

DEVELOPING THE INTEGRATED RAPID PUBLIC TRANSPORT NETWORK (IRPTN) FOR THE ETHEKWINI MUNICIPAL AREA

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ABSTRACT

1 INTRODUCTION

Public Transport in the South African cities is characterized by a myriad of problems emanating from the historical inequalities of the apartheid city structure. It's in this context that Government's Public Transport Action Agenda has been crafted to redefine and restructure the current disjointed and unresponsive system.

The National Department of Transport has set out a process to assist in translating the public transport vision articulated in the NLTA (National Land Transport Act) which consists of a three phased strategy as follows;

Accelerated Recovery and Catalytic Projects	(2007-2010)
Promote and Deliver Basic Networks	(2010-2014)
Advance and Sustain Accessible Networks	(2014-2020)

The above strategy is aimed towards the development of a new fully integrated public transport system incorporating all modes within a formal contract based public transport system. Inherent in the strategy is the need to incorporate the existing minibus taxi industry into the new restructured system which implies a formalization of the industry and eligibility to benefit from available public transport subsidies currently restricted to commuter rail and certain tendered commuter bus contracts.

The key objectives of restructuring the Public Transport (PT) system are:

- To provide an adequately frequent service for passengers in terms of national government policy.
- To ensure a more reliable service through the operation of monitored contracts
- To eliminate the uncertainty inherent in non-contracted services and to reduce duplication and inefficiencies

2 BACKGROUND

A number of different public transport restructuring efforts have been initiated over the years in order to redress fundamental public transport burning issues namely:

One of the first initiatives driven at the municipal level was the Fundamental Restructuring of Public Transport Project (FRPT), which was completed in 2001.

In 1996 the National Department of Transport (NDOT) developed the white paper on National Transport Policy which was followed by the Moving SA initiative which effectively escalated the customer to the centre of the decision making process .Subsequently the NDOT initiated the Fundamental Restructuring of PT system (FRPT) which was aimed at providing an integrated sustainable and cost effective public transport system. Unfortunately due to various factors including the lack of a comprehensive funding regime this initiative could not progress to the implementation stage.

The funding of public transport is often seen to be a cost to society .This aspect needs to be turned around to be reflected as an investment to society at large. The restructuring of public transport services will not necessarily lead to a complete eradication of subsidies. Safe to say in certain cases where the current service does not meet even basic service levels, costs and hence subsidies may increase if the restructured service leads to a significant improvement in service levels .Simply throwing more money at transport operators to provide the same low-quality service, will not rescue a poorly managed system from collapse. To be effective, subsidies have to be applied carefully within a competently planned and managed system that provides superior convenience.

The second thrust has been notably the Cabinet approval of the Public Transport Strategy in January 2007 with a strong focus on accelerated modal upgrading and integrated rapid public transport networks. This action translates into implementing catalytic integrated rapid public transport projects in the 12 cities and 6 districts.

One of the first tasks of this process was the compilation of the Ethekwini IRPTN scoping study which translated the National Strategy into broad programs for Ethekwini

The Scoping Study - Implementation Framework seeks to articulate the vision and steps required to implement a public transport system that integrates all modes into a seamless and high-quality network.

The overall goal of this initiative is to improve the quality of life for the City's residents through the provision of an Integrated Public Transport Network that is rapid, safe and secure, convenient, clean, affordable, and socially equitable.

There is sufficient international best practice to clearly demonstrate that quality public transport networks are achievable and does in fact transform societies and cities in a remarkable manner if implemented with a holistic and sustainable agenda.

3 APPROACH TO THE IRPTN

Much planning has been done throughout the country and in Ethekwini in terms of resurrecting an ailing public transport system. Millions if not billions of rands have been expended in investigating and finding solutions to our dysfunctional public transport system only for the reports to be shelved and collect dust due to the lack of resources and funding to implement such systems.

The development of the PT Operations Plan component is being carried out in three phases, as shown in Figure 1.

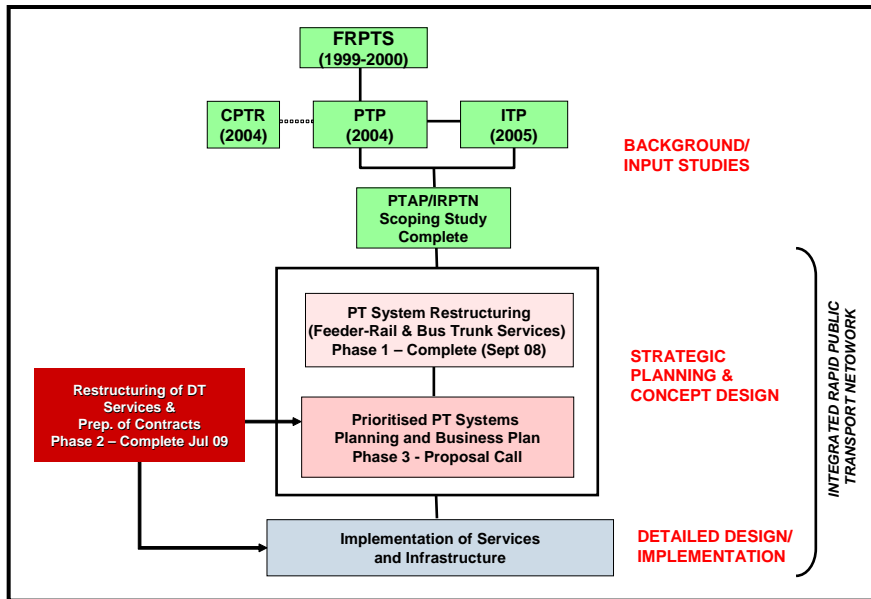


Figure 1: Planning Programme in Relation to Previous Investigations and Work-in Progress

