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Executive Summary

Introduction

In 2006, a feasibility study conducted by the Limpopo Department of Roads & Transport recommended that the potential for passenger rail services be investigated. In 2009, Phase 1 of said investigation concluded that there was sufficient *a priori* merit to conduct a pre-feasibility study to further explore a business case for the creation of a rail commuter between Polokwane and Mokopane (also referred to as Corridor A) as well as a rail regional service between Polokwane and Jane Furse (also referred to as Corridor D) – both investigations being the object of this pre-feasibility report, funded by the Department and managed by PRASA.

Assessment of the Polokwane – Mokopane Commuter Corridor

The existing rail link between Polokwane and Mokopane consist of a single track line serving both freight and Shosholoza Meyl passenger traffic. The Shosholoza Meyl service is unsuitable for commuting as it is a three day a week long distance service from Gauteng to Musina that passes through the corridor at around 03h00 of the morning to reach Polokwane more than 90 minutes later. The service is also unreliable and plagued by frequent breakdowns. Currently, commuters use Kombi- or Minibus Taxi and private vehicles to commute between Polokwane and Mokopane. Any rescheduling of the frequency to suit commuters would need to be accompanied by an extensive infrastructural and operating equipment refurbishment as well as passenger amenities and communication facilities to attract the commuting public to the service. Requisite investments cannot be justified on projected commuter demand estimate as a stand alone exercise, but should be effected as a part of the complete overhaul of the existing Shosholoza Meyl long distance service – as motivated in a separate study on the Shosholoza Meyl offering between Gauteng and Polokwane.

Assessment of the Polokwane – Jane Furse Regional Rail Corridor

The proposed regional rail service is a green fields initiative. Two alignments were considered - one via Chuenespoort and the other via Zebediela. The via-Chuenespoort option was discarded due to both environmental and terrain as well as market demand considerations. Potential passengers for the rail corridor are currently using Kombi- and Minibus Taxi and private vehicles to travel to and from Polokwane and Jane Furse, and the various towns and villages in-between. As established by the *in loco* survey conducted by team, the overwhelming majority of trips between Polokwane and destinations in between the City and Jane Furse evidenced commuter characteristics – mostly daily, but also some weekly.

Findings

The team acknowledges that rail investments are ‘lumpy’ (indivisible for a given capacity), that rail capacity cannot be stored (unused path is lost), and that railways exhibit ‘economies of density’ (the long-run average cost slopes downward) and so, unit costs decline as output rises – spreading fixed costs over more traffic units. The team further accepts the national and provincial strategic development intent and, hence, the need to effect a fundamental overhaul of the public transport provision in the province.

Notwithstanding the latter, and, taking into account rail investments characteristics mentioned above, the team concluded that market availability is insufficient at this stage to justify embarking on a detail feasibility assessment in the immediate to short term (5 to 10 years) period. However, the team is also keenly aware of the evolving economic character of the Province – due to the numerous investment initiatives underway in the Province. Equally, other initiatives of national government and other neighbouring provinces will impact on the prospects for the passenger rail development in the Province – in particular, the Moloto Corridor initiative in relation to the corridors under review. This means, that not only the evolving economic circumstances of the Province need to be re-assessed in the short term, but also complementary initiatives elsewhere have to be factored into the regular high-level feasibility assessments to ascertain the opportune time to revisit the recommendation not – as yet - to proceed with a detail feasibility on rail passenger services on the two corridors discussed hereunder.

Recommendations

That:

- ✓ All interested Parties - the national passenger rail Agency (PRASA), provincial authorities charged with land-use planning, transportation delivery and economic development , local authorities in whose jurisdiction the system alignment will traverse, the Department of Transport (custodian of the rail competency), Transnet Freight Rail (in the eventuality that the Agency is may contemplate the chosen alignment to further develop its network for rail freight transport), the National Planning Commission, etc), of the intention to initiate a rail-based public transport corridor on the determined alignments, and
- ✓ The Department of Roads and Transport (DRT) causes that formal land-use planning processes to provide for the required reserve along the alignment be engaged with, and that pro-active prevention of any intrusion that may compromise the required reserve, and
- ✓ DRT ensures regular re-assessment of province-wide and corridor-specific economic and public transport related developments with the view to identifying the appropriate window of opportunity to proceed with the detail feasibility on Corridors A & D.

1. Strategic Case

1.1. Introduction

Limpopo province contains approximately 12% of South Africa's population and contributes 6.7% to the GDP. Approximately 85% of the population lives in a dispersed pattern in the rural areas. It is difficult to service them with effective mass transport systems. In concert with the rest of the country, rapid urbanisation is manifest in Limpopo as well. The current rail network (Figure 1) in the province comprises of:

- ✓ The mainline between Gauteng and Musina (Beitbridge). The line is electrified with 25 KV AC between Pyramid and Polokwane. The branch lines to Zebediela, Mabatlane (Vaalwater) and Marble Hall are inactive
- ✓ The 3KV DC electrified line from Kaapmuiden to Phalaborwa via Hoedspruit.
- ✓ A link line between Hoedspruit and Groenbult via Tzaneen.
- ✓ A line from Gauteng via Rustenberg and Thabazimbi to Lephalale.
- ✓ A line from Steelpoort via Burgersfort and Lydenburg to Belfast in Mpumalanga.
- ✓ A line from Roossenekal to Dewert near Middleberg in Mpumalanga

Public transport within the province is mainly provided by an extensive Kombi-Minibus taxi and subsidized bus services network. Shosholoza Meyl provides economy class intercity passenger rail services on the Gauteng-Musina mainline and the Kaapmuiden-Phalaborwa rail line. AUTOPAX (City to City and Translux buses), private bus operators and taxis provide extensive services between Gauteng and the main centres of the province. Many people walk for long distances. LDV (Bakkies) and animal drawn (donkey) vehicles are also extensively used in the rural areas. The province is promoting the usage of bicycles through the Shova Kalula (Ride Easy) program.

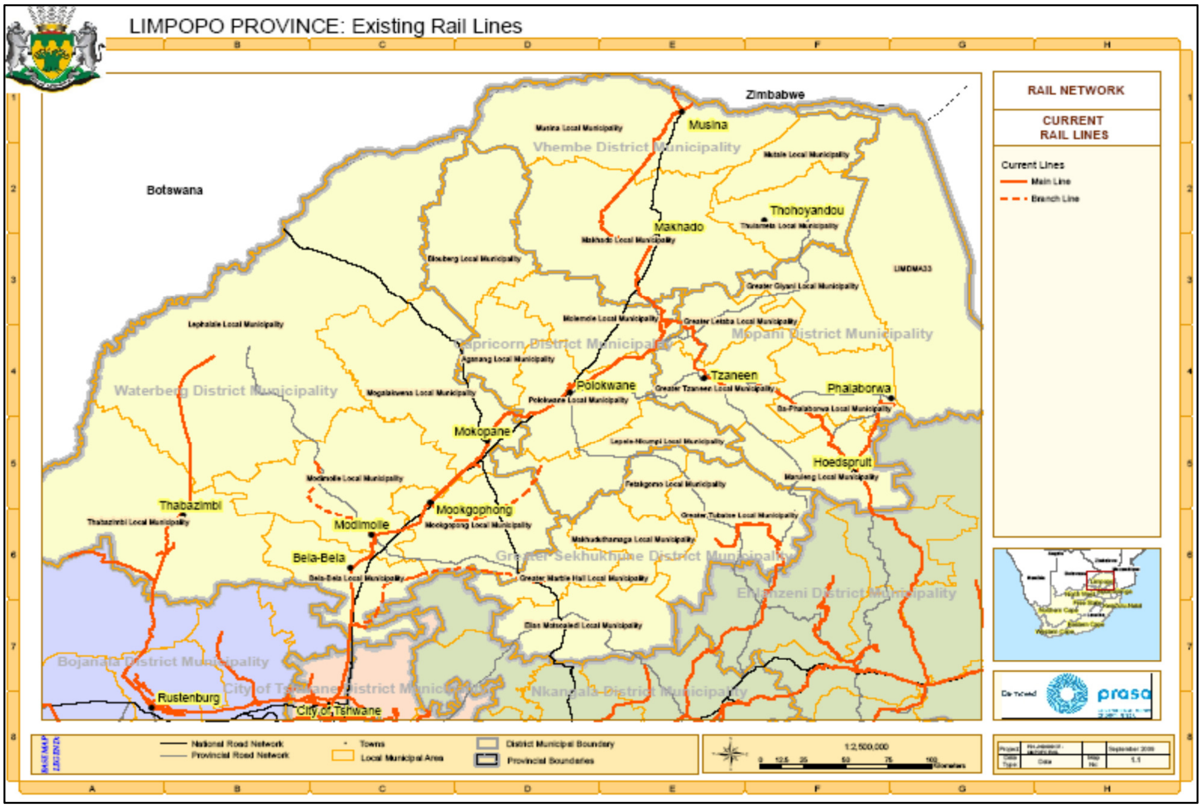


Figure 1 Existing Rail Lines in Limpopo Province

1.2. Transport Problems & Issues

1.2.1. Background

Table 1.2.1, although rather dated, shows the usage spread for the most commonly used motorised travel modes in Limpopo Province (according to the NHTS, 2003).

Table 1.2.1 Modes of Transport

Percentage of Population and Mode of Transport						
Train	**Bus**	**Metered Taxi**	**Minibus-taxi**	**Sedan Taxi**	**Bakkie Taxi**	**Car**
0,1%	5,6%	0,6%	17,7%	0,3%	0,7%	7,7%

1.2.2. Economy, Accessibility and Integration

Modal integration of long-distance public transport services in Limpopo is limited, and, generally, the current public transport system lacks effective modal integration at all levels. Collection and distribution services at termini are inadequate and not integrated with the main line modes. A significant portion of households does not or have limited access to public transport, or cannot afford it. The practice of monthly migration trips on public transport makes use of low quality buses and mini-bus taxi services. Long-distance rail suffers from very old rolling stock, low demand and hence low profitability. Many services have been discontinued.

1.2.3. Safety , Climate Change and Air Quality

Traffic safety is a major problem for all vehicles – whether private cars, busses or mini-bus Taxi transport. Multiple causes/reasons for the poor safety record, the prominent of which are poor roads, un-roadworthy vehicles, fatigue due to long driving hours and limited law enforcement. Similar to the rest of the country – although to a more extent – private car usage and ownership is on the increase, with the attendant fossil fuel environmental concerns. A shift from private to public transport will have to be established.

1.2.4. Summary of Problems to be addressed

According to the National Department of Transport Public Transport Strategy 2007, the envisaged transport system should be such that it displays the following characteristics:

- ✓ High quality networks that are fully integrated (modal integration);
- ✓ Single integrated rapid commuter service;
- ✓ Mobility solution that is attractive to both current PT users as well as current car users;
- ✓ Modal shift of 20% from car work trips to PT by 2020;
- ✓ Improved quality of PT to a level of service that is car competitive; and
- ✓ Radical transformation of the PT service delivery system.

The current public transport system is characterised by various shortcomings related to poor quality service in terms of service offered, punctuality, reliability and frequency. Although some areas in the Limpopo Province do have regular public transport systems, the major part of the Province still require a well-designed service with good coverage in order to ensure that all areas benefit. Passenger rail faces many challenges as a result of a long history of inadequate investment in rail rolling stock, infrastructure and operations as well as the loss of appropriate managerial and technical (engineering) skills within the industry.

In the rapidly urbanising metropolitan areas, the provision of new rail corridors has not kept pace with the rapidly changing urban landscape, and limited coverage in key areas of urban expansion persists – along an ever diminishing rail market share, which needs to be addressed through aggressive ‘back to rail’ initiatives. In this regard, railway passenger services need to be strategically positioned and aligned with the evolving spatial developments.

As the sphere entrusted with the rail competency, the Department of Transport (DOT) has given priority to rail (both freight and passenger) revival throughout South Africa. To their credit, Limpopo Provincial Authorities have decided to take this window of opportunity to prioritize the development opportunity of commuter rail services in the Province. It is thus that a Passenger Rail plan for the province has been developed and, through this certain initiatives have been identified to 'kick start' passenger rail corridors and services. Phase 1 made determinations to assist in the decision making w.r.t to prioritization of the development and entry into the project cycle of certain of said initiatives that are deemed to possess potential for implementation.

The Phase 1 Evaluation Criteria for New Rail Corridors were as follows**:**

Filter 1 - Strategic Merit Test (SMT):

- ✓ Meeting the transport system objectives, policies and strategies.
- ✓ Demand and travel behaviour.
- ✓ Realistically achievable.
- ✓ Reasonability of indicative costs.

Filter 2 - Rapid Appraisal (Rapid feasibility)

- ✓ Rapid benefit-cost analysis
- ✓ An indicative assessment of the main benefits and costs, without a high level of accuracy.

Lastly, high level estimates were done for the capital cost (2009 Rand). These estimates give an indication of the capital requirements for the infrastructure of the different options.

1.3. Scheme Objectives

The objectives are to achieve modal integration, increase in passenger rail mode share, promote enhanced system accessibility, enhance trip safety and better trip security, enhance customer experience in a transit oriented development that supports densification which contributes to economic scheme viability along financial sustainability and environmentally sound development of corridor principles.

1.3.1. Routes & technology review

Corridor A: Polokwane Mokopane Commuter Service

Presently the link between Polokwane and Mokopane stations consists of a rail line of 65 km electrified with 25 kV AC. The current average travelling time is 1 1/4 hours whereas it's approximately ¾ hour by road. The modelling in Phase 1 indicated that 38,181 passengers would travel daily in 2010 for work purposes in the corridor that begins in the residential areas of Mokopane and traverses through the industrial /commercial areas of Polokwane to end at the educational complex of Mankweng. The existing line is a single track line with with 6 passing loops.

Corridor D: Polokwane –Moloto Corridor

The Moloto Corridor project aims to link Moloto in Mpumalanga to Tshwane with a standard gauge rail line. The proposed service would be provided with double decker train set.

Figure 1.4 Approximate location of Rail options that could link to the Moloto Corridor

The corridor could be extended in future via Jane Furse to Burgersfort. A 36km new rail line could be provided from Polokwane to Zebediela with a possible extension to Lebowakgomo, and then further to Jane Furse, ultimately, linking with the Moloto Corridor. The total distance from Polokwane to Jane Furse is approximately 150 km as depicted on Figure 1.4 above.

