CITY OF CAPE TOWN

Transit Oriented Development Strategic Framework

Transit Oriented Development (TOD) represents the intricate relationship between "Transit" (the operational/ access imperative of an urban environment) and "Development" (the spatial manifestation of those that are within the urban economy). TOD is about changing, developing and stimulating the built form of the city in such a way that the movement patterns of people and goods are optimised to create urban efficiencies and enable social equality and economic development.

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The City of Cape Town's Transport and Urban Development Authority

Abbreviations and Acronyms

BRT	Bus Rapid Transit
CBD	Central Business District
CDS	City Development Strategy
CIDs	City Improvement Districts
CITP	Comprehensive Integrated Transport Plan (previously referred to as the ITP)
COD	City Oriented Development
CTSDF	Cape Town Spatial Development Framework
CTZS	Cape Town Zoning Scheme
DoRA	Division of Revenue Act
DSP	District Spatial Plan
EESP	Energy, Environmental and Spatial Planning
IHSF	Integrated Human Settlement Framework
IDP	Integrated Development Plan
IPTN	Integrated Public Transport Network
IRT	Integrated Rapid Transit
ITP	Integrated Transport Plan
ITS	Intelligent Transport System
IZs	Integration Zones
LVC	Land Value Capture
LUPA	Land Use Planning Act
MATR	Municipal Asset Transfer Regulations
MFMA	Municipal Finance Management (Act 56 of 2003)
MLTF	Municipal Land Transport Fund
MPBL	Municipal Planning By-Law
MRE	Municipal Regulatory Entity
NDoT	National Department of Transport
NLTA	National Land Transport (Act 5 of 2009)
PRE	Provincial Regulatory Entity
PTISG	Public Transport Infrastructure and Systems Grant
PTIG	Public Transport Infrastructure Grant
PTNG	Public Transport Network Grant
PTNOG	Public Transport Network Operations Grant
PTOG	Public Transport Operating Grant
SARS	South African Revenue Service
SCM	Supply Chain Management
SDA	Service Delivery Agreement
SDS	Social Development Strategy
SPLUMA	Spatial Planning and Land Use Management Act
SPUD	Spatial Planning and Urban Design
TAPs	Transit Accessible Precincts
TAZs	Transport Analysis Zones
TDM	Travel Demand Management
TDA	Transport and Urban Development Authority
TIC	Transport Information Centre
TMC	Traffic Management Centre
TOD	Transit Oriented Development
TDM	Travel Demand Management
UDZ	Urban Development Zone

Approved by the Council of the City of Cape Town on 31 March 2016 @ 10:00

Glossary

Within the context of this TOD Strategy, the following definitions apply:

Bi-directional flow: is a balanced two-way commuting flow or pattern which ensures efficient use of available transit capacity.

Densification: Increased use of space, both horizontally and vertically, within existing areas/properties and new developments, accompanied by an increased number of units and/or population threshold.

Heuristic optimisation: The heuristic optimisation method uses a genetic algorithm to produce a series of trip productions and attractions, referred to as a generation. The generation contains a population made up of individuals. An individual is made up of a set of trip productions and attractions. In this context a land use scenario is seen as an individual, thus the algorithm produces 'genetically enhanced' or improved variants of it.

Intensification: achieving a greater spectrum of mixed uses (commercial, industrial and residential) through the increased use of space, both horizontally and vertically, within existing areas or properties and new developments, accompanied by an increased number of units and/or population thresholds, in accessible, high opportunity locations.

Land Value Capture (LVC): policy and regulatory mechanisms that allow a public entity to "capture" the increased value (direct or indirect) of land resulting from private and/or public sector improvements.

Mixed land use: Area of existing or proposed horizontal and/or vertical integration of suitable and compatible residential and non-residential land uses within the same area or on the same parcel of land; implies contextually appropriate intensity of land uses that should facilitate efficient public transport and a vibrant local urban environment.

Overlay zones: Is a regulatory tool that refers to a zoning, in addition to the base zoning, stipulating the purposes for which land may be used and the development rule which may be more or less restrictive than the base zoning.

Tidal flow: Is a periodic variation in the pattern of transit commuting associated with centralised employment location and peak travel demand. That is, high concentration of public transport trips inbound to the CBD during the morning peak and outbound in the evening peak.

Transport Analysis Zones (TAZs): Unit of theoretical spatial subdivision of the city for the purpose of transport modelling and analysis.

Transit Accessible Precincts (TAPs): These are spatially defined zones used to measure the performance of the model outputs of the TOD Comprehensive Model. Precincts are confined to a 500m radius from a higher order public transport station. They were identified based on their level of access to the transit network.

Trip: Is travel from a point of origin to a destination point per selected mode of travel.

Transition zones: These are classified as areas between the TAPs and the City's urban edge.

Journey: A single journey may be made up of multiple trips for example in a home to work public transport journey a traveller may walk to a taxi or feeder bus stop (one walking trip), catch a taxi or feeder bus to a BRT station (one taxi or feeder bus trip), travel by BRT to a taxi or feeder bus stop (one BRT trip), catch a taxi or feeder bus to an approximate final destination (an additional taxi or feeder bus trip) and walk the rest of the way to the final destination (additional walking trip). This typical journey would therefore consist of five trips.

Trip attraction: Refers to the destination of a trip or series of trips. Destinations are influenced by the purpose/s for which land is used and the time of day. Generally speaking non-residential land use (e.g. business, industrial, office, education) attract trips in the morning when everyone travels to work. The flow is reversed in the afternoon when everyone travels back home.

Trip production: Refers to the origin of a trip or series of trips. Origins are influenced by the purpose/s for which land is used and the time of day (see also: trip attraction).

Unmet demand: The demand from a transport-optimisation perspective for trip-producing and/or trip-attracting land use/s at varying levels of intensity which cannot be accommodated by the available supply of same given the current land use requirements or current land use trend (e.g. current residential/non-residential mix).

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SECTION 1:

Introduction – Regulatory and Policy Context

1. Introduction

Transit Oriented Development (TOD) represents the intricate relationship between "Transit" (the operational/ access imperative of an urban environment) and "Development" (the spatial manifestation of those that are within the urban economy). TOD is about changing, developing and stimulating the built form of the city in such a way that the movement patterns of people and goods are optimised to create urban efficiencies and enable social equality and economic development.

In the context of this Strategic Framework, TOD is seen as a planning, design and implementation approach that can be employed to address inefficiencies in the urban form of the city. TOD does not solely belong to one discipline but rather is seen as a key transversal development and management premise to addressing urbanisation, urban growth and service delivery with transport being the catalyst to achieving operational efficiencies in the urban environment for both the City and its citizens. It is an approach that enables a change in the principles of the space economy, forcing long term efficiencies through integrated implementation and service delivery.

Taking the above into account the purpose of the City of Cape Town TOD Strategic Framework is to identify the tools and mechanisms to be employed by various role players who have a collective impact on development to ensure that they move progressively toward a more sustainable, compact and equitable urban form.

1.1. Methodology

Figure 1 on page 9, provides a graphical representation of the methodology for the development of the TOD Strategic Framework as well as the structural logic of this document.

The first stage of the document explores the integrated land use and transport inefficiencies that prevail in the City of Cape Town. This is critical to grasp the key challenges facing the city and more importantly the reasons that drive these challenges. This is followed by an overview of the concept of Transit Oriented Development and its potential as a long term development strategy to address the urban inefficiencies of Cape Town and a detailed analysis of the role players and their motives for engaging in development to establish a vision for TOD in Cape Town.

In order to identify a suitable sequence of plans to implement TOD, it becomes necessary to establish a desired end state or common goal to progress towards. To this end the TOD Comprehensive Land Use Model was used in Stage 3 to identify the most sustainable urban form that would result in the complete realisation of the principles, objectives and vision of TOD for Cape Town.

Based on the key findings from the above, Stage 4 identifies the necessary TOD programmes and associated strategic levers to shift development progressively toward the City's desired end state. This gives effect to a TOD implementation toolkit which contains tools categorised at the metropolitan, corridor, nodal, precinct and project scales of planning to facilitate the implementation of the relevant TOD programme.

Stage 6 of the methodology, adopts two high-level spatial targeting mechanisms to depict how one would apply the most appropriate tool(s), contained in the toolkit, to the relevant sector (public and private) of development. This is followed by a plan of action (Stage 7) to implement TOD and finally an approach to monitoring and evaluation (Stage 8).

1. *Problem Statement and Strategic Intent*

A broad overview of the key urban development challenges experienced in Cape Town and why we have selected TOD as our solution.

2. *Defining Transit Oriented Development*

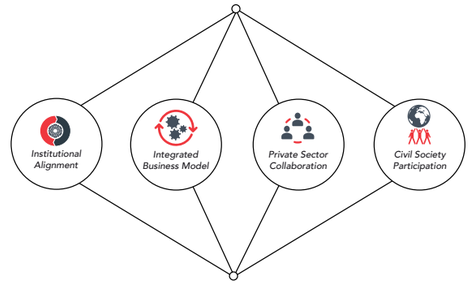
In the Context of Cape Town.

3. *Desired End State: TOD Comprehensive*

Working towards the most sustainable urban form for Cape Town.

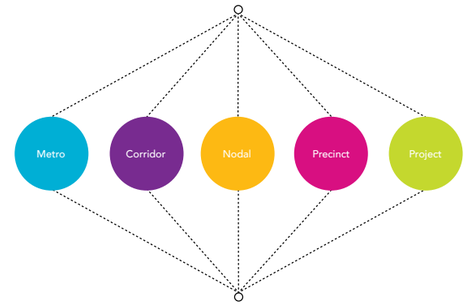
4. *TOD Programmes for Strategic Intervention*

Fundamental programmes to ensure the successful implementation of TOD in Cape Town.



5. *Strategic Levers*

Each focus area will propose a set of strategic levers and tools to facilitate the implementation of TOD categorised in terms of their appropriate scale of planning.



TOD Toolkit

6. *Higher Level Spatial Targeting*

7. *Implementation Plan for TOD Programmes*

8. *Monitoring and Evaluation*

Figure 1: TOD Strategic Framework Methodology and Structure

2. Problem Statement

Cape Town's urban form and structure is characterised by dispersed development patterns and inequitable access for many of its users. In part, this can be attributed to segregated apartheid planning, but more recently has become a trend exacerbated by socio-economic reality. Population and residential densities in many of the formally developed areas of the city remain extremely low by international standards and access is further constrained by mountain and sea. This has led to the development of poorer residential communities in locations far away from employment and opportunities, making the cost of providing and using a high quality public transport unsustainable (for the City and households).

The contributing factors to this dilemma include:

- A radial transport network.
- Historical spatial planning and socio-economic engineering which has resulted in:
  - The majority of the urban poor residing in remote areas.
  - Dispersed communities with no economic base and with little development between them.
  - The separation of land uses and long distances between places of work and residence.

The City of Cape Town has attempted to address many of these factors through sound development policy and key projects targeted at achieving a sustainable form of development and to address past injustices through improved urban, environmental and socio-economic efficiencies. Whilst significant progress has been made since 1994, the pace of improvement has been slow. Furthermore in some instances inappropriate public-led investment projects and development regulations have worsened the city's urban form with financial, social and environmental consequences.

This is evident by the following developmental characteristics:

2.1. High Operational Cost of Public Transport

Providing high quality and affordable public transport has become a significant focus of the City of Cape Town over the last five years to facilitate equitable and affordable access to the public (especially the poor). This is evident by new transit developments such MyCiTi and PRASA's Rail Modernisation Plan. However, the ongoing operational costs necessary to sustain this standard of public transport in the current dispersed urban form of Cape Town has become financially unsustainable, which is particularly evident in the City's rollout of MyCiTi. Current land use patterns result in longer distance trips, tidal flows and limited seat renewals, factors which make it very difficult to generate sufficient revenue returns to stay within a reasonable level of subsidisation. The 2015 MyCiTi Business Plan for Phase 1 and the N2 Express BRT service have recently reported a R52 million unfunded deficit for the 2016/17 financial year, a result of public transport responding to the demand for travel based on the existing spatial patterns of the city. This strengthens the desire to manage development more sustainably and compactly. The City and National Grant Funding for public transport are placing more pressure on municipalities to vigorously pursue effective land use intervention and forms of Transit Oriented Development to ensure the long term sustainability of public transport and a more efficient use of grant funding.

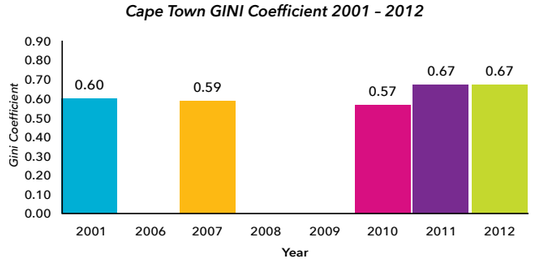


Figure 2: Cape Town's Gini Coefficient
(Western Cape Provincial Treasury, 2011; Wesgro, 2012; Bosch et. al., 2010)

2.2. Rising Social Inequality

- Figure 2 below depicts Cape Town's Gini coefficient which measures the city's income equality. South Africa's income disparity is among the highest in the world and whilst Cape Town is seen as the least unequal city in South Africa, its coefficient remains significantly high and has, in fact, risen in recent years. This developmental indicator suggests that the City requires stronger initiatives to redress past injustices and promote inclusivity. Furthermore public-led investment decisions that support social polarisation, such as housing located in dormitory locations (where access to economic and social opportunities is constrained), need to be reconsidered. According to Transport for Cape Town's Transport Development Index, 95% of public transport users are in the low to low-medium income groups. The average direct transport cost for the low income public transport user group is 45% of their monthly household income. The greater the cost of transport the less disposable income poor communities have, and the greater inequality exists. The following factors are considered to contribute to the high levels of inequality:

- unemployment or having a poor quality (i.e. low paid or precarious) job
- low levels of education and skills
- the size and type of family
- gender
- disability or ill-health
- being a member of minority ethnic groups
- living in a remote or very disadvantaged community

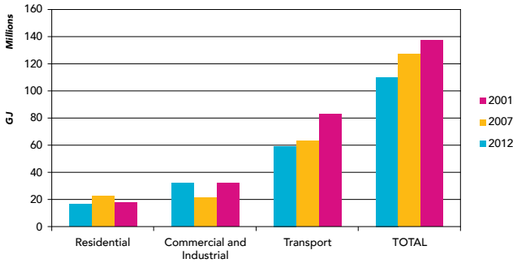
Taking the above into account, going forward, the City of Cape Town must learn to use its resources more effectively to address inequality.

2.3. Environmental Degradation

2.3.1. Energy Consumption and Greenhouse Gas Emissions

Transport continues to dominate energy consumption in Cape Town. This is made up of passenger, commercial, industrial (petrol and diesel) and aviation and marine transport. An astounding 91% of all liquid fuel relating to passenger transport is consumed by private cars, with an associated annual cost of R10–12 billion (ZAR in constant 2005 terms). Public transport such as Metrorail, buses and minibuses, on the other hand (which transport nearly half of all city passengers daily) consumes only 9% of all liquid fuel relating to passenger transport (Cape Town State of Energy Report, 2015). The massive sums of carbon emissions from private sector transport result in poor levels of air quality and an acceleration of climate change which lowers the City's resilience. Based on the indicators above it stands to reason that embracing TOD can significantly minimise Cape Town's footprint by inducing a greater shift to public transport.

Cape Town Energy Consumption By Sector 2001 – 2012
(including aviation, international marine, electricity losses)



Sources: CCT, DoE, Eskom, SAPIA, SEA

Cape Town Emissions By Sector 2012
(including aviation, international marine, electricity losses)

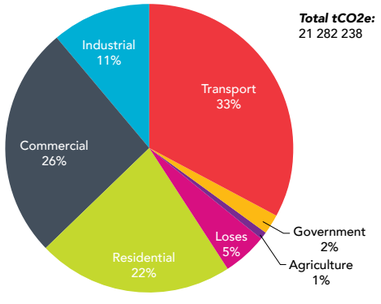


Figure 3: Transport Energy Consumption and Vehicle Emissions in Cape Town

2.3.2. Sprawling Urban Footprint

As new developments are located on the outskirts of the city, urban sprawl contributes to the loss of valuable land for Cape Town's future growth potential, and also drives up the cost of services (such as electricity, water and waste removal) which must be supplied to increasingly outlying and peripheral areas. Urban sprawl has created long travel distances with fragmented and dispersed urban activity patterns, which make it difficult to develop a viable public transport system. This has a negative impact on the mobility of poorer people, who are dependent on public transport (travel and fuel costs), and is unsustainable in an oil-constrained world (City of Cape Town Densification Policy, 2012).

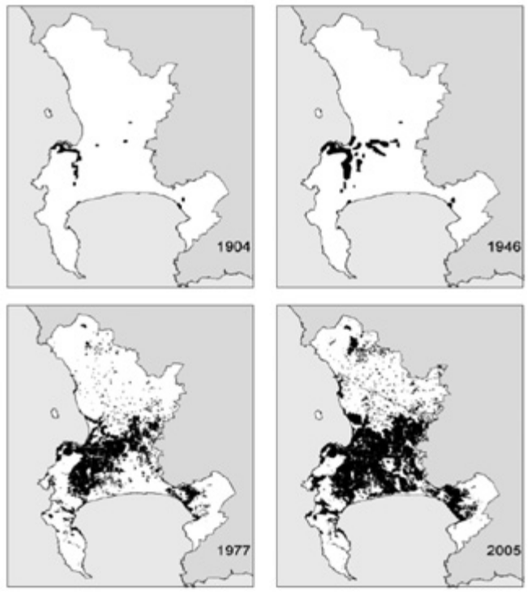


Figure 4: Cape Town's Urban Footprint

2.4. Reason for Challenges Facing Cape Town

To a large extent the City's inability to restructure its urban form sustainably can be attributed to following key inefficiencies:

2.4.1. Fragmented Governance

There appears to be a disconnect between the policy directives which pertain to sustainable development and some of the decisions made by various directorates of local, provincial and national government. The number of the City's long term policy statements of intent without implementation on the ground indicates that conventional solutions of funding mechanisms and policy coordination are insufficient and not well-matched to existing barriers. As a government institution the City is under immense pressure to act swiftly on development decisions such as housing in order to address the short term needs of the poor, which tends to conflict with the principles of sustainable development and TOD.

Key Challenges

a) Lack of Institutional Alignment

The City of Cape Town is structured in hierarchical line directorates which enable specialisation in specific areas and provides a clear chain of accountability. However, this type of organisation has its shortcomings,
as each directorate is vertically isolated in its own 'silo' with minimal horizontal links between directorates
and departments within directorates.

This may result in:

- decisions made in isolation from other departments
- contradictory approaches to single issues
- duplication of work
- missed opportunities in improving service delivery
- difficulties in implementing coordinated strategy
- complexities of rules and regulations, due to sectoral differences in goals and priorities
- lack of clarity around who should take the lead/ responsibilities, and possibly a lack of vision and belief (e.g. does TOD strategy leave the redevelopment of station precincts up to the market, or led by authorities? If roles are not clearly defined, nobody will take responsibility)
- changing planning context under less than ideal financial and political circumstances

b) Inappropriate and Contradictory Policy

Legislation and policy (at local, provincial and national scale) sometimes hinder the City's ability to effectively manage the growth of Cape Town's urban form sustainably (for example road classification standards/ requirements which impede incremental densification and undermine the use of public transport services).
In addition there are some national legislative requirements that prevent the City from leveraging their assets in a way that will effectively influence the private sector.
For example the MFMA prevents the sub-contracting of immovable property which limits the City's ability to engage effectively with property developers (MFMA, No. 56 of 2003). Furthermore spatial planning policy directives have not been matched with changes in the zoning scheme and other regulations. Thus following planning policy has not made the process significantly easier for the developer in comparison to developing in an area that is not aligned with policy. Coordination between conventional divergent sectors of land use planning and transport, across multiple levels of scale and sufficiently responsive market conditions are required for TOD implementation.

2.4.2. Lack of Integrated Financial Resources

The city's current urban form makes the cost of operating high quality public transport, at a level attractive enough to influence travel demand behaviour, unsustainable. Government and other public transit operating companies cannot afford to provide a level of service that is efficient and accessible to residents who are located far from high order trunk services. A greater intensity of business, commercial and mixed use development in the right location is required to substantially improve bi-directional flows, seat renewal and off-peak ridership, which can significantly improve the financial feasibility of public transit.

It is widely viewed that TOD can lower infrastructure costs in the long run but the initial TOD infrastructure needs can be considerable and can require extensive public investment. There is no single source of funds for TOD; instead, a number of funding sources are needed such alternative revenue sources (i.e. Land Value Capture), private sector partnerships. (Sustainable Cities Institute, 2013). National funding in South Africa is currently structured in a very ad hoc sense, which often causes a misalignment between development opportunities. There needs to be a degree of flexibility built into current funding structures to enable a cross-subsidisation of funding of projects that align to the same TOD agenda.

2.4.3. Sub-optimal Relationship with the Private Sector

Property development, from the perspective of the developer, can be broadly described as a process which is based on supply and demand. Much like any other economic activity it seeks to meet the demands which arise in the property market such as demand for space to work in, to operate businesses from, to live in and spaces for leisure or recreational activities (Isaac, et al. 2010). Historically private sector led developments have largely ignored the City's proposed spatial restructuring planning policy directives. This is due, largely, to a lack of understanding of the market and particularly the motives that drive private sector led development.

Key Challenges

a) Perceived Financial Risk

Developers and investors may find it difficult to conceive that TOD can be profitable particularly in areas that lack market demand. There is a perception that TOD involves higher risks and costs than other types of development. However recent engagements with lending institutions suggest that they see value in compact growth and TOD for the following reasons:

- Promotes critical mass, and prevents relocation away from existing growth areas.
- Compact development improves the proportion of disposable income available for property investment and ability to repay loans over transport costs.

b) Lack of engagement and understanding of the property market and private sector in developing policy which translates to interventions and mechanisms to achieve TOD

c) Uncertainty

Uncertainty describes an outcome that may or may not occur and its probability of occurring is unknown. This usually applies when there is a lack of knowledge and poor or imperfect information about all factors that will impact on the success of a potential development or project. Municipal land use planning-approvals required to legalise development proposals (through zoning and building regulations) sometimes create uncertainty. Existing timeframes for land use applications in Cape Town are 180 days from day of receipt (City of Cape Town Municipal Planning By-Law: Chapter 7, part 3, number 102 (1)). However there are instances whereby the complexity and scale of a development proposal may result in further delay. In terms of the By-Law, the municipality is allowed to extend the timeframe without the applicant's (or in this case the developer's) agreement (City of Cape Town Municipal Planning By-Law: Chapter 7, part 3, number 102 (2)). Furthermore the process in itself is very bureaucratic and onerous especially if other approvals are necessary such as EIAs (Environmental Impact Assessments), HIAs (Heritage Impact Assessments) etc. The combination of these factors makes it unclear to developers. As a result the process either deters their interest because of the risk of time delays is unknown or it can create higher costs during the construction period of development which will impact on the success or failure of the development in question.

The same problem of uncertainty is experienced by businesses and entrepreneurs in that the cost of doing business is affected by the barriers to starting, operating, the bureaucracy involved in doing business (i.e. planning approvals, business licences), access to land, the cost of infrastructure and the cost of enforcing contracts. The risk of doing business is likely to be lower if the rules of the development game are transparent, predictable and well enforced (OECD, 2004).

2.4.4. Unsustainable User Culture

Key Challenges

a) Negative Preconception of TOD

Resistance to TOD comes from residents of existing neighbourhoods and communities that may be targeted for transit improvements. Residents may have concerns that TOD will detract from the character of the neighbourhood, create localised traffic congestion or lower property values due to the potential integration of income groups. The resistance also comes from new residents, as expressed by choices made to buy homes in the suburbs rather than in TOD areas.

To begin to identify what changes are necessary, or rather how the City can use its resources in a better way, to address the problems described in this chapter, it becomes clear that the City requires an integrated and united approach to progressively move towards a more sustainable urban form.

3. Strategic Intent

The Cape Town City Council in its unanimous approval of the Integrated Public Transport Network (IPTN) Plan in 2014, ref C59/06/14, took the decision to investigate a TOD approach to addressing urban inefficiencies in Cape Town through the development of a Transit Oriented Development Comprehensive land use scenario and to use the IPTN Plan as a "guideline for the alignment of all City plans and projects for community development along the identified corridors". The intent of the TOD Strategic Framework is to establish an implementation plan for TOD to be adopted by the City both politically and administratively.

The TOD Comprehensive land use scenario is a representation of the TOD assumptions and principles contained in the IPTN. The land use scenario was developed to assess the impacts of such a scenario on the IPTN (i.e. all future development based on TOD principles and assumptions). In the context of this Strategic Framework this land use scenario is useful in that it depicts the optimised location of future growth in Cape Town (projected new development) for 2032 to support the City's current IPTN and principles of TOD. Within this framework it is intended to be used in its current form as a strategic informant to the ideal locations of new residential and non-residential developments at a metropolitan scale. The TOD Comprehensive land use scenario will continue to be refined according to the outlined methodology but the intent of the scenario remains constant i.e. to illustrate the ideal locations of future residential and non-residential growth towards the year 2032. The land use scenario will evolve through ongoing refinement and optimisation using sensitivity testing and incorporation of physical, environmental, economic and social realities. As such, the TOD Comprehensive land use model can be used as a land use scenario in future metropolitan development planning.

The TOD Strategic Framework for the City of Cape Town is seen as a policy mechanism to implement TOD in Cape Town. It identifies the tools and mechanisms to be employed by various role players who have a collective impact on development to ensure that they move progressively toward the new TOD vision for the City. Ultimately the TOD Strategy must trigger a paradigm shift through direct public and private sustainable investment into the built form. Figure 5 on page 17 depicts the institutional role of the TOD Strategic Framework within the City's administration and decision-making processes.

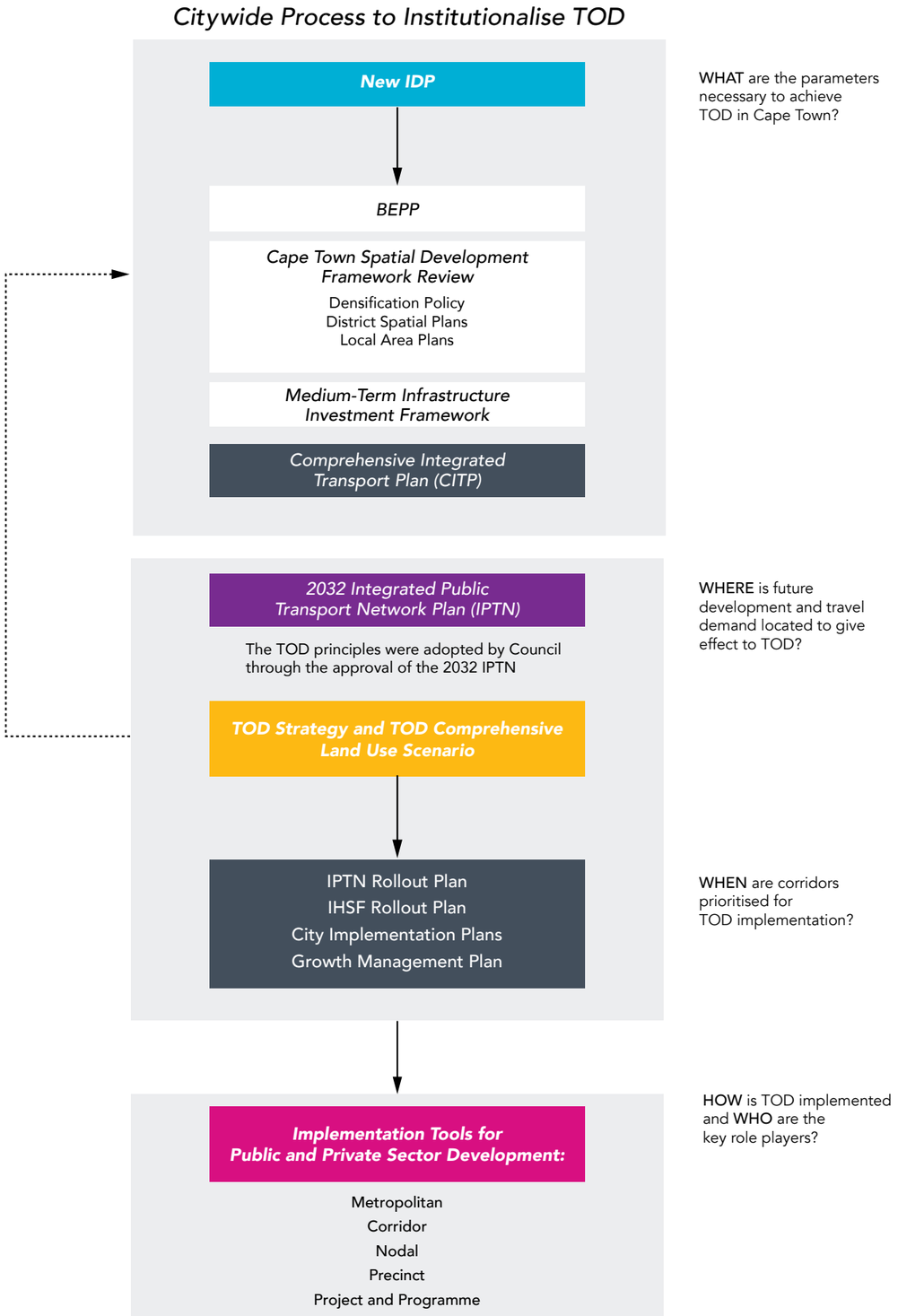


Figure 5: Strategic Intent of the TOD Strategic Framework

4. Defining TOD

4.1. International TOD Perspective and Best Practice

There are multiple theoretical descriptions of Transit Oriented Development in planning literature; most often it is used to describe an approach to development that responds to an integrated, hierarchical public transport network in relation to its intensity and density. "Transit Oriented Development (TOD) is a term which encapsulates the process of focussing the development of housing, employment, activity sites and public services around existing or new railway stations served by frequent, high quality and efficient intra-urban rail services (Cervero, 1998; Curtis et al., 2009). TOD is designed to create a relatively high density, compact and mixed urban form (Loo et al., 2010). In the United States, TOD is now a very important part of a broader smart growth approach to urban development including new urbanism, urban infill, urban growth boundaries, historic preservation, affordable housing and inclusionary zoning (Goetz, 2012)." (Knowles, R.D, Journal for Transport Geography 22, 2012).

