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Transport Oriented Development as a developmental technique to uplift urban nodes in Metropolitan Regions: Bellville CBD, Cape Town

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Abstract

Urban growth in the last 30 to 40 years has experienced and unprecedented increase. This is mostly due to the growth of developing countries and the expansion of their urban environments. With more people flowing into urban areas, in search for better opportunities; many growing urban centers have been struggling to keep up.

This document looks to address growing cities specifically through the perspective of mobility and accessibility. Assessing the ways in which mobility can foster more efficient and equitable development in growing cities. The focus of the project is on the Cape Town Metropolitan Area and the Bellville CBD area (and surrounds) in particular. The fragmented spatial configuration of this area gives a perfect opportunity to test some of the most fundamental ideas around mobility and accessibility.

Thus the project uses Transit Oriented Development as a means to assess how transit can be used to influence and stimulate development. Through the use of case studies, from around the world, a spatial intervention is proposed to take advantage of the opportunities available in Bellville in terms of improving mobility and urban growth through Transit Oriented Development.

To conclude, it is found that Transit Oriented Development can be used extensively in the Bellville Area, given the proximity f high mobility routes and an urban form that allows for in-fill development, thus addressing issues of sprawl and underutilize land that are common in the area.

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Table of Contents

Figures, Tables and Maps List

Figures

Tables

Maps

Chapter 1

1 Introduction

Considering the growing rate of South African cities, with rural-to-urban migration increasing year after year, there is a vital need to create integrated transport systems in order to be able to maintain and handle this growth. Urban sprawl in South African cities has been a feature of urban growth for the past 50 years, compounded by apartheid planning cities tend to be very fragmented with large vacant spaces that could be used for in-fill development. This fragmented urban fabric has led to cities with a heavy reliance on public transport and transit systems that are designed around a centralized system of labour provision as opposed to optimum connectivity.

Thus this research will be focused around answers to two key questions that are meant to address issues of urban growth in South African cities and the global south in general. Urban mobility will be the epicentre of confronting urban growth and creating connected society. The research questions that have been chosen for this research project are as follows,

> *To what extent can transport hub infrastructure development foster mixed use and mixed density urban development?*
>
> *How could TOD influence the built environment along with the development potential of the Bellville CBD area?*

These questions will be investigated through the investigation of literature and contextual realities of the project site. These questions will then be answered by the creation of a spatial plan to reflect the findings of the literature and the adjusted to the spatial realities of the project site.

The focal point of this dissertation is the Bellville Transport interchange in the Cape Town Metropolitan Area. The site is characterized by a systemic fragmentation that is distinctive of the transportation hubs in Cape Town at large. Its infrastructure includes a Golden Arrow bus terminal and a taxi rank, but it is greatly removed from the Bellville Train station. Many commuters are employed in the urban sections of Bellville, and must turn to alternative transport options as links to these areas are severely limited (CoCT, 2013). The surrounding space is also not utilized as efficiently as it could be. For example, the vacant portion of land in the south side is currently used to store discarded Transnet infrastructure, but could instead be allocated to more productive functions (CoCT, 2012).

When plotting a development plan, it is imperative to follow a prescribed framework. Transport Oriented Development (TOD), a globally established theoretical field, is a prime example. Its goals are inclusive of diverse contexts and purposefully open-ended, and are therefore applicable to cases of African origin (Cervero et al., 2004). The Federal Transit Administration (USA) describes TOD's characteristics as encompassing high density development, accommodation for both automobiles and pedestrians, and new building construction (Cervero et al., 2004). However, TOD has been astoundingly lacking in both Cape Town and the country as a whole.

The only recent development that actually adheres to TOD principles is the Integrated Transport Plan of the City of Cape Town, which has not passed ratification by the provincial government and thus remains a draft in stasis (CoCT, 2013). The precedent of a progressive spatial plan is therefore needed to transform transport nodes into zones of employment and development. This dissertation analyses the Bellville Transportation Intersection and present a comprehensive plan that tackles these issues. The optimal system would accommodate the diversity of the local population and take into account the

livelihoods of their communities. This set of reforms would represent the country on both a national and international scale, and attract the attention of transit developers.

The spatial plan encapsulates the normative discourse of the 'Just City'. The principles of the 'Just City' are rooted in the monumental shift away from the purely technical perspective of the 20th century (Fainstein, 2005). The change in urban planning stemmed from a recognition that urban areas do not merely serve a significant developmental purpose, but also have value of anthropological and social nature. According to this perspective, the social pressures of environmental sustainability and poverty cannot be ignored (Fainstein, 2005). These issues must instead be addressed and integrated into the core of planning theory. A 'Just City' would therefore revolve its urban plan around the problems faced by residents, and consider the implications on residents in future generations (Fainstein, 2005).

The proposed reforms for the area are thus part of a greater local action plan with a vision of spatial and transit-oriented development. The research provided has been directed specifically at the spatial plan of the Bellville Interchange and surrounding areas. Developmental theory was also utilized to inform decisions and potential interventions, as no exclusive policy for TOD has been prescribed in the city of Cape Town (Swilling, 2006). However, one must also note Cape Town's considerable district area projects, under which Bellville Interchange is addressed in the Tygerberg Area District Plan (CoCT, 2012). These district level SDFs will naturally in inform the area and help with directing TOD development. It is crucial to note that the Bellville Interchange is positioned at the end of the Voortrekker Corridor, which has been marked as top-priority and will therefore be the focal point of the local action plan.

The research is primarily concerned with the exploration of two central themes. The first is a critical analysis of TOD in order to design a working plan for the Bellville Transport Intersection. The second is a more intensive contextual analysis for the purpose of selecting relevant aspects of TOD. The research itself was oriented around fostering a mixed urban density and developing the socio-economic landscape. This was the first critical step in formulating a local action plan. The majority of the information for the research was extracted from library material and journals both off-line and online. Following these preliminary preparations, the next step was the actual analysis of the site. For the TOD theory to be applied and solidified, a contextual analysis had to be performed. This task involved physical site visits in order to grasp a realistic understanding of issues in the area. By speaking to business owners and residents, rare and unique insights into local challenges were acquired. In addition, first-hand observation of participants increased the accuracy of the site analysis. The nuances of communication became evident, clarifying the information that would later develop the TOD spatial plan.

The information that could not be extracted from report and literature analysis was obtained through open-ended interviews and conversations. These face-to-face interactions allowed for a better grasp of the area's perspectives and attitudes. Perhaps the most important interviews were with officials who were involved with the development of the Integrated Transport Plan for Cape Town, as well as professionals working with major infrastructure projects in the city. The most notable of these were members of Golden Arrow and South African National Taxi Council (SANTACO) and the Department of Transport and the Passenger Rail Agency of South Africa (PRASA). In addition, it was vital to speak with academics with comprehensive knowledge of TOD and transport development in general. Interviews with business owners was also important due to the mixed-zone characteristic of TOD. After the necessary information was collected, reflections from the analysis stage were compiled and drawn up. A practical implementation of a workable spatial plan was outlined, and the conclusions explained thoroughly through the comparison of relevant case studies.

Case study based research was used to determine the appropriate application of TOD in the setting of the Bellville transportation hub. This method is particularly effective when gathering an exhaustive understanding of a specific location. Yin (1998) claims that information can be obtained from various sources, and is not exclusive to conventional evidence (for example, quantitative and qualitative data). This approach was especially useful for the analysis of the Bellville transportation hub, as quantitative data and primary research collection were limited due to time constraints. Secondary data, such as professional observations and historical sources, were therefore also utilized to examine the operation of transport hubs in Bellville specifically and Cape Town overall. This methodology necessitated the analysis of TOD case studies so parallels between the site and these cases could be drawn.

The next chapter begins to build the argument of this research project by focusing extensively on the literature around mobility, land use development and transit's impact on the urban form. The literature review will create the foundation on which to answer the research questions that have been posed.

