The World Bank
Kampala City Council
Government of Uganda

PRE FEASIBILITY STUDIES
FOR THE DEVELOPMENT
OF A LONG TERM INTEGRATED
BUS RAPID TRANSIT SYSTEM
FOR GREATER KAMPALA
METROPOLITAN AREA

Final Report

May 2010

ItP
integrated transport planning

In association with

IBIS TRANSPORT CONSULTANTS
The World Bank
Kampala City Council
Government of Uganda

PRE FEASIBILITY STUDIES FOR THE DEVELOPMENT OF A LONG TERM INTEGRATED BUS RAPID TRANSIT SYSTEM FOR GREATER KAMPALA METROPOLITAN AREA

Final Report
May 2010

Produced by:
Integrated Transport Planning Ltd
50 North Thirteenth Street
Central Milton Keynes
MK9 3BP
UK

Tel: +44 1908 259718
Fax: +44 1908 605747
Contact: Colin Brader
Email: brader@itpworld.net

www.itpworld.net
# CONTENTS

<table>
<thead>
<tr>
<th>EXECUTIVE SUMMARY</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(11 Pages)</strong></td>
<td></td>
</tr>
</tbody>
</table>

## 1 INTRODUCTION

- Structure of Report
- Stakeholder consultation

## 2 BACKGROUND

- Policy context
- Current travel conditions
- Operating context

## 3 WHAT IS BRT AND HOW MIGHT IT BE APPLIED IN GREATER KAMPALA?

- Route Options
- Strategic choices
- Design Options – Running Ways and Stations
- Further Operational Considerations

## 4 TRANSPORT SUPPLY AND DEMAND DATA COLLECTION AND ANALYSIS

- Data Collection and Existing Data
- Traffic Count and Occupancy Count Data
- Current Demand Levels
- Travel Conditions on the Corridors
- Passenger Patterns on Routes
- Public Transport Users
- Socio-economic Data
- Conclusion

## 5 TRAVEL DEMAND FORECASTING

- Methodology
- Forecast demand
- Conclusion

## 6 CONCEPTUAL DESIGN

- Application of BRT in Greater Kampala
- Depot Design and Location
- BRT and Non Motorised Transport (NMT)

## 7 EVALUATION OF ALTERNATIVES

- 

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**F:1115\Final Report\Final Reportv5.docx**

14/05/2010
Non-motorised transport 150
Public transport network planning 151
Public Service Vehicle (PSV) Regulations 151
Communications strategy 152

TABLES

Table 3-1: Evaluation of Median Operation with Median Station 27
Table 3-2: Evaluation of Median Operation with Bilateral Stations 29
Table 3-3: Evaluation of Bilateral Operation 31
Table 3-4: Relative Advantages and Disadvantages of Vehicles 33
Table 4-1: Summary of ITP Traffic Counts (6am – 10pm) 37
Table 4-2: Summary of ITP Total Passenger Counts (all vehicles) (6am – 10pm) 39
Table 4-3: Summary of ITP Total Public Transport Passenger Counts (6am – 10pm) 40
Table 4-4: Summary of JICA Traffic Counts (6am – 10pm) 42
Table 4-5: Current Demand: Daily Traffic Flow (both directions) (6am – 10pm) 44
Table 4-6: Current Demand: Daily Passenger Flow (both directions) (6am – 10pm) 45
Table 4-7: Mystery Traveller Routes 46
Table 4-8: Public Transport Journey Fares 46
Table 4-9: Public Transport Journey Speeds (daily averages) 49
Table 4-10: Willingness to Pay for an Improved Public Transport Service/Mode 63
Table 5-1: Forecast Demand, Daily Passenger Flows (2013, both direction, 6am–10pm) 71
Table 5-2: Forecast Abstraction rates Public Transport Modes to BRT (2013) 74
Table 5-3: Fare and Journey Time Elasticities 77
Table 7-1: Forecast BRT Demand by corridor, all day two way trips, 2013 89
Table 7-2: Ease of Implementation Summary 93
Table 7-3: Existing Matatu journey times and modelled BRT times by corridor 96
Table 7-4: Journey Time savings possible with BRT by route 97
Table 7-5: Routes Ranked According to Daily Pedestrian Flow 98
Table 7-6: Routes Ranked According to Daily Pedal Cycle Flow 98
Table 7-7: Routes Ranked According Potential Tributary Opportunities 99
Table 7-8: Overall Ranking for Integration 99
Table 7-9: Routes Ranked According to Accessibility for Low Income Population 100
Table 7-10: Routes Ranked According to Accessibility for Low Income Population 101
Table 7-11: Routes Ranked According to Potential Environmental and Social Impacts 102
Table 7-12: Overall Route Appraisal Summary 103
Table 8-1: Infrastructure Capital Cost Estimate Summary 125
Table 8-2: Pilot Route Demand Estimates and Frequencies (2013 opening) 126
Table 8-3: Pilot Route Service Provision 126
Table 8-4: Peak Vehicle and Fleet Requirement 127
Table 8-5: Driver Requirement 128
Table 8-6: Annual Operating Cost Summary 129
Table 8-7: BRT System Operating Costs 130
Table 8-8: Annual BRT System Fare Revenues 131
Table 8-9: Vehicle Financing Assumptions 132
Table 8-10: Fleet leasing costs 132
Table 8-11: Annual operating costs against system revenue 133

FIGURES

On or Follows Page
Figure 2-1: Kampala City Centre Context Plan 6
Figure 2-2: Extract from GKMA Masterplan, 2004 7
Figure 2-3: Extract from JICA Presentation: Peak Hour Vehicle Speeds Recorded February 2010 7
Figure 3-1: BRT Route Options 17
Figure 3-2: Extract from GKMA Masterplan, 2004 20
Figure 4-1: Location of JICA and ITP traffic counts 37
Figure 4-2: Public Transport (Matatus / Large Buses) Passenger Counts (6am – 10pm) 40
Figure 4-3: Ratio Between ITP to JICA Traffic Count 42
Figure 4-4: Public Transport Journey Times 47
Figure 4-5: Boarding and Alighting Patterns on Gayaza Rd (inbound) 50
Figure 4-6: Boarding and Alighting Patterns on Gayaza Rd (outbound) 50
Figure 4-7: Boarding and Alighting Patterns on Jinja Rd (inbound) 52
Figure 4-8: Boarding and Alighting Patterns on Jinja Rd (outbound) 52
Figure 4-9: Boarding and Alighting Patterns on Entebbe Rd (inbound) 54
Figure 4-10: Boarding and Alighting Patterns on Entebbe Rd (outbound) 54
Figure 4-11: Boarding and Alighting Patterns on Masaka Rd (inbound) 56
Figure 4-12: Boarding and Alighting Patterns on Masaka Rd (outbound) 56
Figure 4-13: Boarding and Alighting Patterns on Bombo Rd (inbound) 58
Figure 4-14: Boarding and Alighting Patterns on Bombo Rd (outbound) 58
Figure 4-15: Boarding and Alighting Patterns on Kira Rd (inbound) 60
Figure 4-16: Boarding and Alighting Patterns on Kira Rd (outbound) 60
Figure 4-17: Percentage of Public Transport Users Feel is a ‘Problem or Serious Problem’ 62
Figure 4-18: Sex by Vehicle Mode 64
Figure 4-19: Age by Vehicle Mode 65
Figure 4-20: Socio-economic Status by Vehicle Mode 66
Figure 5-1: Forecast Demand, Daily Public Transport Passenger Flows (2010-2030) 71
Figure 5-2: Forecast Demand, Daily BRT Passenger Flows (2013) 74
Figure 5-3: Forecast Demand Map, Daily BRT Passenger Flows (2010-2030) 75
Figure 5-4: Forecast Demand, Daily BRT Passenger Flows (2010-2030) 76
Figure 5-5: Forecast Savings in Journey Time (hours) (2013) 78
Figure 6-1: Conceptual Layout: Median Operation – Median Stations 82
Figure 6-2: Conceptual Layout: Median Operation – Bilateral Stations 82
Figure 6-3: Conceptual Layout: Bilateral Operation 84
Figure 6-4: BRT Conceptual Layouts 84
Figure 6-5: Depot Conceptual Design 84
Figure 7-1: BRT Route Options 88
Figure 7-2: Minimum Right of Way Width Availability Along Key Links 95
Figure 7-3: Pilot Corridor 106
Figure 7-4: Long Term Network Route B1 106
Figure 7-5: Pilot Route Extension 107
Figure 7-6: Long Term Network Route A2 / A3 107
Figure 7-7: Long Term Network Route A4 108
Figure 7-8: Long Term Network Route B2 108
Figure 7-9: Long Term Network Route B3 109
Figure 7-10: Long Term Network Route B4 109
Figure 7-11: Routeing options for access to the City Centre 110
Figure 7-12: Routeing options within City Centre 111
Figure 7-13: BRT Routes in the City Centre 114
APPENDICES

Appendix A: Draft Terms of Reference for Detailed Design

Appendix B: Engineering Constraints Figures

The Integrated Transport Planning team includes Kagga & Partners, IBIS Transport Consultants Ltd and Balancia.
EXECUTIVE SUMMARY

Integrated Transport Planning Limited (ITP) has been appointed to undertake a Pre Feasibility Study for the Development of a Long Term Integrated Bus Rapid Transit (BRT) System for Greater Kampala Metropolitan Area. The project supports 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.”

A BRT network for Greater Kampala has been developed and analysed which can form part of a long term strategy. Through multi criteria appraisal a pilot BRT route has been identified that can be developed in the short term in order to both demonstrate and test the application of BRT but also to offer early benefit to a significant number of the local travelling public.

The study is a prefeasibility study and as such does not develop the detail of implementation but does establish that the implementation of BRT in Greater Kampala is deliverable, in its widest sense, and financially viable. Subsequent study stages will develop the pilot corridor through feasibility, detailed design and implementation. A draft Terms of Reference for feasibility and detailed design studies is included within the Final Report.

This Pre-Feasibility Study has been carried out under the close supervision and guidance of a Task Force drawn from the key stakeholders most closely concerned with the development of the urban passenger transport sector in Greater Kampala.

Operating Context

Kampala City Council estimated that in 2007 there were nearly 8,000 minibuses operating urban services in the Greater Kampala Metropolitan Area. The majority of the minibuses have 14 seats with a few larger vehicles. These minibuses are regularly over crowded, emit high levels of pollutants, involve long journey times and high levels of discomfort for passengers.

Despite it being many years since large buses were routinely operated within Kampala, there is a residual memory of service quality and affordable fares that can be exploited by the BRT initiative. However service pricing will be crucial in obtaining public acceptance, and so fares should be no higher than those officially charged by UTODA (and avoid the peak-demand extortion that is widely reported). If this is achieved, then time savings and service access convenience can effectively be passed through to passengers for free.

Equally encouraging, given the potential power to block reform that has been demonstrated by operator associations in some other countries in Africa, is the attitude of UTODA with regard to the proposed sector reform. The National Chairman has gone on record to advise his members to move away from mini-buses towards larger buses, and to organise on a route basis. Discussions with leading officials indicate a willingness to engage with the BRT initiative provided that this is not used to exclude them from the urban transport market that they have developed and exploited over the past two decades.

What is BRT and how might it be applied in Greater Kampala?

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.

It is a system based approach that addresses all the essential components of passenger transport supply in a holistic manner, and hence creates synergies that raise both its overall effectiveness and its efficiency. It therefore considers:

- The vehicles providing the services, including their accessibility and comfort levels;
- The running-ways over which the services are operated, including their segregation;
- The stations and terminals through which passengers access the transport services;
- The service plan that connects those stations and terminals most efficiently;
- The supporting technical systems, such as ticketing and passenger information.

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 are already appearing on the main arterial corridors in Kampala, and rapid growth will bring others into consideration within the planning horizon.

Strategic choices for the BRT system in Greater Kampala include the route structure of the system, operator access to the system and the nature of stations within the system. Further considerations include the level of cost recovery required from passengers, and the use of any commercial surplus derived from the system operation.

We have argued for an ‘externalised’ route system, providing direct services from the main BRT trunk corridor to principal destinations in its catchment, on the grounds of operational flexibility and economic efficiency. This also avoids the need for costly interchange stations, and the land acquisition they would entail. This concept also enables future incremental expansion of the system as funding and land acquisition permits.

Operator access would be controlled through service contracting, with competitive tender as the network develops. Net-cost contracting, whereby the operator is responsible for the collection and protection of his own revenue, on the grounds of allocation of revenue risk and the alignment of incentives. The contractual arrangements would enable the system manager to control and co-ordinate the flow and quality of the service offer.

The nature of BRT stations is determined primarily by the modalities for revenue collection within the system. Our research in similar countries indicates that pre-paid ticketing is not appropriate for a large section of the population, and that the alternative of on-board fares collection remains valid. This permits the use of open stations that are easier to insert into a constrained urban environment, and these are compatible with a future implementation of smart-card ticketing using on-board validation.

It is recommended that the BRT system recovers all direct bus operational and financing costs, together with system management and infrastructure maintenance. At current fares levels, this should still offer a significant commercial surplus arising from faster operation and the economies of large buses. This surplus should be applied to system development, rather than fares reductions that would not be sustainable over the network.
Recommendations are made as to the configuration of BRT running ways and stations within the highway, size of vehicles, and passenger accessibility. Median BRT operation with bilateral stations is preferred for operational flexibility and ease of insertion. Standard 12m buses with 2-step entry operating from low platforms would suit the vast majority of passengers, without constraining system capacity at the stations.

**Transport Supply and Data Collection and Analysis**

Data has been collected relating to current levels of travel demand by mode, the daily travel conditions experienced by public transport users, and also the sensitivities and valuations of travellers of all modes to the various aspects of travel. Data collected for the GMKA Transport Master Plan has also provided a valuable dataset from which to develop a strong understanding of travel patterns, and has not been overlooked in the development of the transport model.

The estimated current demand levels indicate that public transport demand is highest along Jinja Road, with approximately 120,000 passengers per day, and second highest on Entebbe Road, with approximately 105,000 passengers per day. Private car travel demand is highest on Entebbe Road with approximately 65,000 passengers per day.

Travel and commercial characteristics differ between the routes analysed. Average fare levels vary between 70 USh/km (Jinja Road and Masaka Road) to 130 USh/km (Kira Road).

There is a direct and negative correlation between fare levels and traffic speeds. As well as a variation in average fare levels between routes, there is also some variation in fare levels within routes, and this lack of fare reliability is a characteristic which transport users often dislike.

Operational speeds for matatus and large buses vary considerably, ranging from 10 km/hr (Kira Road) to 23 km/hr (Entebbe Road), reflecting relatively low operational speeds, and the potential advantages of BRT over current public transport provision (it is expected with efficient operation and the benefits of physical segregation from general traffic that BRT can achieve average speeds of up to 25km/hr).

In-vehicle stationary time, the time passengers spend in the vehicle while it is loading and unloading passengers, forms a considerable proportion of total journey time (20% to 35%). This is a particular characteristic over which BRT can have a significant advantage, with the efficiency of passenger boarding and alighting much improved.

Passenger perception surveys reveal that the main problems public transport users cite with current provisions are low levels of comfort and safety and high journey times (particularly dwell times).

73% of passengers indicate a willingness to pay for a trip in a comfortable and air conditioned vehicle (a type of vehicle typical on a BRT service). The average increase in fare they are willing to incur is approximately 200 USh.

Matatu passengers form a broad section of Kampala demographics; there is an even split between males and females, all age groups are well represented (although the majority are
under 30), and all income groups are well represented, broadly in line with overall income split within Greater Kampala.

**Travel Demand Forecasting**

An urban transport demand model was developed to:

- forecast future demand for transport without BRT (the do-nothing scenario);
- forecast the likely response after the introduction of a new BRT system;
- and to inform an appraisal of potential BRT pilot routes.

Forecast demand levels for the do-nothing scenario in the year 2013 reveal that passenger transport will be highest on Jinja Road with 175,000 passengers per day (representing a 45% increase on current demand levels) and second highest on Entebbe Road with 140,000 passengers per day (representing a 35% increase on current demand levels). The relative ranking of the busiest routes remain constant and there will be some divergence in overall volume levels.

Car transport demand will remain highest on Entebbe Road with approximately 90,000 passengers (representing a 40% rise on current levels) and second highest on Jinja Road with approximately 70,000 passengers per day (representing a 55% rise on current levels). Therefore, the relative ranking of the two busiest routes in terms for car travel remains constant; however, there will be some convergence in terms of the volume of car travel.

By 2030, public transport demand is predicted to increase exponentially and demand on Jinja Road will exceed 700,000 passengers per day; this is approximately 5 times current levels and will present major challenges to public transport planners.

Demand will also remain high on Entebbe Road (approximately 500,000 passengers per day, and on Masaka and Bombo Road (between 200,000 and 300,000 passengers per day).

With BRT introduction, rates of abstraction from matatus are expected to vary between 66% (Port Bell Road) and 82% (Bombo Road). This reflects the likelihood that BRT will dominate the public transport market on all routes, however, current operators will maintain some services and continues to operate.

Forecast demand for BRT in the year 2013 is expected to be highest on Jinja Road with approximately 135,000 passengers per day and second highest on Entebbe Road with 105,000 passengers per day.

Forecast demand for BRT in the year 2013 will be significant (over 80,000) on Bombo and Masaka Road. Forecast demand will be very low for Port Bell Road; with less than 20,000 passengers per day forecast for the year 2013.

Relative rankings will remain constant throughout the forecast period (2010 – 2030) with some evidence of divergence. The demand on Jinja Road will rise to approximately 550,000 per day. The demand will also be high on Entebbe Road (375,000 per day), Masaka Road and Bombo Road (approximately 200,000 per day).
BRT Concept Definition

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.

Where localised narrowings are necessary, BRT and general traffic lanes can be reduced to 3.0m and kerbed segregation can be reduced to 0.5m.

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 lay-by 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.

The conceptual layout for the proposed BRT station arrangement is shown below:
City Centre Penetration and Accessibility

A plan for the BRT routes and stations in the City Centre has been provided 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.

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.

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.

Route Appraisal and Recommendation of Pilot Route

In order to guide the selection of route or routes that should form the pilot BRT corridor, and the subsequent development of the long term BRT network, a route appraisal system has been developed to rank the routes in order of preference. Each route was analysed and ranked based on the following criteria:

- Levels of personal mobility (potential demand)
- Ease of implementation
- Transport impacts (potential for reducing passenger travel time)
- Integration with other transport modes / future network
- Increased accessibility for low income population (coverage in low income areas)
- Institutional Constraints
- Environment and social impacts

The route receiving a the highest score in the appraisal is Jinja Road, followed by Bombo Road, and these two routes in combination are recommended for development of the pilot corridor. It is 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.

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.

An illustration of the proposed pilot corridor is provided below:

---

**Long Term BRT Vision**

A long term BRT vision is presented which illustrates how routes could be phased to reach an overall city wide BRT network, as illustrated below:
It should be noted that each and every route illustrated (including the proposed pilot corridor) would be subject to full feasibility study to ensure economic viability.

**Development of a BRT Corridor**

Capital costs for the proposed concept design for the pilot corridor were derived. These are set out as follows:

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost (US$ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preliminaries (inc Design, Utilities Diversion, and Resettlement)</td>
<td>16.93</td>
</tr>
<tr>
<td>Earthworks, Drainage, Pavement</td>
<td>48.37</td>
</tr>
<tr>
<td>Stations, Depot</td>
<td>5.88</td>
</tr>
<tr>
<td>Ancillary Works</td>
<td>5.39</td>
</tr>
<tr>
<td>Junction Upgrades</td>
<td>25.00</td>
</tr>
<tr>
<td>Contingencies</td>
<td>10.16</td>
</tr>
<tr>
<td>Supervision</td>
<td>6.70</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>118.43</strong></td>
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</table>

Cost per kilometre 8.46

These costs include a significant element for upgrading junctions, which may be at least partially met by other projects (such as the JICA study), however they have been included here in the interests of presenting a robust assessment.

Based on the forecast demand levels and outline of the proposed pilot route, an indicative service plan is proposed which provides the required levels of passenger capacity to meet that demand whilst making provision for some irregularity of demand within the peak hour.

The time-table for the three periods can be summarised as:

- **Peak** – 8 hrs weekdays (0600-1000 and 1600-2000)
- **Inter-peak** – 6 hrs weekdays (1000-1600), 12hrs Saturdays (0800-2000)
- **Off-peak** – 2 hrs weekdays (2000-2200), 4 hrs Saturday (0600-0800 and 2000-2200) and 16 hrs Sundays and Public Holidays
Route peak hour service offer
Vehicle frequency (buses per hour)

<table>
<thead>
<tr>
<th>Route</th>
<th>Peak</th>
<th>Inter-peak</th>
<th>Off-peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mukono - Bwaise</td>
<td>2,430</td>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td>Kireka - Bwaise</td>
<td>1,944</td>
<td>24</td>
<td>16</td>
</tr>
<tr>
<td>Mukono - Kyebando</td>
<td>1,215</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>Kireka - Kyebando</td>
<td>1,944</td>
<td>24</td>
<td>16</td>
</tr>
</tbody>
</table>

The annual operating costs and potential system revenue have been calculated as follows. Operating costs incorporates all direct annual costs required to supply the service schedule outlined above. It therefore includes driver’s wages, customer service staff / conductor’s wages, maintenance staff wages, fuel costs, tyre costs, vehicle maintenance materials and licensing and insurance premiums. The sum of all direct operating costs is estimated at approximately US$11.8 million.

The sum of all costs (direct operating costs, systems management, vehicle fleet leasing and infrastructure maintenance) is estimated at approximately US$21.4 million.

Expected annual system revenue is approximately US$37 million, and an assumed 15% allocated for operator overheads and profit is estimated at approximately US$5.6 million.

<table>
<thead>
<tr>
<th>Cost Element</th>
<th>Value</th>
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<tbody>
<tr>
<td>Operating Costs</td>
<td>$11,774,449</td>
</tr>
<tr>
<td>Systems Management</td>
<td>$618,577</td>
</tr>
<tr>
<td>Annual repayment for vehicle fleet</td>
<td>$6,668,847</td>
</tr>
<tr>
<td>Infrastructure maintenance</td>
<td>$2,368,600</td>
</tr>
<tr>
<td>Total operating costs</td>
<td>$21,430,473</td>
</tr>
<tr>
<td>Annual revenue (minus 10% fare collection and leakage)</td>
<td>$37,416,806</td>
</tr>
<tr>
<td>Gross operating margin</td>
<td>$15,986,333</td>
</tr>
<tr>
<td>less Operator overheads and profit (15% of net revenue)</td>
<td>($5,612,521)</td>
</tr>
<tr>
<td>Net Operating Surplus</td>
<td>$10,373,812</td>
</tr>
</tbody>
</table>

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.
An economic appraisal of the scheme has been conducted and the Benefit Cost Ratio (BCR), Net Present Value (NPV) and Internal Rate of Return have been calculated as follows.

<p>| | |</p>
<table>
<thead>
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<tbody>
<tr>
<td>BCR</td>
<td>1.41</td>
</tr>
<tr>
<td>NPV (million US$)</td>
<td>87.53</td>
</tr>
<tr>
<td>IRR</td>
<td>18%</td>
</tr>
</tbody>
</table>

Applying sensitivity analysis; a simultaneous 20% reduction in journey time savings benefits and a 20% increase in capital costs, the Pilot BRT Route will remain economically feasible, with a BCR of 1.08, NPV of $19 million and an IRR of 13%.

Therefore, the economic benefits of the system exceed the economic costs by a considerable margin and the scheme can therefore be regarded as economically feasible.

**Regulatory and Institutional Framework**

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.

International best practice has demonstrated the importance of integrating transport and land-use (physical) planning so as to ensure efficient outcomes in both domains. Were the Kampala Capital City Authority to be established, this 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.

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.

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 Central Government.

**Supporting Actions Necessary for Sustainable BRT Development**

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.

**Conclusion**

This study has examined major transport routes within Greater Kampala and through multi criteria appraisal made a recommendation for the further development and implementation of a BRT pilot route in the short term. The potential patronage that might be attracted by BRT on this route has been derived, operating cost calculated and capital cost defined. The potential revenue is in excess of operating cost by a significant margin and as such it may be concluded that BRT in the form envisaged should be sustainable through private operator delivery.

The capital cost of providing a pilot BRT route in the form envisaged would be US$118.43 million. This would be developed and maintained by the public sector who would also provide the appropriate regulatory and institutional support structure. The economic rate of return of 18% on this investment comfortably exceeds the standardised development cost of capital of 12% for such a project.
1 INTRODUCTION

1.1 Integrated Transport Planning Limited (ITP) has been appointed to undertake a Pre Feasibility Study for the Development of a Long Term Integrated Bus Rapid Transit (BRT) System for Greater Kampala Metropolitan Area. The project supports 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.”

1.2 The Terms of Reference for the study defines the objectives as to:

“Define the long term conceptual design of the BRT system for GKMA based upon the current and forecasted travel demand as dictated by the land use and development plans by the local administration, and to prepare terms of reference for: detailed engineering design covering both the infrastructural, operational and PPP aspects, institutional setup and financial controls necessary for implementation of a pilot BRT system on a selected priority corridor in the short terms. The study will have a long term vision with specific actions to be implemented in the short terms”

1.3 Our approach to this project has been to fully understand the local context in order to develop a conceptual definition BRT that is tuned to local context and local user needs. As such, whilst international experience in BRT is referred to, the focus has been to create Greater Kampala BRT. In doing so we have referenced existing data sources, collected new data, sought to understand existing policy and strategic context, institutional and regulatory reform requirements in addition to understanding the physical context into which BRT must be inserted.

1.4 Whilst a potential BRT network for Greater Kampala has been developed which can form part of a long term strategy a pilot BRT route has been identified, through multi criteria appraisal, that can be developed in the short term in order to both demonstrate and test the application of BRT but also to offer early benefit to significant number of the local travelling public.

1.5 The study is a prefeasibility study and as such does not develop the detail of implementation but does establish that the implementation of BRT in Greater Kampala is deliverable, in its widest sense, and financially viable. Subsequent study stages will develop the pilot corridor through feasibility, detailed design and implementation. A draft Terms of Reference for feasibility and detailed design studies is offered as part of this project.

Structure of Report

1.6 This report has been structured to reflect both the study Terms of Reference and to demonstrate a logical process of analysis and investigation in order to arrive at the definition of BRT in Greater Kampala.

- Chapter Two outlines the background to the study including policy context, current travel conditions and institutional context.
- Chapter Three defines BRT and considers, initially, how it might be applied in Greater Kampala.
- Chapter Four considers transport supply and demand, outlining existing data, newly collected data and the implications that this has for the development of BRT.
Chapter Five describes the method of transport demand forecasting applied to BRT identifying the potential patronage of BRT across the main corridors throughout Greater Kampala.

Chapter Six applies the BRT definition considered in Chapter Three to the local Greater Kampala context arriving at applicable conceptual definition. This includes access considerations, depot design and the role of non motorised transport.

Chapter Seven applies multi criteria analysis to the Greater Kampala network in order to identify and recommend a BRT pilot route. It also discusses how BRT can fit within Kampala City Centre.

Chapter Eight focuses upon the proposed pilot corridor considering physical implementation issues, defining an initial capital cost estimate. It further considers a draft service plan, the cost of supporting such a service plan and the commercial viability for private sector provision of BRT services. It also references the draft Terms of Reference for feasibility and detailed design of the BRT pilot route, which is included at Appendix A.

Chapter Nine examines the regulatory and institutional framework required to support BRT development and operation and examines the long term planning and regulatory needs.

Chapter Ten suggests supportive actions that might be pursued in order to maximise the benefit of BRT to meet overall accessibility and strategic objectives within Greater Kampala.

Stakeholder consultation

1.7 This Pre-Feasibility Study has been carried out under the close supervision of a Task Force drawn from the key stakeholders most closely concerned with the development of the urban passenger transport sector in Greater Kampala. These are as follows (with number of representatives):

- Kampala City Council (1)
- Ministry of Works and Transport (2)
- Uganda National Roads Authority (1)
- World Bank (1)

1.8 At the commencement of the assignment the Consultant team was briefed by the Task Force on its ambitions for the study in addressing the escalating problems of congestion in the metropolitan area, reinforcing the pertinent aspects of the Terms of Reference that had been prepared for this purpose. Due emphasis was placed on stakeholder consultation as a key element of the work programme, and offers made to facilitate any meetings as required for this purpose.

1.9 In turn the Consultant team was able to explain its consultation led approach that applied to all its studies, but particularly those in sub-Saharan Africa with its very different generic and specific challenges in comparison with sector experience in the advanced economies.
1.10 Throughout the study the Consultant team has interacted with the Task Force on a regular basis, both individually and collectively, and has thus received guidance and counsel as to development approaches being considered from time to time.

1.11 This process of informal consultation with the key stakeholders has been supplemented by wider consultation both with a BRT Technical Committee established for this purpose and also with a wider audience invited to a Workshop for this purpose.

1.12 In addition to the Task Force members identified above, the Technical Committee represents the following stakeholder interests:

- Civil Society Organisations (1)
- Institute for Transportation & Development Policy (1)
- Ministry of Financial Planning and Economic Development
- Ministry for Lands, Housing and Urban Development
- Mukono and Wakiso District Local Governments (1 each)
- National Transport Experts (1)
- Uganda Bus Owners Association (1)
- Uganda Police (1)
- Uganda Taxi Operators and Drivers Association (1)

1.13 The preliminary findings of the study were presented to the Technical Committee on 28 January 2010, and approval was given then to develop that approach to form the Interim Report, delivered in February 2010. Following on from the presentation, further consultations were held with individual members of the Technical committee to discuss matters of specific interest so as to ensure their continued alignment with the study objectives.

1.14 In turn, the Interim Report was presented at a public stakeholders’ Workshop on 5 March 2010 chaired by the Ministry of Works and Transport. During extensive plenary sessions after each of the presentation sections, a wide range of searching questions were responded to and the views expressed have been taken into account in preparing the Draft Final Report, which was delivered in April 2010.

1.15 Further questions from representatives of the Technical Committee and the Sector Working Group were expressed at the Draft Final Report presentations, which have been taken into account in preparation of this Final Report. The questions were compiled and formally submitted to the Consultant and have been addressed either through reference to this Final Report, or through direct response.

1.16 Underpinning this formal stakeholder consultation, we have also made strenuous efforts to develop an understanding of the passengers themselves and their needs and aspirations for public transport provision in Kampala. This process has involved focus group discussions, passenger interviews at terminals and stops, and extensive travel around the network so as to experience the daily problems at first hand.

1.17 Finally, we have begun to engage with the Press so as to sensitise the public as to the potential of Bus Rapid Transit, and build on the excellent work of ITDP in this area that
included sponsoring an earlier visit from Enrique Peñalosa (the former Mayor of Bogotá, Colombia, responsible for the famous TransMilenio BRT system) to Kampala.
2 BACKGROUND

Policy context

2.1 The National Transport Master Plan, originally developed in 2005, included a Transport Master Plan for the Greater Kampala Metropolitan Area (GKMA). This plan set out a general framework for development of the transport sector over the period 2008-23. Whilst the plan has since been extensively reviewed and refined, its fundamental recommendations still stand.

2.2 The sub-sector development plan for GKMA included the following elements:

- Establishment of a single GKMA Transport Authority;
- Adoption of the Transit-Oriented Development concept;
- Re-organisation and restructuring of the public transport services and fleet;
- Introduction of a Bus Rapid Transit (BRT) system;
- Improvement of existing road network and non-motorised transport facilities;
- Development of dual carriageways;
- Road junction improvements and signalisation (62 locations); and
- Development of a Traffic Management System.

2.3 The capital costs budgeted over the 15 year period were estimated to total some US$ 1.181 billion, comprising the following allocations:

- US$ 625 million for road improvements;
- US$ 125 million for traffic management and safety improvements; and
- US$ 431 million for new bus ways and equipment (4 bus ways).

2.4 An additional budget of US$ 19 million was also provided for the start-up costs of the various institutions proposed in the Master Plan. These included a Transport Master Plan Unit in the Ministry of Works and Transport; a Metropolitan Area Transport Authority and Executive; a Multi-sectoral Transport Regulatory Authority; and a National Road Safety Authority.

2.5 It will thus be seen that Government has placed a high priority on the resolution of the current urban transport problems in Greater Kampala, and is prepared to back its’ policies with very substantial investments. Within those listed, Bus Rapid Transit is the largest single component, with each of the 4 bus ways estimated to cost in excess of US$ 100 million. Because of the scale involved, these projects are assumed to be co-financed by Uganda’s development partners on a programme basis.

2.6 The Uganda Transport Sector Development Project of the International Development Association (co-financed by the UK Department for International Development) is planned as part of that long-term sector development programme. If successful, it is anticipated that future projects will be forthcoming to ensure a rolling programme over the plan period.

2.7 The Project Appraisal Document for the Transport Sector Development Project identifies Urban Congestion as being a major challenge in the sector. With rapidly increasing
population, and even faster increase of motorisation, the Kampala Metropolitan Area is moving rapidly (sic) towards total gridlock. Concerted, rapid and effective measures are needed to avoid this, and lessons need to be learnt from Asian and Latin American cities that have experienced similar growth in past decades. These include:

- Urban transport demand **cannot** be satisfied by individual vehicles or the construction of more road space;
- Existing road space needs to be used more efficiently by curbing individual vehicles, and the introduction of effective mass transit;
- One of the most effective means of control of access to the central business district is through comprehensive parking management (reflecting the high cost of urban space);
- Scarce urban transport space must be used most effectively to enhance mobility of people (not cars) by providing space for pedestrians, bicycles, and mass transit; and
- To get control of the urban transport situation an effective and well funded **Urban Transport Authority** must be created.

2.8 The Transport Sector Development Project supports the introduction of Bus Rapid Transit in Greater Kampala, through financing the Feasibility Study and Detailed Design of a pilot route, and will develop the legal framework for the creation of urban transport management capacity. Both of these actions are main components of the Implementation Strategy of the Transport Master Plan for the Greater Kampala Metropolitan Area, being part of the National Transport Master Plan.

**Current travel conditions**

2.9 ITP has undertaken an initial site appraisal of the Greater Kampala Metropolitan Area (GKMA) in order to get an impression of the level of physical works required for BRT implementation.

*Kampala City Centre*

2.10 A crucial area which the BRT corridor would need to penetrate is Kampala City Centre. Figure 2-1 illustrates the City Centre context and discusses some site specific issues.

2.11 Some of the more general highway issues relevant to the GKMA are described as follows.

*Road width*

2.12 It was reported that 57% of roads within the Kampala City area are less than 6m in width, with 28% being two lane roads and 15% being 3 lanes or wider. The lack of highway width potentially makes the implementation of segregated bus lanes particularly challenging. The constrained nature of the road network means it is of paramount importance to make the most efficient and effective use of the space available.

2.13 In Chapter 7 of this report, each potential BRT route is appraised in terms of a number of factors, one of which being ‘Ease of Implementation’. Right of way corridor width is a key consideration within the route appraisal.

*Congestion / Junction Capacity*

2.14 There are a number of congestion hotspots within Kampala, particularly surrounding the taxi parks and Central Kampala areas such as Kampala Road, Namirembe Road, Entebbe
Figure 2-1: Central Kampala Context Plan

- Kampala Road – busy and overloaded in terms of car parking. Potential to utilise carriageway with more effective use and improved regulation.

- Entebbe Road – dual carriageway in both directions with wide central median.

- Luwum Street – one-way eastbound. Car parking on both sides and in centre of carriageway.

- Ben Kiwukisa Street – very constrained due to on-street parking. High pedestrian activity, encroachment and on-street parking. Here northbound traffic was using both sides of carriageway preventing southbound movement. Can take one hour to reach junction with Luwum Street.

- Luwum Street – two-way between Ben Kiwukisa Street and Buziga Street. Motorists queue for long periods on approach to taxi parks.

- Stationary left due to motorists waiting to enter taxi park.

- View of Taxi Park from Luwum Street.

- Entebbe Road / Luwum Street Junction – signal controlled, police occasionally take control.
Road and Jinja Road. A high level of delay is often experienced around the ‘Shoprite’ and ‘Clock Tower’ junctions to the south of the City Centre. Work undertaken as part of the GKMA Transport Master Plan demonstrates that congestion is problematic in the City Centre, while vehicle speeds are generally acceptable outside of the built up Kampala area.

Figure 2-2: Extract from GKMA Masterplan, 2004

2.15 As part of a parallel study, JICA are undertaking a review of the road network within the GKMA, with a view of proposing measures to improve conditions for general traffic. The following extract was taken from a recent JICA presentation, and highlights where existing delay is experienced:

Figure 2-3: Extract from JICA Presentation: Peak Hour Vehicle Speeds Recorded February 2010

2.16 These diagrams indicate that in the morning the worst delay is experienced around the initial stretches of Entebbe Road and Nsambya Road close to the City Centre, as well as around the Jinja Road / Yusufu Lule Road junction. Inbound traffic also experiences delay along Bombo Road and Port Bell Road. In the evening outbound traffic experiences delay along Bombo Road, Jinja Road and Port Bell Road.
2.17 The main supply of public transport in Kampala is by minibus, which are known locally as taxis or matatus. All matatu routes in Kampala terminate at either the Old Taxi Park or the New Taxi Park, which are the central matatu terminals located in Kampala City Centre. The traffic circulation to enter and leave the Taxi Parks is relatively poor. Matatus share road space with pedestrians and street traders and queue up in long lines, very often blocking intersections and obstructing traffic flows from other directions as well.

2.18 As is typical for the centre of any capital city, car parking is at a premium. Not only does this result in occasional illegal parking, but also drivers circulating the city centre looking for parking spaces exacerbate congestion problems.

2.19 Car parking is regulated in the city centre. A receipt is obtained on arrival and the following charges were reported to apply between 7am and 6pm:

- 400 Shillings per hour up to 2 hours
- 400 shillings for every subsequent 30 minutes
- If no payment is received in 24 hours, a 2,000 shilling fine is issued

2.20 However a monthly ticket is available for 30,000 Shillings, which is equivalent to only four 10-hour days of parking and hence encourages private-car commuting rather than managing its demand. The daily parking cost for a regular commuter is below that of a single fare on most routes, and is particularly attractive when passengers are also carried.

2.21 It is considered that with the development of BRT, there should be careful consideration regarding the location, regulation and quantity of City Centre car parking. Although car parking is heavily constrained, this may be beneficial in encouraging more sustainable modes of travel such as walking, cycling and public transport use, as the availability of car parking is known to have a large influence on modal choice. Increasing the supply of car parking may send the wrong message, as people should be encouraged to enter the City Centre using sustainable modes of travel.
Pedestrian Activity

2.22 Particularly around the taxi parks there is very high pedestrian activity and limited footway width, making movement particularly constrained. Pedestrianisation of certain streets has been considered as part of previous studies. It may be possible to ban general traffic from certain streets and devote the majority of the highway to pedestrian / cycle use, while still maintaining a BRT system penetrating through the heart of the city centre.

Highway Encroachment

2.23 The effect of local traders and commercial activity encroaching onto the highway seems common in the Greater Kampala Metropolitan Area, but this can have a serious impact on the capacity of the road network. Traders tend to utilise the available footway width, which forces pedestrians to walk in the carriageway, which in turn can reduce the capacity of the road network substantially. The problem is particularly common in the City Centre, around the Taxi Parks.
Poor organization of unloading facilities for retail shops

2.24 The provision of goods for retail shops, particularly in the City Centre, is poorly organized. Trucks seem to have access to the whole City Centre area all day long. Due to heavy congestion, trucks tend to park at the wider end of street and unload their goods. These are then distributed to the different retail shops often by hand cart or by hand, with a large number of boys carrying the goods – through the heavy pedestrian flows - to the shops. This unloading process leads to a relatively high obstruction of the traffic and pedestrian flows.

Footway / Carriageway Condition

2.25 The deterioration of the footway and carriageway can severely affect highway conditions. It was reported as part of the Transport Master Plan that 24% of paved road and 47% of gravel roads in the Kampala City area are in poor condition. Traffic can be reduced to walking pace to negotiate pot holes and bumps in the carriageway. Pedestrians often are forced to walk in the carriageway, as either there is no footway available, or it is very difficult / hazardous to negotiate. This can be particularly problematic at night in locations where there is no street lighting, as the pedestrian can be forced to chose between trying to negotiate the footway area, and risk injury from trips and falls, or walk in the carriageway and risk being struck by a vehicle.

Inadequate Carriageway Delineation

2.26 ITP observed many examples of carriageway that were sufficiently wide enough to accommodate more than one lane of traffic, however the inadequate delineation resulted in traffic treating the road as single carriageway. It is thought that better road marking and the installation of better roadside kerbing in certain locations could offer a relatively low cost method of significantly increasing road capacity.

Road Safety

2.27 Road safety is known to be an issue in Kampala, and ITP observed numerous occurrences of ‘near misses’. Driver behaviour is a key factor, with many drivers ignoring regulations.
Motorcycle users appear to be particularly at risk. A targeted media campaign could be effective in altering driver behaviour and reducing the number of casualties.

2.28 In addition, the condition of vehicles on the road and the presence of street lighting also has an impact on road safety.

Pollution

2.29 Pollution is a big problem in Kampala, with vehicle exhaust emissions contributing largely to poor air quality. Severe congestion, the age of vehicles on the road and the over-supply of public transport vehicles all contribute to poor air quality.

Implications for BRT Development

2.30 The above observations highlight the potential issues that must be faced with implementation of BRT, but also opportunities that exist to improve the general transport situation within Greater Kampala. Limited road width potentially provides a significant obstacle, although there may be opportunities for the highway corridors to be expanded with the development of BRT lanes.

2.31 With regard to congestion, BRT provides an attractive alternative to the private car and may encourage modal shift. Through proper segregation and BRT priority through road junctions, there is potential for reduced and more reliable journey times. With car parking being problematic in the City Centre, this may further aid the attractiveness of BRT as an alternative.

2.32 Highway encroachment can affect BRT particularly if the BRT operates to the sides of the carriageway, rather than along the centre. The running lane options are explained in more detail later in the report.

2.33 The development of BRT can improve the situation for pedestrians, with the development of either at grade crossings or pedestrian over-bridges. In addition, formal sidewalks would be constructed alongside the BRT corridors which would be to the benefit of road safety.

2.34 BRT can have a significant beneficial impact on pollution, with potential to reduce the number of matatus operating and decrease congestion.

Operating context

2.35 Kampala City Council estimated that in 2007 there were nearly 8,000 minibuses providing urban services in the Greater Kampala Metropolitan Area. The majority of the minibuses have 14 seats with a few larger vehicles. These minibuses are regularly over crowded, emit high levels of pollutants, involve long journey times and high levels of discomfort for passengers.