The concept of TOD, which focuses on the symbiotic relationship between urban development and transport, is used internationally to varying degrees from the Americas, to Europe and Asia to create more liveable cities and make use of the Land Value Capture, primarily associated with main public transport lines.

4.1.1. Institute of Transport Development Policy: TOD Standard

The Transit Oriented Development (TOD) Standard ("the Standard") is an initiative developed by the Institute for Transportation and Development Policy (ITDP) to draw on international expertise to come to a common understanding of what constitutes urban development best practice. This includes promoting sustainable urban transport while minimising the use of personal motor vehicles and reducing the Greenhouse Gas (GHG) emissions and other negative externalities associated with their use.

The Standard recognises urban development projects that are located within walking distance of a high-capacity transit stations and that present specific urban design and land use characteristics known to support, facilitate and prioritise the use of public transport, walking, cycling and other non-motorised modes. As such, the Standard recognises development that is pro-actively oriented toward, rather than simply adjacent to, public transport.

The TOD Standard is based on ITDP's Principles of Urban Development for Transport in Urban Life as follows:

- ✓ *Develop neighbourhoods that promote walking [WALK]*
- ✓ *Prioritise non-motorised transport networks [CYCLE]*
- ✓ *Create dense networks of streets and paths [CONNECT]*
- ✓ *Locate development near high-quality public transport [TRANSIT]*
- ✓ *Plan for mixed use [PLAN]*
- ✓ *Match density and transit capacity [DENSIFY]*
- ✓ *Create compact regions with short commutes [COMPACT]*
- ✓ *Increase mobility by regulating parking and road use [SHIFT]*

Together, these urban development principles are intended to foster efficient spatial configurations that enable high-quality, car-free lifestyles.

The Purpose of the TOD Standard

The Standard is an assessment, recognition and policy guidance tool uniquely focused on the integration of land use and transport practices. It is aimed at a broad range of urban development stakeholders, including governments, developers and investors, planners and designers, sustainable development advocates and interested citizens. It can be used to:

- Evaluate the transit orientation of completed urban development projects
- Evaluate projects at the planning or design phases to identify gaps and opportunities for improvement
- Guide policy and regulations relevant to urban planning, transportation planning, land use, urban design and parking (Source: ITDP TOD Standard)

Whilst all the TOD principles identified in the ITDP TOD Standard are relevant to TOD in general the City of Cape Town TOD Strategic Framework must consider the principles of TOD that are relevant for our specific problems and the development solutions to address these problems and a means to implement them.

4.1.2. C40 Climate Change Leadership Group TOD Network

C40 is a network of the world's megacities taking action to reduce greenhouse gas emissions. With a unique set of assets, the C40 works with participating cities to address climate risks and impacts locally and globally. Cities worldwide are aiming to create more liveable, well-connected communities to reverse the trend of "urban sprawl" development, which relies on private vehicle travel and poorly connected public transport routes. The C40 Transit Oriented Development Network aims to support global cities to become more compact and connected, minimising vehicle kilometres travelled and increasing access to public transportation and economic activity.

The C40 Transit Oriented Development Network creates a platform to share best practices from around the world to accelerate and advance actions and policies for integrated land use and transportation. Transit oriented development approaches offer solutions to reduce carbon emissions, traffic congestion, and air-pollution, while also increasing economic prosperity by connecting housing to economic and employment opportunities. The City of Cape Town participated in the first workshop of the global TOD Network which took place in Addis Ababa, Ethiopia on the 24th, 25th and 26th of February 2014. Since this workshop C40 has convened several webinars which provide a live web-based platform for cities from around the world to present and share lessons learnt and innovations with regard to TOD in practice.

C40 does not provide specific strategies or tools for TOD itself but it creates an enabling environment for the City to draw from the experiences of other global cities which assist in the design of an appropriate and effective strategy for Cape Town.

4.2. TOD in the Context of Cape Town

South Africa's National Development Plan 2030 outlines "an approach to change" which shows the cycle of development with social cohesion illustrating the relationship between development and the quality of life of the citizens, a concept at the heart of TOD. The National Government's Priority Outcomes speak to TOD in three of the outcomes, namely:

- Outcome 6: An effective, competitive and responsive economic infrastructure network
- Outcome 8: Sustainable human settlements and an improved quality of household life
- Outcome 9: Responsive, accountable, effective and efficient local government system

It becomes clear that TOD is a development strategy with a bias towards viable public transport and therefore speaks to urban form, development type, development intensity and development mix. TOD requires a city's transport system to respond to urban development in a way that caters for the needs of the passengers while remaining affordable to the City and its residents however it may also require the development of new transport infrastructure to be used proactively, to drive sustainable and compact development. The dynamic interplay between land use and transport results in a virtuous cycle of benefits for the future growth of the city and its citizens (see Figure 6 on page 20). The adoption of sustainable principles to stimulate compact and mixed development around public transport will provide optimum land use conditions to enable an affordable, accessible and efficient public transport system in Cape Town. In turn a compact city form and sustainable public transport system will result in the following environmental, social and economic efficiencies:

- reduced energy consumption and emissions
- provides access to economic opportunity, by linking jobs to housing and enhancing social mobility. This reduces direct and indirect costs for households and employers which enables better monetary retention (savings) and ability to participate in the economy
- improved economic growth in terms of attracting and facilitating new investment and entrepreneurship

Figure 6: Virtuous Cycle of TOD

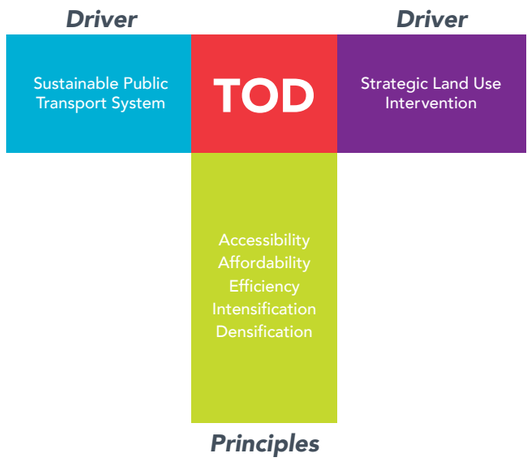


Figure 7: TOD Principles

Taking the adjacent diagram into account and in terms of the 2032 Integrated Public Transport Network (IPTN) plan TOD as it applies to the City of Cape Town is defined Cape Town's best long term development strategy to address spatial inequality, improve public transport affordability, and arrest sprawl, which is driven by the integration of sustainable public transport and strategic land use intervention and built on the principles of affordability, accessibility, efficiency, intensification and densification (see Figure 7: TOD Principles).

The core TOD principles are defined below:

1) **Affordability** – reduce the cost of public transport to commuters and the cost of providing public transport to the City.

2) **Accessibility** – facilitate equal access to social and economic activity through strategic urban development and the provision of safe public transport.

3) **Efficiency** – provide an environment and level of service that reduces trip lengths and dependence on private vehicles.

4) **Intensification and Densification** – manage the desired form, composition and location of urban development conducive to affordable, accessible and efficient public transport.

Whilst the objectives and principles of TOD in Cape Town provide a base to inform long term development planning it still becomes fundamental to the establishment of a potential implementation strategy for TOD to understand the key role players that drive development.

4.3. Drivers of Development

Development is ultimately a product of the decisions made by people; therefore it is essential to understand the different roles and responsibilities they play in the development process, and in particular the factors that inform their decisions and actions. This is necessary to begin to identify the appropriate tools and mechanisms to shift their behaviour which will in turn alter the form and manner in which development occurs across Cape Town and facilitate the orientation of development around transit.

The four key agents or stakeholders are as follows:

Figure 8: Key Role-players in Property Development Process

4.3.1. User Market

The user market is made up of people (in the form of citizens, entrepreneurs and businesses) and their needs, material desires and purchasing power. They ultimately determine the demand to which the market responds. In terms of property, demand represents the potential users of a development, i.e. the buyers, renters, clientele or customers it will attract (Appraisal Institute, 2014).

Residents

In the context of Cape Town there are two broad groups of residential user markets: those who have the luxury of choice (the ability to buy and/or rent) and those whose choices are limited (the inability to buy and/or rent). These groups are often serviced by different agencies; the private sector caters for choice whereas government prioritises social equity. However there are instances where both the private and public sector work together, when public subsidies are offered to the private sector to develop social housing (i.e. GAP). Table 1 on page 23 contains a number of demand side factors that will inform choice of location and form of development for residential users.

The behaviour of citizens in South Africa is currently embedded within a culture of low density and suburban development, which is exacerbated by the City's approach to sustainable urban development in both user markets. In terms of choice users, the approval of development application outside the urban edge has set a dangerous precedent for further sprawling development. Furthermore the continued rollout of low density RDP houses has fashioned an expectation from the needs user to receive standardised single dwelling low density housing typologies. Whilst RDP-type housing is considered dense in the context of Cape Town, its continued rollout limits the City's potential to pursue higher density options.

Sector of Development	Demand-side Factors
Residential Market	• Financial considerations such as savings levels and lending requirements (e.g. interest rates on mortgages, points charged, loan-to-value ratios) • Land use patterns and directions of city and area growth and development • Factors affecting the physical appeal of the neighbourhood, e.g. geography and geology (climate, topography, drainage, bedrock and natural or man-made barriers) • Local tax structure and administration, assessed values, taxes and special assessments • Availability of public services and community facilities (cultural institutions, educational facilities, health and medical facilities, fire and police protection, access to technology) • Externalities (noise, odours etc.)

Table 1: Demand-side Factors for Choice Residential Users (Adapted from the Appraisal Institute, 2014)

Business

Business needs are focused primarily on profitability. The following table depicts a number of demand-side factors that will inform the location and form of development for businesses by property sector.

Sector of Development	Demand-side Factors
Retail Market	• Household incomes and percentage of income spent on retail purchases (effective purchasing power) and percentage of disposable income spent on various specific retail categories • Rate of sales retention in a potential trade • Profit benchmarks for retail facilities and sales volume per square foot • Retail vacancy and trends in the market • Land use patterns and directions of growth of the city • Accessibility (transportation services and highway systems) and cost of transportation • Factors that affect the appeal of the retail centre (image, quality of goods and tenant reputation)
Office Market	• Area employers who use office space, current and estimated future staffing needs • Category/nature of work • Land use patterns and directions of growth of the city • Accessibility (transportation services and highway systems) and cost of transportation • Factors that affect the appeal of the retail centre (quality of construction, management, and mix of tenants) • Availability of support facilities (shops, restaurants, recreational facilities)
Industrial Market	• Presence of raw materials • Exchange capability (currency values and trade barriers) • Area employers who use industrial space, current and estimated availability of skilled and unskilled labour • Land use patterns and directions of growth of the city • Accessibility (transportation services and highway systems) and cost of transportation • Employment in manufacturing, wholesale, retail, transportation, communications or public utilities • National and regional economic growth that affects local demand • Retail sales (applicable in market analysis for retail storage and wholesale distribution properties) • Cargo flows by transport type (i.e. truck, rail, water, air) and product type (i.e. high or low bulk)

Table 2: Demand-side Factors of Businesses (Adapted from the Appraisal Institute, 2014)

4.3.2. Private Sector Developers

A developer's principle goal is to derive the highest profit from an investment, which can be achieved through the acquisition (purchase) and disposal (sale) of property or financing the development/redevelopment of new space. They do this by identifying the demand in the property market such as demand for space to work in, to operate businesses from, to live in and spaces for leisure or recreational activities (Isaac, et al. 2010), determining its financial feasibility and finally by embarking on a process of development (described in Figure 9). It is critical to note that no private sector led project will get built unless it yields a return on investment or receives a public subsidy to compensate for underperformance (Belzer and Autler, 2002). Each developer is unique and will likely have its own profit benchmark, which is a function of cost and income and will ideally be projected through a developer's feasibility.

4.3.3. Investors

An investment institution's primary focus, when lending funds to developers, is how the loan fits into their loan portfolio and its marketability on the secondary market. They specifically offer loans to developer who can provide the best surety. All investors require a financial return on their investment.

4.3.4. Government

Although development activity is largely dominated by the private sector, it usually takes place within a regulatory framework set by government, through development plans and control mechanisms (i.e. zoning regulations). Furthermore there are specific forms of development which are undertaken solely by government such as public and recreational facilities, offices for its own use and affordable housing where government is seen both as the developer and investor.

4.3.5. Public and Private Motives for Engaging in Development

Private Sector (Formal)

The private sector prioritises financial gain over public good. Their mandate is to meet the financial obligations of their investors and to turn a profit. Each developer is unique and will likely have its own profit benchmark, based on their cost and income projections, however their ideal goal is to maximise profits (factors that increase income) and minimise risk (factors that reduce costs).

The following factors associated with income and costs are considered as key informants to a developer's decision-making process when undertaking development feasibilities:

Income:

- **Market Indicators:** Vacancy rates, property values and rental returns from adjacent properties will determine if the location and market is ripe for new development.
- **Marketability:** The attractiveness of the development and it surrounds to the potential buyers, which includes the quality of development and its surrounding area (i.e. accessibility to transport, amenities, safety etc.).

Costs:

- **Land Costs:** Developers tend to have a maximum price they are willing to spend on land in a particular location.
- **Infrastructure Availability:** new infrastructure requirements will trigger a development contribution which increases the capital cost of the developer.
- **Certainty and Timing:** lags in the construction period due to delayed or prolonged planning approvals result in higher holding costs. Uncertainty in planning approvals (land use, environmental, access arrangements etc.) may also deter developers from engaging in development.
- **Development Costs:** demolition costs, site clearance and preparation, building cost (main contract), building cost inflation, landscaping, external signage, contingencies, offsite works, interest on loans, parking etc. Direct costs related to both the type and quality of the end product.

Private Sector (Informal)

Informal economic development takes the form of small scale business in localised markets (e.g. spazas, hawkers etc.) which is often clustered around public transport facilities and areas with high pedestrian circulation. The City needs to optimise the following to promote informal development where it is contextually appropriate and aligned to TOD principles:

- Provision of public services (e.g. waste collection and management, consideration and integration social and transit)
- Provision of commercial space (public incubators, trading stalls etc.)
- Allow flexible development parameters and guidelines that permit the use and conversion of residential space; provision and design of such properties should manage the negative externalities (e.g. noise) and accommodate (e.g. through increased infrastructure capacity)
- Development of public transport facility management capabilities by the informal sector
(South African Cities Network, 2015)

Public Sector

The public sector's primary reason for engaging in development is to promote public good and provide basic services for all. However due to backlogs created by historic decisions and policy which has consequently led to high levels of social inequality, promoting social equity has become a key motive for engaging in development (which often translates in the prioritisation of the short term needs of the poor). The restrictive nature of human settlements grants coupled with political pressure to expedite the rollout of housing and the associated attractiveness of greenfields developments has resulted in the provision of services to the poor in poor locations.

Taking this into consideration it becomes clear that the development process is quite complex and agents that regulate the process have different motives which often impacts on the location and form development takes. What is perceived to be sustainable in terms of City policy and regulation is not always profitable and what is profitable is not always sustainable. Typically (in Cape Town) the private sector has largely ignored the City's proposed spatial restructuring planning policy directives, which have sought to promote densification and mixed use in transport corridors and restrict further sprawl of low density development on the periphery. A similar disregard for policy has also been experienced by the public sector and their approach to housing delivery which has consequently led to the development of poorly located housing settlements in isolation from economic and social opportunities and affordable transport, exacerbating spatial inequality as oppose to redressing it.

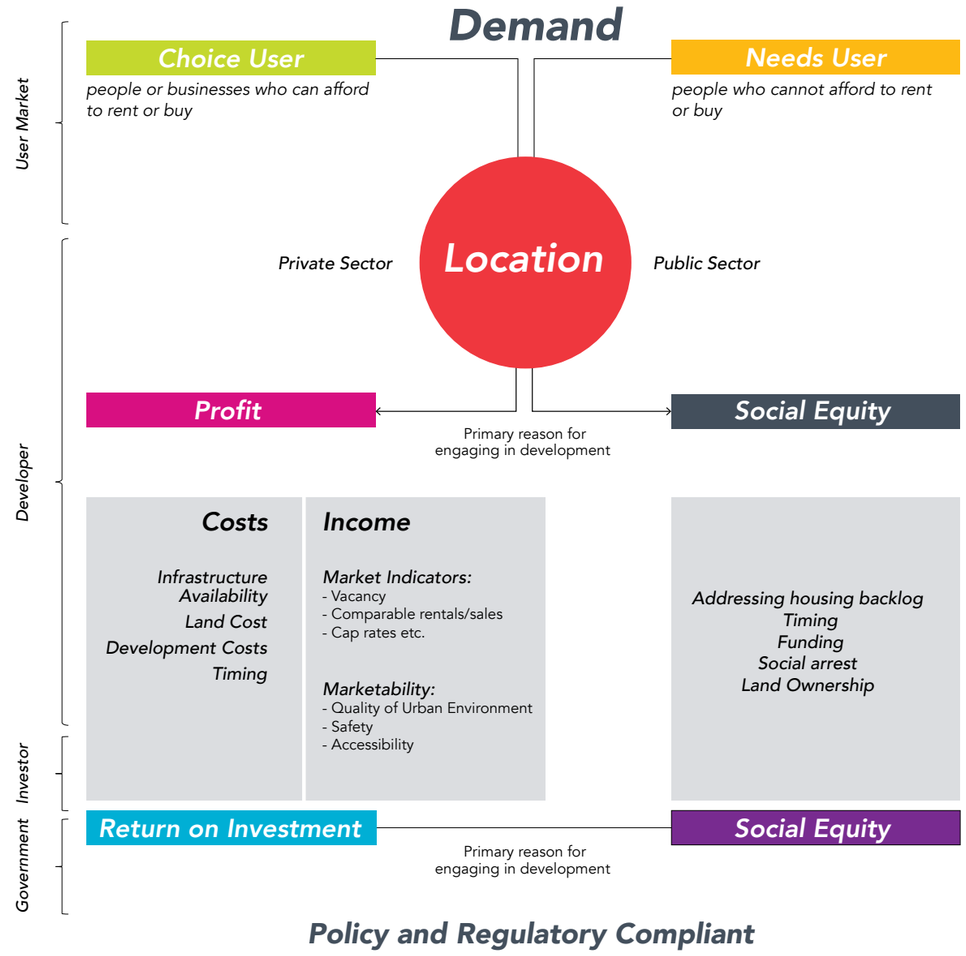


Figure 9: Motives for Engaging In Development

4.3.6. TOD Applied at Different Scales

It is acknowledged that TOD means different things at different scales. Understanding this difference helps to identify the appropriate tools and mechanisms to implement TOD and the scale of planning at which they should be applied.

At a metropolitan scale TOD intervention should ideally try to consolidate the relationship between land use and travel patterns across the city with the principle aim of achieving an optimisation of travel that meets a set of predefined indicators (refer to Table 10 in Chapter 11). Development of land produces and attracts trips with varying characteristics depending on the type and location of the land use. This theoretical optimisation between travel demand patterns and strategic land use form the basis for the TOD Comprehensive urban growth land use scenario (discussed later in this document). To this end TOD at the metropolitan scale as applied to Cape Town currently seeks to employ the future growth of the city by spatially distributing optimum land uses to ideal locations at the ideal time to optimise citywide travel patterns toward long term efficiency and sustainability.

The next level of TOD can be applied at a corridor level where the focus must be on land development to promote bi-directional flow of trips and the financial sustainability of trunk public transport services whilst playing a role in achieving the metro scale balancing mentioned above. Integrated transport and land use planning at a corridor scale is required to give context to local area and precinct planning initiatives. This will promote land development along selected transit corridors, where the combination of transport investment and development would optimise the utilisation of transport.

At nodal, precinct and project level TOD principles can be applied to facilitate better interfaces between the transport systems, land developments and people. A key consideration is the allocation of space, creation of more opportunities for walking and cycling and greater use of public spaces with sound urban design to create a sense of place. This is illustrated graphically in Figure 10 on page 27.

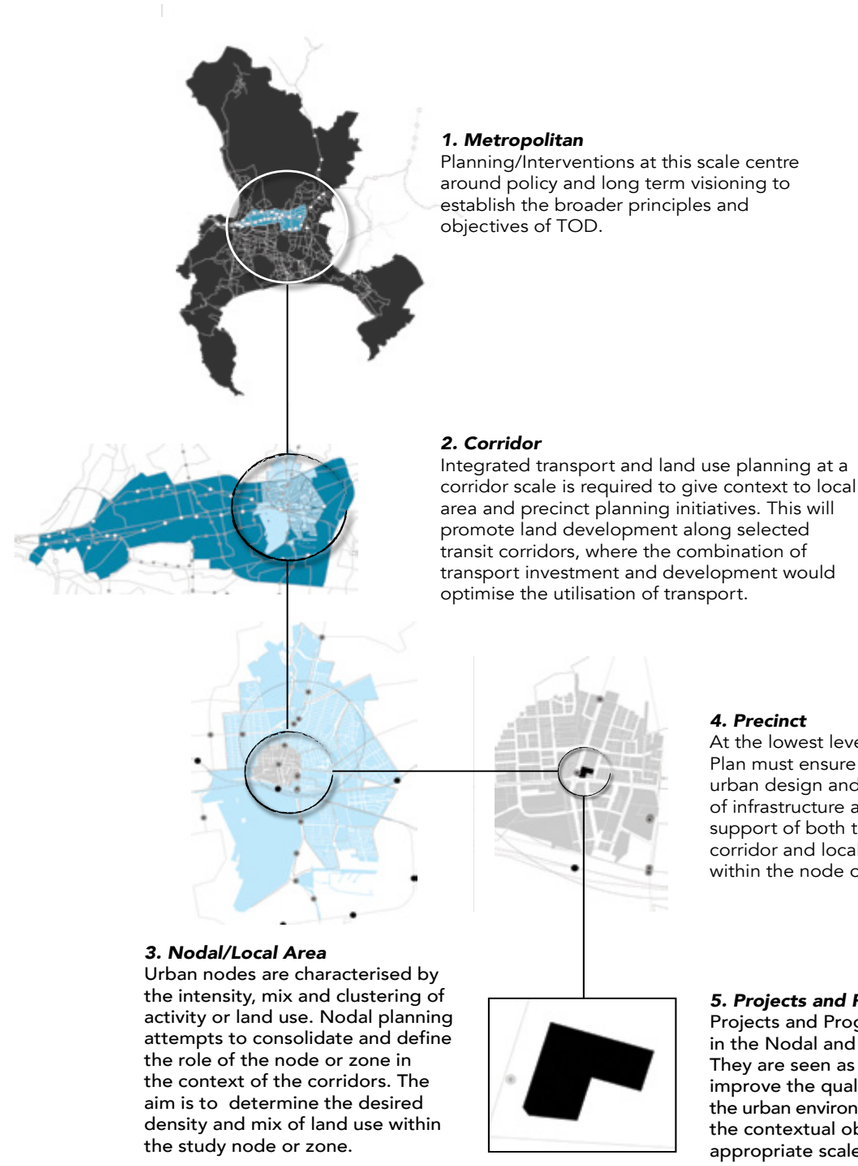


Figure 10: TOD and the Different Scales of Planning

4.4. Desired Outcomes

In October 2014 TDA, formerly known as Transport for Cape Town (TCT), hosted a Transit Oriented Development Summit with the aim of engaging with a wide range of stakeholders and role players to help provide a focused approach to developing an effective TOD Strategy. The Summit was held over two days starting with key note addresses to stimulate the debate and culminating in a World Café style workshop where each delegate was afforded the opportunity to engage on various aspects of TOD. The outcomes of this very informative summit are best described graphically as in Figure 11 below.

The desired outcome of TOD in general is a future spatial form of Cape Town that is compact, well connected, efficient, resilient and conducive to economic efficiency and equality whilst providing cost effective access and mobility with the least possible environmental impact.

The desired outcome of the City of Cape Town TOD Strategic Framework is to determine specific mechanisms for public and private investment that will give effect to efficiencies in the built form. Further to this the TOD Strategic Framework must identify the type, location and sequence of future land use development in support of TOD principles and to develop and provide a set of appropriate tools and mechanisms to enable City Departments to achieve the outcomes of TOD as approved and for private development to follow suit.

4.5. Vision

The vision for Transit Oriented Development for Cape Town is:

To progressively move toward a compact, well connected, efficient, resilient urban form and movement system that is conducive to economic and social efficiency and equality whilst providing cost effective access and mobility, with the least possible negative impact on the environment.

4.6. Objectives

The objectives of TOD in Cape Town are defined as follows:

1) Maximise "location efficiency" so that people can walk, cycle and use public transport. This can be achieved through a comprehensive approach to land use density, mix and intensity, as well as a focus on prioritised public transport at a metro, corridor, nodal and precinct scale.
2) Boost ridership and minimise congestion thereby ensuring that the public transport system becomes more viable.
3) Provide a rich mix of housing, shopping, recreational and transportation choices.
4) Enable cost and operational efficiencies in the provision and design of urban infrastructure.
5) Drive down the cost of the User Access Priority for both new and existing residents.
6) Create a sense of place.

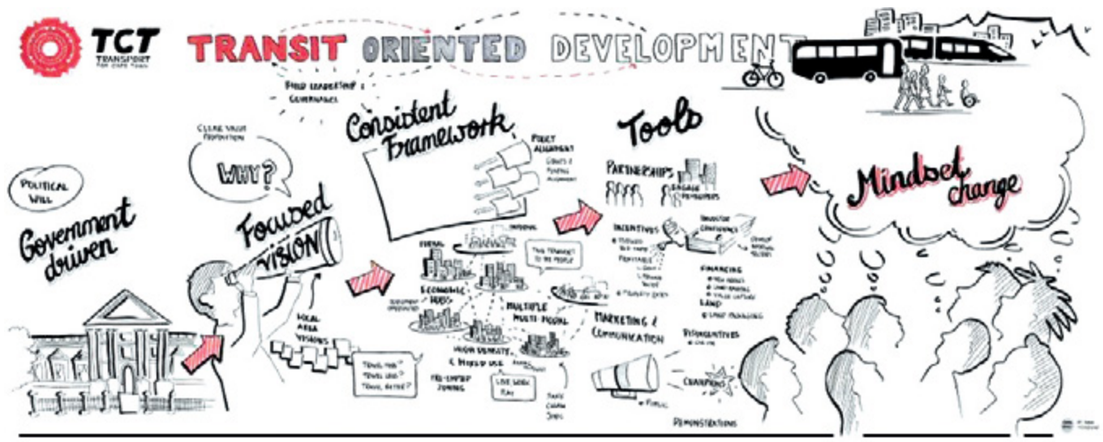


Figure 11: Graphic Harvest of Outcome of TOD Summit October 2014

5. Regulatory and Policy Context

Below is a summary of key policy at national government level which provides the mandate for local government to develop its own TOD policy and strategies. There is a quagmire of policies and strategies in play within the functioning of the City of Cape Town which may either facilitate or create obstacles to achieving TOD principles. A thorough audit will need to be undertaken on all relevant policy and strategies of the City to identify those that create barriers to TOD that will need to be amended or eliminated.