Chapter 2

2 Literature Review of Transit Oriented Development (TOD)

This chapter focuses on examining the existing literature on TOD in order to lay the foundations for the research and plan that is to be produced in this thesis. The structure of the literature will be conducted as follows. The first part will be simply to identify why the use of TOD is desired. What values and characteristics does this development strategy hold, that it is favored over any other type of intervention? Following that, an extensive definition of TOD is looked at, focusing on the key aspects and how they are defined and to what extent these definitions are case specific. This section of the review looks at creating a deep understanding of TOD in order to be able to look at the history of its development and its implementation around the world through various examples. This brings us to the next section which will be focusing on contextualizing TOD in a spatial sense. Comparing the two global regions' parallels and differences can be highlighted in order to get a true understanding of the factors that influence TOD in varying developmental concepts.

In summation, this literature will cover the following critical topics:

- Restructuring and Densification, discussing urban mobility.
- Defining Transit Oriented Development.
- The role of Transit Oriented Development in the modern planning discourse.
- Limitations of Transit Oriented Development.

2.1 Restructuring and Densification: Discussing Urban Mobility

When it comes to urban development, there tends to be a sense of permanency about the urban form. Established urban practices and urbanization patterns can give the impression of permanency. Various factors come into play in terms of influencing urban structure and form. A big determining factor is often mobility practices (UN Habitat, 2004a). This section will begin the literature review by having a look at the urban mobility and how it can affect urban form through the lens of urban restructuring and densification. It will look at how urban areas can be maximized in terms of access to public transport stops, and the effect that these public transport stops have on urban densities (UN Habitat, 2004a). This discussion additionally provides the reasoning behind the use of TOD (which will be defined in detail later in this chapter) by

looking at urban mobility and how the needs of commuters has shaped urban structure and density.

2.1.1 Urban Mobility

Mobility become a vital and key dynamic of urbanization, along with the infrastructure related to this mobility, forming the backbone of urban form. The consideration of urban mobility has become more important than ever, considering that current urbanization patterns are posing unparalleled challenges to urban mobility systems, especially in developing countries (UN Habitat, 2013). Figure 2.1 depicts that the biggest increase in urban growth in the next few years is in Africa (UN Habitat, 2013). Africa is the region that is set to face the greatest challenges in terms of coping with increasing demands on transport infrastructure (UN Habitat, 2013).

In order to solve this rising issue of mobility in urban environments, there needs to be a strong departure point via an ideological and theoretical framework that aids the alleviation of the challenges posed by urban mobility. So it is not sufficient to only improve the physical aspects of transport infrastructure like speed, safety, and efficiency. Although they are important, **accessibility** needs to be the focus (UN Habitat, 2013). Essentially, this means that mobility in urban environments is usually developed through a transport bias. Planners and authorities alike plan and implement huge transport and infrastructure projects without looking at how accessible they are, catering transportation modes for the people that use them (UN Habitat, 2013). Transport and mobility are treated as demands, enabling people access to other people and places. However, while this is a key aspect of mobility, it is not the only key aspect (UN Habitat, 2013). Removing the need for such extensive travel and optimizing the value of being at the destination is vital for sustainable mobility.

2.1.2 Restructuring and Densification

The accessibility and sustainable mobility discourse also includes focusing heavily on the built form of urban environments – particularly the optimization of urban density and the fostering of a sense of place (UN Habitat, 2012). The strong sense of place and mixed-use functions, along with the combination of high density settlements, will minimize the need for extended movement, enhance economies of agglomeration and encourage non-motorized transport. Hence, the bottom line for accessibility is the quality and efficiency of reaching destinations whose distances are reduced, in addition to affordability and inclusiveness in the use of the provided facilities (UN Habitat, 2013).

However, urban restructuring cannot occur without identifying what is called the 'transport bias'. This refers to the favored modes of transport in urban environments that receive preference over other modes. For example, in developing countries, private transport is seen as an aspirational mode; upwardly mobile social groups prefer to own a private vehicle if they have the means, rather than take public transport.

This leads to sprawling urban environments with low densities, and mobility is reduced for those that cannot afford private transportation. Thus, by focusing on creating a more dense urban form connected by a transport hierarchy that puts public transport first, the restructured urban environment becomes possible.

2.1.3 Integration of Land-use and Transport Planning

The relationship between land-use and transport planning is a vital one. The development of a Sustainable transport system begins with the efficient organization of urban space around it (UN

Habitat, 2012). The main objective is to reduce the dependence for mobility by reducing the number of trips and length of travel distance (UN Habitat, 2013). This leads to optimized urban densities, and functionality of urban places is further enhanced.

Ignoring the relationship between land-use and transport planning has led to urban sprawl, which is very evident in most large cities. The post-War period in the Global North saw the rise of suburbia and increase in private vehicle ownership, creating a context of sprawling cities; land-use and transport planning were at odds and were thus implemented unsustainably. In the Global South, there were large peri-urban areas with informal and illegal patterns of land use; these conditions were a result of increased rural to urban migration, along with a lack of coherent transport and land-use planning to address increasing influxes to urban areas in the post-colonial era.

Having looked at the idea behind urban mobility and accessibility, the next section of the literature review will look at how to address these issues of accessibility and urban growth. This will be achieved by applying the principles of urban mobility and land-use planning to the developmental technique of TOD. The next section will focus on defining TOD and looking at how it fits into the sustainable mobility paradigm.

2.2 Defining Transit Oriented Development (TOD)

TOD is a fairly dynamic concept to try and define, given the differing contexts that it was developed in. In most of the literature on TOD, there has been one accepted initial and rough definition developed by the annual Federal Transit Reports (TCRP). Cervero and Curtis define TOD as being a term that;

> *"…encapsulates the process and planning of housing developments, employment, activity sites and public services around existing or new railway stations served by frequent, high quality and efficient in- urban rail services,"* (Cervero, 1998; Curtis et al., 2009).

However, variations in its implementation have added various aspects to this definition – though the basic premise has not changed. The difference is seen in how TOD is interpreted in differing contexts around the planning environment. However, before these differences are highlighted, it is useful to be able to have an overview of the historical development of TOD – in other words the origins of this development principle. Looking at the origins at TOD will lead to a better understanding of how that definition came to be, in addition to how the development principle formed and evolved its values from the earliest moments of transit development in the 19th century.

2.2.1 Origins of TOD

TOD has had a divergent birth, all based on its context. I will be focusing on the founding contexts of TOD, which take place mainly in North America and Northern and Western Europe. I will be using examples from the mentioned regions in order to evaluate the evolution of the concept.

In North America, the concept of TOD was a result of studies conducted on its transit systems in various municipalities around the country. Boarnet et al. focus on the city of San Francisco – specifically the nature of its extensive transit network during the 19th Century, with its famous tram system (Boarnet, 1998). The first transit review was carried out during the 1970s; it was used to analyze the impact of transit stations on land uses in the metropolitan areas of San Francisco (Boarnet, 1998). Given the socio- economic pressures of the decade, the municipality was looking to increase the ridership of its public transport networks in order to decrease traffic congestion and air pollution. The investigation found that the newly developed Bay Area Rapid Transit (BART) light rail system made some optimistic assumptions about economic development around the BART stations (Boarnet, 1998). During the planning process it was assumed that stations would become hubs of activity, given that they are the contact points for riders; however, the reality was very different. Many of the stations were located in low density suburban areas that suffered from low ridership numbers, and were thus left barren and relatively low in development activity (Boarnet, 1998). Stations with high volumes of foot traffic were found to accommodate mostly commercial activities with very little to no residential development (Boarnet, 1998). Furthermore, private car usage was high, so most working commuters were traveling directly to work; that was situated in a transport hub, which showed that suburban residents still preferred their own private transport (Boarnet,1998).

