



LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

**DEPARTMENT OF
ROADS & TRANSPORT**

Travel Demand Management Study

Business Plan: PT Demand Study

Mopani District Municipality

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1 Introduction

The Department of Roads and Transport: Limpopo Province has undertaken an overall Travel Demand Management (TDM) Study covering Mopani and Capricorn District Municipalities. This business plan focuses on the Mopani District Municipality. As described in the District Municipality's TDM report, five pilot programmes were listed in which feasible pilot projects could be identified for short-term implementation. The TDM programmes identified for further investigation included the following:

- Maintain a Road Network Management System (RNMS)
- **Undertake a public transport demand study**
- Undertake NMT Planning
- Undertake a traffic signals study
- Undertake a road safety study.

This document covers the business plan for the implementation and promotion of Public transport demand study in the Mopani District Municipality and is also applicable to the various local municipalities (Greater Giyani, Greater Letaba, Ba-Phalaborwa, Greater Tzaneen and Maruleng). The purpose of this business plan is not to forward an argument for public transport provision, but to provide a plan to implement a public transport system in the whole of Mopani and on a more detailed level in Polokwane. This business plan fits into the larger TDM Policy of the District Municipality as well as all the other relevant frameworks and policies.

1.1 Definition of Public Transport

The general definition of public transport is a passenger transportation service that is usually local in scope and is available to any person who pays a prescribed fare. It usually operates on established schedules along designated routes with specific stops and is designed to move a relatively large number of people. For a public transport system to be successful, it must be efficient and reliable, safe, affordable, comfortable and accessible to many. The most common modes of transport used are mini-bus taxis, buses and rail.

1.2 Why Public Transport is important?

The main role of public transport is to provide accessibility and mobility. When public transport is made affordable users are able to get to their place of work or other destinations safely and comfortably. The use of public transport helps to minimize the harmful effects of automobiles on the environment by getting more people with private vehicles out of their cars and into public

transport vehicles. In so doing, public transport also minimizes traffic congestion on the roads.

The main focus with the development of the Public Transport study for Mopani District Municipality is to enhance mobility of people from their places of residence to places of work and to access economic centres, schools, health facilities and entertainment centres with ease. It is further aimed at identifying the areas less well served and make plans to have them served.

2 The South African context

Public transport has become a very important issue in South Africa because of the fact that over 68% of South Africans rely on some form of public transport every day (Duff-Riddell, 2010); however the supply of safe and convenient public transport is not enough to meet the demand available. It has been realised that upgrading of highways is not going a long way to reduce the traffic congestion. The most common modes of public transport in South Africa include mini-bus taxis, buses and in some areas rail.

The government has seen the need for public transport in the country and as such has put in place certain policies that will facilitate and serve as guidelines in providing public transport. These policies affect funding, the spatial arrangements of land use structures, the operations, planning and regulation.

The issues that are being faced in the public transport industry include the issue of land use segregation. The location of most business hubs in one central location has distorted travel patterns. This is because most routes require very high capacity during the peak periods in one direction and return trips run at a loss. The mini-bus industry poses some political difficulties and lack of cohesion within the taxi associations. This industry however poses some exceptional opportunities of being able to service a wider network. There is also an issue of affordability of the fare. The government seeks to attain the goal of each person not spending more than 20% of their money salary on public transport. However with the present minimum daily wage, passengers will not be able to afford any form of public transport with 20% of their monthly earnings.

Until recently, public transport in the Mopani District Municipality has not received the attention it deserves. Nonetheless, these issues facing the public transport system can be mitigated with proper planning and consideration of all important planning factors.

3 Public transport design guidelines

The guidelines to be discussed in this manual will fall under the following main headings:

- Design data requirements
- Network design
- Vehicle selection and fleet estimation
- Time-table design and crew rostering
- System costing
- Key performance indicators

These main headings will be discussed in detail under individual sections. The guideline will be explained extensively to convey the scope of the investigation. Various strategies and examples will be given where possible to show how the investigations can be carried out.