The recommendations from Phases 1 & 2 provide background and input to Phase 3 which is the development of the IRPTN and related public transport services plan. Particular consideration needs to be given to the influence of these phases on the structuring of the public transport system and the implementation programme for the IRPTN across the Municipal area. It builds on the completed work from Phases 1 and 2 and includes the development of a Business Plan for an optimum service and cost effective public transport system. Figure 2 below shows in outline form the various components of Phase 3, including the requirements for the Support Systems / Services Plan and Business Plan which are essential elements in defining a fully integrated, affordable and sustainable public transport system.

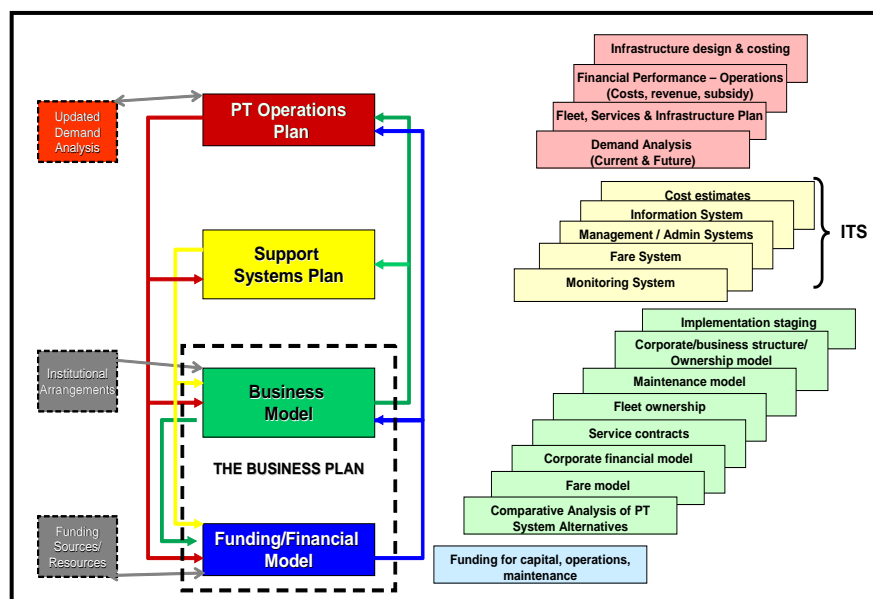


Figure 2: Process Flow Diagram for Phase 3

As shown in figure 2, the overall public transport system is defined by two inter-related plans, these being:

- The Public Transport Operations Plan consisting of the public transport network (IRPTN), the associated infrastructure, fleet and PT routes and services
- The Support Systems Plan comprising the ITS based monitoring, fare, information, management and administration systems that provide essential information to the operators, management and users of the PT services

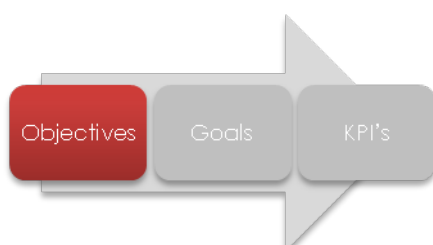
The PT Operations Plan in Phase 3 is based on an updated assessment of demand, assigned and interpreted into the requirements for PT services by selected optimum modes for feeders and trunk services as well as direct / “complimentary” services, along defined corridors in the IRPTN. The PT Operations Plan will include a recommended services plan with fleet requirements by mode (type and numbers of vehicles) as well as all elements of infrastructure that comprise the IRPTN including priority infrastructure treatment within the corridors, interchanges, stations, depots and any other required infrastructure.

Further, the investigation will also include the development of a prioritized program for the phased implementation of the recommended strategy, throughout the metropolitan area, over a 10-15 year period. This will include a detailed definition of the first phase of the program, supported by a “stand-alone” business plan, which is operationally and financially viable, for the short to medium term. As shown in Figure 1, the strategic planning and concept design phase of this project, together with preliminary design of the infrastructure projects in the first phase of implementation comprise the full extent of Phase 3.

In summary the approach to this study will ensure that:

- A full wall to wall public transport system inclusive of trunks, complimentary and feeder services is provided
- Phase 1 of the PTAP plan is part of the full IRPTN plan for Ethekwini.
- Consultation with the affected stakeholders is part of the process to ensure full buy-in before implementation
- Implementing a single corridor at a time, the process of change can thus be piloted and the transition more manageable.
- Implementing the corridors in phases will also assist in National Government and Ethekwini Municipality in terms of funding the roll-out of the plan over a number of financial years.
- The approach to the planning of Ethekwini’s IRPTN was based on the following motto, “short-term wins, jeopardizes long term goals”.

