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PUBLIC TRANSPORT SERVICE NETWORK:

INITIAL OPERATIONAL AND BUSINESS PLANS

Final Report

12 December 2016

Royal HaskoningDHV
Enhancing Society Together

STELLENBOSCH

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SYNOPSIS: The Initial Operational and Business Plan for the Stellenbosch Public Transport Service Network provides a framework for the implementation of a proposed pilot phase bus service within the Stellenbosch Municipality. This report comprises a high level operational and business plan including an estimate of the required operational cost and revenue associated with the proposed pilot phase.		
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QUALITY VERIFICATION: This report has been prepared under the controls established by a quality management system that meets the requirements of ISO 9001:2000.		

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EXECUTIVE SUMMARY

Introduction

The Initial Operational and Business Plan, as part of the Stellenbosch Public Transport Service Network (PTSN) has been prepared in accordance with the recommendations set out in the Stellenbosch Comprehensive Integrated Transport Plan 2015 – 2020 (CITP).

The current public transport system in Stellenbosch is provided by Minibus taxi services operating in most parts within Stellenbosch, of which a high number of routes serve common destinations following only slight variations of routes within corridors. The Minibus taxi operations also include unlicenced operators who compete with licenced operators.

Additional to this, Stellenbosch is served by a bus service which operates between Stellenbosch and Somerset West, tourist bus operators operated by private operators and a number of private operators transporting scholars between Stellenbosch, Somerset West, and the Cape Town northern suburbs. Furthermore, a MetroRail service operates between Stellenbosch, Paarl and Cape Town.

The proposed process for development of the Stellenbosch Public Transport Service Network is in compliance with the Department of Transport guidelines and requirements for funding from the Public Transport Network Grant.

Initial Operations Plan

The operational plan was based on the BRT Planning Guide of 2007, and considers the Cost, Design, Performance and Impacts that the proposed transport technology may have on the existing transport system.

The vehicle floor height was considered and "low entery" vehicles have been proposed to allow for boarding and alighting at kerb hight. This will also allow seemless integration between the proposed service in Stellenbosch and the existing MyCiti Bus operations in Cape Town. Furthermore, low entry vehicles can possibly be funded through the Department of Transports (DoT) Public Transport Network Grant (PTNG). The vehicle types considered are the Solo Bus (12m) with a capacity of 70 passengers and the Midi-Bus (9m) with a capacity of 45 passengers.

A Transport Demand Model (EMME4) was used to assist in informing the operational parameters of the proposed pilot system. The model was prepared for the Stellenbosch Municiaplity and has been adapted from the City of Cape Town Transport Demand Model which included areas such as Paarl, Stellenbosch and Somerset West. The model input pertaining to Stellenbosch was refined and the model output used to inform the Operations Plan and subsequent plans within this report. The model considered the current transport system and modelled the transport system in year 2032 which included modelling the proposed pilot routes.

Universal Access within the proposed transport systems is guided by the Stellenbosch CITP and the DoT Requirements for Universally Accessible Transport. The proposed transport system improvements will include universally accessible vehicles and infrastructure from the outset.

The operational characteristics include a 16 hour service, 20 "Optare" (9m) Midi-buses operating at 10 min intervals during the peak hour and 20 and 30 mins during the periods outside of the peak at a practical speed of 15km/h. Furthermore, it is proposed that the service have an integrated ticketing system, a smartcard fare collection and an integrated timetable which considers the other public transport operations.

Detailed Operations System

Two routes were chosen for the pilot phase of the PTSN. These two routes are between Cloetesville and James Town (Route 1) and between Khayamandi and Idas Valley (Route 7). The routes are considered to have two legs, the first leg terminates at the Bergzicht rank in Merriman Street and the second leg terminates at James Town (for Route 1) and Idas Valley (for Route 7).

The proposed system capacity is based on a 10 min frequency, a capacity of 45 passengers and a load factor of 80% during the peak hours, and either a 20 or 30 min frequency during off-peak periods at a 50% load factor. The number of vehicles required is based on the system capacity and will therefore require 9 and 11 vehicles for Route 1 and Route 7 respectively, which totals 20.

Infrastructure Requirements

Route infrastructure comprises of a number of facilities required to allow efficiency within the transport system. Infrastructure improvements may include; embayments, ticketing facilities, changing signalling etc. However, the detail thereof is not discussed in the report.

Business and Institutional Plan

The proposed business structure includes the management and operating of the transport system through various entities to allow for optimal responsibility. These entities would act as a public transport service agent, vehicle operating contracror, fare system contractor and control system contractor.

The Stellenbosch Municipality will ensure effective control of the management of bus operations through an appropriate mechanism, considered in terms of the section 78 of the Municipal Systems Act. In terms of the Stellenbosch CITP the planning authority will continue to manage the strategic planning, network planning, marketing and administration and financial control of the public transport system.

Furthermore, the potential for Industry Transition and an outline of Operator contracts are summarised.

The PTSN implementation will follow a phased approach as cost, the availability of resources and capacity are usually constraining factors. The implementation of the pilot phase is proposed to take place over a 4 year period from 2016/17 to 2019/20. This includes preparing a detailed operational and Business Plan and concluding in the establishment of a Management Entity, Industry Transition and construction of required Infrastructure.

The financial implications of rolling out the Stellenbosch PTSN are two fold, firstly those costs associated with the operations of the proposed service and those associated with the capital cost. An operating cost of R28 per km was used along with an estimated cost of the vehicles at R2.9m per vehicle. A zonal based fare was used and the revenue, depending on the zone, was either R5 or R7 per trip per passenger. Additionally, a sensitivity analysis of the revenue income was conducted to determine the change in the deficit/ surplus through a change in the passenger demand.

The scenario likely to realise in Stellenbosch is a hybrid public transport system whereby the proposed midi-bus and taxi operators serve the same corridors within Stellenbosch.

The total estimated cost of implementing the proposed pilot system is approximately R151 million over the 4 year period and includes the cost of infrastructure. It is anticipated that the funding required for the implementation of the Stellenbosch PTSN pilot phase will be funded through the National DoT PTNG.

Conclusion

The Stellenbosch PTSN Initial Operational and Business Plan sets out the framework for the provision of an integrated public transport system for the Stellenbosch Municipality.The proposed plan has been built on the prinicples as set out in the Stellenbosch CITP, BRT Planning guidelines and PTNG guidelines in order to submit an application to NDoT for funding the implementation of the proposed pilot system.

In order to ensure continuity of the PTSN it is required that consultation with the various stakeholders take place, that a more detailed operational and business plan be prepared and that council approval take place before submission of an application to DoT for PTNG funding.

Recommendations:

The overall recommendations of this report are that:

a) The Stellenbosch Municipal Council takes note of the outcome and conclusions of the proposals for the introduction of a Public Transport Service Network in Stellenbosch, in particular the institutional and financial implications.

b) The proposal for the introduction of a Public Transport Service Network in Stellenbosch be supported, in principle, subject to:-

c) The support of the Western Cape Government and the National Department of Transport being obtained for the proposals and for the future submission of an application for grant funding from the national Public Transport Network Grant.

d) The preparation of further detailed institutional, business and operational plans to affirm cost and revenue estimates and the sources and availability of funding.

Abbreviations

AFC	Automated Fare Collection
BRT	Bus Rapid Transit
CBD	Central Business District
CCTV	Closed-circuit Television
CITP	Comprehensive Integrated Transport Plan
COCT	City of Cape Town
DoT	Department of Transport
DTPW	Department of Transport and Public Works
DWA	Department of Water Affairs
EMME/4	Computer modelling software brand name
GABS	Golden Arrow Bus Service
GIS	Geographic Information System
GPS	Environmental Science. the quality of not being harmful to the environment or depleting natural resources, and thereby supporting long-term ecological balance:
Integrated	Combining or coordinating separate elements so as to provide a harmonious, interrelated whole
IPTN	Integrated Public Transport Network
IPTOC	Integrated Public Transport Operations Centre
IRT	Integrated Rapid Transit
ITS	Intelligent Transport System
MBT	Minibus Taxi
Modal Split	A modal share (also called mode split, mode-share, or modal split) is the percentage of travellers using a particular type of transportation or number of trips using said type.
MTEF	Medium Tern Expenditure Framework
NLTA	National Land Transport Act No 5 of 2009
NMT	Non-Motorised Transport
PPTIF	Provincial Public Transport Institutional Framework
PTI	Public Transport Interchange
PTNG	Public Transport Network Grant
PTSN	Public Transport Service Network
SDF	Spatial Development Framework
Sustainability	The ability to be sustained, supported, upheld, or confirmed. The quality of not being harmful to the environment or depleting natural resources, and thereby supporting long-term ecological balance
TCT	Transport for Cape Town
UDAP	Universal Design Access Plans
VOC	Vehicle Operating Cost

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1. INTRODUCTION

1.1 Purpose

The Stellenbosch Public Transport Service Network (PTSN) report has been prepared in accordance with the recommendations for the introduction of an integrated public transport network contained in the Stellenbosch Comprehensive Integrated Transport Plan (CITP) 2016 – 2020. The CITP was approved by the Stellenbosch Council and was submitted to the MEC Transport and Public Works.

The CITP proposes that the existing, un-coordinated, bus and minibus-taxi public transport services operating in the Stellenbosch municipal area be transformed into a quality public transport service network based on a reformed business model, including adherence to all standards and requirements set out in the National Land Transport Act (NLTA) and other applicable legislation, as well as the requirement to upgrade existing services to be fully universally accessible over a reasonable period of time.

As stated in the Stellenbosch CITP, the guiding principles for the proposed public transport system are as follows:

- The public transport system will be planned and developed in compliance with the “Guidelines and Requirements: Public Transport Network Grant: 2016/2017, for Business Plan preparation underpinning Budget Proposals for MTEF 2017/18 to 2019/20” of the Department of Transport dated 21 April 2016, with the intention of the Stellenbosch Municipality submitting an application to secure grant funding.
- The public transport system will be planned and developed in consideration of and parallel to the transformation, empowerment and upliftment of the local Stellenbosch public transport operators.
- The objective of the public transport system will be to improve public transport service levels and the quality of life of the residents in the Stellenbosch Municipal area.
- The public transport system will be developed in phases with the ultimate goal of the introduction of an Integrated Public Transport Network in accordance with National Transport Policy and the NLTA.
- The public transport system will be planned with the objective of achieving financial sustainability.

This report comprises the preliminary planning phase in respect of the following:

- The initial Operational Plan for the first (pilot) phase of the PTSN
- The initial Business Plan for the first (pilot) phase of the PTSN

1.2 Background and Context

The Stellenbosch Municipality is a part of the Cape Town functional region and is largely semi-rural in nature with higher development densities located in the towns; Stellenbosch, Franschhoek, Klapmuts and Pniel. Urban growth is concentrated in Stellenbosch with several new housing estates being developed, an influx of business and gradual expansion of tertiary academic facilities. As a result, traffic volumes have increased rapidly and there is high car ownership within the higher income sector. Commuter traffic within and through Stellenbosch has increased to the extent that there is traffic congestion at the main intersections and a general shortage of parking in the CBD.

Public transport in Stellenbosch is currently provided by:

- Minibus taxi services to all areas within Stellenbosch, with links to the smaller surrounding settlements. The minibus taxi public transport services are characterised by a multitude of closely spaced routes serving common destinations and a high incidence of unlicensed, informal services acting in competition with licensed operators.
- A limited bus service between Stellenbosch and Somerset West
- Special tourist bus services provided by private operators.
- A number of private operators transporting scholars between Somerset West and Stellenbosch and between the Cape Town northern suburbs and Stellenbosch.
- A passenger rail service operating between Stellenbosch, Paarl and Cape Town.

Further information on the existing public transport system can be found in Chapter 3 of the Stellenbosch CITP.

1.3 Policy and Legislation

The National Land Transport Act (No. 5 of 2009) (NLTA), Section 11, assigns responsibilities to the three spheres of government. While national and provincial government are responsible for transport policy and strategy, the municipal sphere is responsible for developing local policy and strategy within its area; based on national and provincial guidelines. Specifically the municipal sphere is responsible for the preparation of an Integrated Transport Plan and the implementation thereof including the planning, implementation and management of a modally integrated public transport network and travel corridors.

Chapter 5 of the NLTA requires that municipalities, as planning authorities, must integrate existing public transport services into the larger public transport system in terms of the Integrated Transport Plan. This can take place through negotiated contracts, subsidised contracts and commercial contracts. Initially negotiations can take place with existing local public transport operators, however other external role-players could be included if this is found to be advantageous. Section 6 of the NLTA requires that existing services be rationalised in this process to achieve a safe, reliable and cost effective public transport system.

While the requirements of national and provincial transport policy are well documented, the implications for municipalities (as Planning Authorities) of undertaking the new functions of planning and implementing such a transport system should be carefully considered. Amongst the more challenging aspects are the following:

- Financial implications for municipalities of planning, implementing and maintaining the public transport system: While government subsidies are currently available, the long term financial implications are not certain and municipalities may be required to meet part of the on-going operational and maintenance costs as well as other aspects such as security, marketing, cleansing etc.
- Consultations and negotiations with role-players and the public transport industry: Government has stated that there will be no loss of legitimate jobs or profits when implementing a new public transport system. Existing operators must be empowered to participate in the process of negotiated contracts and must be compensated fairly where appropriate. This process necessitates intensive research and negotiations.
- Municipal capacity: In order to manage, monitor and administer the public transport system, the Municipality must undertake new functions internally or must outsource the functions to an external entity. This requires a "Section 78" investigation in terms of the Municipal Systems Act to determine the most appropriate mechanism for undertaking the new functions.
- Procurement: The Municipality requires a clear procurement strategy for operating contracts, professional services, design and construction of infrastructure, ticketing system, purchase of vehicles, safety and security amongst many other services. Unless this process is dealt with effectively, severe delays to the project could be experienced.

1.4 Strategic Approach

The strategic approach to the planning, design and operation of the Stellenbosch public transport system must be guided by the goals and objectives of the Stellenbosch Municipality and the CITP. The goals and objectives of the CITP (Chapter 2) provide guidance in this respect. The following key aspects must receive consideration.

1.4.1 Sustainable system

The following aspects are characteristic of a sustainable transport system and must guide the implementation process:

- Accessibility and quality of service
- Multi-modal approach
- Integration of operations

- Correct harmful trends
- Manage mobility demand of car users
- Incorporates “full” costs, including environmental impacts
- Integrated planning of landuse and transport

1.4.2 Integrated system

The public transport system must be truly integrated to provide transport that allows optimal movement between modes, origins and destinations in terms of:

- Inter-connectivity between transport routes and modes including rail, private car and non-motorised transport
- Co-ordinated timetables and schedules that allow transfers between routes and modes with a minimum waiting time
- Minimum number or transfers between routes and services to reach a particular destination
- Minimum number of fare transactions between transfers
- Interconnected information systems
- Infrastructure that facilitates smooth transfers between modes and services and provides the appropriate facilities.