3.1 Design data requirements

The credibility of the data used in planning a public transport system is very vital to the success of the system. This is because all the analysis and recommendations are based on the results that are gathered from this initial data. The process of obtaining the design data should therefore be done with extra caution. This section sets out the information that is needed prior to the actual planning of the public transport system. It also shows and explains the various mediums through which this data can be collected.

The design data to be discussed include:

- Travel demand
- Demographic data
- Spatial data
- Service routes

3.1.1 Travel demand

Travel demand data for a public transport system includes the number of people who are currently using the system and also the number of people who will be able to use it if the supply increased. Demand data should also include the following information:

- number of people coming from each area
- time of day that they utilise the service
- origin and destination of trips

This information helps you to make a valued judgement on as to whether the system needs to be upgraded or not. This is done by looking at the demand data against the supply of the existing system and evaluating the shortfall.

Data can be collected using the following mediums:

- Questionnaires
- Manual counts
- Counters
- Smart cards
- GPS tracking

3.1.2 Demographic data

Demographic data is information about the people that live in the area that is to be serviced. This information includes race, population, age groups, income levels and occupation, amongst others. This information is important in understanding the needs of the people in that area. It also helps to understand the dynamics of the area and the expectations of the people.

Data can be collected using the following mediums:

- Questionnaires
- Demographic information could also be obtained from the municipalities or local government.

3.1.3 Spatial data and service routes

Spatial data is information about the area that is being investigated. This information includes the size of the area, its location, attractions and places of interest in the area and the topography of the area. It is also beneficial to find out about any proposed future developments and where they will be developed. This information helps you to plan the basic network of the system. It gives you a spatial outlook about why and where trips are made. Service routes are the routes that are currently being utilised by the existing public transport system. These routes will form the base network of the new system.

Data can be collected using the following mediums:

- Town planners
- Cell phone and GPS tracking

3.2 Network design

A public transport network is considered effective when it is spread widely enough in order to serve the vast majority of the community it was designed for. The success of the network also relies on the individual routes and facilities that are used. Despite the detail with which the individual routes are chosen to develop the network, it must be continuously monitored from time to time to make sure that the initial design is still effective and is serving the needs of the community. This section states the different types of networks and sets out the factors and steps taken when designing a network for a public transport system.

3.2.1 Types of networks

Public transport route networks do not always have a defined pattern or conform to any particular pattern. However there are some basic network patterns that are usually implemented either on their own or combined. These network patterns are:

- Collector-distributive network
- Grid network
- Radial and circumferential network

3.2.2 Type of service

Dedicated travel way

This is when a travel way is reserved exclusively for the use of the public transport service in that network. This segregated driveway can be built for an exclusive bus service or for all bus services in the area. In the latter option the lane is called a High Occupancy Vehicle Lane (HOV Lane). The advantage of dedicated travel way system is that it allows the system to work efficiently by eliminating the impact of traffic congestion. The permanent infrastructure of a dedicated travel way improves public perception of bus travel. This system can be a bit costly since this new infrastructure will have to be built. In certain instances, one of the lanes used for mixed traffic is converted to a dedicated bus lane, which in turn makes the mixed traffic congestion even worse. The cost and benefits of this system are weighed in order to make an adequate decision.

