CIG UGANDA

SERVICE PLAN ASSESSMENT REPORT Abridged Version

Bus Rapid Transit-KCCA/GKMA | June 2020

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Cover photos: CIG Uganda

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

AADT	Annual Average Daily Traffic
ADT	Average Daily Traffic
ALS	Axle Load Survey
ATC	Automated Traffic Count
BRT	Bus Rapid Transit
CIG	Cities and Infrastructure for Growth
DM	Do Minimum
DMRB	Design Manual for Roads and Bridges
DP	Do Project
DRC	Democratic Republic of Congo
EB	Eastbound
GDP	Gross Domestic Product
GEH	Geoff Havers error statistic
GKMA	Greater Kampala Metropolitan Area
GoU	Government of Uganda
JTC	Junction Turning Count
JTS	Journey Time Survey
KBE	Kampala Bombo Expressway
KBME	Kibuye-Busega - Mpigi Expressway
KCCA	Kampala City Council Authority
KFP	Kampala Flyover Project
KJE	Kampala Jinja Expressway
KNBP	Kampala Northern Bypass
KOB	Kampala Outer Belt
KSB	Kampala Southern Bypass
LOS	Level of Service
MCC	Manual Classified Count
MoWT	Ministry of Works and Transport
MoFPED	Ministry of Finance Planning and Economic Development
MUBS	Makerere University Business School
NB	Northbound
NDP	National Development Plan
NMT	Non-Motorised Traffic
NNER	Nakasero - Northern Bypass Express Route
NTMP	National Transport Master Plan
OD	Origin-Destination
PCU	Passenger Car Unit
RSI	Roadside Interview
SACCO	Savings and Credit Cooperative Society
SATURN	Simulation and Assignment of Traffic to Urban Road Networks
SB	Southbound
SPV	Special Purpose Vehicle

TMC	Tondeka Metro Company
UBOS	Uganda Bureau of Statistics
UC	User Class
UDC	Uganda Development Corporation
UIA	Uganda Investment Authority
UMA	Uganda Manufacturers Association
UNRA	Uganda National Roads Authority
VoT	Value of Time
vph	Vehicles Per Hour
WB	Westbound
WTP	Willingness to Pay

ACKNOWLEDGEMENTS

The report was prepared by CIG Consultant; Isaac Muyinza and peer reviewed by CIG team comprising of Benjamin Olobo, Infrastructure Advisor; Dick Komakech, Deputy Team Leader and Helena McLeod, Team Leader.

We would like to acknowledge the input of the team at the Ministry of Works and Transport and other sector players for their contribution and input into the report.

EXECUTIVE SUMMARY

Objective of the Assignment

The purposes of the assignment was to undertake a review of the proposed Bus Rapid Transit (BRT) proposals for Greater Kampala.

The proposed BRT project for Greater Kampala, proposed in 2010 was intended to alleviate the existing and forecast transport problems in Kampala. In particular the project was to support the then Kampala City Council's vision for the City as a; "secure, economically vibrant, well managed, sustainable and environmentally pleasant City that anyone would enjoy visiting and living in." The proposed BRT network was developed for the short term and long-term at the time. Unfortunately, no further work has been undertaken to develop the BRT concept further, to allow actual implementation, even though it is still considered alive.

In the last two years, the Tondeka Metro scheme has been developed. Tondeka Metro is a proposed mass transit bus system (MTBS) that aims to launch bus services in Greater Kampala. Its proposed scale is quite significant that it is considered a likely precursor of the future BRT system.

The Cities and Infrastructure for Growth (CIG) programme intended to review the service plan proposed for the BRT at prefeasibility stage, to test its applicability in the current environment. However, the seemingly imminent implementation of the Tondeka project, shifted the CIG focus. A decision to review the Tondeka project was then taken.

Current Transport Challenges

The growth of the day-time urban population in Kampala City, the low capacity of Kampala road infrastructure and the predominant low capacity public transport vehicles (14-seater minibuses and motorcycles) have collectively contributed to the significant congestion in the City.

Motorcycle transport dominates the vehicle trips in the City with a lion's share of approximately 55%. Mini buses have a share of trips of 15% on average. However, as expected the higher trip share by motorcycles does not translate into high passenger trips. Minibuses carry the lion's share of passengers of all vehicular trips (over 50%), motorcycles (20%) and the private car (about 10%).

The transport system is inefficient, in desperate need of mass transit solutions. A 14-seater capacity mini bus would require 5 trips in order to transport the same number of passengers as a 65-seater bus. With such a system, any added road capacity would be quickly filled up.

Further, due to a large number of vehicles and motor cycles on the roads, urban transport in the GKMA is also characterized with a large number of accidents some of which lead to fatalities. According to the 2018 Annual Crime and Traffic Report, there were 5,245 accidents on the roads of GKMA out of 12,805 nationwide. This accounts for more than 41 percent of all accidents registered on Ugandan roads during the year. Twenty-one percent of these were fatalities, which is quite significant.

The Proposed Tondeka Mass Transit Bus System (MTBS)

The proposed Tondeka Metro MTBS is a bus-based system for Greater Kampala Metropolitan Area. In brief, it is proposed to provide the capacity of a BRT-type bus system. However, it would not have the specific infrastructure of a BRT, such as segregated bus lanes and the elaborate bus interchanges.

Project Stakeholders and Ownership

Project Stakeholders

From available information, the following stakeholders were identified.

- Ashok Leyland / Tondeka Metro Company (TMC) - SPV;
- Ministry of Finance, Planning and Economic Development;
- Ugandan Development Company (UDC);
- Ministry of Works and Transport;
- Kampala Capital City Authority;

The project stakeholders and their roles are summarised in the figure below.

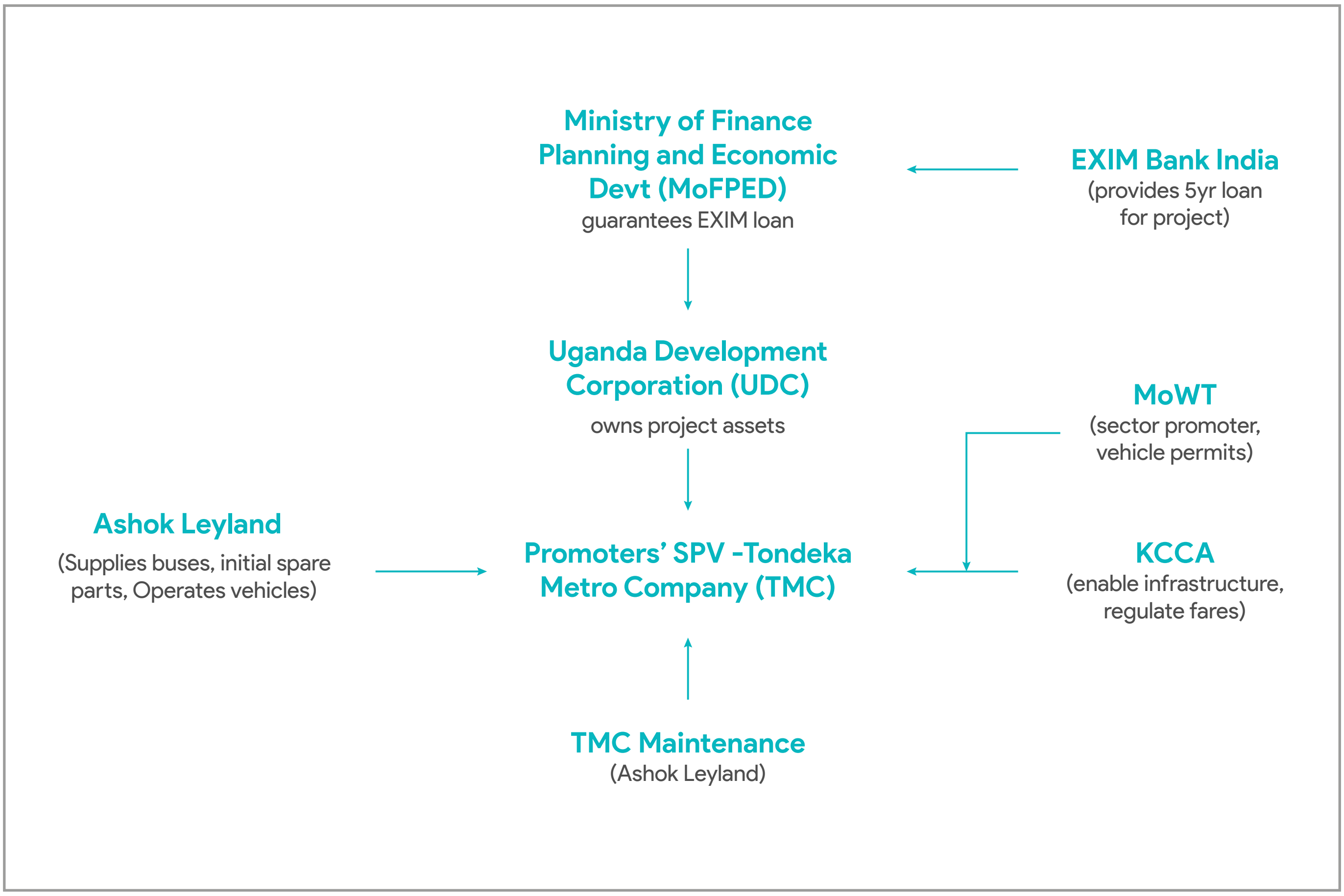


Figure 1: Summary of stakeholder roles

From the above figure and the understanding provided by Section 4.5 of the report in general, Tondeka Metro Company is the SPV and is separate from Ashok Leyland.

Project Ownership

The key bodies with regard to ownership of the project are UDC and Tondeka Metro company.

The UDC will be the executing body of this initiative, most probably through a special purpose vehicle (SPV). This is normal way for a Government agency to manage a project of this magnitude.

Tondeka Metro company will also be managed under their own SPV.

However, the ownership of the project i.e. shareholding, between UDC and the Tondeka SPV is not clear.

Proposed Technology

Ashok Leyland will supply the Jan Bus, a single step with entry and exit doors, front engine and fully-flat floor bus. According to internet literature, the JanBus is powered by a 225 Horse Power turbo charged diesel engine with 165 litres fuel tank.

It was reported that Ashok Leyland will deliver end to end transport solutions in covering vehicle supply, local managerial and technical skill development, service workshop development, intelligent tracking solution (ITS), and financial support.

Figure 2: The proposed Jan Bus

Regulatory Framework

The key regulatory framework under which the proposed Tondeka project has been established through the Consultant's research.

The loan to finance the commencement of the project, to buy assets and establish the necessary project infrastructure is guaranteed by the MoFPED, enabled by the Public Finance Management Act 2015 (PFMA 2015), Sections 39 ① and ②. These sections of the PFMA 2015 allow the Minister, with the approval of Parliament, guarantee the repayment of a loan raised within or outside Uganda, even for private entities.

This is conditioned on the purpose of the loan being in public interest, and the borrower being able to service the loan.

The nature of procurement i.e. the means by which Tondeka Metro Company (the promoters' SPV) is procured or allowed to run the operations by Government is established based on Sections 33 and 34 ② i.e. a contracting authority (in this case UDC) accepting an unsolicited proposal.

Proposed Fares and Routes

The project proposed that passengers will be charged UGX 1,200 for a one-way trip, UGX 3,500 for a daily pass, UGX 18,000 for a mega rider weekly pass and UGX 55,000 for a super mega monthly ride pass. These fixed charges are intended to incentivize bus use for low income population.

The routes to be served are shown in Figure 5 below.

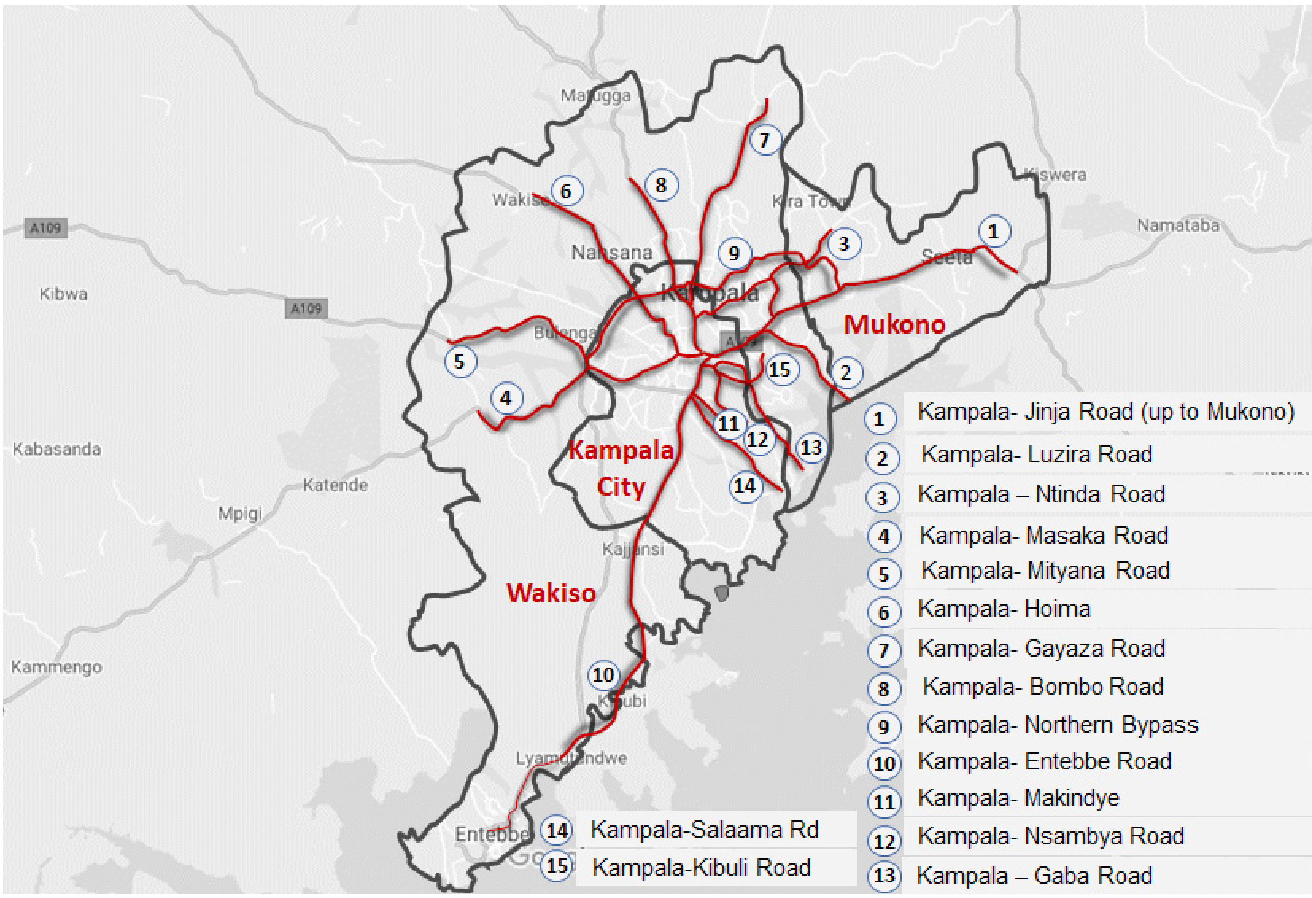


Figure 3: Routes to be served by Tondeka

Implementation Strategy

It was indicated that the project would be launched in September 2020. The plan is to implement the project in two phases according to available public information. The initial phase would include deploying 980 buses. As the population of the Kampala expands, it was envisaged that an additional 1,000 to 2,000 buses would be acquired as part of Phase II implementation.

The first 980 buses will be supplied directly from India by Ashok Leyland. It is proposed to obtain subsequent bus stock under the Kiira Motor scheme in Uganda. It is reported that Ashok Leyland is working with Kiira Motors to effect knowledge and technology transfer.

Assimilation of Matatu Personnel

It has been reported that the project will provide create employment of between 10,000 and 20,000 personnel. Each bus requires drivers and conductors for each operating shift. In addition to drivers and conductors, the project requires route managers, inspectors, supervisors, and maintenance staff. It is proposed that the project would assimilate matatu personnel into some of the created jobs.

Expected Project Outcomes

The project expects the following outcomes:

- Decongestion of urban areas and ensuring organized flow of traffic in and around Kampala.
- Journey time savings – the decongestion is expected to result in significant saving in journey time, according to available information.
- The project expects to evolve into a BRT system in fulfilment of the long-term aspirations of KCCA and MoWT.
- Convenience through cashless transactions – this mode of operation has been touted in the media as “a game changer for Kampala”.

Traffic Model Development and Traffic Forecasts

A traffic model used to assess the proposed Tondeka scheme was developed, calibrated and validated as discussed in Chapters 5, 6 and 7 of the report. The model calibration and validation was successful and the base model deemed fit to be used for future passenger demand forecasting.

The approach used for forecasting traffic and passenger demand is discussed in Chapter 8 of the report.

From the above exercises, model outputs were extracted and analysed to provide answers to key questions in line with the specific tasks of the assignment.

Outcomes of the Assignment and Consultant’s Opinion

The proposed Tondeka Mass Transit Bus System has been assessed in line with the specific duties of the assignment as set out in Sections 1.3 of the main report. A number of issues with regard to the proposed scheme – its set up, underpinning data, expected outcomes, etc have been highlighted as discussed in Chapter 9.

The Tondeka scheme is being readied for implementation. However, key questions on the highlighted inadequacies require clarification. On the whole, it is difficult to see the proposed project achieving significant success as it stands.

As a conclusion to the assignment, the Consultant has attempted to rank the issues with regard to criticality. This ranking is presented in Table 2 below. The following are the meanings of the colour coding:

- Red stands for critical issue – with a high potential impact on project outcome/success, and are identified for the attention of the relevant project approval committee. These issues generally require resolution as soon as possible.
- Amber stands for secondary issue – with a lower impact, but still with potential to affect project outcome and are identified for the attention of the relevant project approval committee. Resolution is generally less urgent but important.
- Green stands for an observation - not critical to project outcome but could improve efficiency and lessen delivery risk. They are identified for the attention of the project manager and the project team.

CLASSIFICATION OF ISSUES AND RECOMMENDATIONS			
Class	**Issue**	**Description of Issue**	**Recommendation**
C1	Existing and future passenger demand	The picture with regard to passenger demand is not clear. There seems to be an overestimation of demand and hence all downstream assessments such as bus fleet, revenue and project benefits could be in error. The Project's estimated 980 buses at commencement raises questions on the quality of the passenger demand estimate.	The passenger demand must be clarified.
C2	Transport modelling and analysis	The basis for expected decongestion benefits, mode shift and all other anticipated benefits should ideally be underpinned by rigorous analysis through modelling.	Detailed traffic modelling should be strongly considered to provide comfort on the project passenger estimates
C3	Regulatory framework	With regard to project initiation, the regulatory framework seems sufficient but with challenges. There are already reports that procurement of Tondeka as an operator was undertaken but not following competitive processes. The regulatory framework during the operation of the project is not clear. How is MoWT/KCCA going to ensure that the project meets key performance indicators given its scale? What are the considerations on revenues to the local governments in the GKMA?	The regulatory framework requires significant review in order to ensure success of the project.
C4	Contracting authority	The proposed ownership of the project assets by UDC seems well placed. However, the ability of UDC to manage a transportation contract is questionable. For a transport project of this nature and magnitude, the right contracting authority would be expected to be the MoWT or KCCA. A project organisation where MoWT/KCCA are legally involved, would support the project better and increase the likelihood of success.	The right contracting authority should be identified immediately to manage the project on behalf of Government.
C5	Project financing	The project is to be funded by a loan guaranteed by Government through the Ministry of Finance. The Government of Uganda is therefore liable for the repayment of the project loan.	It is imperative that the project case be well defined in the short to medium term (0 to 10 years), to ensure its success and ability to repay the Government guaranteed loan.
C6	Bus facilities	There is no mention of the provision of bus facilities such as bus lanes, stops, stations, etc. Also, the Consultant's estimate of passenger demand and hence bus fleet shows that, the Tondeka project requires a maximum of 652 buses at the start of its operations, about 673 in 2025 and 766 in 2035 (see Section 9.9). These estimates are also based on on-schedule running, which would be unlikely without dedicated bus lanes.	This is a key success factor and needs urgent attention.

CLASSIFICATION OF ISSUES AND RECOMMENDATIONS			
Class	**Issue**	**Description of Issue**	**Recommendation**
S1	Availability of a sound feasibility study	The Consultant has not had access to the feasibility study – it is expected that this was undertaken. A number of issues such as expected patronage, routes, proposed bus fleet, etc, raise questions.	A review of the feasibility study is required
S2	Project ownership and Promoters	The proposed project ownership is not clear. This is key information that would be required by the public in order to provide comfort and stave off resistance to the project. Also, who exactly are the Promoters is not clear. The proposed role of Ashok Leyland within the Tondeka SPV beyond the supply of the buses should be confirmed	Clarity on shareholding between the UDC and Tondeka SPV should be clarified. Also, clarity is required on the level of involvement of Ashok Leyland in the Tondeka SPV beyond the supply of buses.
S3	Implementation strategy	The project documents propose a first batch of 980 buses, to be launched in 2020. A further 1,000 – 2,000 buses are proposed as part of Stage II. No implementation timelines are given for stages II, the supply simply premised on "future demand growth in the GKMA." The proposed partnership between Ashok Leyland and the Government of Uganda to build capacity for bus manufacture through Kiira Motors is an incentive for the Government to buy into the guaranteeing of the project loan. However, with no commitment to when the additional buses would be required, it is hard to see how the proposed Ashok Leyland partnership would be progressed.	The implementation strategy requires clarity. It is important that decisions are made by Government on the basis of clear project plans.
S4	Project routes	The routes that have been proposed through the media are not exhaustive and cannot support the proposed 980 buses. The full network needs to be clarified. Further, any potential cap on the extent of the route network by Government would have implications on further expansion and profitability. This could also affect the requirement to extend the network to better consider GESI issues.	The project routes need to be clarified by the Project Team and KCCA/MoWT.

Table 2: Classification of issues and recommendations

1.0 INTRODUCTION

1.1 Background

Appointment of the Consultant

1.1.1 The Consultant was appointed by Ondrac International Development – SMC Ltd (representing Cardno International Development) to undertake a review of the proposed Bus Rapid Transit (BRT) proposals for Greater Kampala.

Proposed BRT Project Background

1.1.2 The proposed BRT project for Greater Kampala was proposed in 2010 as a "Long Term Integrated Bus Rapid Transit (BRT) System for Greater Kampala Metropolitan Area." A prefeasibility study for the project was undertaken by Integrated Transport Planning Ltd (ITP) of the United Kingdom (UK)[1].

1.1.3 The project's main objective was to alleviate the existing and forecast transport problems in Kampala. In particular the project was to support the then Kampala City Council's vision for the City as a; "secure, economically vibrant, well managed, sustainable and environmentally pleasant City that anyone would enjoy visiting and living in."

1.1.4 A potential BRT network for Greater Kampala was developed by ITP which could form part of a long-term strategy. However, pilot BRT routes were also identified, that could be developed in the short term in order to both demonstrate and test the application of BRT but also to offer early benefit to the local travelling public.

1.1.5 The ITP study was a prefeasibility study and as such did not develop the detail of implementation. The study established that the implementation of the BRT network in Greater Kampala was deliverable, and financially viable. It was intended that subsequent study stages would develop the pilot corridor through feasibility, detailed design and implementation. Draft Terms of Reference for the subsequent feasibility and detailed design studies were developed as part of the study.

1.1.6 Unfortunately, no further work has been undertaken to develop the BRT concept further, to allow actual implementation. The BRT project has remained alive as far as the Government of Uganda is concerned because of its obvious potential benefits to the Greater Kampala area.

1.2 The Assignment

1.2.1 On the above basis, the Cities and Infrastructure for Growth (CIG) programme intended to review the service plan proposed for the BRT at prefeasibility stage, to test its applicability in the current environment. It was also proposed to review the proposed BRT project with regard to facilities that cater for women, children and the marginalised, among other aspects. Finally, the assignment was to develop a revised service plan for the BRT that was applicable to the existing transport environment in Greater Kampala.

1.2.2 This assignment was part of a series of other interventions, under the CIG programme, supported by the UK's Department for International Development.

1.3 Specific Duties of the Assignment

1.3.1 The following specific duties were identified by the Consultant's contract for this assignment.

i. Become and remain familiar with the BRT concept proposal both strategically and technically.
ii. Review the service plan earlier prepared and update to include GESI considerations. Incorporate BRT Service Plan review and update according to international best practice in BRT service planning.
iii. Review the previous BRT Service Plan and familiarise with its architecture and conceptual development. Identify areas of concern and prepare a matrix to show areas that need to be updated.
iv. In conjunction with the GESI specialist, identify the GESI gaps with the previous Service Plan and draw a strategy for incorporating GESI in the Service Plan review and updates, along with climate change considerations to provide for robust and resilient infrastructure solutions.

[1] Prefeasibility Study for the Development of a Long-Term Bus Rapid Transit System for Greater Kampala Metropolitan Area, May 2010 (Integrated Transport Planning Ltd in Association with IBIS Transport Consultants)

v. Capture as much of the existing commuter taxis demand currently using the corridor as possible and analyse to draw trends and conclusions on the demand and facility locations; estimate the political and economic impact of job displacement of existing transport suppliers and evaluate pragmatic trade-offs that may be considered in this light in order to mitigate political resistance.
vi. Assess and identify scenarios that minimises land acquisition, reduces the capital costs needed for transfer stations, minimises travel time for passengers, and attracts the most passengers.
vii. Undertake analysis and modelling to identify optimal time savings for the most time for all the transit passengers in the corridor, both those on the BRT system and those that cannot use the BRT system.
viii. Undertake assessment and identify the optimal BRT service plan that carries the most passengers per bus and analyse the associated bus/fleet capacity to attain an optimal outcome. For example, studies to inform route selection and design taking into consideration the transport requirements and business and safety needs of women and girls, and the marginalised; analysis to ensure that selection is not only determined on the basis of the highest economic return routes, but also on the basis of the importance of ensuring that BRT serves the needs of women, girls and the marginalised.
ix. Identify through assessment and analysis the sections that have the highest rate of return of any capital investment in the corridor.
x. Be aware of external stakeholder needs and demands, filtering possible responses through regular technical team meetings, in order to ensure corporate consistency in any such engagement.
xi. Any other duties relevant to this job description as may be considered by the expert or Infrastructure Lead.

1.4 Changes to the Assignment

1.4.1 The above requirements notwithstanding, the delay in the undertaking of further studies to prepare the proposed BRT project for implementation has been a serious concern to the general public. There has been no serious commitment from Government to the project, evidenced by the lack of allocated funds for project development.

1.4.2 Transport challenges have increased significantly since the time of the BRT prefeasibility study. Of particular concern is the significant congestion on Kampala roads, currently lasting from morning to evening, and the high cost of public transport.

1.4.3 Since the demise in the 1980's of the Uganda Transport Corporation (UTC) that provided formal bus transport in Kampala, paratransit (its technically term) characterised by minibus and motorcycle use for public transport, has dominated Kampala and the nation at large. This is a current trend in many developing nations. But it comes a cost of high fares, increased congestion and high accident rates.

1.4.4 On the positive side, the lack of a formal government backed transport system has also opened up opportunities for private investment in public transport. In recent years, a few firms have attempted to invest in bus transport. These include Pioneer Bus, Awakula Ennume Bus, UTODA, to mention a few. Of these, Pioneer Bus, made a significant impact on inception due to the relatively sizeable investment that had been made of about 100 buses. However, this was short lived, as much of its fleet was grounded due to issues with its financing model. Awakula Ennume and other ventures have been too small in scale to make any significant impression.

1.4.5 In the last two years, another venture has been in development stage. The proposed Tondeka Metro has been developed. Tondeka Metro is a proposed mass transit bus system (MTBS) that aims to launch bus services in Greater Kampala. It is a proposed private led intervention, backed by a Government guarantee. Its proposed scale is quite significant that it is considered a likely precursor of the future BRT system.

1.4.6 During the consideration of this assignment, the proposed Tondeka scheme was unearthed. Given its proposed scale of implementation and the significant impact it is likely to have on transport and traffic operation in the Greater Kampala in the short and long term, it was deemed prudent to shift the proposed review of the BRT project under this assignment to a review of the Tondeka scheme. The specific duties of the assignment as listed in Section 1.3 remained unchanged.

1.5 Report Structure

1.5.1 Chapter two describes the current situation, particularly in Greater Kampala, with respect to the transport challenges i.e. congestion and accident.

1.5.2 Chapter three describes the proposed BRT – the concept, BRT pilot route and long-term solutions, the regulatory framework among others. It also identifies the actions that were identified as being necessary in order to support the BRT development.

1.5.3 Chapter four presents the proposed Tondeka project. What it is, objectives, proposed technology, the project ownership, implementation strategies and others.

1.5.4 Chapters five, six and seven describe the development of the traffic model used to assess the Tondeka project – model development approach, model calibration and validation.

1.5.5 Chapter eight discusses the traffic forecasting approach. It discusses the historical socio-economic trends and future forecasts, and establishes the traffic growth rates. The chapter discusses the passenger demand and establishes the bus fleet forecast.

1.5.6 Chapter nine discusses the traffic modelling results especially in line with the specific duties of the assignment. Chapter ten presents the conclusions of the assignment.

2.0 THE CURRENT SITUATION

2.1 The City of Kampala and the GKMA

2.1.1 Kampala City is Uganda's national and commercial capital. The City is also the centre Kampala District which occupies an area of 189 sq. Km in south central Uganda.

2.1.2 Kampala is a fast-growing city, listed as the thirteenth fastest growing city by City Mayors Statistics[2], with annual population growth rate of 4%. It is predominantly spread over seven prominent hills close to Lake Victoria. The name Kampala originates from the many impalas that were present during the 19th century on the present-day Old Kampala hill.

2.1.3 Overtime, with natural growth and rural urban migration, Kampala City grew from one hill (Old Kampala) to "the city of seven hills" and currently even more. The seven hills include Mulago, Kololo, Kibuli, Rubaga, Old Kampala, Namirembe and Makerere. Although, it has outgrown the tile of seven hills, the original seven remain important focal points with important landmarks of religious, cultural, and colonial significance.

Source: internet images

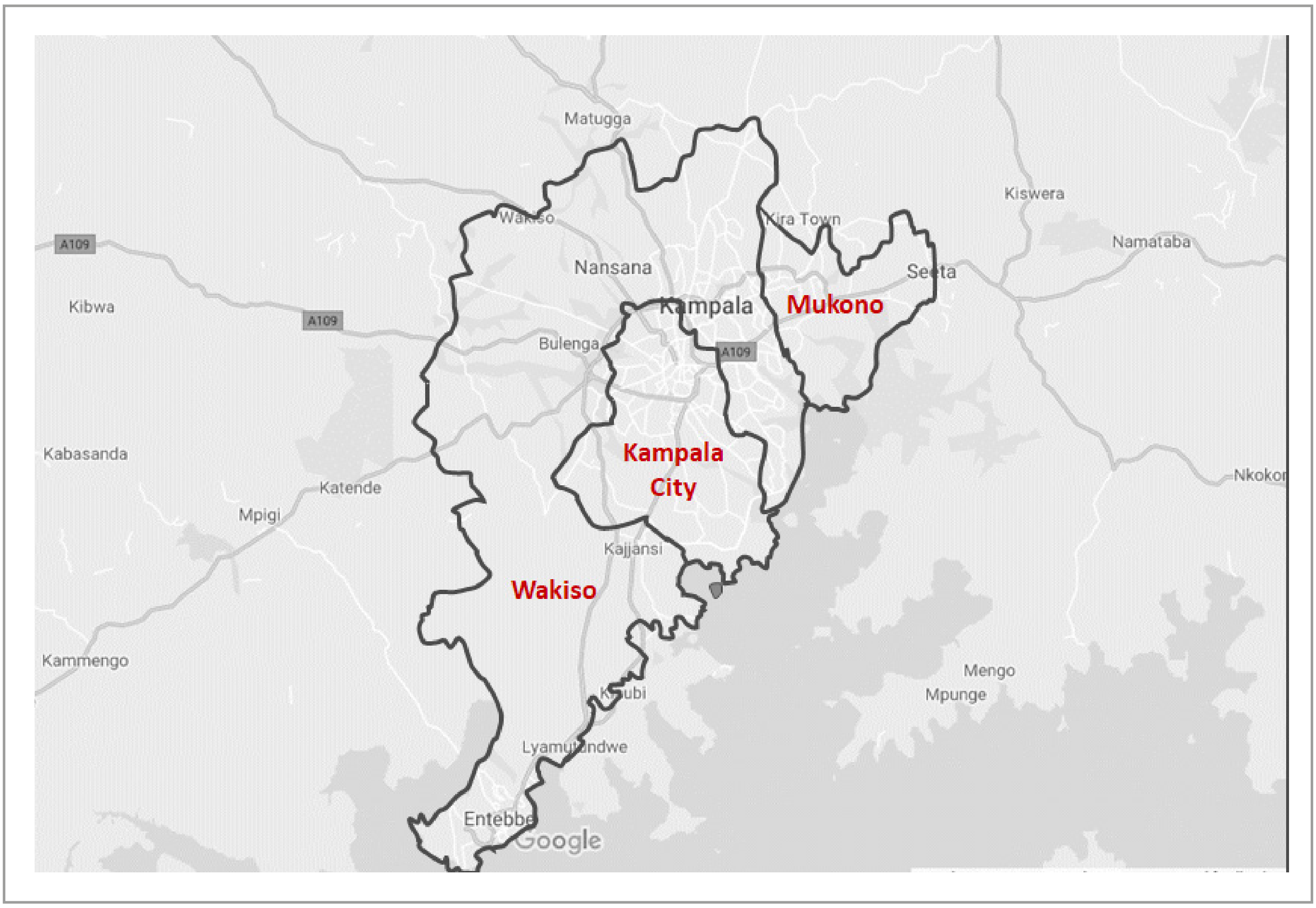
Figure 2-1: Kampala City centre

2.1.4 Kampala is a city with bustling activity both day and night. In 2016, it was ranked the best East African city to live in[3], ahead of Nairobi, Kigali and Dar es Salaam.

2.1.5 Kampala, the capital city of Uganda, is also a city that has now grown beyond its administrative boundaries. Originally planned for a population of 150,000 people, the city now spans an area that includes the surrounding districts of Mukono and Wakiso. Kampala City together with the areas covered in Wakiso and Mukono Districts, forms the Greater Kampala Metropolitan area (GKMA), Figure 2-2 below.