This pre-feasibility assesses the merits of a rail ink from Polokwane to Jane Furse - via Lebowakgomo / Zebediela, and, eventually the Moloto Corridor The study needs to determine the preferred linkage between Polokwane and Jane Furse, assess infrastructure and operations options, and, develop a business case.

1.4. Policy Context – Strategic Fit

1.4.1. National policy

Various documents have been assessed to ensure concurrence with national public transport policy and established goals and objectives to be pursued. These include:

- ✓ The White Paper on Transport,
- ✓ Moving South Africa,
- ✓ Rural Transport Strategy for South Africa, 2007,
- ✓ National Land Transport Strategic Framework, 2006-11,
- ✓ Public Transport Action Plan, 2007-10,
- ✓ Public Transport Strategy, 2007,
- ✓ NATMAP 2050, including theme papers (on the rail gauge and passenger rail technology),

The pre-feasibility initiative under assessment hereunder is in harmony with all these documents and policy papers reviewed for conflict.

1.4.2. Provincial policy

An identical assessment was also undertaken w.r.t concurrence with Provincial policies. Particular attention was paid to the content and intent of:

- ✓ Limpopo in Motion, 2003 &
- ✓ The Limpopo Employment Growth and Development Plan which also contains the following rail-centric high impact initiatives:

High Impact Initiatives	**High Impact Projects**
Limpopo Rail Development Plan	Develop a Provincial plan with the intention to extend the current local rail network
Improvement or modernisation of Train Control Systems	The train control systems and rolling stock in use require refurbishment or modernisation. Transnet Freight Rail will be engaged to enhance its core network by upgrading and expanding its core rail infrastructure

High Impact Initiatives	High Impact Projects
Introduction of Services on existing rail lines	Musina -Gauteng Corridor
	Branch Lines
	Polokwane -Kaapmuiden (Nelspruit) Corridor
	Lephalale - Rustenburg : Gauteng Corridor
Development of New Rail Lines	Makhado-Thohoyandou Link (Link Thohoyandou to mainline at Makhado)
	Makhado-Lephalale(Provide new line along the northwest corridor)

1.4.3. PRASA documentation

PRASA documentation was equally in accordance with the initiative under review in this pre-feasibility.

1.4.4. Local Authority ITPs

Local Authority ITPs along the chosen alignment are also in harmony with the initiativge. In fact, the team had opportunities to consult with representatives of these LAs during the conduct of the study

2. The Value for Money Case

2.1. Introduction

This section sets out the Value for Money Case for the two priority corridors A & D. It contains the following information:

- ✓ A summary of the **preferred schemes descriptions**, which forms the basis for the appraisal and value for money assessments;
- ✓ A summary of the **scheme costs**, including the capital costs, operating and maintenance costs, but exclude quantified risk assessment and do not account for optimism bias (a tendency of scheme promoters to underestimate costs and implementation programmes);
- ✓ A summary of the key findings from the **public transport and passenger demand modelling** for the preferred schemes;
- ✓ The completed **scheme appraisal** (and supporting analysis) for the preferred schemes; and
- ✓ High-level **sensitivity analyses**, assessment of the **next-best alternative w.r.t Corridor D** as well as a summary **choice of gauge evaluation**.

2.1.1. Summary scheme descriptions

2.1.1.1. Polokwane to Mokopane Rail Commuter Service – Corridor A

The assessment aims to examine the existing conditions within the catchment area along the Polokwane to Mokopane corridor, with a view to establish the high-level feasibility for implementing a passenger rail commuter service between the two centroids.

2.1.1.2. Polokwane to Jane Furse Regional Rail Service – Corridor D

The assessment aims to examine the existing conditions within the catchment area along the Polokwane to Jane Furse corridor, with a view to establish the high-level feasibility for implementing a passenger regional rail service between the two centroids. This will include a comparative advantage assessment of the two alternative alignments, i.e., alternatively via Chuenspoort or via Zebediela.

2.2. Scheme Costs

2.2.1. Characteristics and costs of scheme rolling stock

The scheme costs are specific to the mission at hand – specifically, the market segment being addressed. Figure 3.2.1 below depicts characteristics applicable to the Corridor A market – viz., suburban commuter, whilst Corridor D is more suited to Intercity rolling stock-type equipment. As this pre-feasibility recommends that a single network approach be adopted for both corridors, the scheme costs the study has computed are based on the conventional Intercity rolling stock equipment - similar to the Gautrain, as highlighted on Figure 3.2.1 below.

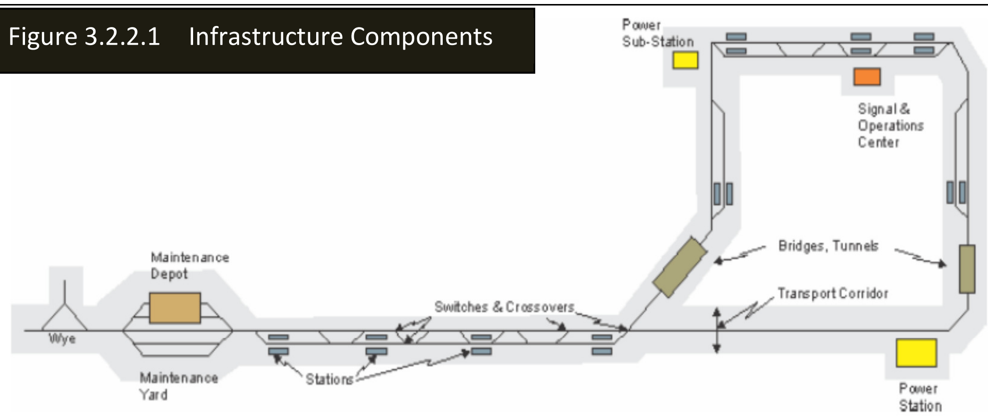
Figure 3.2.1 Characteristics of Passenger Rolling Stock

Type of Service	Speed (kph)	Passengers per Car	Passengers per Train	Cars per Train	Typical Distance	Cost/ Train-US$
Tram	40	120	240	2	1-2 km	$4 m
Metro	70	160	720	6	2-4 km	$12 m
Light Rail	80	100	400	4	5-10 km	$6 m
Suburban Commuter	120	80	480	6	15-20 km	$12 m
Conventional Intercity	160	80	640	8	25-120 km	$12 m
High Speed Rail	250-350	70	560	8	250-350 km	$25 m

2.2.2. Scheme Infrastructure Components

Scheme infrastructure components recommended are common to both Corridors A & D, under review herein, and, are schematically represented below on Figure 3.2.2. a comprehensive sizing of the system includes infrastructure components structures – such as maintenance depot, switches and crossovers, which allow trains to change from one track to another, and maintenance and sorting yards, where cars are arranged in the correct order, etc.

Figure 3.2.2.1 Infrastructure Components



The single most significant cost component that has been determined is that – initially – a single track will suffice. As the capacity of a railway line is determined by the longest time for trains to move between passing sidings, the detail feasibility will have to maximize capacity by paying special attention to each of the three components in the 'Scott's Formula' with the objective to compute the optimal permutation that will maximize operational capacity. The indicative capacity relationship is depicted below for the 'Scott's Formula' which states:

N = E x 24 x 60 x T,

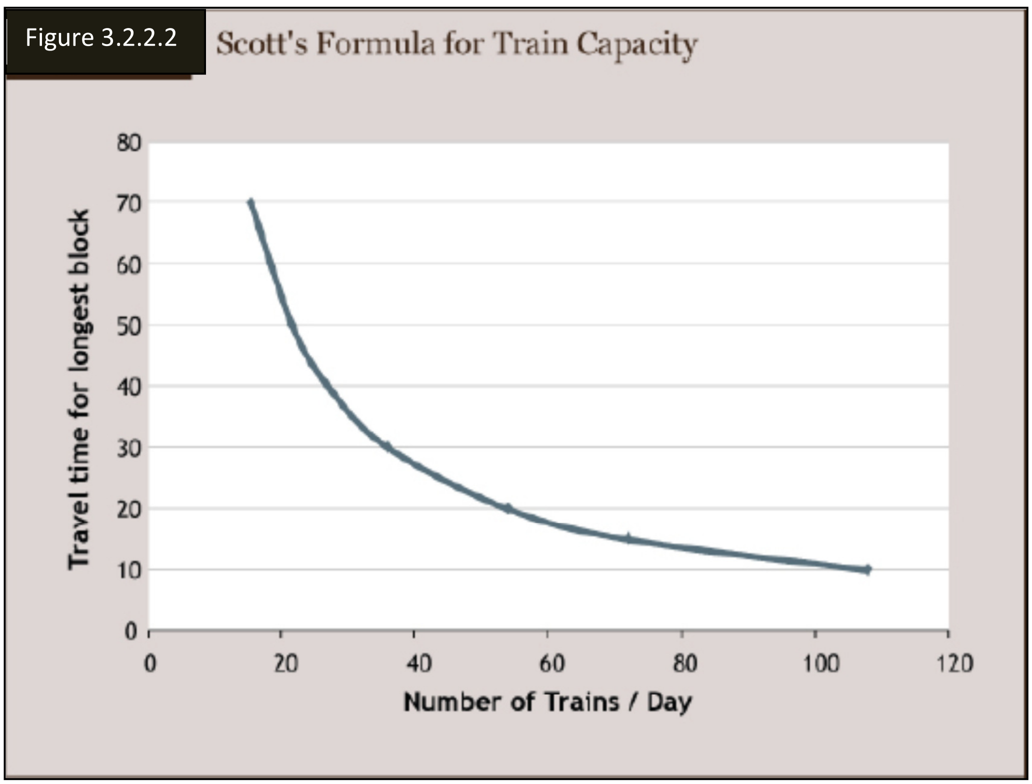
Where:

N = Number of trains/day,

E = the efficiency of signalling system, and

T = the longest Travel and stopping time in minutes between passing sidings on a given line.

Figure 3.2.2.2 Scott's Formula for train capacity



The value for money proposition inherent in the initial single track approach advocated in this business plan will impact not only on line capacity as argued above, but also achievable speeds as indicated by the 'T' in the Scott's Formula. This pre-feasibility has argued for a conventional intercity-type hardware that will allow speeds of up to 160km/h. This takes into account the longer-term requirement of a double track which would not be constrained as the single track is. The single track specification will have to be revisited by the detail feasibility to factor in capacity permutations that the Moloto connectivity will impose on the D corridor. However, typically, the recommended specification will allow for about 30 trains a day (or 15 trains a day, each way). Equally, the immutable relationships mean that as the number of trains increases, interference between trains increases and delays to all trains on the line tend to get larger as well.

Value for money considerations proposed in this study remains robust, once one takes into account that notwithstanding the apparent capacity and speed constraints of a single track, the system has built-in flexibility in that, as the number of trains increases further, the scheme will connect passing sidings to provide a piece of double track, permitting trains to pass while still moving and saving on the stopping and starting times in the fullness of time (medium to long term), as demand increases. Eventually, to create more capacity, the entire line will be double tracked.

Lastly, although dual use for freight and passenger traffic concurrently is suggested in this pre-feasibility to maximize cost recovery, detail feasibility will have to confirm the validity of this system feature. Indeed, a large speed differential between freight and passenger operations tend to limit line capacity – even on double track systems, and the detail feasibility will have to model the validity of the dual-use recommendation with the view to prescribe an optimized configuration taking into account survey outputs at the time and the province-wide passenger rail connectivity requirements for the Limpopo network as a whole and within the national context.

2.2.3. Railway gauge

The choice of gauge is significant in a value for money discourse. Narrow gauge, similar to PRASA's legacy network is cheaper to build than broader gauge for engineering and construction costs reasons – cuts and fills smaller, there is les earth moving or blasting required, tunnels smaller, sleepers less costly, etc. (For example, some Latin American railways built to move banana harvests are only 560mm, a size that can be built quickly and cheaply, and also easily relocated when demand so requires). In South Africa to date, the narrow gauge has been the norm, and – generally – a new railway line should match the specifications of the predominant gauge if said new line is to be part of a national network. This pre-feasibility study aligns itself to NATMAP 2050 in agitating for standard gauge as the gauge of choice for the scheme. Also compelling in this regard, standard gauge implementation will allow significant flexibility - including competitive OEM bidding in the procurement of rolling stock as most high speed passenger rolling stock is built (and originally designed for) standard gauge, thus further strengthening the value for money proposition.

2.2.4. Capital costs

A detailed breakdown of the combined Corridor A & D scheme costs (and the underlying cost assumptions) is outlined in the Financial Case. The capital costs are based on widespread experience of similar capital works.

The estimated initial investment is R12'022m, excluding pre-programme entry preparatory costs. A summary breakdown of this is provided in Table 3.2.4, below. All costs exclude allowance for optimism bias.

Table 3.2.4 Summary Capital Costs

Item	R million
Engineering works	10 922
Land costs (excluding opportunity costs)	323
Site supervision costs	269
Sub-total	**11 514**
Preparatory costs	45
Risk budget	546
Total	**12 105**

2.2.5. Maintenance and operating costs

A detailed breakdown of the combined Corridor A & D scheme maintenance and operating costs are included in the Financial Case, and summarised in Table 3.2.4, below. Similar to the capital costs, the maintenance and operating costs are based on widespread experience of similar schemes.

The annual maintenance costs for the scheme are estimated at R29m per year, for the first year, escalating to R88m in 40 years. These costs cover upkeep of the infrastructure, ITS systems and power costs.

Additional to the annual maintenance costs but not factored into the above costs, are costs of maintaining parking facilities (park & ride), bus and taxi terminals, general costs (staff, utilities, etc), security, marketing and promotion of the new service. These costs need to be assessed and compiled during the detailed feasibility.

Table 3.2.5 Summary Operating Costs (Rm)

Item	PRASA (ave. 2010/2011)	Scheme Costs (ave. first 10 years)
Annual operating costs	6'080	502

2.2.6. Risk assessment and optimism bias

Only costs escalation has been taken into account in the tables below, but the detail feasibility will have to consider a quantified risk assessment at chosen confidence levels, and derive risk-adjusted appraisal costs.

We would also suggest that the detail feasibilities account for the tendency of scheme promoters to under-estimate costs and implementation programmes – also known as the optimism bias. Also, as the schemes are developed, we expect that cost estimates should become more refined over time, and hence it should be possible to better quantify and value risks, and to better capture the factors that contribute to appraisal optimism within the risk management process. Hence, as the risk analysis improves as a scheme develops, it is expected that on average the risk-adjusted scheme cost estimates will increase, while the applicable level of optimism bias will decrease.