In Western Europe, this has been done a little differently. The example that we will look at really defines the origins of TOD in the planning discourse. Copenhagen compiled an extensive transit focused plan as far back as 1947 (Knowles, 2012). Planners were anticipating the post-economic boom and they realized that there needed to be an organized plan based on the spread of the city along preexisting corridors of development (Knowles, 2012). Considering how early this plan was formulated, the market economy and suburbanization were ideas still in their infancy; thus, planners were able to influence these new developmental theories through planning that used balance and equity as its focal point. This lead to the formulation of the renowned 'Five Finger' plan of Copenhagen. This essentially refers to development along five corridors (fingers) of urban development, which were designated by this early form of TOD (Knowles, 2012). It was planned along preexisting suburban railway lines which were designated to be electrified to provide rapid and reliable transport directly into Copenhagen's CBD (Knowles, 2012). Every station was planned to be a focal point of high density housing with local shopping facilities; each planned suburb would be linked to the next one and onto Copenhagen's CBD (Knowles, 2012).

In terms of TOD in the Global South, the Bus Rapid Transit system of Curitiba in Brazil comes to mind. Most of the literature hails this as one of the most significant public transport innovations of the 20th Century. It not only transformed the notion of public transport in the context of the Global South, but also for the Global North; that is how effective its implementation and design have been. Its major appeal in the Global South discourse is that it addresses the aspirational ideologies behind many public transport projects. During the 1960s and 70s, many developing countries were aspiring to build advanced public transport systems modeled after the European and, to a limited extent, the American model (Cervero, 1998). That meant investment into big, complex public transport systems based on expensive rail and underground infrastructure. In Brazil, this was the case with many cities during the 1970s; a federal investment grant was supplied to improve public transport infrastructure throughout the country (Lindau et al., 2010). At this particular point in Brazil's history, many public institutions and organizations were fragmented and lacked any sort of cooperation; municipalities regularly battled each other for funds (Lindau et al., 2010). What the Curitiba authorities managed to achieve during this time was institutional cohesion by using the federal funds to direct development in busway corridors to direct its future growth (Lindau et al.,

2010). The Institute of Research and Urban Planning of Curitiba (IPPUC) and the Urban Development Authority of Curitiba (URBS) formed a partnership that saw IPPUC be in charge of formulating the spatial plans and determining which development corridors were ripe for development. Meanwhile, the UBRS was in charge of implementing these plans in the city of Curitiba (Lindau et al., 2010). However, what makes this case truly unique – apart from the institutional unity and cohesion – was the fact that other smaller cities in the metropolitan area of Curitiba cooperated with the IPPUC and URBS to bring the corridor development plan to the metropolitan area of Curitiba (Lindau et al., 2010).

Singapore is known for its highly efficient mass transit system (MRT) that has managed to effectively use planning in conjunction with quality housing development (Curtis et al., 2009). Urban growth in Singapore has been highly influenced by a unique mode of planning and development of new towns, integrating land use with the MRT; consider the idea of a ring shaped city and the principle of TOD in new town development (Curtis et al., 2009). This strategy was introduced in a city-wide plan in 1971, when levels of private car use were reaching unsustainable levels; the rapid economic growth during the 1960s had created an aspirational society that saw public transport as undesirable and a sign of being of lower social standing (Curtis et al., 2009). The 1971 plan included three transit lines parallel to four development corridors that created links to a concentration of urban cores, regional centers, sub-centers and new peripheral towns (Curtis et al., 2009).

Now that the origins of TOD have been looked at as a means of defining the developmental technique, this chapter goes on to assess the importance of TOD in the modern planning discourse. The cases that have been briefly discussed here will be looked at in extensive detail in in Chapter 3: the Precedents chapter.

2.3 Transit Oriented Development favorable in the modern planning discourse

Urban environments by their very nature foster movement and transit through space. With the growth of urban centers around the world during the late 20th and early 21st centuries, there has never been a more important time to focus on transit or movement. Many developed economies find themselves in a situation of suffocation, with the growth of urban centers; congestion, traffic, noise and pollution have been a very real concern for major urban centers.

From a historical perspective, the advent of public transport in many Global North Urban Centers towards the end of the 1800s and early 1900s addressed the issues of congestion. However, the modern era of development – especially in the post-war era of the 1960s and 1950s, which saw the rise of suburban environments – led to the sprawling of many large urban centers in the Global North. This led to large isolated urban settlement with very little connectivity options, forcing residents to rely on the private vehicle as their sole means of transport.

Now this is where the appeal of Transit Oriented Development (TOD) becomes very important. The growth of cities in the Global North have mainly pushed the limits of the urban edge as a result of the reasons discussed above. In the late 1980s, the modernist planning perspective aimed to address the increased spread of cities especially in North America, where cities were expanding into vast distances. The focus of this new planning paradigm was to intensify urban development

and focus on the efficient usage of land available to authorities and developers. Densification was the key to addressing traffic congestion, air and noise pollution. Thus, the promise of TOD looked at reducing the amount of traffic congestion in large urban centers by focusing development on transit infrastructure. It increased the appeal of transit by building mixed use developments around major transit intersections. The principle was that anything anyone could want would be centered on transit hubs – the "live, work and play" philosophy. This is what TOD offers to modern spatial planners.

However, the true appeal of TOD lies in its ability to market itself as a viable, reliable and convenient form of development; this is deeply tied with reliability and speed of the transit networks in any given area. According to the United Nations Global Report on Human Settlements, in order for transit to be seen as a viable form of transport, it must be able to beat the private vehicle in terms of time and efficiency (UN Report 1). Hence, TOD looks at making mass transit more attractive by taking distance out of the equation, by developing mixed use transport nodes that attract residents and users to them, and by offering 'car beating' – for lack of better word – efficiency and convenience. Additionally, according to the same report, TOD offers spatial interventions that address congestion, air pollution and traffic in urban areas (UN Report 1). Some of these measures include pedestrianizing of busy streets with high residential densities or restructuring city blocks to be oriented toward public transport use.

Despite what TOD offers in terms of spatial interventions, it has been developed to address the changes that we experience within modern urban environments. The Federal Transit Company (known as TRCP) in the United States has looked at how changing demographics and socio-economic realities have led to a rise in the interest in public transport in North America. The 2007 TCRP Report shows that younger families are more willing to live in densely populated urban areas in close proximity to working opportunities as well good public transport (TCRP, 1996). Additionally, childless couples tend to require less space, thus requiring more dense housing complexes, in addition to retirees who are looking to downsize their living areas (TCRP, 1996). Very often vulnerable groups, both economically and in age, tend to rely heavily on public transport; transit plays a vital role in their everyday life, which then adds on to the justification for TOD, considering that mixed use and mix income settlements are part and parcel of the TOD philosophy (TCRP). Environmental benefits can also be linked to TOD; given the fact that it is intended to tackle traffic, congestion and pollution, many of these issues are directly connected to climate change and global warming. Thus, TOD focuses on using the most that we have in urban environments, limiting the sprawl of urban centers and using space more efficiently to decrease dependence on fossil fuels through private car use and long distance commutes (UN Habitat, 2004). This also has the ability to apply pressure on policy debates; according to Boarnet, the pressures of climate change and urban stagnation have led to TOD being used as a means to an end for a myriad of transport policies around the world (Boarnet 1998). Boarnet looks at how cities in North America use the values and logic of TOD to further and achieve environmental targets that are entrenched in transport policies for various cities around the US (Boarnet 1998). Essentially, TOD can be used as a means to an end in regards to transport policy, which makes it even more appealing for future urban development; I will be looking at this extensively later on in the review as I contextualize the concept and focus on a couple of examples.

So far we have been looking at the obvious spatial and societal justifications for TOD; there is more that TOD can offer in terms of improving existing systems and promoting transit use growth. For example, in many modernist implementations of urban spatial planning, TOD has been the basis for planning and the infrastructure was developed after the formulation of a TOD influenced spatial plan. An example of such an approach was the Spatial Development

Plan for the city of Amsterdam; this was famously known as the 'five finger plan' (UN Habitat, 2005). Additionally, in the US, TOD has been used to increase ridership on existing transit networks; I speak more about this in the contextual section. This shows that TOD can be attractive to differing cases and differing needs. However, throughout the literature there are two main implementations – or, rather, uses – of TOD: the drive to increase ridership and developmental incentivization (Boarnet 1998).