1.4.3 Equitable system

The system should strive to avoid destructive competition between modes and provided for fair participation of all in terms of:

- Accessibility for the disabled and pedestrians
- Meet the basic needs of all for transport
- Promote social integration

1.4.4 Cost effective system

The system should strive to be cost effective and efficient in terms of:

- Optimum use of financial resources
- Minimal duplication of services
- Affordable fares

1.5 Framework for a Public Transport Service Network

The framework for the development of public transport in Stellenbosch takes the above factors into consideration as well as the need for intensive consultation with affected role-players (specifically the existing public transport operators), the requirements of the Department of Transport and the recent initiatives of the Western Cape Government to assist Local Municipalities through the Provincial Public Transport Institutional Framework (PPTIF).

The proposed process for the development of the PTSN is in compliance with the Department of Transport guidelines and requirements for funding from the PTN Grant as well as a parallel process with a strong focus on the transformation of the existing public transport industry. The following are the key tasks and inputs to the planning process:

- Approval by the Stellenbosch Municipality of the initial system concept and principles as set out in the CITP
- Preparation of demand forecasts, a proposed route network and operational parameters
- Development of an initial Operations and Business Plan for submission to the Department of Transport for approval
- Stakeholder consultation
- The submission of an application to the DOT for funding through the Public Transport Network Grant (PTNG).

The consultation phase will include the establishment of a consultative forum or steering committee. Town Councillors should be delegated to participate in this process in order to provide political support and guidance.

Other important role-players that must be included in the consultation and planning process are educational institutions. The University of Stellenbosch has an important role to play as it is a high trip generator and it has already proposed a public transport system to serve students and staff.

1.5.1 Requirements of the Department of Transport

In the “Guidelines and Requirements: Public Transport Network Grant: 2016/2017, for Business Plan preparation underpinning Budget Proposals for MTEF 2017/18 to 2019/20”, the Department of Transport sets out the various project types that qualify for funding from the national Public Transport Network Grant. These include, not only Bus Rapid Transit systems with dedicated priority infrastructure more appropriate for large cities, but includes support for conventional bus and minibus services (a quality Public Transport Service Network) in smaller cities and towns provided that certain requirements, such as the transformation of the existing business and operational model, compliance with universal accessibility and operational improvements are introduced.

In the case of the Stellenbosch Municipality, neither the resources nor the space in the historical part of the town of Stellenbosch are available for consideration of a “full” BRT system. It is thus proposed that the latter option be pursued and that a Public Transport Service Network (PTSN) be planned and implemented in stages with the focus on transformation of the existing bus and minibus system, the implementation of an initial pilot phase and an overall phased approach.

1.5.2 Provincial Public Transport Institutional Framework (PPTIF)

During the process of the preparation of the CITP, the Municipality was informed of the initiative of the Western Cape Government to develop a Provincial Public Transport Institutional Framework (PPTIF) with the primary aim of addressing the key constraints to improving both public and non-motorised transport in the non-metropolitan areas of the Western Cape and to incorporate lessons learnt through the implementation of public transport improvement initiatives in South Africa, particularly in George and Cape Town by developing a flexible and context specific approach to public and non-motorised transport improvement, the development of enhanced institutional and organisational models and the development of a cost model and funding strategy.

It was indicated that the Stellenbosch Municipality has been identified as one of the priority areas to benefit from this programme over the next five years.

1.5.3 Process for the Development of the Public Transport Service Network

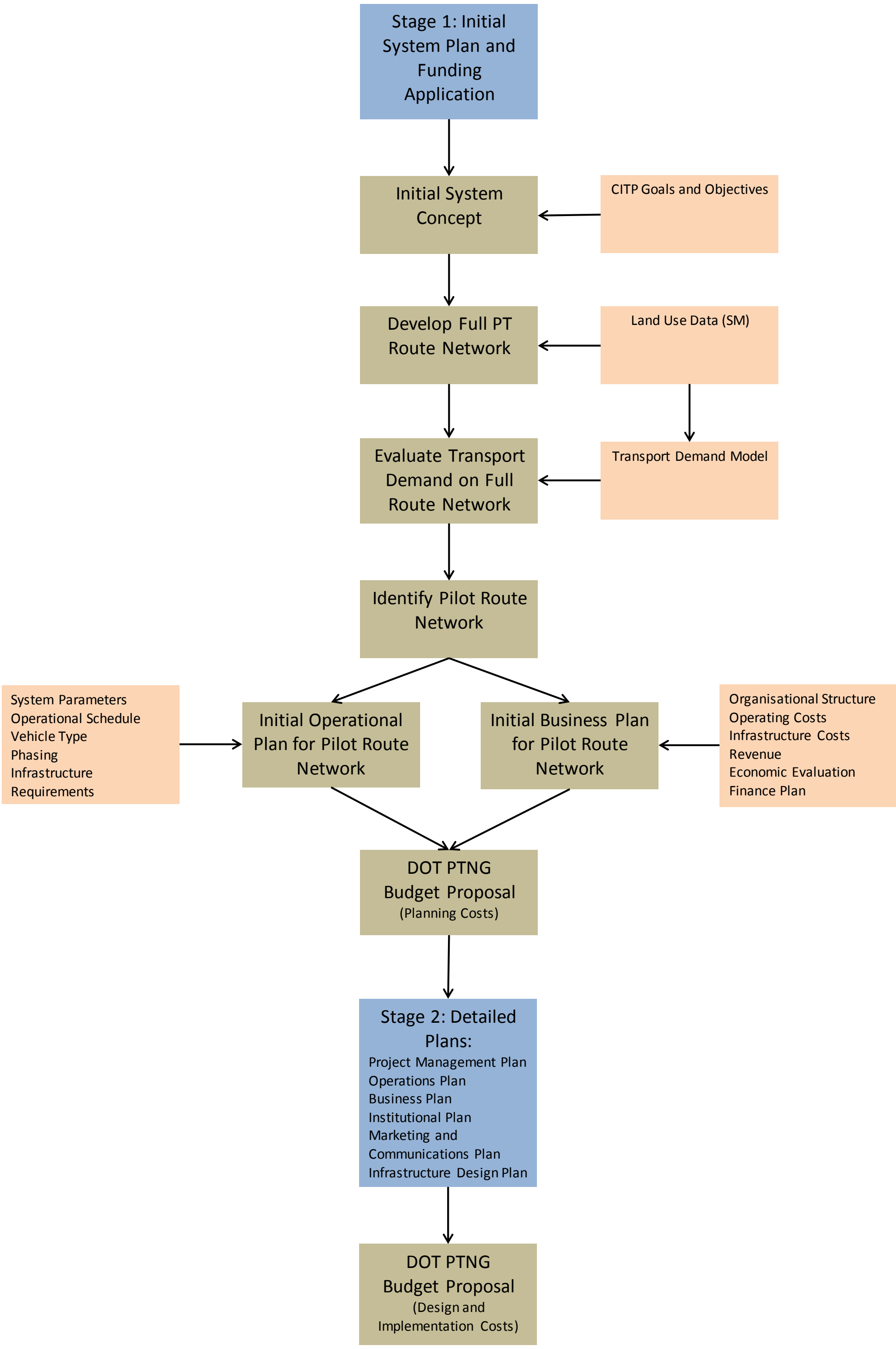
The proposed process for the development of the PTSN is in compliance with the Department of Transport guidelines and requirements for funding from the PTN Grant. The planning process has been divided into two phases in line with the current available resources as follows:

Phase 1: Development of the initial system concept, full route network, demand modelling, identification of a pilot phase route network, preparation of initial Operations and Business Plans in respect of the pilot routes.

Phase 2: Detailed planning and design including preparation of a Project Management Plan, full Operational and Business Plans, Institutional Plan, Marketing and Communications Plan, Infrastructure Design Plan and Budget Proposal.

The process is indicated in Figure 1-1.

Figure 1-1: PTSN Planning Process



2. INITIAL OPERATIONS PLAN

2.1 Transport Technologies and Modes Evaluated

The BRT Planning Guide, 2007 provides the following factors that should be considered when choosing a particular type of public transport technology:

- Cost: Capital cost of infrastructure and property acquisition, operating costs, planning costs
- Planning and management: Planning and implementation time, management and administration costs (e.g. monitoring of operations and contracts)
- Design: Scalability, flexibility, diversity vs. homogeneity
- Performance: Capacity, travel time / speed, service frequency, reliability, comfort, safety, customer service, image and perception
- Impacts: Economic, social, environmental and urban impacts

A Public Transport Service Network should be designed taking local circumstances and resources into consideration. While the implementation of a Bus Rapid Transit system with dedicated public transport lanes and larger vehicles has the benefit of providing a fast and reliable service, it is extremely costly and occupies a large amount of existing road space which is not always available in Stellenbosch, especially in the town centre.

In the Stellenbosch urban area, it is proposed that the public transport system consist of a quality bus system operating in mixed traffic with selective improvements at intersections to give priority to public transport and in so doing reduce travel times. This alternative will have the least capital cost and impact on the built environment.

2.1.1 Vehicle Floor Height

One of the primary purposes of a rapid bus system, in terms of its performance, is to reduce the time for passengers to board and alight from the vehicles. A prerequisite, to achieve this, is to provide for level boarding at bus stops and modal interchanges, where the bus floor height matches the platform height. The advantage of this is that passengers can board the bus quickly without having to negotiate any steps. A further advantage is that universal access is provided for passengers with mobility challenges.

The two scenarios for level boarding are high-floor buses with pedestrian ramps to closed stations (approximately 900mm floor height) and low-entry (approximately 300mm floor height) vehicles. The current trend internationally is to specify low-entry buses as these buses allow for flexibility of operation on routes where there are no dedicated bus lanes and the buses can load at low platforms on the side of the road.

The term “low-entry” is specifically used to indicate that boarding / alighting from the vehicle is at kerb height, but allows for the design possibility that a portion of the interior floor of the bus may be raised (with an internal ramp or step up) to achieve additional seating over the engine, wheel arches and fuel tank, compared to an entirely low-floor bus in which the engine, wheel arches and fuel tank protrude above the bus floor.

The Department of Transport has specified that all new vehicles to be procured through the PTN Grant must be of the low entry type.

2.1.2 Type of Vehicle and Capacity

Two categories of low-entry vehicles are considered for use in Stellenbosch, based on the maximum practical loadings that have been observed on these types of vehicles, as reported in the BRT Planning Guide (2007) and from experience gained in public transport operations in other cities. The sizes and maximum practical capacities for each of the two categories of low entry vehicles are indicated in Table 2-1. The length of the different types of vehicles has been rounded to the nearest metre, although in practice each manufacturer's vehicle may be slightly more or less than this length.

It must be emphasised that these vehicle practical capacities are approximately 15% lower than the legal capacities specified by vehicle manufacturers, because although manufacturers are allowed to assume a standing density of 4.5 persons per square metre of aisle space when they specify vehicle capacity, in practice this standing density has seldom been achieved on bus systems in South Africa as people seem to not want to stand so close together and would rather wait for the next bus.

Table 2-1: Bus Vehicle Passenger Capacity

Vehicle Type	Length (Metres)	Practical Capacity	
Solo Bus	12	70	
Midi-Bus	9	45	

2.2 Transport Demand Model

The planning of a sustainable Public Transport System for the Stellenbosch Municipality requires a comprehensive analysis of the current and future demand for public transport based on development trends and transport patterns. In 2008 a transport model was developed for Stellenbosch based an extensive data collection exercise including a household interview survey. The City of Cape Town's EMME/3 transport model was used as the base which would also allow for the testing of transport scenarios beyond the municipal border of Stellenbosch.

The data collection for the model included traffic counts at more than 30 key intersections as well as permanent Provincial counting stations and household interview surveys collected in 2009. The primary source of spatial planning data was the 2003 draft Spatial Development Framework for Stellenbosch.

At the time, only a 2009 morning peak model was prepared and long term future land use scenarios were not tested due to the fact that the SDF was only in draft form. There was also certain data (employment statistics) that were not surveyed. Subsequently the SDF was approved by Council in 2012 and is again being revised.

The final 2010 report on the Stellenbosch transport modelling recommended that additional information be obtained to improve the transport model and that long term scenarios be tested using the latest land use information. The report recommended that:

- Additional surveys be conducted to include farming activities
- Information be collected from schools to develop a school trip model
- The latest traffic counts be included
- The Stellenbosch land use GIS be updated with more accurate residential information
- A detailed employment survey be undertaken

The 2009 model outputs have been used to test public transport service parameters (frequencies and vehicle type) for the Stellenbosch system (refer to section 2.3.2). However the updating of the model, including extensive surveys as proposed above is beyond the scope of the current study. The Stellenbosch transport demand model has been adapted from the City of Cape Town EMME/3 transport model in terms of the land use projections received from the Stellenbosch Municipality and was used to determine the future passenger demand on pilot routes proposed for implementation in the Stellenbosch Municipal area .

A separate report has been prepared which unpacks the Transport Demand Model application for the Stellenbosch PTSN.

2.3 Network Route Plan (Full System)

2.3.1 Spatial Development Framework

Chapter 4 of the CITP contains a summary of the Spatial Development Framework approved by the Stellenbosch Municipality Council in 2012. The approach that was adopted was to focus high density development at nodes located at strategic intersections of road and rail networks, or to intensify the development of existing nodes. The settlement nodes connected by road and rail networks are shown in Figure 2 of the SDF and are indicated in Figure 2-1.

Figure 2-1: Stellenbosch Settlement Nodes Connected by Road and Rail Networks

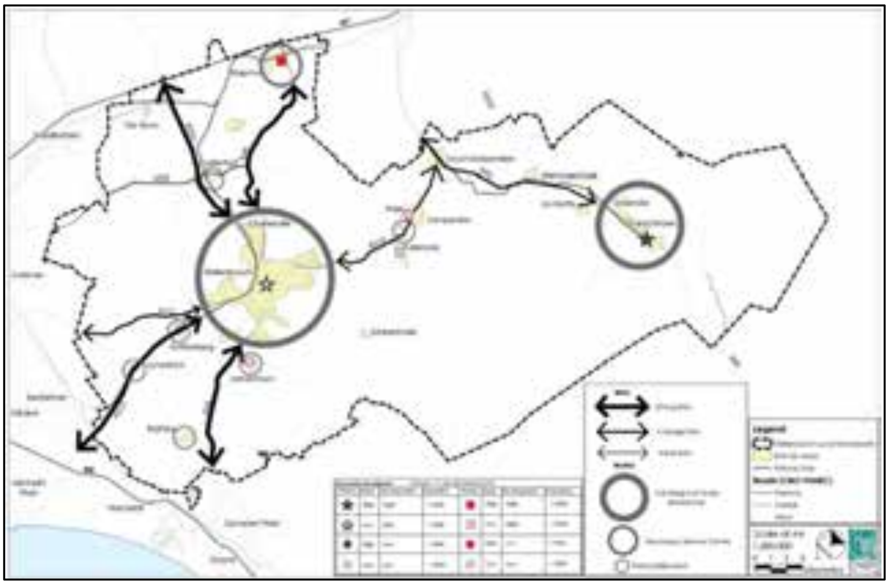


Figure 2-1 indicates the corridors with strong, medium and weak links as well as the sub-regional nodes (Stellenbosch and Franschhoek) and secondary service centres (Klapmuts) which are a high priority for development.