The economic appraisal below shows the scheme cost evolution over 40 years.

Table 3.2.6 Economic Appraisal Scheme Costs (Rm)

Item	Yr 1-10	Yr 11-20	Yr 21-30	Yr 31-40	Total
Invest. Costs excl. Infl	12 199	755	850	4 601	**18 406**
Invest. Costs incl. Infl	12 214	1 172	2 741	21 924	**38 051**
Assumed cpi	5%	5%	5%	5%	

2.3. Passenger Demand

2.3.1. Summary modelling approach

This subsection of the business plan underpins and provides the very basis for the recommendations made as to the way forward w.r.t the creation of the commuter and regional passenger rail services that are the objectives of this pre-feasibility assessment. Comprehensive detail discussion is included in the Market Analysis Report appended hereto.

A detailed transit assignment model has been developed for the study for accurately forecasting the ridership levels for Polokwane –Mokopane and Polokwane – Moloto Corridor. Important aspects for forecasting were considered which are mentioned below:

- ✓ Forecast using the four Step Method(EMME3 Software)
- ✓ Interregional traffic volume is based on NATMAP
- ✓ Passenger transport: Updated the NATMAP model of percentage shares among transportation modes to reflect existing situation
- ✓ Prerequisites: Ensure safety and access to rail stations

The forecasting method is presented in Figure 3.3.1.1 and study methodology in Figure 3.3.1.2

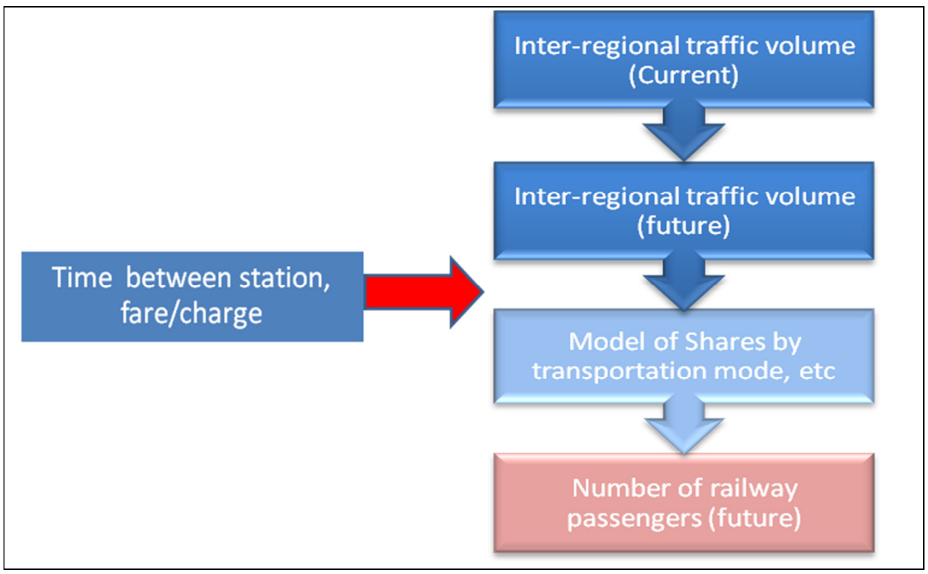


Figure 3.3.1.1 Forecasting Methodology

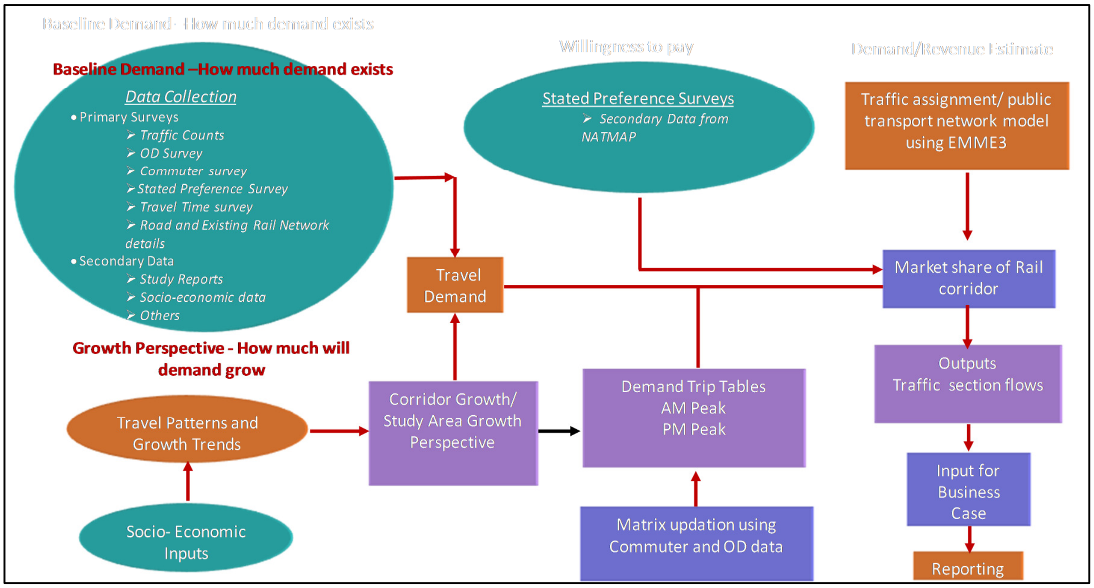


Figure 3.3.1.2 Study Methodology

2.3.2. Forecast years and scenarios

The future travel pattern was forecasted till 2050. Both internal and external traffic streams were estimated separately and included in the transit assignment and an O-D matrix computed. Having not conducted link (Mokopane –Polokwane and Polokwane - Jane Furse) Stated Preference Surveys, the team relied on findings of NATMAP. As the latter was not corridor specific, but macro-modelled, the team supplemented the NATMAP data with the physical counts (bus/taxi).

Further, a 76% a mode switch is assumed. Although the team realises that a conventional view on this “mode switch” rate may be viewed as rather on the high side, it must be borne in mind the design of the service absorbs the current service providers and assigns them to become feeders to the rail. Nonetheless, the team has allowed for residual activity – business as usual, as it were – where some current suppliers may choose to continue independent of the re-engineered rail-based services, hence the 24% residual market.

The base year model is calibrated for the year 2010 using the data from NATMAP 2050 projections – specifically, the NATMAP’s Middle Scenario. The team accepted the growth percentage of 5% for middle scenario, and added 1% due account for the corridor-specific economic developments the team is aware of. As a ‘check-and-balance’ measure, the team confirmed the additional 1% during Stakeholder consultations. Finally, the team also accounted for the potential traffic that will arise from the link to the Moloto corridor – currently undergoing feasibility assessment by the Department of Transport.

At a local (micro) level, an indicator related to performance of the economy was gathered from the Infrastructure Development Plans (IDPs) in the respective districts through which the rail corridors lie and analysed. Specifically, employment and development potential, including recorded past trends and future prospects as well as emerging opportunities as recorded in the IDPs of the 3 nodes of the network were factored into market viability considerations. The team singled out the economic performance of the construction sector at a local level as a good indicator of past and forecast future economic performance in the study area. From this, average annual growth rates were computed using time –trend analyses as summarized under Table 3.3.2.1, below. As the data used is rather old, the detail feasibility will have to confirm the findings through appropriate and more recent data – probably, through primary data created by the study team.

Table 3.3.2.1 Annual Growth Rates of construction sector

NODE	SOURCE	
Mokopane	MOGALAKWENA LOCAL MUNICIPALITY : 2011/12 IDP REVIEW	Time Period = 1994-2001 Annual Growth Rate = 6.3%
Jane Furse	SEKHUKUNE DISTRICT MUNICIPALITY – DRAFT 2012-2013 IDP/BUDGET	Time Period = 1994-2000 Annual Growth Rate = 0.32%
Polokwane	2010/2011 DRAFT NTEGRATED DEVELOPMENT PLAN	Time Period = 2001 - 2008 Annual Growth Rate = 8.76%

Ramp up factors considered in the ridership estimation have taken into account ramp up patterns on BRT corridors in South Africa and rail corridors world-wide, and do not anticipate mopping-up the available market – as discussed above. The factors are as follows:

- ✓ First Year operation: 50 %
- ✓ Second Year to year + 40: 80 %

2.3.3. Demand and Station Boarding/Alighting Estimates/Scenarios

The demand estimates are for the morning peak hour of 0500- 0700 hrs and evening peak hour of 1600 hrs -1800hrs and represent Peak Passenger Per two Hours Per Direction, and representing 70% of total demand – with the residual taken up by leisure/general/shopping trips. The model is an AM /PM peak hour model – which was also the indicator used to right-size the infrastructure and operations system design.

Below is a representation of the estimates in tabular form. In the case of the Polokwane – Jane Furse/Moloto Corridor, both the options viz. via Chuneesport and Lebowakgomo were modelled, before the Zebediela Option was chosen as set out in detail in the Option Development Report appended hereto. Consequently, only thevia Zebediela is depicted below in Table 3.3.3.2. **Annexures 1** and **2** appended hereto show the detail workings.

Table 3.3.3.1 Station Boarding and Alighting Passenger Per two Hours Per Direction (2050) - Mokopane to Polokwane - Morning Peak

Route	Embark	Dis- embark	Total in Section
Mokopane	18463	0	18463
Commuter Station 1	15454	0	33917
Commuter Station 2	6736	0	40654
Commuter Station 3	6633	0	47286
Commuter Station 4	7213	0	54499
Commuter Station 5	541	0	55040
Commuter Station 6	7693	0	62733
Commuter Station 7	0	5126	57607
Commuter Station 8	0	17616	39990
Polokwane	0	39992	0
	62733	**62734**	

Table 3.3.3.2 Station Boarding and Alighting Passenger Per two Hours Per Direction (2050) - Jane Furse to Polokwane via Ga- Rakgoatha (Near Zebediela) Morning Peak

Route	Embark	Dis- embark	Total in Section
Jane Furse	6115	0	6115
Difapyae	5284	0	11399
Ga-Marishane	1325	0	12724
Makadikwe	314	0	13038
Mashabela	251	0	13289
Ga-Masemola	2493	0	15782
Marulaneng	1772	0	17554
Lebowakgomo South	11760	3760	25554
Lebowakgomo	44218	14468	55303
Mmakotse	3340	0	58643
Ga-Rakgoatha	5566	0	64210
Drop	0	0	64210
Plaas	0	0	64210
Commuter Station 7	0	8271	55938
Commuter Station 8	0	19158	36781
Polokwane	0	36781	0
Total	**82438**	**82438**	

2.3.4. Service integration – Feeder & Distribution

The market viability determined hereunder is dependent on service design. Indeed, the current market is in the main ‘owned’ by the Kombi/Mini-bus industry, complemented by a small subsidized bus service.

Service redesign aims to realize – at once – service attributes for public transport reform (both passenger/user and service provision attributes) that public passenger transport should exhibit in the future, as well as underpin market viability to support the rail-based corridors under assessment. The inclusive approach adopted by the team is designed to achieve these objectives. Hence, the feeder and distribution system designed to maximize the absorption of current market ‘owners’. Maximization of ‘reach’ or ‘depth’ also dictates that the service design targets the private vehicle niche market. Consequently, attributes to attract this niche market have been included in the service design parameters.

Lastly, the service design accepts that provision must be made to allow for the integration of this scheme to the Provincial and, ultimately, National passenger rail network. And advance consideration made herein concerns the Moloto rail corridor currently under feasibility consideration by the Department of Transport.

2.3.4.1. Indicative feeder and distribution service requirements

Tables 3.3.4.1.1 and 3.3.4.1.2 below depict the Peak requirements for the scheme's commuter service and regional passenger services under consideration, to be further modelled more definitively during detail feasibility.

Table 3.3.4.1.1 Indicative Requirement of Feeder and Distribution Services for Polokwane –Mokopane Corridor (2050)

Station	AM Peak Hour Boarding Passengers (2050)	Bus(60 seater buses)	Midi-Bus(18 seater)	22 Seater taxi	16 Seater taxi	13 Seater taxi
Mokopane	18463	9	10	12	8	7
Commuter Station 1	15454	4	10	9	6	6
Commuter Station 2	6736	2	5	4	3	3
Commuter Station 3	6633	2	4	4	3	3
Commuter Station 4	7213	2	5	4	3	3
Commuter Station 5	541	0	0	0	0	0
Commuter Station 6	7693	2	5	4	3	3
Commuter Station 7	5126	2	5	4	3	3
Commuter Station 7	17616	5	10	10	7	7
Polokwane	39992	5	11	13	9	8

Table 3.3.4.1.2 Indicative Requirement of Feeder and Distribution Services for Polokwane –Jane Furse Corridor (2050)

Station	AM Peak Hour Boarding Passenger (2050)	Bus(60 seater buses)	Midi-Bus(18 seater)	22 Seater taxi	16 Seater taxi	13 Seater taxi
Jane Furse	6115	7	13	9	7	6
Difapyae	5284	6	11	8	6	5
Ga-Marishane	1325	2	3	2	1	1
Makadikwe	314	0	1	0	0	0
Mashabela	251	0	1	0	0	0
Ga-Masemola	2493	3	5	4	3	2
Marulaneng	1772	2	4	3	2	2
Lebowakgomo South	11760	14	17	11	9	12
Lebowakgomo	44218	22	23	26	19	23
Mmakotse	3340	4	7	5	4	3
Ga-Rakgoatha	5566	7	12	8	6	6

2.4. Infrastructure and Operations

The Infrastructure and Operations reports set out in some detail the norms and standards to be accounted for during detail feasibility. Also, the recommendation is for the two corridors under assessment to be provided as an integrated system using the standard gauge. Indeed, the two corridors share the same alignment from Polokwane up to the recommended turn off at km 267.8, where they separate to continue to their respective destinations.