4 KEY PERFORMANCE INDICATORS



A project’s very reason for being is related to the specific purpose and objectives it has to serve and achieve. Very often, the success or effectiveness of a project is difficult to measure because its purpose isn’t clearly understood and specific objects were not set at the start. In this

regard, it was an essential part of the eThekweni IRPTN Project to have clearly defined objectives with associated goals and Key Performance Indicators (KPI's) that would firstly allow for the assessment of various design alternatives and secondly to measure the system's performance post implementation.

The establishment of KPIs for the IRPTN began with the development of a shared vision within the municipality and the various line departments. In this regard, a closer examination of the definition of public transport was needed to have a wider sectoral buy-in.

It was found that the classical definition of public transport was good from a pure transportation perspective however was limited in terms of creating a shared vision among all internal stakeholders.

Passenger transportation services, usually local in scope, that are available to any person who pays a prescribed fare. It usually operates on established schedules along designated routes with specific stops and is designed to move relatively large numbers of people. Transit vehicles include light, heavy, commuter rail, bus, trolley, and automated guideway. Transit can also have flexroutes and be demand responsive. (Vermont Land Use Education & Training Collaborative)

Consequently, a more contemporary definition was formulated within the Municipality:

Is the provision of a transportation service in a systematic, efficient, reliable and safe manner that makes economic and non economic opportunities accessible throughout the day to the entire public that are remote from such opportunities. (Cervaro, Vuchic, et al)

Based on the contemporary definition and through a series of workshops with various stakeholders, the following scheme objectives were decided on:

- Equity of access to opportunity
- Reduction of the overall impact of transport on the environment
- Promotion of a livable city
- Enhance the city's spatial structure
- Provide a quality of service for captive users that is also acceptable to traditional car users
- Have a positive impact on the city's economy

Based in the objectives, the following KPI's were selected and will form part of the IRPTN Business Plan. These KPI's are given in Appendix A.

5 DEMAND ANALYSIS

The development of a public transportation network is dependent on numerous factors. Accurate demand estimation is a key success factor in a networks long-term sustainability. As important as the accuracy of demand estimation is, it certainly is not an exact science and one needs to always be mindful of unrealistic expectations with regard to accuracy or precision of estimates.

The quality of the demand estimation is undoubtedly dependent on the availability of sound data and the robustness of the assumptions contained in the demand estimation model. Demand estimation for the design of a public transportation system is a complex

task with numerous outputs being required to inform some of the following design processes:

- Mode selection and need for priority treatment.
- Develop realistic revenue estimates considering discounts for pensioners and scholars.
- Specify vehicles with regard to capacity
- Fleet sizing
- Service Frequency

The outputs of the above design processes need to be robust and flexible so that the designed system can adequately accommodate demand and encourage public transport mode share increase over the investment life of the infrastructure. In this regard, the demand estimation for the eThekweni IRPTN was undertaken in two stages:

- Development of base year demand matrices
- Demand forecasting

a. Base Year Demand Matrices

The base year matrices were developed using the 2008 eThekweni Municipality Household Travel Survey (HTS, 2008), recent screen line, cordon counts and 2008 Rail Census Data. The HTS was undertaken for a coarse zonal system that comprised the aggregation of Municipality’s 338 Traffic Analysis Zones (TAZ) into 60 sectors. Consequently, 60 by 60 sector matrices were generated and disaggregated to 338 by 338 matrices using the latest demographic data for the TAZ’s and a spreadsheet based disaggregation algorithm. The base year matrices generated is illustrated in Figure 3.