The public transport system should focus on the strong corridors but maintain accessibility on the less important corridors. This may mean that corridors where the travel demand is high will require larger vehicles operating at a high frequency to meet the demand.

The areas further away from the main corridors are mainly rural in nature and cannot be economically served by scheduled public transport services. Longer walking distances from surrounding areas to the public transport routes will therefore have to be accepted or local informal transport will have to be used to gain access to the nearest scheduled public transport route.

2.3.2 Routes within the Stellenbosch Town

The planning of an integrated route network for Stellenbosch was carried out during the preparation of the Stellenbosch Municipality CITP in 2015. The Stellenbosch route network requires a centrally located Terminal to act as the hub of a typical “hub-and-spoke” route network. This Terminal will act as a major transfer point between routes and services. All routes should therefore pass through the Terminal which will provide for transfers to any destination on the network.

At present, the road based public transport operates primarily from the Bergzight Terminal in Stellenbosch. Although centrally located, this may not be the ideal location to service the Stellenbosch University as an end destination. Alternatively, the scheduling of services can be adapted to serve the University without the need for an additional transfer. It should also be noted that the Adam Tas Corridor (R44) is to be planned as a "Transit Oriented Development" corridor. This corridor is aligned along the main commuter railway line in Stellenbosch. In future, a major transport terminal could be located in the corridor. This would necessitate the adjustment of the PTSN route network.

A typical Public Transport Network comprises the following hierarchy of routes:

- Trunk Routes – High capacity routes operated mainly on dedicated lanes of dual carriageways with centrally located closed bus stations and utilising articulated or solo buses with right hand side doors.
- Express Routes – High capacity routes with limited stops operated mainly on the major road system, including freeways, with solo buses with left hand side doors and right hand side doors to facilitate kerb-side loading of passengers as well as loading at centrally located closed bus stations.
- Main Routes – Medium to high capacity routes with frequent stops operated on the major road network utilising solo buses with left hand side doors and right hand side doors to facilitate kerb-side loading of passengers and loading at centrally located closed bus stations where possible.
- Area (or local) routes – Low capacity "feeder" routes operated mainly on residential roads with frequent stops utilising midi-buses with left hand side doors to facilitate kerb-side loading of passengers.

The decision as to which route type or classification should be considered in the case of Stellenbosch is based on the likely corridor capacity that will be required during the peak hour. The BRT Planning Guide, 2007 (p. 251) states that the corridor capacity is calculated as the product of vehicle capacity, load factor, frequency and the number of stopping bays per route, which results in capacity being stated as the flow of passengers per peak hour per direction (pphpd).

Table 2-2 shows the corridor capacity that can be achieved for different sizes of low entry buses, assuming an operating frequency of 40 articulated buses per hour on trunk routes with closed stations (which is a headway of 90 seconds) and 20 buses per hour (3 minute headway) for solo and midi-buses with on-board fare collection through a single door with one stopping bay at each station along a route, a load factor of 1.0 and a practical vehicle capacity (which is 85% of the legal capacity). For two stopping bays per station on the route this capacity will be doubled and with three stopping bays per station it will be trebled.

Table 2-2: Corridor Capacity

Vehicle Type	Vehicle Length (Metres)	Practical Vehicle Capacity (85% of Legal Capacity)	Frequency (Veh/hr.)	Headway (Seconds)	Corridor Capacity (pphpd)
Articulated Bus	18	100	40	90	4 000
Solo Bus	12	70	20	180	1 400
Midi-Bus	9	45	20	180	900

Where the passenger demand on a route exceeds 4 000 passengers per hour, express services should be introduced which only stop at the main stations along a route.

Taking into consideration the severe traffic congestion being experienced in central Stellenbosch, it may be necessary to improve the capacity of intersections and other traffic bottlenecks by providing additional dedicated turning or queue bypass lanes and special signal phasing for public transport vehicles. This will reduce journey times and improve the quality of service.

The following criteria were applied in the route identification and selection process:

- The routes recommended in the 2011 CITP and the transport modeling results
- Public transport stops should generally be within a 400m walking distance from the community they serve
- Routes should be planned to provide a better or equal service to the local communities when compared to the current taxi services in these areas
- Natural features e.g. steep slopes, watercourses, undeveloped (bushy areas) that make walking to a route difficult must be taken into consideration
- The classification and quality of the road network (e.g. residential roads vs. collector or arterial roads)
- Routes should be seelcted so as not to concentrate trips on a particular route so as to create very low headways between vehicles, particularly in residential areas
- Adjacent land uses and types of development

Figure 2-2 indicates the proposed ultimate public transport route network in the Stellenbosch urban area. The proposed routes provide linkages from the suburbs to the central Terminal as discussed above.

It is proposed that the routes be classified as Main Routes operating in mixed traffic except at critical pinch points on the network where additional lanes can be provided e.g. at intersections. The PTSN main routes indicated in Table 2-3 are proposed.

Table 2-3: Proposed Main Route Destinations and Lengths

Route Number	Destination	Length (km)
1	Kayamandi (west) to Idas Valley	8.88
2	Kayamandi (east)	3.45
3	Idas Valley (south)	4.24
4	Devon Valley / Unie Park	3.65
5	Onder Papegaaiberg / Unie Park	6.97
6	Paradyskloof	4.80
7	Jamestown / Cloetesville (west)	11.3
8	Techno Park	6.1
9	Brandwacht	3.99
10	Cloetesville (east)	4.55
11	Die Boord	4.43

Figure 2-3 indicates the 400m walking radius from the planned stops on the route network. The figure illustrates that the majority of the service area is well covered and that only small pockets have a longer walking distance than 400m. A larger coverage area of 500m radius has been allowed from the Bergzight Terminal since it is unlikely that passengers would be willing to pay a fare to only travel 500m.

2.3.3 Long Distance (Regional) Routes

Figure 2-4 indicates the proposed long distance (or regional) route network for the Stellenbosch Municipality. The proposed routes take into account the linkages and development nodes proposed in the SDF as well as the main tourist routes.

The regional routes indicated in Table 2-4 are proposed:

Table 2-4: Proposed Long Distance (Regional Routes)

Route Number	Destination	Length (km)
1	Stellenbosch – Cape Town Airport	29.3km
2	Stellenbosch – Bellville	26.4km
3	Stellenbosch – Paarl (1)	34.9km
4	Stellenbosch – Somerset West	19.8km
5	Stellenbosch – Eersterivier	19.0km
6	Stellenbosch – Paarl (2)	31.3km
7	Stellenbosch – Franschhoek	30.9km
8	Franschhoek - Paarl	33.1km

In addition to the above regional routes, minor routes and feeder routes can be provided by unscheduled minibus services as is currently the case.

The regional routes provide accessibility to all parts of the Stellenbosch Municipal Area with linkages to Somerset West, Paarl and to Cape Town with minimum transfers by using proposed interchange points with the proposed MyCiTi network. The linkage points with the proposed MyCiTi system are shown on Figure 2-4.

2.3.4 Passenger Rail Routes

The passenger rail network within the Stellenbosch Municipal area provides linkages between Stellenbosch and Paarl, Somerset West and Bellville.

There are seven railway stations which fall within the Stellenbosch Municipal area; namely:

- Klapmuts
- Muldersvlei
- Koelenhof
- Du Toit
- Stellenbosch
- Vlottenburg
- Lynedoch

The planning of an integrated public transport network has been carried out to provide linkages between the bus routes and rail stations. The location of the rail stations within the Stellenbosch town is indicated on Figure 2-2. The regional rail network is indicated on Figure 2-4.

Figure 2-2: Proposed Stellenbosch Route Network

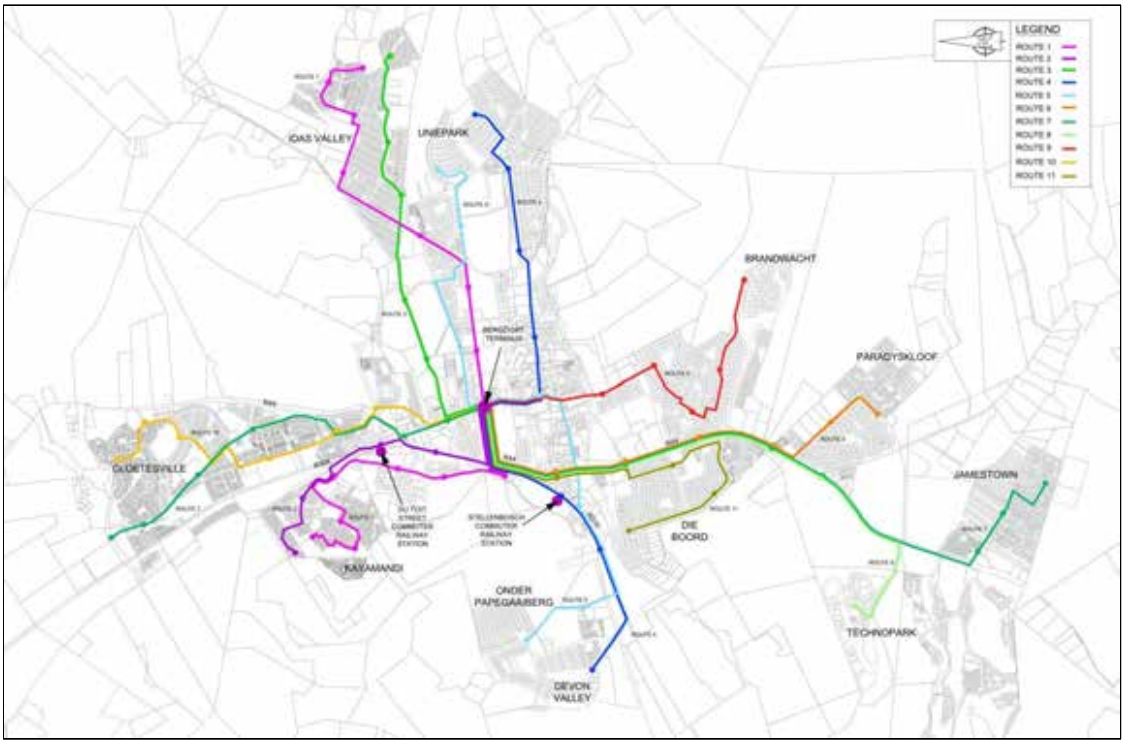


Figure 2-3: Proposed Stellenbosch Route Network with Service Coverage

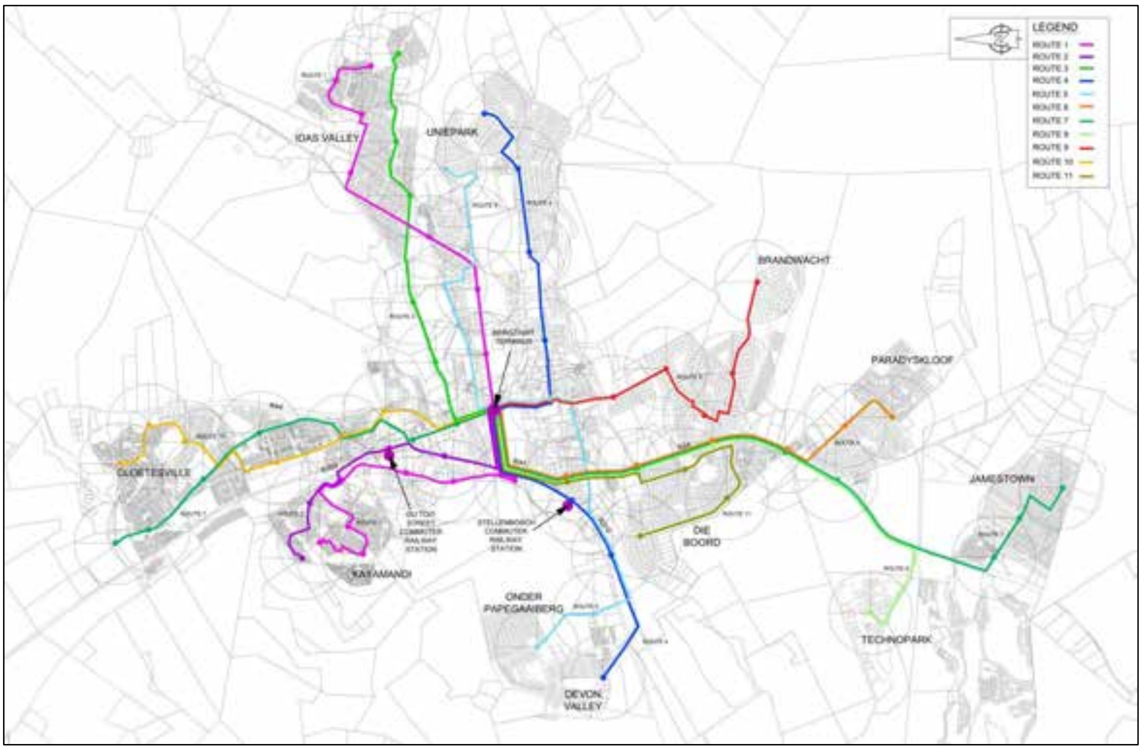
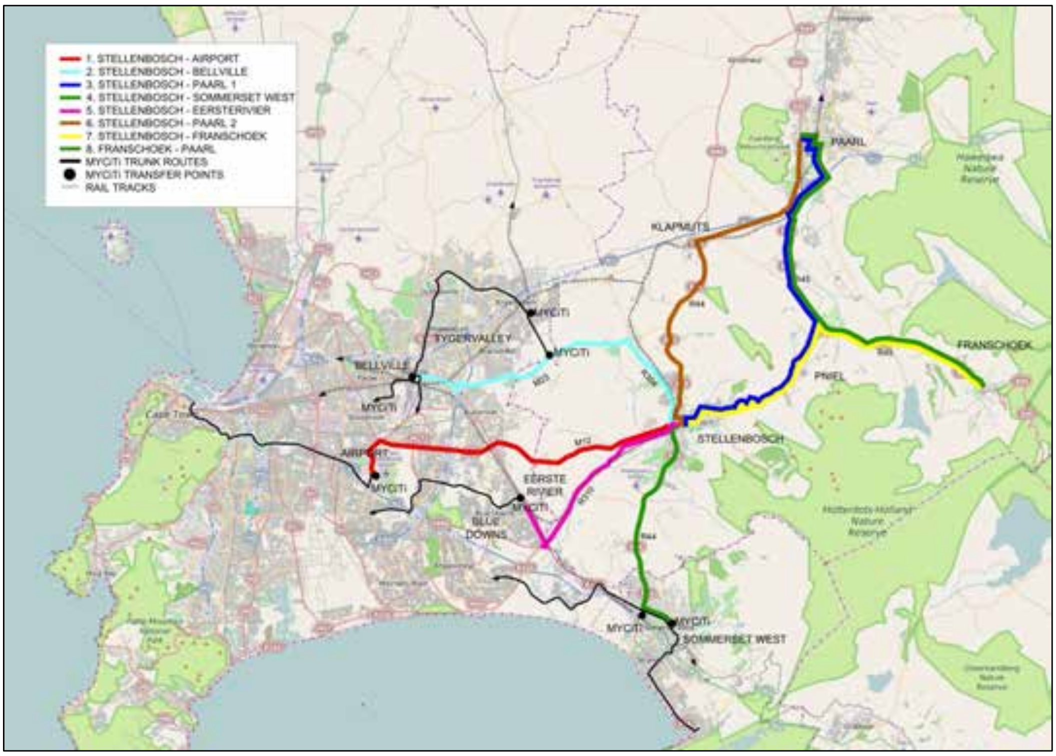