[1] http://www.citymayors.com/statistics/urban_growth1.html

[2] 18th Annual Quality of Living Survey of the World's top 230 cities by Mercer (New York)



Source: Google maps, Consultant's analysis

Figure 2-2: Greater Kampala Metropolitan Area extents

2.2 Population and Economy

2.2.1 Kampala City is estimated to have a population of 1,650,800 people (2019) based on data from the Uganda Bureau of Statistics (UBOS). The GKMA region has a population of about four million people, approximately 10% of the national population.

2.2.2 Of the 4 million inhabitants of GKMA, about two million live and work in Kampala City and a further two million commutes into the City to work during the day and then return to the outskirts in the evening. This commuting pattern has strong implications for transportation. Public transport must be coordinated across administrative boundaries to get people to and from their residences to their places of work.

2.2.3 In 2015 the GKMA, generated an estimated nominal GDP of $11.6 billion (constant US dollars of 2011) . This was more than half of Uganda's GDP for that year, underscoring the importance of the GKMA. Kampala City alone contributed an estimated $6.3 billion, implying a share of the national GDP of 28.6%. Wakiso and Mukono contributed $4.3 billion (19.6%) and $1 billion (4.5%) respectively.

2.2.4 Therefore, the GKMA area which comprises of 10% of the national population, contributes an estimated 52.7% of the national economy. It is the engine of the Uganda's development and is expected to continue to be so in the foreseeable short- and long-term future.

2.3 Transport Challenges

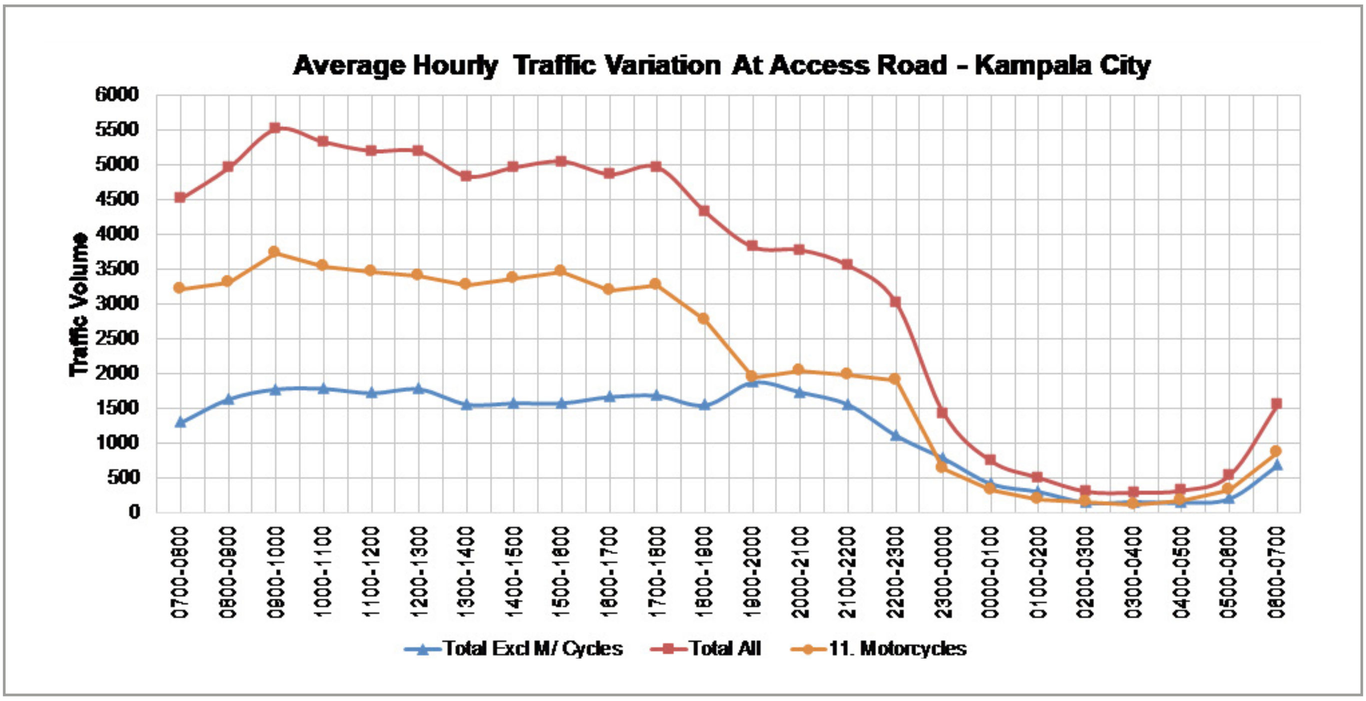
Traffic Congestion

2.3.1 The growth of the day-time urban population in Kampala City, the low capacity of Kampala road infrastructure and the predominant low capacity public transport vehicles (14-seater minibuses and motorcycles) have collectively contributed to the significant congestion in the City.

[4] "Estimation and Mapping of Sub-National GDP in Uganda Using NPP-VIIRS Imagery", Wang, Xuantong; Rafa, Mickey; Moyer, Jonathan D.; Li, Jing; Scheer, Jennifer; Sutton, Paul (16 January 2019).

2.3.2 Traffic congestion frequently lasts from morning to evening on most days of the week. Figure 2-3 below demonstrates the prevalence of traffic congestion on Access Road (near Kitgum Junction). From Figure 2-3, it is clear that the total traffic volume observed in the morning stays almost constant throughout the day (7am to 7pm) at an average of 5,000 vehicles for both directions. This is a significant volume, the inclusion of motorcycles notwithstanding.

2.3.3 Traffic volumes start to reduce significantly from 7pm onwards.



Source: Consultant's analysis

Figure 2 3: Route of proposed project

2.3.4 Motorcycle transport dominates the vehicle trips in the City with a lion's share of approximately 55%. Mini buses have a share of trips of 15% on average. As shown in Figure 2-3, for Access Road, motorcycle trips are significantly higher than the sum of all other trips. However, as expected the higher trip share by motorcycles does not translate into high passenger trips. Minibuses carry the lion's share of passengers of all vehicular trips (over 50%), motorcycles (20%) and the private car (about 10%).

2.3.5 The use of low capacity vehicles for public transport means uncoordinated pickups and drop-offs. This uncoordinated nature of mini buses especially, affects both traffic flow and potential revenue. The number of times a taxi has to stop and pick up or drop off passengers is high and this affects all other road users.

2.3.6 Still the use of low capacity vehicles for public transport system is considered inefficient for a fast-growing City, due to the congestion that it creates and economic burden to the City and the nation as a whole. A coordinated mass transit bus system would have a significant positive impact. For instance, 14-seater capacity mini bus would require 5 trips in order to transport the same number of passengers as a 65-seater bus.

Source: Internet images

Figure 2-4: Typical evening traffic jam at Clock Tower, Entebbe Road

2.3.7 Given the prevailing situation, it is needless to say that if nothing is done to improve the public transport system, any added road capacity would be quickly filled up.

Accidents Rates

2.3.8 Due to a large number of vehicles and motor cycles on the roads, urban transport in the GKMA is also characterized with a large number of accidents some of which lead to fatalities. According to the 2018 Annual Crime and Traffic Report, there were 5,245 accidents on the roads of GKMA out of 12,805 nationwide. This accounts for more than 41 percent of all accidents registered on Ugandan roads during the year.

2.3.9 The report shows that majority of GKMA accidents were minor (1,939 accidents). However, fatalities were substantial—at least 665 accidents in GKMA involved fatalities, which made up 21 percent of all fatal accidents in the country.

2.3.10 Improvements in the delivery of urban transport services can greatly improve safety and ultimately reduce the number of fatal accidents.

3.0 THE PROPOSED BUS RAPID TRANSIT (BRT)

3.1 Introduction

3.1.1 Bus Rapid Transit (BRT) is a high-quality bus-based transit system that delivers fast, comfortable, and cost-effective urban mobility through the provision of segregated right of way infrastructure, rapid and frequent operations, and excellence in marketing and customer service. It enhances personal mobility both through reducing travel time, and hence also its cost of provision, and by improving the travel experience.

3.1.2 Bus Rapid Transit is an appropriate technology for the efficient and effective movement of passenger volumes in excess of some 6,000 passengers per peak hour and direction, and can still handle five times that flow with appropriate specification and design. Such levels of demand were already appearing on the main arterial corridors in Kampala at the time of the BRT design, and rapid growth has now increased demand perhaps beyond what was forecast for the 10-year period 2010 - 2020.

3.2 BRT Conceptual Definition

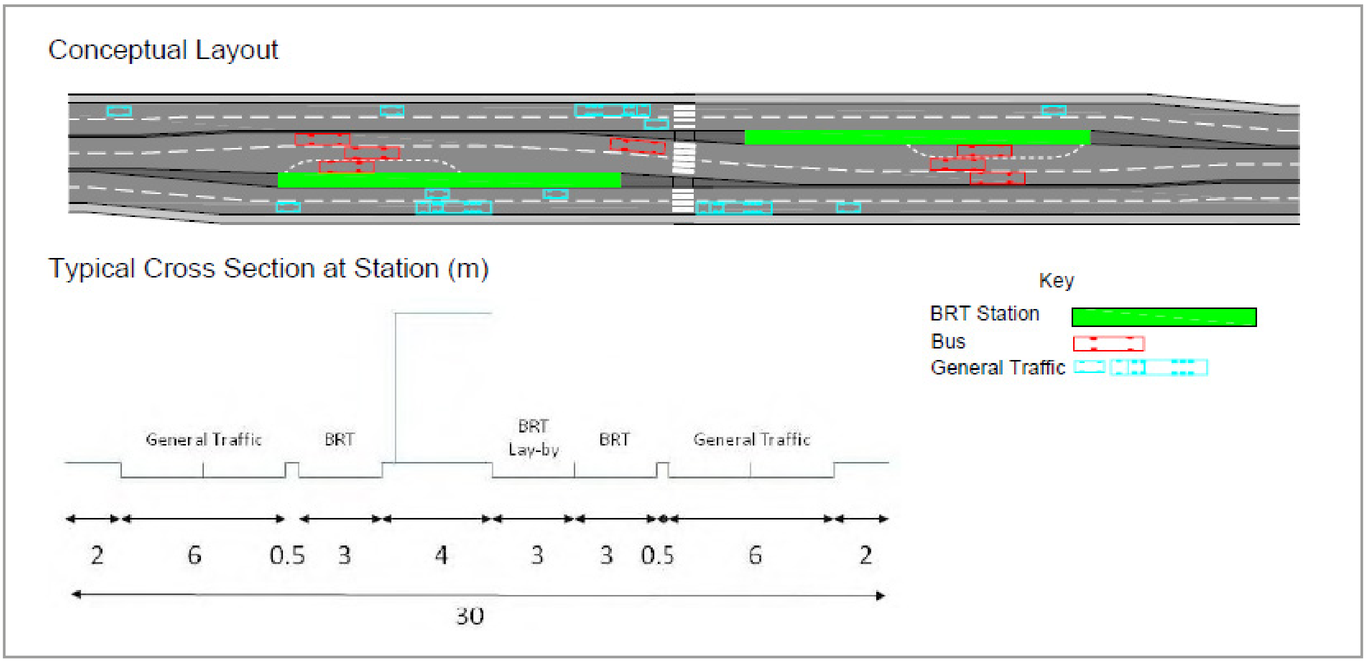
3.2.1 The proposed concept design for the pilot route corridor is a median operation system with staggered bilateral stations. This would typically be implemented within a 30m right of way cross section, although the minimum cross section requirement between stations is 23m. Typically, between stations the configuration of the highway would be as follows:

- Median operation BRT lanes in each direction either side of the carriageway centreline, typically 3.5m in width.
- 2.5m kerbed segregation separating the BRT lanes from general traffic lanes. This area can either provide pedestrian refuge points, or can be landscaped.
- Two general traffic lanes in each direction, typically 7.0m in width for each pair of lanes.
- Pedestrian footways on both sides of the carriageway, not less than 2.0m in width.
- Pedestrians to cross at grade.

3.2.2 Where localised narrowing is necessary, BRT and general traffic lanes can be reduced to 3.0m and kerbed segregation can be reduced to 0.5m.

3.2.3 Through BRT stations, BRT and general traffic lanes can narrow to 3.0m width, and kerbed segregation between BRT and general traffic lanes can narrow to 0.5m in width. A bus layby is to be provided at each station stop. Station platforms are to be 4.0m in width, with at grade pedestrian crossing facilities to the platforms provided along pedestrian desire lines.

3.2.4 The conceptual layout for the proposed BRT station arrangement is shown below:



Source: BRT Prefeasibility Report

Figure 3-1: BRT conceptual layout

3.3 City Centre Penetration and Accessibility

3.3.1 A plan for the BRT routes and stations in the City Centre was designed based on an analysis of the existing situation and on different possible BRT routeing concepts. The long-term plan consists of building three BRT routes in the city centre; on Kampala Road, Entebbe Road and Ben Kiwanuka Street. A total of five stations are foreseen in the City Centre. Not all the three BRT routes and five stations will be built at the same time. The routes and stations could be phased in three phases, as follows:

- BRT corridor on Kampala Road (as the first part of the trunk corridor).
- BRT corridor on Entebbe Road (as the second part of the trunk corridor).
- BRT corridor on Ben Kiwanuka Street

3.3.2 Since not all stations will be used at full capacity from the moment of opening, stations can be built partly (e.g. with only three out of five intended bus bays) and extended in the later phases.

3.3.3 Essential to the City Centre Plan is that a BRT system in the City Centre will only be successful when sufficient mobility management measures will be implemented. In this way the number of motorised vehicles (cars, trucks and matatus) can be reduced, walking facilities can be improved and the overall urban quality and economic situation in the City Centre can be improved.

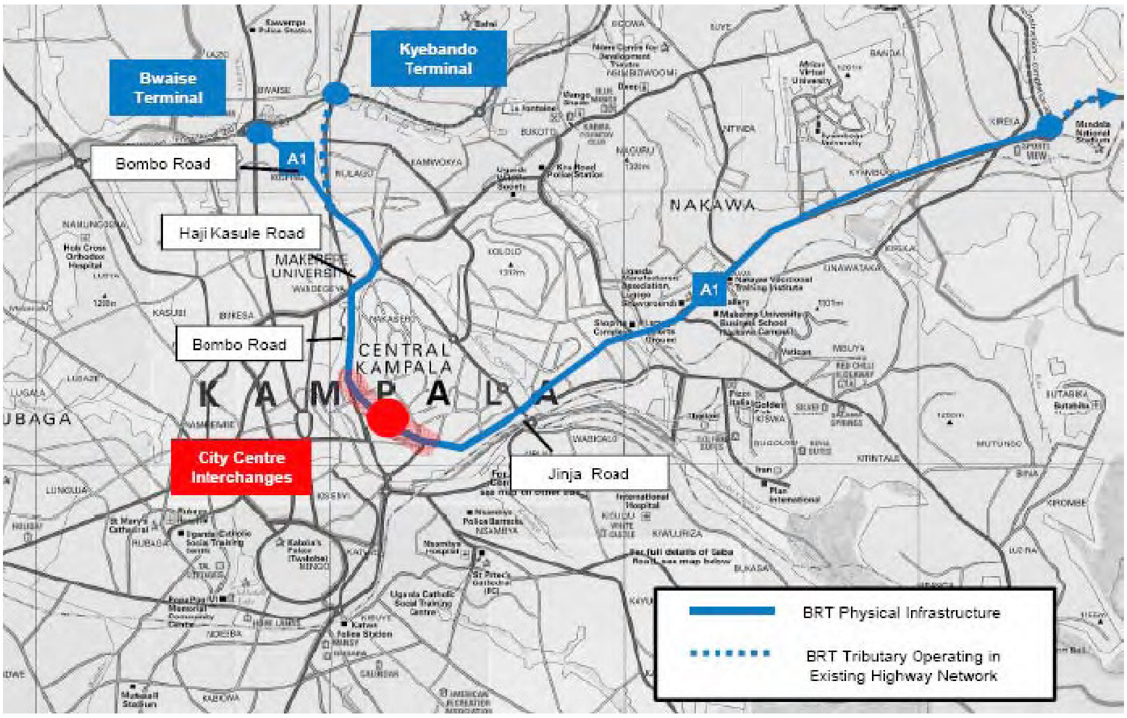
3.4 The BRT Pilot Route

3.4.1 Based on the demand forecast, the route that received the highest score in the appraisal was Jinja Road, followed by Bombo Road, and these two routes in combination were recommended for development of the pilot corridor.

3.4.2 It was proposed that physical infrastructure for the pilot corridor is constructed from Bwaise in the north, running along Bombo Road, Yusufu Lule Road North, Haji Kasule Road and back on to Bombo Road, and then continuing through the city centre along Kampala Road before heading east along Jinja Road as far as Kireka.

3.4.3 With the externalised system and running lane and station configuration proposed, BRT services are not limited by the extent of the physical infrastructure. This is why for the pilot corridor it is proposed that tributary services continue as far as Mukono to the east, and along Gayaza Road to the north. Therefore, along these sections, BRT buses would continue out of the segregated BRT lane and mix with general traffic.

3.4.4 An illustration of the proposed pilot corridor is provided below:



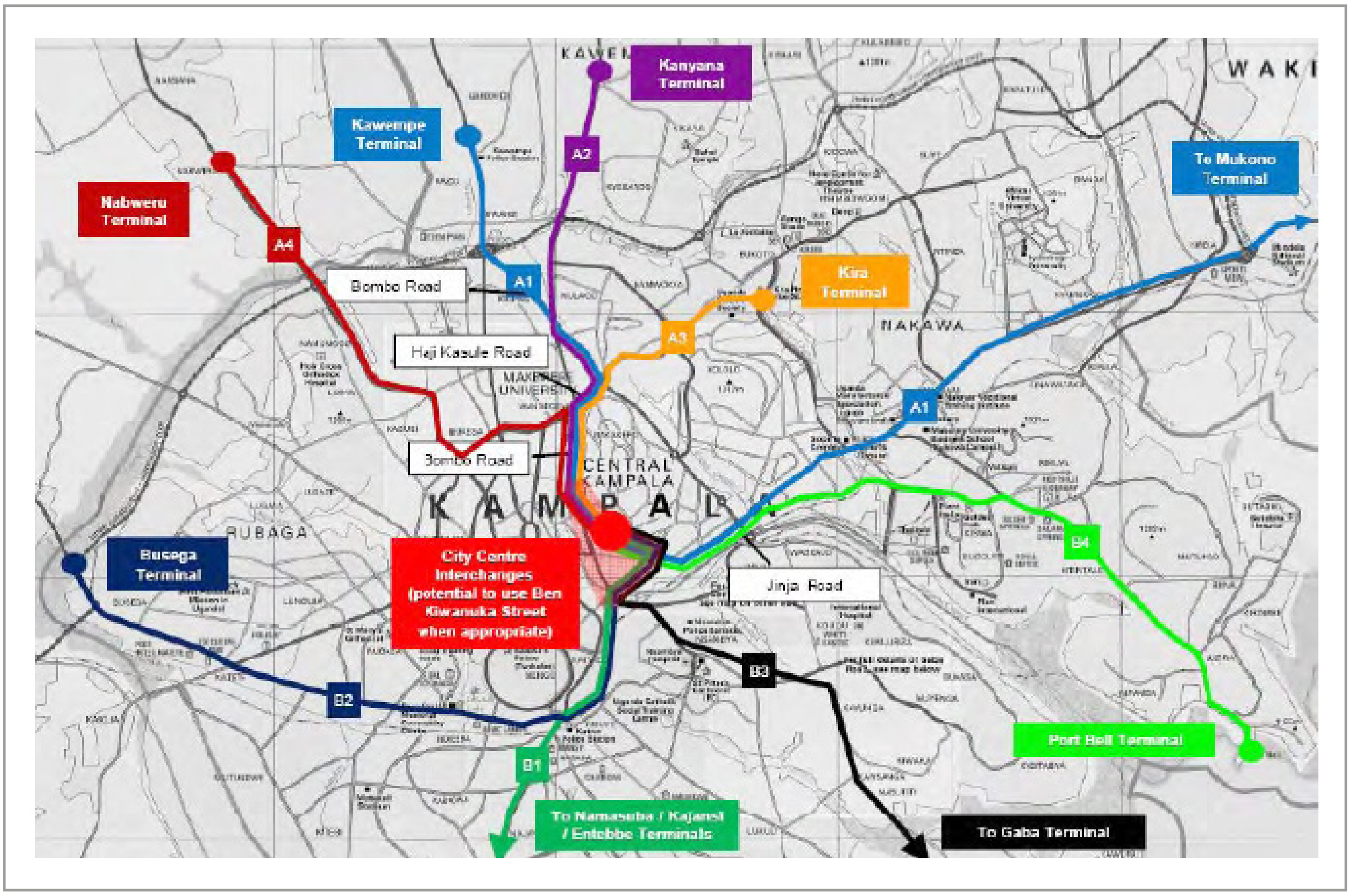
Source: BRT Prefeasibility Report

Figure 3-2: Proposed BRT pilot corridor

3.5 Long Term BRT Vision

3.5.1 A long-term BRT vision is presented which illustrates how routes could be phased to reach an overall city-wide BRT network, as illustrated in Figure 3-3. The corridors making up the network include:

- Jinja Road (Mukono) to City Centre;
- Bombo Road (Kawempe) to City Centre;
- Gayaza Road (Gayaza) to City Centre;
- Hoima Road (Wakiso) to City Centre;
- Masaka Road (Busega Roundabout) to City Centre;
- Entebbe Road (Entebbe) to City Centre;
- Port Bell Road (Luzira Port Bell) to City Centre;
- Gaba Road (Gaba) to City Centre;



Source: BRT Prefeasibility Report

Figure 3-3: Proposed BRT network

3.6 Financial and Economic Analysis of the Pilot Route

3.6.1 It was intended that each selected route (including the proposed pilot corridor) would be subject to full feasibility study to ensure economic viability. These feasibility studies have not taken place to date, placing the development of the BRT on hold for close to 10 years.

3.6.2 Perhaps as always, the most influential factor is financing for the implementation of the project. The prefeasibility study estimated a total capital cost for implementation of the pilot route of USD118.4 million at a cost per kilometre of USD8.5 million. It is a significant sum for a single route.

3.6.3 Nonetheless, the revenues of the system are shown to be well in excess of operating costs and the balance is expected to be in excess of $10 million per annum. It can therefore be concluded that the BRT pilot route is financially feasible.

3.6.4 Economically, the BRT pilot route was estimated to yield a Benefit to Cost Ratio (BCR) of 1.41, a Net Present Value (NPV) of USD87.5 million and an Internal Rate of Return of 18%. Economically, the BRT pilot was deemed feasible.

3.7 Regulatory and Institutional Framework

3.7.1 The following regulatory and institutional framework was identified for the proposed BRT.

3.7.2 Restricted operator access to the BRT system will require the introduction of 'controlled competition' for the right to operate the specified services. This system of economic regulation should be extended to the core public transport network in GKMA, and could be empowered by the current governing legislation, the Traffic and Road Safety Act, 1999. The institutional capacity needed for the planning and specification of these services would have to be developed though, as the Transport Licensing Board is inactive in the urban sector.

3.7.3 International best practice has demonstrated the importance of integrating transport and land-use (physical) planning so as to ensure efficient outcomes in both domains. The established Kampala Capital City Authority would provide an appropriate overarching institution to ensure such co-ordination. A Metropolitan Area Transport Authority (MATA) would then work alongside the proposed Metropolitan Physical Planning Authority (MPPA), but with the remit established in the National Transport Master Plan.

3.7.4 For this to occur, though, would require several amendments to the Kampala City Authority Bill currently before the House. Firstly, the creation of MATA would need to be included in the Memorandum to the Bill. An additional Part to the Bill would then be required for the establishment and functions of MATA, analogous to that for MPPA. Finally, the Third and Fifth Schedules to the Bill would need to be amended to match the functions and directorates of the Kampala Capital City Authority (KCCA) to the objectives set for MATA.

3.7.5 Within this institutional structure, MATA would be responsible to KCCA for the planning and economic regulation of public transport services and (in conjunction with MPPA) for the planning of the infrastructure over which these operated. However, responsibility for funding and maintaining such infrastructure development would rest with the responsible Ministry of Works and Transport (MoWT).

3.8 Supporting Actions Necessary for Sustainable BRT Development

3.8.1 This pre-feasibility study has identified a range of supporting actions necessary for the effectiveness and sustainability of BRT development and operation. These include:

- Demarcation of 30m Rights-of-Way on the main arterial corridors, with land acquisition as necessary within the curtilage.
- Development of a road hierarchy, particularly through the trading centres, to restrict kerbside access. Formalisation of lay-byes and turning lanes would also be needed.
- Highway and traffic management development compatible with future BRT expansion, so as not to preclude later insertion on the grounds of sunk investment.
- Car demand management and parking control, both so as to support transit-oriented development and to release road-space for BRT development.
- Non-motorised transport network, both to support BRT as feeder and distributor and also to provide alternative safe routeings to the city centre.
- Public transport network planning, to support the introduction of controlled competition onto an efficient network.
- Public service vehicle (PSV) regulations, to bring this up to date (and harmonise within COMESA) whilst supporting efficient BRT development.
- Stakeholder engagement and communications strategy, both to minimise risks to BRT implementation and to sell the concept to the general and travelling public.

3.9 Consultant's Comment

3.9.1 This prefeasibility study examined major transport routes within Greater Kampala and through multi criteria appraisal made a recommendation for the further development and implementation of BRT routes in the short (pilot routes) and long term.

3.9.2 The study established that the BRT system was economically and financially viable. However, for implementation to take place, starting with the pilot scheme, detailed feasibility studies were needed. These have not taken place to date and all the prefeasibility forecasts and considerations in this regard would be out of date currently.

3.9.3 The study also identified the regulatory and institutional framework that was required in accordance with international best practice, for the BRT project to succeed. This framework is largely yet to be put in place. A number of amendments have taken place to the KCCA regulatory framework and initiatives have been made to further regulate and improve public transport. But these have been few and are not focused on the BRT project development. BRT-specific changes that were recommended by the study are yet to commence.

3.9.4 Finally, the study also identified actions that were required to commence in order to prepare for BRT development. For example, the demarcation of a 30m right of way and ensuring highway and traffic management development that is compatible with BRT development. These actions have largely not taken place in the last 10 years. It renders the development of BRT even more challenging financially due to the ever-escalating land prices and physical developments (transport and non-transport related) along the corridors that are incompatible with BRT.

3.9.5 In conclusion, the implementation of BRT is still possible. However, the challenges with regard to political will, financing and operation keep mounting due to ever advancing development in the City that is not BRT compatible.

4.0 THE PROPOSED TONDEKA METRO MASS TRANSIT BUS SYSTEM (MTBS)

4.1 Introduction

4.1.1 This provides and understanding of the proposed Tondeka MTBS.

4.1.2 The information presented in this section is largely based on newspaper reports and internet literature. Most reports seem to be similar and a number of statements in those reports are attributed to the Tondeka Metro Board Chairman and other members of the Tondeka team. As such, the information was deemed fairly reliable to provide an understanding of the proposed Tondeka solution.

4.2 What is Tondeka Metro MTBS?

4.2.1 The proposed Tondeka Metro MTBS is a bus-based system for Greater Kampala Metropolitan Area. In brief, it is proposed to provide the capacity of a BRT-type bus system. However, it would not have the specific infrastructure of the BRT, such as segregated bus lanes and the high capacity bus stops and stations.

4.2.2

4.2.3 It is expected but not fully considered at this stage that it would be accorded specific bus stops by KCCA and in the future perhaps, even be given priority at most signalised junctions.

4.3 Need and Goal for Tondeka Metro

4.3.1 There is an undeniable urgent need to improve public transport in order to curb congestion in the city of Kampala and Greater Kampala at large, and make public transport more comfortable, convenient and affordable. To this end, the Tondeka Mass Transit Bus System was proposed.

4.3.2 It is considered that this initiative may evolve into the planned BRT system, if the BRT enabling environment and financing can be put in place.

4.3.3 The main goal of Tondeka Metro is to transform the urban transport for GKMA with a fully integrated transport solution. It has been stated in various forums that the intervention will several challenges such as;

- Journey time savings;
- Reduced congestion in the city;
- Increase the safety on roads.
- Social inclusion by catering for less privileged people in the communities such as persons with disabilities, etc; and
- Reduced transport fares.

4.3.4 Other wider economic and security goals include:

- Creation of employment. Various reports have mentioned figures between 10,000 and 20,000 as the jobs expected to be created; and
- Make public transport more affordable to the over 2,000,000 daily commuters in the GKMA.

4.4 The Tondeka Solution

The Tondeka Bus

It was reported that Ashok Leyland will deliver end to end transport solutions in covering vehicle supply, local managerial and technical skill development, service workshop development, intelligent tracking solution (ITS), and financial support.

Technology

4.4.1 Ashok Leyland will supply the Jan Bus, a single step with entry and exit doors, front engine and fully-flat floor bus. According to internet literature, the JanBus is powered by a 225 Horse Power turbo charged diesel engine with 165 litres fuel tank.

4.4.2 The Jan Bus has an intelligent transportation system (ITS) that provides: passenger information system; internal/external surveillance camera system; real time vehicle tracking with GPS- at no additional costs to the Government.

Source: Internet images

Figure 4-1: Proposed Jan Bus for Tondeka Metro

4.4.3 Below are the Jan Bus salient features;

- 12m Front Engine Semi Low Floor Bus (650mm Floor Height)
- Fully Flat Floor throughout the Passenger Saloon
- Modular Body - Accommodates different Applications / Door Combinations
- CRS (Common Rail System) Engine
- AMT (Automated Manual Transmission)
- Full Air suspension (Kneeling arrangement available)
- Tubeless Radial Tyres
- Confirms to latest UBS (Urban Bus Specification)
- Multiplex Wiring
- Latest ITS (Intelligent Transportation System) features enabled

Intelligent Transport System

4.4.4 The Jan Bus comes with a full Intelligent Transport System (ITS) system providing; cashless ticketing, GPS tracking and reporting system, fleet maintenance management for scheduled repairs, fuel consumption monitoring, preventive maintenance spares tracking, passenger information system, internal and external surveillance cameras.

4.5 Stakeholders

4.5.1 The following stakeholders have been identified to play a role in the proposed project. The Consultant has used newspaper reports and internet literature to identify potential roles for each stakeholder.

Ministry of Finance, Planning and Economic Development

- Negotiate credit facility and secures loan agreement with the Exim Bank of India
- Guarantees the loan from Exim Bank of India on behalf of Government.
- Will have to ensure that repayment of loan meets the agreed schedule.

Ugandan Development Company [UDC]

- Will own and oversee the bus fleet on behalf of Government.

Ministry of Works and Transport

- Sector promoter of the project.
- A key stakeholder but no specific roles were communicated.

Kampala Capital City Authority

- A sector promoter.
- May provide bus infrastructure such as bus lanes three years after commencement, but this promise is not confirmed.

Ashok Leyland / Tondeka Metro Company (TMC) - SPV

- Operate & manage the buses.
- Operate the revenue collection via the cashless system.

4.6 Project Ownership

4.6.1 From publicly available information and some consultation, the following is the Consultant's understanding of the project ownership.

4.6.2 The UDC will be the executing body of this initiative, most probably through a special purpose vehicle (SPV). This is normal way for a Government agency to manage a project of this magnitude.

4.6.3 The Tondeka Metro company will also be managed under their own SPV. However, the ownership of the project i.e. shareholding, between UDC and the Tondeka SPV is not clear.

4.6.4 The project proposal seems to have been given to Government by Tondeka Metro. Because, there is no likelihood of appointing competing bus operators, it's likely that UDC will enter into a gross-cost contract with the Tondeka SPV as the operator. Tondeka SPV will then be paid a specified sum to provide a specified service for a specified period. All revenue collected is for the appointing authority, the UDC, with Tondeka only paid in accordance with operator costs, overheads and profit. A gross-contract differs from a Route Contract in which the authority issues a contract for the operation of one specified route or a specified group of routes.

4.6.5 Tondeka Metro, will plan the transport system, operate the infrastructure (bus stops, interchanges, terminals, depots, etc) and implement activities. The company will also provide all related services for operation of the bus fleet including maintenance. Table 4-1 summarises the Consultant's understanding of the project ownership.

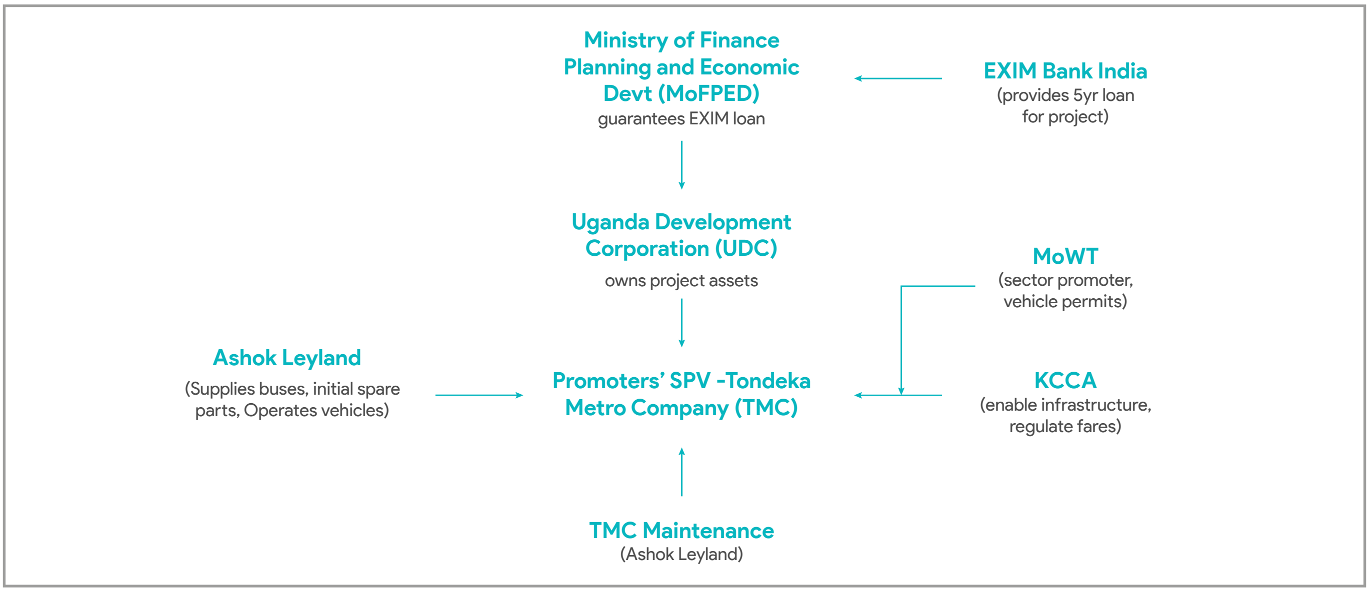
SUMMARY OF TONDEKA PROJECT OWNERSHIP

	Shareholder	%ge	Comments
1	Uganda Development Cooperation (UDC)	Unknown	UDC is the representative of the Ministry of Finance Planning and Economic Development/ Government for the investment loan in this project. It shall create a SPV for this project (UDC-SPV) The UDC-SPV shall be owners of all assets covering the bus fleet, initial spares, tools, ICT system & infrastructure (depots and workshops).
2	Promoters/ Investment SPV	Unknown	Detailed traffic modelling should be strongly considered to provide comfort on the project passenger estimates

Table 4-1: Summary of project ownership

4.7 Operating Structure

4.7.1 From the above discussion, the project operating structure is understood as shown in Figure 4-2 below.



Source: Consultant's analysis

Figure 4-2: Project operating structure

4.7.2 The project proposes to use a line of credit provided by EXIM Bank of India, guaranteed by the Ministry of Finance, Planning and Economic Development of Uganda. This is likely to be through the National Export Insurance Account (NEIA) programme, as had been proposed in Kenya.