Vehicle and Driver Licensing

2.36 New public service vehicles have to be licensed by the Transport Licensing Board, an agency of the Ministry of Works. The minibuses based in Kampala are either supposed to be licensed for urban or inter-urban routes. There are however no limits imposed on the number of vehicles which can operate on either route and in practice vehicles seem to switch between urban and interurban services, particularly at weekends and holidays.
2.37 The Government of Uganda published a Statutory Instrument in June 2004 requiring seat belts to be fitted to all minibuses and used by all passengers.

2.38 A special group D licence is required to drive any public service vehicle including minibuses. Drivers must be over 25 years old and must receive instruction from an instructor licensed by the Director of Transport and Communications to provide instruction in driving this type of vehicle.

Route Allocation

2.39 The Transport Licensing Board has the duty to “furnish to the Minister once in every year a list of routes and packages of routes covering the whole of Uganda, selected and assembled so as to provide transport services to meet reasonable passenger demand and which will be reasonably efficient and economic either as listed singly or otherwise for both large and small prospective operators.” The Licensing Board is then expected to take into account its findings, to grant operators the necessary omnibus licence to:

- run a service for the carriage of passengers over such fixed route or routes as the Board may direct;
- run a scheduled service over such routes at such frequency and regularity as the Board may direct; and
- to incorporate such intermediate stops as the Board may direct.

2.40 The Transport Licensing Board therefore has considerable power to determine the routes operated by different operators and the quality of service provided. In practice it devotes more effort to monitoring and regulating the inter-urban routes, particularly the large bus routes, than the minibus routes in Kampala. Licences to operate minibuses in Kampala do not specify particular routes or times of operation. The licence does specify whether the minibus should operate town or more distant country routes. However in practice minibus operators appear to switch between town and country routes depending upon the demand. The Licensing Board does not try to restrict the number of minibuses operating in Kampala.

Monitoring of Service Quality

2.41 No Government organisation is currently concerned with monitoring service quality, although UTODA (see below) will have a good appreciation of the level of service relative to demand on different routes.

The Role of UTODA

2.42 The Uganda Taxi Operators and Drivers Association (UTODA) plays a very important role in the de facto regulation of the minibus industry in Kampala. All operators and drivers are expected to be members of this association which was set up to further their interests. As a result UTODA has very considerable power over the industry.

2.43 In 1986 UTODA won a contract from Kampala City Council to manage the two main minibus parks in Kampala. They have retained this contract ever since 1986 and today they have parks and offices in 27 districts.

2.44 UTODA charge the minibus drivers a fixed daily fee on their first entry into the main taxi terminals. They also charge an exit fee on each departure that varies depending upon the length of route and hence the fare paid. Drivers also have to pay a fee to UTODA if they
pick up passengers at the intermediate bus stops that are supervised by UTODA staff. Finally, members have to pay a monthly fee.

Vehicle Inspections

2.45 All public service vehicles have to be inspected by the Transport Licensing Board inspectors annually before issue of the appropriate vehicle licence.

Fares

2.46 There is no State control of fares, but UTODA defines standard fares for each route. Specimen fares quoted in 2005 were USh 300-500 (US cents 15-25) to Natete (6 km), USh 700 to Mukono (22 km), USh 1,200-1,300 to Entebbe (40 km). However the actual fares paid by passengers are determined by the taxibus operators depending upon the state of the market. Fares increase in the peak periods and at times of high demand, such as just before Christmas when supply also goes down, some urban taxibus drivers find it more profitable to switch to interurban routes. At quiet periods, though, passengers can negotiate fares down by bargaining before boarding.

2.47 It was reported in 2005 that motorcycle taxis charge USh 500-1000 shillings (US cents 25-50) per journey. Generally these will be relatively short journeys either in the City Centre or connecting areas not well served by taxibuses with the taxibus network.

Working Methods and Conditions for Minibus Drivers

2.48 Drivers hire minibuses from owners for a daily charge. The drivers are responsible for providing fuel and paying the charges for using the UTODA terminals. The drivers tend to work long hours although in the off peak period much time is spent waiting to fill up at the minibus park. On an inspection visit to the main minibus terminal in Kampala the Consultants were told that there might be 20 minibuses waiting to load for one route and that the expected queuing time at the terminal could be more than 90 minutes. UTODA have estimated that the minibuses on local routes within the Kampala Metropolitan Area make on average about five round trips per day and may carry about 150 passengers per day.

Financial Viability of Public Transport Operators

2.49 It was reported in 2005 that the owners of minibuses do not earn sufficient to make it worthwhile investing in new vehicles. The Consultants interviewed one owner whose family has been involved in the provision of minibuses for over 10 years. He confirmed that whilst it had at one time been a very profitable activity this was no longer the case. A few years ago he owned 10 vehicles but this had now reduced to three as he gradually withdrew from the business.

Passenger Satisfaction with the Service Provided

2.50 Public transport passengers in Kampala have very little choice. Unless they are prepared to use the motorcycle or normal taxis they have to use the minibus service.

2.51 The Consultants found that there was considerable dissatisfaction with the service offered. One particular problem is that the vehicles tend to wait at the terminal until they are fully loaded. This means that passengers who want to board at other stops a little distance from
the terminal often cannot do so because the minibuses are still full, though extra passengers may be taken on beyond the licensed capacity.

2.52 The passengers also intensely disliked the uncertainty as to the level of fare that they would have to pay. They did not know what this would be until they boarded the vehicle. This meant that poorer passengers making the journey home after work did not know whether they could pay or whether they would have to walk.

2.53 In general the passengers thought that the service offered by the minibuses was poor. Female passengers were also concerned about the likelihood of harassment and complained that the conductors tended to encourage rather than try to suppress such behaviour when it was observed. There was however some sympathy for the drivers whom passengers realised did not find it easy to make a satisfactory living. There was also a feeling that UTODA extracted too much revenue from drivers and that this inevitably increased the fares which passengers had to pay.

Large Buses

2.54 It was reported in 2005 that despite the fact that Kampala had not been served by larger buses for 10 years (and then only briefly) there was a strong consensus in favour of reintroducing big buses. This was partly because of dissatisfaction with the level of service offered by the minibuses and partly because of the feeling that traffic congestion might be reduced with fewer bigger buses. It might also have reflected the fact that the possibility of a private company starting to operate bigger buses has been aired in the newspapers.

Affordability

2.55 The affordability of public transport is clearly a concern to many passengers and it is believed that large numbers walk long distances to work because they cannot afford to pay the minibus fares.

Summary of Implications for BRT

2.56 The regulatory and institutional context for BRT development in Greater Kampala will be explored in more detail in Chapter 9 below. The more significant issues in this context therefore relate to the current quality of service, and the attitude of the operator association in respect of changes in the sector.

2.57 Despite it being many years since large buses were routinely operated within Kampala, there appears to be a residual memory of service quality and affordable fares than can be exploited by the BRT initiative. However service pricing will be crucial in obtaining public acceptance, and so fares should be no higher than those officially charged by UTODA (and avoid the peak-demand extortion that is widely reported). If this is achieved, then time savings and service access convenience can effectively be passed through to passengers for free.

2.58 Equally encouraging, given the potential power to block reform that has been demonstrated by operator associations in some other countries in Africa, is the attitude of UTODA with regard to the proposed sector reform. The National Chairman has gone on record to advise his members to move away from mini-buses towards larger buses, and to organise on a route basis. Discussions with leading officials indicate a willingness to engage with the BRT
initiative provided that this is not used to exclude them from the urban transport market that they have developed and exploited over the past two decades.
3 WHAT IS BRT AND HOW MIGHT IT BE APPLIED IN GREATER KAMPALA?

3.1 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.

3.2 BRT is a system based approach that addresses all the essential components of passenger transport supply in a holistic manner, and hence creates synergies that raise both its overall effectiveness and its efficiency. It therefore considers:

- The vehicles providing the services, including their accessibility and comfort levels;
- The running-ways over which the services are operated, including their segregation;
- The stations and terminals through which passengers access the transport services;
- The service plan that connects those stations and terminals most efficiently;
- The supporting technical systems, such as ticketing and passenger information.

3.3 Its name derives from the three essential characteristics of the system:

- It employs the **bus** as the means of mechanised mobility, rather than rail transport that is often presumed as the appropriate mode to achieve high capacity. This then results in lower investment costs and greater operational flexibility.
- The system is **rapid** in that it increases travel speeds, both in absolute terms but also in comparison with the general traffic in the highway alongside the system, through segregation of its running ways from that traffic.
- The system provides **transit**, that is the high volume movement of people in an urban environment. It becomes appropriate when demand levels reach some 6,000 passengers per peak hour and direction (one 100-capacity bus per minute), and can still handle five times that flow with appropriate specification and design.

3.4 Within these broad parameters, the permutations of infrastructural and operational design options are enormous reflecting the diversity of urban environments. BRT systems in current operation range from the capital intensive that run on new reservations and have grade separation from general traffic, to far lower cost options that involve little more than reallocation of existing road space and traffic priorities. There is no one standard design, though sometimes the TransMilenio system in Bogotá is taken as the exemplar.

3.5 The purpose of this Pre-Feasibility Study is firstly to determine the most appropriate design concept, and then to select the best corridor for its pilot implementation as part of a longer-term network. It is to create a BRT that is applicable to Greater Kampala, learning from experience elsewhere but not replicating it wholesale. This process requires the measurement of current travel demand, and its estimation in the future as the conurbation grows and the system affects travel behaviour. The accuracy of that prediction will depend on the degree of integration between land use and transport planning, and the effectiveness of the controls made on the former.
3.6 It is also necessary to test the practicality of inserting the BRT concept into the existing road network, identifying where this will need to be expanded, and estimating the costs relating to its construction including land acquisition and mitigation of the environmental and social impacts arising. It is recognised that contested land acquisition presents a major challenge in Greater Kampala, both in respect of cost and time, and so the pilot route must minimise this to the extent possible.

3.7 The benefits of the system derive from lower travel costs, primarily from the higher level of productivity and economies of scale of large buses running within the system in comparison with minibuses operating in traffic congestion, but there are also time savings and potential safety improvements. Pricing of travel within a BRT system, though, is ultimately a political decision as to whether the economic benefits are primarily captured by the passengers or by the system investors. In general we prefer the latter, as it provides funding for expansion of the system.

**Route Options**

3.8 Central to this study is an analysis of the proposed routes which could form part of the future BRT network, both in terms of the pilot route, and as part of the long term network.

3.9 The route options were initially presented within the terms of reference but have evolved through discussion and analysis. The final route options taken forward for evaluation are illustrated in Figure 3-1 below.
It should be noted that routes have not only been considered in isolation, but that the interaction and combination of route options has also been considered.

**Strategic choices**

The most fundamental choice in the conceptual design of a BRT system is as to whether the system be ‘closed’ or ‘open’. However these descriptions are often used loosely in the BRT literature, and can actually apply in three domains:

- route structure of the system;
- operator access to the system; and

![Figure 3-1: BRT Route Options](image)
the nature of stations within the system.

3.12 The remaining strategic choices to be made within a BRT system are as to the level of cost recovery that will be required from passengers, and the choice of beneficiaries of the gains made by the public investment in the system.

3.13 Each of these will now be examined below:

**Route structure**

3.14 The two choices are to design the route system with a core trunk service running between terminals and indirect feeder services accessing this at interchange stations (closed), or to provide direct services from the trunk along the paths of high feeder demand (open).

3.15 In order to avoid confusion, we will use the categorisation of these two approaches as that defined by the US Federal Transit Administration – internalised and externalised respectively. However the former is also sometimes referred to as LRT-Lite, in that it mimics application of Light Rail Transit to a network where indirect feeder service is inevitable. For the direct system, we will refer to the integrated feeder routes as tributary routes so as to distinguish them from indirect feeder services.

3.16 The theoretical advantage of an internalised system is that it maximises potential transit capacity within a corridor. As the buses are not affected by any travel on the external road network, operational headways (time gaps between buses) can be closely managed and the highest possible number of buses can pass through the system. However this is a production not a consumption benefit, unless the buses are all equally and highly loaded.

3.17 If the delivery of passengers to the interchange stations is irregular, as it will be if the feeder buses are operating in general traffic, then the system must be capable of dealing with that challenge. Either the system must run with spare capacity to deal with surges in demand, or passengers must wait until sufficient capacity becomes available. The former clearly reduces the average load factor (percentage of vehicle capacity occupied), and hence raises the cost per passenger, and the latter imposes a time penalty on those making the interchange as well as requiring increased capacity at the stations to handle the numbers involved.

3.18 Detailed analysis has also shown that indirect services have lower economic benefits than direct services where there are more than two potential tributary services feeding into the trunk BRT corridor. This factor is even greater where such potential direct services join the trunk relatively close to the section of peak demand in the corridor. This arises because spare bus capacity has to be provided from the terminal to the point of interchange in order to carry these passengers, and this necessarily lowers the average load factor and hence raises the cost per passenger.
The following figure illustrates forecast public transport demand as predicted as part of the National Transport Master Plan study. Examination of the highest demand corridors suggests that each has several high-capacity feeder routes, and many of these join quite close to the city centre.

![Figure 3-2: Forecast Public Transport Demand from GKMA Masterplan](image)

A further disadvantage of indirect services is the size and cost of the interchange stations needed to handle high passenger demand, potentially far more than 1,000 passengers per peak hour. At the least this would need the capacity to handle a minimum of 70 minibuses per hour, and potentially far more, arriving randomly. Space for such interchange stations also needs to be found within the highway reservation, or a pedestrian stage and road crossing needs to be included in the individual journey at significant personal cost. Examination of the arterial road network in Greater Kampala suggests that this might only be a possibility on outer parts of Jinja Road, and in all other cases land would need to be acquired for the interchange.

In avoiding these problems, an externalised BRT system also offers a number of other major advantages. Firstly it retains the flexibility of a bus over a fixed-track system to operate off-route. At one level, this provides operational security against an accident or other blockage within the system in that the bus can by-pass this in the parallel road network; this also allows for running way repair or maintenance. It may be observed that rail systems often need bus substitution services at weekends, and the same applies to highly internalised BRT systems.
3.22 Of more significance, the bus can reach closer to the sources of travel demand in dispersed suburbs limited only by the physical capacity of the roads for use by large vehicles. This, in turn, means that any feeder stage in an individual journey will be shorter and, given the higher travel cost per kilometre of all feeder modes, also cheaper. Further, because the far higher number of potential interchange points are well dispersed through the metropolitan area, the passenger handling capacity needed at each is greatly reduced. This in turn makes informal interchange practical, and this can be handled within the highway reservation.

3.23 Where the demand on these direct, or ‘tributary’, services approaches that justifying full BRT infrastructure investment then they can be upgraded accordingly. This allows for progressive roll-out of the BRT system over time, and places no capital constraint on the extent of the system in the manner imposed by an internalised system. In turn, this flexibility allows for a more rapid roll-out and increased geographic coverage within the metropolitan area to the benefit of a greater proportion of the population.

3.24 Finally, an externalised system enables the potential for a two-tier service targeted both at ordinary commuters and current car users. Introduction of such differentiated service offered in both Harare and Nairobi proved highly popular and profitable, and resulted in significant modal diversion away from private cars; as such, this is a supporting initiative to car demand management. The routes covered by the higher class service would differ from the rest outside the core infrastructure, travelling from the lower-density suburbs where park-and-ride schemes might also be introduced. However these services would then share the BRT running ways through to the city centre, where alternative stations would be provided.

Operator access

3.25 Here the two choices are whether to open the BRT infrastructure to all potential operators, or to restrict it to selected operators providing services specified by the system manager. The latter approach may be defined as managed access to the BRT system.

3.26 In almost all BRT systems around the world, access is controlled by contracts between the BRT system manager and the bus operator(s) to provide services specified by the manager. This allows for the service offer to be tightly defined, and therefore for the bus stations and infrastructure to be designed accordingly. This results in a BRT system that is both effective and efficient, and optimises the match of transport supply to demand so as to minimise the cost of travel.

3.27 The contractual arrangements allow the system manager to:

- Manage the volume and distribution of transport supply;
- Manage the flow of vehicles within the system;
- Manage the quality of service;
- Ensure consistency of supply across operators; and
- Co-ordinate and intervene where required.

3.28 Ideally the allocation of such service contracts should be made through a transparent and competitive tender process, known as ‘controlled competition’. While the intention to move
to such a system of economic regulation of bus services has been expressed by Kampala City Council, the legal framework is not yet in place for this. However the current system of bus regulation, as defined in the Traffic and Road Safety Act, 1998, could be applied to ensure closed access – albeit by administrative decision, rather than competitive process. As such, the regulatory framework need not be a barrier to the preferred strategy.

3.29 One further advantage of service contracts is that charges can be levied on the operator(s) for the right to use the infrastructure. Such charges would be applied in the first instance to defray the necessary costs incurred by the system manager in ensuring orderly operation, and in providing such higher-level passenger services (ticketing, information, etc) as might be required. The charge would also cover routine infrastructure cleaning and maintenance costs, and make provision for periodic maintenance as required. The charges required to fund these expenditures would be much lower than the cost savings to the bus operator(s) from the usage of the system, and so would still permit a reduction in fares in comparison with traditional bus services.

3.30 It should also be noted that ‘closed’ operator access need not preclude a differentiated BRT service offer, as explored in the previous section. The two standards of service would only need to be separately contracted, and operating controls devised and set such that each didn’t interfere with or extract patronage from the other. The only proviso would need to be that the premium service employed vehicles that were compatible with the infrastructure, including the ability to pass any physical entry barriers provided.

3.31 The alternative of open operator access was intentionally applied only once, in the pilot BRT system in Jakarta, Indonesia. Because of the obvious attraction to operators of reduced running times, far too many buses attempted to join the system and the infrastructure was overwhelmed. Sadly this permanently damaged the public perception of BRT such that future mass transit plans in that city are now based on rail-based modes.

3.32 A similar situation arose recently in Turkey, where the BRT system managers had failed to conclude contracts with potential operators in advance of the opening of the infrastructure. In order to avoid public humiliation, open operator access had to be authorised as an interim measure. However, now that the system is operational and its benefits are clear, controlled access is gradually being introduced.

Station type

3.33 Most BRT systems around the world employ ‘closed’ (restricted passenger access) stations as a direct requirement of their fares’ collection methodology. Under this scenario, tickets are purchased outside the station and validated on entry through some form of intelligent turnstile that either checks that the appropriate payment has been made or deducts the appropriate charge from a stored-value card.

3.34 The main benefit of a closed station, other than this travel validation, is the creation of an orderly environment for efficient passenger boarding. However the implications of this are
that the station needs to be physically large enough to handle passenger volumes if there are any service delays, and that intending passengers have no opportunity to change their journey under such circumstances.

3.35 It should also be noted that a fares’ collection system that is dependent on closed stations must be applied at all stations throughout the network. This is relatively simple and cheap to secure in an internalised system, in that there are relatively few stations involved, but far more challenging in an externalised system with multiple tributary routes. However the other advantages of an externalised system in a dispersed demand network are so immense that this is insufficient justification for a change in that concept.

3.36 The choice of fares’ collection methodology is also affected by the fares structure to be used within the BRT system. Potential travel distances within Greater Kampala vary widely, with those from Entebbe or even Mukono to central Kampala being far greater that those from Bugolobi or Natete for example. Under these circumstances, it is necessary to employ some form of graduated or zonal fares structure to match the fare paid (roughly) to the cost of service provision. A flat fare required for cost recovery over the full network would be provide a deterrent to short-distance travel, and result in passenger diversion to less efficient modes.

3.37 The application of graduated fares with station validation will inevitably require intelligent turnstiles on the exit as well as the entry, either to check that the appropriate ticket had been purchased or to return a fares balance onto a stored-value card where a decrementing fares technology had been employed. This further increases the investment costs, and is likely to cause delay while passengers with invalid tickets are handled by station staff.

3.38 Finally, application of station validation for ticketing necessarily implies that the form of contracting between the system manager is ‘gross cost’, that this the operator is rewarded purely for his service offer in terms of bus kilometres delivered and not for the number of passengers carried or revenue generated. This arises because there is no direct linkage between payment of the fare and the use of any specific vehicle (or operator, in a multi-operator system). This also implies that the ticketing system provides less useful information for network planning purposes.

3.39 All of these problems can be avoided with ‘open’ stations, where the fares’ collection or validation can be made on the bus rather than at the station. At the lowest system level the fares could be collected on-board the bus, and the use of a roving conductor rather than the driver for this purpose minimises the impact on station dwell-time. Modern electronic ticket-issuing machines not only print a secure ticket at point of sale but also provide an audit trail that includes automatic generation of trip waybills, and so high levels of revenue integrity can still be obtained.

3.40 At the higher level of technology implied by electronic stored-value tickets (‘chip cards’ or ‘smart cards’), validation can be made on the bus both on entry and at exit. Over-riding fraud control can be obtained through charging the maximum fare for the route on boarding and rebating the appropriate amount when alighting. If a GPS system is used for automatic vehicle location in order to determine the appropriate values for each transaction, then extremely detailed travel usage data can also be obtained.
3.41 Finally, the open-station concept allows for the option of ‘net-cost’ contracting, where the bus operator is responsible for his own revenue collection and integrity and the margin over his operating costs determines his profitability. This not only aligns his own incentives with those of the BRT system manager, but also avoids the need for a revenue guarantor of last resort capable of accepting the risk of systemic failure in the fares collection system.

3.42 The potential disadvantage, though, of net cost contracting is that the BRT system manager may only have a relatively low level of knowledge of operator revenues. This makes it more difficult to establish the right balance of benefit between the operator, the passenger, and the BRT system ‘owner’. As such, the contract would need to require disclosure of passenger volumes on a routine basis with these then being verified periodically by survey.

Cost recovery

3.43 In most transit systems in developing countries, fares levels are set so as to enable at least the recovery of the full direct operating cost of the service and avoid the need for subsidy to cover any shortfall in this domain. International experience has shown both that a reliance on direct subsidy reduces any incentive for efficient operation, and that subsidy payments become increasingly unaffordable to the system manager with the ultimate risk of default and system collapse. Examples of these effects unfortunately have been widespread in Sub-Saharan Africa in the past, and have been one of the main causes of the emergence of un-regulated minibus services as bus replacements with their attendant consequences of road congestion, low service standards, and environmental nuisance.

3.44 The question then arises as to how much of the capital costs, or investment return, should be borne by the passenger and whether any shortfall should be made good by the system manager. General practice, employing a public / private partnership whereby the operator is responsible both for the provision of the buses and their operation, recognises the need for the operator to recover his financing costs and make a reasonable return on his investment; unless this is the case, the investment just won’t be made.

3.45 However it would still be possible for the system manager to support any profit shortfall, either directly or through subsidising the bus procurement and / or financing. In either case there is a risk of the subsidy being captured by the operator rather than the passenger, but at least a capital subsidy offers security to the operator in that it is effectively paid up-front. Ultimately the choice is political as to whether the subsidy is justified in meeting transport policy objectives, and in societal terms recognising the opportunity cost to Government of that expenditure.

3.46 In the case of BRT (or any rail-based system), though, there is also the question of potential cost recovery of the public investment in the system infrastructure. Full cost recovery of this investment from passengers would result in fares that were almost certainly unaffordable, and would result in passengers seeking alternative modes of travel that would defeat the purpose of the investment in the first place. Further, the BRT passengers would not be the only beneficiaries of the system in that reductions in congestion and environmental nuisance benefit society at large; as such, they should not be expected to pay for these.

3.47 The recommended approach under such circumstances is first to ensure full recovery of direct BRT system operating costs, such as cleaning, operational management, and routine
maintenance of the infrastructure, together with setting-aside a provision for its periodic maintenance to ensure sustainability of condition over time. The failure of the latter in many rail-based transit systems was the underlying cause of their eventual collapse, as operating costs increase and speeds reduce as a result of track deterioration. It would be prudent not to make the same mistake, so as to ensure the sustainability of BRT over the long term.

3.48 Whether any further contribution to investment cost recovery should be paid by passengers is again a political choice. It is widespread practice that the fares within the BRT system should be no higher than those paid in the alternative mode prior to its introduction, and clearly these fares would not be subject to the arbitrary hikes at times of peak demand that are typical of the minibus sector. This is generally possible without any subsidy other than in respect of infrastructure investment cost recovery, and time-saving benefits to passengers can therefore be passed through for free.

3.49 However for BRT systems where demand levels are high, investment costs relatively low, and the speed gains large in comparison with previous congestion, it should still be possible to generate a substantial cashflow surplus whilst meeting all the above objectives for cost recovery. Under these circumstances, it can be argued that this surplus should be captured by the system manager and not passed through to passengers either in fares reductions or in artificially high service levels at times of low travel demand. Provided that it is lawful for the BRT system manager to retain such surpluses, these can then be reinvested in expansion of the network so as to increase its rate of roll-out and geographic coverage.

3.50 The alternative of utilising the potential surplus to offer lower fares within the BRT system is economically dangerous, and may well still not result in significant modal diversion from pedestrian commuting. For the existing matatu passengers, our surveys indicate that some three quarters would actually pay more for a better / faster service, so offering them lower fares would deprive the system of significant income for no clear personal advantage.

3.51 Further, these lower fares would need to apply throughout the bus network or else there would be the continuing paradox of passengers paying higher fares for poorer service; this would not be sustainable across the metropolitan area without operational subsidy. Finally, international experience suggests that the order of fares reduction required to change behaviour amongst the lowest income commuters can be very significant; this compounds the long-term need for subsidy, which may then not prove to be affordable.

**Design Options – Running Ways and Stations**

*Operation within the Median with Median Stations*

3.52 Median operation is a key feature of TransMilenio in Bogotá; it ensures that the vehicle is kept away from interruptions caused by roadside activity. As such, median location within the roadway increases the travel speed, as there are fewer conflicts with vehicles entering and leaving the road, and with other transport vehicles attempting to pick-up and drop-off passengers or goods. As a result running time can be reduced resulting in a smaller vehicle fleet and depot requirement and consequent reduction in operating (whole life) costs.
3.53 Median operation can also aid system identity by showing, obviously and clearly, that the BRT is a high status form of transport protected from general traffic. It also can reduce the overall width requirement where the stations platform is shared between buses running in either direction. Dependent upon issues such as fare collection and loading requirements shelter and other station requirements can also be shared.

3.54 Median operation does however take the transport away from the origin and destination of trips creating severance between the point of access and activity. This is usually resolved through the use of over bridges supported by fences at ground level preventing crossing in front of traffic. The need to access via an over bridge affects the accessibility of BRT and unless lifts are provided, acts against disabled access provision. It increases access time, where the value of time is low this has less effect. It also increases physical effort required to access the system which again has greater effect where there is a sensitivity to physical effort. The degree to which these factors become a deterrent to use is dependent upon the relationship between time, cost and the availability of alternatives. As such they are issues that should be explored through stated preference surveys to take full account of local factors.

3.55 To operate within the median, with median stations, vehicles in Kampala must have doors located on the right and vehicle crossing movements across the median must be managed/banned. Table 3-1 makes a comparison of the benefits and disbenefits associated with such operation.
### Table 3-1: Evaluation of Median Operation with Median Station

<table>
<thead>
<tr>
<th></th>
<th>Benefits</th>
<th>Disbenefits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical</strong></td>
<td>Effective use of under utilised road space (broad median) and hence less adverse effect upon road capacity at stations</td>
<td>Greater reduction of road capacity where median is New Jersey Barrier type</td>
</tr>
<tr>
<td></td>
<td>If overall Right-of-Way permits, may allow retention of median structures and landscaping</td>
<td>Passing lanes at bus stations require often extensive realignment of the existing roadway</td>
</tr>
<tr>
<td></td>
<td>Aids clear system identity</td>
<td>Staggered median stations may prove difficult to insert because of length</td>
</tr>
<tr>
<td><strong>Operational</strong></td>
<td>Minimised conflict with turning traffic / more effective junction control</td>
<td>Single station can cause confusion and there may be capacity issues</td>
</tr>
<tr>
<td></td>
<td>Lower risk of illegal intrusion at junctions</td>
<td>Staggered median stations lose their operational efficiency when travel demand direction is heavily peaked</td>
</tr>
<tr>
<td></td>
<td>Greater control of run times (through limited road edge interruption) can lead to smaller fleet size and depot requirement</td>
<td>No direct interface with feeder services / other access modes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vehicle requires doors on right (or on both sides) and require conversion for ‘cascading’ to lighter duties towards the end of their useful life</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vehicles with doors on both sides lose seating capacity</td>
</tr>
<tr>
<td><strong>User interface</strong></td>
<td>System clearly defined</td>
<td>Feeder services remote from BRT and therefore interchange will add to user costs</td>
</tr>
<tr>
<td></td>
<td>Location away from other activity simplifies policing with safety benefits</td>
<td>Stations likely to be remote from feeder services, adding to cost of interchange</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Physical effort of access</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Increased access time</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Disability access problems</td>
</tr>
<tr>
<td><strong>Socio-Economic</strong></td>
<td>No need to remove road side activity</td>
<td>Separation of BRT and economic activity</td>
</tr>
<tr>
<td><strong>Financial</strong></td>
<td>Lower operating cost through better controlled run times</td>
<td>Potential high capital cost</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High system operating cost through need for additional vehicles</td>
</tr>
</tbody>
</table>
**Median operation with bilateral stations**

3.56 An adaptation of the above would be to operate within the median but locating stations bilaterally, although still within the median. This would increase the overall width requirement as a station would be required for each direction of travel, however this may be required anyway if loadings are high. In any case, the specific width requirement may be reduced by staggering the station locations along the running way, and this flexibility may facilitate their insertion. The vehicle would have doors located on the, conventional, left side which would make them compliant with conventional lateral running and enable ‘cascading’ to lighter duties at the end of their BRT lives.

3.57 Within this arrangement there is a need to consider the management of pedestrian flows across running lanes in conjunction with platform access from the roadside.

3.58 Whilst possessing many of the characteristics of the ‘median operation median station’ option, the location of bilateral stations close to junctions can make integration with feeder services more effective. The benefits and disbenefits of median operation are as that of the median station option above. Table 3-2 below therefore highlights *additional* issues associated with this option and highlights in red those issues identified above that no longer apply.
Table 3-2: Evaluation of Median Operation with Bilateral Stations

<table>
<thead>
<tr>
<th></th>
<th>Benefits</th>
<th>Disbenefits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical</strong></td>
<td>More effective use of road capacity with offset stations, as bi-directional busway can be used as passing lane</td>
<td>May require two connections to pedestrian over bridge</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cost of demolition of broad median structures</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Potential relocation of street lighting</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Impact upon over-bridge supports</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Potential drainage impact</td>
</tr>
<tr>
<td><strong>Operational</strong></td>
<td>Can enable direct integration with feeder services</td>
<td>Single station can cause confusion</td>
</tr>
<tr>
<td></td>
<td>Increased capacity of stations</td>
<td>Vehicle requires doors on right</td>
</tr>
<tr>
<td></td>
<td>Management of directional flow</td>
<td></td>
</tr>
<tr>
<td><strong>User interface</strong></td>
<td>Reduced cost of interchange if feeder services are integrated</td>
<td>Management of pedestrian flows across running lanes</td>
</tr>
<tr>
<td></td>
<td>Stations can be closer to non-integrated feeder services</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Increased certainty through clearer definition</td>
<td></td>
</tr>
<tr>
<td><strong>Socio-Economic</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Financial</strong></td>
<td></td>
<td>Slightly higher capital cost</td>
</tr>
</tbody>
</table>

3.59 The adoption of bilateral stations with median operation, as opposed to median stations, is largely dependent upon capacity requirements, the management of passing lanes (if required) and the integration of the BRT system with its feeder services. In general, where the absolute capacity of the system is not the key selection criterion, this option minimises both operating and passenger costs. The capital cost increase of providing two stations, instead of one, has to be offset against the more effective use of road-width capacity (other than where there is a broad median). The potential need to provide two separate connections to any over-bridge must be justified in terms of system management, achievement of objectives and whole life cost.
Median operation with cross over at stations

3.60 To get over the issue of needing doors on the offside of the vehicle a cross over can be provided on the approach to a station with median operation. This method of operation creates some complexity upon the station approach which can become hazardous where high frequency and/or a mix of express and stopping services are present. The primary advantage is seen within a system that operates both median and bilateral operation where a conventional approach would require doors on both sides of the vehicle. This, whilst not presenting difficulty in manufacture, reduces internal (carrying) capacity. Costs are roughly similar to that of median running with shared central stations. This option is effectively a variant of the median operation with median station.

Bilateral operation

3.61 Bilateral operation ensures a direct interface between BRT and trip origin and destination that are accessed, without exception, from the roadside. This distinct advantage carries with it the potential conflict with road side activity, trading parking etc., which can significantly affect run times. With bilateral running stations can be integrated into the surrounding land use with full advantage taken of existing buildings, onward journeys are readily made without conflict, if destination lies on the same side as alighting.

3.62 With bilateral operation vehicle doors can remain on the nearside only allowing flexibility in the use of the vehicle fleet if required.

3.63 Traffic management at junctions is more complex with bilateral operation with potential conflict between left turning traffic and the BRT vehicle. This may be overcome with advance traffic signals that allow a BRT vehicle to move ahead of turning traffic but this reduces the overall capacity of the junction. Similarly access to road side activity, access points etc. is not possible for other traffic in the presence of bilateral BRT lanes.

3.64 Table 3-3 compares advantages and disadvantages of bilateral operation.
Table 3-3: Evaluation of Bilateral Operation

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Disbenefits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical</strong></td>
<td>Potential reduced road capacity with reallocation of road space (as median operation)</td>
</tr>
<tr>
<td>Reduced impact upon median street furniture / utilities</td>
<td>Drainage issues may need to be resolved</td>
</tr>
<tr>
<td>Simple in construction</td>
<td>Alternative arrangements need to be made for kerb access for general traffic</td>
</tr>
<tr>
<td>Bus lay-byes inset into the kerb enable passing lanes at stations and hence effective use of road capacity</td>
<td></td>
</tr>
</tbody>
</table>

| Operational | Some road-side interruption inevitable with reduction in journey time |
| Positive relationship with origin/destination | More interference from turning traffic, requiring effective management of side roads and access |
| Better interface with feeder services of whatever mode. | |
| Assists general traffic flow as well as bus movement | |

| User interface | Need to cross to counter direction requires management / over-bridges |
| Users not isolated when awaiting vehicles. | |

| Socio-Economic | Potential effect upon local trading economy |
| Potential to maximise / manage land use change / economic growth through presence of BRT | |

| Financial | Any unreliability in journey times will result in increased operational cost |
| Significantly lower construction costs | |

*Median Operation with Tidal flow*

3.65 Where there is a strong tidal flow, often found on radial routes running into a major employment centre, the overall road width may be utilised more effectively by having a lane which switches direction according to the majority flow. The switching requires careful management in order to ensure safe operation. This is usually achieved through an ITS system consisting of overhead gantries that signify when, and when not, the lane is in use. Some form of detection is placed within the lane that can monitor movement and direction of flow with switchover managed through a short period of lane closure.

3.66 For a tidal flow system to work there is a need for a very strong and distinct tidality to movement. The bus that opposes the tidal flow must still operate unhindered in order to
maintain even headways for the return (major movement) journey and to offer a good level of service. There can be significant construction cost savings due to a requirement for a single lane only but ongoing costs are incurred in maintaining a relatively sophisticated ITS management system. Positioning of stations where tidal flow is operational is problematic due to the bi-directional flow of vehicles that will access them and the switching of direction may cause confusion amongst users.

3.67 Whilst this method of operation has been used in many instances to control general traffic we are not aware of a situation where it has been used to control buses.

Further Operational Considerations

Bus Size and Configuration Options

3.68 Whilst it is inappropriate to identify and recommend vehicle makes and specific vehicle types, it is necessary to identify key issues of vehicle specification that have either an effect upon operational efficiency, infrastructure requirement, or system identity. Vehicle size and type is one key consideration, though local regulations may place constraints. Typical options include 12.0m and 13.7m rigid, and 16.5m and 18.0m articulated buses. Bi-articulated and double-deck buses are also technically feasible, but operational constraints exclude these options in most cities.

3.69 The size of vehicle determines the carrying capacity, and hence, fleet size. Key to carrying capacity is the proportion of passengers seated and standing relative to acceptable personal space requirements. When considering different types of bus, it is important to use a constant basis of evaluation in this regard.

3.70 The relative advantages and disadvantages of each vehicle are reviewed in Table 3-4.

3.71 In addition to vehicle size the following key features need to be considered:

- Cost: purchase cost, economic life and potential resale value
- Floor height: to meet accessibility requirements aiding efficient boarding and alighting to minimise bus dwell times
- Availability: to ensure competition in purchase to minimise cost, implying standard vehicles and adopting international standards
- Maintenance: an ability to maintain vehicles and manufacture support is essential in order to ensure reliability
- Robustness: track record of vehicle, complexity of basic repairs, ability to repair at roadside, reliability and longevity
- Flexibility: to ensure that fleet purchase is not limited to specific routes and cascading to other operations when the BRT fleet is replaced to maintain high standards demanded. Important considerations are door positions, on the left preferred, and angles of approach and departure
- Safety: strength of body, chassis design, braking effectiveness and fire protection
- Environment: local and global emissions, noise levels and other waste products
- Regulations: compliance with local weight, height, width and length restrictions.
Table 3-4: Relative Advantages and Disadvantages of Vehicles

<table>
<thead>
<tr>
<th>Bus Type</th>
<th>Usage</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.0m Rigid</td>
<td>Most common form</td>
<td>Significant choice</td>
<td>Capacity limited</td>
</tr>
<tr>
<td></td>
<td>Max capacity 95</td>
<td>Flexibility for re-utilisation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Max seats 50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.7m Rigid</td>
<td>Emerging high-capacity standard</td>
<td>Higher capacity leads to fewer buses for ease of operational management</td>
<td>Capacity reduces when maximum seats are fitted</td>
</tr>
<tr>
<td>(3-axle)</td>
<td>Max capacity 150</td>
<td>Capital and operating cost per passenger similar to or better than 12m rigid bus</td>
<td>Slight reduction in manoeuvrability</td>
</tr>
<tr>
<td></td>
<td>Max seats 58</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16.5m Articulated (trailer)</td>
<td>Historic high-capacity standard</td>
<td>No loss of capacity when maximum seats are fitted</td>
<td>Higher capital cost per passenger place</td>
</tr>
<tr>
<td></td>
<td>Max capacity 130</td>
<td></td>
<td>Difficult to reverse, so operational and depot constraints</td>
</tr>
<tr>
<td></td>
<td>Max seats 58</td>
<td></td>
<td>Requires extended bus-stop platforms</td>
</tr>
<tr>
<td>18m Articulated (pusher)</td>
<td>Employed in many BRT schemes</td>
<td>Higher capacity leads to fewer buses for ease of operational management</td>
<td>Higher capital and operating costs per place</td>
</tr>
<tr>
<td></td>
<td>Max capacity 180</td>
<td></td>
<td>Difficult to reverse, so operational and depot constraints</td>
</tr>
<tr>
<td></td>
<td>Max seats 67</td>
<td></td>
<td>Requires extended bus-stop platforms</td>
</tr>
</tbody>
</table>

3.72 The running way and station configuration determines the required door locations of the buses. Median operation with median stations requires the door to be located on the offside of the vehicle (on the right in Kampala), which prevents the bus from operating outside of the BRT network and reduces system flexibility. It is possible to fit doors on both sides of the bus to avoid this problem, but the inevitable loss of seats makes this option unattractive to passengers.

3.73 Median operation with bilateral stations, or bilateral operation, allows the doors to be located on the nearside of the vehicle (on the left in Kampala), which allows greater flexibility, as buses can also operate away from the specialised BRT corridors. This has the further advantage that buses can be cascaded to other duties at the end of their useful life, so full investment cost recovery need not be made within this period.

Bus Station Platform Specification and Access

3.74 Level entry from stations into the buses substantially reduces passenger boarding time, from an average of 2 seconds per passenger to less than 1 second which has a flow-through effect of reducing station dwell time, cycle time and hence fleet size as well as being a distinct access advantage for those with impaired mobility, carrying shopping,
children etc. as well as the disabled. This advantage, though, relies on operational discipline to ensure that the bus is docked accurately alongside the platform as the deployment of bridging plates itself raises dwell times.

3.75 However level-access stations are not only more expensive to construct (and difficult to insert), but they also limit station capacity by preventing the efficient use of multiple platforms for different services. Data from Bogotá shows that a second platform only has a 30% utilisation rate, which virtually offsets the capacity advantage of its articulated buses. Further they must be standardised across the network, or buses be provided with two means of boarding (losing seats and raising costs). Observation has also shown that usage of accessible mass-transit systems by those confined to a wheel-chair is minimal, and thus that the increased expenditure does not necessarily satisfy that societal goal.

3.76 The level of assisted accessibility that the BRT is designed to give is therefore a relevant consideration. Designing for the profoundly disabled would require level boarding and accurate vehicle docking. It would also require appropriate access to stations (using lifts if footbridges are used) and appropriate provision for onward journeys. Designing for those with mobility issues requires attention to interfaces between pedestrian-infrastructure and vehicle-infrastructure but to a lesser extent. The World Bank Accessibility Guidelines published in March 2007\(^1\) gives guidance upon the consideration of disability access in World Bank promoted projects. The guidance recognises the benefit to the travelling public in general in designing for disability and the effect of inaccessible public transport on the poorest sections of the community, it states:

“Lack of access to transport creates income poverty. Inaccessible design of the transport services limits access for the disabled and the elderly, and many other groups, to social, political and cultural activities, and thus perpetuates exclusion.”

3.77 The guidance is however pragmatic stating that, “In most cases, applying Western disability standards and facilities to deliver access solutions and ensure universal access in transport systems is not affordable or realistic for the provider or for the users in low-income countries - as most of them are too poor to pay the costs of such standards.”

Fares collection methodology and equipment needs

3.78 Use of pre-paid fare collection systems has been found to have the largest positive effect upon controlling run times. Shorter station dwell times reduce fleet size and thus result in reduced costs for station and depot infrastructure. However this effect can only be achieved if bus doorways are wide enough for the simultaneous free flow of passengers in both directions, and this then requires an aperture of some 1,400mm. Unfortunately this is not achievable within the angles of bus approach and departure required for compatibility with sustainable road conditions in Kampala.