Figure 2-4: Proposed Stellenbosch Long Distance Route Network



2.3.5 Integration of Rail, Bus and NMT

Integration of modes and services should take place at key points in the proposed public transport system. These are the following:

- Central Bus Terminal: Provision should be made at the Terminal for facilities to accommodate the following services:
  - Solo bus – Stellenbosch peak services
  - Standard buses – Existing bus services between Stellenbosch, Somerset West and the Northern Suburbs
  - Midi-buses – Stellenbosch peak and off-peak services
  - Mini-bus – existing services to other towns
- Stellenbosch and Du Toit Railway Stations: Facilities for Solo / Midi-bus services operating on public transport routes i.e. stops, signage shelters
- Interchange points between routes: Platforms, shelters, signage, toilets.
- Stops: Shelters, signage, approach sidewalks.
- NMT facilities to /from Bus Terminals and Railway Stations.

2.3.6 Route Descriptions for all Categories of Routes

The route descriptions for the short distance routes indicated in Figure 2-2 are listed in Table 2-5.

Table 2-5: Short Distance Public Transport Route Descriptions

Route Number	Route Description	Route Distance
1	Begin at the intersection of Lindida Road and Van Dyk Road, proceed Northward on Lindida Road which then becomes Hector Road. Continue on Hector Road to the intersection of Hector Road and Adendorff Road, take a right onto Adendorff Road until Bloekom Ave and Adendorff Road intersection. Proceed Westward on Bloekom Ave until the road ends at Lelie Street and Bloekom Ave intersection. Turn left at the intersection onto Lelie Street and an immediate left onto Rustenberg Road. Proceed on Rustenburg Road crossing Helshoogte Road, Rustenberg Road becomes Cluver Road, proceed on Cluver Road until the large traffic circle. At the traffic circle exit onto Merriman Ave, proceed on Merriman Ave until Bergzight Terminal. From Bergzight Terminal proceed Westwards on Merriman Ave until the intersection of Merriman Ave and Adam Tas Road. Proceed Southward on Adam Tas Road then turn into George Blake Road, proceed on George Blake Road then proceed straight onto Rand Road. Proceed Northward on Rand Road which becomes Masitandane Road. At Masitandane Road and Bassil Road intersection, proceed on Bassil Road.	8.8km
2	At Bergzight Terminal proceed Westwards on Merriman Ave until Merriman Ave and Adam Tas Road. Proceed Northward on Adam Tas Road until the Adam Tas Road and Bird Street intersection. Proceed Northward on Bird Street until the Bird Street and Masitandane Road intersection. Proceed on Masitandane Road and continue northward on Masitandane Road after the small traffic circle. At the Masitandane Road and Makupula Road intersection, proceed Northward on Makupula Road.	3.45km

Route Number	Route Description	Route Distance
3	At Bergzight Terminal proceed Northward on Bird Street until the Jan Celliers Road and Bird Street intersection. Proceed Eastwards on Jan Celliers Road which becomes Hamandshand Road, proceed until the road ends at the intersection of Hamandshand Road and Helshoogte Road. Proceed Eastwards on Helshoogte Road until the intersection of Helshoogte and Rustenburg Road, proceed on Rustenburg Road until the intersection of Rustenburg Road and Old Helshoogte Road. Proceed Eastwards on Old Helshoogte Road until the intersection of Old Helshoogte Road and Assegaai Road. Proceed shortly on Assegaai Road where the route ends at the intersection of Assegaai Road and Maroela Road.	4.24km
4	Route begins at the intersection of Rozendal Road and Provinsie Road, proceeds South-Westward on Provinsie Road until the intersection of Provinsie Road and Martinson Road. Proceed Westward on Martinson Road until the intersection of Martinson Road and Morkel Road, proceed on Morkel Road which becomes Jonkershoek Road, proceed straight onto Van Riebeeck Street after the mini traffic circle. Proceed on Van Riebeeck Street which becomes Plein Street, at the large traffic circle proceed Northward on Bird Street until the intersection of Bird Street and Meriman Ave where the Bergzight Terminal is. From the Bergzight Terminal, proceed Westwards on Merriman Ave until the intersection of Marriman Ave and Adam Tas Road. Proceed Southwards on Adam Tas Road until the intersection of Adam Tas Road and Devon Valley Road, proceed on Devon Valley Road until the intersection of Devon Valley Road and Tarentaal Road where the route ends.	7.31km
5	Route begins at the intersection of Transvaal Road and Unie Road, proceed South-Westwards on Unie Road until the intersection of Martinson Road and Unie Road. Proceed Westward on Martinson Road until the large traffic circle where the route proceed on Soeteweide Road. Proceed on Soeteweide Road until the intersection of Soeteweide Road and Groeneweide Road, proceed on Groeneweide Road until the intersection of Groeneweide Road and Banghoek Road. Proceed Westwards on Banghoek Road until the intersection of Baghoek and Bird Street, proceed Southwards on Bird Street until the Bergzight Terminal. From the Bergzight Terminal proceed Southwards on Bird Street until the intersection of Bird Street and Dorp Street. Proceed Westwards on Dorp Street crossing Strand Road until the intersection of Dorp Street and Adam Tas Road. Proceed Southwards on Adam Tas Road until the intersection of Adam Tas Road and Oude Libertas Road, proceed straight on Oude Libertas Road which becomes Flamingo Road then the route ends at the intersection of Flamingo Road and Kokkewiet Road.	6.97km
6	Route begins at the Bergzight Terminal and proceeds Westwards on Merriman Ave until the intersection of Merriman Ave and Adam Tas Road. Proceed Southwards on Adam Tas Road then continue on Strand Road until the intersection of Strand Road and Paradyskloof Road. Proceed on Paradyskloof until the mini traffic circle then Proceed on Wildebosche Road until the route ends at the mini traffic circle where Florida Road and Wildebosche Road intersects.	4.8km
7	Route begins at the intersection of Welgevonden Boulevard and Lang Road. Proceed Soutward on Lang Road which becomes Langstraat Suid Road until the intersection of Langstraat Suid Road and Adam Tas Road. Proceed Southward on Adam Tas Road until the intersection of Adam Tas Road and Bird Street, Proceed Southward on Bird Street until the Bergzight Terminal. From the Bergzight Terminal proceed Westward on Merriman Ave until the intersection of Merriman Ave and Adam Tas Road. Proceed Southwards on Adam Tas Road then proceed on Strand Road until the intersection of strand Road and Webersvalleipad. Proceed on Webersvalleipad until the intersection of Webersvalleipad and Pajarolaan. Proceed on Pajarolaan until the intersection of Pajarolaan and Festival Street, proceed on Festival Street, the route then ends at the intersection of Festival Street and Earlobelle Crescent.	11.3km

Route Number	Route Description	Route Distance
8	Route begins at Bergzight Terminal, proceeds Westwards on Merriman Ave until the intersection of Merriman Ave and Adam Tas Road. Proceed Southward on Adam Tas Road which becomes Strand Road. Proceed Southwards on Strand Road until the intersection of Strand Road and Quantum Street. Proceed straight on Quantum Street which becomes Elektron Road, at the intersection of Electron Road and Tegno Road proceed on Elekron Road until the route ends at the intersection of Elektron Road and Quantum Street.	6.1km
9	Route begins at Bergzight Terminal then proceeds Southward on Bird Street, at the first large traffic circle continue straight onto Mill Street which becomes Piet Retief Street. Proceed Southwards on Piet Retief Street until the intersection of Piet Retief Street and Welgevallen Road. Proceed South-Westward on Welgevallen Road until the intersection of Welgevallen Road and Buitekring Road, proceed Westwards on Buitekring Road until the intersection of Buitekring and Lower Road. Proceed Southwards on Lower Road until the intersection of Lower Road and Buitekring Road. Proceeds Eastwards on Buitekring Road until the Intersection of Buitekring Road and Pleunis Road. Proceed on Pleumis Road until the intersection Pleunis and Brandwacht Road, proceed Eastwards on Brandwatcht Road until the route ends which is after the intersection of Brandwacht Road and Le Seuer Road	3.99km
10	Route Begins at Bergzight Terminal then proceeds Northward on Bird Street until the intersection of Bird Street and Kromrivier Road. Proceed on Kromrivier Road then immediately enter Faure Street, proceed on Faure Street which becomes La Colline Road, proceed until the intersection of La Colline Road and Langstraat Suid Road. Proceed Westwards on Langstraat suid Road until the intersection of Langstraat Suid Road and Curry Road. Proceed on Curry Road until the intersection of Curry Road and Last Road, proceed on Last Road until the intersection of Last Road and Lang Road. Proceed Northwards on Lang Road until the intersection of Lang Road and Rhode Road, proceed on Rhode road until the intersection of Rhode Road and Hendrikse Road. Proceed Eastward on Hendrickse Road until the intersection of Hendrikse Road and Welgevonden Boulevard. Proceed on Welgevonden Boulevard until the route ends at the intersection of Welgevondens Boulevard and Protea Street.	4.55km
11	Route Begins at Bergzight Terminal then Proceeds Westwards on Merriman Ave until the intersection of Merriman Ave and Adam Tas Road. Proceed Southward on Adam Tas Road then proceed on Strand Road until the intersection of Strand Road and Van Reede Road. Proceed Westwards on Van Reede Road until the intersection of Rhodes Noord Road, proceed Southwards on Rhodes Noord Road until the intersection of Rhodes Noord Road and Lovell Road. Proceed on Lovell Road until the intersection of Lovell Road and Saffraan Ave where the route ends.	4.43km

The route descriptions for the long distance routes indicated in Figure 2-4 are listed in Table 2-6.

Table 2-6: Long Distance Public Transport Route Descriptions

Route Number	Route Description	Route Distance
1	Route begins at Bergzight Terminal then proceeds Westwards on Merriman Ave until the intersection of Adam Tas Road and Merriman Ave, then proceeds Southwards on Adam Tas Road which then becomes Polkadraai Road. The route proceeds on Polkadraai Road passing Van Riebeeck Road and under Kuils River Road until the intersection of Robert Sobukwe Road and Polkadraai Road, the route then proceeds South-Westwards on Robert Sobukwe Road until the intersection of Robert Sobukwe Road and Borcherds Quarry Road. The route then proceeds Southwards on	29.6km

Route Number	Route Description	Route Distance
	Borcherds Quarry Road then ends at the Airport.	
2	Route begins at Bergzight Terminal then proceeds Northwards on Bird Street which then becomes the R304, the route proceeds on the R304 until the intersection of the R304 and Bottelary Road. The route then proceeds Westward on Bottelary Road until the intersection of Bottelary Road and La Belle Street, then proceeds Southwards on La Belle Street until the intersection of La belle Street and Strand Street. The route then proceeds North-Westwards on Strand Street which becomes Voortrekker Road, the route proceeds on Voortrekker Road until the intersection of Voortrekker Road and Modderdam Road. The route proceeds southwards on Modderdam Road until the intersection of Belrail Road and Modderdam Road, then proceeds Westwards on Berail Road where the route ends at the Bellville terminal.	27.2km
3	Route begins at Bergzight Terminal then proceeds Eastwards on Merriman Ave until the large traffic circle, then proceeds North-Eastward on Cluver Road until the intersection of Cluver Road and Helshoogte Road. The route then proceeds Eastwards on Helshoogte Road until the intersection of Helshoogte Road and the R45, the route then proceeds North-Westward on the R45 until the intersection of R45 and Main Street. The route then proceeds North-Eastwards on Main Street then proceeds North-Eastwards on the N1. The route proceeds on the N1 until the off-ramp for Jan Van Riebeeck Drive, the route then proceeds North-Westwards on Jan Van Riebeeck Drive Until the large traffic circle. The route proceeds Westwards on Market Street then at the next Traffic circle the route proceeds Northward on Bergrivier Boulevard Suid until the intersection of Bergrivier Boulevard Suid and Lady Grey Street. The route then proceeds Westwards on Lady Grey Street and ends at the Paarl Stop.	34.1km
4	Route begins at Bergzight Terminal then proceeds Southwards on Bird Street until the intersection of Bird Street and Alexander Road. The route proceeds Westwards on Alexander Road until the intersection of Adam Tas Road and Alexander Road, then proceeds Southwards on Adam Tas Road then Southwards on Strand Road. The route proceeds on Strand Road which then becomes the R44 which then becomes Broadway Boulevard, then at the intersection of Broadway Boulevard and Main Road the route proceeds Eastwards on Main Road then ends at the Somerset West Stop.	20.4km
5	Route begins at Bergzight Terminal then proceeds Westwards on Merriman Ave until the intersection of Adam Tas Road and Merriman Ave, then proceeds Southwards on Adam Tas Road until the intersection of Adam Tas Road and Baden Powell Drive. The route then proceeds Southwards on Baden Powell Drive, it passes over Van Riebeeck Road, then enters Van Riebeeck Road and proceeds North-Westward on Van Riebeeck Road until the route ends at Eersterivier Stop.	19.6km
6	Route begins at Bergzight Terminal then proceeds Northwards on Bird Street until the intersection of Bird Street and Adam Tas Road, the route then proceeds Eastwards on Adam Tas Road which then becomes the R44. The route proceeds Northwards on the R44 until the intersection of the R44 and Old Paarl Road, the route proceeds Eastwards on Old Paarl Road which then becomes Main Street, the route proceeds on Main Street until the intersection of Main Street and Lady Grey Street. The route proceeds Eastwards on Lady Grey Street then ends at the Paarl Stop.	30.2km
7	Route begins at Bergzight Terminal then proceeds Eastwards on Merriman Ave until the large traffic circle, the route then proceeds North-Eastward on Cluver Road until the intersection of Cluver Road and Helshoogte Road. The route proceeds Eastwards on Helshoogte Road until the intersection of Helshoogte Road and the R45, the route proceeds South-Eastwards on the R45 which then becomes Huguenot Road, the route then ends at the Franschoek Stop.	31.2km

Route Number	Route Description	Route Distance
8	Route begins at the Franschhoek Stop then proceeds North-Westwards on Huguenot Road which then becomes the R45, the route proceeds on the R45 until the intersection of the R45 and Old Paarl Road. The route then proceeds North-Eastwards on Main Street then proceeds onto the N1, the route exits the N1 at the Jan Van Riebeeck Drive offramp. The route then proceeds North-Westwards on Jan Van Riebeeck Drive until the large traffic circle where the route proceeds Westwards on Market Street. The route proceeds on Market Street until the large traffic circle then proceeds Northwards on Bergrivier Boulevard Suid until the intersection of Bergrivier Boulevard Suid and Lady Grey Street, the route then proceeds Westwards on Lady Grey Street then ends at the Paarl Stop.	33.7km

2.4 Universal Access Design Policy and Plan

The Stellenbosch CITP, Chapter 8, discusses transport infrastructure. As part of this there is a focus on universal access. The Stellenbosch CITP indicates that, “all transport facilities must be universally accessible to all users”, and goes further in saying, “all new facilities must comply with this standard and existing facilities should be retro-fitted as soon as possible”. Furthermore, it is a requirement of the Department of Transport that an “Access Consultant” be appointed by the Stellenbosch Municipality to ensure universal access requirements are achieved and to prepare a detailed Universal Access Plan.