The preceding section has focused on why TOD is desirable in the Global North. However, the attractiveness of TOD has also started spreading to the Global South with increasing speed, along with some pioneering innovations. TOD in the developing world has been seen more and more valuable in growing urban environments (UN Habitat, 2005). The ever-increasing influx of people into the growing urban centers of the Global South has resulted in many large cities choking in traffic, congestion, air pollution and stressed transport infrastructure (UN Habitat, 2005). These issues are very similar to those of cities in the Global North; however, the reality for developing countries is very different. Whereas in the Global North, in-migration was a slow and gradual process that could more or less be predicted, migration patterns in developing countries are much more rapid and influenced by a lack opportunities in the peripheries (UN Habitat, 2004). This essentially means that developing countries have a much faster time scale in terms of having to deal with issues of planning and urbanization.

In addition to the rapid nature of urbanization in the Global South, lack of resources and skills compound the difficulties associated with planning, and in particular transit or transport planning (Currie, 2006). Often public transport services have aged infrastructure and aspirational societies that value the ownership of private vehicles, causing ridership to be quite low (Currie, 2006). In addition, routes, policy and plans are outdated, and do not reflect the rapidly changing demographics of urban centers.

Socio-economic change in the developing world has seen the growth of middle class families with increasing disposable income. This, in turn, has resulted in the increase of aspirational products – such as private vehicles – leading to traffic, congestion, urban sprawl and creaking transport infrastructure, which has seen the call for transit upgrades and development grow louder. In this review, I will be looking at quite famous examples of TOD in the global south to get a sense of the differences in terms of discourses around ridership, urban and commercial development, and policy implementation. Examples will include the Bus Rapid Transit (Currie, 2006) system that was pioneered in Curitiba in Brazil. Infrastructure development has been linked to the developmental hierarchy that focuses on people first; the case of Bogota exemplifies the manifestation of one of the core values of TOD.

2.4 Constraints and Issues associated with Transit Oriented Development

Throughout this literature review there has been a recurring theme – an invisible wall so to speak – that we reached whenever we looked at the differing contexts of TOD around the world. There was this eventual admission that there are some aspects of TOD that do not quite seem to work

out, or some eventual process occurs that starts to change the positive outcomes of TOD. In this section, I will be expanding on the many times – as mentioned earlier – of these issues or constraints that are associated with TOD. Now, contexts may differ around the world, but the fact of the matter is that there is a trend to the issues associated with TOD. Many of these issues are part of the ideology itself, and include failings from the varied conception of transit based mixed use and income, urban and commercial developments. However, there is a trend of evolving issues as a result of the implementation of TOD that also begin to pose as a constraint to TOD. I am by no means arguing that contextual constraints do not matter. By all means they do. However, this being a review of the literature on TOD specifically, it only makes sense to try and look at the failings of the ideology a bit more extensively rather than merely looking at its failings within a system. At times however, it is hard to distinguish which constraint is a result of ideology and which is a result of contextual reality. For the simple fact that, as I mentioned in the definition section, TOD can be very context specific, we need to be careful in terms of identifying what a systemic issue is and what is contextual. Many instances of TOD, such as Copenhagen for example, were formulated and implemented decades before the actual concept existed; one can therefore look at that case and say the context informed the ideology. Essentially it becomes a 'chicken and the egg' situation, for lack of a better phrase. Now, in order to break down the constraints of TOD, I will separate them into three main categories: fiscal barriers, zoning limitations and implementation methods. Upon my review of the literature, these three categories express the overarching limitations of TOD on a cross-contextual scale. They summarize and group the most pressing constraints against TOD and make it easier to get an understanding of how these overarching issues affect TOD in varying contexts around the world.

2.4.1 Fiscal Barriers

Financing is always the limiting factor when one speaks about a development policy or ideology. The ultimate decider in many projects is the cost, and that is the unfortunate reality of 21st century capitalist economies. Thus, TOD is not exempt from this and faces some interesting challenges in this regard.

No matter in what context one looks a TOD, there is almost always the issue of funding. One would assume that the issue of actually developing the transit infrastructure would be the biggest cost. However, in many cases it has been shown to be the smallest. The issue here lies with how TOD is being implemented in the context we are looking at. For example, in San Francisco, the introduction of TOD was used to improve an already existing transit system, which needed to improve in terms of increasing ridership and development around stations (Boarnet, 1998). The biggest issue the authorities in San Francisco had concerned the development of mixed use land uses around major stations; the main reason for this was the authorities in the US administer transit development funds on a federal basis, so that means the authorities have to compete for funding, which very often results in small budget and transit projects being under-funded (Boarnet, 1998). The problem arises when authorities are forced to allow the open market to determine the demand for development around stations, as opposed to following the land uses of the scheduled plan (Boarnet, 1998). Thus, the full potential of TOD plans in the case of San Francisco were not realized because the market determines its investment through a completely different set of values; one example would be satisfying demand, as opposed to TOD, which seeks to create and mold it in the process (Boarnet, 1998). San Francisco TOD planners found out that

investors had an inclination to invest in 'cash cow' developments, such as malls and office complexes that would guarantee the investors returns on their investment in the short term, but fail to take the long term consequences into account (Boarnet, 1998). Additionally, housing developments – in terms of profit returns – cannot cope with commercial zones and shopping malls; thus, the TOD principle of mixed use and density is lost through a lack of developmental direction (Boarnet, 1998).

However the authorities in San Francisco were able to address this issue through federal development incentives and proactive urban planning – such as pedestrianization of streets and traffic slowing – which began to increase the demand for residential developments in the area, thus forcing investors to diversify and accommodate increased housing demand (Boarnet 1997). However, the problem of funding and investment can also work the other way around. In the example of Copenhagen in recent years, there has been an increase in neo-liberal developmental strategies in new sections of the famous 'Five Finger Plan' (Knowles, 2012). In the last decade, the development of the Orestad region in Copenhagen has been facilitated by private companies and investors; the state-governed TOD plan was circumvented as an issue of cost cutting, backed by the claim that development was needed in that particular area and the authorities had overlooked it (Knowles, 2012). However, upon further analysis of the developments that started to materialize in the area, it was clear that mixed income and mixed use residential development had been favored to up-market expensive lofts, catering to the trendy market (Knowles, 2012). This was at odds with the objectives of Copenhagen's planner's idea for the area. However, it showed that government's efforts to cut costs as a result of global slowdown just meant that development could not be governed once opened up to the market. It is essentially at odds with the developmental ideals of TOD; once the market gets to decide, it is going to be lopsided development towards what supports the famous 'triple bottom line'.

2.4.2 Zoning Limitations

This constraint could easily link into the fiscal barriers. However, what makes it stand out is in cases where development is governed by the principles of TOD, as zoning legislation and implementation can hamper the development of TOD nodes. We look at the example of San Francisco once more, where many zoning regimes were and still are vague and land around stations are often zoned as mixed use with no specific structure as to how development should be directed (Boarnet, 1998). Often, density allowances in the zoning schemes do not allow for the development of functional TOD nodes; they either force developers to downscale their plans or to just not invest at all (Boarnet, 1998). However, additional zoning can reflect market demands which – as mentioned earlier – is an issue with TOD; for example, in San Francisco, a survey carried out by Boarnet et al. discovered that commercial zoning of land was seen as more favorable compared to high density housing development (Boarnet, 1998). However, this is where TOD begins to contradict itself to a degree; to simply have mixed use zoning becomes a bureaucratic nightmare, as commercial zoning is also needed to spur TOD nodes at major stations and intersections. Thus, the housing component of TOD can be at odds with the commercial component, making careful use of zoning schemes necessary to strike the balance (Boarnet, 1998).

On the other hand, local communities also have some hand in terms of opposing certain zoning schemes being passed. While this might not be an issue with zoning per say, zoning schemes are reinforced by residents' association. For example, in Singapore, people living in low density housing had preconceived notions of high density residential development and exercised a fair amount of

resistance to high density development (Curtis et al., 2009). High density residential developments are often deemed by the public and by investors as a thing to avoid due to the negative stigma associated with it, thus establishing zoning schemes that are reinforced despite objections from residents.