4.7.3 The assets acquired through the 5-year loan from EXIM Bank of India will be registered under UDC (through a special purpose vehicle) until the loan is repaid. It is planned that in three years, the project would have repaid the loan. TMC would then launch on the Ugandan Stock Exchange.

4.8 Regulatory Framework

4.8.1 The key regulatory framework under which the proposed Tondeka project has been established through the Consultant's research.

4.8.2 The loan to finance the commencement of the project, to buy assets and establish the necessary project infrastructure is guaranteed by the MoFPED, enabled by the Public Finance Management Act 2015 (PFMA 2015), Sections 39 ① and ②. These sections of the PFMA 2015 allow the Minister, with the approval of Parliament, guarantee the repayment of a loan raised within or outside Uganda, even for private entities.

4.8.3 This is conditioned on the purpose of the loan being in public interest, and the borrower being able to service the loan.

4.8.4 The nature of procurement i.e. the means by which Tondeka Metro Company (the promoters' SPV) is procured or allowed to run the operations by Government is established based on Sections 33 and 34 ② i.e. a contracting authority (in this case UDC) accepting an unsolicited proposal.

4.9 Proposed Fares and Routes

4.9.1 The Tondeka project is designed to cover the 4 zones all major routes in the GKMA. It will also cover all key roads within Kampala. The Promoters estimate the daily number of passengers to be 1.47 million daily .

4.9.2 Passengers will be charged UGX 1,200 for a one-way trip, UGX 3,500 for a daily pass, UGX 18,000 for a weekly travel, and UGX 55,000 for a monthly travel card . These fixed charges will serve to incentivize bus use for low income population —who make up the majority of public transport users in GKMA.

4.10 Service Routes

4.10.1 From information gathered in various reports, the Consultant has determined the proposed extend of the Tondeka bus operation. Table 4-2 and Figure 4-3 present the routes proposed by the Tondeka project to be served.

[5] www.newvision.co.ug (Sh600b greater Kampala public bus transport project set to start, 2nd February 2020)
[6] www.pmldaily.co.ug (Cashless Tondeka Metro buses to improve mobility in Kampala, expected to hit roads in 9 months time, 11 December 2019)

ROUTES TO BE SERVED BY TONDEKA		
Part of GKMA	**Route No.**	**Routes**
Eastern Routes	1	Kampala- Jinja Road (up to Mukono)
	2	Kampala- Luzira Road (Up to Kirombe)
	3	Kampala – Ntinda Road (Up to Namugongo)
Western Routes	4	Kampala- Masaka Road (Up to Nsangi)
	5	Kampala- Mityana Road (Up to Buloba)
	6	Kampala- Hoima (Up to Wakiso)
Northern Routes	7	Kampala- Gayaza Road (Up to Gayaza)
	8	Kampala- Bombo Road (Up to Kawanda)
	9	Kampala- Northern Bypass Road
Southern Routes	10	Kampala- Entebbe Road
	11	Kampala- Makindye (Up Makindye ku Gombola)
	12	Kampala- Nsambya Road (Up to Lukuli)
	13	Kampala – Gaba Road (Up to Gaba)
	14	Kampala-Salaama Road (Up to Munyonyo)
	15	Kampala-Kibuli Road (Up to Namuwongo)

Table 4-2: Routes to be served by Tondeka

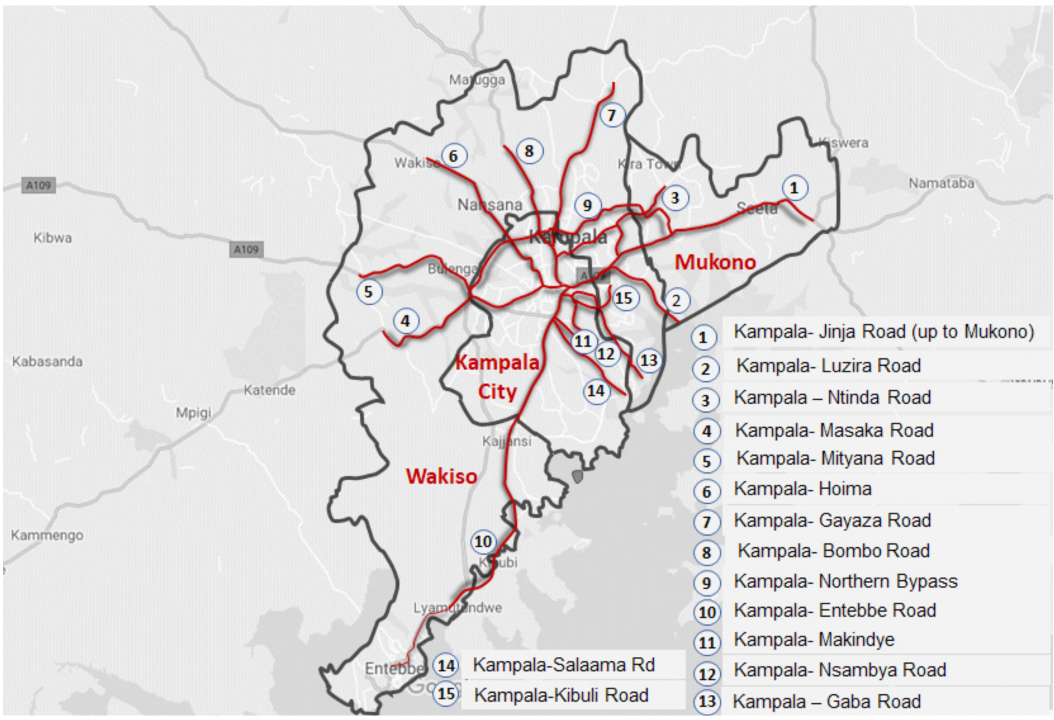


Figure 4-3: Routes to be served by Tondeka

4.11 Project Implementation Strategy

4.11.1 The Promoters of the project in a stakeholder meeting held in early 2020, indicated that the project would be launched in September 2020.

4.11.2 The plan is to implement the project in two phases. The initial phase will include deploying 980 buses. As the population of the Kampala expands, it is envisaged that an additional 1,000 to 2,000 buses are procured according to available information. It has been reported also that the first phase fleet would be delivered as follows; 400 buses at the start and then about 200 buses every month until the figure of 980 is attained. However, the scheduling of the second phase les clear.

4.11.3 The number of buses required initially is substantial. It has been argued that the number is justified due to nature of operation - a pick and drop rather than buses waiting to be filled with passengers before moving.

4.11.4 The first 980 buses will be supplied directly from India by Ashok Leyland. It is proposed to obtain subsequent bus stock under the Kiira Motor scheme in Uganda. It is reported that Ashok Leyland is working with Kiira Motors to effect knowledge and technology transfer.

4.12 Assimilating Matatu Personnel

4.12.1 It has been reported that the project will provide create employment of between 10,000 and 20,000 personnel. Each bus requires drivers and conductors for each operating shift. In addition to drivers and conductors, the project requires route managers, inspectors, supervisors, and maintenance staff. It is proposed that the project would assimilate matatu personnel into some of the created jobs.

4.12.2 The project has proposed to prioritise the training and assimilation of matatu drivers into the project. The immediate need will be to train and acquire bus driver's licences.

4.12.3 The project also intends to encourage matatu owners (small and large) to invest in the project and become shareholders. However, at what stage this will be done is not clear.

4.13 Expected Project Outcomes

4.13.1 Like most developing countries around the world, Uganda will have to forge forward with a more organized mode of mass public transport. This will not only bring sanity on the roads but will also ensure a safer and well-regulated transport solution is available to its city dwellers.

4.13.2 The project expects the following outcomes:

- Decongestion of urban areas and ensuring organized flow of traffic in and around Kampala.
- Journey time savings – the decongestion is expected to result in significant saving in journey time, according to available information.
- The project expects to evolve into a BRT system in fulfilment of the long term aspirations of KCCA and MoWT.
- Convenience through cashless transactions – this mode of operation has been touted in the media as "a game changer for Kampala".

4.14 Consultant's Opinion and Conclusions

4.14.1 The Consultant has discussed the proposed Tondeka project in this chapter, drawing from information publicly available. However, as expected, for a project of the size indicated by the project documents, there are more questions than answers. These are summarised below.

Extent of Feasibility Study and Traffic Analysis

i. Availability of a sound feasibility study. It is expected that a feasibility study would have been undertaken for

the project but the Consultant has not had access to this. However, with respect to available information on a number of issues such as expected patronage, routes, proposed bus fleet, etc, the extent and thoroughness of the study raises questions.

ii. Existing and future passenger demand: the picture with regard to passenger demand is not clear. There seems to be an overestimation of demand.

iii. Transport modelling and analysis: again this relates to the analysis that would be included in the feasibility study. Much has been reported about the expected decongestion of the city, journey time savings, shift from car travel to buses, etc. However, it is recognised that the Tondeka buses will not have segregated bus lanes. It was reported that KCCA may provide the infrastructure needed in three years' time. The key question therefore is, what is the basis of the expected decongestion benefits?

The Proposed Bus

iv. The proposed Jan Bus: the proposed size (90 passenger capacity) and features of the bus to be used seems adequate. Ashok Leyland is an internationally renowned supplier of such vehicles and it is also expected that it would be able to supply the proposed first batch of 980 buses.

Project Ownership, Financing and Operations

v. Project ownership: the proposed project ownership is not clear. Information available states that after repayment of the loan, the project company (the promoters' SPV) will be launched on the stock exchange. The key question is then, what is the proposed shareholding between the UDC and the project company?

vi. The exact promoters are unknown. It is always imperative for a project that would be backed by Government that a due diligence on the promoters is undertaken. From available information, the make-up of the project promoters SPV is not clear. There are a number of questions in this respect even with information held in the public domain – who exactly are the promoters, what is the role of Ashok Leyland, how much local content, etc. These require answers.

vii. Contracting authority: the only form of contract that is feasible between the UDC and the Tondeka Metro company is a gross cost contract. UDC would be the contracting authority. The ability of the UDC to manage a contract of this type may be questionable. Firstly, the project idea seems to squarely belong to the Promoters – the project proposal to UDC was an unsolicited one. Secondly, for a transport project of this nature and magnitude, the right contracting authority would be expected to be the Ministry of Works and Transport or KCCA (working hand in hand with the GKMA local authorities). A project organisation where MoWT/KCCA are legally involved, would set key performance indicators and would support the project in promptly considering and approving rights of way for buses and other facilities. As it is, the project would seem to be a private transport business and would receive less support from the right sector Government agencies.

viii. The Ashok Leyland: the relationship between Ashok Leyland and the project promoters is not clear. Available information indicate that Ashok Leyland will operate the proposed bus service in addition to supplying the first batch of buses (980 buses). However, there are questions to this. Ashok Leyland's name would significantly add credibility to the Promoters team. Evidence of their involvement beyond the supply of buses would be welcome.

ix. Financing: the project is to be funded by a loan guaranteed by Government through the Ministry of Finance. The Government of Uganda is therefore liable for the repayment of the project loan. It is therefore imperative that the project case be well defined in the short to medium term (0 to 10 years), to ensure its success and ability to repay the Government guaranteed loan.

Regulatory Framework

x. Regulatory framework: the regulatory framework required is of two main parts: for project initiation and securing funding, and for project operation.

   a) With regard to project initiation, the regulatory framework seems sufficient but would expect challenges. The law allows Government to contract an operator such as Tondeka, for an unsolicited project idea that is public interest. The law also allows Government to secure funding for such a project as proposed. However, there are already reports that procurement of Tondeka as an operator was undertaken but did not follow a competitive process.

   b) Further, the regulatory framework during the operation of the project is less clear. The status of the project from MoWT and KCCA's view beyond the public support declarations that is available in the media, is not clear. How is MoWT/KCCA going to ensure that the project meets key performance indicators given its scale? What are the considerations on revenues to the local governments in the GKMA? Available information indicates that local authorities would expect some level of windfall. This is not clear and the likely risk will be opposition to the project by the local councils through the existing matatu operations.

Proposed Passenger Fares and Routes

xi. Proposed passenger fares: the proposed passenger fares seem very fair and attractive. The fare structure is expected to be the main reason for the shift from matatus to buses. It is however likely that matatu operations would respond by reducing their fares. Given the projects lack of segregated bus lanes, this may pose a risk to project success.

xii. Project routes: the routes proposed by the Project are not exhaustive and would not support the proposed fleet of 980 buses. The information compiled by the Consultant has been gathered from various sources. It is important for the Tondeka project and KCCA/MoWT to clarify on the exact routes.

Implementation Strategy and Assimilation of Matatu Personnel

xiii. Implementation strategy: the project documents proposed a first batch of 980 buses, to be launched in

2020. A further 1,000 to 2,000 buses are proposed as part of Stage II. No implementation timelines are given for stages II, further supply of buses is premised on future growth in demand – which itself is not clear. The proposed partnership between Ashok Leyland and the Government of Uganda to build capacity for bus manufacture through Kiira Motors is an incentive for the Government to buy into the guaranteeing of the project loan. However, with no commitment to when the additional buses would be required, it is hard to see how the proposed Ashok Leyland partnership would be progressed.

xiv. Assimilation of matatu personnel: the project estimates that it would create 10,000 to 20,000 jobs according to available information. This claim requires justification.

Project Outcomes

xv. Decongestion of the City: This claim is not substantiated and is not plausible. From a technical perspective, a significant level of decongestion cannot be achieved unless the project can lead to mode shift (especially from car to bus). This is most possible if there is segregation of the bus operations to make them faster and reliable and hence more attractive to car users.

xvi. Cashless system: the project is committed to providing low fares and a cashless system. This is plausible and is expected to be of great convenience to the passengers.

xvii. Precursor to BRT: the project may well be a precursor to the introduction of BRT running. However, this depends on commitment to the project by the Government. The project is likely to be structured as a private-sector led initiative. BRT infrastructure would realistically only be implemented by Government - because of its extent and cost. Conversion of the private-sector initiative to a Government BRT initiative, would likely have legal and cost challenges. This draws back to required clarity in project ownership.

4.15 Need for CIG Intervention

4.15.1 The review of the project information that have been availed to the Consultant's raises a number of observations and questions. However, even without these questions, the objective of the CIG intervention is to establish an independent opinion on the likely impacts of the proposed Tondeka project to the growth of the GKMA, and how the project caters for women, children and the marginalised.

4.15.2 The regulatory and operational aspects aside, the likely impacts are not clear. It is clear that without the right regulatory and operational environment, the project's success would be limited and would have no significant impact.

4.15.3 The efforts of this report are focused on understanding the likely project impact to the City and GKMA in its proposed structure.

5.0 TRAFFIC MODEL DEVELOPMENT

5.1 Introduction

5.1.1 This section discusses the development of the traffic model. It also summarises the traffic data collection that enabled the building of the model.

5.2 Summary of Traffic Data Collection Process

Existing Usable Traffic Data

5.2.1 The assignment did not include a budget for the collection of primary survey data. As such, the modelling and analysis has relied on secondary data. An extensive data collection process was undertaken as part of assignment. The following types of traffic data pertinent to the development of the model was collected:

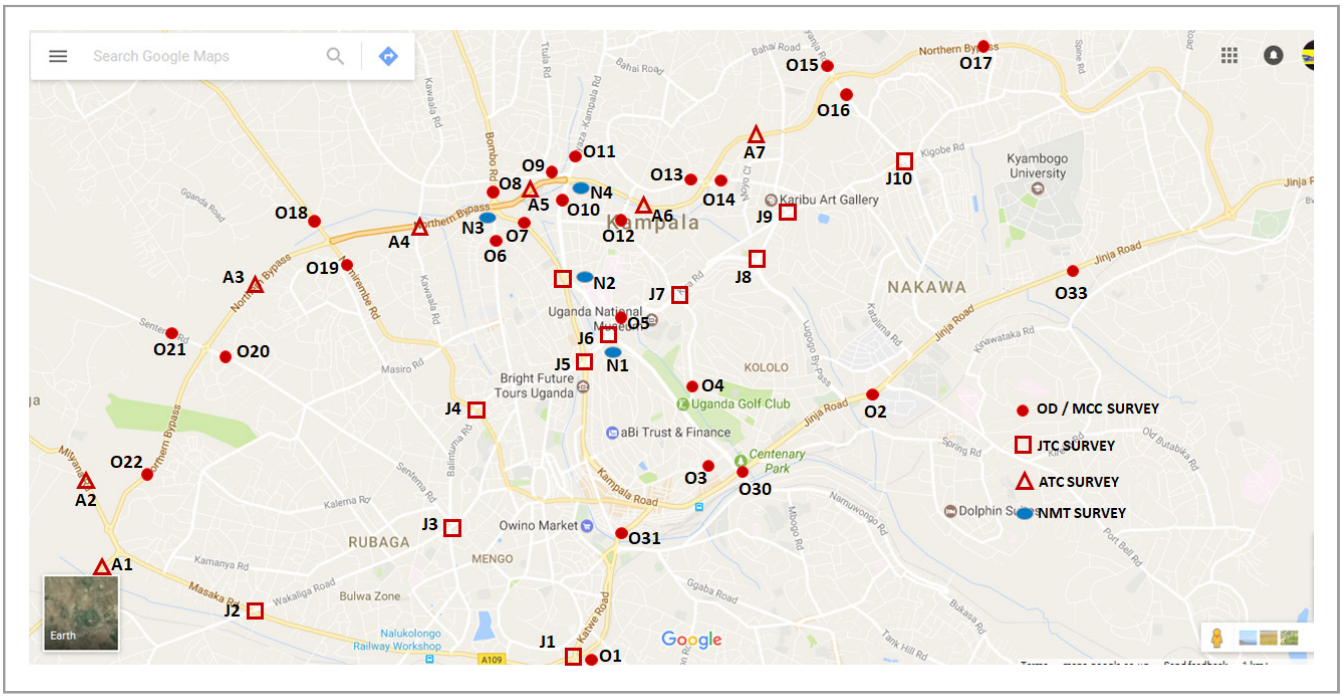
- Origin - Destination (OD) surveys;
- Manual classified counts (MCC);
- Automated traffic counts (ATC) where available;
- Junction turning counts (JTC).

5.2.2 Extensive and reliable non-motorised traffic data that is highly pertinent to the analysis could not be obtained. Currently, a significant number of people come to Kampala on foot. This group could potentially switch mode to bus given the right fare and service. As such, non-motorised traffic data is important and could a direction to take for further refinement of the model.

5.2.3 The assignment has made use of traffic data collected as part of the Nakasero – Northern Bypass Expressway Route study. Some limited data has also been collected from the ongoing studies from UNRA and the MoWT. Figure 5-1 below shows the locations of the survey points where the data was collected.

5.2.4 As shown from the location map, the data set lacked adequate coverage within the Central Business District (CBD). Nonetheless, origin-destination and count data on all key routes into the City is captured at the peripherals of the CBD. This would be adequate to establish the passenger demand into the CBD – no route starts and ends within the CBD, although a significant number of passengers would be expected to hop on and off a bus service within the CBD.

5.2.5 The lack of CBD data means that potential congestion within the CBD that impacts on the bus services cannot be captured adequately. The direction that was taken was therefore to assess the impact of the Tondeka project on the proposed service routes outside the CBD.



Source: Google Maps, Steward analysis

Figure 5-1: Location of survey points

5.3 Characteristics of Matatu Services and Passenger Demand

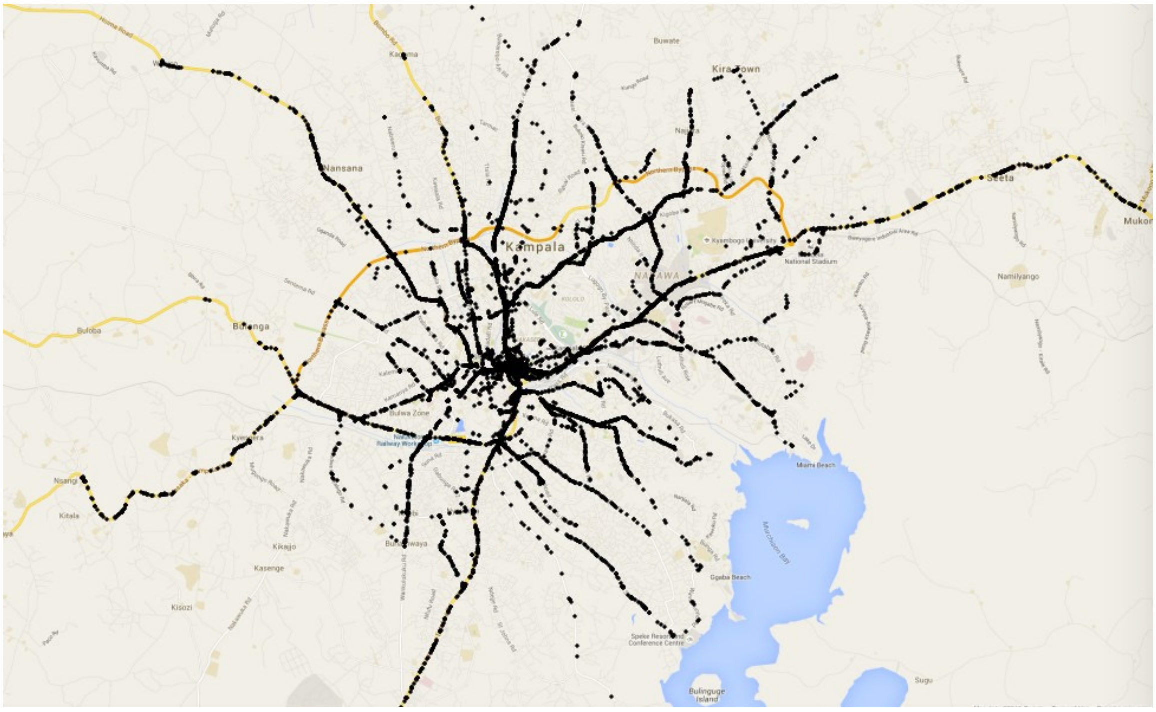
ITDP Passenger Data

5.3.1 The assignment also evaluated data collected by the Institute for Transportation and Development Policy (ITDP). Since early 2013, ITDP has been assisting MoWT with the planning and design of a high-quality public transport system in Kampala in particular the proposed BRT. Key to developing effective transport solutions in the city is an accurate understanding of existing transport services. The key output for ITDP was to help MoWT and KCCA create the Kampala Mobility Map.

5.3.2 To create the Mobility Map, ITDP undertook a series of passenger surveys in March 2015, including:

- **Frequency-occupancy (FO) survey:** An FO survey records how frequently each bus or taxi route runs and the approximate occupancy of each vehicle;
- **Boarding-alighting (BA) survey:** The BA survey is an on-board count of how many passengers get on and off of a taxi or bus at each stop along the route;
- **Transfer surveys:** A transfer survey is helpful in order to get a better sense of full passenger trips, including trip origin and trip destination, beyond a single route.

5.3.3 Figure 5-2 shows the main output of their work – the locations of boarding and alighting matatus. From Figure 5-2, it is clear why the matatus ("taxis") pose quite a serious challenge to road operations.



Source: ITDP – Kampala Mobility Survey Report

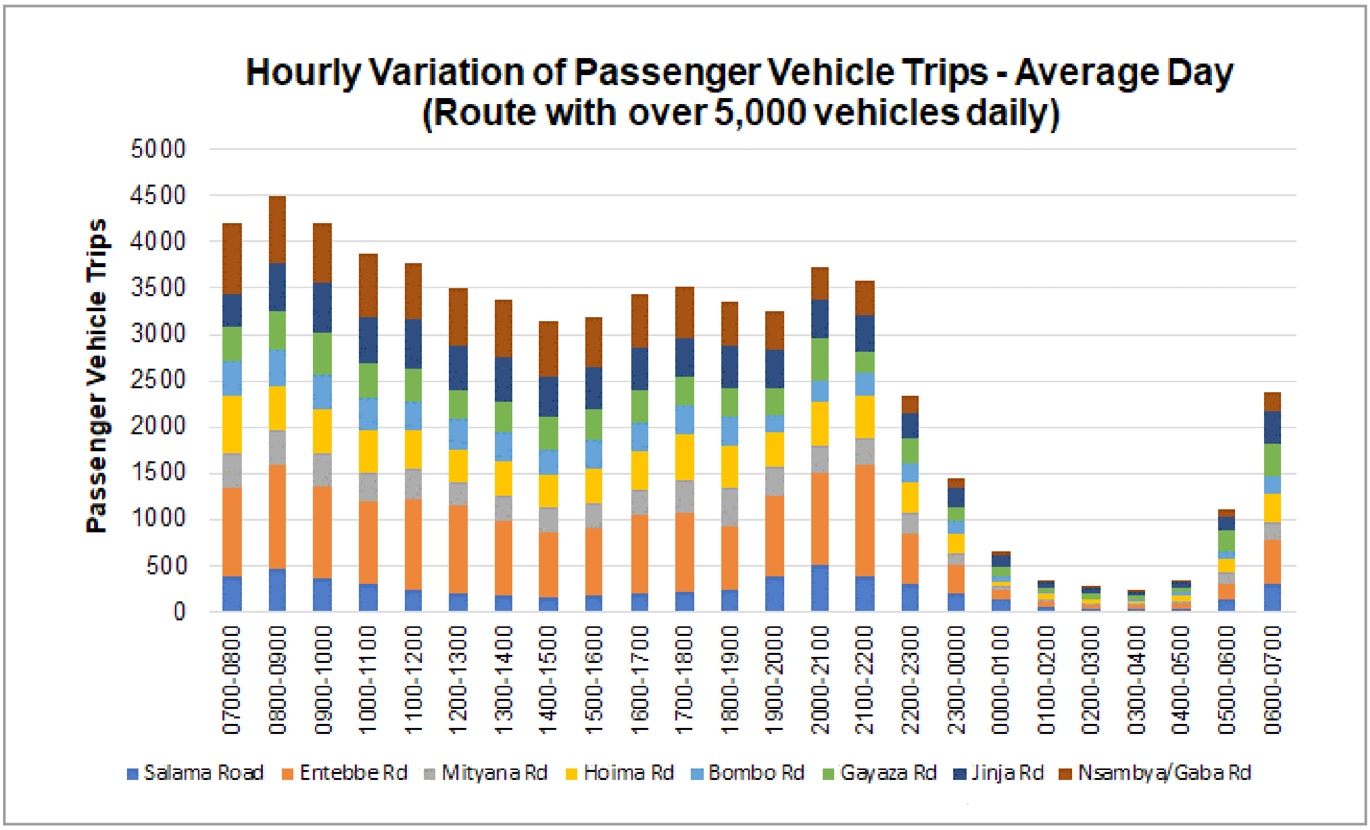
Figure 5-2: Boarding and alighting points for matatus on key routes into the City

Variation of Passenger Vehicle Volumes on Key Routes

5.3.4 From reliable traffic count data collected, an estimate of the hourly passenger vehicle trip volumes on all key routes that would likely be served by the proposed Tondeka project was made. The figures were generated for an average week day by hour for 24 hours of the day. Daily totals were also obtained.

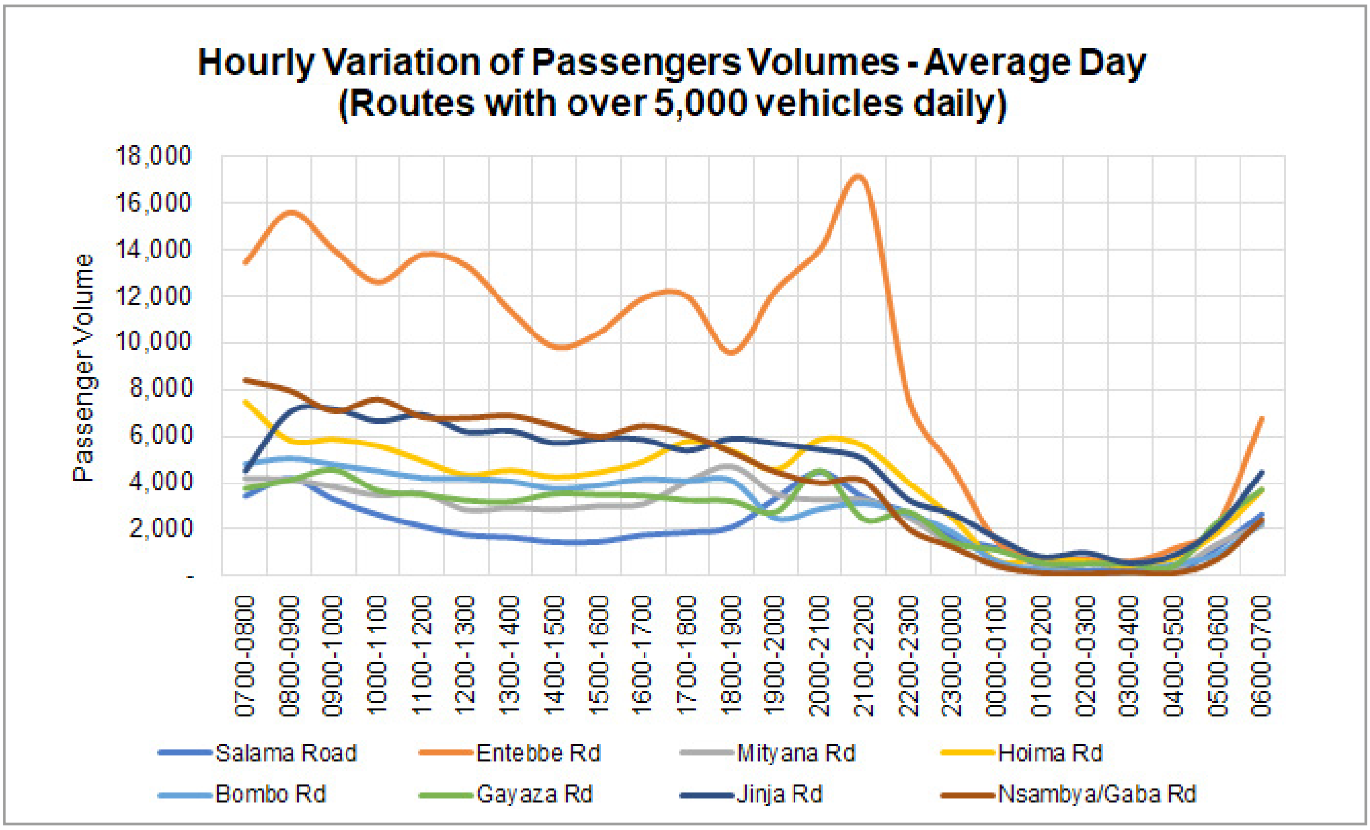
5.3.5 Further, from Origin-Destination data in the same set as above, average occupancy rates for mini buses and medium buses (combined) were estimated by route. These occupancy rates together with the passenger vehicle count numbers obtained above were used to estimate the passenger volumes by hour of day and for the entire day.

5.3.6 Figures 5-3 and 5-4 present the results of the analysis. Table 5-1 confirms the average daily estimates for passenger vehicles and number of passengers per route, for routes with the highest demand (over 5,000 passenger vehicle trips per day).



Source: Consultant's analysis

Figure 5-3: Hourly variation of passenger vehicle trips for the average day (selected routes)



Source: Consultant's analysis

Figure 5-4: Hourly variation of passenger volumes for the average day (selected routes)

ESTIMATED PASSENGER VEHICLE TRIPS AND PASSENGER DEMAND					
	Surveyed Route	Tondeka Routes	Total Matatus	Average Occupancy	Total Daily Passengers
1	Salama Road	Kampala-Salaama Road (Up to Munyonyo)	5,537	9	49,837
2	Makindye Rd	Kampala- Makindye (Up Makindye ku Gombola)	3,897	7	27,278
3	Entebbe Rd	Kampala- Entebbe Road	15,460	14	216,439
4	Masaka Rd	Kampala- Masaka Road (Up to Nsangi)	4,596	13	59,742
5	Mityana Rd	Kampala- Mityana Road (Up to Buloba)	5,525	11	60,776
6	Northern Bypass	Kampala- Northern Bypass Road	2,153	11	23,687
7	Hoima Rd	Kampala- Hoima (Up to Wakiso)	7,874	12	94,488
8	Bombo Rd	Kampala- Bombo Road (Up to Kawanda)	5,325	13	69,221
9	Gayaza Rd	Kampala- Gayaza Road (Up to Gayaza)	6,584	10	65,840
10	Kisasi-Ntinda	Kampala – Ntinda Road (Up to Namugongo)	3,294	11	36,233
11	Nalya Rd	Kampala – Ntinda Road (Up to Namugongo)	1,125	7	7,874
12	Jinja Rd	Kampala- Jinja Road (up to Mukono)	8,157	13	106,045
13	Old Port Bell Rd	Kampala- Luzira Road (Up to Kirombe)	4,468	14	62,546
14	Nsambya/ Gaba Rd	Kampala-Kibuli Road (Up to Namuwongo) Kampala – Gaba Road (Up to Gaba) Kampala- Nsambya Road (Up to Lukuli)	9,291	11	102,197
15	Ntinda-Kira	Kampala – Ntinda Road (Up to Namugongo)	2,070	9	18,629

Source: Consultant's analysis

Table 5-1: Estimated passenger vehicle trips and passenger demand

5.3.7 From Figures 5-3 and 5-4, it is clear that the passenger vehicle trips and passenger volumes vary by hour, being highest in the morning and evening. The morning period is typically 7am to midday and the evening peak period is 5pm to 10pm.

5.3.8 From the data, the busiest routes currently (in order) are; Entebbe Road, Jinja Road, Hoima Road, Gayaza Road. From the available survey data, Nsambya Road was surveyed at a point between Clock Tower and Nsambya Junction – as such, the high demand shown in Table 5-1 is for the three routes; Kampala – Kibuli, Kampala – Gaba and Kampala – Nsambya.