5.1. National Development Plan Vision 2030

The South African National Development Plan (NDP) is a broad strategic framework to guide key choices and actions.

Context of the National Government Priority Outcomes

- Outcome 6 – An effective, competitive and responsive economic infrastructure network
- Outcome 8 – Sustainable human settlements and an improved quality of household life
- Outcome 9 – Responsive, accountable, effective and efficient local government system

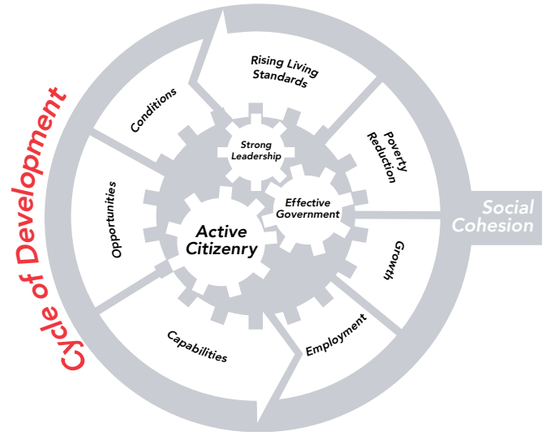


Figure 12: National Development Plan – Approach to Change

5.2. Draft Integrated Urban Development Framework (IUDF) 2014

The IUDF marks a new deal for South African cities and towns. It sets out a policy framework to guide the development of inclusive, resilient and liveable urban settlements, while squarely addressing the unique conditions and challenges facing South Africa's cities and towns. It provides a new approach to urban investment by the developmental state, which in turn guides the private sector and households.

The eight levers are premised on an understanding that (1) spatial planning forms the basis for achieving integrated urban development, which follows a specific sequence of urban policy actions; (2) integrated transport that informs (3) targeted investments into integrated human settlements, underpinned by (4) integrated infrastructure network systems and (5) efficient land governance, which all together can trigger (6) economic diversification and inclusion, and (7) empowered communities, which in turn will demand (8) deep governance reform to enable and sustain all of the above.

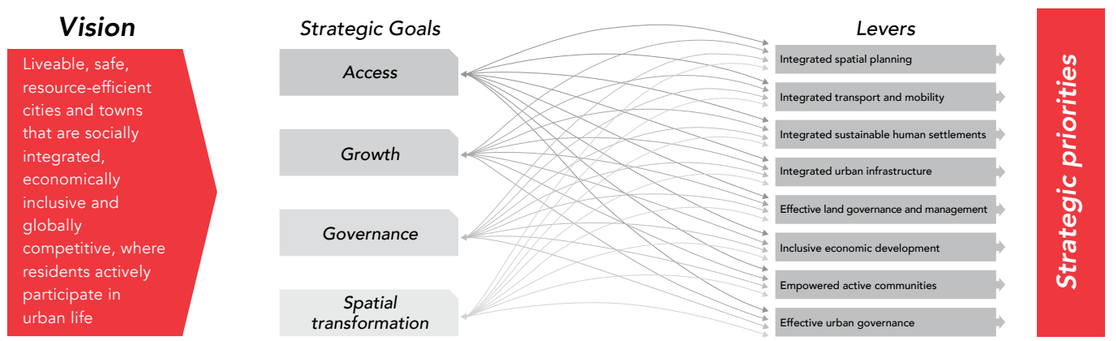


Figure 13: Draft Integrated Urban Development Framework (IUDF), 2014

SECTION 2:

Desired End State: Comprehensive TOD-Land Use Scenario

6. Desired End State: TOD Comprehensive

6.1. Premise and Purpose

On 25 June 2014 Council approved the City of Cape Town's Integrated Public Transport Network (IPTN), ref C59/06/14, a network plan intended to guide the development of rail and road-based transport infrastructure to accommodate existing and future travel demand within the city. The year 2032 was chosen as a possible future state for the IPTN in Cape Town.

The approved IPTN was primarily informed by a Pragmatic Transit Oriented Development (PTOD) urban growth land use scenario. This scenario did not extensively explore the holistic benefits of embracing TOD as a long term development strategy to its fullest extent or adequately consider the potential of brownfield development.
To effectively address these limitations, the IPTN Plan recommended the formation of TOD Comprehensive (TODC), a fourth land use scenario which best encompasses the core principles of sustainable development with the potential to influence optimum public transport movement in Cape Town more affordably, accessibly and efficiently. The premise for developing TODC was to assess its impact on the preferred IPTN and to quantify the benefits of TOD (i.e. lower operational costs) using a performance based model linked to the TOD principles approved as part of the 2032 IPTN (refer to section 4.2). Furthermore a list of land use assumptions was developed in the IPTN to guide the direction of TODC (refer to Annexure A).

It is important to note that the TOD Comprehensive land use scenario is a product of an analytical exercise to determine the extent to which TOD benefits might be realised. Whilst the focus for the TOD comprehensive land use model has been, to a large degree, based on theoretical possibilities, there are many policy implications which stem from this process, especially if the latter is proven. As such TOD Comprehensive is viewed as a desired end state or best possible urban form to address the integrated transport land use inefficiencies of our city, thus new principles, ideas, implementation tools and land use interventions that were identified during the study, have been included in this strategic framework.

6.2. Parameters for the TOD Comprehensive Land Use Scenario

The principles set out in the IPTN represent ideal characteristics of a sustainable public transportation network and urban development context, thus giving effect to the following key transport objectives and associated higher level land use interventions:

Transport	Land Use
1. Reduce travel distances: to reduces the cost of commuter travel and improve operational viability of public transport.	Intensify and diversify urban development in close proximity to public transport stations.
2. Optimise bi-directional flows.	Promote an appropriate mix and form of residential, social and economic activity between urban nodes along higher-order public transport corridors.
3. Generate a greater level of seat renewal (balancing trip attractions and productions)	Promote an appropriate mix and form of residential, social and economic activity between district and local nodes along higher-order public transport corridors.

Table 3: Transport Objectives and Associated Land Use Interventions

The land use scenario employs a number of assumptions (as contained in the approved IPTN) which are contained in the TOD Comprehensive land use scenario Technical Report (see Annexure A) in order to support the intention of this metropolitan-scale scenario. These assumptions were used to generate the scenario and as such do not consider items such as land value, income-group specific travel behaviour, and exclude more detailed-scale assumptions regarding neighbourhood-level dynamics, locational requirements for firms and individual user preferences for amenity.

6.3. Methodology

The model to develop TOD Comprehensive underwent a four stage process illustrated below.

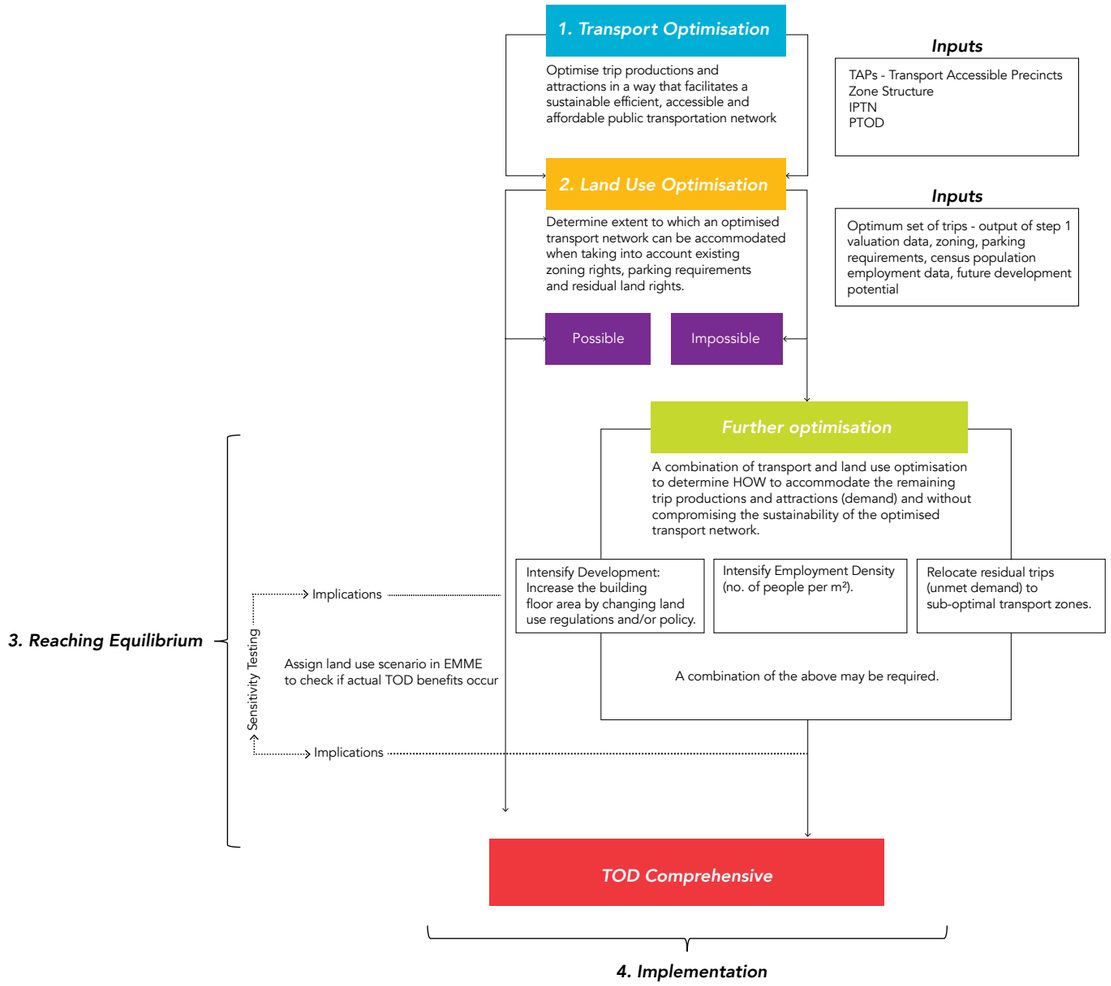


Figure 14: Schematic Depiction of the TODC Methodology

Further detail on the methodology is described in the TOD Comprehensive Scenario Land Use technical report, attached to this framework as Annexure A.

6.4. Transit Accessible Precincts (TAPs)

A significant consideration in the allocation of development in terms of TOD was the establishment of TAPs. These are spatially defined zones used to measure the performance of the model outputs of the TOD Comprehensive Model.

Precincts are confined to a 500m radius from a higher order public transport station. They were identified based on their level of access to the transit network.

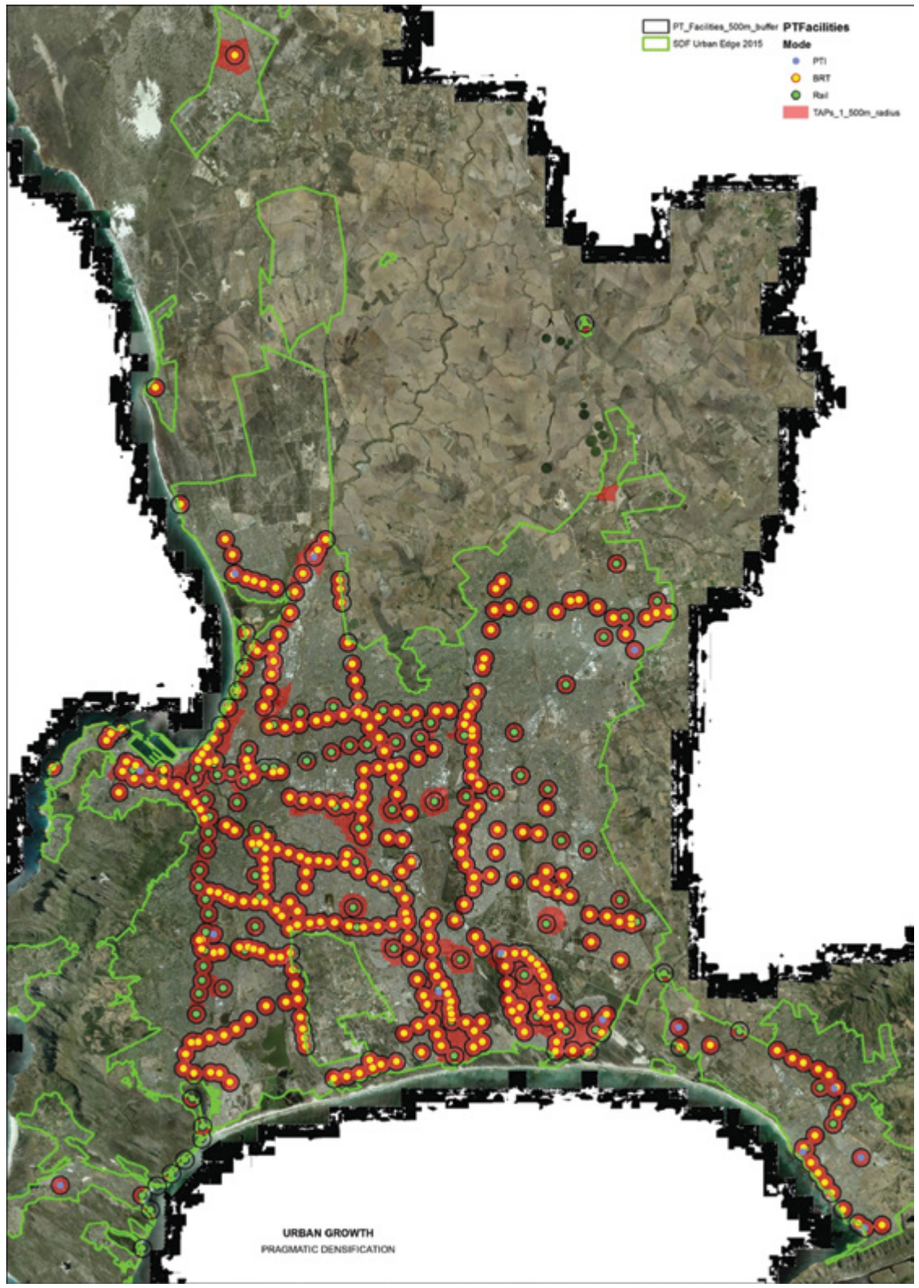


Figure 15: Transit Accessible Precincts (500m radius around rail and BRT stations)

6.5. Preliminary Findings

6.5.1. Transport Optimisation:

Following the transport optimisation process, Figure 17 shows the optimal location of new trips in 2032 per TAZ based on the six indicators discussed previously in this section. The yellow depicts new trip productions (generated from future residential development) and the red, new trip attractions (generated from future non-residential development such as retail, office, industrial and community facilities). When juxtaposed to the current spatial distribution of existing trips (refer to Figure 6) the following key conclusions can be made:

- A need for more trip producing land uses in TAZs located along transport corridors that contain high levels of trip attracting land uses. This requires the development of more residential opportunities in existing economic areas/nodes.
- There is also a need, although not as prevalent as above, to locate more trip attracting land uses (economic and social opportunities) in TAZs that are dominated by residential development, most noticeably in the Metro South East (MSE).
- The optimised scenario in Figure 16 illustrates a more compact distribution of future growth with less growth towards the edge of the city.

Current Situation

Pie size depicts intensity of use (largest pie = 24000 Ps + As)
Pie split depicts diversity of use (Residential vs Non-residential)

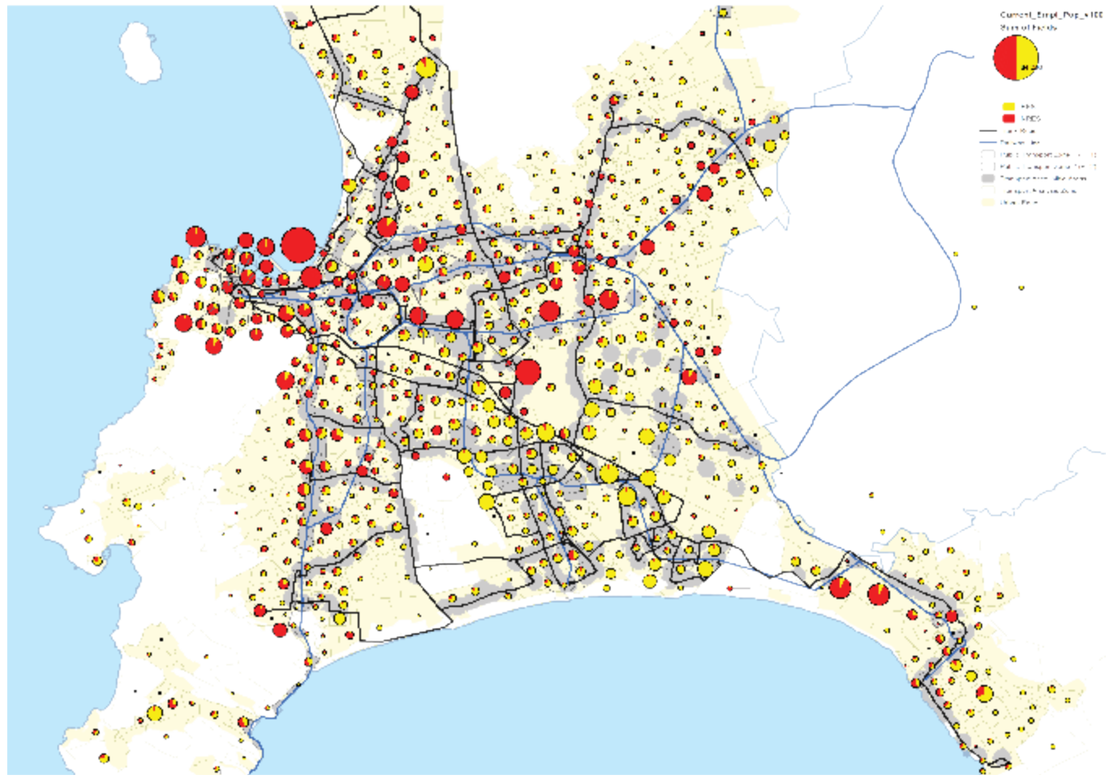


Figure 16: Current trips

Demand

Following Transport's Optimisation Process

Pie size depicts intensity of use (largest pie = 24000 Ps + As)
Pie split depicts diversity of use (Residential Vs. Non-residential

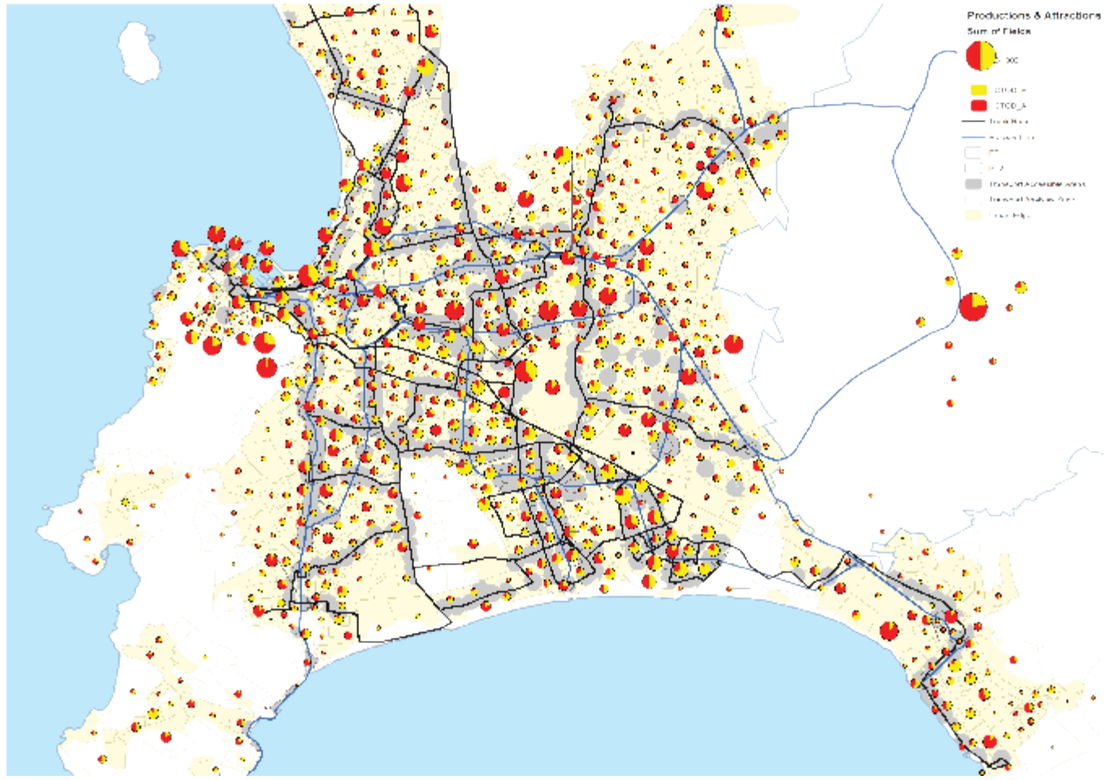


Figure 17: Spatial Allocation of New Trips Following Transport Optimisation Process

Theoretically, if the City manages to locate the exact quantity and ratio of trip producing and attracting land uses per TAZ depicted in the map above, the following integrated transport and land use efficiencies may be achieved (refer to Figure 18 below):

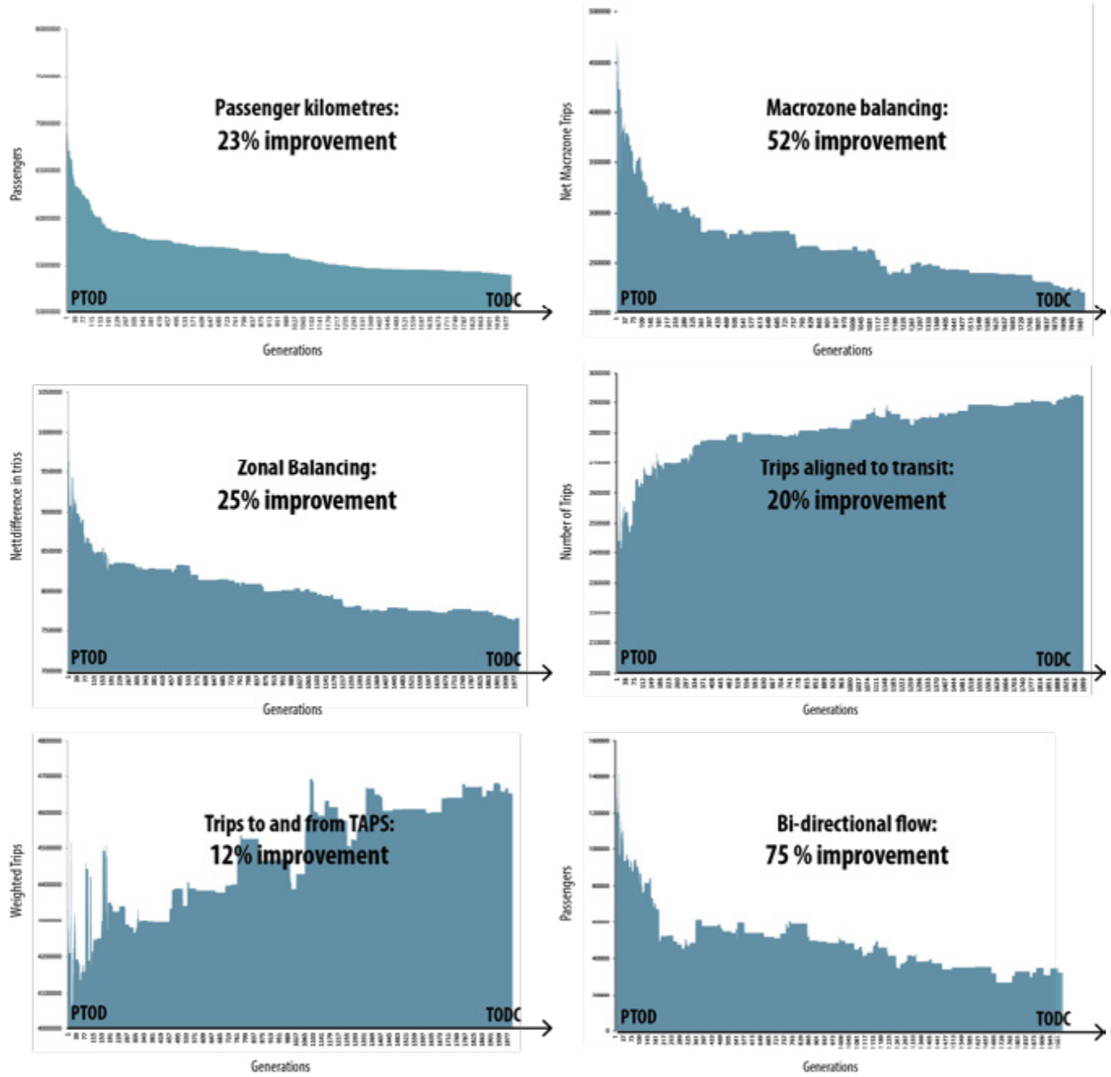


Figure 18: Potential Optimisation Improvements

It must be noted that the figures above represent an improvement from the PTOD land use scenario (which was used as basis for developing the IPTN).

6.5.2. Land Use Optimisation

The initial output of the land use optimisation process can be seen in Figure 19 and Figure 20 on page 38, which express the transport ask (trip productions and attractions) in the form of dwelling units and GLA. Figure 19 illustrates the future demand in terms of residential and economic development and Figure 20 depicts total development (existing and future).

Initial TOD Comprehensive Scenario (Growth Only)

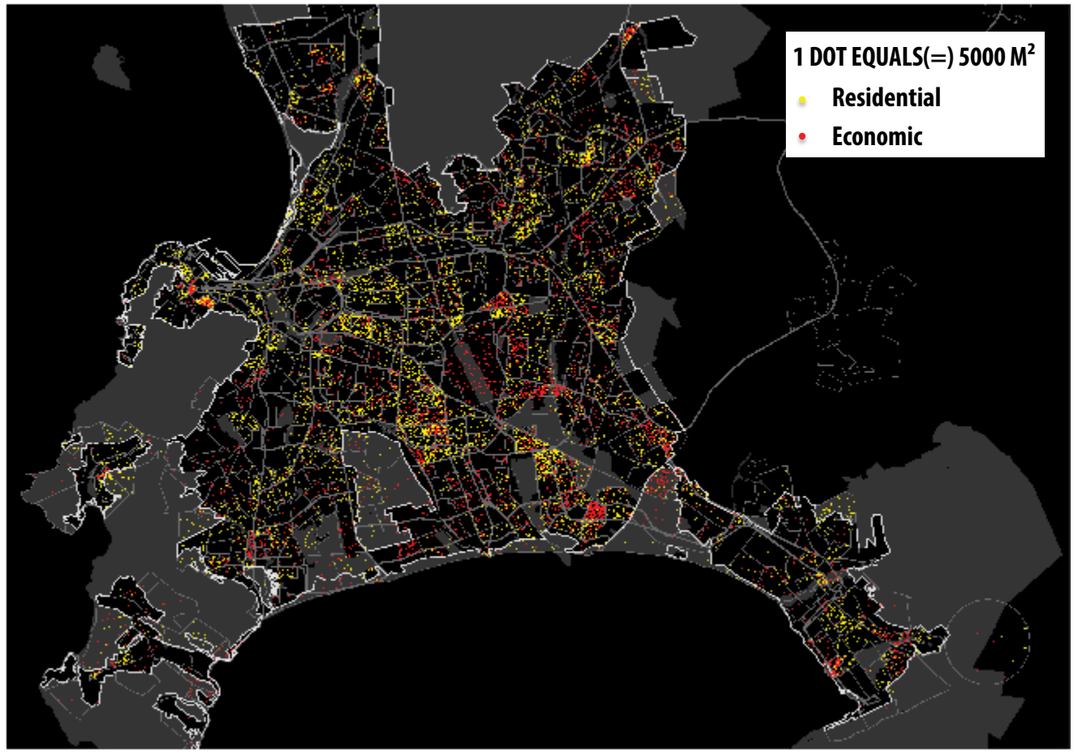


Figure 19: TOD Land Use Scenario Depicting Growth Only

Initial TOD Comprehensive Scenario (Existing development + growth, excluding unmet demand)

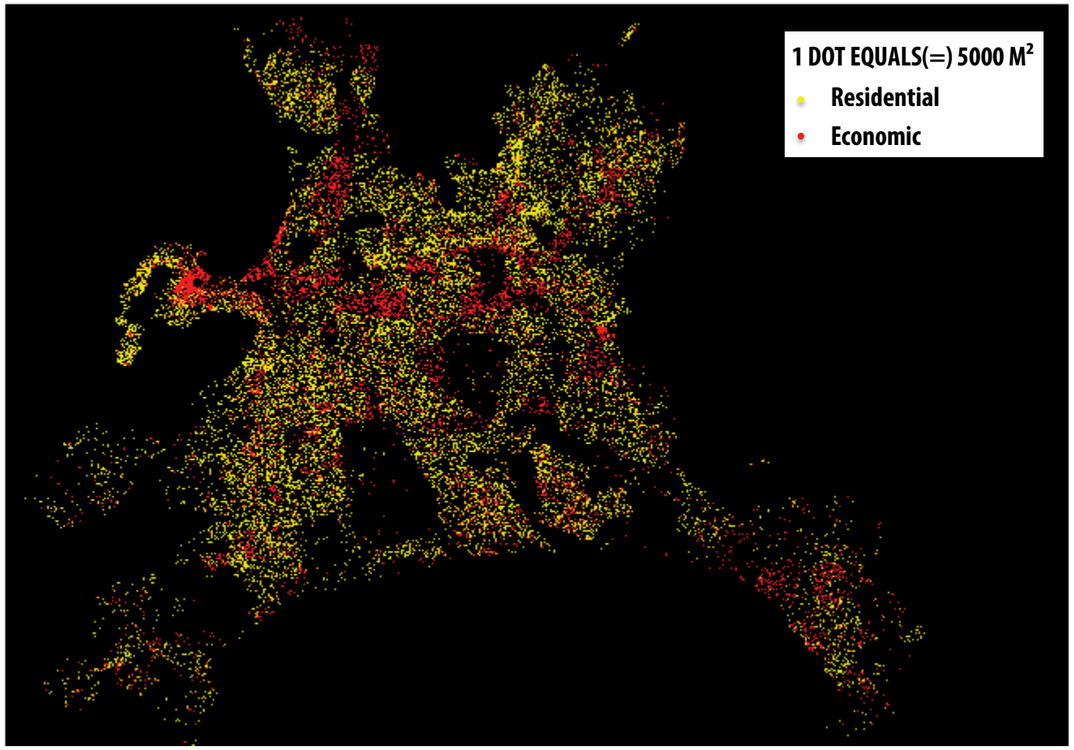


Figure 20: TOD Land Use Scenario Depicting Current and Future Development

The following maps (Figure 21 and Figure 22) show the comparison between transport demand (converted into dwelling units and GLA) and available land use supply (calculated based on the parameters discussed in section 6 and Annexure A).