Although the team’s recommendation is to hold the detail feasibility back in the short term (5 to 10 years), certain preparatory activities have to accomplished in the immediate term. These include:

- ✓ Advising all interested Parties - the national passenger rail Agency (PRASA), provincial authorities charged with land-use planning, transportation delivery and economic development , local authorities in whose jurisdiction the system alignment will traverse, the Department of Transport (custodian of the rail competency), Transnet Freight Rail (in the eventuality that the Agency is may contemplate the chosen alignment to further develop its network for rail freight transport), the National Planning Commission, etc), of the intention to initiate a rail-based public transport corridor on the determined alignments, and

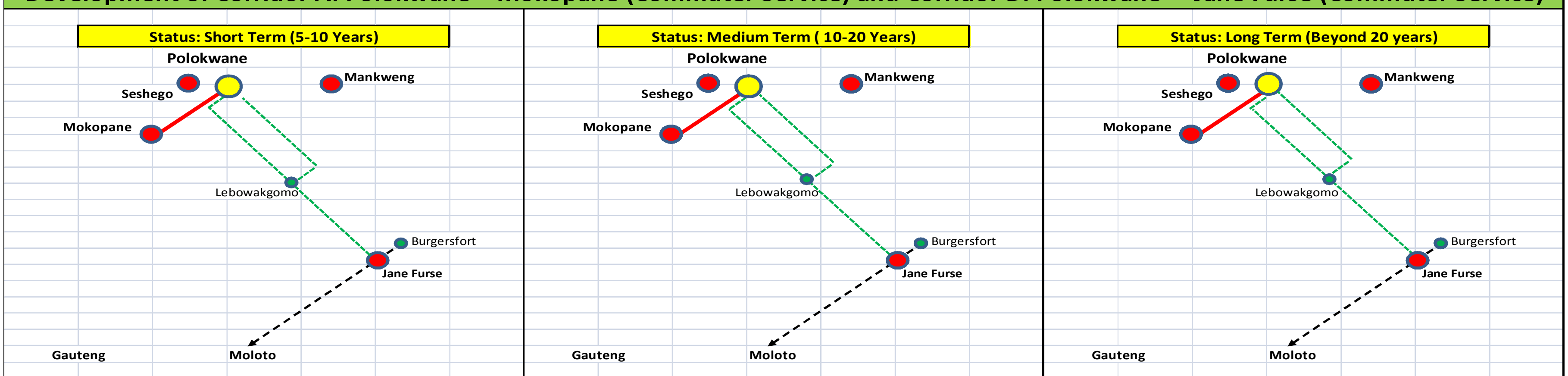
- ✓ Engage into formal land-use planning processes to provide for the required reserve along the alignment, and pro-active prevention of any intrusion that may compromise the required reserve.

2.4.1. Infrastructure design parameters

In the medium term (10 to 20 years), a single standard gauge track line is recommended. The combined network length is 207kms. Beyond 20 years, a double track line would be required to be constructed. To the extent that the single track line would feature numerous passing loops, construction of a double track will be – to an extent – a matter of joining the loops to double the track. A schematic representation of the network development over time is depicted on Figure 3.4.1.1, and permanent way design parameters to be factored into the detail feasibility included in Table 3.4.1.2, below.

Figure 3.4.1.1: Network Development

Development of Corridor A: Polokwane – Mokopane (Commuter Service) and Corridor D: Polokwane – Jane Furse (Commuter Service)



Short Term – Legend:

- A. Polokwane – Mokopane: Commuter Service; and
- D. Polokwane – Jane Furse

- demand better served by road based public transport mode like Taxi, Bus and possibly BRT

Further Connections

Medium Term – Legend:

- A. Polokwane – Mokopane: Commuter Service:
- D. Polokwane – Jane Furse

- demand better served by road based public transport mode like Taxi, Bus and possibly BRT; but
- LDRT monitors market developments within the identified corridors and when market viability is reached , the rail option on these corridors be reviewed and confirmed through detailed Feasibility Study

LDRT shares the findings with the affected local authorities and PRASA with a view to ensure that the identified alignment is not compromised by conflicting developments and are preserved for future development of rail corridors as identified in the pre-feasibility study

Further Connections

Long Term – Legend:

- A. Polokwane – Mokopane: Commuter Service:
- D. Polokwane – Jane Furse

Implementation of the following possibly underway:
1) standard gauge single track or doubletrack line after verification of travel demand, 2) Vmax =160 kmph,3) no additional sidings, 4)change of track only at stations

Further Connections

Table 3.4.1.2 Design Parameters

Parameter	Design
Design speed:	160 km/h
Maximum axle load:	25 t
Rails:	UIC 60
Rail inclination:	On track: 1: 40 On turnouts: 1 : ∞
Gauge:	1435 mm (cape gauge)
Sleeper:	Pre-stressed concrete mono-block
Sleeper spacing:	600 mm
Turnout sleepers:	Pre-stressed concrete mono-block sleepers
Ballast thickness:	30 cm (under sleeper surface)
Ballast shoulder width:	40 cm
Scope of ballast shoulder:	1 : 1.5
Ballast size:	31.5 / 63 mm
Rail fastening system:	Elastic rail fastening
Welding track and turnouts:	Continuous Welded Rails (CWR)
Welding procedure:	Flash-butt and Thermite welding
Inclination platform:	1 : 20
Sub-layer:	According to the sub-grade conditions

Recommended track work norms and standards to be used are derived from the established South African environment, complemented by those adopted from the International Union of Railways.

2.4.1.1. Earthworks and Structures

Earthworks minimum standards, number and extent of civil work structures (bridges, tunnels, etc) to be further considered during detail feasibility have are detailed in the technical report on Infrastructure.

2.4.2. Operational considerations

The operations concept concerns itself primarily with the scheme's capacity, scheduling and safety as depicted below on Figure 3.4.2.1. The operational methodology used for and to be used in the detail feasibility for dimensioning the scheme is depicted on Figure 3.4.2.2 overleaf.

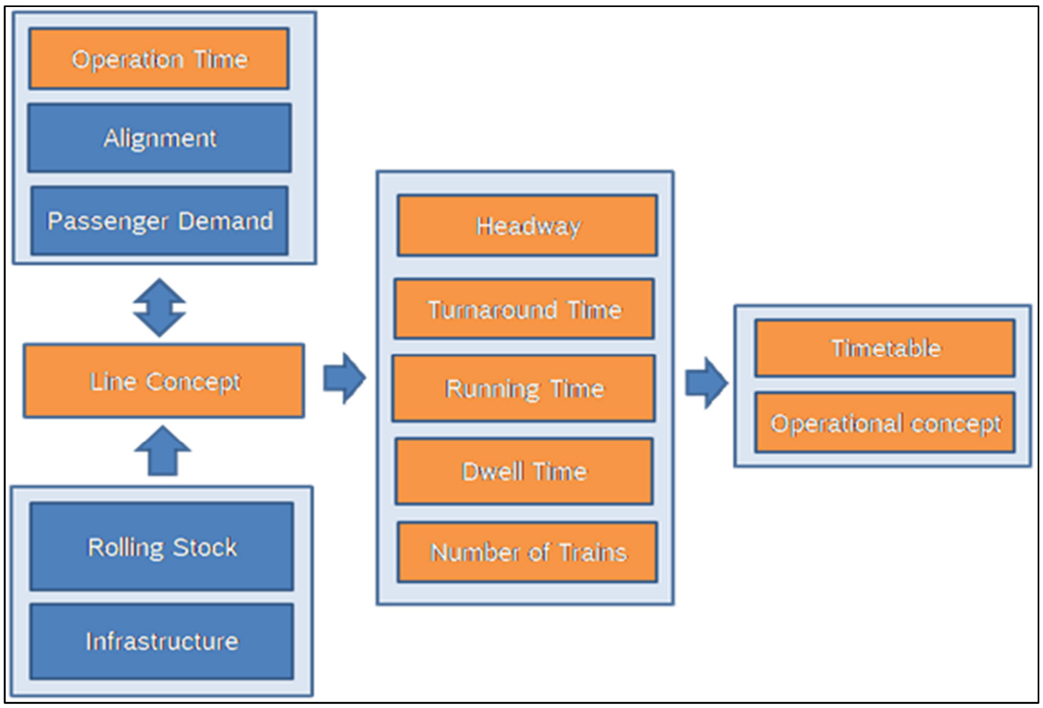


Figure 3.4.2.1 Operational Concept development

A continuum ranging from a commercial speed of 90km/h through to the design speed of 160km/h specified for both the infrastructure and operations components was computed to test the corresponding commercial speeds achievable on the commuter line between Polokwane and Mokopane. This is illustrated on Table 3.4.2.1, below.

Similarly, the exercise was affected for the Polokwane to Jane Furse regional service, but for this portion of the network, only the 160km/h commercial speed was computed, as represented in Table 3.4.2.2 overleaf.

Figure 3.4.2.2 Dimensioning the scheme operating characteristics

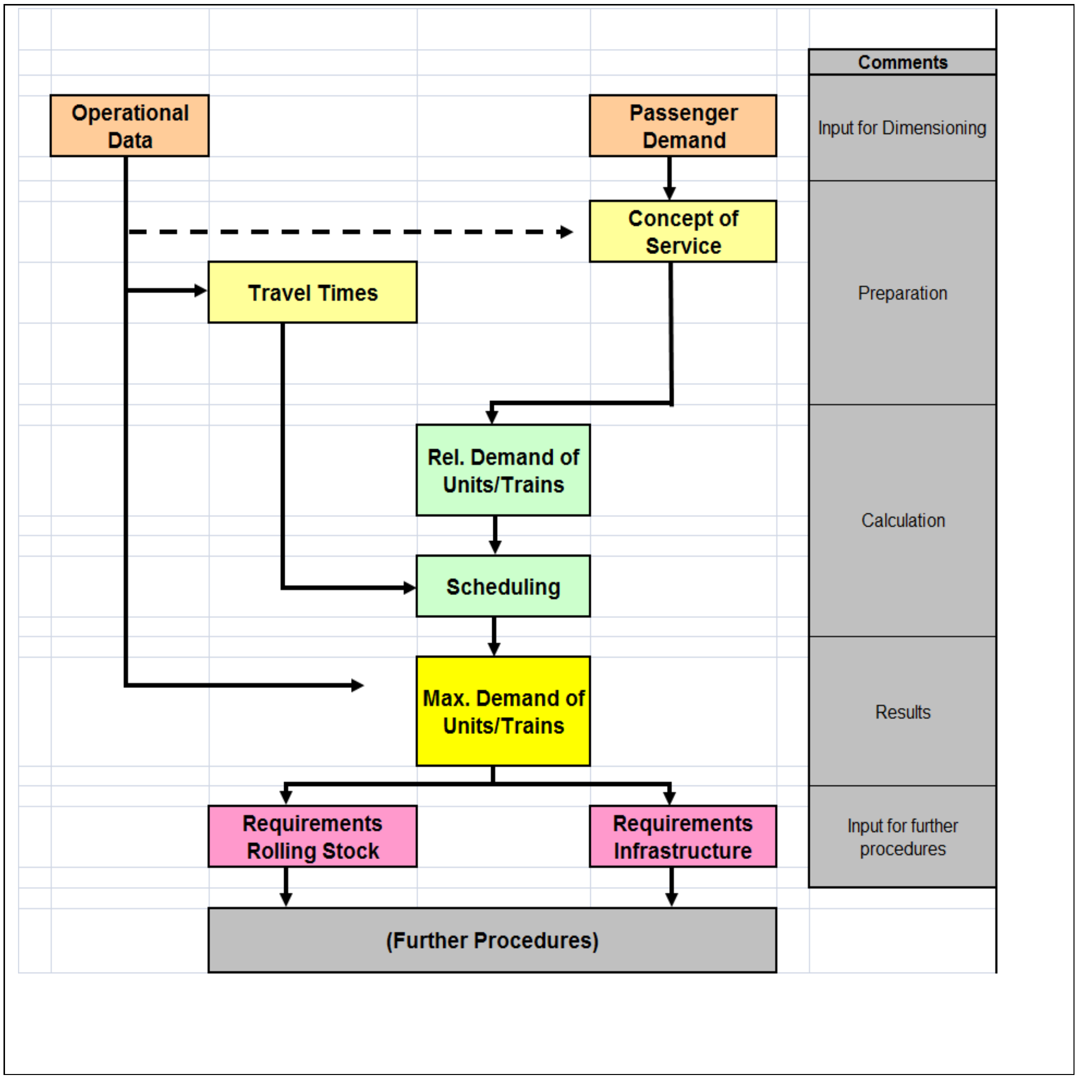


Table 3.4.2.1 Commercial Speed determination - Polokwane to Mokopane Rail Commuter Service

Route		Distance	Run-time (120)	Time additive	Margin	Dwell time	Travel-time
		(km)	(min)	(min)	(min)	(min)	(min)
Maximum Commercial Speed: 90 km/h							
Mokopane	1	0		-		-	
Mokopane - Commuter Station 1	2	6.75		1		1	
Commuter Station 1 - Commuter Station 2	3	2.88		1		1	
Commuter Station 2 - Commuter Station 3	4	10.00		1		1	
Commuter Station 3 - Commuter Station 4	5	5.08		1		1	
Commuter Station 4 - Commuter Station 5	6	12.19		1		1	
Commuter Station 5 - Commuter Station 6	7	14.37		1		1	
Commuter Station 6 - Commuter Station 7	8	9.60		1		1	
Commuter Station 7 - Commuter Station 8	9	1.65		1		1	
Commuter Station 8 - Polokwane	10	2.27		1		-	
Total		**65**	**43**	**9**	**5**	**8**	**65**
Mean Commercial Speed: 120 km/h							
Mokopane	1	0		-		-	
Mokopane - Commuter Station 1	2	6.75		1.5		1	
Commuter Station 1 - Commuter Station 2	3	2.88		1.5		1	
Commuter Station 2 - Commuter Station 3	4	10.00		1.5		1	
Commuter Station 3 - Commuter Station 4	5	5.08		1.5		1	
Commuter Station 4 - Commuter Station 5	6	12.19		1.5		1	
Commuter Station 5 - Commuter Station 6	7	14.37		1.5		1	
Commuter Station 6 - Commuter Station 7	8	9.60		1.5		1	
Commuter Station 7 - Commuter Station 8	9	1.65		1.5		1	
Commuter Station 8 - Polokwane	10	2.27		1.5		-	
Total		**65**	**33**	**14**	**4**	**8**	**59**
Mean Commercial Speed: 140 km/h							
Mokopane	1	0		-		-	
Mokopane - Commuter Station 1	2	6.75		1.7		1	
Commuter Station 1 - Commuter Station 2	3	2.88		1.7		1	
Commuter Station 2 - Commuter Station 3	4	10.00		1.7		1	
Commuter Station 3 - Commuter Station 4	5	5.08		1.7		1	
Commuter Station 4 - Commuter Station 5	6	12.19		1.7		1	
Commuter Station 5 - Commuter Station 6	7	14.37		1.7		1	
Commuter Station 6 - Commuter Station 7	8	9.60		1.7		1	
Commuter Station 7 - Commuter Station 8	9	1.65		1.7		1	
Commuter Station 8 - Polokwane	10	2.27		1.7		-	

