, development banks, private sector, etc.) and training and education on road safety assessments, low-cost safety engineering, etc. Moreover, ensure that road safety design standards recognise and integrate human factors and vehicle design.

Road Safety Research: Promote road and mobility safety research on infrastructure improvements and evaluation of road safety innovation projects.

Road Safety Regulation Harmonisation: Promote road safety through global/regional harmonisation of road safety regulation.

Vehicle Licensing and Road Worthiness: Promote harmonised motor vehicle safety regulation and vehicle assessment programmes to inform consumers about motor safety performance. Ensure that as part of vehicle road worthiness, all new vehicles are equipped with functional and adequate seat belts and anchorages, and whenever possible with technologies such as anti-lock braking and airbags for both private cars and public transport fleet.

Fiscal Incentives: Fiscal incentives could be particularly useful to discourage import and export of vehicles that do not comply with the minimum safety standards. Similarly, vehicles that comply with road safety standards could enjoy fiscal benefits.
Road Safety Awareness, Education and Communication Activities: Comprehensive programmes/campaigns improving road user behaviour should be developed with particular attention to promoting awareness of road safety risk factors and preventive measures to influence road user behaviour for all road user groups, including children, youngsters, professionals and illiterates, e.g. Road Safety day/week/month Campaigns.

Road Safety Compliance: Establish speed limits, drink-drive laws, motorcycle helmets, seat belts and child transport, vehicle load limit, passenger and freight transport and occupational health and safety laws, and other related measures (including policies and practices) designed to discourage related injuries and fatalities on the roads. In parallel, ensure that these compliance measures are enforced.

Driver licensing and testing: Ensure that all driving schools are accredited and a proper driver training curriculum is in place and enforced. An organised and updated database should be kept. Learner Drivers should also only be allowed to drive on the roads provided they have the “L” sign clearly displayed on their vehicle and adhere to speed limits (which should be lower than the average acceptable speed for more experienced drivers).

Incident and Response Management Systems: Emergency services response should be immediate and appropriate treatments provided, preferably working under a nationwide emergency number. Similarly, all admin and pre-admissions should be precise and clear to reduce delays and related fatalities.

Road User Insurance Schemes: The sustainability of the post-crash response service can be acquired by the establishment of road user insurance schemes to finance the rehabilitation of road accident victims, e.g. mandatory third-party liability.

Trauma Care Systems: Emergency services should be supported by a well-established hospital trauma centre system with quality assurance.

Based on the proposed “High-Level” Road Safety Strategy, relevant stakeholders and their respective roles were proposed and are presented in Figure 3-33. To ensure the success of the Road Safety Strategy implementation and enforcement, the identified stakeholders should share the common goal of making Rwanda’s roads safer for its users.
3.2.8.5.2 Conclusion

The main step towards improving road safety in Rwanda (and elsewhere) is making Road Safety a priority on the political agenda of the country; after all, road safety is a government function. A lead Ministry or a National Road Safety Council (NRSC) or Commission should assume responsibility for the concerted effort. Road Safety cannot, however, be the responsibility of government alone. Donors, non-governmental organisations (NGOs), commercial sector, civil societies and the public in general play an important role in promoting road safety.

Whilst a lot can be learnt from the world’s best practices on road safety, it is equally important to promote local research and development to establish sustainable solutions that address the local challenges in Rwanda. Because nothing is perfect and static, it is essential that all policies, strategies and “good practice guidelines” are monitored and (re)evaluated on a regular basis, thus allowing for innovation and progress.

3.2.8.6 Way Forward - Proposed “High-Level” Road Safety Strategy Projects

Based on the road accident analysis and road safety environment in Rwanda, five (5) strategic interventions are proposed. As part of achieving the proposed objectives, short term activities are defined, together with the responsible implementing/superintending entities.

3.2.8.6.1 STRATEGY 1: Road Safety Strategy Implementation

It is recognised that nationally there is no Road Safety Strategy in Rwanda. In establishing a road safety strategy in Rwanda, the first step would be to legislate road safety and establish roles and responsibilities. Roads authorities have a major role in road safety as they not only provide, but also maintain the road network for the road users.
Objective: To develop and implement a National Road Safety Strategy

Short –Term Activities:\n- Establish a Road Safety Agency
- Develop Road Safety Legislation and assign roles and responsibilities

Responsibility: MININFRA, RTDA and Rwanda Police at all government levels

Figure 3-34 summarises the typical process required for such implementation. As illustrated, the first step is to create a vision, then diagnose the problem and establish its magnitude. The subsequent stage entails establishing goals, objectives and targets that are in line with the socio-economic reality of the country. Countermeasures can be established through scenario building.

When designing and implementing the road safety programme/plan, it is important to account for funds and resources. Similarly, to ensure successful implementation, it is vital to monitor the implementation and develop evaluating measures/indicators. The information from the evaluations must then be fed back and amended into the programme/plan.

3.2.8.6.2 STRATEGY 2: Accident and Casualty Analysis

To ensure a cost-effective intervention, it is important to diagnose and establish the magnitude of the road safety problem in Rwanda. From the analysis in Section 3.2.8.2, it is evident that most accidents in the country are concentrated in the urban centre of Kigali; therefore, local authorities should consider the City of Kigali.

\[^{13}\] A 3 to 5 year timeframe is considered short-term.
Kigali as the priority area for a pilot study or hot spot analysis. Nonetheless, it is equally important to broaden the approach to include rural accident zones. Typically, to conduct a road safety audit, an independent engineer is contracted. Usually, the engineer takes along government representatives (of road sector institutions) to partake in the process as a form of capacity building and knowledge transfer.

Objective: To identify high-accident areas and prioritise intervention

Short Term Activities:
- Conduct Hot Spot Analysis\(^{14}\) followed by road safety audits
- Map high accident zones to ensure effective patrolling and policing resources are deployed where most needed, i.e. exact time and place
- Develop accident database

Responsibility: MININFRA, RTDA and Rwanda Police at all government levels

3.2.8.6.3 STRATEGY 3: Road Driver Negligence Enforcement

58 per cent of road accidents in Rwanda are caused by negligence; therefore addressing road negligence should be a priority in the country.

Objective: To reduce negligence driving and related offences and accidents

Short Term Activities:
- Improve law enforcement on compulsory accident prevention measures (with adequate penalties). This includes:
  - Compulsory use of motorcycle helmets and car seat belts;
  - Standardizing and enforcing alcohol limit and zero tolerance for drunk-driving;
  - Moderating speed allowance;
  - Penalising unsafe practices such as using handheld cell phones while driving and overloading of vehicles;
  - Increasing penalties for repeat offenders and unlicensed drivers;
  - Patrol high-accident areas through road blocks, speed cameras and control, etc.; and
  - Educate road users on road safety.

Responsibility: MININFRA, RTDA and Rwanda Police at all government levels.

3.2.8.6.4 STRATEGY 4: Pedestrian Casualties Reduction

From the road accident analysis, it was evident that pedestrians and passengers are the main road accident victims in the country.

Objective: To reduce the number of pedestrian fatalities

Short Term Activities:
- Develop road safety education programs and awareness campaigns at schools, workplaces, etc.
- Use media to promote awareness of road safety and preventive measures
- Increase road rules enforcement on the use of seat belts/helmets for both driver and passengers, as well as driver obedience to road signage
- Monitor speed levels by using stationary and mobile speed cameras on high accident zones and during high accident periods

\(^{14}\) Refer to Section 4 – Highest Accident Zones
Design for pedestrians and separate NMT movement from vehicle movement by building designated lanes and increasing road signage

Responsibility: MININFRA, RTDA and Rwanda Police at all government levels.

3.2.8.6.5 STRATEGY 5: Build Strategic Road Safety Partnerships

The process of developing a national road safety strategy should be multi-disciplinary and dynamic. It requires the involvement of all road safety organizations including government, NGOs, communities and civil societies.

Objective: To strengthen and form partnerships with other agencies and community groups

Short Term Activities:

- Rwanda must sign, ratify, and adhere to international treaties and conventions such as the 1949 Vienna Convention on Road Traffic and the 1968 Vienna Convention on Road Signs and Signals
- In partnership with member states, e.g. COMESA, and Vienna Conventions, develop “Good Practice Guidelines” and establish monitoring and evaluating indicators, as well as milestones and targets in promoting road safety
- On a local level, initiate community based solving initiatives, especially for remote/rural areas

Responsibility: MININFRA, RTDA and Rwanda Police at all government levels.

3.2.8.7 General Conclusions and Recommendations

Based on the analysis of road safety in Rwanda as well as the United Nations’ Global Plan for the Decade of Road Safety 2011 – 2020, short term projects were identified for Rwanda (refer to Section 3.2.8.6). The proposed projects should be viewed as immediate interventions to address the current road safety challenges in Rwanda. Nonetheless, these interventions will, in the short to medium term form the basis of a Road Safety Strategy in the country.

In light of the above, the consultant strongly recommends that in the medium to long term, a Road Safety Strategy be implemented in Rwanda.

3.2.9 Road Capacity and Continuity Analysis

The road network of the RSTMP was analysed by way of assessing its operational capacity and strategic transport demand of the RSTMP road network in order to determine and identify capacity and bottleneck improvement requirements that exist within the said road network.

In order to analyse and assess the capacity and transport demand of the RSTMP road network, the following distinct but inter-related models were used and developed, namely:

- First Order Network Assessment (FONA) – capacity assessment model;
- Highway Transport Model (HTM) – capacity assessment model providing additional support to FONA; and
- VISUM Strategic Transport Demand Model – multi-modal transport demand assessment model (refer to Chapter 5 for a detailed description regarding the Strategic Transport Demand Model).

The above mentioned Transport Models were developed as part of Working Paper 03.

Before each of the models are discussed in detail, definitions of overarching concepts and scenarios used as basis for the transport modelling analysis approach adopted as part of the RSTMP, is required. Therefore the following sections are aimed at providing such detail, after which the above mentioned models will be discussed.
3.2.9.1 RSTMP Transport Modelling Analysis Approach

Level of Service (LOS) analysis is an internationally recognised approach for benchmarking the capacity of transportation infrastructure (facility) such as roadways, intersections, footways, etc. in terms of its operational conditions within a traffic stream, measured in terms of outputs such as speed and travel time, freedom to manoeuvre, traffic interruptions, comfort, and convenience, that it is and could be providing, for its users (pedestrians, drivers, cyclists, etc.).

The Highway Capacity Manual (HCM) defines LOS as:

‘A qualitative measure describing operational conditions within a traffic stream, based on service measures such as speed and travel time, freedom to manoeuvre, traffic interruptions, comfort, and convenience.’ (HCM, 2000).

![Highway LOS Range](https://www.route228.com/virtMtg/elements/LOS.gif)

The key performance indicator that is used to evaluate the status of vehicular operations on a roadway is therefore expressed in terms of a Level of Service (LOS). LOS is indicated by using the letters of the alphabet (‘A’ through to ‘F’), ‘A’ representing the best operating conditions and ‘F’ the worst. When new road infrastructure is designed, most public sector entities tend to require a design LOS of at least ‘C’ in the design year – in other words, if a facility is designed to last for a period of seven years, in year seven the facility should preferably still operate at a LOS of ‘C’. The reality within most countries, however, is at a level that is usually substantially lower than this ideal situation, especially in and around urban environments.

The LOS is determined by using different approaches as recommended by the HCM. For two-lane and multi-lane freeways, the approaches to measure LOS differ but provide the practitioner with results that are comparable.

- **Two-lane facilities**
  - LOS is determined in terms of both percentage time-spent-following and average travel speed. These two factors provide a representative measure of the efficiency of mobility. The worst of the two measures is taken as representative of the facility.

- **Multi-lane facilities**
  - LOS is determined as a relationship between the average passenger-car speed and the traffic density. It provides an indication of the freedom of a vehicle to manoeuvre within the traffic stream as well as the vehicle’s proximity to other vehicles.
3.2.9.2 Standardisation of the RSTMP Network for Traffic and Capacity Analyses

Figure 3-9 below demonstrates the relationship between the Highway Traffic Model (HTM); the First Order Network Analysis (FONA) Model; and the Transport Model developed for the Strategic Transport Master Plan for the Republic of Rwanda. In the context of the discussion under the previous section, the FONA Model and the HTM Model captures road capacity and the Transport Model is where traffic projections are made.

The Rwanda Network data was standardised in order to be applied in all three model platforms in order to provide consistent analysis input/output in terms of condition, traffic and capacity analysis. Therefore the data that was utilised for the HDM analysis was also utilised for the Transport Model as well as for FONA.

3.2.9.3 Traffic Scenarios

Four traffic growth scenarios were developed for the Rwanda Strategic Transport Road Master Plan, namely:

- 2010 Base Year Scenario (40 km/h posted speed limit for urban areas and 60 km/h posted speed limit for rural areas),
- 2010 Base Year Scenario (80 km/h posted speed limit for urban areas and 100 km/h posted speed limit for rural areas),
- 2020 Target Year – Conservative Traffic Growth Scenario
- 2020 Target Year – Optimistic Traffic Growth Scenario

In the absence of land use projections spanning the study period, it is considered standard practice to utilise projected GDP growth rates as a proxy for future traffic growth. As discussed in more detail in Part I, the Rwanda economies are projected to grow realistically at 5%/annum or more optimistically at 8%/annum.

It is usually expected that traffic growth would exceed GDP, by up to a factor of two (i.e. traffic growth could be double the GDP growth rate). To calibrate the GDP-traffic relationship, comprehensive traffic counts are required, i.e. traffic counts that are taken all year round at fixed locations and enable a year-by-year assessment.

In the case of the Rwanda, there is an absence of reliable data showing historical road traffic growth (the dominant regional transport mode). An analysis of historical traffic counts at recurring counting stations...
shows high variances in growth rates, pointing to a combination of unreliable or un-standardised data and/or very variable growth. The median growth rate is 1%/annum and the average 13%/annum. Given the statistical paucity of the data, the realistic and optimistic economy growth rates which fall between these two measures appear to be an adequate proxy for traffic growth, i.e. an additional traffic growth factor is not applied over and above GDP growth.

The following traffic growth rates were developed and represent each traffic scenario:

<table>
<thead>
<tr>
<th>Traffic Scenario</th>
<th>Traffic Volume</th>
<th>Traffic Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010 Base Year (30 and 60 km/h)</td>
<td>Base year traffic volumes assuming ideal road conditions</td>
<td></td>
</tr>
<tr>
<td>2010 Base Year (80 and 100 km/h)</td>
<td>Base year traffic volumes assuming ideal road conditions</td>
<td></td>
</tr>
<tr>
<td>2020 Realistic</td>
<td>Base volume with compound growth rate of average Rwanda GDP projected growth rate, assuming ideal road conditions</td>
<td>5%/annum</td>
</tr>
<tr>
<td>2020 Optimistic</td>
<td>Base volume with compound growth rate of average Rwanda GDP growth rate times 1.6, assuming ideal road conditions</td>
<td>8%/annum</td>
</tr>
</tbody>
</table>

*Source: Aurecon, 2011*

The traffic scenarios developed are summarised in the following table:

<table>
<thead>
<tr>
<th>Traffic Scenarios</th>
<th>Target LOS</th>
<th>Crawling Vehicles</th>
<th>Heavy</th>
<th>Accuracy Assumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010 Base Year</td>
<td>D</td>
<td></td>
<td>30%</td>
<td>Very Fine – 1 vehicle increment</td>
</tr>
<tr>
<td>2020 5% Growth</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2020 8% Growth</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Source: Aurecon, 2010*

3.2.9.4 Interface of Roads Capacity Assessment and Transport Model

The Transport Model (“VISUM”) is utilised across all transport modes to assess the relationship between traffic and infrastructure capacity, i.e. it identifies where actual or projected traffic does or is likely to exceed the infrastructure’s ability to process that traffic at an acceptable level of service. In the case of roads, the high-level assessment carried out by means of the Transport Model is refined by applying the more detailed First Order Network Assessment (FONA) model.

Table 3-30 below demonstrates the interface between the roads capacity assessment (FONA) and the Transport Model.
Table 3-30: Interface of Roads Capacity Assessment (FONA), Highway Traffic Model (HTM) and Transport Model (VISUM)

<table>
<thead>
<tr>
<th>Comparator</th>
<th>FONA</th>
<th>HTM</th>
<th>Transport Model (VISUM)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Focus</strong></td>
<td>Roads Operational Capacity</td>
<td>Roads Operational Capacity</td>
<td>All Modes (roads, rail, air, pipeline, etc.) Strategic</td>
</tr>
<tr>
<td><strong>Data Input</strong></td>
<td>Network geometry</td>
<td>Network geometry</td>
<td>Land Use, Socio-economic Data</td>
</tr>
<tr>
<td></td>
<td>Traffic volumes (30th highest hour – adopted from ADT)</td>
<td>Traffic volumes</td>
<td>Network geometry and constraints</td>
</tr>
<tr>
<td></td>
<td>Network constraints</td>
<td>Network characteristics</td>
<td></td>
</tr>
<tr>
<td><strong>Output</strong></td>
<td>LOS (two-lane facilities) in terms of percentage time-spent-following,</td>
<td>LOS (two-lane facilities) in terms of percentage time-spent-following,</td>
<td>Traffic Volumes Desire Lines Volume-Capacity Ratios</td>
</tr>
<tr>
<td></td>
<td>LOS (two-lane facilities) in terms of average travel speed,</td>
<td>LOS (multi-lane facilities) in terms of traffic density</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LOS (multi-lane facilities) in terms of average passenger-car speed</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>LOS (multi-lane facilities) in terms of traffic density</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Growth</strong></td>
<td>Compound (static value)</td>
<td>Compound (static value)</td>
<td>Mode zone specific – linked to land use / socio-economic (dynamic)</td>
</tr>
<tr>
<td><strong>Network</strong></td>
<td>Existing links (paved links only)</td>
<td>Compound (static value)</td>
<td>Existing and new links</td>
</tr>
<tr>
<td><strong>Assignment of Traffic</strong></td>
<td>No traffic assignment (only volumes assessed)</td>
<td>Compound (static value)</td>
<td>Dynamic traffic assignment</td>
</tr>
</tbody>
</table>

*Source: Aurecon, 2010*

3.2.9.5 Treatment of New Links

The FONA Model and HTM Model investigates and assesses only existing paved road links on the National paved road network of Rwanda.

The Transport Model, however, analyses new road links based on land use and other socio-economic data utilised to generate traffic. Traffic is assigned to new links based on the aforementioned analysis.

Therefore, both the Transport Model and FONA facilitate data transfer which in turn enables superior road network analysis.

3.2.9.6 First Order Network Assessment (FONA)

The First Order Network Assessment (FONA) Model is essentially a modelling tool developed by Aurecon based on the Highway Capacity Manual 2000 (HCM) (Transportation Research Board, 2000) methodology calculations with the purpose of providing a first order ‘snapshot’ analysis of the existing operating conditions of a country's major roadways using the existing road infrastructure and traffic volumes as base input.

The FONA analysis approach is based on the HCM two-lane and multi-lane freeway operational calculations. The definition of a **two-lane freeway** is a single-roadway providing for two-way traffic. Traffic travelling in a...
particular direction, wishing to overtake slower moving vehicles, therefore have to make use of overtaking opportunities allowed by the absence of barrier (no-overtaking) lines (informed by the road's horizontal and vertical alignment) and gaps in the stream of oncoming (opposing) traffic. Generally in the EAC roads environment, rural roads tend to fall under this description.

**Multi-lane freeways**, on the other hand, generally tend to occur in the proximity of urban / metropolitan areas. A multi-lane freeway provides for multiple lanes of travel per direction. This type of roadways generally is divided by a median barrier in the middle of the road although this is not a requirement for this particular classification. The major difference however lies in the traffic's ability to overtake slower moving vehicles without having to contend with oncoming traffic flowing in the opposing direction.

The key performance indicator that is used to evaluate the status of vehicular operations on a roadway is expressed in terms of Level of Service (LOS). LOS is indicated by using the letters of the alphabet (‘A’ through to ‘F’), ‘A’ representing the best operating conditions and ‘F’ the worst. When new road infrastructure is designed, most public sector entities tend to require a design LOS of at least ‘C’ in the design year – in other words, if a facility is designed to last for a period of seven years, in year seven the facility should preferably still operate at a LOS of ‘C’. The reality within most countries, however, is that it is usually at a level substantially lower than this ideal situation, especially in and around urban environments.

The LOS is determined by using different approaches as recommended by the HCM. For two-lane and multi-lane freeways, the approaches to measure LOS differ but provide the practitioner with results that are comparable.

- **Two-lane facilities**
  - LOS is determined in terms of both *percentage time-spent-following* and *average travel speed*. These two factors provide a representative measure of the efficiency of mobility. The worst of the two measures is taken as representative of the facility.

- **Multi-lane facilities**
  - LOS is determined as a relationship between the *average passenger-car speed* and the *traffic density*. It provides an indication of the freedom of a vehicle to manoeuvre within the traffic stream as well as the vehicle’s proximity to other vehicles.

The process flow of the FONA Model HCM calculation is shown in Figure 3-37.
For each homogenous section of road, the following information was calculated:

- The LOS in the base year (selected base year was 2010);
- The LOS in the target year (selected target year is 2020);
- The estimated vehicular flow in the target year at an assumed traffic growth rate;
- The estimated vehicular flow at which a threshold/target LOS of ‘D’ will be reached for each roadway segment analysed;
- The year during which the threshold/target LOS will be reached assuming no upgrades and an assumed traffic growth rate;
- The number of additional lanes required per direction in order to achieve/maintain the threshold/target LOS for each road segment analysed;
- The LOS that will be achieved within the target year assuming that the additional required lanes are provided.

The benefit of following this methodology is that it aligns with international best-practice. The methodology allows for refinement of results on selected roadways by refining the accuracy of input data in order to achieve this and it provides a first-order estimate of the actual operating conditions on Rwanda’s major road network identified for the Strategic Transport Master Plan, thereby allowing quick insight into the scale of upgrading that would be required to maintain a nominal economic growth rate over time, assuming that for at least the next 10 years, Rwanda will remain dependent on road-based transportation as a fundamental part of commuter, recreational and freight transportation.
Information relating to the current traffic volumes, traffic composition, and road network geometry are required in order to determine the current road capacity and traffic demand along the primary road network within Rwanda.

To populate the model with suitable data for the primary road network, the following information collection, validation, parameter calculation and model population process was followed. The process is illustrated in Figure 3-38 below. A detailed description of the process is provided in Working Paper 03.

Figure 3-38: Information Collection and Model Populate Process

The road infrastructure and operational assumptions relating to the FONA Capacity Assessment model parameters are shown in Table 3-31.

Table 3-31: Parameter Assumptions

<table>
<thead>
<tr>
<th>FONA Parameter Required Description</th>
<th>Parameter Assumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of lanes</td>
<td>1 lane per direction (for the majority of the network validated using data provided by RTDA)</td>
</tr>
<tr>
<td>Dual carriageway or single carriageway</td>
<td>Data received from RTDA.</td>
</tr>
<tr>
<td>Lane width</td>
<td>Assumed 3.4m where no other data was available</td>
</tr>
<tr>
<td>Lateral clearance distance left hand side</td>
<td>Assumed 1.8m clearance</td>
</tr>
<tr>
<td>Lateral clearance distance right hand side</td>
<td>Assumed 1.8m clearance</td>
</tr>
<tr>
<td>30th Highest Design Hour</td>
<td>Applied k-factor per count station to calculate the 30th highest design hour from ADT.</td>
</tr>
<tr>
<td>Percentage heavy vehicles in traffic stream</td>
<td>Secondary data</td>
</tr>
</tbody>
</table>
| Percentage recreational vehicles in traffic stream | Assumed: 
- Urban classified links = 0.5% 
- Rural classified links = 5% |
<table>
<thead>
<tr>
<th>FONA Parameter Required Description</th>
<th>Parameter Assumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terrain Type</td>
<td>Global Mapper survey(^{15}) of terrain classified according to level, rolling or mountainous terrain</td>
</tr>
<tr>
<td>Driver population indicator</td>
<td>Assumed:</td>
</tr>
<tr>
<td></td>
<td>- Urban traffic = 1.0</td>
</tr>
<tr>
<td></td>
<td>- Rural traffic = 0.85</td>
</tr>
<tr>
<td>Number of accesses per kilometre of link</td>
<td>Google Earth survey</td>
</tr>
<tr>
<td>- Definition: nr of times the secondary road intersects with primary roads</td>
<td>Assumption based on terrain type:</td>
</tr>
<tr>
<td></td>
<td>- Level = 20%,</td>
</tr>
<tr>
<td></td>
<td>- Rolling = 50%,</td>
</tr>
<tr>
<td></td>
<td>- Mountainous = 80%</td>
</tr>
<tr>
<td>% of link with no passing opportunities</td>
<td>Base free flow speed obtained from RTDA:</td>
</tr>
<tr>
<td></td>
<td>- Urban = 60km/h,</td>
</tr>
<tr>
<td></td>
<td>- Rural = 40km/h,</td>
</tr>
<tr>
<td>Base free flow speed</td>
<td>Assumed:</td>
</tr>
<tr>
<td></td>
<td>- Urban = 0.92 (Verified by counts),</td>
</tr>
<tr>
<td></td>
<td>- Rural = 0.88 (Verified by counts)</td>
</tr>
<tr>
<td>Urban or Rural road link classification</td>
<td>Google Earth Survey identifying large settlements and cities</td>
</tr>
</tbody>
</table>

**Source: Aurecon, 2010**

The above-mentioned process was followed each time the secondary data set was updated to form one complete set of information. The data set was hosted in a GIS platform where all the model parameters and the road geometry parameters could be linked to the physical location of the road segment. Other information pertaining to the corridor names, and model link preference numbers were also hosted in this file, therefore allowing standardisation, interrelationship and interface of data between the three model platforms.

The FONA Analysis Output Characteristics are summarised in Table 3-32 below.

---

\(^{15}\) Google Earth 2010 was used to fly along the primary roads in 3D view and determine the terrain and other attributes.
### Table 3-32: FONA Analysis Output Characteristics Summary

<table>
<thead>
<tr>
<th>No.</th>
<th>Data Field</th>
<th>Description</th>
<th>Range</th>
<th>EAC Road Network Characteristics</th>
</tr>
</thead>
</table>
| 1.  | Lanes      | Number of lanes (Base year scenario) | 1 to 4 lanes | - 100% of Rwanda National Road Network consists of 1 Lane per direction  
- 0% of Rwanda National Road Network consists of 2 Lanes per direction |
| 2.  | Lane_width | Lane width (m) | 3.0m to 3.9m | - Total Rwanda National Road Network is assumed to be 3.4m in width per lane. |
| 3.  | Verge_width_L | Lateral clearance distance to obstacle next to road | 0m to 1.8m | - Total Rwanda National Road Network is assumed to have a lateral clearance of 1.8m. |
| 4.  | Verge_width_R |  |  |  |
| 5.  | Opp. Flow  | Opposing Flow (Same hour as 30th Highest Hourly Volume) | 0 to 2000 | - 0-100 30th Highest Hourly Volume per direction constitutes 94.87% (2,713.28km) of the total Rwanda National Road Network  
- 101-200 30th Highest Hourly Volume per direction constitutes 3.54% (101.24km) of the total Rwanda National Road Network  
- 201-420 30th Highest Hourly Volume per direction constitutes 1.59% (45.47km) of the total Rwanda National Road Network |
| 6.  | %HV        | % Heavy vehicles in traffic stream (Base year scenario) | 0% to 100% | - 59% (1,687.40km) of the total Rwanda National Road Network operates with 20% Heavy Vehicles  
- 22% (629.20km) of the total Rwanda National Road Network operates with 50% Heavy Vehicles  
- 19% (543.40km) of the total Rwanda National Road Network operates with 75% Heavy Vehicles |
| 7.  | %RV        | % Recreational vehicles in traffic stream | 0% to 50% | - 8% (228.80km) of the total Rwanda National Road Network operates with 5% Recreational Vehicles  
- 92% (2,631.20km) of the total Rwanda National Road Network operates with 0.5% Recreational Vehicles |
| 8.  | PHF        | Peak Hour Factor | 0 to 1.0 | - 92% (2,631.20km) of the total Rwanda National Road Network operates with a PHF of 0.88  
- 8% (228.80km) of the total Rwanda National Road Network operates with a PHF of 0.92 |
| 9.  | Terrain    | Terrain type (proxy for link gradient) | Level to Mountainous | - Level terrain constitutes 6% (171.6km) of the total Rwanda National Road Network  
- Mountainous terrain constitutes 26% (743.6km) of the total Rwanda National Road Network  
- Rolling terrain constitutes 67% (1,916.2km) of the total Rwanda National Road Network |
<p>| 10. | Driver_Pop (fp) | Driver Population Indicator | 0.85 to 1.0 | - 92% of the driver population in Rwanda represents seasonal, non-local driver compositions and |</p>
<table>
<thead>
<tr>
<th>No.</th>
<th>Data Field</th>
<th>Description</th>
<th>Range</th>
<th>EAC Road Network Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>non-commuter drivers in the traffic stream</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• 8% of the driver population in Rwanda represents commuter traffic with local drivers in the traffic stream</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>LOA/km</td>
<td>Number of accesses per kilometre of link</td>
<td>0 to 24 Accesses</td>
<td>• 0 LOA/km = 1 933.36km (67.60%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• 1 LOA/km = 492.49km (17.22%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• 2 LOA/km = 219.36km (7.67%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• 3 LOA/km = 99.81km (3.49%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• &gt;4 LOA/km = 114.11km (0.04%)</td>
</tr>
<tr>
<td>12.</td>
<td>BFFS</td>
<td>Base Free Flow Speed</td>
<td>&gt;70km/h &lt;100km/h</td>
<td>• 14.7% (420.42km) of the Rwanda National Road Network operates at a Base Free Flow Speed of 70km/h</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• 46.9% (1 341.34km) of the Rwanda National Road Network operates at a Base Free Flow Speed of 80km/h</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• 38.4% (1 098.24km) of the Rwanda National Road Network operates at a Base Free Flow Speed of 90km/h</td>
</tr>
<tr>
<td>13.</td>
<td>%No_Pass</td>
<td>% of link with no passing opportunities</td>
<td>0% to 90%</td>
<td>• 20% of links with no passing opportunities constitutes 185.61km (6.49%) of the total Rwanda National Road Network</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• 50% of links with no passing opportunities constitutes 754.75km (26.39%) of the total Rwanda National Road Network</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• 80% of links with no passing opportunities constitutes 1 919.63km (67.12%) of the total Rwanda National Road Network</td>
</tr>
</tbody>
</table>

Source: Aurecon, 2010
3.2.9.6.1 FONA Results

The following sections of the report provide details of the FONA results in terms of the following Scenarios (given the abovementioned assumptions and parameters) for the Rwanda Primary Paved Road Network (for Rwanda as a whole and per Province of Rwanda):

- 2010 base year (40 – 60km/h)
- 2010 base year (80 – 100km/h)
- 2020 5% traffic growth
- 2020 8% traffic growth

RSTMP FONA Results – All Scenarios

Table 3-33 and Figure 3-39 below represent the summary of Rwanda FONA results for all scenarios.

Table 3-33: Rwanda – Percentage Road Network Length Operating at Level of Service Intervals

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010 Base Year (40 &amp; 60km/h)</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>11.1%</td>
<td>88.9%</td>
<td>100%</td>
</tr>
<tr>
<td>2010 Base Year (80 &amp; 100km/h)</td>
<td>10.6%</td>
<td>0.5%</td>
<td>76.2%</td>
<td>12.7%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100%</td>
</tr>
<tr>
<td>2020 5% Growth</td>
<td>8.5%</td>
<td>2.6%</td>
<td>51.4%</td>
<td>37.5%</td>
<td>0.2%</td>
<td>0.0%</td>
<td>100%</td>
</tr>
<tr>
<td>2020 8% Growth</td>
<td>7.7%</td>
<td>3.4%</td>
<td>40.4%</td>
<td>47.2%</td>
<td>1.5%</td>
<td>0.0%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: FONA Results, Aurecon 2011

With regards to Table 3-33 above, the following observations can be made:

- The 2010 Base Year Scenario (40 & 60 km/h) shows that the Rwanda National Road Network is operating at undesirable levels with 11.1% and 88.9% of the total length of road network being analysed operating at a LOS E and F respectively. **This is a clear indication of the impact operating speed (amongst others) has on the level of service.**

- The 2010 Base Year Scenario (80 & 100 km/h) shows that the Rwanda National Road Network is operating at acceptable levels with only 76.2% and 12.7% of the total length of road network being analysed operating at a LOS C and D respectively.

- The 2020 5% Growth Scenario shows an increase in Road Network operating at LOS C and D (51.4% and 37.5% respectively).

- The 2020 8% Growth Scenario shows a further increase in Road Network operating at LOS C and D (40.4% and 47.2% respectively).

The above results are depicted graphically in Figure 3-39 below and spatially in Map 3-16, Map 3-17, Map 3-18, and Map 3-19 below.

With regards to Map 3-16: FONA Results – Base Year 2010 Scenario (40 and 60 km/h), the following is noted:

- Sections of the RN6, RN7, RN9, RN10, and RN19 show LOS E the remainder of the Rwanda National paved route that was analysed reflect a LOS F.

With regards to Map 3-17: FONA Results – Base Year 2010 Scenario (80 and 100 km/h), the following is noted:

- The most noteworthy observation is the dramatic change from an operating speed of 40 – 60 km/h to 80 – 100 km/h has on the LOS.

- A large number of the National Road Network being analysed operates at a LOS C.

- Sections of the RN1, RN3, RN4, RN8, RN9 and RN15, operate at a LOS D.

- Sections of RN6, RN7, RN9, and RN1 (close to the southern border) operate at LOS A.
With regards to Map 3-18: FONA Results – Scenario 2020 5% Growth, the following is noted:

- More than half of the Rwanda National Road Network being analysed operate at a LOS C.

With regards to Map 3-19: FONA Results – Scenario 2020 8% Growth, the following is noted:

- Almost half of the Rwanda National Road Network being analysed operate at a LOS D.

Source: FONA Calculation Results – Aurecon, 2010

*Figure 3-39: Rwanda First Order Network Assessment Results – All Scenarios*
Map 3-16: FONA Results – Base Year 2010 Scenario (40 and 60 km/h)
Map 3-17: FONA Results – Base Year 2010 Scenario (80 and 100 km/h)
Map 3-18: FONA Results – Scenario 2020 5% Growth
Map 3-19: FONA Results – Scenario 2020 8% Growth
Southern Province FONA Results – All Scenarios

Table 3-34 below represents the percentage road length operating at LOS intervals for the Southern Province for all Scenarios.

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010 Base Year (80 &amp; 100 km/h)</td>
<td>16.3%</td>
<td>0.3%</td>
<td>76.0%</td>
<td>7.4%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100%</td>
</tr>
<tr>
<td>2020 5% Growth</td>
<td>16.3%</td>
<td>0.0%</td>
<td>60.8%</td>
<td>22.4%</td>
<td>0.3%</td>
<td>0.0%</td>
<td>100%</td>
</tr>
<tr>
<td>2020 8% Growth</td>
<td>15.6%</td>
<td>0.5%</td>
<td>44.5%</td>
<td>38.4%</td>
<td>0.9%</td>
<td>0.0%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: FONA Results, Aurecon 2011

Figure 3-40 below demonstrates graphically the percentage road length operating at LOS intervals for the Southern Province for all Scenarios.

Figure 3-40: Southern Province – Percentage Road Network Length Operating at LOS Intervals

Source: FONA Results, Aurecon 2011
Western Province FONA Results – All Scenarios

Table 3-35 below represents the percentage road length operating at LOS intervals for Kenya for all Scenarios.