Demand And Supply: Non-Residential

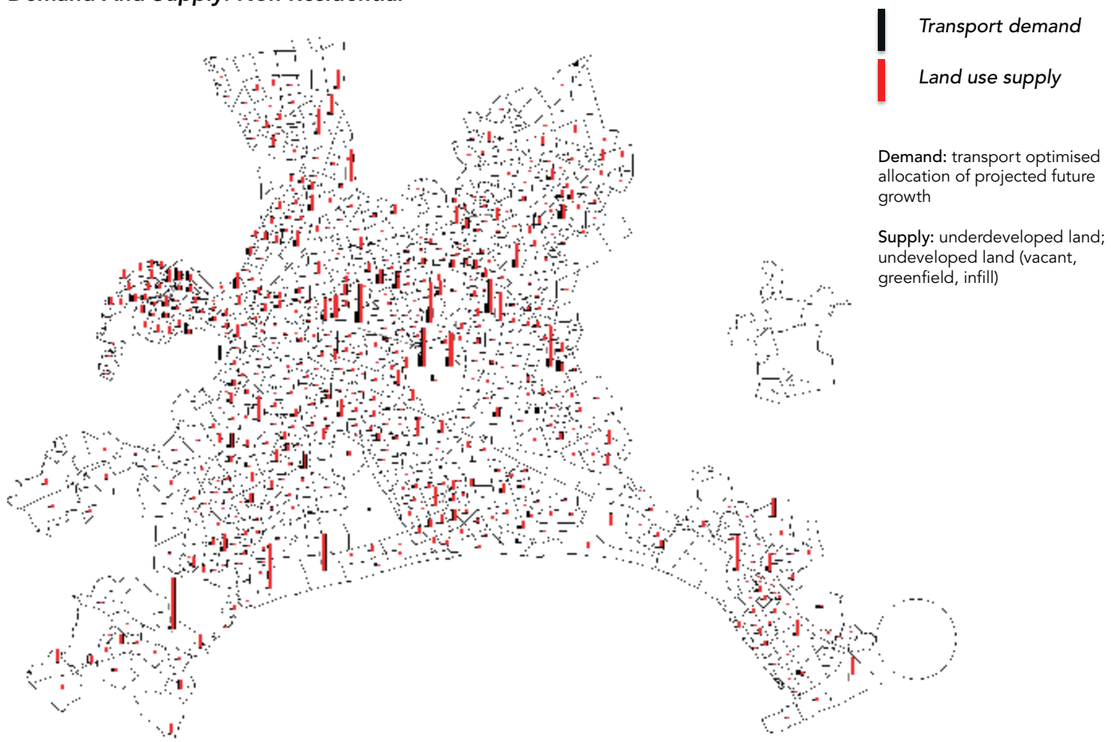


Figure 21: Non-residential Demand and Supply

Demand And Supply: Residential

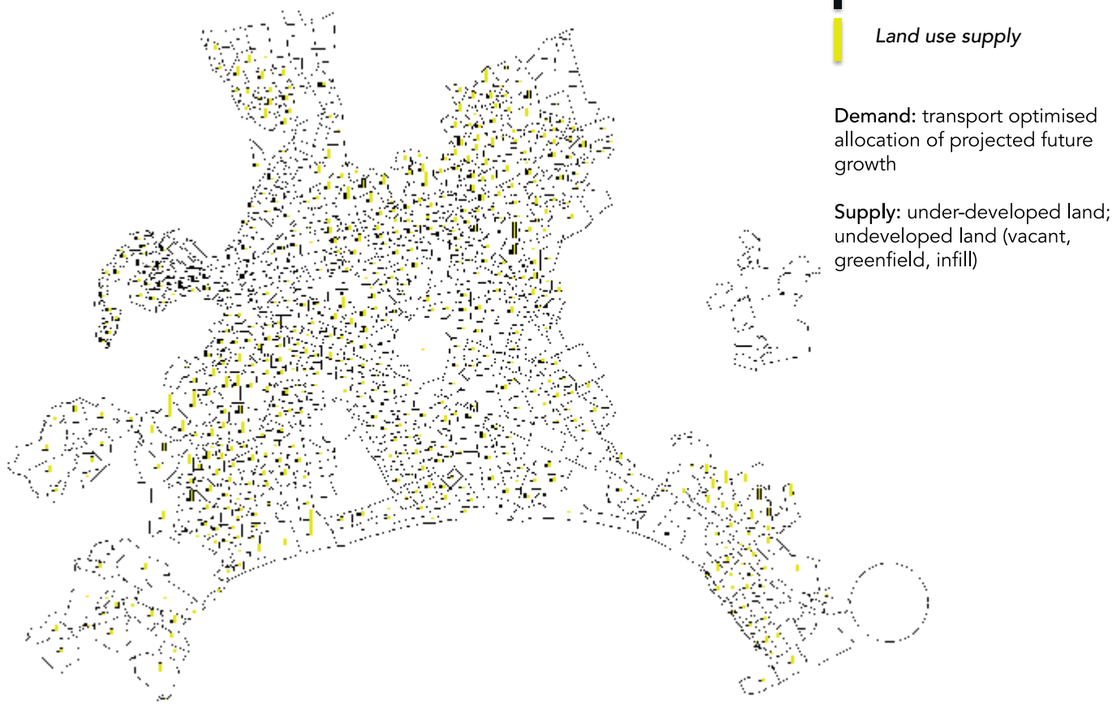


Figure 22: Residential Demand and Supply

Unmet Demand

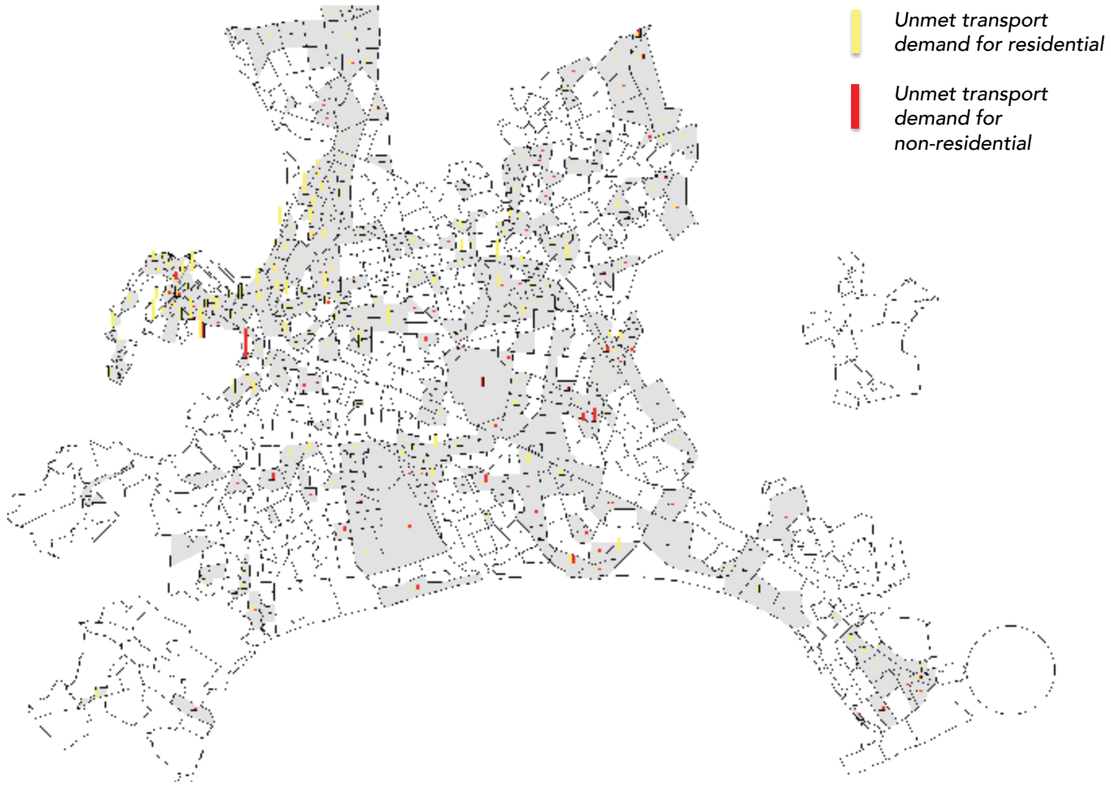


Figure 23: Unmet Demand

The figures above illustrate that it is theoretically possible to accommodate a significant portion of the transport demand (optimised trip productions and attractions) via residual floor area from latent development rights and/or vacant land that will give effect to the integrated efficiencies depicted in Figure 18. However a number of core economic nodes within the city do not have sufficient capacity (residual floor area or vacant land) to absorb the demand for new residential development (or trip producing land uses), depicted in Figure 23 on page 41. Most noticeable are some of the core urban nodes in Cape Town CBD, Century City and Bellville. To address this shortfall in land supply further land use optimisation will be employed in the next phase of the methodology to best accommodate the optimised transport network where sustainably/spatially appropriate. This will be done by adjusting the following variables:

a. Land use mix and intensity of use of building floor space (persons per m²: household size/employment density)
b. Space recovered through parking zone change (lower parking requirement)
c. [a] and [b] further optimised through rezoning/departures from standard development rules (height, coverage, floor factor)
d. Relocation to adjacent TAZ with spare floor area capacity

6.6. Preliminary Review of the Optimisation Processes

6.6.1. Transport Optimisation Process:

- Heuristic optimisation provides an excellent method for optimising multiple and conflicting parameters. The process is in itself heuristic and is being refined along the way particularly regarding the data.
- The process is very time and resource-consuming. Computational resources are especially problematic, because the algorithm used in both the transport and land use optimisation modelling relies on proprietary software (EMME), so modelling is restricted to a single instance of the programme at any one time, limiting the opportunities writing the script to accommodate parallel processing.

6.6.2. Land Use Optimisation Process:

- Quantifying the existing land use is a long, complex, manual process which requires the use of a variety of sources.
- Filling the gaps in the data requires inventive, iterative work and a significant amount of time. However, the work done on establishing the base year (current) land use picture can be incorporated into many different processes and initiatives e.g. MTIIF.
- Parking provision plays a significant role in the intensity of the land use that can actually occur. Where rights for intense land use may currently exist, these may in practice be significantly reduced by parking provision.
- Not everything has been taken into account e.g. physical restrictions, title deed restrictions, heritage restrictions etc. therefore could be overestimating the possible land use availability.

6.7. Way Forward for TOD Comprehensive

The development of the TOD Comprehensive land use scenario represents a highly complex and nuanced methodological approach to integrated land use and transport planning. Its potential as a modelling tool to inform future urban growth and travel demand is unprecedented and could add significant value to the City's development strategies (i.e. the IHSF, MTIIF, CTSDF etc.). This is reflected in Figure 5: Strategic Intent of the TOD Strategic Framework which identifies TOD Comprehensive as a key input into the citywide process to institutionalise TOD within the City of Cape Town's administration.

The product (land use scenario) and model at this phase of the methodology requires further optimisation, iterations, testing and peer review to accommodate the unmet demand and improve its reliability and authenticity as a tool to facilitate sustainable development. The end product must then be used as a key strategic input into the City's development plans at the metropolitan scale of planning to inform the ideal location of new residential and non-residential development. Whilst the land use scenario may not be finalised, it shows the City's intent to progress positively from PTOD to CTOD. Therefore outputs from this process, have been contextualised within the TOD strategy as the desired end state.

6.8. Prioritisation of TOD Intervention

6.8.1. IPTN Implementation Plan

While the IPTN project has developed the ultimate integrated public transport network and high level operations plan, the phased implementation plan thereof is still being finalised and therefore a preliminary implementation plan is provided here. The IPTN draft preliminary Implementation Plan provides a provisional rollout plan detailing the phased implementation of the IPTN towards 2032, as shown in Table 4.

It should be noted that the current preliminary sequence of rollout of IPTN corridors provided here is subject to change. However, the planned work on the Lansdowne Wetton Corridor in 2015/2016 is confirmed as the next phase. The uncertainty with respect to the sequence of rollout only applies to Corridor 4 onwards. The Implementation Plan will however be submitted to Council for approval in the last quarter of 2015. Any changes will only impact on the outer year of this application (i.e. 2019/20) and such changes will be incorporated into next year's application.

Priority	Corridor
1	Lansdowne Wetton (T11/12) Corridor
2	Blue Downs Rail Corridor (City implementing feeders)
3	Klipfontein – CBD (D12) Corridor
4	Khayelitsha – Century City (T17) Corridor
5	Eersterivier – Blouberg (T16) Corridor
6	Symphony Way (T13) Corridor
7	Gordon's Bay – Retreat (T10) Corridor
8	Strandfontein – CBD (T15) Corridor
9	Westlake – Bellville (T14) Corridor
10	Kraaifontein – Century City (T19) Corridor

Table 4: IPTN Corridor Prioritisation (as at July 2015, IPTN Draft Implementation Plan)

6.8.2. Integration Zones (IZs)

To give effect to the spatially targeted and performance-related Integrated City Development Grant (ICDG), the City has identified and endorsed two Integration Zones namely, the Metro South-East Integration Zone and the Voortrekker Road Corridor Integration Zone. They are identified and prioritised based on their primary public transport linkages that connect emerging urban nodes with established ones (including the two major metropolitan nodes: the Cape Town and Bellville CBDs).

The IZs represent a joint commitment (between the City and the National Treasury) to plan, fund and implement projects and approaches that are best able to transform the spatial structure of the city. Performance-related funding allocations and monitoring of targets is core to the IZ rationale. This rationale is being extended by the further development of Catalytic Urban Development Projects within the IZs. The Integration Zone projects underway must identify and facilitate TOD opportunities along these important corridors.

Figure 24 below shows the proposed sequence of rollout of the IPTN 2032 Plan with particular focus on the next three financial years. The figure also indicates the completed portions of the network.

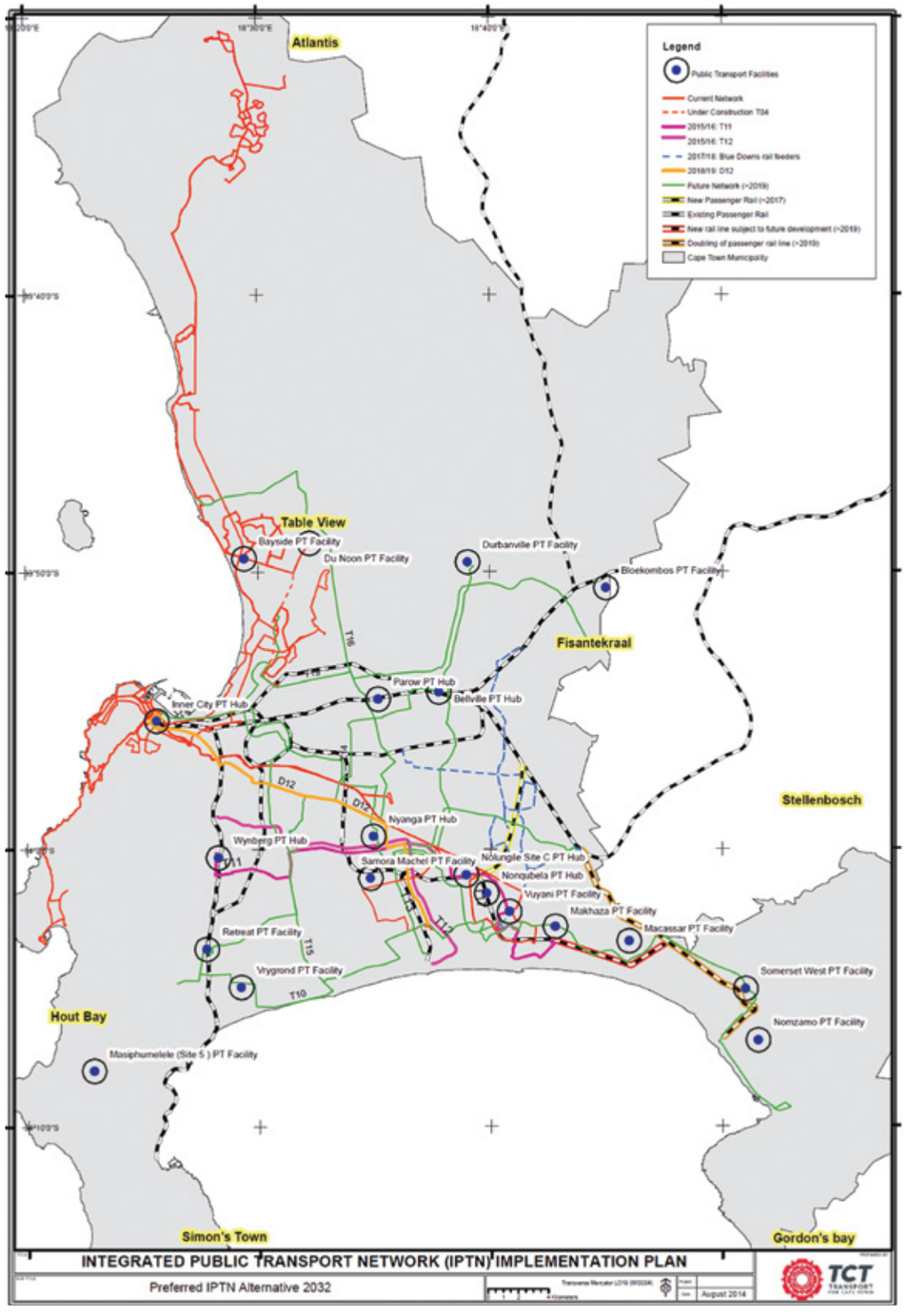


Figure 24: Proposed IPTN Overall Network Plan rollout next three years

7. TOD Implementation Programmes

Based on the integrated land use and transportation challenges facing our city, the understanding of the role players and their reasons for engaging in development and TOD in the context of Cape Town and lastly the establishment of ultimate desired end state, this section identifies the necessary strategic levers to implement TOD and address said challenges.

As mentioned previously the inability of the City to restructure its urban form sustainably can be attributed to the following key inefficiencies:

- The sub-optimal relationship between the City and the private sector.
- Government's mandate to address social inequality through rapid, short term and low-cost means of development.
- Lack of funding to pursue long term compact sustainable development options.
- A public culture of low density development and car-dominated behaviour.

Therefore to effectively address these integrated inefficiencies the TOD Strategic Framework attempts to consolidate the City's resources towards changing the behaviour of the key role players that drive development. It specifically attempts to optimise the factors that underlie their motives for engaging in the development process, and in so doing, shift their current business as usual approach to one aligned to the principles and objectives of TOD. This requires an effective form of urban growth and travel demand management, which centres on the following programmes depicted in Figure 25 below:

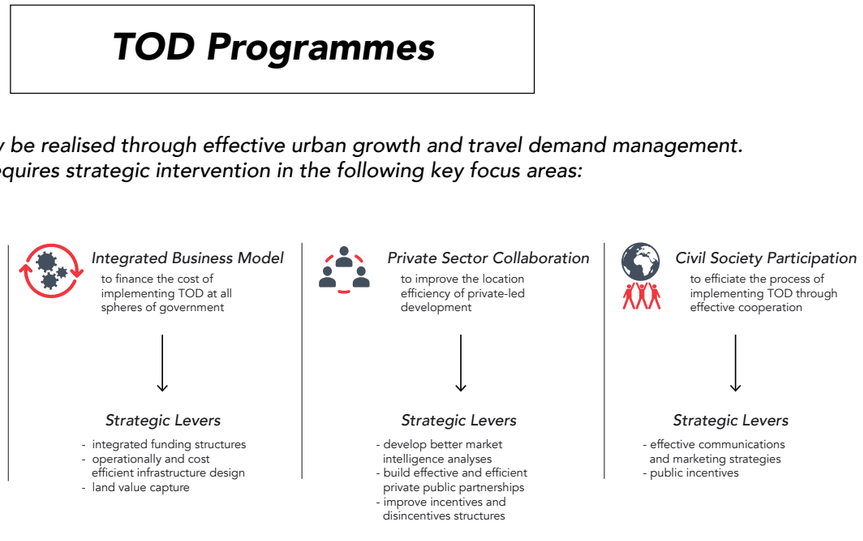


Figure 25: TOD Strategic Programmes

7.1. Institutional Alignment

It is paramount that the Transit Oriented Development (TOD) Strategic Framework for the City of Cape Town is approved as the basis to align all City strategic and built environment plans with the principles, objectives and vision of TOD for Cape Town to ensure integrated and coordinated delivery of services. The following strategic levers have been identified to facilitate Institutional Alignment:

7.1.1. Strategic Levers

Policy and regulatory realignment at all scales

All existing corporate strategic policy and development frameworks (IDP, SDF, IHSF, EDS, and CDS etc.) must incorporate TOD principles and objectives (to the extent that they have not already been embedded) in order to institutionalise TOD within all directorates of the City and ensure that TOD principles and objectives are key considerations in the assessment of all private sector development approvals and public sector led development across Cape Town. This requires further investigation to determine whether there are obstacles to TOD in approved City policies/strategies and ensuring that new policies and policy reviews prioritise TOD and are consistent with TOD principles and objectives.

Taking this into account the following amendments to existing corporate and development policy directives, spatial designations and catalytic projects is required:

a) IDP (Integrated Development Plan)

The new IDP must incorporate TOD principles and programmes into its sector plans and the following urban development policies and structure plans to the extent that this is not already embedded in said policies and plans:

i. 2032 IPTN (Integrated Public Transport Network)

The IPTN Review must test the impact of TOD Comprehensive on its network plan.

ii. CTZS (Cape Town Zoning Scheme) Regulations

Incorporate the TAPs as an overlay zone (which will effectively absorb the PT1s and PT2s) to accommodate relaxed develop rights consistent with the development parameters (i.e. uses, floor factors, height restrictions, setbacks, parking etc.) identified in the TOD Comprehensive land use scenario. This will create certainty and reduce risk to potential private sector investors.

iii. IHSF (Integrated Human Settlements Framework)

The TOD Comprehensive land use scenario should inform the IHSF, to maximise the location-efficiency of new housing and human settlement development in line with the desired density and composition of residential and non-residential development.

iv. MTIIF and Growth Management Plan

MTIIF must test the impact of TOD Comprehensive on the future rollout of infrastructure and identify the most financially sustainable alternative to pursue in the City's Utilities Master Plan and Growth Management Plan.

v. CTSDF (Cape Town Spatial Development Framework)

The TOD Comprehensive land use scenario should inform the review of the City's Spatial Development Framework, to ensure alignment between future development and principles and objectives of TOD.

b) Legislation

To the extent that existing municipal, provincial and national legislation present barriers to the implementation or utilisation of TOD levers and tools identified in the TOD toolkit, it is critical that the City embark on further research to overcome these barriers and if necessary initiate any processes to amend said legislation. The legal mandates of different government spheres and departments need to be aligned and accountable.

Change Management

a) TOD Manual

The City of Cape Town has adopted policies (such as the Densification Policy, Tall Buildings Policy and the Urban Design Policy) which set sustainable design parameters to guide the form of future development. Whilst these policies currently support the principles and objectives of TOD, they often get misinterpreted or disregarded in the planning of infrastructure and assessment of land use applications at the nodal and precinct level. Furthermore there are some engineering standards in place, such as the Western Cape Road Access Guidelines, that prohibit TOD outcomes (or contravene current design principles) and are generically applied without considering site specific implications and contextual factors that are historically oriented towards COD (Car Oriented Development). The use of standards that relate to road layouts, parking and/or access are often inappropriately applied in a South African context, especially in terms of human settlements planning. To this end the manual is seen as a design mechanism to integrate sound TOD design principles (currently embedded within City policy) and engineering standards to inform an appropriate application of policy guidelines to the assessment of private and public development by giving consideration to TOD outcomes at the nodal and precinct scale, particularly the interface between land use and transport and how potential development will be used by people.

b) Transversal Management System (TMS)

The City has recently adopted a Transversal Management approach to address the fragmentation of service delivery. The primary purpose of the TMS is to ensure that the City's directorates collaborate in the delivery of services. It is a management device to improve integration and coordination of service delivery and planning by creating structures in which political leadership, senior managers and officials can work together and communicate. It is a way to improve citywide strategic alignment through inclusive strategic planning processes to improve integration and coordination of service delivery and planning. It operates within the existing hierarchical structure, but complements this structure with additional platforms for cross-directorate communication and decision-making. The TMS aims to ensure that directorates collaborate around identified themes and through 'organic' groupings (issues falling into the mandate of multiple departments).

7.2. Integrated Business Model

It is widely viewed that TOD can lower infrastructure costs in the long run but the initial TOD infrastructure needs can be considerable and can require extensive public investment (Sustainable Cities Institute, 2013). There is no single source of funds for TOD; instead, a number of funding sources are needed. Furthermore it is important that the City safeguard against excessive fiscal spend to ensure that it's financially secure to continue the long term implementation of TOD related projects. The following strategic levers have been identified to help the City finance the cost of implementing TOD:

7.2.1. Strategic Levers

Value Capture

Value capture levers enable the City to recover some or all of the value that public infrastructure generates for the private sector and ensure that it retains the maximum value of its assets when leased or disposed to the private sector. The revenue or income generated by these levers can be used to offset high operational costs linked to the provision of high quality public transport and future TOD projects.

a) Land Value Capture

Policy and regulatory mechanisms that allow a public entity to "capture" the increased value (direct or indirect) of land resulting from private and/or public improvements.

b) Revenue Enhancement Mechanisms

The following revenue enhancement levers, income-generating opportunities and mechanisms to improve existing revenue, linked to TOD, inter alia have been identified for the City's perusal:

i. Improved Parking Management and Tariff Structures

Increased parking tariffs can significantly support the City's TOD and TDM objectives to manage the impact of parking on land use and to incentivise certain travel behaviour thus increasing use of public or non-motorised transport and reducing congestion. Furthermore it is considered a pivotal value capture mechanism which can be used to sustain the City's transit investment by generating additional income. Establishing commercially competitive parking tariffs can potentially increase revenue to the City and a more effective business design of parking management enables a better retention of revenue generated from parking.

ii. Retail Opportunities and Appropriate Commercialisation of Transit Stations

Incorporating the provision for retail opportunities in the design of stations and surrounding precincts have been identified by the City as a potential revenue enhancement and land value capture mechanism to help subsidise the cost of operating high quality public transit, promote local and large scale economic development, improve the passenger's overall transit experience and give effect to encouraging appropriate forms of Transit Oriented Development (TOD). Commercialisation of stations improves ridership, passenger convenience and generates a greater level of seat renewal. As such it is important that the future design of MyCiTi infrastructure adopt appropriate design principles that can accommodate retail and/or social facilities inside and above stations and reinforce commercial opportunities external to the station, within the station precinct (where appropriate).