3.79 However whilst pre-paid ticketing can have an obvious economic benefit, it has significant cultural and management issues that must be seen to be acceptable and accommodated. Within a public transport system that is currently cash based on vehicle the move to advance payment will require behavioural change. In Brazil, when a cash alternative

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payment was mandated, 50% of riders abandoned pre-paid smart-card ticketing. Research in Lagos suggests that stored-value tickets would only be welcomed by 10% of passengers, with at least 30% of potential passengers being excluded by the affordability of such a system.

3.80 The point at which payment is made can be at turn-styles, as in Curitiba, or through advanced ticket purchase checked on vehicle, as in most European systems. The degree of enforcement, space required to manage ticket purchase and acceptance/trust of the system proposed are key considerations in arriving at a preferred approach.

**Marketing of BRT services**

3.81 The creation of a BRT brand and the marketing of BRT as an enhanced form of public transport to prospective users and those with a stake in its development and delivery can have significant advantages. In Lagos intensive marketing of the BRT concept was undertaken prior to implementation in order to ensure that all those on the corridor, particularly prospective users, were fully aware of the advantages it would bring. The result was a powerful group of BRT advocates that eased the pain of implementation and ensured that any politician, of whichever persuasion, had to support BRT. Marketing of the system continued through early days of operation and continues to this day in the form of regular meetings of a BRT parliament, question time on local radio and suggestions for improvement. Involvement of the public through this process has created strong local ownership ensuring that it is a ‘peoples project’ and not a seen as a government initiative.
4 TRANSPORT SUPPLY AND DEMAND DATA COLLECTION AND ANALYSIS

4.1 This chapter describes the current travel demand and supply characteristics in the GMKA and the methodology and data sources employed. The nature of this study, particularly the scope of objectives and the preceding activities carried out, has been appraised by the study team in order to ensure the most appropriate methodology and data gathering exercises are applied.

4.2 This pre-feasibility study requires, inter-alia, the short listing of routes and operation configuration. Therefore, the study area includes the whole of GMKA and can be considered large. Route rankings are of the greater significance and the required degree of precision can be regarded as relatively less critical, though this should not compensate on the reliable estimate of total demand. Therefore, the main data gathering objectives of the study team was to obtain information encompassing the entire study area and employ any pre-existing sources to both validate and deepen our understanding of travel characteristics.

4.3 Specifically, the Terms of Reference of this study requires the consultants to collect “socio-economic data and information on transport demand and supply in GKMA, origins and destinations, travel patterns and modal split, traffic volumes (motorised and non-motorised, pedestrian) and traffic flows”.

Data Collection and Existing Data

4.4 The following outlines the data obtained by the ITP study team:

- Classified traffic counts (6am – 10pm) – 7 locations around the Kampala conurbation. Following consultation with Kampala City Council, the survey methodology was adapted to include non-motorised flows as mode shift from walking to BRT is potentially an important consideration.

- Mystery traveller surveys (recorded over three days) – Survey staff recorded details of existing journey times and conditions along six key existing public transport routes.

- Traveller interviews (recorded over three days) – Survey staff interviewed people using a variety of modes to understand their socio-economic background, origins and destination of travel, purpose of travel, and potential attractors to BRT.

4.5 Previous activities undertaken pertinent to this study are the National Transport Master Plan and the Greater Kampala Road Network and Transport Improvement Study (the latter carried out under a JICA Collection Programme)

National Transport Master Plan

4.6 The consultant has received information which was used to produce the EMME/2 public transport modelling work as part of the National Master Plan Study. Of particular interest are the (expanded) origin-destination (OD) matrices used to construct the models and the socio-economic figures used to derive its conclusions. The interrogation of the OD matrices is further discussed in the subsequent chapter.
4.7 JICA Collection Programme

The JICA data collection team have provided details of the count information collected to inform the Greater Kampala Road Network and Transport Improvement Study (which is an ongoing project). The following information is most relevant to this chapter and was obtained in January 2010:

- Classified vehicle counts (12 locations around Kampala conurbation)
- Origin-destination interviews (9 locations around Kampala conurbation)

4.8 The traffic counts undertaken by the JICA Collection Programme has been used to check both the consistency and enhance the traffic counts obtained by the ITP study team; the outcome of which is critical for the estimation of current demand levels.

4.9 In addition, OD matrices are available from the study, which will be further explored in the subsequent chapter as it relates much closer to travel demand and forecasting.

**Traffic Count and Occupancy Count Data**

4.10 Table 4-1, below, presents the total traffic flows recorded at each of the count sites throughout the day (6 am – 10pm).

**Table 4-1: Summary of ITP Traffic Counts (6am – 10pm)**

<table>
<thead>
<tr>
<th>No of units</th>
<th>Masaka Road</th>
<th>Bombo Road</th>
<th>Entebbe Road</th>
<th>Gayaza Road</th>
<th>Jinja Road</th>
<th>Kira Road</th>
<th>Natete Road</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inbound</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Matatus/Buses</td>
<td>2,736</td>
<td>3,315</td>
<td>4,940</td>
<td>2,719</td>
<td>5,983</td>
<td>1,829</td>
<td>3,036</td>
</tr>
<tr>
<td>Cars/Taxis</td>
<td>3,810</td>
<td>4,311</td>
<td>9,372</td>
<td>3,784</td>
<td>9,564</td>
<td>5,612</td>
<td>3,058</td>
</tr>
<tr>
<td>Motorcycles</td>
<td>4,225</td>
<td>3,625</td>
<td>5,177</td>
<td>3,963</td>
<td>5,607</td>
<td>4,094</td>
<td>3,439</td>
</tr>
<tr>
<td>Truck</td>
<td>761</td>
<td>624</td>
<td>1,050</td>
<td>631</td>
<td>1,063</td>
<td>277</td>
<td>217</td>
</tr>
<tr>
<td>Bicycle</td>
<td>1,543</td>
<td>2,165</td>
<td>780</td>
<td>2,587</td>
<td>694</td>
<td>830</td>
<td>307</td>
</tr>
<tr>
<td>Pedestrian</td>
<td>1,968</td>
<td>3,352</td>
<td>6,816</td>
<td>2,468</td>
<td>1,949</td>
<td>1,385</td>
<td>1,229</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>15,043</strong></td>
<td><strong>17,392</strong></td>
<td><strong>28,135</strong></td>
<td><strong>16,152</strong></td>
<td><strong>24,860</strong></td>
<td><strong>14,027</strong></td>
<td><strong>11,286</strong></td>
</tr>
<tr>
<td>Outbound</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Matatus/Buses</td>
<td>2,735</td>
<td>3,011</td>
<td>4,661</td>
<td>2,324</td>
<td>5,881</td>
<td>1,990</td>
<td>2,210</td>
</tr>
<tr>
<td>Cars/Taxis</td>
<td>3,015</td>
<td>4,779</td>
<td>8,293</td>
<td>2,712</td>
<td>14,049</td>
<td>7,285</td>
<td>2,830</td>
</tr>
<tr>
<td>Motorcycles</td>
<td>4,485</td>
<td>5,782</td>
<td>2,557</td>
<td>3,074</td>
<td>5,641</td>
<td>3,396</td>
<td>3,085</td>
</tr>
<tr>
<td>Truck</td>
<td>1,091</td>
<td>789</td>
<td>137</td>
<td>539</td>
<td>996</td>
<td>201</td>
<td>347</td>
</tr>
<tr>
<td>Bicycle</td>
<td>1,707</td>
<td>1,556</td>
<td>537</td>
<td>2,734</td>
<td>901</td>
<td>870</td>
<td>286</td>
</tr>
<tr>
<td>Pedestrian</td>
<td>2,183</td>
<td>6,924</td>
<td>2,450</td>
<td>2,737</td>
<td>2,571</td>
<td>2,095</td>
<td>1,751</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>15,216</strong></td>
<td><strong>22,841</strong></td>
<td><strong>18,635</strong></td>
<td><strong>14,120</strong></td>
<td><strong>30,039</strong></td>
<td><strong>15,837</strong></td>
<td><strong>10,509</strong></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>30,259</strong></td>
<td><strong>40,233</strong></td>
<td><strong>46,770</strong></td>
<td><strong>30,272</strong></td>
<td><strong>54,899</strong></td>
<td><strong>29,864</strong></td>
<td><strong>21,795</strong></td>
</tr>
</tbody>
</table>

4.11 A diagram illustrating the survey count locations is presented in Figure 4-1, below.
4.12 The traffic counts outlined in Table 4-1 reveal that:

- Inbound/outbound balances are generally neutral for most of the routes, however, there is a strong inbound traffic balance in Entebbe Road and a slight outbound balance in Bombo Road and Jinja Road.
- Overall traffic levels are highest on Jinja Road with approx 55,000 units and second highest on Entebbe Road with approximately 45,000 units.
- Car/ taxi traffic is highest on Jinja Road with approximately 25,000 vehicles and second highest on Entebbe Road with approximately 20,000 vehicles.
- Public transport traffic is highest on Jinja Road with over 10,000 vehicles and second highest on Entebbe Road with slightly under 10,000 vehicles.

4.13 Table 4-2, below, presents the total passenger flows. This was derived by the vehicle occupancy counts integrated in the traffic flow data.
Table 4-2: Summary of ITP Total Passenger Counts (all vehicles) (6am – 10pm)

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Masaka Road</th>
<th>Bombo Road</th>
<th>Entebbe Road</th>
<th>Gayaza Road</th>
<th>Jinja Road</th>
<th>Kira Road</th>
<th>Natete Road</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inbound</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak Hr (7am-8am)</td>
<td>4,245</td>
<td>4,196</td>
<td>13,534</td>
<td>7,012</td>
<td>10,885</td>
<td>3,314</td>
<td>5,288</td>
</tr>
<tr>
<td>Morning Peak (7am-10am)</td>
<td>11,196</td>
<td>11,848</td>
<td>35,397</td>
<td>17,653</td>
<td>33,691</td>
<td>8,376</td>
<td>14,046</td>
</tr>
<tr>
<td>All day</td>
<td>41,157</td>
<td>56,234</td>
<td>93,278</td>
<td>45,915</td>
<td>110,997</td>
<td>39,309</td>
<td>43,871</td>
</tr>
<tr>
<td><strong>Outbound</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak Hr (5pm-6pm)</td>
<td>2,597</td>
<td>4,362</td>
<td>6,779</td>
<td>3,157</td>
<td>9,131</td>
<td>3,460</td>
<td>2,441</td>
</tr>
<tr>
<td>Afternoon Peak (4 pm-7pm)</td>
<td>7,892</td>
<td>14,521</td>
<td>20,124</td>
<td>9,086</td>
<td>23,024</td>
<td>8,003</td>
<td>7,448</td>
</tr>
<tr>
<td>All day</td>
<td>49,878</td>
<td>68,193</td>
<td>82,651</td>
<td>44,411</td>
<td>106,428</td>
<td>37,246</td>
<td>37,930</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>91,034</strong></td>
<td><strong>124,427</strong></td>
<td><strong>175,929</strong></td>
<td><strong>87,355</strong></td>
<td><strong>217,425</strong></td>
<td><strong>76,555</strong></td>
<td><strong>81,801</strong></td>
</tr>
</tbody>
</table>

4.14 The passenger counts outlined in Table 4-2 reveal that:

- Inbound/outbound balances are generally neutral for all routes combined.
- Recorded passenger counts are highest on Jinja Road (approximately 220,000) and second highest on Entebbe Road (approximately 175,000).
- On most routes, morning peak hours are twice as compressed as afternoon peak hours. This is generally expected.

4.15 Table 4-3 below repeats this analysis only for the public transport (matatu and large bus) passengers.
Table 4-3: Summary of ITP Total Public Transport Passenger Counts (6am – 10pm)

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Masaka Road</th>
<th>Bombo Road</th>
<th>Entebbe Road</th>
<th>Gayaza Road</th>
<th>Jinja Road</th>
<th>Kira Road</th>
<th>Natete Road</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inbound Peak Hr</td>
<td>2,299</td>
<td>1,485</td>
<td>7,153</td>
<td>3,236</td>
<td>8,397</td>
<td>1,611</td>
<td>3,245</td>
</tr>
<tr>
<td>Morning Peak Hr</td>
<td>6,303</td>
<td>5,585</td>
<td>16,410</td>
<td>8,703</td>
<td>23,806</td>
<td>4,247</td>
<td>9,219</td>
</tr>
<tr>
<td>All day</td>
<td>22,197</td>
<td>32,420</td>
<td>43,917</td>
<td>24,055</td>
<td>71,494</td>
<td>19,352</td>
<td>27,981</td>
</tr>
<tr>
<td>Outbound Peak Hr</td>
<td>1,559</td>
<td>2,238</td>
<td>3,239</td>
<td>2,051</td>
<td>4,017</td>
<td>1,412</td>
<td>1,051</td>
</tr>
<tr>
<td>Afternoon Peak Hr</td>
<td>4,778</td>
<td>7,278</td>
<td>10,946</td>
<td>5,675</td>
<td>10,159</td>
<td>2,882</td>
<td>3,459</td>
</tr>
<tr>
<td>All day</td>
<td>27,884</td>
<td>36,403</td>
<td>49,297</td>
<td>23,709</td>
<td>55,621</td>
<td>15,930</td>
<td>20,824</td>
</tr>
<tr>
<td>Total</td>
<td>50,081</td>
<td>68,823</td>
<td>93,214</td>
<td>47,764</td>
<td>127,115</td>
<td>35,282</td>
<td>48,804</td>
</tr>
</tbody>
</table>

4.16 The passenger counts outlined in Table 4-3 reveal that:

- Inbound/outbound balances are still broadly neutral for all routes combined, but there are significant variances on some routes such as Natete Road, Jinja Road and Masaka Road; this effect is demonstrated in Figure 4-2, below.

- This would suggest some asymmetric travel caused by congestion effects, such as between Natete Road and Masaka Road in particular. It may also indicate significant travel outside the hours surveyed.

- The proportion of inbound travel in the peak hour is broadly consistent across most of the routes, averaging 11.4% of the daily total. However some routes, such as Bombo Road in particular, have lower factors reflecting intense local congestion at that period.

4.17 Figure 4-2, below, presents the total passenger flows in public transport (matatus and large buses).
4.18 JICA traffic counts were collected on 12 main routes in the Kampala conurbation area. Traffic flows for non-motorised means of transport were not collected. Vehicle occupancy counts were also not collected. A diagram illustrating the survey count locations is presented in Figure 4.2, above.

4.19 Counts were conducted over for the entire 24 hour period. For purpose of analysis and comparison with the ITP traffic counts, the JICA traffic counts were converted to the 16 hour time equivalent (6am-10pm) coinciding with the ITP counts.

4.20 Table 4-4, below, presents the total traffic flows recorded at each of the count sites relevant to this study; the nine short-listed routes. Figures for Bombo Road have been adjusted to also include a set proportion of traffic counted on Sir Apollo Kaggwa Road as there was a concern that the survey station on Bombo Road alone would not adequately capture the entire patronage of the route.
Table 4-4: Summary of JICA Traffic Counts (6am – 10pm)

<table>
<thead>
<tr>
<th>No of units</th>
<th>Masaka Road</th>
<th>Bombo Road</th>
<th>Entebbe Road</th>
<th>Gayaza Road</th>
<th>Jinja Road</th>
<th>Kira Road</th>
<th>Natete Road</th>
<th>Gaba Road</th>
<th>Hoima Road</th>
<th>Port Bell Road</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inbound</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Matatus/Buses</td>
<td>1,395</td>
<td>2,325</td>
<td>4,117</td>
<td>2,184</td>
<td>4,960</td>
<td>2,440</td>
<td>3,209</td>
<td>2,137</td>
<td>3,280</td>
<td>1,066</td>
</tr>
<tr>
<td>Cars/Taxis</td>
<td>4,035</td>
<td>5,691</td>
<td>9,953</td>
<td>3,284</td>
<td>7,413</td>
<td>7,585</td>
<td>3,645</td>
<td>5,913</td>
<td>2,124</td>
<td>4,954</td>
</tr>
<tr>
<td>Motorcycles</td>
<td>3,953</td>
<td>7,628</td>
<td>7,032</td>
<td>4,120</td>
<td>4,663</td>
<td>3,632</td>
<td>3,476</td>
<td>6,697</td>
<td>5,396</td>
<td>2,442</td>
</tr>
<tr>
<td>Truck</td>
<td>641</td>
<td>450</td>
<td>595</td>
<td>180</td>
<td>856</td>
<td>122</td>
<td>167</td>
<td>169</td>
<td>187</td>
<td>101</td>
</tr>
<tr>
<td>Total</td>
<td>10,024</td>
<td>16,092</td>
<td>21,697</td>
<td>9,768</td>
<td>17,892</td>
<td>13,779</td>
<td>10,497</td>
<td>14,916</td>
<td>10,987</td>
<td>8,563</td>
</tr>
<tr>
<td>Outbound</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Matatus/Buses</td>
<td>900</td>
<td>2,644</td>
<td>5,343</td>
<td>1,776</td>
<td>4,947</td>
<td>2,061</td>
<td>2,012</td>
<td>2,059</td>
<td>3,088</td>
<td>742</td>
</tr>
<tr>
<td>Cars/Taxis</td>
<td>4,669</td>
<td>5,123</td>
<td>8,278</td>
<td>2,777</td>
<td>7,426</td>
<td>7,703</td>
<td>2,680</td>
<td>4,892</td>
<td>2,451</td>
<td>3,887</td>
</tr>
<tr>
<td>Motorcycles</td>
<td>4,047</td>
<td>5,746</td>
<td>5,693</td>
<td>3,745</td>
<td>2,527</td>
<td>2,471</td>
<td>3,130</td>
<td>6,523</td>
<td>4,725</td>
<td>2,028</td>
</tr>
<tr>
<td>Truck</td>
<td>695</td>
<td>363</td>
<td>504</td>
<td>299</td>
<td>672</td>
<td>154</td>
<td>245</td>
<td>228</td>
<td>227</td>
<td>143</td>
</tr>
<tr>
<td>Total</td>
<td>10,311</td>
<td>13,875</td>
<td>19,818</td>
<td>8,597</td>
<td>15,572</td>
<td>12,389</td>
<td>8,067</td>
<td>13,702</td>
<td>10,491</td>
<td>6,800</td>
</tr>
</tbody>
</table>

| Total         | 20,335      | 29,967     | 41,515       | 18,365      | 33,464     | 26,168    | 18,564      | 28,618    | 21,478     | 15,363         |

4.21 The traffic counts outlined in Table 4-4 reveal that:

- The inbound/outbound balances are generally neutral
- Overall traffic is highest on Entebbe Road (approx 42,000) and second highest on Jinja Road (approx 33,000)
- Overall public transport (matatu / large bus) vehicle counts are highest on Jinja Road (approximately 10,000) and second highest on Entebbe Road (9,500)
- High vehicle counts are also recorded on Bombo Road and Gaba Road (approx 30,000) but mode share for public transport is much lower
- The ratio of traffic between Jinja Road and Port Bell Road is approximately 2:1

4.22 Figure 4-3, below, shows the ratio of the ITP to JICA traffic counts. The counts are comparable such that they include coinciding time periods and vehicles (motorised only).
4.23 The traffic count ratios outlined in Figure 4-3 reveal that:
- ITP counts are lower than the JICA traffic counts on all routes (except on Jinja Road).
- The ITP counts are approximately between 60% and 85% of the JICA traffic counts.
- The average of the ratio between ITP and JICA traffic counts (excluding Jinja Road) is 74%.
- The JICA counts are approximately 20% higher than the ITP counts on Jinja Road.

4.24 The JICA counts were conducted in January 2010 and during the school holiday period. For this reason, lower counts seem counter intuitive. There are a multiple of potential reasons to explain the lower recorded counts, however, Figure 4-1 reveals that the JICA traffic count stations are much closer to Kampala City Centre. This is the most likely cause of the higher JICA traffic count recordings.

4.25 The Jinja Road survey station is the only JICA survey station that is further away from Kampala City Centre and this is the only road for which higher traffic counts were produced from the ITP surveys. This further strengthens the diagnosis outlined in the preceding paragraph.

4.26 Because the variation between the ITP and traffic counts are not due to serious flaws with the methodology or execution of the surveying/data gathering exercise, the use of the JICA counts to fill gaps and enhance the ITP traffic count data remains applicable.

Current Demand Levels

4.27 The survey station on Jinja Road was situated west of the junction with Port Bell Road, therefore a proportion of the (high) traffic and passenger levels will be abstracted to Port Bell Road further along the vehicle’s travel path (see Figure 4-1). In addition, there are no
recorded counts for Hoima Road and Gaba Road. Therefore, the traffic counts collected by the JICA data collection team have been used to modify and fill such missing gaps.

4.28 The JICA counts have been used to derive ITP equivalent traffic counts for Gaba Road and Kira Road using the average JICA to ITP traffic recording ratio (74%, see above).

4.29 The ratio between the Jinja Road to Port Bell Road traffic count recorded by JICA is approximately 2:1 (see above). This ratio has been applied to apportion the Jinja Road counts collected by ITP.

4.30 ITP undertook counts on both Masaka Road and Natete Road as likely patronage for the Masaka Road route option would be drawn by users of these two strategic roads. Therefore, a combination of counts recorded on both these roads is included in the current demand figures for the Masaka Road route.

4.31 In addition, the traffic counts only include traffic passing the survey station(s), and therefore, have the potential to omit vehicles flowing out/joining the route before/after the survey station. The mystery traveller surveys and resulting boarding and alighting figures have been used to correct for this downward bias.

4.32 All these modifications are included in the current demand estimates presented in Table 4-5 and Table 4-6, below.

**Table 4-5: Current Demand: Daily Traffic Flow (both directions) (6am – 10pm)**

<table>
<thead>
<tr>
<th>Vehicles</th>
<th>Gayaza Road</th>
<th>Jinja Road</th>
<th>Port Bell Road</th>
<th>Gaba Road</th>
<th>Entebbe Road</th>
<th>Masaka Road</th>
<th>Hoima Road</th>
<th>Bombo Road</th>
<th>Kira Road</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matatus/Buses</td>
<td>5,699</td>
<td>11,315</td>
<td>2,027</td>
<td>3,449</td>
<td>10,662</td>
<td>9,901</td>
<td>5,119</td>
<td>6,875</td>
<td>3,819</td>
</tr>
<tr>
<td>Cars/Taxis</td>
<td>7,362</td>
<td>17,158</td>
<td>9,837</td>
<td>8,873</td>
<td>19,610</td>
<td>11,877</td>
<td>3,667</td>
<td>9,852</td>
<td>12,897</td>
</tr>
<tr>
<td>Motorcycle</td>
<td>7,965</td>
<td>7,612</td>
<td>5,050</td>
<td>10,866</td>
<td>8,558</td>
<td>14,769</td>
<td>8,143</td>
<td>10,146</td>
<td>7,490</td>
</tr>
<tr>
<td>Truck</td>
<td>1,322</td>
<td>1,982</td>
<td>329</td>
<td>327</td>
<td>1,307</td>
<td>2,700</td>
<td>332</td>
<td>1,529</td>
<td>478</td>
</tr>
<tr>
<td>Bicycle</td>
<td>5,991</td>
<td>1,249</td>
<td>566</td>
<td>2,157</td>
<td>1,460</td>
<td>4,398</td>
<td>1,584</td>
<td>4,056</td>
<td>1,700</td>
</tr>
<tr>
<td>Pedestrian</td>
<td>5,855</td>
<td>3,542</td>
<td>1,604</td>
<td>4,806</td>
<td>10,238</td>
<td>7,037</td>
<td>3,526</td>
<td>11,048</td>
<td>3,480</td>
</tr>
<tr>
<td>Total</td>
<td>34,194</td>
<td>42,857</td>
<td>19,413</td>
<td>30,477</td>
<td>51,834</td>
<td>50,684</td>
<td>22,371</td>
<td>43,506</td>
<td>29,864</td>
</tr>
</tbody>
</table>
Table 4-6: Current Demand: Daily Passenger Flow (both directions) (6am – 10pm)

<table>
<thead>
<tr>
<th>Vehicles</th>
<th>Gayaza Road</th>
<th>Jinja Road</th>
<th>Port Bell Road</th>
<th>Gaba Road</th>
<th>Entebbe Road</th>
<th>Masaka Road</th>
<th>Hoima Road</th>
<th>Bombo Road</th>
<th>Kira Road</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matatus/Buses</td>
<td>53,841</td>
<td>119,674</td>
<td>21,891</td>
<td>34,434</td>
<td>103,617</td>
<td>92,171</td>
<td>51,080</td>
<td>74,579</td>
<td>35,282</td>
</tr>
<tr>
<td>Cars/Taxis</td>
<td>19,380</td>
<td>45,720</td>
<td>26,306</td>
<td>23,393</td>
<td>64,824</td>
<td>27,281</td>
<td>9,614</td>
<td>24,796</td>
<td>24,717</td>
</tr>
<tr>
<td>Motorcycle</td>
<td>13,552</td>
<td>14,239</td>
<td>9,472</td>
<td>20,409</td>
<td>15,159</td>
<td>32,739</td>
<td>15,203</td>
<td>20,215</td>
<td>11,377</td>
</tr>
<tr>
<td>Bicycle</td>
<td>5,991</td>
<td>1,249</td>
<td>566</td>
<td>2,157</td>
<td>1,460</td>
<td>4,398</td>
<td>1,584</td>
<td>4,056</td>
<td>1,700</td>
</tr>
<tr>
<td>Pedestrian</td>
<td>5,855</td>
<td>3,542</td>
<td>1,604</td>
<td>4,806</td>
<td>10,238</td>
<td>7,037</td>
<td>3,526</td>
<td>11,048</td>
<td>3,480</td>
</tr>
<tr>
<td>Total</td>
<td>98,619</td>
<td>184,424</td>
<td>59,839</td>
<td>85,200</td>
<td>195,298</td>
<td>163,626</td>
<td>81,007</td>
<td>134,694</td>
<td>76,555</td>
</tr>
</tbody>
</table>

4.33 The current demand figures outlined in Tables 4-5 and 4-6 show that:

- Total public transport vehicle counts are highest on the Jinja Road route with approximately 11,000 matatus / buses per day and second highest on Entebbe Road with approximately 10,500 per day.
- Total car / taxi traffic is highest on Entebbe Road with approx 19,500 vehicles per day and second highest on Jinja Road with approximately 17,000 per day.
- Total public transport passenger flows are highest on Jinja Road with approximately 120,000 passengers per day and second highest on Entebbe Road with approximately 105,000 per day. Public transport demand is also high on Masaka Road with approximately 90,000 passengers per day.
- Total car / taxi passengers are highest on Entebbe Road with approximately 65,000 passengers per day and second highest on Jinja Road with approx 45,000 passengers per day.

Travel Conditions on the Corridors

4.34 Mystery Traveller Surveys were conducted along six of the routes (Gayaza Road, Jinja Road, Entebbe Road, Masaka Road, Bombo Road and Kira Road). Table 4-7, below provides further background information on the routes.
Table 4-7: Mystery Traveller Routes

<table>
<thead>
<tr>
<th>Route</th>
<th>Distance (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gayaza Road</td>
<td>8.8</td>
</tr>
<tr>
<td>Jinja Road</td>
<td>21.9</td>
</tr>
<tr>
<td>Entebbe Road</td>
<td>14.1</td>
</tr>
<tr>
<td>Masaka Road</td>
<td>19.1</td>
</tr>
<tr>
<td>Bombo Road</td>
<td>10.9</td>
</tr>
<tr>
<td>Kira Road</td>
<td>7.4</td>
</tr>
</tbody>
</table>

4.35 These surveys have provided valuable information on boarding and alighting patterns, travel speeds, occupancy rates, and the route lengths offer some indication on the supply of public transport provision along the route. Such data is not only useful for demand forecasting purposes, but can also aid in the overall planning design, e.g. provision of segregated routes, fare levels, location and size of stations etc.

4.36 The outputs from the mystery traveller surveys is summarised below. Firstly, fares (Table 4-8), journey times (Figure 4-4) and speeds (Table 4-9) will be reported. Detailed description of boarding and alighting patterns and average occupancy rates will be subsequently presented on a route by route basis.

Public Transport Fares, Journey Times and Speeds

4.37 The table below provide a summary of the fares paid for each of the routes. They include only fares paid on journeys over the entire length of the route.

Table 4-8: Public Transport Journey Fares

<table>
<thead>
<tr>
<th>Route</th>
<th>Direction</th>
<th>Fare Levels (U Sh)</th>
<th>Route Distance (km)</th>
<th>Average Fare (U Sh/km)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Min.  Average Max.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gayaza Road</td>
<td>Inbound</td>
<td>800 974 1000</td>
<td>8.8</td>
<td>111</td>
</tr>
<tr>
<td></td>
<td>Outbound</td>
<td>1000 1000 1000</td>
<td>8.8</td>
<td>114</td>
</tr>
<tr>
<td>Jinja Road</td>
<td>Inbound</td>
<td>1000 1553 2500</td>
<td>21.9</td>
<td>71</td>
</tr>
<tr>
<td></td>
<td>Outbound</td>
<td>1000 1563 3500</td>
<td>71</td>
<td>71</td>
</tr>
<tr>
<td>Entebbe Road</td>
<td>Inbound</td>
<td>500 1043 1500</td>
<td>14.1</td>
<td>74</td>
</tr>
<tr>
<td></td>
<td>Outbound</td>
<td>500 1223 1300</td>
<td>87</td>
<td></td>
</tr>
<tr>
<td>Masaka Road</td>
<td>Inbound</td>
<td>1000 1214 1500</td>
<td>19.1</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>Outbound</td>
<td>1000 1488 1500</td>
<td>78</td>
<td></td>
</tr>
<tr>
<td>Bombo Road</td>
<td>Inbound</td>
<td>500 947 1000</td>
<td>10.9</td>
<td>87</td>
</tr>
<tr>
<td></td>
<td>Outbound</td>
<td>1000 1139 1500</td>
<td>105</td>
<td></td>
</tr>
<tr>
<td>Kira Road</td>
<td>Inbound</td>
<td>800 930 1000</td>
<td>7.4</td>
<td>126</td>
</tr>
<tr>
<td></td>
<td>Outbound</td>
<td>800 988 1000</td>
<td>133</td>
<td></td>
</tr>
</tbody>
</table>

4.38 The fare levels outlined in Table 4-8 reveal that:
Fares range from 500 USh to 3500 UShs. Fares per kilometre range from 64 to 133 USh per kilometre. These variations are large but expected in a city with little formal public transport provision.

On every route there some fare variation, a characteristic of transport supply which users dislike.

Average fare levels vary considerably between the routes. The most expensive route to travel is Kira Road (approximately 130 USh per km). The least expensive routes to travel are Jinja Road and Masaka Road (approximately 70 USh per km).

There is a negative correlation between average vehicular (matatu/bus) speed and fare levels (compare Tables 4-7 and 4-8). The more expensive the public transport fare in terms of USh per km the lower the network speeds (and vice versa). This relationship is expected.

The outbound/inbound fare balance is generally neutral, however, a difference exists on the Entebbe Road route and the Bombo Road route (outbound is approximately 20% more expensive in both cases).

The figure below provides a summary of the journey times for each of the routes. This is disaggregated between out of vehicle (waiting at the bus stop), in-vehicle stationary (time spent in the vehicle while the bus is waiting to load passengers) and in-vehicle moving (time spent in the vehicle while the matatu/bus is travelling). The latter component is a function of actual congestion on the route. The sum of all three components is equivalent to travel time. Disaggregating these components is relevant because transport users associate varying levels of sensitivity to each time cost. The journey times presented in the table below only include journeys over the entire length of the route.
4.40 The journey times outlined in Figure 4-4 reveal that:

- A large proportion of the journey time, between 19% and 36% is spent in the vehicle waiting for the bus to load (other) prospective passengers. This is expected and is common commercial practice for informal public transport providers.

- In-vehicle stationary time as a proportion of total travel time is lowest on the Bombo Road route (19%).

- In-vehicle stationary time as a proportion of total travel time is highest on the Entebbe Road route, outbound (36%), though the average for both directions is higher on the Kira Road route (32%). However, these routes form the three shortest journey times overall, therefore, public transport operators may feel that they can afford to keep transport users waiting because the “threshold” total time cost is less likely to pass for passengers.

- Out of vehicle waiting time (at bus stop) forms a low proportion of total journey time. This is expected as public transport units in the city are numerous. However, these waiting values will have an impact on mode shift to BRT because public transport users are very sensitive to this form of time cost.

4.41 Table 4-9 below provides a summary of average speeds for each of the routes. This is disaggregated between speed experienced by the passenger (incorporating total wait time and including waiting for the bus to arrive at the bus stop), commercial speed (excluding time at bus stop but including dwell time, time spent while vehicle is stationary waiting to
load passengers) and moving speed (only time spent with vehicle in motion). These speeds are averaged throughout the day and therefore incorporate a higher proportion of non-peak periods.

Table 4-9: Public Transport Journey Speeds (daily averages)

<table>
<thead>
<tr>
<th>Route</th>
<th>Direction</th>
<th>Speeds (km/hr)</th>
<th>passenger experience</th>
<th>commercial speed</th>
<th>moving speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gayaza Road</td>
<td>Inbound</td>
<td>11.7</td>
<td>12.3</td>
<td>17.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Outbound</td>
<td>11.2</td>
<td>11.8</td>
<td>18.2</td>
<td></td>
</tr>
<tr>
<td>Jinja Road</td>
<td>Inbound</td>
<td>19.2</td>
<td>19.9</td>
<td>29.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Outbound</td>
<td>20.9</td>
<td>22.4</td>
<td>28.7</td>
<td></td>
</tr>
<tr>
<td>Entebbe Road</td>
<td>Inbound</td>
<td>17.8</td>
<td>21.8</td>
<td>29.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Outbound</td>
<td>22.2</td>
<td>23.1</td>
<td>36.9</td>
<td></td>
</tr>
<tr>
<td>Masaka Road</td>
<td>Inbound</td>
<td>20.5</td>
<td>21.4</td>
<td>30.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Outbound</td>
<td>22.9</td>
<td>23.3</td>
<td>30.7</td>
<td></td>
</tr>
<tr>
<td>Bombo Road</td>
<td>Inbound</td>
<td>13.2</td>
<td>13.8</td>
<td>17.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Outbound</td>
<td>12.2</td>
<td>13.1</td>
<td>16.4</td>
<td></td>
</tr>
<tr>
<td>Kira Road</td>
<td>Inbound</td>
<td>9.9</td>
<td>10.0</td>
<td>15.1</td>
<td></td>
</tr>
</tbody>
</table>

4.42 Much of the information pertinent to the issue on travel speed has been covered in the preceding paragraphs regarding journey times. While journey times have been used to discuss the cost to users and passengers, in the following bullet points, vehicular speeds will be used to explain the efficiency of the network and the public transport system:

- Moving speeds vary between 15 km/hr on Kira Road (very congested) to 37 km/hr on Entebbe Road (not congested but not free flowing). There may be more benefits derived by introducing BRT to routes with high congestion as the segregated rights of way will remove vehicles away from the traffic congestion freeing space for private vehicles.
- Outbound and inbound moving speeds are similar for all routes, except in the case for Entebbe Road whereby inbound speeds are 31 km/hr compared to an outbound speed of 37 km/hr.
- Commercial speeds are very low, ranging from 10 km/hr on the Kira Road route to a maximum speed of 23 km/hr on Entebbe Road. BRT commercial speeds will be very competitive against such current public transport performances and with proper planning and infrastructure can easily achieve 25 km/hr.

Passenger Patterns on Routes

4.43 This section details the boarding and alighting profiles of the routes covered in the mystery traveller surveys. These patterns are recorded for both the inbound and the outbound direction.

4.44 Informal public transport provision is generally focused on maximising revenues, and as such will aim to pick up passengers at any opportunity. As such, boarding and alighting can occur at many points along the route, often outside of the formal stop locations. Designated stops are also often referred to by different names, or by nearby landmarks. In
coding the mystery traveller surveys, all the reported stops have been rationalised in order to identify the most popular stops.

4.45 Specific outputs are boarding and alighting numbers at the most popular stops, cumulative boarding and alighting (the total number of boarders and alighters in all the stops preceding and including the stop), and cumulative net boarding (which represents the number of people on the bus and is a direct function of the occupancy level).

4.46 For all routes on the inbound direction, cumulative net boarding is zero at the final stop (usually the city centre; Old Taxi Park or New Taxi Park). This finding is as expected.

4.47 For all the routes on the outbound direction, cumulative net boarding remains positive at the final recorded stop which indicates that there is a nominal demand beyond the final stop. BRT planners should take notice of the value of this demand level when considering the length of BRT service along the route.

4.48 In addition, on the inbound route, cumulative alighting is greater than boarding by a nominal value at the end of the trip and this is evidence of existing passengers which have boarded prior to the enumerator starting the surveys. This finding is internally consistent with the finding in the preceding paragraph and represents demand for the BRT service prior to the first recorded stop.

*Gayaza Road*

4.49 Figures 4-5 and 4-6, below, present boarding and alighting patterns on Gayaza Road.

![Boarding and Alighting Patterns on Gayaza Road](image)

*Figure 4-5: Boarding and Alighting Patterns on Gayaza Road (daily averages, inbound)*

4.50 The main outputs from the boarding and alighting information outlined in Figure 4-5, above are:
The average public transport vehicle (matatu / bus) carries an average of 21 passengers towards the centre on the Gayaza Road route, 50% of which board at the Mpererwe Stage.

Approximately 50% of passengers alight between the Wandegeya Stage and Old / New Taxi Park reflecting the overall demand for the centre as the destination.

The average number of passengers per seat is 1.36.

Average occupancy levels peak at the Kanyanya Stage where they are almost 80% full.

The final station is either Old Taxi Park or New Taxi Park. Matatus / buses usually stop at only one of these stations throughout their travel.

Including the Mpererwe, other chief boarding stations are Kanyanya, Kalerwe and Wandegeya.

Including the Old/New Taxi Park, other chief alighting stations are Kalerwe, Wandegeya and the Shell Kampala Road Stage.

The main outputs from the boarding and alighting information outlined in Figure 4-6, above are:

- The average public transport vehicle (matatu / bus) carries an average of 17.5 passengers outbound along the Gayaza Road route, 80% of which board at Old / New Taxi Park.
- Approximately 50% of passengers alight prior to Kyebando Stage.
- An average of two passengers; approximately 10% of total demand, remain on the bus beyond the Mpererwe Stage.
- The average number of passengers per seat is 1.25.

Figure 4-6: Boarding and Alighting Patterns on Gayaza Road (daily averages, outbound)
Average occupancy levels peak from the onset; Old / New Taxi Park, whereby the vehicles are on average 100% full. This is to be expected, as the buses queue to enter the taxi park and wait for their turn to pick up a full load of passengers before departing.

Old / New Taxi Park is the chief boarding station. Mpererwe is the chief alighting station, but the Kanyanya, Kyebando and Kalerwe Stages are also important destinations.

**Jinja Road**

4.52 Figures 4-7 and 4-8, below, present boarding and alighting patterns on Jinja Road.

*Figure 4-7: Boarding and Alighting Patterns on Jinja Road (daily averages, inbound)*

4.53 The main outputs from the boarding and alighting information outlined in Figure 4-7, above are:

- The average public transport vehicle (matatu / bus) carries an average of 22 passengers towards the centre on the Jinja Road route, 55% of which board at the Mukono Stage.
- Approximately 50% of passengers alight between the Nakawa Stage and Old Taxi Park reflecting the overall demand for the centre as the destination.
- The average number of passengers per seat is 1.38.
- Average occupancy levels peak at the Seeta Stage where they are approx 75% full. However, occupancy levels remain above 70% up to and including the Banda Stage.
- The Mukono Stage is the chief boarding station.
- Including Old Taxi Park, other notable alighting stations are the Seeta, Bweyogerere, Kireka, Nakawa Stages and Nakasero Market.
The main outputs from the boarding and alighting information outlined in Figure 4-8, above are:

- The average public transport vehicle (matatu / bus) carries an average of 18 passengers outbound along the Jinja Road route, approximately 80% of which board at Old Taxi Park.
- Alighting activity is minimal up to the Namanve Stage, after which it accelerates.
- An average of three passengers; approximately 15% of total demand, remain on the bus beyond the Mukono Stage.
- The average number of passengers per seat is 1.22.
- Average occupancy levels peak from the onset; Old Taxi Park, whereby the vehicles are on average 100% full.
- Old Taxi Park is the chief boarding station. Mukono is the chief alighting station, but the Seeta Stage is also a prominent destination.
Entebbe Road

4.55 Figures 4-9 and 4-10, below, present boarding and alighting patterns on Entebbe Road.

Figure 4-9: Boarding and Alighting Patterns on Entebbe Road (daily averages, inbound)

4.56 The main outputs from the boarding and alighting information outlined in Figure 4-9, above are:

- The average public transport vehicle (matatu / bus) carries an average of 18 passengers towards the centre on the Entebbe Road route, approximately 65% of which board at the Kajansi Stage.
- Approximately 50% of passengers alight between the Katwe Stage and Old Taxi Park reflecting the overall demand for the centre as the destination.
- The average number of passengers per seat is 1.08.
- Average occupancy levels peak at the Zana Stage where they are almost 75% full.
- Kajansi is the chief boarding station.
- Old Taxi Park is the chief alighting station; however, the Kibuye Stage is also a prominent centre for alighting activity.
4.57 The main outputs from the boarding and alighting information outlined in Figure 4-10, above are:

- The average public transport vehicle (matatu / bus) carries an average of 18 passengers outbound along the Entebbe Road route, approximately 90% of which board at Old Taxi Park.
- An average of 2.5 passengers; approximately 15% of total demand, remain on the bus beyond the Kajansi Stage.
- The average number of passengers per seat is 1.15.
- Average occupancy levels peak from the onset; Old Taxi Park, whereby the vehicles are on average 102% full (slightly above capacity).
- Old Taxi Park is the chief boarding station.
- Alighting activity takes off at the Kibuye Stage and is steady until reaching Kajansi where there is a major spike in alighting.
Masaka Road

4.58 Figures 4-11 and 4-12, below, present boarding and alighting patterns on Masaka Road.

![Figure 4-11: Boarding and Alighting Patterns on Masaka Road (daily averages, inbound)](image)

4.59 The main outputs from the boarding and alighting information outlined in Figure 4-11, above are:

- The average public transport vehicle (matatu / bus) carries an average of 20 passengers towards the centre on the Masaka Road route, only approximately 35% of which board at the Nsangi Stage.
- Approximately 50% of passengers alight between the Bakuli / Mengo Stage and Old Taxi Park reflecting the overall demand for the centre as the destination.
- The average number of passengers per seat is 1.41.
- Average occupancy levels peak at the Kyangera and Kulukande Stages where they are almost 80% full.
- The Nsangi Stage is the chief boarding station; however, the Kyangera Stage is another notable origin.
- The Old Taxi Park is the chief alighting station.
4.60 The main outputs from the boarding and alighting information outlined in Figure 4-12, above are:

- The average public transport vehicle (matatu / bus) carries an average of 21 passengers outbound along the Masaka Road route, 70% of which board at Old / New Taxi Park.
- Alighting activity is minimal until the Busega Stage and increases steadily thereafter.
- An average of three passengers; approximately 15% of total demand, remain on the bus beyond the Nsangi Stage.
- The average number of passengers per seat is 1.47.
- Average occupancy levels peak from the onset; Old Taxi Park, whereby the vehicles are on average 102% full.
- Old Taxi Park is the chief boarding station. Nsangi is the chief alighting station, but the Kyangera stage is another major destination station.
**Bombo Road**

4.61 Figures 4-13 and 4-14, below, present boarding and alighting patterns on Bombo Road.

![Figure 4-13: Boarding and Alighting Patterns on Bombo Road (daily averages, inbound)](image-url)

4.62 The main outputs from the boarding and alighting information outlined in Figure 4-13, above are:

- The average public transport vehicle (matatu / bus) carries an average of 19 passengers towards the centre on the Bombo Road route, approximately 75% of which board at the Kagoma / Kawempe Stage.
- Approximately 65% of passengers alight between the YMCA Stage and Old / New Taxi Park reflecting the overall demand for the centre as the destination.
- The average number of passengers per seat is 1.11.
- Average occupancy levels peak at the Kawempe Ketifalawo Stage where they are approximately 80% full.
- The final station is either Old Taxi Park or New Taxi Park. Matatus / buses usually stop at only one of these stations throughout their travel.
- The Kagoma / Kawempe Stage is the chief boarding station.
- Old Taxi Park and New Taxi Park are the chief alighting stations.
4.63 The main outputs from the boarding and alighting information outlined in Figure 4-14, above are:

- The average public transport vehicle (matatu / bus) carries an average of 16 passengers outbound along the Bombo Road route, 85% of which board at Old / New Taxi Park.
- Alighting activity is minimal until the Bwaise Stage; 80% of passengers alight after this station.
- An average of 3.5 passengers; approximately over 20% of total demand, remain on the bus beyond the Kagoma / Kawempe Stage.
- The average number of passengers per seat is 1.14.
- Average occupancy levels peak from the onset; Old / New Taxi Park, whereby the vehicles are almost 100% full.
- Old / New Taxi Park is the chief boarding station. The Kagoma / Kawempe Stage is the chief alighting station, but the Bwaise Stage and Kawempe Ketifalawo Stages are also important destinations.
4.64 Figures 4-15 and 4-16, below, present boarding and alighting patterns on Kira Road.