**Table 3-35: Western Province – Percentage Road Network Length Operating at LOS Intervals**

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010 Base Year (80 &amp; 100km/h)</td>
<td>26.7%</td>
<td>1.7%</td>
<td>62.8%</td>
<td>8.7%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100%</td>
</tr>
<tr>
<td>2020 5% Growth</td>
<td>17.9%</td>
<td>10.6%</td>
<td>50.0%</td>
<td>21.7%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100%</td>
</tr>
<tr>
<td>2020 8% Growth</td>
<td>15.3%</td>
<td>13.2%</td>
<td>42.9%</td>
<td>28.8%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100%</td>
</tr>
</tbody>
</table>

*Source: FONA Results, Aurecon 2011*

Figure 3-41 below represents graphically the percentage road length operating at LOS intervals for the Western Province for all Scenarios.

**Figure 3-41: Western Province– Percentage Road Network Length Operating at LOS Intervals**

*Source: FONA Results, Aurecon 2010*
Eastern Province FONA Results – All Scenarios

Table 3-36 below represents the percentage road length operating at LOS intervals for the Eastern Province for all Scenarios.

**Table 3-36: Eastern Province – Percentage Road Network Length Operating at LOS Intervals**

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010 Base Year</td>
<td>0.0%</td>
<td>0.0%</td>
<td>90.1%</td>
<td>9.9%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100%</td>
</tr>
<tr>
<td>2020 5% Growth</td>
<td>0.0%</td>
<td>0.0%</td>
<td>68.0%</td>
<td>31.8%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100%</td>
</tr>
<tr>
<td>2020 8% Growth</td>
<td>0.0%</td>
<td>0.0%</td>
<td>56.5%</td>
<td>43.3%</td>
<td>0.2%</td>
<td>0.0%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: FONA Results, Aurecon 2011

Figure 3-42 below represents graphically the percentage road length operating at LOS intervals for the Eastern Province for all Scenarios.

**Figure 3-42: Eastern Province– Percentage Road Network Length Operating at LOS Intervals**

Source: FONA Results, Aurecon 2011
Town of Kigali FONA Results – All Scenarios

Table 3-37 below represents the percentage road length operating at LOS intervals for the Town of Kigali Province for all Scenarios.

Table 3-37: Town of Kigali Province – Percentage Road Network Length Operating at LOS Intervals

<table>
<thead>
<tr>
<th>Town of Kigali</th>
<th>Scenarios</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010 Base Year</td>
<td>0.0%</td>
<td>0.0%</td>
<td>46.8%</td>
<td>53.2%</td>
<td>0.0%</td>
<td>0.0%</td>
<td></td>
<td>100%</td>
</tr>
<tr>
<td>2020 5% Growth</td>
<td>0.0%</td>
<td>0.0%</td>
<td>7.0%</td>
<td>93.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td></td>
<td>100%</td>
</tr>
<tr>
<td>2020 8% Growth</td>
<td>0.0%</td>
<td>0.0%</td>
<td>5.9%</td>
<td>88.2%</td>
<td>5.9%</td>
<td>0.0%</td>
<td></td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: FONA Results, Aurecon 2010

Figure 3-43 below represents graphically the percentage road length operating at LOS intervals for Town of Kigali Province for all Scenarios.

Figure 3-43: Town of Kigali Province Tanzania – Percentage Road Network Length Operating at LOS Intervals

Source: FONA Results, Aurecon 2011
Northern Province FONA Results – All Scenarios

Table 3-38 below represents the percentage road length operating at LOS intervals for the Northern Province for all Scenarios.

**Table 3-38: Northern Province – Percentage Road Network Length Operating at LOS Intervals**

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010 Base Year</td>
<td>0%</td>
<td>0%</td>
<td>88.7%</td>
<td>11.3%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>2020 5% Growth</td>
<td>0%</td>
<td>0%</td>
<td>33.8%</td>
<td>66.2%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>2020 8% Growth</td>
<td>0%</td>
<td>0%</td>
<td>21.5%</td>
<td>74.6%</td>
<td>4.2%</td>
<td>0%</td>
<td>100%</td>
</tr>
</tbody>
</table>

*Source: FONA Results, Aurecon 2011*

Figure 3-44 below represents graphically the percentage road length operating at LOS intervals for Northern Province for all Scenarios.

*Figure 3-44: Northern Province – Percentage Road Network Length Operating at LOS Intervals*

*Source: FONA Results, Aurecon 2011*
Based on the FONA Analysis and Results, several mitigation measures are required to improve the LOS from the modelled LOS to the selected design LOS D.

The conclusions per analysis scenario are as follows:

- **2010 base year (40 – 60km/h)**

  It can be concluded that the majority of the roads will operate at LOS E and F. However, the FONA analysis method was developed to analyse freeways with speed limits varying between 70km/h and 100km/h. When the speed limits on the roads do not fall within this increment the results of FONA is tending to model the LOS far worse than actually experienced on the roads. The mitigate this it is proposed that a Highway Transport Model (HTM) is developed to model the scenario. In the following section the analysis methodology and the results of the HTM model is presented.

- **For the 2010 base year (80 – 100km/h)-, 2020 5% traffic growth-, 2020 8% traffic growth** scenario’s projects are listed in Table 3-39 below to influence the LOS modelled to attain the design LOS of LOS D. The projects comprise of the addition of a travel lane per direction for the identified section of road.

- **The spatial location of the projects listed in Table 3-39 and shown in Map 3-20, Map 3-21, and Map 3-22.**

### Table 3-39: FONA Recommendations: Lane Additions

<table>
<thead>
<tr>
<th>From To</th>
<th>Total Length (m)</th>
<th>2020 5% growth</th>
<th>Total Length (m)</th>
<th>2020 8% growth</th>
<th>Total Length (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kibungo to Kigarama</td>
<td>1489</td>
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<td></td>
</tr>
<tr>
<td>Rubengera to Kavungu</td>
<td>583</td>
<td>Rubengera to Kavungu</td>
<td>583</td>
<td>RN 7</td>
<td></td>
</tr>
<tr>
<td>530</td>
<td></td>
<td>530</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ryabega to Kahi</td>
<td>441</td>
<td>Ryabega to Kahi</td>
<td>441</td>
<td>RN 5</td>
<td></td>
</tr>
<tr>
<td>531</td>
<td></td>
<td>531</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cyakabili to Mwitegero</td>
<td>699</td>
<td>Cyakabili to Mwitegero</td>
<td>699</td>
<td>RN 3</td>
<td></td>
</tr>
<tr>
<td>801</td>
<td></td>
<td>801</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gamoto to Bigega</td>
<td>27257</td>
<td>Gamoto to Bigega</td>
<td>27257</td>
<td>RN 1</td>
<td></td>
</tr>
<tr>
<td>804</td>
<td></td>
<td>804</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Astrida to IsaviSave</td>
<td>6484</td>
<td>Astrida to IsaviSave</td>
<td>6484</td>
<td>RN 1</td>
<td></td>
</tr>
<tr>
<td>805</td>
<td></td>
<td>805</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gashirabwoba to Shagasha/Mabanda</td>
<td>3386</td>
<td>Gashirabwoba to Shagasha/Mabanda</td>
<td>3386</td>
<td>RN 6</td>
<td></td>
</tr>
<tr>
<td>806</td>
<td></td>
<td>806</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gisuma to Gatandara</td>
<td>2209</td>
<td>Gisuma to Gatandara</td>
<td>2209</td>
<td>RN 6</td>
<td></td>
</tr>
<tr>
<td>807</td>
<td></td>
<td>807</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gatandara to Mururu</td>
<td>593</td>
<td>Gatandara to Mururu</td>
<td>593</td>
<td>RN 6</td>
<td></td>
</tr>
<tr>
<td>808</td>
<td></td>
<td>808</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bugarama to Gombaniro</td>
<td>1029</td>
<td>Bugarama to Gombaniro</td>
<td>1029</td>
<td>RN 10</td>
<td></td>
</tr>
<tr>
<td>809</td>
<td></td>
<td>809</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Musenyi to Mutete</td>
<td>3500</td>
<td>Musenyi to Mutete</td>
<td>3500</td>
<td>RN 2</td>
<td></td>
</tr>
<tr>
<td>810</td>
<td></td>
<td>810</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Butare to Gikongoro</td>
<td>25310</td>
<td>Butare to Gikongoro</td>
<td>25310</td>
<td>RN 6</td>
<td></td>
</tr>
<tr>
<td>811</td>
<td></td>
<td>811</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Map 3-20: 2010 Base Year Projects Identified (80 – 100km/h)
Map 3-21: 2020 Future Year Projects Identified (80 – 100km/h) 5% traffic growth
Map 3-22: 2020 Future Year Projects Identified (80 – 100km/h) 8% traffic growth
3.2.9.7 Highway Transport Model (HTM)

The FONA analysis model was developed to analyse road link capacity on a first order level. The HCM analysis method followed in the FONA model is primarily for two lane highway’s with speed limits between 70 and 100 km/h. In Rwanda the speed limits on the freeways vary between 40km/h in urban areas and 60km/h in rural areas. Taken these speed limits into account it is noted that the speed limits on freeways in Rwanda fall outside of the speed limits identified for the HCM method. The result of the speed limit not within the set parameters of HCM method is that the LOS modelled by FONA is far worse than experienced while driving along roads in Rwanda.

To improve the analyses method the Highway Transport Model (HTM) can be employed, the model accommodate speed limits from 30- to 120 km/h and provide LOS along the road at 20 m intervals. The HTM model use macroscopic analysis modelling techniques to determine the capacity of the road, taking into account the impact of vertical and horizontal alignment, barrier lines, traffic volumes and composition.

The analysis of intersections and road links is often represented in terms of Level of Service (LOS) for evaluation purposes. The LOS represents a qualitative ranking of the traffic operational conditions experienced by users of the roadway. Current practice designates six levels of service ranging from A to F, with LOS A representing the best operating conditions and LOS F the worst in terms of congestion and delay.

In the category (LOS A-C), vehicles operate at/near their free-flow speeds. A vehicle’s freedom to manoeuvre is slightly impacted and queues of travelling vehicles occur rarely, if at all. Road segments that operate at LOS A-C provide motorists with a desired quality of service.

LOS D-F are operating conditions in which breakdowns of vehicular flows occur regularly. These operating conditions are characterised by long queues of vehicles that operate at very low speeds. Stationary queues are very common and slow crawling movements of traffic occur usually in a cyclic fashion of stopping and crawling. Vehicles cannot operate at their desired speeds and there is little or no freedom to manoeuvre.

For the purposes of the Rwanda primary road network analysis, a LOS C was adopted as the desired LOS along the primary road network. The links chosen for evaluation were analysed using the follower density methodology to determine the LOS.

In the instances where a link is operating at a LOS D and lower the mitigating measure to improve the LOS is the addition of a climbing lane. The provision of a climbing lane did not only rest on the LOS. In addition to the LOS the following criteria was used to determine if a climbing lane can be provided:

- Climbing lane can only be provided on rural sections of the road where the speed limit is 60km/h;
- where the speed differential between the passenger cars trucks is more than 16km/h;
- the heavy vehicle volume is more than 20 vehicles per hour;
- where the length of climbing lane required exceeds 300m.

The Highway Capacity Manual 2000 (HCM 2000) (TRB, 2000) methodologies used the following parameters for calculating LOS:

- Percent Time Spent Following (PTSF) and
- Average Travel Speed of vehicles.

The HCM 2000 methodologies for calculating PTSF over-estimates the actual percentage of followers. This over-estimation is probably due to several local factors that are not prevalent in developed countries. Instead, Follower Density should be used as a measure for calculating the LOS in developing countries. Using Follower Density gives a greater weight to traffic flow and an overall more accurate LOS than the HCM method. The LOS calculating method that will be used throughout this report is based on the Follower Density principle.

Follower Density is calculated by multiplying “the percentage followers” with “the traffic density” (measured in “followers/km/lane”). The advantages over existing measures are (1) that it gives greater weight to the flow of traffic, (2) it automatically takes the travelling speed into account, (3) it provides a uniform methodology for both two-lane and multi-lane freeways.

For the purposes of the HTM model only the base year 2010 with speed limits of 40km/h urban areas and 60km/h for rural area.
In order to analyse the capacity of the road links of Rwanda a comprehensive set of data and information is required. The following information is required for a successful HTM evaluation:

- Traffic Volumes, preferably as Average Annual Daily Traffic (AADT), with a split of heavy and light vehicle modes
- Peak Hour Factors (PHF), Directional Splits and Q/AADT values
- Accurate X,Y,Z coordinates with corresponding peg distances
- Peg distances of sections with differing speed limits
- Cross section elements info (lane width, shoulder width, median width, etc. for differing sections of the road)
- Peg distances of different barrier lines.

Comparing the above list of required data with the data collected for the FONA Model it is evident that the majority of the data was already collected as part of the FONA Model data collection process. It must be noted that the accuracy of the data collected during the FONA data collection process are collected for first order analysis and estimation processes. Thus to improve on the outcome of the HTM models for the primary roads of Rwanda detailed elevation data at 5m contour intervals. The only data item not collected as part of the FONA data collection process is the existing barrier lines. The methodology to assume these barrier lines is detailed subsequently.

The detail level of the horizontal and vertical alignment of the roads is fairly low, extracting the information from the base data used to populate the model. However, the attempt with the HTM model was to improve the FONA model results and thus used the same base data in order to compare apples with apples.

Detail HTM studies will be required before implementation of the below listed recommendations will be possible. The actual start and end positions of the climbing lanes needs to be determine in the detail studies.

In Table 3-40 the results of the HTM model is presented. The percentage climbing lanes (additional capacity) required to achieve a LOS D per primary route are indicated. The result of HTM is compared with the results from the FONA model. It is evident that the road improvements results from HTM are significant lower than the FONA model and more in line with the LOS experienced by road users.

**Table 3-40: HTM Results versus FONA Results For Base Year 40km/h and 60km/h speed limits.**

<table>
<thead>
<tr>
<th>Route Number</th>
<th>Total Route length</th>
<th>Km Climbing Lane Direction 1</th>
<th>Percentage Climbing Lane Direction 1</th>
<th>Km Climbing Lane Direction 2</th>
<th>Percentage Climbing Lane Direction 2</th>
<th>FONA Results Additional Lanes Required both directions</th>
</tr>
</thead>
<tbody>
<tr>
<td>RN 1</td>
<td>170.7</td>
<td>78.9</td>
<td>46%</td>
<td>78.48</td>
<td>46%</td>
<td>20%</td>
</tr>
<tr>
<td>RN 2</td>
<td>78.9</td>
<td>47.14</td>
<td>60%</td>
<td>38.78</td>
<td>49%</td>
<td>0%</td>
</tr>
<tr>
<td>RN 3</td>
<td>167</td>
<td>70.9</td>
<td>42%</td>
<td>60.26</td>
<td>36%</td>
<td>0%</td>
</tr>
<tr>
<td>RN 4</td>
<td>149.3</td>
<td>80.82</td>
<td>54%</td>
<td>87.86</td>
<td>59%</td>
<td>0%</td>
</tr>
<tr>
<td>RN 5</td>
<td>117.6</td>
<td>19.86</td>
<td>17%</td>
<td>17.94</td>
<td>15%</td>
<td>0%</td>
</tr>
<tr>
<td>RN 6</td>
<td>151</td>
<td>41.96</td>
<td>28%</td>
<td>45.2</td>
<td>30%</td>
<td>39%</td>
</tr>
<tr>
<td>RN 7</td>
<td>82.7</td>
<td>29.04</td>
<td>35%</td>
<td>23.18</td>
<td>28%</td>
<td>29%</td>
</tr>
<tr>
<td>RN 8</td>
<td>25.1</td>
<td>9.48</td>
<td>38%</td>
<td>5.64</td>
<td>22%</td>
<td>0%</td>
</tr>
<tr>
<td>RN 9</td>
<td>30.4</td>
<td>1.02</td>
<td>3%</td>
<td>13.38</td>
<td>44%</td>
<td>37%</td>
</tr>
<tr>
<td>RN 10</td>
<td>7.7</td>
<td>1.98</td>
<td>26%</td>
<td>0.96</td>
<td>12%</td>
<td>44%</td>
</tr>
</tbody>
</table>

The result of the HTM model is the provision of climb lanes along the primary roads of Rwanda. The spatial location of these climb lanes are presented in Map 3-23.
Map 3-23: Climb Lanes required in Base Year 40km/h and 60km/h scenario.
3.2.10 Other Initiatives Supporting the Strategic Road Transport Network

This section identifies initiatives that fall outside the road transport network but play an important supporting role. These include the following and will be discussed in turn:

- Alternative Project Appraisal Technique for Non-Classified Gravel Roads
- Regional Non-Tariff Barrier Programme;
- Non-Motorised Transport; and
- Rural/District Roads Programme (ASSETIP).

3.2.10.1 Alternative Project Appraisal Technique for Non-Classified Gravel Roads

The total road network comprise of 14,000km of road, 4,698km are classified roads of which 2,860km are paved national roads and 1,835 km unpaved gravel roads. The rest of the 9,302km of the road network is unclassified and unpaved roads. No standard capacity analysis methodology exists for these types of roads.

However, the first step to improve capacity along a gravel road is to pave the road and thus increase the operating speed along the road. Several analysis techniques are found in the literature to evaluate when to pave a road and when not to do so.

Factors that influence the decision to pave a road are (Rodger Young, 2006):

- Paving helps to seal the surface from moisture and protects the base and subgrade material,
- Eliminates dust problems,
- Smoothness - Has higher user acceptance,
- Accommodate many types of vehicles that do not operate as effectively on gravel roads,
- Matter of trade-offs,
- Maintenance - Properly maintained, a gravel road can serve general traffic adequately for many years.

The study states that the following conditions are required when a gravel road is considered to be paved:

- When local agencies considering paving roadways for one of the following reasons:
  - Reducing roadway maintenance cost,
  - Providing a smooth riding surface,
  - Eliminating environmental (dust) problems.
- A requirement is that the local agencies should have a policy and criteria for paving gravel roads.

When considering the pavement of a road or several gravel roads the agency must first have the following in place to ensure that the roads will be maintained and operated effectively. The systems that needs to be in place are:

- Roadway management program.
- Must be commitment to effective management
- Traffic conditions and usage – life and maintenance requirements of a roadway is affected by the number of vehicles and their weight
- Economic Evaluation of the life cycle cost between gravel and paved road based on traffic volumes.
- The comparison of life cycle cost
for a paved and gravel road is shown to the right. It is important to note that the initial cost associated to the paved road is higher than the gravel road with low maintenance schedule. The importance of maintenance is most important cause not of the roads will have a full life cycle if the maintenance is not done according to the maintenance schedule.

A study done by the University of Minnesota - Centre for Transportation Studies (LATP) to determine to pave roads or not found that:

“Traffic is a primary factor in deciding to pave or not to pave. The Minnesota study found that gravel road maintenance costs per mile appear to increase considerably after an ADT level of 200 vehicles per day. On the other hand, the South Dakota study found that paved roads are most cost-effective at ADT levels above 150 vehicles per day. So, decisions can be made based on traffic data, local construction and maintenance costs, and area growth values to determine if and when a roadway should be paved.” (Minnesota Local Technical Assistance Program, 2006)

Kentucky Transportation Centre, University of Kentucky prepared a list of 10 Questions that needs to be answered before a decision is made to pave a gravel road. These questions and a summary of the answers are shown in Table 3-41.

**Table 3-41: When Should We Pave A Gravel Road – Ten (10) Questions and Answers:**

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. After Developing a Road Management Program</strong></td>
<td>A road management system is a common sense, step-by-step approach to scheduling and budgeting for road maintenance work. It consists of surveying the mileage and condition of all roads in the system, establishing short-term and long-term maintenance goals and prioritizing road projects according to budget constraints. Steps in a Road Management Program:</td>
</tr>
<tr>
<td>1. Inventory the roads.</td>
<td>The amount of time available and the miles of road in a county or city will determine how much detail to go into.</td>
</tr>
<tr>
<td>2. Assess the condition of the roads.</td>
<td>Develop simple and easy techniques to use each year. Maintain a continuing record of the assessed condition of each road so that changes in condition can be noted easily and quickly.</td>
</tr>
<tr>
<td>3. Select a road management plan.</td>
<td>Select the most appropriate treatment to repair each road, bridge, or problem area.</td>
</tr>
<tr>
<td>4. Determine overall needs.</td>
<td>Estimate the cost of each repair job using generalized average costs and tally up the total. Establish long-range goals and objectives that in turn will help the agency justify its budget requests.</td>
</tr>
<tr>
<td>5. Establish priorities.</td>
<td>Keep good roads in good shape (preventive maintenance) and establish a separate budget, or request a temporary increase, to reconstruct really bad roads.</td>
</tr>
<tr>
<td><strong>2. When the Local Agency Is Committed to Excellence</strong></td>
<td>A commitment to effective management is an attitude. It is a matter of making sure that taxpayers’ money is well spent— as if it were one’s own money. It does not mean paving streets with gold but it does mean using the best materials available. It does not mean taking short cuts resulting in a shoddy project but it does mean using correct construction techniques and quality control. A commitment to effective management means planning for 5 or even 10 years instead of putting a band-aid on today’s problem. It means taking the time to do things right the first time and constructing projects to last.</td>
</tr>
<tr>
<td><strong>3. When Traffic Demands It</strong></td>
<td>The average daily traffic volumes (ADT) used to justify paving generally range from a low of 50 vehicles per day to 400 or 500. When traffic volumes reach this range, serious consideration should be given to some kind of paving. The functional importance of the highway should also be considered. Generally speaking, if the road is a major road, it probably should be paved before residential or side roads are paved. On the other hand, a residential street may be economically sealed or paved while a road with heavy truck usage may best be surfaced with gravel and left unpaved until sufficient funds are available to place a thick load-bearing pavement on the road.</td>
</tr>
</tbody>
</table>
| **4. After Standards Have Been Adopted** | Written standards in the areas of design, construction and maintenance define the level of service we hope to achieve. They are goals to aim for. Without written standards there is no common understanding about what a local government is striving for in road design, construction and maintenance. In deciding to pave a gravel road, is the local...
5. After Considering Safety and Design

Paving a road tempts drivers to drive faster. As speed increases, the road must be straighter, wider, and as free as possible from obstructions for it to be safe. Paving low volume roads before correcting safety and design inadequacies encourages speeds which are unsafe, especially when the inadequacies “surprise” the driver. Because of the vast mileage of low volume roads, it is difficult to reduce speeds by enforcement. Roads must be designed to provide safe travel for the expected volume at the design speed. To do this a number of physical features must be considered:

- Sight Distance;
- Design Speed;
- Alignment and Curves;
- Surface Friction;
- Lane Width; and
- Super-elevation.

6. After the Base and Drainage Are Improved

“Build up the road base and improve drainage before paving.” This cardinal rule cannot be stressed enough. If the foundation fails, the pavement fails. If water is not drained away from the road, the pavement fails. Paving a road with poor base or with inadequate drainage is a waste of money. It is far more important to ask, “Does this road need strengthening and drainage work?” than it is to ask, “Should we pave this gravel road?”

7. After Determining the Costs of Road Preparation

The decision to pave a gravel road is ultimately an economic one. Policy makers want to know when it becomes economical to pave.

There are two categories of costs to consider:

- Total road costs; and
- Maintenance costs.

Local government needs to determine what the costs are to prepare a road for paving. Road preparation costs are the costs of construction before paving actually takes place.

8. After Comparing Pavement Life and Maintenance Costs

A second financial consideration is to compare maintenance costs of a paved road to maintenance costs of a gravel road. To make a realistic comparison we must estimate the years of pavement life (how long the pavement will be of service before it requires treatment or overlay) and the actual cost of paving. It is at this point that we can begin to actually compare costs between the two types of roads.

9. After Comparing User Costs

Not all road costs are reflected in a road budget. There is a significant difference in the cost to the user between driving on a gravel surface and on a paved surface. User costs, therefore, are appropriate to consider in the pave/not pave decision. By including vehicle-operating costs with construction and maintenance costs, a more comprehensive total cost can be derived.

Vehicles cost more to operate on gravel surfaces than on paved surfaces, often 2 or 3 times greater than for bituminous concrete roads in the same locations. There is greater rolling resistance and less traction which increase fuel consumption. The roughness of the surface contributes to additional tire wear and influences maintenance and repair expenses. Dust causes extra engine wear, oil consumption and maintenance costs.

10. After Weighing Public Opinion

Public opinion as to whether to pave a road can be revealing, but it should not be relied upon to the exclusion of any one of points 1-9 already discussed.

3.2.10.1.1 Conclusion:

It can be concluded that the main consideration to pave or not to pave is not an easy decision and once a road is paved it does not mean that it disappear from the problem list it is added to the maintenance schedule and cost to public sector.

From the literature survey the following factors needs to be considered carefully before a road is selected to be paved:

- Is a Road Management system in place?
- Is the maintenance approach towards gravel and paved roads agreed upon in Rwanda?
• Are the design standards available for detail design of low volumes roads that is adopted to Rwanda circumstances?

• Is the traffic volume per day available and is it more than 200 vehicles per day?

If the answers to these questions are positive it is recommended that critical links hampering connectivity and accessibility of local communities to the national road network is identified. These links needs to be evaluated based on the following question from the 10 Question list above:

• Consider Safety and Design – When roads are paved the average travel speed increases. The road design needs to be changed to align with higher travel speeds,

• Will improvement of the base and drainage provide a better road and exclude the need to pave?

• Evaluate the costs of road preparation – construction and maintenance cost;

• What is the outcome when comparing pavement life and maintenance costs,

• What will the effect be on user costs?

Based on the outcome of this analysis the roads that really required to be paved for accessibility and that will be cost effective will then be selected.

3.2.10.2 Regional Non-Tariff Barrier (NTB) Programme

Multilateral trade agreements have brought down tariff barriers to trade following negotiations under the General Agreement on Tariffs and Trade (GATT). However, non-tariff barriers (NTBs) have gained prominence as alternative trade policy instruments for domestic industry protection or for regulating trade. NTBs are barriers to trade that are not tariffs and include both trade-restricting measures such as quotas, technical barriers, etc. and trade-promoting measures such as export subsidies etc. In their application, NTBs are increasingly raising market access concerns at both global and regional levels.

On March 2, 2004, member states of the EAC signed a protocol for establishment of the East African Community Customs Union which commits the member states to eliminate NTBs.

Policy makers within the EAC should consider abolishing or reducing the applied NTB’s within the specific sectors. Such policy measures have a great potential of improving the welfare of people living in the EAC countries (including Rwanda). Addressing the negative effects to trade associated with NTBs requires effective policy actions by the national governments of member states in the EAC. The following policy actions are proposed:

• Streamline administrative requirements to improve on efficiency

  Traders adhere to a number of administrative requirements for trade in East Africa including: licences, municipal permits, customs clearance, road toll stations, weighbridges, standards and certification. These procedures are necessary for disease control, security and quality and consumer health considerations, but there is a need to improve the efficiency in these procedures to minimize time loss and avoid unnecessary extra costs to trade.

  Policy actions to increase efficiency in administrative procedures to trade can include:

  o Agreements to harmonize trade regulations and procedures for example through creation of single check border points across neighbouring countries. License or border clearance procedures and documentation could be harmonised across municipal or across the region through the Regional Economic Communities (RECS). This would speed up implementation of procedures at point of origin and the border and minimize time loss at check points such as roadblocks, weighbridges, council and municipalities.

  o Build capacity at check points in terms of enhancing the human capacity through training, provision of all necessary equipment in good working condition, upgrade customs information systems to allow for effective communication on changes in policy related to cross border trade and improve access to required documentation for trade by decentralising licensing agencies.

• Remove unnecessary barriers that contribute to increased transportation costs.

  Inefficiencies in trade administrative procedures increase the transportation costs of trade goods in EAC. In addition, corruption, lack of clear information for all administrative procedures required for trade by the traders and poor road conditions contribute significantly to increased transportation costs. Corruption was reported to be a common problem among all countries; for example more than two thirds of beef cattle traders in Kenya and Tanzania and about a half in Uganda reported to have given
bribes to be able to easily trade (ASARECA, 2009). Complications in the administrative procedures and lack of adequate information on trade requirements and awareness on trade reforms and regulation by the traders make them unable to meet some of the requirements and resort to paying bribes. They also find it more appealing to engage in informal trade. Both of this adds to transaction costs.

Simplification of the administrative procedures and improvement of access to information by all levels of traders especially small scale traders will make it more likely for traders to adhere to the regulations. The study also found that vehicle hire and maintenance was the highest contributor to transportation costs, respondents indicated that poor road conditions were one of the factors contributing to the need for frequent maintenance. High fuel costs were also stated to be a big factor for high vehicle charges. While improvement of roads in the EAC region (both feeder roads as well as international trading routes) is one of the areas that the governments would want to invest in, one option that could also be explored is the reduction of domestic taxes which constitute a large proportion of fuel prices.

- Removal or reduction of NTBs should be tackled as a group and not one-by-one
- Governments should not reduce one main NTB and expect a major increase in trade; to have a major impact; NTBs should be reduced as a group.
- Since NTBs are similar across the region, a region-wide approach for tackling NTBs might be less costly and as effective as national-specific or sector-specific approaches.
- Design and implement monitoring systems to provide feedbacks to the relevant authorities on the control of unnecessary barriers to trade in the EAC region.

3.2.10.3 Non-Motorised Transport and Intermediate Means of Transport Accommodation

The total transport system does not only comprise ‘formal’ modes of transport but also consist of ‘informal’ means of transport which is often referred to as ‘intermediate means of transport’ (IMT) or ‘non-motorised transport’ (NMT). IMT is furthermore a collective term and could, in a strict sense, form part of intermodal transport, although the latter term is more commonly used for the formal transport modes.

IMTs are widely used in the developing world both to improve the efficiency of directly productive tasks, and to serve as a bridge between rural fields and villages and nearby road networks or market towns. Africa has been lagging behind other developing regions in its adoption of IMTs to increase mobility and rural productivity. Some of the reasons are:

- perceived technological degradation – African policy makers view motor transport as the only feasible alternative. This cannot be justified when viewed in the context of preponderance of head- and back-loading as exist in many remote parts;
- rural transport institutional and planning gaps – national transport planning systems in Sub-Saharan Africa have often neglected the secondary and tertiary roads that serve rural areas; and have largely ignored the off-road transport and travel that make up the bulk of rural journeys by excluding these conditions in planning approaches;
- invisible and uncounted traffic – planning and decision-making processes do not take into account the mobility needs of rural people simply because of the gap in data.

The application of IMT is, however, not only restricted to the rural areas, but has also establish itself under most chaotic traffic conditions in African cities as both as a flexible and affordable mode of transport to the benefit of the very poor, who are economically captive to non-motorised transport, as well as the less poor. While the regulatory system governing transport and in particular public transport is inadequate and ineffective in meeting demand, travel conditions are very difficult in terms of traffic safety, quality of and accessibility to services and air pollution caused by motorised transport. The two major modes of IMT are walking and cycling. Recent studies have indicated that especially for shorter trips undertaken, more than 50% of trips are entirely on foot. City authorities are finding it difficult to manage and control street markets and footway activities when most of the streets either do not have sidewalks or are encroached upon by street vendors or blocked by illegally parked cars and motorcycles.

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NMT should be encouraged not only by providing infrastructure but by ensuring that pedestrians and other NMT users feel safe and secure in their environment and that services and land use is orientated towards the NMT network.

The one disadvantage of NMT is that long distances can be exhausting and therefore planning should consider the proximity of services to homes and to one another.

NMT/IMT plays an integral part of road safety and is included under the proposed “High-Level” Road Safety Strategy for Rwanda (refer to Section 3.2.8).

It is recommended that the City of Kigali be chosen as a pilot city to implement a NMT Strategy. The following is recommended contents of a NMT/IMT Strategy for Rwanda based on a Pilot Study for Kigali City:

- **Vision and Objectives for NMT in Kigali City:**
  - Gives direction to the NMT strategy and presents the over-arching role of NMT in Rwanda, including public transport integration and the importance of universal access (i.e. access for all);
  - Provides broad direction on dealing with NMT in the city and relates to principles such as the promotion of mixed-use development, densification, walkable communities, etc.
  - Objectives are also important as they are used to prioritise NMT projects identified for implementation.

- **NMT Infrastructure and Environment Register**
  The transport register should cover the full spectrum of data collection necessary for the planning of all types of transport infrastructure and operations. This includes all non-motorised transport remembering the importance of NMT in accessing public transport, possibly as a type of public transport or goods-transport in some rural areas, and as a primary mode on its own.

  It is important to have an understanding of the existing environment before planning new facilities. As far as possible, information that can be shown spatially should be documented on a map. The register should therefore include the following:
  - The NMT networks: including roads, pedestrian ways and cycle ways, indicating the type of facility along each section of the route (i.e. on street, separate facility, pedestrian only route etc)
  - The NMT amenities: indicating the facilities available such as benches, bicycle lock up facilities, bicycle repair shops etc
  - Existing land use: to indicate the location of areas in demand, such as schools, shops, business areas and sports facilities
  - Public transport facilities: to indicate where NMT demand will be concentrated
  - Physical obstacles: constraints to NMT such as topography, and highly trafficked roads

  Data can be collected by various means, preferably making use of existing sources of information and supplementing this where necessary with additional data collected by roadside surveys, roadside counts, etc.

- **NMT Needs Assessment**
  The NMT needs assessment must give adequate attention to non-motorised transport, keeping in mind particularly the needs of learners and persons with disabilities.

  The NMT strategy must look at the needs of the same groups, giving attention to:
  - the needs of learners;
  - the needs of persons with disabilities;
  - the avoidance of land use distortions and longer travel distances.

  The NMT needs of a community can be assessed using the NMT Register, consultation with stakeholders (the public, schools and learners, the disabled, the elderly, commuters, local businesses etc.) and from demand estimation. The latter can be determined by modelling, surveys or estimations which may include information on origins and destinations, coupling or trip chains, timing and route choice. Traffic studies and the identification of hazardous locations will also assist in identifying the NMT improvement needs.

  The needs that are assessed should consider not only the routes (ways), but crossings, amenities and land use orientation (particularly for surveillance).
Mapping can also be a very useful tool to understand NMT spatially. This can include:

- Origin and destination mapping is useful to understand peoples movements, using prominent land use and the gathered data.
- Actual route mapping. Determining the "detour factor" or (pedestrian directness ratio” (PDR) is a useful tool in assisting with route determination as it indicates the ratio of the distance an NMT user must travel over the straight (as-the-crow-flies) distance. (Ref: Randall, T and Baetz, B, 2001: “Evaluating pedestrian connectivity for suburban sustainability”, Journal of Urban Planning and Development, Vol 127, No 1, March, p1-15).
- NMT flows
- Traffic accidents. Indicators, such as EAN (equivalent accident numbers) can be useful in determining the most dangerous intersections.
- Pedestrian ‘desire lines’.
- Learners routes to school.

It is important to involve the stakeholders in assessing their needs. This highlights the needs directly from those involved and gets people involved in their environment. This will also help in getting the plan passed at the end of the process. This process can be long and difficult but it is worth engaging with groups. It should also be remembered that the people that are consulted are the current users and can give valuable insight to improve NMT infrastructure to encourage NMT use as an alternative to motorised forms of transport.

- Plan development and evaluation

The NMT strategy must deal with the development and maintenance of all NMT infrastructure and amenities including path ways, cycle ways, crossings and amenities/facilities. Once the objectives of the NMT strategy have been developed, the existing infrastructure is understood and the needs for improvement have been identified, a plan should be developed to address these needs. Once this has been done, the plan can be evaluated, projects prioritised and a financial plan drawn up on the costs and possible funding of the projects

- Implementation and monitoring

Once the interventions have been decided on, they can be displayed on a map using a similar format used in the mapping of the existing environment. Using the same mapping format also makes updating of the infrastructure and environment register easier when the strategy is reviewed. A table of all the projects and the estimated costs should be produced to enable funding to be motivated for.