Route		Distance	Run-time (120)	Time additive	Margin	Dwell time	Travel-time
Total		**65**	**28**	**16**	**4**	**8**	**56**
Maximum Commercial Speed: 160 km/h							
Mokopane	1	0		-		-	
Mokopane - Commuter Station 1	2	6.75		2		1	
Commuter Station 1 - Commuter Station 2	3	2.88		2		1	
Commuter Station 2 - Commuter Station 3	4	10.00		2		1	
Commuter Station 3 - Commuter Station 4	5	5.08		2		1	
Commuter Station 4 - Commuter Station 5	6	12.19		2		1	
Commuter Station 5 - Commuter Station 6	7	14.37		2		1	
Commuter Station 6 - Commuter Station 7	8	9.60		2		1	
Commuter Station 7 - Commuter Station 8	9	1.65		2		1	
Commuter Station 8 - Polokwane	10	2.27		2		-	
Total		**65**	**24**	**18**	**4**	**8**	**54**

Table 3.4.2.2 Commercial Speed Determination - Polokwane to Jane Furse Rail Service

Vmax = 160 km/h							
Route		**Distance**	**Run-time**	**Time additive**	**Margin**	**Dwell time**	**Travel-time**
		(km)	(min)	(min)	(min)	(min)	(min)
Polokwane to Lebowakgomo via Ga-Tshwene							
Polokwane	1	0		-		-	
Polokwane - Ga-Tshwene	2	36.06		2		2	
Ga-Tshwene - Lebowakgomo	3	13.16		2		2	
Total		**49.22**	**19**	**4**	**2**	**4**	**29**
Polokwane to Lebowakgomo via Ga- Rakgoatha							
Polokwane	1	0.00		-		-	
Polokwane - Commuter Station 8	2	2.27		2		2	
Commuter Station 8 - Commuter Station 7	3	1.65		2		2	
Commuter Station 7 - Ga-Rakgoatha	4	53.63		2		1	
Ga-Rakgoatha - Mmakotse	5	9.16		2		1	
Mmakotse - Lebowakgomo	6	3.30		2		2	
Total		**70.01**	**27**	**10**	**4**	**8**	**49**
Lebowakgomo to Jane Furse							
Lebowakgomo - Lebowakgomo South	7	5.85		2		2	
Lebowakgomo South - Marulaneng	8	11.61		2		1	
Marulaneng - Ga-Masemola	9	14.65		2		1	
Ga-Masemola - Mashabela	10	14.22		2		1	
Mashabela - Makadikwe	11	7.80		2		1	
Makadikwe - Ga-Marishane	12	3.31		2		1	
Ga-Marishane - Difapyae	13	8.18		2		1	
Difapyae - Jane Furse	14	5.42		2		1	
Total		**71.04**	**27**	**16**	**5**	**9**	**57**

2.4.3. Maintenance considerations

Maintenance was considered and specified detail assessment in two separate aspects, i.e., as it affects infrastructural and operational performance, and as set out in the Infrastructure and Operations' technical reports, respectively.

2.4.4. Facilities

Facilities are considered – distinctly – on the one hand, as those facilities accruing to the rail corridor (i.e., system- specific) and the rail operations in the narrow sense, and facilities required for the complementary functions performed by the feeder and distribution functions, on the other hand.

2.4.4.1. System-specific Facilities

These facilities are specified for the operation of the rail service, and include depots, maintenance sheds, terminals, stations and corresponding passenger amenities, system operations-specific as well as passenger service-focused communications, etc. The detail feasibility considerations of these are included in the technical assessments for infrastructure and operations.

2.4.4.2. Ancillary/complementary Facilities

These facilities underscore the economic, financial and business model 'game changer' attributes of the scheme, and so serve to re-model the terms and conditions for the provision of public passenger transport into the future, and so better serve the attainment of the changed policy objectives in this regard. Indicative artist impressions for the various facilities are included in the Market Analysis report appended hereto.

The ancillary facilities serving the feeder and distribution system integrate the rail station precinct (and the rail backbone) to said system by providing the physical link between rail and these complementary services, consisting of – for example,:

- ✓ Station access – in- and egress facilities, including 'kiss-and-ride';
- ✓ operational facilities dedicated to the feeder and distribution services;
- ✓ pedestrian facilities, etc.

Detail feasibility should ensure that above-mentioned amenities and facilities are planned and designed to enhance passenger experience by providing a high level of service during transfers. Some of the design principles to be observed include optimized:

- ✓ shared access to the station precinct for different modes and services;
- ✓ value-added facilities like commercial and financial services premises;

- ✓ vehicle circulation in and out of the station precinct;
- ✓ choice of on- and off-street parking and drop-off;
- ✓ safety, comfort and convenience for pedestrian passenger;
- ✓ minimized mode conflicts, etc.

2.4.5. Service integration – Feeder & Distribution

The market viability determined hereunder is dependent on service design. Indeed, the current market is in the main 'owned' by the Kombi/Mini-bus industry, complemented by a small subsidized bus service.

Service redesign aims to realize – at once – service attributes for public transport reform (both passenger/user and service provision attributes) that public passenger transport should exhibit in the future, as well as underpin market viability to support the rail-based corridors under assessment. The inclusive approach adopted by the team is designed to achieve these objectives. Hence, the feeder and distribution system is designed to maximize the absorption of current market 'owners'.

Maximization of 'reach' or 'depth' also dictates that the service design targets the private vehicle niche market. Consequently, attributes to attract this niche market have been included in the service design parameters.

The service design accepts that provision must be made to allow for the integration of this scheme to the Provincial and, ultimately, National passenger rail network. This perspective is also accommodated in the forward-looking perspective taken herein w.r.t the Moloto rail corridor currently under feasibility consideration by the Department of Transport, and expected to impact significantly on the scheme's viability.

Lastly, the scheme's connectivity between Polokwane and Jane Furse connecting to the Moloto Corridor provides an alternative rapid rail link between Limpopo's administrative capital and national administrative and business centres in Gauteng - ahead of the high speed rail line between Gauteng and Polokwane anticipated in the NATMAP 2050 proposal.

2.5. Environmental Considerations

In terms of environmental sensitivity, the scheme option (Polokwane – Zebediela – Jane Furse) is the least environmentally sensitive. The via-Chuenespoort option entails more pronounced environmental sensitivity - mainly due to the fact it traverses a protected area. In addition, the presence of vulnerable and endangered ecosystems, as well as cultural and historical features along this alignment makes it less desirable from an environmental sensitivity perspective. Subject to confirmation by the detail feasibility EIA, the cost of mitigation that would arise, were the via-Chuenespoort route to be chosen, are expected to negate any advantages inherent in that route.

The environmental recommendation is thus that – subject to a detailed EIA, the scheme adopts the Polokwane – Zebediela – Jane-Furse route.

2.6. Additional Scheme Benefits Appraisal

2.6.1. Climate change

As a sub-objective, the reduction of greenhouse gas emissions has been identified as a critical contribution from transport operations throughout the country within the National Transport Master Plan 2050. As such, this objective attaches itself to all future transportation investments, and hence it will have to be quantified during detail feasibility assessment of the schemes. Also, cognizance should be taken of the National Response Policy to climate change and GHG emissions endorsed by Cabinet on the 12th October 2011, as well as the Climate Change Response Measurement and Evaluation System anticipated within 2 years.

2.6.2. Support economic growth

Various individual socio-economic benefits and/or outputs that should support economic growth across a significant radius along the corridors of the scheme, and generally in the project areas, are expected from the implementation of this scheme. These must be quantified during the detail feasibility, but should include:

- ✓ An improvement of public transport reliability & connectivity in the Province. Based on a dedicated runway, rail is – when well managed – inherently reliable. Detailed feasibility will have to focus on connectivity and multi-modal interfaces – both i.t.o public transport priority measures that aim to improve reliability (e.g., public transport priority measures and frequencies) of road-based transport as well as fostering road-rail modal synergies.
- ✓ Wider economic impacts, including agglomeration and labour labour supply impacts, and the
- ✓ Promotion of equality of opportunity, i.t.o aspects concerning accessibility, affordability of personal mobility and a redress of regional economic imbalance within and between Limpopo and the rest of the country.

3. The Delivery Case

3.1. Introduction

This section outlines the Delivery Case. It is structured as follows:

- ✓ **Project Planning** – containing an indicative Project Plan, identifying milestones, timescales, critical path and key dependencies;
- ✓ **Risk Management** – indicating the processes that need to be considered during the detail feasibility of individual schemes in identifying and costing key project risks as well as developing a Risk Management Strategy for the scheme for reviewing, managing and mitigating risks as appropriate;
- ✓ **Stakeholder Management** – outlining how key stakeholders must be engaged during the detail feasibility assessment; and
- ✓ **Evaluation and Benefits Realization** – outlining a proposed Evaluation Plan to be undertaken during detail feasibility for monitoring scheme performance.

3.2. Project Planning

3.2.1. Programme steering and resourcing

The scheme represents an effort at fast-tracking the delivery of a restructured public transport based on the rail technology. As such, we anticipate that the Limpopo Department of Roads & Transport will maintain a keen interest in the delivery process as they will be the primary sponsors of the schemes alongside PRASA and/or a private party engaged on a Delegated Management or any appropriate version of a Public Private Partnership.

We also anticipate that the various Local Authorities along the corridors of the scheme will also need to participate to ensure that their constituencies' needs and concerns get ventilated during the detail feasibility assessments. It is thus desirable that these 2 spheres of government in Limpopo be accommodated in the structure designed to oversee the detail feasibility and ultimately, also implementation – should a 'go-ahead' be obtained following the detail feasibilities.

Figure 4.2.1 below sets out an indicative governance and programme management structure/resourcing levels.

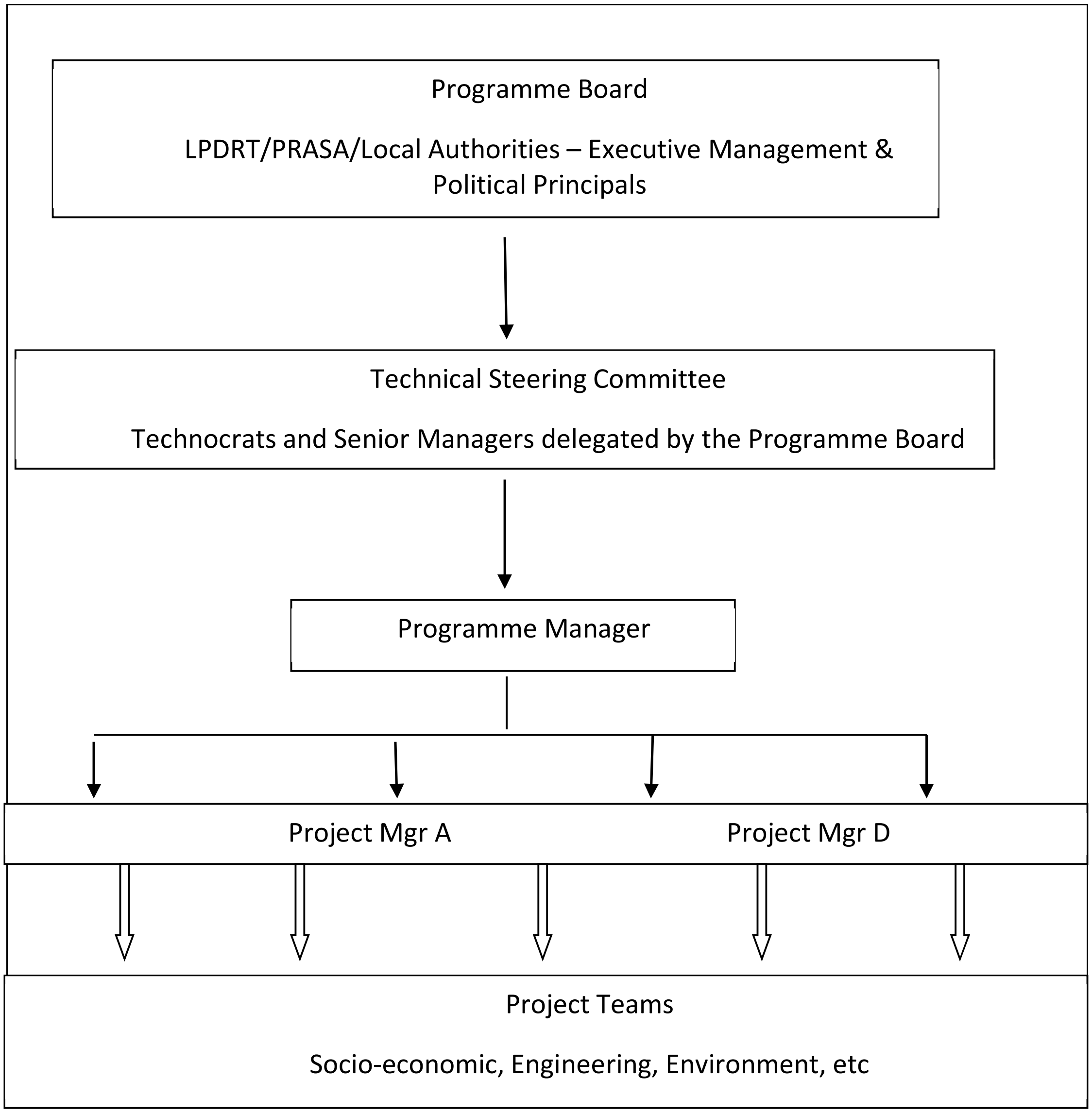


Figure 4.2.1: Scheme Governance and Delivery Arrangements

A successful delivery of the scheme will require an evolving set of project resources that is best able to respond to the specific challenges and tasks faced at any one point in the delivery of the schemes. The responsibilities and organizational arrangements for the development and delivery will necessarily vary accordingly to suit the following phases.