The following high level parameters are proposed to be considered in the future planning and design of MyCiTi stations:

• Potential and Scale

The scale of potential retail opportunities should be linked to the station's projected demand and minimum threshold size. Where there is an opportunity for significantly larger stations with substantial transferring pax volumes (i.e. Philippi station in the Lansdowne Wetton corridor), a greater level of engagement with the private sector may be necessary to pursue its potential integration into large-scale commercial developments (i.e. shopping centres) and identify possible co-funding options to subsidise the cost of operation (similar to what has been agreed to regarding the Table Mountain MyCiTi service).

• Location and Form

Market

Ideally a market and LSM (Living Standards Measure) analysis should be undertaken to determine what products are in demand. This will likely inform the type of space required to accommodate that product. However the design of retail/commercial facilities should also be sufficiently flexible to allow for different types of retail products and enable its intended occupier to adjust to changing markets. Attention should also be paid to context and opportunities for informal commercialisation and civic development (i.e. social facilities).

Broader Station Precinct

Consideration of the broader station precinct structuring elements must be taken into account (i.e. zoning, land use and access) to ensure that the design of the station complements its current and future commercial and mixed use potential. This will inform the location and structure of any future retail opportunity (i.e. inside, above or adjacent to the station). For instance the position and form of the station layout should seek to maximise exposure to foot traffic and pedestrian flow (which can be achieved through active and permeable edges). This is illustrated in the design of retail facilities constructed for Gardens station, which enables its occupier to trade inwards and outwards to capture foot traffic external to the station. In a similar vein the design of stations should be cognisant of existing pedestrian flows in established (local) commercial environments so not as to limit its commercial viability once implemented.

Alignment of Public Grants to give Effect to TOD outcomes

The City must pursue methods to align grants to give effect to integrated Transit Oriented Development. A greater degree of accountability is required by all City line departments to ensure alignment between development projects and the objectives of TOD. This is currently being prioritised through the City's Built Environment Performance Plan (BEPP). A BEPP is a plan which aligns grant funding allocated to municipalities for infrastructure development to national and local policy objectives.

Enable Cross-subsidisation of Funding Sources to Supplement TOD Initiatives

Public funding structures require a greater degree of flexibility to cross-subsidise projects that have an impact on the overall sustainability of the city's urban form. This is necessary to ensure that the City's developmental projects are aligned to the same desired end state and that one project does not create negative or financially-burdensome implications for the other. For example if the capital cost of pursuing more sustainable forms of housing in transit-adjacent locations is considered too high and not within budget for its applicable line (i.e. Human Settlements), national funding conditions should permit other departments/directorates to make use of its own capital funding to supplement that cost in order to assist them to implement such TOD measures; as the alternative will likely result in higher lifecycle operational costs for public transport, a direct consequence of having to service poorly located human settlements.

Moderation of Public Transit

A review of operational practices and service characteristics (referred to as a 'moderation' exercise) was undertaken around mid-2014, six to eight months after the major rollouts of the Phase 1A MyCiTi system, starting from the end of 2013, to analyse the passenger take-up of existing services, rationalise services and balance supply with passenger demand. Through this first round of the moderation exercise the service was adjusted to correlate demand and supply and more cost-effective approaches have been adopted where possible.

Moderation measures are seen as necessary but short to medium solutions to improve travel demand patterns in the period required to achieve an appropriate form of TOD (refer to Figure 26 below), which if fully realised will hopefully reduce the need to travel. Moderation measures are required to enhance the long term financial viability of public transport, such as forced peak capping (smoothing travel demand between peak and off peak periods) and the integration of paratransit services, i.e. hybrid models (providing an alternative mode to absorb the unmet demand as a result of peak capping). Based on the city's current urban form, the cost of operating public transport at a level attractive enough to induce a modal shift is not always feasible; hence the consideration of moderation measures (rooted in affordability) as a trade-off.

Granted this may impede the efficiency of the service however is considered essential to sustain an adequate level of service in the interim (as opposed to no service). The diagram below depicts the life cycle of travel demand measures required to off-set the operational cost associated with operating public transport services. As land use patterns improve with the implementation of vigorous TOD interventions, the need for moderation or cost cutting measures (or the degree to which they are applied) becomes less significant. In theory, the affordability of the service will be prioritised in the short term but will eventually stabilise as TOD becomes realised. This will result in an optimum balance between affordability, accessibility and efficiency – features of an integrated public transport network.

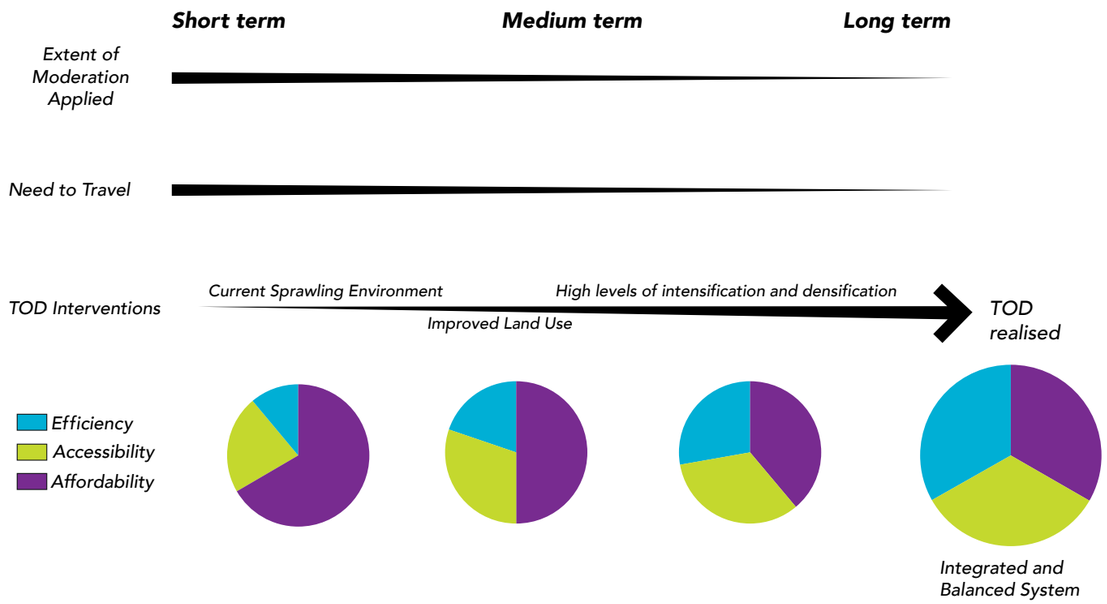


Figure 26: Relationship between Public Transport Operational and Financial Efficiencies and TOD

Flexible Infrastructural Design – Ramping Up

The process of integrated public transport and land use planning must align to one another, as there is uncertainty associated with the realisation of the TOD Comprehensive Land Use Scenario. To mitigate this risk and ensure that the City can afford to implement development projects in line with TOD, it is important for the design of actual operations and the construction of infrastructure to respond to appropriate passenger demand volumes as they materialise over time, to ensure (to the extent reasonably possible) that such operations are affordable to the City from available resources in every financial year.

The following graphic serves as an example to illustrate the potential incorporation of flexibility in the design of infrastructure or in this instance the design of a trunk station:

1. The sub-structures of the station are constructed when the roadway and stop are initially built.
2. The section where the station is to be located in future is initially covered over and utilised as passing lanes, while the base beneath where the stop is situated can be constructed such that, when the stops are removed and the station constructed, the area of the stop becomes the passing lane.

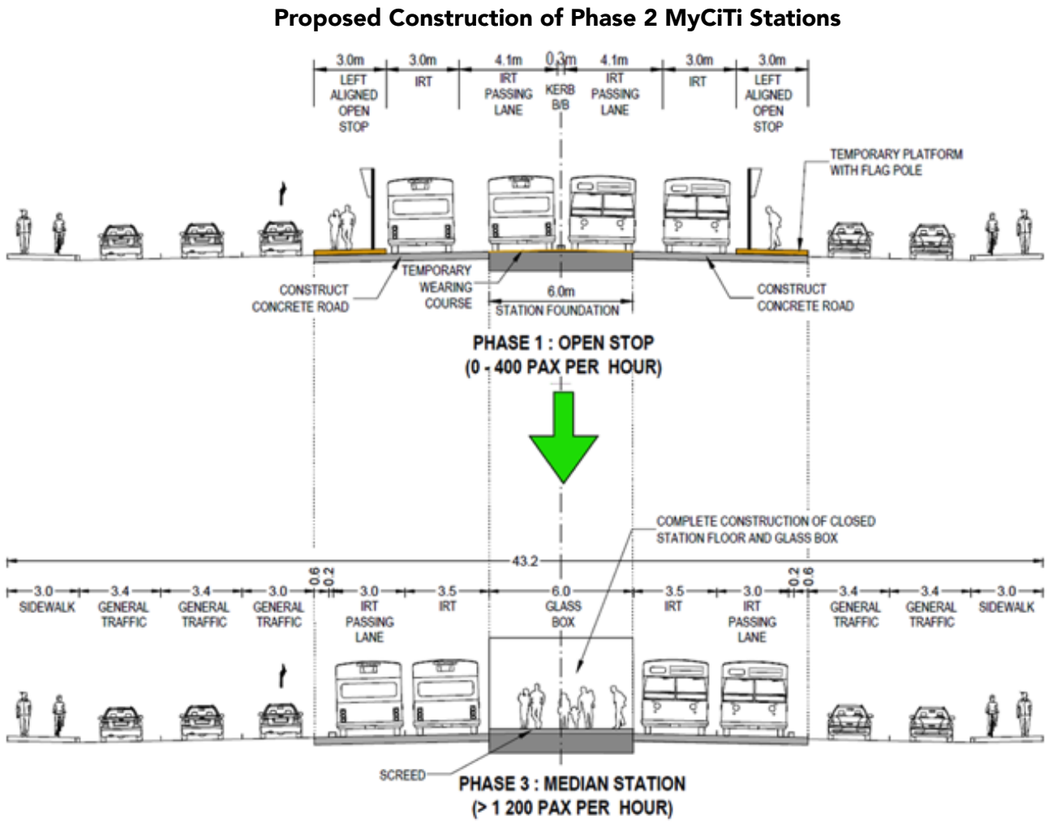


Figure 27: Adaptation of Station from Open to Closed

Figure 27 above illustrates that it is possible for transport infrastructure to 'ramp-up' to demand as it materialises to ensure the best (sustainable) utilisation of funding. To this end flexibility should be built into planning of infrastructure in future rollout of public transit, accounting for the full life-cycle cost of the system and related infrastructure.

7.3. Civil Society Participation:

The user is unquestionably the most important role player in the development process. As such this TOD programme identifies levers to provoke a change in current unsustainable user behaviour as it attempts to improve their choice mode of transport, place of work and place of residence through Travel Demand Management (TDM), effective communication and the formation of a public sustainable-rewards programme.

7.3.1. Strategic Levers:

Marketing

The need for improved maps and illustrations as part of a media campaign has been identified to facilitate a greater understanding of the scale and impact of TOD and graphically depict, for marketing purposes, the concept of TOD. This is important to effectively communicate to decision makers, and to members of the public who are often resistant to development applications that propose higher densities and intensity of land uses. It is considered that City of Cape Town examples of corridors, precincts and sites identified for land use intensification in response to the City's emerging Integrated Public Transport Network (IPTN) will be the most effective manner to communicate what is meant by TOD at a corridor, precinct and local level.

Public Incentives

The City's current development controls do not incentivise or disincentivise appropriate forms of development in strategic locations. It is proposed that all rates based and development contribution frameworks are aligned to TAPS and the TOD Comprehensive land use scenario, to positively reinforce users who make sustainable choices and optimise the factors that inform location and choice of residential development to choice users (discussed previously in section 4.3.1 of this framework).

Travel Demand Management

Travel Demand Management (TDM) promotes the use of modes with a lower environmental and economic cost over those with higher costs. At the same time it encourages travel with a lower economic and social value to occur at times when the financial and environmental costs of accommodating it are lower. It therefore promotes smarter travel choice, such as travelling outside the peak, or against the peak flows, using more efficient modes, such as walking, cycling, public transport or rail for freight movement, rather than private cars and road freight vehicles. This is necessary to induce a behaviour shift of current car-dominated behaviour. The City of Cape Town is currently developing a TDM strategy to identify and implement the necessary measures and implementation mechanisms to encourage efficient and sustainable transport, with an emphasis on the efficient movement of people and goods, rather than vehicles (Draft TDM Strategy, 2015). A key priority of this strategy is to induce a modal (and user behavioural) shift from private to public transport.

A broad spectrum of TDM interventions is available. TDM measures that have been applied in Cape Town include the following:

- BMT lanes (dedicated lanes for public transport), consisting of separate dedicated busways, and semi-dedicated bus lanes in existing roadways for exclusive public transport use in peak periods. This approach requires minimal infrastructure improvements, but increased law enforcement;
- Parking management by adjusting the supply and cost of parking to encourage the use of public transport;
- Improved traffic signal settings to optimise the flow of traffic and changes to network capacity to the advantage of public transport specifically;
- Flexi-time, alternative working and education times and compressed working hours;
- Ride-share programmes (also referred to as car-pooling);
- Freight management (off peak delivery times of goods).

Other typical TDM measures being pursued in Cape Town through the City's TDM Strategy, as public transport systems are improved, include the following: public transport subsidies for companies or developments which actively support public transport usage; network TDM capacity improvements by increasing or decreasing in network capacity to the advantage of public transport specifically; private vehicle restriction zones; taxation policies to discourage private vehicle subsidies and tax rebates where public transport is actively promoted; congestion pricing and travel pricing (e.g. fuel levies).

NMT Improvements

Non-motorised transport (NMT), which includes walking, cycling and the use of animal-drawn carts, amongst others, is a valuable component of the transportation system and is, ultimately, an element of all journeys. NMT is an essential connectivity mode to public transport. The planning, design and implementation of development (transit or land use) at a precinct level must be take into consideration efficient, safe and accessible urban design characteristics that maximise NMT circulation, improve liveability and create a sense of place to surrounding communities.

7.4. Private Sector Collaboration

This programme centres on levers to influence a change in behaviour of businesses and developers to move progressively towards TOD. It specifically identifies potential mechanisms (for the City to consider) to optimise the factors that drive the location of businesses and motives for engaging in the development process by developers and investors (discussed in section 4.3. of this framework).

7.4.1. Strategic Levers

Better Engagement (A shift from Control to Collaboration):

Establish a joint development forum to effectively engage with the private sector before major infrastructure projects.

Incentives to stimulate development consistent with TOD development guidelines:

Incentives are mechanisms to stimulate private sector development and leverage public investment. They are designed to change the behaviour of economic factors or influence their decisions in order to achieve specific outcomes. Incentives must be restricted to developers who meet given criteria such as locating in a TOD precinct and meeting the desired form and composition of land use. Standard incentive packages can involve financial rewards such as discounts, leveraging of City's property assets, rebates, tax holidays and subsidies or they may involve non-financial inducements in the form of exemptions from certain regulation or reporting standards (ECAMP, 2013).

Disincentives to curb development in undesirable locations:

Disincentives are mechanisms to discourage private sector development in locations that conflict with the principles of TOD. They are designed to curb sprawling development patterns. These could include increased development contributions, parking levies and planning restrictions.

Streamlined and Transparent Planning Approvals:

The City needs to work toward streamlining applications in line with strategic planning initiatives and TOD precincts to provide certainty and transparency to developers and businesses.

Use of the Property Cycle as a Forecasting Tool for Planning Intervention:

The property cycle is defined as recurrent but irregular fluctuations in the rate of all-property total return recurring predisposed to a number of exogenous and endogenous factors (Royal Institution of Chartered Surveyors (RICS) Report 1994). The location of a property is commonly pigeonholed as the key determining factor to successful real estate investment, yet perhaps just as important or if not more, is timing. A well-chosen property is likely to generate greater return in the future, not only in the form of capital growth but also in the form of rental returns. To maximise return it is critical to understand the property cycle and more precisely what stage of the cycle should one consider investment into the property market. In order for the City to identify the most appropriate tool to influence market trends and the appropriate time to implement it, it must consider the different stages in the property cycle to exploit its significance as a forecasting mechanism.

There may be potential, where the City can leverage its tools in a way that attempts to shift the timing of the property cycle, however it must be noted that in some markets or geographic locations, this may be improbable.

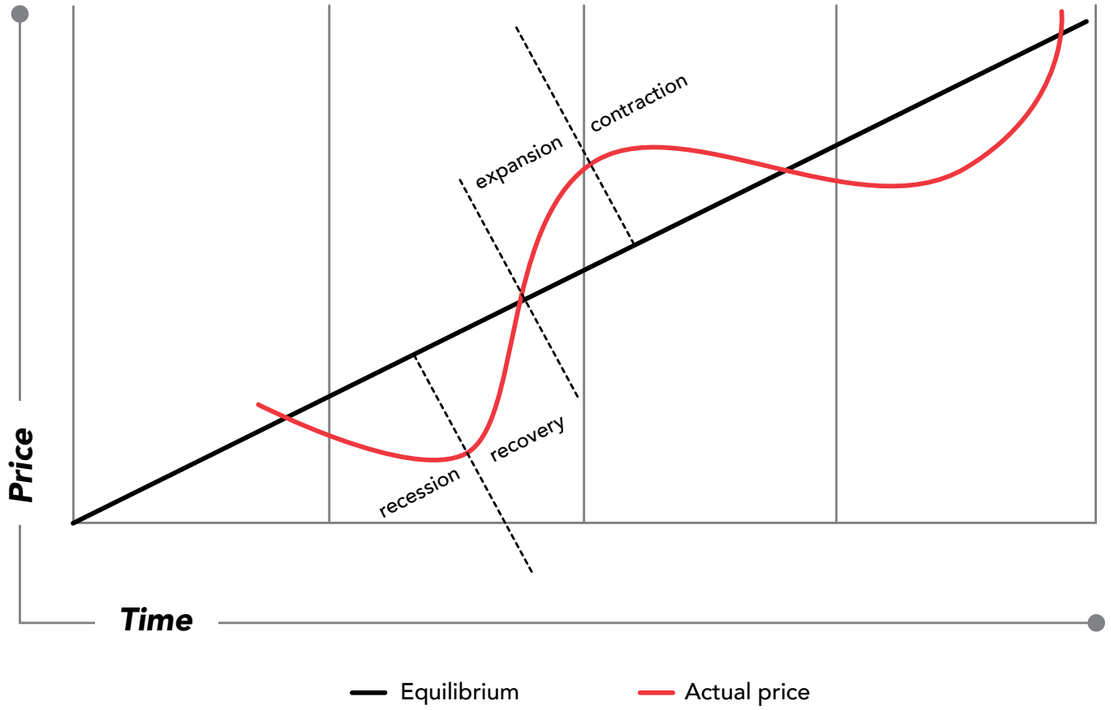


Figure 28: Stages of the Property Cycle (adapted from Pyhrr et. al, 1999 and real estate View, 2011).

8. Implementation Strategy

8.1. TOD Toolkit

This section identifies the mechanisms necessary to implement the strategies discussed above. It introduces a TOD 'toolkit' of parts as mechanisms categorised in terms of the TOD 'scales of intervention' i.e. metropolitan level, corridor level, nodal and precinct level. This is important to institute TOD at a high level, highlight the significance of implementation and expedite the selection of appropriate tools to implement TOD at the different scales of planning.

The toolkit as depicted in Table 5 to Table 7 below contains a multitude of mechanisms, interventions and tools within and outside the City's control, which can be applied at a corridor, node and precinct level to facilitate the outcome of TODC. This ensures the ideal selection of implementation tools to suit the context and appropriate scale of planning (refer to section 4) in an effective and efficient way.

8.1.1. Hierarchy: Interventions Categorised in Terms of their Scale and TOD Programme

Metropolitan Scale

Tools at this scale are intended to regularise the mechanisms necessary to implement TOD at a corridor, nodal and precinct scale; ideally through a process of policy/legislation amendment and consolidation.

Furthermore it is necessary to consolidate all public investment at this scale toward a common action plan for implementation to ensure alignment between land use and transport planning.

Category	Mechanism/Tool	Purpose		Example	Regularisation of Tool	TOD Programme
Institutional and Policy Alignment: Align existing land use regulations and City-policy directives with TOD principles and objectives.	Amendment of existing high level strategic policy and development frameworks (IDP, SDF, Densification Policy, IHSF etc.).	To institutionalise TOD within all directorates of the City and ensure that TOD principles are applied to all private sector development approvals and public sector led development across Cape Town. These may require amendments to specific: Policy directives Spatial designations Catalytic projects Closer alignment with TOD principles		Integrated Public Transport Network (IPTN)	IPTN	Institutional Alignment
				Incorporate TOD principles and objectives into the IDP	IDP	
				Cape Town Spatial Development Framework	CTSDF	
				Align grant condition through the BEPP	BEPP	
				Integrated Human Settlement Framework	IHSF	
				Determine the impact of TOD Comprehensive on the Densification Policy	Densification Policy	
	Amend housing policies, including IHSF.	Enhance the current delivery of public sector housing. In particular quantify the impact of current human settlement projects on the operational cost of providing public transport cost comparison		Considering alternative typologies and locations conducive to higher densities and integrated land uses. Placing greater emphasis on spend and resources around brownfield development.	IHSF	Institutional Alignment
	Amend road classification standards/requirements which impede incremental densification and undermine the use of public transport services.	Enable greater densification and prioritisation of public transport.		Amend road classification standards/requirements which impede incremental densification and undermine the use of public transport services.	Western Cape Road Classification Guidelines (2002)	Institutional Alignment
	Streamline land use application process for development proposals in line with TOD.	Fast track development in desirable locations		DAMS	SPLUMA, LUPA, CTZS	Private Sector Buy-in
	Western Cape Government and City of Cape Town Game Changer Model	Model to identify a possible pipeline of public sector properties offering key development opportunities to realise spatial transformation – inclusive, transit oriented development and aims to facilitate reflection on what it will take to actually realise these opportunities within acceptable timelines		I.e. NUNU, Philippi Node	City of Cape Town TOD Strategic Framework	Institutional Alignment
Public incentives to improve behaviour change	Sustainable Public Rewards Programme with monetary incentives.	To influence choices aligned to TAPs.		• Government housing subsidies aligned to TAPs • Property rates discounts in TAPs • Lower Development Contributions in TAPs	• City of Cape Town Policy • Development Contribution Policy • Rates Policy	Civil Society Buy-in
Change Management	TOD Manual	Integrate sound TOD design principles (currently embedded within City policy) and engineering standards to inform an appropriate application of policy guidelines to the assessment of private and public development by giving consideration to TOD outcomes at the nodal and precinct scale		• Access requirements • Road layouts • Parking (trip generation rates) etc.	City of Cape Town Policy	Institutional Alignment
	TDM Strategy	To identify and implement the necessary measures and mechanisms to encourage efficient and sustainable transport, with an emphasis on the efficient movement of people and goods, rather than vehicles (Draft TDM Strategy, 2015). A key priority of this strategy is to induce a modal (and user behavioural) shift from private to public transport		• Public transport subsidies for companies or developments which actively support public transport usage; • Network TDM capacity improvements by increasing or decreasing in network capacity to the advantage of public transport specifically; • Private vehicle restriction zones; taxation policies to discourage private vehicle subsidies and tax rebates where public transport is actively promoted; • Congestion pricing and travel pricing (e.g. fuel levies)	City of Cape Town Policy	Civil Society Buy-in

Table 5: TOD Toolkit – Metropolitan Scale

Corridor, Nodal and Precinct Scale

Category	Mechanism/Tool		Purpose	Example	Regularisation of Tool	TOD Programme
Strategic Planning Frameworks New (and changes to existing) development frameworks aligned to TOD principles and objectives to the extent that they are not already embedded in said policies/ frameworks.	New development and/or urban design frameworks at applicable scales and changes to existing frameworks (DSPs, LASDFs, Local Plans etc.). All planning frameworks must identify mechanisms to mitigate the impacts of gentrification in TOD precincts and nodes.		To establish specific land use and design guidelines to manage and guide the growth and form of corridor, nodal and precinct development in line with TOD principles and strategies (including NMT Strategy).	• Corridor plans • District Spatial Plans • Local Area Development Frameworks • Urban design frameworks	SPLUMA/LUPA	Institutional Alignment
Appropriate Infrastructure Design	Flexible transit infrastructure		To ensure that the design and construction of infrastructure allows for operations to respond to appropriate passenger demand volumes and the external contextual environment as they materialise over time, to ensure (to the extent reasonably possible) that such operations are affordable to the City from available resources in every financial year.	• Ramping up for demand. • Adaptability for different operations.	Relevant business plans and business parameters	Integrated Business Model
	Integrate social amenities with Public Transport infrastructure at appropriate transit locations or where opportunities exist based on the context of the node of precinct. i.e. stations and public transport facilities		To promote better utilisation of resources, improve ridership, passenger convenience and improve the overall quality of life of residents at a nodal and precinct scale.	• Libraries, clinics, post offices located on top of IRT station or at PTIs.	Concept plans for IPTN implementation	Institutional Alignment
Development Incentives: Mechanisms to stimulate private sector development and leverage public investment.	Tax incentives/discounts to property developers		Incentivise development in TOD precincts.	Urban Development Zones	UDZ Income Tax Act 58 of 1962	Private Sector Buy-In
	Government funding		Subsidise catalytic private sector development. No developer or investor will elect to build in an undesirable location unless it yields a profitable return on investment or in this case receives a subsidy to compensate for its underperformance. Engagement with the private sector is required to determine the appropriate returns warranted and if certain return thresholds can be met.	Private sector subsidies and loans	• MFMA(Municipal Asset Transfer Regulations) • DORA	Private Sector Buy-In
Public land development programmes: To leverage and expropriate land in support of transit investment.	TOD land disposal/release programme		To identify, package, aggregate and condition strategically located City-owned land in support of TOD and release to the market for development.	Targeted land disposal programme including, inter alia, de-proclaimed road widening scheme (Canterbury/Maynard) in key locations	• City of Cape Town Policy on the Management of certain of the City of Cape Town's Immovable Property • MFMA	Private Sector Buy-In
	Land banking and assembly		Acquire aggregate parcels of land near or within TOD precincts where local development is expected to dramatically increase the plot's value, package the land for appropriate development and sell leasehold rights to private sector to develop.	Property Acquisition Policy	• City of Cape Town Policy on the Management of certain of the City of Cape Town's Immovable Property • MFMA	Private Sector Buy-In
	Lease and disposal of air rights		Leverage development above public infrastructure and facilities such as mass transit stations and other public facilities to achieve a greater density and intensification of appropriate land uses. The clustering of public facilities and convenience facilities in close proximity to transit will allow trip chaining which is key to effective TOD.	TOD land disposal programme	• City of Cape Town Policy on the Management of certain of the City of Cape Town's Immovable Property • Municipal Asset Transfer Regulations	Private Sector Buy-In
Proactive planning: Anticipatory planning mechanisms to fast track development in TOD precincts.	Pre-packaging land		Predetermine the form, type and mix of development in support of TOD linked to the TAPs. Change the applicable development rules of erven to ensure appropriate development-intensification of TOD precincts.	Proactive/Blanket rezoning (Langa) Overlay zones Amending height restrictions, etc.	Cape Town Zoning Scheme Regulations	Private Sector Buy-In
Public Private Partnerships	Establish better forums for engagement		To ensure alignment of proposed development with phasing of transit infrastructure. Open lines of communication. Actively pursue development.	Private Sector engagement forums	• MOU • IDP	Private Sector Buy-In

Corridor, Nodal and Precinct Scale

Category	Mechanism/Tool		Purpose	Example	Regularisation of Tool	TOD Programme
Additional levies assigned to parcels of land/property which have been identified as having received a direct and unique benefit from a public project						
Value Capture: Tools to ensure the City recovers some or all of the value that public infrastructure generates for private landowners, to offset high operational costs.	Higher taxation of land (rates)		Retain greater interest in the investment of public infrastructure projects and upgrades.	• The identification of Special Assessment Districts aligned to existing and new public investment/infrastructure projects • Development contributions • Land value increment taxes	• Rates Policy • City's Development Contribution Policy	Integrated Business Model
	Parking levies, congestion tax		To disincentivise private vehicle use, whilst generating additional income to offset operational costs associated with the provision of high quality public transport.	• Parking levies • Congestion tax	• Rates Policy • City's Development Contribution Policy • TDM Strategy	Integrated Business Model
	Improved management of parking and setting of parking tariffs		To capture the best value of City-owned parking (managed, park and rides, and off-street).	• Revised Parking Tariff	• Parking Management Tender • City of Cape Town Parking Policy	Integrated Business Model
	Improve commercialisation (formal and informal) in and around public transport stations, precincts, nodes and PTIs in the design of IRT Infrastructure and pre-packaging of land		Commercialisation of stations improves ridership, passenger convenience and generates a greater level of seat renewal. Furthermore it provides additional revenue generating opportunities for the City, through leasing or disposal (during the boom phase of the property cycle).		Future City of Cape Town Commercialisation Strategy	Integrated Business Model
Development Controls: Regulatory tools to manage urban development processes in support of transit investment.	Maximum parking requirements in areas where there is an imbalance between development and parking		To prevent an additional supply of parking and discourage the use of private vehicles.		• CTZS	Integrated Business Model
	Monthly Operational Levy incorporated into the City's Development Contribution calculation		To offset the costs of operating public transport infrastructure in unsustainable locations.		• City's Development Contribution Policy	integrated Business Model
Marketing Tools: Improve political and public palatability of TOD	Media Campaigns		To effectively depict what TOD could potentially look like (high density and mixed use development) and communicate the benefits associated with TOD.	• 3D visual aids across scales of TOD	• CITP	Civil Society Buy-in

Table 6: TOD Toolkit Corridor, Nodal and Precinct Level

Project and Programme Scale

Category	Mechanism/Tool	Purpose	Example	Regularisation of Tool	TOD Programme
Projects and Programmes	BEPP Catalytic Projects	Champion projects to: • Kick-start development interest from private sector in key locations along higher order public transport infrastructure • Facilitate local (formal and informal) economic development • Improve access to public facilities and social amenities	Refer to list of projects in the BEPP and the TOD Game Changer Model	• BEPP • Western Cape Government and City of Cape Town Game Changer Model to promote Urban Integration	All
	NMT Improvement (walkability and cycling)	Improve walkability, to and around IRT stations and PTIs. To improve the assessment private and public sector development applications	Provide direct pathways	Non-motorised Transport Strategy and design toolkit	All
	Urban Regeneration aligned to the appropriate stage of the property cycle	To improve the quality of the urban environment – improve market responsiveness	• Public space upgrades • Safety and security initiatives (i.e., VPUU) • Involving supporting/ streamlining establishment of CIDs, and giving these greater scope for intervention (e.g. physical security improvements, CCTV, etc.)		All

Table 7: TOD Toolkit Project and Programme Scale

9. Application of TOD Toolkit

9.1. Public Sector

9.1.1. Selection of Development Projects Publicly Funded by Government

The mandate for the TOD Game Changer Working Group is to develop specifications for a multi-year pipeline of urban development projects on state land and an action plan associated with this pipeline to ensure that:

- resources are being efficiently allocated between the two spheres of government in particular, so that
- projects are being appropriately and adequately prepared and packaged to be made available to the market at the right time.