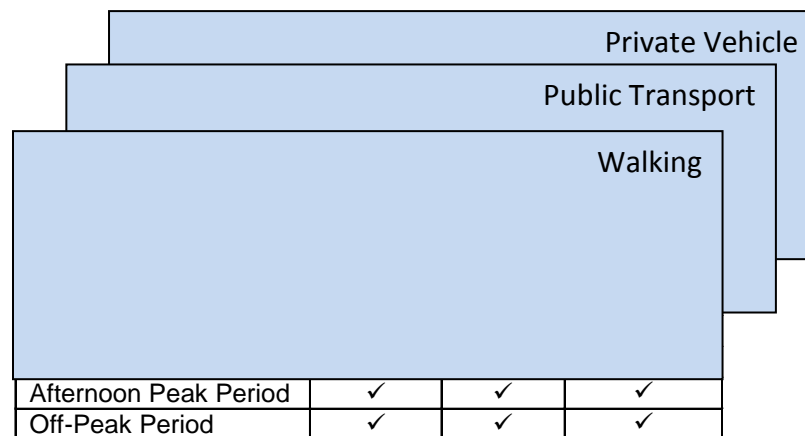


Figure 3: Base Year Matrices

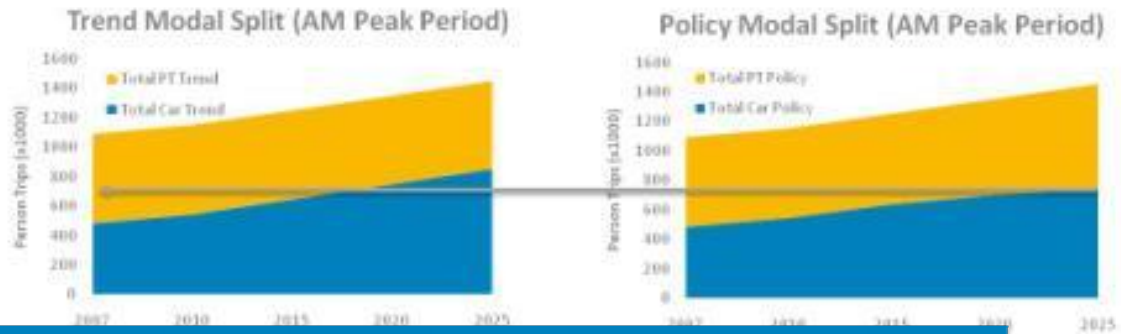
The screen line and cordon counts were used to calibrate and validate the generated matrices.

b. Demand Forecasting

Travel demand forecasting was undertaken using the base matrices described in section 5.1 and demographic forecasts. To establish a suitable design envelop for the system, numerous forecast scenarios were established that considered the following factors:

- Differential growth rates per Traffic Analysis Zone (TAZ)

- High development growth (Worst case for public transport capacity provision)
- Suppressed development growth (Worst case for public transport revenue collection)
- Policy modal shift achievement



	2007	2010	2015	2020	2025	MS %
Total PT Trend	607.2	606.0	603.6	601.1	599.0	40%
Total PT Policy	607.2	606.0	611.8	649.1	709.4	49%

Currently, there are some 600,000 public transport users during the commuter peak period. With low population growth forecasts, this number is unlikely to increase by 2025. However, the number of car users is expected to increase if there is no intervention.

Should a policy modal shift of 20 percent of HBW trips be achieved, approximately 100,000 new public transport users can be attracted to the system by 2025. The equivalent road capacity required to transport these 100,000 potential public transport users by private car is approximately 19² freeway lanes by 2025.

In this regard, a high quality public transport service that is focused on the end user and is not structured around a captive market is essential for the long term sustainability of the eThekweni Municipality.

6 NETWORK DEVELOPMENT

The eThekweni IRPTN was initiated on the premise and principles of the Public Transport Action Plan (NDoT, 2007). The approach adopted by the municipality ensured the development of a “wall to wall” public transport network that was free of competing segments and could be incrementally implemented over time.

The development of the network was informed by recent, sound travel demand data (see Section 5) and the need to serve the largest percentage of the municipal population in a cost efficient manner without compromising the quality of service.

The network comprises five elements:

- Trunk Routes
- Feeder Routes
- Complementary Routes
- Transfer Stations
- Park and Ride Facilities

¹ Figures are represented in 1000's

² 100,000 marginal demand, 2,000veh/h/lane Capacity, average Journey length 12km

The focus of this paper is on the development of the trunk routes.

Apart from simply developing a robust network, the municipality has certainly recognized the need for a systems approach that pays particular attention to “soft issues” like:

- Stakeholder consultation
- Institutional restructuring
- Public transport industry transitioning through the phased implementation of the network.

The network comprises a number of network elements, the configuration of which has been informed by:

- Demand Patterns
- Population Density
- Existing Road Network Configuration
- Realizing more efficient transfer facilities that make more economical use of space
- Accessibility needs

a. Trunk Routes

A total of nine trunk public transport routes have been identified for implementation. No mode bias was introduced to the design process. Instead, a range of modes was considered as illustrated in Figure 4.

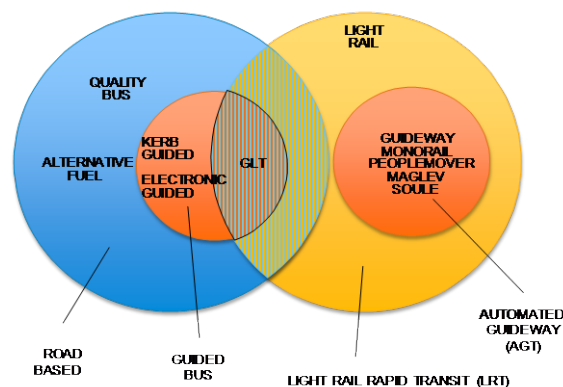


Figure 4: Mode Options

The mode selection for the trunk routes were premised on six selection criteria:

- Criteria 1 – Capacity (Can the mode satisfy the demand?)
- Criteria 2 – Reliability
- Criteria 3 - Modal Efficiency (capital cost/km; pax/cost)
- Criteria 4 - Mode Share (Can the mode increase market share?)
- Criteria 5 - Regeneration/Land use integration (Does the mode have wider benefits to adjacent land-use activities?)
- Criteria 6 – Deliverability (Is the mode easily implementable and unconstrained by local technology or industry wide limitations?)