2.4.3 Implementation Methods

This constraint may be quite context specific, but it is vital in understanding that the medium through which TOD is achieved can have a huge influence in terms of the success or failure of the development. This example especially applies to contexts where public transport is being rejuvenated or developed from scratch. Many of the following issues will resonate with the Global South in particular.

Now there are two well-known methods of facilitating TOD, which are through rail or bus transit systems. In the context of the Global North, rail systems dominate the discourse for the simple fact that they were designed for mass transit, and building on them can only further and facilitate the growth of TOD. In addition, it reduces the costs substantially, given that the infrastructure already exists. In the Global South, however, the implementation of TOD can be very constrained given a shortage of skills, resources and capital to complete big, rail mass transit projects; thus, the result of this is the formation of the Bus Rapid Transit (BRT) system in Curitiba, that has spread to many other countries around the world (Currie, 2006). Now the issue with implementing a new form of public transport is that you have to deal with a number of realities. Currie argues very well in his assessment of people's reaction to the implementation of the BRT system in Curitiba. Seeing as how the mode of transport that facilitates TOD is the back bone of the ideology, this can become a huge constraint as well, especially when introducing ground breaking ideas, such as the BRT or BTOD (Bus Transit Oriented Technology) (Currie, 2006). Currie's analysis focuses in particular on the use of BTOD, relative to the common use of rail.

Performance, Magnitude, and Implications for Development Risk

The issue is that the bus is not capable of performing at the scale and permanency that is offered by rail, and this has a knock-on effect on many factors related to TOD (Currie, 2006). Developers and land owners, for instance, might be more attracted to the permanence of rail transit as opposed to the flexibility and fickle nature of bus routes (Currie, 2006). Given the flexibility of bus routes, this greatly increases the risk of investing in transit-supportive land use (Currie, 2006). However, this does not mean that TOD is

not possible with bus routes; it just makes it harder to secure commitment from developers and land owners. However, if enough confidence is shown by planners, then there is nothing stopping the permanency of bus routes – especially in the context of BRT with segregated bus lanes. While they are not as permanent as rail tracks, there is some credence to their permanence.

'Newness'

This challenge relates to the public appeal of a transport mode. Currie argues that the California Department of Transport (CDOT) claimed that the "newness of rail systems provided an advantage over BTOD" (2006). The major issue with public perception is that if rail is introduced, people are attracted to it; they are curious and begin to use it – especially in contexts where it has never been used before – whereas buses have less appeal and often have negative connotations in peoples' minds (Currie, 2006). Additionally, given that TOD aims to change the status of land use

and the reputation of certain areas, the 'newness' factor is quite important in terms of attracting the amount of interest and innovation TOD needs to succeed (Currie, 2006).

Pedestrian Access

Creating slow pedestrian friendly spaces with BTOD can at times be quite difficult, if one compares it to rail (Currie, 2006). Bus stations often have numerous lines coming into them, and with large buses operating at a high frequency in streets with pedestrians, it can get quite hazardous (Currie, 2006). This is likely to be an issue for the bigger bus stations, which tend to be the focus of BTOD. However, not much has been done to address this, though physical interventions can be made to prevent pedestrians having to get in the way of buses. However, there is also the downside of having associated costs begin to rise, once again bringing up a constraint (Currie, 2006).

Modal Stigmatization

BTOD suffers from the stigmatization by users to a large extent. Currie finds that a large proportion of transit users valued the use of rail as opposed to bus; riders felt as though they had gained 4 to 10 minutes from their commute (2006). The issue here is if users are not willing to accept buses, then it can become quite difficult for developers to promote BTOD. However, Currie notes that developers are not really concerned with that perception, given the fact that BRT systems tend to overcome that with the appeal of the raised platform bus stops as well as the capsule design, made famous by the Curitiba BRT system.

Chapter 3

3 Case Study Precedents

This chapter aims to rationalize the theoretical concepts that were expressed in the Literature Review chapter. The focal point is to have an in depth look at the case studies that were mentioned in the literature in order to analyze the planning processes and techniques that will be used to inform my own design process. Essentially looking at the different methods of spatial configuration used, trying to look at the most relevant and useful interventions for the site that I am looking at.

3.1 Introduction

Precedent analysis is required because it gives me the ability to come up with tried and tested principles for my own spatial intervention. Theory feeds into the design process in terms of directing intervention, however there is need to be able to implement these theories through informed design practices. Considering that TOD is governing my spatial development; looking at cases that have successfully implemented the strategy is of paramount importance. However it is vital to frame the reason for the use of TOD as a development strategy. Often the contextual realities of different cases around the world define how TOD is used, thus there needs to be close attention paid to the developmental context of these cases.

The structure of this chapter, follows a very basic formula, one that looks at each case with the same lens. That is through the developmental context it was implemented in, the spatial context and the design. Each of the four major cases I look at in this chapter are based on the implementation of TOD as a means of promoting economic and residential development. I focus on **Copenhagen** as a flagship case for corridor based TOD that has defined the development technique and has continued to pioneer new groundbreaking theory and design of TOD on a global scale. Following that looking at how private investment and development can drive TOD; **San Francisco** is an example of market led TOD that managed to find the balance between public and private involvement. **Curitiba,** in Brazil then looks at how, alternative ideas towards transport modes can form part of TOD scheme, essentially without the need for expensive modes such as rail, but rather using an innovative BRT system that aims to increase the public's confidence in public transport and to do it sustainably. The final and fourth case looks at the strength of institutional cohesion and vision, through the implementation of TOD in **Singapore**.

3.2 Copenhagen: "The Five Finger Plan"

3.2.1 Origins

Copenhagen compiled an extensive transit focused plan as far back as 1947 (Knowles, 2012). Planners were anticipating the post-war (WWII) economic boom and they realized that there needed to be an organized plan based on the spread of the city, along preexisting corridors of development (Knowles, 2012). Considering how early this plan was formulated, the market economy and suburbanization were infant ideas, thus planners were able to influence these new developmental theories through planning that used balanced and equity as its focal point. This lead to the formulation of the renowned 'Fiver Finger' plan of Copenhagen. This basically refers to development along five corridors (fingers) of urban development (Figure 1), which were designated by this early form of TOD (Knowles, 2012). It was planned along preexisting suburban railway lines which were designated to be electrified to provide rapid and reliable transport directly into Copenhagen's CBD (Knowles, 2012). Every station was planned to be a focal point

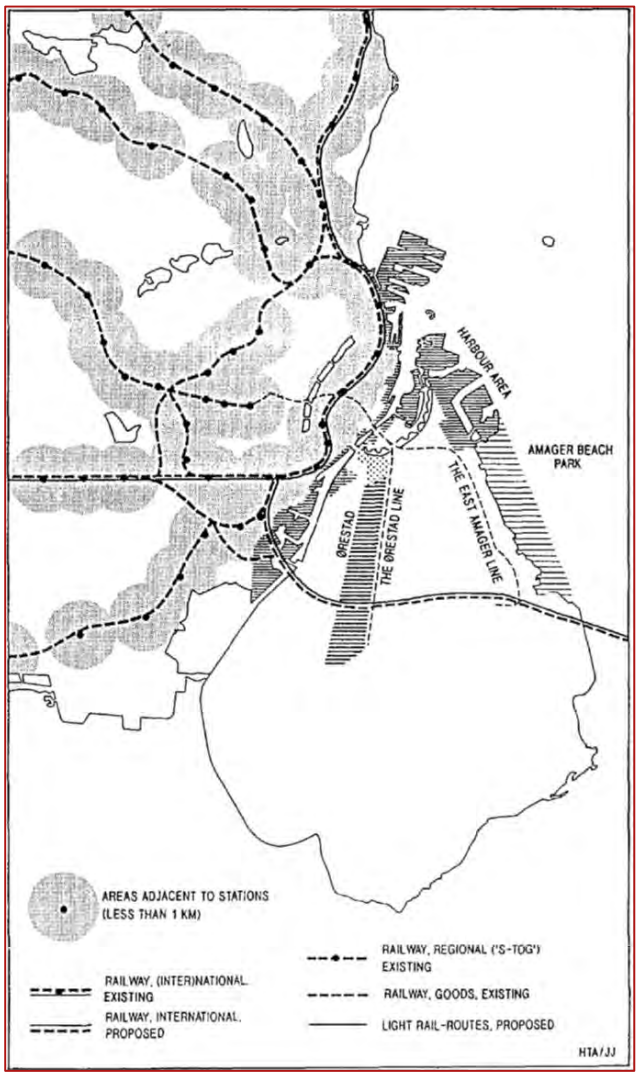

FIGURE 3.1 COPENHAGEN FIVE FINGER PLAN SOURCE: (KNOWLES, 2012)

for high density housing and contain local shopping facilities; each planned suburb would be linked to the next one and onto Copenhagen's CBD (Knowles, 2012).