- ✓ **Phase 0 – Review of the pre-feasibility assessments** to incorporate evolutionary changes and any further adjustments that may result from the passage of time or prescribed by the Programme Board;
- ✓ **Phase 1 – Design Developments**, development of the detailed feasibility, business cases and proposals to a level where it achieves Programme

Entry or formal entry into the Public Private Partnership project cycle according to Regulation 16 of the PPP feasibility process – including the development of a suitable reference model and public sector comparator;

- ✓ **Phase 2 – Powers and Planning**, engagement with the planning processes to achieve the required powers for delivery and operation;
- ✓ **Phase 3 – Final Design**, including detailed technical design sufficient to enable successful procurement of the necessary contractors and service agreements;
- ✓ **Phase 4 – Construction**, mobilization, testing, commissioning; and
- ✓ **Phase 5 - Operation** and post-implementation review for lessons learned and bench-marking.

3.2.3. Project plan & program

Figure 4.2.2 below depicts an indicative implementation process map.

3.2.4. Critical path and dependencies

Key programme dependencies anticipated include:

- ✓ Phase 0/1 – consisting of the a programmed:
  - Review of real conditions and market evolution – in particular - demand evolution along Corridor D, as the mining activities in the Eastern Limb gather momentum.
  - And active monitoring which should include an ongoing assessment of the anticipated feasibility assessment and a probable go-ahead for Moloto Corridor project, the sustained monitoring and evaluation of progress with the project to derive 'knock-on' effects on the evolving options available to Limpopo for sustainable improvements to the provision of public transport along the Polokwane – Jane Furse corridor (connecting to the Moloto Corridor).
  - And ongoing review of recommendations of this pre-feasibility assessment – including any changes to the procurement of a detail feasibility study team and the governance thereof that may be necessary as a result of the passage of time.
- ✓ Programme Entry and Conditional Approvals – for preliminary design, EIAs, land requirements and procurement, planning permissions, etc.
- ✓ Full Approval – for detailed design and construction of the scheme, as well as procurement for the implementation and operations phase.

3.2.5. Milestones

Indicative milestones are set out in Figure 4.2.4 below:

Figure 4.2.4: Indicative Key Scheme Delivery Milestones

Milestone	Timeframe
Scheme Pre-feasibility review and Approval(s) w./without amendments	Year 2012 + 5-10 years = Year X
Scheme Programme Entry Approvals	X+1 year
Detail Feasibility Bid & Service Provider Approval(s)	X+1 year
Scheme Detail Feasibility Approval(s)	X+2 years
Programme Entry Bid(s) Approval(s), Procurement Contracts & Service Provider Appointment(s)	X+3 years
Negotiations & Signing of Scheme Programme(s) Design & Build	X+4 years
Start of Works	X+4.5 years
Completion of Works	X+11 years
Scheme Testing, Ramp-up & Commissioning	X+11 years
Scheme Launch & Operation	X+12 years

3.3. Risk Management

A risk management strategy setting out processes for identifying and managing scheme risks should be developed during the detail feasibility, with the aim to formulate a formal quantified risk assessment process.

3.3.1. Risk Register

A risk register that will be continually reviewed in a formalised routine should be developed.

3.3.2. Quantified Risk Assessment (QRA)

During the detailed feasibility, the QRA must be determined using a credible methodology, such as the Monte Carlo simulation method and the @RISK software. The risk exposure should also be included in the economic analysis to determine the applicable benefit-to-cost ratio.

3.3.3. Mitigation Plans

Risks identified by the detail feasibility must be paired to appropriate mitigation plans and detailed action plans for major risks – including the identification of individual risk owners.

3.4. Stakeholder Management

3.4.1. Overview of Stakeholder and Public Consultation

Prospective Stakeholders to be considered in the detailed feasibility include:

- ✓ Land Owners and affected parties,
- ✓ Decision makers,
- ✓ Statutory bodies – including utilities,
- ✓ Special interest groups,
- ✓ Industry groups, &
- ✓ Potential users
    - o The approach to Stakeholders takes various forms and consists of:
        - ▪ Individual meetings and interaction with parties concerned about the proposals with specific interests in certain elements of the schemes, such as transport organizations and/or utilities to obtain input into the design of the scheme at an early stage;
        - ▪ Presentations to and/or meetings with groups of people with similar and/or special interests, both to

disseminate information and negate incorrect rumours and identify appropriate mitigation measures where necessary;

- Regular and formal communication with decision makers, and
- Appropriate, formal statutory consultation/communication with relevant planning authorities, environmental authorities, etc.

Figure 4.4.1 below sets out a suggested communication framework for Stakeholder consultation. The type and frequency of communication will relate to the level of involvement of Consultees in the scheme and their need for information and/or involvement.

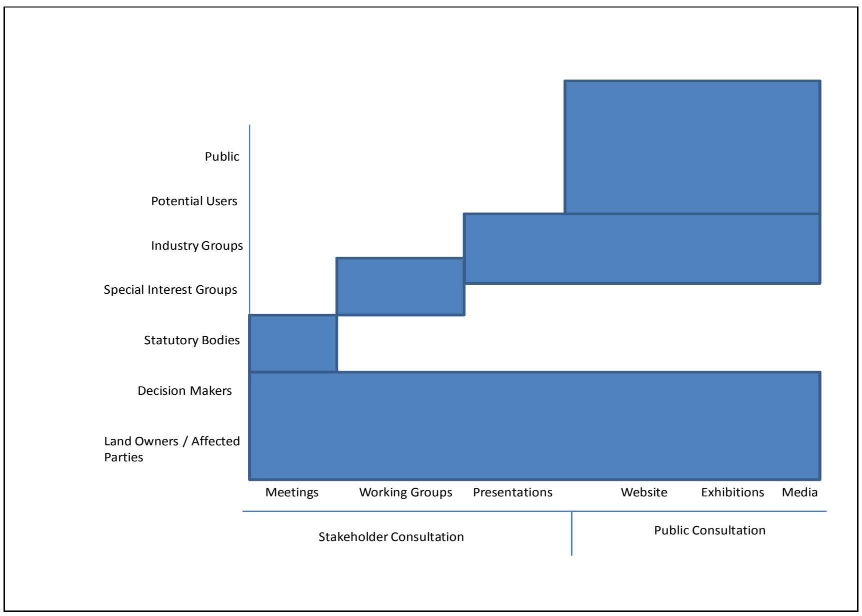


Figure 4.4.1 Communication Framework for Stakeholder Consultation

3.4.2. Communications framework

Detailed feasibility should develop an appropriate communications framework whose principles should – typically – include:

- ✓ Targeted and specific communication activities i.t.o type of communication, concerns/issues to be addressed;
- ✓ Iteratively designed process, capturing and factoring in feedback;

- ✓ Explicitly addressing objections, and maintaining a
- ✓ Record of consultations which must be publicly available.

3.5. Monitoring & Evaluation

3.5.1. National, provincial & local role players

Indicators and targets are key to the successful roll out of the scheme. Certain norms and standards for public transport in the country have been derived at National level and should be factored into the detail feasibility. Limpopo provincial and local authorities along the corridors of the scheme will – no doubt – also have their specific provincial perspective as to what the schemes should achieve, and these must be also factored into the detail design.

3.5.2. M&E plan

The M&E Plan should be aligned with the anticipated benefits generated by the schemes to ensure that along with the target performance levels, they can also be fully realized. Detail design should – typically – include key stages of M&E as depicted in Table 4.5.2 below.

Table 4.5.2 Key Stages of M&E

Stage	Description
Identify scheme objectives	As set out herein
Evaluation scoping	Process / methodology, programme and funding identified
Identify an appraise baseline data	Baseline data identified. Gap analysis undertaken to ensure that the scheme objectives and indicators are fully represented by the available data
Collect required data	Timescales and data sources identified
Analysis and reporting	Timescales for analysis and evaluation

3.5.3. Scheme specific monitoring

Specific quantitative public transport data is expected to be made available by the operator that will help monitor and evaluate the performance of the scheme. Detail design should evolve the appropriate input/output metrics. These should include patronage and revenue levels, reliability and punctuality and customer satisfaction levels. Detail design should also design baseline and monitoring templates for undertaking post implementation surveys to identify any changes in travel behavior brought about by the introduction of the scheme. Typically, these should include:

- ✓ Environmental data,
- ✓ Existing patronage on routes affected by the introduction of the scheme,
- ✓ Traffic levels on key routes,
- ✓ Mode choice surveys, and
- ✓ safety (on trains) and incident/accident records (on trains and along the affected corridors)

3.6. Quality Assurance

Detail design should develop a Quality Plan for the scheme.

4. The Commercial Case

4.1. Outline Procurement Strategy

Detail design will identify and set objectives for the procurement process, undertake a SWOT analysis of the available options in respect of their ability to meet the set procurement objectives, assess the attaching risks and compute the financial implications of the different procurement options.

4.1.1. Procurement objectives

Whether public, public-private partnership or any hybrid thereof, the procurement strategy must ensure:

- ✓ All scheme elements that require procuring are identified,
- ✓ Timely and cost-effective procurement consistent with the overall delivery of the scheme,
- ✓ The process is consistent with all legal requirements, and
- ✓ Contract requirements can be delivered over the duration of implementing the scheme.

4.1.2. System Characteristics

Detail design must be in tune with a number of system characteristics that the scheme must offer to position itself as attractive and competitive alternative to potential users. These include:

- ✓ Competitive and reasonably priced fares,
- ✓ Maximum safety and security of passengers,
- ✓ Transit information designed to be easy to understand and navigate,
- ✓ On-board & in-travel modern communications amenities and facilities,
- ✓ High quality waiting areas with real time passenger information and up to date service information, which is easily and readily available,
- ✓ Improved journey times and reliability when compared to alternatives,
- ✓ A frequency in sync with demand,
- ✓ Etc.

4.1.3. Design parameters

The above characteristics translate to design parameters that the detailed feasibility should account for, which include:

- ✓ Inter-modal and inter-operable ticketing system,
- ✓ Operational modal integration to facilitate connecting services feeding into and from the scheme network,
- ✓ Scalability (to the extent possible – with due regard of the 'lumpy' nature of rail investments, and with regard to the long-term nature of rail investments), whilst maximizing opportunities for incremental expansion of the provincial network to create a core strategic network,
- ✓ Affordability and delivery efficiencies – seeking opportunities to crowd-in private sector investments, including not only contractor involvement, but also design and build, design build operate, or other suitable PPP/PFI options,
- ✓ Fast and reliable journey times,
- ✓ Etc.

4.1.4. Infrastructure and system wide elements

Detail feasibility should account for a comprehensive list of infrastructure elements as well as support/complementary elements, including:

- ✓ Permanent way, power and signalling,
- ✓ Structures, park and ride, cycle, bus & taxi load/off-load facilities,
- ✓ At strategic locations – mode integration terminals,
- ✓ CCTV,
- ✓ End to end communications,
- ✓ Real time public transport information,
- ✓ Etc.

4.1.5. Service provision

The sole mandate for PRASA to provide passenger rail services has been successfully complemented through the PPP Gautrain scheme. Detail feasibility should actively explore comparable opportunities on the Limpopo scheme. Corridor D, in particular, as it also seeks to link to the Moloto Corridor, which is likely to be procured through some form of PPP, may be a likely candidate for PPP-based implementation as a natural extension of the Moloto scheme. An appropriate SWOT analysis should give suitable options for service provision – including operation by PRASA. At any rate, Limpopo would be well served to issue an open request for proposals to measure appetite in the market place, and to benchmark any prospective offering.

4.2. Commercial Risks

4.2.1. Local market considerations

The commercial risk is an obvious risk to the financial viability of the contemplated schemes. However, the current country-wide drive to re-establish rail services has to be motivated beyond pure commercial viability. Indeed, the nation-wide 'back-to-rail' campaign is rooted in the long-term perspective of transformation of public transport provision - post democratization. It is, of necessity, an effort at restructuring public transport provision and taking said service provision quality considerations into a new era, - both i.t.o equitable access and sustainability as well as quality of provision. Hence, a transformation premium is to be expected, but the detail feasibility should be mindful that the general trajectory of the financial feasibility of the scheme should be towards maximizing quasi commercial viability (especially w.r.t operating costs) in the foreseeable future.

Integration of complementary non-rail and value-added services into overall network efficiency will serve to secure long-term financial viability and reduce/contain commercial risk.

Public transport services along the corridors of the envisaged scheme is dominated by Kombi/minibus Taxis and a small participation by contracted subsidized bus services. On corridor A , Shosholoza Meyl provides a compromised commuter service to Polokwane, operating at rather odd hours for it to be a factor i.t.o existing services.

LP DRT reports good relations with the Taxi Industry. However, taking heed of goings-on elsewhere in the country when it comes to industry transformation efforts by the various local authorities, it will be prudent for the detailed feasibility to anticipate arduous engagement with Taxi operators along the scheme corridors. To the extent that a number of precedents where success has been achieved in involving the Taxi operators (e.g, Rea Vaya BRT in Johannesburg), but also instances where a stalemate has installed itself (PE), the detailed feasibility team composition should include a strong component of seasoned negotiators paired with participants with a deep local knowledge, alongside a good measure of political will from local authorities in whose jurisdiction scheme corridors lie.

Although healthy anticipation is good, anecdotal observations during the demand assessment seem to indicate a willingness to accept/contemplate market reform from the Taxi Driver fraternity.

4.2.2. Revenue risk and strategic considerations

The overarching risk is the uncertainty of “buy-in” by the current “market owners” – both i.t.o agreeing to the business model re-engineering, and the consequential increase in transparency (effect to owners of the implied widened tax net) as well the terms of such switch into a formalized business model.

As a matter of principle, rail financial sustainability depends on the ability to recover fixed as well as long-term variable costs. In South Africa – indeed for most of the world’s rail passenger services – this remains an ideal, and long-term budgetary support is required, even at efficient input-cost levels and with optimal pricing circumstances. The cost recovery challenge is even greater for heavily peaked suburban services or less heavily utilized regional – as is the case for the scheme under consideration. Also, world-wide practices have shown that that it is impossible for a single passenger railway route to make a positive contribution above long-run variable costs and many barely cover short-run costs. Again, this is anticipated to prove that case for this scheme.

Therefore, the ticket pricing that was considered for the pre-feasibility provides for an integrated service, i.e., includes the costs for feeder and distribution services to the rail backbone. The quantum used is a 19% discount off current fare practices along the corridors A & D by the Kombi- and +Mini-bus and bus services operating various routes along the corridors. The extent to which the negotiated quantum for the remuneration of these complementary services lies within the levels assumed in this pre-feasibility assessment, and, the extent (and effectiveness) to which these requisite services are integrated to the rail backbone, will impact decisively on both business and financial viability of the scheme. This aspect presents a pivotal strategic risk to the scheme.