**Figure 4-15: Boarding and Alighting Patterns on Kira Road (daily averages, inbound)**

4.65 The main outputs from the boarding and alighting information outlined in Figure 4-15, above are:

- The average public transport vehicle (matatu / bus) carries an average of 20 passengers towards the centre on the Kira Road route, almost 60% of which board at the Ntinda Stage.
- Approximately 50% of passengers alight between the Wandegeya Stage and Old / New Taxi Park reflecting the overall demand for the centre as the destination.
- The average number of passengers per seat is 1.38.
- Average occupancy levels peak at the Ntinda Stage where they are almost 85% full.
- The final station is either Old Taxi Park or New Taxi Park. Matatus / buses usually stop at only one of these stations throughout their travel.
- Ntinda is the chief boarding station.
- Including Old/New Taxi Park is the chief alighting station; however, the Wandegeya Stage is also a prominent destination.
4.66 The main outputs from the boarding and alighting information outlined in Figure 4-16, above are:

- The average public transport vehicle (matatu / bus) carries an average of 16.5 passengers outbound along the Kira Road route, over 80% of which board at Old / New Taxi Park.
- Approximately 50% of passengers alight prior to the Kabira Stage.
- Alighting patterns on this route vary to the other route corridors. There is notable alighting activity between the Wandegeya and the Kamwokya Stages. After a lull in movements, major alighting restarts at the Bukoto Stage.
- The average number of passengers per seat is 1.18.
- Average occupancy levels peak from the onset; Old / New Taxi Park, whereby the vehicles are on approximately 95% full.
- Old / New Taxi Park is the chief boarding station. Ntinda is the chief alighting station, however, the Wandegeya, Mulago, Kamwokya and the Bukoto Stages are also common destinations for passengers.

Public Transport Users

4.67 It is critical to understand the users of public transport as a consumer group. Further insight into their perceptions and experiences can provide planners with detailed information into the current performance of the system and satisfaction levels of service users. Successful interventions can therefore be better identified.

4.68 In order to access this type of information, face to face interviews, involving both qualitative and quantitative questions are required. The consultant conducted Traveller Interviews over a period of three days and across a variety of modes in the GMKA.
Public Transport User Perceptions

4.69 Traveller perceptions for all modes were obtained; however, of particular relevance to this study is perception of public transport users and this is presented in Figure 4-17, below.

![Figure 4-17: Percentage of Public Transport Users Feel is a ‘Problem or Serious Problem’](image)

4.70 The main outputs from the information outlined in Figure 4-17, can be summarised as:

- The majority of public transport users (approximately 70%) do not view the number of matatus / buses as a problem
- The majority of public transport users (60%) do not view the need to interchange as a problem
- However, the majority of public transport users (approximately 60%) feel that the current provision is uncomfortable, unsafe, involves a long journey time (including time for matatus to fill). These are specific attributes in which BRT can deliver improvements.

Willingness To Pay

4.71 Public transport users were asked their willingness to pay to for a superior service. The sample size for this particular question includes 763 respondents and the main findings are:

- 73% of public transport users are willing to pay an additional fare for a comfortable air-conditioned mass transit bus service. The average additional fare they are willing to pay is 203 USh
- 78% of public transport users are willing to pay for a comfortable mass transit bus service which saves ten minutes of travel time. The average additional fare they are willing to pay is 211 USh
- 87% of public transport users are willing to pay for a comfortable mass transit bus service which saves twenty minutes of travel time. The average additional fare they are willing to pay is 302 USh
Table 4-10: Willingness to Pay for an Improved Public Transport Service/Mode

<table>
<thead>
<tr>
<th>Willingness to pay for:</th>
<th>Percentage of Public Transport users</th>
<th>Average Additional Fare (U Sh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comfort &amp; Air conditioning</td>
<td>73%</td>
<td>203</td>
</tr>
<tr>
<td>Comfort &amp; 10 minutes time saving</td>
<td>78%</td>
<td>211</td>
</tr>
<tr>
<td>Comfort &amp; 20 minutes time saving</td>
<td>87%</td>
<td>302</td>
</tr>
</tbody>
</table>

**Socio-economic Data**

4.72 The ITP Traveller Interview surveys also provided valuable information regarding the socio-economic backgrounds of the transport users and the findings are summarised in the following pie-charts.
Key Findings:

- Matatu users are split roughly evenly between males and females. It is the mode with highest share of female users.
- Approximately two-thirds of car users, motorcycle users and cyclists are male.
- Vast majority of pedestrians are male.

Figure 4-18: Sex by Vehicle Mode
Matatu users form a good representation of all age groups, though the majority are under 30.

Car have the highest average age; with around half being between 30 to 40 years of age.

Pedestrian and cyclists are very young with approximately 75%-85% under the age of 30.

Figure 4-19: Age by Vehicle Mode
High Income 9%
Middle Income 35%
Low Income 24%
Unemployed 4%

Matatu

High Income 28%
Middle Income 38%
Low Income 19%
H/wife / Ret./ Stud. 14%
Unemployed 1%

Car

Key Findings:
Car users are mainly drawn from the upper echelons of society, particularly high and middle income earners
Matatus users are derived from a broad section of society; roughly representative of Kampalan society
Pedestrians and bicycle are generally from a lower socio-economic background; with over half of users low income earners or unemployed
These findings are as expected

Figure 4-20: Socio-economic Status by Vehicle Mode
Conclusion

4.73 Data obtained has produced a wealth of information on travel demand and conditions on all short-listed routes. The counts collected by the JICA collection team are on the whole higher than the counts collected directly by ITP. This is mainly due to the location of traffic count survey stations, and therefore, using the two sources to gain a full picture of current demand levels remains the most appropriate strategy.

4.74 The estimated current demand levels indicate that public transport demand is highest on Jinja Road with approximately 120,000 passengers per day and second highest on Entebbe Road with approximately 105,000 passengers per day. Private car travel demand is highest on Entebbe Road with approximately 65,000 passengers per day.

4.75 Travel and commercial characteristics differ between the short-listed routes. Average fare levels vary between 70 USh/km (Jinja Road and Masaka Road) to 130 USh/km (Kira Road). There is a direct and negative correlation between fare levels and traffic speeds. As well as a variation in average fare levels between routes, there is also some variation in fare levels within routes, and this lack of fare reliability is a characteristic which transport users often dislike.

4.76 In-vehicle stationary time, the time passengers spend in the vehicle while it is loading and unloading passengers, forms a considerable proportion of total journey time (20% to 35%). This is a particular characteristic which BRT can have a significant advantage.

4.77 Moving speeds vary between 15 km/hr (Kira Road) to 37 km/hr (Entebbe Road). These variations suggest that some routes are currently undergoing higher capacity pressures and this should be considered carefully by BRT planners. Operational speeds for matatus and large buses also vary considerably, ranging from 10 km/hr (Kira Road) to 23 km/hr (Entebbe Road), reflecting relatively low operational speeds, and the potential advantages of BRT over current public transport provision.

4.78 On the inbound direction, the average number of passengers per seat varies between 1.08 and 1.41. Maximum vehicle occupancy levels range from 70% and 85% of capacity. On the outbound direction, the average number of passengers per seat varies between 1.14 and 1.25 and vehicles are usually full at the first station (Old Taxi Park or New Taxi Park). The average number passengers per seats stated above are quite low and represent a low seat turn over. This suggests that the routes are city centre centric in terms of origin and destination choice. The implication of this is that the average profit / revenue capacity of each seat is low and this in turn has an effect on operational management.

4.79 Passenger perception surveys reveal that the main problems public transport users cite with current provisions are low levels of comfort and safety and high journey times (particularly dwell times).

4.80 73% of passengers indicate a willingness to pay for a trip in a comfortable and air conditioned vehicle (a type of vehicle typical on a BRT service). The average increase in fare they are willing to incur is approximately 200 USh.

4.81 Matatu passengers form a broad section of Kampala demographics; there is an even split between males and females, all age groups are well represented (although the majority are
under 30), and all income groups are well represented, broadly in line with overall income split within Greater Kampala.
5 TRAVEL DEMAND FORECASTING

5.1 Within the context of this study, the demand forecasting exercise focuses on identifying the potential patronage levels which BRT would attract in order to inform the selection of the pilot route. The forecasts must be sensitive to the evolving nature of travel demand in Kampala, in terms of changing geography including new development, the pressures of growth in the demand for travel, and also the increased pressures on the existing transport network. Deriving robust estimates of future travel demand also provide the basis of the viability assessment of the pilot BRT system.

5.2 The derivation of stop-by-stop forecasts go beyond the requirements at this stage of feasibility planning, but an important aspect of the modelling is to develop an understanding of travel movements both along specific corridors and between corridors in order to understand the principal travel desire lines within and across the city.

5.3 As part of the study, primary data has been collected relating to current levels of travel demand by mode, the daily travel conditions experienced by public transport users, and also the sensitivities and valuations of travellers of all modes to the various aspects of travel. Data collected for the GMKA Transport Masterplan has also provided a valuable dataset from which to develop a strong understanding of travel patterns, and has not been overlooked in the development of the transport model.

5.4 This Chapter presents a summary of the demand forecasting, outlining the methodology adopted in estimating and developing the transport model, the results of the forecasting in terms of potential demand for BRT in future year scenarios and the important conclusions which can be drawn from these results.

Methodology

5.5 The general process is to employ reliable and accurate data to an urban transport demand model for the GMKA to:

- forecast future demand for transport without BRT (the do-nothing scenario); and to
- forecast the likely response after the introduction of a new BRT system.

5.6 Future demand will be influenced by evolving travel patterns due to overall growth in trip making through population growth/increased income and changes in travel patterns due to land use changes (new development/industry location). In addition, modal shift over time in the absence of the BRT system is likely to occur, and can be forecast as a function of increasing income levels which leads to an increase in the modal share of private car. These interactions need to be balanced and accessed.

5.7 To accurately forecast future demand levels (current and future) Origin and Destination (O-D) matrices are vital to estimate the changes in growth and pattern of travel. Furthermore, a transport choice model has been used to forecast the impact of the new system on mode choice.

Origin-Destination Matrix

5.8 There are two comprehensive O-D matrices available for the GMKA; data collected by the JICA data collection team and data collected for the GMKA Transport Master Plan. In addition, ITP conducted limited surveys (ITP Traveller Interviews) in which travel patterns
have been obtained and an estimate current O-D matrix derived; this has been used to validate and assess the two former O-D matrices.

5.9 The patterns of O-D movements obtained from the ITP Traveller Interviews are much more consistent with the GMKA Transport Master Plan O-D matrix. In both matrices, current proportion of travel to the CBA constitutes approximately 50% of all O-D patterns. It can also be confirmed that the index of correlation coefficient for all O-D movements in the ITP and GMKA Transport Master Plan matrices is 0.65, a very high index given the size of both models.

5.10 The GMKA Transport Master Plan’s expanded O-D matrix also estimates current public transport demand and it is approximate to the current demand levels presented in Table 4-6.

5.11 It can therefore be concluded after a comprehensive interrogation of the available data that the O-D matrix obtained from the GMKA Transport Master Plan is accurate and consistent and has been used by the consultant to estimate the future demand for travel in the study area.

*Urban Transport Model*

5.12 A new BRT system will provide a completely new mode of travel, extending the modal choice options for travellers. The way travellers respond to this new mode will depend on how the journey characteristics compare to the existing mode, and traveller sensitivity to factors such as fare levels and journey times. The urban transport model applies transport micro-economic principles to public transport users in order to estimate the demand for BRT.

5.13 Whilst all passengers will exhibit different sensitivities and hence responses to these attributes, passengers who currently travel by different modes are more likely to display similar characteristics, and therefore travellers can be grouped by current modal choice for the purposes of estimating likely response.

5.14 ITP have conducted surveys of transport users in the GMKA to obtain reliable estimates of journey attributes, passenger sensitivities and preferences such as willingness to pay for an improved (BRT) system.

*Forecast demand*

*Do-Nothing Scenario*

5.15 Public transport and car O-D matrices have been applied to ascertain future do-nothing demand levels. These two modes form the vast majority of transport demand; however, the following assumptions have been made regarding other modes.

5.16 It is assumed, like in other low/middle income countries, that motorcycle growth will progress at a faster rate than cars. Evidence of motorcycle growth in Uganda is scarce therefore data has been imported from other countries\(^2\), whereby, the elasticity of motorcycle growth to car growth has been estimated as 1.06 for the levels of GDP per capita prevalent in Uganda.

\(^2\) Drafting Motorbike Master Plan under Market Orientation and Globalization, Dr. Kenichi Ohno, 2007
5.17 Bicycle growth has been set to follow the growth rate of the motorcycle growth (see bullet point, above).

5.18 Population growth has been forecast based on the predicted level of population growth for all unique O-D pairs.

5.19 The Table below presents the forecast levels of transport demand / passenger flows for the year 2013.

Table 5-1: Forecast Demand, Daily Passenger Flows (2013, both direction, 6am–10pm)

<table>
<thead>
<tr>
<th>Vehicles</th>
<th>Gayaza Road</th>
<th>Jinja Road</th>
<th>Port Bell Road</th>
<th>Gaba Road</th>
<th>Entebbe Road</th>
<th>Masaka Road</th>
<th>Hoima Road</th>
<th>Bombo Road</th>
<th>Kira Road</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matatus/Buses</td>
<td>68,450</td>
<td>172,799</td>
<td>26,478</td>
<td>43,170</td>
<td>138,671</td>
<td>115,676</td>
<td>66,118</td>
<td>93,810</td>
<td>44,389</td>
</tr>
<tr>
<td>Cars/Taxis</td>
<td>26,011</td>
<td>70,608</td>
<td>33,706</td>
<td>30,633</td>
<td>91,086</td>
<td>35,847</td>
<td>12,917</td>
<td>32,975</td>
<td>32,907</td>
</tr>
<tr>
<td>Motorcycle</td>
<td>18,442</td>
<td>22,264</td>
<td>12,312</td>
<td>27,162</td>
<td>21,708</td>
<td>43,630</td>
<td>20,764</td>
<td>27,315</td>
<td>15,378</td>
</tr>
<tr>
<td>Bicycle</td>
<td>8,225</td>
<td>1,862</td>
<td>731</td>
<td>2,855</td>
<td>2,089</td>
<td>5,916</td>
<td>2,136</td>
<td>5,490</td>
<td>2,269</td>
</tr>
<tr>
<td>Pedestrian</td>
<td>6,439</td>
<td>4,170</td>
<td>1,703</td>
<td>5,282</td>
<td>11,388</td>
<td>7,788</td>
<td>4,016</td>
<td>11,918</td>
<td>3,969</td>
</tr>
<tr>
<td>Total</td>
<td>127,569</td>
<td>271,701</td>
<td>74,931</td>
<td>109,102</td>
<td>264,942</td>
<td>208,858</td>
<td>105,951</td>
<td>171,508</td>
<td>98,913</td>
</tr>
</tbody>
</table>

5.20 The main outputs from the information outlined in Table 5-1, can be summarised as:

- Total public transport passenger flows are highest on Jinja Rd with approximately 170,000 passengers per day (approximately 45% higher than current day levels) and second highest on Entebbe Road with approximately 140,000 per day (approximately 30% higher than current day levels). Public transport demand is also high on Masaka Road with approximately 115,000 passengers per day.
- The relative ranking of corridors based on volume of public transport (matatus and large buses) passengers is the same in the forecast year 2013 and current day levels.
- Total car / taxi passengers are highest on Entebbe Road with approximately 90,000 passengers per day (approximately 40% higher than current day levels) and second highest on Jinja Road with approx 70,000 passengers per day (55% higher than current day levels), indicating a convergence of private car travel between the two routes.

5.21 The levels of forecast public transport increase vary between 20 – 45% reflecting annual increases of 6 – 13%. There is (anecdotal) evidence that such increases have not been experienced since the GMKA National Master Plan and its period of data collection. In the absence of reliable traffic growth updates it has been decided to continue with the assumed growth factors. It is advisable, however, to treat the forecast rates of increase as maximum and pay greater attention to the relative ranking order of the routes, which would remain unchanged in the case of applying traffic growth amendments.

5.22 The figure below presents the forecast level of public transport (matatus and large buses) passenger flows for the current year, 2010 until 2030.
5.23 The main outputs from the information outlined in Figure 5-1, can be summarised as:

- Total public transport passenger flows will be highest on Jinja Road throughout the forecast period, rising to over 700,000 passengers per day in the year 2030. They will be second highest on Entebbe Road rising to approximately 500,000 per day. These levels are approximately five times higher than current levels. It highlights the exponential nature of travel demand and the forthcoming challenges to transport planners in the future.

- The rate of increase for public transport travel over the forecast period is relatively lower for Masaka Road and Bombo Road and is forecast to be between 200,000 and 300,000 passengers per day, this is approximately three times higher than current levels. This level of demand is still substantial and will bear increasing pressure on the infrastructure along the routes.

- Demand for Gayaza Road, Hoima Road, Kira Road, Gaba Road and Port Bell Road will remain lower and is forecast to be between 60,000 and 190,000 passengers per day in 2030.

**BRT Scenario**

5.24 The urban transport model applies transport micro-economic principles, particularly a logit choice model, in order to estimate the demand for BRT. This allows for the calculation of the abstraction rates from matatus and buses to BRT.
5.25 It is important to stress that the BRT scenario does not model implementation of BRT on all routes, but only the introduction of each BRT route separately. The former is likely to yield higher patronage and abstraction rates for BRT given the likely benefits to accrue from allowing more direct routes and an enhanced and integrated hub and spoke system.

5.26 In addition, the model also assumes that existing public transport (matatus and large buses) will not be prohibited from operating along the route and therefore be granted permission to remain in the market. Higher levels of regulation, either, disallowing or constricting matatus to operate on the route will yield higher patronage and abstraction rates for BRT. In the model, however, existing public transport operators will not be given the exclusive right of way assumed for the BRT mode.

5.27 The model inputs required include, inter-alia, journey characteristics for the current (matatus and large buses) and new mode (BRT), as well as socio-economic attributes and sensitivities of public transport users. In this study the following inputs have been applied:

- A Value of Time (VoT) of US$0.50/hr which is approximately 1040 USh/hr. This value is applied to time spent in vehicle. This value has been based upon Stated Preference studies conducted by ITP in other African cities, namely, Lagos.
- Normal guidance on public transport modelling advises that the value of out of vehicle time to be double the rate of in-vehicle time. Therefore the value of out of vehicle time is approximately 2080 USh/hr.
- BRT fares are set equal to current fare levels on each route. Therefore none of the calculated abstraction rates are derived from changes in fare levels.
- BRT operational speeds will be assumed to equal 25 km/hr and the in-vehicle journey time is calculated by dividing the route distance by this speed. In-vehicle journey times for the current mode (matatus and large buses) are available for each route from the data obtained and is presented in Figure 4-4.
- Passenger capacity in normal standard BRT buses meeting COMESA standards equals approximately 95. A load factor of 85% of this value is then taken, resulting in a planning capacity of 81. This value is used to calculate the likely headway and out of vehicle times experienced by BRT passengers. Out of vehicle journey times for the current mode (matatus and large buses) are available for each route from the data obtained and is presented in Figure 4-4.
- An interchange penalty of 10 min in vehicle time is applied on all O-D trips requiring an interchange and this remains constant for both alternative modes. Therefore none of the calculated abstraction rates are from changes in interchange levels between matatus and BRT.
- BRT is a superior mode, with not only faster journey times but a more comfortable experience (seating and layout, air conditioning etc). ITP Traveller interviews reveal a willingness to pay an extra 200 USh for a trip in a typical BRT vehicle. Therefore a value of 200 USh has been applied as the mode constant advantage toward BRT.

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3 Bus Rapid Guidance Planning Guide, ITDP, June 2007 and WebTag, Department for Transport, UK
5.28 The table below presents abstraction rates from public transport users to the new BRT mode.

Table 5-2: Forecast Abstraction rates Public Transport Modes to BRT (2013)

<table>
<thead>
<tr>
<th>Route</th>
<th>Abstraction to BRT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gayaza Road</td>
<td>81%</td>
</tr>
<tr>
<td>Jinja Road</td>
<td>74%</td>
</tr>
<tr>
<td>Port Bell Road</td>
<td>66%</td>
</tr>
<tr>
<td>Gaba Road</td>
<td>69%</td>
</tr>
<tr>
<td>Entebbe Road</td>
<td>72%</td>
</tr>
<tr>
<td>Masaka Road</td>
<td>67%</td>
</tr>
<tr>
<td>Hoima Road</td>
<td>81%</td>
</tr>
<tr>
<td>Bombo Road</td>
<td>82%</td>
</tr>
<tr>
<td>Kira Road</td>
<td>78%</td>
</tr>
</tbody>
</table>

5.29 The abstraction rates presented in Table 5-2 can be summarised as:

- Abstraction rates vary between 66% and 82%; suggesting that BRT will be the most popular form of public transport, however, existing modes will continue to serve some passengers.
- The highest rates of abstraction (over 80%) are forecast for Bombo Road, Gayaza Road and Hoima Road.
- Intermediate levels of abstraction (70% - 80%) are forecast for Entebbe Road, Jinja Road and Kira Road.
- Relatively low levels of abstraction (65% - 70%) are forecast for Port Bell Road, Masaka Road and Gaba Road.

5.30 The model also applies an abstraction rate from other transport modes based on current travel and transport characteristics and user’s perceptions.

5.31 Current guidance and practice suggests a potential abstraction rate from motorised vehicles ranging between 5 and 20%\(^4\). In this study, it is assumed that the rate of abstraction from cars and motorcycles is 5% (the lower value within the guidance range) throughout the forecast period. This is based on past experience in other African cities, namely Lagos, and on the current travel conditions in Kampala and the routes. Moving speeds range between 15 km/hr to 40 km/hr (see Table 5-8) which implies limited advantage of BRT speeds over car speeds, and therefore smaller rates of abstraction.

5.32 In addition, the ITP Traveller Interviews revealed qualitative evidence for willingness to change modes and this evidence suggests that abstraction rates from non-motorised modes (pedestrians and cyclists) is similar to that from cars and motorcycles. Therefore, it is assumed that the abstraction rates from pedestrians and cyclists are 5% throughout the forecast period.

5.33 The figure below presents the estimated volume of passenger demand for BRT in the forecast year 2013.

---

5.34 The forecast demand presented in Figure 5-2 can be summarised as:

- BRT demand will be highest on Jinja Road whereby the forecast number of daily passengers will equal approx 135,000. BRT demand will be second highest on Entebbe Road where approximately 105,000 users are forecast.

- BRT demand is forecast between 55,000 – 85,000 daily passengers on Masaka Road, Bombo Road, Gayaza Road and Hoima Road.

- BRT demand will be lower than 40,000 on Kira Road and Gaba Road. On Port Bell Road, the forecast levels of demand will is under 20,000 daily passengers.

5.35 These figures are represented geographically on a map base as follows:
Figure 5-3: Forecast Demand Map, Daily BRT Passenger Flows (2010-2030) (6am–10pm)

5.36 Figure 5-3 demonstrates the potential for demand to combine on various routes on approach to the city centre. For example, as Hoima Road, Bombo Road, Gayaza Road and Kira Road combine, the demand level coming into the city centre would be very high.

5.37 The figure below presents the forecast level of BRT passenger flows for the current year, 2010 until 2030.
5.38 The main outputs from the information outlined in Figure 5-4, can be summarised as:

- Total BRT passenger flows will be highest on Jinja Road throughout the forecast period, rising to over 550,000 passengers per day in the year 2030. They will be second highest on Entebbe Road rising to approximately 375,000 per day.
- The forecast level of BRT demand will also be high for Bombo Road and Masaka Road whereby the estimated number of passengers in the year 2030 is estimated as approximately 200,000.
- Demand will remain under 100,000 passengers per day for BRT in Kira Road, Gaba Road and Port Bell Road.

**Sensitivity Analysis**

5.39 BRT demand will be most sensitive to fare levels and journey times as these are variables most often compromised by operational and financial realities, therefore, sensitivity analysis has been conducted on these two variables. Price and journey time elasticities (based on a 10% change in the variable) are presented in the table below.

**Table 5-3: Fare and Journey Time Elasticities**

<table>
<thead>
<tr>
<th>Route</th>
<th>Own</th>
<th>Cross</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fare</td>
<td>-0.78</td>
<td>0.68</td>
</tr>
<tr>
<td>Journey Time</td>
<td>-0.38</td>
<td>0.45</td>
</tr>
</tbody>
</table>

5.40 The elasticity levels outlined above can be summarised as:
The own fare elasticity of (BRT) demand is estimated at -0.78, estimating the impact of a 10% rise in fares to be a reduction of 7.8% in the demand for BRT. A value of -0.78 can be described as 'slightly inelastic'. Such a finding is realistic as normally urban transport fares have an own price elasticity value of between -0.4 and -1.0. In the face of perfect competition from matatu operators, the higher range value is expected.

The own journey time elasticity of (BRT) demand is estimated as -0.38, estimating the impact of a 10% rise in journey times to be a reduction of 3.8% in the demand for BRT. A value of -0.38 can be described as 'inelastic'. It is expected that public transport users are less sensitive to journey times than they are to fares.

The cross elasticity of matatu fares to (BRT) demand is estimated at 0.68, estimating the impact of a 10% rise in matatu fares to be a rise of 6.8% in the demand for BRT. The cross elasticity of matatu journey times to (BRT) demand is estimated at 0.45, estimating the impact of a 10% rise in matatu journey times to be a rise of 4.5% in the demand for BRT. Given the values for own prices and journey time elasticities, the estimated cross elasticities are internally consistent.

The implications of the above elasticity fares should be noted. In particular, BRT fares should remain competitive. A rise in the fare level will produce an almost equivalent reduction in demand. Journey time increases are less sensitive to fare increases and an operational trade off of this nature should at least consider these elasticity findings.

In addition, in the event of fuel price volatility, fuel efficient BRT vehicles will produce dividends for BRT operators as Matatu fares will increase higher than BRT fares which could on balance raise the demand for BRT.

**Journey Time Savings**

Because BRT has a likely operational speed advantage over matatus, there will be overall time savings for users which represent most of the wider economic impacts of the project. Such time savings will transfer into the wider economy through reduced employee time spent in traffic (which can be valued at the wage rate of the employee) and reduced commute time which results in increased levels of societal welfare, and increased catchment area of skilled staff for employers (which will be transferred into commercial productivity gains). There are other economical and welfare advantages, the precise valuation of which is beyond the scope of this study.

The findings of reduced travel time are explored further in later chapters regarding route prioritisation and ranking, however, the following headline data on journey time savings is presented in the diagram below.

---

5 Transport, Wider Economic Benefits and Impact on GDP, Department for Transport, UK, 2006
Potential journey time savings are the largest on Bombo Road and are approximately 31,000 hours per day. Journey time savings are highest on Bombo Road due to a balance of above average demand levels and high disparity between BRT travel speeds and current travel speeds.

The journey time saving are second highest on Jinja Road; approx 26,000 hours per day.

Applying a value of time of US$0.5 per hour and the number of working days per year (250) indicates that the direct annual time savings of implementing BRT is approximately US$4 million for Bombo Road and US$3.5 million for Jinja Road. This is not the consultants’ estimate on the impact on GDP and is only a basic and limited form of analysis formulated as a ball-park estimate.

The journey times savings are forecast to be less than 8,000 hours per day on Port Bell Road, Gaba Road and Masaka Road, reflecting limited economic benefits.

**Conclusion**

Future demand levels have been estimated by applying available data, particularly OD matrices, journey characteristics and sensitivities to an urban transport model. Forecasts for years 2010 – 2030 have been developed for both the do-nothing and BRT scenarios.

The forecast demand levels detailed in this chapter are likely to represent maximum levels of demand and more detail should be focussed on the relative ranking between routes. More accurate forecasts should be made at later stages of the project, particularly, at the feasibility stage, whereby it is predicted that absolute forecast levels will be adjusted downwards.
**Do-Nothing Scenario**

5.48 Forecast demand levels for the do-nothing scenario in the year 2013 reveal that passenger transport will be highest on Jinja Road with 170,000 per day (representing a 45% increase on current demand levels) and second highest on Entebbe Road with 140,000 passengers per day (representing a 35% increase on current demand levels). The relative ranking of the busiest routes remain constant and there will be some divergence in overall volume levels.

5.49 By 2030, public transport demand will have increased exponentially and demand on Jinja Road will exceed 700,000 passengers per day; this is approx 5 times current levels and will present major challenges to public transport planners.

5.50 Demand will also remain high on Entebbe Road (approximately 500,000 passengers per day, and on Masaka and Bombo Road (between 200,000 and 300,000 passengers per day).

5.51 Car transport demand will remain highest on Entebbe Road with approximately 90,000 passengers (representing a 40% rise on current levels) and second highest on Jinja Road with approximately 70,000 passengers per day (representing a 55% rise on current levels). Therefore, the relative ranking of the two busiest routes in terms for car travel remains constant; however, there will be some convergence in terms of the volume of car travel.

**BRT Scenario**

5.52 Abstraction rates will vary between 66% (Port Bell Road) and 82% (Bombo Road) reflecting the likelihood that BRT will dominate the public transport market on all routes, however, current operators will maintain some services and continue to operate.

5.53 Forecast demand for BRT in the year 2013 will be highest on Jinja Road with approximately 135,000 passengers per day and second highest on Entebbe Road with 105,000 passengers per day.

5.54 Forecast demand for BRT in the year 2013 will be significant (over 80,000) on Bombo and Masaka Road.

5.55 Forecast demand will be very low for Port Bell Road; with less than 20,000 passengers per day forecast for the year 2013.

5.56 Relative rankings will remain constant throughout the forecast period (2010 – 2030) with some evidence of divergence. The demand on Jinja Road will rise to approximately 550,000 per day. The demand will also be high on Entebbe Road (375,000 per day), Masaka Road and Bombo Road (approximately 200,000 per day).

**Sensitivity Analysis and Journey Time savings**

5.57 An (own) fare elasticity value of -0.78 has been calculated, estimating a 10% increase in BRT fare levels to lead to a 7.8% reduction in BRT demand. This suggests that an increase in fare levels will lead to an almost proportionate decrease in demand levels. This should be considered carefully by BRT planners and the operational detail should therefore be configured towards lower costs. In addition, in the case of fuel price rises/volatility, more fuel efficient vehicles could generate advantages for BRT as the rate of inflation for BRT will be lower than for matatus which service with inefficient and older vehicles.
5.58 The (own) journey time elasticity of -0.38 has been estimated, suggesting lower levels of sensitivity to demand for journey time than for fare increases. Planners should consider tradeoffs between fare and journey time carefully and take the disparity in elasticity levels into account.

5.59 Journey time savings are highest on Bombo Road, with an average 31,000 hours saved per day. They are second highest on Jinja Road with approx 26,000 hours saved per day.
6 CONCEPTUAL DESIGN

Application of BRT in Greater Kampala

6.1 Chapter 3 of this report sets out advantages and disadvantages of different BRT running lane and station configurations. This Chapter illustrates how some of these concepts could be taken forward within Greater Kampala.

6.2 It is known that the majority of roads in Greater Kampala are UNRA and KCC are pursuing the acquisition of land to enable 30m right of way corridors on major arterial routes into Kampala. For these key arterial routes it is assumed that dual carriageways are required for general traffic. In light of this, schematic design options have been put forward to illustrate how running ways and stations can be fitted into this available cross section. These are presented in Figures 6-1 to 6-3:

6.3 It is recommended that crossings are provided at grade, to increase accessibility for disabled persons and to reduce the physical effort and time required to access BRT. It also avoids the need for costly pedestrian over bridges (which are known to be infrequently used in the African context) and fencing to encourage their use. An inevitable disbenefit is increased delay for general traffic, which will need to stop to allow pedestrians to cross. To minimise the disruption to general traffic, it is likely that pedestrian crossings would be signal controlled.

![Conceptual Layout](image)

Typical Cross Section at Station (m)

![Typical Cross Section](image)

**Figure 6-1: Median Operation – Median Stations**

6.4 With this option, the bus operates along the central median, with stations located within the median. Stations are staggered to maximise the available road width. As discussed in Chapter 3, this option requires doors on the right hand side of the bus, and buses would require conversion for ‘cascading’ to lighter duties towards the end of their useful life.
Buses with doors on both sides could be used, although these offer less seating capacity. For this reason, this option is not recommended.

6.5 Note the general traffic lanes are each 3m wide through the station area. This is slightly less than the typical 3.5m that would be considered for a standard traffic lane, however this is thought to offer two advantages; it means that the limited road space can be allocated to other aspects, such as providing a wider station platform, and the narrowing of the lanes would reduce vehicle speeds through the station area. It is envisaged that this will provide a pedestrian friendly environment around the station areas.

**Figure 6-2: Median Operation – Bilateral Stations**

6.6 With this option, the bus operates along the central median, with stations located along either side of the median. The doors can be located on the left hand side of the bus, to enable flexibility in operations and the ability to cascade buses to lighter uses. In the event of a vehicle breakdown, buses would be able to overtake the stationary vehicle. The benefits of this option and the reason it is recommended as the preferred option are described in Chapter 3.
6.7 With this option, the bus operates along the side of the carriageway, and stations are located along either side, staggered to maximise available road width. Dual carriageways for general traffic are provided either side of a central median. The median provides opportunity for attractive landscaping.

6.8 Figure 6-4 illustrates how BRT can integrate with existing road junctions in Greater Kampala. This illustrates the following:

- Inset 1 illustrates a conceptual design for a signalised cross roads
- Inset 2 illustrates typical road width cross sections within a 30m right of way width, but also shows how this could be narrowed to a minimum of 23m should a carriageway narrowing be required.
- Inset 3 illustrates how a signalised T-junction could sit alongside a BRT station.

**Depot Design and Location**

6.9 The depot will be the BRT operating base. It will provide parking accommodation, servicing and maintenance facilities for vehicles, an administrative function, and facilities for staff.

6.10 In practice, it is recommended that a single depot should not accommodate in excess of 300 vehicles. A concept design is presented as Figure 6-5, which illustrates a depot capable of accommodating up to 300 buses. The overall site area required is 5 Hectares.
Inset 1: Signalised Cross Roads with BRT Insertion

Inset 2: Maximum Right of Way Narrowing

Inset 3: Signalised T Junction Followed by BRT Station

World Bank

Greater Kampala Metropolitan Area BRT Pre Feasibility Study

Concept Designs

Figure 6-4
Bus Parking Area for 300 buses - surfaced with concrete. 45 degree sawtooth parking so each bus is accessible. Buses drive into spaces forwards and reverse out. Where possible, each bus allocated its own space so buses responsible for water or oil leaks can be identified. Assumed bus bay dimensions: 13m x 4.15m

Inspection Pits - buses drive in forwards and reverse out. Each pit needs to be 1-1.1m wide with steps at each end. Area needs to be covered and well lit. Each pit requires electricity, compressed air, work benches (to be located at rear of workshop) and good drainage.

Wash Area - buses to be washed after fuelling. Good surface and drainage facilities as well as water supply required.

Canteen, social, office areas, rest rooms etc

Fueling Area - buses to be fuelled on arrival - two weeks supply of fuel for 300 buses = approximately 450,000 litres

Employee / Visitor Parking (separate vehicular access)

Spare parts, equipment storage, workshops

Workshop space may need to include the following:

- Equipment for maintenance of tyres including a compressor and safety cage for safe inflation.
- Tyre / tube storage
- Unit shops for repair and overhaul of engines, gearboxes, axles, steering boxes etc
- Equipment such as lathes, milling machines, drills etc.
- Unit shops for repair of specialist equipment such as ticket machines, air-conditioning equipment, communications equipment
- Fuel injection shop for testing, calibrating and overhauling fuel injection systems
- Electrical shop for repair and overhaul of electrical components (should be kept clean and free of moisture). A separate area may be required for maintenance of batteries.
- An area for body repairs and painting
- A trimming shop for repair of seats
- Suitable storage for all equipment and materials (which may include hazardous materials such as paints and solvents)
This should be considered a minimal space requirement for this number of buses, as the concept design features an ideal, rectangular shaped site. An irregular shaped site would require a larger site area.

6.11 For the pilot corridor, it may be appropriate to consider two depots smaller than illustrated. These could be located at either ends of the corridor, or the two depots could even be situated on the same site, but separated so that each depot is self contained with its own vehicular access and facilities.

6.12 The concept design illustrates 45 degree ‘sawtooth’ parking bays, which makes each bus accessible without the need to move others. This is important to enable drivers to be assigned to buses, and overcomes operationally difficulties if certain buses, for example, cannot be started.

6.13 Given the size requirements of the depots, a main consideration will be the identification of sufficient land available, and the cost of this land. Cost/land constraints will need to be balanced against operational efficiencies of depot sites in close proximity to the corridor, and may lead to preference for sites towards the end of the tributary services where land may be more easy to come by and less costly than within the city.

Environmental Considerations

6.14 The activities of a bus depot and workshop can have a significant impact on the environment. If adequate measures are not taken they can cause serious damage.

6.15 The main potential problems are traffic congestion caused by buses entering and leaving the depot, pollution from exhaust fumes and excessive noise from the vehicles themselves and from other workshop activities. Less visible, but often more serious, is environmental damage caused by waste oil or spilled fuel entering the drainage system or polluting nearby rivers. A vehicle workshop generates a considerable quantity of waste oil and if this is not disposed of properly it can cause serious pollution.

6.16 These environmental problems should be minimised with good design of the facilities, proper maintenance, and good discipline and housekeeping.

6.17 Site selection should consider the potential environmental effects.

BRT and Non Motorised Transport (NMT)

6.18 The Terms of Reference (TOR) of this study highlights the importance of the integration of the new BRT system with walking, cycling and other Non-Motorized Transport (NMT) modes.

6.19 NMT in an African context is very often considered in relation to urban poverty. Walking and cycling are cheap modes of transport, especially in comparison with the use of a car. This is definitely true for the context of Greater Kampala Metropolitan Area where in the morning and evening rush hours many people walk on the main arterial roads to work or home. According to the TOR (1.4.3) the average trip length for walking is 4 kilometres. Taking into account that the average walking speed is 5 or 6 kilometres an hour, this means an average walking time of 45 minutes (one way). It is expected that a substantial group of the people walking are commuters who do not have money to pay for public transport.
6.20 According to the paper of "Cycling in African Cities: Status and Prospects" the following average costs per kilometre apply for the different transport modes in Africa:

- walking: 2 US$ cents/km
- bicycle: 3 US$ cents/km
- bus: 4 US$ cents/km
- car: 30 US$ cents/km

6.21 These figures have to be considered with care since they are now 10 years old. Furthermore, it is expected that ‘bus’ in this context refers to informal public transport (like matatus) while regulated public transport (like BRT) normally faces lower fares.

6.22 In a more global context, walking and cycling are definitely not transport modes for the urban poor. In South-American countries for example, bicycling is very much considered as a leisure activity for the middle class. In many European countries, the utilitarian use of bicycles is spread over all income groups, while in the Netherlands bicycle usage among high income groups is even higher than that in low income groups.

**Walking and cycling: sustainable transport modes**

6.23 After decades of decline in walking and cycling modal shares, many cities throughout the world recognize the advantages of walking and cycling (e.g. low use of space, CO2 neutral, contributes to a healthy lifestyle) and have developed cycling inclusive policies.

6.24 There are however constraints for walking and cycling in the Greater Kampala Metropolitan Area: certain urban areas are quite hilly and there are hardly any cycling parking facilities available in the City Centre.

**Walking and cycling in the context of this BRT pre-feasibility study**

6.25 Walking will be the dominant mode of transport for people to reach the BRT stations. Walking alongside BRT routes and direct walking routes to the BRT stations (Redways in the City Centre) are integrated parts of the outcomes of this pre-feasibility study.

6.26 This study will not provide a firm NMT Master Plan. This study will however give some first recommendations for better facilities for pedestrians and bicyclists. An important aspect of this, is the required improvement in road safety for pedestrians. As described in chapter 2, more than 50% of the people dying on the roads in the Greater Kampala Metropolitan Area are pedestrians.