The interventions should be designed to provide adequate and safe facilities (there are many international best practice guidelines available that can be applied to Rwanda). Some things to look out for in design are:
- Pathway width
- Paving material
- Gradient
- Stairs
- Landscaping
- Street furniture
- Lighting

The quality of construction should be given attention as poor construction can lead to the facilities not being usable by pedestrians and cyclists. In addition, Poles can be placed in the middle of pathways, making them difficult or even dangerous to use for everyone other than an able bodied pedestrian.

It is recommended that, where possible, NMT infrastructure is provided with public transport infrastructure. For example, when a new public transport stop is constructed, pathways to the stop are implemented at the same time to provide access to the public transport system.

- Monitoring

Monitoring the effectiveness of new interventions and the changes in travel patterns can provide useful insight that can be used to refine the strategy and interventions in subsequent reviews.
3.2.10.4 Rural/District Roads Programme (ASSETIP)

A third model which is extensively being used in francophone Africa is a contract executing agency (like a private sector project implementation unit), set up to execute donor-financed infrastructure projects. The Agence d’Exécution d’Intérêt Publique (AGETIP) often referred to as a public works and employment agency has a board composed of well-known figures (which does not include government representatives), a general manager appointed by the board, other line managers (administrative, financial and technical), staff hired and private sector terms and conditions of service who are paid competitive salaries.

In Rwanda, the agency is called the Association for the Execution of Works of Public Interest (ASSETIP) and was established in 2004.

The agency is set up as a private, non-profit association and pays no taxes. The agency works on behalf of local authorities who delegate certain functions to the agency. The local government usually reserves the right to select the projects and the agency then: (i) recruits consultants to carry out detailed engineering; (ii) invites bids and awards contracts for supervision and works, manages the contracts, and pays the contractors directly from a special account opened in its own name. The agency is subjected to a bi-monthly management and financial audit and an annual technical audit.

The advantages of the AGETIP/ASSETIP are that it: (i) gets around cumbersome government procurement regulations; (ii) streamlines payment procedures; and (iii) pays high salaries and therefore attracts well motivated, high quality staff.

The disadvantages are that: (i) the arrangements are not subject to competitive bidding; (ii) it is almost entirely dependent on continued donor funding; and (iii) it probably hampers development of the local consultancy industry (by creaming off staff and monopolising all contract execution work for itself under a tax-free operating environment).

AGETIP/ASSETIP has a short term role to play, particularly in economies where the local consulting industry is relatively underdeveloped. However, in future ASSETIP could play a vital role on a District and Local level in terms of institutional support, capacity and skills transfer within the transport sector of Rwanda.

3.3 RSTMP Rail Network

3.3.1 Introduction

The rail mode comes into its own for longer-distance hauls of fairly large volumes of cargo. At the other end of the transport spectrum, this mode is an important commuter carrier in dense urban areas. In a mature transport system with large passenger demand, rail is a viable long-distance (high-speed) passenger carrier.

3.3.2 Overview

Rwanda does not presently have a rail network. The rail systems of neighbouring countries extend towards but do not reach Rwanda:

- The URC/RVR (Uganda) mainline from Mombasa goes as far as Kampala. The Kampala-Kasese branchline is inoperational although RVR is investigating the feasibility of reopening it.
- The TRL (Tanzania) mainline from Dar es Salaam reaches Mwanza and Kigoma. The Kigoma section especially is subject to service interruptions because of the poor state of repair. The plan to extend a branchline from Isaka to Kigali is well advanced.
- The SNCC (DRC) system has a branchline from Kabalo to Kalemié. The SNCC system is in the process of being rehabilitated.

3.3.3 Rail Classification

In the absence of a rail system, the issue of network classification does not arise. Rail classification would be relevant when a hierarchy of rail applications start to emerge, e.g. urban rail, local freight rail, regional freight rail, etc.

In the broader region, a formal classification system has also not been adopted. In Southern Africa where there is a broader rail network, the general classification merely differentiates between “mainline” and “branchline.”
3.3.4 Rail Standards

Uniform rail standards ensure continuity of service and also have other benefits such as economies of scale in construction and operation. This is especially important for a landlocked country of which the rail system has to tie in with that of its neighbours.

There are three main categories of standards, i.e. track, equipment and operations standards.

Track standards are dominated by the question of gauge. In the region, RVR and TRL are both Narrow Gauge (1 000mm) while SNCC is Cape Gauge (1 067mm). There is a plan in the region to replace the NG system with Standard Gauge (1 435mm). The gauge decision is vexing for especially TRL where the system is in need of large-scale rehabilitation.

Other track standards that are particularly important are:

- Uniform general axle loads so that wagons and payloads can be standardised
- Uniform track geometric standards to ensure sufficient speeds

Key equipment standards are:

- Standardised mainline locomotive fleet allowing for ease of maintenance and improved availability and utilisation
- Standard wagon, coupling and braking systems
- Standardised maximum train lengths.

As regards operating standards, these are clearly more important the busier the rail system is and the more operators require access to the lines. In the regional context, the operating interface between adjacent national railway systems is crucial, including the rules of whether locomotives may cross the border, how wagons are handed over from one operator to another, and where and how Customs duties are performed.

Other operating standards include:

- Uniform track maintenance procedures
- Scheduled train services around which shippers can plan.

3.3.5 Rail Initiatives

In the region, there are two plans investigating possible future expansion of the rail system. The EAC Rail Master Plan (EARMP) proposed new links, including from Isaka (TRL) to Kigali with a branchline into Burundi, and from Kigali via Kabale to Bihanga/Kasese (URC/RVR). The Great Lakes Railway Pre-feasibility Study has investigated links from Bukavu to Kigali, Bujumbura to Kigali and Gisenyi to Kigali. The topography of the terrain along the Bujumbura-Kigali and Bukavu-Kigali sections is not conducive to a rail solution. Kigali-Kasese is feasible from a construction perspective.

The major rail initiative in Rwanda is the development of the Isaka-Kigali line, with a branch from Keza via Gitega to Musongati in Burundi. This development is seen as a strategic initiative to improve the freight link to the coast and a crucial platform for the industrialisation of the country.

The line would extend 493km from Isaka to Kigali, with the Burundi section contributing a further 197km. Two studies have been carried out on this line (DBMNL and BNSF) and a study to detail the solution is currently in progress. The feasibility studies have indicated that the line would carry general freight in mining-related cargo, as well as passengers.

The line is planned at Standard Gauge, although this would have implications for the existing TRL line from Dar es Salaam which is built at Narrow Gauge. Rwanda and Tanzania are therefore promoting the upgrading of Dar es Salaam-Isaka and the construction of Isaka-Kigali as one contiguous project.
The possibility of extending the line to Gisenyi has been considered, although studies in this regard have not been carried out.

### 3.3.6 Rail Network Recommendations

The following are the main rail initiatives that emanate from the Transport Strategy:

- The Isaka-Kigali extension should be pursued to construction. Issues that remain to be resolved are the funding and operating model, specifically how attractive the venture would be to private investors and operators. There may be a requirement for some public or grant funding to seed the track investment. Train operations should be seamless with the TRL system which may imply that the TRL operator also operate the Rwanda section. If not, the Rwanda operator should have open access to the TRL system to avoid unnecessary hand-overs and related delays.

- The railway line should land in Kigali in a manner that properly ties into local transport and land use. The inter-modal solutions required are discussed in Section 3.7.

- The extension from Kigali to Gisenyi is at the concept stage, and its development will rely on the demonstrated success of the Isaka-Kigali line. Given the fairly high-density settlement along that corridor, it would be prudent at this time to determine an optimum routing and to reserve the route from encroachment. Whether and when the extension is built is a decision that can be taken in the longer term.

- A high-traffic corridor that requires a high volume transit solution is that between Kigali and the new international airport at Bugesera, and an option is that rail be used. However, in the foreseeable future this link would be served by road transport.

In more general terms, the redevelopment of the rail mode in the wider region is receiving fresh attention. There is a plan to establish a rail competency at the EAC. Issues to be addressed include a position on the preferred gauge, open access on the regional rail network and other rail standards. Rwanda’s rail interest is closely tied to especially developments on the TRL system, but will in time also be integrated with RVR. It is therefore important that the country participate fully in the regional rail debate.
3.4 Strategic Aviation Network (Airports and Communication / Navigation / Surveillance)

Air transport is expected to play an important role in long-haul passenger transport, i.e. specifically to link Rwanda with neighbouring countries and the rest of the world.

3.4.1 Overview

There are seven functioning airfields in Rwanda at present (refer to Map 3-24 below). The main airport in Rwanda is Kigali International Airport which is located at Kanombe, which is about 10km from the city centre. This is the main international aviation gateway to the country.

Kigali International has both terminal and airside capacity constraints. An interim terminal upgrade should to alleviate immediate landside pressure. The short, single runway is not designed to accommodate fully-laden wide body aircraft (necessary for long haul). However, it cannot be extended due to the terrain and the airport’s proximity to Kigali City.

Due to the limited capacity of the current airport which is anticipated to be reached by 2015 and other limitations, a new international airport is being planned at Bugesera about 40km South-East of Kigali. The future role of the KIA is currently not decided yet, although it understood this role might entail use as a possible military asset. The specific role is pending discussions between the City of Kigali and the Rwandan Defence Force.

The other airports in the national airports network are Kamembe (Ruzizi), Gisenyi, Ruhengeri, Butare, Gabiro and Nemba. Karongi Airport has also recently been identified as having potential to serve as a Tourist Circuit Airport.

3.4.2 Airport Classification

There is no formal airport classification system in place in Rwanda presently. However, such a system has been proposed for the EAC.

Various systems for airport classification are applied internationally. These systems are based on criteria such as function of the airport, level of traffic (passenger or cargo), design and safety criteria. The proposed EAC system is based on the Federal Aviation Administration (FAA) stratification categories, and the International Civil Aviation Organization (ICAO) reference codes.

The airport classification system proposed in the EAC is based on a distinction between four airport classes as shown in Table 3-42.

Table 3-42: Proposed Airport Classification System for Rwanda

<table>
<thead>
<tr>
<th>Airport Classification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>International Airport</td>
<td>Airports supplying a wide range and frequency of international services, including intercontinental services and a full range of domestic services. Flights can be scheduled or unscheduled, and the airport can accommodate large aircraft.</td>
</tr>
<tr>
<td>Regional Airport</td>
<td>Airports catering for the main air traffic demand of individual regions. They are concerned with the provision of domestic services, including links with gateway airports, a range of charter services, and may also provide short-haul international services. Flights can be scheduled or unscheduled. Aircraft are typically smaller than at International Airports.</td>
</tr>
<tr>
<td>Tourist Circuit</td>
<td>Airports specifically targeted at improving access for tourists, accommodating mostly charter or non-scheduled movements with fairly small aircraft.</td>
</tr>
<tr>
<td>Local Airport</td>
<td>All airports not falling under International, Regional or Tourist Circuit airports. These would typically cater for general aviation only.</td>
</tr>
</tbody>
</table>
Map 3-24: Current Airports of Rwanda
The EAC Master Plan previously proposed the following classifications for Rwandan airports:

- International: Kigali International
- Regional: Kamembe
- Tourist Circuit: Gisenyi, Ruhengeri and Butare
- Local: Nemba and Gabiro.

However, it is understood that Gisenyi, Ruhengeri, Butare and Gabiro might also in future fulfil the role of a regional airport in this classification and should be updated accordingly in time. Furthermore, a Tourist circuit Airport has been identified at Karongi.

### 3.4.3 Regional and National Standards

Aviation technical standards are generally regulated by the International Civil Aviation Organisation (ICAO) which is a specialized agency of the United Nations. In terms of national and regional standards, it is specifically important to adhere to the standards and recommended practices of ICAO standards, such as those that relate to air navigation and aviation infrastructure.

The following ICAO standards are of specific relevance for the Rwanda Aviation Industry:

- ICAO Annexure 11 – Air Traffic Services
- ICAO Annexure 14 – Aerodromes.

In addition, the existence of regionally accepted standards, under the ICAO Africa-Indian Ocean Regional Air Navigation (AFI-RAN) network also has a specific bearing on the Rwandan aviation sector.

Regarding these aviation standards, the following main issues should be noted:

- The development and implementation of aviation standards should be discussed and agreed at a regional level
- The current airport infrastructure in Rwanda needs to evaluated against these standards, and remedial actions undertaken where required (and feasible)
- The development of future airports, specifically the Bugesera airport, needs to be done in line with these standards.

### 3.4.4 Proposed Airport Developments

There are two ongoing airport initiatives namely Bugesera International Airport and Kamembe Airport.

#### 3.4.4.1 Bugesera Airport

The vision of the new Bugesera airport is that it will be a full service international airport designed to serve the needs of Rwanda’s growing air passenger and cargo traffic as it increasingly integrates with the rest of the world. It further aims to develop into a Central African hub airport and a gateway airport linking the Great Lakes region of Africa to the world – serving as the termination point for several European, American and Asian airlines and providing connections to all parts of Africa.

The project uses a flexible design, which allows for construction and expansion in intermediate phases according to traffic demand levels. The project is divided into three phases as illustrated in Map 3-25 to allow for a projected capacity within specific timeframes.
The feasibility study was completed in 2007, including a land use plan; a Master plan: Business and financial analysis including revenue plans; and a detailed financial plan.

A second phase of detailed design studies was rolled-out in 2009 when the Government engaged a British engineering firm, TPS for a detailed technical and feasibility study. According to the TPS study, the airport would cost an estimated US$600 million upon completion. The Government plans to reassess the technical design and costing of the new airport in order to explore the possibilities of downsizing the costing, to between US$300 and US$400 million. There will be an approximate four-year construction period.

MINECOFIN called for an expression of interest for “A 25 year PPP Concession Contract for the Bugesera International Airport, Rwanda”. The closing date was end October 2011.

3.4.4.2 Kamembe Airport

The Kamembe airport is in the process of undergoing a runway extension at present.

3.4.4.3 Development of Air Transport in Rwanda

The RCAA and RwandAir have recently developed an Activity Schedule that highlights key development proposals and programmes to further develop air transport in Rwanda. The key challenges identified by the Air Transport Development Activity Schedule are presented as follows:

- **Capacity Building Challenges** (Budget Identified to address Capacity Building Challenges = US$15m):
  - Regulator lacks investment for both human and infrastructure capacity to accomplish its mandate.
  - National Carrier depends on expatriate workforce for essential jobs. (e.g. Pilots, technicians, inspectors, etc.)
  - Current staff with practical management experience are few
  - No national aviation centre to support the air industry
  - Shortage of certified a. Air Traffic Controllers b. Air Worthiness Inspectors c. Flight Operations Inspectors
  - Retention of qualified professional staff. Air Navigation Services (ANS) Infrastructure

- **Safety Challenges**:
  - Acute shortage of Technical personnel with the required qualification/experience

- **Financial Challenges**:
  - Low investment in Infrastructure and human capacity building in Air transport area.

- **Legal/Policy Challenges**:
  - Yamoussoukro not fully implemented.
  - No clear national policy guideline on the administration of traffic rights
  - ICAO requires clear separation of roles of a regulator from that of the operator
  - No legal frame work to attract public and private sector investment in air transport activities.
3.4.5 Air Navigation Services (ANS) Infrastructure

The table below summarises the ANS infrastructure in place in 2009.

<table>
<thead>
<tr>
<th>Equipment Name</th>
<th>Type</th>
<th>Category of operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Instrument Landing System (ILS)</td>
<td>N/A</td>
<td>CAT. I</td>
</tr>
<tr>
<td>- 1x Localizer (LLZ)</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>- 1x Glide Path (GP)</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>- 1x DME</td>
<td>Landing DME (100w)</td>
<td></td>
</tr>
<tr>
<td>2. 1x VHF Omni-directional range(VOR)</td>
<td>Conventional (CVOR)</td>
<td>N/A</td>
</tr>
<tr>
<td>3. 1x Distance Measuring Equipment(DME)</td>
<td>Navigation DME (DMEN)-1kW</td>
<td>N/A</td>
</tr>
<tr>
<td>4. 1x Non-Directional Beacon (NDB)</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

The Rwanda Civil Aviation Authority (RCAA) and SITA also announced the introduction of digital-based data link services at Kigali International Airport which will eliminate total reliance on voice communications for digitally equipped aircraft. The Digital-ATIS (Air Traffic Information System) system and an air-ground data link service will be in place in the immediate future and is in line with ICAO requirements. The use of a Flight Information Processing System (FIPS) will improve efficiency and safety for proper air traffic management.

It is recommended that the development of the new Bugesera airport take the current and future planning of ANS infrastructure into account. It is anticipated that CNS planning will be carried out in accordance with the AFI-RAN requirements. Also, as the region moves towards unified upper airspace control, CNS infrastructure requirements will increasingly be directed by regional requirements. 18

3.5 Strategic Inland Waterways Network

Whereas inland waterways (IWW) were key to unlocking trade in the wider Great Lakes area, the importance of this mode has been overtaken by more flexible, lower-cost and higher capacity alternatives – especially roads. In the Transport Strategy, IWW is likely to fulfil a local, rather than national role.

3.5.1 Overview

IWW options in Rwanda relate primarily to Lake Kivu and the Akagera River (linked to Lake Victoria). The Rusizi River is generally acknowledged to be not navigable.

3.5.1.1 Lake Kivu

The cost structure of marine transport is such that it has relatively high terminal costs and relatively low shipment cost compared to other modes, such as road transport. Short-haul lake transport will therefore be at a disadvantage if a trip is not long and if the lake transport portion of that trip is not large. Lake Kivu has a surface area of 2 400km², which means that it is 50km wide on average. In comparison, Lake Tanganyika is 673km long from end-to-end, and Lake Victoria 319 km (from Port Bell to Mwanza). It is therefore not expected that Lake Kivu will play a major role in long-haul transport, especially as the other transport modes develop around it.

The Economic and Technical Feasibility Study for Water Transport on Lake Kivu (2009) investigated the potential for the provision of water transport on Lake Kivu. The primary findings were that modest volumes could be achieved (120 passengers and 15 to 20 tons of cargo on the lake daily). This would consist of purchasing two vessels, construction of buildings for ports services and facilities with ship terminals to handle the daily passenger numbers and cargo. It is expected that the major (primary) ports will be located at Rubavu/Gisenyi, Karongi and Rusizi with smaller (secondary) ports at Nkora, Mugenero, Kirambo and Nyamirunbi.

18 Under the EAC Treaty partner states agreed to the establishment of a unified upper area control system, i.e. a regional upper flight information region (UFIR) to be controlled by one upper area control centre (UACC).
3.5.1.2 Akagera River

The Kagera flows from Lake Rweru (1 450 m) on the Rwanda/Burundi border from where it forms the border between Rwanda and Burundi, Tanzania and Uganda variously, flowing into Lake Victoria at a point North of Bukoba. Apart from the Rusumo Falls 60 km downstream from Lake Rweru at the confluence of the Kagera and Ruvubu rivers on the Rwanda-Tanzania border, the river is meandering with only a slight drop in elevation to Bukoba (1 150m), more than 360 km downstream from Rusumo.

The navigability of the Akagera River was also studied in 2009. It specifically investigated navigability from Kagutumba to Lake Victoria, with the intention that river transport would interface with lake transport linking Rwanda to Kenya, Tanzania and Uganda. The primary findings were that the existing hydro-meteorological data required for engineering designs is limited, specifically regarding spatial variation of water levels along the river. Although the volume of traffic that could be diverted to the river was estimated to be about 1Mtpa by 2020, the river project was likely to be overtaken by other initiatives in the rail and road sector and may therefore be difficult to justify.

A further study is on-going presently. Issues under investigation in a current study include whether there is a suitable lake port at the mouth of the river or in the vicinity of the mouth, the river delta shallow areas, the navigability of the upper reaches where there are many narrow bends, the possible loss of about 130km of navigable river where the main river flow will be diverted to accommodate a proposed hydropower scheme at Rusumo, and the varying levels and flow rates of the river. There are distinctly seasonal changes with typical minimum water depths of 2 metres (and maximum depths up to 4 or 5 metres). Ports being considered are somewhere upstream of Kagutumba, and possibly Kemondo Bay on Lake Victoria. Furthermore, connections with existing ports on the DRC side of the Lake is also considered - Links to Goma (opposite Ribavu) and Bukavu (opposite Rusizi). This strategy is beyond the 10 year implementation framework of the RSTMP.

Although the study findings are awaited, based on the available information, it is expected that the study will conclude that the river can be navigated at certain times of the year. This operational time window would have to be expanded by means of substantial infrastructure implementation such flow control dams and canalisation in places to overcome the restricted navigation in parts where the river has too many bends and is narrow and to make the economies of scale acceptable. The length of tow and size of vessel would be restricted depending on the infrastructure proposed. The most suitable vessel would be flat-bottomed container barges which could accommodate most of the cargoes envisaged, which in turn could overcome the costs involved in multi modal handling at the Ports and standardise the type of equipment required. These barges would be towed by powerful river tugs.

3.5.1.3 Recent Strategies and Priorities of IWW Identified by RTDA

Rwanda does not have any major experience so far with relevant instruments, new developments or projects as a basis for the development of an integrated maritime policy.

Thus, the compilation and consolidation of existing key measures and national legislative action in the field of maritime policy will be a core task in developing the "Maritime Development Plan". The following salient items proposed are highlighted and it is recommended that the following be developed:

- The implementation of an advanced ferry system for both passengers and cargo vessels on Lake Kivu, serving the major communities along the shores.
- The possible introduction of inland waterways navigation on the Akagera river, connecting Rwanda with Lake Victoria.
- Investigating the possibilities of connecting Lake Kivu with Lake Tanganyika.
- Developing ferry systems on other larger Rwandese lakes
- The creation of a new shipbuilding industry for national (and international) construction and maintenance of vessels and applied equipment.
- Implementation of a tourism-based inland waterways structure plus promotion of such system in the international context.
- Implementation of inland navigation legal and regulatory structures and control systems
- Development and implementation of a safety & security policy for all inland waterways related activities
• A communication platform of inland waterways actors including policymakers at local, district and national level, associations as well as economic and social partners with the objective of coordinating and monitoring the implementation of the action plan,

• Maintaining an on-going dialogue and exchange of information on current developments, planned projects, best practice opportunities, problems and conflict areas.

• Adapting existing and new funding instruments to meet the requirements of maritime policy.

• Introduction of PPP's for financing and operating newly implemented systems

• Identifying special requirements of the inland waterways and related sectors, as well as determining need for new action.

• Identifying new key projects.

3.5.2   IWW Port Classification

Currently, there is no inland waterway infrastructure classification available or in use in Rwanda. Although there is not a standard approach to the classification of ports and terminals, for consistency, Rwanda may consider an approach that correlates with other network infrastructure classifications used for roads, aviation and rail.

For the purposes of the RSTMP, the inland waterway infrastructure classification focuses primarily on the inland waterway nodes, namely the ports and terminals. It is proposed that two levels of lake port be recognised. Primary lake ports (or terminals) would be Rubavu, Karongi and Rusizi. Secondary lake ports would be Nkora, Mugonero, Kirambo and Nyamirundi. The Lake Kivu Water Transport Feasibility Study proposed that the port authority headquarters be located at Rubavu. This is also likely where the main ship repair workshops would be based.

In the case of the Akagera River, the primary ports would be Kagitumba and Bukoba/Kemondo Bay.

3.5.2.1   IWW Standards

There are no formal national facility and equipment standards in place for IWW, but there are various regional and international norms that apply. Trading on the inland lakes is considered to be international trade and thus, for many years in the past, international maritime rules and standards have applied. This has been overtaken in recent time and IMO has set standards and rules for vessels operating on the inland waterways of Africa. Also, member states of the EAC have ratified a Tripartite Inland Waterways Agreement to facilitate cooperation in infrastructure services for inland waterway transport. There is need to review, rationalise and harmonise the existing water transport legislation and policies so as to promote consistency in the sector (i.e. consistency between waterway transport on Lake Victoria, Lake Kivu and the Akagera River).
Map 3-26: Primary and Secondary Lake Ferry Terminals
Map 3-27: Akagera River Inland Waterway Transport Network
3.6 Strategic Pipelines Network

Pipelines are the preferred, lowest-cost transport solution for liquid petroleum products and crude oil, except at fairly low levels of demand.

3.6.1 Overview

The regional pipeline network responds to the needs and requirements of the upstream (extraction and import/export) and midstream (refining and processing) sub-sectors. The KPC system distributes petroleum products through Kenya and towards Uganda (Refer to F6, F7 and F8 denoted in Map 3-28). Although designed to transport refined products, the TAZAMA line now exclusively exports crude to Zambia (Refer to F44 denoted in Map 3-28). Recent developments in Uganda could lead to the region becoming an oil producer and exporter. Events in South Sudan could furthermore result in crude exports transiting the region.

Currently, land-locked countries of the East African Community (such as Uganda, Rwanda and Burundi) import all of their petroleum requirements by road and rail, through either the Port of Mombasa or Dar es Salaam.

Currently Rwanda has no pipeline network in place and there are no immediate plans to implement a pipeline network. However, given the continuing demand for liquid petroleum products and crude oil and the economic growth trend of Rwanda, the viability of implementing a pipeline network will become a reality in future.

Liquid petroleum products and crude oil storage in Rwanda (50 days) is regarded as under par in comparison to the remainder of the East African Community countries. This situation has led to fuel shortages that have had a serious adverse effect on price levels.

3.6.2 State of Explorations, Discoveries and Pipelines in Rwanda

The East African Region has a total of 22 sedimentary basins on which there are approximately 75 exploration blocks, 48 of which have been licensed to various companies or consortia. In Rwanda specifically, the Government is still undertaking a technical evaluation to define the country’s oil potential. Natural gas has been discovered in Rwanda in the lower depths of Lake Kivu which is thought to contain some 1 940 Bcf of methane. No development licenses have been granted as yet.

Current petroleum consumption in Rwanda is in the order of 250,000 tonnes per annum. The economics of pipelines require that they carry at least 2 Mtpa or more. As a reference point the Mombasa Nairobi petroleum pipeline has a capacity of 7.7Mtpa and its extension from Nairobi to Eldoret, a capacity of 1.9Mtpa. It is unlikely that petroleum demand in Rwanda will justify constructing a petroleum pipeline in the foreseeable future, however, it would be prudent to set aside a pipeline reserve.

3.6.3 Rwanda’s Integration with Planned Pipeline Initiatives

A number of pipeline initiatives are planned within the East African Community and there is potential for Rwanda to align and integrate with these initiatives in order to fast-track pipeline transportation as a mode option within the country.

A feasibility study for the construction of the Dar es Salaam-Mwanza Petroleum Products Pipeline was commissioned in 1997 by the Tanzania Petroleum Development Corporation with the objective of transporting petroleum products by pipeline from Dar es Salaam to Mwanza and with storage depots located along the route. The objectives also included supply petroleum products to Uganda, Rwanda, Burundi and the DRC and contribute to the development of Tanzania’s infrastructure by improving security of supply and also releasing road and rail capacity.

Although promoted by TPDC, recent interest in building a similar pipeline between Dar es Salaam and Mwanza has been shown by the Qatari Noor Oil group and other parties. These plans are however linked to the construction of a refinery on the Tanzanian coast, for which EIA studies and land acquisition have, reportedly, already commenced. An important consideration from a regional perspective is how the potential of refining oil products in Uganda will play out and how this will affect the configuration of the Dar es Salaam-Mwanza pipeline.
Map 3-28: Existing Pipelines within the East Africa Region
The Uganda-Kampala Pipeline link project was first conceived to link Uganda into the existing Mombasa-Eldoret pipeline. This would open the possibility of an extension to Rwanda and eventually onto Burundi. While an MOU between Uganda and Rwanda was signed to implement the project, it is understood that this forms part of the agreement between Uganda and Tamoil East Africa on the Eldoret-Kampala extension. However, that extension is currently on hold until the implications of the oil finds at Lake Albert are known, including whether and how Uganda will export oil and petroleum products.

Additional Pipeline proposals that have come to light recently are:

- New alignment of Kampala-Kigali Pipeline proposed: Kagitumba-along the border to Katuna-Gicumbi-Kigali.
- Additional future pipeline link to Lake Kivu: Kigali-Muhanga-Ribavu
- Additional future pipeline link to Lake Kivu: Huye-Rusizi (pipeline feeder branching from the Kigali to Bujumbura alignment)
3.7 Inter and Multi-Modal Infrastructure

3.7.1 Concept of Modal Interchanges

Multi-modal transportation is the transportation of passengers or freight by means of more than one mode. Multi-modal transport is generally categorised in terms of the following (Refer to Figure 3-46):

- Long-haul (trunk) services, i.e. generally large-capacity services carrying large numbers of passengers or large volumes of goods (generally aggregated / bulked) over long distances on a relative simple route network, generally between major settlements or cities.
- Short-haul (distribution or feeder) services, i.e. generally smaller-capacity services carrying lower numbers of passengers or lower volumes of goods (generally disaggregated) over shorter distances on a much more complicated distribution route network with the purpose of distribution passengers and freight within an urban context (within a city).

![Figure 3-46: Conventional System vs. Trunk and Feeder System](image)

The use of more than one mode implies that some form of change-over is required between modes and between the trunk and feeder services. In recent years, an increasing emphasis has been placed on designing these change-over or terminal facilities that make such transfers easier and more seamless.

In the context of the Transport Strategy it is important to identify opportunities for modal transfer facilities stemming from the inter-city and inter-regional movement of passengers and goods. The identification, detail planning and implementation of modal transfer facilities is essentially a city planning function and not a national planning function, however, it is necessary to seek alignment between the Rwanda National passengers and freight transport services and these multi-modal facilities within the Rwanda STMP.

It is important to note that a detail multi-modal facility investigation was not part of the Rwanda STMP scope. However, the Strategy should lay down principles of determining multi-modal facility positions and to strive towards integration with the Kigali City Master Plan.

3.7.2 Conceptual Positioning of Multi-Modal Facilities

Multi-modal facilities or terminals facilitate the modal change-over between long-haul and long-haul, or between long-haul and short-haul passenger and freight transport services. These change-over positions should be located at the outskirts of the city, where long-distance high-order routes enter the city limits and the network changes to a more complicated distribution network. Locating the multi-modal facilities on the city limits or outskirts prevents large capacity modes manoeuvring the geometrically constrained urban roads. The concept of ring-road positioned multi-modal facility locations is shown in Figure 3-47.
Long-haul transport services therefore take place on the outside of the city limits and short-haul (distribution) services take place within the city limits.

A central defining feature of the radial city multi-modal facility concept is the ring-road / ring-rail which connects the various multi-modal facilities. The ultimate success of these multi-modal facilities rests on their inter-connectivity and accessibility to the core of the urban centre, therefore the existence or establishment of a ring-road and/or ring-rail connector is critical.

3.7.3 Rwanda STMP-Kigali City Transport Integration

Kigali is the capital and largest city of Rwanda and is situated near the geographic centre of the nation. It is the economic, cultural, and transport hub of the country. Most of the passenger and freight transport in the country originates from, goes to or passes through the city.

Given that the transport system of Rwanda is a radial network originating from Kigali city centre, a similar approach to determining the multi-modal facility positions can be followed as shown in Figure 3-47.
The transport network servicing Kigali City essentially divides the city into three sectors (refer to Figure 3-48). The Eastern sector includes the Free Trade Zone multi-modal facility and the Kigali International Airport multi-modal facility. The Southern sector includes the Kicukiro multi-modal facility and the Bugesera Airport multi-modal facility. The North-western sector includes Nyabugogo (Gatsata) multi-modal facility.

### 3.7.3.1 Free Trade Zone Multi-Modal Facility

The Free Trade Zone is located approximately 11km east of Kigali city centre. The primary purpose of this facility will be the storage and redistribution of freight. It is therefore proposed that a freight multi-modal facility be located at the Free Trade Zone.

It is envisaged that the Trade Free Zone will be served initially by road infrastructure and later by freight rail and pipeline infrastructure, as these modes become feasible in future. This would require the multi-modal facility design to accommodate road, rail and pipeline freight, as well as the interchange of freight between these different modes.

It is envisaged that the Trade Free Zone Multi-modal facility would contain warehouses and storage facilities, the fuel storage depot, container depot, rail sidings and a cargo handling terminal, and heavy vehicle parking, services and overnight facilities.

The transhipment activities envisaged for the Trade Free Zone Multi-modal facility includes (refer to Figure 3-49) a road-rail interface including load centre, and a road-road interface including trans-loading, cross-docking and warehousing.
3.7.3.2 Kigali International Airport Multi-Modal Facility

The Kigali International Airport is located south-east of Kigali city centre. It is a medium sized international airport housing three terminals. The main terminal can accommodate six small to mid-size aircraft, but it can also accommodate a Boeing 747 jet. A cargo terminal is also located at the airport.

The primary purpose of this facility is to serve the international, regional and domestic passenger and cargo markets. The airport is primarily served by road infrastructure, and this will continue for the foreseeable future. This would require the multi-modal facility design to accommodate primarily road based modes. Although the facility should only accommodate road-based modes, the following different road-based modes should be accommodated:

- A public transport multimodal facility, accommodating a Quality Bus Service from Kigali CBD, conventional bus services, metered taxis (with dedicated holding areas and loading and off-loading zones) and minibus taxis (with dedicated holding areas and loading and off-loading zones)
- Private transport (with dedicated parking areas for short-term and long-term parking)
- Road freight (low volume / high value goods to be accommodated at the cargo terminal only).
3.7.3.3 Bugesera International Airport Multi-Modal Facility

The new Bugesera International Airport will be constructed in the Bugesera district, approximately 40km south of Kigali city centre.

Phase I is designed to provide capacity over a 20 year planning horizon (to 2030) and consists of building a single runway (for B-747-400 aircraft) and passenger terminal building, cargo facility with refrigerated storage, modern control tower, other facilities and access roads. The facilities are designed to remain operational under poor weather conditions and power outages. In Phase I the airport will support up to 18 aircraft movements per hour (peak) and the terminal will have capacity for 450 enplaning and departing passengers per hour at peak times. Up to 1.8 million passengers can be served per year at IATA service standard C. The planning and design of the airfield will conform to International Civil Aviation Organisation (ICAO) Standards.

The primary purpose of this facility is to serve the international, regional and domestic passenger and cargo markets. The airport is primarily served by road infrastructure, and this will continue for the foreseeable future. However, if the Rwanda rail infrastructure expands in future, a rail link between Kigali City and the airport may be considered.

Given this background, the multi-modal facility would be designed to accommodate primarily road-based modes. Although the facility should only accommodate road based modes, the following different road-based modes should be accommodated:

- A public transport multimodal facility, which should accommodate the following:
  - Quality Bus Service from Kigali CBD, which may take the form of an “Airport Flyer” bus service
  - Metered taxis (with dedicated holding areas and loading and off-loading zones)
  - Minibus taxis (with dedicated holding areas and loading and off-loading zones)
- Private transport (with dedicated parking areas for short-term and long-term parking)
- Road freight (low volume / high value goods to be accommodated at the cargo terminal only)

The typical airport layout with multi-modal transfer facilities as shown in Figure 3-50 could be considered. It should be noted that a site-visit conducted during the course of this study indicated that there is room for
additional road upgrades to the Kigali-Bugesera (RN15) route. Initial assessment of the route indicated that
the route could benefit from horizontal realignment to improve the sight distance as well as the addition of
climbing lanes along sections of steep upgrades to facilitate a higher level of service and improve road
safety.

It is also important that the airport multi-modal transfer facility links link to airport terminal stations in Kigali
City.

3.7.3.4 Kicukiro Multi-Modal Facility

The proposed Kicukiro multi-modal facility is located approximately 8km south-east of Kigali City CBD. The
primary purpose of the Kicukiro Multi-modal facility is to facilitate the transfer of passengers between road-
based public transport service modes, namely:

- Quality Bus Service
- Conventional Bus
- Minibus Taxis.