5.3.9 The demand presented in Table 5-1 is the total passenger demand. This would be shared between the minibuses, existing bus services and the proposed Tondeka service. It would be interesting to compare the estimated demand in Table 5-1 to that estimated by Tondeka.

5.4 Overview of Model Building Methodology

5.4.1 The Tondeka Project model network was developed using the SATURN suite of transport modelling programs. This is a sophisticated traffic assignment and simulation package used worldwide for the analysis of complex road networks. The program allows for the modelling of delays on links and at junctions and can be ably used to model traffic conditions in both urban and rural road environments.

5.4.2 For SATURN to operate successfully, the traffic model must comprise of three essential elements. These are:

- A road network containing all the main traffic assignment routes within the area of influence that is being analysed;
- A zone system of geographic areas that generate and attract vehicle trips;
- A trip matrix that contains the demand for travel by vehicles between the various geographic zones.

5.4.3 SATURN employs an iterative traffic assignment and simulation procedure. The trip matrix is first assigned onto the road network via the assignment module and traffic chooses the minimum cost route between its origin and destination, calculated from user specified generalised cost parameters for time and distance.

5.4.4 Following the assignment stage, SATURN runs a simulation process that determines arrival and departure profiles of traffic through all the junctions in the modelled road network that are being specifically simulated. This information is used by the program to calculate queues and delays at these junctions, which are then returned to the assignment procedure, where a new set of routings through the network, are calculated.

5.4.5 The simulation and assignment procedures are combined within SATURN in the module SATALL. This process will continue until the reassignment of traffic between successive assignment/simulation loops is sufficiently small as to be considered of no importance. The model is then considered to have reached equilibrium or to have converged and is deemed to be suitable for interrogation and analysis. A diagrammatic representation of the SATURN assignment process is provided in Figure 5-5.

5.5 Base Year and Model Time Periods

5.5.1 The model was developed for the following two time periods for a base year of 2017 – the year in which the bulk of the data was collected. It is advisable to set the model base year as the year the data is collected to avoid forecast errors in the base model.

- AM peak period (0700 – 1000); and
- PM peak hour (1700 – 2000).

5.5.2 For both time periods, the average hour was modelled to represent the entire model period. The average hour differs from the peak hour because it's an average of the hourly traffic flow within the time period. The peak hour represents the highest hourly flow in the period. Within Kampala CBD, the difference between peak and average hourly flows has narrowed substantially because of the prevalent heavy congestion. Analysis has shown that average hour flow is now within 5% of the peak hour flow. As such, the average hour can be used as a basis for the traffic model to simplify analysis without significant loss in accuracy.

5.5.3 The modelling procedure adopted allows for the comparison of modelled flows against observed data for each of the AM and PM time periods, as well as providing information on link speeds and journey times and highlighting capacity problems across the network. Output from the traffic model is used to undertake the economic appraisal of the proposed highway improvements in the corridor as well as analysis of the environmental impacts.

5.6 Model Network Building

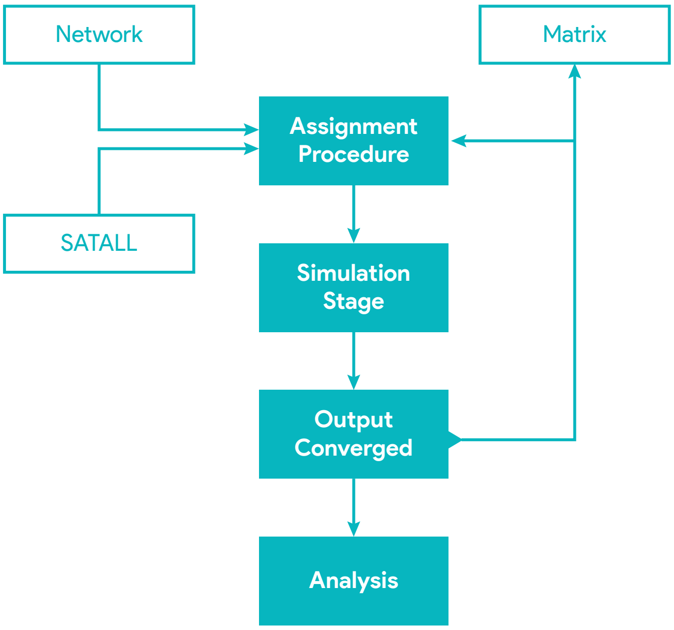
5.6.1 Traffic models developed for use by SATURN can comprise a two-tier definition of the highway network:

- The simulation network; and
- The buffer network.

5.6.2 All links and junctions that are considered to be important to the accurate routing of traffic through the model study area should be included in one of these tiers of coding.

5.6.3 The highway network for the Tondeka Project model was developed from the following sources:

- Road network inventory study data;
- Published maps (google maps mainly); and
- Relevant road network data held within traffic models from other highway studies.



Source: Consultant's analysis

Figure 5-5: SATURN assignment process

5.6.4 A road network inventory study provides information on links and junctions so that they could be specifically coded into the model network. This data is collected by means of a survey on all links and junctions of interest which need to be correctly coded within the model. The survey is especially undertaken at signalised traffic where layout plans of the junction and information on the signal staging of the green and inter-green timings are estimated on site.

The Simulation Network

5.6.5 The simulation network is a more detailed element of the overall model coding and can be provided for both links and junctions. It allows for the specific input of turn saturation flows at junctions, link capacities, speeds and capacity at free flow among others. The saturation flows provide limits to the maximum volume of traffic that can make a specific turning movement at a junction within a one-hour modelled time period. This allows for the SATURN programme to calculate queues and delays that occur at junctions and it is the magnitude of these that influences route choices for traffic through the network.

5.6.6 Simulation junctions are joined together by links to which a free flow speed is allocated. Alternatively, a speed flow curve can be allocated to a link, with the curve being dependent on the characteristics of the link, such as carriageway type, location, number of lanes and carriageway standard. Where a free flow speed only is allocated to a link, traffic on this link will always travel at this speed unless this speed is reduced by the presence of queues and delays at the upstream junction. Where a speed flow curve is allocated, the speed of traffic will reduce as flow on the link increases.

5.6.7 Saturation flows input into the modelled road network were estimated from onsite measurements and observations in accordance with the advice and methodology contained in the documents listed below.

- The Highway Capacity Manual; and
- SATURN manual (chapter 15).

5.6.8 All saturation flows were estimated and input to the model in passenger car units (PCUs). Generally, saturation values in the range 350 – 1,500 pcu per hour per lane were used in coding the network.

5.6.9 Where required, speed-flows curves were added to the network to enable better replication of speed profiles. The values shown in Table 2-1 extracted from the appropriate references were used.

NETWORK CODING PARAMETERS							
Link type	Free flow speed (kph)	No. of lanes per Direction	Level of service	Recommended capacity (veh/hr/ln)	Coded Capacity (pcu/hr/ln)	Speed Capacity (kph)	Reference
Rural (existing links)	50 - 100	1	D	1,000 – 1,180	500 - 1,000	50	Exhibit 12-5, HCM[7]
Rural (proposed links)	100	2 - 3	D	1,100 – 1,500	1,250	60	Exhibit 12-5, HCM
Urban (existing)	50	1	D	300 - 800	400 - 800	25	Exhibit 10-6, HCM
Flyover links	80	2 - 4	D	1,200 – 1,500	1,250	25	Exhibit 12-5, HCM

Table 5-2: Network coding parameters

5.6.10 The determination of link capacity values assumed the following:

- Access density – 15 access points per Km. This is the number of access points or junctions per Km.
- Percent heavy vehicles – less than 5% from observed data.
- Peak hour factor – 0.9 (recommended default value)
- Level of service – LOS D has been assumed. This implies that ability to manoeuvre on the highway is restricted due to traffic congestion. There is a maximum density of 21 pcu/km/lane. At this level of service, any minor disruption will cause extensive queues and deterioration of service.

5.6.11 The determination of link capacity also considered additional factors such poor lane discipline, poor speed control, etc. of the Ugandan road environment. These effects tend to reduce the capacity of the link in question.

The Buffer Network

5.6.12 The second element of network coding within SATURN is the buffer network. Coding for this element is much simpler than for the simulation network, with details coded on a link rather than a junction basis. Hence no turning saturation flows are coded and no junction delays are calculated. In this case, the model assumes no delays at junctions.

5.6.13 All buffer network links are allocated a speed flow curve, which is used by SATURN to calculate link delays. These delays determine the route choice of traffic travelling through the buffer network.

5.6.14 The model developed consisted of predominantly simulation coding. Buffer coding was restricted to the extents of the modelled network and did not significantly influence the working of the model.

5.6.15 The model network includes all links and junctions that are considered to have an influence on route choice through the study area. All road classes in the corridor are represented in the traffic model, together with a number of unclassified routes that provide local access. The structure of the model allows for the occurrence of multi routing occurring, where traffic has a number of alternative route choices between an origin–destination pair.

5.7 Zoning System

5.7.1 The zone system adopted for the model comprised of a total of 137 zones, at 3 distinct levels:

- Zones representing the main origins or destinations within Kampala City;
- Zones representing Kampala suburbs such as Kibuye, Wandegeya, Bweyogerere, etc.
- Zones representing areas along major routes to and from the city, districts and regions inside and outside Uganda.

5.7.2 The zones within Kampala are the smallest size used in the model, so as to allow for trips to, from and within this key area to be more accurately modelled. In this area, zone represent specific locations, buildings or a collection of buildings.

[7] Highway Capacity Manual 2000

5.7.3 In the area outside Kampala, the zones are larger in size and tend to represent entire towns or regions, such as Mukono, Lugazi, Jinja, Entebbe etc. Finally, a number of larger external or regional zones have been included. These are district or regional based areas and are intended to capture traffic from or to all areas of the country and region.

5.7.4 Table 5-3 below shows a description of the zones included in the traffic model. It should be noted that the description of the zones in Table 5-3 represents the most popular destination(s) in that zone.

DESCRIPTION OF MODEL ZONES

Zone	Description	Other Key Destinations	Zone	Description	Other Key Destinations
1	Acacia Avenue	DFCU, Protea Hotel Kampala	2	Acacia Mall	Capital Radio, Kisementi
3	Banda	Kireka, Kyambogo, Steel & Tube	4	Bank of Uganda	Grand Imperial Hotel
5	Buganda Road	Buganda Rd Primary Sch, Multichoice	6	Luzira	Port Bell, Uganda Breweries
7	Bukasa	Kirinya	8	Bahai Temple	Kampala Quality Sch, Kyebando, kisalosalo
9	Kawempe	Lugoba, Mbogo, Tula	10	Lugala	Kosovo, Masanafu
11	City Square	Cairo Bank, Mapeera House, City House, Crane Bank (former), Pioner Mall, EADB	12	Communications House	Christ the King Church, Kampala Casino, Nandos
13	Electoral Commission		14	Equatorial Mall	Kisekka Market, KCCA Central Division offices
15	Fairway Hotel	Sezibwa Rd, TWED Towers, DFCU HQs	16	Golf Course	
17	Goods Shade	Fire Brigade, Seroma	18	Green Hill School	Kisugu
19	Hotel Africana	Centenary Park, Speke Apartments, Wampewo Avenue	20	Industrial Area (6th, 7th Streets)	National Housing, Vivo Energy, Shell
21	Industrial Area (2) (1st, 2nd, 3rd, 4th Street)	Club Silk, Angenoir, Sadolin, New Vision	22	Industrial Area (3) (5th Street)	Fresh Diary, Bata Factory
23	Internal Affairs	Immigration, Jinja Rd Police, UMI	24	Kabalagala	American Embassy
25	Gayaza Rd	Kalerwe, Buwambo, Katalemwa, Kiteezi, Mpererwe, Namere	26	Kampala International Hospital	
27	Kampala Road	Bank of Baroda, Kamu Plaza, Post Office, Umeme Offices	28	Kamwokya	Kira Rd, Kira Rd Police, UWA, Pride Head Offices
29	Ggaba	Gaba Rd, Bunga	30	Katwe	Queensway
31	Kibuli	Depo, Kibuli CID, Kibuli Hospital, Kibuli Mosque	32	Kibuye	Makindye, Makindye Baracks, Mubaraka
33	Kitgum House	Kingdom Kla, Bank of Africa	34	Mengo-Kisenyi	Kafumbe Mukasa, Owino area, Kisenyi
35	Kololo	Kololo Airstrip, High Court, Interpol	36	Lugogo Bypass	Kampala Parents, Kololo High

DESCRIPTION OF MODEL ZONES

Zone	Description	Other Key Destinations	Zone	Description	Other Key Destinations
37	Lugogo Mall	Game, Shoprite, MTN Arena, UMA, Kiboko	38	Lumumba Avenue	NAADS, TWED Plaza, Star Times
39	Makerere University	Makerere Kavule, Ku Bbiri, Full Gospel	40	Kawaala	Sir Apollo Kaggwa Rd, MBI, UCC Kasubi, Makerere Kikoni
41	Kyengera	Mugongo, Kasenge	42	Butabika	CMI, Kasokoso, Kinawataka, Mbuya Barracks
43	Mengo-Bulange	Mengo Palace, Bulange	44	Min of Finance	Foreign Affairs, Prime Minister/Presidents Offices, UBOS, Labonita
45	Mityana / Mubende	Fort Portal, Kyegegwa, DRC	46	Mukwano Factory	Mukwano Rd, Ku Yard
47	Muyenga	Muyenga Hill, Tank Hill	48	Naguru	Naguru Police Barracks, Naguru Police HQs
49	Najjanankumbi	Namasuba, Freedom City, Kikajjo, Ndejje, Zana	50	Nakasero Rd	Medical Access, Multiplex, Nakasero Hospital
51	Luwum Street	Market St, Energy Centre, Nakasero Market	52	Nakawa	Nakawa Market, Cooper Motors
53	Kasubi	Lubya, Nakulabye, Namungoona	54	Nambole	Nambole Stadium
55	Nalya	Kyaliwajjala, Mbalwa, Metroplex, Kamuli Rd	56	Namugongo	Catholic and Protestant Martyrs Shrines
57	Nansana	Nansana, Kyebando, Kibuloka, Yesu Amala	58	Nasser Rd	Nkrumah Rd
59	Dewinton Rd	National Theatre	60	Bunamwaya	Kabowa, Kabusu, Ndeeba, Nyanama, Wankulukuku
61	Nakivubo	Nakivubo Rd, KK Hotel, New Park, Nakivubo Stadium	62	Nsambya	Kevina, Nsambya Barracks, Nsambya Hospital, Ave Maria
63	Kisasi	Kampala Academy, Kulambiro, Ndere Centre	64	Najeera	Najeera I, Najeera II
65	Garden City	Golf Course Hotel, Oasis Mall	66	Agakhan	Gadafi Rd, Jomayi Offices, LDC, Mukwano Mall, Namayiba Park
67	Kikuubo	Bus Park, Mukwano Arcade, Nabugabo Rd, Old Taxi Park, Shawuliyako	68	Bakuli	City Oil, Namirembe Rd, Pride Theatre, Victorious Sch
69	City Hall	KCCA, Kimathi Av, Min of Educ, Min of Justice, Min of Lands, Parliament, Prliament Av	70	Min of Works	Meat Packers, Uganda police Engineering Dept
71	Mengo Hospital	Namirembe Hill, Ndejje University, Rubaga Hospital, Wakaliga	72	Rwenzori House	Rwenzori Towers, Rwenzori Courts

DESCRIPTION OF MODEL ZONES					
Zone	**Description**	**Other Key Destinations**	**Zone**	**Description**	**Other Key Destinations**
73	Munyonyo	Speke Resort	74	Hannington Rd	Imperial Royale, Serena Hotel
75	Kampala Club	Sheraton Hotel, Nakasero Primary School	76	Shoprite Downtown	
77	Nakawa Court	Nakawa Industrial Area, URA Nakawa	78	Speke Hotel	Standard Chartered Ban, Workers House
79	All Saints Church	Nakasero State House, Pearl of Africa Hotel	80	NEMA	NWSC, Victoria University
81	Crested Towers	MTN Towers, Nile Avenue, UBC, URA Kampala	82	Uganda House	Cham Towers
83	Railway Station	Esso Corner, Commercial Plaza	84	Min of Health	Arirang
85	Usafi Market	Pan African Square, Clock Tower	86	Eight Street	Monitor Offices, Wabigalo
87	Wandegeya	Public Service	88	Watoto Main	Kyaggwe Rd, Fido Dido, Sure House
89	Arua Park	Ben Kiwanuka, Channel St, Cooper Complex, Gazaland, William St, Wilson Rd	90	Yusuf Lule Rd	Course View Towers, UNDP offices
91	Mulago	Mulago Hospital, Medical Sch, Museum, NBS, TASO Hqs	92	Kajjansi	Katale, Kitende, Lweza, Mild May, Prayer Mountain
93	Nsambya Villa Park	Arena Mall	94	Bweyogerere Industrial Park	Kakajjo
95	Katosi	Buikwe, Wantoni	96	Jinja and East	Busia, Busoga, Kenya, Kaliro, Malaba, Lugazi, Namataba, Namawojjolo,Palisa
97	Namanve Business Park	Coca Cola, Azam, Rwenzori	98	Seeta	Kigunga, Kiwanga
99	Kayunga	Kalagi, Kasawo, Nakifuma	100	Namilyango	Nantabulirirwa
101	Mukono	Colline Hotel, Mukono Taxi Park, Uganda christian University	102	Sonde	
103	Kira		104	Gayaza	Bugema University, Kasangati, Magigye, Namulonge, Kabanyoro
106	Semuto	Kapeeka, Sanga, Nakaseke	107	Bombo and North	Luwero, Bweyale, Kiryandongo, Lira, Gulu, Nakasongola, West Nile, South Sudan
108	Busunju	Kakiri, Namayumba, Hoima	109	Matugga	Maganjo, Kagoma, Kawanda, Migadde

DESCRIPTION OF MODEL ZONES					
Zone	**Description**	**Other Key Destinations**	**Zone**	**Description**	**Other Key Destinations**
110	Wakiso TC	Wakiso District HQs, Mende, Senge, Kavumba	111	Sentema	Temangalo, Bukasa, Lukwanga
112	Bulenga	Bbira, Nakuwadde	113	Buloba	Bulaga, Bujuko, Mityana Rd
114	Masaka and South	Mpigi, Kyotera, Bushenyi, Mbarara, Rwanda, Burundi, Kabale	115	Buddo	Nabbingo
116	Buddo	Nabbingo	117	Maya	Katende
118	Nakawuka	Nateete, Nateete, Kinaawa, Kasenge	119	Busabala	Gangu, Kibiri, Masajja
120	Entebbe Airport	Kalangala	121	Bwebajja	Abayita Ababiri, Corsu, Gangu, Kawuku, Namulanda
122	Entebbe Town	Kasenyi, Kitoro, National Medical Stores	123	Salama Rd	Salama, Munyonyo, Kibiri
124	Lukuli	Lukuli Rd, Buziga, Nanganda	125	Kiruddu	Katuso, Kabojja Int. Sch,
126	Kansanga	KIU, East African University, Ksanga Market	127	Bugolobi	Bugolobi Flats, Village Mall, Silver Springs
128	Kitintale	Port Bell Rd	129	Ntinda	Bukoto, Stretcher, Radio Simba, Victoria Hospital
130	Busega	Busega, Samona, etc	131	MUBS	Nakawa Business Park, Agakhan Hospital
132	Bwaise	Katooke, Kazo, Nabweru	133	Lungujja	Lungujja, Kosovo, Kitunzi
134	Bombo Rd	Norvik Hospital, Bible House, Little Flowers	135	Gganda	Jennina, Lubigi
136	Kigowa	Kisota, Nsimbiziwoome	137	Kyaggwe	

Table 5-3: Description of model zones

5.8 Matrix Building

5.8.1 Trip matrices were developed for the PM time period, for the following three user classes:

- User Class 1 - Cars and sports utility vehicles (4WDs);
- User Class 2 – minibuses (matatu) and buses; and
- User Class 3 – All trucks including trailers and semi-trailers.

Origin-Destination Data

5.8.2 The matrices were derived from origin – destination (OD) data captured at a number of locations. During the OD surveys, a sample of traffic was interviewed with drivers questioned on the journey that they were making. This allowed data to be collected on the origin and destination of the trip, together with information on vehicle type and occupancy. The OD surveys were complemented with weekday and weekend manual classified counts (MCC) and junction turning counts (JTC).

5.8.3 Prior to using the data, logic checks were undertaken on the OD data at this stage to ensure that the observed trip looked sensible in relation to the link where it had been observed and any illogically recorded movements were removed.

5.8.4 A comparison of the total number of trips observed during the OD survey with the observed counts collected from MCC surveys is presented in Table 5-4. The required sample size mainly depends on total amount of traffic at the site of the survey. For low volume links with 12-hour MCC of up to 1,000 vehicles, a minimum of sample size of 10% is generally accepted. For higher volume counts, lower percentages are acceptable. Table 5-4 shows that an adequate OD sample to enable robust matrix building was collected at each OD survey site.

COMPARISON OF REQUIRED SAMPLE SIZE WITH ACTUAL COLLECTED SAMPLE				
Site	**Description and Direction**	**Total Interview Sample (AM & PM)**	**Total MCC (AM & PM)**	**Sample %ge**
OD1 – Seguku	**Both directions**	**959**	9,772	9.8%
OD2 – Nakawa	**Both directions**	**1,130**	10,728	10.5%
OD3 – Nile Avenue	**Both directions**	**911**	6,171	14.8%
OD4 – Acacia Avenue	**Both directions**	**728**	4,591	15.9%
OD5 – Kira Rd	**Both Directions**	**755**	8,714	8.7%
OD6 – Sir Apollo Kaggwa	**Both Directions**	**839**	5,631	14.9%
OD7 – Bombo Rd	**To Bwaise**	**550**	2,647	20.8%
OD8 – Bombo Rd	**To Kampala**	**477**	4,785	10.0%
OD9 – Tula Rd	**Both Directions**	**853**	3,869	22.0%
OD10 – Gayaza Rd	**To Gayaza**	**351**	3,608	9.7%
OD11 – Gayaza Rd	**To Kampala**	**380**	3,498	10.9%
OD12 – Kisingiri St	**Both Direction**	**768**	6,378	12.0%
OD13 - Kyebando	**To Kampala**	**237**	1,202	19.7%
OD14 - Kyebando	**To Kyebando**	**419**	2,603	16.1%
OD15 – Kyanja Rd	**To Kampala**	**369**	3,625	10.2%
OD16 – Kyanja Rd	**To Kyanja**	**309**	3,276	9.4%
OD17 - Nalya	**Both Directions**	**951**	6,355	15.0%
OD18 – Hoima Rd	**To Hoima**	**553**	2,653	20.8%
OD19 – Hoima Rd	**To Kampala**	**557**	4,626	12.0%
OD20 – Sentema Rd	**To Sentema**	**386**	2,423	15.9%
OD21 – Sentema Rd	**To Kampala**	**307**	1,100	27.9%
OD22 – NBP Mityana Jn – Sentema Jn	**Both Directions**	**711**	7,478	9.5%
Totals		**13,500**	**105,733**	**12.8%**

Table 5-4: Comparison of required sample size with actual collected sample

Creation of OD Matrices

5.8.5 Matrices of observed OD movements were then built for the AM and PM peak periods, for of the three user classes, for each OD survey site. As these matrices only represented only the interview sample at each site, the sample matrices were expanded to the average weekday observed traffic flows at each survey site.

5.8.6 The observed traffic flows were calculated from MCC data collected at each of the OD sites. Average daily traffic (ADT) data collected from MCC surveys was used as a proxy for annual average daily traffic (AADT) by assuming a seasonal correction factor of 1.0. Usual practice in developing countries would be to adjust the data for variations of traffic due to seasonal activities such as agricultural seasons but such data was unavailable. However, the consultant considers that the urban nature of the corridor means that the impact of school term time traffic is so high and should not be averaged out together with seasons which have significantly less traffic. School term periods span for a total of 8 months in a year. A seasonal correction factor of 1.0 ensures the full impact traffic on the corridor, which occurs in 8 out of 12 months of the year.

5.8.7 The matrix building processes including matrix extraction (from OD data), factoring to observed MCC counts, removal of multiple counting and matrix additions were undertaken. Figure 5-6 summarises the matrix building process. Table 5-5 shows the PCU factors that were used to convert vehicle trip matrices into PCU trip matrices. These were calculated from observed data.

PCU CONVERSION FACTORS	
User Class	**Compound PCU Factor**
UC1 - Cars / 4WD	**1.00**
UC2 - Buses	**1.10**
UC3 - Trucks	**1.30**

Table 5-5: PCU conversion factors

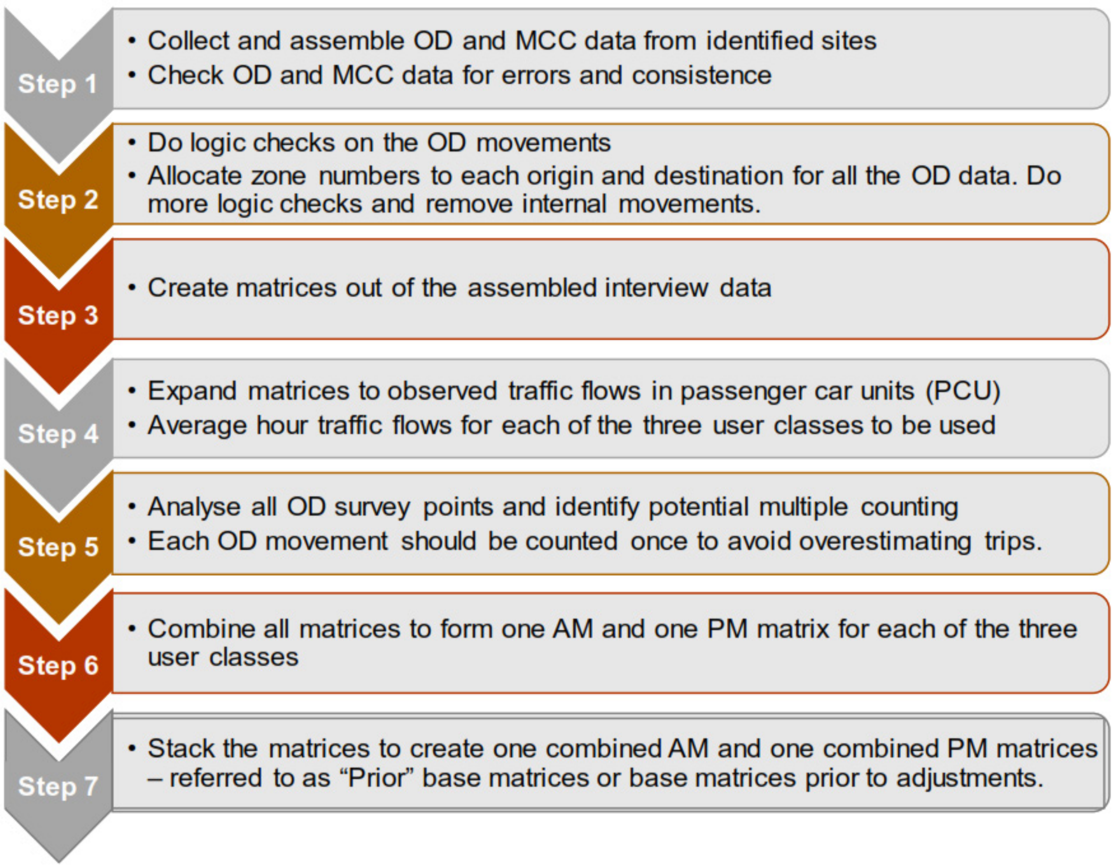


Figure 5 6: Summary of matrix building process

Base Trip Matrices

5.8.8 A base trip matrix for each user class and time period was produced by combining the user class matrices from each of the OD survey sites for each time period. This resulted in three matrices for cars (UC1), buses (UC2) and trucks (UC3).

5.8.9 Table 5-6 presents the base matrix totals before the commencement of the assignment process.

BASE MATRIX TOTALS (AVERAGE AM/PM HOUR, PCU)		
User Class	**AM Matrix Total**	**PM Matrix Total**
UC1 - Cars / 4WD	24,073	25,204
UC2 - Buses	8,983	7,699
UC3 - Trucks	2,771	3,433
Total – All classes	**35,827**	**36,336**

Table 5-6: Base matrix totals

6.0 MODEL CALIBRATION

6.1 Introduction

6.1.1 Following the successful completion of the network and trip matrix building processes, SATURN assignments were undertaken and the process of model calibration commenced. The calibration process requires that the assignment of the trip matrix to the highway network reproduce fully, within certain accepted limits, a set of observed data. During the model calibration process, adjustments can be made to both the trip matrices and the highway networks, so as to improve the match between observed and modelled data.

6.1.2 This section of the report considers the techniques used and the changes made during the model calibration process and also discusses the results obtained.

6.2 Network Adjustments

6.2.1 Network calibration involved the checking and adjustment of the model highway network. The network was rigorously checked to ensure that all of the coded details were correct as much as possible, especially with regard to link lengths, turn saturation flows and free flow speeds. These were corrected if errors were found, or adjusted if this was considered to be appropriate. The model networks were also checked to see that all banned movements were prohibited in the model coding and that similarly, all permitted movements were allowed.

6.2.2 To assist in network calibration, traffic routings across the network were checked by assigning individual site OD matrices onto a loaded SATURN assignment file for a single iteration. The output from this process allowed an analysis to be undertaken to determine how much traffic from the site OD matrix assigned itself onto the model link where the traffic had been observed during the survey process. It also showed what alternative routes traffic was using and allowed network coding adjustments to be made. Following this, the process was repeated until an acceptable level of traffic from the site OD matrix was assigning to the relevant link.

6.2.3 As part of the network calibration process, adjustments were also made to the loading points of the model zones. This was done so as to ensure that all zones loaded to and from the network at locations that were sensible and did not create unreasonable ‘bottle necks’ in the network.

6.2.4 Where network changes were considered appropriate, they were made to the model network in a consistent and sensible way.

6.3 Matrix Adjustments

6.3.1 Adjustments were also made to the trip matrices to improve the quality of the base trip matrices. This process was undertaken using a combination of analysis and network assignment.

6.3.2 The objective of matrix adjustments was to attempt to match assigned link flows in the model with observed traffic counts for those links, while maintaining the original trip distribution characteristics of the base matrix.

6.3.3 Initial assignments using the “prior” base matrices suggested that there was some significant shortfall in traffic especially in the areas between Kitgum junction and Mulago junction (along Yusuf Lule Road), for some arterial links connecting to the Northern Bypass, Entebbe road traffic among others. This was not surprising. Due to increasing traffic congestion and traffic jams in the peak periods, a significant amount of Yusuf Lule traffic uses a number of rudimentary “short-cuts” to get to the city. An OD survey in each of these “short-cuts” is not feasible due to a lack of suitable locations for survey along these routes and the expected high cost of undertaking them.

6.3.4 To remedy the above observation, MCC and JTC data was analysed for key links in the network to determine the flows on each link where possible. The relevant OD movements were then analysed and small incremental changes made to determine their effect on the assignment of traffic onto the network.

6.3.5 The matrix adjustments were considered separately for each of the three user classes used in the model to ensure that any adjustment made was sensible and in line with observed traffic. Given the city-based nature of the model, and the high proportion of UC1 traffic (see Table 6-1), adjustments were mainly realised in the UC1 class.

6.3.6 Each time small changes to the matrices were made, an assignment process was undertaken to test the improvement in the modelled data compared to the observed. The changes were made to one or two origin-destination pairs at a time in order to minimise error. Where traffic on a particular link of zone was deemed under or overestimated, the relevant changes were made to each of the user class matrices.

6.3.7 The matrix adjustment process relies upon the use of high-quality count data for input and for the purposes of this study; MCC data from all the OD survey site locations was used.

6.3.8 Tables 6-1 and 6-2 below present a comparison of matrix totals before and after matrix adjustment in the AM and PM model periods respectively.

COMPARISON OF AM BASE MATRICES BEFORE AND AFTER MATRIX ADJUSTMENT			
Matrix	**Total Before Matrix Adjustment**	**Total After Matrix Adjustment**	**Difference (%)**
UC1 - AM	24,073	25,439	5.7%
UC2 - AM	8,983	8,983	0%
UC3 - AM	2,771	2,771	0%
Total – All classes	**35,827**	**37,193**	**3.8%**

Table 6-1: Comparison of AM base matrices before and after adjustment

COMPARISON OF PM BASE MATRICES BEFORE AND AFTER MATRIX ADJUSTMENT			
Matrix	**Total Before Matrix Adjustment**	**Total After Matrix Adjustment**	**Difference (%)**
UC1 - PM	25,204	25,536	1.3%
UC2 - PM	7,699	7,856	2.0%
UC3 - PM	3,433	3,482	1.4%
Total – All classes	**36,336**	**36,874**	**1.5%**

Table 6 2: Comparison of PM base matrices before and after adjustmentment

6.3.9 From Tables 3.1 and 3.2 above, the largest change occurs in UC1 - AM of 5.7% or 1,372 trips. UC1 is largely composed of small cars and utility vehicles (4WDs). These make largely personal trips and are not restricted in which route they can use. As such a number of them in peak hour traffic seek “short cuts” to exit the city. UC2 and UC3 on the other hand are largely routed journeys i.e. will follow a certain route. These classes also frequently seek to make “short cuts” but are more restricted because they are more sensitive to length of route.

6.3.10 Figures 6-1 and 6-2 below shows a comparison of the trip length distribution of matrices before and after matrix adjustment. Trip length distribution analysis is used to check that after matrix adjustments, the integrity and character of the trip matrices are not changed significantly.

6.3.11 The results of the trip length distribution analysis above confirm that the matrix adjustment process is not altering the character of the base matrices and that the output matrices from the adjustment process are robust and suitable for use in the SATURN assignment process.