6.27 The recommendations of this study are described in three different menus:

- Menu 1: Make Kampala a walkable city:
  - Include the construction of pedestrian footways (with a width of minimal 1.50 meters) at both sides of every urban road to be built. Do not allow any blocking street furniture on these pavements.

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Construct wider pedestrian pavements (minimal 2 metres wide) along all BRT routes to accommodate high passenger flows to and from the BRT stations.

Provide BRT routes with raised zebra crossings every 400 meters.

- Menu 2: Provide cycling infrastructure
  - Provide separate cycling infrastructure for private bicycles and boda boda bicycles (taxi bicycles) through the formulation of a bicycle path master plan. This master plan is mentioned as a separate plan within the framework of the Transport Sector Development Project funded by the World Bank.
  - Ideally, such a bicycle path master plan would provide bicycle routes parallel to the BRT routes, having a different catchment area than the BRT stations.
  - Provide sufficient and safe bicycle parking facilities and waiting areas for boda boda bicycles at the BRT stations outside the BRT trunk corridor.

- Menu 3: Increase road safety by traffic calming
  - Provide zebra crossings on BRT corridors to have an easy access to the BRT stations.
  - Redesign all the intersection corners on the BRT corridor: by a smaller radius and redesign of Y-shapes, the speed of cars and motor cycles can be reduced.
  - Introduce road narrowing in busy urban areas; make narrow car lanes as narrow as 2.75 metres (instead of app. 3.50 meters).
7 EVALUATION OF ALTERNATIVES

Introduction

7.1 Central to this study is an analysis of the proposed routes which could form part of the future BRT network, both in terms of the pilot route, and as part of the long term network.

7.2 The routes under consideration are illustrated again in Figure 7-1 below:

![Figure 7-1: BRT Route Options](image)

**Figure 7-1: BRT Route Options**

7.3 In order to guide the selection of route or routes should form the pilot BRT corridor, and the subsequent development of the long terms BRT network, a route appraisal system has been developed to rank the routes in order of preference.
7.4 The routes are ranked based on the following criteria:

- Levels of personal mobility (potential demand)
- Ease of implementation
- Transport impacts (potential for reducing passenger travel time)
- Integration with other transport modes / future network
- Increased accessibility for low income population (coverage in low income areas)
- Institutional Constraints
- Environment and social impacts

Potential Demand

7.5 Passenger demand is fundamental in deciding which corridors should be prioritised for BRT implementation. Corridors with the highest potential for attracting patronage not only bring the benefits of BRT to the greatest number of travellers, but also offers the best opportunity to demonstrate strong financial viability and successful operation.

7.6 The demand forecasts presented in Chapter 5 form the basis for the potential demand appraisal. The number of passengers forecast to use a BRT service have been forecast for each route under a ‘free-choice’ scenario where BRT competes against existing modes. The level of trip making over a 16 hour operational period (0600-2200) is presented below, with a relative ranking in terms of potential demand given to each route.

Table 7-1: Forecast BRT Demand by corridor, all day two way trips, 2013

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Route</th>
<th>Two way</th>
<th>Ranking Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Route 2</td>
<td>Jinja Road</td>
<td>133,258</td>
</tr>
<tr>
<td>2</td>
<td>Route 5</td>
<td>Entebbe Road</td>
<td>105,503</td>
</tr>
<tr>
<td>3</td>
<td>Route 6</td>
<td>Masaka Road</td>
<td>82,599</td>
</tr>
<tr>
<td>4</td>
<td>Route 8</td>
<td>Bombo Road</td>
<td>80,670</td>
</tr>
<tr>
<td>5</td>
<td>Route 1</td>
<td>Gayaza Road</td>
<td>58,182</td>
</tr>
<tr>
<td>6</td>
<td>Route 7</td>
<td>Hoima Road</td>
<td>55,449</td>
</tr>
<tr>
<td>7</td>
<td>Route 9</td>
<td>Kira Road</td>
<td>37,461</td>
</tr>
<tr>
<td>8</td>
<td>Route 4</td>
<td>Gaba Road</td>
<td>33,058</td>
</tr>
<tr>
<td>9</td>
<td>Route 3</td>
<td>Old Port Bell Road</td>
<td>19,769</td>
</tr>
</tbody>
</table>

7.7 Jinja Road exhibits the greatest level of forecast demand at almost 140,000 trips per day. This level of demand can be considered to be very high on an international scale, although still well within the operating potential of a BRT system. Entebbe Road also exhibits more than 100,000 trips per day, with Masaka and Bombo Road following with around 80,000
trips per day. The remaining routes have much less levels of demand at less than 50% of the highest corridor demand.

**Ease of Implementation**

7.8 The consultant has undertaken analysis on the ease of implementation element of the route appraisal. The ranking is based on the following two key aspects:

- Existing highway corridor width and potential land take.
- General costly engineering aspects, such as level differences and the need for new bridge structures

7.9 Each route has been analysed to establish the physical constraints that will affect each corridor. Based on this information a ranking system has been devised to compare the corridors directly. The detailed engineering constraints diagrams are presented in figures B1 to B9, which are included at Appendix B. The available usable highway corridor widths have been measured every 100m along each route from aerial photography. Although it is not possible to determine accurately the level of land take based on these measurements, they do provide a good, consistent basis for comparing widths of the existing road corridors. The engineering and width constraints are detailed on each plan, and a brief summary of each route is included below.

*Route 1: (Figure B1) Gayaza Road*

7.10 This route could combine with the Bombo Road route from south of the Yusufu Lule Road North junction. Refer to Figure B8 for continuation into the City Centre from Yusufu Lule Road North. Key challenges include:

- The substandard width, measured from aerial photography at approximately 15m along the majority of the route, therefore could require significant land take;
- Encroachment from market traders, as the route passes through the market to the south of the northern bypass; and
- Level differences to the carriageway edges north of the northern bypass.

*Route 2: (Figure B2) Jinja Road*

7.11 The initial section of this route could also be used by services to Port Bell. Comments on this route are set out as follows:

- The route offers good potential for BRT insertion in the initial section, with a wide corridor width and two or three lanes in each direction up to Nakawa.
- BRT would require priority through the heavily congested junctions of Yusufu Lule Road and Old Port Bell Road.
- The width is lost after Nakawa, where it generally varies between 15 and 20m.
- It would be costly to achieve full segregation over the northern bypass junction, as this is a single carriageway flyover, which would require a new structure for widening.

*Route 3: (Figure B3) Port Bell Road*

7.12 The initial section of this route from the City Centre follows Jinja Road. There are then two options:
Utilise Old Port Bell Road. This offers a generally higher existing carriageway width, and provides a more direct route to the City Centre from Port Bell. A disadvantage is that it crosses the railway line at grade.

Utilise Port Bell Road. This is narrower, and there is a bridge over the railway line which would require a new structure should widening be required for a segregated bus lane. This route has the advantage of providing a stop outside Nakawa University.

7.13 It is assumed that Old Port Bell Road would be utilised for BRT as it avoids the railway bridge and has a larger road width.

7.14 The route continues to Port Bell, although the highway corridor width is generally less than 20m.

Route 4: (Figure B4) Gaba Road

7.15 This route starts at the Clock Tower junction, which would require redesigning to give buses priority. In addition the bridge structure over the river to the north of this junction would need further construction work if the road corridor is to be widened. It then heads east and crosses the railway line at grade.

7.16 The general cross section of the highway corridor ranges from 17-30m through the built up areas of Kabalagala, Kayunga and Kansanga.

Route 5: (Figure B5) Entebbe Road

7.17 As for Route 4, this route would need to negotiate the Clock Tower and Shoprite junctions to the south of the City Centre, which would need to be redesigned to get buses through efficiently and the bridge structure over the river between the two junctions would need further construction work if the road corridor is to be widened.

7.18 Following this, southbound buses could use Queen’s Way, which is currently a one way southbound dual carriageway. The introduction of a segregated bus lane would be relatively straight forward along this link.

7.19 Northbound buses could utilise the parallel link to the west, which is a two-way dual carriageway.

7.20 To the south, Entebbe Road continues as a dual carriageway link to Nakukuba. Level differences would make widening of the carriageway costly in many locations, therefore a segregated BRT lane may need to utilise one general traffic lane along the dual carriageway.

Route 6: (Figure B6) Masaka Road

7.21 There are two route options to head toward Natete; one which uses Masaka Road (illustrated with a solid line on Figure B6), and one which uses Natete Road (illustrated with a dashed line).

7.22 The Natete Road option was found to be very constrained in terms of highway width and the proximity of buildings to the carriageway. There are also many sections with significant level differences to the sides of the carriageway, making the prospect of widening the corridor problematic. On this basis, Natete Road is discounted as a viable BRT corridor.
7.23 Masaka Road offers a better carriageway width, with buildings further from the carriageway. However there is significant road side activity, especially around Katwe and Natete.

7.24 At Natete there is a signal controlled crossroads, which would need to be redesigned to accommodate BRT. Further west is a three arm roundabout, then the route continues south-west through the Marshland. There is a significant drop in levels either side of the carriageway through this section, and the road crosses the railway line by way of an overbridge, therefore significant widening through this area could present engineering challenges.

*Route 7: (Figure B7) Hoima Road*

7.25 Hoima Road could follow the same route as the Bombo Road route up to the junction with Makerere Hill Road. Both Makerere Hill Road and Hoima Road are of relatively constrained, with highway corridor widths in the region of 15m.

7.26 The route crosses the Northern Bypass with a four arm roundabout. To achieve effective bus priority measures, this junction would need to be redesigned.

*Route 8: (Figure B8) Bombo Road*

7.27 Bombo Road heads north from the City Centre. There is an electricity substation within the central median, which would be costly to relocate.

7.28 The Haji Kasule Road / Yusufu Lule Road route is preferred to the direct Bombo Road route as they are both dual carriageway links with more potential for BRT segregation.

7.29 There are several roundabouts that would require redesign for complete BRT segregation, these include:
- Yusufu Lule Road / Haji Kasule Road;
- Bombo Road / Gayaza Road; and
- Bombo Road / Northern Bypass, which is grade separated

7.30 The section of Bombo Road between the Gayaza Road junction and the northern bypass (reference 13 of figure B8) appears constrained with limited potential for significant widening.

*Route 9: (Figure B9) Kira Road*

7.31 Kira Road would join the Bombo Road and Gayaza Road routes at the Gayaza Road / Yusufu Lule Road roundabout. From there it continues north-east along a dual carriageway section of relatively generous highway corridor width, although street lighting and telegraph poles would need to be relocated were the median to be removed.

7.32 The second half of this route towards Ntinda is far more constrained, with widths of around 15m. There is limited potential for widening through this section due to the proximity of property to the public highway.

*Ease of Implementation Appraisal*

7.33 In order to appraise the routes, the potential land take requirement per kilometre was the primary consideration, as this was highlighted to the client to be particularly problematic in the Kampala context. In Chapter 6 of this report, it is discussed that the theoretical corridor...
width required for BRT insertion is 30m. The ranking is primarily based on the potential level of land take and resettlement required to achieve this corridor width.

7.34 The rankings are adjusted with a score for 'general engineering difficulties', which includes any costly interventions that may be required along the routes. This was based on the site appraisal of the consultant.

7.35 Many routes offer better potential for implementation close to the City Centre, and then the width reduces as the route extends further away. In order to highlight this concept, routes that show distinct changes in road width are also broken down into sections. For the overall appraisal, only the scores for the initial sections of each route are taken forward for inclusion in the overall appraisal process, as these sections of each route would be more favourable for initial construction. The outer sections of each route could be developed at a later stage, should the funds be available and should the engineering and land take issues be overcome.
### Table 7-2: Ease of Implementation Summary

<table>
<thead>
<tr>
<th>Route</th>
<th>Subsections</th>
<th>Length Measured</th>
<th>Minimum Width</th>
<th>Average Width</th>
<th>Potential Land Take</th>
<th>Potential Land Take Per km</th>
<th>Score</th>
<th>Engineering Difficulties</th>
<th>Adjusted Score</th>
<th>Details of engineering difficulties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gayaza Road</td>
<td></td>
<td>10.2</td>
<td>12.0</td>
<td>18.6</td>
<td>121150</td>
<td>11877</td>
<td>2</td>
<td>-1.5</td>
<td>0.5</td>
<td>Level Differences north of northern bypass</td>
</tr>
<tr>
<td>Bombo Road South of</td>
<td>Bombo Road / Gayaza Road Junction</td>
<td>2.7</td>
<td>12.0</td>
<td>27.4</td>
<td>11150</td>
<td>41296</td>
<td>8</td>
<td>-0.5</td>
<td>7.5</td>
<td>Relocation of electricity substation close to City Centre required</td>
</tr>
<tr>
<td></td>
<td>Gayaza Road North of Bombo Road / Gayaza Road Junction</td>
<td>7.4</td>
<td>13.0</td>
<td>15.3</td>
<td>110000</td>
<td>14865</td>
<td>0</td>
<td>-1</td>
<td>0</td>
<td>Level Differences north of northern bypass</td>
</tr>
<tr>
<td>Jinja Road</td>
<td></td>
<td>20.5</td>
<td>12.0</td>
<td>19.6</td>
<td>220767</td>
<td>10769</td>
<td>3</td>
<td>-1</td>
<td>2</td>
<td>Segregation over northern bypass junction costly</td>
</tr>
<tr>
<td>Jinja Road West of</td>
<td>Port Bell Road</td>
<td>3.8</td>
<td>23.2</td>
<td>30.1</td>
<td>5917</td>
<td>1557</td>
<td>10</td>
<td></td>
<td>10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Jinja Road East of Port Bell Road</td>
<td>16.6</td>
<td>12.0</td>
<td>17.1</td>
<td>214850</td>
<td>12943</td>
<td>1</td>
<td>-1</td>
<td>0</td>
<td>Segregation over northern bypass junction costly</td>
</tr>
<tr>
<td>Port Bell Road</td>
<td></td>
<td>8.0</td>
<td>14.0</td>
<td>18.5</td>
<td>92600</td>
<td>11600</td>
<td>2</td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Gaba Road</td>
<td></td>
<td>9.1</td>
<td>17.0</td>
<td>23.6</td>
<td>59300</td>
<td>6516</td>
<td>6</td>
<td></td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Entebbe Road</td>
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<td>15.4</td>
<td>16.0</td>
<td>26.3</td>
<td>81400</td>
<td>5286</td>
<td>7</td>
<td>-3</td>
<td>4</td>
<td>Complete redesign of Clock Tower and Shoprite junctions with bridge over river. Large level differences either side of carriageway.</td>
</tr>
<tr>
<td>Entebbe Road North of</td>
<td>Nakuruba</td>
<td>7.6</td>
<td>18.0</td>
<td>30.9</td>
<td>17500</td>
<td>2303</td>
<td>9</td>
<td>-3</td>
<td>6</td>
<td>Complete redesign of Clock Tower and Shoprite junctions with bridge over river. Large level differences either side of carriageway.</td>
</tr>
<tr>
<td>Entebbe Road South of</td>
<td>Nakuruba</td>
<td>7.7</td>
<td>16.0</td>
<td>21.8</td>
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<td>8299</td>
<td>5</td>
<td></td>
<td>5</td>
<td></td>
</tr>
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<td>Masaka Road</td>
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<td>16.7</td>
<td>13.0</td>
<td>19.2</td>
<td>197800</td>
<td>11832</td>
<td>2</td>
<td>-1</td>
<td>1</td>
<td>Complete redesign of Clock Tower and Shoprite junctions with bridge over river. Large level differences either side of carriageway.</td>
</tr>
<tr>
<td>Holma Road</td>
<td></td>
<td>13.3</td>
<td>14.0</td>
<td>17.4</td>
<td>170750</td>
<td>12838</td>
<td>2</td>
<td>-1</td>
<td>1</td>
<td>Relocation of electricity substation close to City Centre required</td>
</tr>
<tr>
<td>Bombo Road</td>
<td></td>
<td>5.5</td>
<td>12.0</td>
<td>22.3</td>
<td>47050</td>
<td>8555</td>
<td>5</td>
<td>-0.5</td>
<td>4.5</td>
<td>Relocation of electricity substation close to City Centre required</td>
</tr>
<tr>
<td>Bombo Road South of</td>
<td>Bombo Road / Gayaza Road Junction</td>
<td>2.7</td>
<td>12.0</td>
<td>27.4</td>
<td>11150</td>
<td>4130</td>
<td>8</td>
<td>-0.5</td>
<td>7.5</td>
<td>Relocation of electricity substation close to City Centre required</td>
</tr>
<tr>
<td>Bombo Road North of</td>
<td>Bombo Road / Gayaza Road Junction</td>
<td>5.5</td>
<td>12.0</td>
<td>17.2</td>
<td>35900</td>
<td>6527</td>
<td>6</td>
<td></td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Kira Road</td>
<td></td>
<td>6.6</td>
<td>12.0</td>
<td>22.0</td>
<td>56350</td>
<td>8538</td>
<td>5</td>
<td>-0.5</td>
<td>4.5</td>
<td>Relocation of electricity substation close to City Centre required</td>
</tr>
<tr>
<td>Kira Road West of</td>
<td>Lugogo Bypass Junction</td>
<td>3.4</td>
<td>12.0</td>
<td>27.9</td>
<td>10150</td>
<td>2985</td>
<td>9</td>
<td>-0.5</td>
<td>8.5</td>
<td>Relocation of electricity substation close to City Centre required</td>
</tr>
<tr>
<td></td>
<td>Kira Road East of Lugogo Bypass Junction</td>
<td>3.1</td>
<td>14.0</td>
<td>15.6</td>
<td>46200</td>
<td>14803</td>
<td>0</td>
<td></td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>
7.36 The results indicate that the initial section of Jinja Road (up to the Port Bell junction) shows the least costly potential for insertion in engineering terms. This is followed by the initial section of Bombo Road route (defined as Bombo Road – Haji Kasule Road – Yusufu Lule Road North).

Further information on right of way corridor widths

7.37 Property boundary plans were obtained from Kampala City Council covering all routes under consideration within the KCC administrative area. The minimum distance between properties provides an indication for the potential for land take along each link. This information is summarised on Figure 7-2.

![Figure 7-2: Minimum Right of Way Width Availability along Key Links](image)

Transport impacts (potential for reducing passenger travel time)

7.38 The priority measures and enhanced service offer which BRT can provide will lead to improved journey times, reliability and overall travel experience. These benefits will be most marked on corridors where current travel conditions are the poorest, whether through extreme congestion or low quality of service offer.

7.39 To evaluate the potential improvement that BRT would bring over existing conditions on the various corridors, the typical journey conditions have been analysed against estimates
of BRT journey times. Existing travel conditions have been observed through the mystery traveller surveys which recorded waiting times and stop-by-stop journey times as well as fare levels and other journey attributes.

7.40 Fare levels for BRT are assumed within the modelling to remain in line with existing fares, although detailed decisions regarding fare structure and levels would be undertaken before implementation. Fares are therefore not included in the analysis.

7.41 The differentials in wait time and journey time on existing matatu services have been analysed on a corridor by corridor basis. These are then compared against corresponding journey times and wait times which could be expected with a BRT service, based on average run-speeds and headways which correspond to the observed levels of demand. The flowing table summarises the wait times and journey times for each mode:

Table 7-3: Existing Matatu journey times and modelled BRT times by corridor

<table>
<thead>
<tr>
<th>Route</th>
<th>Matatu</th>
<th></th>
<th>BRT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wait time</td>
<td>Journey Time</td>
<td>Wait Time</td>
</tr>
<tr>
<td>Route 1</td>
<td>Gayaza Road</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Route 2</td>
<td>Jinja Road</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Route 3</td>
<td>Port Bell Road</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Route 4</td>
<td>Gaba Road</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>Route 5</td>
<td>Entebbe Road</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>Route 6</td>
<td>Masaka Road</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Route 7</td>
<td>Hoima Road</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Route 8</td>
<td>Bombo Road</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Route 9</td>
<td>Kira Road</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

7.42 To rank the corridors in terms of potential improvement in travel conditions, the absolute journey time saving is important, rather than say the saving per km, as this represents the real time savings for each traveller. The chosen metric for comparison is:

7.43 Average Journey Time for Matatu (including wait time and in vehicle journey time) - Average Journey Time for BRT (including wait time and in vehicle journey time)

7.44 This gives the traveller time saving possible through the implementation of BRT. The results are summarised in the table below:
Table 7-4: Journey Time savings possible with BRT by route

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Route</th>
<th>Route Length (Km)</th>
<th>Journey Time Matatu (min)</th>
<th>Journey Time BRT (min)</th>
<th>Time Saving (min)</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Route 8 Bombo Road</td>
<td>11</td>
<td>103</td>
<td>54</td>
<td>49</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>Route 1 Gayaza Road</td>
<td>9</td>
<td>92</td>
<td>45</td>
<td>47</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>Route 7 Hoima Road</td>
<td>11</td>
<td>101</td>
<td>54</td>
<td>47</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>Route 9 Kira Road</td>
<td>7</td>
<td>84</td>
<td>40</td>
<td>45</td>
<td>9</td>
</tr>
<tr>
<td>5</td>
<td>Route 2 Jinja Road</td>
<td>22</td>
<td>131</td>
<td>106</td>
<td>25</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>Route 5 Entebbe Road</td>
<td>14</td>
<td>86</td>
<td>69</td>
<td>17</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Route 6 Masaka Road</td>
<td>19</td>
<td>106</td>
<td>93</td>
<td>13</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>Route 4 Gaba Road</td>
<td>11</td>
<td>70</td>
<td>58</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>Route 3 Port Bell Road</td>
<td>11</td>
<td>69</td>
<td>60</td>
<td>9</td>
<td>2</td>
</tr>
</tbody>
</table>

7.45 Bombo Road demonstrates the potential for large journey time savings as existing journey times are high given the length of the route. It is followed closely by Gayaza, Hoima Road and Kira Road in terms of potential transport impact. The longer routes, Jinja and Masaka, are observed at mid to bottom table. As the majority of congestion occurs on the approach to the City Centre, a longer route does not always mean greater journey time savings are possible as much of the route may be relatively free running beyond the confines of the Central highway network.

**Integration with other transport modes / future network**

7.46 This element of the appraisal considers opportunities for each route to link with existing pedestrian and cycling routes, as well as opportunities for development of the future public transport network, which might include tributary services, either to be provided as BRT services or utilise existing Matatu capacity.

**Walking Connections**

7.47 All potential BRT route options can link with existing pedestrian desire lines, as they all lie on arterial routes. In order to compare which routes may offer the most potential to capture walk trips, the number of pedestrians along each route was derived from the survey data. The results are detailed as follows:
Table 7-5: Routes Ranked According to Daily Pedestrian Flow

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Route</th>
<th>Inbound</th>
<th>Outbound</th>
<th>Two way</th>
<th>Ranking Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Route 8 Bombo Road</td>
<td>3,352</td>
<td>6,924</td>
<td>10,276</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>Route 5 Entebbe Road</td>
<td>6,816</td>
<td>2,450</td>
<td>9,266</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>Route 6 Masaka Road</td>
<td>2,583</td>
<td>3,059</td>
<td>5,641</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>Route 1 Gayaza Road</td>
<td>2,468</td>
<td>2,737</td>
<td>5,205</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>Route 4 Gaba Road</td>
<td>2,180</td>
<td>2,147</td>
<td>4,327</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>Route 9 Kira Road</td>
<td>1,385</td>
<td>2,095</td>
<td>3,480</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Route 7 Hoima Road</td>
<td>1,606</td>
<td>1,644</td>
<td>3,250</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>Route 2 Jinja Road</td>
<td>1,318</td>
<td>1,790</td>
<td>3,108</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>Route 3 Port Bell Road</td>
<td>631</td>
<td>781</td>
<td>1,412</td>
<td>1</td>
</tr>
</tbody>
</table>

7.48 Bombo Road and Entebbe Road show high levels of pedestrian activity, therefore there would be potential to attract considerable number of pedestrians onto BRT.

Cycling Connections

7.49 The consultant witnessed little in the way of dedicated cycling infrastructure within Kampala, therefore the main arterial road corridors are thought to also offer the most direct cycle routes. However, there is potential ease the journey of the cyclist by providing the option to interchange with BRT.

7.50 The number of cyclists along each route was derived from the survey data. The results are detailed as follows:

Table 7-6: Routes Ranked According to Daily Pedal Cycle Flow

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Route</th>
<th>Inbound</th>
<th>Outbound</th>
<th>Two way</th>
<th>Ranking Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Route 1 Gayaza Road</td>
<td>2,587</td>
<td>2,734</td>
<td>5,321</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>Route 8 Bombo Road</td>
<td>2,165</td>
<td>1,556</td>
<td>3,721</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>Route 6 Masaka Road</td>
<td>1,697</td>
<td>1,850</td>
<td>3,547</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>Route 4 Gaba Road</td>
<td>1,028</td>
<td>915</td>
<td>1,943</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Route 9 Kira Road</td>
<td>830</td>
<td>870</td>
<td>1,700</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>Route 7 Hoima Road</td>
<td>757</td>
<td>700</td>
<td>1,458</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Route 5 Entebbe Road</td>
<td>780</td>
<td>537</td>
<td>1,317</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>Route 2 Jinja Road</td>
<td>469</td>
<td>627</td>
<td>1,097</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>Route 3 Port Bell Road</td>
<td>225</td>
<td>274</td>
<td>498</td>
<td>1</td>
</tr>
</tbody>
</table>
7.51 The data suggests Gayaza Road shows the highest levels of cycling activity, therefore may offer most potential to attract considerable number of pedestrians onto BRT.

**Opportunities for Bus Tributary Services**

7.52 The potential for tributary services is of key importance, as these could substantially increase the level of usage along certain sections of the BRT network, especially close to the City Centre. The potential number of for tributary routes for each route is summarised as follows:

**Table 7-7: Routes Ranked According Potential Tributary Opportunities**

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Route</th>
<th>Potential Tributaries</th>
<th>Number</th>
<th>Ranking Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Route 1 Gayaza</td>
<td>Hoima Road, Bombo Road, Kira Road</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>Route 7 Hoima</td>
<td>Gayaza Road, Bombo Road, Kira Road</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>Route 8 Bombo</td>
<td>Gayaza Road, Hoima Road, Kira Road</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>Route 9 Kira</td>
<td>Gayaza Road, Hoima Road, Bombo Road</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>Route 2 Jinja</td>
<td>Port Bell Road</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>Route 3 Port</td>
<td>Jinja Road</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Route 5 Entebbe</td>
<td>Masaka Road</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>Route 6 Masaka</td>
<td>Entebbe Road</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>Route 4 Gaba</td>
<td>None</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

7.53 Combining the scores for each of the above elements on an equal basis gives the following overall rankings for integration:

**Table 7-8: Overall Ranking for Integration**

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Route</th>
<th>Pedestrian</th>
<th>Cycle</th>
<th>Tributary</th>
<th>Ranking Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Route 8 Bombo</td>
<td>10</td>
<td>7</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>Route 1 Gayaza</td>
<td>5</td>
<td>10</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>Route 9 Kira</td>
<td>3</td>
<td>3</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>Route 7 Hoima</td>
<td>3</td>
<td>3</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>Route 6 Masaka</td>
<td>5</td>
<td>7</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>Route 5 Entebbe</td>
<td>9</td>
<td>2</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>Route 4 Gaba</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>Route 2 Jinja</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>Route 3 Port</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>
7.54 Bombo demonstrates strong performance under the Integration heading due to the high levels of observed slow mode activity along the corridor (walk and cycle) and the possibility to serve a number of tributaries from the main corridor.

**Increased accessibility for low income population (coverage in low income areas)**

7.55 Improving public transport accessibility for people living in low income areas is a fundamental objective of BRT. In order to ascertain which route option best covers low income areas, demographic data from the National Transport Masterplan was interrogated.

7.56 Within the Masterplan data, the number of people living within each parish that are classified as 'low income' was reported. The BRT routes were overlaid on the parish mapping base to ascertain which parishes were affected by which routes. This allowed the number of low income people affected by each route to be determined. The results are as follows:

**Table 7-9: Routes Ranked According to Accessibility for Low Income Population**

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Route</th>
<th>Potential Number of Low Income People Affected</th>
<th>Ranking Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Route 2 Jinja Road</td>
<td>99,017</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>Route 7 Hoima Road</td>
<td>90,357</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>Route 5 Entebbe Road</td>
<td>89,072</td>
<td>9</td>
</tr>
<tr>
<td>4</td>
<td>Route 9 Masaka</td>
<td>80,967</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>Route 2 Gayaza</td>
<td>79,279</td>
<td>8</td>
</tr>
<tr>
<td>6</td>
<td>Route 3 Kira</td>
<td>75,726</td>
<td>8</td>
</tr>
<tr>
<td>7</td>
<td>Route 5 Bombo</td>
<td>69,653</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>Route 6 Gaba</td>
<td>51,436</td>
<td>5</td>
</tr>
<tr>
<td>9</td>
<td>Route 4 Port Bell Road</td>
<td>43,463</td>
<td>4</td>
</tr>
</tbody>
</table>

7.57 The results indicate that Jinja Road provides accessibility for more low income areas that other routes, although routes 1 to 6 all provide high levels of accessibility for low income area.

**Institutional Constraints**

7.58 The main consideration that would preference one route over any other from an institutional viewpoint is the number of administrative areas that the route would pass into. The higher the number of local authorities involved, the more issues may arise. For example, a route that remained entirely within the administrative area of Kampala City Council would be preferable to a route that also went into Wakiso or Mukono administrative areas.

7.59 Therefore a simple ranking has been applied to reflect the number of administrative areas each route could potentially enter. This is summarised as follows:
Table 7-10: Routes Ranked According to Accessibility for Low Income Population

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Route</th>
<th>Number of administrative areas potentially affected</th>
<th>Ranking Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Route 3 Port Bell Road</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>Route 4 Gaba Road</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>Route 1 Gayaza Road</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>Route 5 Entebbe Road</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>Route 6 Masaka Road</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>Route 7 Hoima Road</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>Route 8 Bombo Road</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>Route 9 Kira Road</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>9</td>
<td>Route 2 Jinja Road</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 7-10 illustrates that Port Bell Road and Gaba Road would be least affected by multiple local authorities, whilst Jinja Road is the only route that could potentially extend through Kampala, Wakiso and Mukono.

**Environmental and Social Impacts**

7.61 In order to assess the environmental and social impacts, detailed site appraisal was undertaken which involved a video survey along all routes. Based on this site appraisal, environmental and social implications of the implementation of BRT are summarised and a ranking is applied. This ranking is based on a comparative assessment of the amount of roadside retail activity that may need to be relocated and number of trees that may need to be removed.
Table 7-11: Routes Ranked According to Potential Environmental and Social Impacts

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Route</th>
<th>Social and Environmental Considerations</th>
<th>Ranking Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Route 2 Jinja Road</td>
<td>Minimal impact on approach to City Centre due to wide existing highway corridor. Trees in central median between Old Port Bell Road and Port Bell Road junctions. Generally low impact.</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>Route 9 Kira Road</td>
<td>Minimal impact from City Centre to Bombo Road / Makerere Hill Road junction due to wide existing highway corridor. Trees in central median along Bombo Road. Trees in central median along Kira Road. Retail activity around Ntinda.</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>Route 3 Port Bell Road</td>
<td>Significant roadside activity around the town of Kitintale. Generally low impact to City Centre.</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>Route 5 Entebbe Road</td>
<td>Significant retail activity alongside Katwe Road on approach to City Centre and through Nakukuba.</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>Route 6 Masaka Road</td>
<td>Significant retail activity alongside Katwe Road on approach to City Centre and through Ndeeaba.</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>Route 7 Hoima Road</td>
<td>Minimal impact from City Centre to Bombo Road / Makerere Hill Road junction due to wide existing highway corridor. Trees in central median along Bombo Road. Significant roadside activity around Hoima Road / Kimera Road / Masiro Road junction (Kawaala Market).</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>Route 8 Bombo Road</td>
<td>Minimal impact from City Centre to Bombo Road / Gayaza Road junction due to wide existing highway corridor. Trees in central median along Bombo Road. Roadside retail activity around Bwaise and through Kawempe.</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>Route 1 Gayaza Road</td>
<td>Minimal impact from City Centre to Bombo Road / Gayaza Road junction due to wide existing highway corridor. Trees in central median along Bombo Road. Gayaza Road between Bombo Road junction and Northern Bypass has significant retail and market activity alongside existing narrow carriageway. Some roadside activity to north of Northern Bypass.</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>Route 4 Gaba Road</td>
<td>Roadside activities present through Nsambya and Kansanga.</td>
<td>4</td>
</tr>
</tbody>
</table>
Route Appraisal Results

7.62 The table below brings the scores under each of the appraisal criteria together for the routes. Within the table a weighting factor was applied based on the relative importance of each criteria. These weighting factors were discussed tabled to the Technical Committee during the workshop on the 5th February 2010.
<table>
<thead>
<tr>
<th>Ranking</th>
<th>Route</th>
<th>Jinja Road</th>
<th>Route 8</th>
<th>Bombo Road</th>
<th>Route 1</th>
<th>Gayaza Road</th>
<th>Route 9</th>
<th>Kira Road</th>
<th>Route 5</th>
<th>Entebbe Road</th>
<th>Route 7</th>
<th>Holma Road</th>
<th>Route 6</th>
<th>Masaka Road</th>
<th>Route 4</th>
<th>Gaba Road</th>
<th>Route 3</th>
<th>Port Bell Road</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Route 2</td>
<td>10</td>
<td>2.5</td>
<td>10</td>
<td>2.5</td>
<td>5</td>
<td>0.8</td>
<td>3</td>
<td>0.3</td>
<td>10</td>
<td>1.0</td>
<td>0</td>
<td>0.0</td>
<td>5</td>
<td>0.3</td>
<td>5</td>
<td>0.5</td>
<td>7.9</td>
</tr>
<tr>
<td>2</td>
<td>Route 8</td>
<td>6</td>
<td>1.5</td>
<td>7.5</td>
<td>1.9</td>
<td>10</td>
<td>1.5</td>
<td>10</td>
<td>1.0</td>
<td>7</td>
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<td>5</td>
<td>0.3</td>
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<td>0.5</td>
<td>7.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Route 1</td>
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<td>7.5</td>
<td>1.9</td>
<td>10</td>
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<td>0.4</td>
<td>6.7</td>
<td></td>
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</tr>
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<td>Route 9</td>
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<td>0.8</td>
<td>8.5</td>
<td>2.1</td>
<td>9</td>
<td>1.4</td>
<td>6</td>
<td>0.6</td>
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<td>0.8</td>
<td>5</td>
<td>0.3</td>
<td>7</td>
<td>0.7</td>
<td>6.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Route 5</td>
<td>8</td>
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<td>1.5</td>
<td>3</td>
<td>0.5</td>
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<td>0.5</td>
<td>9</td>
<td>0.9</td>
<td>5</td>
<td>0.3</td>
<td>5</td>
<td>0.5</td>
<td>6.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Route 7</td>
<td>4</td>
<td>1.0</td>
<td>1</td>
<td>0.3</td>
<td>10</td>
<td>1.5</td>
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<td>0.6</td>
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<td>0.9</td>
<td>5</td>
<td>0.3</td>
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<td>0.5</td>
<td>5.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Route 6</td>
<td>6</td>
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<td>1</td>
<td>0.3</td>
<td>3</td>
<td>0.5</td>
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<td>0.6</td>
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<td>5</td>
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</tr>
<tr>
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<td>Route 4</td>
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<td>10</td>
<td>0.5</td>
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<td>0.4</td>
<td>4.3</td>
<td></td>
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</tr>
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<td></td>
</tr>
</tbody>
</table>

**Table 7-12: Overall Route Appraisal Summary**

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Route</th>
<th>Jinja Road</th>
<th>Route 8</th>
<th>Bombo Road</th>
<th>Route 1</th>
<th>Gayaza Road</th>
<th>Route 9</th>
<th>Kira Road</th>
<th>Route 5</th>
<th>Entebbe Road</th>
<th>Route 7</th>
<th>Holma Road</th>
<th>Route 6</th>
<th>Masaka Road</th>
<th>Route 4</th>
<th>Gaba Road</th>
<th>Route 3</th>
<th>Port Bell Road</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Route 2</td>
<td>10</td>
<td>2.5</td>
<td>10</td>
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</tr>
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<tr>
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<td>Route 9</td>
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<td>2.1</td>
<td>9</td>
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<td>8</td>
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<td>0.3</td>
<td>3</td>
<td>0.3</td>
<td>5</td>
<td>0.5</td>
<td>10</td>
<td>0.5</td>
<td>4</td>
<td>0.4</td>
<td>4.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Route 3</td>
<td>2</td>
<td>0.5</td>
<td>2</td>
<td>0.5</td>
<td>2</td>
<td>0.3</td>
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<td>0.2</td>
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<td>0.5</td>
<td>6</td>
<td>0.6</td>
<td>3.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
7.63 The results indicate that Jinja Road is the most desirable corridor to develop for BRT, with Bombo Road a clear second. On this basis, Jinja Road and Bombo Road is proposed for development of the initial pilot BRT corridor.

7.64 As discussed in Chapter 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, as discussed further in Chapter 8, 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.

**Development of the Network**

7.65 Using the network appraisal results, a proposed vision for the initial and long term development of the network is presented within Figures 7-3 to 7-10.

7.66 The proposed pilot route forms Route A1 of the phased network development, as shown on Figure 7-3. The phased development of the network could be implemented piece by piece as funds become available, and tributary services could be implemented prior to full segregation being achievable. It should be noted that each route (including the pilot corridor) would be subject to a full feasibility study to ensure economic viability.
Figure 7-3: Pilot Route Corridor

Figure 7-4: Route B1 – Route towards Entebbe constructed
Figure 7-5: Pilot Corridor Extension - Extension along Bombo Road and continuation along Jinja Road

Figure 7-6: Route A2 / A3 – Extensions along Gayaza Road and Kira Road
Figure 7-7: Route A4 – Extension along Hoima Road

Figure 7-8: Route B2 – Extension along Masaka Road
Figure 7-9: Route B3 – Extension along Gaba Road

Figure 7-10: Route B4 – Extension along Port Bell Road
City centre penetration and management

7.67 This section provides different routeing concepts for the BRT system to the City Centre and within the City Centre.

Access to the City Centre

7.68 When routeing the nine given BRT routes to the City Centre, three possible routeing concepts can be used:

- Option A: a route coming in to the City Centre and turning back to itself;
- Option B: a combination of two different routes forming one route through the City Centre;
- Option C: a route making a loop around the City Centre and then turns back on to itself.

7.69 Figure 7-11 visualizes the three options.

![Routeing options for access to the City Centre](image)

**Figure 7-11: Routeing options for access to the City Centre**

7.70 Concept A is the way public transport by matatus is currently organized in Kampala. When travelling from one part to another part of the city, a transfer from one to another vehicle has to be made. This is not very user-friendly and also causes the need of space consuming transfer stations (like the two Taxi Parks right now). Furthermore, concept A is bringing passengers to a certain location within the City Centre and terminates there, it does not serve the whole area of the City Centre.

7.71 In this respect, option C serves a much larger area than option A. As in option A, the route turns back to itself but it also makes a one-way loop through the City Centre. This option is very attractive when only one route is serving the City Centre and one wants to serve an area within the City Centre as large as possible.

7.72 Option B however is very efficient when developing a larger network in the long term. Option B combines two routes and links them together. Routes do not terminate in the City
Centre; they only have slightly longer dwelling times at the busy stops in the centre. With option B one can travel from one part to another part of the city without a transfer. When more routes will appear on the network different combinations of routes can be made to give many passengers the possibility to travel without a transfer.

7.73 From the three described options, option B is chosen as the preferred routeing concept to access the City Centre.

Routeing within the City Centre

7.74 When deciding the routes in the City Centre, three possible routeing concepts can be used:
- Concept 1: BRT route stays on the main road;
- Concept 2: BRT route on the main road but it also makes detour (to serve a larger area);
- Concept 3: BRT route is following a parallel road to the main road.

7.75 Figure 7-12 visualizes the three options.

![Routeing options within the City Centre](image)

Figure 7-12: Routeing options within the City Centre

7.76 The most important required features of the BRT corridors in the City Centre are speed and reliability. Therefore it is important to have direct routes (no or few left/right turns) and wide
roads (large right of way). In a way one needs to ‘protect’ the BRT corridor in the City Centre from disturbance from parking, crossing other traffic, etc.

7.77 Having these features in mind, option 2 is assessed as poor performing because it is not following a direct route: it turns off the main road and later turns back to the main road. Option 3 is often used in cities with a grid street pattern where different roads run completely parallel to each other and where they have more or less the same right of way. This is not the case in Kampala. Option 1 is considered the best option in relation to the required features: option 1 provides a direct route on a wide road and – with sufficient parking and car demand management measures – option 1 will provide the best operation of the BRT routes.

7.78 From the three described options, option 1 is chosen as the preferred routeing concept within the City Centre.

*What kind of City Centre is desired?*

7.79 Above the routeing concept of two routes forming one through route (concept B) in combination with the concept that the route always stays on the main road (option 1) is recommended.

7.80 In this stage of the process it is good to think about other issues which do effect the operation of a new BRT system. One can think about questions: how do people access the BRT stops, is car parking conflicting with the BRT, are BRT stops isolated functional locations to enter a vehicle or are they integrated with the urban structure. These bring us basically to the question: What kind of City Centre do we want?

7.81 Do we want a City Centre with only a newly planned BRT or do we want a City Centre which is more planned, where we have thought about urban planning?

7.82 The important idea behind urban planning is integration of activities: work, housing, shops, schools, restaurants, etc. Transport is the link between all these activities and is vital for a city. Transport can form the shape of a city and can have a big influence on the daily life of its inhabitants. The City Centre with all its activities needs a good transport system (like BRT) but one cannot just formulate the transport component without considering the functions of the City Centre. It is important to ask what kind of city you want to live in. With the answer in mind you can model the City Centre to fit that vision and formulate urban transport policies in compliance with that vision.

7.83 It is not in the scope of this study to answer the question “What kind of City Centre do we want to live in?” but we consider it important to address some direct issues linking this question to the new BRT corridor. This following list of questions is an attempt to open up the discussion, not to give clear answers or directions.

*Cars, where do we see them driving?*

7.84 Cars are necessary for the greater urban economy but in the context of a City Centre, cars are not very efficient modes of transport. The question is: where do we want to see them driving and parking in the City Centre?
7.85 Four possible answers to this question are given here:
- Cars share the same road (not lane) together with BRT;
- Cars share the same road with BRT but through traffic is forbidden (blocked);
- Cars are separated from BRT (on parallel road);
- Cars are completely separated from BRT (city ring).