It is envisaged that the Kicukiro Multi-modal facility will be served initially and primarily by road infrastructure. However, the Isaka-Kigali rail link would – for passenger transport purposes – land at Kicukiro as well.

The design of the multi-modal facility will depend on whether it is a road-based multi-modal facility or a road-rail multi-modal facility. For reference purposes, a design example of both a road-based multi-modal facility (refer to Figure 3-51) and a road-rail multi-modal facility (refer to Figure 3-52) has been provided.

*Figure 3-51: Road-based Multi-modal Facility Reference Design Example*
3.7.3.5 Nyabugogo (Gatsata) Multi-Modal Facility

The proposed Nyabugogo (Gatsata) multi-modal facility is located approximately 3km north-west of Kigali City CBD. Its primary purpose is to facilitate the transfer of passengers between road-based public transport service modes in the same manner as Kicukiro.

The typical road-based / road-rail multi-modal layout with multi-modal transfer facilities as shown in Figure 3-50 could be considered.
4. RSTMP Transport Services

4.1 Introduction

‘Transport services’ refers to the transport operations that make use of the transport infrastructure to move people and goods. Transport infrastructure often has significant economies of scale and therefore is a natural monopoly. In contrast, the barriers to entry for transport services are much lower and the units of production (i.e. transport vehicles) much smaller which allow better utilisation rates to be achieved than what is generally possible with the infrastructure.

The distinction between transport ‘infrastructure’ and ‘service’ is not always clear-cut. In the case of pipelines and CNS/ATM, to a large extent, the service entails providing and operating the infrastructure. The two aspects are integrated. Another pertinent example in Rwanda is rail. In a mature rail market the provision of operations by multiple operators may be separated from the provision of the track which is made available on an ‘open access’ basis. Where there is a single rail service operator with track utilisation being low, the system economics would dictate that the rail and rail service be integrated.

The nature of transport operations is conducive to competition. This is true where the main goal is ‘mobility’, i.e. travel speed. Stops required for ‘access’ purposes reduce the overall speed. The transport system is a compromise between mobility and access requirements, with mobility services attracting a premium and therefore generally candidates for multiple service providers. Access services are provided where the benefits of transport outweigh the cost thereof and the ability of the market to pay for it. Such ‘social’ transport services may take the form of a mass transit service in an urban area, or a public bus service in a rural setting. Here, the compromise of speed is usually acceptable as a trade-off for proper accessibility.

A public transport service may start off as a social service, with insufficient demand to make the system pay for itself from the onset. Over time, though, because of the availability of the system, the numbers increase and the system becomes more financially viable.

Mobility services naturally gravitate to the private sector and access service to the public sector. However, access (public) services should be provided in a commercial manner as well. This implies that the service – even if it does not pay for itself financially – must be operated efficiently and cost-effectively. This may be achieved by positioning the public entity responsible for that service as the ‘buyer’ of the service from the private sector.

In the chapter on transport infrastructure, it was indicated how different transport modes are better suited to certain types of demand, volumes and travel distances. For the Transport Strategy, the earmarked roles are:

- Road transport, as the most versatile mode of transport, will remain the dominant means of moving goods and passengers, between main national centres. For passengers, road transport will provide the ‘access’-type cross-border service
- Air transport will provide the passenger ‘mobility’ service to link the country with the region and the rest of the world. As demand increases, it is foreseen that a domestic mobility service will develop
- Rail transport will be introduced, providing long-distance goods mobility in competition with road transport, and some short-distance passenger transport access
- Pipeline transport will, in turn, compete with road and rail for the mobility of petroleum products
- Inland waterway services will be of an access nature.

4.2 Road Transport Services

4.2.1 Road Freight Services

The domestic road freight industry is deregulated in the sense that there are no requirements for transport operators to be licensed to carry on their operations, although this is an area that RURA is investigating to formalise the industry. Road freight transport operations are all private, with rates made on a negotiated basis. Services are all non-scheduled, i.e. delivered on an as-required basis.

At the regional level, cross-border road freight is governed by agreements with member states of the EAC. There is no formal bi-lateral agreement in place with the DRC.
It is envisioned that market access for regional road transport providers shall in future be regulated at the EAC level, taking the form of a licence which is renewable periodically. The actual issuing of the licence will take place at the country level, by RURA in the case of Rwanda.

4.2.2 Road Passenger Transport Services

Currently, road-based passenger services are provided by minibus taxis and buses, with both services covering short and long distance routes. The market is deregulated with RURA issuing service licences and setting fares ceilings. There are about 30 licensed operators that provide inter-city passenger transport in Rwanda. Regional transport follows the same pattern as for road freight transport.

ONATRACOM is a government-owned road transporter, offering services between Kigali and the major towns, covering more than 80% of the national bus network. ONATRACOM buses also serve some remote areas along dirt roads not otherwise accessible by public transport. The company therefore provides services in competition with the private sector, but is also the service provider of ‘last resort’ in that it provides social services that are not commercially attractive to the private sector.

Current and future contracts with ONATRACOM should include clearly when and in what circumstances service contracts will be taken away from ONATRACOM (e.g. as a result of new service taking over, etc.). It is clearly not in the scope of the RSTMP to address such detailed issues.

4.2.3 Quality Bus Service

The current road transport system is generally acknowledged to be inefficient and costly. Passenger transport services are uncoordinated. Most services emphasise access (multi-stops) at the cost of mobility. The Land Use and Development Master Plan for Rwanda accordingly identified the concept of a Quality Bus Corridor (QBC) providing quality bus services between cities. The QBC would be a dedicated service on major roads linking important cities and nodes within Rwanda providing a faster and more convenient service that would successfully compete with the private car.

The advantages of a QBC system include:

- Improved passenger transport infrastructure;
- Traffic management and environmental improvements;
- Passenger transport service prioritisation and improvement;
- Enhancing integration with other modes of transport (i.e. cycle and pedestrian facilities);
- Improving information to the public on the passenger transport services provided; and
- Improved working environment between passenger transport operators.

The following QBCs were identified in the course of developing the Transport Strategy:

<table>
<thead>
<tr>
<th>Origin – Destination</th>
<th>Kigali – Gatsibo</th>
<th>Kigali – Bugesera</th>
<th>Kigali - Nyagatare</th>
<th>Kigali - Kamonyi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of Route (km)</td>
<td>Unknown</td>
<td>25</td>
<td>161</td>
<td>44</td>
</tr>
<tr>
<td>Current Patronage (pax/day)</td>
<td>1 200</td>
<td>1 400</td>
<td>1 000</td>
<td>800</td>
</tr>
<tr>
<td>Future Patronage (pax/day)</td>
<td>2 300</td>
<td>2 100</td>
<td>2 100</td>
<td>900</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of Route (km)</td>
<td>71</td>
<td>88</td>
<td>55</td>
<td>132</td>
</tr>
<tr>
<td>Current Patronage (pax/day)</td>
<td>1 200</td>
<td>700</td>
<td>900</td>
<td>700</td>
</tr>
<tr>
<td>Future Patronage (pax/day)</td>
<td>1 800</td>
<td>1 200</td>
<td>1 300</td>
<td>1 700</td>
</tr>
</tbody>
</table>
### Origin - Destination

<table>
<thead>
<tr>
<th></th>
<th>Kigali – Rubavu</th>
<th>Kigali – Musanze</th>
<th>Kigali - Muhanga</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of Route (km)</td>
<td>156</td>
<td>92</td>
<td>65</td>
</tr>
<tr>
<td>Current Patronage (pax/day)</td>
<td>600</td>
<td>400</td>
<td>800</td>
</tr>
<tr>
<td>Future Patronage (pax/day)</td>
<td>1 700</td>
<td>1 200</td>
<td>1 000</td>
</tr>
</tbody>
</table>

Other 9 routes do not have comprehensive information.

The proposed QBC system is illustrated in Map 4-1 and also under the Chapter dealing with the Transport Demand Model (refer to Section 5).

### 4.2.3.1 QBC Infrastructure Needs

The required infrastructure for an optimal QBC service system is shown in Table 4-2:

**Table 4-2: Required Infrastructure Needs for QBC Service**

<table>
<thead>
<tr>
<th>Infrastructure</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>QBC Service infrastructure</strong></td>
<td>The basis for provision of infrastructure for the QBC service is impacted by the anticipated patronage per QBC. There are three levels of infrastructure that can be provided for a QBC service, namely:</td>
</tr>
<tr>
<td></td>
<td>• <strong>Full Designated Bus Corridor</strong>; where the bus mode and any other passenger transport service is provided with a designated lane along the complete length of the bus corridor.</td>
</tr>
<tr>
<td></td>
<td>• <strong>A Partially Designated Bus Lane</strong>; where the bus mode and any other passenger transport service is provided with a designated lane in certain sections of the bus corridor warranting a designated bus lane.</td>
</tr>
<tr>
<td></td>
<td>• <strong>Shared Bus Lane</strong>; where the bus mode and any other passenger transport service is integrated with the traffic flow along the bus corridor.</td>
</tr>
<tr>
<td></td>
<td>It is anticipated at this point that the QBCs will require no designated bus lane. This should however be checked during the detailed feasibility study of each corridor to determine if designated bus lanes should be provided within built-up areas.</td>
</tr>
<tr>
<td><strong>Passenger Transport Bus Stops</strong></td>
<td>Location of passenger transport loading and off-loading areas along the public transport route need to be provided at a point that is safe for the passenger transport vehicle to stop. Other aspects that need to be considered include:</td>
</tr>
<tr>
<td></td>
<td>• Lighting at these passenger loading and off-loading points;</td>
</tr>
<tr>
<td></td>
<td>• Passenger transport information;</td>
</tr>
<tr>
<td></td>
<td>• Design of passenger transport stops need to be adequate (i.e. drainage to ensure no puddling of water);</td>
</tr>
<tr>
<td></td>
<td>• Provision of shelters with seats and/or litter bins.</td>
</tr>
</tbody>
</table>
Map 4-1: Proposed Quality Bus Corridor Routes

Total Distance: 1,260km
Number of Routes: 20
4.2.3.2 Key Performance Indicators for QBCs

Development of key performance indicators is required for the QBC Service to gain a competitive advantage over the other modes of road passenger transport service for long and inter-city passenger transport. The service should therefore be measured and quantified.

From the Rwanda National Land Use and Development Master Plan, aspects which are key to the service include the use of new vehicles, high frequency services, reduced journey times and reliable bus services, improved passenger facilities at terminals, better passenger information, and a safe environment. To achieve these goals, the following key objectives need to be captured in a performance monitoring system:

- Corridor bus journey times;
- Corridor bus speed;
- Comparison of the QBC Service with other services
- Passenger waiting times;
- Quantification of the effect of the QBC on all modes through time series modelling; and,
- Passenger journey assessment.

4.2.3.3 Integrating the QBC System with Other Modes

The provision of a QBC service is not about buses only. It also needs to take into consideration the operations of other modes of passenger transport within the same environment (i.e. roads) as well as across other mode of transport (i.e. rail, air, NMT).

Minibuses and Taxi Minibuses should complement the bus service by focussing on settlements that are remote from bus services (refer to Table 4-3 below).

ONATRACOM may also provide some of these services.

<table>
<thead>
<tr>
<th>Table 4-3: Routes / Settlements that are remote from Public Transport Services (Bus Services)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Routes/Settlements that are remote from bus services</td>
</tr>
<tr>
<td>Kigali - Ngororero</td>
</tr>
<tr>
<td>Muhanga - Kigali</td>
</tr>
<tr>
<td>Kigali - Rwamagana</td>
</tr>
<tr>
<td>Kigali - Ngoma</td>
</tr>
<tr>
<td>Kamonyi - Kigali</td>
</tr>
<tr>
<td>Ngororero - Kigali</td>
</tr>
<tr>
<td>Kigali - Nyabihu</td>
</tr>
<tr>
<td>Kigali - Nyamagabe</td>
</tr>
<tr>
<td>Rwamagana - Kigali</td>
</tr>
<tr>
<td>Kigali - Gakenke</td>
</tr>
<tr>
<td>Kigali - Karongi</td>
</tr>
<tr>
<td>Ngoma - Kigali</td>
</tr>
<tr>
<td>Nyabihu - Kigali</td>
</tr>
<tr>
<td>Kigali - Kayonza</td>
</tr>
<tr>
<td>Nyamagabe - Kigali</td>
</tr>
<tr>
<td>Karongi - Kigali</td>
</tr>
</tbody>
</table>
4.2.3.4 QBC Operations

The provision of transport services through QBC provides a good opportunity for a public private partnership. Aspects that need to be considered during the development of the PPP include: QBC contracts type; phasing of services if any; procurement of operators; and the QBC financial model. Refer to Chapter 8 for further details.

4.2.4 Bus Service between Bugesera Airport and Kigali

The planned Bugesera International Airport is located beyond Kigali City and requires an appropriate medium-distance public transport solution. A medium-term road solution is been proposed, whilst a rail-connectivity solution is proposed in the long-term (refer to Figure below). The road solution would entail an airport express bus, not dissimilar to the QBC Service discussed above, and it is recommended that such a service be investigated as part of the QBC.

4.3 Rail Transport Services

The decision on the optimal structuring of rail transport service provision is will face Rwanda shortly with the construction of the Isaka-Kigali rail extension of the TRL system. The service will be dominated by long-haul trade freight with the potential of some more localised passenger services.

Given the projected volumes, there will be a single operator. Since the line is effectively a branch of the Tanzania system, and given the increased efficiencies associated with a non-interrupted service, the operator on the TRL system should also be granted the franchise to operate the Rwanda (and Burundi) lines. In the short-term this will be TRL itself, in the light of the cancellation of the concession with RITES. Thereafter, a new concession is likely to be awarded with improved contracts compared to the RITES transaction.

Rwanda, through RURA, should position itself to participate in the procurement process. It is expected that the EAC would facilitate such a three-way discussion between Tanzania, Rwanda and Burundi. The operating licence would be awarded multi-laterally by the three countries. It would be for an integrated track-rail operation service.

4.4 Air Transport Services

Historically, the development of air transport was subjected to severe economic constraints. Airlines were mostly owned and operated by governments who applied large-scale protectionist policies both for domestic and international services. Over the past twenty five years, however, the emphasis in air transport has progressively shifted to commercialisation, privatisation, liberalisation and globalisation as well as the development of new and innovative trading agreements.

The main role of air transport is regional and international connectivity and mobility. RwandAir is the designated national carrier and provides services to the region (Bujumbura, Dar es Salaam, Entebbe/Kampala, Kilimanjaro, Mombasa, Nairobi), the rest of Africa (Addis Ababa, Brazzaville,
RwandAir operates scheduled domestic services linking Kigali with Cyangugu/Kamembe and Gisenyi. There are at least two non-scheduled carriers registered in the country. Internationally, the trend remains that domestic air services (cabotage) remains reserved for carriers owned and registered in a country. Where regionalisation is advanced (e.g. the European Union) cabotage rights in a member state become available to carriers of other member states too. It is anticipated that this is the direction that will be taken in the EAC as well. In the meantime, it is proposed that Rwanda deregulate the domestic air services market so that there will not be an artificial limitation on air services responding to growing demand.

As regards international (including regional) air services, it is presently an EAC member state’s prerogative to negotiate and award these on a bilateral basis. For intra-Africa services, the Yamoussoukro Decision requires countries of the continent to share air transport rights freely. It is expected that the EAC will enforce this requirement on its member states at least. For intercontinental services, again following the EU example, it is foreseen that rights to/from East Africa will be awarded at the regional level by a body designated by the EAC.

As the degree of integration increases in East Africa, member states will come under pressure not to provide artificial advantages to national carriers. This will include preventing subsidies to loss-making airlines, or supporting airlines’ specific programmes (e.g. route development and equipment purchase).

4.5 Air Navigation Service Provision

Rwanda presently provides lower airspace (approach and aerodrome) control via the RCAA at Kigali International Airport. Upper airspace (area/overflight) control is provided by Tanzania through the TCAA.

Under the Treaty partner states agreed to the establishment of a unified upper area control system, i.e. a regional upper flight information region (UFIR) to be controlled by one upper area control centre (UACC). A study covering Kenya, Tanzania and Uganda found that such a unified UACC would be feasible, but the study has not yet been expanded to include Rwanda and Burundi. A point of contention was how the lower airspace services would be protected if cross-subsidies currently derived from overflight revenue were to be directed to the UACC.

Before Rwanda takes a unilateral view on changing the current model for the provision of CNS/ATM, the investigations into an optimal regional model should be concluded at EAC level.

4.6 Inland Waterway Transport Services

4.6.1 Lake Kivu Transport Services

Lake transport services are presently provided on an ad hoc basis and outside any formal transport licensing regime. As per the Economic and Technical Feasibility Study for Water Transport on Lake Kivu (Draft Final Report), September 2009, the intention is to formalise lake transport. The service would entail a scheduled passenger and freight service operated with a fleet of two vessels. The transport operator would be required to determine the optimal route options for operation in order to maximise ferry operating hours and to achieve the highest attainable service levels using the available fleet. The feasibility study proposed the following two route options, i.e. a local service stopping at all lake ferry terminals en-route, or an express service/local service overlap with one vessel operating a local service and the other an express service only stopping at major ports.

The projected demand (250 passengers and 15t to 20t cargo per day) is too low to sustain a commercially viable service and it is anticipated that a government subsidy would be required until the passenger volumes increase. Although a service of this nature should be provided commercially and privately, a degree of commercial and subsidy income will be required. There will therefore be a single operator appointed under some form of concession agreement. The preparation of the tender specifications, concession contract as well as the concession contract negotiations can be jointly
undertaken by the RTDA and RURA with the support of the Public Investment Technical Team and the PPP Unit.

Future linkages with ports on the DRC side of the Lake (e.g. at Goma and Bukavu) is also being considered. It is important to note that facilities (i.e. port and road links) at these locations are limited at this stage and would require upgrading should such linkages with the DRC on Lake Kivu be pursued.

4.6.2 Akagera River Transport Services

Transport on the Akagera River, if conclusively proven to be technically feasible, will entail similarly limited passenger and cargo demand as on Lake Kivu, but probably lower. If shown to be technically feasible, and if the Government of Rwanda wishes to support the development of the river as a transport route, river transport rights should be awarded to a single operator to maximise the commercial potential. Otherwise, rights should be deregulated and local operators should be allowed to ply their trade on the river without economic limitation.

4.7 Pipeline Transport Services

Pipeline infrastructure and services are generally operated as one business. In other words, pipelines are considered an integrated service whereby the entity who constructs the pipeline generally operates the services.

Given the inherent difficulties of vertically separating infrastructure provision and transport services in the pipeline mode, it would be logical to subsume the pipeline transport services under the infrastructure provision responsibilities of the designated pipeline concessionaire.

In the case of natural monopoly infrastructure, such as pipelines, Third Party Access (TPA) will come into play after the infrastructure has been constructed and operated for a sustained period. A TPA policy requires owners of natural monopoly infrastructure facilities to grant access to those facilities to parties other than their own customers, usually competitors in the provision of the relevant services, on commercial terms comparable to those that would apply in a competitive market.
5. Strategic Transport Demand Model (VISUM)

The purpose of the model developed for the Rwanda Strategic Transport Master Plan is to provide assistance with regard to strategic transport decisions. Focus of the model is thus on the movement of persons and goods between major towns in Rwanda and between neighbouring countries.

The majority of the road and rail network to be represented in the model are outside urban areas where the Average Daily Traffic (ADT) are more applicable than the peak hour traffic. The model was therefore developed to represent the ADT on the roads and other transport infrastructure. The conversion of ADT volumes to peak hour traffic volumes can be done as part of the management information system if needed.

The model was developed using comprehensive state-of-the-art transportation planning software (ptv VISUM).

It is important to note that data was crucial to the model and that both the model is dependent on the comprehensiveness, quality and applicability of data.

The model followed the standard four step modelling process consisting of trip generation, trip distribution, modal split and assignment of vehicles on the representing road network. The model was developed in two separate components, a passenger component and a freight component, which was both assigned to the model network.

The goal of this multimodal model was to identify the optimum modes and routes of transport for the estimated passenger and freight movements within the region, advising on appropriate transport investments for the future.

Besides the base year transport demand model (2010), a possible future scenario was also developed. The target year scenario was 2020.

The Rwanda National Land Use Development and Development Master Plan describe three future scenarios in terms of land use and development:

- **Alternative Red (worse/critical)** in this scenario we present the land-use scenario if development continues in an uncontrolled, ad.hoc/laissez-faire mode. It is a ‘predictive’ scenario – extrapolation of currents trends and processes and business as-usual;
- **Alternative Yellow (fair/acceptable)** in this scenario we present the land-use scenario if development continues in a relatively managed and controlled way. It is an ‘exploratory’ scenario – construction alternative, plausible futures;
- **Alternative Green (good/prosperous)** in this scenario we present the land-use scenario if development continues in a very controlled way. It is a ‘normative’ scenario

AURECON was advised by the National Land Centre and Office of the Register of Land Titles to use the Green Alternative and population projections for modelling and planning purposes. The approved National Land Use and Development Master Plan was developed based on this scenario.

5.1 Transport Modelling Data

5.1.1 Transport Network Data

The network level of detail is appropriate for a strategic model at a national scale and therefore consisted mainly of national and other higher order roads and only those local roads providing links to activity nodes of strategic significance to the region as a whole. It was important to ensure that all zones are linked to one another via the represented network. The road network will be coded as two-way links.

The following link parameters will be used:

- Road Type / Class
- Length
- Modes applicable
- Speed – The speed to be coded will depend on whether speed data are available or not. The speed limits are to be used as the speed of the link where no speed data are available.
average speeds recorded are to be used for those links where speed data are to be used. A distinction should be made between the average speed for light and heavy vehicles.

- Number of lanes
- Hourly capacity per lane

Mountain passes were represented in terms of distance and speed in the network. The actual distance of the pass and the average speed of vehicles in the pass were coded.

Air routes were represented by two-way links as well and were coded as such and the parameters mentioned previously were applicable to these links as well, but instead of hourly capacity per lane one had to specify passenger capacity as well as freight capacity.

5.1.2 Transport Service Data

Ideally passenger transport services are described in terms of:

- Mode (car, bus, minibus taxi)
- Route description
- Origin
- Destination
- Frequency
- Direct cost to the user
- Journey time

Ideally freight transport services are described in terms of:

- Mode (road, air and future pipeline and future rail)
- Product category Product
- Origin
- Destination
- Frequency
- Transport cost per kilometre
- Journey time

5.1.3 Demographic Data

Base year population data was readily available per district. Demographic data required per traffic zone includes aspects such as:

- Total population
- Employed (possibly in more detail categories)
- Unemployed
- Vehicle ownership
  Where this data was not available, assumptions was made, based on national data.

5.1.4 Land Use and Commodity Production Data

The land use data required is largely dependent on the trip purposes. The typical trip purposes associated with metropolitan or urban models are not applicable in this study.

The majority of the road network represented in the model was outside urban areas where longer distance trips are more applicable than shorter trips such as trips to work or school.

The main trip purposes were passenger and freight trips, with freight trips categorized per commodity.

The following land use data is required to model freight trips:

- Data on mining, agriculture and production of goods etc per district
  Land use and commodity projections for the horizon year, were not be available on district level. In the absence of land use projections spanning the study period, it is considered standard practice to utilise projected GDP growth rates as a proxy for future traffic growth. These
assumptions were made in accordance with the *Rwanda National Land Use Development and Development Master Plans*.

5.1.5 Traffic Data

Road traffic data was available on most major routes. No primary data collection took place; only secondary traffic data was used.

12-hour classified traffic data was available at 52 locations. Traffic data is classified in terms of motorcycle, car, bus, minibus taxi and heavy vehicle.

<table>
<thead>
<tr>
<th>Road ID</th>
<th>Road_Name</th>
<th>Section</th>
<th>Position</th>
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<tbody>
<tr>
<td>RN1</td>
<td>Kigali-Butare-Akanyaru</td>
<td>Gitikinyoni-Gitarama</td>
<td>Kamonyi</td>
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<td>Nyanza-Butare</td>
<td>Rusatira</td>
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<td>Mukoni-Akanyaru</td>
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<td>Butare-Mukoni</td>
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<td>Gitarama-Nyanza</td>
<td>Ruhango</td>
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<td>RN2</td>
<td>Kigali- Gatuna</td>
<td>Rukono-Gatuna</td>
<td>Rwamaga</td>
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<td>Nyacyonga-Gaseke</td>
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<td>Gaseke-Rukono</td>
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<td>Gatsata Nyacyonga</td>
<td>Kabuye</td>
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<td>RN3</td>
<td>Kigali-Kayonza-Rusumo</td>
<td>Rwamagana-Kayonza</td>
<td>Nyagatovu</td>
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<td>Kanombe-Rugende</td>
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<td>Rugende-Gishari</td>
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<td>Kayonza-Kibunge</td>
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<td>Kibaya-Cyunuzi</td>
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<td>Cyunuzi-Rusumo</td>
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<td>Rubona</td>
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<td>RN 4</td>
<td>Kigali-Ruhengeri-Gisenyi</td>
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<td>Kiryi-Kimonyi</td>
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<td>Gakenke</td>
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<td>Shyorongi-Base</td>
<td>Mukoto</td>
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<td>Gitikinyoni-Shyorongi</td>
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<td>RN 5</td>
<td>Kayonza-Kagitumba</td>
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<td>Museniy</td>
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<td>Kiramuruzi-Gabiro</td>
<td>Kabarore</td>
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<td>Kayonza-Kiramuruzi</td>
<td>Gahini</td>
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<td>RN 6</td>
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<td>Akadashya-Rusizi</td>
<td>Kamembe</td>
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<td>Buhinga-Akadashya</td>
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<td>Kitabi-Buhinga</td>
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<td>Nyamagabe - Kitabi</td>
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<td>Butare-Nyamagabe</td>
<td>Sovu</td>
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<td>RN 7</td>
<td>Gitarama-Kibuye</td>
<td>Rubengera-Kibuye</td>
<td>Ruragwe</td>
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<td>Rufungo-Rubengera</td>
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<td>Mero-Giko</td>
<td>Nyarurange</td>
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<td>Gitarama-Mero</td>
<td>Mero</td>
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<tr>
<td>RN 8</td>
<td>Ruhengeri-Cyanika</td>
<td>Ruhengeri-Muhoza</td>
<td>Muhoza</td>
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</tbody>
</table>
The classified counts were used to verify the base year demand model.

Vehicle occupancy was also required, this was however not available at these count locations. Vehicle occupancy data were however available for Kigali City as part of the project “Planning & Design of a Public Transport System for Kigali City” done by SSI. SSI provided the following average vehicle occupancy rates for Kigali City:

- Private vehicles: 1.9
- Minibus taxis: 14.8
- Bus: 22.6

The vehicle occupancy for private vehicles and minibus taxis in the rest of Rwanda were assumed to be the same as in Kigali City. Much higher vehicle occupancy for buses was however reported elsewhere. The Economic and Technical feasibility study for water transport on Lake (2010) reported bus vehicle occupancies of 90 plus persons per bus. Average bus occupancy of 60 was therefore assumed.

Origin and Destination (OD) data was collected as part of the Rwanda National Land Use and Development Master Plan.

The OD data was used for identifying trip making characteristics for trip generation and trip distribution. The following information was available:

- Vehicle type
- Origin
- Destination
- Type of freight as well as tonnage or passengers

Since only limited OD surveys were conducted at each counting station a weighing factor was required to estimate the vehicles for each OD pair captured in the OD survey. These weighing factors were calculated using the classified counts that corresponded with the OD survey count locations.

Trip frequency and number of passengers were not recorded. Almost 8,000 vehicles were surveyed at 7 different locations. Surveys were conducted at:

- Gahanga
- Gatuna
- Kamonyi
- Rubavu
- Rugende
- Rusumo
- Shyorongi
Map 5-1: Count Locations
Map 5-2: OD Survey Locations
5.1.6 Zone System

The 30 districts in Rwanda formed the traffic zones for this model. Each zone was represented by a separate polygon. Zones connect like a puzzle and no islands were allowed.

The three digit numbering system was used for internal zones. The first digit represents the province and the last two digits represent the district. The following numbers were used for each province:

- 101 – 103 : Town of Kigali
- 201 – 208 : Southern Province
- 301 – 307 : Western Province
- 401 – 405 : Northern Province
- 501 – 507 : Eastern Province

The locations of the District Offices were used as centroids for the zones.

Five external zones were created for:

- Burundi
- Tanzania
- Kenya
- Uganda
- The Congo
Map 5-3: Traffic Zoning System
5.2 Base Year Model

5.2.1 Trip Generation

Trip generation is the first step in the demand modelling process. It involves forecasting the number of person trips that will start or end in a traffic zone.

To estimate the regression equations for passenger and freight trips multiple linear regression analyses was carried out in order to develop the equations needed for the estimation of trip attractions and trip productions. The regression analysis compared the trips from the OD Survey.

The freight commodities in the survey were aggregated into 6 categories, namely:

- Agriculture
- Building Material
- Bulk Agriculture
- Foodstuff
- Household Goods
- Mining

Trips for all freight categories yielded good comparisons with population per district office sector. This is due to the labour intensive nature of the Rwandan economy. For mining trips, only districts with significant mineral deposits were used in the trip generation process. Although population is a determining factor in trip generation and distribution of freight trips, freight is expected to grow at a higher rate than the population due to economic growth.

Freight demand is expected to increase in relation to the projected growth rate per commodity or sector. The high growth scenario as aimed for in the Green Scenario was used in this study. Future trips were therefore generated according to the trip generation rates developed in the model development and then projected towards the expected total per commodity according the growth rates of the Green Scenario.

5.2.2 Trip Distribution

Trip distribution is where the origin-destination pattern of travel is determined. The result of a trip distribution model is a trip matrix.

Different types of trip distribution models have been developed over the years to distribute trips among origin-destination (O-D) pairs. The model that was applied here are a synthetic (or gravity) model.

The gravity model was applied for each trip purpose and income combination, using the parameters determined during the calibration process. The result is 7 full origin destination matrices.

Map 5-4 and Map 5-5 show the trip distribution results for the base year.
Map 5-4: Base Year Passenger Distribution: Volumes and Destination
Map 5-5: Base Year Freight Distribution: Volumes and destinations
5.2.3 Modal Split

Modal split is a term used to allocate total person trips to the different modes of transport. Modal split is done after the trip distribution phase. The modal split modal take into account captive users for both person and freight trips. Captive users are those that will not change to a different model no matter changes in the parameters used to apply the modal split.

Calibration of the mode choice model was based on the level of data availability and aggregation.

The modal split for passenger trips was done in two phases a primary modal split where motorised trips are split between private and public trips followed by a secondary modal split where the public transport passenger trips were split into bus and taxi minibus modes. Provision was also made for future modes such as passenger rail. Although motorcycle taxis are predominant within the cities and towns, it was considered to be a local mode of transport and not therefore not within the scope of a strategic model for the RSTMP.

Figure 5-1: Mode Choice Decision Tree

The following assumptions were applied:

- Bus travel time = 1.5 x private vehicle travel time based on averages of actual travel times between specific origins and destinations
- Taxi travel time = 1.2 x private vehicle travel time
- Future rail speed = 50 km/hr based on the Feasibility study for the Isaka-Kigali/Burundi Railway Project
- IWW speed on Lake Kivu = 27 km/hr based on Lake Kivu Feasibility study
- Bus fare = 12.1 RwF per kilometre based on averages of actual fares between specific origins and destinations
- Taxi fare = 19.5 RwF per kilometre based on averages of actual fares between specific origins and destinations
- Rail fare = 6.05 RwF per kilometre based on the fact that the rail cost per tonne kilometre for rail is half of that for road transport
- IWW fare on Lake Kivu = 6.05 RwF per kilometre. According to the Lake Kivu Feasibility study the water transport should be as cheap as possible

The process of freight modal choice was represented by a multinomial LOGIT model, which calculates the probability of a transport mode choice. Provision was also made for future modes such as transport of freight by rail. The specific utility depends on mode attributes (travel time and cost).
The following assumptions from the Feasibility study for the Isaka-Kigali/Burundi Railway Project study were applied:

- Road Speed = average network speed for heavy vehicles
- Rail Speed = 50 km/hr
- Road Cost = 0.1 USD per Tonne km
- Rail Cost = 0.050 USD per Tonne km

5.2.4 External Trips

Two external vehicle matrices were developed for the base year. These matrices were however only partial due to the limited number of survey locations. The matrices were developed from the OD data in the National Land Use Master Plan. A matrix correction technique was used to produce complete matrices for passengers and freight, using traffic counts at or near border posts.

Figure 1-3 shows the external passenger trips per day and Figure 1-4 shows the freight trips per day for the base year.

![Figure 5-2: Base Year External Passenger Trips (Vehicles per day)](image-url)
5.2.5 Base Year Model Demand

5.2.5.1 Base Year Road Based Traffic Demand

Ninety seven per cent of passenger transport is by public transport and only 3 per cent by private transport. The split between bus and minibus taxi is 87% by taxi and 13% by bus.

All freight is transported by road based transport.

5.2.5.2 Base Year Rail Demand

Currently there is no rail system in Rwanda

5.2.5.3 Base Year Inland Water Transport Demand

Lake Kivu is by far the largest of Rwanda’s lakes forming the border with the DRC. There are occasional boat services between the ports of Rusizi, Karongi and Giseny, but these do not run to a regular timetable and often have to be chartered. There are also boats used to ferry people to some of the islands in the lake, but these also do not run regularly. Therefore no demand matrices were developed for the base year.

5.2.5.4 Base Year Air Transport Demand

A passenger air matrix was developed for the base year. It was based on:

- The EAC base year air passenger model (which was based on flight schedules)
- Domestic flight schedules.

For the base year there are 12,000 scheduled seats on international flights and 600 domestic scheduled seats per week to and from Kigali airport. International flights are from Burundi, Kenya, Tanzania, Uganda, Somalia, Ethiopia, Sudan, Democratic Republic of Congo, South Africa, other African countries as well as the rest of the world. Assuming an 80 per cent occupancy there were just over half a million arrivals and departures at Kigali airport per annum in 2010.
5.2.6 Traffic Assignment

The final stage in the four-step approach is the assignment of the trip demand onto the transport networks. This model uses the equilibrium assignment procedure for private transport. The equilibrium procedure distributes demand according to Wardrop’s first principle “every individual road user chooses his route in such a way that his trip takes the same time on all alternative routes and that switching routes would only increase personal journey time”. The state of equilibrium is reached by multi-successive iterations, based on an incremental assignment as a starting solution. In the inner iteration step, two routes of a relation are brought into a state of equilibrium by shifting vehicles. The outer iteration step checks if new routes with lower impedance can be found as a result of the current network state. The following maps show the traffic assignment results.

The main findings of this scenario include:

- Kigali is the main trip generator and attractor for national trips which means that the main flow of traffic occurs to and from the City of Kigali
- The majority of passenger movement takes place along the RN 1 between Kigali and Gitarama and and Ruhango and on the RN 3 between Kigali and Rwamagana.
- There is also notable passenger movement on the RN 4 between Gisenyi and Ruhengeri and Ruhengeri and Kigali as well as on the RN 1 between Gitarama and Butare.
- The majority of freight movement takes place along the RN 1 between Kigali and Gitarama and and Ruhango and on the RN 3 between Kigali and Rwamagana
- There is also notable freight movement on the RN 4 between Gisenyi and Ruhengeri and Ruhengeri and Kigali as well as on the RN 1 between Gitarama and Butare.

5.2.7 Model Validation

After the demand matrices have been assigned to the network, the final stage in the process is to assess the degree of correlation between the modelled assigned demand and the observed demand.