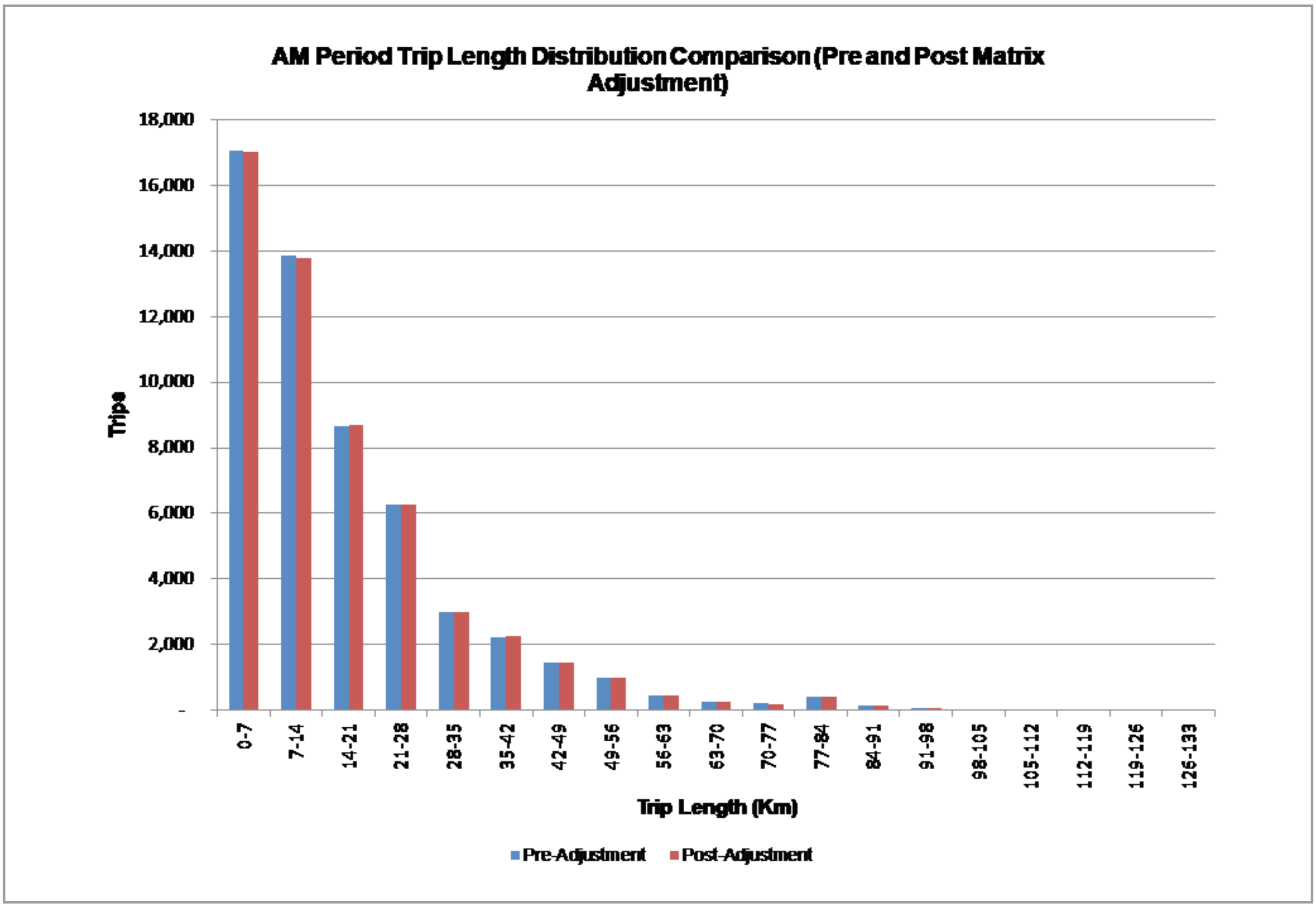


Figure 6-1: AM trip length distribution analysis

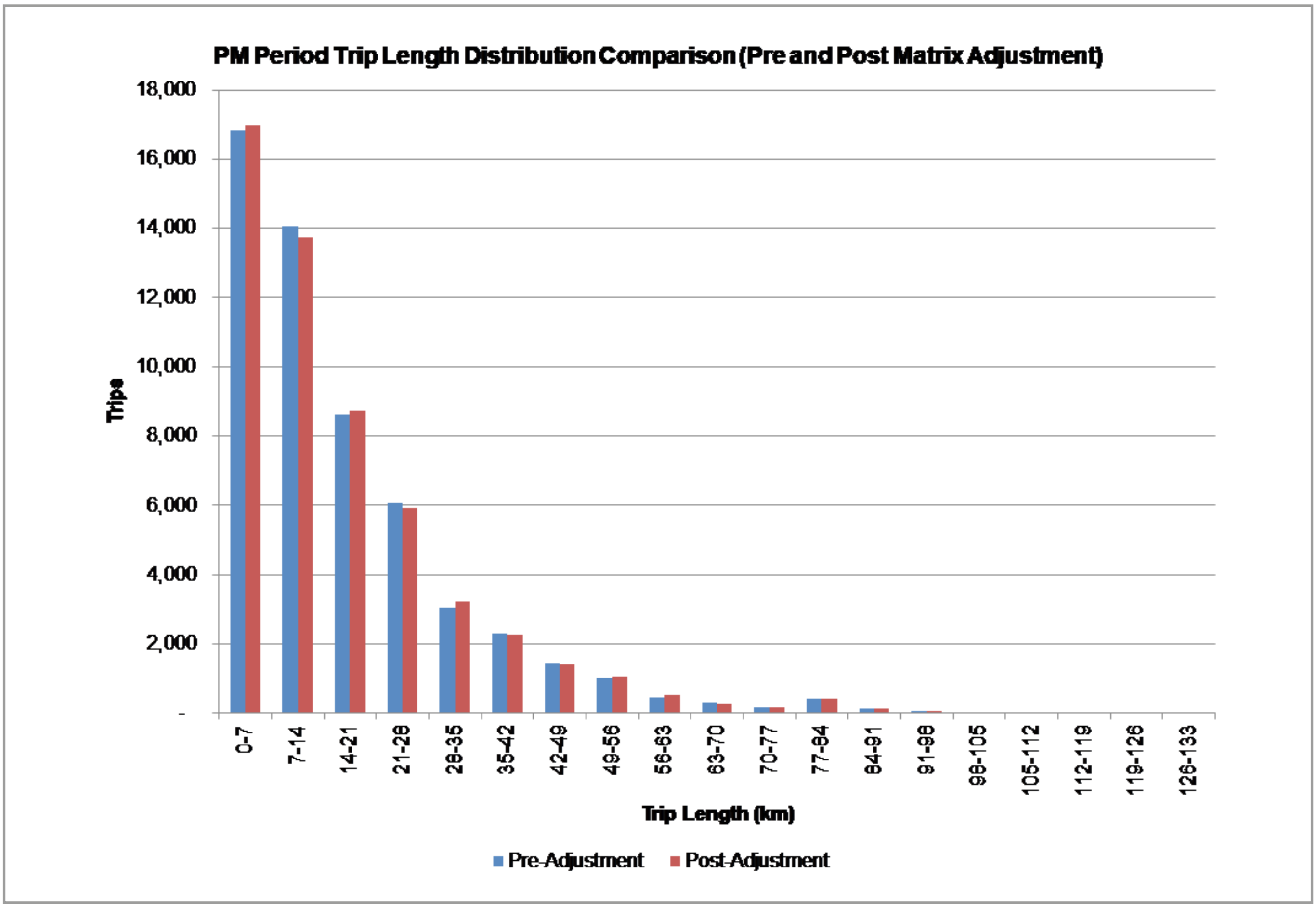


Figure 6-2: PM trip length distribution analysis

6.4 Assignment Method

6.4.1 As has been previously outlined in this report, the three key elements of a SATURN model (highway network, zoning system and trip matrix) are brought together in an assignment process.

6.4.2 A number of varying assignment types is available within SATURN. For this study, the default Wardrop Equilibrium assignment was considered to be most appropriate. Under this method, traffic is assigned such that the cost of travel on all possible routes between the same origin – destination pair is equal to the minimum cost of travel for that pair.

6.4.3 The assignments undertaken for this study were also multi user class, with separate trip matrices for each of the three user classes stacked into the assignment matrix.

6.5 Generalised Costs

6.5.1 Generalised cost parameters were input to the model networks for time and distance. The values were used to determine the minimum cost routes by which traffic assigns itself onto the network. One of the advantages of adopting a multi user class assignment approach is that it allows different generalized cost values to be used for different vehicle types, reflecting the different approaches to travel that these vehicles can have. For example, car and trucks drivers would have different considerations for using a particular route based on the characteristics of their vehicles.

6.5.2 As part of the calibration process, a series of test assignments were run using a variety of different generalised cost values. The values that provided the best results in terms of a comparison of observed and modelled data were then adopted for the study. The following generalized cost values were therefore used:

- UC1 - Cars / 4WD; time = 1.0, distance = 0.0
- UC2 - Buses; time = 1.0, distance = 0.0
- UC3 - Trucks; time = 1.0, distance = 0.50

6.5.3 The generalised cost figures above imply that cars and bus drivers would base their decision for using a particular route purely on the time it takes to move from point A to point B. The user class UC2 (buses) is dominated by minibuses (matatus) whose primary consideration is time. On the other hand, truck drivers would have some consideration of how long the route is in addition to the time it takes to move from A to B.

6.6 Calibration Results

6.6.1 The principal means of assessing the results of the model calibration process was a comparison of observed and modelled flows selected links. The links used for testing the calibration of the model were those at which are located at the junctions where the OD surveys were undertaken.

6.6.2 Different measures can be used to compare modelled and observed traffic flows. The most obvious for consideration are; percentage differences, absolute differences and GEH statistics.

6.6.3 However, each of these different measures has their shortcomings. Using a percentage difference can emphasise small differences when the flows are small. Using absolute differences can cause the differences in high flow links to overshadow major inconsistencies in lower flow links.

6.6.4 A measure that has been devised to overcome this problem is the GEH error statistic (named after its inventor Geoff Havers). The GEH error statistic compares two values and weights the difference according to the average of the two flows. It is the recommended calibration and validation measure by the UK Design Manual for Roads and Bridges (DMRB) Volume 12.

6.6.5 The weighting is not linear but takes the form of a square root function and is defined by the following relationship:

$$\mathrm{GEH} = \sqrt{\frac{2(\mathrm{M} - \mathrm{C})^2}{\mathrm{M} + \mathrm{C}}}$$

Where:

M = modelled flow, and C = observed flow.

6.6.5 DMRB provides guideline standards for an acceptable level of model calibration and these are reproduced in Table 6-3 below

DMRB CALIBRATION GUIDELINES	
Criteria and Measures	**Acceptability Guidelines**
GEH statistics: individual flows, GEH<5	>85% of cases
Individual flows within 100 vph* for flows < 700 vph	
Individual flows within 15% for flows < 700-2700 vph	
Individual flows within 400 vph for flows > 2700 vph	
Journey times within 15% (or 1 minute, if higher)	

*vehicles per hour. Source: Design Manual for Roads and Bridges (DMRB)

Table 6-3: DMRB calibration guidelines

6.6.6 Table 6-3 above implies that the GEH should be 5 or less for acceptable calibration or the absolute difference between the modelled and actual flows is acceptable. The guidance also stipulates that this should be so for at least 85% of links used for calibration.

Calibration Results

6.6.7 The model shows that it attained a calibration of 85.2% in both the AM and PM periods compared to a minimum of 85% stated in DMRB. Out of a total of 27 calibration links analysed, 23 links have acceptable GEH values in both peak periods.

6.6.8 Tables 6-4 and 6-5 summarise the results of the model calibration.

AM LINK FLOW CALIBRATION RESULTS						
Link Reference	**Link Description**	**Observed Flow (PCU)**	**Modelled Flow (PCU)**	**Absolute Diff**	**GEH***	**Pass**
93669069	Kamwokya - Mulago RBT	1,245	1,228	17	0.5	OK
90699366	Mulago RBT - Kamwokya	868	744	124	4.4	OK
92929376	Sir Apollo - Bwaise KNBP Jn	512	611	99	4.2	OK
93769292	Bwasie KNBP - Sir Apollo	216	297	81	5.0	OK
90728135	Kubbiri - Bwaise KNBP Jn	123	511	388	21.8	No!
80898937	NBP Kisasi - Nalya	521	629	107	4.5	OK
89378089	NBP Nalya - Kisasi	687	802	116	4.2	OK
92219220	NBP Mityana - Sentema	924	997	73	2.3	OK
92209221	NBP Sentema - Mityana	764	901	137	4.7	OK
94489196	Kisingiri street twds city	652	544	109	4.4	OK
91969448	Kisingiri street twds kyebando	280	274	5	0.3	OK
94529463	Tula Rd to Kawempe	337	288	50	2.8	OK
94639452	Tula Rd to Kalerwe	544	656	112	4.6	OK
81338093	Kubbiri - Kalerwe KNBP	584	473	111	4.8	OK
94528093	Gayaza Rd - Kalerwe KNBP	787	899	112	3.9	OK
81459415	Bweyogerere - Seeta	834	918	84	2.8	OK
94158145	Seeta - Bweyogerere	709	844	136	4.9	OK
93449083	Nile Av - Garden City	516	581	66	2.8	OK
90839344	Garden City - Nile Av	794	933	139	4.7	OK
80018002	Lugogo-Nakawa	808	799	9	0.3	OK
80019214	Nakawa-Lugogo	1,282	1,138	144	4.1	OK
90689252	Fairway - Acacia Av	952	330	622	24.6	No!
92529068	Acacia Av - Fairway	1,274	1,185	88	2.5	OK
81378096	Kasubi - KNBP Hoima Rd	552	667	115	4.7	OK
95648096	Hoima - KNBP Hoima Rd	1,381	1,531	150	3.9	OK
92249220	Masanafu - KNBP Sentema	413	62	351	22.8	No!
92239220	Sentema - KNBP Sentema	307	101	206	14.5	No!
Total number that passes (number)						23
Total number that passes (%)						85.2%

Table 6-4: Traffic flow calibration results for AM

PM LINK FLOW CALIBRATION RESULTS						
Link Reference	Link Description	Observed Flow (PCU)	Modelled Flow (PCU)	Absolute Diff	GEH*	Pass
93669069	Kamwokya - Mulago RBT	965	944	21	0.7	OK
93669074	Mulago RBT - Kamwokya	958	1,028	70	2.2	OK
92929376	Sir Apollo - Bwaise KNBP Jn	846	832	14	0.5	OK
93769292	Bwasie KNBP - Sir Apollo	689	430	260	11.0	No!
90728135	Kubbiri - Bwaise KNBP Jn	674	576	98	3.9	OK
80898937	NBP Kisasi - Nalya	674	692	18	0.7	OK
89378089	NBP Nalya - Kisasi	644	723	80	3.1	OK
92219220	NBP Mityana - Sentema	632	763	131	5.0	OK
92209221	NBP Sentema - Mityana	847	922	75	2.5	OK
94489196	Kisingiri street twds city	379	476	97	4.7	OK
91969448	Kisingiri street twds kyebando	946	851	95	3.2	OK
94529463	Tula Rd to Kawempe	335	288	47	2.7	OK
94639452	Tula Rd to Kalerwe	489	496	7	0.3	OK
81338093	Kubbiri - Kalerwe KNBP	770	650	121	4.5	OK
94528093	Gayaza Rd - Kalerwe KNBP	655	726	71	2.7	OK
81459415	Bweyogerere - Seeta	1,103	1,051	52	1.6	OK
94158145	Seeta - Bweyogerere	611	724	113	4.4	OK
93449083	Nile Av - Garden City	715	825	110	4.0	OK
90839344	Garden City - Nile Av	369	746	377	16.0	No!
80018002	Lugogo-Nakawa	1,112	957	155	4.8	OK
80019214	Nakawa-Lugogo	1,009	1,157	148	4.5	OK
90689252	Fairway - Acacia Av	1,364	637	727	23.0	No!
92529068	Acacia Av - Fairway	1,114	1,125	11	0.3	OK
81378096	Kasubi - KNBP Hoima Rd	693	827	134	4.9	OK
95648096	Hoima - KNBP Hoima Rd	984	1,362	379	11.1	No!
92249220	Masanafu - KNBP Sentema	543	562	19	0.8	OK
92239220	Sentema - KNBP Sentema	162	142	20	1.7	OK
Total number that passes (number)						23
Total number that passes (%)						85.2%

Table 6-5: Traffic flow calibration results for PM

Calibration Conclusions

6.6.9 The model calibration process was undertaken successfully and produced a good standard and quality of results for both time periods modelled.

6.6.10 A comparison of observed and modelled links has shown a good match between the observed and modelled data sets that meets the acceptability standards as stated in DMRB.

7.0 MODEL VALIDATION

7.1 Introduction

7.1.1 Following the successful completion of the model calibration process, model validation was undertaken. Validation is required so as to provide further confidence that calibration has produced a traffic model that is performing sensibly and reliably.

7.1.2 Model validation was undertaken against the following criteria:

- Independent flow data;
- Journey time data; and
- Model convergence.

7.2 Independent Flow Validation

7.2.1 As part of the validation process, observed and modelled link flows were compared for a number of highway links comprising all of the key highway routes within the study area.

7.2.2 None of the observed data used in the calibration process was used in validation. The count data used in validation is therefore considered to be 'independent' and provides additional confidence that the model is capable of reproducing observed conditions across its entire network.

7.2.3 The comparison of the observed and modelled flows as part of the model validation process was assessed using the same DMRB standards as were used for model calibration.

Validation Results

7.2.4 Analysis of the results shows a good standard of match between the observed and the modelled data. In the AM period, of the 44 links analysed, 41 links representing 93.2% have an acceptable GEH value or have flow differences within acceptable ranges. In the PM period, of the 44 links analysed, 38 links representing 86.4% have an acceptable GEH value or have flow differences within acceptable ranges. The validation results are summarised in Tables 7-1 and 7-2.

AM LINK FLOW VALIDATION RESULTS						
Link Reference	Link Description	Observed Flow (PCU)	Modelled Flow (PCU)	Absolute Diff	GEH*	Pass
90999069	Wandegeya - Mulago RBT	917	1,066	148	4.7	OK
90699099	Mulago RBT - Wandegeya	1,465	1,628	163	4.1	OK
91969069	Kubbiri - Mulago RBT	1,102	1,197	95	2.8	OK
90699196	Mulago RBT - Kubbiri	826	767	59	2.1	OK
90699100	Mulago RBT - Fairway	329	243	85	5.0	OK
91009069	Fairway - Mulago RBT	353	265	89	5.1	OK
91989041	Queensway - Kibuye	1,430	1,362	68	1.8	OK
90419200	Kibuye - Katwe	1,948	2,023	75	1.7	OK
80858944	NBP Nalya - Nambole	367	593	226	10.3	No!
89448085	NBP Nambole - Nalya	448	448	0	0.0	OK
89368090	NBP Kisasi - Nalya	547	629	82	3.4	OK
80908936	NBP Nalya - Kisasi	669	802	134	4.9	OK
80918936	NBP Kyebando - Kisasi	1,012	862	149	4.9	OK
80938092	NBP Kalerwe - Kyebando	795	678	116	4.3	OK
80928093	NBP Kyebando - Kalerwe	971	1,075	104	3.3	OK
80948093	NBP Bwaise - Kalerwe	789	1,135	346	11.1	No!
80938094	NBP Kalerwe - Bwaise	932	1,084	151	4.8	OK
93728096	NBP Bwaise - Hoima	1,323	1,497	173	4.6	OK
92208096	NBP Sentema - Hoima	813	918	105	3.6	OK
80969220	NBP Hoima - Sentema	840	962	122	4.1	OK
93589072	Wandegeya - Kubbiri	719	503	216	8.7	No!
90729358	Kubbiri - Wandegeya	1,048	1,009	40	1.2	OK
91429143	Mukwano RBT - Mbogo Rd Jn	344	312	31	1.7	OK
91419146	Mukwano - 7th Street	127	205	78	6.1	OK
91469141	7th Street - Mukwano	277	218	59	3.7	OK
91419148	Mukwano - 6th Street	181	114	67	5.5	OK
91489141	6th Street - Mukwano	222	207	15	1.0	OK
93859135	Nsambya - Junction	1,014	988	26	0.8	OK
91409386	Mukwano rd - Kibuli	179	86	93	8.1	OK
93869140	Kibuli - Mukwano Rd	204	205	2	0.1	OK
80138012	Bweyogerere - Nambole	739	769	30	1.1	OK
90839084	Garden City - Kitgum	1,079	989	90	2.8	OK
90849083	Kitgum - Garden City	715	848	132	4.7	OK
90719096	Wandegeya - Equatoria	1,680	1,663	17	0.4	OK
90969071	Equatoria - Wandegeya	1,293	1,143	150	4.3	OK
92489073	Jinja Rd - Kitgum	1,828	1,754	74	1.7	OK
90739248	Kitgum - Jinja Rd	1,315	1,177	138	3.9	OK
91349073	Kampala Rd - Kitgum	634	763	129	4.9	OK
92789073	Yusuf Lule - Kitgum	940	1,006	67	2.1	OK
90739278	Kitgum - Yusuf Lule	958	869	89	3.0	OK
91419173	Access Rd - Kitgum	1,015	1,002	13	0.4	OK
91739141	Kitgum - Access Rd	762	843	81	2.9	OK
92269222	Kyengera - Busega	1,133	1,266	133	3.8	OK
92229226	Busega-Kyengera	727	868	141	5.0	OK
Total number that passes (number)						41
Total number of links						44
Total number that passes (%)						93.2%

Table 7-1: Traffic flow validation results for AM

PM LINK FLOW VALIDATION RESULTS						
Link Reference	Link Description	Observed Flow (PCU)	Modelled Flow (PCU)	Absolute Diff	GEH*	Pass
90999069	Wandegeya - Mulago RBT	1,588	957	632	17.7	No!
90699099	Mulago RBT - Wandegeya	1,231	1,083	148	4.3	OK
91969069	Kubbiri - Mulago RBT	1,109	1,122	13	0.4	OK
90699196	Mulago RBT - Kubbiri	967	1,620	654	18.2	No!
90699100	Mulago RBT - Fairway	497	228	269	14.1	No!
91009069	Fairway - Mulago RBT	705	684	21	0.8	OK
91989041	Queensway - Kibuye	1,604	1,780	176	4.3	OK
90419200	Kibuye - Katwe	1,458	1,635	177	4.5	OK
80858944	NBP Nalya - Nambole	509	602	93	3.9	OK
89448085	NBP Nambole - Nalya	304	353	49	2.7	OK
89368090	NBP Kisasi - Nalya	589	692	103	4.1	OK
80908936	NBP Nalya - Kisasi	720	723	3	0.1	OK
80918936	NBP Kyebando - Kisasi	991	899	92	3.0	OK
80938092	NBP Kalerwe - Kyebando	786	912	126	4.3	OK
80928093	NBP Kyebando - Kalerwe	961	1,058	98	3.1	OK
80948093	NBP Bwaise - Kalerwe	927	1,083	156	4.9	OK
80938094	NBP Kalerwe - Bwaise	848	984	136	4.5	OK
93728096	NBP Bwaise - Hoima	1,289	1,480	191	5.1	OK
92208096	NBP Sentema - Hoima	679	649	30	1.2	OK
80969220	NBP Hoima - Sentema	803	900	98	3.4	OK
93589072	Wandegeya - Kubbiri	540	659	120	4.9	OK
90729358	Kubbiri - Wandegeya	1,124	964	160	4.9	OK
91429143	Mukwano RBT - Mbogo Rd Jn	345	314	31	1.7	OK
91419146	Mukwano - 7th Street	191	147	44	3.4	OK
91469141	7th Street - Mukwano	222	146	76	5.6	OK
91419148	Mukwano - 6th Street	189	101	88	7.3	OK
91489141	6th Street - Mukwano	205	124	81	6.3	OK
93859135	Nsambya - Junction	826	869	43	1.5	OK
91409386	Mukwano rd - Kibuli	211	97	114	9.2	No!
93869140	Kibuli - Mukwano Rd	232	177	56	3.9	OK
80138012	Bweyogerere - Nambole	591	612	21	0.9	OK
90839084	Garden City - Kitgum	1,067	1,203	136	4.0	OK
90849083	Kitgum - Garden City	1,331	1,162	169	4.8	OK
90719096	Wandegeya - Equatoria	1,683	1,437	246	6.2	OK
90969071	Equatoria - Wandegeya	1,609	1,406	202	5.2	OK
92489073	Jinja Rd - Kitgum	2,358	2,215	143	3.0	OK
90739248	Kitgum - Jinja Rd	2,632	1,512	1,120	24.6	No!
91349073	Kampala Rd - Kitgum	834	967	133	4.4	OK
92789073	Yusuf Lule - Kitgum	1,208	1,212	4	0.1	OK
90849083	Kitgum - Yusuf Lule	1,331	1,162	169	4.8	OK
91419173	Access Rd - Kitgum	1,254	869	385	11.8	No!
91739141	Kitgum - Access Rd	866	955	89	3.0	OK
92269222	Kyengera - Busega	728	866	139	4.9	OK
92229226	Busega-Kyengera	1,004	1,052	48	1.5	OK
Total number that passes (number)						38
Total number of links						44
Total number that passes (%)						86.4%

Table 7-2: Traffic flow validation results for PM

7.3 Journey Time Validation

7.3.1 In undertaking journey time validation, it is required that the traffic model reproduces within acceptable limits the observed journey time. For this to happen, a number of roads and links that have a significant influence of the objectives of the model, must be selected from the onset. For this exercise, a total of 13 links were selected. They comprised of links on the Northern Bypass and arterial links that would have a significant influence on the effectiveness of the proposed expressway. Table 7-3 below describes the links chosen for journey time validation.

DESCRIPTION OF JOURNEY TIME SURVEY ROUTES	
	Links
1	Link 1 – Bwaise NBP junction to Kubbiri junction
2	Link 2 – Kubbiri junction to Mulago junction
3	Link 3 – Mulago junction to Fairway junction
4	Link 4 – Watoto Church to Wandegeya
5	Link 5 – Wandegeya to Kubbiri junction
6	Link 6 – NBP Nalya to Kisasi
7	Link 7 – NBP Kisasi to Kyebando
8	Link 8 – NBP Kyebando to Kalerwe
9	Link 9 – Kalerwe to Hoima Rd
10	Link 10 – NBP Hoima Rd to Sentema
11	Link 11 – NBP Sentema to Busega
12	Link 12 – Bulange Mengo to Sentema junction
13	Link 13 – Bwaise NBP junction to Kawempe

Table 7-3: Description of journey time survey routes

7.3.2 From the full set of observed data, a mean journey time was calculated for each of the surveyed routes for each direction of travel. This information was then compared with journey time data output from the model assignments.

7.3.3 For the comparison of observed and modelled journey time data, DMRB recommends that the modelled time be within +/- 15% of the observed (or 60 seconds if higher) for 85% of the routes surveyed. The results of the journey time analysis are shown in Tables 7-4 and 7-5.

AM PEAK JOURNEY TIME VALIDATION RESULTS						
Ref	Description	Obs JT (sec)	Model JT (sec)	Diff (sec)	% Diff	<15% or <60 sec
93758135	Link 1 – Bwaise NBP junction to Kubbiri junction	260	210	-50.0	-24%	Yes
90728135	Link 1 – Kubbiri junction to Bwaise NBP junction	200	174	-25.7	-15%	Yes
90729196	Link 2 – Kubbiri junction to Mulago junction	760	767	7.2	1%	Yes
90699196	Link 2 – Mulago junction to Kubbiri junction	160	102	-57.6	-56%	Yes
90699100	Link 3 – Mulago junction to Fairway junction	100	109	8.6	8%	Yes
95489364	Link 3 – Fairway junction to Mulago junction	240	207	-32.8	-16%	Yes
91299095	Link 4 – Watoto Church to Wandegeya	140	198	57.5	29%	Yes
90719096	Link 4 – Wandegeya to Watoto Church	180	198	18.3	9%	Yes
90729358	Link 5 – Kubbiri junction to Wandegeya	740	795	54.9	7%	Yes
89378089	Link 6 – NBP Nalya to Kisasi	390	359	-30.8	-9%	Yes
89368090	Link 6 – NBP Kisasi to Nalya	240	195	-45.3	-23%	Yes
89368091	Link 7 – NBP Kisasi to Kyebando	180	126	-53.8	-43%	Yes
80918936	Link 7 – NBP Kyebando to Kisasi	240	690	449.6	65%	No
80918092	Link 8 – NBP Kyebando to Kalerwe	1020	1102	82.0	7%	Yes
80938092	Link 8 – NBP Kalerwe to Kyebando	150	108	-41.6	-38%	Yes
80938094	Link 9 – Kalerwe to Hoima Rd	210	154	-55.5	-36%	Yes
93748094	Link 9 – NBP Hoima Rd to Kalerwe	600	197	-403.5	-205%	No
80969220	Link 10 – NBP Hoima Rd to Sentema	210	262	51.7	20%	Yes
92209221	Link 11 – NBP Sentema to Mityana	300	323	23.5	7%	Yes
92219220	Link 11 – NBP Mityana to Sentema	240	186	-54.3	-29%	Yes
92339235	Link 12 – Bulange Mengo to Sentema junction	720	663	-57.4	-9%	Yes
92209224	Link 12 – Sentema junction to Bulange Mengo	900	655	-244.8	-37%	No
95599453	Link 13 – Bwaise to Kawempe	360	302	-57.6	-19%	Yes
94539559	Link 13 – Kawempe to Bwaise	520	605	84.8	14%	Yes
Total number that passes (number)						21
Total number of links						24
Total number that passes (%)						87.50%

Table 7-4: AM peak journey time validation results

PM PEAK JOURNEY TIME VALIDATION RESULTS						
Ref	Description	Obs JT (sec)	Model JT (sec)	Diff (sec)	% Diff	<15% or <60 sec
93758135	Link 1 – Bwaise NBP junction to Kubbiri junction	260	209.3	-50.68	-24%	Yes
90728135	Link 1 – Kubbiri junction to Bwaise NBP junction	180	192.0	12	6%	Yes
90729196	Link 2 – Kubbiri junction to Mulago junction	240	220.3	-19.75	-9%	Yes
90699196	Link 2 – Mulago junction to Kubbiri junction	220	268.0	48.03	18%	Yes
90699100	Link 3 – Mulago junction to Fairway junction	180	137.8	-42.18	-31%	Yes
95489364	Link 3 – Fairway junction to Mulago junction	340	358.2	18.22	5%	Yes
91299095	Link 4 – Watoto Church to Wandegeya	240	221.5	-18.55	-8%	Yes
90719096	Link 4 – Wandegeya to Watoto Church	160	127.6	-32.36	-25%	Yes
90729358	Link 5 – Kubbiri junction to Wandegeya	320	271.0	-48.97	-18%	Yes
89378089	Link 6 – NBP Nalya to Kisasi	340	844.5	504.48	60%	No
89368090	Link 6 – NBP Kisasi to Nalya	390	657.9	267.86	41%	No
89368091	Link 7 – NBP Kisasi to Kyebando	240	218.4	-21.62	-10%	Yes
80918936	Link 7 – NBP Kyebando to Kisasi	270	299.6	29.63	10%	Yes
80918092	Link 8 – NBP Kyebando to Kalerwe	500	457.6	-42.39	-9%	Yes
80938092	Link 8 – NBP Kalerwe to Kyebando	90	108.6	18.61	17%	Yes
80938094	Link 9 – Kalerwe to Hoima Rd	120	66	-54.2	-82%	Yes
93748094	Link 9 – NBP Hoima Rd to Kalerwe	300	333	32.8	10%	Yes
80969220	Link 10 – NBP Hoima Rd to Sentema	240	274.1	34.1	12%	Yes
92209221	Link 11 – NBP Sentema to Mityana	480	550.9	70.86	13%	Yes
92219220	Link 11 – NBP Mityana to Sentema	390	352.3	-37.74	-11%	Yes
92339235	Link 12 – Bulange Mengo to Sentema junction	520	467.7	-52.35	-11%	Yes
92209224	Link 12 – Sentema junction to Bulange Mengo	480	436.8	-43.2	-10%	Yes
95599453	Link 13 – Bwaise to Kawempe	440	403.2	-36.8	-9%	Yes
94539559	Link 13 – Kawempe to Bwaise	340	302.4	-37.6	-12%	Yes
Total number that passes (number)						21
Total number of links						24
Total number that passes (%)						87.50%

Table 7-5: PM peak journey time validation results

7.3.4 The data in Tables 7-4 and 7-5 above shows a good match between the observed and the modelled data. In both AM and PM periods, the tables show that 87.5% of the 24 links analysed have acceptable differences between observed and modelled journey times.

7.4 Model Convergence

7.4.1 Model convergence is measured during the assignment process to determine the degree that traffic between origin – destination pairs is altering routes between each assignment iteration. Only when a model has obtained an acceptable level of convergence can it be relied upon to produce robust and reliable results.

7.4.2 The SATURN manual recommends the following criteria for acceptable model convergence:

- Percentage of link flows differing by less than 5% - should be greater than 95%;
- percentage of turn delays differing by less than 5% - should be greater than 95%; and
- variational inequality proportions – greater than zero.

7.4.3 Table 7-6 below summarises the convergence statistics for the 2017 base year AM and PM models.

MODEL CONVERGENCE STATISTICS		
Convergence Statistics	**AM**	**PM**
Percent link flows, %	98.99%	99.93%
Percent turn delays, %	99.45%	99.66%
Variation inequality (V.I), %	0.003%	0.001%
Total – All classes	**36,336**	**36,874**

Table 7-6: Model convergence results

7.5 Validation Conclusions

7.5.1 The traffic model is accurately replicating observed link speeds and delays to a standard consistent with that acceptable in DMRB. The model also seems to be replicating observed traffic flows on a variety of links across the highway network to a standard consistent with DMRB guidance. The link counts show good correlation with the observed traffic flows. Over 85% of the links have GEH less than 5 and journey time performance of the model is of a good standard.

7.5.2 Further, the model is converging within the allowable DMRB standards.

7.5.3 In conclusion, the model has performed well and in accordance with all DMRB criteria. It was concluded that the 2017 base traffic model was validated successfully and to an acceptable standard. ***It is hence deemed fit to form a basis for testing the proposed project route options.***

8.0 TRAFFIC FORECASTING

8.1 Introduction

8.1.1 This section discusses the process undertaken to estimate future levels of traffic. It presents the methodology used to develop the traffic forecasts and the results of forecast assignments.

8.1.2 The estimation of future traffic growth in the traffic model area has considered the growth in traffic based on historic and forecast growth trends in the pertinent factors such as GDP and population.

8.1.3 The estimation of future traffic growth factors was undertaken in two stages. In the first stage an attempt has been made to establish the nature of historic growth trends of growth factors that are pertinent to future traffic growth. These include; historic traffic data, fuel consumption, GDP and GDP per capita growth, population growth, agricultural productivity and import and export statistics. Analysis of the historic trends for all these factors has made use of data from the Uganda Bureau of Statistics (UBOS)[8].

8.1.4 The second stage established the relationship between the past trends in the pertinent factors and traffic growth, and enabled the establishment of elasticity factors. These together with other considerations helped the establishment of traffic growth rates.

8.2 Opening Year and Forecast Period

8.2.1 The assumed opening year of the project was assumed as 2021. The Promoters of the project have indicated that the project will be launched in September 2020. For prudence, the first full year has been considered as 2021.