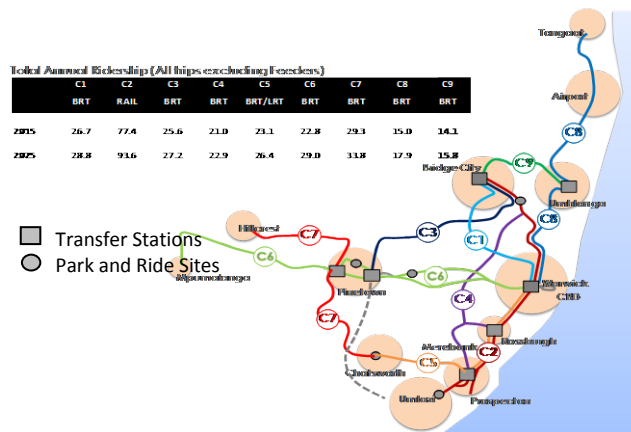


Figure 5: Trunk Route Network

The proposed rapid transit network is shown in Figure 5. Connecting bus services and local services to key nodes on the rapid transit alignments will complement this network.

In this configuration, C2 is rail only, with improved infrastructure and services. Apart from C2, Bus Rapid Transit (BRT) provides the main form of public transport. Both rail and BRT are important elements of the IRPTN and working together in an integrated way suggesting that a comprehensive network can be created that attracts high numbers of users, benefiting both modes. C2 has interfaces with BRT services at a number of locations, which offer opportunities to transfer from one mode to another and in combination provide a wide range of rapid journey opportunities.

Retaining C2 as rail has opportunities to enhance BRT also – improving travel opportunities and raising the standard of public transport will benefit both rail and BRT as more people are attracted to the network. Adding BRT also provides additional capacity with the potential to both expand the market and relieve rail congestion at peak times. With infrastructure improvements in place, the efficiency of rail should improve and hence it can operate more effectively than at present with faster journeys.

C1 offers additional capacity for journeys between Bridge City and the CBD although many rail journeys will originate to the south of Berea Road. Similarly, C8 provides additional capacity to rail for part of the route to the north of the CBD in the Umhlanga corridor. C4 has been extended northwards into Bridge City to provide through services from the south. Between the CBD and Mobeni, C5 offers BRT services alongside rail; this allows for users from the Chatsworth area to avoid interchanging and also provides additional capacity for this part of the route. However, even with this additional capacity in place, rail offers the most appropriate means of moving large numbers of passengers in the core north-south corridor.

Demand for BRT trips towards Tongaat was found to be limited and instead, C8 has been diverted to operate via the airport, leaving the railway to Tongaat and beyond as the main means of accessing this corridor and supporting its viability.

Associated with each of the trunk corridors are a series of feeder routes that helps enhance the trunk route catchment.

On the BRT network, demands range from 15.8 million pax to 28.8 million pax, which are above threshold demands for viable BRT routes. Detailed ridership analysis has been concluded for the network with boarding and alighting demands at individual stations being determined. The data along with detailed operational planning, allows for the design of cost effective stations and transfer facilities. A sample of boarding and alighting data is given below.

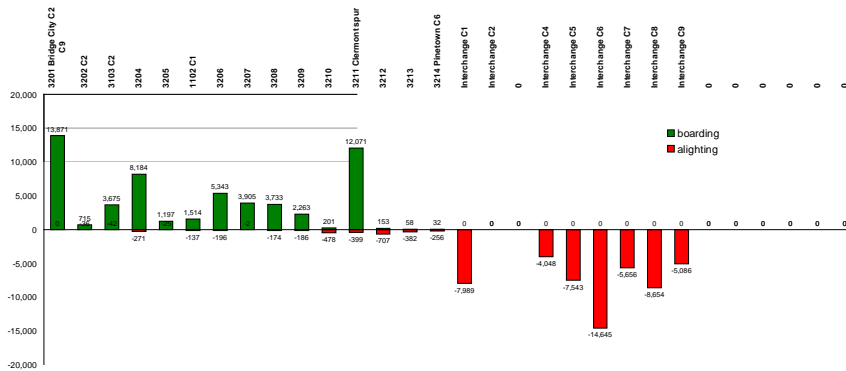


Figure 6: Boarding and Alighting

In the trunk network plan, Warwick Junction is a key transfer node in the system. Based on the current trunk network configuration, a number of trunk routes will penetrate the CBD thereby reducing the demand for transfer at Warwick Junction and ultimately the footprint required for public transport.

b. Effectiveness and Summary

Population density³ across the eThekweni Municipality is illustrated in Figure 7 below. The coverage of the trunk and feeder routes coincide with the more densely populated zones of the city thereby ensure maximum benefit of the investment to as many people as possible.