52 bi-directional classified traffic counts were available, providing 104 data points to compare modelled traffic with observed traffic. According to Table 1 in the report Traffic count on National Paved Roads Network (2010) there were 11 count locations on urban and semi-urban links. They were on the following links:

- RN15 on the section Kicukiro-Gahanga
- RN15 on the section Nyamata-Gahembe
- RN3 on the section Kigali-Kanombe
- RN3 on the section Kanombe-Rugende
- RN3 on the section Gishari-Rwamagana
- RN1 on the section Butare-Mukoni
- RN6 on the section Kadastro-Rusizi I
- RN7 on the section Gitarama-Mero
- RN2 on the section Gatsata-Nyacyonga
- RN4 on the section Kiryi-Kimonyi
- RN4 on the section Gisenyi-Border

These counts were excluded from the comparison to exclude local trips since the focus of the model was on the movement of persons and goods between major towns in Rwanda and between neighbouring countries.

The report Traffic count on National Paved Roads Network (2010) states that the traffic count campaign did not take into account the urban sections of surveyed roads on the following roads:

- Kigali-Gitikinyoni section of RN 1
- Kigali-Gatsata of RN2
• Kigali-Kanombe section of RN 3

These were excluded because manual counting is not the adequate technique for such large traffic flow. It is better to resort to automatic traffic count for these urban sections.

The implications of the short trips in the close vicinity of cities and urban areas and capacity analysis as well as accessibility problems at these locations are best evaluated in Provincial or even District transport demand models. The scale and network detail does not allow such evaluations in a national demand model for strategic purposes.

Observed and modelled demand was compared, using a measure such as the R2 statistic. The passenger vehicle comparison yielded a linear goodness of fit of an R2 = 0.90 with a slope of 1.05 and for and the freight vehicle comparison an R2 = 0.83 with a slope of 1.0. This is considered very robust considering that it is a national model, developed for strategic purposes. When using the model one should be cognisant of the fact that the model was calibrated and validated for travel demand of persons and goods between major towns in Rwanda and between Rwanda and neighbouring countries.

This was however not the only means of model validation. Additional validation criteria were applied using the GEH test on individual link flows.

The GEH statistic is defined as:

\[
GEH = \sqrt{\frac{(M - C)^2}{0.5(M + C)}}
\]

Eighty four per cent of individual link flows for passenger vehicles resulted in a GEH statistic of 5 or less and 93 per cent of individual link flows for freight vehicles resulted in a GEH statistic of 5 or less. This is considered very good considering that it is a national model, developed for strategic purposes therefore no matrix adjustment techniques were required to improve the comparison.

<table>
<thead>
<tr>
<th>Criteria / Measure</th>
<th>Validation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlation analysis</td>
<td>Validation</td>
</tr>
<tr>
<td>Correlation coefficient R²</td>
<td>Passenger 0.90</td>
</tr>
<tr>
<td>Slope of the best fit regression line</td>
<td>1.01</td>
</tr>
<tr>
<td>GEH &lt;= 5 test</td>
<td>80% of individual links</td>
</tr>
</tbody>
</table>

5.2.8 Model Use

The model was developed as a national strategic model and should be used as such. The capabilities of the model include the following:

• The impact of any new roads, road upgrades or road closures on:
  o modal split
  o congestion
  o route choice

• Determining the impact on modal split of changes in public transport such as:
  o new or altered routes
  o changes in fares
The model has the ability to evaluate the impact of:

- increase / decrease in population
- change in population and / or employment densities
- change in vehicle ownership rate
- change in international trade

### 5.2.9 How to Improve the Model

It is important to note that data is crucial to the model and that the model is dependent on the comprehensiveness, quality and applicability of data. The following data or surveys could improve the existing national model:

- Classified counts before and after each town, not in built up areas
- Future counts also at existing count locations in order to create a history of counts for traffic growth
- Vehicle occupancy surveys
- OD surveys for freight transport using pre-coded origins and destinations
- OD surveys specific for passenger transport using pre-coded origins and destinations
- Travel time surveys
- Detailed public transport information such as schedules or headways
- Detailed land use information per traffic zone for the base year and target year
- Stated preference surveys regarding mode choice for passenger as well as freight traffic
Map 5-6: Base Year Passenger Traffic Volume (Persons per Average Day)
Map 5-7: Base Year Freight Traffic Volume (Ton per Average Day)
Map 5-8: Base year public transport volume per mode (passengers per day)
5.3 Future Year Transport Model

5.3.1 Future Year Strategic Transport Demand Model Network Scenarios

A future demand scenario was developed for assignment on the different network scenarios. Various assumptions were made in order to develop the future demand matrices. Each assumption is discussed briefly in the following sections.

The following network scenarios were modelled and evaluated:

- **Scenario 1**: Current network
- **Scenario 2**: Current network with Rail included for passengers & freight
- **Scenario 3**: Current network with new and improved road links
- **Scenario 4**: Network with improved road links AND quality bus services on Quality Bus Corridors
- **Scenario 5**: Current network with proposed Inland Waterway Transport
- **Scenario 6**: Current network with Rail included for passengers & freight according to the Great Lakes Study

The following section describes each network scenario in short:

- **Scenario 1**: Current network. The current network (refer to Map 5-9) is the network as is with no road upgrading and no rail network. The country has a very dense classified road transport network consisting of National and District roads and a dense unclassified feeder road network.

- **Scenario 2**: Current network with Rail included for passengers & freight. In this scenario a railway line is included as proposed in the *Rwanda National Land Use Development and Development Master Plan*. This railway line is to provide both passenger and freight transport. The railway line (refer to Map 5-10) enters Rwanda near Rusumo in the south-east to Kerehe then Bugusera and Kigali, then Kamonyi and finally Muzanse where it splits to the Congo and Uganda.

For modelling purposes it was assumed that the fares would be half of bus fares per kilometre and that the train would be able to travel at 50km/hr.

- **Scenario 3**: Current network with new and improved road links. In this scenario, the network is improved in terms of connectivity. The following links are upgraded to surfaced roads which can accommodate speeds of up to 60 km/hr (refer to Map 5-11):
  - RN 17 from RN 6 to RN 7
  - RN 7 from RN 17 to RN 16
  - RN 16 from RN 7 to RN 4
  - RN 42 from NYARUGURU to RN 24
  - RN 24 from RN 42 to RN 1
  - RN 19 from RN 1 to RN 41
  - RN 41 from RN 19 to GISAGARA
  - RN 29 from RN 1 to RN 15
  - RN 27 from RN 13 to RN 18
  - RN 18 from RN 27 to RN 20
  - RN 20 from RN 18 to new link
  - Local link with new link to connect the RN 20 to the RN 25
  - RN 25 from new link to local link
  - Local links
  - RN 31 between the RN4 and the RN 1
• RN 20 linking up with the RN 4

• **Scenario 4:** Current network with improved road links AND quality bus services on Quality Bus Corridors (refer to Map 5-12). The 10 origin-destination pairs with the highest passenger demand for 2020 was identified as the Quality Bus Corridors. In addition to these routes a link along the shore of Lake Kivu: Ribavu-Karongi-Buhinga-Rusizi was included specifically for the tourism market. The 10 origin-destination pairs with the highest passenger demand for 2020 were:
  - Kigali – Gatsibo
  - Kigali – Bugesera
  - Kigali – Nyagatare
  - Kigali – Ruhango
  - Kigali – Huye
  - Kigali – Rubavu
  - Kigali – Gicumbi
  - Kigali – Nyanza
  - Kigali – Musanze
  - Kigali – Muhanga

• **Scenario 5:** Current network with proposed Inland Waterway Transport. This scenario includes inland waterway transport on Lake Kivu Feasibility Study as well as international links as per the Great Lakes Study. The possibility of the inland water transport on the Agekara River was considered. The Preparation of the Feasibility Study for the Navigability of the Akagera River however concluded that the project is not viable from an economic viewpoint and it is unlikely that it would be attractive to investors.

• **Scenario 6:** Current network with Rail included for passengers & freight according to the Great Lakes Study.
Map 5-9: Scenario 1: Current Road Network
Map 5-10: Scenario 2: Current Road Network with Rail included for Passenger and Freight
Map 5-11: Scenario 3: Current Road Network with New and Improved Road Links
Map 5-12: Scenario 4: Quality Bus Services on Quality Bus Corridor
Map 5-13: Scenario 5: Current network with proposed Inland Waterway Transport
Map 5-14: Scenario 6: Current network with Rail included for passengers & freight according to the Great Lakes Study
5.3.2 Future Transport Model Demand

5.3.2.1 Future Passenger Demand

Passenger demand is expected to grow in relation to population growth. The Green Scenario is aiming at a low population growth with a rate of 2.5% per annum. The worst case scenario was however modelled here. A higher population growth rate of 3.2% per annum was applied. The population projection table provided by the RDTA was used in this study.

![Population projection (2010 - 2020)](image)

The private transport share would grow in relation to the growth in vehicle ownership. The current growth rate in vehicle ownership is 2.3% per annum (Transportation Steering Committee Draft).

5.3.2.2 Future Freight Demand

Freight demand is expected to increase in relation to the projected growth rate per commodity or sector. The high growth scenario as aimed for in the Green Scenario was used in this study. The table below shows the projected growth rate per sector for the high growth scenario as projected in the Economy and Labour Market Steering Committee Report from the Rwanda National Land Use Development and Development Master Plan.

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Sector</th>
<th>Growth Rate per annum (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>Primary</td>
<td>8.63</td>
</tr>
<tr>
<td>Building Material</td>
<td>Secondary (Construction)</td>
<td>7.04</td>
</tr>
<tr>
<td>Bulk Agriculture</td>
<td>Primary</td>
<td>8.63</td>
</tr>
<tr>
<td>Foodstuff</td>
<td>Tertiary</td>
<td>9.83</td>
</tr>
<tr>
<td>Household Goods</td>
<td>Tertiary</td>
<td>9.83</td>
</tr>
<tr>
<td>Mining</td>
<td>Secondary (Mining)</td>
<td>11.77</td>
</tr>
</tbody>
</table>

*Table 5-3: Projected Growth Rates per sector used in the model*
Map 5-15: Future Year Passenger Demand Distribution: Volumes and Destinations
Map 5-16: Future Year Freight Demand Distribution: Volumes and Destinations
5.3.2.3 Future External Traffic

External traffic demand is expected to increase at 7.5% per annum as projected in the Feasibility Study for the Isaka - Kigali / Keza - Gitega - Musongati Railway Project.

*Figure 5-5: 2020 External Passenger Trips (Vehicles per day)*

*Figure 5-6: 2020 External Freight Trips (Ton per day)*

5.3.2.4 Future Rail Demand

The model predicts a significant change in mode should rail be introduced to the network as described in Scenario 4. Around 11,300 tons per day could shift from road based transport to rail freight by 2020. This will be largely due to a shift of 80 per cent of imports and exports to rail. This was calculated as part of the modal split in the demand model as discussed earlier in the document. For the Isaka-Kigali line the model predicts 2,300
tons per day, this translates to 850,000 tons per annum. This is much lower than what is estimated in the Feasibility Study for the Isaka - Kigali / Keza - Gitega - Musongati Railway Project where it is estimated that by 2024 there will be 3.12 million tons per transported between Keza and Bugusera.

The Great Lakes Study projected an ultimate demand of 2.5 million tons per annum on this section of the line. The Great Lakes study was however not linked to a timeline but rather provided ultimate demand.

Large freight volumes are expected on the northern alignment from Kigali to Uganda with 6,800 tons per day. No feasibility studies have been executed for the northern extension. It is therefore not likely that this section will be completed by 2020.

By 2020 there will be passenger rail demand of 23,000 passengers per day for the entire rail network including the northern extension. On the link between Tanzania to Kigali there will be passenger rail demand of 5 500 passenger per day. This was calculated as part of the modal split in the demand model as discussed earlier in the document.

5.3.2.5 Future Inland Waterway Transport Demand

The model estimates that 55 passengers per day will travel on water based transport on Lake Kivu. Taking into account the possible demand as estimated in the great lakes study there is potential for 5540 tons of freight to be transported across Lake Kivu per day.

5.3.2.6 Future Air Transport Demand

For the target year of 2020 it is estimated that there will be 45 000 domestic travellers per annum and around 1.6 million international arrivals and departures. Of the international passengers, fifty per cent will be in transit. The base year matrix was developed based on the base year EAC passenger model as well as domestic flight schedules. The growth rates for future traffic were based on projections by the RCAA.

According to the RCAA, Air Traffic from Kigali airport is expected to reach 1.5 million by 2017 when the Bugusera International Airport is scheduled to open. By 2025 it is expected to hit the 3 million mark and by 2030 3.5 million. Fifty per cent of the traffic will be direct transit through the airport without entering Kigali city. This figure will grow to 70% after 2030 as the RwandAir route network expands. This is in line with developments in Kenya Airways and Ethiopian Airlines both of them are players in the same market.

5.3.3 Guidelines for Determining the Type of Public Transport Infrastructure

It is recommended that the South African guidelines for determining the type of public transport infrastructure be applied here. Moving South Africa has developed a broad set of guidelines for determining the type of public transport infrastructure which will be appropriate to each corridor.

The guidelines are as follows:

- High passenger-volume corridors with more than 40,000 passengers per direction per day will probably support a rail - or dedicated public transport road - infrastructure in congested areas. Public transport nodes (stations and interchanges) in these high-ridership corridors will be supported by feeder services rendered by buses or minibus taxis.
- Moderate-ridership corridors with 10,000 to 40,000 passengers per day per direction are likely to be served by a road infrastructure, with priority or dedicated lanes for public transport over parts of the corridor. The line-haul services in these corridors will largely be provided by buses, supplemented by both buses and taxis at nodal public transport interchanges.
- Low-ridership corridors will characteristically have fewer than about 10,000 passengers per day per direction, and are likely to have some road-based priority schemes. Many of these low-ridership corridors will be feeder corridors. All the roads can be expected to be paved and the line-haul function or feeder function will fall primarily to taxis or small road-based vehicles.
Map 5-17: Network Proposals for 2020
5.4 Economic Analysis of Transport Model Scenarios

The purpose of this Section is to present the methodology and the results of the Economic Analysis of the Transport Model Scenarios developed for the Rwanda Transport Master Plan.

5.4.1 Methodology Adopted

When performing the economic analysis of the scenarios, the methodology as outlined below was adopted.

5.4.1.1 Alternative Specification

In order to facilitate an economic analysis, different alternatives have to be specified to test for feasibility of the proposed project(s). The economic analysis will compare each alternative with the status quo to determine the feasibility of each alternative.

To determine the feasibility of the scenarios, the following should be noted:

- The Base Network Scenario or the status quo (i.e. the situation without any projects or improvements) was defined as Alternative 0 and the total transport costs of Alternative 0 was compared with the total transport cost of Alternative 1, 2, 3, 4 and 5.
- Alternatives 1, 2, 3, 4 and 5 were formulated as Rail Scenario, Improved Road Links, Quality Bus Corridor, IWW Scenario and All Projects, respectively. Alternative 5: All Projects, combines all projects (i.e. Rail Scenario, Improved Road Links, Quality Bus Corridor and IWW Scenario) as one project.

5.4.1.2 Analysis Period

A 20-year analysis period was used for the economic assessment.

5.4.1.3 Economic Costs and Benefits

All costs and benefits were expressed in economic costs or resource costs (i.e. excluding taxes and subsidies) and an economic cost factor of 0.82 as used by the African Development Bank was used to convert all the Financial Prices pertaining to project implementation to Economic Costs. The benefits expressed in terms of vehicle operating cost savings and time savings as obtained from HDM-4 are in Economic Cost terms, as these have been obtained after deducting all taxes from the vehicle operating cost inputs.

5.4.1.3.1 Costs

The following costs were taken into consideration:

- Alternative 1 - Rail Scenario: 615 km at US$1 830 894 per km totalling US$ 1,126,000,000 Financial Prices or US$ 923,320,000 Economic Costs.
- Alternative 2 - Improved Road Links: 1,048 km of links to improve with a width of 3.5m and an unit cost of US$190 per square metre totalling US$696,920,000 in Financial Prices or US$571,474,400 in Economic Costs.
- Alternative 3 - Quality Bus Corridor: The Pilot Study for about 50km from Kigali to Bugasera was costed at US$ 24.55 million. The provision of a Quality Bus Corridor on the overall 1702 km would then amount to US$ 835.682 million.
- Alternative 4 - IWW Scenario: The costs of the IWW Scenario was estimated at US$ 271,600,000 in Financial Prices.
- Alternative 5 - All Projects: The total costs in Financial Prices of all the above projects would then amount to US$2,930,202,000 in Financial Prices or US$2,402,765,640 in Economic Costs.

5.4.1.3.2 Benefits

The following benefits were considered:
Reduced vehicle operating costs; and
Travel time savings.

Reduced Vehicle Operating Costs

With the provision of the planned projects, there will be savings in vehicle operating costs due to the following:

- **Alternative 1: - Rail Scenario**: Less freight will be carried by road and a substantial amount of passengers will be transported by rail.
- **Alternative 2 - Improved Road Links**: The provision of improved links will provide shorter travel distances and more economic travel speeds (speed improvement from 52 km per hour to 60 km per hour) resulting in savings in Vehicle Operating Costs which was modelled by using HDM-4.
- **Alternative 3 - Quality Bus Corridor**: A significant amount of passengers will be transported reducing the amount of travel by other modes of transport such as cars and/or taxis.
- **Alternative 4 - IWW Scenario**: There will be a modal shift from some of the existing modes to Inland Waterways.
- **Alternative 5 - All Projects**: All the benefits of Alternatives 1 to 4 will accrue to Alternative 5.

The vehicle operation costs were calculated based on the assumptions derived from HDM-4 as shown in

*Table 5-4: Heavy Vehicle Operating Cost Assumptions based on HDM-4 Guidelines*

<table>
<thead>
<tr>
<th>VEH_NAME</th>
<th>Unit</th>
<th>Heavy</th>
<th>Light</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCSE</td>
<td>No</td>
<td>1.8</td>
<td>1</td>
</tr>
<tr>
<td>NUM_WHEELS</td>
<td>No</td>
<td>22</td>
<td>4</td>
</tr>
<tr>
<td>NUM_AXLES</td>
<td>No</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Annual Km</td>
<td>km</td>
<td>50000</td>
<td>15000</td>
</tr>
<tr>
<td>Annual Hours</td>
<td>hours/year</td>
<td>1700</td>
<td>600</td>
</tr>
<tr>
<td>Life</td>
<td>Years</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Passengers</td>
<td>No</td>
<td>0</td>
<td>3.9</td>
</tr>
<tr>
<td>WEIGHT_OP</td>
<td>ton</td>
<td>45</td>
<td>1.3</td>
</tr>
<tr>
<td>ESAL</td>
<td>No</td>
<td>4.62</td>
<td>0</td>
</tr>
<tr>
<td>Costs VEH</td>
<td>US$</td>
<td>134522</td>
<td>20346</td>
</tr>
<tr>
<td>Costs TYRE</td>
<td>US$</td>
<td>396.73</td>
<td>75.36</td>
</tr>
<tr>
<td>Costs FUEL</td>
<td>US$</td>
<td>0.52</td>
<td>0.55</td>
</tr>
<tr>
<td>Costs OIL</td>
<td>US$</td>
<td>2.55</td>
<td>2.55</td>
</tr>
<tr>
<td>Costs LABOUR</td>
<td>US$</td>
<td>3.17</td>
<td>3.17</td>
</tr>
<tr>
<td>Costs CREW</td>
<td>US$</td>
<td>3.33</td>
<td>0.43</td>
</tr>
<tr>
<td>Costs OHEAD</td>
<td>US$</td>
<td>11838</td>
<td>335.87</td>
</tr>
<tr>
<td>Interest Rate</td>
<td>%</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>
The calculated vehicle operating costs are as follows:

<table>
<thead>
<tr>
<th>VEH_NAME</th>
<th>Unit</th>
<th>Heavy</th>
<th>Light</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costs WORK</td>
<td>US$</td>
<td>0.41</td>
<td>2.67</td>
</tr>
<tr>
<td>Costs NONWRK</td>
<td>US$/hour</td>
<td>0.41</td>
<td>2.67</td>
</tr>
</tbody>
</table>

The road vehicle operating costs per year were calculated separately for light vehicles and heavy vehicles as follows:

\[
VOCPA = AADT \times CD \times D \times VOCPK
\]

Where:

- \( VOCPA \) = Vehicle Operating Cost per Annum (US$/year)
- \( AADT \) = Vehicles average annual daily traffic (Number)
- \( CD \) = Calendar days per year (Number)
- \( D \) = Distance (km)
- \( VOCPK \) = Vehicle operating cost per km

**Travel Time Savings**

As in the case of reduced transport costs, the provision of projects, will reduce the time it will take to travel between a given origin and destination.

As in the case of the VOC, time calculated by means of HDM-4 was applied to the vehicle – kilometres travelled (AADT x CD x Distance) to arrive at an annual time cost.

### 5.4.2 Analysis Results

The analysis results are shown in foregoing tables in terms of the following:

- Costs for Base Network (Alternative 0)
- Costs for Alternative 1 - Rail Scenario
- Costs for Alternative 2 - Improved Road Links
- Costs for Alternative 3 - Quality Bus Corridor
- Costs for Alternative 4 - IWW Scenario
- Costs for Alternative 5 - All Projects
- Comparison of Costs
- Economic Feasibility Indicators
### Table 5-5: Cost Analysis Results for Alternative 0 – Base Network

<table>
<thead>
<tr>
<th>Year</th>
<th>US$ per Year</th>
<th>Capital Costs</th>
<th>VOC-LV</th>
<th>VOC-HV</th>
<th>Time-LV</th>
<th>Time-HV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>0</td>
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<td>91 715 592</td>
<td>199 762 358</td>
<td>96 301 372</td>
<td>3 196 198</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>94 467 060</td>
<td>205 755 229</td>
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<td>3 292 084</td>
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<td>97 301 072</td>
<td>211 927 886</td>
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<td></td>
</tr>
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<td></td>
<td>100 220 104</td>
<td>218 285 722</td>
<td>105 231 109</td>
<td>3 492 572</td>
<td></td>
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<td>106 323 508</td>
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<td>3 705 269</td>
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<td>6</td>
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<td>109 513 214</td>
<td>238 526 702</td>
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<td>7</td>
<td></td>
<td>112 798 610</td>
<td>245 682 503</td>
<td>118 438 541</td>
<td>3 930 920</td>
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<td>253 052 978</td>
<td>121 991 697</td>
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<td>9</td>
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<td>260 644 568</td>
<td>125 651 448</td>
<td>4 170 313</td>
<td></td>
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<tr>
<td>10</td>
<td></td>
<td>123 258 087</td>
<td>268 463 905</td>
<td>129 420 991</td>
<td>4 295 422</td>
<td></td>
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<tr>
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<td></td>
<td>126 955 829</td>
<td>276 517 822</td>
<td>133 303 621</td>
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<td>130 764 504</td>
<td>284 813 357</td>
<td>137 302 729</td>
<td>4 557 014</td>
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</tr>
<tr>
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<td></td>
<td>134 687 439</td>
<td>293 357 757</td>
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<td>4 693 724</td>
<td></td>
</tr>
<tr>
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<td>138 728 063</td>
<td>302 158 490</td>
<td>145 664 466</td>
<td>4 834 536</td>
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</tr>
<tr>
<td>15</td>
<td></td>
<td>142 889 904</td>
<td>311 223 245</td>
<td>150 034 400</td>
<td>4 979 572</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td></td>
<td>147 176 602</td>
<td>320 559 942</td>
<td>154 535 432</td>
<td>5 128 959</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td></td>
<td>151 591 900</td>
<td>330 176 740</td>
<td>159 171 495</td>
<td>5 282 828</td>
<td></td>
</tr>
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<td>18</td>
<td></td>
<td>156 139 657</td>
<td>340 082 042</td>
<td>163 946 639</td>
<td>5 441 313</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td></td>
<td>160 823 846</td>
<td>350 284 504</td>
<td>168 865 039</td>
<td>5 604 552</td>
<td></td>
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<tr>
<td>20</td>
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<td>165 648 562</td>
<td>360 793 039</td>
<td>173 930 990</td>
<td>5 772 689</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
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### Table 5-6: Cost Analysis Results for Alternative 1 – Rail Scenario

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Table 5-7: Cost Analysis Results for Alternative 2 – Improved Road Links
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### Table 5-9: Cost Analysis Results for Alternative 4 – IWW Scenario

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Table 5-10: Cost Analysis Results for Alternative 5 – All Projects

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### Table 5-11: Comparison of Costs (Undiscounted) (US Dollar per year)

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<th>Alternative 3: Quality Bus Corridor</th>
<th>Alternative 4: IWW Scenario</th>
<th>Alternative 5: All Projects</th>
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### Table 5-12: Comparison of Costs (Discounted at 12%) (US Dollars per Year)

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<th>Alternative 3: Quality Bus Corridor</th>
<th>Alternative 4: IWW Scenario</th>
<th>Alternative 5: All Projects</th>
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<td>Year</td>
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<td>Alternative 5: All Projects</td>
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<td>0.02</td>
<td>1.29</td>
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5.4.2.1 Economic Feasibility Indicators

The feasibility of each alternative was indicated in terms of the following economic indicators:

- Internal Rate of Return (IRR);
- Net Present Value (NPV);
- Benefit/Cost Ratio (B/C Ratio); and

Alternatives are considered Economically Viable when they conform to the following:

- **NPV**: positive;
- **IRR**: higher than the opportunity cost of capital (OCC); and
- **B/C**: greater than one.

The B/C ratio is similar to the IRR in functionality, in that it can also be used to prioritise independent projects. It should be noted that the calculation of an IRR is not always possible because its calculation is based on an iterative procedure\(^\text{19}\). Therefore, due to the cash flow nature of the net-benefits, it is sometimes possible to obtain no IRR solution or more than one IRR solution. The NPV is used to determine the most feasible project within a range of mutually exclusive projects.

All three criteria listed above give consistent results in this case, as is evident from Table 5-12 above.

It is evident from the NPV, IRR and the B/C Ratio that:

- Alternative 1, Alternative 3 and Alternative 5 are **viable**;
- Alternative 2 and Alternative 4 are **not considered viable** as a result; however the overall viability is obtained through Alternative 5.

\(^\text{19}\) The IRR is the discount rate where the NPV (the sum of all discounted net benefits) is equal to zero.
6. Future RSTMP Transport Network and Service Configuration

The future Rwanda transport network is the spatial translation of transport network and transport services strategies developed as part of this Strategy, drawing from the vision, goals and development objectives of a number of strategic planning documents of the Rwanda Transport Sector.

The following spatial translation or sketch planning initiatives stemming from the strategic transport master plan (refer to preceding chapters) are shown in Figure 6-1:

- New road links and road upgrades to improve network continuity
- Planned railway network and services (including future network and services extensions)
- Aviation classification and associated works for international, regional and local airports
- Inland waterway ferry terminals and transport services
- Freight network, weighbridges and truck stops / roadside stations
- One-stop border posts upgrades and multi-modal transfer facility development
- Planned pipeline network extension on the Uganda-Kampala Pipeline link
- Planned public transport networks including a Quality bus service and an Airport flyer bus service.
Figure 6-1: Future Rwanda Transport Network
7. RSTMP Transport Institutional Arrangements

7.1 Introduction

Beyond the specific physical network and related transport services, the success and sustainability of the Rwanda Transport network is directly related to the strength of the institutions that oversee the sector. Institutions are the means by which policy decisions are made effective. Policies without organisations capable and willing to implement them are not credible.  

7.2 Guiding Principles

Five main principles undergird the institutional development recommendations:

- Separation of Functions;
- Market-Based Solutions;
- Regional Integration;
- Establishing Legal ‘Ownership’ of Transport Functions; and,
- Customer Focus.

The above principles are discussed in the following sections.

7.2.1 Separation of Functions

With the potential for conflict of interest, policy formulation and strategic planning, provision of transport, and oversight and enforcement of the policy objectives should be separated from each other. Moreover, the owners and providers of transport infrastructure and services need to be independent from those that oversee these owners and providers. This separation becomes increasingly important in the context of possible market-based solutions and private sector participation.

7.2.2 Market-Based Solutions

In line with international best practice, the transport sector should increasingly move towards solution with great private sector involvement, except where services have clear strategic or monopolistic characteristics. To this end there should be an increasing application of liberal market rules, but in the absence of market sources, there should be interventions by Government to support the market (and protect the consumer). Therefore, even where these characteristics preclude strong private involvement, a greater level of commercialisation should be pursued.

7.2.3 Regional Integration

The Master Plan is not being developed in isolation. Specifically, it needs to integrate to a larger regional institutional reality. Here it is specifically important to recognise that various oversight and regulation functions will increasingly be moving to a regional (EAC) level.

7.2.4 Establishing Legal ‘Ownership’ of Transport Functions

Legal ownership should be established by assigning primary responsibility for management of a specific transport-related function to a particular entity or agency.

7.2.5 Customer Focus

The transport system should respond to customers’ (users’) requirements in terms of needs, efficiency and costs.
7.3 Institutional Model Overview

There are two broad categories of transport-related functions which need to be assigned to appropriate institutions: governance and delivery. Governance has to do with policy-making and planning, and oversight. Policy and planning provide the direction (the vision) for the sector.

Oversight entails ensuring that appropriate safety, security and technical standards are in place, the right to provide an infrastructure or service (market access regulation) and the setting of limits on incumbents (economic regulation, e.g. tariff setting).

Under the ‘separation of functions’ principle expounded on above, good practice is to house safety and technical regulation in a separate, arm’s length government agency. This body would be separate from the institution delivering the infrastructure or service, and also separate from the body that oversees and regulates the market from an economic perspective. However, economies of scale considerations may imply that it is not practical or affordable to set up such safety regulators for every transport or utilities sub-sector. The same consideration applies to market access regulation. In a regional context, it is expected that as an increased degree of integration is pursued, region-wide oversight agencies be established which can pool resources and ensure a consistent standard across the region.

Delivery entails the provision of transport infrastructure and services. Infrastructure provision entails the physical transport nodes (airports, ports, etc.) and links (road and rail). From a regional perspective, it would be expected that there would be a layer of infrastructure that interconnects the region, that this layer would have a fairly common standard to promote integrated transport operations, and that it would be provided, managed and funded in a similar manner. The delivery aspects of infrastructure are covered in Chapter 3 (Strategic Transport Network), whereas the institutional arrangements are addressed in this discussion.

Transport services are the provision of freight and passenger services. Except for local, social services it is expected that transport services of a national nature would in principle be provided on a deregulated, competitive basis by the private sector. However, there may be instances where the public sector should ensure the provision of transport in the last resort. The transport services delivery model is addressed in Chapter 4 (Transport Services), with government’s oversight and transporter-of-last resort obligations the focus in this chapter.

7.4 Current Institutional Structure

The existing institutional arrangements for the transport sector are summarised in Table 7-1. The policy and planning function is clearly assigned to MININFRA, although the ministry has non-transport obligations as well. The ministry’s transport obligations are supported by the RTDA, which has a dual mandate of sector planning and infrastructure delivery (mainly national roads). Under RURA, the safety regulation function is in some instances shared with its market access regulation function. RTDA is the government agency responsible for the provision of infrastructure, although this function overlaps with the RCAA in the case of airports. The RCAA is both infrastructure service provider and aviation safety regulator. For roads, and to a lesser extent airports, some degree of user charging is in place. Transport services are largely provided by the private sector, with the publicly-owned ONATRACOM providing road passenger services. There are presently no rail or pipeline infrastructures or services, but these reside under the policy and planning oversight of MININFRA as well.

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<td>ONATRACOM/Private Sector</td>
<td>Private Sector</td>
<td>Public/Private Sector (RwandAir)</td>
</tr>
</tbody>
</table>
7.5 Policy & Planning

The parent Ministry responsible for transport in Rwanda is the Ministry of Infrastructure (MININFRA) which is also responsible for four other sub-sectors addressing Energy, Habitat and Urbanism, Water and Sanitation and Meteorology. The Ministry is responsible for overall transport policy and strategic planning, the creation of a transport enabling environment, and setting of transport rules, regulations and standards.

The need to give due attention to the transport component of MININFRA’s ambit has been acknowledged by the recent establishment of a semi-autonomous agency, the Rwanda Transport Development Agency (RTDA). The RTDA was established to assist the Ministry with the management and administration of the transport sector. However, the RTDA equally has infrastructure delivery obligations, mostly regarding roads, but also in relation to airports and rail. The RTDA should ideally focus either on strategic transport planning or infrastructure delivery. If infrastructure, it may be considered to establish a separate ministry dedicated to all aspects of transport (a Ministry of Transport or MoT).

7.6 Safety and Technical Regulation

7.6.1 Roads & Road Transport

The ‘safety’ aspect of roads and road transport include the configuration (design) of the infrastructure and its condition, the volumes and composition of the traffic traversing the infrastructure and the interplay between infrastructure and traffic. Safety refers to all safety-promotion or risk-reduction measures taken with respect to transport infrastructure planning, development and operation as well as the delivery of transport services in the interest of persons that may be participating as passengers, operators or members of the public or property, who may be affected by transport activities involving accidents or incidents.

‘Security’, on the other hand, refers to threats to the transport system from outside the transport domain, i.e. the illegal interference against transport infrastructure, operations and services. Although transport roleplayers must participate to ensure security, this area is primarily the domain of the Rwanda National Police (RNP) and not MININFRA.

The anticipation of, and planning for, traffic is integral to the process of designing, operating and maintaining roads. In that sense, road safety is an RTDA responsibility. The standards that the RTDA must comply with should not be set by RTDA itself, but by MININFRA. The Ministry must accordingly have a capability to take the initiative on standards and oversee the RTDA’s execution thereof.

Like infrastructure, the certification/inspection of vehicles and driver standards and aspects such as the transport of hazardous materials, contribute to safety.
From a regulatory perspective vehicle/driver/operations licensing should remain a function of RURA and where necessary the organisation should be further empowered to effectively fulfil these responsibilities. It is recognised that the Rwanda National Police is entrusted with motor vehicle inspection centres. Consideration should, however, be given to outsourcing these facilities to private enterprise, but controlled and monitored by RURA, properly capacitated.

The institutional responsibility for road traffic management should be designated to an appropriate roads authority or agency to operate under the auspices of a Ministry responsible for transport – i.e. the RTDA. Road traffic management has for a long time been a complex issue and is likely to remain so for the future. Road traffic laws and practices depend on a large number of variables directly related to both road traffic operational aspects as well as road safety.

Notwithstanding the regulation of road infrastructure and vehicle standards, there remains a need to accentuate ‘road safety’ as a discipline in its own right. There are for instance road safety programs extending into wider domains other than vehicle safety standards. These include road safety research into a spectrum of human behaviour topics and systematic identification of hazardous locations that are equally important from a road traffic point of view. There are furthermore instances where road traffic and road safety would share equally in the results of traffic information systems.

In all countries road safety is primarily a public interest, but which cannot easily be brought into the market economy. Even if parts of road safety work can be commercialised and financed by users’ fees, road safety must remain a government function. Road safety furthermore requires the participation of many different organisations and sectors and the challenge is for these organisations to work together.

Either a lead Ministry or a National Road Safety Council (NRSC) or Commission should assume responsibility for the concerted effort. Coordination is best done by a multi-disciplinary NRSC supported by a permanent Secretariat or road safety specialists, led by a senior government official or a high-calibre Executive Director.

Road Safety can, however, not be the responsibility of government alone. The commercial sector, service organisations and non-governmental organisations (NGOs) play an important role in increasing road safety awareness.