Table 2-7 indicates the requirements laid down by the DOT in respect of Universal Access in terms of planning and infrastructure design.

Table 2-7: Department of Transport Requirements for Universally Accessible Transport

Production of the Universal Design Access Plans (UDAP)	Basic Minimum Requirement	Reason
Production of the UDAP	Needs to be produced in accordance with the UDAP template produced by the DOT	To provide a comparable plan through which to describe, monitor and evaluate the implementation of universal access.
	Development of the UDAP by the access consultant	To ensure that there is consistency between the standards in the plan that minimum standards can be implemented and that relevant legislation is complied with.
Transport Planning	Ensure that the network is as compact as possible to enable general life activities to be situated as close as possible to public transport	To aim for a network that follows the principles of the building regulations part S
	Development of the entire network so that facilities are easy to reach and are within 50m of each other	
	Design of crossings to take passengers to or from a public transport stop or station are safe from vehicular traffic and allow passengers to board the vehicle as fast as possible.	To enable passenger safety and allow the public transport system to operate as efficiently as possible.

Production of the Universal Design Access Plans (UDAP)	Basic Minimum Requirement	Reason
Operational context	Compliance of contracts and licences with the Promotion of Equality and Unfair Discrimination Act, where it applies.	To enable compliance with existing legislation.
Marketing and Communications	Compliance with SANS minimum standards.	To ensure compliance with relevant standards
Customer Care	Compliance with SANS standards and a system for on-going consultation to be integrated within the system with customer feedback, for all categories of passenger.	To ensure that service users are able to provide feedback on the service that they receive, and to ensure that this feedback is used to improve services.
	Consideration of the implications of the Promotion of Equality and Unfair Discrimination Act	
Fare System	Policies, procedures and practices developed to mitigate problems experienced by passengers with special categories of need, within usual procedures and as addendums, where this is required.	To ensure that problems identified with using the Electronic Fare System are contained.
Passenger Information	All stations and stops must include a universally legible system of attaining information about the services (whether IT, internet or telephone or paper based) signage, including emergency signage, system maps and route maps.	To ensure recognition and usage of passenger information across the entire spectrum of society and visitors to South Africa.
	Compliance with SANS standards and where lacking, ISO standards	
Infrastructure (Whether internal or external, control room or depot)	Compliance with part S of the Building Regulations and accompanying SANS standards in all aspects of the built environment, not solely in buildings. This means that all stations and kerbside stops should form a level service with a gradient of at least 1:50. These platforms should also be level with the bus floor at entry doors.	This is the minimum standard affecting functional requirements in buildings. Whilst other parts of the Building Regulations refer to some functional requirements, these are not inclusive of people with disabilities. However, these projects acknowledge that passengers with special categories of needs including people with disabilities use aspects of the built environment other than merely stations.
	Access through the fare gates / turnstiles for parents with prams, people in wheel chairs, and with luggage. Proper approval of plans required under part S by a competent person (environmental access). For the purposes of the PTN grant, this person is the access consultant.	
Vehicles	Level boarding between the vehicle and the platform of the station without a gap	To maintain equality in dwell time for all passengers at all stops and stations.
	No mechanical lifts on vehicles or security gates for fare avoidance	These prolong the dwell time required to board the vehicle for certain people and prevent others from using the vehicles.

Production of the Universal Design Access Plans (UDAP)	Basic Minimum Requirement	Reason
		Mechanical lifts are prone to inconsistent operation and carry a heavy service overhead, which needs to be managed through the contract with the operator. This results in additional staff costs and lack of service provision to certain elements of the population.
	All new trunk vehicles shall have the capacity to accommodate two or more people in wheel chairs, or parents with prams. (The footprint required for either category of passenger shall be interchangeable).All new feeder vehicles shall accommodate one such footprint.	The National Department of Transport has performance standards available to illustrate the standards required in each vehicle.
	All vehicles must include the provision of designated seating for priority passengers (people with disabilities, or who are elderly, parents with prams, and pregnant women) which must be easy to board or alight from.	

According to the above requirements, all new public transport infrastructure and vehicles purchased for use on the public transport system must be universally accessible from the outset. If existing public transport vehicles are utilised, these must be converted or replaced by universally accessible vehicles within a reasonable time.

As stated above, it is proposed that low entry vehicles be utilised to serve the Stellenbosch route network. These vehicles can accommodate wheel chair access. All new infrastructure must be equipped with ramps and tactile surfaces and other facilities to universally accessible standards.

2.5 Operational Characteristics

Table 2-8 summarises the operational parameters that must be fixed during the detailed bus system design process.

Table 2-8: Design Operational Parameters

Item	Destination	Comments
1	Peak Hour Load Factor	The percentage of a vehicle's total capacity that is actually occupied. A high load factor is an indication that the system is being effectively utilised but is more prone to "crush loads" when disruptions, delays, obstruction and stoppages occur.
2	The distance between stations and stops	The distance between stations and stops is determined by the targeted operating speed and the distance which passengers are prepared to walk in order to board a bus. (a distance of 800m has been used in the planning of the Stellenbosch route network, which is a maximum walk of 400m to the nearest stop along a route)

Item	Destination	Comments
3	System capacity and speed.	In order to reduce the amount of vehicles required, it is critical to achieve the highest possible running speed of vehicles.
4	Hours of Operation	Start Time and End Time for the Stellenbosch system is proposed to be 16 hours (05:00 – 21:00)
5	Headways between vehicles	To determine the most suitable vehicle type to be allocated to a route, it is necessary to make a decision on the minimum and maximum headway that is acceptable, where headway is defined as the time interval between successive vehicles operating on a route. The recommended headway is 3 minuntes and the maximum is 10 minutes in peak hours and 30 minutes in off peak periods.
6	Cycle time	The cycle time of each route is calculated to include the running time of the inward and outward journey plus dwell time at stops and layover time at the end terminals. Thus is different from each route and depends on route length and stops.
7	Universal Accessibility	“Universal Accessibility” is the principle that all public facilities should be available to all people and be easy to access and use irrespective of the personal ability of each individual. All facilities and public transport services must therefore allow people with disabilities to access and use the facilities and services in a similar manner to any able person.
8	Vehicle type and capacity	-Low entry vehicles are preferred and capacity depends on passenger demand and headway.
9	Vehicle floor height	One of the primary purposes of a rapid bus system is to reduce the time for passengers to board and alight from the vehicles. A prerequisite, to achieve this, is to provide for level boarding where the bus floor height matches the platform height

2.5.1 System Capacity and Speed

To minimise the number of vehicles required, it is critical to achieve the highest possible running speed of vehicles and lowest possible dwell time at stops. In the absence of public transport vehicle running time data on every route, running speed calculations to determine the vehicle requirements and operating schedules should initially be based on the “practical speed” shown in Table 2-9. Initially the actual running speed may be somewhat less than the target speed until operations are running smoothly. However, attaining the target speed is more economical in terms of its influence on turnaround times and hence vehicle procurement requirements.

Table 2-9: Bus running Speeds

Mode	Route Infrastructure	Routes	Practical Speed	Target Speed
Articulated/ Solo Bus	Dedicated Bus Lanes	Trunk Routes	25 km/hr.	30 km/hr.
Solo Bus	Mixed Traffic / Few Stops	Main Routes	18 km/hr.	20m/hr.
Solo Bus / Midi-bus	Mixed Traffic / Frequent Stops	Certain Main Routes and All Area Routes	15 km/hr.	18 km/hr.

2.5.2 Hours of Operation (Start Time and End Time)

All services are scheduled to operate for sixteen hours (16 hrs.) per day. These operating hours conform substantially to the public transport strategy of the Department of Transport (PTSAP, 2007) which specifies that trunk services should operate for at least 16 hours per day.

The proposed operating hours for weekdays are indicated in Table 2-10 and are subject to adjustment depending on circumstances in the Stellenbosch area. On Saturdays and Sundays the operating hours can be reduced to 06:00 – 20:00 depending on morning and evening passenger demand.

Table 2-10: Operating Hours (weekdays)

Period	Time
Early Morning Off-peak	05:00 – 06:00
AM Peak	06:00 – 08:00
Off-peak	08:00 – 15:00
PM Peak	15:00 – 18:00
Evening	18:00 – 21:00

2.5.3 Headways

To determine the most suitable vehicle type to be allocated to a route, it is necessary to make a decision on the maximum headway that is acceptable, where headway is defined as the time interval between successive vehicles operating on a route.

All public transport services should be operated according to maximum headways as indicated in Table 2-11, but headways can be reduced below this maximum according to the supply required to meet the projected travel demand. The headway operated is dictated by operational circumstances. A minimum headway of 3 minutes should be adopted however; this may effectively reduce the peak capacity. It is assumed that 50% of the passengers that are affected by the reduced capacity in the critical peak would either travel earlier or later, effectively spreading the demand and making the peak longer. The demand on the shoulders of the peak hours can be increased to levels similar to the peak hour. The normal week day peak periods, to be confirmed by surveys, are 06:00 to 08:00 and 15:00 to 18:00.

Table 2-11: Maximum Headways

Period	Maximum Headways (minutes)
Early Morning Off-peak	20
am Peak	10
Off-peak	30
pm Peak	10
Evening Off-peak	30

2.5.4 Cycle Times

The cycle time of each route is calculated to include the running time of the inward journey plus dwell time at stops and layover time at the end terminal plus the running time of the outward journey plus dwell time at stops and thus is different for each route. The specific right-of-way type should be taken into consideration as it affects the overall running time.

The dwell time at stops and layover principle used is estimated to be 20% of the total inward and outward running time.

2.5.5 Intermodal Operations and Integration

Ticketing:

It is proposed that a new integrated ticketing system, using smart card technology be implemented that will allow transfers between the different services that form the public transport system. This system will not initially be integrated with the systems used by the existing bus, mini-bus and rail operators. It is the ultimate goal that when the full public transport system is operational, all public transport modes ticketing will be fully integrated.

Fare Collection System:

It is recommended that a smartcard fare collection system be used which relies on a passenger tapping the pre-loaded card on a fare validator when entering a closed station or a vehicle at an open stop. The fare structure can be based on a flat rate, distance travelled or a zonal system. When transferring between vehicles or stations, irrespective of mode, the passenger may be given a maximum transfer time to get on the next vehicle to complete the journey (travelling in the same direction) without having to pay another fare. The passenger must tap on and off every vehicle used on the journey, which enables the fare to be automatically collected for the whole journey.

Timetables:

An integrated timetable will need to be prepared for all modes that form part of the public transport system so that a passenger using the system and needing to make a transfer will know how long the waiting time will be until the next vehicle arrival. Obviously the various operators must adhere strictly to their schedules and the Contracting Authority must monitor adherence and apply penalties to operators for non-adherence.

3. DETAILED OPERATIONS SYSTEM PLAN FOR PRIORITISED CORRIDOR

3.1 Route Network

The Stellenbosch route network is composed of a number of existing and proposed public transport routes that have been planned to create seamless interaction of public transport and NMT.

It is proposed that the first phase will consist of the implementation of new "pilot" PTSN routes that will operate in conjunction with the existing public transport network. Subsequent phases will be implemented as additional routes are added. One should note however, that the route network proposed is not necessarily final. As the town continues growing, changes in land use may result in amending proposed future routes or adding routes.