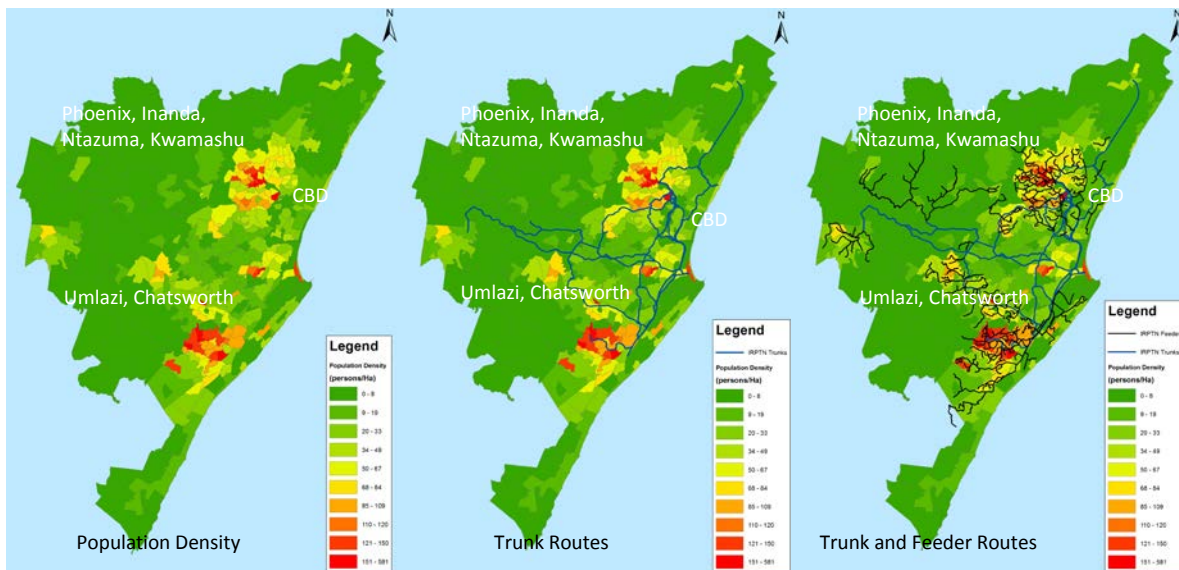


Figure 7: Population Density

³ Red represents the highest density (>150 persons/hectare), Green the lowest (<8 persons/hectare)

A detailed design of all routes in the ultimate system was undertaken. In this regard, coverage and accessibility were key factors considered. Figure 8 below is an illustration of the detail of the network coverage plans that have been prepared.

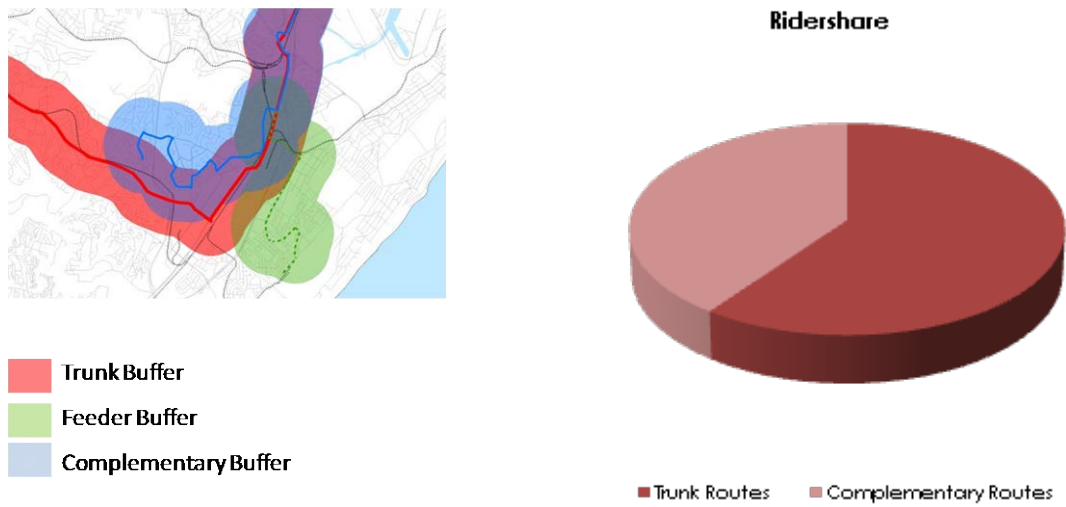


Figure 8: Sample Coverage Plan

The Municipal Population is approximately 3,600,000 of which, some 28 percent would be within 800m of the ultimate trunk network. When considering the entire Public Transport Network⁴, approximately 85 percent of the municipal population would be within 800m of a service.

In terms of ridership share, Trunks routes are expected to carry some 60 percent of all public transport trips, whereas, complementary routes would carry the balance (40 percent).

The following phased implementation of the IRPTN has been developed taking into account the various aspects discussed in this section:

- Phase 0: Durban Transport (Not illustrated – Industry Transition Phase)
- Phase 1: C1, C3, C9
- Phase 2: C2, C5, C7
- Phase 3: C4, C8
- Phase 4: C6