7.6.2 Functional Areas of Road Safety

An approach to road safety strategy may involve accident prevention, injury reduction, knowledge base development and capacity building measures. This approach can be translated into several road safety functions can in turn be encapsulated into several programs. To gain some impression of the scope and multi-disciplinary nature of these programs, the following list of areas where road safety initiatives could be active, is presented:

- driver fitness (driver training and testing) – to aim to ensure an acceptable level of competency of drivers through the enhancement of the driving license system and effective adjudication of offenders;
- vehicle safety standards and testing – development of acceptable standards and effective and efficient enforcement of the applicable standards are prerequisites for occupant protection as well as pedestrians;
- pedestrian safety – improving pedestrian and cyclist safety includes implementation of a combination of road traffic education and engineering solutions;
- fleet operations management – more stringent licensing and operational requirements to be enforced;
- human behaviour – elements of human behaviour impacting on road safety such as alcohol and drug abuse;
- fraud and corruption – a contributing factor to road traffic accidents due to un-roadworthy vehicles and incompetent drivers being given legitimacy through corrupt practices that need to be eradicated;
- traffic law enforcement – traffic policy need to be properly trained and equipped to effectively perform their functions;
- emergency medical services – timely and proper treatment of road casualties is essential for reducing the severity of injury to road accident victims and should be supported by an effective emergency communication system;

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21 Third African Road Safety Congress, April 1997
traffic information systems and analysis – this is the cornerstone of all road safety activity and is essential for the diagnosis of road traffic accidents and incidents;

• safety engineering – to design roads that will improve road safety;

• road safety research – programs that aim at improving knowledge about factors contributing to road traffic accidents;

• children’s traffic education;

• road safety publicity;

• financing road safety - two funding sources could be considered: (i) a road safety levy on insurance premiums; and (ii) road funds.

7.6.3 Current Road Safety Legal Framework

In order to gain a proper understanding from an institutional perspective on the current legal arrangements addressing road safety, the following could be briefly reflected upon:

7.6.3.1 Accra Declaration (Ministerial Round Table: African Road Safety Conference, 2007)

Rwanda was a delegate at the Accra Declaration of African Ministers responsible for Transport and Health on 8 February 2007 in Accra, Ghana. In terms of the declaration, Rwanda is committed to work together to stop the growing epidemic of death and injuries on our (Rwanda’s) roads.

In essence the declaration commits Rwanda to implement and strengthen the required legislation, action and enforcement plans to ensure that measurable targets to reduce fatalities due to road accidents are met. In this regard a target of halving fatalities by 2015 has been set.

7.6.3.2 Road Traffic and Road Safety Act (Draft)

This draft Act regulates Road Traffic and Road Safety; the licensing of drivers and motor vehicles, and the compulsory requirements for minimum motor vehicle insurance; the movement of pedestrians, motorised and non-motorised vehicles, loaded or mounted draught animals, and livestock on roads, highways and public ways of the country; and provides for a road safety system and traffic management.

The Act makes provision for the establishment of an advisory National Road Safety Committee who should consult on matters such as:

• Implementation and setting up laws relating to Road Traffic and Road Safety

• Establishment of Vehicle Inspections and Testing centres

• Establishment and the preparation of guidelines for the operation of Motor vehicle driving schools

• Establishment of guidelines for Driving License Examination

• Installation and rehabilitation of road signs and signals

• Delineation of entrance and exit ways to or from different services for road users along the road.

Road Traffic and Road Safety Act (Draft) is structured around four chapters, namely:

• Road Traffic and Road Safety;

• Vehicle inspection and testing;

• National Road Safety Committee; and

• Road Safety measures.

Nonetheless, not all of the above aspects including the system of road safety and traffic management are discussed in detail in the draft legislation. In this regard, the main thrust of the Act is driving rules and regulations (road safety measures) and matters directly connected thereto.

7.6.3.3 Traffic Police and Road Traffic Act

Traffic Police and Road Traffic Act regulates traffic on the public highway, of pedestrians, of vehicles loaded or mounted draught animals and livestock.
7.6.3.3.1 National Road Safety Council

Road safety should be coordinated by a National Road Safety Council (NRSC). The approach adopted in the draft act is strongly supported. The model for the NRSC developed by the World Bank as detailed in the WP 05 could serve as a useful example to guide this initiative. The Council’s responsibilities would include setting out goals and objectives on road safety work in the country, coordinating the work of all the organisations involved in road safety promotion, procuring sufficient resources for road safety work, advising the Minister on road safety related legislation, and controlling and coordinating the planning and implementation of road safety programs as well as monitoring and evaluation.

The Council should be supported by a Secretariat. The primary function of the Secretariat will be to act as the operational, coordinating and implementing arms of the NRSC. The specific duties of the Secretariat will be closely associated with the key areas of listed above. It would typically have a permanent staff and representatives from the National Police, RTDA, Ministry of Education and Ministry of Health.

7.6.4 Aviation

The operation of safe, efficient and regular air services is enabled internationally by the Civil Aviation Organisation (ICAO) under the Chicago Convention on International Civil Aviation. In Rwanda, the Rwanda Civil Aviation Agency (RCAA) promotes the safe, regular, secure and efficient use and development of civil aviation in the country. It is responsible for aviation safety and security, maintenance and management of the airport and aerodrome system, the provision of air traffic management services and the interaction with the international civil aviation community on behalf of the Government of Rwanda.

Clearly, the RCAA currently fulfils both the regulatory and service provision role in terms of aviation infrastructure and ANS. International best practice has increasingly moved toward a clear separation between these regulatory and services provision roles. The main benefit of such separation is that it provides the opportunity for greater commercialisation of service delivery while ensuring service quality through regulatory independence and avoiding any possible conflicts of interest.

There are essentially two models to house the functions currently performed by the RCAA. The existing arrangement can be retained, i.e. an integrated RCAA, but with the service delivery functions clearly distinguished from the safety regulatory functions in a ring-fenced arrangement. In this case, an “Air Traffic Management” (ATM) unit should be established and selected services reallocated to the Air Transport Unit and the Airports Unit. The alternative would be the formal separation of the RCAA and service delivery, which is then allocated to an airports authority. In terms of economies of scale the ATM unit could be retained in the RCAA or, preferably, assigned to the airports authority.

Although a more diverse national airports network is envisioned, for the time-being, the national access airport (presently Kigali International, but in future Bugesera) will dominate the airports scene. Given the intention to develop Bugesera under a PPP model, setting up an airports authority now would be premature. Therefore, the integrated RCAA model will be retained in the medium term, with ATM and airports clearly ringfenced.

At the regional level, there are plans to further develop the Civil Aviation Safety and Security Oversight Agency (CASSOA) to assume regulatory functions on behalf of Member States. When this happens, the national CAA regulatory functions would migrate to that body with the airports and ATM functions (in as far as these are not taken up in the regional UACC) remaining in (what would then be) the national airports and ATM authority. It is strongly suggested that the RCAA keep abreast with the regional developments in this regard when considering restructuring.

7.6.5 Railways

Rail safety is not governed under international convention as is the case with aviation and maritime transport. However, the same requirement for safety and (to a lesser extent) harmonised technical standards apply to this mode.

Rail issues are increasingly being addressed at the EAC level. One initiative is the possible establishment of a regional railway safety regulator, working in liaison with the respective national railway safety regulators. Such a national regulator does not formally exist in Rwanda at present, with this function nominally resorting under MININFRA.
7.6.6 Inland Waterways

For inland waterways, the standards and specifications of vessel construction, fitments and qualifications of the crew are all set by IMO, including standards and rules for vessels operating on inland waterways.

In October 2009, the ministers responsible for maritime transport in Africa adopted the African Maritime Transport Charter. The objectives of the Charter are, amongst others, to promote the effective implementation of international maritime instruments to which member states are parties and to encourage the establishment and support of maritime and ports administrations.

Rwanda may consider establishing such a maritime authority to oversee the national sub-sector. However, initiatives in the EAC are towards establishing a regional maritime and inland waterway safety regulatory body. This would also be in line with the Charter which promotes closer cooperation among the member states. Until such body is operational, it would be prudent to retain the inland waterway oversight function within MININFRA (or the potential MOT).

7.6.7 Pipelines

The safety oversight situation of pipeline infrastructure and transport mirrors that of railways. This area is not yet a target for regional oversight. At the national level, the respective roles of the Ministry of Lands, Environment, Forestry and Mining and MININFRA will have to be clarified.

7.6.8 National Transport Safety Authority

MININFRA or MOT could consider establishing a National Transport Safety Authority (NTSA). This would be an entity that houses the non-roads safety oversight functions until such time that these bodies are created at the regional level. This entity would house the functions required with the development of the new rail, inland waterway and pipeline infrastructures and transport for which safety regulatory capacity needs to be created in any event. Combining these sub-sectoral responsibilities under one agency should have some scale benefits not available if separate regulators were established for each of these fairly small industries.

It would probably be the least disruptive to retain the aviation safety oversight function in the already operational RCAA (although the RCAA’s service delivery and economic regulatory functions would migrate from that entity).

7.7 Economic and Market Access Regulation: Role of RURA

The Rwanda Utilities Regulating Agency (RURA) is the economic regulator overseeing some aspects of the transport sector, specifically passenger road transport authorisation and tariffs. Tariffs for road freight transport, air transport and airports and ANS are not regulated at present. The authorisation of air transport services pertains to the RCAA.

The transport tariff regulation function should not reside with agencies that are also involved in safety oversight or delivery. In the case of airports, their natural monopoly characteristics require greater oversight from a tariff and service standards perspective. The present arrangement of airports and ANS tariffs being set by the delivery agency (RCAA) should therefore be unwound and this function moved to RURA. In future, rail and pipeline tariffs should equally be overseen by RURA.

For market access, the RURA obligations should be extended so that the Agency has a formal obligation to coordinate cross-border transport rights for road and rail transport with neighbouring states. The regulation of air service rights will in future be moved to a regional level, especially in terms of the Yamoussoukro Decision, and therefore the air service right regulation should in the interim be assigned to RURA. RURA would also participate in the selection of a rail operator for the future rail system, and – if regulated – also issuing transport rights for inland waterways.

With regards to Road Safety, RURA should oversee all road safety strategies and initiatives in future until a National Road Safety Council or National Transport Safety Authority is in place.
7.8 Infrastructure

7.8.1 Roads

7.8.1.1 Roads Hierarchy

In terms of the National Road Network Law (Draft), the ‘National Road Network’ is made up of national roads, District and City of Kigali Roads (category 1) and District and City of Kigali Roads (category 2) as arterial roads linking District Roads (category 1) with community centres. The National Road Network Law (Draft) aims at regulating the national road network and to determine its reserve and classification.

7.8.1.2 Road Provision

The separation between the purchaser (the Road Fund) and the service providers (Road departments and Agencies) is fundamental when developing sound road sector reforms. This principle is often ignored when drafting road fund legislation resulting in road funds collecting too many conflicting responsibilities, which often include funding, planning and management of road works. In such cases the road fund acts both as the customer for services provided, as well as the provider of those services. This creates an obvious conflict of interest, which weakens financial discipline and compromises efforts to control costs and maintain quality.

The RTDA is responsible for the provision and maintenance of roads at the national level. In accordance with the decentralised policy of government, some road responsibilities have been transferred from the central government to the provincial governments and the districts within each province.

The functions in respect of procurement, monitoring and evaluation (M & E) and contract management are all included as part of the roads directorate under the Managing Director. It can therefore be assumed that detail planning, design and construction and maintenance work will be performed by the private sector. This arrangement is aligned with best practice and should be maintained.

Specific provision is made for axle load control as part of the RTDA’s functional responsibilities. The actual establishment of weighbridges and their operation should, however, be outsourced and even concessioned out.

7.8.1.3 Road Funding

The National Road Fund (NRF or ‘Fonds d’Entretien Routier’ (FER)), previously the RMF, is the institution responsible for collection and disbursement of money intended for road maintenance. Law No. 52bis/2006 of 12/12/2007 Determining the Attributions, Structure and Functioning of the Road Maintenance Fund gives effect to the establishment of the FER as a legal entity with administrative and management autonomy under the auspices of MININFRA.

The Fund, as a legal entity with administrative and management autonomy, carries out revenue collection, payment of maintenance activities, monitoring and technical audits as well as financial audits.

The REF is funded by monies from the public budget, Government or donor subsidies (grants), fuel levies, road toll on foreign vehicles and annual road tolls on local vehicles, overload and other fines, interest on its investments, and from other more incidental sources.

These funds may be used for maintenance purposes only, including rehabilitation. It should be noted that the FER Act does not define ‘maintenance’, but the Roads Act (Law N°55/2011 of 14/12/2011 Governing Roads in Rwanda) does so by including both routine and periodic maintenance in the definition. The FER may fund maintenance on all public roads, which are all ways opened to public traffic by land, i.e. national roads, district and city of Kigali roads and specific roads. The FER disburses monies in terms of an annual public roads maintenance programme as approved by the Minister, and has to see that the monies disbursed are spent as planned.

The FER is overseen by a Board of Directors, appointed by the Minister in charge of roads, i.e. MININFRA. Three of the seven Board positions are reserved for persons from the private sector. Their relationship is governed by a performance contract, as is the relationship between Management and the Board.

The FER is an example of a second generation road fund. First generation funds entailed earmarking selected road-related taxes and charges and depositing them into special off-budget accounts or road funds.

23 SSATP: Financing of Road Maintenance in Sub-Saharan Africa: Mustapha Benmaamar; Sept. 2006
Second generation funds entails the creation of a specific legal and institutional framework which would assure proper management of the funds and accountability to users and government.

The scope of the national transport master plan does not allow a detailed investigation of transport role players. However, from the statutory instruments creating and circumscribing the FER, some general issues may be pointed where the FER’s legal mandate differs from other, similar road funds in Africa. Salient issues identified include:

- There is no overriding statement of intent for the FER. It would be expected that the FER is guided by some efficiency criterion, e.g. that it may only allocate funds to activities that would have net benefits, or that would minimise the overall transportation cost. As the Act stands, it is not clear what is legitimate road maintenance expenditure; there is no test that FER us required to apply. The absence of such an overall goal or directive implies that the FER has an obligation to approve the activities included in the annual public roads maintenance programme.

- It is not clear how the annual public roads maintenance programme accounts for urban roads relative to non-urban roads. At present, funds are allocated approximately 59% to non-urban and 31% to urban roads. There is no indication how FER should assess the relative award of funds.

- The FER Act and Roads Act do not align well regarding the funding responsibilities for roads. The Roads Act states that national roads maintenance and development shall be funded by the Government, whereas the FER Act provides for monies from various sources, including road user charges.

- The FER reports to MININFRA, which is the same ministry that oversees the RTDA. The more typical model is to avoid conflict of interest between managing roads and purchasing efficient roads outputs by having the roads agency report to a ministry of transport or works, and the fund to report to the ministry of finance.

- The existence of a Board with back-to-back performance contracts is good practice. However, there is a trend towards giving the road users (the private sector) a larger say in the oversight of the fund to ensure that economically justified roads outputs are purchased. Government can purchase socially beneficial roads outputs by means of grants.

- Tension should be encouraged between the roads provider (RTDA) and roads output purchaser (FER) to ensure that good value for money is attained. This relationship is usually structured by means of a formal agreement (a ‘procedures agreement’) between the fund and roads agency so that the both parties are clear on the diary, content of the roads programme, efficiency measures the fund will employ, and the fund’s means of verifying the agency’s performance.

### 7.8.1.4 Rural Roads

The provision of rural roads, i.e. category 1 and category 2 roads providing inter and intra-district connectivity, resorts with the Districts.

Amongst its responsibilities the District Council is responsible for the development and monitoring of public transport of persons and goods as well as the maintenance of classified roads and bridges in the District as well as the management of non-classified roads, including signposting and street lights. The transportation function is conducted in collaboration with all other ‘concerned’ organizations involved in transport matters.

Instructions of the District Council establish the inventory of District Roads. Such instructions indicate the status of the roads, their order of importance, their maintenance and inspection as well as the preliminary survey preceding the inventory.

With respect to funding, it is important to note that the Government pays into a Common Development Fund for the Districts and the City of Kigali. An amount of money not less than 10% of Government’s annual revenue is paid in order to promote development and to strengthen the economic development of the Districts and the City of Kigali within the context of decentralisation.

A model which is extensively being used in francophone Africa is a contract executing agency (i.e. a private sector project implementation unit) called the Agence d’Exécution d’Intérêt Publique (AGETIP) and is established to execute donor-financed infrastructure projects. The AGETIP often referred to as a public works and employment agency has a board composed of well-known figures within the industry (which does not include government representatives), a general manager appointed by the board, other line managers (administrative, financial and technical), staff hired and private sector terms and conditions of service who are paid competitive salaries.
In Rwanda, the agency is called the Association for the Execution of Works of Public Interest (ASSETIP), and was established in 2004. ASSETIP is mainly active within rural areas of Rwanda where the local consulting industry is relatively underdeveloped.

The agency is set up as a private, non-profit association and pays no taxes. The agency works on behalf of local authorities who delegate certain functions to the agency. The local government usually reserves the right to select the projects and the agency then: (i) recruits consultants to carry out detailed engineering; (ii) invites bids and awards contracts for supervision and works, (iii) manages the contracts, and (iv) pays the contractors directly from a special account opened in its own name. The agency is subjected to a bi-monthly management and financial audit and an annual technical audit.

The advantages of the AGETIP/ASSETIP are that it: (i) gets around cumbersome government procurement regulations; (ii) streamlines payment procedures; and (iii) pays high salaries and therefore attracts well motivated, highly qualified staff.

The disadvantages are that: (i) the arrangements are not subject to competitive bidding; (ii) it is almost entirely dependent on continued donor funding; and (iii) it probably hampers development of the local consultancy industry (by creaming off staff and monopolising all contract execution work for itself under a tax-free operating environment).

AGETIP/ASSETIP has a short term role to play, particularly in economies where the local consulting industry is relatively underdeveloped. However, in future ASSETIP could play a vital role on a District and Local level in terms of skills transfer and consultancy within the transport sector of Rwanda.

It is therefore recommended that the AGETIP/ASSETIP is consulted with regards to developing District and Local Municipal support and skills transfer as well as providing vital engineering consultancy services. The AGETIP/ASSETIP should therefore play a key role in the development of the Rwanda Rural Road Management Plan under the guidance of the RTDA.

7.8.2 Aviation Infrastructure

As discussed previously, there is a need to separate the obligation to develop and operate airports from their safety and technical regulation. Apart from potential conflicts of interest, such separation is also proposed due to the fact that it would open the possibility of increased private involvement in airport development and operation, and thereby ensure greater commercialisation of the service.

The ATM service delivery function would follow airports institutionally. However, the regional initiative to establish an upper airspace control centre (UACC) would imply that at least some ATM functions migrate to such regional body. That would leave lower airspace functions in the airports and ANS authority.

7.8.3 Rail Infrastructure

The operational role that rail plays in Rwanda and in its neighbouring countries is primarily for the transport of cargo over long distances. With this long distance, and by implication regional role of rail in mind, the planning, funding and implementation of rail should be coordinated regionally. More specifically, as the Rwanda rail system will firstly be an extension of the TRL (Tanzania) system, the rail development and operating responsibility will have to be coordinated at least bilaterally. It is foreseen that the first development (Isaka-Kigali) will entail some form of PPP – as discussed in Chapter 8 (Implementation).

It is recommended that a Rail Management Agency be developed. Such an agency would be the agent of the MOT and will be tasked with overseeing the operations of rail services. The rail management agency will not operate the rail service (that will be the responsibility of the concessionaire) but will be committed to the good corporate governance and prudent financial management that is essential for the achievement of a strategic rail service in Rwanda.

7.8.4 Inland Waterway Infrastructure

The inland waterway transport system plays a modest role in the national transport arrangements today and traffic projections are that it will continue to fulfil largely a localised function. It is expected that public support would therefore be required to unlock the IWW system, in the form of facilitating or even providing port infrastructure. The actual operations – especially the types of vessels anticipated on Lake Kivu – may also require public backing. The PPP potential of IWW is also considered in Chapter 8 (Implementation).
7.8.5 Pipelines

The development of pipeline infrastructure into Rwanda will take place when the commercial logic dictates that a dedicated transport infrastructure is justified financially. There will therefore be a tipping point when it becomes feasible to switch from more general transport modes (road, rail) to a dedicated pipeline. As with rail, the system will be an extension of the regional pipeline system. It is likely that ownership and operation concept already applicable will be extended to Rwanda. Safety and technical oversight will be coordinated amongst the countries through which the pipelines pass through and are likely to become a regional function in time. Pipeline infrastructure provision will reside with the Energy Agency.

7.8.6 Multi-modal Facilities

In the case of the Bugesera Airport multi-modal facility will be integral to the operation of the airport and would therefore be developed and operated as part of the airport facility and under the concession agreement. The multi-modal long-short distance passenger interface facilities within Kigali will be developed under the auspicies of Kigali City. Given the commercial retail potential associated with such facilities, it is likely that the city will pursue development thereof based on a private investment model. There would be similar private development potential at the freight transport multi-modal facility as well. For both the passenger and freight facilities, it is anticipated that the developer would act a landlord letting out facilities to other private entities to operate.

7.9 Transport Services

As noted previously, the base model for transport services is private provision in competition under open market access arrangements. The exceptions to this general rule would be some road passenger transport services, rail and IWW. It would be expected that the entity contracting/issuing market access licenses for transport would also be responsible to plan the public transport requirement and to contract service providers to perform public transport. Characteristics of Transport Services include:

- The development of node identification and route plans;
- Contract with service providers;
- Contract to include specific public service obligations (PSO’s) and
- Contract to include agreement on shadow tariffs for PSO’s.

7.9.1 Road Passenger Transport Services

Some areas that are too remote or do not generate sufficient demand to make private provision attractive will be serviced by the State Owned Office National des Transports Commun (ONATRACOM) where possible and until such time as a viable alternative becomes available. ONATRACOM presently operates on about 80% of the national bus route network and is the current inter-city public transport service in Rwanda.

At district level, District Councils are responsible for planning, integration and coordination of public transport within their areas of jurisdiction;

The private sector is responsible for the main form of public transport, i.e. the taxi or "twegerane" for providing a stopping taxi service, as well as an express service similar to a bus service for longer distances;

With the development of quality bus corridors and services, and the encouragement of private participation in that system, the bus transport level of service will be upgraded generally. However, there will be areas not served or not served properly by QBS. In these parts, ONATRACOM will remain the bus service operator of last resort, providing a public access service possible at a lower level of service than QBS. As routes develop and passenger numbers increase, public service routes could progressively be converted into QBS routes.

7.9.2 Rail Services

For some time, at least, the focus of rail operations would be to embed a proper service and to develop the rail market. The rail operator would require some protection in the form of an exclusive operating arrangement. In the near term, the issue of multiple, open access to the rail infrastructure would therefore not arise.
7.9.3 Inland Waterways

Similar to rail, the IWW operations on especially Lake Kivu where a not-insignificant initial capital layout is required, will require providing the operator sole operating rights. In the case of the Kagera River, transport operations may be carried out over shorter distances and with smaller vessels, so that the transport service market could possibly be structured more atomistically.

7.10 Summary Future Institutional Arrangements

The proposed future institutional responsibilities may be summarised as follows:

| Table 7-2: Future Institutional Arrangements: Responsible Entities per Function |
|---|---|---|---|---|---|
| Roads | Road Transport | Inland Waterways | Airports, ANS & Air Transport | Rail | Pipelines |
| **Policy and Planning** | MoT | | | | |
| Safety Regulation and Enforcement | NRSC | Police | NTSA | RCAA | NTSA |
| Infrastructure Provision | RTDA | - | RTDA | PPP/ UACC | RTDA |
| Infrastructure Funding | RMF | - | General Fiscus (MINECOFIN) / PPP / Development Partners |
| Economic & Market Access Regulation | - | RURA (pax) | RURA (including Public Transport Planning function) |
| Transport Services | - | Private (commercial) ONATRACOM (public) | | Private Sector |

With reference to Table 6-2, the following should be noted:

- The Ministry of Transport (MoT) has been established and is dedicated to all aspects of Transport.
- RURA is now responsible for Road Transport and includes a Public Transport Planning role.
- RCAA is now responsible for safety functions only
- Creation of NTSA for smaller modes and NRSC for roads
- Private Sector services remain active for non-road modes of transport however, Rail Services include PSOs

It should be noted that in a number of instances, initiatives at the regional level would overtake events at the national level. Especially in the case of safety and technical regulation, it is foreseen that functions which are presently carried out at national level will migrate to regional institutions.

It is important that an institutional enabling environment be established, that is conducive towards the employment of the RSTMP by means of developing the necessary tools (policies and legal instruments) on which the RSTMP could be affected.
8. Implementation of the Strategy

Transportation master planning ultimately results in a set of projects that should be implemented. Funding has to be channelled meaningfully to ensure that the right kind of projects, that has the biggest economic impact, and that aligns best with most elements addressed in the transport vision, receives the highest priority.

8.1 Introduction

A detailed review of the options for private participation in the Rwandan transport sector was developed in Working Paper 7 (WP7) of this project. This section serves to highlight salient aspects of this review, with specific focus on the actions required to stimulate and enable such private participation, as well as the possible projects that can be targeted in this regard.

It should be noted that the focus here is on the specific actions required to move transportation Public Private Partnerships (PPPs) forward in Rwanda, and therefore much of the detail in the WP7 will not be repeated here (such as the theoretical underpinnings of PPPs, or the details of the current PPP institutional framework). Rather, the actions needed are discussed under the following headings:

- PPP project opportunities; and
- Institutional Implementation Issues.

Prior to that we start with a brief review of the context for PPPs in the Rwandan Transport sector.

8.2 Context for PPPs in Rwanda

8.2.1 Framework for Delivering PPPs

The introduction and use of PPPs in Rwanda has been promoted in a number of policy instruments and institutional developments. At the highest level, PPP-type arrangements are promoted in Vision 2020 (under the “Private Sector-led Development” development pillar), and in the Economic Development and Poverty Reduction Strategy Paper (EDPRS). The National Public Investment Policy (NPIP) further represents the main policy for private participation in Rwanda.

In addition, substantial work has been done (and is still in progress) to develop the legal, financial, institutional, and implementation environment required for PPPs in Rwanda. This includes:

- The development of the Public Finance Investment Policy (PFIP);
- Establishment of a number of institutions focussed on delivering and regulating PPPs, including the Public Investment Committee (PIC), the Public Investment Technical Team (PITT), and the PPP unit;
- Incorporating the provision of PPPs into the law on Public Procurement (Law No 12/2007 of 27/03/2007);
- Development of a draft law for the specific governance of Privately Financed Infrastructure Projects; and
- Development of detailed PPP guidelines as contained in the PPP Handbook.

8.2.2 PPP Investment Program

As part of this drive, the government is now in the process of formulating a long term (2011-2020) PPP investment program which will focus on “an optimal number of strategic projects so as to ensure efficient development of project development capacities, prioritization, and sound financing mechanism” (Gara, 2011). A number of proposed pilot projects have been identified in this regard, including two transport sector projects:

- The development of the new Bugesera International Airport (estimated size: US$ 600 million): Detailed engineering studies completed and transaction advisory services underway; and
In addition to these “high-end” PPP projects, there is also substantial scope for “low-end” PPPs in the Rwandan transport sector. Low-end PPP's are little more than general contractual agreements that contain one or more of the typical characteristics of a PPP and are commonly in use today without being labelled as a PPP. Performance based management contracts for transport infrastructure and services typically fall into this category. As reported in WP7, there might in fact be more opportunities for these low-end type PPP projects in Rwanda.

8.2.3 Appropriate PPP Models for the Rwandan Transport Sector

To identify the PPP models that might be appropriate for the Rwandan Transport sector, there are six key issues that need to be reviewed in view of the Rwandan transport context:

- Asset ownership;
- Applying user charges;
- Traffic related contracts;
- Governmental affordability;
- Donor support; and
- Social issues.

Based on an assessment of these issues, the following conclusions are drawn in WP7:

- The greatest opportunity in the Rwanda Transport Sector is for low-end PPPs, in the form of either management of service contracts.
- The limited scope for private ownership of infrastructure assets additionally precludes (for the most part) the application of divestitures.
- There are however also limited opportunities for high-end PPPs, specifically for capital projects that can generate significant donor support to offset capital costs.

The specific projects proposed in this regard are reviewed in Chapter 8.3 below.

8.3 Specific PPP Project Opportunities

In line with the approach in the broader Transport Master Plan, the opportunities for private participation (and PPPs) within the Rwandan Transport Sector can be identified along the six main transportation modes:

- Road transport;
- Aviation;
- Railways;
- Inland water ways;
- Pipelines; and
- Multimodal facilities.

The specific opportunities for private sector participation are presented graphically within this framework in Figure 8-1 below.
As shown in Figure 8-1, opportunities can be classified into three main functional spheres:

- Transport infrastructure development;
- Transport infrastructure operation and maintenance; and
- Transport service provision.

We discuss each in turn.

### 8.3.1 Infrastructure Development Opportunities

As elaborated in WP7, the development of transport infrastructure is generally provided by the public sector due to the monopolistic nature of the assets, and the strong externalities involved. The move towards PPPs however seeks to transfer some of this responsibility to private providers, specifically where the revenue potential (from user fees) is sufficient to attract private funding and financing. Unfortunately, as we show below, the Rwanda transport sector has only limited opportunities for private participation in the creation of transport infrastructure (PPPs in the purest sense of the term). As shown in the figure, this includes the following possible projects:

- Development of overloading control facilities;
- Development of new truck stop facilities;
- Development of the Bugesera airport; and
- Development of passenger and freight intermodal facilities in Kigali.

### 8.3.2 Infrastructure Operation and Maintenance Opportunities

The maintenance of transport infrastructure provides much greater scope for private involvement. Here we propose that the following projects can also be done under a PPP-type arrangement (in addition to the PPPs proposed above):
8.3.3 Transport Operation Opportunities

The provision of transport services has an even greater scope for private provision than the other two spheres. Generally, governments internationally have moved away from providing services in this sphere, as opening up this sector to private competition has generally been found to drive down costs and improving efficiencies. Governments generally only stay involved in this sphere based on strategic and social (access) considerations. For this reason, the activities of ONATRACOM and Rwandair can be considered for possible privatisation but with continued public sector involvement – as a minimum it is suggested that the activities of these organisations should be based on commercial principles (with selected public funding or support). Other possible projects in this sphere include:

- The provision of a bus service linking Bugesera airport with Kigali;
- The provision of a regional quality bus service;
- Providing water transport services on Lake Kivu and the Akagera river;
- The introduction of a domestic aviation service might also be considered in future.

We lastly note that the development of the proposed railway link to the Dar-Isaka railway should be delivered as a vertically integrated service, with the concessionaire responsible for the operation and maintenance of both the infrastructure and rolling stock (and provision of rail service). This integration (at least initially) would simplify the rail contract by transferring risk to a single private entity. The significant capital investment required for the rail infrastructure development (specifically in relation to the revenue potential) would most probably limit the possibilities for full PPP-type arrangements. As discussed in WP7, the formation of a cross-border entity to unify the interests of the governments involved (Tanzania, Rwanda, and Burundi) is lastly imperative to the success of this possible project.

8.3.4 PPP Projects Summary

Table 8-1 provides more detail on the list of possible PPP projects identified above. Each project is described in terms of the following characteristics:

- Transport mode;
- Functional sphere;
- Brief project description;
- Private sector role; and
- Public sector involvement.
### Table 8-1: Details of proposed PPP projects

<table>
<thead>
<tr>
<th>Mode</th>
<th>Project Description</th>
<th>Sphere</th>
<th>Private sector role</th>
<th>Government involvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road</td>
<td>Development of overloading control facilities at Gatumo, Rusumo, Kibugabuga, Muhanga, and at the RN6/RN33 junction.</td>
<td>Infrastructure development, operation and maintenance</td>
<td>Financing, design, construction, operation and maintenance of the facility</td>
<td>Oversight and regulation</td>
</tr>
<tr>
<td>Road</td>
<td>Development of new truck stop facilities in the Eastern, Northern, Western, and Southern Provinces (These truck stops / roadside stations may also be incorporated in the Trade Free Zone Freight Multi-modal facility).</td>
<td>Infrastructure development, operation and maintenance</td>
<td>Financing, design, construction, operation and maintenance of the facility</td>
<td>Oversight and regulation</td>
</tr>
<tr>
<td>Road</td>
<td>Development of low-cost toll roads on: • Road RN3 from Kigali to Kayonza; • Road RN4 from Musanze to Gisenyi (Rubavu); and • Road RN16 from Gisenyi (Rubavu) to Rubengera.</td>
<td>Infrastructure operations and maintenance</td>
<td>Provision of tolling infrastructure, maintenance and improvements on road concession. Transfer of technical and financial (revenue) risk to private provider.</td>
<td>Oversight, regulation, and tariff setting</td>
</tr>
<tr>
<td>Road</td>
<td>Implementation of Performance Based Maintenance and Management or Roads (PMMR) Contracts on regional roads (See WP7 section 6.2.2 for more details)</td>
<td>Infrastructure operations and maintenance</td>
<td>Contractor is paid a fixed amount per kilometre to maintain and manage a road at a specified service level, penalties for non-attainment</td>
<td>Oversight and regulation, controlling performance</td>
</tr>
<tr>
<td>Road</td>
<td>Provision of the ONATRACOM bus service on either a commercialised or privatised basis</td>
<td>Transport operations</td>
<td>Commercialisation and possible privatisation of bus service. Separate service contracts can also be considered for bus fleet management.</td>
<td>Oversight and regulation; provision of public subsidy (but structured to not detract from commercial imperative)</td>
</tr>
<tr>
<td>Road</td>
<td>Provision of a bus service between Bugesera airport and Kigali</td>
<td>Transport operations</td>
<td>Provision of a full transport service including bus fleet operation, ticketing, etc.</td>
<td>Oversight and regulation</td>
</tr>
<tr>
<td>Road</td>
<td>Quality bus service through-out Rwanda</td>
<td>Transport operations</td>
<td>Provision of a full transport service including bus fleet operation, ticketing, etc.</td>
<td>Oversight and regulation; possibility of public subsidy can be considered</td>
</tr>
<tr>
<td>Aviation</td>
<td>Development of the new Bugesera airport</td>
<td>Infrastructure development, operation and maintenance</td>
<td>Financing, design, construction, operations and maintenance of the new airport</td>
<td>Oversight, regulation, and tariff setting</td>
</tr>
<tr>
<td>Aviation</td>
<td>Management of regional airports at Kamembe, Gisenyi, Ruhengeri and Butare</td>
<td>Infrastructure operations and maintenance</td>
<td>Management of regional airfields under commercial principles</td>
<td>Oversight and regulation; large infrastructure work can be funded by</td>
</tr>
</tbody>
</table>
8.4 Institutional Issues for PPP Implementation

As detailed in WP7, the implementation of transport PPPs in Rwanda will require some work at an institutional level. Specifically the following will need to be addressed:

- Capacity building in RTDA;
- Appointing the most appropriate project officer;
- Early identification of feasible projects;
- Managing the PPP project stream;
- Engaging with experienced advisors;

<table>
<thead>
<tr>
<th>Mode</th>
<th>Project Description</th>
<th>Sphere</th>
<th>Private sector role</th>
<th>Government involvement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(and possibly Gabiru and Nemba in future)</td>
<td>Transport operations</td>
<td>Provision of a regional aviation transport services by a private company.</td>
<td>government</td>
</tr>
<tr>
<td>Domestic aviation services</td>
<td></td>
<td></td>
<td>This sector can be partially deregulated, with public licensing of providers</td>
<td></td>
</tr>
<tr>
<td>Rail</td>
<td>Proposed new railway to connect Rwanda (and Burundi) to the port of Dar es Salaam in Tanzania. The line will link to the existing TRL railway at Isaka in Tanzania.</td>
<td>Infrastructure operations and maintenance, and transport operations</td>
<td>The high capital cost required will probably limit private financing, so the project will most probably only entail a vertically integrated service, with the concessionaire responsible for the operation and maintenance of both the infrastructure and rolling stock, as well as the provision of the rail service</td>
<td>Oversight, regulation, and tariff setting</td>
</tr>
<tr>
<td>Pipelines</td>
<td>Uganda-Kampala Pipeline link (Uganda-Rwanda-Burundi Oil Pipeline Extension)</td>
<td>Infrastructure development, operation and maintenance</td>
<td>Financing, design, construction, operations and maintenance of the extension of the pipeline by Tamoil East Africa</td>
<td>Oversight and regulation of the contract, although the cross-border nature of the project will most probably require the formation of a inter-governmental agency to oversee and regulate the contract</td>
</tr>
<tr>
<td>Intermodal</td>
<td>Development of the Nyabugogo (Gatsata) passenger intermodal passenger facility (taxi-bus) in Kigali-west</td>
<td>Infrastructure development, operation and maintenance</td>
<td>Financing, design, construction, operation and maintenance of the facility. The project revenue will be based on allowing commercial rights for ancillary facilities.</td>
<td>Oversight and regulation</td>
</tr>
<tr>
<td></td>
<td>Development of the Kicukiro passenger Multi-modal facility (taxi-bus-airport-rail) in southern Kigali</td>
<td>Infrastructure development, operation and maintenance</td>
<td>Financing, design, construction, operation and maintenance of the facility. The project revenue will be based on allowing commercial rights for ancillary facilities.</td>
<td>Oversight and regulation</td>
</tr>
<tr>
<td></td>
<td>Development of a Free Trade Zone Multi-modal Facility (road freight – container terminal – rail) located approximately 11km east of Kigali city centre</td>
<td>Infrastructure development, operation and maintenance</td>
<td>Financing, design, construction, operation and maintenance of the facility. Project revenue will be based on user fees.</td>
<td>Oversight and regulation</td>
</tr>
</tbody>
</table>
8.4.1 Capacity Building in RTDA

The implementation of PPPs in the transport sector will require substantial capacity to be built within the RTDA. The current guidelines specifically call for the identification of a project officer and a project team within the procuring institution. As the custodian of developments in the Rwanda Transport sector, this capacity will therefore need to be built in the RTDA. We make the following comments in this regard:

- The choice of the project officer is critical for the success on PPPs, as we discuss in Chapter 8.4.2 below.
- It is recommended that a single PPP project team be established within the RTDA, who covers projects in all subsectors. This is suggested as we believe the size of the anticipated program does not merit redundancy in the RTDA.
- The correct management of the project flow is needed to ensure that the optimal level of capacity is retained within the RTDA. This is discussed further in section 8.4.4 below.