The proposed first phase pilot routes are indicated on Figure 3-1 and comprise the two routes listed in Table 3-1:

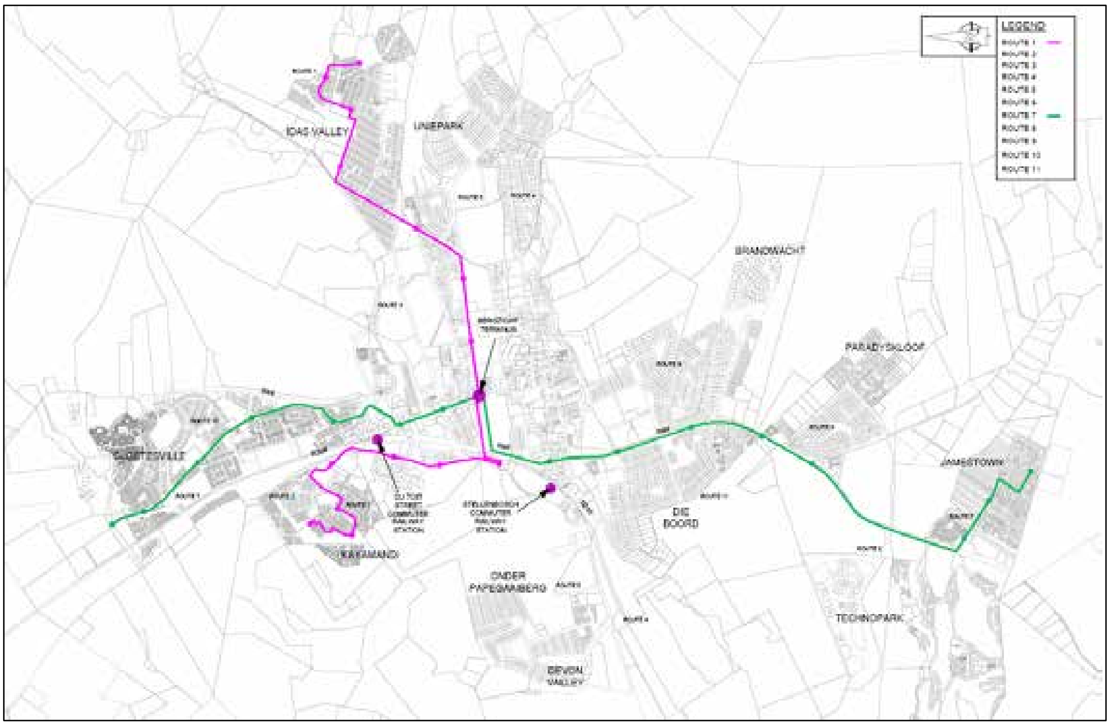
Table 3-1: Pilot Route Network

Route Number	Description	Route Length (km)
1	Kayamandi to Idas Valley via Bergzight and University of Stellenbosch.	8.88
7	Cloetesville to Jamestown via Bergzight	11.30

The above two routes form the central "spine" of the proposed future network and provides good service coverage and connectivity to a large area of Stellenbosch while serving the central business core as well as the University of Stellenbosch. These routes also originate in the residential areas where there is already a captive market for travel by public transport and the new service is likely to be strongly supported, ensuring a measure of financial viability.

It is therefore proposed that routes 1 and 7 be further investigated for implementation as the first phase "pilot" PTSN for Stellenbosch.

Figure 3-1: Proposed Pilot Route Network



3.1 Travel Demand on the Pilot Routes.

The EMME/3 model was used to estimate the passenger demand on the two pilot routes. The model was updated using the latest land use data from the Stellenbosch Municipality. The outputs from the model are documented in a separate report and were used to inform the 2020 travel demand in Stellenbosch which is summarised in Table 3-2.

Table 3-2: Travel Demand on Pilot Routes

Route	Route Section	Travel Demand (2015) Pass./ hr.		Travel Demand (2020) Pass./ hr.	
		Inbound	Outbound	Inbound	Outbound
1	Khayamandi to CBD	420	180	459	193
	Idas Valley to CBD	300	250	346	280
7	Cloetesville to CBD	240	40	325	53
	Jamestown to CBD	94	152	127	203

The peak passenger volume of 459 passengers per hour and 325 passengers per hour in the inbound direction towards the CBD on the Kayamandi and Cloetesville routes 1 and 7 respectively represents the maximum passenger demand informed by the output of the transport demand model.

The “practical capacity” based on a minimum headway of 5 minutes and a load factor estimated at 80% of vehicle capacity is shown in Table 3-3 for midi-bus and Solo-bus for the two routes to be operated.

Table 3-3: Practical Service Capacity

Route	Vehicle	Vehicle Practical Passenger Capacity (incl. standing)	Peak Service Headway / Trips per Hour	Load Factor	Practical Service Capacity
1 and 7	Midi-bus	45	5 min. 12 trips per hour	80%	432 pass. / hr.
1 and 7	Solo-bus	70	5 min. 12 trips per hour	80%	672 pass. / hr.

Table 3-3 indicates that the practical capacity of the Main Route service is 432 and 672 passengers / hour based on a 5 minute headway utilising the Midi-bus and Solo-buses respectively.

Based on the proposed system using Midi-buses, which assumes a headway of 10 min (6 trips per hour) and a load factor of 80%, the system capacity is capped at 216 passengers per hour. A hybrid system operated by the Midi-bus and supported by the existing mini-bus taxi system, will be able to accommodate the full peak demand of 459 passengers per hour, assuming a higher load factor.

The solo-bus operation can accommodate the peak hour demand but with significant unutilised capacity. When one considers the other peak volumes the consideration of a Midi-bus is favourable over that of a solo-bus due to the likelihood of unutilised capacity.

It is thus recommended that a fleet of Midi-buses be used to provide the service on the pilot routes.

3.2 Service Schedules and Timetables

The proposed service schedule for Routes 1 and 7 is indicated in Table 3-4 for weekdays, Saturdays and Sundays. The following should be noted:

- A minimum headway of 10 min. has been adopted to facilitate coordinated schedules.
- An extended pm peak is proposed to accommodate the dispersed demand during this period.
- Headways are planned to be competitive with the alternative bus and mini-bus services

The following tables indicate the proposed service schedules for weekdays, Saturdays and Sundays.

Table 3-4: Service Frequency on Pilot Main Routes (Weekday) (Minutes)

Route	Off-peak	am peak	Off-peak	pm peak	Off-peak
	(05:00 – 06:00)	(06:00 – 08:00)	(08:00 – 15:00)	(15:00 – 18:00)	(18:00 – 21:00)
1	15 minutes	10 minutes	20 minutes	10 minutes	30 minutes
7	15 minutes	10 minutes	20 minutes	10 minutes	30 minutes

Table 3-5: Service Frequency on Pilot Main Routes (Saturday) (Minutes)

Route	Off-peak	am / pm service	Off-peak
	(05:30 – 07:30)	(07:30 – 18:00)	(18:00 – 20:30)
1	30 minutes	20 minutes	30 minutes
7	30 minutes	20 minutes	30 minutes

Table 3-6: Service Frequency on Pilot Main Routes (Sunday) (Minutes)

Route	Off-peak	am / pm service	Off-peak
	(05:30 – 07:30)	(07:30 – 18:00)	(18:00 – 20:30)
1	30 minutes	30 minutes	30 minutes
7	30 minutes	30 minutes	30 minutes

3.3 Fleet Size

The fleet required for each route has been sized for the morning peak hour practical passenger capacity indicated in Table 3-3.

The required vehicle fleet to accommodate the passenger demand depends on the following variables:

- The peak passenger demand (the am peak hour has been used in the calculations). During the off-peak, the passenger demand reduces and the number of vehicles required also reduces
- The return travel distance (km) from origin to destination to origin
- The return travel time (min.) from origin to destination to origin, including dwell time at intermediate stops and turnaround time at the destination. (For the purposes of initial estimates, the total trip time has been increased by 20% (see section 2.5.4) to allow for stops and turnaround time.)
- Vehicle travel speed (See section 2.5.1). An average travel speed of 15km/hr. has been used for services operating in mixed traffic.
- Vehicle passenger capacity and load factor (see section 2.3.6) -a load factor of 80% occupancy has been used.
- Number of spare buses required to allow for breakdowns is 7% of the total required.

An example of a typical calculation to determine the number of vehicles required for operations on a specific route is indicated in Table 3-7.

Table 3-7: Vehicle Requirement: Example Calculation

Item	Calculation	Result
Peak passenger demand (passengers / peak hour)	-	460
Return Trip Distance (km)	-	12
Vehicle running speed (km/hr.)	-	15
Return Travel time (min.)	=(trip distance/travel speed)*60	48
Dwell time at stations and turnaround time	add 20%	9.6
Total Return Travel Time (min.)		57.6
Vehicle capacity	-	45
Vehicle Trips / am peak (rounded up to nearest vehicle)	=pass. per am peak/(vehicle capacity*0.8)	13
Peak Vehicle Requirement (no. of vehicles rounded up to nearest vehicle)	=(veh. trips per am peak/60)*return travel time	11

The calculation for the required number of vehicles to operate routes 1 and 7, based on a practical capacity of 216 passengers per hour and a 10 minute headway, for the Stellenbosch PTSN Pilot system is indicated in Table 3-8.

Table 3-8: Pilot Services Vehicle and Driver Requirements

Route	Type of Vehicle	Vehicle Capacity	am Peak Direction Passengers (06:00 - 08:00)	Return Travel Time (min)	Trip Distance (km) One Direction	Peak Vehicle Trips per Hour (@80% capacity)	Peak Vehicle Requirement	Peak Frequency	No Vehicles Incl. 7% Spare	No of Drivers (1.6 per veh.)
1	Midi Bus	45	216	79	8.88	6	8	10	9	13
7	Midi Bus	45	216	100	11.3	6	10	10	11	16
TOTAL							18		20	29

The two pilot routes will be operated by low entry Midi-buses with a capacity of 45 passengers. The buses will have doors on the left sides to allow kerb-side boarding.

A total of 18 midi-buses, regular low entry buses will be required to serve the passenger demand. An additional 2 buses are required on standby to accommodate any breakdowns and routine maintenance of the buses i.e. a total of 20 buses.

According to the National Department of Transport, Municipalities will be able to purchase buses from the Public Transport Infrastructure (PTI) Grant, subject to the availability of funds, and provided that the buses remain in the ownership of the Municipality and can be leased to an operating company. Alternatively, a special purpose entity will have to be formed by the Stellenbosch Municipality to purchase buses using funds obtained from creditors, or alternatively buses will have to be purchased by the operating entities themselves.

3.4 Drivers Duties

Driver duties are regulated by the Bargaining Council. Drivers are not permitted to drive longer than 5 hours without a break of at least 30 minutes, and may not be on duty (including driving time and meal times) within a spread-over for longer than 14 hours per day. The maximum hours to be worked in a week may not exceed 45 normal hours and 5 overtime hours. Additionally, at least one full day shall be given off duty in a period of seven consecutive days.

The driver duties will be determined according to this guideline and also layover times of vehicles during off-peak periods of reduced service frequencies. Driver duties can only be determined when the detailed scheduling of routes is performed later in the design process. A provisional ratio of 1.6 drivers per vehicle will be required for operation during the peak times.

According to the preliminary service schedule contained in Section 3.2, the number of drivers required is 29 (Refer to Table 3-8).

3.5 Operational Statistics

Table 3-9 indicates the operational statistics for the Stellenbosch pilot services in terms of the estimated number of vehicle-kilometres travelled per week. Based on detailed scheduling previously carried out, the number of out-of-service vehicle-kilometres travelled was limited to 3% of the total in-service vehicle-kilometres travelled; however this depends on the location of the Depot.

It should be noted that the figures are estimated based on the operating schedule and should be confirmed after the preparation of detailed Timetables.

Table 3-9: Operation Statistics (Vehicle Kilometres Travelled)

				Weekday	Saturday	Sunday		
Route	Leg	Type of Vehicle	Trip Distance (km) One Direction	Vehicle Km / day (two way)	Vehicle Km / day (two way)	Vehicle Km / day (two way)	Total Veh km / week	Estimated out of service veh-km (3% of total) per week
1	1	Solo Bus (9m)	3.3	403	248	185	2 445	73
	2		5.58	681	419	312	4 135	124
7	1	Solo Bus (9m)	4.5	549	338	252	3 335	100
	2		7.082	864	531	397	5 248	157
Total				2 496	1 535	1 146	15 162	455

3.6 Transfers

The following types of transfer will occur in the PTSN, which information is used as input to determine the required sizes of the stations along each route:

- Initial boarding – where the passenger board the first public transport mode for the trip;
- Boarding transfer – represents a passenger transferring from one public transport mode to another at a transfer station;
- Through passengers – all passengers remaining on the public transport mode at a station;
- Alighting transfer – represents passengers alighting and transferring to another public transport mode at that station;
- Final alighting – represents passengers alighting at the end of the public transport trip and walking to their final destination.

Transfers can be expected to take place at the Bergzight Terminal and at commuter rail stations.

Double stops should be provided at these locations to accommodate the expected demand for transfers.

3.7 Fare Structures and Levels

3.7.1 Fare Structure

Various alternative fare structures are possible, from a purely distance based fare structure to a single flat fare for the entire area. It is proposed to simplify the current Mini-bus fare structures which are usually different for every route. It is further proposed that the fare structure for the PTSN will be distance based, meaning that the fare for a particular route will depend on the relative length of the route.

Fare rates must still be determined and will be similar to rates currently charged for public transport.

The fare structure to be used is the subject of a separate investigation.

3.7.2 Automated Fare Collection

According to the requirements of the DOT to remove cash payments from the PTSN as soon as possible, an Automated Fare Collection (AFC) system will be implemented from the start of PTSN operations in Stellenbosch. An AFC system allows fares to be collected by an independent fare collection agency without cash being handled on the buses, reducing the instances of fare evasion or fraud, and improving the security of drivers (who otherwise would collect fares) and passengers.

It is proposed that AFC validators be installed on the vehicles operating the routes. Passengers will then “tap-on” with their smartcard when boarding the bus, and “tap-off” when leaving the bus at their destination, or to transfer to another route. The fare validator will be equipped with a GPS that will be able to determine the distance travelled by the passenger through particular zones and the fare validator will then deduct the correct fare from the passenger’s smartcard.

Passengers will be allowed to transfer between PTSN routes at a reduced fare for the second leg of the journey. If passengers “tap-on” to another route within a specific time after “tapping-off” from an PTSN service (for example a time of 30 minutes), the fare validator will recognise a transfer between PTSN services, and will amend the fare of the trip accordingly.

A separate business entity should be employed by the Stellenbosch Municipality to carry out the fare collection for the PTSN as a whole. The vehicle operators will therefore not be involved in the collection of fares from passengers.

The revenue collection entity will:

- Provide staff and operate ticket sale kiosks, at terminals and major bus stops.
- Employ on-bus ticket inspectors. Any passenger not holding a valid ticket will be fined an amount still to be determined. If the passenger cannot pay, this person must be reported to the police.

3.8 Traffic Modelling

To determine the impact on traffic flow on the road network where PTSN services will be operated, particularly at intersections, traffic modelling should be carried out. Solutions should be proposed to solve traffic congestion problems at intersections e.g. by providing additional lanes for public transport vehicle.

4. INFRASTRUCTURE REQUIREMENTS

A wide range of infrastructure is required to provide a public transport system that is of a high quality and provides an improved level of service to the customer. The infrastructure should be standardised and branded with a unique identity across the system elements including vehicles, ticketing systems, customer information and infrastructure. The following section provides a description of the basic infrastructure requirements that should be considered in the design process.

4.1 Route Infrastructure

Route infrastructure comprises of the following facilities:

- Roadside stops (embayments or kerbside and supporting NMT infrastructure).The approximate location of bus stops is indicated on Figure 2-3. The position of the stops is based on a service coverage of 400m walking distance from each stop. A more detailed investigation is necessary to locate the stops on site taking local conditions, sight distance and street furniture into consideration.
- Passenger shelters – located at roadside stops at appropriate locations with lighting and information panel displaying route and timetable information
- Turn-around facilities at the route terminals (mini-circle or hammer head)
- Road signage

4.2 Terminals

It is proposed that Stellenbosch be served by a main Terminal located in the town centre. At present the Terminal for the existing minibus taxi services is located at the Bergzight taxi Terminal on the corner of Merriman Avenue and Bird Street. It is possible that this Terminal will be relocated to a new location that will reduce the need to transfer in the town centre en-route to the University campus. A suitable alternative site should be the subject of a detailed feasibility study to evaluate land requirements, services, accessibility and environmental impacts.