5. The Financial Case

5.1. Introduction

This section sets out the Financial Case for the schemes. It contains the following information:

- ✓ A detailed breakdown of the capital costs,
- ✓ Treatment of inflation in the costs estimates,
- ✓ An estimate of eligible preparatory costs between Phase 0/1 and programme entry,
- ✓ Maintenance and operating costs,
- ✓ Financial sustainability, and
- ✓ Preliminary sources of funding

Capital costs are defined as the costs required to engineer, design, and construct the respective schemes considered hereunder. Capital costs are based on widespread experience of similar capital works. The detail feasibility will benchmark said costs against a suitable and agreed reference case. The costs are in 2011 prices, and inflation over the scheme development has been adopted from the National Transport Master Plan 2050, whilst construction cost has not been factored-in.

A recent benchmark for construction costs in SA is available from the Gautrain experience. However, the use of this experience for the detail feasibility assessment will have to be circumspect, and explicitly take into account the specific circumstances of the Gautrain implementation and isolate peculiar and Gautrain scheme-specific variables from contaminating the input variables.

The cost estimates should be subjected to refinement using a quantified risk assessment – as discussed under 4.3.2 above – during detail feasibility to derive total risk-adjusted capital cost estimates.

5.2. Capital Cost Estimating Approach

5.2.1. General considerations

For railway transport, neither infrastructure nor service capacity can be stored, i.e., if unused said capacity is lost. In other words, higher train set vehicle productivity is crucial to better commercial performance for service providers – just as higher infrastructure utilization is crucial to better commercial performance for the infrastructure.

Also, transport infrastructure tends to be location-specific and physically fixed or difficult to move. It is also 'lumpy' (provided in indivisible increments for a range of possible output), such that it exhibits economies of density – declining marginal cost, as the intensity of use increases.

As capacity is perishable, service design, marketing strategies and pricing policies must seek to increase capacity utilization.

5.2.2. Scheme cost structures

Generally, costs have been classified into rail network infrastructure and train operations. Costs pertaining to structures were also estimated, but the detail feasibility will revisit all costs when better market surveys and viability indicators are available. Cost indicators computed hereunder are meant to allow the team to arrive at formulating the 'go-no go' recommendation that is required from the pre-feasibility assessment.

5.2.2.1. Infrastructure network costs categories

Infrastructure costs have a component that is essentially fixed – invariant with the level of infrastructure usage, but variable relative to other factors such as engineering standards, terrain, climate, management efficiency, etc. The scheme under consideration exhibits a comparative fixed cost component estimated at slightly less than 70% of total infrastructure costs. We expect that detail feasibility will confirm that the variable component should vary over the long term by traffic levels – although it should prove 'sticky' downwards in the short to medium term.

In tandem with studies we have conducted elsewhere, we expect the detail feasibility will demonstrate the economies of density, with a long-term average cost curve sloping downwards, and unit costs declining as utilization increases, spreading the fixed costs of track provision over more and more traffic units – at least until capacity is reached and capacity enhancements are required.

Guideway: This category includes at-grade, cut-and-cover, embedded, tunnel and elevated guideway structures that provide the foundation for the installation of trackwork facilities. These guideway sub-categories include the costs for grubbing, excavation, grading, concrete work, ballast, drainage, backfill and restoration of landscaping to original or better.

Trackwork: Includes the basic track assets such as running rail, ties, ballast, direct fixation components, rail fastening systems and rail welding. Special trackwork components such as single and double crossovers, turnouts and grade crossings are also included in this category.

Facilities: Including maintenance facilities, expansion or modification of existing operation control centres. Whilst vehicle repair and maintenance shops, office support areas, control centres and surveillance are included, no provision is made for heavy maintenance; body work and painting have been provided for.

Systems: this category includes costs for traction power, signalization, communications and fare collections systems. Traction power systems include costs for structures, transformers, switch gear, ancillary equipment, sub-stations, tie combined costs needed cab, wayside and control centre equipment. It also involves the signals at special track-work locations such as junctions and crossovers as well as the signaling of apparatus between these locations. Communications systems include equipment and materials at stations and on-board trains to install connections between passengers, operators and the central control facility. Fare collection costs include fare collection equipment at rail stations such as turnstiles and token vending machines, and apparatus required to control and operate the equipment.

Stations: including costs bus shelters/stops, parking, signage – graphics/artwork, platforms. Fare collection systems are provided for within the Systems budget.

Special Conditions: These comprise of elements included in any of the Capital cost categories and not covered by contingency factors – yet large enough to be identifiable at this stage of scheme(s) development.

- ✓ **Mobilization:** Mobilization costs for setting up;
- ✓ **Contingency:** As the scheme moves through the development phases from planning too preliminary engineering to design and construction, contingency factors can be reduced as the scheme is more completely defined. For our pre-feasibility, a contingency factor of 25% will be added to the cost elements identified above;
- ✓ **Soft Costs** being the engineering and design, construction management & project management;
- ✓ **Right-of-Way** has not been considered, but will be a factor at computing comprehensive scheme costs at detail feasibility.

Table 6.2.2.1a, below, lists capital items and their unit costs comprising the database developed for this study for the Commuter Corridor A & D. Again, two categories have been defined, i.e., hard construction category (e.g., guideway, stations, etc.) and add-on construction category (i.e., soft costs, right-of-way, environmental mitigation costs, etc). The latter were typically estimated as a percentage of hard construction costs and benchmarked against wide-spread experience of similar schemes. Also, we have given order of magnitude estimates.

Table 6.2.2.1a Cost estimation for standard gauge track UIC 60: Corridor A & D

Descriptions	**Unit**	**Standard gauge track UIC 60**		
		Continuous welded track		
		Quantity	**Unit Price**	**Total Price**
			ZAR	ZAR
Rail 60 kg/m	m	2.00	600.00	1,200.00
Pre-stressed concrete sleeper	piece	1.67	450.00	751.50
Fasteners	set	1.67	160.00	266.70
Ballast supply and transport	m^3	2.65	220.00	583.00
Ballast installation, bottom	m^3	1.60	100.00	160.00
Ballast installation, top	m^3	1.05	150.00	157.50
Track laying	m	1.00	650.00	650.00
Tamping	m	1.00	80.00	80.00
Welding – FBW (18 m rails)	piece	0.09	1,300.00	115.60
Welding – TH (18 m rails)	piece	0.01	1,700.00	25.20
Distressing	m	1.00	40.00	40.00
				4,029.50
Others		10 %		403.00
Total of Estimation (track/m)				4,432.50
Total of Estimation (track/m), roundup				**4,500.00**
Supply of turnout type UIC 60 – 500 – 1:12	unit	1		**750,000**
Supply of turnout type UIC 60 – 300 – 1:9	unit	1		**600,000**

Supply of turnout type UIC 60 – 190 – 1:9	unit	1		**500,000**
Laying of turnout type UIC 60 – 500 – 1:12	unit	1		**250,000**
Laying of turnout type UIC 60 – 300 – 1:9	unit	1		**150,000**
Laying of turnout type UIC 60 – 190 – 1:9	unit	1		**100,000**

Construction costs for the 65 km single track line are estimated below on Table 6.2.2.1b:

Table 6.2.2.1b Construction costs for standard gauge track UIC 60: Corridor A

Item	Unit	Quantity	Unit Price	Total Price
Perway construction				ZAR
Polokwane – Mokopane				
Track	m	65,000	4,500 ZAR/m	292,500,000
Stations				
Track	m	8,000	4,500 ZAR/m	36,000,000
Turnouts 1:12	piece	30	1,000,000 ZAR/p	30,000,000
Total Perway				358,500,000
Total Perway, roundup				**360,000,000**

Corresponding maintenance cost estimates are given on Table 6.2.2.1c below:

Table 6.2.2.1c Maintenance cost estimation for standard gauge track UIC 60: Corridor A

Year	Line	km	Costs (ZAR) / km	Costs (ZAR) / Line
1	Polokwane – Mokopane	65.000	84.500	5,492,500
2	”	”	88.400	5,746,000
3	“	“	92.200	5,993,000
4	”	”	96.100	6,246,500
5	“	“	99.900	6,493,500
6	”	”	103.800	6,747,500
7	“	“	107.700	7,000,500
8	”	”	111.500	7,247,500
9	“	“	115.400	7,501,000
10	”	”	119.200	7,748,500
11	“	“	123.100	8,001,500
12	”	”	126.900	8,248,500
13	“	“	130.800	8,502,000
14	”	”	134.700	8,755,500
15	“	“	138.500	9,002,500
16	”	”	142.400	9,256,000
17	“	“	146.200	9,503,000
18	”	”	150.100	9,756,500
19	“	“	153.900	10,003,500
20	”	”	157.800	10,257,000
21	“	“	161.600	10,504,000
22	”	”	165.500	10,757,500

23	“	“	169.400	11,011,000
24	”	”	173.200	11,258,000
25	“	“	177.100	11,511,500
26	”	”	180.900	11,758,500
27	“	“	184.800	12,012,000
28	”	”	188.600	12,259,000
29	“	“	192.500	12,512,500
30	”	”	196.400	12,766,000
	Total:	65.000		273,852,500
	Total, roundup:			**275,000,000**
	Annual average:			**9,200,000**

Construction costs for the 70.500km single track line are estimated below on Table 6.2.2.1d.

Table 6.2.2.1d Construction costs for standard gauge track UIC 60: Corridor D (Polokwane-Ga-Rakgoatha-Lebowakgomo)

Item	Unit	Quantity	Unit Price	Total Price
Perway construction				ZAR
Polokwane – Ga-Rakgoatha - Lebowakgomo				
Track	m	70,500	4,500 ZAR/m	317,250,000 R
Stations				
Track	m	6,000	4,500 ZAR/m	27,000,000 R
Turnouts 1:12	piece	24	1,000,000 ZAR/p	24,000,000 R
Total Perway				368,250,000 R
Total Perway, roundup				**370,000,000 R**

Corresponding maintenance cost estimates are given on Table 6.2.2.1e below:

Table 6.2.2.1e Maintenance costs estimation for standard gauge track UIC 60: Corridor D (Polokwane-Ga-Rakgoatha-Lebowakgomo)

Year	Line	km	Costs (ZAR) / km	Costs (ZAR) / Line
1	Polokwane – Ga-Rakgoatha-Lebowakgomo	70.500	84.500	5,957,250
2	"	"	88.400	6,232,200
3	"	"	92.200	6,500,100
4	"	"	96.100	6,775,050
5	"	"	99.900	7,042,950
6	"	"	103.800	7,317,900
7	"	"	107.700	7,592,850
8	"	"	111.500	7,860,750
9	"	"	115.400	8,135,700
10	"	"	119.200	8,403,600
11	"	"	123.100	8,678,550
12	"	"	126.900	8,946,450
13	"	"	130.800	9,221,400
14	"	"	134.700	9,496,350
15	"	"	138.500	9,764,250
16	"	"	142.400	10,039,200
17	"	"	146.200	10,307,100
18	"	"	150.100	10,582,050
19	"	"	153.900	10,849,950
20	"	"	157.800	11,124,900
21	"	"	161.600	11,392,800
22	"	"	165.500	11,667,750

23	"	"	169.400	11,942,700
24	"	"	173.200	12,210,600
25	"	"	177.100	12,485,550
26	"	"	180.900	12,753,450
27	"	"	184.800	13,028,400
28	"	"	188.600	13,296,300
29	"	"	192.500	13,571,250
30	"	"	196.400	13,846,200
	Total:	70,500		297,023,550
	Total, roundup:			**300,000,000**
	Annual average:			**10,000,000**

Construction costs for the 71.000km single track line are estimated below on Table 6.2.2.1d:

Table 6.2.2.1d Construction costs for standard gauge track UIC 60: Corridor D (Lebowakgomo-Jane Furse)

Item	Unit	Quantity	Unit Price	Total Price
Perway construction				ZAR
Polokwane – Jane Furse				
Track	m	71,000	4,500 ZAR/m	319,500,000
Stations				
Track	m	8,000	4,500 ZAR/m	36,000,000
Turnouts 1:12	piece	32	1,000,000 ZAR/p	32,000,000
Total Perway				387,500,000
Total Perway, roundup				**390,000,000**

Corresponding maintenance cost estimates are given on Table 6.2.2.1f below:

Table 6.2.2.1f Maintenance costs estimation for standard gauge track UIC 60: Corridor D (Lebowakgomo-Jane Furse)

Year	Line	km	Costs (ZAR) / km	Costs (ZAR) / Line
1	Lebowakgomo – Jane Furse	71.000	84.500	5,999,500
2	"	"	88.400	6,276,400
3	"	"	92.200	6,546,200
4	"	"	96.100	6,823,100
5	"	"	99.900	7,092,900
6	"	"	103.800	7,369,800
7	"	"	107.700	7,646,700
8	"	"	111.500	7,916,500
9	"	"	115.400	8,193,400
10	"	"	119.200	8,463,200
11	"	"	123.100	8,740,100
12	"	"	126.900	9,009,900
13	"	"	130.800	9,286,800
14	"	"	134.700	9,563,700
15	"	"	138.500	9,833,500
16	"	"	142.400	10,110,400
17	"	"	146.200	10,380,200
18	"	"	150.100	10,657,100
19	"	"	153.900	10,926,900
20	"	"	157.800	11,203,800
21	"	"	161.600	11,473,600
22	"	"	165.500	11,750,500
23	"	"	169.400	12,027,400

24	”	”	173.200	12,297,200
25	“	“	177.100	12,574,100
26	”	”	180.900	12,843,900
27	“	“	184.800	13,120,800
28	”	”	188.600	13,390,600
29	“	“	192.500	13,667,500
30	”	”	196.400	13,944,400
	Total:	71,000		299,130,100
	Total, roundup:			**300,000,000**
	Annual average:			**10,000,000**

5.2.2.2. Stations costs

Costs estimates for stations are given on Tables 6.2.2.2a, 6.2.2.2b for the Polokwane-Mokopane and Polokwane-Jane Furse links, respectively.