The Working Group will identify a possible pipeline of public sector properties offering key development opportunities to realise spatial transformation associated with Transit Oriented Development objectives within acceptable timelines.

9.2. Private Sector

9.2.1. Selection of Tools to Effectively Manage Private Sector Led Development

The TOD comprehensive process identified a set of Transport Accessible Precincts (TAPs), which should become the primary anchor for strategic intervention to ensure sustainable forms of development in close proximity to transit. Figure 29 below, spatially assigns the type of tools to strategic areas in Cape Town according to their perceived level of market demand, once determined in the next scale of planning. However the needs of businesses (as discussed in section 4.3.1) in relation to their sector of the property market should also be taken into consideration when applying the tools, to effectively influence their choice of location.

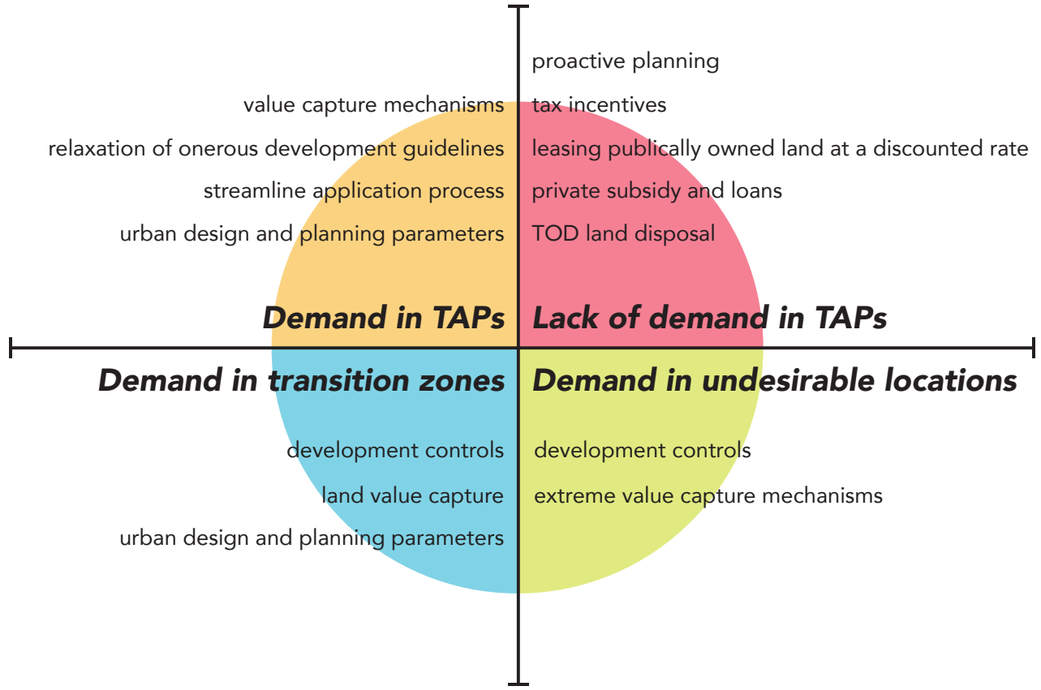


Figure 29: Spatial Targeting of Implementation Tools

9.2.2. Demand in TAPs:

These are classified as areas that are both strategic (in terms of their proximity to public transit) to the City and desirable from a market perspective. Ideally the City should take full advantage of value capture tools in these areas but also ensure that onerous restrictions which contribute to the use of private motor vehicles are curbed and encourage appropriate forms or types of development necessary to support transit. The example below illustrates how tools can be applied in this instance.

Example: Blaauwberg Road (Corridor Scale)

Land use along Blaauwberg Road is primarily characterised by single residential dwellings with spurts of commercial activity clustered around Marine Circle, Table View, Wood and Boy de Goede MyCiTi stations (refer to figure 30 below). In recent years there has been a growing trend to convert existing residential properties to commercial uses. This is apparent in the high number of illegal businesses along its length and influx of rezoning, temporary departure and consent use applications made to the local district office for commercial/ business uses (refer to Figure 31 on page 57 which depicts some of the current illegal uses and land use applications). The appetite for mixed use development presents a rare opportunity where both the private and public sectors have similar development interests therefore simplifying the nature of intervention required to implement an appropriate form of TOD in this location. This is particularly important to improve the operational viability of the City's transport investment along the Table View Corridor, which requires a greater intensity of business, commercial and mixed use development to substantially improve bi-directional flows, seat renewal and off-peak ridership.

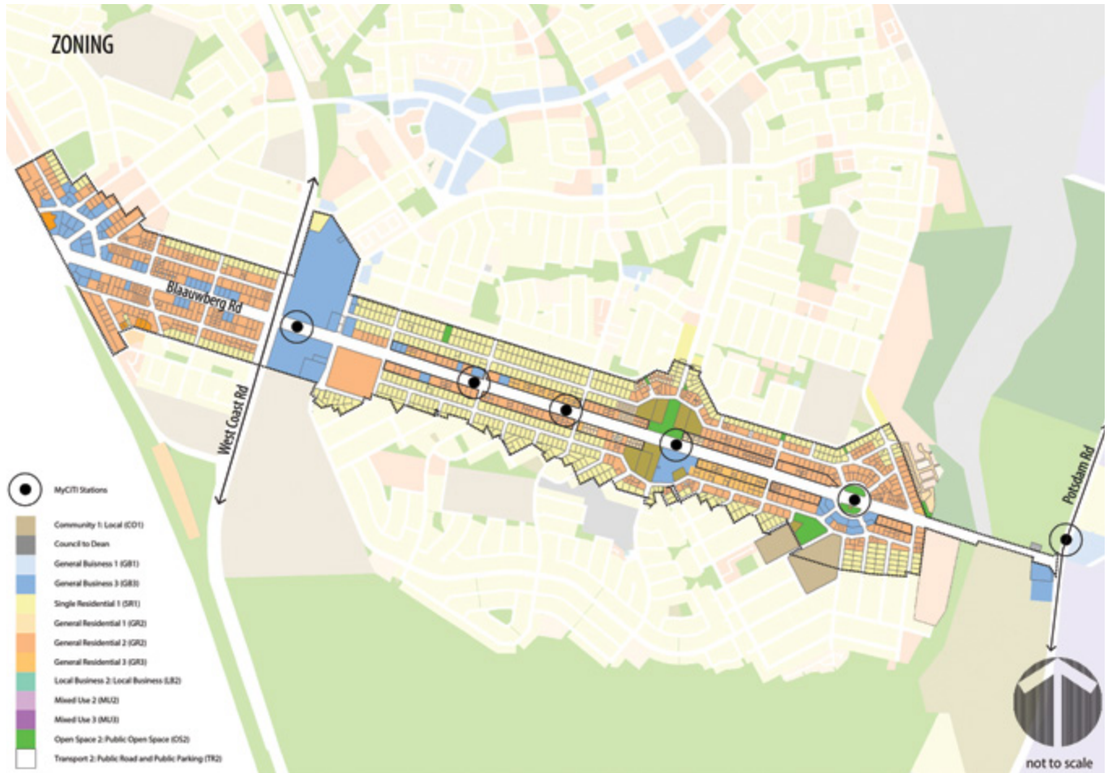


Figure 30: Zoning

Demand For Commercial Development

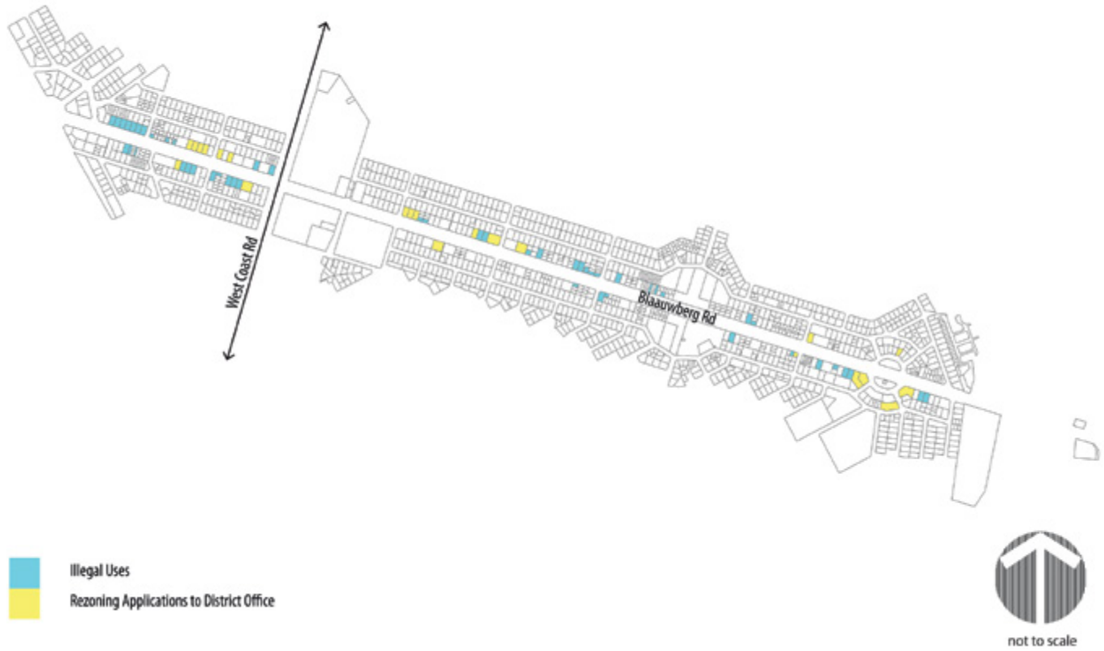


Figure 31: Illegal Uses and Rezoning Applications

Blockages to Mixed Use Development:

There are two key regulatory barriers impeding the desired form of sustainable urban development: restrictive title deed conditions attached to residential properties along the full length of Blaauwberg Road and onerous Access Spacing requirements imposed by the Western Cape Road Access Guidelines (2002). Blaauwberg Road is currently classified as a Class II Primary Arterial. As such, the approval of applications to rezone to business uses is limited to properties located every 90m from an intersection along its length (see conceptual depiction on page 60).

Access Spacing

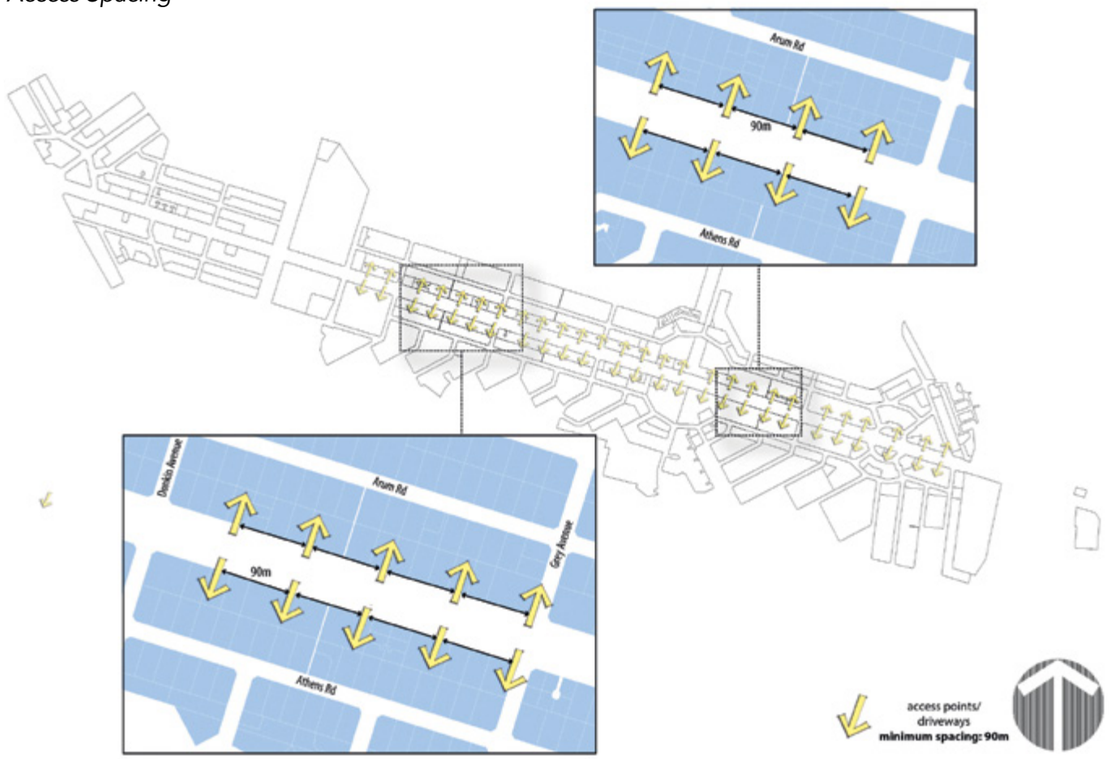


Figure 32: Access Spacing

Solution using TOD Toolkit:

This is considered to be a corridor level planning issue and the most appropriate way forward is to relax access requirements through a deviation from policy or downgrade of the class of road. Reduced access requirements from every 90m to every 45m (allowing every second erf along Blaauwberg Rd to convert to business) is more desirable from a land use perspective to achieve the optimum intensity of mixed use development. Whilst there is a concern that more businesses will raise existing congestion levels and impact negatively on vehicular/pedestrian safety, it has been suggested that the level of impact would be marginal due to the scale of commercial development in demand. Furthermore the City should embark on a blanket removal of title deed restrictions (proactive planning) to regularise the change of land use from a land use planning perspective.

9.2.3. Lack of Demand in TAPs:

These are defined as areas which are strategic but undesirable to the market. The lack of demand must be further understood/investigated and mitigated to determine its potential. Only potential sites should be considered for intervention. To this end a greater degree of incentives should be applied to attract development. These range from catalytic projects such as urban regeneration programmes which improve the marketability of the area to more radical incentives (i.e. public subsidies, proactive rezoning, density bonuses, land subsidies, etc.) to reduce the cost of development to developers. These are only viable if the lack of a demand can be remediated by resolution of issues that are precluding development; however, if the area is poorly located, the use of incentives will result in development that distorts the market and will require long term support in order to remain viable. The example below illustrates how tools can applied in this instance.

9.2.4. Example: Strandfontein Road (Nodal Scale)

TDA has prepared a Land Use Strategy for the Lansdowne Wetton Corridor (LWC). This serves as the land use component and next scale in planning and implementation for this phase of the IPTN. The Strategy is intended to "convey the corridor vision and objectives based on the need to densify and intensify within the LWC to support public transport. While the Strategy covers the LWC in its entirety, it focusses on the nodal concept of Transport Oriented Development (TOD) and identifies major urban nodes of priority for investment".

Targeted location	Long term land use and built form	Actions and Key Considerations
9. Strandfontein (M17): Japhta K Masemola Rd (M9) to New Ottery Rd – refer to Figure 33 on page 64	**West:** residential intensification **East:** mixed use intensification: residential, commercial and industrial **West of Strandfontein:** • Second dwellings • 5 -12 storey residential **East of Strandfontein:** • 4-10 storey mixed use developments – commercial developments with small scale/ light industrial development on ground floor with offices above	• Nature of route will prevent the making of an interactive interface • Redevelopment of existing single residential requires consolidation and coordinated development by the private sector

Table 8: Lansdowne Wetton Corridor Land Use Strategy Nodal Identification

A number of the proposals made above assume a positive response from the private sector to transit investment. There is no guarantee that this will materialise or if there is in fact appetite from the private sector to take up some of the development proposals such as 15-storey residential units or 10-storey mixed units. Furthermore it is extensively out of character with the surrounding area. This can be seen in Figure 33: Strandfontein Road Current Built Form, which depicts existing development along the suggested portion of Strandfontein Road. Toward the west development is primarily single dwelling residential in character whereas parcels of land toward the east are agricultural and used for industrial activity.

Most of the land parcels are privately owned, which leaves the City with limited leveraging opportunities. One of the most significant factors for developers is their ability to recover costs. The further west one goes, property prices generally tend to increase and the feasibility of investing in this area becomes constrained. Without leveraging a significant incentive such as land, particularly for affordable housing, the prospect of attracting private sector development interest is marginal.

Solution using TOD Toolkit:

In the type of market environment suggested above, the City will have to employ radical implementation tools to attract private sector investment. In addition to proactive planning measures, it may have to consider interest free loans, property acquisition (land banking) etc.

Figure 33: Strandfontein Road Current Built Form

9.2.5. Demand in Transition Zones:

These are classified as areas between the TAPs and the City's urban edge. Ideally one would determine the appropriate form of intervention or tools through a local planning analysis.

9.2.6. Demand in Undesirable Locations:

These are essentially areas outside Cape Town's urban edge and are in direct conflict with the principles and objectives of TOD. It is proposed that City apply extreme value capture and development control to disincentivise private sector led development interests in these locations.

9.2.7. Identification of Champion Projects

The criteria for identification and prioritisation of TOD champion projects will be established by the City of Cape Town TOD Technical Working Group.

10. Implementation Plan for TOD programmes

TOD Programme	Levers		Actions	Level of engagement required	Research to be undertaken	Timeframe
Institutional Alignment 	Institutional and Policy Alignment: Align existing land use regulations and City-policy directives with TOD principles and objectives		Incorporate TOD principles and objectives into the IDP			B
			Align Cape Town Spatial Development Framework to TOD principles, objectives and vision			B
			Align grant contributions in BEPP with TOD Comprehensive indicators			B
			Investigate and include alternate housing typologies and locations conducive to higher densities and integrated land uses in the IHSF (Integrated Human Settlement Framework)			B
			Determine the impact of TOD Comprehensive on the Densification Policy			B
			Incorporate TOD principle, objectives and vision into corporate strategies			B
			Amend road classification standards/requirements which impede incremental densification and undermine the use of the public transport services.			B
						B
	Change Management		Finalise the Western Cape Government and City of Cape Town Game Changer Model			B
			Develop a TOD manual			B
	Strategic Planning Frameworks. New (and changes to existing) development frameworks aligned to TOD principles and Objectives		Corridor plans			B
			District Spatial Plans			B
			Local Area Development Framework			B
			Urban design frameworks			B
	Catalytics Projects and Programmes		Identify and implement key catalytic projects and progammes			C
Integrated Business Model 	Value Capture: Tools to ensure the City recovers some or all of the value that public infrastructure generates for private landowners, to offset high operational costs		Establish Special Assessment Districts align to existing and new public investments/infrastructure projects			B
			Amend the Development Contributions Policy in line withs TAPs			B
			Investigate and implement land value increment taxes			B
			Establish congestion tax			B
			Establish appropriate parking levies			B
			Develop a Commercialisation Strategy			B
			Investigate and consider the implementation of maximum parking requirements in areas where there is an imbalance between development and parking.			B
	Development Controls: regulatory tools to manage urban development processes in support of transit investment		Investigate the possibility of incorporating a monthly operational levy into the City's Development Contributions Policy			B
			Streamline land use application process for development proposals in line with TOD and located in TAPs			B
Private Sector Collaboration 	Development incentives: mechanisms to stimulate private sector development and leverage public investment		Extend Urban Development Zones			B
			Investigate and consider the implementation of Private Sector Subsidies and Loans			C
	Public land development programmes to leverage and expropriate land in support of transit investment		Establish an appropriate Property Acquisition and Disposal Policy aligned to TOD (including the acquisition, lease and disposal of air rights)			B
			Streamline lease and disposal of land for TOD type development			B
	Proactive planning: anticipatory planning mechanisms to fast track development in TOD precincts		Convert TAPs into an incentive Overlay zone using Section 19 of the City of Cape Town Municipal Planning By-Law. 2015			B
Civil Society Participation 	Public incentives		Investigate and consider the implementation of Government Housing Subsidies aligned to TAPs			B
			Investigate and consider the implementation of Lower Development Contributions in TAPs			B
			Investigate and consider the implementation of potential rates discounts in TAPs			B
	Marketing Tools: Improve political and public palatability of TOD		Establish a Marketing Campaign for TOD management			B
	Travel Demand Management		Develop a Travel Demand Strategy			A
	Non-Motorised Transport		Develop (update) Non-motorised Transport Strategy and design toolkit			A

Key			
Level of engagement required to regularise implementation tool (assumed that public participation is a fix)	Municipal (within the City's control)	Provincial	National (and Provincial)
Level of research to be undertaken	Research Complete	Research Underway	Further research required
Timeframe to research and regularise tool	A: 1 – 2 years	B: 2 – 5 years	C: 5 – 15 years

Table 9: TOD Implementation Programme

11. Monitoring, Evaluation and Review

The TOD Technical Working Group, established as part of the City of Cape Town Transversal Management System, is responsible for the development and review of the TOD Strategy as well as the facilitation, coordination, and monitoring of the implementation of TOD projects as defined in Chapter 3 of the approved TOD Technical Working Group Terms of Reference.

The City's Transport Development Index (TDI) has been identified as an effective monitoring tool to assist the TOD Technical Working Group to track the progress of implementation of TOD Programmes as the City strives to progressively move toward its desired end state and vision for TOD. The first generation of the TDI was designed and developed (between 2014 and 2015) by TDA to enable the effective monitoring (progress-tracking) of its service delivery interventions over time by establishing a data driven, factual baseline for access priority costs of the various user groups. This is invaluable as this data can be analysed per Transport Analysis Zone, per income group, per corridor or across the city as a whole.

The second generation of the TDI is currently under development which will incorporate refinements and improvements on the first generation in addition to providing the design for a data warehouse as a central repository and control for all transport data. It is proposed that the development of the second generation of the TDI includes the measurement of the TOD Comprehensive Land Use Scenario indicators as defined in section 5 of Annexure A (TOD Comprehensive Technical Report) and as per Table 10 below.

Key Transport Objectives	Modelling Objectives	Indicator	Unit of Measure
Reduce travel distances	1. Maximise trips (productions and attractions) in TAPs[2] (Transit Accessible Precincts)	Increase number of trips that originate or are destined for a TAP	TAP-weighted trips
	2. Minimise trip lengths	Fewer passenger kilometres	Passenger km
	3. Maximise the number of people using public transport	Increased number of trips aligned to public transit lines (i.e. where both Origin and Destination for trip occurs in a zone that is traversed by a trunk line)	Trips
Generate a greater level of seat renewal	4. Minimise the difference between productions and attractions in TAZ	Greater balance in productions and attractions in TAZs	Productions and Attractions
	5. Minimise the difference between productions and attractions in macro TAZ	Greater balance in productions and attraction in Macro TAZs	Productions and Attractions
Balance bi-directional flows	6. Minimise the difference between people travelling in the opposite directions	Greater balance of trips	Trips

Table 10: Transport Modelling Objectives and Indicators

This will enable the City to effectively track progress of TOD objectives and improvements annually. Consideration needs to be given to alignment with existing or future BEPP indicators and the rationalisation of indicators by National Treasury which is currently underway.

[2]Transit Accessible Precincts (TAPs) are spatially defined zones used to measure the performance of the model outputs (or in this context the 'individual'). Precincts are confined to a 500m radius from a higher order public transport station and filtered through DIMs (Development Intensity Modifiers). They were identified based on their level of access to the transit network.

12. Strategy Review

This document is intended to form a Strategic Framework for the implementation of TOD. However it is acknowledged that further work and refinement is required in order for it to evolve into a complete strategy. For this purpose the TOD Strategic Framework should be updated annually for the first three years (until 2017) and thereafter every five years as a strategy aligned to the term of the IDP.

SECTION 3:

Annexure A

13. Annexure A: TOD Comprehensive Land Use Scenario Technical Report

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1. Introduction

This document provides a brief account of the process adopted by the City's Transit Oriented Development (TOD) Working Group to produce a land use scenario entitled "TOD Comprehensive".

2. Problem Statement

Cape Town's urban form and structure is characterised by dispersed development patterns and inequitable access for many of its citizens. In part, this can be attributed to segregated apartheid planning, but more recently has become a trend exacerbated by socio-economic reality (inequality). Population and residential densities in many of the formally developed areas of the city remain extremely low by international standards and access is further constrained by mountain and sea. This has led to the development of poorer residential communities in locations far away from employment and opportunities (i.e. jobs, education and public amenities), making the cost of providing and using high quality public transport unsustainable (for the City and households).

The Integrated Public Transport Network (IPTN) planning exercise emphasised the need for a more comprehensive approach to TOD and to develop a land use scenario that incorporated sustainable transport planning principles into assumptions for future urban growth. Practically, the transport network must respond to the demand for travel and is informed by the spatial patterns of the city that will, in turn, determine the cost efficiencies of the network. It was therefore important to generate a land use scenario that supported sustainable patterns for travel. The cost efficiencies of the proposed network are vulnerable to the following key themes:

a) An extensive feeder network: The City's public transport network is being planned to meet internationally-accepted standards, which applied to Cape Town's current spatial patterns would make them costly and financially unstainable to operate. For example, one requirement is that 80% of the population are located within 500m walking distance of a station or stop. As a result, an extensive feeder network is required to serve communities in sprawling low-density areas, reducing the financial sustainability of the network.

b) Prevalence of tidal flows: The spatial fragmentation of residential areas from places of work results in single direction commuter demand from point to point. Consequently, the majority of public transport vehicles are required to service this demand pattern during peak. This represents an inefficient and costly travel pattern, compounded by the need to provide fleet sizes to accommodate the dominant direction of passenger movements. An optimum mix between residential and work opportunities in centralised locations is necessary to effectively improve tidal flows by providing bi-directional demand for movement and therefore more efficient utilisation of vehicles.

c) Limited seat renewal: The travel behaviour along corridors in Cape Town is primarily line haul where a full bus leaves its origin and reaches its destination with marginal boarding and alighting along that corridor. This pattern is less efficient when compared to a system servicing shorter trips where there is significant boarding and alighting evenly spread along a route. Corridors that have a number of active and well-intensified nodes and precincts along its length, generate a greater level of seat renewal (i.e. the number of times a seat is used by a different passenger along a single vehicle trip).

d) Longer travel distances: South Africa has high levels of income inequality, with a significant proportion of low income households using public transport and located in distant locations from opportunities. This combined with other factors increasing costs, places large financial burdens on Cape Town's vulnerable but also leads to a higher subsidy requirement for fares.

e) High peak-to-base ratios: The city has high peak demand requirements and low off-peak demand, which makes public transport expensive to operate, since much of the investment (capital and operational) is significantly underutilised outside of the peak periods. Uniform work and school times, and the location of homes away from economic and social activity are the main contributors to this inefficiency.