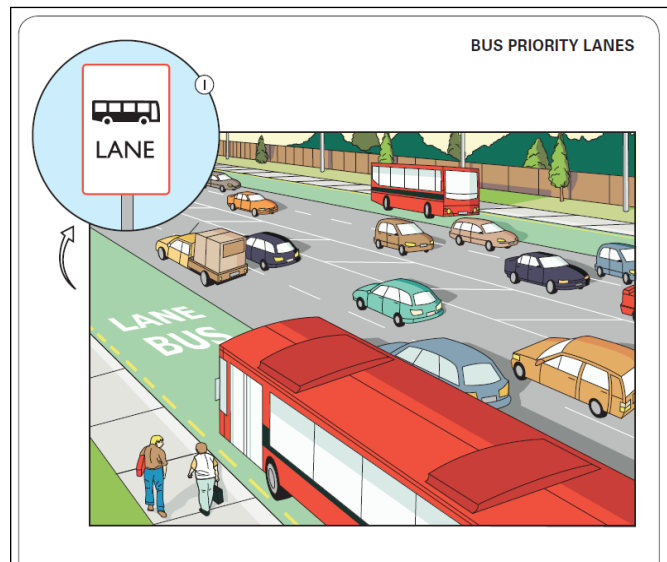


Figure 3.1: Conceptual Layout of a dedicated bus lane

Mixed traffic system

This is when a public transport service is operated sharing lanes with mixed traffic. This bus service is thus affected by surrounding mixed traffic congestion. The bus is not able to run efficiently at all times and this can lead to a decrease in patronage. In areas of low mixed traffic congestion this system is able to function adequately.

3.2.3 Route choice

The following steps are taken when choosing the routes to be utilized in a public transport network system.

1. *Determine the origin-destination demand of the area.* This information is obtained from the design data. It shows the number of people going from one node to another node within a certain period of time. Usually it shows passenger trips for every hour.
2. *Carry out a demand assignment to the network.* This step shows which routes the passengers use when getting from one node to the other node.
3. *Determine route volumes using the origin-destination data.* These route volumes are obtained by using the numbers from the O/D matrix and the demand assignment network. The numbers are then totalled to find out the total number of passengers using a particular route? to get to their respective destinations.
4. *Try to eliminate very low volume routes by carrying out a route rationalisation exercise.* After the route volumes have been totalled there will be certain routes that will have very low demand but since those passengers need to be serviced, their demand will be added to the closest route with a higher demand.

5. *Determine passenger flows for interchange points.* Using the route volumes and after deciding on the type of network pattern to utilize, the number of passengers that will be serviced at interchange points can be obtained. This will help to deduce the number of vehicles that will be required.

Other factors to consider when choosing routes in a network

The following factors can be used as design guides in choosing suitable routes for a public transport network. These are;

- Minimising the total distance walked
- Minimising the maximum distance walked
- Minimising the average distance from main centres
- Minimising the total generalised cost for all users.

3.2.4 Locating interchange facilities

Simple stops

Public transport stops are designed based on approximate stops or at certain locations along a street. This decision must be made before the stops can be incorporated into the network design.

The three options for stop locations are;

- near-side of an intersection (NS)
- far-side of an intersection, after the intersection (FS)
- between two intersections (MB)

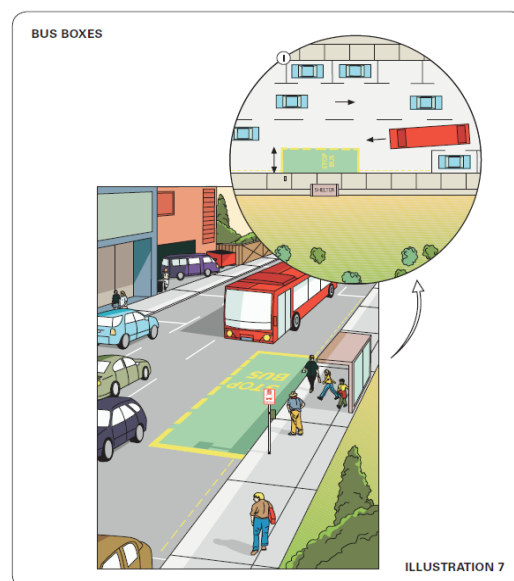


Figure 3.2: A bus stop location between two intersections
Source: New Zealand Travel Demand Management Manual, 2007

One option may be chosen for the entire network; however the most popular option in most countries is the NS option. It is also always advised to keep your stop locations uniform so that passengers get accustomed to where they are.