8.2.2 A forecast or evaluation period of 15 years has been considered. The UNRA guidance[9] suggests that an evaluation of 15 to 20 years should be used. A shorter period has been used due to the higher uncertainty of a much longer period for a passenger transport project.

8.2.3 However, to mitigate the impact of uncertainty in forecasting, the UNRA guidance limiting the level of growth in the future was considered. Traffic growth rates have been developed for the first 10 years of the forecast period. Beyond the first 10 years, the traffic growth would be limited to a maximum of 3% per annum for each of the vehicle classes.

8.3 Forecast Methodology

8.3.1 Similar to the base model building process, the approach to traffic forecasting used was to develop trip matrices and highway model networks that best represent the future scenarios considered. The trip matrices (future trip matrices) developed in line with pertinent factors such as GDP growth, population growth, etc. were considered sufficient to represent future traffic volumes on the road network.

8.3.2 The future highway networks consider the expected changes in the road network within the study corridor with or without the project. Due to the usual infrastructure improvement programmes, it is usual to expect improvements to the road network. These improvements would influence the network performance when the project is implemented.

8.3.3 The future trip matrices and highway networks were developed for two possible outcomes;

- Do Minimum – this considers that the project is not implemented but some improvements to the general road network are made. These improvements could minor in form of routine maintenance to some roads or could be major highway projects undertaken in other parts of the network.
- Do Project Case – this considers that the Tondeka project is implemented. In addition to this, the improvements to the network considered as part of the Do Minimum case would still be undertaken.

8.3.4 The future trip matrices were produced for an expected most likely traffic growth outcome (central growth). Low and high growth scenarios were estimated but not modelled. These scenarios were in line with possible national economic and demographic growth outcomes. The three scenarios are defined as follows:

- Central growth – this traffic growth scenario considered the expected national economic growth trends as well as commercial and non-commercial developments. The future highway networks included in this model

[8] Uganda National Bureau of Statistics – Statistical Abstracts for 2017 and other years.
[9] Procedural Guide to Economic Road Feasibility Studies (UNRA, March 2006)

scenario consist of only those projects that UNRA currently has definitive plans for.

- Low growth – this scenario was developed in line with UNRA guidance. The traffic demand is reduced by 15% in this scenario. The UNRA guidance recommends a reduction between 10% and 25%. The suggested reduction of 15% is considered reasonable because car ownership in the country is still at very low level and higher traffic growth is likely to prevail.
- High growth – this scenario was also developed in line with UNRA guidance. Traffic demand is considered to be 20% higher than in the central case. The UNRA guidance suggests an increase of between 10% and 25%. This was considered reasonable given the expected traffic growth trends.

8.4 Analysis of Traffic Growth Trends

Historic Traffic Growth

8.4.1 The estimation of historic traffic growth rates has utilised available traffic data from the available traffic survey database. It was considered from the onset that the blanket use of national traffic growth trends as is common in many studies would not be appropriate for this study for the following reasons;

- The city nature of the study area provides for a congested network. Whilst, car ownership nationwide would tend to increase, the number of trips using the city centre network would not increase at the same rate.
- The growth of trips on the rural areas of the national road network significantly differs from the growth of trips in Kampala. As such, the differential growth has to be considered separately. Figure 8-1 shows what has been considered urban (Kampala). All other areas outside the marked area are considered semi-urban and rural.

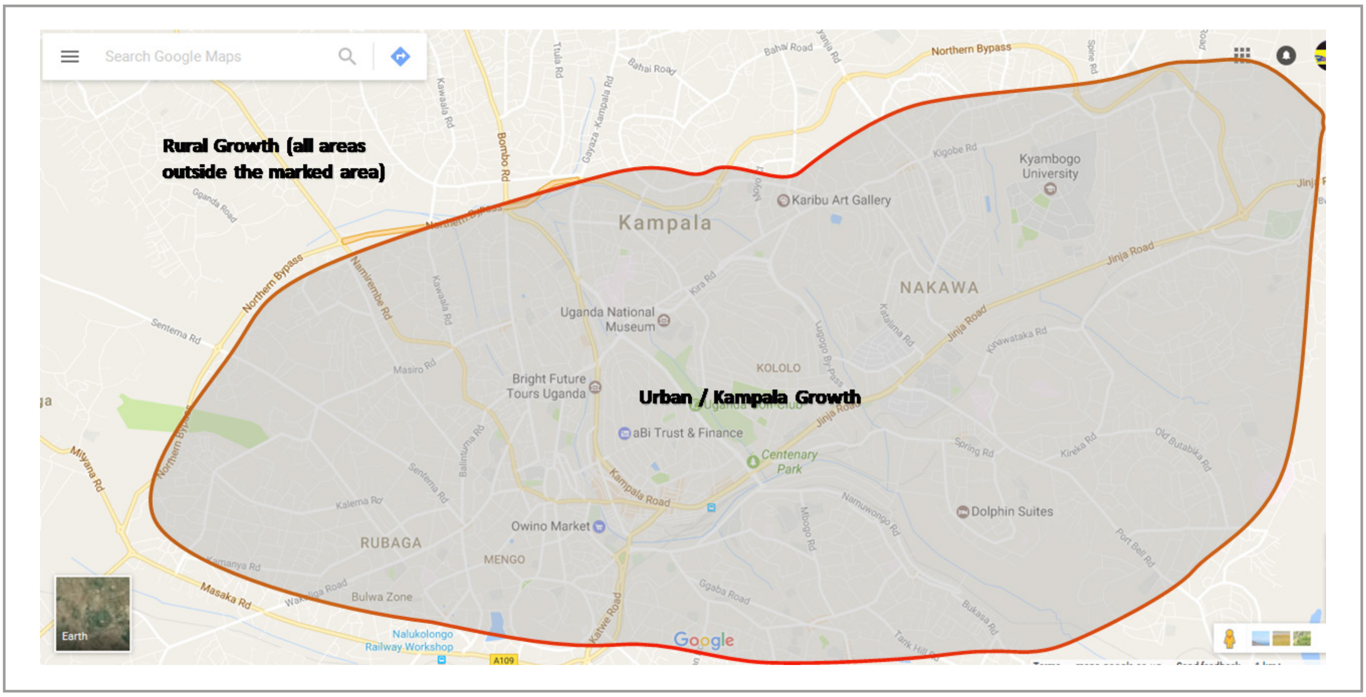


Figure 8 1: Areas to which urban/Kampala growth and rural growth apply

8.4.2 To enable a robust analysis, city traffic data collected as part of the Kampala Urban Traffic Improvement Plan (KUTIP) in 2001 was obtained and compared to other available data. The following sources have been used:

- Traffic data collected as part of this study;
- Traffic data collected as part of the Kampala Flyover Project;
- Traffic data collected as part of the Kampala – Jinja highway project in 2010 and 2017.
- Traffic data collected as part of the Kampala Southern Bypass project in 2012.
- Any other available data pertinent to the project influence area.

8.4.3 The comparison of available data allowed an analysis to establish the average growth rates between 2001 and 2017. A summary of this comparison is shown in Table 8-1 for Kampala and in Table 8-2 for semi-urban and rural sections. Only those points on the network possessing sufficiently reliable traffic data for at least two separate years have been presented in the table below. The traffic data considered is average daily traffic for vehicles only excluding motorcycles.

COMPARISON OF HISTORIC DATA FOR KAMPALA			
Name of road	**2001 Data**	**2015 Data**	**Annual Average Growth Rate**
Bombo Road – near Wandegeya Jn	30,281	34,356	0.96%
Haji Kasule Road	12,530	33,531	11.97%
Access Road near Kitgum Jn	16,857	25,894	3.83%
Station Road	12,359	10,675	-0.97%
Entebbe Road near Ebb Rd Jn	17,608	22,098	1.82%
Mukwano Road	14,838	9,206	-2.71%
Nsambya Road	19,723	18,804	-0.33%
Makerere Hill Road	5,532	15,614	13.02%
Yusuf Lule (Kitante) near Kitgum Jn	17,058	36,978	8.34%
Jinja Rd twds Kitgum Jn	32,817	36,437	0.79%
Mengo Hill Road near Clock Tower	14,459	11,683	-1.37%
Acacia Avenue	16,613	35,994	8.33%
Kafu Road	4,775	6,717	2.90%
Sezibwa Road	9,625	11,590	1.46%
Sixth Street	6,819	5,197	-1.70%
Kafumbe Mukasa Road	2583	2,635	0.14%
Average			**2.91%**

Table 8-1: Historic traffic growth trend for Kampala

8.4.4 Table 8-1 shows some significant reduction in link traffic for the years 2001 and 2015, some of which would even seem unrealistic. This is likely to be due to changes in priorities on the road network and the associated reassignment in traffic. This reassignment could have been temporary for example due to road construction works or permanent due to changes in priorities of certain links e.g. if a 2-way link is changed to one-way. Overall, the positive and negative changes in traffic flows on the network are considered sufficient to help establish the annual traffic growth rate.

8.4.5 From Table 8-1, it can be deduced that annual average traffic growth on links within Kampala from 2001 to 2015 is 2.91%.

8.4.6 When the traffic data is further broken down into the three user classes; cars, buses and trucks, the specific annual average growth rates were obtained as 2.9%, 3.04% and -0.13% respectively.

COMPARISON OF HISTORIC DATA FOR SEMI-URBAN AND RURAL LINKS			
	2001 Data	**2017 Data**	**Annual Average Growth Rate**
Average flow on links	10,875	15,405	5.95%

Table 8-2: Historic traffic growth trend for other areas

8.4.7 A similar exercise undertaken for semi-urban and rural roads deduced that annual average traffic growth 2001 to date is about 6% as shown in Table 8-2.

8.4.8 When the traffic data is further broken down into the three user classes; cars, buses and trucks, the specific annual average growth rates were obtained as 6.3%, 3.7% and 7.2% respectively.

8.5 Analysis of Population Growth Trends

8.5.1 Estimates of historic population growth were determined from population data provided by UBOS and the World Bank. Historic population growth has been analysed for national population and central region population. Table 8-3 below presents the historic growth figures for the period 2002 – 2017.

POPULATION DATA (UBOS & WB DATA)

Year	UBOS DATA				World Bank Data			
	National Popn, mn	Natnl Grth, %	Central Popn, mn	Central Grth, %	National Popn	Natnl Grth, %	Central Popn	Central Grth, %
2002	24.23	2.8%	6.58		25.72		3.15	
2003	25.09	3.5%	6.82	3.6%	26.62	3.53%	3.32	5.47%
2004	25.96	3.3%	7.07	3.5%	27.57	3.54%	3.52	5.80%
2005	26.83	3.2%	7.31	3.4%	28.54	3.54%	3.72	5.78%
2006	27.70	3.1%	7.56	3.3%	29.55	3.53%	3.93	5.77%
2007	28.56	3.0%	7.81	3.2%	30.59	3.52%	4.16	5.75%
2008	29.43	2.9%	8.05	3.1%	31.66	3.51%	4.40	5.73%
2009	30.30	2.9%	8.30	3.0%	32.77	3.50%	4.65	5.71%
2010	31.17	2.8%	8.54	2.9%	33.92	3.49%	4.91	5.70%
2011	32.03	2.7%	8.79	2.8%	35.09	3.47%	5.19	5.67%
2012	32.90	2.6%	9.04	2.7%	36.31	3.46%	5.49	5.66%
2013	33.77	2.6%	9.28	2.7%	37.55	3.43%	5.80	5.64%
2014	34.63	2.5%	9.53	2.6%	38.83	3.41%	6.12	5.61%
2015	35.52	2.5%	9.78	2.5%	40.14	3.38%	6.46	5.57%
2016	36.56	2.9%	10.09	3.1%	41.49	3.35%	6.82	5.55%
2017	37.67	3.0%	10.41	3.1%				

Source: UBOS data, SC analysis

Table 8-3: Population data National and Central Region

8.5.2 In estimating future population growth, the UBOS data was preferred because of its consistency. The national population data shows that population growth rates declined significantly between 2003 and 2015, falling from a high of 3.5% per annum to 2.5%. However, the data also shows a rebounding of these rates the last two years 2016 and 2017. UBOS does not give a reason for this unexpected increase. The average annual population growth rate over the last 10 years is 2.7%.

8.5.3 For population in central Uganda, the growth rate also shows a decline between 2003 and 2015 and a rebounding of the same in 2016 and 2017. The average annual population growth rate over the last 10 years is 2.8%.

8.5.4 In establishing future growth rates, it was considered that growth in the future will follow existing trends. The method of 3-year running average was used to estimate future rates. Using this method, it is considered that the signs of a rebound in population growth rates will average out and the growth rates would become more uniform. The predicted growth rates have been benchmarked to the NTMP[10] forecasts as shown in Table 8-4 below.

FORECAST NATIONAL AND CENTRAL REGION POPULATION GROWTH			
Forecast	**2008 - 2017**	**2018 - 2024**	**2025 - 2035**
NTMP (National)	3.8%	3.5%	-
NTMP (Central Region)	3.0%	2.75%	-
Consultant's Forecast (National)	2.7% (historic)	2.8%	2.8%
Consultant's Forecast (Central Region)	2.8% (historic)	3.0%	3.0%

Source: UBOS, World Bank data, Consultant's analysis

Table 8-4: Forecast national and central region population growth

8.5.5 The forecasts shown in Table 8-4 above are plotted in Figure 8-2 below. The Consultant forecasts that the national population would be 106.4 million, while the population in the Central region only would be 30.99 million.

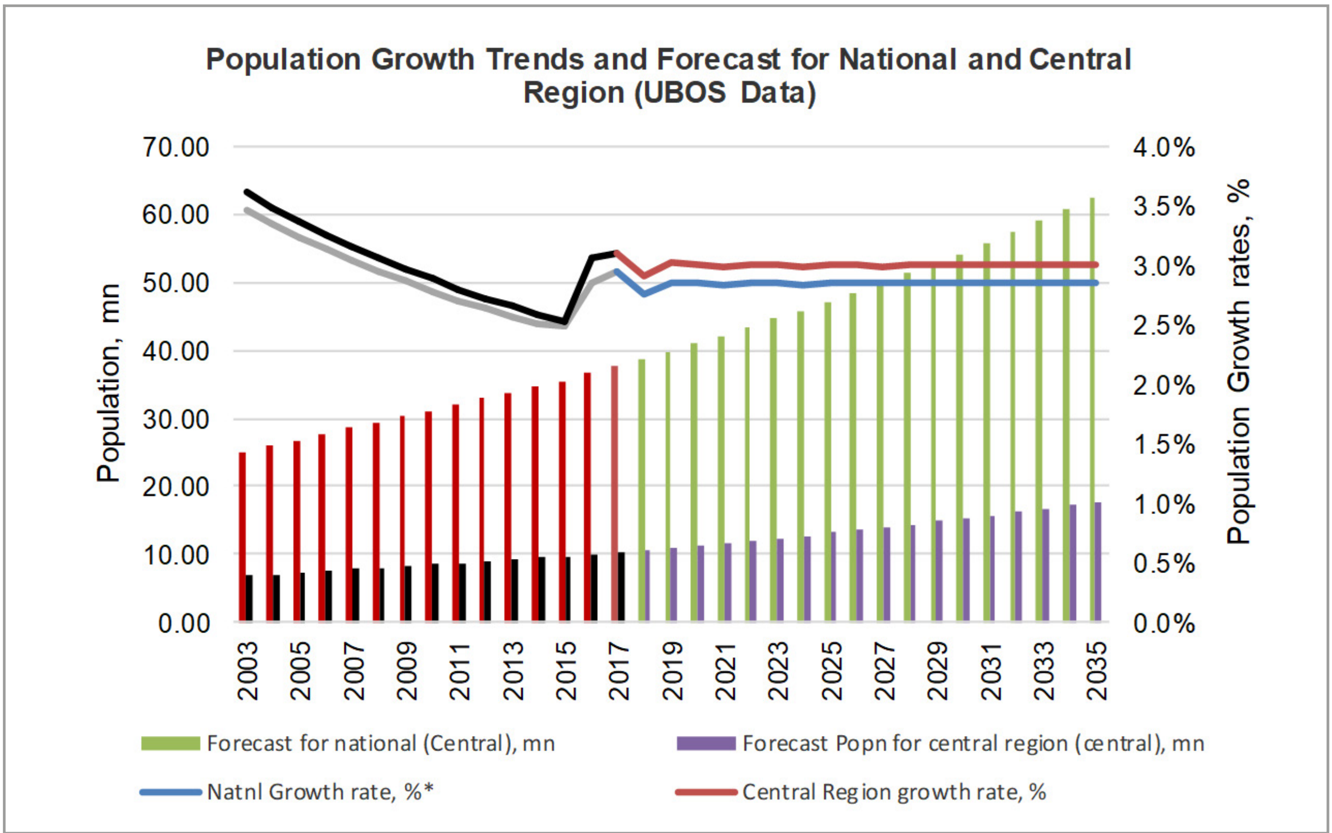


Figure 8-2: Forecast national and central region population growth (2003 – 2054)

[10] National Transport Master Plan Including a Transport Master Plan for Greater Kampala Metropolitan Areas – Abridged Version, August 2009

8.6 Analysis of Economic Growth Trends

GDP Growth

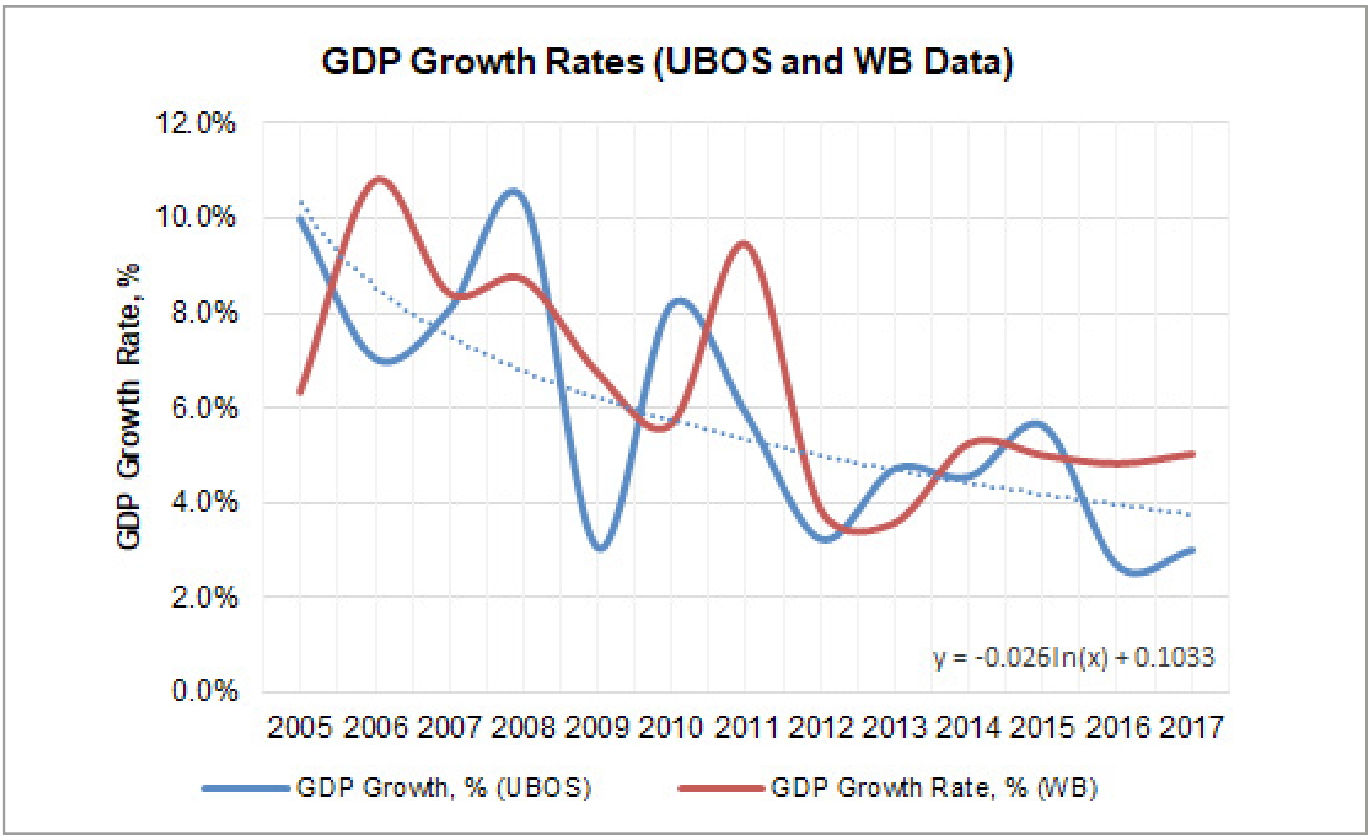
8.6.1 Historic growth in gross domestic product (GDP) has been estimated from UBOS data. Table 8-5 below presents a summary of GDP performance for the period 1998 – 2015. Prices are expressed in a constant 2009/10 prices. For comparison, growth rates derived from independent World Bank data are also included in the table.

POPULATION DATA (UBOS & WB DATA)				
Year	UBOS DATA		World Bank Data	
	GDP (UGX, Bn)	Growth Rate, %	GDP (USD, Mn)	Growth Rate, %
2004	27,478			
2005	30,226	10.0%	13,704	6.3%
2006	32,358	7.1%	15,182	10.8%
2007	34,968	8.1%	16,459	8.4%
2008	38,614	10.4%	17,892	8.7%
2009	39,792	3.1%	19,098	6.7%
2010	43,055	8.2%	20,179	5.7%
2011	45,583	5.9%	22,084	9.4%
2012	47,056	3.2%	22,935	3.9%
2013	49,276	4.7%	23,755	3.6%
2014	51,517	4.5%	25,001	5.2%
2015	54,413	5.6%	26,250	5.0%
2016	55,856	2.6%	27,516	4.8%
2017	58,711	5.1%	28,579	5.0%

Source: UBOS, World Bank data, Consultant's analysis

Table 8-5: Uganda GDP performance 2004 – 2017 (Constant 2009/10 prices)

8.6.2 Table 8-5 shows that the GDP in absolute terms over the period 2004 – 2017 has increased year on year. However, the growth rate has generally slowed since 2009 compared to the late 2000s. Figure 8-3 show a plot of the GDP growth rates.8.6.3



Source: UBOS, World Bank data, Consultant's analysis

Figure 8-3: Uganda GDP trends

8.6.3 Figure 8-3 shows that the UBOS growth rate is mirrored by the World Bank trend in general. A trendline imposed on the UBOS trend shows that the GDP growth rate has slowed gradually over the period 2004 – 2017. Both UBOS and WB trends showed a rebound in growth rates between 2013 and 2015, however, the UBOS trend shows a significant fall in 2016 but starts to pick up in 2017.

8.6.4 GDP growth has generally followed a turbulent trend over the period 2004 – 2017. This trend is expected to continue for the foreseeable future, slowly steading up to an upward trend as the economy improves in the future.

8.6.5 The Consultant's GDP forecast has considered the proposed investment plan within the core areas of the economy as presented in the NDPII. The proposed increase in investment in the agricultural sector is expected have a significant influence on GDP. The agricultural economy accounts for 25% of Uganda's GDP and generates the bulk of the export earnings. Ongoing campaigns such as the OWC/NAADS[11] scheme, and other targeted government programmes have the potential to improve the sector and help increase incomes of an estimated 75% of the population engaged in the sector. The growth in the agricultural sector would also have significant positive impacts on the agro-processing industry, boosting industrialisation.

8.6.6 The Government of Uganda has also made inroads into fighting unemployment especially among the youth, although this remains quite high – estimated at 70%. A number of programmes have been promoted in recent years, aimed at building capacity among the youth, women and disadvantaged groups. Improvements have been small and slow to achieve. Moreover, they require further investment to be sustained.

8.6.7 Other efforts such as the promotion of credit schemes, support to artisan groups, support to manufacturing including promotion of industrial parks development, etc have gained momentum over the last ten years. These are also expected to significant contribute to GDP performance.

8.6.8 Further, the efficacy of the above efforts is considered key. Many government programmes tend to achieve significantly less than targets. There are also other key risks to growth namely; weather related shocks to the country's largely rain-fed agricultural sector, current instability of the banking system, low foreign direct investment (FDI), and delays to execution of budgeted capital spending by Government. The current low business confidence,

[11] Operation Wealth Creation / National Agricultural Advisory Services (NAADS)

the ongoing strife in South Sudan and high credit costs all continue to reduce private domestic investment – which is considered to be a feasible recovery measure. If these were to improve significantly, economic growth would rebound much quicker.

8.6.9 The prospect of oil production is considered the most likely driver of GDP growth forecasts over the forecast period 2018 - 2035. The Consultant estimates that the production of oil will commence by the year 2025, however a busy construction period of oil facilities will precede this. It is therefore considered that this impact of oil production and revenues will start to positively impact the economy even before the start of oil production. Private foreign investment in the oil sector could help support the recovery of economic growth, following the issuance of exploration permits.

8.6.10 8.6.10 The above arguments for the growth of GDP notwithstanding, the ongoing national and global economic constrictions are likely to have a negative impact on growth in the medium and long term.

8.6.11 Further, experience in Africa suggests that there is potential for less than adequate management of oil resources – a crucial driver of GDP. Weak public sector management still remains as the biggest risk to economic growth. With this in mind, it is considered that realising high forecast growth in GDP as indicated in NDPII would have significant challenges.

8.6.12 Discontent within the population against the government is also fuelling a risk of social unrest in urban areas, although the nation seems well protected against any destabilisation by the large security apparatus. As a country, Uganda remains a target for terrorist attacks, that have become a significant threat to the East African region. Depending on severity, these could significantly destabilise economic growth.

8.6.13 The most critical risk to economic recovery is regional instability, particularly in South Sudan. Recent elections in Kenya posed a risk to business, and this is still considered a regional risk. The real risk of further flaring up of conflict in South Sudan, and any renewed refugee inflows that would add to the estimated 1 million South Sudanese already in the country is a downside risk to economic growth. Meanwhile, further delays in the completion of a public investment program would prevent the productivity that could be gained from enhanced infrastructure, while an acceleration in domestic arrears would have an adverse impact on private investment and worsen the credit challenge.

8.6.14 8.6.14 Given the foregoing arguments, the Consultant has considered that the economy will remain weaker than the NDPII forecast[12]. The Consultant's forecast has considered that the growth in GDP growth would average 3.4% in the period up to 2020 to reflect the slow the economic weakness and turbulence of recent years. The forecast future growth rates are shown in Table 8-6.

SUMMARY OF GDP GROWTH FORECAST

Year	NDPII Forecast*	Consultant's Forecast
2017	5.9%	3.0%
2018	6.4%	3.5% (actual)
2019	6.6%	3.6% (indicative)
2020	6.8%	5.0%
2021 – 2024	7.0%	5.5%
2025 – 2029	7.3%	6.3%
2030 – 2035	7.6%	9.9%

Source: UBOS, NDPII data, Consultant's analysis. *As given or implied from NDPII, Tables 4.1 & 5.1 (pages 101, 130)

Table 8-6: Summary of GDP forecast

[12] Second National Development Plan (NDPII) 2015/15 – 2019/20, Table 5.1, Page 130.

GDP Per Capita

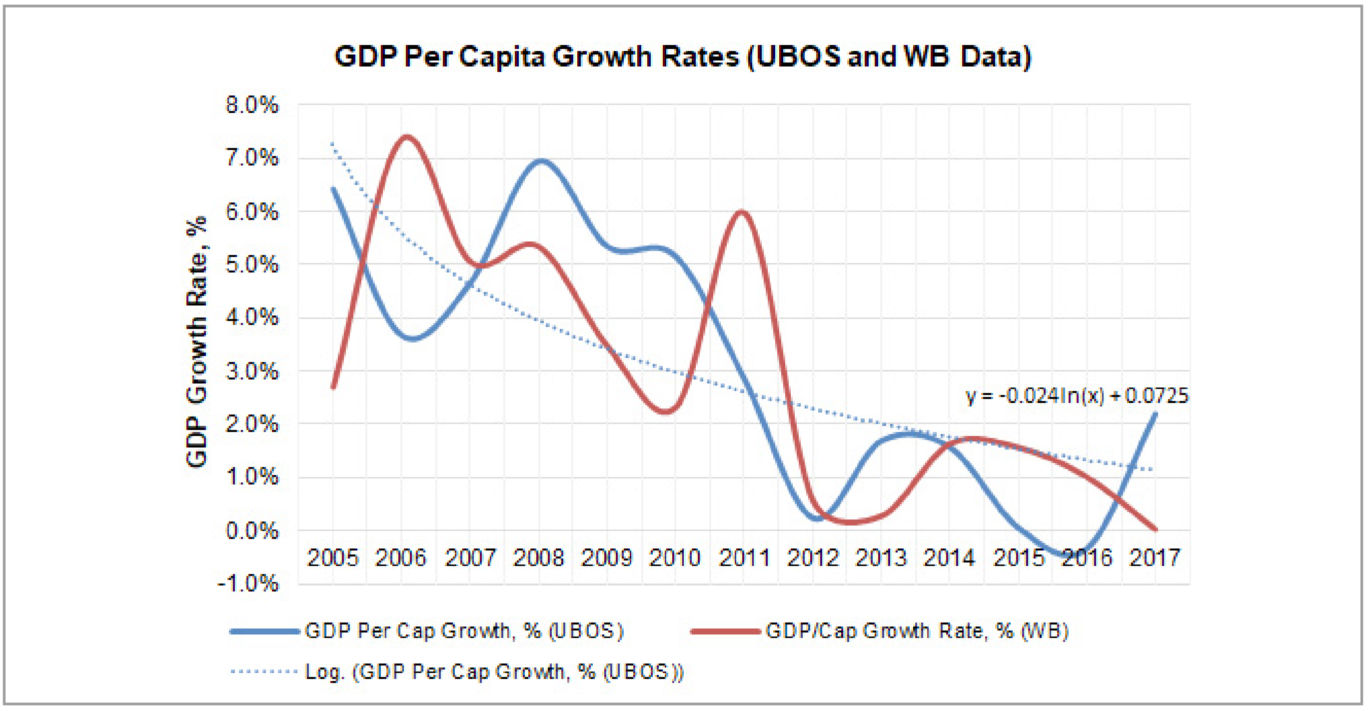
8.6.15 GDP per capita is defined simply as the GDP per person. It can also be referred to as average annual personal income. Table 8-7 below summarises the historic GDP per capita growth for the period 2004 – 2017. The also includes the per capita growth rates indicated from independent World Bank data.

UGANDA GDP PER CAPITA PERFORMANCE 2004 – 2017 (2009/10 PRICES)				
Year	UBOS DATA		World Bank Data	
	GDP / Cap (UGX)	Growth Rate, %	GDP / Cap (USD)	Growth Rate, %
2004	1,054,837		480.5	
2005	1,122,604	6.4%	495.00	3.0%
2006	1,163,855	3.7%	531.36	7.3%
2007	1,218,066	4.7%	558.19	5.0%
2008	1,302,668	6.9%	587.95	5.3%
2009	1,372,310	5.3%	608.36	3.5%
2010	1,443,052	5.2%	622.50	2.3%
2011	1,484,276	2.9%	659.63	6.0%
2012	1,487,944	0.2%	663.49	0.6%
2013	1,513,164	1.7%	665.42	0.3%
2014	1,537,000	1.6%	676.34	1.6%
2015	1,538,000	0.1%	686.98	1.6%
2016	1,533,000	-0.3%	694.01	1.0%
2017	1,566,726	2.2%	694.29	0.0%

Source: UBOS, World Bank data, SC analysis.

Table 8 7: GDP per capita growth 2004 – 2017 (2009/10 prices)

8.6.16 Table 8-5 shows that the GDP per capita in absolute terms over the period 2004 – 2017 has increased year on year. However, the growth rate has declined significantly, reducing to negative growth in 2016 according to UBOS data. Figure 8-4 shows a plot of the GDP per capita growth rates.



Source: UBOS, World Bank data, Consultant's analysis

Figure 8-4: Uganda historic GDP per capita growth rate

8.6.17 As with GDP growth, Table 8-5 above shows that the growth rate indicated by UBOS data is mirrored by World Bank data. According to UBOS data, GDP per capita growth was highest in 2008, averaging 6.9%. The decline started in 2009 and continued significantly, despite a rebound in fortunes in 2013-2014. In 2016, UBOS reported a negative growth of -0.3% although this rebounded to 2.2% in 2017.

8.6.18 With regard to forecast growth in GDP per capita, the factors underlying GDP growth that have been discussed in the last section also apply to GDP per capita. In particular, the investment as well as weather-related risks in agriculture, regional opportunities in South Sudan and Kenya and the related risks of instability, instability in the banking system and an increase in the Government's domestic debt – further worsening the personal credit challenge, opportunities in the oil sector and the proposed Government investment programme and their related risks.

8.6.19 The growth in GDP per capita is hence expected to follow a growth trend similar to that of GDP. Table 5-8 below presents the Consultant's forecast and compares it to the NDPII forecast. The Consultant's forecast is accordingly cautious and conservative when compared with the NDPII forecast. It has been considered that the growth in personal incomes will continue to be challenging over the forecast period 2018 - 2035.