Despite the focus on nodal development at stations along the developmental corridors, emphasis is still maintained in terms of using transit as a means to accessing work in Copenhagen's CBD (Figure 2). Essentially this was meant to encourage the exploitation of synergies between transport and land-use features, and Figure 2 depicts this synergy and integrated strategy between land use that was used in the Copenhagen plan, to include the CBD in this new integrated strategy (Bertolini, Curtis & Renne, 2012). This connection to the CBD is vital in terms of access to employment giving time for those nodal zones to develop. Along the these corridors of development, in the 1947 plan, empty space was designated to be developed into industrial land, this was to be done where the fingers connected with developed urban zone (Knowles, 2012). So what we see here is a rare inclusion of industrial development in

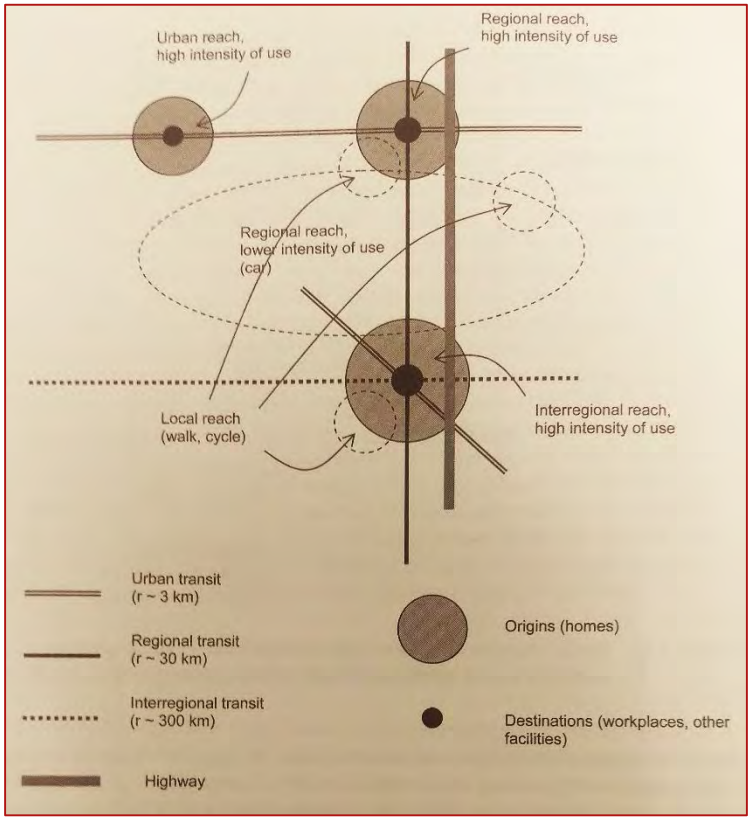

FIGURE 3.2 INTEGRATED STRATEGY OF SYNERGY BETWEEN TRANSPORT AND LAND USE FEATURES

TOD that does not often manifest in many TOD plans, as the more modern implementation of the theory focuses more on dense urban form and sustainable forms of mixed use development. However it was interesting to note, given how I have said that TOD can be quite dynamic and can vary from case to case.

3.2.2 Evolution of the Five Finger Plan

The 'Five Finger' plan has evolved as the city has grown and in 1974 it was turned into a fully-fledged Regional Plan with its basis in TOD once more. The implementation of TOD principles became legally binding, and various standards were laid out (Knowles 2012). There was the inclusion of terminal towns, large park-and-ride facilities and proposed ring roads between corridors (Knowles, 2012). However a slow in the growth of the city in terms of population and in the economy meant that the city authorities had to spur growth, thus their focus turned to a 1km radius around transit stations and in 1989 they enforced the development of light industrial and service facilities within that 1km radius (Knowles, 2012). This shift also coincided with Copenhagen getting less attention in terms of development planning as priority was given to other cities, siting a lack of urban growth and demand (Knowles, 2012).

In the 1990s Copenhagen was back in the developmental spotlight as various critical industries such as the shipyards of the city were closed, this required new links to offer employment to those areas, which the TOD plan that had been implemented in the 1980s managed to address. Not only was deindustrialization affecting the city but out-migration of wealthier families was proving to be an issue that was eroding the tax earning of the city (Knowles, 2012). With this TOD was called upon once more in the development of Orestad New Town (Figure 3) that continued with principles of TOD but controversially ushered in the era of neo-liberal economic

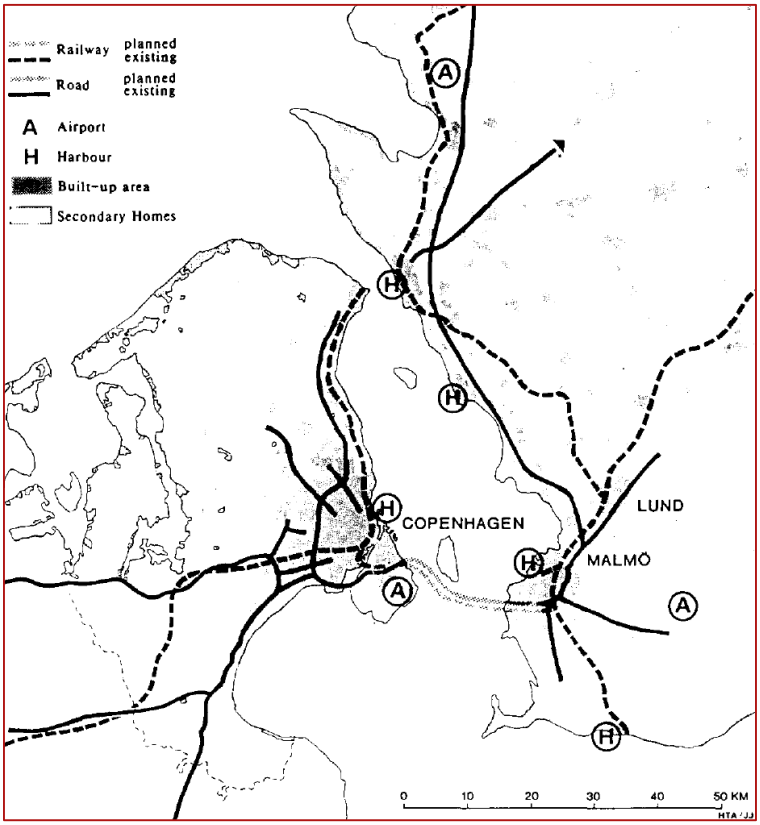

FIGURE 1.3 EVOLUTION OF THE FIVE FINGER PLAN SOURCE: (KNOWLES, 2012)

development in Denmark that saw the city shift from its social democratic welfare-oriented perspective (Knowles, 2012).

3.2.3 Conclusions

The origins of TOD in Copenhagen I argue; show admirable amount of foresight from the authorities to recognize trends and responding to the pro-actively and embrace the development and dynamic and flexible developmental plans that address the changing needs of growing cities. This is one example that major cities in developing countries can learn from, given the need for cities in developing countries to adapt to rapidly changing economic and social circumstances. Hence next we look at the origins of TOD in a developing country's context.