There are a number of factors that influence the location of a stop, for this reason a combination of stop locations are usually used in one network. These factors are;

- timing of traffic signals
- geometry of turning and stopping
- vehicular and pedestrian traffic conditions, and
- Passenger access.

Terminals

Terminals are the ending and starting points of vehicles in a public transport system. It is the main end and start point in the trip. These terminals are therefore located in business hubs or in central locations. The location of terminals must be very strategic so that the majority of the passengers will start and terminate their journey at the main terminal. This is to maximize the running cost of the service.



Figure 3.3: Main bus terminal Praha Florenc in Prague.
Source: www.prague-information.eu/Pics/florenc.jpg

Depots

Depots serve as storage places for the vehicles after service hours or when the bus is not being utilized. These depots usually also house the maintenance section of the service. Its location should therefore be as centralised as possible to facilitate the movement of buses and drivers from the terminals. However due to the amount of space that is needed, it is not always feasible to put up a depot in the main areas of town.

3.3 Vehicle selection and fleet estimation

The type of vehicles and the total number of the fleet affect the efficiency as well as the cost of the public transport system. Initial travel demand data collected is used in assessing which vehicle type and capacity will be suitable on certain routes and at certain times of the day. This means that your data collection procedures should be done with utmost care so that your results are as close to reality as possible. This section states the types of vehicles regularly used in transport systems. It also sets out the considerations that are made in selecting vehicles for different routes and for deciding the right fleet size for a network.

3.3.1 Types of vehicles

The commonly used vehicles include the following;

- High floor buses: These buses are entered by climbing stairs to get to the floor of the bus. The bus floor is usually in excess of 1200mm above the ground. This makes this bus difficult to access for elderly and some disabled.



Figure 3.4: MAN high floor bus intercity buses for the FIFA 2010 World Cup

Source: www.man-mn.pt/.../800/BusEXPL_FIFA2010.jpg

- Semi-high floor buses: These are also accessed by climbing stairs however the bus floor is usually between 800-1100mm above the ground. It is not as high as the high-floor buses but the stairs still make it difficult to access by the elderly and some disabled.
- Low entry buses: These buses have no stairs at the entry points. Its entry point is the same level as the front floor of the bus. There are steps at the back of the bus leading to seats with a raised floor level. These buses are friendlier to elderly and some disabled people.



Figure 3.5: Interior of a low entry bus by Volvo

Source: Volvo Buses Environment Blog

- Low floor buses: These buses have very low floor levels, usually between 350mm and 450mm. However the very low floor makes it difficult to use on any terrain.



Figure 3.6: Low-Floor Entry Bus

Source: www.wangarattacoachlines.com.au/www/566/files...

- Wheel chair accessible buses: These buses usually have a lift that enables disabled passengers with wheel chairs to access the buses. These buses, even though effective, are very expensive and the use of the lift increases boarding times at bus stops.



Figure 3.7: Wheel chair lift mechanism in buses

Source: <http://img.diytrade.com>



Figure 3.8: Disabled person in a wheelchair being lifted into a bus

Source: <http://img.diytrade.com>

3.3.2 Vehicle size options

There are so many vehicle size options and the largest size is not always the right choice. The main advantage of a larger vehicle size stems from the lower operating costs, usually driver labour costs per passenger carried. However in a low demand area these buses tend to mean low frequencies and longer waiting times for passengers. Standard vehicle sizes available are summarised in the table below.

Table 3.1: Vehicle capacities

Vehicle Type	Vehicle Length (meters)	Capacity (passengers per vehicle)
Bi-articulated	24	240-270
Articulated	18.5	120-170
Standard	12	60-80
Mini-bus (A)	6	25-35
Mini-bus (B)	4	13-15

Source: (Wright & Hook, 2007)

The articulated bus is increasingly becoming the more favoured size as compared to the bi-articulated. This is because of the following reasons:

- Large numbers of articulated vehicle orders have reduced cost savings due to economies of scale in manufacturing;
- The heavy weight of the bi-articulated vehicles reduces fuel efficiency and makes it difficult to accelerate rapidly;
- Length of bi-articulated vehicles creates problems when turning at corners with tight radii.