Lastly, in Chapter 8.4.7 we discuss the possibility of having the PPP unit take a stronger project delivery role than what is currently envisioned in the PPP handbook. This would reduce the amount of PPP capacity that needs to be built in the RTDA.

8.4.2 Appointment of the Project Officer

The PPP guidelines allow for the appointment of a “Public Investment Focal Point” to act as Project Officer and project champion. This role player is employed by the Procuring Institution, and manages and leads the project on the institution’s behalf. In South Africa the choice of project officer has proven to be the single most important factor in determining the project’s future success.

The Rwandan PPP guidelines provide guidance on the selection of the optimal project officer. We do not wish to duplicate these guidelines, but wish to highlight that the successful project officers need to have at least the following characteristics:

- Strong political support within the Procuring institution;
- A thorough understanding of the Rwanda public sector (and specifically the Transport sector);
- Project management and leadership experience;
- A foundational understanding of the PPP process; and
- Some technical understanding of the project being delivered.

Experienced high-ranking public officials generally make the best Project Officers as they generally have the political support, public sector understanding, and leadership abilities required to make the project successful. Experience in South Africa has however shown that it is challenging to attract this type of individual to the project officer post, because:

- The once off nature of the assignment does not necessarily fit with high level officials’ career paths;
- It is difficult to remunerate these officers at the scales of high-ranking officials; and
- Retaining these individuals after the project is difficult as their PPP experience make them very attractive in the private sector.

We therefore wish to highlight that substantial upfront work is needed for the selection, training, and retention of project officers.

8.4.3 Early Identification of Feasible Projects

Research has shown that the success of PPP programs internationally is greatly dependent on the level of success of the first “pilot” PPP projects being undertaken. This is due to the fact that PPPs generally entail
large public projects delivered in a drastically new way that takes a few years to realize. To ensure that programs retain the level of political commitment needed to implement them requires “early successes” to illustrate the benefit of the PPP model. We therefore propose that it is imperative that the most appropriate projects are identified up front. A number of projects that might be pursued as PPPs are presented in Chapter 8.3 – the initial choice of projects should be guided by:

- The social and economic return that the project provides;
- The strategic focus of the government;
- The political support that the project enjoys (including the possibility for donor support); and
- The financial capacity of the government (as reflected in the applicable MTEF), specifically if government-supported PPP projects are initiated.

8.4.4 Managing the PPP Project Stream

A related matter is the project deal stream, i.e. the list of PPP projects that will be procured in future. The optimal project stream entails a consistent flow of new PPP projects that are delivered, with limited “bunching” and few periods with no deals being planned or executed. It is important that the deal stream be managed for a number of reasons:

- Firstly, private bidders undergo large investments to participate on the procurement of PPP projects. If bidders see a consistent project stream, they are able to recuperate this investment over more project (as the investment is generally related to understanding the local market). A consistent project stream will therefore both ensure a higher level of competition (by attracting more bidders), and limit the procurement cost (as bidders will recuperate investments over a number of bids).
- A consistent project stream is also helpful in ensuring that the public sector learning is not lost, and that capacity is strengthened over time. The project delivery teams learn numerous lessons on a PPP deal, and ensuring future projects which they can work on generally relates to higher quality and more efficient project development and procurement.

The specific number of projects being delivered in parallel will greatly depend on the capacity of the public sector (both technical and financial). We would however suggest that the Rwandan PPP market is small enough that not more than 2 PPP projects should be developed and delivered at the same time (across all sectors). The ideal flow for transportation projects will be where the project team completing one PPP deal can move onto the next PPP as soon as Financial Close is reached.

8.4.5 Engaging with Experienced Advisors

It is anticipated that, at least initially, the government will be highly reliant on the support of experienced transaction advisors. The PPP handbook provides sufficient guidance on how to ensure the appointment of the most appropriate advisors. Still, we want to reiterate here the importance of advisors that:

- Are experienced in developing and delivering PPP projects in developing contexts
- Sufficiently understand the Rwanda context specifically the transportation sector

In addition, it is imperative that projects are not delivered under the leadership of advisors. Experience in the South Africa has shown that projects only successfully achieve the envisioned public aims, if they are delivered under strong public leadership. The role of the project officer is critical here.

8.4.6 Standardizing Project Documents

The standardization of PPP documents (such as concession contracts) has been widely pursued in existing PPP programs internationally, for two reasons:

- It reduces the amount of work needed on each transaction, and thereby reduces project development and procurement costs
- It ensures that different projects are delivered in a consistent way, which increases market confidence

Standardization however should be applied with caution, as no two projects are exactly alike (specifically in Rwanda where the opportunities for PPPs as identified above are a variety of different sectors). In addition, overreliance on standardized documents limits the rigor that the project needs to apply during project development.
The South African PPP unit has addressed this issue by rather developing detailed guidance documents in different sectors which (it is hoped) will limit project costs and increase consistency.

8.4.7 The Role of the PPP Unit

As we have shown, the existing PPP guidelines propose a strong project development and procurement role from procuring institutions. This is very much in line with international practice, specifically in large PPP programs where substantial dealflow merits PPP delivery capacity to be built in all the different infrastructure sectors.

We would however suggest that this model might not be optimal for Rwanda. The dealflow that might be supported by the current Rwandan public budget would probably entail the annual delivery of at most 3 projects. This means that some sectors will go 2 – 3 years without having any PPP projects delivered. Building, and sustaining, capacity in all infrastructure sectors would be both costly and challenging. Rather we propose the following:

- Building substantial project delivery capacity within the PPP unit
- Assigning greater approval roles to PITT so that the PPP unit will not be required to make any formal approvals
- Have representatives from the applicable procuring institution involved in the project team to both ensure the project is in line with departmental aims and to ensure consistency when the delivery phase of the projects starts. These representative do not need to be as high-ranking as the current project officer role
- Build substantial capacity only within those departments that will definitely be delivering a number of deals

This revised model will ensure that capacity building within the Rwanda government can be optimally focussed, and will also ensure greater consistency and efficiency (as one team within the PPP unit will be delivering the majority of projects).

It should be noted that a similar institutional revision has recently happened in the South African PPP field, with the PPP unit now delivering projects on behalf of some line agencies.

8.4.8 Addressing Weaknesses in the Institutional Framework

The WP7 contains a detailed assessment the current institutional, legal and policy framework under which transportation PPPs are to be pursued in Rwanda. The following salient comments are worth repeating here, and should be addressed as a priority:

- The PPP unit should have a stronger role in the development of PPP regulations;
- The strong separation between the PPP Unit and PITT would merit having a dedicated representative from PITT to be involved with project development, which would help to expedite the approval process;
- The current policy allows for too many organizations to be involved with PPP delivery. This involvement should be simplified, as it would reduce the amount of institutional capacity that needs to be built for the delivery of PPPs.
- The role of the project officer will be a key determinant of the success of any PPP project. Funding for this role should be made available from the PPP facility.
- The respective roles of the PPP unit versus the procuring institution should be clarified.
- The options analysis requirement in the PPP Handbook should be simplified, and only one VfM assessment should be required to be undertaken.
- There is scope for streamlining the project approval process (reducing the approval steps from 3 to 2) to ensure quicker project approval timeframes.
- The law regulating Public Procurement also needs some work, as outlined in WP7
9. RSTMP Projects and Programmes

The Strategy takes a long-term view on the future and strategic transportation system of Rwanda and identifies programmes and projects that secure the integrity of the system today as well as laying the foundation for the future.

The objective of this Chapter is to provide a process that would enable the successful appraisal and scheduling of projects and programmes that were identified as part of the RSTMP.

This is specifically essential for projects that need to compete for funding from the same budget group.

9.1 Project and Programme Scheduling Approach

The approach followed for the RSTMP project and programme scheduling is summarised in the steps illustrated in the figure below.

1. Categorise Projects
2. Determine where prioritisation is required
3. Define possible prioritisation tool
4. Conclusion and recommendation regarding prioritisation of projects
5. Prioritise projects (Working Paper 08)

9.2 Required Prioritisation

As mentioned before, prioritisation is essential for projects that need to compete against each other from the same budget group. All the projects from each category will be listed and ranked based on related criteria. The following comments apply to the projects from each category.

Road Infrastructure Projects

The road infrastructure projects resulted mainly from the transport model which included various capacity- and road safety analysis. These projects are therefore all warranted and already ranked according to the importance on the road network capacity and safety.
Other Transport Infrastructure Projects

Additional transport infrastructure projects and studies were identified by analysing the status quo of the transport services and identifying the gaps in order to provide fundamental services across all transport modes. These projects need to be prioritised as input into the final consolidated list of projects.

Institutional Projects and Studies

The transport institutional arrangements (infrastructure) were analysed and covered the transport institutions related to roads, rail, airports, inland waterways, pipelines, and multi-modal facilities. From this, institutional and policy related projects and studies were identified in order to address the shortfalls and to optimise existing structures responsible for the implementation of transport infrastructure projects in Rwanda. Some of these projects need to compete for funding from the same budget group similar to other project categories and therefore also needs to be prioritised.

9.3 Prioritisation Method

In order to prioritise the identified projects and studies with a mix of both competing and aligned project objectives of transport into one unified list of projects, a project evaluation methodology was sought that could take into account a number of qualitative and quantitative aspects simultaneously, and which can accommodate changes in planning emphasis and project life-cycle implications over time (Refer to Figure 9-2).

**Figure 9-2: Evaluation Framework Requirements**

To fully take into account all factors relevant in deciding which projects to favour, a method was followed that takes all the relevant system constraints into account. The following model methodologies were considered:

- Categorical Judgement Model (P Barlow, Nov 1978, NITRR-CSIR);
- Summated Ratings Model (P Barlow, Nov 1978, NITRR);
- Analytic Hierarchy Process Model (TL Saaty, August 1983 IEEE);
- Utility Analysis Model (JV Baxa, January 1981, CSIR);
After considering these alternative models against the basic requirements and environment as stated before, the generalised utility analysis model methodology was deemed to be the most suitable approach. The selection of the utility analysis (Multi-criteria Analysis) was based on the following associated benefits:

- A utility analysis provides a structured input for the decision-maker;
- A utility analysis provides an indication of the overall effectiveness with which alternatives will satisfy the complex target system; and
- A utility analysis is a transparent approach which allows the decision-makers to gauge the sensitivity of the various analysis parameters as part of the evaluation process.

9.3.1 Defining Multi-criteria Analysis (MCA)

The definition of a Multi-criteria Analysis is:

“Utility analysis (Multi-Criteria Analysis - MCA) is in effect a semi-quantitative means of ‘trading off’ the effects of implementing any given scheme, that is, the relative desirability of achieving a given set of goals and objectives and the degree to which this target system is fulfilled, are combined to give a measure of how far each scheme will go in meeting all or any of the goals and objectives, and so provides the answer to the question of effectiveness of the scheme. The distinguishing feature of utility analysis is that it can handle financial, quantitative and qualitative effects simultaneously. Consequently, all of the impacts or effects of a project which can be envisaged can be included in the analysis.”

– Evaluation of Transportation Projects – Utility Analysis; JV Baxa; January 1981; CSIR.

9.4 Project Prioritisation Process

The Rwanda Strategic Transport Master Plan Project Prioritisation Process could possibly be developed as a Multi Criteria Analysis (MCA) assessment based on the development directives of the country as a whole. Figure 9-3 illustrates how such a process could work.

*Figure 9-3: Possible RSTMP Project Prioritisation Process*

Each of the elements of this RSTMP Project Prioritisation Process is discussed in terms of methodology and rationale.
9.4.1 Projects

Projects were identified during the development of the RSTMP as well as a result of discussions held at stakeholder workshops and meetings. Direct client discussions as well as stakeholder participation in the form of workshops also gave input into the final proposed projects.

It is recommended that a system be put in place in order to update the project list on an annual basis and to review the priorities of projects already on the list.

9.4.2 Screening

The screening process highlighted projects that:

- Aligned Regionally;
- Have Strategic Importance; and that
- Contributes to Economic Development.

This ensures projects that align to the regional development and planning, that have significant impact on a nationwide scale and that, once implemented, will contribute to economic development.

9.4.3 Exempted Projects

Identified projects that should be exempted from the process are usually projects that are identified as crucial to the RSTMP (e.g. Politically Motivated Flag Ship Projects) and are normally reliant on different motivation criteria and budget sources. The RSTMP MCA did not include projects of this nature. However, such project can be included in future updates of the RSTMP.

9.4.4 Remaining Candidate Projects

The remaining candidate projects which have not been exempted or which have not failed the screenings have to be assigned a project priority by means of the MCA within the RSTMP Project Prioritisation Process.

9.4.5 Multi Criteria Analysis

The approach to developing a MCA is shown schematically in Figure 9-4 below.

*Figure 9-4: Multi-criteria Analysis Model Development Approach*
The process of establishing a utility or MCA model can be simplified as follows:

- The overarching goals and objectives of the RSTMP to be met by each project/ study are represented in a structured way in the form of a "decision-tree";
- Goals and objectives may include quantitative and qualitative factors i.e. financial factors, technical considerations, project maturity or readiness criteria, economic criteria, social obligations, legal obligations etc;
- Overarching goals must be established for which relevant objectives have to be established. Each objective requires a specific input (such as an answer to a “qualitative” question or an input value such as a “quantitative” cost parameter for example);
- The relationship between the goals, objectives and their related qualitative and quantitative inputs is then modelled based on a predetermined method or value function, to provide an output;
- The value function or model relies on relative preferences associated with each goal, objective or criterion i.e. the branches of the decision tree. Determining relative preferences can be simplified as follows (Refer to Figure 9-5):
  - Define the relative preferences for each goal that was set out;
  - Define relative preferences for each objective that was set out; and
  - Weight each criterion that was set up to reflect their relative importance.

*Figure 9-5: Determining MCA Preferences / Weights Example*

By following these steps, each alternative can be ‘scored’ to attain a measurement of performance that can be translated into a number of points. The points system with which each criterion is weighted, as indicated on the matrix of utilities, is a number between 0 and 100.
The implication of this multiplication is that the further a parameter is located towards the left of the model-tree, the greater is its influence on the ultimate score of the project. It is, however, further complicated by the restraint placed on each branch of the tree through the respective selected weights of each branch. Two separate criteria on two different branches of the model tree may be on the same vertical level but will have different effects on the ultimate score as a result of the “parent weight” of each branch.

### 9.4.5.1 MCA Calibration

The goals, objectives, criteria, weights and scores of the MCA model is initially developed from a desktop exercise based on available data and literature, as well as the professional judgement of the consultants in terms of master planning and project prioritization. After the initial model has been developed the goals, objectives, criteria, weights and scores are calibrated through a series of workshops with the project stakeholders in order to obtain early buy-in into the process and to ensure that the model preferences reflects that of the stakeholder organizations concerned.

Given the limited scope allowances of the RSTMP in this regard, a workshop was held in September 2011 to, amongst others, workshop the RSTMP MCA and assist with its calibration. The outcome of this workshop allowed sufficient input in order to develop the RSTMP MCA. However, it is important to note that it is common practice to update an MCA and that the RSTMP MCA should be updated in the future course of the RSTMP project cycle by means of additional workshops with relevant stakeholders in order to re-evaluate the weighting for the various criteria of the MCA. This is also important as priorities change year-by-year especially when comparing which of the Vision Pillars are more important than others.

### 9.4.5.2 Measurement of Criteria

In terms of MCA each of the criteria is rated in terms of the specific project being assessed, each criterion is scored between 0 and 100 points with zero indicating that the specific project will be least beneficial in terms of the specific criterion while 100 indicates it is most beneficial.

The MCA takes the form, as shown previously, of multiple criteria feeding into each objective, multiple objectives feeding into each goal and finally multiple goals feeding into the total project score. Each criterion is assigned a weighting, the various criteria weightings, that make up an objective, adds up to 100. Each objective is also assigned a weighting, the various objectives that make up a goal, adds up to 100 as well. Each goal is given a weighting, the weighting of all goals adds up to a 100 and this score out of 100 is the total project score and the basis upon which it is ranked.

The following equation shows how the project score is determined:

$$ P_{1,q} = \sum_{1}^{k} (G_k \times \sum_{1}^{m} (O_m \times \sum_{1}^{n} C_{wn} \times C_{sn})) $$

Where $P_{1,q}$ represents the total projects score for project 1 to q (q being the total number of projects), and

$G_k$ represents the goal score, where $k$ is the total number of goals, and

$O_m$ represents the objective score, where $m$ is the total number of objectives, and where

$C_{wn}$ gives the weighting of the criteria and $C_{sn}$ refers to the score (1 – 100) given to the criterion for the specific project, where $n$ is the total number of criteria.

### 9.4.6 Prioritised Project List

Once the MCA has been completed, all projects will be populated with a priority value and ranked according to priority (assigned by the MCA). It is proposed that prioritisation categories are used as follows:

- **I:** Short term implementation (1 – 2 years);
- **II:** Medium term implementation (2 – 5 years); and
- **III:** Long term implementation (5 – 10 years).

### 9.5 Identification of Prioritisation / Evaluation Criteria

In order to evaluate/prioritise the RSTMP projects identified, appropriate evaluation criteria need to be identified. As previously mentioned, these criteria should strive to advance regional integration through project implementation by fostering various outcomes such as the enhancement of competitiveness,
development of human resources, reducing poverty, improving peace and security, and democratizing the state and society. Similarly the evaluation criteria should align with the Vision Pillars identified as part of the RSTMP development process (refer to Section 1.4 and Figure 9-6).

**Figure 9-6: Diagrammatic Representation of the RSTMP’s Alignment with Rwanda’s Transport Vision Pillars**
The following Evaluation Criteria was developed and utilised based on the Vision Pillars for the RSTMP and is also based on the project prioritisation methodology and weighting developed during the East African Trade and Transport Facilitation Project (2010) as well as the results of a focused workshop held with Rwanda Officials in September 2011:

Table 9-1: Evaluation Criteria and Measures Applied

<table>
<thead>
<tr>
<th>Evaluation Criteria</th>
<th>Weighting</th>
<th>Evaluation Criterion / Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Readiness</td>
<td>30%</td>
<td>1.1 ID Project Life Cycle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.2 Completion Timeframe</td>
</tr>
<tr>
<td>2. Social Accessibility and Choice</td>
<td>18%</td>
<td>2.1 Does the project improve accessibility of rural communities?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.2 Is this project linked to an important National node?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.3 Does this project link a rural area to an economic centre/employment area/public amenities and services?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.4 Does this project support a National / Regional priority corridor?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.5 Does this project promote modal choice or seamless integrated transport?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.6 Does this project facilitate an equitable transport system with special attention to special transport users?</td>
</tr>
<tr>
<td>3. Economic Development</td>
<td>25%</td>
<td>3.1 Does this project reduce the cost of transportation of people/goods?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.2 Does this project reduce the time associated with transporting people/goods?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.3 Does this project result in job creation?</td>
</tr>
<tr>
<td>4. Affordability / Financing</td>
<td>15%</td>
<td>4.1 Does this project generate additional operational and maintenance cost?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.2 Is the maintenance and operational cost of this project recovered during its operational stage?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.3 Does this project promote the user pays principle?</td>
</tr>
<tr>
<td>5. Impact (Social, Environmental and Economic)</td>
<td>12%</td>
<td>5.1 Does this project promote the use of low-carbon energy sources?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.2 Does this project promote the use of public transport?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.3 Does this project eliminate bottlenecks/delays and resource wastage?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.4 Does this project promote the use/implementation of new/cost saving technologies?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.5 What is the extent of the project and who are the beneficiaries?</td>
</tr>
</tbody>
</table>
9.6 RSTMP Prioritized Projects and Programmes Results

The RSTMP MCA process described in the previous sections of this report resulted in a prioritized list of projects (refer to Table 9-2) that reflect the priorities of the RSTMP based on the RSTMP Vision Pillars.

Table 9-2: RSTMP Strategic Projects Identified and Prioritized

<table>
<thead>
<tr>
<th>No.</th>
<th>RSTMP Projects</th>
<th>MCA Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Quality Bus Corridor Service (Development of High Quality Bus Public Transport Service on major road corridors of Rwanda) - Feasibility Study and Concept Design</td>
<td>83</td>
</tr>
<tr>
<td>2.</td>
<td>Quality Bus Corridor Service - Pilot Project (Development of High Quality Bus Public Transport Service Pilot Project between Kigali and Bugesera Airport)</td>
<td>79</td>
</tr>
<tr>
<td>3.</td>
<td>Quality Bus Corridor Service Operations (investigation on the potential of PPP in terms of the operations of the Quality Bus Corridor Service)</td>
<td>79</td>
</tr>
<tr>
<td>4.</td>
<td>Development of a Strategy for the integration of the Quality Bus Corridor Service with other Public Transport Modes</td>
<td>78</td>
</tr>
<tr>
<td>5.</td>
<td>Development of the Nyabugogo (Gatsata) Multi-Modal Transport Facility (Kigali City North-Western Sector) - Pre-Feasibility</td>
<td>76</td>
</tr>
<tr>
<td>6.</td>
<td>Implementation of the Quality Bus Corridor Service Integration with other Public Transport Modes Strategy</td>
<td>76</td>
</tr>
<tr>
<td>7.</td>
<td>Development of the Bugesera Airport Multi-Modal Transport Facility (Kigali City Southern Sector) - Pre-Feasibility</td>
<td>75</td>
</tr>
<tr>
<td>8.</td>
<td>Development of the Kigali-Gisenyi Route alignment Railway Reserve - Pre-Feasibility</td>
<td>73</td>
</tr>
<tr>
<td>9.</td>
<td>Development and Implementation of the Lake Kivu Inland Waterway Transport System and Service (Passengers and Cargo) includes detailed design, EIA and PPP; Construction of infrastructure (incl. 7 ports); Delivery of Vessels; System Implementation and Operation</td>
<td>72</td>
</tr>
<tr>
<td>10.</td>
<td>Development and Provision of the ONATRACOM Bus Service (Commercialized or Privatized basis) for areas identified as remote or without transport services</td>
<td>72</td>
</tr>
<tr>
<td>11.</td>
<td>Development of the Kicukiro Multi-Modal Transport Facility (Kigali City Southern Sector) - Pre-Feasibility</td>
<td>70</td>
</tr>
<tr>
<td>12.</td>
<td>Development of National Road Safety Standards in line with Road Safety Strategy to be implemented by RTDA and overseen by MININFRA</td>
<td>69</td>
</tr>
<tr>
<td>13.</td>
<td>Pre-Feasibility Study on the Rusizi River Navigability</td>
<td>69</td>
</tr>
<tr>
<td>14.</td>
<td>Develop and Implement Rural Road Management Strategy Programme in association with ASSETIP</td>
<td>68</td>
</tr>
<tr>
<td>15.</td>
<td>Development of the Free Zone Freight Multi-Modal Transport Facility (Kigali City Eastern Sector) - Pre-Feasibility</td>
<td>68</td>
</tr>
<tr>
<td>16.</td>
<td>Upgrade of the Rusizi/Cyangugu Border Post (Rwanda and DRC Border)</td>
<td>67</td>
</tr>
<tr>
<td>17.</td>
<td>Capacity Upgrade Investigation Study of the RN1 based on cumulative FONA results (capital first order cost relates to addition of passing lane in both directions - for illustrative purposes only and dependent on detailed investigations)</td>
<td>66</td>
</tr>
<tr>
<td>18.</td>
<td>Capacity Upgrade Investigation Study of the RN2 based on cumulative FONA results (capital first order cost relates to addition of passing lane in both directions - for illustrative purposes only and dependent on detailed investigations)</td>
<td>66</td>
</tr>
<tr>
<td>19.</td>
<td>Capacity Upgrade Investigation Study of the RN3 based on cumulative FONA results (capital first order cost relates to addition of passing lane in both directions - for illustrative purposes only and dependent on detailed investigations)</td>
<td>66</td>
</tr>
<tr>
<td>20.</td>
<td>Capacity Upgrade Investigation Study of the RN4 based on cumulative FONA results (capital first order cost relates to addition of passing lane in both directions - for illustrative purposes only and dependent on detailed investigations)</td>
<td>66</td>
</tr>
<tr>
<td>No.</td>
<td>RSTMP Projects</td>
<td>MCA Score</td>
</tr>
<tr>
<td>-----</td>
<td>--------------------------------------------------------------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>21.</td>
<td>Capacity Upgrade Investigation Study of the RN5 based on cumulative FONA results (capital first order cost relates to addition of passing lane in both directions - for illustrative purposes only and dependent on detailed investigations)</td>
<td>66</td>
</tr>
<tr>
<td>22.</td>
<td>Capacity Upgrade Investigation Study of the RN6 based on cumulative FONA results (capital first order cost relates to addition of passing lane in both directions - for illustrative purposes only and dependent on detailed investigations)</td>
<td>66</td>
</tr>
<tr>
<td>23.</td>
<td>Capacity Upgrade Investigation Study of the RN7 based on cumulative FONA results (capital first order cost relates to addition of passing lane in both directions - for illustrative purposes only and dependent on detailed investigations)</td>
<td>66</td>
</tr>
<tr>
<td>24.</td>
<td>Capacity Upgrade Investigation Study of the RN8 based on cumulative FONA results (capital first order cost relates to addition of passing lane in both directions - for illustrative purposes only and dependent on detailed investigations)</td>
<td>66</td>
</tr>
<tr>
<td>26.</td>
<td>Rwanda participation in regional initiatives to Develop Technical Guidelines and Standards for planning and operation of infrastructure of Rwanda, including feasibility and funding approaches (Road, Rail, IWW and Airports)</td>
<td>66</td>
</tr>
<tr>
<td>27.</td>
<td>Capacity Upgrade Investigation Study of the RN3 based on cumulative FONA results (capital first order cost relates to addition of passing lane in both directions - for illustrative purposes only and dependent on detailed investigations)</td>
<td>65</td>
</tr>
<tr>
<td>28.</td>
<td>Pre-Feasibility Study on the Construction of the Kigali City Bypass/Ring Road</td>
<td>64</td>
</tr>
<tr>
<td>29.</td>
<td>Pre-Feasibility Study on an Additional Future Pipeline Reserve and Linkages from Lake Kivu onto Kampala (Kigali-Muhanga-Ribavu and Huye-Rusizi)</td>
<td>64</td>
</tr>
<tr>
<td>30.</td>
<td>Rwanda participation in regional initiatives to design and establish a Road Management System (RMS) / Integrated Road Network Management System (IRNMS) (excl. data collection)</td>
<td>64</td>
</tr>
<tr>
<td>31.</td>
<td>Capacity Upgrade Investigation Study of the RN1 based on cumulative FONA results (capital first order cost relates to addition of passing lane in both directions - for illustrative purposes only and dependent on detailed investigations)</td>
<td>63</td>
</tr>
<tr>
<td>32.</td>
<td>Capacity Upgrade Investigation Study of the RN10 based on cumulative FONA results (capital first order cost relates to addition of passing lane in both directions - for illustrative purposes only and dependent on detailed investigations)</td>
<td>63</td>
</tr>
<tr>
<td>33.</td>
<td>Capacity Upgrade Investigation Study of the RN2 based on cumulative FONA results (capital first order cost relates to addition of passing lane in both directions - for illustrative purposes only and dependent on detailed investigations)</td>
<td>63</td>
</tr>
<tr>
<td>34.</td>
<td>Capacity Upgrade Investigation Study of the RN3 based on cumulative FONA results (capital first order cost relates to addition of passing lane in both directions - for illustrative purposes only and dependent on detailed investigations)</td>
<td>63</td>
</tr>
<tr>
<td>35.</td>
<td>Capacity Upgrade Investigation Study of the RN4 based on cumulative FONA results (capital first order cost relates to addition of passing lane in both directions - for illustrative purposes only and dependent on detailed investigations)</td>
<td>63</td>
</tr>
<tr>
<td>36.</td>
<td>Capacity Upgrade Investigation Study of the RN5 based on cumulative FONA results (capital first order cost relates to addition of passing lane in both directions - for illustrative purposes only and dependent on detailed investigations)</td>
<td>63</td>
</tr>
<tr>
<td>37.</td>
<td>Capacity Upgrade Investigation Study of the RN6 based on cumulative FONA results (capital first order cost relates to addition of passing lane in both directions - for illustrative purposes only and dependent on detailed investigations)</td>
<td>63</td>
</tr>
<tr>
<td>38.</td>
<td>Capacity Upgrade Investigation Study of the RN7 based on cumulative FONA results (capital first order cost relates to addition of passing lane in both directions - for illustrative purposes only and dependent on detailed investigations)</td>
<td>63</td>
</tr>
<tr>
<td>No.</td>
<td>RSTMP Projects</td>
<td>MCA Score</td>
</tr>
<tr>
<td>-----</td>
<td>--------------------------------------------------------------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>39.</td>
<td>Capacity Upgrade Investigation Study of the RN8 based on cumulative FONA results (capital first order cost relates to addition of passing lane in both directions - for illustrative purposes only and dependent on detailed investigations)</td>
<td>63</td>
</tr>
<tr>
<td>40.</td>
<td>Capacity Upgrade Investigation Study of the RN9 based on cumulative FONA results (capital first order cost relates to addition of passing lane in both directions - for illustrative purposes only and dependent on detailed investigations)</td>
<td>63</td>
</tr>
<tr>
<td>41.</td>
<td>Pre-Feasibility Study on the Kampala-Kigali-Bujumbura Pipeline Products Line</td>
<td>62</td>
</tr>
<tr>
<td>42.</td>
<td>Audit and Amend Road Traffic and Safety Act to include Road Safety Strategy</td>
<td>61</td>
</tr>
<tr>
<td>43.</td>
<td>Capacity Upgrade Investigation Study of the RN3 based on cumulative FONA results (capital first order cost relates to addition of passing lane in both directions - for illustrative purposes only and dependent on detailed investigations)</td>
<td>60</td>
</tr>
<tr>
<td>44.</td>
<td>Strategic Regional Airports Development Strategy (Includes plans for restructuring of Aviation Services - Domestic, Regional and International)</td>
<td>60</td>
</tr>
<tr>
<td>45.</td>
<td>Develop and Implement NMT National Strategy (Kigali City Pilot)</td>
<td>59</td>
</tr>
<tr>
<td>46.</td>
<td>Development of the Akagera River Port Reserve at Kagitumba - Pre-Feasibility</td>
<td>58</td>
</tr>
<tr>
<td>47.</td>
<td>Feasibility Study: Lake Victoria Basin International Ferry and Shipping</td>
<td>58</td>
</tr>
<tr>
<td>48.</td>
<td>Feasibility Study on the Development of low-cost Toll Roads: RN16 from Gisenyi (Rubavu) to Rubengera</td>
<td>57</td>
</tr>
<tr>
<td>49.</td>
<td>Pre-Feasibility Study on the Construction of the Huye Bypass</td>
<td>57</td>
</tr>
<tr>
<td>50.</td>
<td>Pre-Feasibility Study on the Construction of the Muhanga Bypass</td>
<td>57</td>
</tr>
<tr>
<td>51.</td>
<td>Pre-Feasibility Study on the Construction of the Musanze Bypass</td>
<td>57</td>
</tr>
<tr>
<td>52.</td>
<td>Navigability of the Akagera River (flow control dams and canalisation) includes 2nd Feasibility Study and Modal Split Study; Detailed Design; Construction Infrastructure (Canalization and Ports); Safety and Security Measures; and Operational Facilities</td>
<td>56</td>
</tr>
<tr>
<td>53.</td>
<td>Develop and implement Rwanda Roads Classification System, including Road Design Specifications and a Signage Strategy</td>
<td>56</td>
</tr>
<tr>
<td>54.</td>
<td>Development of the Rwanda Overload Control Strategy (aligned with the EAC)</td>
<td>56</td>
</tr>
<tr>
<td>55.</td>
<td>Gitarama Weighbridge Project (Gitarama North of Muhanga)</td>
<td>54</td>
</tr>
<tr>
<td>56.</td>
<td>Ferry System on other Lakes (includes: Feasibility Studies (integrated national approach); Construction of Infrastructure and Safety Measures; Delivery of Vessels; System Implementation and Operation</td>
<td>54</td>
</tr>
<tr>
<td>57.</td>
<td>Audit and Amend National Road Network Law</td>
<td>54</td>
</tr>
<tr>
<td>58.</td>
<td>Implementation of Performance Based Maintenance and Management of Roads (PMMR Contracts (PPP))</td>
<td>53</td>
</tr>
<tr>
<td>59.</td>
<td>Kigali Airport Interim Terminal Upgrade</td>
<td>53</td>
</tr>
<tr>
<td>60.</td>
<td>Harmonisation of Vehicle Road Worthiness Standards</td>
<td>53</td>
</tr>
<tr>
<td>61.</td>
<td>Akanyaru Weighbridge Project at Akanyaru Border Post</td>
<td>52</td>
</tr>
<tr>
<td>62.</td>
<td>Cyangugu Weighbridge Project at Cyangugu BorderPost</td>
<td>52</td>
</tr>
<tr>
<td>63.</td>
<td>Gatuna Weighbridge Project at Gatuna Border Post</td>
<td>52</td>
</tr>
<tr>
<td>64.</td>
<td>Gisenyi Weighbridge Project</td>
<td>52</td>
</tr>
<tr>
<td>65.</td>
<td>Rusumo Weighbridge Project at Rusumo Border Post</td>
<td>52</td>
</tr>
<tr>
<td>66.</td>
<td>Feasibility Study on the Development of low-cost Toll Roads: RN4 from Musanze to Gisenyi (Rubavu)</td>
<td>51</td>
</tr>
<tr>
<td>67.</td>
<td>New Bugesera International Airport Construction Project</td>
<td>51</td>
</tr>
<tr>
<td>68.</td>
<td>Kayonza Weighbridge Project</td>
<td>50</td>
</tr>
<tr>
<td>69.</td>
<td>Future Land Use Planning and Requirements of Regional Airports (Gisenyi Airport, Ruhengeri Airport, Butare Airport and Gabiro Airport) and Tourist Airports (e.g. Karongi Airport)</td>
<td>49</td>
</tr>
<tr>
<td>No.</td>
<td>RSTMP Projects</td>
<td>MCA Score</td>
</tr>
<tr>
<td>-----</td>
<td>--------------------------------------------------------------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>70</td>
<td>Feasibility Study on the Development of low-cost Toll Roads: RN3 from Kigali to Kayonza</td>
<td>45</td>
</tr>
<tr>
<td>71</td>
<td>Strategy on the Establishment and Empowerment of a National Transport Accident Investigation Authority</td>
<td>45</td>
</tr>
<tr>
<td>72</td>
<td>Feasibility Study on the best locations of Truck Stops/Roadside Stations countrywide</td>
<td>44</td>
</tr>
<tr>
<td>73</td>
<td>Construction of 3 Truck Stops/Roadside Stations (in line with Feasibility Study)</td>
<td>44</td>
</tr>
<tr>
<td>74</td>
<td>Upgrade of the Cyanika Border Post (Rwanda and Uganda Border)</td>
<td>43</td>
</tr>
<tr>
<td>75</td>
<td>Implementation of CNS/ATM</td>
<td>41</td>
</tr>
<tr>
<td>76</td>
<td>Kamembe Airport and Gisenyi Airport Interim Terminal Upgrade</td>
<td>39</td>
</tr>
<tr>
<td>77</td>
<td>Rwanda Aviation Human Resource Development</td>
<td>33</td>
</tr>
<tr>
<td>78</td>
<td>Establish Aviation Training Facility</td>
<td>32</td>
</tr>
<tr>
<td>79</td>
<td>Strategy on the Establishment and Empowerment of National Search &amp; Rescue Coordinating Agency</td>
<td>30</td>
</tr>
</tbody>
</table>

To assist with the implementation of the RSTMP, the prioritised projects are grouped in terms of the following RSTMP Programmes (in no particular order):

- **Strategic Road Infrastructure Development Programme**;
- **Strategic Transport Development Programme (Aviation Infrastructure and Services)**;
- **Strategic Transport Development Programme (Inland Waterways Infrastructure and Services)**;
- **Strategic Transport Development Programme (Pipeline Infrastructure and Services)**;
- **Strategic Transport Development Programme (Rail Infrastructure and Services)**;
- **Strategic Transport Development Programme (Strategy, Policy and Institutional)**; and
- **Strategic Transport Development Programme (Surface Public Transport Infrastructure and Services)**.