To address the integrated urban development and transport challenges in the city, TDA and the former EESP directorate identified TOD as a practical solution.

3. Transit Oriented Development – Definitions, Principles and Objectives

In line with the 2032 approved IPTN plan TOD as it applies to the City of Cape Town is defined as a long term development strategy to address spatial inequality, improve public transport affordability, and arrest sprawl, which is driven by the integration of sustainable public transport and strategic land use intervention and built on the principles of affordability, accessibility, efficiency, intensification and densification. The core TOD principles are defined on your right:

1. Affordability – reduce the cost of public transport to commuters and the cost of providing public transport to the City.
2. Accessibility – facilitate equal access to social and economic activity through strategic urban development and the provision of safe public transport.
3. Efficiency – provide an environment and level of service that reduces trip lengths and dependence on private vehicles.
4. Intensification and Densification – manage the desired form, composition and location of urban development conducive to affordable, accessible and efficient public transport.

The principles set out above represent ideal characteristics of a sustainable public transportation network and urban development context, thus give effect to the following key transport objectives and associated higher level land use interventions:

Transport	Land Use
1. Reduce travel distances: to reduce the cost of commuter travel and improve operational viability of public transport.	Intensify and diversify urban development in close proximity to public transport stations.
2. Optimise bi-directional flows.	Promote an appropriate mix and form of residential, social and economic activity between urban nodes along higher-order public transport corridors.
3. Generate a greater level of seat renewal (balancing trip attractions and productions).	Promote an appropriate mix and form of residential, social and economic activity between district and local nodes along higher-order public transport corridors.

Table 1: Transport Objectives and Associated Land Use Interventions

4. Background and Purpose of TOD Comprehensive:

On 25 June 2014, Council approved the City of Cape Town's Integrated Public Transport Network (IPTN), a network plan intended to guide the development of rail and road-based transport infrastructure to accommodate existing and future travel demand within the city. The year 2032 was chosen as a possible future state for the IPTN in Cape Town.

The approved IPTN was primarily informed by a Pragmatic Transit Oriented Development (PTOD) urban growth land use scenario. This scenario did not explore the holistic benefits of embracing TOD as a long term development strategy to its fullest extent or adequately consider the potential of brownfield development. To effectively address these limitations, the IPTN Plan recommended the formation of TOD Comprehensive, a fourth land use scenario which best encompasses the core principles of sustainable development with the potential to influence optimum public transport movement in Cape Town more affordably, accessibly and efficiently. The purpose for developing TODC is to assess its impact on the preferred IPTN and to quantify the benefits of TOD (i.e. lower operational costs) using a performance based model linked to the TOD principles approved as part of the 2032 IPTN (referred to page 74). Furthermore a list of land use assumptions was developed in the IPTN to guide the direction of TODC (refer to Annexure A).

It is important to note that the product of this process is not meant to be a policy, strategic framework or development plan; it is an analytical exercise to determine the extent to which TOD benefits might be realised. Whilst the focus for this model has been, to a large degree, based on theoretical possibilities, there are many policy implications which stem from this process, especially if the latter is proven. Therefore new principles, ideas, implementation tools and land use interventions, which flow from this study, should become the precursor for the TOD Strategy to manage the urban development process in support of transit.

5. Methodology

Taking the previous principles into account the TOD Working Group conceived the following methodology to develop TODC:

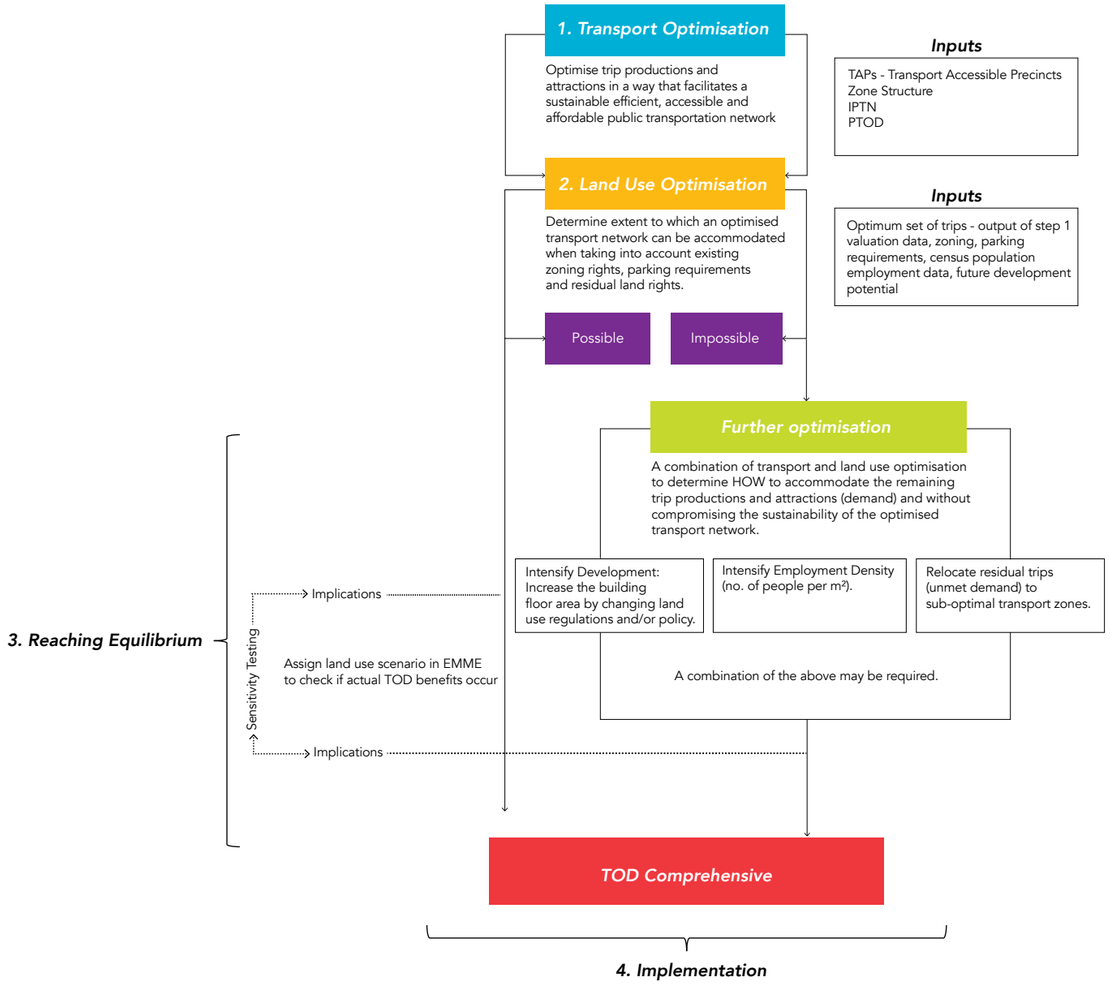
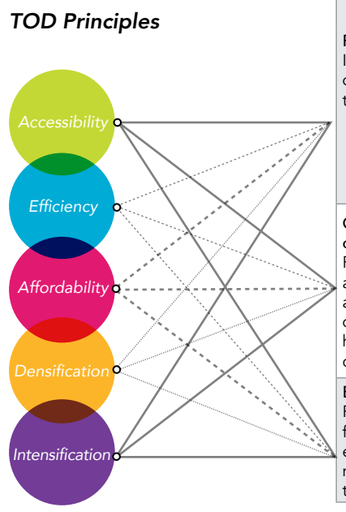


Figure 1: Schematic Depiction of the TODC Methodology

A description of the key process followed is described below:

1. Transport Optimisation

Transport optimisation employs a heuristic model to spatially assign the future travel demand patterns, namely trip productions[1] and attractions[2] across the city, using indicators aligned to the core principles and objectives of TOD (i.e. improving public transport affordability, efficiency and accessibility, and encouraging greater levels land use intensification and densification – see Table 2 on below). The optimised trip distribution pattern generated using this approach is an improvement over the previously assumed land use pattern generated by the PTOD scenario. The indicators used to optimise the 2032 land use distribution are listed in Table 2:



Integrated Transport and Land Use Objectives	Modelling Objectives	Indicator	Unit of Measure
Reduce travel distances: Intensify and diversify urban development in close proximity to public transport stations.	1. **Maximise trips (productions and attractions) in TAPs (Transit Accessible Precincts)**	Increase number of trips that originate or are destined for a TAP	TAP-weighted trips
	2. **Minimise trip lengths**	Fewer passenger kilometres	Passenger km
	3. **Minimise the number of people using public transport**	Increased number of trips aligned to public transit lines (i.e. where both Origin and Destination for trip occurs in a zone that is traversed by a trunk line)	Trips
Generate a greater level of seat renewal: Promote an appropriate mix and form of residential, social and economic activity between district and local nodes along higher order public transport corridors.	4. **Minimise the difference between productions and attractions in TAZ**	Greater balance in productions and attraction in TAZs	Productions and Attractions
	5. **Minimise the difference between productions and attractions in macro TAZ**	Greater balance in productions and attraction in Macro TAZs	Productions and Attractions
Balance bi-directional flows: Promote an appropriate mix and form of residential, social and economic activity between urban nodes along higher-order public transport corridors.	6. **Minimise the difference between people travelling in the opposite directions**	Greater balance of trips	Trips

Table 2: Transport Modelling Objectives and Indicators

The heuristic method uses a genetic algorithm (based on NSGA-II3) to produce a series of trip productions and attractions, referred to as a generation. The generation contains a population made up of individuals. An individual is made up of a set of trip productions and attractions (refer to Figure 2 for conceptual depiction). In this context the PTOD scenario is seen as an individual, thus the algorithm produces 'genetically enhanced' or improved variants of it.

The indicators are then used to measure each individual's performance according to their specific modelling objectives in Table 2. The score of each individual within the population is weighted and ranked. The group of individuals is then assigned into pairings using a semi-random process, and the characteristics from each individual are shared to produce a new set of individuals. The model then scores the new individuals using the same performance indicators. This is followed by a process of natural selection or until the best individual, or the most optimum transport network, has been identified.

[1] Trip producing residential locations

[2] Trip attracting activities e.g. employment, school, shopping etc.

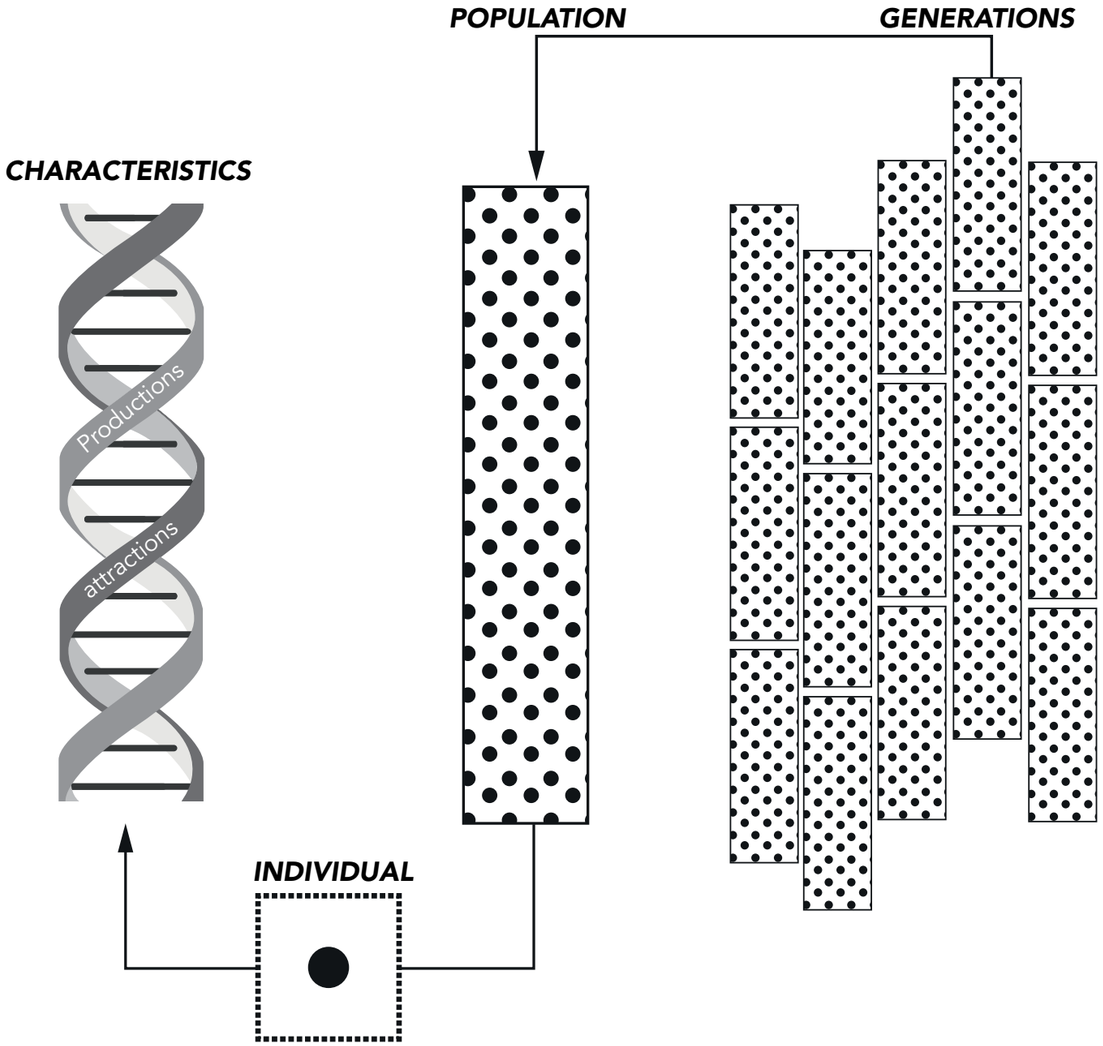


Figure 2: Genetic Analogy

2. Land Use Optimisation

The initial stage of land use optimisation determines if the product of the optimised trip productions and attractions (step two), also referred to as the demand[4], can be accommodated within the current development regulatory environment. This is achieved by calculating the supply or the total available building floor area (dwelling units and GLA) for development within each transport zone using existing land use regulations such as zoning rights for under-developed/partially developed land (greenfield sites) and residual potential of current developed sites (brownfield sites), parking requirements and forward planning policy (refer to Figure 3 on page 79). The full set of land use assumptions used to calculate the supply is listed in Annexure A.

It is important to note, whilst density does not feature as a key input into the model; it is dealt with in the spatial allocation and concentration of trip attractions and productions. In this phase of the methodology productions will be converted to dwelling units and attractions to GLA. Therefore density should be viewed as an output of the optimisation process, ideally to manage the form of optimised productions (residential growth) and attractions (commercial and public facility growth), in support of the grade/level of transport network in the IPTN.

[4] Demand: Optimised set of trip productions and attractions (product of step 2) converted into dwelling units and GLA.

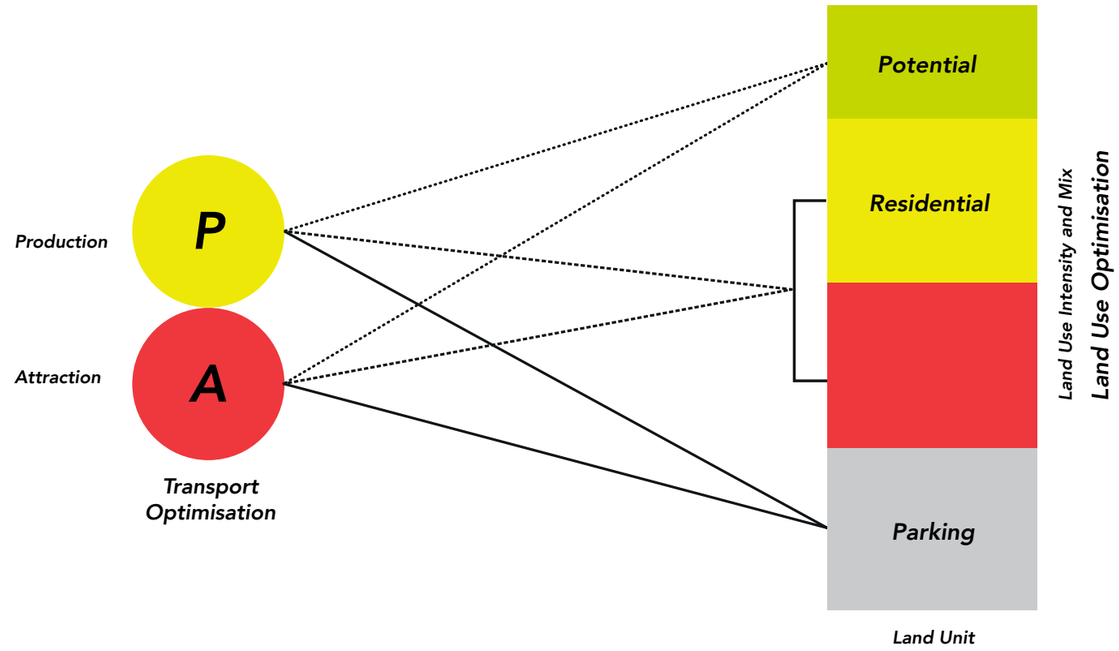


Figure 3: Land Use Optimisation Process

3. Reaching Equilibrium

If the demand (optimised set of trip productions and attractions) cannot be contained within the existing regulatory land use environment (referred to as the supply[5]) - the unmet demand[6] will require further transport and land use optimisation to determine the extent to which it can be accommodated through further intensification of building floor space (persons per m²: household size/employment density) or relocation to neighbouring TAZs, and without compromising the sustainability of the optimised transport network.

Taking the above into account, equilibrium in the context of TOD is reached when land use and public transport become mutually beneficial (or where they positively reinforce one another). This phase can therefore be seen as an iterative and dynamic continuum (see figure on page 76) where each optimisation process becomes more refined and informative to the other. It seeks to find the optimum balance between sustainable public transport and strategic long term development, and identify where future development patterns and regulatory parameters can be modified to accommodate an optimum transport network (this may require further transport and land use optimisation).

[5] Supply: The total available building floor area for development converted into dwelling units and GLA.

[6] Unmet demand: The demand which cannot be accommodated through the available supply.

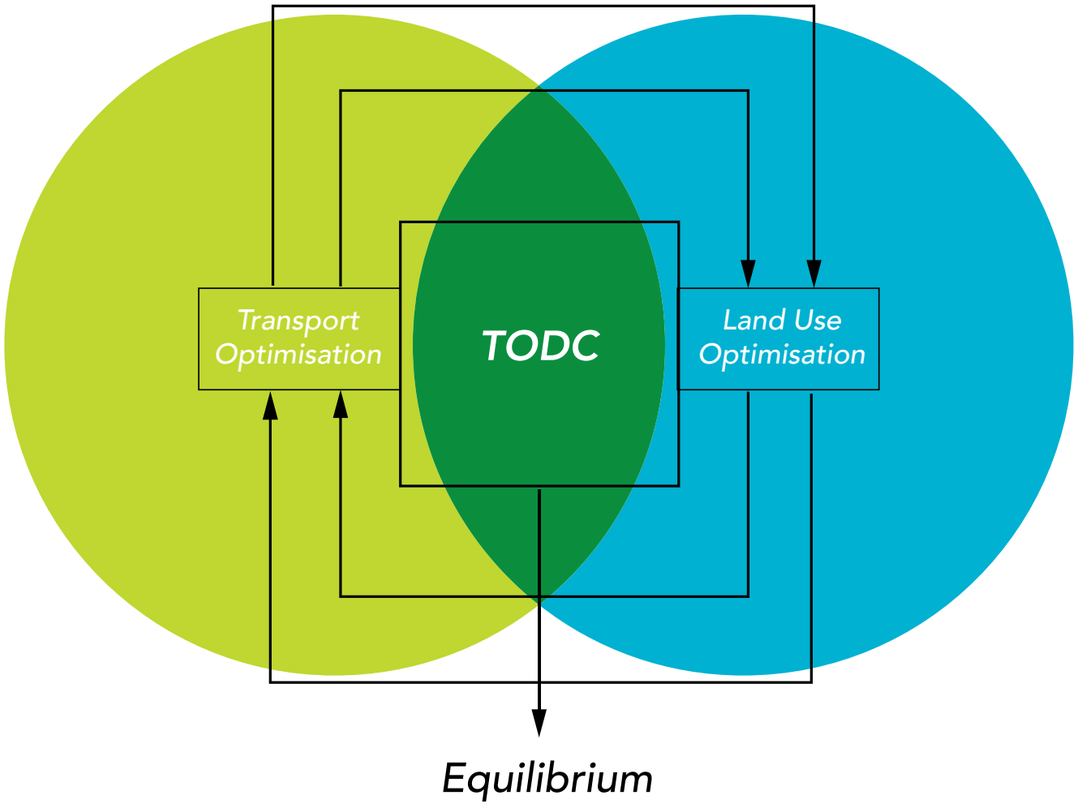


Figure 4: Reaching Equilibrium

Once equilibrium between transport and land use has been achieved, further sensitivity testing will be conducted to improve the authenticity of the model output. These, inter alia, may include:

- Assigning a different weighting to transport indicator
- Assigning a different weighting to TOD precincts
- Spatially allocating future trips along existing transport infrastructure
- Spatially allocating future trips along existing and approved transport infrastructure
- Redistributing existing development (i.e. temporary human settlements)
- Incorporation of ECAMP

After the TODC scenario has been adequately tested it will be periodically reassigned into the EMME model to quantify the exact impact of the proposed land use scenario on the 2032 IPTN (specifically to determine the operational savings that can be realised).

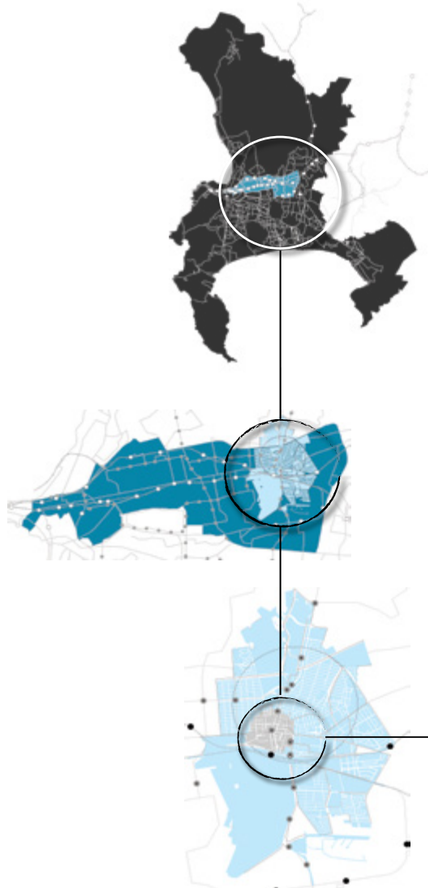
4. Implementation

Implementation is a by-product of the optimisation process. Throughout the course of developing TODC, multiple policy levers and tools were identified to explore the practical and policy implications likely to be encountered should TODC be implemented, particularly in light of current market realities. This process set out to determine the mechanics required to facilitate a radical shift from the current behaviour and practice associated with business-as-usual development to an approach aligned to the principles of TOD.

For example what changes to the existing regulatory land use environment are necessary, how does one stimulate the market's appetite to respond to TOD? The mechanisms resulting from this process will feed into the City's TOD Strategy.

4.1. The TOD Toolkit

It is proposed that the TOD strategy is amended to introduce a TOD 'toolkit' of parts as mechanisms categorised in terms of the TOD 'scales of intervention' i.e. Metropolitan level, Corridor level, Nodal and Precinct level. This is important to institute TOD at a high level, highlight the significance of implementation and expedite the selection of appropriate tools to implement TOD at the different scales of planning.



1. Metropolitan
Planning/Interventions at this scale centre around policy and long term visioning to establish the broader principles and objectives of TOD.

2. Corridor
Integrated transport and land use planning at a corridor scale is required to give context to local area and precinct planning initiatives. This will promote land development along selected transit corridors, where the combination of transport investment and development would optimise the utilisation of transport.

3. Nodal/Local Area
Urban nodes are characterised by the intensity, mix and clustering of activity or land use. Nodal planning attempts to consolidate and define the role of the node or zone in the context of the corridors. The aim is to determine the desired density and mix of land use within the study node or zone.

4. Precinct
At the lowest level, the Precinct Plan must ensure appropriate urban design and placing of infrastructure and facilities, in support of both the higher order corridor and local destinations within the node or zone.

5. Projects and Programmes
Projects and Programmes are identified in the Nodal and Precinct planning stages. They are seen as practical mechanisms to improve the quality and attractiveness of the urban environment in order to facilitate the contextual objectives of TOD at the appropriate scale.

Figure 5: Scales of TOD Planning

6. Preliminary Findings

6.1. Transport Optimisation:

Following the transport optimisation process, Figure 7 shows the optimal location of new trips in 2032 per TAZ based on the six indicators discussed in section 5. The yellow depicts new trip productions (generated from future residential development) and the red, new trip attractions (generated from future non-residential development such as retail, office, industrial and community facilities). When juxtaposed to the current spatial distribution of existing trips (refer to Figure 6) the following key conclusions can be made:

- An increase in trip producing land uses in TAZs located along transport corridors that contain high levels of trip attracting land uses. This requires the development of more residential opportunities in existing economic areas/nodes.
- There is also a need, although not as prevalent as above, to locate more trip attracting land uses (economic and social opportunities) in TAZs that are dominated by residential development, most noticeably in the Metro South East (MSE).
- The optimised scenario in figure 7 illustrates a more compact distribution of future growth with less growth towards the edge of the city.