Table 6.2.2.2a Stations estimates – Polokwane-Mokopane - Corridor A

Stations	**Cost Estimate in Rands**		
	Station at-grade	**Other facilities (Assuming a contingency of 30%)**	**Total**
Mokopane	4517643	1355293	**5,872,936**
Commuter Station 1	3781392	1134418	**4,915,809**
Commuter Station 2	1648220	494466	**2,142,686**
Commuter Station 3	1622899	486870	**2,109,768**
Commuter Station 4	1764854	529456	**2,294,310**
Commuter Station 5	132364	39709	**172,073**
Commuter Station 6	1882255	564677	**2,446,932**
Commuter Station 7	1254197	376259	

			1,630,457
Commuter Station 8	4310465	1293139	**5,603,604**
Polokwane	0	0	**0**

Table 6.2.2.2b Stations estimates – Polokwane-Jane Furse - Corridor D

Stations	**Cost Estimate in Rands**		
	Station at-grade	**Other facilities (Assuming a contingency of 30%)**	**Total**
Jane Furse	16,292,929	4,887,878	21,180,807
Difapyae	14,078,761	4,223,628	18,302,390
Ga-Marishane	3,530,134	1,059,040	4,589,175
Makadikwe	835,534	250,660	1,086,195
Mashabela	668,427	200,528	868,956
Ga-Masemola	6,642,501	1,992,750	8,635,252
Marulaneng	4,720,771	1,416,231	6,137,003
Lebowakgomo South	31,332,556	9,399,766	40,732,322
Lebowakgomo	117,810,410	35,343,123	153,153,534
Mmakotse	8,898,445	2,669,533	11,567,979
Ga-Rakgoatha	14,830,743	4,449,223	19,279,966
Commuter Station 7	22,037,231	6,611,169	28,648,400
Commuter Station 8	51,042,822	15,312,846	66,355,669
Polokwane	97,995,702	29,398,710	127,394,413

5.3. Treatment of Inflation

The following annual inflation rates have been used for all schemes hereunder:

- General inflation – 5%
- Preparatory, supervision and land costs inflation – 5%
- Operating and maintenance inflation – 5%

Tables 6.3.1 A & 6.3.1 D below gives summary cost breakdowns for the individual schemes.

Table 6.3.1 Summary Costs – Corridor A

Item	R million
Engineering works	3 430
Land costs (excluding opportunity costs)	101
Site supervision costs	84
Sub-total	**3 615**
Preparatory costs	14
Risk budget	171
Total	**3 801**

Table 6.3.1 Summary Costs – Corridor D

Item	R million
Engineering works	7 492
Land costs (excluding opportunity costs)	221
Site supervision costs	185
Sub-total	**7 898**
Preparatory costs	31
Risk budget	375
Total	**8 304**

5.4. Operating Costs & Assumptions

Similar to the capital costs, the maintenance and operating costs have been based on widespread experience of similar schemes. Scheme operating costs vary substantially in the long run with traffic volumes. However, in the short term, this relationship is not proportional – excerpt, perhaps for the energy component, which the detail feasibility will analyse. A detailed breakdown of these is included in Annexure ….. The analyses are based on several key decisions that have a direct bearing on rail O&M costs, viz.,

5.4.1. Train Operations Assumptions

Train operating assumptions:

- ✓ Number of round trips per weekday:
- ✓ Peak headway:
- ✓ Number of round trips on Weekend and Holiday:
- ✓ Off-Peak, weekend & Holiday headway:
- ✓ Number of Train Operating Crew:

- ✓ Crew working conditions & remuneration:
- ✓ Support staff (incl. supervision):
- ✓ General, Managerial and Administrative Assumptions
- ✓ Fare Collection Assumptions

Vehicle maintenance assumptions:

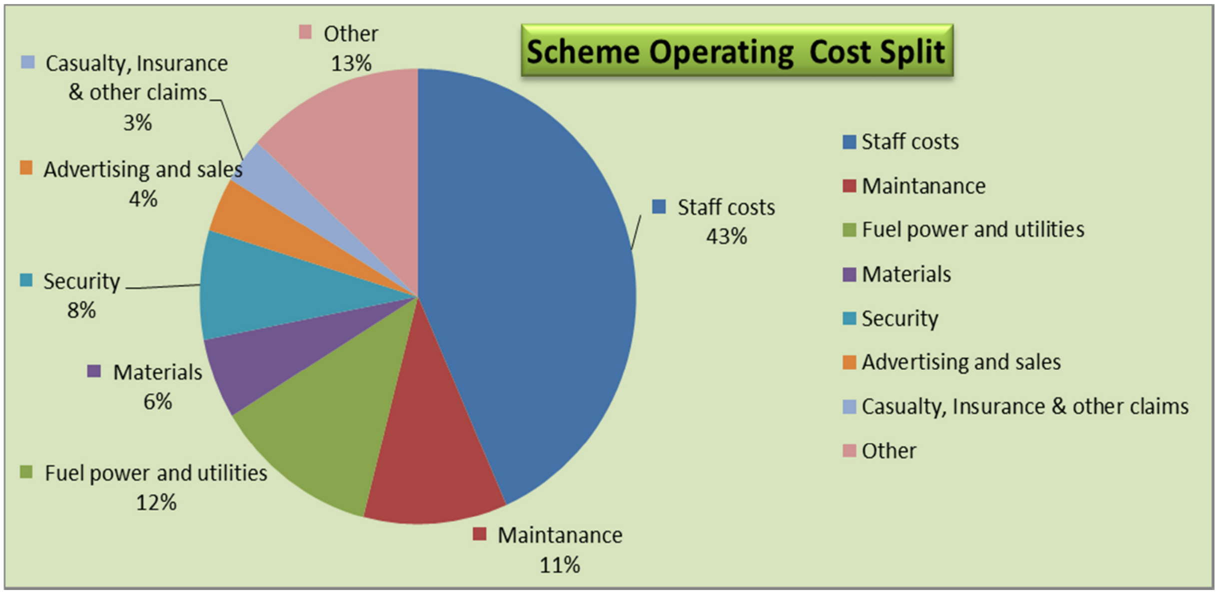
- ✓ Fleet:
- ✓ Train set:
- ✓ Staffing:
  - Mechanical: X/vehicle (y/powered & x/unpowered)
  - Cleaning: A/vehicle
  - Supervision
- ✓ Energy Assumptions:
- ✓ Materials & Consumables

Operating costs have been based on widespread experience of similar schemes.

Figure 5.4.1.1 Schematic representation of Scheme Operating costs

Item	Yr 1-10	Yr 11-20	Yr 21-30	Yr 31-40	Total
Staff costs	1 541	2 968	3 121	3 178	**10 807**
Maintanance	286	731	795	851	**2 663**
Fuel power and utilities	326	835	908	972	**3 041**
Materials	153	391	425	455	**1 424**
Security	365	522	522	522	**1 931**
Advertising and sales	104	265	288	308	**964**
Casualty, Insurance & other claims	153	218	218	218	**808**
Other	353	904	983	1 051	**3 291**
Total	**3 280**	**6 834**	**7 260**	**7 555**	**24 928**

Table 5.4.1.2 Scheme Operating Costs



Annual operating costs included cover:

5.4.2. Train Operating Costs

- ✓ Direct operating costs
- ✓ Infrastructure access Costs
- ✓ Energy Costs
- ✓ General, Managerial and Administrative Costs
- ✓ Costs for operating ancillary structures and amenities,
- ✓ Security,
- ✓ Utilities,
- ✓ Marketing and promotion of the scheme(s), and
- ✓ Below the line “order-of-magnitude” estimates on modal integration.
- ✓ Contingency

5.4.3. Feeder Service Costs

5.4.3.1. To realize a best-in-class service provision, integrated ticketing is mandatory, and the assumption is that a portion of the collected revenue will accrue to Feeder Services Providers. This means that some form of revenue share dispensation will instituted to provide the requisite institutional transparency and independent revenue sharing mechanism. This will be further specified in the detail feasibility.

5.4.4. Maintenance costs

Similar to the approach taken i.r.o operating costs, maintenance costs have been based on widespread experience of similar schemes.

Annual maintenance costs included cover:

- ✓ Provision for major (outsourced) maintenance
- ✓ ongoing maintenance of infrastructure
- ✓ maintenance of ancillary structures and amenities (stations and shelters, terminals, park & ride, immediate grounds, etc),
- ✓ ITS , etc

5.4.5. Corporate overheads

Dependent on the institutional arrangements for delivery, corporate costs have not been factored in. The detail feasibility will seek to develop a public sector comparator independent from the PRASA cost structure to benchmark the preferred institutional dispensation for the scheme – including indicated improvement in corporate performance, if PRASA is the service provider of choice for the scheme.

5.5. Preparatory Costs

Preparatory costs consist of detailed feasibility preparation costs estimated at R40m.

5.6. Pricing

As a matter of principle, financial sustainability depends on the ability to recover fixed as well as long-term variable costs. In South Africa – indeed for most of the world's rail passenger services – this remains an ideal, and long-term budgetary support is required, even at efficient input-cost levels and with optimal pricing circumstances. The cost recovery challenge is even greater for heavily peaked suburban services or less heavily utilized regional – as is the case for the scheme under consideration.

World-wide practices have shown that that it is impossible for a single passenger railway route to make a positive contribution above long-run variable costs and many barely cover short-run costs. Again, this is anticipated to prove that case for this scheme.

The ticket pricing that was considered for the pre-feasibility provides for an integrated service, i.e., includes feeder and distribution services to the rail backbone. The quantum used is a 19% discount off current fare practices along the corridors A & D by the Kombi- and +Mini-bus and bus services operating various routes along the corridors.

5.7. Financial Sustainability

The *a priori* assumption made hereunder is that the State Passenger Rail Agency, PRASA, will operate the schemes. As much as it is accepted practice that infrastructure creation costs are funded through the public/quasi-public purse, no effort must be spared in investigating and formulating alternative service delivery options during detailed feasibility.

A concerted effort at bringing subsidy requirements into reasonable/circumscribed levels prescribes that a zero-base assessment to determine subsidy requirement be computed by the detailed feasibility team – rather than adopting and projecting current average or historical values from PRASA.

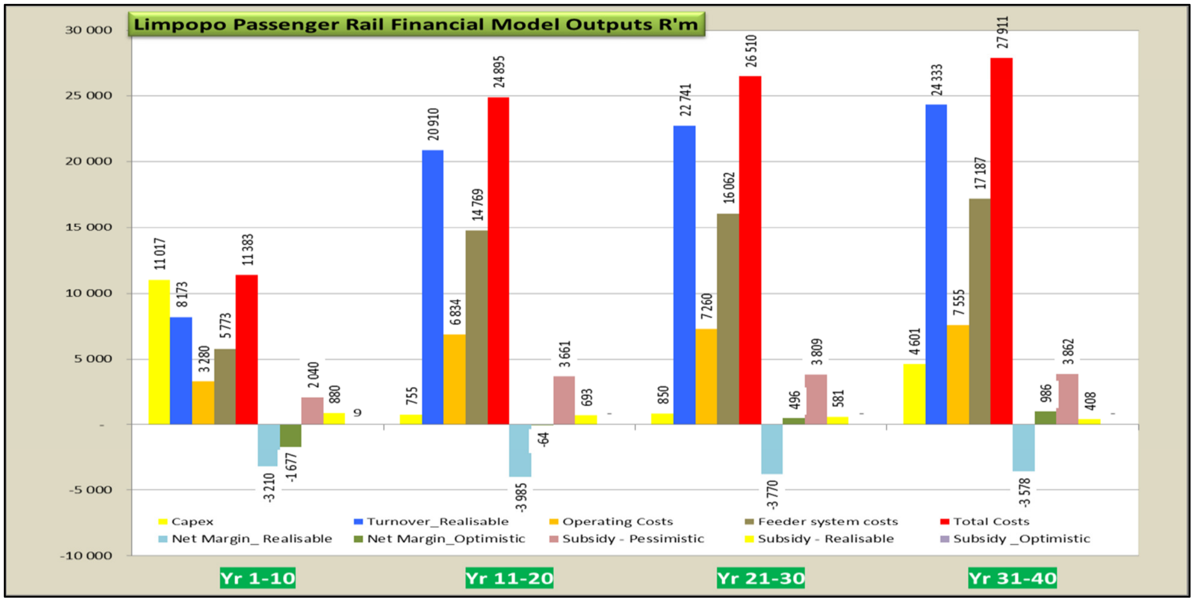
Equally, detailed feasibility must include an analysis of alternative institutional operating model – factoring in various permutations of public-private-partnerships and/or delegated management.

Headline outcomes for the scheme's financial performance are summarised in Rm, as follows:

- ✓ The initial R11bn capital investment is sufficient for the plan period under review – 40 years -, but will require to be complemented with smaller periodic expenditure over the following two decades, as certain categories of assets need to be renewed. Only in the fourth decade is a significant capital injection required for system capacity expansion to accommodate the increased traffic volumes that are expected to arise as the system matures, and economic activity in these corridors grows sufficiently to justify said capacity expansion.
- ✓ Although the pricing level assumed for the pre-feasibility lies well within current market practices along the two corridors - in fact, a 25% percent discount to Kombi- Mini-bus & Bus fares has been allowed for, fare box considerations will require much more circumspection during the detail feasibility. Indeed, it remains the norm in most public rail transport projects, globally and locally, that total rail operating costs tend to consistently exceed fare revenue, and almost never cover said total operating costs. Fiscal budgetary support is unavoidable in most instances. Notwithstanding, this pre-feasibility has provided a significant portion of available fare amount to remunerate feeder/distribution services costs.
- ✓ Feeder system revenue share maintains a steady 69:31 relationship to rail, before subsidies. This is not meant to suggest that it will cost more to run the feeder services than to run the rail backbone. The relationship is only meant to provide sufficient cover to attract current 'market owners' into the fold. Actual compensation will most probably be well within the envisaged levels. Excess budget can be re-allocated to rail to further mitigate requisite subsidies.
- ✓ Although net profit levels will remain negative during the course of the project, except in the optimistic scenario. A significant observation is that the

permutations are very conservative, and that the absolute quantum of the requisite subsidy does not increase over the assessed period – if anything, the expectation is that the subsidy should decline over time..

NB: The optimistic scenario assumes a 7% annual growth in demand whilst the realizable and pessimistic scenarios assume 6% & 5% demand growth, respectively



5.8. Funding Sources

The Development Bank of Southern Africa could be approached for grant funding for the development of the detail feasibility study when the indicators confirm the timeliness of such a study.