The above mentioned RSTMP Programmes are defined in the following sections with tables of each RSTMP Programme depicting the relevant projects identified in order of MCA Score.

### 9.6.1 Strategic Road Infrastructure Development Programme

The RSTMP Strategic Road Infrastructure Development Programme relate to the strategic road network and upgrades/interventions identified during the development of the RSTMP. It includes new road links, capacity improvement investigations, strategic freight transport infrastructure, border post infrastructure studies, bypass infrastructure studies, etc. For a full list refer to Table 9-3.

### 9.6.2 Strategic Transport Development Programme (Aviation Infrastructure and Services)

The RSTMP Strategic Transport Development Programme (Aviation Infrastructure and Services) relate to strategic aviation upgrades/interventions identified during the development of the RSTMP. For a full list refer to Table 9-4.

### 9.6.3 Strategic Transport Development Programme (Inland Waterways Infrastructure and Services)

The RSTMP Strategic Transport Development Programme (Inland Waterways Infrastructure and Services) relate to the strategic IWW network and services upgrades/interventions identified during the development of the RSTMP. For a full list refer to Table 9-5.
9.6.4 Strategic Transport Development Programme (Pipeline Infrastructure and Services)

The RSTMP Strategic Transport Development Programme (Pipeline Infrastructure and Services) relate to the strategic pipeline interventions identified during the development of the RSTMP. For a full list refer to Table 9-6.

9.6.5 Strategic Transport Development Programme (Rail Infrastructure and Services)

The RSTMP Strategic Transport Development Programme (Rail Infrastructure and Services) relate to the strategic rail network and services upgrades/interventions identified during the development of the RSTMP. For a full list refer to Table 9-7.

9.6.6 Strategic Transport Development Programme (Strategy, Policy and Institutional)

The RSTMP Strategic Transport Development Programme (Strategy, Policy and Institutional) relate to the strategic strategies, policy and institutional requirements and interventions identified during the development of the RSTMP. For a full list refer to Table 9-8.

9.6.7 Strategic Transport Development Programme (Surface Public Transport Infrastructure and Services)

The RSTMP Strategic Transport Development Programme (Surface Public Transport Infrastructure and Services) relate to the strategic surface public transport infrastructure and services requirements and interventions identified during the development of the RSTMP. For a full list refer to Table 9-9.
### Table 9-3: RSTMP Strategic Road Infrastructure Development Programme

<table>
<thead>
<tr>
<th>No.</th>
<th>RSTMP Project Programme</th>
<th>RSTMP Projects</th>
<th>MCA Score</th>
<th>Short Term: Year 1 to 2 (USD Million)</th>
<th>Medium Term: Year 3 to 5 (USD Million)</th>
<th>Long Term: Year 6 to 10 (USD Million)</th>
<th>Grand Total (USD Million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Strategic Road Infrastructure Development Programme</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Capacity Upgrade Investigation Study of the RN1 based on cumulative FONA results (capital first order cost relates to addition of passing lane in both directions - for illustrative purposes only and dependent on detailed investigations)</td>
<td>66</td>
<td>31.81</td>
<td></td>
<td></td>
<td>31.81</td>
<td></td>
</tr>
<tr>
<td>1.2</td>
<td>Capacity Upgrade Investigation Study of the RN2 based on cumulative FONA results (capital first order cost relates to addition of passing lane in both directions - for illustrative purposes only and dependent on detailed investigations)</td>
<td>66</td>
<td>45.35</td>
<td></td>
<td></td>
<td>45.35</td>
<td></td>
</tr>
<tr>
<td>1.3</td>
<td>Capacity Upgrade Investigation Study of the RN3 based on cumulative FONA results (capital first order cost relates to addition of passing lane in both directions - for illustrative purposes only and dependent on detailed investigations)</td>
<td>66</td>
<td>61.58</td>
<td></td>
<td></td>
<td>59.58</td>
<td></td>
</tr>
<tr>
<td>1.4</td>
<td>Capacity Upgrade Investigation Study of the RN4 based on cumulative FONA results (capital first order cost relates to addition of passing lane in both directions - for illustrative purposes only and dependent on detailed investigations)</td>
<td>66</td>
<td>91.00</td>
<td></td>
<td></td>
<td>91.00</td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>RSTMP Project Programme</td>
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<td>Medium Term: Year 3 to 5 (USD Million)</td>
<td>Long Term: Year 6 to 10 (USD Million)</td>
<td>Grand Total (USD Million)</td>
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<td>Long Term: Year 6 to 10 (USD Million)</td>
<td>Grand Total (USD Million)</td>
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<td>Implementation of Performance Based Maintenance and Management of Roads (PMMR) Contracts (PPP)</td>
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<td>1.33</td>
<td>Feasibility Study on the Development of low-cost Toll Roads: RN4 from Musanze to Gisenyi (Rubavu)</td>
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<td>51</td>
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<td>Kayonza Weighbridge Project</td>
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<td>Feasibility Study on the best locations of Truck Stops/Roadside Stations countrywide</td>
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<td>44</td>
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<td>Construction of 3 Truck Stops/Roadside Stations (in line with Feasibility Study)</td>
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<td>Upgrade of the Rusizi/Cyangugu Border Post (Rwanda and DRC Border)</td>
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<td>Upgrade of the Cyanika Border Post (Rwanda and Uganda Border)</td>
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## Table 9-4: RSTMP Strategic Transport Development Programme (Aviation Infrastructure and Services)

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<th>Long Term: Year 6 to 10 (USD Million)</th>
<th>Grand Total (USD Million)</th>
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<td>New Bugesera International Airport Construction Project</td>
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<td>Future Land Use Planning and Requirements of Regional Airports (Gisenyi Airport, Ruhengeri Airport, Butare Airport and Gabiro Airport) and Tourist Airports (e.g. Karongi Airport)</td>
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<td>Implementation of CNS/ATM</td>
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<td>Kamembe Airport and Gisenyi Airport Interim Terminal Upgrade</td>
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<td>Rwanda Aviation Human Resource Development</td>
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<td>Establish Aviation Training Facility</td>
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<td><strong>553.38</strong></td>
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### Table 9-5: RSTMP Strategic Transport Development Programme (Inland Waterways Infrastructure and Services)

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<th>Short Term: Year 1 to 2 (USD Million)</th>
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<th>Long Term: Year 6 to 10 (USD Million)</th>
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<td>3.0</td>
<td>Strategic Transport Development Programme (Inland Waterways Infrastructure and Services)</td>
<td>Development and Implementation of the Lake Kivu Inland Waterway Transport System and Service (Passengers and Cargo) includes detailed design, EIA and PPP; Construction of infrastructure (incl. 7 ports); Delivery of Vessels; System Implementation and Operation</td>
<td>72</td>
<td>44.50</td>
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<td>Development of the Akagera River Port Reserve at Kagitumba - Pre-Feasibility</td>
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<td>3.2</td>
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<td>Feasibility Study: Lake Victoria Basin International Ferry and Shipping</td>
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<td>Navigability of the Akagera River (flow control dams and canalisation) includes 2nd Feasibility Study and Modal Split Study; Detailed Design; Construction Infrastructure (Canalization and Ports); Safety and Security Measures; and Operational Facilities</td>
<td>56</td>
<td>209.90</td>
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<td>3.4</td>
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<td>Ferry System on other Lakes (includes: Feasibility Studies (integrated national approach); Construction of Infrastructure and Safety Measures; Delivery of Vessels; System Implementation and Operation</td>
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| | Total | 0.35 | 254.90 | 16.10 | 271.35 |
### Table 9-6: RSTMP Strategic Transport Development Programme (Pipeline Infrastructure and Services)

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<td>Strategic Transport Development Programme (Pipeline Infrastructure and Services)</td>
<td>Pre-Feasibility Study on an Additional Future Pipeline Reserve and Linkages from Lake Kivu onto Kampala (Kigali-Muhanga-Ribavu and Huye-Rusizi)</td>
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<td>Pre-Feasibility Study on the Kampala-Kigali-Bujumbura Pipeline Products Line</td>
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### Table 9-7: RSTMP Strategic Transport Development Programme (Rail Infrastructure and Services)

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<td>Development of the Kigali-Gisenyi Route alignment Railway Reserve - Pre-Feasibility</td>
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<tr>
<td>5.1</td>
<td></td>
<td>Development of the Kigali-Gisenyi Route alignment Railway Reserve - Pre-Feasibility</td>
<td>73</td>
<td></td>
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<td>5.2</td>
<td></td>
<td>Upgrade and Construction of the Dar es Salaam-Isaka-Kigali/Keza-Gitega-Musongati Railway Line</td>
<td>66</td>
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<td>0.00</td>
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</tr>
<tr>
<td>No.</td>
<td>RSTMP Project Programme</td>
<td>RSTMP Projects</td>
<td>MCA Score</td>
<td>Short Term: Year 1 to 2 (USD Million)</td>
<td>Medium Term: Year 3 to 5 (USD Million)</td>
<td>Long Term: Year 6 to 10 (USD Million)</td>
<td>Grand Total (USD Million)</td>
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<tr>
<td>6.0</td>
<td>Strategic Transport Development Programme (Strategy, Policy and Institutional)</td>
<td></td>
<td></td>
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<tr>
<td>6.1</td>
<td>Development of a Strategy for the integration of the Quality Bus Corridor Service with other Public Transport Modes</td>
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<td>0.68</td>
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<td>Development of National Road Safety Standards in line with Road Safety Strategy to be implemented by RTDA and overseen by MININFRA</td>
<td></td>
<td>69</td>
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<td></td>
<td></td>
<td>3.00</td>
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<tr>
<td>6.3</td>
<td>Pre-Feasibility Study on the Rusizi River Navigability</td>
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<td></td>
<td></td>
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<td>6.4</td>
<td>Develop and Implement Rural Road Management Strategy Programme in association with ASSETIP</td>
<td></td>
<td>68</td>
<td>0.50</td>
<td></td>
<td></td>
<td>0.50</td>
</tr>
<tr>
<td>6.5</td>
<td>Rwanda participation in regional initiatives to Develop Technical Guidelines and Standards for planning and operation of infrastructure of Rwanda, including feasibility and funding approaches (Road, Rail, IWW and Airports)</td>
<td></td>
<td>66</td>
<td>4.00</td>
<td></td>
<td></td>
<td>4.00</td>
</tr>
<tr>
<td>6.6</td>
<td>Rwanda participation in regional initiatives to design and establish a Road Management System (RMS) / Integrated Road Network Management System (IRNMS) (excl. data collection)</td>
<td></td>
<td>64</td>
<td>1.50</td>
<td></td>
<td></td>
<td>1.50</td>
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<tr>
<td>6.7</td>
<td>Audit and Amend Road Traffic and Safety Act to include Road Safety Strategy</td>
<td></td>
<td>61</td>
<td>3.00</td>
<td></td>
<td></td>
<td>3.00</td>
</tr>
<tr>
<td>No.</td>
<td>RSTMP Project Programme</td>
<td>RSTMP Projects</td>
<td>MCA Score</td>
<td>Short Term: Year 1 to 2 (USD Million)</td>
<td>Medium Term: Year 3 to 5 (USD Million)</td>
<td>Long Term: Year 6 to 10 (USD Million)</td>
<td>Grand Total (USD Million)</td>
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<tr>
<td>6.0</td>
<td>Strategic Transport Development Programme (Strategy, Policy and Institutional)</td>
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<td></td>
<td></td>
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<td>6.8</td>
<td>Strategic Regional Airports Development Strategy (Includes plans for restructuring of Aviation Services - Domestic, Regional and International)</td>
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<td>60</td>
<td>0.50</td>
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<td>0.50</td>
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<td>6.9</td>
<td>Develop and Implement NMT National Strategy (Kigali City Pilot)</td>
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<td>59</td>
<td>0.60</td>
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<td></td>
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<td>6.10</td>
<td>Develop and implement Rwanda Roads Classification System, including Road Design Specifications and a Signage Strategy</td>
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<td>56</td>
<td>0.50</td>
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<td>6.11</td>
<td>Development of the Rwanda Overload Control Strategy (aligned with the EAC)</td>
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<td>56</td>
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<td></td>
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</tr>
<tr>
<td>6.12</td>
<td>Audit and Amend National Road Network Law</td>
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<td>54</td>
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<td>6.13</td>
<td>Harmonisation of Vehicle Road Worthiness Standards</td>
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<td>53</td>
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<td></td>
<td></td>
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</tr>
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<td>6.14</td>
<td>Strategy on the Establishment and Empowerment of a National Transport Accident Investigation Authority</td>
<td></td>
<td>45</td>
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<td></td>
<td></td>
<td>1.50</td>
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<tr>
<td>6.15</td>
<td>Strategy on the Establishment and Empowerment of National Search &amp; Rescue Coordinating Agency</td>
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<td>30</td>
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<td><strong>Total</strong></td>
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<td></td>
<td><strong>18.93</strong></td>
<td><strong>0.00</strong></td>
<td><strong>0.00</strong></td>
<td><strong>18.93</strong></td>
</tr>
<tr>
<td>No.</td>
<td>RSTMP Project Programme</td>
<td>RSTMP Projects</td>
<td>MCA Score</td>
<td>Short Term: Year 1 to 2 (USD Million)</td>
<td>Medium Term: Year 3 to 5 (USD Million)</td>
<td>Long Term: Year 6 to 10 (USD Million)</td>
<td>Grand Total (USD Million)</td>
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</tr>
<tr>
<td>7.0</td>
<td>Strategic Transport Development Programme (Surface Public Transport Infrastructure and Services)</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>7.1</td>
<td>Quality Bus Corridor Service (Development of High Quality Bus Public Transport Service on major road corridors of Rwanda) - Feasibility Study and Concept Design</td>
<td></td>
<td>83</td>
<td>2.50</td>
<td></td>
<td></td>
<td>2.50</td>
</tr>
<tr>
<td>7.2</td>
<td>Quality Bus Corridor Service - Pilot Project (Development of High Quality Bus Public Transport Service Pilot Project between Kigali and Bugesera Airport)</td>
<td></td>
<td>79</td>
<td>21.50</td>
<td></td>
<td></td>
<td>21.50</td>
</tr>
<tr>
<td>7.3</td>
<td>Quality Bus Corridor Service Operations (investigation on the potential of PPP in terms of the operations of the Quality Bus Corridor Service)</td>
<td></td>
<td>79</td>
<td>0.20</td>
<td></td>
<td></td>
<td>0.20</td>
</tr>
<tr>
<td>7.4</td>
<td>Development of the Nyabugogo (Gatsata) Multi-Modal Transport Facility (Kigali City North-Western Sector) - Pre-Feasibility</td>
<td></td>
<td>76</td>
<td>11.40</td>
<td></td>
<td></td>
<td>11.40</td>
</tr>
<tr>
<td>7.5</td>
<td>Implementation of the Quality Bus Corridor Service Integration with other Public Transport Modes Strategy</td>
<td></td>
<td>76</td>
<td></td>
<td>0.30</td>
<td></td>
<td>0.30</td>
</tr>
<tr>
<td>7.6</td>
<td>Development of the Busesera Airport Multi-Modal Transport Facility (Kigali City Southern Sector) - Pre-Feasibility</td>
<td></td>
<td>75</td>
<td>11.40</td>
<td></td>
<td></td>
<td>11.40</td>
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<tr>
<td>7.7</td>
<td>Development and Provision of the ONATRACOM Bus Service (Commercialized or Privatized basis) for areas identified as remote or without transport services</td>
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<td>72</td>
<td>0.25</td>
<td></td>
<td></td>
<td>0.25</td>
</tr>
<tr>
<td>No.</td>
<td>RSTMP Project Programme</td>
<td>RSTMP Projects</td>
<td>MCA Score</td>
<td>Short Term: Year 1 to 2 (USD Million)</td>
<td>Medium Term: Year 3 to 5 (USD Million)</td>
<td>Long Term: Year 6 to 10 (USD Million)</td>
<td>Grand Total (USD Million)</td>
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<tr>
<td>7.0</td>
<td>Strategic Transport Development Programme (Surface Public Transport Infrastructure and Services)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>7.8</td>
<td>Development of the Kicukiro Multi-Modal Transport Facility (Kigali City Southern Sector) - Pre-Feasibility</td>
<td>70</td>
<td></td>
<td></td>
<td>22.80</td>
<td>22.80</td>
<td></td>
</tr>
<tr>
<td>7.9</td>
<td>Development of the Free Zone Freight Multi-Modal Transport Facility (Kigali City Eastern Sector) - Pre-Feasibility</td>
<td>68</td>
<td></td>
<td></td>
<td>22.80</td>
<td>22.80</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
<td>14.15</td>
<td>55.90</td>
<td>23.10</td>
<td>93.15</td>
</tr>
</tbody>
</table>
9.6.8 RSTMP Project Programme Summary

The following Table 9-10 presents a summary of the RSTMP Programmes identified. The summary includes the total cost per timeframe and the total cost per programme. It is important to note that the timeframes allow flexibility in that the programmes can be implemented within the timeframe and could then extend over the next timeframe. It is therefore critical that the RTDA further develop the proposed programmes as they see fit.

<table>
<thead>
<tr>
<th>No.</th>
<th>RSTMP Project Programme</th>
<th>Short Term: Year 1 to 2 (USD Million)</th>
<th>Medium Term: Year 3 to 5 (USD Million)</th>
<th>Long Term: Year 6 to 10 (USD Million)</th>
<th>Grand Total (USD Million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Strategic Road Infrastructure Development Programme</td>
<td>361.18</td>
<td>445.61</td>
<td>0.00</td>
<td>804.79</td>
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<td>2.0</td>
<td>Strategic Transport Development Programme (Aviation Infrastructure and Services)</td>
<td>28.00</td>
<td>553.38</td>
<td>2.00</td>
<td>583.38</td>
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<td>3.0</td>
<td>Strategic Transport Development Programme (Inland Waterways Infrastructure and Services)</td>
<td>0.35</td>
<td>254.90</td>
<td>16.10</td>
<td>271.35</td>
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<td>4.0</td>
<td>Strategic Transport Development Programme (Pipeline Infrastructure and Services)</td>
<td>0.00</td>
<td>0.00</td>
<td>1,135.77</td>
<td>1,135.77</td>
</tr>
<tr>
<td>5.0</td>
<td>Strategic Transport Development Programme (Rail Infrastructure and Services)</td>
<td>0.00</td>
<td>0.00</td>
<td>1,126.00</td>
<td>1,126.00</td>
</tr>
<tr>
<td>6.0</td>
<td>Strategic Transport Development Programme (Strategy, Policy and Institutional)</td>
<td>18.93</td>
<td>0.00</td>
<td>0.00</td>
<td>18.93</td>
</tr>
<tr>
<td>7.0</td>
<td>Strategic Transport Development Programme (Surface Public Transport Infrastructure and Services)</td>
<td>14.15</td>
<td>55.90</td>
<td>23.10</td>
<td>93.15</td>
</tr>
</tbody>
</table>

Grand Total | 422.61 | 1,309.78 | 2,302.97 | 4,033.36 |
9.7 RSTMP Budget

The parent Ministry responsible for transport (as well as its budgetary concerns) in Rwanda is the Ministry of Infrastructure (MININFRA). The need to give due attention to the transport component of MININFRA’s ambit has been acknowledged by the recent establishment of a semi-autonomous agency, the Rwanda Transport Development Agency (RTDA). The RTDA was established to assist the Ministry with the management and administration of the transport sector. The budget for transport resides with MININFRA and the RTDA with the following budgetary programmes currently in place (relevant to transport capacity expenditure):

- Development of Infrastructure for Opening-Up Rwanda; and
- Development and Maintenance of Road Transport Infrastructure.

This section aims to provide a summary of the current economic outlook of Rwanda, provide details regarding the current budget (relating to transport) and to provide guidelines in terms of the future budgetary requirements as it relates to the implementation of the RSTMP Project Programmes (identified in previous sections of this report).

9.7.1 Rwanda’s Economic Outlook

Rwanda’s long-term development goals are embedded in its Vision 2020 which seeks to transform Rwanda from a low-income agriculture-based economy to a knowledge-based, service-oriented economy by 2020. It envisages real growth of eight percent annually, to be achieved through: (i) deepening reforms, including in the business environment; (ii) investing in major infrastructure (power, transport, and ICT); (iii) increasing agricultural productivity; and (iv) investing in skills development needed for economic modernization.

Within this long term vision, the Economic Development and Poverty Reduction Strategy (EDPRS) assign the highest priority to accelerating growth to create employment and generate exports. The strategy is framed around three strategic flagship programs:

- Flagship one (growth) targets economy-wide improvements in productivity. Its goal is to transform Rwanda’s economy away from subsistence agriculture towards increased commercial agriculture, as well as manufacturing and services.
- Flagship two (Vision 2020 Umurenge Program) focuses on ensuring growth is widely shared by creating economic opportunities for the poorest Rwandans. VUP has three components: (i) public works; (ii) credit packages; and (iii) direct income support.
- Flagship three (governance) seeks to strengthen political and economic governance, and build institutions and capacity of the state. It envisages a wide range of reforms to strengthen public sector institutions and capacity and also includes aspects needed to create an attractive business environment including strengthening commercial justice systems, regulatory and administrative frameworks, and promoting principles of good corporate governance.

The government also recognizes the key role of the private sector in accelerating growth and reducing poverty, and is therefore looking for innovative ways to finance its development beyond traditional partners and instruments. It has accordingly been undertaking reforms to improve the business environment and to reduce the cost of doing business. Rwanda was named top performer in the Doing Business 2010 report, among the ten most improved economies in 2011, and ranked 3rd easiest place to do business in Africa in 2012.

According to the World Bank, Rwanda’s growth performance has been remarkably strong over the past two years. Real growth accelerated to about 7.2 percent in 2010 and 8.6 percent in 2011 from 4.1 percent in 2009. Production of non-tradables, such as construction and other services took off, accompanied by a booming mining sector. Continued high growth in services and construction was largely the result of the fiscal expansionary stance that the Government has followed since 2006, which in turn was financed by large foreign aid flows. In 2011, industrial sector growth overtook growth in services, due to soaring performance in mining and construction. Production in the mining sector increased in 2011 and continued to benefit from record world mineral prices. Agriculture remains a mainstay of the economy, albeit with declining importance. That said, over the past five years it has accounted for 35 percent of GDP, 73 percent of employment (according to the latest household survey of 2010/11), and 45 percent of export earnings.

Inflationary pressures resurfaced in tandem with rising global food prices and spikes in oil process in 2011. In common with neighboring countries, food and energy have been the leading inflation drivers. Food prices (35 percent of the consumption basket) increased from a negative 2.7 percent in December 2010 to a record 15.5 percent in February 2012. Energy inflation also rose. This led to headline inflation increasing nearly
uninterrupted in 2011 from historic lows in the last quarter of 2010 (0.2 percent in December) to its highest levels since mid-2009. Core inflation peaked at 9.0 percent in September 2011 and remained persistently high. The Central Bank of Rwanda, Banque Nationale du Rwanda (BNR), started to lift its policy rate in October 2011 to contain inflation pressures. However, the key repo rate was only raised marginally by a cumulative 100 basis points to seven percent, leaving it negative in real terms. Core inflation only started to retreat in February 2012 after Government reduced fuel taxes for a second time in January 2012, in order to contain price pressures from energy products to the rest of the economy.

Rwanda remains highly dependent on grants from its Development Partners. About 40 percent of the budget is financed by grants, adding up to 11.0 percent of GDP in 2010/11. This can easily turn into vulnerability if donors were to reduce their foreign assistance to Rwanda in the context of the fiscal consolidation exercises being implemented by many of them, including in connection to the sovereign debt crisis in the Euro zone. At the same time, revenues are still among the lowest in the East African Region. Although these over-performed during 2010/11 reaching 14.0 percent of GDP owing to higher direct taxes and excise duties these higher revenues were offset by higher than projected expenditures in all categories except externally financed capital expenditures, resulting in a widening of the fiscal deficit to 3.8 percent of GDP, compared to 0.5 percent in 2009/10. Finally, as trade shifts increasingly to the EAC partners, losses in the collection of international trade taxes are expected to become permanent with such permanent shifts in the revenue structure needing to be addressed in further consolidation efforts.

Rwanda’s economic outlook for 2012 is positive, but with increasing medium-term risks. Real GDP growth is projected to slow down in 2012 and further more in 2013 and 2014, due to the impact of the fiscal consolidation efforts and the uncertainties of the global outlook. Rwanda’s growth outlook is tied to a recovery in the global economy, which would ensure robust export demand, stable commodity prices, increasing tourism arrivals and continued aid inflows. Any shock in international commodities prices would severely hamper Rwanda’s balance of payments and growth outlook and could increase domestic inflationary pressures.

9.7.2 Current Budget (2010-2012)

The current budget of Rwanda (2012/2013) reflects a total budget allocation of $2,301,137,933.32 (sourced from the Ministry of Finance and Economic Development). Previous years were also investigated and Table 9-11 provides an assimilation of the Rwanda Transport Budget (CAPEX) for the year 2010 – 2012.

Table 9-11: Rwanda Transport Budget (CAPEX) for 2010 – 2012

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Total Budget for Transport</td>
<td>$91,428,990.56</td>
<td>$75,615,002.08</td>
<td>$161,986,231.46</td>
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<tr>
<td>Total CAPEX Budget for Transport</td>
<td>$91,428,990.56</td>
<td>$59,614,171.52</td>
<td>$150,779,860.04</td>
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<td>Internal Funding for Transport  (Roads)</td>
<td>$44,211,428.57</td>
<td>$14,760,797.34</td>
<td>$27,725,913.62</td>
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<td>Internal Funding for Transport  (Other Modes)</td>
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<td>$12,396,510.21</td>
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<tr>
<td>External Funding for Transport  (Roads)</td>
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<td>$46,916,166.30</td>
<td>$124,202,738.29</td>
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<tr>
<td>External Funding for Transport  (Other Modes)</td>
<td>$4,287,619.32</td>
<td>$1,541,528.24</td>
<td>$4,347,109.63</td>
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<tr>
<td>TOTAL Budget: Roads</td>
<td>$79,052,500.80</td>
<td>$61,676,963.64</td>
<td>$151,928,651.91</td>
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<tr>
<td>Acquisition of fixed assets</td>
<td>$-</td>
<td>$56,652,046.69</td>
<td>$143,631,873.00</td>
</tr>
<tr>
<td>TOTAL Budget: Other Modes</td>
<td>$12,376,489.76</td>
<td>$13,938,038.45</td>
<td>$10,057,579.55</td>
</tr>
<tr>
<td>Acquisition of fixed assets</td>
<td>$-</td>
<td>$2,962,124.82</td>
<td>$7,147,987.03</td>
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</table>

Table Notes: $1 = RWF602

Results assimilated from the Approved Budgets (2010 – 2012) sourced from Ministry of Finance and Economic Planning
9.7.3 Budget Expenditure Required for the RSTMP Project Programmes Identified

The Table 9-12 provides an outline of the RSTMP Project Programme Budget Expenditure requirements for the next 10 years outside the current budgetary requirements of Rwanda.

<table>
<thead>
<tr>
<th>No.</th>
<th>RSTMP Project Programme</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>Year 6</th>
<th>Year 7</th>
<th>Year 8</th>
<th>Year 9</th>
<th>Year 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Strategic Road Infrastructure Development Programme</td>
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<td>$180.59</td>
<td>$148.54</td>
<td>$148.54</td>
<td>$148.54</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>2</td>
<td>Strategic Transport Development Programme (Aviation Infrastructure and Services)</td>
<td>$14.00</td>
<td>$14.00</td>
<td>$184.46</td>
<td>$184.46</td>
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</tr>
<tr>
<td>3</td>
<td>Strategic Transport Development Programme (Inland Waterways Infrastructure and Services)</td>
<td>$0.18</td>
<td>$0.18</td>
<td>$84.97</td>
<td>$84.97</td>
<td>$84.97</td>
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<td>$3.22</td>
<td>$3.22</td>
<td>$3.22</td>
<td>$3.22</td>
</tr>
<tr>
<td>4</td>
<td>Strategic Transport Development Programme (Pipeline Infrastructure and Services)</td>
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<td></td>
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</tr>
<tr>
<td>5</td>
<td>Strategic Transport Development Programme (Rail Infrastructure and Services)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$225.20</td>
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<td>6</td>
<td>Strategic Transport Development Programme (Strategy, Policy and Institutional)</td>
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<tr>
<td>7</td>
<td>Strategic Transport Development Programme (Surface Public Transport Infrastructure and Services)</td>
<td>$7.08</td>
<td>$7.08</td>
<td>$18.63</td>
<td>$18.63</td>
<td>$18.63</td>
<td>$4.62</td>
<td>$4.62</td>
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<tr>
<td></td>
<td><strong>Grand Total</strong></td>
<td><strong>$211.31</strong></td>
<td><strong>$211.31</strong></td>
<td><strong>$436.59</strong></td>
<td><strong>$436.59</strong></td>
<td><strong>$436.59</strong></td>
<td><strong>$460.59</strong></td>
<td><strong>$460.59</strong></td>
<td><strong>$460.59</strong></td>
<td><strong>$460.59</strong></td>
<td><strong>$460.59</strong></td>
</tr>
</tbody>
</table>
Table 9-13 presents both a future projection of the current budget (refer to Table 9-11) and the RSTMP Project Programme budget requirements (refer to Table 9-12) based on a Pessimistic (5% growth rate), Realistic (9% growth rate), and Optimistic (14% growth rate). The Realistic Growth Rate is sourced from the current World Bank Economic Country Review (2012) and reflects the current trends of the Rwanda Economy.

### Table 9-13: Analysis Results of Current Budget Forecast and Additional Budget Required for the RSTMP Project Programme

<table>
<thead>
<tr>
<th>Year</th>
<th>2012/2013 ($Million)</th>
<th>2013/2014 ($Million)</th>
<th>2013/2015 ($Million)</th>
<th>2013/2016 ($Million)</th>
<th>2013/2017 ($Million)</th>
<th>2013/2018 ($Million)</th>
<th>2013/2019 ($Million)</th>
<th>2013/2020 ($Million)</th>
<th>2013/2021 ($Million)</th>
<th>2013/2022 ($Million)</th>
<th>2013/2023 ($Million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pessimistic (5%)</td>
<td>$150.78</td>
<td>$158.32</td>
<td>$166.23</td>
<td>$174.55</td>
<td>$183.27</td>
<td>$192.44</td>
<td>$202.06</td>
<td>$212.16</td>
<td>$222.77</td>
<td>$233.91</td>
<td>$245.60</td>
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<tr>
<td>RSTMP Programme Budget Requirement</td>
<td>$211.31</td>
<td>$211.31</td>
<td>$436.59</td>
<td>$436.59</td>
<td>$436.59</td>
<td>$460.59</td>
<td>$460.59</td>
<td>$460.59</td>
<td>$460.59</td>
<td>$460.59</td>
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</tr>
<tr>
<td>Shortfall Required</td>
<td>$(52.99)</td>
<td>$(45.07)</td>
<td>$(262.05)</td>
<td>$(253.32)</td>
<td>$(244.16)</td>
<td>$(258.53)</td>
<td>$(248.43)</td>
<td>$(237.82)</td>
<td>$(226.68)</td>
<td>$(214.99)</td>
<td>$(214.99)</td>
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<tr>
<td>Realistic (9%)</td>
<td>$164.35</td>
<td>$172.57</td>
<td>$181.20</td>
<td>$190.26</td>
<td>$199.77</td>
<td>$209.76</td>
<td>$220.24</td>
<td>$231.26</td>
<td>$242.82</td>
<td>$254.96</td>
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<tr>
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<td>$211.31</td>
<td>$436.59</td>
<td>$436.59</td>
<td>$436.59</td>
<td>$460.59</td>
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<td>$460.59</td>
<td>$460.59</td>
<td>$460.59</td>
<td>$460.59</td>
</tr>
<tr>
<td>Shortfall Required</td>
<td>$(46.95)</td>
<td>$(38.74)</td>
<td>$(255.40)</td>
<td>$(253.32)</td>
<td>$(244.16)</td>
<td>$(258.53)</td>
<td>$(248.43)</td>
<td>$(237.82)</td>
<td>$(226.68)</td>
<td>$(214.99)</td>
<td>$(214.99)</td>
</tr>
<tr>
<td>Optimistic (14%)</td>
<td>$171.89</td>
<td>$180.48</td>
<td>$189.51</td>
<td>$198.98</td>
<td>$208.93</td>
<td>$219.38</td>
<td>$230.35</td>
<td>$241.87</td>
<td>$253.96</td>
<td>$266.66</td>
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<tr>
<td>RSTMP Programme Budget Requirement</td>
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<td>$460.59</td>
<td>$460.59</td>
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<tr>
<td>Shortfall Required</td>
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<td>$(30.82)</td>
<td>$(247.09)</td>
<td>$(237.61)</td>
<td>$(227.66)</td>
<td>$(217.77)</td>
<td>$(206.64)</td>
<td>$(193.94)</td>
<td>$(187.3)</td>
<td>$(180.04)</td>
<td>$(173.34)</td>
</tr>
</tbody>
</table>

It is clear from Table 9-13 that the RSTMP project programme would require additional funding over the next 10 years for it to be successful.