The inner City Centre (within the triangle): what to do with it?

7.86 The inner City Centre (the area within the triangle) is a very busy area with many retail shops and many pedestrians visiting the shops. Car parking is very prominent and the area is very congested, mainly with matatus queuing up for one of the Taxi Parks. Congestion is high and the overall quality of life is low in the area. The question emerges what to do with this area in the long term.

7.87 Three possible answers to this question are given here:
- Keep this area within the triangle completely open for motorised traffic (current situation);
- Reduce motorised transport in the area by around 50% (by e.g. reducing parking spaces by 50%);
- Close the area completely for motorised traffic (so the area will be only accessible for pedestrians and bicycles).

The future of the Taxi Parks?

7.88 With the new BRT system and the extension of the BRT network, the market for matatus will change. Matatus will find new market (e.g. feeding the BRT stations) and there will be a less need for large central Taxi Parks. This process will probably take years but at the end of this process, the current locations can be used for new functions (like housing, offices or a recreational park). So the question about the future of the Taxi Parks can be answered with the following possible answers:
- Keep the current situation of large Taxi Parks;
- Reduce slowly the size of the Taxi Parks and introduce new functions on the parts which become available;
- Relocate the Taxi Parks to smaller locations outside the City Centre;

Where do we walk, do we cycle?

7.89 Walking facilities in the City Centre are very poor now and need to be improved to give direct walking routes to the BRT. Direct easy recognizable walking routes to the BRT stations will enlarge the catchment area of the BRT stops and therefore the patronage. Cycling is not much seen in the City Centre now due to the unsafe traffic and lack of bicycle parking facilities. Besides that, the question can be raised if we want to encourage people to use the bicycle to the City Centre or not.
7.90 Three possible answers to this question of “Where do walk, do we cycle?” are:
- Provision of direct recognizable walking routes to the BRT stops (e.g. in a star form);
- Direct walking routes + pedestrianisation of the busy retail area;
- Direct walking routes + network for pedestrians;
- Direct walking routes + network for pedestrians and cyclists;

7.91 As was mentioned before, this list of four questions with different answers is intended to open the discussion and to see the development of BRT in a wider scope.

**BRT routes in the City Centre**

7.92 This section gives the exact location of the BRT routes in the City Centre. The proposal presented in this chapter has a certain grade of flexibility so it can deal with different solutions and answers to the “What kind of city we want” question raised in the former chapter.

7.93 The BRT routes are based on the median operation with bilateral stations. This means that the exclusive bus ways are planned in the middle of the road but the platforms are on both sides of the bus way. This means that conventional buses (doors on the left side) can be used on the BRT corridors.

7.94 Following the presented option B and option 1 (in chapter 3), the logical BRT routes are presented in figure 7-13.
The routeing is based on the following:

- BRT routes will only be situated on Kampala Road, Entebbe Road and Ben Kiwanuka Street (the triangle);
- BRT routes will have median bus ways (one lane per direction) with passing lanes at the stations;
The three corners of the triangle will be completely redesigned to accommodate the regular traffic and insert the BRT route;

- to relieve the north east corner of the triangle (intersection Kampala Road / Entebbe Road), cars and motorcycles will not be allowed on this corner;
- motorised traffic will be encouraged to use alternative routes such as Yusufu Lule Road, Mukwano Road and possibly also Lumumba Avenue and Nkrumah Road/Nasser Road. This can be done through modifications of junctions (and signalling systems) in the area around the City Centre.

7.96 Following the concept of the T-shaped trunk infrastructure, it is proposed to build the BRT corridor on Kampala Road first followed by the corridor on Entebbe Road. Later on – with a possible extension of the trunk infrastructure – the BRT route on Ben Kiwanuka Street can also be developed.

7.97 Since the closure of the intersection Kampala Road/Entebbe Road (the north east corner of the triangle) for motorised traffic, it is forecasted that less cars will use the main roads in the City Centre.

7.98 The three BRT routes in the City Centre have the following technical specifications:

- Section length Kampala Road from point A to point B: app. 1,400 metres;
- Section length Entebbe Road from point B to point C: app. 900 metres;
- Section length Ben Kiwanuka Street from point C to point A: app. 1,300 metres;
- Minimum width: 26 meters (2 footways, 2 BRT lanes, 4 car lanes);
- Maximum width: 46 meters (2 broad footways, 2 platforms for BRT station, 4 BRT lanes, 2 car lanes, trees and landscaping).

**BRT stations in the City Centre**

7.99 This section provides the potential location of the BRT stations in the City Centre. The location of the BRT stations is based on distances between stations varying from 500 to 700 meters (outside the City Centre these distances will be longer). Furthermore the locations are chosen in such a way that the BRT stations are accessible from many directions and would be highly visible. Therefore most of the BRT stations in the City Centre are located at or near intersections.

7.100 The City Centre could have a total of 5 BRT stations as indicated on the map below (figure 7-14). The BRT stations will have a visible design and will have a relatively narrow and long form. Different buses stop behind each other on different docking stations at the station. In this way, the capacity of the BRT stations is high while the stations can be fitted easily in the relatively narrow streets of the City Centre.

7.101 It is proposed to build the stations in three phases. The first phase is for stations 1, 2 and 3 (when the route on Kampala Road will be built) and the two remaining stations are built in two later phases.
7.102 An important feature of the BRT stations is that from every station, direct clearly indicated walking routes (in a star form) will lead to the different areas around the station in order to increase the catchment area of every station. The walking routes will be chosen in such a way that schools, health facilities, markets and shops can be reached easily by using such a walking route. The walking routes can be branded as Redways with a specific design (see also the next chapter).

7.103 The following can also be included when designing the BRT stations in the next phase:
The land of the Railway Station Depot (owned by the Ministry of Works and Transport) will be available in 2-3 years. This gives BRT station 4 an opportunity to become a large BRT station with a possible interface with a future regional bus stations and national railway station;

Where people cross to the stations, the cars will have only one lane. This gives the opportunity to work with non-signalized raised zebra crossing.

Consider a complete pedestrianisation of the busy retail area from City Square to the intersection Ben Kiwanuka Street/Luwum Street. This will create a pedestrian area with a high economic profile from BRT station 2 to BRT station 5.

7.104 Each station might have 3-5 bays (bus docking stations). Therefore five BRT stations in the City Centre might have the following technical specifications:

- three bays: 76 meters length
- four bays: 103 meters length
- five bays: 130 meters length
- Width of every platform: 2.5 – 5 meters.

7.105 It must be noted that the platform width can be modified based on right of way (ROW) of every road.

**Maximum number of passengers per platform**

7.106 Platform capacity is determined by the width and the length of the station. Suppose we use the minimum platform width, i.e. 2.5 meters, then the maximum platform capacity (for standing passengers) can be estimated as follows:

- three bays: 760 passengers
- four bays: 1030 passengers
- five bays: 1300 passengers

**Mobility management measures**

7.107 Following the section titled ‘What kind of City Centre is desired?’ and having in mind the conceptual design of the BRT routes and stops (as presented in the last two sections), some suggestions are made for mobility management measures as follows.

7.108 Mobility Management is a concept to promote sustainable transport and to manage the demand for car use by changing travellers’ attitudes and behaviour. Mobility Management (also called Transportation Demand Management) is a general term for strategies that result in more efficient use of transportation resources. At the core of Mobility Management are soft measures like information and communication, organising services and coordinating activities of different partners. Soft measures most often enhance the effectiveness of hard measures like a new BRT line. Mobility Management measures do not necessarily require large financial investments and may have a high cost-benefit ratio.

7.109 The next four mobility management measures are proposed for the City Centre.
Introduction of a new parking tariff system

7.110 A new parking tariff system which will encourage commuters to park their cars outside the triangle will be a simple and a very effective instrument to decongest the city centre. A new parking tariff system can allow the scarce parking spaces for short parking, e.g. shop visitors buying goods at shops. A further differentiation of the existing tariffs is recommended. One can think about free parking for the first 30 minutes, 400 shillings for every subsequent 30 minutes and – if parked longer than 2 hours – 1200 shillings for every subsequent 30 minutes.

Introduction of easy walkways (Redways)

7.111 The proposed direct walking routes (in a star form) to the different BRT stations can be branded in the City Centre as Redways. These are easy walkways with a broad design, flat pavement (in red tarmac) where street traders, vehicle parking and any other obstructions are prohibited, and this would be strictly enforced by the police. Redways are low cost investments making the City Centre more attractive and increasing the catchment areas of the BRT stations (and therefore increasing the number of passengers). The exact routeing of the Redways will be chosen in such a way that there will be always an easy and short Redway from schools, health clinics, offices and shopping facilities in the City Centre to the nearest BRT station.

Co-ordination of unloading goods in the City Centre

7.112 As described previously in this report, the unloading facilities for retail shops are poorly organized at present. Unloading trucks and the provision of goods to the retail shops could be improved by co-ordinated actions, preferably by an organization – if in existence – representing the shop keepers. One can think about allocating time slots (e.g. from 6 am till 9 am) when trucks have free access to certain streets and can unload in front of the shops.

BRT Media campaign and ‘Transit Oriented Development’

7.113 BRT will shape not just the city centre, but the pattern of development along each corridor. The concept of Transit Oriented Development needs to be explained to the public and to the business community. Transit Oriented Development refers to mixed-use residential or commercial areas designed to maximize access to public transport. A new TOD area in Kampala would be centred on a BRT station, and surrounded by relatively high-density development with progressively lower-density development spreading outwards from the centre. With a media campaign about BRT and the TOD concept, business stakeholders will be encouraged to open high-density businesses and shops close to the future BRT stations, increasing passenger levels of the BRT system.

Overview and phasing

7.114 In this City Centre Plan, a plan for the BRT routes and stations in the City Centre has been given based on an analysis of the existing situation and on different possible BRT routeing concepts. The plan consists of building three BRT routes in the city centre (as per figure 7-13) on Kampala Road, Entebbe Road and Ben Kiwanuka Street. A total of five stations are foreseen in the City Centre, as represented in figure 7-14.

7.115 It is important to stress that 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) with stations 1, 2 and 3.
- BRT corridor on Entebbe Road (as the second part of the trunk corridor) with station 4.
- BRT corridor on Ben Kiwanuka Street with station 5.

7.116 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.

7.117 An important conclusion of this City Centre Plan is that a BRT system in the City Centre will only be successful when sufficient mobility management measures will be taken. 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.

Summary

7.118 As determined by the above network appraisal, it is recommended that Jinja Road and Bombo Road be developed for the BRT pilot route, with tributary services continuing to Mukono and along Gayaza Road as far as Kyebando, and a proposed phased programme for delivery of the longer term network is set out. It should be noted that all routes (including the pilot corridor) would be subject to a full feasibility study to ensure economic viability.
8 DEVELOPMENT OF THE BRT PILOT CORRIDOR

Selection of the BRT pilot corridor

8.1 The multi-criteria appraisal from the previous chapter rated the Jinja Road route as being the highest priority, followed by Bombo Road, and then Gayaza Road, Kira Road and Entebbe Road virtually equal.

8.2 However implementation of any of these single routes would require a city-centre terminal, with services being turned back at that point. As also argued in the previous chapter, we do not believe that such a terminal is either desirable or feasible. As such, a through-route is seen as the preferred option for the BRT pilot corridor.

8.3 In selecting this through-route, though, consideration needs to be given not only to the rankings of its component parts but also to the matching of passenger demand on its two sides such that any need for short-turning in the city centre is minimised. Further, the BRT pilot corridor should maximise access to the heart of the city to the extent possible.

8.4 Taking all these factors into account, the corridor from Jinja Road through the city centre to Bombo Road was selected for the pilot BRT implementation. This selection is justified on the following bases:

- This corridor combines the two highest ranked individual routes.
- If a tributary service on Gayaza Road (the third ranked route) is also provided, then passenger demand levels on the eastern and northern arms of the corridor are very similar; this allows for all pilot BRT services to be run through the city centre.
- BRT operation along the full length of Kampala Road would maximise access to the central business district as defined in the previous chapter.

Physical definition of pilot corridor

8.5 The proposed pilot corridor is defined from the route appraisal. The route is 14.0km in length and runs from the Bombo Road / Northern Bypass junction in the north (Bwaise), to the Jinja Road / Northern Bypass junction in the east (Kireka) via Yusufu Lule Road North, Haji Kasule Road, Bombo Road, Kampala Road and Jinja Road. A detailed description of the route is provided as follows:

- The northern terminal would be in the vicinity of the Bombo Road / Northern By-pass roundabout, and offer interchange to local matatu services. Its exact location would be the subject of detailed design considerations.
- The route then runs south along Bombo Road for a distance of approximately 1.3km. Some widening of this existing single carriageway link is required.
- The route passes through the Bombo Road / Gayaza Road / Yusufu Lule Road North junction from the north-western arm of Bombo Road to the south-eastern arm of Yusufu Lule Road North, which is currently a four arm roundabout of 67m inscribed circle diameter. This roundabout would need redesigning to allow BRT priority, and the future potential BRT tributary along Gayaza Road, as well as a station in the vicinity of the junction, should be considered in the design.
A BRT tributary along Gayaza Road would be a high priority as funding permits, and short-term arrangements could include an informal interchange at the Northern By-pass roundabout (where there is a matatu stage just to the north).

The route continues south along Yusufu Lule Road, which is dual carriageway with central kerbed median. The link continues 0.3km over a three arm roundabout of 40m inscribed circle diameter, which would need redesigning to allow BRT priority. Dwaliro Road forms the third arm of the roundabout to the north-east.

To the south-east of this junction, the route passes along Yusufu Lule Road North for a distance of 0.6km. It then reaches a roundabout with Haji Kasule Road, Kira Road and Yusufu Lule Road. This 53m wide roundabout would need to be redesigned to offer BRT priority between Yusufu Lule Road North and Haji Kasule Road, but it should also be considered that Kira Road to the north east could be developed as a tributary, and a station should be provided in close proximity.

Haji Kasule Road is a dual carriageway link with central kerbed median. The route continues along this road for 0.47km heading south-east until it reaches the signalised cross roads between Makerere Hill Road and Bombo Road. This junction would need to be redesigned to allow the BRT priority from Haji Kasule Road to the southern Bombo Road arm. This area may attract significant patronage to and from Makerere University, therefore a station should be considered in the vicinity of this junction.

From here, the route runs south along Bombo Road, a dual carriageway link, for 1.23km until the junction with Kampala Road. Within the median to the north of this junction there is an electricity substation which will require relocation. The Bombo Road / Kampala Road / Ben Kiwanuka Street junction would need to be redesigned to allow BRT priority, and this location could offer a good opportunity for the northern City Centre station.

The route continues along Kampala Road and through the heart of the city. A central station could be developed in the vicinity of Constitutional Square. The issue of on street car parking will need to be addressed to allow BRT insertion along this dual carriageway link.

After 1.14km the route reaches the signalised T-junction of Kampala Road / Entebbe Road / Jinja Road. This could be redesigned to allow BRT priority, as well as offering a location for a third city centre station.

The route then continues east along Jinja Road, which is a dual carriageway link or greater between the Kampala Road / Entebbe Road junction and the Port Bell junction, a distance of 3.75km. Key junctions that require conversion along this link include the Jinja Road / Yusufu Lule Road signalised cross roads, the Jinja Road / Old Port Bell Road four-arm roundabout and the Jinja Road / Port Bell Road signalised T junction.

BRT stations could be located at the Jinja Road / Yusufu Lule Road junction, between the Old Port Bell Road and Port Bell Road junctions, and at the Port Bell Road junction. A station at the Port Bell Road junction would provide good accessibility for the Makerere University Nakawa Campus.
The route then heads east along Jinja Road for approximately 4.8km. This section is largely single carriageway. Stations could be provided approximately at 800m intervals, at key population centres along the corridor such as Kyambogo, which could provide a connection to the Kyambogo University.

The eastern terminal would then be provided at Kireka, with its exact location subject to detailed design considerations. A local bus circulation so as to access the Bweyogerere catchment might also be included.

Beyond the Kireka terminal, a BRT tributary would operate in mixed traffic along the main highway pending its eventual dualisation.

The route is illustrated in Figure 8-1 as follows:

![Figure 8-1: Pilot Route Definition](image)

How was the length of the physical infrastructure defined?

The decision to promote a route as far as Bwaise in the north and Kireka to the east was predominantly based on demand and the available rights of way. The analysis presented in section 5 reveals the existing boarding and alighting patterns along each route. Figures 4-7, 4-8, 4-13 and 4-14 demonstrate that the buses are generally fully occupied between these points and the City Centre, and less occupied further out, therefore the benefits of segregation would be most felt within between the City Centre and the points identified.
8.8 This is supported by evidence of existing public transport provision, supplied by Kampala City Council, which confirms that public transport supply begins to tail off beyond these proposed termination points.

8.9 In addition, the journey time saving benefits from physical segregation will begin to reduce the further from Kampala City Centre it is implemented, as traffic generally is more free flowing. If there is a desire to maximise impact from a higher initial investment, rather than develop the pilot corridor beyond the points identified, the preferred approach would be develop further routes of the proposed long term network closer to the City Centre where the impact would truly be maximised.

**Concept Design to be implemented along Pilot Route Corridor**

8.10 The proposed concept design for the pilot route corridor, which results from the discussions included as part of Chapter 3 and consultation with relevant stakeholders, is a median operation system with staggered bilateral stations, as illustrated in Figures 6-2 and 6-4 of this report. This would typically be implemented within a 30m right of way cross section. Between BRT stations this would comprise:

- Median operation BRT lanes in each direction either side of the carriageway centreline, typically 3.5m in width.
- Two 2.5m kerbed segregation areas separating the BRT lanes from general traffic lanes. These areas can either provide pedestrian refuge points, or can be landscaped. Where the full 30m right-of-way is not locally available, the segregation can be reduced to as little as 0.5m.
- 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 and covering the storm-water drains.

8.11 Where necessary the corridor can narrow to a minimum of 23.0m between stations. This assumes 3.0m running lanes and 0.5m kerbed segregation between general traffic and BRT lanes, although 2.0m pedestrian footways are to be retained throughout on both sides of the carriageway.

8.12 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 lay-by is to be provided at each station. Station platforms can be up to 4.0m in width, with at-grade pedestrian crossing facilities to the platforms provided along pedestrian desire lines.

**Infrastructure Capital Cost Estimate**

8.13 In order to estimate capital costs associated with the pilot route corridor, Kagga & Partners ascertained costs for conceptual design elements, as described in Chapter 6 and as set out above.

8.14 In addition, the depot design, which is included as Figure 6-5, was costed. This conceptual layout is capable of accommodating up to 300 buses. As discussed later in this Chapter,
the estimated fleet size required at launch for the pilot corridor is 222 vehicles. Therefore this concept design is slightly in excess of the actual size initially required. However the rate of increase projected for demand in the corridor is such that it would reach capacity within some two or three years after launch, leaving time for additional depot sites to be procured and developed.

8.15 The overall infrastructure capital cost results are summarised as follows:

Table 8-1: Infrastructure Capital Cost Estimate Summary

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost (US$ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preliminaries (inc Design, Utilities Diversion, and Resettlement)</td>
<td>16.93</td>
</tr>
<tr>
<td>Earthworks, Drainage, Pavement</td>
<td>48.37</td>
</tr>
<tr>
<td>Stations, Depot</td>
<td>5.88</td>
</tr>
<tr>
<td>Ancillary Works</td>
<td>5.39</td>
</tr>
<tr>
<td>Junction Upgrades</td>
<td>25.00</td>
</tr>
<tr>
<td>Contingencies</td>
<td>10.16</td>
</tr>
<tr>
<td>Supervision</td>
<td>6.70</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>118.43</strong></td>
</tr>
<tr>
<td>Cost per kilometre</td>
<td><strong>8.46</strong></td>
</tr>
</tbody>
</table>

Service plan

8.16 Based on the forecast demand levels and outline of the proposed pilot route, an indicative service plan is proposed which provides the required levels of passenger capacity to meet that demand whilst making provision for some irregularity of demand within the peak hour. For this purpose, an average load-factor of 85% has been assumed. This reduces the rated passenger capacity of a standard bus from 95 passengers to 81 for planning purposes.

8.17 According to the passenger flow profiles observed in the classified/occupancy counts, approximately 12% of travel occurs in the peak hour\(^7\). Therefore, peak hour BRT flows can be derived which provide the means of estimating the peak hour bus capacity requirement. Assuming a peak vehicle loading of approximately 81 passengers, and an average seat turnover the required vehicle frequencies for each section of route are presented below.

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\(^7\) This is calculated as 11.7% for Jinja Rd and represents the average between the three routes.
Table 8-2: Pilot Route Demand Estimates and Frequencies (2013 opening)

<table>
<thead>
<tr>
<th>Route</th>
<th>Peak hour passenger flow (at planning screen-line)</th>
<th>Vehicle frequency (buses per hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jinja Road</td>
<td>6,927</td>
<td>86</td>
</tr>
<tr>
<td>Bombo Road</td>
<td>4,348</td>
<td>54</td>
</tr>
<tr>
<td>Gayaza Road</td>
<td>3,020</td>
<td>38</td>
</tr>
</tbody>
</table>

8.18 Because of the profile of passenger demand running along the length of the corridor, two separate terminals are assumed on Jinja Road, at Mukono and Kireka, such that their combined service offer can better match the higher level of demand on the inner portion of the route compared to the outer portion. Services from each of these terminals are then run to Bwaise and Kyebando respectively so as to provide the initial BRT network on the pilot corridor.

8.19 Adapting the required vehicle frequencies to provide rounded headways for each of these four services that are operationally workable, the following frequencies are proposed for the peak hours. In addition, vehicle frequencies are also provided for the Inter-peak and Off-peak periods (which are 67% and 50% of the peak period, respectively).

Table 8-3: Pilot Route Service Provision

<table>
<thead>
<tr>
<th>Route</th>
<th>Peak hour service offer</th>
<th>Vehicle frequency (buses per hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Peak</td>
</tr>
<tr>
<td>Mukono - Bwaise</td>
<td>2,430</td>
<td>30</td>
</tr>
<tr>
<td>Kireka - Bwaise</td>
<td>1,944</td>
<td>24</td>
</tr>
<tr>
<td>Mukono - Kyebando</td>
<td>1,215</td>
<td>15</td>
</tr>
<tr>
<td>Kireka - Kyebando</td>
<td>1,944</td>
<td>24</td>
</tr>
</tbody>
</table>

8.20 The time-table for the three periods can be summarised as:
- Peak — 8 hrs weekdays (0600-1000 and 1600-2000)
- Inter-peak — 6 hrs weekdays (1000-1600), 12 hrs Saturdays (0800-2000)
- Off-peak — 2 hrs weekdays (2000-2200), 4 hrs Saturday (0600-0800 and 2000-2200) and 16 hrs Sundays and Public Holidays

Operating cost and Commercial Viability

8.21 In order to demonstrate that the operation of a BRT service is viable, the initial service plan presented above has been used as the basis for deriving broad operating costs. This
financial viability assessment focuses on the costs which would be borne by an operator in running the BRT service at the above levels of frequency. These costs would include:

- Driver wages
- Customer Service Staff / Conductor wages (on-bus personnel)
- Maintenance staff wages
- Fuel costs
- Tyre costs
- Maintenance materials
- Insurance and licensing

**Vehicle Fleet**

8.22 In addition, the purchase or financing of vehicles is an important element of operating costs and these are considered below. The vehicle requirement is a function of the operating headways (frequency) and the round trip times during the peak period. Vehicle layover is required to provide for driver breaks and to enable the reestablishment of vehicle headways in order to prevent vehicle bunching and a layover period of 10 minutes is recommended. Table 8-4 shows the total service time (including layover), Peak Vehicle Requirement (PVR) and fleet requirement. Fleet requirement is PVR plus 10% allowing for vehicles which may be out of service due to break down or the need for routine maintenance. The 10% figure assumes that buses will be fully maintained and not permitted to leave the depot if they do not pass daily inspections.

<table>
<thead>
<tr>
<th>Route</th>
<th>Total Service Time + layover (mines)</th>
<th>Vehicle frequency (buses per hour)</th>
<th>PVR</th>
<th>Fleet Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mukono – Bwaise</td>
<td>165</td>
<td>30</td>
<td>82</td>
<td>91</td>
</tr>
<tr>
<td>Kireka – Bwaise</td>
<td>92</td>
<td>24</td>
<td>37</td>
<td>41</td>
</tr>
<tr>
<td>Mukono – Kyebando</td>
<td>169</td>
<td>15</td>
<td>42</td>
<td>47</td>
</tr>
<tr>
<td>Kireka – Kyebando</td>
<td>96</td>
<td>24</td>
<td>38</td>
<td>43</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>93</strong></td>
<td><strong>200</strong></td>
<td></td>
<td><strong>222</strong></td>
</tr>
</tbody>
</table>

8.23 The fleet requirement to support the service plan set out above is estimated at 222 vehicles. The cost and financing of these is covered in more detail below.

**BRT Road-crew Schedule**

8.24 The number of drivers and customer service staff required to operate the vehicle fleet for the standard BRT operating hours is shown in the table below.
Table 8-5: Driver Requirement

<table>
<thead>
<tr>
<th>Service</th>
<th>Driver Requirement</th>
<th>Customer Service Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRT driver requirement</td>
<td>493</td>
<td>493</td>
</tr>
</tbody>
</table>

8.25 The total driver requirement to operate the fleet is 493. Assuming an average wage of 500,000 shillings per month, the annual driver costs would be $1,421,834.

8.26 Customer service staff would work alongside the driver on-board each bus and therefore the customer service staff requirement is identical to that of the driver. At a wage of 250,000 Shillings per month, the annual cost of the customer service operatives would be $710,917.

Fuel

8.27 The number of vehicle km travelled is estimated at 14,613,951 in total. An average fuel consumption of 0.35 litres per kilometre has been considered with fuel cost of $1 per litre (2080 Shillings). On this basis the annual fuel cost is approximately $5,114,883.

Tyres

8.28 Tyre replacement costs from large fleet operations have been examined and a cost of $0.04 per vehicle kilometre assumed, giving an annual tyre replacement cost of $665,309.

License and Insurance costs

8.29 The likely licensing costs are uncertain. At this stage of assessment therefore we have assumed a cost of $3,000 per vehicle which predominantly covers comprehensive vehicle insurance as would be required by a financier. This gives an annual license and insurance cost of $660,000.

Maintenance

8.30 Planned preventative vehicle maintenance consists of both staff and material costs and varies over the vehicle life. At this stage of assessment we have considered a requirement of 0.8 persons per vehicle and a (parts) maintenance cost of $0.125 per kilometre as used in the World Bank HDM model. An average engineering salary has been taken as 400,000 Shillings per month giving an annual maintenance staff cost of $409,846 and a parts maintenance cost of $2,079,090.

Operating Cost Summary

8.31 Table 8-6 summarises the estimated cost of operating the BRT services. Values in Ugandan Shillings have been converted to US Dollars at a rate of 2,080 to the Dollar. Costs are clearly indicative at this stage of planning.
Table 8-6: Annual Operating Cost Summary

<table>
<thead>
<tr>
<th>Cost Element</th>
<th>Cost</th>
<th>UGX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driver</td>
<td>$1,421,834</td>
<td>2,957,413,748</td>
</tr>
<tr>
<td>Customer Service</td>
<td>$710,917</td>
<td>1,478,706,874</td>
</tr>
<tr>
<td>Fuel</td>
<td>$5,821,453</td>
<td>12,108,622,956</td>
</tr>
<tr>
<td>Tyre</td>
<td>$665,309</td>
<td>1,383,842,623</td>
</tr>
<tr>
<td>Licence and Insurance</td>
<td>$666,000</td>
<td>1,385,280,000</td>
</tr>
<tr>
<td>Maintenance Staff</td>
<td>$409,846</td>
<td>852,480,000</td>
</tr>
<tr>
<td>Maintenance Material</td>
<td>$2,079,090</td>
<td>4,324,508,198</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$11,774,449</strong></td>
<td><strong>24,490,854,399</strong></td>
</tr>
</tbody>
</table>

8.32 Applying the above total cost to the network served shows that the total operating cost is approximately $0.71 per vehicle km. It should however be noted that this applies to direct operational costs only and does not include bus purchase or lease costs, operator profit margins, BRT system management, fare collection costs, and infrastructure maintenance.

**BRT system management**

8.33 System management is an important element of effective BRT operation, particularly with the high frequency operations required to support the levels of demand observed on the pilot corridor. A central control centre with personnel to oversee the BRT operations and respond to incidents is essential to efficient operations. Whether the management of the system remains in the control of the Ministry or is passed to the operating agent, the costs of system management should be derived from BRT system revenues, either directly or in the form of an access charge. Capital costs are involved in setting up the control centre. It is however assumed here that only ongoing charges are borne by system operations. The table below summarises these ongoing costs:
Table 8-7: BRT System Operating Costs

<table>
<thead>
<tr>
<th>Cost element</th>
<th>Number required</th>
<th>Cost per annum</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRTCC premises cost (3 room office overlooking pilot route)</td>
<td>1</td>
<td>$7,500</td>
<td>$7,500</td>
</tr>
<tr>
<td>Vehicle to BRT communications charges (high volume data link)</td>
<td>1</td>
<td>$250,000</td>
<td>$250,000</td>
</tr>
<tr>
<td>Computer software and maintenance</td>
<td>1</td>
<td>$25,000</td>
<td>$25,000</td>
</tr>
<tr>
<td>Mobile supervisory unit vehicle costs</td>
<td>6</td>
<td>$3,000</td>
<td>$18,000</td>
</tr>
<tr>
<td>Tow truck agreement contract (in case of BRT breakdowns)</td>
<td>1</td>
<td>$25,000</td>
<td>$25,000</td>
</tr>
<tr>
<td>BRT operations manager</td>
<td>1</td>
<td>750,000 Sh/month</td>
<td>$8,654</td>
</tr>
<tr>
<td>BRTCC Staff</td>
<td>24</td>
<td>500,000 Sh/month</td>
<td>$69,231</td>
</tr>
<tr>
<td>Bus stop supervisors</td>
<td>80</td>
<td>250,000 Sh/month</td>
<td>$115,385</td>
</tr>
<tr>
<td>Terminus Dispatchers</td>
<td>15</td>
<td>300,000 Sh/month</td>
<td>$25,962</td>
</tr>
<tr>
<td>Mobile supervisory unit</td>
<td>12</td>
<td>400,000 Sh/month</td>
<td>$27,692</td>
</tr>
<tr>
<td>Mobile maintenance unit</td>
<td>20</td>
<td>400,000 Sh/month</td>
<td>$46,154</td>
</tr>
<tr>
<td><strong>Total system operating costs</strong></td>
<td></td>
<td></td>
<td><strong>$618,557</strong></td>
</tr>
</tbody>
</table>

System revenues

8.34 Available data has shown fare levels to vary based on the journey length and journey time. Fare rates along the full length of the corridor (e.g. Mukono – Kampala Centre), as presented in Chapter 4 and derived from the Mystery Traveller Surveys, has been applied accordingly. However, for shorter routes, or sub-routes, (e.g. Kireka – Kampala Centre, Bwaise to Kampala Centre etc.) fare rates are derived using existing fare levels obtained from other available data sources, mainly the JICA O-D Surveys. Total demand for all routes and sub-routes is proportioned according to the relative frequency provision as presented in Table 8-3. Adopting such assumptions allows system revenues to be forecast. Fare, demand and revenue levels, disaggregated for all routes, are presented in Table 8-8 below.
### Table 8-8: Annual BRT System Fare Revenues

<table>
<thead>
<tr>
<th>Service</th>
<th>Sub-route</th>
<th>Demand (two-way)</th>
<th>Fare (UGX)</th>
<th>Daily Revenue</th>
<th>Annual Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>UGX</td>
<td>US$</td>
<td>UGX</td>
</tr>
<tr>
<td>Mukono - Bwaise</td>
<td>Mukono - Centre</td>
<td>38,196</td>
<td>1550</td>
<td>59,204,516</td>
<td>19,445,698,929</td>
</tr>
<tr>
<td></td>
<td>Centre - Bwaise</td>
<td>41,293</td>
<td>900</td>
<td>37,163,362</td>
<td>12,206,290,768</td>
</tr>
<tr>
<td>Kireka - Bwaise</td>
<td>Kireka - Centre</td>
<td>30,557</td>
<td>1000</td>
<td>30,557,170</td>
<td>10,036,489,770</td>
</tr>
<tr>
<td></td>
<td>Centre - Bwaise</td>
<td>33,034</td>
<td>900</td>
<td>29,730,689</td>
<td>9,765,032,614</td>
</tr>
<tr>
<td>Mukono - Kyebando</td>
<td>Mukono - Centre</td>
<td>19,098</td>
<td>1550</td>
<td>29,602,258</td>
<td>9,722,849,465</td>
</tr>
<tr>
<td></td>
<td>Centre - Kyebando</td>
<td>19,857</td>
<td>900</td>
<td>17,871,312</td>
<td>5,869,825,158</td>
</tr>
<tr>
<td>Kireka - Kyebando</td>
<td>Kireka - Centre</td>
<td>30,557</td>
<td>1000</td>
<td>30,557,170</td>
<td>10,036,489,770</td>
</tr>
<tr>
<td></td>
<td>Centre - Kyebando</td>
<td>31,771</td>
<td>900</td>
<td>28,594,100</td>
<td>9,391,720,252</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>244,364</td>
<td>N/A</td>
<td>263,280,577</td>
<td>86,474,396,726</td>
</tr>
<tr>
<td></td>
<td>Total (minus 10% fare collection and leakage)</td>
<td>37,416,806</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8.35 Total annual revenues are estimated at $41,574,229.

8.36 A proportion of system revenues must be allocated to fare collection to cover printing, sales commission, and revenue protection measures. In addition, an allowance for revenue leakage should also be made to cover overriding, ticket evasion or fraud. The combined impact of such variables is assumed to equal 10% of revenues. The adjusted annual revenues are therefore to equal US$37,416,806.

**Vehicle leasing**

8.37 Vehicle costs will account for a significant proportion of overall operating costs if these are to be borne by the BRT operator. Generally, the capital required to purchase vehicles outright, at a likely cost of around $100,000 makes this prohibitive for the operator, and hence financing is an attractive option. The table below summarises the lease-purchase costs of the vehicle fleet, and the assumptions underpinning them:

---

8 Annual revenues are calculated by applying the estimated patronage for full service weekdays and an assumed proportion (of a full working day) for Saturdays, Sundays and Public Holidays. The applied sum of factors produces an annualised revenue rate equivalent to 328 full service days.
Table 8-9: Vehicle Financing Assumptions

<table>
<thead>
<tr>
<th>Cost Element</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus vehicle purchase cost</td>
<td>$100,000</td>
</tr>
<tr>
<td>Interest Rate</td>
<td>25%</td>
</tr>
<tr>
<td>Operational life within BRT system</td>
<td>8 years</td>
</tr>
<tr>
<td>Annual repayment per bus (level payments at end of each year over operational life – 8 payments)</td>
<td>$30,040</td>
</tr>
</tbody>
</table>

8.38 The figure of $100,000 per bus is a generous estimate for modern vehicles meeting the standards of accessibility and comfort expected in a BRT system, and recognising the distance of Kampala from their potential sources of supply together with duty implications of their importation. Should the traditional urban bus type (regionally assembled and bodied truck-derivative chassis) as deployed elsewhere in COMESA be found acceptable, then a far lower capital cost could apply. However, in our opinion, such an approach would then not be commensurate with the scale of public investment in the BRT system and the level of expectation that this will create.

8.39 Based on the fleet size requirement outlined above, the payments for vehicle finance may be expected to be of the following order. These should be added to the ongoing operating costs.

Table 8-10: Fleet leasing costs

<table>
<thead>
<tr>
<th>Fleet size</th>
<th>222</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual repayments for vehicle fleet</td>
<td>$6,668,847</td>
</tr>
</tbody>
</table>

Operator Profit

8.40 The details of an agreement with prospective BRT operators are for future negotiations; however, it is reasonable to present an approximate commercial return for any private operator at this (pre-feasibility) stage. It is therefore assumed that 15% of net revenues will approximate the operator’s overhead and profit margin with this figure being the target return on sales for the major international transport groups.

8.41 The total operator’s profit is therefore estimated to equal $5,612,521

Infrastructure Maintenance

8.42 In the absence of detailed engineering designs and specifications it is difficult to estimate the required level of maintenance for the infrastructure (carriageway, bus stops etc). However, experience from previous studies and other Sub-Saharan cities, e.g. Lagos, has shown this can be approximated at an annual cost of 2% of the infrastructure cost.

8.43 Therefore, annual infrastructure maintenance costs are estimated to equal $2,368,600.
Financial Viability

8.44 The demand forecasts can be used to derive indicative estimates of revenue. Comparing potential system revenue to the above costs provides a basis for assessing the commercial viability of running the BRT route from an operator’s perspective.

8.45 Annual operating costs including vehicle leasing are presented against system revenues (allowing for fare collection and revenue leakage) in Table 8-11 below:

<table>
<thead>
<tr>
<th>Cost / Revenue Element</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Costs</td>
<td>$11,774,449</td>
</tr>
<tr>
<td>Systems Management</td>
<td>$618,577</td>
</tr>
<tr>
<td>Annual repayment for vehicle fleet</td>
<td>$6,668,847</td>
</tr>
<tr>
<td>Infrastructure maintenance</td>
<td>$2,368,600</td>
</tr>
<tr>
<td>Total operating costs</td>
<td>$21,430,473</td>
</tr>
<tr>
<td>Annual revenue (minus 10% fare collection and leakage)</td>
<td>$37,416,806</td>
</tr>
<tr>
<td>Gross operating margin</td>
<td>$15,986,333</td>
</tr>
<tr>
<td>less Operator overheads and profit (15% of net revenue)</td>
<td>($5,612,521)</td>
</tr>
<tr>
<td>Net operating surplus</td>
<td>$10,373,812</td>
</tr>
</tbody>
</table>

8.46 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. However, the operating surplus can be further applied for the following purposes, as discussed earlier in Chapter 3:

- System expansion
- Cross-subsidisation of less profitable routes
- Reducing fares rates

Economic Evaluation of BRT Pilot Route

8.47 The surplus between annual passenger revenues and operational costs, as highlighted above, demonstrates the financial feasibility of the Pilot BRT Route. However this does not cover all benefits as there are significant wider economic benefits which will be experienced within the study area. Further it doesn’t include recovery of the public investment in the BRT infrastructure.

8.48 There are generally three forms of benefits from such a transport scheme: consumer surplus; producer surplus and externalities.
8.49 Consumer surplus is derived from lower cost incurred by passengers. In the absence of fare changes, this is driven purely by lower time costs.

8.50 Producer surplus is the net increase in economic benefits derived by all transport providers. In the context of this project this is mainly derived from the reduction of vehicle operating costs by displacing passengers from matatu to more efficient BRT vehicles. BRT operating costs have been included within the financial evaluation presented previously in this chapter, but the corresponding savings from fewer operating matatus has not been accounted for as it did not have a direct benefit in financial terms to the scheme promoter. However this does contribute towards societal benefits.

8.51 In both the calculation of the above benefits, only the estimated change in consumer and producer surplus is relevant and required.

8.52 Externalities are benefits transferred to society in general rather than those directly involved as either consumers or producers. Examples of externalities include lower costs to other highway users, lower vehicle emissions and higher safety levels. To maintain a conservative estimate of societal benefit, potential external benefits are not included within the appraisal, and the impact is assumed to be neutral.

8.53 The economic appraisal scenario assumes detailed engineering design consultancy starting in the year 2011, a capital and infrastructure development phase of 18 months (2012-mid 2013) followed by full and continuous operation for the remaining forecast years (mid 2013 – 2030).

8.54 The recommended World Bank discount rate of 12% is applied.

**Consumer Surplus**

8.55 Review of the mystery traveller surveys demonstrates that many journeys will enjoy lower journey times using the BRT route. (Total journey time savings in the year 2013 is detailed in Chapter 5 and average journey time savings are presented in Chapter 7).

8.56 The implementation of the scheme will produce a total of 640 million hours savings between the years 2013 (Q3)– 2030. Applying an assumed rate of increase on the value of time in real terms will yield total benefits with a Net present Value (NPV) of approximately US$197 million. This constitutes 66% of total benefits (see Figure 8-2).

**Producer Surplus**

8.57 The benefit attributable to a reduction in vehicle operating costs has been calculated based on the forecast transfer of trips to BRT, and the estimated resulting reduction in matatu vehicle kilometres, which are estimated to have an average operating costs of one third of a BRT vehicle in order to account for the lower fuel consumption and expenditure on lower maintenance. This is likely to be conservative given the condition of many of these vehicles.

---

9 If transport operators respond to lower production costs by reducing passenger fares then the value of this benefit will be transferred to users as consumer surplus.

10 Historic real GDP and population growth rates were used to forecast the real VoT for all forecast years. (Historic GDP growth rates are sourced from Annual Economic Affairs Performance Review 2008/09, Ministry of Finance, Planning and Economic Development) (Population growth are sourced from World Bank Development Indicators, 2010)
8.58 The implementation of the scheme will produce total benefits with an NPV of US$103 million attributable from a reduction in vehicle operating cost between the years 2013 (Q3)–2030. This constitutes 34% of total benefits (see Figure 8-2).

![Pie chart showing consumer surplus and producer surplus percentages.]

Figure 8.2 Percentage of Total NPV (US$300 million) Derived for Consumer and Producer Surplus

**Project Costs**

8.59 Total infrastructure costs (2012Q1–2013Q3), maintenance (routine and periodic) and the change in operating costs for the subsequent years will incur total costs with an NPV of US$212 million.

**Net Economic Benefits**

8.60 The table below provides an overview of the main economic appraisal indicators.

**Table 8-12 Economic Appraisal Indicators (2010 – 2030)**

<table>
<thead>
<tr>
<th>Appraisal indicator</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCR</td>
<td>1.41</td>
</tr>
<tr>
<td>NPV (million US$)</td>
<td>87.53</td>
</tr>
<tr>
<td>IRR (%)</td>
<td>18%</td>
</tr>
</tbody>
</table>

8.61 The economic appraisal indicators highlighted in the table above show that the scheme will:

- Generate total NPV of US$88 million indicating the total NPV of benefits exceeds the NPV of costs. An NPV value greater than zero is indicative of an economically feasible project.
- Produce a Benefit Cost Ratio (BCR) of 1.41, indicating that every US$1.00 expended on the project as costs will yield US$1.41 in benefits. Projects of this scale and nature produce a similar rate of BCR. A BCR value greater than 1.00 is indicative of an economically feasible project.
- Have an Internal Rate of Return (IRR) of 18% indicating that NPV and CBR will remain above zero and unity, respectively, below discount rates of this (high) value.