3.3 Curitiba: The Affordability Model

3.3.1Origins

The famous, Bus Rapid Transit system of Curitiba in Brazil. Most of the literature hails this as one of the most significant public transport innovations of the 20th Century. It essentially transformed the notion of public transport in the context of the Global South but also for the Global North, that is how effective its implementation and design has been. Its major appeal in the Global South discourse is that it addresses the aspirational ideologies behind many public transport projects. During the 1960s and 70s many developing countries were aspiring to build advanced public transport systems modelled after major European cities and to a limited extent American model (Cervero, 1998). That meant investment into big, complex public transport systems based on expensive rail and underground infrastructure. In Brazil this was the case with many cities during the 1970s, a federal investment grant was supplied to improve public transport infrastructure, throughout Brazil (Lindau et al., 2010). At this particular point in Brazil's history many public institutions and organizations were fragmented and lacked any sort of cooperation, with

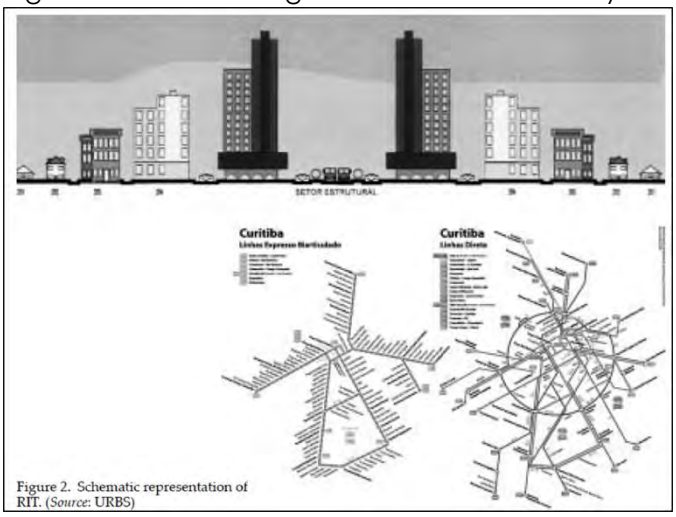

FIGURE 3.4 CURITIBA MASTER PLAN SOURCE: (LINDAU ET AL., 2010)

municipalities battling each other for funds (Lindau et al., 2010). What the Curitiba authorities managed to achieve during this time was institutional cohesion, using the federal funds to direct development in busway corridors to direct its future growth (Lindau et al., 2010). The Institute of Research and Urban Planning of Curitiba (IPPUC) and the Urban Development Authority of Curitiba (URBS) formed a partnership that saw IPPUC be in charge of formulating the spatial plans and determining which development corridors were ripe for development and the UBRS was in charge of implementing these plans in the city of Curitiba (Lindau et al., 2010). However what makes this truly unique, apart from the institutional unity and cohesion, was the fact that, the affordability and sustainability of the project led to other smaller cities in the metropolitan area of Curitiba, following by example and implementing regional plans that allowed for the strip development that we see today (Lindau et al., 2010).

3.3.2 Forming the Planning Visions

The evolution of the Curitiba plan started as early as 1943 and came into maturity in 1965. This section looks at how those plans were formulated and what values and principles were instilled into them (Quade, Douglas &Cervero, 1996).

1943 Agache Plan

This plan was a result of the post-war building boom that gripped the global economy. Just like the Five Finger plan in Copenhagen, the expectation of rapid economic growth led planners to consider new ways of developing cities. The Agache Plan predicted that private transportation would grow rapidly, reiterating the need for grand boulevards and massive overpasses (Quade et al., 1996). One plan suggested widening the city's main road my 60m which would have destroyed some of the largest and oldest buildings in the city (Quade et al., 1996). To improve circulation a hub-and-spoke road system was suggested, in order to link the sprawling suburban areas with the CBD of the city (Quade et al., 1996).

It is vital to note that, the Agache plan was formulated during a time of massive growth as I mentioned earlier, however additionally, Brazil had access to cheap oil, and its ascendency in terms of automobile manufacture, meant that many urban planners were focusing on how to best serve private transportation rather than looking towards public transportation. During this same period, cities across Brazil were already implementing these new modernist planning ideals, most notably, the new Capital Brasilia (Quade et al., 1996).

Curitiba Master Plan 1965

The Agache plan was obviously a no go for the Curitiba authorities, the sheer expense meant that the city could never afford such a massive plan. The Curitiba authorities needed a way to address the rapidly growing city; thus they decided to hold a competition that would see the winner being the 1965 Curitiba Master Plan (Quade et al., 1996).

This plan was meant to limit the sprawling development of Curitiba, to certain defined axes (or corridors) of development. The city had decided to adopt a linear mode of development, which would put the mobility needs of people above those of automobiles (Quade et al., 1996).

Mobility routes would be vital to facilitating development along predefined corridors stemming from the CBD of the city. The CBD would be kept as an exclusive pedestrian zone with emphasis on passenger transit and active street edges (Quade et al., 1996). These development corridors would function as high density pathways for new growth (Quade et al., 1996). However the big question was how to achieve this corridor development effectively and most importantly affordably.

3.3.3 Implementation of the Vision

Integrated Transit Network (RIT)

The RIT was the main tool that would be used by the Curitiba authorities to achieve their vision of the 1965 Master Plan. It takes into the needs for linear, corridor development with an emphasis on hierarchy of land uses and transport modes.

The RIT started out as a municipal incentive but then spread to a metropolitan-wide basis. The RIT seeks the integration of transport and land use in the metropolitan area in order to promote the development of TOD in Curitiba (Lindau et al., 2010). The RIT was conceived around a structural axes that provide the backbone of TOD through the use of relatively low-cost and high impact interventions (Lindau et al., 2010). Thus the BRT system was introduced with segregated bus lanes and raised platform stations along trunk routes, while feeder routes were given flat rates and access to the trunk routes was normalized by the flat rate, meaning integration of different transport modes in the RIT system. Development around the major trunk route stations was planned so as to reflect the principles of TOD with mixed use development radiating outwards. The side blocks along the major trunk route stations are zoned as mixed use high density development; blocks further away from the trunk or 'trinary' road system are zoned for lower density (Lindau et al., 2010).

Trinary Road System

This was vital step in facilitating the growth of development corridors in Curitiba. The function of this system was to integrate mass transit, roadways, and land uses (Quade et al., 1996). Figure 5 shows a top-down view of this system in practice, in Curitiba (Quade et al., 1996). Segregated bus lanes placed centrally through development corridors offer a high-capacity mobility route through the corridor, with transfer points that link to development corridors between each other (Quade et al., 1996). The central bus lanes a flanked by two local one way roads that function as auxiliary lanes, providing access to building fronting the bus lanes (Quade et al., 1996). This trinary road system, stretches for about 10 to 15km from the CBD of Curitiba, which basically means the entire length of the five development corridors that make up the RIT in Curitiba (Quade et al., 1996).