SUMMARY OF GDP PER CAPITA GROWTH FORECAST		
Year	**NDPII Forecast***	**Consultant's Forecast**
2017	6.5%	2.2% (actual)
2018	4.9%	2.8% (actual)
2019	5.7%	2.4% (indicative)
2020	5.4%	2.6%
2021 – 2024	40.7%	3.0%
2025 – 2029	40.7%	4.2%
2030 – 2035	40.7%	5.2%

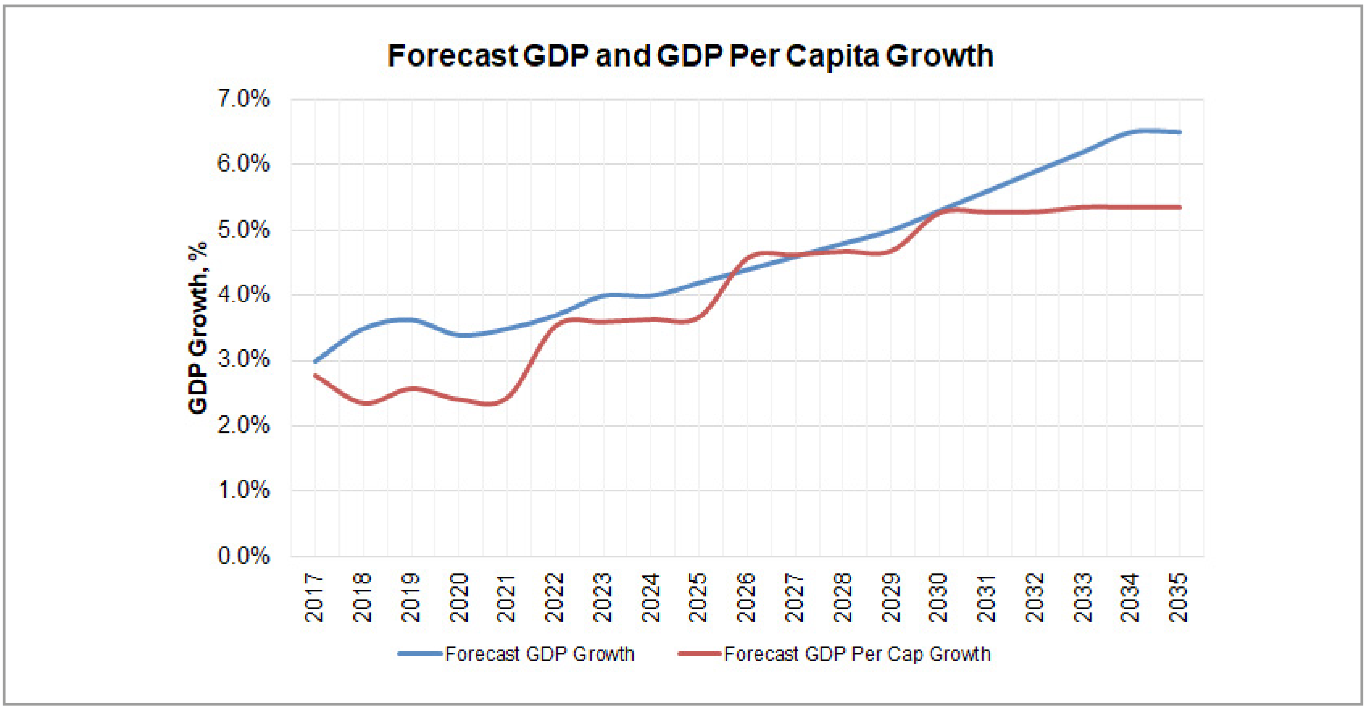
Source: UBOS, NDPII data, Consultant's analysis. *As given or implied from NDPII, Tables 4.1 & 5.1 (pages 101, 130)

Table 8-8: GDP per capita forecast

8.6.20 8.6.20 The relatively slower growth forecast between 2018 and 2020 reflects the ongoing challenges in personal income growth. The prospects of significant improvement in the economy as a result of oil production and improvement in policy delivery by Government is the major driver of improved growth in personal incomes beyond 2020. Nonetheless, the Consultant's deems the NDPII forecast growth difficult to achieve, given the past and recent trends in Government performance. The NDPII Vision 2040 forecast for per capita income is USD9,500 in nominal prices. This would imply an average growth rate of 40.7% for the period 2020 – 2040.

Summary Economic Growth Forecast

8.6.21 Figure 8-5 below summarises the GDP and GDP Per Capita growth forecasts.



Source: Consultant's analysis

Figure 8-5: Uganda GDP and GDP per capita growth rate

8.7 Elasticity Factors

8.7.1 Traffic growth rates were established in respect of the three user classes; cars, buses and trucks. Firstly, elasticity factors were estimated to establish the relationship between traffic demand and demographic and economic trends. The largest elasticity factors were then chosen and together with the relevant growth forecasts, were used to determine the future traffic growth rates.

8.7.2 The demand for transport is usually related to population and economic activity. This relationship is also usually positively correlated i.e. increase in economic activity or population leads to an increase in the demand for travel. The relationship is defined by the elasticity econometric model of the following form.

$$Log_e(Q) = A + E*Log_e(Y)$$

Where:

- **Q** is a measure of transport demand such as number of passengers or number of cars. Q is also known as the dependent variable.
- **Y** is a measure of population or economic activity and is known as the independent variable.
- The factor **E** is the elasticity of demand for travel with respect to the economic activity or population factor **Y**, and **A** is a constant.

8.7.3 Generally, elasticity is measured as percentage change in dependent variables in response to percentage change in independent variables. For example, an elasticity of 0.5 implies a change of 5% in transport demand in response to a 10% change in population or economic activity.

8.7.4 From the analysis of traffic growth, population, GDP and GDP per capita, the average percentage change in each of the variables was determined and elasticity factors then determined. A differentiation was made between traffic growth on the Kampala network and traffic on the remainder of the model network. Tables 5-9 and 5-10 below summarise the elasticity factors for Kampala and other traffic respectively.

ELASTICITY FACTORS FOR KAMPALA TRAFFIC				
	Population	**GDP**	**GDP Per Capita**	**Fuel Consumption**
UC1 – Cars/4WD	0.79	0.50	2.42	0.32
UC2 - Buses	0.83	0.53	2.54	0.33
UC3 - Trucks	0.00	0.00	0.01	0.00

Table 8-9: Summary of elasticity factors – Kampala traffic

ELASTICITY FACTORS FOR SEMI-URBAN AND RURAL TRAFFIC				
	Population	**GDP**	**GDP Per Capita**	**Fuel Consumption**
UC1 – Cars/4WD	1.91	1.22	5.86	0.76
UC2 - Buses	1.14	0.73	3.50	0.46
UC3 - Trucks	1.95	1.25	6.00	0.78

Table 8-10: Summary of elasticity factors – semi-urban and rural traffic

8.7.5 From Tables 8-9 and 8-10 above, elasticity factors to be used in estimating traffic growth rates for each of the individual vehicle types were established. Generally, the elasticity factor corresponding to the highest correlation factors was chosen. The correlation factor is a measure of how well traffic demand is aligned to the independent variable (population, GDP, etc). A summary of the correlation ratios is provided in Table 8-11 below.

CORRELATION RATIOS FOR SEMI-URBAN AND RURAL TRAFFIC				
	Population	**GDP**	**GDP Per Capita**	**Fuel Consumption**
UC1 – Cars/4WD	0.989	0.995	0.995	0.957
UC2 - Buses	0.958	0.967	0.986	0.903*
UC3 - Trucks	0.941*	0.957	0.978	0.894*

*relationship not strong enough.

Table 8-11: Summary of correlation ratios

8.7.6 Table 5-11 shows that traffic growth is positively and strongly correlated to population, GDP, GDP per capita and fuel consumption. From an academic standpoint, the strongest correlations are those that have ratios above 0.95. As such, all elasticities can be used as a basis for future relationships except those highlighted in red in Table 5-11.

8.7.7 Once the elasticity factors are established from the table above, further consideration is given of their reasonableness. In essence, the elasticity factor measures the increase in traffic by each unit increase in population or economic activity. As such, it is important to ensure that this factor is reasonable and in accordance with prevailing conditions on the road. From an examination of the elasticities and their corresponding factors, the following elasticity factors were chosen to determine future traffic growth:

For rural traffic:

- User Class 1 (cars) – 1.91 (population) i.e. a 10% change in population causes a 19.1% change in car traffic.
- User Class 2 (buses) – 1.14 (population) i.e. a 10% change in population causes a 11.4% change in bus traffic.
- User Class 3 (trucks) – 1.25 (GDP) i.e. a 10% change in GDP causes a 12.5% change in truck traffic.

Similarly, for Kampala traffic:

- User Class 1 (cars) – 0.79 (population);
- User Class 2 (buses) – 0.83 (population); and
- User Class 3 (trucks) – 0.01 (GDP per capita).

8.8 Traffic Growth Factors

8.8.1 Table 8-12 summarises the traffic growth factors.

FORECAST GROWTH RATES BY VEHICLE TYPE			
Vehicle Type	**Forecast Average Growth Rates, %**		
	2018 - 2021	**2022 - 2025**	**2026 – 2035**
UC1 - Cars	2.4	2.3	2.2
UC2 - Buses	2.6	2.4	2.2
UC3 - Trucks	0.1	0.1	0.1
UC1 - Cars	5.4	5.4	3.0
UC2 - Buses	3.2	3.2	3.0
UC3 - Trucks	4.6	6.2	3.0

Source: SC analysis. *capped at 3.0 for the period 2030 - 2035

Table 8-12: Average forecast growth rates by vehicle type

8.8.2 The Procedural Guide to Road Economic Feasibility Studies advises consultants to develop forecast for the first 10 years of the evaluation period. For the remainder of the years, the Guide advises that growth rates should be capped at 3.0% for all vehicle types.

8.8.3 The traffic growth rates presented in Table 8-12 above, forecast trip matrices were developed. These are referred to as the Do Minimum forecast matrices because they do not take consideration of the reductions in passenger vehicles when Tondeka is implemented. The matrix totals are below and the effective traffic growth rates.

FORECAST MATRIX TOTALS				
Vehicle Class	**2017**	**2021**	**2025**	**2035**
AM Period				
UC1 - Cars	25,439	28,165	31,886	45,318
UC2 - Buses	8,983	9,998	10,952	14,719
UC3 - Trucks	2,771	3,318	3,302	4,996
PM Period				
UC1 - Cars	25,536	28,264	31,943	44,760
UC2 - Buses	7,856	8,733	9,556	12,910
UC3 - Trucks	3,482	3,901	4,091	6,058

Source: Consultant's analysis

Table 8-13: Forecast trip matrix totals (Do Minimum)

8.9 Passenger Demand and Preliminary Bus Fleet Forecast

8.9.1 From the above trip totals the effective growth rates per annum were obtained. These were then used to make forecasts for passenger demand per route. The analysis enables a comparison of the Consultant's passenger forecast and the Tondeka project forecasts for the opening year. Table 8-14 below presents the comparison.

8.9.2 In Table 8-14, the passenger demand estimated by the Consultant is the maximum passenger demand at the sections where the surveys were conducted. The corresponding Tondeka forecasts are the estimates for those sections.

FORECAST PASSENGER DEMAND

	Surveyed Route	Consultant's 2021 Forecast (Opening Year)	Tondeka Opening Year Forecast (2020)	Consultant's Forecast 2025	Tondeka's Forecast 2025
1	Salama Road	52,692	51,840	57,720	77,979
2	Makindye Rd	28,840	103,680	31,592	42,681
3	Entebbe Rd	228,840	97,200	250,675	338,658
4	Masaka Rd	63,164	77,760	69,191	93,476
5	Mityana Rd	64,258	77,760	70,389	95,094
6	Northern Bypass	25,044	77,760	27,434	37,063
7	Hoima Rd	99,902	69,120	109,434	147,844
8	Bombo Rd	73,187	129,600	80,171	108,309
9	Gayaza Rd	69,612	64,800	76,255	103,019
10	Kisasi-Ntinda	38,309	89,820	41,965	56,693
11	Nalya Rd	8,325	19,519	9,120	12,320
12	Jinja Rd	112,121	77,760	122,819	165,927
13	Old Port Bell Rd	66,129	77,760	72,439	97,865
14	Nsambya/ Gaba Rd	108,052	263,520	118,363	159,906
15	Ntinda-Kira	19,696	46,180	21,575	29,148
		1,058,172	1,324,079	1,159,142	1,565,981

Source: Consultant's analysis

Table 8-14: Forecast passenger demand

8.9.3 Table 8-14 shows that the forecasts for the opening year for the Consultant and Tondeka project are within 25% of each other. However, there are some large differences, notably on Entebbe Road, Nsambya/Gaba Road, Makindye Road, and others. Except for Entebbe Road, the Tondeka forecasts seem higher.

8.9.4 In the Tondeka Project Feasibility Report, Section 3.5.2 refers to a total demand of close over 4.5 million. The conclusion drawn from this figure is that "it will take the promoters a considerably short period of time to break-even for this investment. Similarly, the Government of Uganda won't find challenges to service the loan for the buses." This is very misleading because the quoted figure includes multiple counting of passengers. For example, Jinja Road is 6 sections and each section has a passenger demand which contributes to the overall estimated total. However, there would be many passengers that traverse multiple sections of the route but would have paid one fare and not multiple fares that would contribute to the level of profitability implied.

8.9.5 The above error could have contributed to the high estimation of the bus fleet. From the Consultant's hour by hour forecast of passengers, the required bus fleet was estimated for the forecast years 2021, 2025 and 2035. Table 8-15 summarises the estimates.

FORECAST BUS FLEET SIZE										
	Surveyed Route	Maximum Passengers in busiest Hour			Hypothetical Bus Numbers			Realistic Bus Numbers Per Route / Hour (Both Directions		
		Max Hourly Pax 2021	Max Hourly Pax 2025	Max Hourly Pax 2035	Est. Buses 2021	Est. Buses 2025	Est. Buses 2035	No. Bus 2021	No. Bus 2025	Est. Buses 2035
1	**Salama Road**	**4,748**	5,201	7,027	40	43	59	40	40	59
2	**Makindye Rd**	**2,361**	2,586	3,494	20	22	29	20	22	29
3	**Entebbe Rd**	**17,881**	19,587	26,462	149	163	221	60	60	60
4	**Masaka Rd**	**4,336**	4,749	6,416	36	40	53	36	40	53
5	**Mityana Rd**	**4,941**	5,413	7,312	41	45	61	40	40	60
6	**Northern Bypass**	**1,831**	2,006	2,710	15	17	23	15	17	23
7	**Hoima Rd**	**7,912**	8,666	11,708	66	72	98	40	40	60
8	**Bombo Rd**	**5,329**	5,838	7,886	44	49	66	40	40	60
9	**Gayaza Rd**	**4,826**	5,286	7,142	40	44	60	40	40	60
10	**Kisasi-Ntinda**	**2,437**	2,670	3,607	20	22	30	20	22	30
11	**Nalya Rd**	**593**	650	878	5	5	7	5	5	7
12	**Jinja Rd**	**7,538**	8,257	11,156	63	69	93	40	40	60
13	**Old Port Bell Rd**	**6,120**	6,704	9,056	51	56	75	40	40	60
14	**Nsambya/ Gaba**	**8,884**	9,732	13,147	74	81	110	60	60	60
15	**Ntinda-Kira**	**1,512**	1,656	2,237	13	14	19	13	14	19
					677	742	1002	508	519	699

Source: Consultant's analysis

Table 8-15: Preliminary forecast of bus fleet size

8.9.6 The estimation of bus fleet on a specific route considers the maximum passenger volume at any section on the route. For example, on Kampala – Jinja Road, the estimation is based on the maximum passenger volume between Banda and Kyambogo.

8.9.7 The maximum passenger volume is converted into a hypothetical number of buses using a load rate of 120 passengers per bus. This represents 133% of the official bus capacity. Tondeka has suggested that they could load the bus up to 140% of the bus capacity. The average journey time to Kampala from all the routes is 1 hour. So in 1 hour each bus is expected to make only trip (inbound or outbound).

8.9.8 The hypothetical number of buses is then analysed to ensure its sensible. For busy routes such as Entebbe Road, the minimum headway between any two buses has been considered at 2 minutes i.e. a bus arrives at a particular stop every two minutes. For less busy routes, the minimum headway is set at 3 minutes. These headways may not be realised because of congestion in the peak hours, however, assuming non congested conditions, they can be realised. The maximum number of buses per route for 2 minutes and 3 minutes headways are 60 and 40 respectively.

8.9.9 For the forecast year 2035, a minimum headway of 2 minutes has been considered for all routes due to increased passenger volumes.

8.9.10 From the above considerations, the bus fleet sizes to enable servicing of the Tondeka are 508, 519 and 699 buses. Assuming a fleet availability rate (i.e. the proportion of the total fleet available for use) of 90% (Tondeka has assumed 95% availability), the fleet sizes required are 565, 577 and 777 buses.

8.9.11 It should be noted that this forecast is preliminary based on desirable headways. Analysis from the traffic model would be able to confirm the actual journey times and hence how many buses can be operated.

8.9.12 Based on the above, it can be argued that the initial requirement of 980 buses that Tondeka intends to secure is significantly higher than what is likely to be needed to service the routes that have been identified. However, for purposes of our traffic impact analysis, the total 980 buses has been considered, with a fleet availability rate of 90%.

8.9.13 The maximum number of buses that can be operated is confirmed through analysis from the traffic model in Section 9.9.

8.10 Reduction Matatu Traffic Due to the Tondeka Project

8.10.1 The proposed Tondeka Project is expected to be in operation in 2021. The routes to be serviced are indicated in Table 5-1.

8.10.2 An analysis was undertaken from the OD data to understand the likely matatu volumes and destinations that could be removed if the Tondeka project is implemented. Table 8-13 below presents the analysis.

8.10.3 The assumed abstraction rates for matatus had to be made external to the traffic model. The data available could only allow the building of a highway model. As such, public transport demand computations can only be made externally.

8.10.4 The potential abstraction or removal of matatus is expected to depend on the significant fare reduction proposed by Tondeka and the higher quality environment. It is noted that the improved environment inside the bus would also be quickly negated if the proposed 120% - 140% loading of the bus is used. It is not likely that the Tondeka operation would lead to any time savings due to the lack of bus segregation or priority measures.

8.10.5 Reduction in waiting time is also expected to be minimal again due to lack of bus lanes, and the high number of matatus already plying the proposed Tondeka routes.

8.10.6 Because of the above reasons, it is not expected that Tondeka bus operations can realistically completely replace the matatu operations. Table 8-16 hence proposes the low, central and high abstraction rates to provide a range of results. These were established by professional judgement and experience in transport planning.

8.10.7 The full impact of the Tondeka project is expected to occur in the model year 2025. In 2021 when the project starts, the impact on the matatu is assumed to be half the full impact as Tondeka warms into its bus operations.

	Matatu OD analysis			Assumed Matatu Abstraction Rates			Reduction in Matatus (FULL IMPACT) - 2025			Reduction in Matatus (INITIAL IMPACT) - 2020 - 2025		
	Total OD Entries	**Total Matatus to end of route**	**Percent**	Low	Cen	High	Low	Cen	High	Low	Cen	High
Eastern Routes												
Kampala- Jinja Road (up to Mukono)	519	426	82.1%	50%	65%	85%	41%	53%	70%	21%	27%	35%
Kampala- Luzira Road (Up to Kirombe)	139	139	100.0%	60%	75%	90%	60%	75%	90%	30%	38%	45%
Kampala – Ntinda Road (Up to Namugongo)	49	49	100.0%	60%	75%	90%	60%	75%	90%	30%	38%	45%
Western Routes												
Kampala- Masaka Road (Up to Nsangi)	249	190	76.3%	50%	65%	85%	38%	50%	65%	19%	25%	32%
Kampala- Mityana Road (Up to Buloba)	252	188	74.6%	50%	65%	85%	37%	48%	63%	19%	24%	32%
Kampala- Hoima (Up to Wakiso)	444	385	86.7%	50%	65%	85%	43%	56%	74%	22%	28%	37%
Northern Routes												
Kampala- Gayaza Road (Up to Gayaza)	230	227	98.7%	60%	75%	90%	59%	74%	89%	30%	37%	44%
Kampala- Bombo Road (Up to Kawanda)	122	113	92.6%	60%	75%	90%	56%	69%	83%	28%	35%	42%
Kampala- Northern Bypass Road	100	100	100.0%	60%	75%	90%	60%	75%	90%	30%	38%	45%
Southern Routes												
Kampala- Entebbe Road	100	100	100.0%	60%	75%	90%	60%	75%	90%	30%	38%	45%
Kampala- Makindye (Up Makindye ku Gombola)	100	100	100.0%	60%	75%	90%	60%	75%	90%	30%	38%	45%
Kampala- Nsambya Road (Up to Lukuli)	100	100	100.0%	60%	75%	90%	60%	75%	90%	30%	38%	45%
Kampala – Gaba Road (Up to Gaba)	100	100	100.0%	60%	75%	90%	60%	75%	90%	30%	38%	45%
Kampala-Salaama Road (Up to Munyonyo)	100	100	100.0%	60%	75%	90%	60%	75%	90%	30%	38%	45%
Kampala-Kibuli Road (Up to Namuwongo)	100	100	100.0%	60%	75%	90%	60%	75%	90%	30%	38%	45%
				57%	**72%**	**89%**	**54%**	**68%**	**84%**	**27%**	**34%**	**42%**

Table 8-16: Estimated matatu abstraction rates

8.10.8 Table 8-13 shows that the full impact of Tondeka would lead to the removal of 54%, 68% and 84% of the matatus in the low, central and high scenarios. For simplicity, the rates used for modelling were 50%, 65% and 80% respectively.

8.10.9 Removal of the matatus is not the end however. The Tondeka bus is a larger vehicle that the matatu, having a passenger car unit (pcu) equivalent of 2.5 compared to the matatu factor of 1.3. That is, every Tondeka bus is equivalent to two matatu vehicles. This effect to traffic volumes on the network has to be considered.

8.10.10 After creating the future demand matrices using the traffic growth rates presented in Table 8-12, these matrices were treated for the removal of matatus and additional of Tondeka buses.

8.10.11 Tables 8-17 to 8-19 present the estimation of the effective reductions in passenger vehicles (represented by UC2 in the model) after considering the PCU impact of the Tondeka bus.

2021 Matrix Totals		Total PCU	Abstract Rate	Matatus Abstracted	Added Tondeka Buses	Tondeka Bus PCU	Final Total PCU	New Matrix Factor	Effective Reduction
Low	UC2 AM	9998	25%	2,500	882	2205	9,704	0.97	2.9%
Central	UC2 AM	9998	33%	3,249	882	2205	8,954	0.90	10.4%
High	UC2 AM	9998	40%	3,999	882	2205	8,204	0.82	17.9%
Low	UC2 PM	8733	25%	2,183	882	2205	8,755	1.00	-0.2%
Central	UC2 PM	8733	33%	2,838	882	2205	8,100	0.93	7.3%
High	UC2 PM	8733	40%	3,493	882	2205	7,445	0.85	14.8%
						Average Reduction		**Low**	**1.3%**
								Central	**8.8%**
								High	**16.3%**

Source: Consultant's analysis

Table 8-17: Estimated net reduction in passenger traffic (in PCU) with Tondeka in operation (Opening year 2021)

2025 Matrix Totals		Total PCU	Abstract Rate	Matatus Abstracted	Added Tondeka Buses	Tondeka Bus PCU	Final Total PCU	New Matrix Factor	Effective Reduction
Low	UC2 AM	10952	50%	5,476	882	2205	7,681	0.70	29.9%
Cen	UC2 AM	10952	65%	7,119	882	2205	6,038	0.55	44.9%
High	UC2 AM	10952	80%	8,762	882	2205	4,395	0.40	59.9%
Low	UC2 PM	9556	50%	4,778	882	2205	6,983	0.73	26.9%
Cen	UC2 PM	9556	65%	6,211	882	2205	5,550	0.58	41.9%
High	UC2 PM	9556	80%	7,645	882	2205	4,116	0.43	56.9%
						Average Reduction		**Low**	**28.4%**
								Central	**43.4%**
								High	**58.4%**

Source: Consultant's analysis

Table 8-18: Estimated net reduction in passenger traffic (in PCU) with Tondeka in operation (2025)

2035 Matrix Totals		Total PCU	Abstract Rate	Matatus Abstracted	Added Tondeka Buses	Tondeka Bus PCU	Final Total PCU	New Matrix Factor	Effective Reduction
Low	UC2 AM	14719	75%	11,039	1350	3375	7,055	0.48	52.1%
Cen	UC2 AM	14719	85%	12,511	1350	3375	5,583	0.38	62.1%
High	UC2 AM	14719	95%	13,983	1350	3375	4,111	0.28	72.1%
Low	UC2 PM	12910	75%	9,683	1350	3375	6,603	0.51	48.9%
Cen	UC2 PM	12910	85%	10,974	1350	3375	5,312	0.41	58.9%
High	UC2 PM	12910	95%	12,265	1350	3375	4,021	0.31	68.9%
						Average Reduction		**Low**	**50.5%**
								Central	**60.5%**
								High	**70.5%**

Source: Consultant's analysis

Table 8-19: Estimated net reduction in passenger traffic (in PCU) with Tondeka in operation (2035)

8.10.12 8.10.12 From Tables 8-17, 8-18 and 8-19, it is clear that Tondeka bus operations will not lead to sweeping reductions in matatu numbers. This is because of the following considerations:

- The Tondeka routes depend on other local routes where matatus will continue to operate.
- The matatus are likely to significantly reduce their fares in response to Tondeka operations.
- The unlikely reduction in journey time for Tondeka would not lead to as much mode shift as it could have.

8.10.13 In the opening year, the net reduction in passenger vehicles is in the range 1% - 16%, in 2025, the range is 28% - 58%, and for 2035, the range is 50% to 70%.

Development of Forecast Matrices with Tondeka

The net reduction in passenger vehicles above were then used to factor the Do Minimum (without Tondeka) matrices to obtain the "With Tondeka" matrices for three scenarios; low, central and high abstraction rates. Table 8-19 compares the matrix totals for UC2 (bus) for the years 2021, 2025 and 2035, for the "without Tondeka" and "with Tondeka".

COMPARISON OF MATRIX TOTALS: WITHOUT AND WITH TONDEKA						
	AM			**PM**		
Scenario - Abstraction Rate	**2021**	**2025**	**2035**	**2021**	**2025**	**2035**
Without Tondeka	9,998	10,951	14,719	8,733	9,556	12,910
With Tondeka - Low	9,498	7,666	7,065	8,558	6,976	6,584
With Tondeka - Central	8,798	6,023	5,593	7,947	5,542	5,293
With Tondeka - High	7,998	4,380	4,121	7,248	4,109	4,002

Source: Consultant's analysis

Table 8-20: Comparison of matrix totals for without and with Tondeka for AM and PM

8.11 The Future Road Network

8.11.1 As with the future demand trip matrices, it is expected that the road network would change in the future. Future highway network was developed for each of the forecast years. The future road network was derived from the calibrated base year highway network for each of the two model periods. To these future networks, the forecast demand would then be assigned.

8.11.2 A number of highway schemes are currently planned by UNRA and other planning bodies for implementation in the forecast period within the Kampala Metropolitan Area. These networks have potential to influence the assignment of traffic in the GKMA because they affect the supply of road space. The implementation of these networks is independent of the proposed project i.e. they are likely to be implemented whether or not the project is implemented.

8.11.3 As with the trip matrices, the decision as to which highway schemes were allocated to which forecast year is based on the information collected from the relevant planning bodies. Table 8-21 below summarises the highway schemes that were considered and the forecast years to which they were added.

SUMMARY OF HIGHWAY SCHEMES INCLUDED IN DO MINIMUM NETWORKS			
	Scheme Description	**Planning Authority**	**Assumed Opening Year**
Schemes added to 2021 forecast year			
1	Kampala – Entebbe Expressway running from Busega Roundabout to Entebbe including a spur to Munyonyo	UNRA	2018
2	Kampala Northern Bypass widening – widening the existing road to a 2-lane dual carriageway	UNRA	2020
3	Second Kampala Institutional Infrastructure Development Project (KIIDP), Phase 2 – including Acacia Avenue widening and signalisation, Nakawa-Ntinda Road, Lukuli Road	KCCA	2020
Schemes added to 2025 forecast year			
	All schemes added to 2021		
4	Kampala Flyover Project (Phase 1 and 2)	UNRA	2024
Schemes added to 2035 forecast year			
	All schemes added to 2025		
5	Kampala – Jinja Expressway, Phase I (Kampala to Namataba)	UNRA	2026
6	Kibuye–Busega–Mpigi Expressway	UNRA	2026
7	Kampala–Bombo-Expressway	UNRA	2026
8	Kampala Outer Beltway Project	UNRA	2027
9	Kampala – Jinja Expressway, including Phase 2 (Namataba to Jinja)	UNRA	2028
10	Kampala – Busunju Expressway	UNRA	2030

Source: Consultant's analysis

Table 8-21: Summary of highway schemes included in Do Minimum networks

9.0 PROJECT ASSESSMENT RESULTS

9.1 Introduction

9.1.1 The 2021, 2025 and 2035 forecast matrices with and without Tondeka were assigned to the respective model networks for the various forecast years. The assignments were undertaken for the central case, low growth and high growth scenarios. In this section, the results for the central growth modelling are presented – this is the most likely scenario.

9.1.2 The presentation of the results of the traffic modelling is set out in response to the specific objectives listed in Section 1.3 – Specific Duties of the Assignment. These are listed again below.

- Become and remain familiar with the BRT concept proposal both strategically and technically.
- Review the service plan earlier prepared and update to include GESI considerations. Incorporate BRT Service Plan review and update according to international best practice in BRT service planning.
- Review the previous BRT Service Plan and familiarise with its architecture and conceptual development. Identify areas of concern and prepare a matrix to show areas that need to be updated.
- In conjunction with the GESI specialist, identify the GESI gaps with the previous Service Plan and draw a strategy for incorporating GESI in the Service Plan review and updates, along with climate change considerations to provide for robust and resilient infrastructure solutions.
- Capture as much of the existing commuter taxis demand currently using the corridor as possible and analyse to draw trends and conclusions on the demand and facility locations; estimate the political and economic impact of job displacement of existing transport suppliers and evaluate pragmatic trade-offs that may be considered in this light in order to mitigate political resistance.
- Assess and identify scenarios that minimises land acquisition, reduces the capital costs needed for transfer stations, minimises travel time for passengers, and attracts the most passengers.
- Undertake analysis and modelling to identify optimal time savings for the most time for all the transit passengers in the corridor, both those on the BRT system and those that cannot use the BRT system.
- Undertake assessment and identify the optimal BRT service plan that carries the most passengers per bus and analyse the associated bus/fleet capacity to attain an optimal outcome. For example, studies to inform route selection and design taking into consideration the transport requirements and business and safety needs of women and girls, and the marginalised; analysis to ensure that selection is not only determined on the basis of the highest economic return routes, but also on the basis of the importance of ensuring that BRT serves the needs of women, girls and the marginalised.
- Identify through assessment and analysis the sections that have the highest rate of return of any capital investment in the corridor.
- Be aware of external stakeholder needs and demands, filtering possible responses through regular technical team meetings, in order to ensure corporate consistency in any such engagement.
- Any other duties relevant to this job description as may be considered by the expert or Infrastructure Lead.

9.2 Specific Duty (i) – Understanding the Concept Proposal

9.2.1 The understanding of the Tondeka concept has been presented in Chapter 4 of this report. It has been discussed drawing from publicly available information. As such, certain aspects of the projects are still not clear.

9.3 Specific Duty (ii) - Review the Service Plan and Update it with GESI Considerations

9.3.1 GESI (Gender Equality and Social Inclusion) is composed of two parts:

- **Gender Equality** is about transforming the distribution of opportunities, choices and resources available to women and girls, and men so that they have equal power to shape their lives.
- **Social Inclusion** refers to the process of improving the conditions of disadvantaged individuals and groups - such as migrants, indigenous people and other minorities.

9.3.2 From a traffic modelling perspective, the best opportunity to include GESI considerations in the project design occurs at route selection. The Tondeka project has proposed significantly low passenger fares. This level of pricing is likely to be more affordable for sections of the population who cannot afford the existing public transport costs.

9.3.3 The key consideration is therefore the level of connectivity of the various areas of GKMA to the Tondeka routes. It should be noted that the identified bus routes have been established by the Consultant from various sources of information. The set of routes is therefore not confirmed by Tondeka project. Particular emphasis is placed on areas with the poorest people. It is in these areas that GESI considerations are also most important.

9.3.4 Poverty headcount data by sub county in the GKMA for 2015 was obtained from UBOS. The poverty headcount is a measure of the percentage of the total population in each sub county that is below the poverty line. That is people who cannot afford to acquire the basic daily needs. Table 9-1 presents the poverty data for the GKMA.

COMPARISON OF MATRIX TOTALS: WITHOUT AND WITH TONDEKA			
Sub County	**Poverty Headcount, %**	**Sub County**	**Poverty Headcount, %**
Wakiso		Ssisa	9.8%
Wakiso Town Council	9.8%	Nabweru	3.5%
Nansana	5.8%	**Mukono**	
Nangabo	6.4%	Goma	27%
Gombe	12.5%	Mukono TC	10%
Nsangi	6.6%	Nama	16.6%
Wakiso Sub County	10.6%	**Kampala**	
Kira	3.0%	Central Division	2.5%
Katabi	4.7%	Nakawa Division	2.6%
Makindye Sabagabo	3.0%	Makindye Division	2.6%
Entebbe Div A	3.0%	Kawempe Division	2.6%
Entebbe Div B	3.0%	Rubaga Division	2.6%

Source: Consultant's analysis

Table 9-1: Poverty headcount data for GKMA

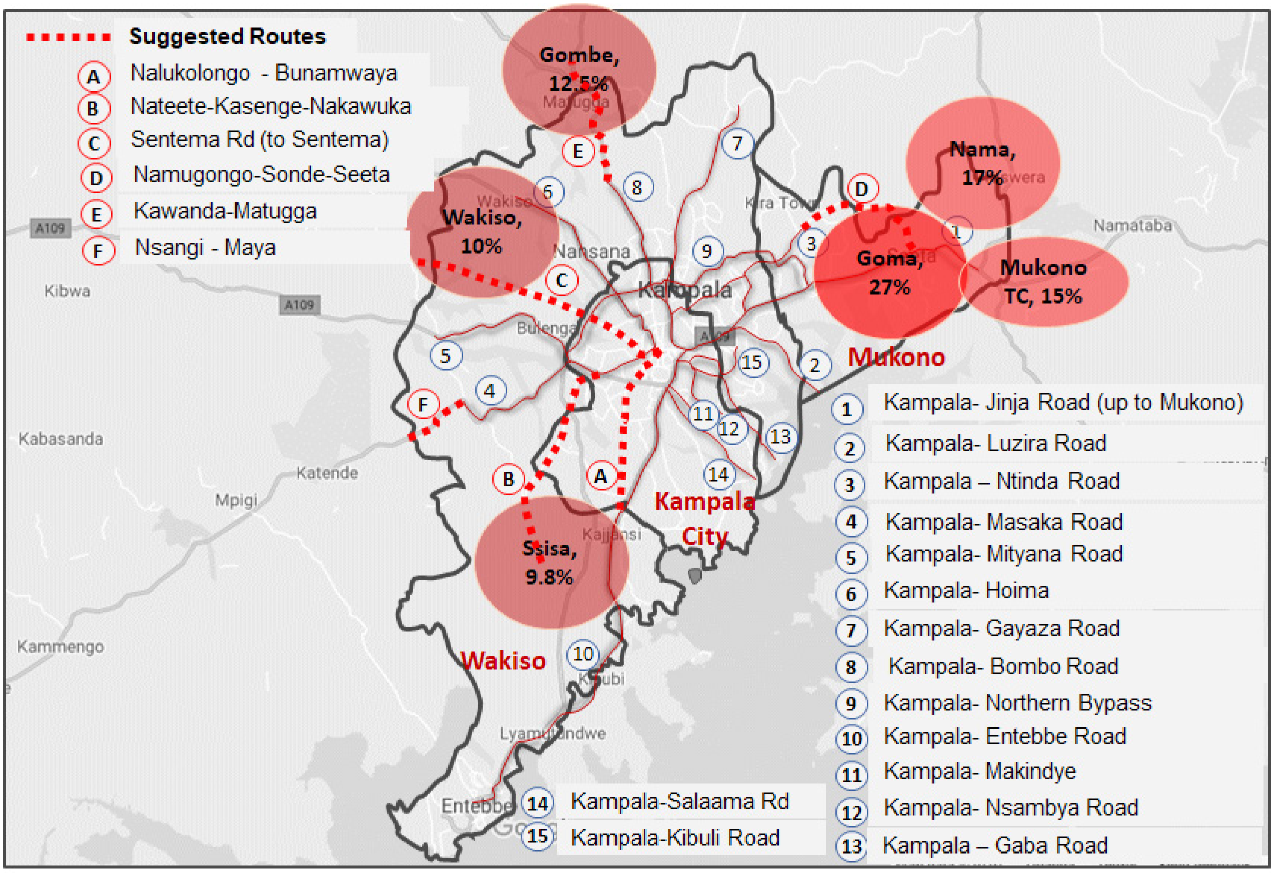
The Millennium Development Goal (MDG) on reduction of poverty in Uganda is 31% headcount or less i.e. a sub county with a poverty headcount of 31% or higher is considered poor. Based on this, no sub county in the GKMA is considered poor. But as Table 9-1 shows, there are areas that are significantly more deprived than others. These are Goma, Mukono Town Council and Nama sub counties in Mukono District, and Wakiso Town Council, Gombe, Wakiso sub county, and Ssisa in Wakiso District.