The following facilities should be provided at the main Terminal:

- Loading bays for 9m, 45 seat Midi Buses or 12m, 70 passenger Solo Buses for the 13 routes proposed to serve the routes in the Stellenbosch town Centre and the 8 long distance routes
- A drop-off facility
- A holding area
- Shelters over the passenger waiting areas
- Lighting
- Signage

- Ablutions
- Buildings for Terminal management staff
- Facilities to accommodate small business / traders

The main Terminal will not function as a holding area for out of service buses in the off peak. Holding for buses will only accommodate sufficient vehicles to allow for driver shift changes or rest breaks. All out of service vehicles must be routed to the Depot for longer duration parking. Fuelling and cleaning will also be carried out at the Depot.

4.3 Traffic Control

All public transport services will operate according to a fixed timetable. It is therefore important that vehicles are not unnecessarily delayed due to traffic congestion that is prevalent at some intersections in Stellenbosch. This is important since it is unlikely that the Stellenbosch public transport system will be provided with dedicated traffic lanes throughout.

It is therefore proposed that a traffic control system be implemented in the Stellenbosch town centre. The system should be capable of managing traffic flows and minimising delays to public transport vehicles. Dedicated bus lanes should be provided at intersections where possible to facilitate turning of public transport vehicles or to allow an early release for buses within the signal phasing.

4.4 Depot Facilities

A Depot is required for public transport vehicles to park overnight and when out of service. The depot should be located in a central position to minimise “dead” mileage from the Depot to the beginning of the route when it comes into service in the morning or when vehicles go out of service. Vehicles going out of service after the peak must return to the depot and not “hold” at the central Terminal. A variety of activities must be provided for, although some may be outsourced. The following facilities should be provided:

- Driver facilities – a locker room with secure facilities for driver’s personal effects.
- A canteen
- Ablutions for drivers
- A secure facility to download ticket machines or handle cash if so required
- Offices for Depot management
- Wash bays
- Fuelling facilities
- A panel shop for minor repairs
- A mechanical workshop for servicing of vehicles
- Parking area for buses
- Parking for drivers and staff personal vehicles

- A secure fenced area
- Security
- Lighting
- Signage

4.5 Control Centre

An Integrated Public Transport Operations Centre (IPTOC) that will provide Call Centre and contract monitoring functionality should be established. The IPTOC can be implemented in stages as the public transport system is further developed.

Key functions of the IPTOC should include:

- **Traffic Monitoring:** The PTSN operates in an environment of mixed traffic for part of the time and timekeeping on the system requires that the buses be given priority at traffic signals under certain conditions. The IPTOC provides a traffic monitoring function with the ability to interact with the signal control system where such interaction is warranted to bring the PTSN back onto its schedule or to relieve critical congestion areas influencing the PTSN.
- **APTMS Monitoring:** an Automatic Public Transport Management System (APTMS) is an application of Intelligent Transport Systems (ITS) that allows the remote management of a public transport service. The IPTOC provides a central repository and window onto all electronic and field monitoring of the PTSN, as well as recording all complaints and enquiries regarding the PTSN. This combined input is used to ensure that the PTSN is operated at optimal efficiency and in accordance with the operating contract against which invoices for service delivery are certified.
- **CCTV Monitoring:** The IPTOC will monitor the CCTV cameras along the PTSN routes including those along the road, in the stations and on buses. Incidents will be responded to in accordance with the nature of the incident through interaction with the appropriate IPTOC function or responding agency.
- **Call Centre:** This centre will provide information to the public in respect of the PTSN, but will also respond to queries in respect of all other local public transport for which information is available. Where calls are received that do not relate to public transport, the Centre will screen and redirect these to the appropriate authorities (responding agencies). Real time information will be made available through the Call Centre on timetables, routes and other relevant information.
- **IT:** Technical expertise to deal with any technical issues that may arise with any system.
- **Automated Fare Collection (AFC):** The AFC will provide functionality for the application of fare policy, sale of tickets and the collection of fare revenue.

All functions of the IPTOC are recorded and the data stored for future reference. Certain data is analysed on an on-going basis and the results made available in near real-time to key role players.

In addition to the above mentioned monitoring by the IPTOC, it will be necessary to monitor a number of key performance indicators, including passenger numbers, fare evasion and service standards.

4.6 NMT Facilities

The Stellenbosch CITP contains proposals for the provision of Non-motorised Transport facilities in terms of the NMT Expansion Plan, 2015/16. It is a requirement that public transport facilities be integrated with the NM network to improve accessibility. Facilities such as sidewalks, cycle tracks and storage facilities for bicycles should be provided. Safe pedestrian crossings must be provided on approaches to public transport facilities.

4.7 Universal Access

All transport facilities must be universally accessible to all users. All new facilities must comply with this standard and existing facilities should be retro-fitted as soon as possible. This includes facilities at:

- Rail Stations
- Public Transport Facilities
- Sidewalks and Road Crossings
- Non-motorised transport facilities

5. BUSINESS AND INSTITUTIONAL PLAN

A detailed Business Plan is required to define the costs (both capital and operational) of the proposed public transport system. The Business Plan should deal with the following:

- Institutional plan and cost for the planning, management and monitoring of the system
- Projected system costs (procurement of vehicles, infrastructure, ticketing system, marketing, safety and security)
- Projected system operational costs
- Projected system income
- Operator compensation costs
- Funding sources and subsidies

5.1 Business Structure

It is proposed that the Stellenbosch public transport service be managed and operated by various entities to allow for optimal responsibility. These entities can comprise the Stellenbosch Municipality which will form an agency referred to as a 'Municipal Entity' which will procure the transport services and infrastructure. The transport services will be provided by a private sector company which will conduct most of the operational tasks under the contract to the Municipality.

The Municipal Entity will operate in terms of a service delivery agreement between the Municipal Entity and the Stellenbosch Municipality. The agreements between the private contractors and the Municipal Entity will be prepared to ensure effective integration of the transport system.

The initial or pilot phase could be carried out internally by a unit within the Stellenbosch municipality, which will report directly to the Director: Technical Services.

The roles players which will be involved in the management and provision of the Stellenbosch public transport services are as follows:

- The public transport service agency or "Municipal Entity"
- The vehicle operating contractor
- The fare system contractor
- The control system contractor
- A station service control contractor

5.2 Institutional Plan

The Stellenbosch Municipality is constitutionally responsible for the provision of 'municipal public transport' in its area as legislated in the National Land Transport Act. In terms of this act the Municipality is responsible for:

"the planning, implementation and management of modally integrated public transport networks and travel corridors for transport within the municipal area and liaising in that regard with neighbouring municipalities [NLTA section 11 (1)(c) (xviii)]."

The Municipality will ensure effective control of the management of bus operations through an appropriate mechanism, considered in terms of section 78 of the Municipal Systems Act and, where applicable, to be considered in terms of section 84 of the Municipal Finance Management Act that will set the terms under which the system operates.

As reiterated in the Stellenbosch CITP 2016-2020, the Stellenbosch Municipality will manage the following in terms of public transport:

- strategic planning of the public transport system;
- network planning, including the phasing of formalised public transport services, letting and monitoring of public transport contracts
- Marketing of the public transport system
- Administration and financial control

The function of building and maintaining public transport infrastructure should be carried out by the relevant existing Department within the Municipality.

A typical organisational structure for the establishment of the Municipal Entity to deal with public transport is shown in Figure 5-1.

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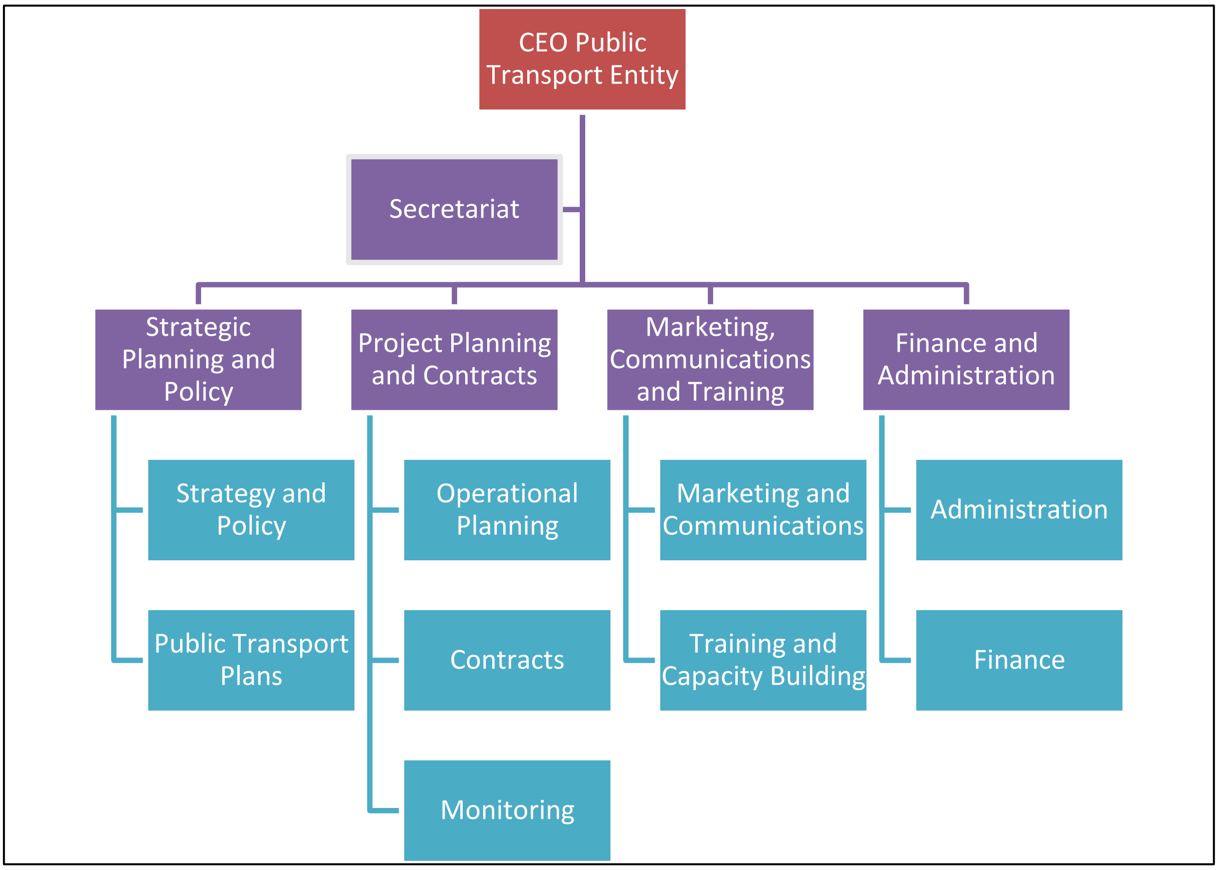
Figure 5-1: Municipal Entity Organisational Structure



5.3 Industry Transition Plan

It is proposed that the existing road based public transport operators be incorporated into the proposed public transport system. Section 41 of the NLTA provides that negotiated contracts may be entered into with public transport operators in their areas, on only, with a view to promote economic empowerment. Such contracts must not exceed 12 years in duration. Thereafter the contracts must be advertised for public tender.

The Industry Transition Plan will entail the formalisation of the existing operators into a business structure such as a co-operative (i.e. a Vehicle Operating Company "VOC") which will be able to enter into a service contract with the Stellenbosch Municipality. Assistance should be offered to the operators to achieve this objective.

Continuous engagement between the public transport service providers, stakeholders and Municipal Entity will take place to ensure transparency and promote open dialog.

5.4 Operator Contracts

The Vehicle Operating Company contracted by the Municipal Entity will provide a scheduled service. The appointment of vehicle operators will be negotiated between the Municipal Entity and the eligible service providers (refer to section 5.3). This negotiation is clearly subject to achieving a reasonable negotiated agreement within a reasonable period. If no agreement is reached through negotiation by a time to be specified by the municipality, it may procure the services through other means of procurement.

The payment of contractors will be based on a “fee per kilometre of service provided” and will take into account the total operational cost and a reasonable profit.

5.5 Phased Implementation Plan

For various reasons it may be desirable to phase the implementation process over a number of months or even years. This may be due to cost, availability of resources or capacity. A number of options may be considered as follows:

- Public Transport Services: Services can be introduced on certain high priority routes according to passenger demand and fare income projections to establish a viable “core” system that can be expanded gradually to other less important routes. Funding availability may dictate the pace of the provision of infrastructure and the subsidisation of operating costs. Initially a “pilot” system could be introduced on one or two routes to test all aspects of the system.
- Infrastructure: The construction of infrastructure can be phased according to the proposed services phasing plan. At the outset it will be necessary to provide facilities for the maintenance and storing of vehicles at a central depot. The size of the depot and the extent of the facilities required will depend on the vehicle fleet size. Some functions e.g. vehicle maintenance could be outsourced. The specifications for the provision of infrastructure are important to maintain a high standard to attract potential customers, although the size of facilities can be scaled down initially.
- Vehicles: According to the Department of Transport requirements, all vehicles should be fully universally accessible. New universally accessible buses must therefore be purchased. It is possible to use limited numbers of existing vehicles for a short period until new buses can be procured.
- Ticketing System: One of the key elements of a new public transport system is the fast journey time compared with other modes. It is thus necessary to speed up the boarding of buses. This can be done by introducing a “tag on tag off” smart card system of fare collection. The other advantage is that this type of system avoids the use of cash and associated security issues.

Figure 5-2 indicates a proposed implementation plan for the construction of infrastructure and support system for the proposed Phase 1 Pilot PTSN services.

Figure 5-2: Phased Implementation Plan (Phase 1 Pilot Service)

Item	Description	Year															
		2016/17				2017/18				2018/19				2019/20			
1	Detailed Operational and Business Plan			■	■	■	■										
2	Detailed Design and Tender					■	■	■	■								
3	Procurement of IPTN Vehicles													■	■	■	■
4	Transformation and Empowerment Process					■	■	■	■	■	■	■	■	■	■		
5	Construction of Infrastructure:									■	■	■	■	■	■	■	■
6	Ticketing System													■	■	■	■
7	Control Centre and ITS															■	■
8	Establish Management Entity Annual Cost													■	■	■	■

5.1 Financial Implications

5.1.1 Introduction

A high level cost model was developed to compare the operating cost of the proposed pilot routes with the potential revenue generated from the route. The output of the cost model is indicated in Table 5-2. The model uses input that is obtained from the EMME travel demand model, the minibus taxi information contained in the Stellenbosch CITP (2015) and assumptions made relating to operating costs.