Current Situation

Pie size depicts intensity of use (largest pie = 24000 Ps + As)
Pie split depicts diversity of use (Residential vs Non-residential)

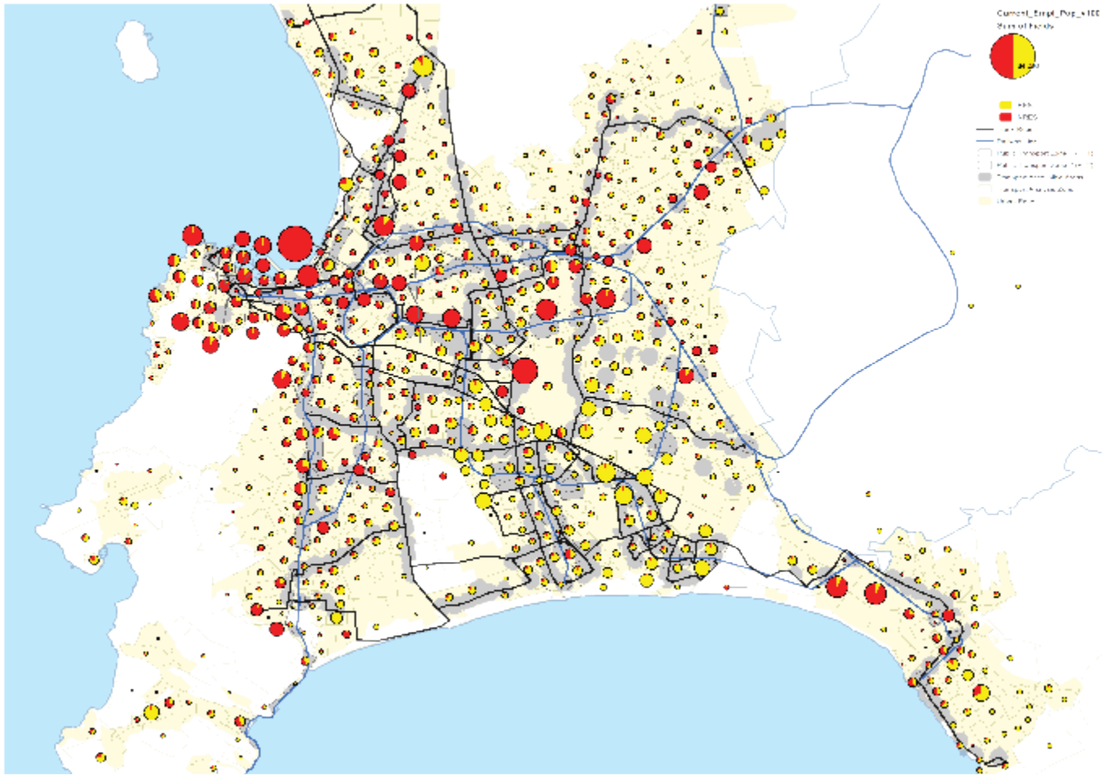


Figure 6: Current Spatial Distribution of Trips

Demand

Following Transport's Optimisation Process

Pie size depicts intensity of use (largest pie = 24000 Ps + As)
Pie split depicts diversity of use (Residential Vs. Non-residential

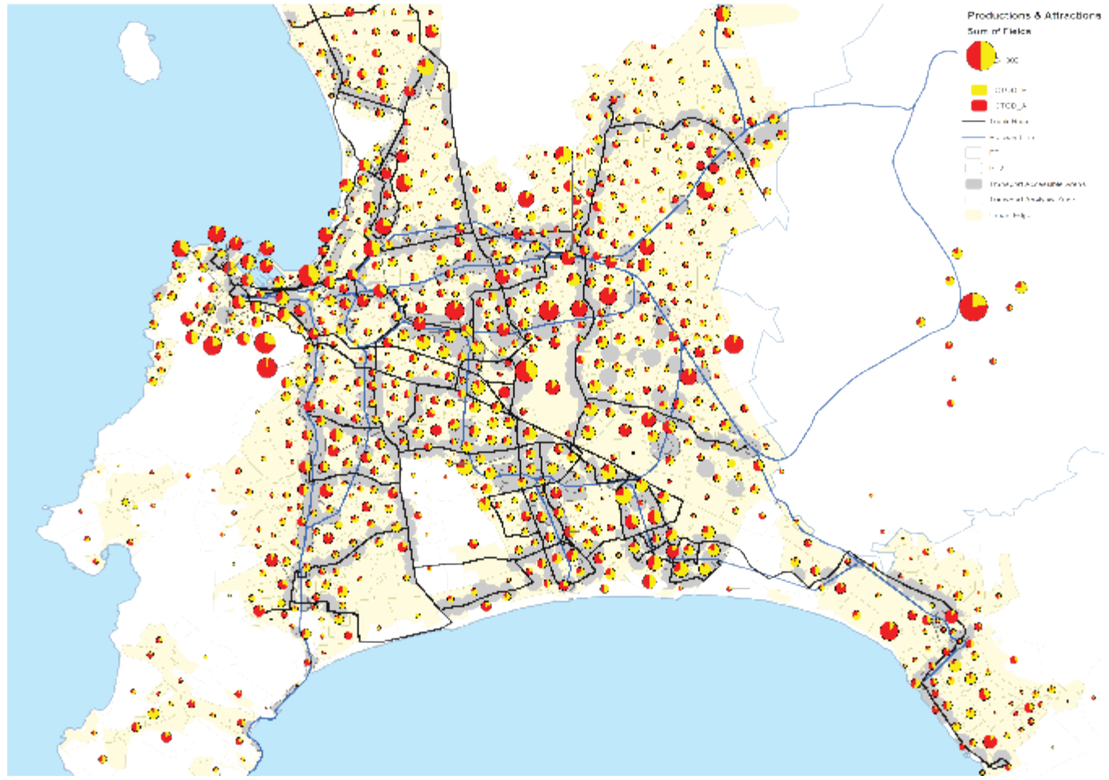


Figure 7: Spatial Allocation of New Trips following Transport Optimisation Process

Theoretically, if the City manages to locate the exact quantity and ratio of trip producing and attracting land uses per TAZ as depicted in the map above, the following integrated transport and land use efficiencies may be achieved (refer to Figure 8 on page 84):

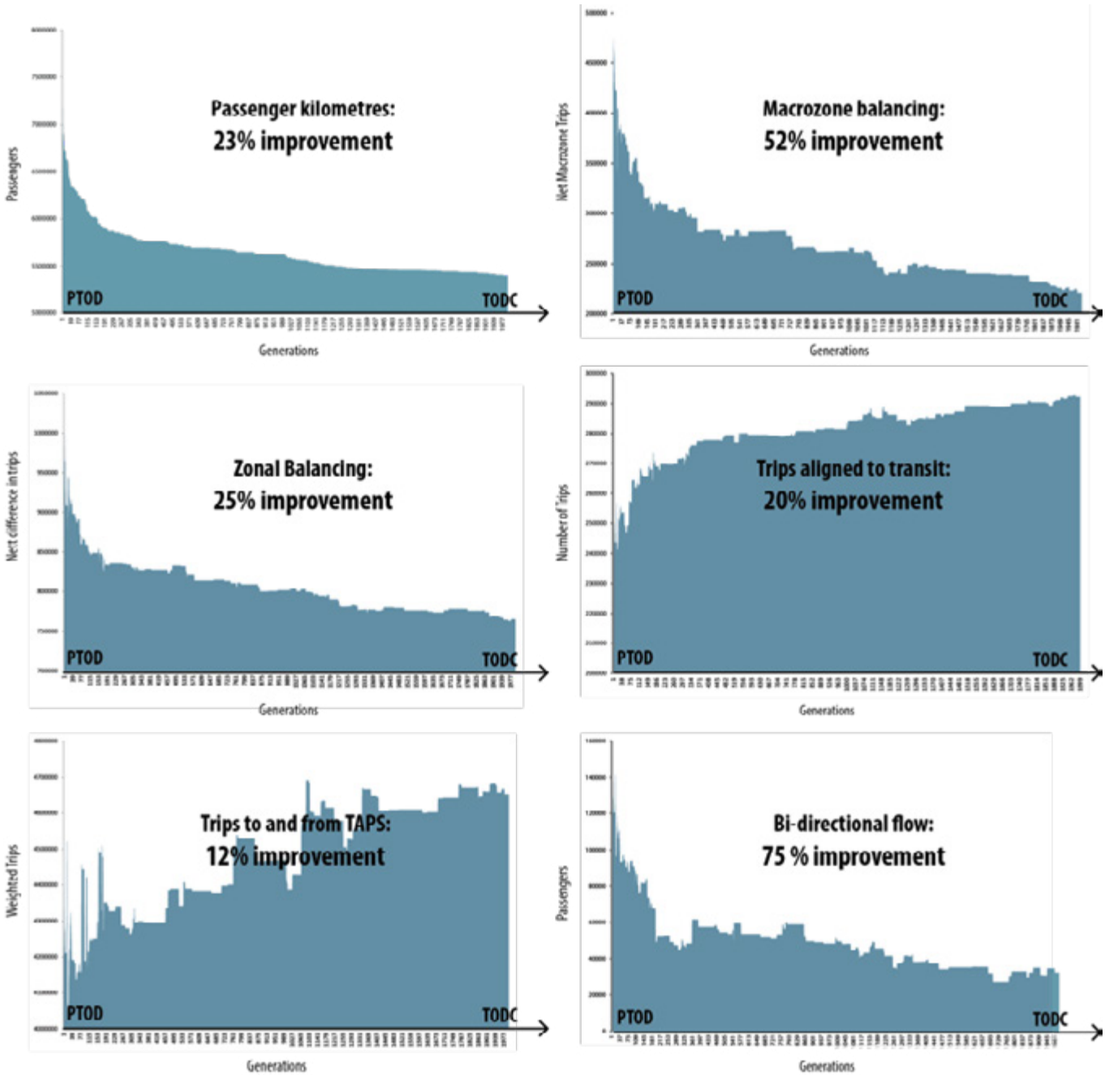


Figure 8: Potential Optimisation Improvements

It must be noted that the figures above represent an improvement from the PTOD land use scenario (which was used as basis for developing the IPTN).

6.2. Land Use Optimisation

The initial output of the land use optimisation process can be seen in Figure 9 and Figure 10 on page 85, which expresses the transport ask (trip productions and attractions) in the form of dwelling units and GLA. Figure 9 illustrates the future demand in terms of residential and economic development and Figure 10 depicts total development (existing and future).

Initial TOD Comprehensive Scenario (Growth Only)

Figure 9: TOD Land Use Scenario Depicting Growth Only

Initial TOD Comprehensive Scenario (Existing development + growth, excluding unmet demand)

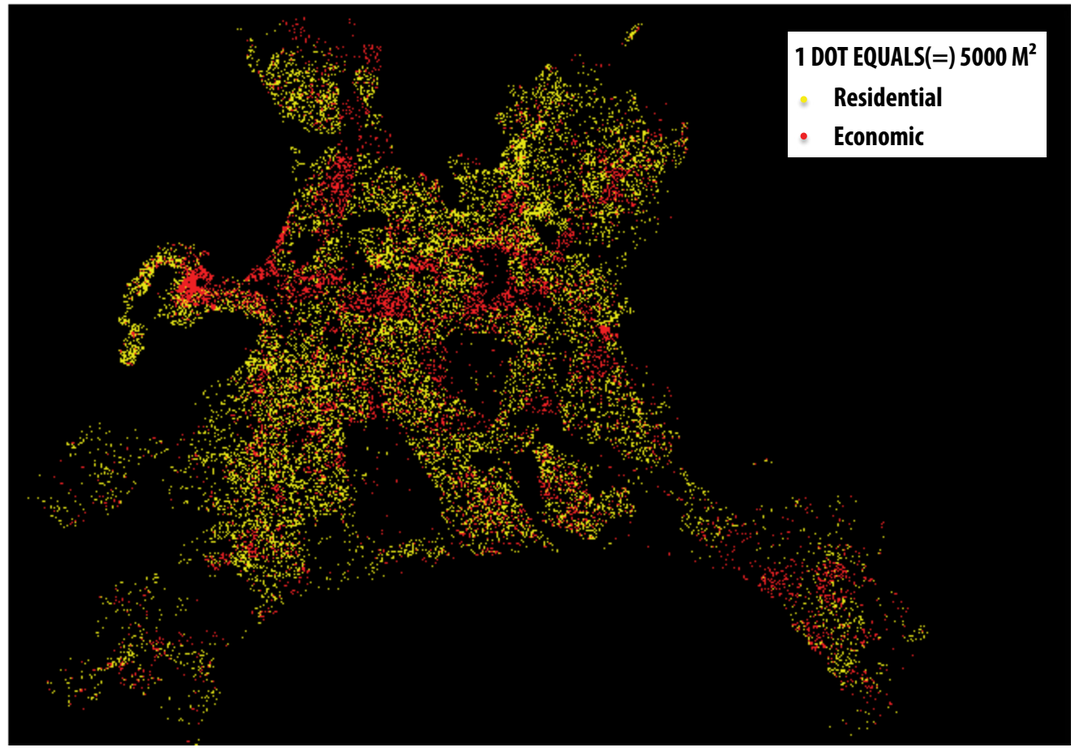


Figure 10: TOD Land Use Scenario Depicting Current and Future Development

The following maps (Figure 11 and Figure 12) show the comparison between transport demand (converted into dwelling units and GLA) and available land use supply (calculated using the parameters identified in Section 5 and Annexure A).

Demand And Supply: Non-Residential

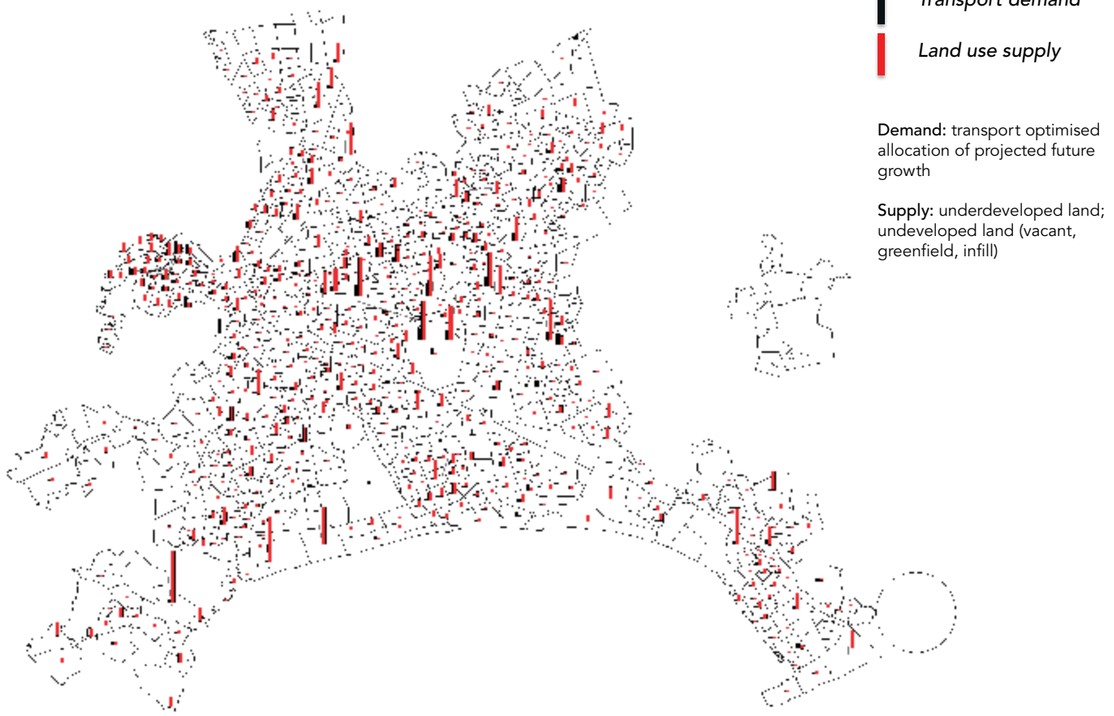


Figure 11: Non-Residential Demand and Supply

Demand And Supply: Residential

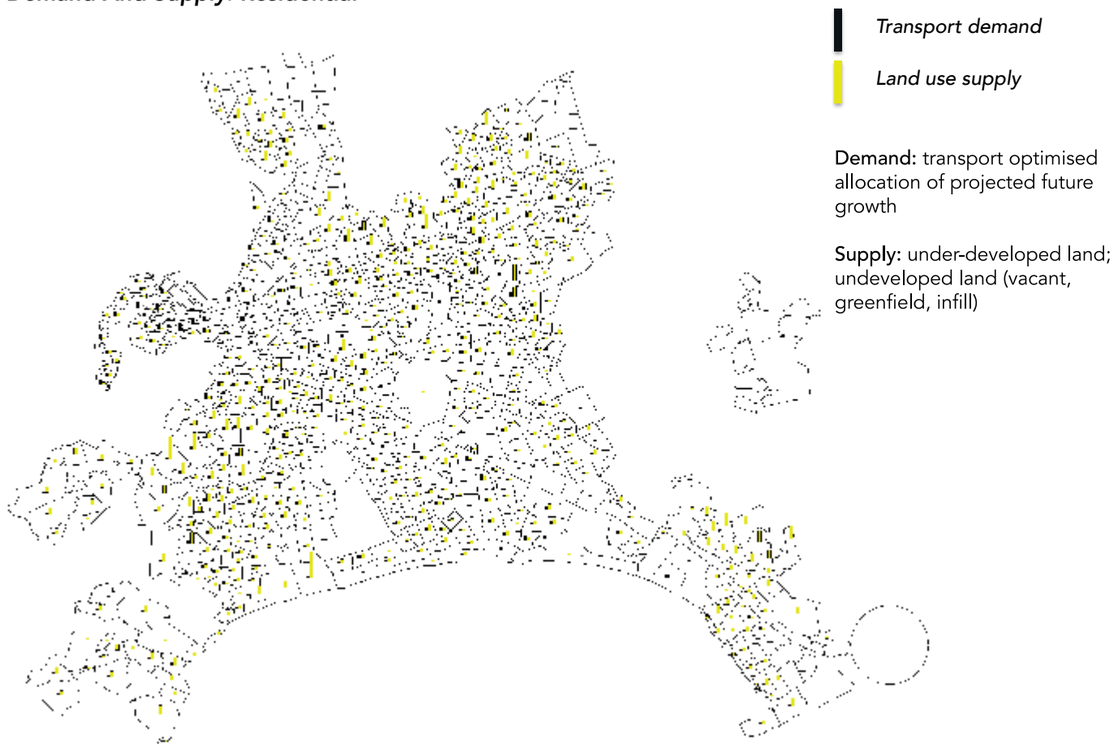


Figure 12: Residential Demand and Supply

The figures illustrate that it is theoretically possible to accommodate a significant portion of the transport demand (optimised trip productions and attractions) via residual floor area from latent development rights and/or vacant land that will give effect to the integrated efficiencies depicted in Figure 8. However a number of core economic nodes within the city do not have sufficient capacity (residual floor area or vacant land) to absorb the demand for new residential development (or trip producing land uses), depicted in Figure 13 on page 88. Most noticeable are some of the core urban nodes in Cape Town CBD, Century City and Bellville. To address this shortfall in land supply further land use optimisation will be employed in the next phase of the methodology to best accommodate the optimised transport network where sustainably/spatially appropriate. This will be done by adjusting the following variables:

a) Land use mix and intensity of use of building floor space (persons per m²: household size/employment density)
b) Space recovered through parking zone change (lower parking requirement)
c) [a] and [b] further optimised through rezoning/departures from standard development rules (height, coverage, floor factor)
d) Relocation to adjacent TAZ with spare floor area capacity

Unmet Demand

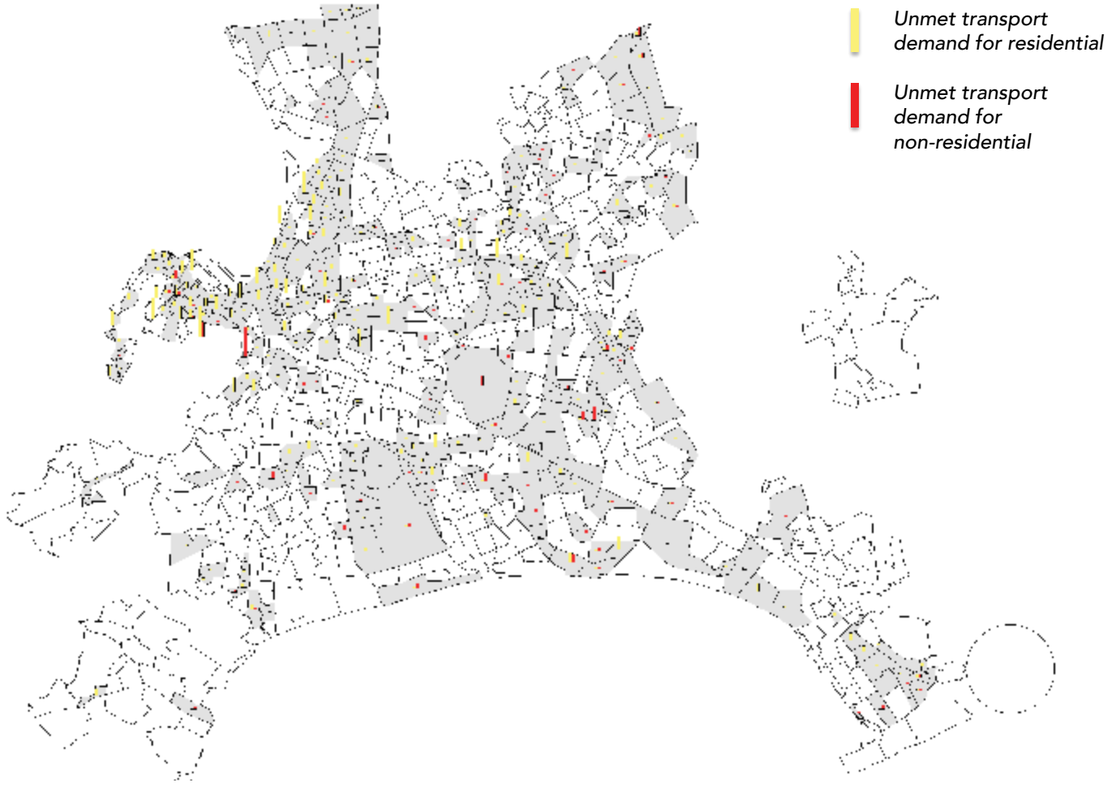


Figure 13: Unmet Demand

6.3. Preliminary Review of the Optimisation Processes

6.3.1. Transport Optimisation Process:

- Heuristic optimisation provides an excellent method for optimising multiple and conflicting parameters. The process is in itself heuristic and is being refined along the way particularly regarding the data.
- The process is very time and resource-consuming. Computational resources are especially problematic, because the algorithm used in both the transport and land use optimisation modelling relies on proprietary software (EMME), so modelling is restricted to a single instance of the programme at any one time, limiting the opportunities writing the script to accommodate parallel processing. In order to facilitate effective and speedy completion of the ideal scenario, and conduct the relevant sensitivity testing identified previously, a list of the computational resources required to complete this exercise can be found in Annexure B.

6.3.2. Land Use Optimisation Process:

- Quantifying the existing land use is a long, complex, manual process which requires the use of a variety of sources.
- Filling the gaps in the data requires inventive, iterative work and a significant amount of time. However, the work done on establishing the base year (current) land use picture can be incorporated into many different processes and initiatives e.g. MTIIF.
- Parking provision plays a significant role in the intensity of the land use that can actually occur. Where rights for intense land use may currently exist, these may in practice be significantly reduced by parking provision.
- Not everything has been taken into account e.g. physical restrictions, title deed restrictions, heritage restrictions etc. therefore could be overestimating the possible land use availability (residual development potential).

7. Way Forward

The development of TOD Comprehensive represents a highly complex and nuanced methodological approach to integrated land use and transport planning. Its potential as a modelling tool to inform future urban growth and travel demand is unprecedented and could add significant value to the City's development strategies (i.e. the IHSF, MTIIF, CTSDF etc.). This is reflected in Figure 14 on page 90, which identifies TOD Comprehensive as a key input into the citywide process to institutionalise TOD within the City of Cape Town's administration.

The product (land use scenario) and model at this phase of the methodology requires further optimisation, iterations, testing and peer review to accommodate the unmet demand and improve its reliability and authenticity. The end product must then be used as a key strategic informant into the City's development plans at the metropolitan scale of planning to identify the ideal locations of new residential and non-residential development.

Although the land use scenario may not be finalised at present, it shows the City's intent to progressively move from PTOD to TODC. Therefore outputs from this process, particularly the implementation component, must be contextualised within the TOD strategy whilst the final scenario undergoes further review.

At the date of submission of this report, the TOD working group completed stage two of the methodology to develop TODC (refer to Figure 1 on page 76) and will effectively move on to Stage 3, Reaching Equilibrium.

Citywide Process to Institutionalise TOD

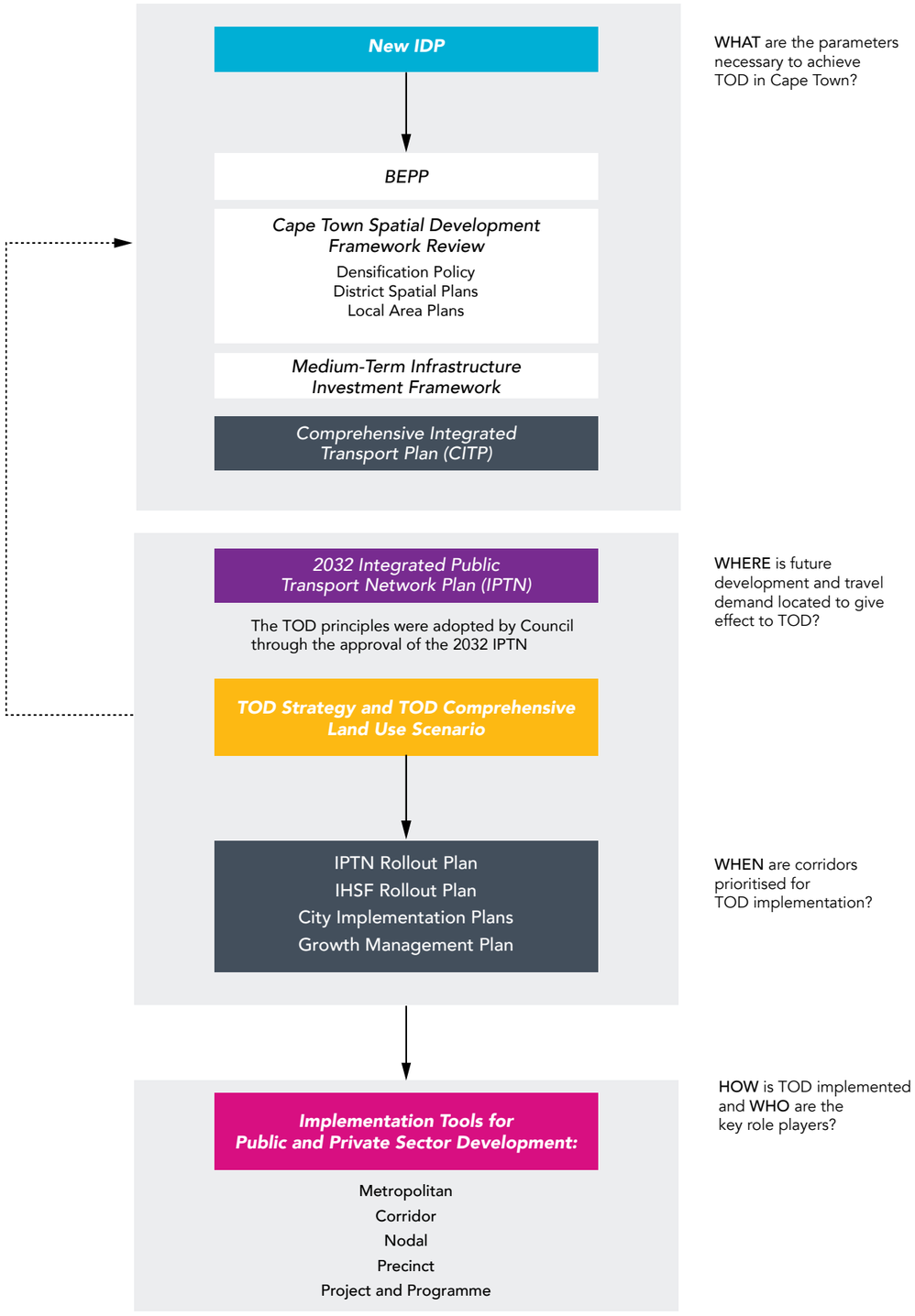


Figure 14: Citywide Process to Institutionalise TOD

8. Risks

Whilst the process to determine TODC is based on a form of scientific logic, particularly the quantification of development rules and zoning rights, one must remember this is still a theoretical exercise where multiple assumptions have been made, in part to compensate for the quality of information/data available and address details which are unknown at this level of planning, but largely to push the boundaries of existing development trends.

In light of the above, we find that the application of the TODC land use scenario in its current stage of the methodology should be limited to the context described in this report.

Annexure A: TODC Land Use Assumptions from the 2032 Approved IPTN Plan

Assumption	Intention	Modelling Mechanism
Household income and land value will not impact where residential development is located	To enable development to be located in a way that supports transit	Disregard land value and allow the spatial distribution of residential units to locate where strategically required
Development will be allocated to priority transit areas using existing theoretical maximum permissible/ deliverable rights, and then – if additional development is required – rezoning/amendment of land use rights will be applied	To focus development in priority transit areas and make use of existing rights, but to allow for further development if the aforementioned is insufficient	Investigate current land use patterns/mix (zoning). Make use of overlays to increase development potential (e.g. DPZs, PT1/2 zones, Urban Development Zone etc.) or decrease development potential where development is encumbered (e.g. road/ railway reserves, biodiversity areas, etc.) Estimate the available rights using highest and best-use assumptions
Parking requirements will be adjusted according to the provisions of Public Transport (PT) zones. If this reduction is not sufficient, further reductions will be modelled	To remove the restrictions placed on bulk[7] by reducing parking requirements	Apply reduced parking requirements to properties that fall within the PT1 and PT2 zones It will be assumed that parking will only be provided on site (i.e. around the building footprint and by making use of one basement parking level)
Land use intensity and land use mix is allocated according to best location for transit capacity utilisation	To use development type and mix in locations that take up existing, unused public transport capacity to use the public transport network more efficiently	Use existing volume/capacity ratios on transit network to allocate development
Development is geo-fenced to existing and planned higher order public transport infrastructure	To illustrate the possible implications of concentrating development around the major public transport network in a way that supported the public transport network	Demarcate a TOD study area along existing high-order (BRT trunk and rail) public transport infrastructure

[7] Bulk is a commonly used term that refers to building magnitude in three dimensions. It is determined by applying all the development rules relating to a particular zoning, namely floor area ratio, coverage and height.

Annexure B: Computational Requirements

Transport Modelling:

Desktop Computer (for productivity) with the following specifications:

- 3GHz Intel Xeon or Core i7 processor
- 32GB RAM
- 4GB GPU
- 500GB SSD
- 64bit OS

This kind of workstation is expensive, usually costing around R50 000.

Land Use Modelling:

Computers must be able to store a lot of data and be able to handle 3D software (CityEngine).

Desktop Computer (for productivity) with the following specifications:

- 3.9GHz Intel Core i7-3970 CPU
- 32GB RAM
- 2 x 1TB SSD HDD
- 2 x 4TB HDD (fast access)
- 64bit OS
- Nvidia K2200 (or better) graphics card
- 27" LED monitor with support for 2560 x 1440 pixel (WQHD) resolution

Laptop Computer (for productivity and mobility) with the following specifications:

- Intel Core i7 processor
- 16GB RAM
- 1 x 1TB SSD HDD
- 1 x 4TB HDD
- 64bit OS
- High performance graphics card

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