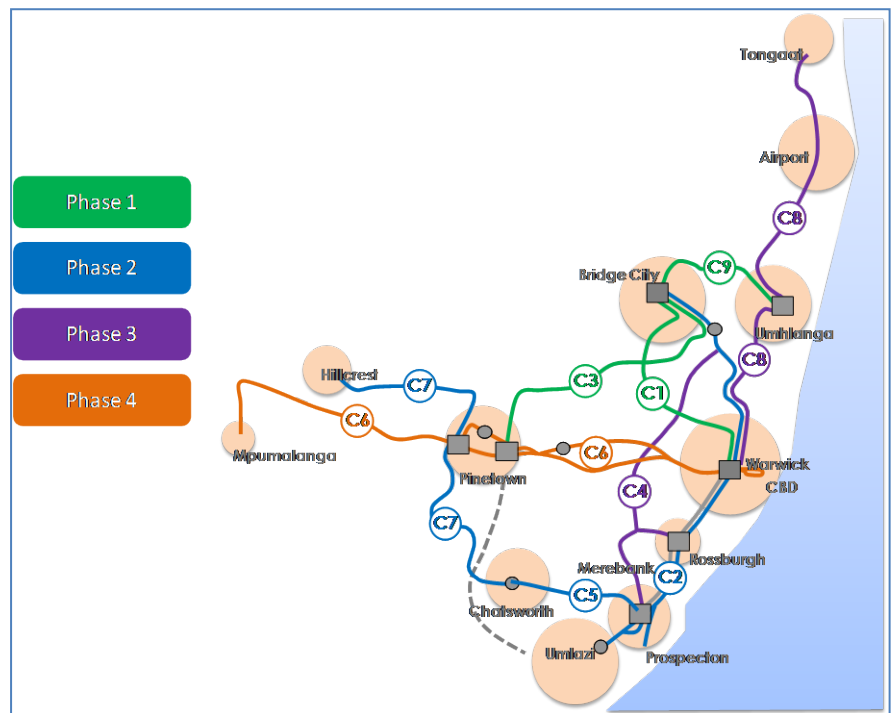


Figure 9: Phasing Plan

⁴ Combination of Trunk, Feeder and Complementary Routes

7 THE LAND-USE

In terms of the successful roll out of EtheKwini's IRPTN plan, EtheKwini Municipality's Development Planning Unit have recognized the need to integrate land use planning with transportation planning especially with the objective of making public transport sustainable within the corridors proposed. The nine trunk corridors have been identified together with the City's Development Planning and Economic Development Planning Departments. This thus ensures that the land uses and economic activities within these corridors will support public transport in terms of derived demand to sustain the public transport system. The City's spatial development and local area plans focus on densification, infilling and mixed land-use of particularly urban development to support public transport. In order to optimize the usage of public transport infrastructure and facilities, and especially to promote the integration of land-use and transport, the IRPTN supports and provide for development in the nine trunk corridors identified.

8 CONSULTATION

Consultations with selected stakeholders have been the approach of this study to secure support for the overall concept of the IRPTN proposals and implementation programme as well as the specifics of Phase 1. The objective of the consultation process is to secure a commitment to support the ongoing process needed to progress the implementation of Phase 1. This is being achieved by ensuring the public transport industry has a level of awareness of the process and key findings of the investigations emerging from the process, from the outset of the project. With this in mind a sub-committee of the project steering committee was set up with selected representatives from the public transport industry. The intent is to keep this committee informed on key aspects of the outcomes of the planning process related to the preparation of the PT Operations Plan. On completion of the planning process, presentations would be made to a broadened representation of the industry and eventually, following Council adoption of preliminary recommendations, the full plan will be presented in workshops to a broad forum of stakeholders

The following stakeholders have been consulted. These stakeholders included:

- EThekwini Line Departments (Architecture, Planning, Environmental, etc)
- PRASA
- SANRAL and KZNDOT
- Mini-bus taxis and bus operators

9 BUSINESS PLAN

The business plan developed for the eThekwini IRPTN is largely based on the considerations contained in the NLTA and further directives issued by National Department of Transport. EtheKwini is in the fortunate position to be lagging the implementation in some of the other larger metropolitan centres and hence is able to draw on the experiences from these centres.

Therefore the approach to this task has been to craft a business plan that takes into account the requirements of the NLTA supplemented by a scan of the initiatives underway in the other major centres in South Africa as well as to study international precedents, most notably South America.

The key aspects of the business plan include:

- Organizational requirements of the relevant public authority, which will be the contracting party on behalf of government.
- Structure of the potential private sector operating entities.
- Procurement and contracting arrangement between public authority and private sector operating entities.
- Scope of the operating contracts in terms of network i.e. separate feeder and line haul services, combined feeder-line haul services, corridor specific or area specific contracts etc.
- Type of contracts gross versus net based contracts and the implications for both contracting parties.
- Involvement of existing and affected operators with the IRPTN network. Particular consideration will be given to translation of modal share to share in private operating entity along particular corridors.
- Capital cost, operating costs and other financial cost considerations.
- Socio-economic considerations.

10 KEY CHALLENGES

In a project that is as ground-breaking as the IRPTN, there will always be challenges because the approach to the project is an innovative mechanism to provide high quality public transport networks within the Ethekwini Municipal Area.

The current challenges can be grouped into the following categories:

a. Institutional

CHALLENGE	CHALLENGE TO BE OVERCOME
<ul style="list-style-type: none"> • The rail corridors in Ethekwini are planned and operated by PRASA. PRASA has their management structures and funding sources which is not linked to the Ethekwini Municipality. 	<ul style="list-style-type: none"> • Planning the corridors together and aligning budgets and plans to fund corridors jointly. • Entering into a memorandum of understanding • Apply for joint funding from National Government
<ul style="list-style-type: none"> • Implementing Trunk corridors on SANRAL and KZNDOT road reserves 	<ul style="list-style-type: none"> • Enter into service level agreements in terms of funding, maintenance, etc. • Enter into memorandum of understanding with respect to building with their road reserves • Align the implementation of the IRPTN phases with both SANRAL and KZNDOT road needs plans
<ul style="list-style-type: none"> • Buy-in and support from SANTACO 	<ul style="list-style-type: none"> • Plan the corridors together • Form a task team with members from SANTACO and the Consulting team to work together in developing the plan. This will ensure that the industry's needs are taken into account