Despite all these factors there may be certain instances where the bi-articulated bus is the appropriate choice.



Figure 3.9: The 18.5 meter articulated bus

Optimizing the vehicle capacity should be one of the last design steps. This is after the number of bus stops have been decided on. The size of the bus also affects the service frequency and waiting times. The vehicle size optimization should be done with those factors in mind. An option to consider is to have a mixed fleet of vehicles of different capacities. These vehicles can then be used at different times of the day depending on the travel demand.

4 Team of professionals

In order to conduct successful Public Transport Demand Planning, it is proposed to include certain key positions as part of the professional team. These positions include amongst others the following:

- A project leader with similar experience and a technical background in this particular field
- A transportation engineer with expertise in public transport planning
- An urban planner who has done Public Transport projects before
- A public participation specialist who can assist with public participation meetings and knows the local conditions

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- A transport economist with public transport planning experience
 - A GIS specialist with public transport experience

5 Advisory group

The most effective means of public participation will be to form an Advisory Group with members representing the broadest segment of the community who will be committed to the project from beginning to end. To assist the consultants, it is proposed for either the District Municipality or the Local Municipality to set up this group prior to the public transport planning projects kicking off. Selected technical staff from the District Municipality or Local Municipality should also form part of the group.

In addition to those obviously affected by the project, it should also be considered to extend committee representation to broader community groups, chambers of commerce, district level officials and others who are not directly impacted but have a clear interest in the outcome. Care should be taken not to have a too large group because it will slow the decision-making process down. The Advisory Group should not be dominated by a small interest group, such as residents of a single street or those interested in a single, narrow issue. A wide variety of representation is necessary and this includes critics as well – it is better to give critics a voice throughout the process than wait to be confronted with opposition at the end.

To name some of the duties of the Advisory Group:

- Assist with checking identified land uses
- Assist with identifying appropriate public transport routes
- Can also be used to assist with data collection
- Assist with reviewing materials intended for distribution to the community
- Reach a quality final product together with the professional team

6 Timeframe

The public transport planning process's duration will depend on the size of the study area. Duration of approximately seven months should be adequate for a District Municipality public transport plan. The context of the study can influence the planning duration, for instance in a large study area it might take more time to travel to far-off destinations. An example of a PT Plan's project schedule is shown in Table 6.1. Note that the tasks' order is not fixed and can be

adjusted to suit the particular conditions.

Table 6.1: Project Schedule

PT Demand Study	Month 1				Month 2				Month 3				Month 4				Month 5				Month 6				Month 7							
	W 1	W 2	W 3	W 4	W 1	W 2	W 3	W 4	W 1	W 2	W 3	W 4	W 1	W 2	W 3	W 4	W 1	W 2	W 3	W 4	W 1	W 2	W 3	W 4	W 1	W 2	W 3	W 4				
Land use identification of study area	■	■																														
Identify PT trip generators and attractions			■																													
Develop PT routes				■	■	■	■																									
Develop Network Design								■	■	■	■	■																				
Technical discussion about PT criteria and infrastructure																◆																
Discussion with Advisory group on proposed PT routes																◆																
Draft PT Network plan distributed																◆																
System design																■	■	■	■	■												
Operational design																■	■	■	■	■												
Hand in PT report																								◆								
Review PT report																								■	■	■						
Discussion with Advisory group on PT report																												◆				
Include comments																												■	■	■		
Conclude PT Plan																																■

7 Budget

It is difficult to give an indication of the budget that will be required for a District Municipality Public Transport Demand Study and for a Local Municipality Public Transport Demand Study. The price range will be affected by the quantity and quality of available data in the study area, in the case of little available data, it will be more expensive. Past experience indicated budgets ranging between R700 000 and R1.5 million in South Africa.

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