9.3.5 An assessment has therefore been made on the level of connectivity of these sub counties with the Tondeka route network. Figure 9-1 below presents a summary of the analysis and the suggested changes to the Tondeka route network in order to ensure that the poorest areas of the GKMA are covered by Tondeka.

9.3.6 The proposed routes are as follows:

- Routes A and B – to help improve connectivity of the south of Kampala and Ssisa sub county in Wakiso.

  The south of Kampala is perhaps an area of the City with the poorest road network, with significantly more unpaved key connectors than any other area. Ssisa sub county on the other hand comprises of key urban centres – Kasenge, Buddo, Nakawuka, and Ssisa, and can be better connected with the proposed Route B.
- Route C – improves connectivity of Wakiso Sub County and Wakiso Town Council.
- Route D – improves the connectivity of Goma Sub County, connecting Namugongo, Sonde and Seeta areas to the primary Tondeka network.
- Route E – provides connectivity to Matugga and the remainder of Gombe Sub County to Kawanda where the proposed Tondeka network currently stops.
- Route F – provides additional connectivity for Nsangi Sub County.



Source: Consultant's analysis

Figure 9-1: Proposed additional routes to improve connectivity of the GKMA

9.4 Specific Duty (iii) - Review the Tondeka Service Plan and Identify Areas of Concern

9.4.1 From the review of the Tondeka proposals, a number of areas that of concern have been highlighted. The particular issues of concern and the Consultant's recommendation are summarised in Table 9-2 below.

AREAS OF CONCERN FROM THE TONDEKA PROPOSALS			
	Area of Concern	**Description of Concern**	**Comment / Recommendation**
1	Availability of a sound feasibility study	The Consultant has not had access to the feasibility study – it is expected that this was undertaken. A number of issues such as expected patronage, routes, proposed bus fleet, etc, raise questions.	A review of the feasibility study is required
2	Existing and future passenger demand	The picture with regard to passenger demand is not clear. There seems to be an overestimation of demand and hence all downstream assessments such as bus fleet, revenue and project benefits could be in error. The Project's estimated 980 buses at commencement raises questions on the quality of the passenger demand estimate.	The passenger demand must be clarified.
3	Transport modelling and analysis	The basis for expected decongestion benefits, mode shift and all other anticipated benefits should ideally be underpinned by rigorous analysis through modelling.	Detailed traffic modelling should be considered to provide comfort on the project passenger estimates

AREAS OF CONCERN FROM THE TONDEKA PROPOSALS			
	Area of Concern	**Description of Concern**	**Comment / Recommendation**
4	Project ownership and Promoters	The proposed project ownership is not clear. This is key information that would be required by the public in order to provide comfort and stave off resistance to the project. Also, who exactly are the Promoters is not clear. The proposed role of Ashok Leyland within the Tondeka SPV beyond the supply of the buses should be confirmed	Clarity on shareholding between the UDC and Tondeka SPV should be clarified. Also, clarity is required on the level of involvement of Ashok Leyland in the Tondeka SPV beyond the supply of buses.
5	Contracting authority	The proposed ownership of the project assets by UDC seems well placed. However, the ability of UDC to manage a transportation contract is questionable. For a transport project of this nature and magnitude, the right contracting authority would be expected to be the MoWT or KCCA. A project organisation where MoWT/ KCCA are legally involved, would support the project better and increase the likelihood of success.	Project organisation and contracting should be reviewed
6	Project financing	The project is to be funded by a loan guaranteed by Government through the Ministry of Finance. The Government of Uganda is therefore liable for the repayment of the project loan.	It is imperative that the project case be well defined in the short to medium term (0 to 10 years), to ensure its success and ability to repay the Government guaranteed loan.
7	Regulatory framework	With regard to project initiation, the regulatory framework seems sufficient but with challenges. There are already reports that procurement of Tondeka as an operator was undertaken but not following competitive processes. The regulatory framework during the operation of the project is not clear. How is MoWT/KCCA going to ensure that the project meets key performance indicators given its scale? What are the considerations on revenues to the local governments in the GKMA?	The regulatory framework requires significant review in order to ensure success of the project.
8	Implementation strategy	The project documents propose a first batch of 980 buses, to be launched in 2020. A further 1,000 – 2,000 buses are proposed as part of Stage II. No implementation timelines are given for stages II, the supply simply premised on “future demand growth in the GKMA.” The proposed partnership between Ashok Leyland and the Government of Uganda to build capacity for bus manufacture through Kiira Motors is an incentive for the Government to buy into the guaranteeing of the project loan. However, with no commitment to when the additional buses would be required, it is hard to see how the proposed Ashok Leyland partnership would be progressed.	The implementation strategy requires clarity. It is important that decisions are made by Government on the basis of clear project plans.

AREAS OF CONCERN FROM THE TONDEKA PROPOSALS			
	Area of Concern	**Description of Concern**	**Comment / Recommendation**
9	Bus facilities	There is no mention of a definitive provision of bus facilities such as bus lanes, stops, stations, etc. Statements attributed to KCCA indicate that the project would commence with available infrastructure (i.e. with no bus lanes, etc) and infrastructure could be provided three years after commencement.	This is a key success factor and needs urgent attention.
10	Proposed Bus Fleet	All available information point to a proposed bus fleet of 980 buses at the commencement of the project. This estimated fleet seems too high. However, the Consultant's estimate of passenger demand and hence bus fleet shows that, the Tondeka project requires a maximum of 652 buses at the start of its operations, about 673 in 2025 and 766 in 2035. These estimates are also based on on-schedule running, which would be unlikely without dedicated bus lanes.	In line with a review of the passenger demand, the proposed bus fleet of 980 buses needs to be reviewed.
11	Assimilation of matatu personnel	The project estimates that it would create 10,000 to 20,000 jobs according to available information.	This claim requires justification. The estimated job creation seems too high.
12	Passenger fares and routes	The proposed passenger fares seem very fair and attractive, and expected to drive the shift to buses. The routes that have been proposed through the media are not exhaustive and cannot support the proposed 980 buses. The full network needs to be clarified. Further, any potential cap on the extent of the route network by Government would have implications on further expansion and profitability.	The proposed fares are applauded. The project routes need to be clarified by the Project Team and KCCA/MoWT.

Source: Consultant's analysis

Table 9-2: Areas of concern from the Tondeka proposals

9.5 Specific Duty (iv) - Identify the GESI Gaps in the Proposed Plans and Draw a Strategy for Their Incorporation

9.5.1 This requirement is likely covered by Specific Duty (ii). With regard to traffic analysis, the GESI considerations can be proposed but would unlikely be tested by the extent of the traffic model available.

9.6 Specific Duty (v) - Capture Existing Commuter Taxis Demand and Estimate the Political and Economic Impact of Job Displacement

Existing Commuter Taxi Demand

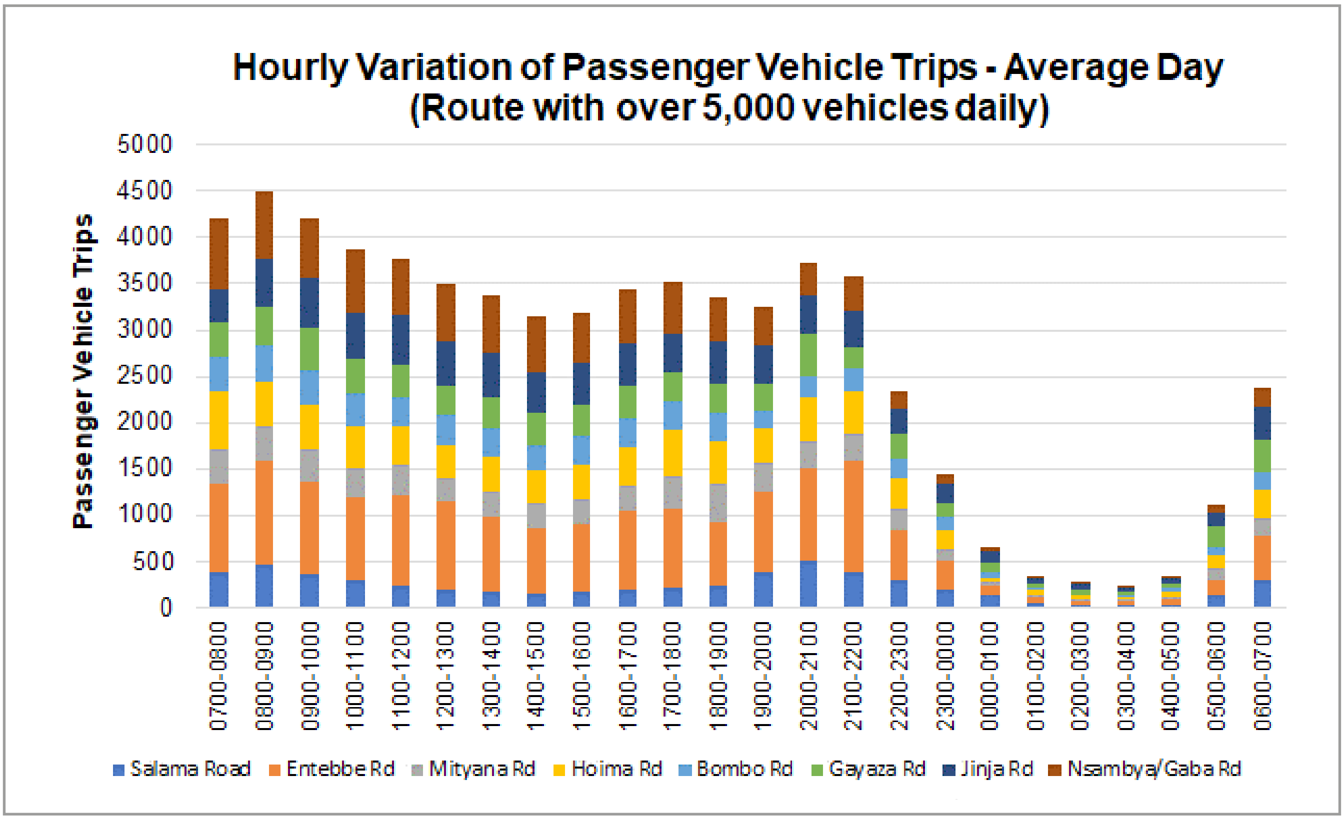
9.6.1 Section 8.4 estimates that the historic growth of commuter taxi demand in Kampala is approximately 3.0%.

9.6.2 9.6.2 Section 5.3 discusses the current taxi demand in Kampala. From this analysis, the hourly commuter taxi trip volumes on all key routes that would likely be served by the proposed Tondeka project was made. The figures were generated for an average 24-hour day.

9.6.3 9.6.3 Further, from the same data, average occupancy rates for commuter taxis were estimated by route. These occupancy rates together with the passenger vehicle count numbers obtained above were used to estimate the passenger volumes by hour of day and for the entire day.

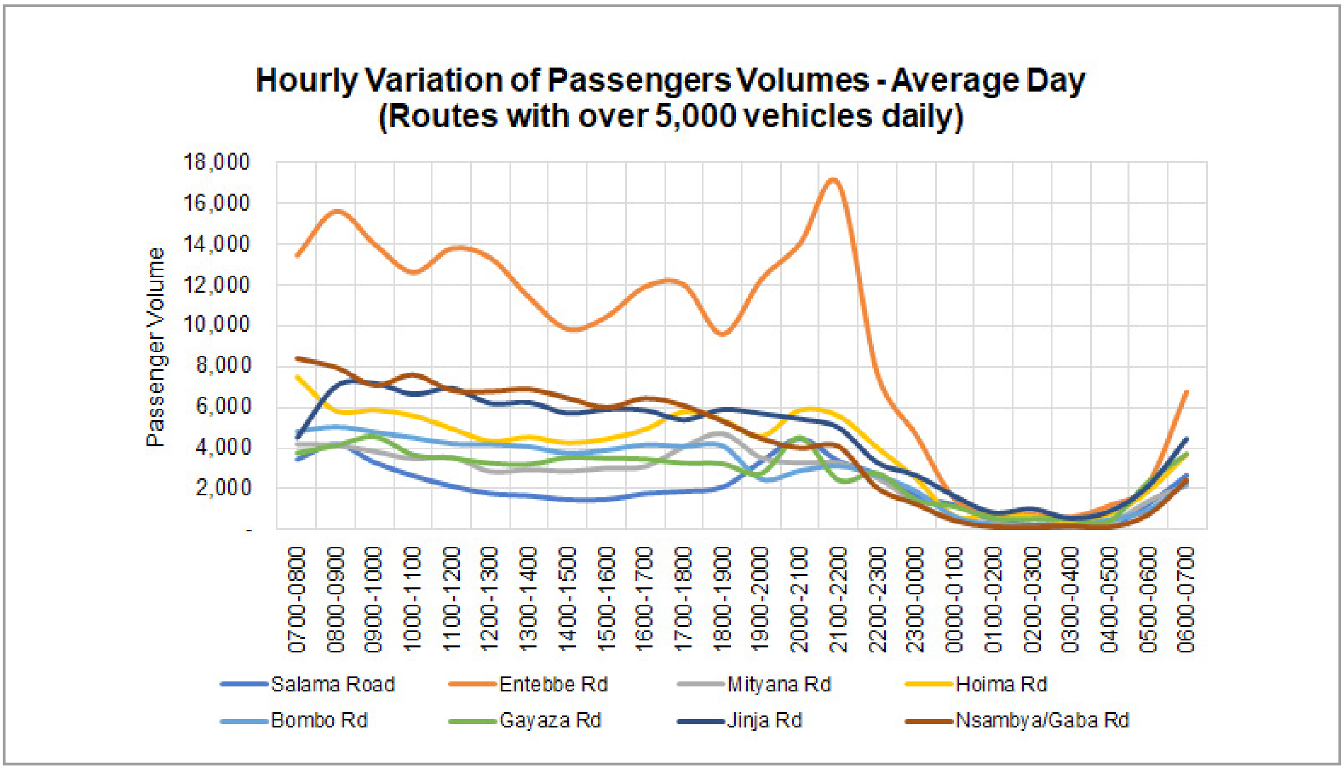
9.6.4 The results are re-presented in Figures 9-2 and 9-3 below. It is clear from these two figures that the passenger vehicle trips and passenger volumes vary by hour, being highest in the morning and evening. The morning period is typically 7am to midday and the evening peak period is 5pm to 10pm.

9.6.5 From the data, by far the busiest routes currently (in order) are; Entebbe Road, Jinja Road, Hoima Road, Gayaza Road.



Source: Consultant's analysis

Figure 9-2: Hourly variation of passenger vehicle trips for the average day (selected routes)



Source: Consultant's analysis

Figure 9-3: Hourly variation of passenger volumes for the average day (selected routes)

9.6.6 The Consultant's estimates for current passenger volumes are presented in Table 9-3. It is important to compare with the Project Team estimates.

ESTIMATED PASSENGER VEHICLE TRIPS AND PASSENGER DEMAND			
	Surveyed Route	**Tondeka Routes**	**Total Daily Passengers**
1	Salama Road	Kampala-Salaama Road (Up to Munyonyo)	49,837
2	Makindye Rd	Kampala- Makindye (Up Makindye ku Gombola)	27,278
3	Entebbe Rd	Kampala- Entebbe Road	216,439
4	Masaka Rd	Kampala- Masaka Road (Up to Nsangi)	59,742
5	Mityana Rd	Kampala- Mityana Road (Up to Buloba)	60,776
6	Northern Bypass	Kampala- Northern Bypass Road	23,687
7	Hoima Rd	Kampala- Hoima (Up to Wakiso)	94,488
8	Bombo Rd	Kampala- Bombo Road (Up to Kawanda)	69,221
9	Gayaza Rd	Kampala- Gayaza Road (Up to Gayaza)	65,840
10	Kisasi-Ntinda	Kampala – Ntinda Road (Up to Namugongo)	36,233
11	Nalya Rd	Kampala – Ntinda Road (Up to Namugongo)	7,874
12	Jinja Rd	Kampala- Jinja Road (up to Mukono)	106,045
13	Old Port Bell Rd	Kampala- Luzira Road (Up to Kirombe)	62,546
14	Nsambya/ Gaba Rd	Kampala-Kibuli Road (Up to Namuwongo) Kampala – Gaba Road (Up to Gaba) Kampala- Nsambya Road (Up to Lukuli)	102,197
15	Ntinda-Kira	Kampala – Ntinda Road (Up to Namugongo)	18,629

Source: Consultant's analysis

Table 9-3: Estimated passenger vehicle trips and passenger demand

Political and Economic Impact of Job Displacement

9.6.7 The impact of the proposed Project on matatu operations and personnel is a key consideration because it has potential to result in resistance to the project. The project has proposed to assimilate matatu operations into the project. The Consultant believes that matatu personnel will mainly be utilised as drivers or conductors. For 980 buses, the estimated total number of driver and conductor positions is about 4,000.

9.6.8 To estimate, the political and economic impact of job losses, it is imperative to have a plausible estimate of the number of commuter taxis in the GKMA. In 2018, Government figures indicated that there were 34,000 commuter taxis in Uganda. Basing on the traffic data trends in the country, 70% (24,000) of these are expected to be operating in and out of the GKMA.

9.6.9 The average number of people employed by each taxi is another key issue. Daily operations typically employ two people (a driver and a conductor). However, a small proportion of taxis work late hours and some throughout the night. During these hours, another set of staff is usually employed. For those majority of taxis that are parked in the night, night car wash is another significant activity. On average, it is estimated that each taxi employs 4 persons. The total population employed in the taxi business in the GKMA is approximately 96,000.

9.6.10 Further, it is expected that the jobs would not all be lost at once. The main impact is likely to be loss of income due to displacement to less profitable operations. The Consultant has estimated this income loss to be in the range 30% to 50% on average in the first five years.

9.6.11 The Consultant's central case abstraction rates are 33% and 65% of all taxis in the GKMA in 2021 and 2025 respectively. The average abstraction in the first five years is approximately 50%. This is equivalent to 12,000 taxis whose staff would likely experience loss of income.

9.6.12 The Consultant has also estimated that the project is likely to use about 652 buses in 2021 and 673 in 2025, giving an average of 663 buses. Supposing drivers and conductors for these vehicles are fully recruited from commuter taxis, the total employment is estimated at 2,652 persons (assuming 4 persons per bus as proposed by the Project). These personnel are assumed to earn at similar rate as before.

9.6.13 Considering all this in an Excel model, the estimated average annual loss of income in the first five year is estimated in the range UGX145 billion to UGX240 billion per annum at current prices.

9.6.14 The above income loss estimate is a significant loss and would like result in gradual opposition to the Project. The President in his letter to the Minister of Finance directed that the Tondeka operations be restricted to only key routes into and out of the city, so that public transport on lesser busy roads be left to commuter taxis for the first few years (probably five years). This is likely to calm down on the political opposition.

9.6.15 Nonetheless, the likely negative impacts to commuter taxis operations would call for robust legal, political and institutional protection to the Project. It is likely that Tondeka operations could be sabotaged at every opportunity if the necessary protections are not put in place prior to commencement.

9.7 Specific Duty (vi) - Scenarios - Land Acquisition and Capital Costs, Passenger Volumes and Travel Time

Optimisation of Land Acquisition and Capital Costs

9.7.1 The project would be most successful if accorded significant bus priority measures. This would entail bus detection at traffic signals, bus lanes, dedicated bus stops, etc. These measures would require additional road space in the majority of cases.

9.7.2 Dedicated bus lanes would especially be paramount in the CBD, i.e. the areas of Kampala within the radius of the Kampala Northern Bypass.

9.7.3 The traffic model built is limited in detail in this area due to a lack of traffic data (see Section 5.2). At this stage, therefore, detailed modelling that would identify the areas where bus priority measures are most needed in order to optimise land acquisition is not possible with the current model. It would be most possible with more detailed traffic data.

Optimisation of Passenger Volumes and Travel Time

9.7.4 This has been analysed in Section 9.8 below.

9.8 Specific Duty (vii) - Analysis and modelling to Identify Optimal Time Savings

9.8.1 Traffic modelling and analysis has been undertaken utilising secondary traffic data sources as described in Chapter 5. The modelling process is described in Chapters 5, 6, 7 and 8 of this report.

9.8.2 The results of the journey time savings analysis have been analysed by route and are presented in Tables 9-4 to 9-6 below.

2021	With Tondeka - Central 2021					
	AM			PM		
	To Kampala			From Kampala		
Route	**Reduction in Volume**	**Tot Time Savings (s)**	**Time Saving / Veh (s)**	**Flow reduction**	**Tot Time Savings (s)**	**Time Saving / Veh (s)**
Mukono - Kampala	7	30	0.04	3	12	0.02
Kampala - Luzira	7	228	0.31	1	15	0.03
Namugongo - Kampala	3	178	0.25	12	25	0.04
Nsangi - Kampala	11	0	0.00	30	49	0.07
Buloba - Kampala	3	122	0.49	15	-11	-0.02
Wakiso - Kampala	13	105	0.16	3	-9	-0.02
Kawanda - Kampala	1	147	0.21	0	-15	-0.02
Gayaza - Kampala	11	89	0.16	1	-17	-0.02
Northern Bypass	0	41	0.08	-1	45	0.07
Entebbe - Kampala	14	284	0.21	94	145	0.18
Makindye - Kampala	-4	223	0.14	272	19	0.03
Lukuli - Kampala	3	112	0.18	6	1	0.00
Gaba - Kampala	5	112	0.25	1	11	0.03
Munyonyo - Kampala	10	135	0.14	149	19	0.06
Namuwongo - Kampala	1	39	0.15	7	7	0.02

Source: Consultant's analysis

Table 9-4: Estimated reduction in link flow and time savings 2021 central abstraction scenario

2025	With Tondeka - Central 2025					
	AM			PM		
	To Kampala			From Kampala		
Route	**Reduction in Volume**	**Tot Time Savings (s)**	**Time Saving / Veh (s)**	**Flow reduction**	**Tot Time Savings (s)**	**Time Saving / Veh (s)**
Mukono - Kampala	36	2	0.00	0	3	0.00
Kampala - Luzira	26	721	0.96	0	-37	-0.08
Namugongo - Kampala	16	789	1.08	27	42	0.06
Nsangi - Kampala	33	50	0.09	87	-10	-0.01
Buloba - Kampala	55	261	0.95	76	-165	-0.38
Wakiso - Kampala	20	191	0.28	83	-140	-0.30
Kawanda - Kampala	13	697	0.97	4	19	0.03
Gayaza - Kampala	41	269	0.45	30	26	0.03
Northern Bypass	20	340	0.66	-4	56	0.08
Entebbe - Kampala	58	1024	0.72	4	226	0.29
Makindye - Kampala	-19	729	0.46	9	1	0.00
Lukuli - Kampala	2	344	0.53	0	-4	-0.01
Gaba - Kampala	23	342	0.75	3	98	0.25
Munyonyo - Kampala	34	416	0.41	5	-2	-0.01
Namuwongo - Kampala	17	92	0.35	0	40	0.14

Source: Consultant's analysis

Table 9-5: Estimated reduction in link flow and time savings 2025 central abstraction scenario

2035	With Tondeka - Central 2035					
	AM			PM		
	To Kampala			From Kampala		
Route	Reduction in Volume	Tot Time Savings (s)	Time Saving / Veh (s)	Flow reduction	Tot Time Savings (s)	Time Saving / Veh (s)
Mukono - Kampala	-17	496	0.46	-9	161	0.24
Kampala - Luzira	61	-47	-0.08	-53	1198	3.02
Namugongo - Kampala	56	1545	2.47	40	600	1.55
Nsangi - Kampala	121	32	0.05	9	6	0.01
Buloba - Kampala	25	1352	3.59	29	-53	-0.12
Wakiso - Kampala	87	413	0.28	60	95	0.07
Kawanda - Kampala	-1	1283	2.05	-26	753	1.61
Gayaza - Kampala	26	1169	1.70	29	848	1.60
Northern Bypass	112	311	0.30	39	220	0.18
Entebbe - Kampala	26	409	0.24	3	315	0.41
Makindye - Kampala	15	1008	1.52	39	132	0.21
Lukuli - Kampala	10	29	0.03	13	1	0.00
Gaba - Kampala	11	99	0.15	-2	61	0.09
Munyonyo - Kampala	63	123	0.18	17	9	0.02
Namuwongo - Kampala	10	-158	-0.17	2	60	0.06

Source: Consultant's analysis

Table 9-6: Estimated reduction in link flow and time savings 2035 central abstraction scenario

9.8.3 From Tables 9-4 to 9-6 above, it is clear that there would be no time savings as a result of the project. This is not surprising and further analysis of the model shows that it is due to two key issues:

- The reduction in traffic flows as a result of reduced matatus creates additional space. But this space is quickly filled up with induced trips. The network is very congested and has trips that cannot be made due to congestion (suppressed traffic). Once additional capacity is created, the suppressed traffic is immediately released to utilise it.
- Secondly, the buses are running with all other traffic. They would there be expected to move at the speed of the traffic stream.

9.8.4 In conclusion, there would be no significant journey time savings for people that would or wouldn't use the Tondeka Metro. It is also important to note that the Tondeka bus operation would not likely lead to worse journey times for those who use public or private transport.

9.9 Specific Duty (viii) - Assess and Identify the Optimal Service Plan with the Highest Passenger Capacity

9.9.1 Using the traffic model, a route by route assessment has been undertaken to determine the maximum possible number of buses that can operate on each route.

9.9.2 It's worth recalling from Section 8.9 that a preliminary assessment of bus fleet size was undertaken. This was based on generic considerations for minimum headway and journey time. In this section the actual maximum number of buses per route are provided based on modelled journey time and minimum headways.

9.9.3 The additional routes that would cater for GESI aspects as discussed in Section 8.3 above have were added to the model. The routes are:

- Routes A: Kampala to Ssisa through Kasenge, Nakawuka and Buddo.
- Route B: Kampala to Bunamwaya
- Route C: Sentema Road to Sentema
- Route D: Namugongo to Seeta through Sonde (Sonde Road)
- Route E: Kawanda to Matugga.
- Route F: Nsangi to Maya

9.9.4 Routes A, B and C are new, while the others are extensions of already proposed routes.

9.9.5 Table 9-7 below summarises the forecast number of buses per route.

MODEL RESULTS – FORECAST MAXIMUM BUSES PER ROUTE IN BOTH DIRECTIONS				
	Route	**2021**	**2025**	**2035**
1	Kampala - Bweyogerere	38	42	54
2	Bweyogerere - Mukono	22	26	34
3	Kampala - Luzira	25	25	32
4	Kampala - Ntinda	24	24	32
5	Ntinda - Namugongo	25	25	35
6	Nsangi - Kampala	23	25	32
7	Buloba - Kampala	41	41	41
8	Kampala - Nansana	40	42	44
9	Nansana - Wakiso	36	36	40
10	Kawanda - Kampala	60	60	60
11	Gayaza - Kampala	37	37	39
12	Northern Bypass	34	34	34
13	Kampala - Zzana	82	82	82
14	Zzana - Entebbe	77	77	77
15	Makindye - Kampala	24	24	24
16	Lukuli - Kampala	10	11	21
17	Munyonyo - Kampala	10	12	18
18	Namuwongo - Kampala	8	8	12
19	Wankulukuku Road	10	13	17
20	Sentema Road	9	11	14
21	Namugongo - Seeta	17	18	24
	TOTALS	**652**	**673**	**766**

Table 9-7: Model results – forecast maximum buses per route (both directions)

9.9.6 From the analysis of model results, the maximum number of buses that can be operated, carrying the most passengers is 652, 673 and 766 in the years 2021 (opening year), 2025 and 2035 respectively.

9.10 Specific Duty (ix) – Assess and Identify the Sections with Highest Rate of Return

9.10.1 This element of work cannot be accurately determined with the limitations of the traffic data. To accurately undertake this, section by section passenger data for each route would be required to be included into the model.

10.0 CONCLUSIONS

10.1 Conclusions

10.1.1 The proposed Tondeka Mass Transit Bus System has been assessed in line with the specific duties of the assignment as set out in Sections 1.3 and 9.1 of this report. A number of issues with regard to the proposed scheme – its set up, underpinning data, expected outcomes, etc have been highlighted as discussed in Chapter 9 above.

10.1.2 The Tondeka scheme is being readied for implementation. However, key questions on the highlighted inadequacies require clarification. On the whole, it is difficult to see the proposed project achieving significant success as it stands.

10.1.3 As a conclusion to the assignment, the Consultant has attempted to rank the issues with regard to criticality. The criticality of the issues is classified as shown in Table 10-1 below.

(red)	**Critical Issues.** These have a high potential impact on project outcome/success, and are identified for the attention of the relevant project approval committee. These issues generally require resolution as soon as possible.
(amber)	**Secondary Issues.** These are lower impact, but still with potential to affect project outcome and are identified for the attention of the relevant project approval committee. Resolution is generally less urgent but important.
(green)	**Observations.** These are not critical to project outcome but could improve efficiency and lessen delivery risk. They are identified for the attention of the project manager and the project team.

Table 10 1: Classification systems for identified issues

10.1.4 Table 10-2 below presents the identified issues in order of criticality. It is recommended that the project is paused for review. The identified critical issues below should be clarified before efforts towards implementation progress farther.

CLASSIFICATION OF ISSUES AND RECOMMENDATIONS

Class	Issue	Description of Issue	Recommendation
C1	Existing and future passenger demand	The picture with regard to passenger demand is not clear. There seems to be an overestimation of demand and hence all downstream assessments such as bus fleet, revenue and project benefits could be in error. The Project's estimated 980 buses at commencement raises questions on the quality of the passenger demand estimate.	The passenger demand must be clarified.
C2	Transport modelling and analysis	The basis for expected decongestion benefits, mode shift and all other anticipated benefits should ideally be underpinned by rigorous analysis through modelling.	Detailed traffic modelling should be strongly considered to provide comfort on the project passenger estimates

CLASSIFICATION OF ISSUES AND RECOMMENDATIONS			
Class	**Issue**	**Description of Issue**	**Recommendation**
C3	Regulatory framework	With regard to project initiation, the regulatory framework seems sufficient but with challenges. There are already reports that procurement of Tondeka as an operator was undertaken but not following competitive processes. The regulatory framework during the operation of the project is not clear. How is MoWT/KCCA going to ensure that the project meets key performance indicators given its scale? What are the considerations on revenues to the local governments in the GKMA?	The regulatory framework requires significant review in order to ensure success of the project.
C4	Contracting authority	The proposed ownership of the project assets by UDC seems well placed. However, the ability of UDC to manage a transportation contract is questionable. For a transport project of this nature and magnitude, the right contracting authority would be expected to be the MoWT or KCCA. A project organisation where MoWT/KCCA are legally involved, would support the project better and increase the likelihood of success.	The right contracting authority should be identified immediately to manage the project on behalf of Government.
C5	Project financing	The project is to be funded by a loan guaranteed by Government through the Ministry of Finance. The Government of Uganda is therefore liable for the repayment of the project loan.	It is imperative that the project case be well defined in the short to medium term (0 to 10 years), to ensure its success and ability to repay the Government guaranteed loan.
C6	Bus facilities	There is no mention of the provision of bus facilities such as bus lanes, stops, stations, etc. Also, the Consultant's estimate of passenger demand and hence bus fleet shows that, the Tondeka project requires a maximum of 652 buses at the start of its operations, about 673 in 2025 and 766 in 2035 (see Section 9.9). These estimates are also based on on-schedule running, which would be unlikely without dedicated bus lanes.	This is a key success factor and needs urgent attention.

CLASSIFICATION OF ISSUES AND RECOMMENDATIONS			
Class	**Issue**	**Description of Issue**	**Recommendation**
S1	Availability of a sound feasibility study	The Consultant has not had access to the feasibility study – it is expected that this was undertaken. A number of issues such as expected patronage, routes, proposed bus fleet, etc, raise questions.	A review of the feasibility study is required
S2	Project ownership and Promoters	The proposed project ownership is not clear. This is key information that would be required by the public in order to provide comfort and stave off resistance to the project. Also, who exactly are the Promoters is not clear. The proposed role of Ashok Leyland within the Tondeka SPV beyond the supply of the buses should be confirmed	Clarity on shareholding between the UDC and Tondeka SPV should be clarified. Also, clarity is required on the level of involvement of Ashok Leyland in the Tondeka SPV beyond the supply of buses.
S3	Implementation strategy	The project documents propose a first batch of 980 buses, to be launched in 2020. A further 1,000 – 2,000 buses are proposed as part of Stage II. No implementation timelines are given for stages II, the supply simply premised on "future demand growth in the GKMA." The proposed partnership between Ashok Leyland and the Government of Uganda to build capacity for bus manufacture through Kiira Motors is an incentive for the Government to buy into the guaranteeing of the project loan. However, with no commitment to when the additional buses would be required, it is hard to see how the proposed Ashok Leyland partnership would be progressed.	The implementation strategy requires clarity. It is important that decisions are made by Government on the basis of clear project plans.
S4	Project routes	The routes that have been proposed through the media are not exhaustive and cannot support the proposed 980 buses. The full network needs to be clarified. Further, any potential cap on the extent of the route network by Government would have implications on further expansion and profitability. This could also affect the requirement to extend the network to better consider GESI issues.	The project routes need to be clarified by the Project Team and KCCA/MoWT.

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