b. Human

CHALLENGE	CHALLENGE TO BE OVERCOME
<ul style="list-style-type: none"> • Appropriate skills available to implement and operate such a high tech system 	<ul style="list-style-type: none"> • Re-engineer the existing ETA's organisational structure to incorporate the organisational required to implement and operate the IRPTN system • Recruit and train personnel now in the planning stage
<ul style="list-style-type: none"> • Technical support skills 	<ul style="list-style-type: none"> • Need to identify and train personnel from within the Municipality • Bring in international professionals to train staff

c. Planning

CHALLENGE	CHALLENGE TO BE OVERCOME
<ul style="list-style-type: none"> • Operational planning process is lengthy due to negotiations with operators 	<ul style="list-style-type: none"> • Consult with the operators at planning stage • Consult with right persons
<ul style="list-style-type: none"> • Too much time wasted on details 	<ul style="list-style-type: none"> • Implement and tweak system as it rolls out in phases

d. Financial

CHALLENGE	CHALLENGE TO BE OVERCOME
<ul style="list-style-type: none"> • PTIS funding not sufficient source for funding • Funding required for the entire roll out. This cannot be guaranteed by National Treasury. • Subsidy • Municipality's have other priorities 	<ul style="list-style-type: none"> • Obtain guarantees from NDOT for the full funding of phases prior to negotiations and implementing the phase

11 CONCLUSION

1. The IRPTN plan for Ethekewini has been developed in line with National policy and as a collective has achieved its objective of producing a very robust and responsive plan that can be programmed to respond to varying degrees of demand. Safe to say that the road ahead will still need to be navigated and reviewed as more intense engagements with the stakeholders happen.
2. Funding continues to be an unresolved complex problem for all aspects of public transport. The increased subsidy cost in the face of decreasing service levels and standards have aggravated the problem by developing an unsustainable trend. The current land use does not lend itself to easing the deficit and longer-term interventions need to rely on.
3. A balanced strategy needs to ensure the private sector based on a modification of the 'user pays' principle which is 'those who benefit, pay', contributes to the costs of public transport. Such a balanced strategy requires that both the private and public sector

participate in funding on the basis that both benefit from the provision of an efficient, sustainable public transport system.

4. There is no doubt that safe, efficient, affordable public transport is a major contributor to a more efficient and stable workforce. Into the future such a system also reduces the need for the higher costs of providing alternative private transport facilities that must be funded by rates and taxes and the cost of growing congestion that affects industry and commerce in areas where public transport systems are inadequate.
5. The Institutional framework provides the context for defining roles and responsibilities as well as arrangements for the integration of functions allocated to each stakeholder group. The current fragmentation with associated uncertainties and inefficiencies must be resolved for progress to be made in addressing all of the above challenges.
6. The institutional and organisational structures and arrangements, and management systems clearly require careful consideration and development to ensure proper integration, capacitation at all levels and a sound basis for ensuring longer term financial independence and sustainability.
7. In order to deliver on the mandate of the Public Transport Action Agenda 4 keys deliverables needs to be achieved in quick succession. Firstly the business plan developed needs total support from all the relevant stakeholders including National Treasury. Secondly wider public consultation needs to thereafter progress in earnest. Thirdly detailed design and implementation needs to proceed together with the setting up of the relevant entities that will manage the contracts. The last element will be the training and skilling of the operators to ensure that they are appropriately coached to manage the business.

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APPENDIX A

Objective	Key Performance Indicator
Equity of access to opportunity	Public transport accessibility - measured as the Percentage of People within a 5minute walk of an IRPTN Service.
	Affordability - measured as the percentage of household income likely to be spent on the new public transport service.
	Home based Work (HBW) Travel Time.
	Residential Density - measured as the number of existing and planning housing units within a transit corridor.
Reduction of the overall impact of transport on the environment	Reduction in carbon emissions - measured as a percentage of existing emissions.
	Impact on natural environment - measure as the footprint of additional space required by transport infrastructure.
Promotion of a livable city	Public safety - measured as the number of incidents per 100,000 passenger kilometers.
	Public security - measured as the number of reporting's per 100,000 passenger kilometers.
	Reduction in congestion - measured as savings of additional freeway lanes.
	Aesthetically pleasing system - measured through focus groups and user perception surveys.
Enhance the city's spatial structure	Balanced flows within transit corridor - measured as the ratio of peak to contra-peak flows.
Provide a quality of service for captive users that is also acceptable to traditional car users	Comfortable loading - measured as the quotient of demand and capacity.
	Schedule adherence - measure as the number of delays per 100,000 vehicle kilometers travelled.
	Passenger waiting times - setting appropriate policy headways
	Availability - specifying minimum hours of service operations per day.
Have a positive impact on the city's economy	Direct job creation – measured as the jobs created during construction and operations of the system.
	Cost efficiency of system – measured as the quotient of revenue and operating expenses.
	Capital expenditure per annual trip – measured as the quotient of capital cost and annual ridership.
	Direct job creation – measured as the jobs created during construction and operations of the system.