8.62 The Figure below presents the cumulative benefits and costs in NPV terms over the horizon of the forecast period (2011-2030)

![Figure 8-3 Cumulative Benefits and Costs (2010-2030)](image)

8.63 Figure 8-3 reveals that:

- The project costs are front ended; high for the initial years and decelerate over the life-cycle of the project. This is typical of infrastructure projects which require initial and significant capital infrastructure costs.

- The project benefits are zero in the initial years as the scheme only becomes operational in the year 2013Q3.

- Project benefits increase steadily with approximately zero acceleration throughout the forecast period. This suggests that the exponential increase in demand (as highlighted in Chapter 5) is somewhat dampened by the discount rate and a resulting regular stream of benefits is derived throughout the forecast period.

- The Pilot BRT’s economic breakeven year is between years 2023 and 2024, as depicted by the intersection between the benefit and cost curves. It is therefore important that the project life extends beyond this date.
Sensitivity Analysis

8.64 To test the sensitivity of the economic analysis a 20% reduction in journey time savings and/or 20% increase in capital costs have been analysed and the results are summarised in the table below.

Table 8-13 Economic Appraisal Indicators (2010 – 2030) - Sensitivity Analysis

<table>
<thead>
<tr>
<th>Appraisal indicator</th>
<th>20% Red. Time Savings</th>
<th>20% Inc. Capital Costs</th>
<th>20% Red. Time Savings AND 20% Inc. Capital Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCR</td>
<td>1.23</td>
<td>1.24</td>
<td>1.08</td>
</tr>
<tr>
<td>NPV (million US$)</td>
<td>48.16</td>
<td>58.34</td>
<td>18.97</td>
</tr>
<tr>
<td>IRR (%)</td>
<td>16%</td>
<td>16%</td>
<td>13%</td>
</tr>
</tbody>
</table>

8.65 Table 8-13 reveals that with both a 20% reduction in journey time savings benefits and a 20% increase in capital costs, the Pilot BRT Route will remain economically feasible, with a BCR of 1.08, NPV of $19 million and an IRR of 13%.

Terms of Reference for Feasibility and Design

8.66 Appendix A contains draft Terms of Reference for a feasibility and detailed design of the pilot BRT route. This task is defined such as to follow directly from this Pre Feasibility Study. It does not seek to replicate the tasks undertaken herein but does include a review/verification of the Pre Feasibility Study in order to ensure complete ownership by the appointed consultants. It is envisaged that the study will use the base data of the Pre Feasibility Study but increase the depth of knowledge and understanding of the BRT market within the corridor in order to optimise the operational service plan and focus physical design upon meeting the needs of that service plan within the context of any known deliverability constraints. The detailed design tasks are specified to be subsequent to feasibility stages, although feasibility will be undertaken with engineering design input, leading to contracting for construction.
9 REGULATORY AND INSTITUTIONAL FRAMEWORK

Introduction

9.1 Personal mobility in a metropolitan area is a highly complex activity, involving a wide range of stakeholders and jurisdictions. It needs to sit within a policy framework that integrates transport and land-use planning, and encourages efficient and effective transport service provision. It also requires effective cross-jurisdictional co-ordination, as travel demand in an expanding conurbation doesn’t recognise political boundaries.

9.2 Fortunately, in the case of the Greater Kampala Metropolitan Area, these prerequisites are largely established at part of the National Transport Master Plan currently with Cabinet for approval. As such this review will focus on the current status, the proposed changes under the NTMP, and a number of issues arising from the detail and the rate of implementation of the Plan. The implications of the Kampala Capital City Bill currently in Parliament will also be considered in this context.

Quality regulation of passenger transport

9.3 Transport regulation can be considered under two aspects: ‘quality’ regulation concerning road safety and physical / environmental standards, and ‘economic’ regulation governing competition between service providers to provide efficient and effective outcomes. Both aspects are covered by The Traffic and Road Safety Act, 1998, and various subsequent Statutory Instruments empowered by it. With regard to Public Service Vehicles, though, the governing Regulations date back to 1971 and were empowered by The Traffic and Road Safety Act, 1970.

9.4 Vehicle regulations pertaining to all road traffic, and governing factors such as size, weight and technical performance are understood to be under review; no draft has yet been made available to the Consultant for comment. However it is likely that these will provide for some consistency with COMESA standards, and so should provide no barrier to operation of high-capacity buses. The only key issue may be as to whether passengers can be carried in trailers and therefore whether articulated buses are an option. Further feedback will be sought.

9.5 The PSV regulations cover both omnibuses and taxicabs, and also include their licensing and classification. The standards set in the omnibus portion, though, are inappropriate for urban operation – though they do recognise the possibility of a double-deck bus. In particular the gangway width needs be no more than 30cm, which is far too narrow for the free movement of passengers making frequent boarding and alighting. This is compounded by a first step height from the ground that may be as much as 45cm, as against the international standard for such operation of 36cm; this acts as major barrier to those with impaired mobility.

9.6 Further the internal height of an omnibus, set at a minimum of 165cm, is inadequate for the large majority of standing passengers. Even though there is no formal recognition of the carriage of standing passengers in urban areas, as is standard international practice and also would be required for commercial viability of large-bus services, the possibility appears to be recognised in the current Traffic and Road Safety Act. This states that no person shall ride … upon a motor vehicle … if it is unsafe by reason of the insufficiency of space
available for that person to stand … This implies that adequate provision in respect of internal height and available floor area is a sufficient condition for such carriage. However it might be prudent to seek legal clarification of this, or to draft a specific amendment to the PSV Regulations.

9.7 Of further interest in the PSV Regulations is the setting of seat pitch at not less than 85cm. This is far in excess of the international standard, effectively set at 70cm, and greater than all omnibuses currently observed in Uganda. An additional impact of this dimension is that it becomes impossible legally to fit as many as 60 seats in a standard bus, and therefore that the classification of a ‘heavy omnibus’ in the Act becomes redundant. It would be preferable if the interpretation of both medium and heavy omnibuses were in respect of their total licensed passenger capacity, both seated and standing where permitted, and not just seating accommodation alone.

Economic regulation of passenger transport

9.8 The official regulatory stance, as captured in the Traffic and Road Safety Act, is ‘quantity’ licensing. The Minister shall cause the road passenger transport industry to be organised, as far as possible, on route basis. The (Transport Licensing) Board shall furnish to the Minister once in every year a list of routes and packages of routes … selected and assembled so as to provide transport services to meet reasonable passenger demand and which will be reason-ably efficient and economic either as listed singly or otherwise for … prospective operators. A public omnibus … operator’s licence shall authorise the holder … to run a service for the carriage of passengers over such fixed route or routes as the Board may direct; to run a scheduled service over such routes at such frequency and regularity as the Board may direct; and to incorporate such intermediate stops on any route as the Board may direct. … the Board shall meet to consider, allocate and offer one or more of the previously advertised routes or packages of routes to prospective transport operators.

9.9 Clearly such a procedure is designed both to avoid wasteful competition between operators and to ensure adequate network coverage to the extent possible. However it requires some degree of passenger transport planning capacity at the Board in order to ensure an efficient network. Further the license application is not subject to a transparent allocation process, and operator initiatives to improve such efficiency are not possible. Finally, the duration of a public omnibus operator’s licence for a period of five years before review introduces rigidity into the planning of the network which may not be well suited to a rapidly developing area.

9.10 For whatever reasons, though, this process is not being followed within the Greater Kampala Metropolitan Area, with light omnibus licences effectively being issued on demand and not being tied to specific routes or packages of routes. Effectively, since the collapse of Uganda Transport Company, the urban passenger transport market has become deregulated. It is into the resultant regulatory vacuum that UTODA then emerged to organise and co-ordinate public transport supply, a situation that persists to this day.

9.11 It is interesting to note, furthermore, that UTODA is organised on a route or ‘stage’ basis in that each member belongs to a specific operation defined by its terminal and intermediary points. As such, there is no obvious reason for the TLB not to exercise its mandate other than the lack of institutional capacity to plan the network effectively. This task has therefore been delegated to UTODA, but results in planning priorities based on producer rather than consumer interests.
9.12 It should also be noted that UTODA is primarily a terminal manager, and so has relatively little control over transport operations on the road. With many ‘stages’ overlapping each other, and headways on some being very short, driver indiscipline has allowed competition to develop on the routes with damaging consequences including increased congestion at the stops. Lack of control can also result in harmful practices such as short-turning and route changes, and in over-loading out of oversight by the authorities.

9.13 In order to address these problems, Kampala City Council is launching any initiative to bring large-bus operation back into the network. This is being seen as implementing a 2006 NRM manifesto commitment, and has the support of the stakeholder Ministries including Works and Transport; Finance, Planning and Economic Development; and Local Government. The chosen mechanism is competitive tender for specified services, that is competition for the routes – ‘controlled competition’ in the jargon. This would be compliant with international best practice as endorsed by the World Bank and supported by European Union research.

9.14 Introduction of controlled competition would be compatible with the regulatory framework established by the Traffic and Road Safety Act, though the process of license approval would need to be made competitive and transparent rather than administrative. However it is not clear that Kampala City Council is empowered to issue public omnibus licences as it intends, and these would probably still need to be approved by the Transport Licensing Board under the current legislation.

**Sectoral institutional framework**

9.15 As noted earlier, metropolitan passenger transport is both a cross-sectoral and also a cross-jurisdictional issue. As such, this review will address the two aspects separately.

9.16 The primary transport sector authority is the Ministry of Works and Transport, though this responsibility had been held until recently by the former Ministry of Works, Housing and Communications. MoWT is responsible for transport sector policy and its implementation, and also for management of the ‘national’ road network. The MoWT is also responsible for making all Regulations empowered by the Traffic and Road Safety Act, such as providing for classification of roads with reference to their suitability for use by different classes of motor vehicle.

9.17 The Uganda National Roads Authority is an autonomous body under the MoWT established under its own primary legislation in 2006. Its purpose is the management of the provision and maintenance of the national roads network in a more efficient and effective manner, and to render advisory services to Government. UNRA will benefit from the new Road Fund in the performance of its duties, and an increasing proportion of the road network is being passed to its control.

9.18 The Transport Licensing Board is established under MoWT by the Traffic and Road Safety Act, but incorporates external stakeholders such as: (representatives of) Inspector-General of Police; Chairperson of the National Road Safety Council; Solicitor General; and the motor industry. The Secretary to the Board is a public officer, and is responsible for the efficient performance of the functions of the Board. The Board shall carry out its duties under the Act, including regulation of the use of public service vehicles, and discharge of such other functions as the Minister may direct by statutory order. The Board also manages
vehicle inspection centres, and issues certificates of fitness for the licensing of passenger vehicles.

9.19 The National Road Safety Council is also established by the Traffic and Road Safety Act, with its chairperson and members appointed by the Minister; its Secretary is a public officer in MoWT. However, the Council’s powers are limited to research, education and promotion of best practice in the domain of road safety, and it has no direct executive powers.

9.20 MoWT is also responsible for the provision of road safety and traffic control facilities such as road signs, pedestrian crossings, speed restrictions, road closures, one-way traffic, on-street parking, bus stops, loading zones, etc. However, the Traffic and Road Safety Act empowers the Minister, by statutory instrument, to authorise a Local Government to implement specified traffic control measures on its behalf. For example, the Parking of Motor Vehicles Regulations of 2001, applying to Kampala District, empower Kampala City Council to identify roads and streets on which parking places may be designated, and charge a fee for their use.

9.21 Under the Local Governments Act, 1997, local authorities at the District and City levels are responsible for the construction, rehabilitation and maintenance of roads within their own jurisdiction (that don’t form part of the designated national road network) and installation of traffic signals. Responsibility for omnibus stations and related office accommodation, cafes, restaurants, refreshments rooms and other buildings, though, is devolved to Urban councils such as Municipal and Town Councils, or Division Councils where appropriate.

9.22 The Ministry of Local Government is responsible for co-ordinating the financing and delivery of services relating to the local road networks that were devolved to Local Governments under the 1997 Act. To this end, MLG is expected to harmonise and co-ordinate requests for inputs from Local Governments or MoWT and act as a conduit for grants disbursed by MFPED for this purpose. Clearly this role is applicable where a BRT development crosses Council boundaries.

9.23 The Ministry of Lands, Housing and Urban Development holds overarching responsibility in these domains, acting through Local Governments as appropriate where they are mandated with the specific responsibilities. Co-ordination of land use and transport planning therefore becomes a joint responsibility of MLHUD and MoWT. Local Governments are required to prepare comprehensive and integrated development plans for submission to the National Planning Authority.

9.24 Road traffic enforcement is the sole prerogative of the Uganda Police, with no organ of the Ministry of Works and Transport being empowered under the Traffic and Road Safety Act to take direct measures in this domain. The powers of the Police include: the regulation of all traffic; filing traffic accident reports; examination of vehicles on the road for condition and loading; require the removal of vehicles from the highway or parking places if appropriate; and to record all offences against the Act.

9.25 Uganda Taxi Operators and Drivers Association is a national organisation representing the interests of its members, including owners of vehicles that are leased to them. It is organised on a regional basis, with Kampala District being the most significant – and its Chairman now being National Vice-Chairman. The Uganda Bus Owners Association has
little involvement in urban transport, and the Uganda Taxi Owners Association has greatly declined in influence.

9.26 UTODA leases the two main taxi parks in central Kampala (one from KCC), and is in the process of developing interchange taxi parks on each of the main arterials entering the conurbation. It manages the routes over which its members operate through terminal despatch, and sets the fares to be charged for these. It takes admission and departure charges from terminals, and uses these to defray its expenses and also to establish social security (SACCO) funds for its members. Control of those funds is used as a disciplinary lever over the drivers, and in the resolution of disputes between them and the vehicle owners.

**Sector jurisdictional framework**

9.27 Greater Kampala Metropolitan Area is not a Local Government within the meaning of the Act, but rather an agglomeration of Local Governments within the conurbation and vicinity of Kampala that have common interests, particularly in the domain of passenger transport. It covers a radius of some 20km from central Kampala, but extends to 40km on the Entebbe peninsula.

9.28 GKMA is considered to include territories administered by the following Local Governments: Kampala City Council; Entebbe Municipal Council; Mukono Municipal Council; Kira Municipal Council (except Kimwanyi Parish); Nansana Municipal Council; Kajansi Municipal Council; Nsangi Town Council; parts of Wakiso District Council; and parts of Mukono District Council.

9.29 The road network within the GKMA therefore falls under the control of multiple jurisdictions and co-ordination between these is correspondingly complex. The national road network, as currently defined, does not reach into central Kampala but terminates at the following points: Kubiri roundabout (junction of Bombo and Gayaza Roads) in the north; Nakawa foot-bridge on Jinja Road, and Bugolobi junction on Port Bell Road in the east; Kibuye roundabout (junction of Entebbe and Masaka Roads) and Nsambya Road / Kibuli Road junction in the south; and Nakulabye roundabout (junction of Hoima and Makerere Hill Roads) in the west.

9.30 There are other national roads within the metropolitan area, primarily serving buildings or functions of national importance, but these aren’t arterial roads suitable for implementing Bus Rapid Transit. However the UNRA Act empowers the Minister to transfer possession of other roads to its control where this is considered necessary for the performance of the functions of the Authority, and it is understood that this is now likely in the case of the rest of the primary road network in the metropolitan area. However no steps have yet been taken to formalise this process, and it is unlikely in any case before the start of the Financial Year in July because of budgetary considerations.

**Proposed institutional changes**

9.31 The Implementation Strategy for the National Transport Master Plan, including a Transport Master Plan for the Greater Kampala Metropolitan Area, recognises that there are many institutional actors in the sector whose mandate, functions and relationships need to be appropriately defined, streamlined, and harmonised to promote effective implementation and monitoring of transport sector operations in Uganda.
9.32 In particular, the proposed institutional arrangements seek to address the fragmentation of planning, funding and management responsibilities among the different Ministries partially responsible for aspects of transport, and the lack of coherent public policy and guidance that leads to disjointed plans and programmes.

9.33 Three new Authorities are proposed, two at the national level – a Multi-sectoral Transport Regulatory Authority, and a National Road Safety Authority – and a GKMA Metropolitan Area Transport Authority at the local level. A National Transport Master Plan Unit will also be established within the Ministry of Works and Transport, together with a District, Urban and Community Access Roads Agency.

9.34 MTRA is designed to ensure effective regulation of the country’s transport sector, and will be responsible for licensing, economic regulation, safety and environmental issues, and legal services pertaining to all rail, waterways, and public road passenger and freight transport sector operations in the country. These responsibilities will be extended to pipelines as that becomes appropriate in the future, but will not cover civil aviation in recognition of its specialised nature particularly with reference to safety enforcement.

9.35 MTRA shall regulate primarily transport sector services, not infrastructure, and will subsume the functions of the Transport Licensing Board to this end. MTRA will develop its own policy with regard to economic regulation of transport services, and there is a clear rationality to that where complementary modes effectively compete for the same traffics so as to ensure an effective and efficient outcome in the national interest. However what is not so clear is the case for its economic regulation of urban passenger transport, which is also a specialised function if competition is to be for the market rather than in the market. Further it is unclear as to why MTRA should be any more effective than TLB in this regard, especially as this is a local rather than a national activity.

9.36 MATA will act as a single-purpose urban transport authority within the Greater Kampala Metropolitan Area, within a mandate of delegated authority from the component Councils, in relation to transport planning and policy issues and to exercise urban transport functions. It will therefore provide cross-jurisdictional co-ordination, and local accountability, within the urban transport domain. It will be supported by a Metropolitan Area Transport Executive comprising of relevant professionals to handle the technical work involved in planning and programming the investments and implementation of transport strategies.

9.37 It will also receive delegated authority from MTRA to enforce regulatory provisions for licensing, economic regulation and environmental issues. MTRA shall provide MATA with the necessary guidelines and assist it to build the requisite capacity to operationalise the regulatory function, as may be necessary. However it won’t have the power to make such provisions, or act on its own behalf and in response to local concerns and priorities. Further, it is unlikely to have control over its primary infrastructure as this is increasingly transferred to the responsibility of UNRA.

9.38 It is hard to see how this makes MATA an ‘Authority’ in any recognised meaning of the word, and fails to follow the lessons of international best practice. Examples from both developed and developing countries – such as Transport for London, and the Lagos Metropolitan Area Transport Authority – show the importance of a single effective and fully empowered institution in order to address the challenges of urban transport in a holistic manner and in the interests of the affected population. The Transport Sector Development
Project will fund a study to draft legislation for the establishment and empowerment of MATA, and the issues of its functional responsibilities could be explored further at that time.

9.39 The National Road Safety Authority will be a semi-autonomous statutory body responsible for implementing and enforcing road safety measures, and the functions of NRSC will then be transferred to it. No specific provisions are recognised in the urban passenger transport domain, but clearly road safety must be placed at the heart of any proposed reforms in that area. However it might be recognised that special consideration be given to safety regulation within urban areas in recognition of the lower speeds of travel, and hence of the lower risks involved. Issues could include the authority to carry standing passengers, speed control by engine governors rather than external devices, use of seat-belts on stage-carriage services, and the like.

**Kampala Capital City Authority**

9.40 The Kampala Capital City Bill currently before Parliament would establish a Kampala Capital City Authority, with democratic accountability, having jurisdiction over the metropolitan area that includes Kampala City together with the neighbouring districts of Mpigi, Wakiso and Mukono. This Authority would therefore address the lack of co-ordination between Local Governments identified earlier.

9.41 Specific functions of the Authority affecting transport include: to construct and maintain roads; to construct and maintain major drains; to organise and manage traffic; and to carry out physical planning and development control. However most of these functions, particularly for the central business district, remain under central government control,

9.42 Further, the Bill would establish a Metropolitan Physical Planning Authority to develop (and implement) a metropolitan development and structure plan. However public transportation is not mentioned in this context, or anywhere else in the Bill. In addition, the competences required of members of the authority are limited to physical planning, civil engineering, architecture, environment or public health.

9.43 On the positive side, though, the Bill requires the President to seek funding from Parliament to enable the Authority to provide services befitting a capital city, and any extra obligation transferred to the Authority by the Government shall be fully financed by the Government. Taken together, these provisions offer the potential to address the current budget deficit in these regards. The Bill also seeks to create a revenue collection directorate in the Authority, further enhancing institutional capacity in this critical domain.

9.44 Further, the central Government would be responsible for the construction and maintenance of *inter alia*: all roads and streetlights in the central business district; trunk and gateway roads; subways; flyovers; cycle ways and walkways; transport ways; and rails. Thus both the capital and recurrent expenditure requirements for critical transport infrastructure would no longer fall on the concerned Local Government.

9.45 However the Physical Planning Authority would retain responsibility for the construction and maintenance of all roads and streetlights outside the CBD, and cleaning and de-silting all roads in the city. Sadly this listing of responsibilities does not include de-silting of the drains.
Project implementation and governance

9.46 A Transport Master Plan Unit will be established within MoWT to serve as a central office responsible for undertaking all long-term planning activities, for monitoring implementation of the NTMP, and for periodic updating of the Plan in response to changing needs and actual implementation performance. The Unit will be divided in two, with respective responsibility for NTMP and GKMA implementation.

9.47 The Transport Sector Development Project includes a Component for the Preparation of a Kampala Urban Transport Project. This component will be implemented by MoWT, and a special stakeholder committee has been put in place to oversee its implementation. The primary focus is to act as a BRT Technical Committee, with the following membership: MoWT (2); MLHUD (1); MFPED (1); UNRA (1); KCC (2); Mukono and Wakiso District Councils (1 ea); ITDP (1); UTODA (1); UBOA (1); CSOs (1); World Bank (1); Uganda Police (1); National Transport Expert (1). This represents a comprehensive range of stakeholders, except for representation from public transport users; the sole CSO now nominated is focused on road safety, and not user needs.

9.48 The committee members will create a mission statement to guide the development of the envisaged BRT Project until MATA is established. It will supervise the execution of the BRT Pre-Feasibility Study and all subsequent studies; ensure sensitisation of the public to the concept of BRT; make appropriate use of the media at all levels; mobilise and secure political support, and identify a Champion for the Project; establish task forces to address specific project issues; and report to the Steering Committee. The task force for the supervision of the BRT PFS is composed of the following committee members: MoWT (2); UNRA (1); KCC (1); and World Bank (1).

9.49 A Steering Committee will also be established to provide policy direction and public relations and review reports from the Technical Committee; it will also provide a link between project implementation and the Government. Proposed Members are: Permanent Secretaries of the Ministries of Works and Transport; Finance, Planning and Economic Development; Lands, Housing and Urban Development; Chairperson of the Parliamentary Sector Committee on Works and Infrastructure; Directors of National Planning Authority; Uganda National Roads Authority; National Environment Management Authority; Town Clerks of Kampala City; Entebbe Municipal; Mukono District; and Wakiso District Councils.

9.50 This membership strikes an appropriate balance between national and local government interests, but the rank of the Members and size of the committee suggest that it might be difficult to obtain a full level of participation at all meetings. As such, it might be appropriate for it to delegate some of its responsibilities to a core membership drawn from the bodies most directly responsible for or affected by the Project.

Long-term urban transport planning and regulation needs

9.51 International best practice has demonstrated the importance of integrating transport and land-use (physical) planning so as to ensure efficient outcomes in both domains. Were the Kampala Capital City Authority to be established, this 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.

For this to occur, though, would require several amendments to the 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.

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 central Government.
10 SUPPORTING ACTIONS NECESSARY FOR SUSTAINABLE BRT DEVELOPMENT

Introduction

10.1 The primary purpose of a Bus Rapid Transit system is to improve urban personal mobility for a significant proportion of the population through a reduction in journey time, and therefore cost. However not all of the network can justify the capital-intensive investment in fully segregated bus-ways, and road reservations may not be wide enough to accommodate these.

10.2 As such, the effectiveness of the core BRT system must be supported by a range of parallel measures designed to improve the flow of traffic within which the tributary and feeder services are forced to operate. These will include actions in the domains of traffic systems and car demand management, as well as non-motorised transport facilitation.

10.3 In addition BRT should be seen as the top level of a hierarchy of public transport services in the metropolitan area, with vehicle sizes and modes matched optimally both to demand and to infrastructure. At present this hierarchy is deficient in the full-sized buses that offer the least-cost mode in the demand range between 1,000 and 5,000 passengers per peak hour and direction, and an appropriate network of services needs to be planned and facilitated.

Arterial roads Rights of Way (RoW)

10.4 As has been noted earlier, the width of arterial roads in the Greater Kampala Metropolitan Area is low in relation to the traffics that they carry. This problem is of increasing significance the greater the distance from the city centre, but some areas of historic development are also badly constrained.

10.5 Both Kampala City Council and Uganda National Roads Authority have indicated that they have programmes to establish 30 metre RoW on the arterial roads under their respective jurisdictions. However, particularly in the case of Kampala City Council, implementation of such plans is inhibited by the lack of finance for the necessary land acquisition.

10.6 Our analysis has demonstrated that it is possible to insert a fully functional BRT system (with passing lanes at bus stops) within a 30m RoW, Thus the proposed standard for arterial RoW is no barrier to the development of the longer-term BRT network, and these initiatives should be supported as funding permits.

Road hierarchy

10.7 It can be observed that each of the trading centres on the primary roads in Greater Kampala, whether within the conurbation or in the wider metropolitan area, is a focus of major traffic congestion. In most cases this cannot be addressed simply by increasing capacity through dualisation because of the inadequacy of the road reservation. Experience has also shown that the process of land acquisition to widen reservations is both time consuming and very costly. This has been demonstrated both on Entebbe Road and the Northern By-pass.

10.8 As such, an alternative approach is required and it is suggested that this be based on the introduction of a formal road hierarchy together with supporting traffic system management measures. Their purpose would be to prevent the blockage of the arterial highway by local traffic, both through minimising roadside access and turning movements and by making...
proper provision within the highway reservation for turning lanes and vehicle lay-byes. Any increase in community severance caused by the increase in traffic speeds would then need to be compensated through improved pedestrian crossings, including proper mid-highway refuges where it is not practicable for a full traverse to be made within one signal stage.

10.9 In virtually all cases observed, the arterial road reservation is wide enough to permit for three vehicle lanes as well as traffic-separation barriers. Where required, a slight reduction in lane width from the traditional standard would both assist insertion, and act as a traffic calming measure that is both more effective and safer than ‘rumble strips’ or ‘speed humps’. International research has demonstrated that a lane width of 3.0m can be tolerated without any reduction in effective highway capacity.

10.10 The additional road width would then be deployed in a flexible manner, either enabling the insertion of a right-turning lane prior to a junction – such as at Seeta on the road to Mukono – or the construction of lay-byes alternating on the two road sides. These lay-byes would be designated for specific purposes – BRT or inter-city buses, district taxi services, or freight off-loading as appropriate – with connecting sidewalks where these served an interchange function.

10.11 In order to maintain the functionality of the road-side premises, alternative means of access would need to be provided. In some locations this might prove possible by creating a service lane parallel to the highway, with arterial access only at limited points between blocks. In others it will be necessary to open out a service lane one block back from the highway, but this need not be to a high geometric standard as its level of usage will be relatively low. Each locality will need to be evaluated separately to determine the best approach, but the likely investment need would be an order of magnitude lower than highway dualisation.

10.12 It is understood that such an approach was considered during the preparation of the National Transport Master Plan, but no implementation programme has been identified within that or the Transport Sector Development Project. It is strongly recommended that a pilot study be conducted to determine its feasibility at a small number of locations directly associated with the developing BRT network, and that it be included in the detailed design task for that if found to be appropriate.

Highway development and traffic management

10.13 A parallel study in this domain is currently being undertaken by a team funded by the Japan International Co-operation Agency (JICA). Regular meetings and data interchange with that study team have taken place during the preparation of this BRT pre-feasibility study.

10.14 Now that BRT feasibility has been confirmed, at least on the pilot corridor, it is necessary for the Ministry of Works and Transport (and other key stakeholders) to ensure harmonisation of the recommendations of the two studies to avoid conflicting investments.

10.15 It is recognised that Bus Rapid Transit requires allocation of a major portion of the highway RoW, and priority at (and on the approach to) road junctions. Any highway development on a potential BRT corridor should therefore recognise these requirements in its design, even if the BRT implementation is not coincident with its construction.
10.16 BRT insertion also has a major potential impact on the functionality of road junctions, and
the efficiency of traffic-signal staging strategies. In a Transit Oriented Development
concept, BRT should clearly receive priority at road junctions. However, at the very high
frequencies of bus movement envisaged, it is rarely practicable to offer signal-on-demand
to the BRT flow.

10.17 As such, alternative strategies need to be developed particularly at junctions where there
are high volumes of right-turn traffic movements. Options include dedicated traffic turning
lanes (that can sometimes be provided in the ‘shadow’ of a BRT stop), and signalised
roundabouts with BRT operation through their centre.

**Car demand management and parking control**

10.18 Whilst the introduction of BRT and other high-capacity bus services will do much to reduce
congestion in the metropolitan area, it will not prove sufficient in addressing this problem if
the rate of motorisation and peak-hour usage continues to grow. As such, the need for car
demand management has also been recognised as a policy issue.

10.19 With the technologies currently available in Uganda, the most effective means of private car
demand management is in fact parking control. The current status is unacceptable from a
public perspective, with authorised parking even on main thoroughfares and unauthorised
parking on sidewalks and other inappropriate places to the detriment of pedestrians as well
as road users.

10.20 An appropriate response needs to include the following elements:

- Car parking pricing to incentivise changes in personal behaviour;
- Provision of public transport services capable of attracting car users; and
- Development of off-street parking not directly accessed from the highways.

10.21 Current pricing of official short-term on-street parking is set at a level that already
influences personal behaviour, and so probably doesn’t need to be changed greatly.
However monthly tickets are offered at a very significant discount to this rate, such that it is
cheaper for a regular commuter to pay for parking rather than use public transport.

10.22 This is the opposite of an effective demand-management policy, where commuting should
be discouraged and parking space freed up for short-term use so as to avail of retail and
business opportunities in the city centre. It also fails to maximise parking revenues to
Kampala City Council, which we understand to be a sensitive issue. Introduction of BRT will
significantly reduce the number of on-street parking places, and so a re-pricing of those that
remain will be an essential component of sustaining local government support for the
scheme.

10.23 With commuter parking priced appropriately to discourage this practice, there will be more
incentive for illegal parking and a strategy will need to be developed in order to address
this. This will need to comprise both deterrent penalties, including impounding of vehicles,
and an enforcement agency that is appropriately funded and incentivised. Experience in
other African cities has shown that use of Intelligent Transport Systems in parking
enforcement can also prove effective in detecting other motoring offences, such as failure
to pay taxes or have appropriate insurance.
10.24 If an effective parking policy is to retain popular support, it is necessary for the authorities both to counter the arguments made by affected parties and to offer alternatives for those who really have no option. It is always the case that the losers will make the loudest noise, and that the winners will remain largely silent. Political resolve is therefore required, and this should be supported by a public information campaign.

10.25 The most vocal opponents of parking control are the commercial and retail premises on the affected streets who claim that this will drive away custom. However careful thought will suggest that this is not the case, and that it is the lack of availability of short-term parking and not commuter parking that affects business demand. In fact the argument put forward is mostly self-serving, in that the commuter parking is occupied by the business managers for their own convenience and not that of their customers.

10.26 In order to reinforce the disincentive for private-car commuting, it has also been found to be necessary to introduce a differentiated public transport service offer that is attractive to the displaced car users. This approach was highly successful in both Nairobi and Harare, and a clear willingness to pay for an executive class of travel was identified. These services can also be linked to park-and-ride schemes in the more affluent suburbs, such that the car acts as the feeder rather than the trunk mode. Finally, an open BRT infrastructure (together with passing-lanes at stops) can permit the inclusion of such services at an appropriate charge in order further to increase their attraction.

10.27 The final component in the strategy is the development of new off-street parking on purely commercial terms. This is routinely provided in new retail and office developments, but rarely on a standalone basis. However those that insist on the need to commute by private car have demonstrated a high value of personal convenience, and accordingly would be willing to pay appropriate parking charges. The one proviso in this approach, though, is that the approaches to such car parks should not be on the main arterial roads such that queues to enter can affect the primary traffic flows.

10.28 The Transport Sector Development Project will fund a Central Business District parking study and this strategy can be incorporated in its Terms of Reference.

**Non-motorised transport**

10.29 Within an urban mobility strategy, non-motorised transport modes should be seen as being complementary to the formalised public transport system and not competing with it. The SSATP Non-Motorised Transport Pilot Project demonstrated that the provision of separated bicycle tracks along large traffic arterials is a wrong starting point for an urban cycling policy. Further, NMT may not offer significant cost savings in comparison with efficient provision of public transport particularly for longer journeys.

10.30 Our city-centre plan has demonstrated the need and opportunity for enhanced pedestrian paths from BRT stations to the various points of transport attraction in order to minimise the requirement for direct motorised connections. However NMT plays an equally important role as a feeder to formalised public transport, particularly in areas with poor or limited road networks. The requirement in this case is to facilitate the integration of modes at the point of interchange, and this should include the provision of secure bicycle parking in the design of all new large-bus stops where such an activity is likely.
10.31 Bicycles can also offer an appropriate means of personal mobility on the lower demand paths where formal transport is either inaccessible or uneconomic. The key requirement is bicycle paths that provide safe separation from fast car traffic and more direct routings than the main road network. Suburban streets can be appropriate for bicycle paths provided that these do not offer ‘rat run’ alternatives to main-road traffic. Again the Transport Sector Development Project will fund the development of a bicycle path master plan.

Public transport network planning

10.32 As noted earlier, Bus Rapid Transit lies at the peak of a hierarchy of public transport services designed to facilitate passenger demand flows in excess of 5,000 passengers per peak hour and direction. For lesser demand levels, in the range of 1,000 to 5,000 passengers per hour, though, a large bus is still the least-cost mode and hence potentially can offer lower fares than the minibuses (matatu) that currently dominate public transport supply in Kampala.

10.33 However, for large-bus services to be commercially viable and attract appropriate private-sector investment, it is necessary for them to be well planned and specified and for them to be supported by public-transport priority measures at points of traffic congestion so as to ensure their operating speed. The bus routes with the highest demand flows would then be gradually incorporated into the BRT system as that was physically expanded in the future.

10.34 Planning of this second-tier bus network is outside the scope of the BRT pre-feasibility study, but it would be expected to be a priority activity of the new Metropolitan Area Transport Authority when this is eventually established. The primary data necessary are available in the GKMA Transport Master Plan, but technical assistance may be required in order best to translate the demand analysis into efficient and effective route specifications.

10.35 It also needs to be recognised that the rate of conversion of mid-demand routes from matatus to large buses will depend on the profitability of the sector, and hence the level of private investment that it can attract. In the interim period, it will be necessary to plan and regulate the core matatu network in a similar manner as that envisaged for larger buses. At a minimum their services must be designed not to be extractive from the BRT network, but rather complementary to it. Even on sections of the BRT pilot corridor, though, this will still result in some matatu operation on the parallel carriageways.

Public Service Vehicle (PSV) Regulations

10.36 The ruling PSV Regulations are the Traffic and Road Safety (Public Service Vehicles) Regulations, 1971 as amended by the Traffic and Road Safety (Public Service Vehicles) (Amendment) Regulations, 1998. However the latter refers only to the marking of taxicabs and light omnibuses, with all current technical regulations appearing in the former.

10.37 As might be expected under such circumstances, the standards set in these regulations fall generally below current international practice particularly in respect of accessibility. However the specified seat pitch, at 850mm, is considerably in excess of international norms where 700mm to 750mm might be expected. This has the effect of reducing the theoretical seating capacity of all public service vehicles, and probably making all those in current operation illegal.
10.38 It is recommended that a study now be undertaken to update the regulations both to reflect current international standards and to explore the potential for larger vehicle types that could include articulated buses. The opportunity could also be taken to formally recognise standing passengers in urban areas, and to classify omnibuses by their passenger rather than seating capacity.

Communications strategy

10.39 A range of actions in this domain have been identified in the Implementation Strategy for the National Transport Master Plan, under Stakeholder Information and Participation. This recommends that, for each transport infrastructure development project, a detailed stakeholder analysis-driven Information, Education and Communication Strategy be developed and implemented. This will be particularly important in the case of Bus Rapid Transit, as there is very little prior understanding of the concept and its implications for the Greater Kampala Metropolitan Area.

10.40 The Implementation Arrangements for the Uganda Transport Sector Development Project, under which the detailed design of the pilot BRT route will fall, also recognise the need for a communications strategy to sensitis the public to the concepts of BRT and all associated elements. The Technical Committee is tasked inter alia with making appropriate use of the media at all levels, mobilising and securing political support, and identifying a Champion for the Project. These actions can be informed by this Draft Final Report, and commenced with the Stakeholders’ Consultation held on 5th March 2010.

10.41 Supportive articles for the BRT concept and its development in Greater Kampala have already appeared in the local Press. It is suggested that their author be co-opted onto the BRT Technical Committee, and be used to advise this on stakeholder engagement and communication strategy.
Appendix A
Draft Terms of Reference for Detailed Design
FEASIBILITY AND DETAILED DESIGN OF A PILOT BUS RAPID TRANSIT CORRIDOR FOR GREATER KAMPALA

DRAFT TERMS OF REFERENCE

1. TOR PURPOSE

These Terms of Reference (TOR) are for the confirmation of feasibility, design of infrastructure, operational planning and contract preparation for a Pilot Bus Rapid Transit (BRT) system in Greater Kampala.

Passenger transportation in Greater Kampala is plentiful but is badly affected by traffic congestion, excessively reliant on large numbers of small vehicles (known locally as taxis or matatus), and lacks an efficient network. A high proportion of passengers have to make 2-3 transfers to complete their journeys, and there is a lack of high-capacity transportation services, especially effective cross-city links. The public transport network and supply needs to be significantly strengthened to address these weaknesses.

The Study will concentrate on the BRT pilot corridor identified in the Pre Feasibility Studies for the Development of a Long Term Integrated Bus Rapid Transit System for Greater Kampala Metropolitan Area. However it will also make provision for a spur route towards Entebbe.

In summary the work included in this RfP will:

1. Confirm the BRT concept developed within the Pre Feasibility Study
2. Develop passenger and revenue forecasts for the pilot corridors
3. Develop a service plan for each BRT line within the corridors
4. Develop private-sector financing mechanisms for the required rolling stock
5. Develop proposals for planning, institutional and regulatory support of BRT
6. Prepare contract documentation for route service contracting
7. Develop engineering design of route alignment, stations, termini and interchanges, and depots
8. Undertake social and environmental assessment of each route, and prepare mitigation / resettlement plans
9. Undertake financial and economic appraisal
10. Develop an implementation plan
11. Develop a stakeholder engagement and public communication plan
12. Prepare contract documentation for infrastructure construction and supervision

2. CONTEXT

2.1 Background

The National Transport Master Plan, originally developed in 2005, included a Transport Master Plan for the Greater Kampala Metropolitan Area (GKMA). This plan set out a general framework for development of the transport sector over the period 2008-23. Whilst the
plan has since been extensively reviewed and refined, its fundamental recommendations still stand.

The sub-sector development plan for GKMA included the following elements:

- Establishment of a single GKMA Transport Authority;
- Adoption of the Transit-Oriented Development concept;
- Re-organisation and restructuring of the public transport services and fleet;
- Introduction of a Bus Rapid Transit (BRT) system;
- Improvement of existing road network and non-motorised transport facilities;
- Development of dual carriageways;
- Road junction improvements and signalisation (62 locations); and
- Development of a Traffic Management System.

The capital costs budgeted over the 15 year period were estimated to total some US$ 1.181 billion, comprising the following allocations:

- US$ 625 million for road improvements;
- US$ 125 million for traffic management and safety improvements; and
- US$ 431 million for new bus ways and equipment (4 bus ways).

An additional budget of US$ 19 million was also provided for the start-up costs of the various institutions proposed in the Master Plan. These included a Transport Master Plan Unit in the Ministry of Works and Transport; a Metropolitan Area Transport Authority and Executive; a Multi-sectoral Transport Regulatory Authority; and a National Road Safety Authority.

It will thus be seen that Government has placed a high priority on the resolution of the current urban transport problems in Greater Kampala, and is prepared to back its’ policies with very substantial investments. Within those listed, Bus Rapid Transit is the largest single component, with each of the 4 bus ways estimated to cost in excess of US$ 100 million. Because of the scale involved, these projects are assumed to be co-financed by Uganda’s development partners on a programme basis.

The Uganda Transport Sector Development Project of the International Development Association (co-financed by the UK Department for International Development) is planned as part of that long-term sector development programme. If successful, it is anticipated that future projects will be forthcoming to ensure a rolling programme over the plan period.

The Project Appraisal Document for the Transport Sector Development Project identifies Urban Congestion as a being a major challenge in the sector. With rapidly increasing population, and even faster increase of motorisation, the Kampala Metropolitan Area is moving rapidly (sic) towards total gridlock. Concerted, rapid and effective measures are needed to avoid this, and lessons need to be learnt from Asian and Latin American cities that have experienced similar growth in past decades. These include:
- Urban transport demand **cannot** be satisfied by individual vehicles or the construction of more road space;
- Existing road space needs to be used more efficiently by curbing individual vehicles, and the introduction of effective mass transit;
- One of the most effective means of control of access to the central business district is through comprehensive parking management (reflecting the high cost of urban space);
- Scarce urban transport space must be used most effectively to enhance mobility of people (not autos) by providing space for pedestrians, bicycles, and mass transit; and
- To get control of the urban transport situation an effective and well funded **Urban Transport Authority** must be created.

The Transport Sector Development Project supports the introduction of Bus Rapid Transit in Greater Kampala through financing the Feasibility Study and Detailed Design of a pilot route, and will develop the legal framework for the creation of urban transport management capacity. Both of these actions are main components of the Implementation Strategy of the Transport Master Plan for the Greater Kampala Metropolitan Area, being part of the National Transport Master Plan.

### 2.2 Current Travel Conditions

**Road width**

It was reported that 57% of roads within the Kampala City area are less than 6m in width, with 28% being 2-lane roads and 15% being 3-lanes or wider. Within the broader Greater Kampala Metropolitan Area, the proportion of dual-carriageway roads is far lower. The lack of highway width potentially makes the implementation of segregated bus lanes particularly challenging. The constrained nature of the road network means it is of paramount importance to make the most efficient and effective use of the space available.