5.1.2 Operating Costs

In general, operational cost are either directly or indirectly related to the number of vehicles in use, and the number of kilometres travelled. These two aspects are directly related to the demand on the route, the route profile (in terms of route distance and operating speed), and the travel profile over the operating period. This is necessary to ensure that the supply of vehicle trips, at a minimum, matches the demand. It is therefore essential that a cost model includes operational calculations for each proposed route (for both directions of travel) and for at least every hour of operation throughout the day.

It should be noted that due to the level of planning required, a number of the operating cost parameters have not been included in the operating cost calculation. As more detailed scheduling and planning is conducted, so too should the operating cost and revenue be revisited.

A total operating cost of R28 per service km travelled has been estimated based on the current MyCiti bus operations utilising the Optare 9m bus. The total operating cost includes various variable and fixed costs associated with the service.

An estimated R2.9m per bus was used to determine the capital cost related to the acquisition of Optare (9m) buses for Stellenbosch. The total estimated cost for the buses required for pilot Route 1 and Route 7 is R 58m.

Table 5-1 indicates the cost of the buses required for the pilot routes.

Table 5-1 Bus Capital Cost

Route	Number of Buses Required	Cost of New Buses	Estimated Cost of Second-hand Buses
Route 1	9	R 26 100 000.00	R 14 400 000.00
Route 7	11	R 31 900 000.00	R 17 600 000.00
Total	20	R 58 000 000.00	R 32 000 000.00

An investigation into the acquisition of second-hand "Optare" buses from the City of Cape Town MyCiti bus fleet may significantly minimise the initial capital cost for obtaining the bus fleet required for the proposed pilot operation.

5.1.3 Fare Revenue

The fare revenue for the proposed pilot routes are indicated in Table 5-2 below. The estimated revenue considers only the revenue generated from the fare box. However, alternative income streams do exist and can be utilised. These alternative income streams such as revenue generated through advertising, are not explored in this report, but can be considered during more detailed analysis. It should also be noted that the fare was not determined based on user affordability, but is based on existing minibus taxi fares.

A zonal fare has been proposed. A zonal fare implies that for a demarcated zone a flat rate fare will be utilised. The fare for the Cloetesville to Bergzicht and Kayamandi to Bergzicht leg (and the reverse) of Route 7 and Route 1 respectively is fixed at R5 per trip. The fare for the Bergzicht to Idas Valley and Bergzicht to James Town (and the reverse) is fixed at R7 per trip. Figure 5-3 illustrates the notional fare zones for the proposed Route 1 and Route 7. As more detailed planning takes place consideration of the refinement of the zones is recommended.

5.1.4 Operating Cost/ Revenue Summary

Table 5-2 Operating Cost and Revenue Summary (2017)

Item	Route 1		Route 7	
	Leg 1 (K - B)	Leg 2 (B - I)	Leg 1 (C - B)	Leg 2 (B - JT)
Operating Cost	R 4 554 445.05	R 4 721 580.65	R 4 293 295.68	R 7 805 232.44
Operating Revenue	R 7 154 662.50	R 10 016 527.50	R 7 154 662.50	R 10 016 527.50
Deficit/ Surplus	R 2 600 217.45	R 5 294 946.85	R 2 861 366.82	R 2 211 295.06

Table 5-2 illustrates the total direct operating cost and revenue for the proposed pilot routes. It is evident that that the revenue generated from the farebox is larger than the direct operating cost for each leg of the proposed pilot routes.

5.1.5 Sensitivity

A sensitivity analysis was conducted to determine the change in the surplus/deficit of the proposed pilot routes assuming a change in the passenger demand. Table 5-3 and Table 5-4 illustrate the results of a reduction of passenger demand on the Deficit/ Surplus for each of the proposed routes.

The results of Scenario 1 indicate that a 20% reduction in passenger volumes results in a decrease in the surplus of Route 1 and Route 7. However, the results of Scenario 2 i.e a 50% reduction in passenger volumes, indicate that Route 1 and Route 7 have a cost greater than the revenue generated (with the exception of Route1 Leg 2). The net result of implementing both Route 1 and Route 7 under sensitivity Scenario 1 indicated an overall surplus; however this is not achieved under Scenario 2.

Table 5-3 Sensitivty Analysis (20% reduction in passenger demand)

Sensitivity 1 - 20% less passengers				
	Route 1		Route 7	
	Leg 1 (K - B)	Leg 2 (B - I)	Leg 1 (C - B)	Leg 2 (B - JT)
Deficit/ Surplus	R 1 169 284.95	R 3 291 641.35	R 1 430 434.32	R 207 989.56

Table 5-4 Sensitivty Analysis (50% reduction in passenger demand)

Sensitivity 2 - 50% less passengers				
	Route 1		Route 7	
	Leg 1 (K - B)	Leg 2 (B - I)	Leg 1 (C - B)	Leg 2 (B - JT)
Deficit/ Surplus	R -977 113.80	R 286 683.10	R -715 964.43	R -2 796 968.69

Considering the results of existing public transport bus operations within South Africa, it is likely that the implementation of a bus service in Stellenbosch will yield similar results. It is therefore likely, given the high level cost and considering the sensitivity analysis results, that the proposed pilot project will generate a deficit that will need to be subsidised through additional revenue streams.

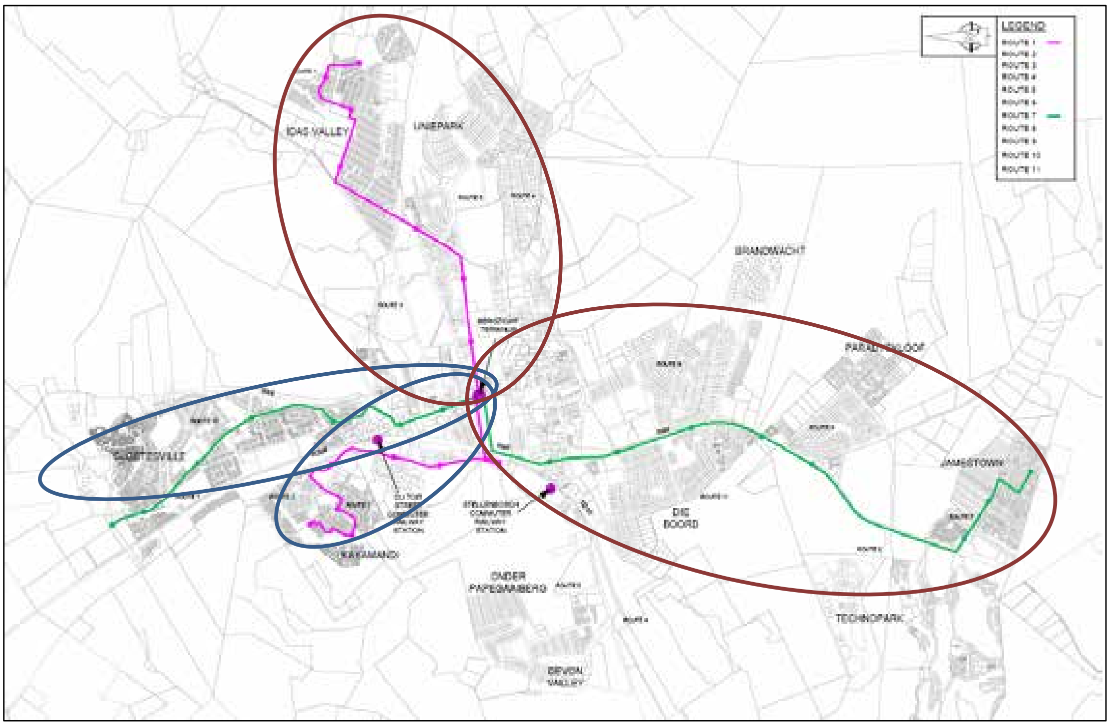


Figure 5-3 Fare Zones

5.1.6 Cost Estimate

An indicative costing for the implementation of the proposed pilot public transport service is set out in Table 5-5 with implementation of the proposed system proceeding in phases over a 5 to 6 year period.

After operations commence the vehicle operating cost will be covered from the fare revenue. Other costs will need to be covered from the PTNG.

Table 5-5: Cost Estimate for Implementation of Pilot Routes: Indicative Costing

No.	Item	Year			
		2016/17	2017/18	2018/19	2019/20
1	Detailed Operational and Business Plan	R 2 000 000			
2	Detailed Design and Tender		R 12 000 000		R 5 000 000
3	Procurement of IPTN Vehicles			R 16 000 000	R 16 000 000
4	Transformation and Empowerment Process		R 5 000 000	R 5 000 000	R 5 000 000
5	Compensation of Operators				
6	Construction of Infrastructure:				
6.1	Route Stops and Shelters				R 10 000 000
6.2	Central Terminal				R 15 000 000
6.3	Temporary Depot				R 15 000 000
6.4	Ticketing System				R 5 000 000
6.5	Control Centre & ITS				R 10 000 000
6.6	Road and Intersection upgrading				R 25 000 000
7	Management Entity Annual Cost				R 5 000 000
	Nett Cost	R 2 000 000	R 17 000 000	R 21 000 000	R 111 000 000

5.2 Funding

It is anticipated that the public transport system in Stellenbosch will be implemented in phases, commencing with one or two routes initially. Operational Plans and Business Plans should be prepared initially for the entire IPTN and then one or two routes selected for implementation of a pilot service. It is estimated that the funding listed in Table 5-5 will be required for planning and implementation of approximately 16 to 20 km of public transport routes utilising midi-buses with a passenger capacity of 45.

The provision of the infrastructure and a fleet of vehicles required for operations to commence as the phases of the public transport service network are implemented are dependent on the availability of sufficient funding. Funds can be applied for from the following sources.

5.2.1 Public Transport Network Grant (PTNG)

This annual conditional grant from national Treasury, channelled through the Department of Transport, is for the provision of infrastructure required for implementation of the approved IPTN or PTSN systems.[1]. The Department of Transport has stressed that direct operating costs must be covered from the system revenue (fares, advertising, rentals etc.)

In the "Guidelines and Requirements: Public Transport Network Grant: 2015/2016, for Business Plan preparation underpinning Budget Proposals for MTEF 2016/17 to 2018/19", the Department of Transport sets out the various project types that qualify for investments from the national Public Transport Network (PTN) Grant.

It is recommended that the Stellenbosch Municipality should approach the Department of Transport with a view to submitting an application for a PTN Grant to plan and implement a quality Public Transport Service Network. To access this funding, approval must be sought from the Department of Transport in the required format. If approved, funding is allocated from the PTN Grant on an annual basis.

Applications are usually made in mid-year and successful applications are gazetted in February of the following year. The Stellenbosch Municipality should base their application on the public transport system proposed in the Comprehensive Integrated Transport Plan. The contents of the application to the DOT should include the following aspects according to the abovementioned Guidelines:

- History of Public Transport Grants
- Outputs and Achievements
- Projected Expenditure
- Operating Costs and Revenues
- Performance Indicators
- Anticipated Progress
- Confirmation of Adherence to PTN Grant Conditions and Requirements
- Itemised Breakdown of Costs
- Itemised Breakdown of Projected Operating Costs and Revenues
- Overall Network Plan
- System Quality Survey
- Assessment of Risks

[1] Previously it was separate grants (PTIG and PTNOG), now combined as the Public Transport Network Grant.

5.2.2 Public Transport Operations Grants (PTOG)

The PTOG was historically a grant allocated by Treasury for provincial governments to subsidise contracted passenger bus operators providing scheduled services. In the Western Cape this grant which subsidises the contracted operations of Golden Arrow Bus Services (GABS) of which one route operates between Somerset West and Stellenbosch.

5.2.3 Other Revenue Sources

Revenue from the fares paid by passengers is the main source of income intended to cover the direct vehicle operating costs of the public transport service provided by the Municipal Entity. Another potential source of direct income for the public transport services is advertising revenue which can be used to fund marketing and communications for the system. Consideration needs to be given to allocating the income from parking for the PTSN and to increase parking charges in areas served by public transport, with the parking revenue assisting in keeping the fares to affordable levels so that car users are influenced to change to using public transport, thereby reducing traffic congestion.

5.2.4 Municipal Funding

Should system revenue not be sufficient to fully cover operating costs, it is likely that the Stellenbosch Municipality will be obliged to allocate fund within the municipal budget. From experience in other cities, that are operating IPTN systems, the Municipality could consider an allocation of between 1 and 4% of rates income to public transport operations.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

This study sets out the framework for the provision of an integrated public transport system for the Stellenbosch Municipality comprising of a network of short and long routes and public transport services that will ultimately provide a safe and convenient service for all the inhabitants of the area as well as tourists and visitors. The system will ultimately provide linkages to the greater Cape Town functional region and facilities such as the Cape Town International Airport. Linkages to the MyCiti Integrated Public Transport Network and commuter rail stations will be provided.

The proposals take into consideration sustainability, equity and cost into consideration.

The role to be played by the existing public transport operators in the area is taken into consideration and proposals are made to provide for their participation and formalisation in the business model.

The role played by the Western Cape Provincial Government and their participation in the planning process is acknowledged, particularly in terms of the proposed public transport institutional framework currently being planned that includes the Stellenbosch Municipality.

A preliminary revenue and cost model has been prepared and the estimated costing presented in the report.

The overall conclusions of the investigation into the provision of a Public Transport Service Network by the Stellenbosch Municipality are that:

- The implementation of a Public Transport Service Network will have major financial and institutional implications for the Stellenbosch Municipality. The preparation of further detailed institutional, business and operational plans are necessary to affirm cost and revenue estimates, the sources and availability of funding required before a final decision can be taken to proceed with the implementation of the proposals.
- The Western Cape Government and the National Department of Transport be approached to ascertain the possibility and requirements for accessing grant funding from the Public Transport Network Grant.
- Consultation with the public transport operators within Stellenbosch be conducted to obtain support and the participation of the operators before the implementation of a pilot phase can take place.
- The City of Cape Town be engaged regarding the possible acquisition of second hand Optare buses from the existing MyCiti bus fleet, as a possible cost saving measure.

6.2 Recommendations

The overall recommendations of this report are that:

e) The Stellenbosch Municipal Council takes note of the outcome and conclusions of the proposals for the introduction of a Public Transport Service Network in Stellenbosch, in particular the institutional and financial implications.

f) The proposal for the introduction of a Public Transport Service Network in Stellenbosch be supported, in principle, subject to:-

g) The support of the Western Cape Government and the National Department of Transport being obtained for the proposals and for the future submission of an application for grant funding from the national Public Transport Network Grant.

h) The preparation of further detailed institutional, business and operational plans to affirm cost and revenue estimates and the sources and availability of funding.