**Congestion / Junction Capacity**

There are a number of congestion hotspots within Kampala, particularly surrounding the taxi parks and Central Kampala areas such as Kampala Road, Namirembe Road, Entebbe Road and Jinja Road. A high level of delay is often experienced around the ‘Shoprite’ and ‘Clock Tower’ junctions to the south of the City Centre, and the Jinja Road junction with Yusufu Lule Road to the east of the City Centre. Work undertaken as part of the GKMA Transport Masterplan study demonstrates that congestion is problematic in the city centre, while vehicle speeds are generally acceptable outside of the built up Kampala area. However more recent surveys have shown far greater congestions impacts, in both spatial and speed terms, and the city centre now regularly approaches gridlock.

**Poor organization of traffic circulation of matatus in areas near the Taxi Parks**

All matatu routes in Kampala terminate at either the Old Taxi Park or the New Taxi Park. The traffic circulation to enter and leave the Taxi Parks is relatively poor. Matatus share road space with pedestrians and street traders and queue up in long lines, very often blocking intersections and obstructing traffic flows from other directions as well.
Car parking

As is typical for the centre of any capital city, car parking is at a premium. Not only does this result in regular illegal parking, but also drivers circulating the city centre looking for parking spaces exacerbate congestion problems.

Car parking is regulated in the city centre. A receipt is obtained on arrival and the following charges were reported to apply between 7am and 6pm:

- 400 Shillings per hour up to 2 hours
- 400 Shillings for every subsequent 30 minutes
- If no payment is received in 24 hours, a 2,000 Shilling fine is issued

However a monthly ticket is available for 30,000 Shillings, which is equivalent to only four 10-hour days of parking and hence encourages private-car commuting rather than managing its demand.

It is considered that with the development of BRT, there should be careful consideration regarding the location, regulation, pricing and quantity of City Centre car parking. Although car parking is heavily constrained, this may be beneficial in encouraging more sustainable modes of travel such as walking, cycling and public transport use, as the availability of car parking is known to have a large influence on modal choice. Increasing the supply of car parking may send the wrong message, as people should be encouraged to enter the city centre using sustainable modes of travel.

Pedestrian activity

Particularly around the taxi parks there is very high pedestrian activity and limited footway width, making movement particularly constrained. Pedestrianisation of certain streets has been considered as part of previous studies. It may be possible to ban general traffic from certain streets and devote the majority of the highway to pedestrian / cycle use, while still maintaining a BRT system penetrating through the heart of the city centre. This will be considered as part of many options for implementation of BRT in the City Centre.

Highway encroachment

The effect of local traders and commercial activity encroaching onto the highway seems common in the Greater Kampala Metropolitan Area, but this can have a serious impact on the capacity of the road network. Traders tend to utilise the available footway width, which forces pedestrians to walk in the carriageway, which in turn can reduce the capacity of the road network substantially. The problem is particularly common in the City Centre, around the Taxi Parks.

Poor organization of unloading facilities for retail shops

The provision of goods for retail shops, particularly in the City Centre, is poorly organized. Trucks seem to have access to the whole City Centre area all day long. Due to heavy congestion, trucks tend to park at the wider end of street and unload their goods. These are then distributed to the different retail shops often by hand-cart or by hand, with a large number of boys carrying the goods – through the heavy pedestrian flows - to the shops. This unloading process leads to a relatively high obstruction of the traffic and pedestrian flows.
Footway / carriageway condition

The deterioration of the footway and carriageway can severely affect highway conditions. It was reported as part of the Transport Masterplan that 24% of paved road and 47% of gravel roads in the Kampala City area are in poor condition. Traffic can be reduced to walking pace to negotiate pot holes and bumps in the carriageway. Pedestrians often are forced to walk in the carriageway, as either there is no footway available, or it is very difficult / hazardous to negotiate. This can be particularly problematic at night in locations where there is no street lighting, as the pedestrian can be forced to choose between trying to negotiate the footway area, and risk injury from trips and falls, or walk in the carriageway and risk being struck by a vehicle. Further problems are caused by localised flooding after heavy rainfall, compounded by poor maintenance and de-silting of drains.

Inadequate carriageway delineation

Throughout Greater Kampala many dual-carriageways are not sufficiently wide enough to accommodate more than one lane of traffic; however the inadequate delineation resulted in traffic treating the road as single carriageway. It is thought that better road marking and the installation of better roadside kerbing in certain locations could offer a relatively low cost method of significantly increasing road capacity.

Pollution

Pollution is a big problem in Kampala, with vehicle exhaust emissions contributing largely to poor air quality. Severe congestion, the age of vehicles on the road and the excessive number of public transport vehicles all contribute to poor air quality.

2.3 Designing for Disability

Disability has many manifestations. In the majority of cases, BRT is readily designed to assist the disabled; enhancing personal mobility, ensuring appropriate passenger-vehicle interface and accessible information and payment systems can be a significant advantage to those with sight or hearing impediments.

Most users of transport do, at some time, have mobility impairment whether it be temporary injury, being encumbered with luggage or accompanying children. As such there is significant benefit in designing for those with mobility impairment. It is however recognised that ensuring universal access to transport can increase cost beyond that which is considered affordable and impose design features that are not physically achievable. In such instances it is often more economic to accommodate the severest of disabilities through other means of transport, such as accessible demand responsive transport. As such the Consultant is expected to take consideration of the needs of mobility impairment and other disabilities but, at the same time, be pragmatic in the pursuit of a system that is accessible for all.

2.4 Design Standards

Local Ugandan and regional COMESA design standards will be used wherever they are available. Where no relevant standards exist, or BRT specific standards are required, reference will be made to best practice and existing research from elsewhere within the context of providing safety for all users and an efficient use of resources.
2.5 Consultation and Stakeholder Engagement

The needs of the user must be ever present through the development and design of BRT, and the Consultant is expected to provide evidence that this will be the case.

BRT will be a new form of public transport in Greater Kampala of a quality and organisation not seen before. As such, the way in which it is developed and portrayed to stakeholders is essential in ensuring BRT meets its objectives. A comprehensive stakeholder engagement and consultation plan is an essential part of the development of BRT. The Consultant will, during the study inception phase, make recommendations on that form of the plan and thereafter provide appropriate technical input to support that plan.

3. THE BRT PRE FEASIBILITY STUDY

The BRT Pre feasibility study was completed in May 2010.

The study supported 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 objectives of the study were to:

“Define the long term conceptual design of the BRT system for GKMA based upon the current and forecasted travel demand as dictated by the land use and development plans by the local administration, and to prepare terms of reference for: detailed engineering design covering both the infrastructural, operational and PPP aspects, institutional setup and financial controls necessary for implementation of a pilot BRT system on a selected priority corridor in the short terms. The study will have a long term vision with specific actions to be implemented in the short terms”

As such the study appraised alternative BRT conceptual designs and their application to the main arterial routes in order to identify an appropriate BRT pilot corridor, and examined the feasibility (to pre-feasibility level) of implementing BRT along that route. The identified pilot corridor is the Jinja Road – Bombo Road alignment. For this routeing an appropriate BRT concept was developed, financial appraisal applied and an institutional / regulatory support system identified.

4. THE PILOT BRT CORRIDOR

The proposed pilot corridor is defined from the route appraisal. The route is 14km in length and runs from the Bombo Road / Northern Bypass junction in the north (Bwaise), to the Jinja Road / Northern Bypass junction in the east (Kireka) via Bombo Road, Yusufu Lule Road North, Haji Kasule Road, Bombo Road, Kampala Road and Jinja Road. In addition, a BRT spur will be provided from Kampala Road through the Kibuye roundabout to Namasuba on Entebbe Road.

A detailed description of the route is provided as follows, and is illustrated below:
The northern terminal would be in the vicinity of the Bombo Road / Northern By-pass roundabout, and offer interchange to local matatu services. Its exact location would be the subject of detailed design considerations.

The route then runs south along Bombo Road for a distance of approximately 1.3km. Some widening of this existing single carriageway link is required.

The route passes through the Bombo Road / Gayaza Road / Yusufu Lule Road North junction from the north-western arm of Bombo Road to the south-eastern arm of Yusufu Lule Road North, which is currently a four arm roundabout of 67m inscribed circle diameter. This roundabout would need redesigning to allow BRT priority, and the future potential BRT tributary along Gayaza Road, as well as a station in the vicinity of the junction, should be considered in the design.

A BRT tributary along Gayaza Road would be a high priority as funding permits, and its detailed engineering design will be included in this assignment. Short-term arrangements could also include an informal interchange at the Northern By-pass roundabout (where there is a matatu stage just to the north).

The route continues south along Yusufu Lule Road, which is dual carriageway with central kerbed median. The link continues 0.3km over a three arm roundabout of 40m inscribed circle diameter, which would need redesigning to
allow BRT priority. Dwaliro Road forms the third arm of the roundabout to the north-east.

- To the south-east of this junction, the route passes along Yusufu Lule Road North for a distance of 0.6km. It then reaches a roundabout with Haji Kasule Road, Kira Road and Yusufu Lule Road. This 53m wide roundabout would need to be redesigned to offer BRT priority between Yusufu Lule Road North and Haji Kasule Road, but it should also be considered that Kira Road to the north east could be developed as a tributary, and a station should be provided in close proximity.

- Haji Kasule Road is a dual-carriageway link with central kerbed median. The route continues along this road for 0.47km heading south-east until it reaches the signalised cross roads between Makerere Hill Road and Bombo Road. This junction would need to be redesigned to allow the BRT priority from Haji Kasule Road to the southern Bombo Road arm. This area may attract significant patronage to and from Makerere University, therefore a station should be considered in the vicinity of this junction.

- From here, the route runs south along Bombo Road, a dual carriageway link, for 1.23km until the junction with Kampala Road. Within the median to the north of this junction there is an electricity substation which will require relocation. The Bombo Road / Kampala Road / Ben Kiwanuka Street junction would need to be redesigned to allow BRT priority, and this location could offer a good opportunity for the northern City Centre station.

- The route continues along Kampala Road and through the heart of the city. A central station could be developed in the vicinity of Constitutional Square. The issue of on-street car parking will need to be addressed to allow BRT insertion along this dual-carriageway link.

- After 1.14km the route reaches the signalised T-junction of Kampala Road / Entebbe Road / Jinja Road. This should be redesigned to allow BRT priority, as well as offering a location for a third city centre station.

- The route then continues east along Jinja Road, which is a dual-carriageway link or greater between the Kampala Road / Entebbe Road junction and the Port Bell Road junction, a distance of 3.75km. Key junctions that require conversion along this link include the Jinja Road / Yusufu Lule Road signalised cross roads, the Jinja Road / Old Port Bell Road four-arm roundabout and the Jinja Road / Port Bell Road signalised T junction.

- BRT stations could be located at the Jinja Road / Yusufu Lule Road junction, between the Old Port Bell Road and Port Bell Road junctions, and at the Port Bell Road junction. A station at the Port Bell Road junction would provide good service accessibility for the Makerere University Nakawa Campus.

- The route then heads east along Jinja Road for approximately 4.8km. This section is largely single carriageway. Stations could be provided approximately at 800m intervals, at key population centres along the corridor such as Kyambogo, which could provide a connection to the Kyambogo University.
In the event that land acquisition needed for full BRT implementation proves not to be possible on the eastern section of this stretch (beyond Banda), then it will be necessary to design alternative public-transport priority measures within the identified constraints.

The eastern terminal would then be provided at Kireka, with its exact location subject to detailed design considerations. A local bus circulation so as to access the Bweyogerere catchment might also be included.

Beyond the Kireka terminal, a BRT tributary would operate in mixed traffic along the main highway to Mukono pending its eventual dualisation. Provision for service interchange and bus turnaround in the vicinity of the Mukono taxi park will need to be designed.

The BRT spur from Kampala Road to Entebbe Road passes south-west to the Shoprite junction and then south through the Clock Tower junction, both of which will need to be redesigned to accommodate BRT priority and make provision for a future BRT route on the Gaba Road alignment.

It will then follow Queensway south to Kibuye roundabout, though consideration may be given to a partial routeing on the parallel Katwe Road. Kibuye roundabout is a five arm junction straddling the railway line, and will need to be redesigned to accommodate BRT priority to Entebbe Road and make provision for a future BRT tributary on Masaka Road.

The southern terminal for the BRT spur will be at Namasuba, with its location to be determined in relation to available land, predicted passenger demand levels, and practicalities of bus turnaround.

5. SCOPE OF WORK

The project consists of, but is not limited to (should the Consultant define additional requirements), the following activities:

1. Confirmation of BRT concept design
2. Passenger and revenue forecasting
3. Operational service planning
4. BRT system management and delivery planning
5. Revenue collection strategy
6. Passenger information strategy
7. Vehicle functional specification
8. Vehicle financing under public / private partnership
9. Development and design of BRT running way and parallel highway
10. Development and design of stops and stations
11. Development and design of interchanges and terminals
12. Development and design of depots
13. Environmental / Social impact assessment and mitigation plans
14. Scheme costing and financial / economic appraisal
15. Risk analysis and sensitivity testing
16. Public communication, including branding and identity
17. Preparation of bid documents (including working drawings), construction packages, traffic diversion plans, and program phasing

5.1 Confirmation of BRT concept design
The Pre Feasibility Study defined a BRT concept that was applicable to the proposed BRT pilot corridor. This concept definition should be reviewed and appraised in light of the increased level of information that is derived as part of the feasibility / detailed engineering design task.

Should this appraisal identify an alternative design concept, then Client approval must be sought before developing subsequent elements of the assignment.

5.2 Passenger and revenue forecasting
Limited data collection was undertaken in order to identify potential BRT routes in Greater Kampala and to recommend a pilot corridor for development and implementation. This data, together with other data collected for other studies within Greater Kampala, will provide some base information but it is envisaged that a significant amount of additional data will be required in order to support the definition and design of the pilot BRT routes within the corridor. Data to be collected will include, but not be limited to:

- Origin- Destination data
- Classified count data
- Public transport occupancy
- Journey time

The consultant should also consider the data requirement to support modal shift parameters including fare elasticity consistent with the form of forecast model proposed.

A data collection plan should be developed and provided within the study inception report that provides full justification of the data to be collected and how it will be used relative to the form of forecasting model proposed.

The consultant is expected to define an appropriate forecasting model for the purposes of developing and designing the proposed BRT. This should address the base situation at system launch, and the future design year of 2030. It should enable the identification of the potential impacts upon other traffic of the BRT and provide a basis for financial/economic analysis.

5.3 Operational service planning
The operational service plan will interpret the conceptual design and seek to accommodate forecast patronage. There will be a need to allow for iteration between forecasting, service plan development and concept definition prior to detailed infrastructure design.

This task should include:
1. Derivation of appropriate bus load factors.
2. Estimation of the number of buses to accommodate demand forecasts, including route definitions for trunk and feeder buses (or operations outside the busway for certain buses, if considered appropriate). Route definitions and scheduling include peak and off-peak frequencies, travel times, and commercial speeds.
3. Estimation of support requirements for buses, such as facilities and equipment for maintenance at depots.
4. Operating cost including drivers, maintenance staff/materials, fuel, tyres, licensing, insurance, depreciation and all other recurring costs relating to BRT operation.
5. Capital cost estimation of bus acquisition, including financing options together with consequent collateral, tenor, and interest rate assumptions.

5.4 BRT system management and delivery planning

The BRT system management plan will interpret the operational service plan, and develop a holistic framework for service delivery. This task will include:

1. Framework for BRT system management.
2. Framework for BRT operations management, including service interruption.
3. Service contracting modalities, and revenue risk allocation.
4. Fares structure, and interchange options, penalties and rebates.
5. Fares levels, and mechanisms for periodic adjustment.
6. Revenue collection and protection strategy
7. Passenger information strategy

Decisions in all these domains cannot be made in isolation from wider network issues and, as such, the Consultant should make recommendations to, and seek guidance and approval from, the Client prior to proceeding to the detail design tasks affected by these decisions.

5.5 Fare collection modalities

Consideration needs to be given throughout the design to methods that will minimise fare evasion and potential ticket fraud. After Client agreement of the proposed revenue collection and protection strategy (task 5.4), the preferred option needs to be developed through to the level of definition of supporting infrastructure whether on-board the bus, in the station, or external to the system. Implications will need to be explored in iteration with the bus stops and stations as appropriate.

The Consultant will be required to recommend and test different fare products (single journey, day, week etc.) and pricing structures to determine their impact upon patronage and revenue together with giving appropriate consideration to the development and management of concessionary fares. Decisions on both fare products and pricing structures cannot be made in isolation of wider network issues and as such the Consultant should make recommendation to, and seek guidance from, the Client.
5.6 Passenger information modalities

The Consultant shall consider the optimum way in which transport information is relayed to both passengers (for mode choice and travel decisions) and operators (for operational planning purposes). This may include the use of real-time passenger information, static displays, off-site information relayed by electronic or other means. In assessing the potential of real time information, consideration needs to be made of benefits to operators and the potential use for priority through signalised intersections.

Decisions on information provision cannot be made in isolation of wider network issues and as such the Consultant should make recommendation to, and seek guidance from, the Client.

5.7 Vehicle functional specification

Vehicle specifications will be developed in accordance with the service plan, understanding of user needs and system concept. An essential consideration will be the ability to source vehicles at a reasonable price through competitive tendering, the ability to maintain (within acceptable tolerances) and the willingness of a potential operator to subscribe to the recommendation.

Key decisions relate to the size of vehicles (standard or articulated), floor height, seating configuration, emissions, power-train and other issues as determined appropriate. The choice of vehicle specifications must also recognize the operating environment in Kampala, the quality of available fuels, and the availability of appropriate technical support services.

Advice is sought on potential purchase lead-in time for BRT implementation.

5.8 Vehicle financing under public/private partnership

The BRT system concept for Greater Kampala envisages a public/private partnership in which the public sector will provide the appropriate infrastructure and a secure regulatory framework, and the private sector will provide and operate the appropriate buses.

This task will investigate the investment climate in Uganda, and the modalities for vehicle finance such as leasing. Terms and tenor of finance options will be fed into the operating cost model to determine the commercial viability of the pilot BRT implementation.

5.9 Development and design of BRT running way and parallel highway

The design of the BRT running way will support the service plan accommodating the operational requirement defined, meet the needs of the user with respect to physical constraint, and integrate with other modes and adjacent land uses, as applicable.

The task requires engineering and architectural design of roads, including reconfiguration and expansion of busway corridor geometry and feeder roads as applicable. Work will include, but not be limited to should the Consultant identify further required tasks:

1. Surveying, soil testing, and topographic studies
2. Utility network mapping and relocation as required (water, sewage, power, phone, etc.)
3. Geometric design of roads and intersections (trunk and feeder where required)
4. Land acquisition identification as applicable
5. Hydraulic and drainage design
6. Traffic engineering, signs, and control devices as required
7. Intersection design which may consist of change in priority, mix with traffic, signalization, or grade separation
8. Street lighting
9. Public space and landscaping designs for the whole public realm to a level agreed to with the Client
10. Pavement structural design, according to geotechnical conditions (as appropriate), BRT and general traffic loads
11. Design of pedestrian access to stations (grade separation if required according to pedestrian and traffic volumes)
12. Pedestrian overpasses, drainage facilities, barriers, and all the complementary civil works
13. Environmental Impact Assessment and mitigation plan according to the requirements of environmental authorities.
14. Implementation plan (timetable and traffic management during construction)
15. The above design shall be at an appropriate level of detail for construction or working drawings.

The benefits of early preliminary engineering design of corridors in response to the service plan, Right of Way constraints and agreement of intervention proposed prior to development of detailed design is recognised.

5.10 Development and design of stops and stations

Station locations should be determined with reference to existing stop locations, location of existing pedestrian overpasses (if appropriate), passenger forecasts, physical opportunity, as well as access and wider traffic management issues. Work will include, but not be limited to:

1. Definition of footprint (access area, fare collection provision, platforms, circulation).
2. Provision of Park-and-Ride facilities where, and if, appropriate
3. Typology of stations according to demand requirements and service plan (small, medium, large; number of platforms).
4. Architectural concept with reference to local architectural style, BRT identity and the wider branding issues of the public transport network.
5. User-related facilities as considered appropriate.
6. Structural and foundation designs.
7. Equipment and services design (electric, water, sewage, communications, signs as required).
8. Construction plans and working drawings.
9. Implementation plan (timetable and traffic management during construction).
10. Exploration of opportunities of joint development (commercial areas to be sold or leased) as appropriate.

5.11 Development and design of interchanges and terminals

Where BRT interchanges with other transport modes and where terminals are to be provided the study will include, but not be limited to:

1. Definition of BRT footprint (access area, fare collection provision, platforms, circulation) according to demand requirements and service plan.
2. Architectural concept with reference to local architectural style, BRT identity and the wider branding issues of the public transport network.
3. User-related facilities as considered appropriate.
4. Structural and foundation designs.
5. Equipment and services design (electric, water, sewage, communications, signs as required).
6. Construction plans and working drawings.
7. Implementation plan (timetable and traffic management during construction).
8. Exploration of opportunities of joint development (commercial areas to be sold or leased if applicable).

5.12 Development and design of depots

The number and optimal location of depots will emanate from the service plan together with the size of fleet to be served. Should the Client identify suitable sites within six months of study commencement, then detailed designs will be required. Should that not be the case, then generic designs should be provided whose elements can be arranged onto any site subsequently acquired. Work will include, but not be limited to:

1. Location, sizing and definition of functional requirement and facilities (access, manoeuvre, fuelling, washing, maintenance and repair, parking).
2. Design of main workshops, stores and maintenance building(s).
3. Definition of ancillary uses that may include administration, operations management, operator areas – cafeteria, training, rest, lockers, etc.
4. Architectural design of the main buildings required.
5. Identification of potential environmental impacts on the site, including waste product disposal.

5.13 Environmental / Social impact assessment and mitigation plans

The Consultant should identify and evaluate the environmental and social impacts and propose mitigation measures appropriate to these impacts. Specifically, the Consultant is expected to:

1. Describe, analyse, and characterise the environmental and social aspects of the area of influence of the Project.
2. Identify special management areas that are environmentally or socially sensitive.
3. Prepare an Environmental Impact Statement (EIS), an Environmental Management Plan (EMP), and a Resettlement Action Plan (RAP) as appropriate.

The EIS should address the BRT corridor, depots, terminals, interchanges and any interventions proposed to feeder routes. An Environmental Assessment shall be undertaken of potential impacts, e.g., loss of trees, adequate drainage, increased pollution levels, health and safety, etc., and appropriate mitigation measures and management arrangements as part of the preparation and implementation of an Environmental Management Plan.

The Environmental Management Plan (EMP) will summarise anticipated environmental and social impacts of the project and will provide details on the measures, responsibilities and scheduling to mitigate these impacts, as well as costs of mitigation and monitoring. The EMP will provide a critical link between the mitigation measures specified in the EIS and the integration of such measures during the implementation and operation of the project.

In the Resettlement Action Plan (RAP) the Consultant shall review existing local resettlement policies and in particular any resettlement policy frameworks applicable to urban development projects. In addition, the Consultant shall address international resettlement policies that may be applicable depending on the source of financing for the project.

Both the EMP and RAP need to consider any temporary land take or traffic diversion during construction.

5.14 Scheme costing and financial / economic appraisal

All aspects of implementing the BRT as proposed must be priced to include both capital and recurring cost with due regard to anticipated levels of inflation, locally derived material costs and the potential for optimism bias. An early indication of potential system costs is required, together with appropriate caveats. This should be provided when the passenger forecasts, service plan and preliminary designs are fixed.

This task should provide, but not be limited to:

1. Detailed cost estimation of infrastructure components, including civil works, land acquisition or clearance, environmental and social mitigation, oversight, administration and taxes.
2. Cost estimation of rolling stock, including bus acquisition, preparation, operation and maintenance.
3. Estimation of maintenance and operation requirements for each of the infrastructure components. Maintenance may include daily cleaning of stations, pedestrian access and terminals, and routine and periodic maintenance of roads, stations, terminals, depots. Operation of infrastructure may include private security and required utilities at stations (water, power and communications).
4. Definition of components of the financial model (capital, operation, maintenance, taxes, financial costs) with the inputs of the technical design model.
5. Review of all the operation and fare collection cost components (e.g. bus acquisition/adaptation, bus operation; operation overhead; fare collection systems implementation and operation, etc.)
6. Estimation of the revenues according to the demand forecasts and fare levels.
7. Advise upon the need for subsidy and how costs might be allocated to reduce the financial burden upon Kampala City Council with respect to optimal system performance and minimal public sector risk.
8. Estimation of finance costs and applicable taxes.
9. Calculation and discussion of acceptable private rate of return according to identified risks (country, sector, project risks).
10. Estimation of financial indicators for private participation in the project.
11. Alternatives Analysis of the business model for allocating project costs, including infrastructure, facilities, operations, and support systems to public and private sector.
12. Sensitivity analysis to changes in input variables.

The socio-economic evaluation should consider, but not necessarily be limited to:

1. Appraising potential impacts: estimation of general travel time, travel cost, operational cost and accident reduction by comparing the situation with and without project implementation, transferring the impacts to monetary units and correcting for market imperfections and transferences inside the community – shadow prices.
2. Estimating the economic costs of implementation in monetary units, both for public and private investment and operating and maintenance costs, while correcting for market imperfections and transferences inside the community – shadow prices.
4. Calculating the distribution of benefits across different user groups (i.e., income).

5.15 Risk analysis and sensitivity testing

The Consultant will prepare a detailed risk analysis for BRT design, covering the design, implementation, operations and financing of the Project, as well as relevant external events. It is expected that a standard methodology can be applied, using industry norms, which will identify risks and assess consequences, probability of occurrence, scale of impacts, and overall impact on the Project. The Consultant will propose the methodology to the Client and gain approval before applying it.

For all identified risks, the Consultant will provide an assessment of the risk and will propose risk mitigation and management measures. For the principal risks identified, the Consultant will conduct sensitivity testing of the financial and economic outcomes appropriate to the scale of the risk. The Consultant will recommend an overall risk management strategy.
5.16 Public communication, including branding and identity

The Consultant should advise upon a public communication strategy to inform and motivate the general public with regard to the BRT system benefits, and the implications of its construction.

This task will include branding and identity issues relating to provision of infrastructure (particularly stops, stations, terminals and interchanges) and information, together with any other aspects that the Consultant considers to have branding implications.

5.17 Preparation of bid documents (including working drawings), construction packages, traffic diversion plans, and programme phasing

For this task, the Consultant is required to:

1. Prepare the functional and technical specifications and contract packages of all project components.
2. Prepare the project implementation plan.
3. Prepare bidding documents and support the Client in the bidding process:
   a. Plan, design, and organize the bidding process
   b. Prepare the bidding documents (i.e., TOR, RFP, evaluation criteria, etc.)
   c. Assist the Client in the analysis and evaluation of proposals
4. Prepare and compile all functional and technical specifications to be presented to eligible (pre-qualified) Contractors in an orderly and clear manner for easy and comprehensive understanding of all project components and requirements.
5. Prepare the detailed functional and technical specifications for each work item, taking into account both current international ‘best practices’ as well as local convention.
6. Prepare appropriate contract packages suitable for tender procurement from both international and local contractors. Factors to be taken into account include:
   a. The location of the project and capability of local industry to compete in view of the aim of supporting the development of domestic capacity in the construction industry
   b. Civil works for road components, including road sections interchanges, sidewalks, landscaping and other features
   c. Civil works for BRT component, including roadways, stations, terminals, depot, maintenance and administrative areas, and pedestrian facilities
   d. Operations bidding, including bus acquisition, bus operations and any other operations that shall be contracted out.
7. Prepare traffic diversion plans and other disruption mitigation during construction
6. STUDY IMPLEMENTATION

6.1 Duration of the Study
The completion of the Study tasks is estimated to take not more than 15 months. The Consultant will prepare a study programme that details all activities as part of the proposal. Additional activities deemed necessary to the Study objectives may be proposed by the Consultant according to his own understanding of the project with associated justification.

The Consultant will identify which activities will be carried out in Kampala and the schedule for on-site presence by all the Study Team members.

6.2 Study Reports
The Consultant will prepare and submit all the following reports specified in the RfP and detailed below, including:

1. Inception Report
2. Preliminary Design and Operations Report
3. Demand and Operations Report
4. Interim Design Report
5. Draft Final Report
6. Final Report

General requirements for these reports include:

1. Reports will be provided in English.
2. Reports will be presented in hard copy and in electronic format as specified by the Client.
3. Hard copy reports will be provided in A4 format, except for drawings and other documents which will be in the appropriate size.
4. All reports will be submitted to the Client as draft versions to allow for feedback and to accommodate Client’s comments.
5. A total of [5] hard copies of all reports will be submitted, except for draft reports where a lower number of copies may be agreed by the Client on a case-by-case basis.

Report One: Inception Report – Month 1
The Inception Report will be submitted within the first month of commencement of the Study. As a minimum, the Inception report will cover:

1. Status of the project, team mobilisation, and logistics,
2. Report on the initial activities including a review of background studies.
3. Data collection plan,
4. Consultation plan,
5. Preliminary concept review,
6. An initial review of the BRT corridor,
7. Any issues arising concerning the Terms of Reference or scope of the work,
8. Finalised timetable for the Project.

Report Two: Preliminary Design and Operations Report – Month 4

Report Two will be submitted within the third month of commencement of the Study. This report will facilitate a discussion on the potential intervention in each BRT corridor together with the optimal use of these corridors prior to progressing with detailed design. As a minimum it will include:

1. Refined BRT Concept definition
2. Preliminary engineering design (alignment and method of segregation where applicable) for the BRT corridor
3. Draft service plan

Report Three: Demand and Operations Report – Month 6

Report Three will be submitted within six months of commencement of the study. It will give stop-by-stop passenger forecasts for each BRT line, with breakdown according to AM, PM and off-peak, weekends and holidays. It will derive annual passenger and revenue forecasts. To meet these forecasts, with respect to preliminary engineering design, a service plan will be presented. Preliminary cost estimates will be provided.

Acceptance of Report Three will mark the end of the planning phase and start of the engineering design phase of the study.

Report Four: Interim Design Report – Month 9

The Interim Design Report will include designs of all traffic engineering measures, including junction improvements, and principal structures within the corridor for Client approval. On acceptance, the Consultant will proceed to finalisation of the detailed construction drawings and preparation of bid documents.

Report Five: Draft Final Report – Month 12

The Draft Final Report shall document all work performed during the study and shall include an Executive Summary of no more than 20 pages plus maps and graphics. In addition it shall include:

1. Detailed design report, construction drawings and cost estimates for all BRT components.
3. Risk analysis.
4. Socio-economic evaluation.
5. Economic and financial evaluation.
Report Five: Final Report- Month 15

The Final Report will take into account comments on the Draft Final Report made by the Technical Committee.

Monthly Progress Reports

The Consultant will submit Monthly Progress Reports, reporting on:

1. Progress of the work, reported against the tasks in the scope of work and schedule.
2. Achievements and outputs.
3. Consumption of resources.
4. Any problems, delays or issues arising, with explanation of the factors involved and the proposed means of resolving problems and restoring the schedule.
5. Planned activities for the following month.

Technical/Discussion Notes

In order to facilitate discussion, portray important technical information and raise issues that require decisions to facilitate progress it is recommended that the Consultant produces technical or discussion notes. These are not formal deliverables and it is expected that Client and/or the Consultant would define their timing, content and purpose as demanded to ensure the study meets its objective and conforms to the work programme.

6.3 Project Management

The Client will designate a Project Manager to provide day-to-day contact, as required, with the study team, and, establish a Technical Committee to support the Study. The Technical Committee will have two weeks to review and comment on each of the report submissions and will approve reports on behalf of the Client. Comments and observations will be taken into account in successive submissions, especially in the revised Final Report.

Project oversight will not be limited to the reports. The Consultant will schedule a bi-weekly meeting with the Project Manager and/or Technical Committee to report on the project progress and to receive input on the project development. Additional meetings will be scheduled with stakeholders according to the project needs (the Consultant will need to schedule these meetings with the collaboration of the Client).

6.4 Composition of the Project Team

The minimum requirements for the Consultant’s project team are presented below. The Consultant can retain other professionals and support personnel as required to complete the study. The Consultant will include within the Study Team a local engineering consultancy with an office in Greater Kampala.

The Consultant is expected to provide expert professionals who have suitable qualifications and extensive experience with relevance to BRT Projects. The qualifications of the team is a major criterion in the evaluation of the proposal and consequently, the Consultant will be obliged to supply the personnel named in the proposal, and to ensure that they are available to the Study when they are needed. Substitution of team members is discouraged
and can only be accepted following submission of alternative CV’s and written approval by the Client.

The Project Team is expected to consist of the following principal members, supported by appropriate survey and technical design staff as appropriate. Suggested time inputs for Team members are indicative only. An individual may fill more than one position if suitably qualified and this is compatible with the overall work programme:

Project Director (4 months)

The Project Director shall have a minimum relevant experience of fifteen (15) years with a minimum specific experience of three (3) years as Project Director/Manager or equivalent for a major urban transport infrastructure project, preferably involving the implementation of BRT. He or she must have considerable project management experience in addition to specific hands-on experience in the planning and implementation of successful BRT systems. Educational requirements for the Project Director include a primary degree in engineering, architecture, urban planning or equivalent. Postgraduate qualification is desirable (at least Master’s Degree or equivalent) in transportation engineering, transportation planning, urban design or city planning.

Project Team Leader (15 months)

The project has two distinct but overlapping phases, feasibility and engineering design. The Team Leader will act under the Project Director giving direct hands-on guidance and input to the project. Whilst the team leader role could feasibly be undertaken by a single individual, consideration ought to be given to a split role with separate persons performing Team Leader duties for feasibility and engineering design. The Team Leader shall have a minimum relevant experience of fifteen (15) years with a minimum specific experience of three (3) years as Project Director/Manager or equivalent for a major urban transport infrastructure project, preferably involving the implementation of BRT. He or she must have considerable project management experience in addition to specific hands-on experience in the planning and implementation of successful BRT systems. Educational requirements for the Project Team Leader include a primary degree in engineering, architecture, urban planning or equivalent and Postgraduate qualification (at least Master’s Degree or equivalent) in transportation engineering, transportation planning, urban design or city planning.

Highway Engineer (5 months)

Bachelor degree in Civil Engineering with professional registration. Minimum experience should be twelve (12) years in road and highway design with a minimum specific experience of three (5) years as a Highway or Road Engineer on urban road Infrastructure projects.

Structural Engineer (5 months)

Bachelor degree in Civil Engineering with professional registration. Post Graduate qualification in Structural Engineering will be an advantage. Minimum experience should be twelve (12) years in structural design of transport infrastructure with a minimum specific experience of five (5) years as Design Engineer for major bridge and/or interchange structures in reinforced concrete.
Pavement Engineer (5 months)
Bachelor degree in Civil Engineering with professional registration. Post Graduate qualification will be an advantage. Minimum experience should be ten (10) years, with a minimum specific experience of five (5) years in pavement design. A track record in design of flexible, rigid and concrete block pavements will be favourably considered.

Materials / Geotechnical Engineer (5 months)
Bachelor degree in Civil Engineering with professional registration. Post Graduate qualification will be an advantage. Minimum experience should be ten (10) years, with a minimum specific experience of five (5) years in materials and geotechnical analysis. A track record in countries with similar geotechnical constraints will be favourably considered.

Hydrologist / Drainage Engineer (5 months)
Bachelor degree in Civil Engineering with professional registration. Post Graduate qualification will be an advantage. Minimum experience should be ten (10) years, with a minimum specific experience of five (5) years in hydrology and drainage design. A track record in design of effective and low maintenance road drainage systems will be favourably considered.

Transport Planning Specialist (6 months)
Bachelor degree in engineering, urban planning with professional registration with a post graduate degree desirable (at least Master degree or equivalent) in transportation planning or city and regional planning. Should have minimum experience of ten (10) years and minimum specific experience of five (5) years in Transportation Planning, including demand and supply modelling and analysis for urban transport systems. He or she must have specific hands on experience in planning and modelling for BRT.

Traffic Engineer (6 months)
Bachelor degree in civil engineering and post graduate degree in traffic or transportation engineering, or equivalent. An internationally recognised professional qualification in traffic engineering is desirable. Minimum experience of five (5) years which must have involved complex urban traffic engineering/traffic management. BRT experience is required.

Intelligent Transport Systems (ITS) Specialist (2 months)
Bachelor degree in civil engineering and post graduate degree in traffic or transportation engineering, or equivalent. An internationally recognised professional qualification in ITS is desirable. Minimum experience of twelve (12) years and minimum specific experience of five (5) years in complex urban traffic and bus management. Experience of BRT systems and in developing countries is an advantage.

Bus Operations Specialist (3 months)
Bachelor degree in engineering, planning, business, or a related field or an internationally recognised professional qualification in transportation. Minimum experience of twelve (12) years and minimum specific experience of five (5) years in urban bus system planning and
operations. Experience in bus operations in developing countries and the implementation and/or management of BRT an advantage.

Bus Regulatory Specialist (3 months)
Bachelor degree in engineering, planning, business, or a related field or an internationally recognised professional qualification in transportation. Minimum experience of twelve (12) years and minimum specific experience of five (5) years in urban bus system planning and regulation. Experience in bus regulation in developing countries and the implementation and/or management of BRT an advantage.

Bus Financing Specialist (3 months)
Bachelor degree in engineering, planning, business, or a related field or an internationally recognised professional qualification in transportation. Minimum experience of twelve (12) years and minimum specific experience of five (5) years in public/private partnerships and/or asset financing. Experience in bus financing in developing countries an advantage.

Architect (3 months)
Bachelor degree or professional qualification in architecture. Post Graduate studies in urban and/or regional planning or landscape architecture will be an advantage. Minimum post qualification experience should be ten (10) years with a minimum specific experience of five (5) years as architect/planner responsible for similar urban projects. Proven experience in urban or industrial design of similar project as well as familiarity with the region will be an added advantage.

Transport Economist/Financial Specialist (4 months)
Bachelor degree in transportation economics or business administration and professional certificate. Graduate studies (at least Master degree or equivalent) in economics or business administration. Minimum experience should be ten (10) years with a minimum specific experience of five (5) years as transport economist or financial specialist in infrastructure and urban transport projects, preferably in Sub Saharan Africa.

Legal Expert (1 month)
Bachelor degree in Law with diploma in legal practice. Extensive experience in legal drafting, governmental systems and institutional legal framework. Must be an advocate of the High Court in a commonwealth country or equivalent and familiar with Uganda legal practice.

Environmental Specialist
Bachelor degree in engineering (or equivalent) with graduate studies (at least Master degree or equivalent) in the environmental field. Minimum experience should be eight (8) years with a minimum specific experience of four (4) years as Environmental Specialist for infrastructure and urban transport studies. Must have direct experience in the preparation and implementation of environmental impact assessment in at least 3 projects consistent with acceptable international standards, such as the World Bank.
Social Impact Specialist

Bachelor degree in social sciences (or equivalent). Minimum experience should be eight (8) years with a minimum specific experience of four (4) years as Social Impact Specialist for infrastructure and urban transport studies. Must have direct experience in the preparation and implementation of social impact assessment and resettlement action plans in at least 3 projects consistent with acceptable international standards, such as the World Bank.

Communications Specialist

Bachelor degree in social sciences, marketing, journalism or media studies (or equivalent). Minimum experience should be eight (8) years with a minimum specific experience of four (4) years as Communications Specialist for major investment initiatives or product launches. Must have direct experience in the preparation and implementation of communication plans and product / service branding preferably in the transport industry.
Appendix B
Engineering Constraint Drawings
See Figure B1 for continued on City Centre

Streets, although buildings quite far back on carriageway edge

Markets areas on sides of carriageway

4 a.m. roundabout, 90° inscribed circle diameter

Telephone poles and street lighting on central left side

Poor quality road surface and drainage issues

Land rises steeply on eastern side

Level difference, land rises on eastern side

Land rises on western side

End of built-up area. Potential for term in side pot facilities

Title: Physical Constraints Plan
Route 1: Gayaza Road

Figure B1
Title:
Physical Constraints Plan
Route 3: Port Bell Road

Figure B3

Key:
- Green: 3 Lane Carriageway
- Yellow: 2 Lane Carriageway
- Red: Single Carriageway

1. Slope to two lanes on approach to signalised junction
2. Access to Nakawa University - busy during school time
3. Bridge over railway line. Would require new structure for widening
4. Level difference on both sides of carriageway
5. Port Bell Road - generally narrow single carriageway. No footway or median
6. Roadside activity
7. Roadside activity
8. Telegraph poles close to carriageway edge
9. See Figure B2 for continuation to City Centre
10. Footway provided bringing street's middle. Drainage problems on approach to underpass
11. Potentially wide enough for two lanes in each direction within existing carriageway
12. At grade railway crossing
13. Paving occurs to south of carriageway where kerbing is provided
14. Old Port Bell Road. Wide single carriageway road with no footway or median
Integrated transport planning

Corridor Width (m)

Gaba Road Highway Corridor Width Measurement

Title:
Physical Constraints Plan
Route 4: Gaba Road

Figure B4
Queen's Way One-way southbound road. Good potential for BRT running lane within existing carriageway

One-way northbound and over short section on approach to clock tower junction

Sign for retail activity, Telega pl pl pl pl pl and drainage channel in wide central median

Two lanes in each direction with kerbing and street lighting and a bng centre. On street parking on eastern side reduces southbound capacity

Five arm roundabout of 80m Inscribed circle diameter

Bridge over railway line. Widening would require new structure

Kebed right turn facility

Sign for road drop to west of carriageway. Protected by crash barrier. Kerbed median and bng centre with bng and street lighting

Kebed right turn facility

Sign for level differences, Verge rises to east, and drops to west. Crash barrier to western side of carriageway

Large drainage channels along western side

Small free a m roundabout. Road switches from single carriageway with no median to south to dual carriageway with kerbed median to north. Crash barrier to western side of carriageway

Verge rises on western side

Roadside activity

Crash barrier on eastern side, then verge falls away. Verge rises on western side beyond drainage channel

Level difference (verge rises on both sides)

Pedestrian over bridge

Title: Physical Constraints Plan Route 5: Entebbe Road

Figure 85
See Figure B9 for continuation into City Centre

1. Wide median with trees and telegraph poles in median
2. Right turning bays within median
3. Wide median continues with trees/telegraph poles/side lights
4. Land does away north of carriage way
5. Three a.m. under about 30 m inscribed circle diameter
6. D.s. image channels both sides
7. Limited potential for widening due to property boundaries
8. Busy commercial lanes
9. Priority controlled cross-roads. Would benefit from traffic signals

Kira Road Highway Corridor Width Measurement (indicative)

Title: Physical Constraints Plan
Route 9: Kira Road

Figure B9