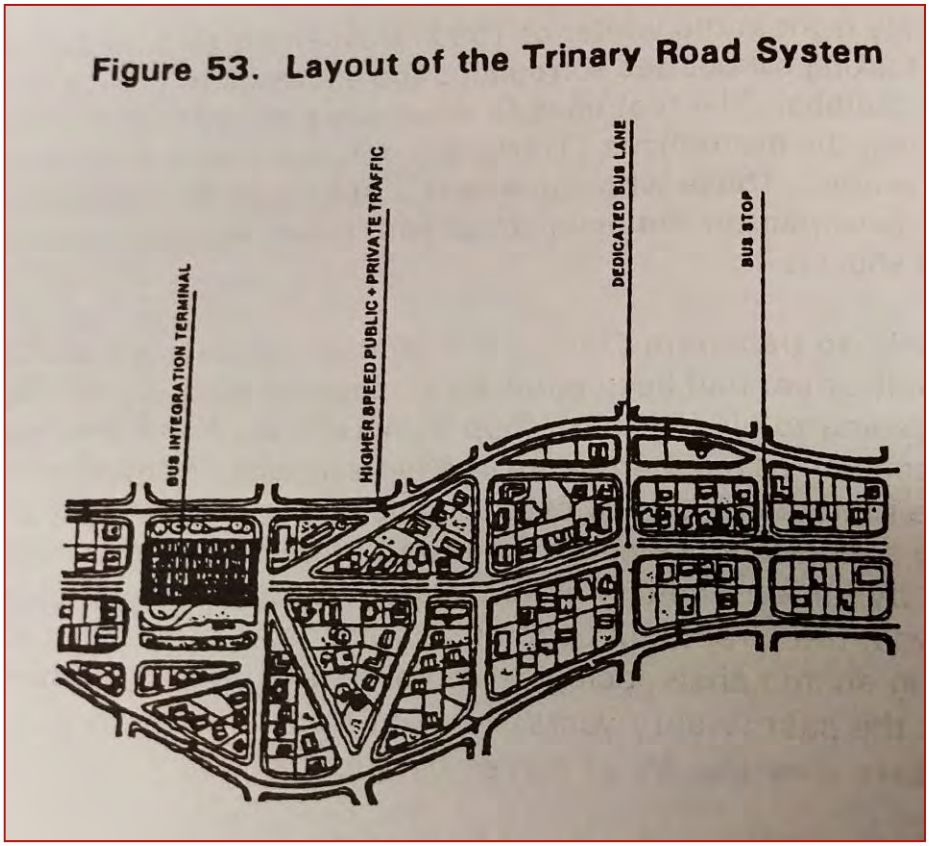

FIGURE 3.2 TRINARY ROAD SYSTEM OF CURITIBA SOURCE: (QUADE ET AL., 1996)

Now having an efficient mobility system was not the only precondition for TOD in Curitiba, the trinary road system imposes a hierarchy of land uses that radiate outwards from the segregated bus lanes (Quade et al., 1996). Figure 6 shows a cross-section of the trinary road system, along with the land use hierarchies that are associated with it. Fronting the segregated bus lanes (essentially the core of the cross-section) land use is focused on high density retail use, which in Curitiba has manifested in the form high rise buildings (Quade et al., 1996). With retail and offices taking up the first few floors, followed by housing. This high density fronting in combination with the high capacity buses and lanes has led to the massive uptake of the BRT system in Curitiba considering that retail and offices are available within walking distance of BRT stops (Quade et al., 1996). This is essentially TOD in its raw form, catering to the servicing of commuters with high activity nodes at stations and along mobility routes, while providing incentives for ridership through efficient and predictable transport modes.

Radiating outwards even further, as shown in Figure 6 we reach the so-called 'housing zone' that sits just outside the development corridor but within walking distance (Quade et al., 1996). Here densities tend to begin to fall, in comparison to the high rises that front the bus lanes, Curitiba has developed 8 to 12 story condos. Further out you get low rise garden apartments and zero lot line structures such as row houses or duplexes (Quade et al., 1996).

It is important to note that the trinary road system was the main way by which Curitiba was able to achieve TOD, focusing on affordable and sustainable planning practices, which worked with the existing development corridors. However there was a considerable amount of

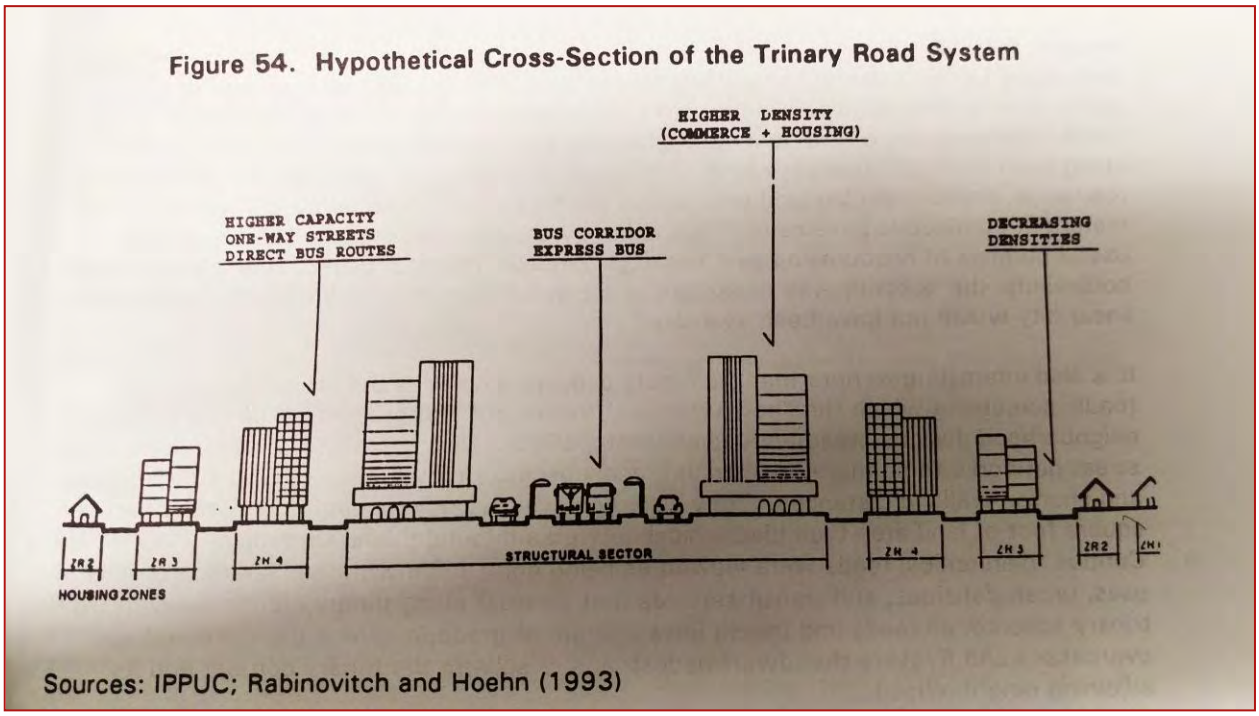

FIGURE 3.3 CROSS-SECTION OF THE TRINARY ROAD SYSTEM SOURCE: (QUADE ET AL., 1996)

Land Use Regulations and Supportive Policies

Considering the political environment that presided over the implementation of the 1965 Master Plan, leading to a very authoritarian style of implementation, there was drastic changes made land use regulations in the form of zoning and changes to housing policies.

Mixed Commercial-Residential Zoning

All parcels of land within two blocks of the trinary road system have been zoned for mixed commercial residential uses (Quade et al., 1996). Zoning regulations require at least 50% of the ground and second floor of buildings fronting the bus lanes must devoted to retail and commercial uses (Quade et al., 1996). Additionally above the second floor buildings are required to be setback by 5 meters so as to cast a shadow on auxiliary lanes, transit ways and most importantly sidewalks (Quade et al., 1996).

Residential zoning regulations have been relaxed within the less dense periphery of the development corridors. The reason for this being that, there was recognition that there needs to be a level of service afforded to the less dense areas; services such as grocery shops, bakeries etc., in order to create a more fine grained urban fabric, and to not lead to congestion of the core activity areas, as a result of resident of less dense areas coming in for services (Quade et al., 1996).

Transit Supportive Housing Policies

Land acquired by the City of Curitiba along developmental corridors from private developers, the city has been able to develop new community assited housing to transportation corridors (Quade et al., 1996). Housing an estimated 17 000 lower-income families (1993 figures) over a period of 25 years. Offering access to efficient and rapid transport by placing these community housing initiatives on the periphery of development corridors.

Another program that has been implemented is the "buy up' program, which is essentially an incentivization program that allows developers to buy extra floors of residential space, by contributing to the Municipal Housing Fund (Quade et al., 1996). These funds are then used by the municipal housing authority to fund the development of low-income housing within the 'housing zone' of the trinary road system (Quade et al., 1996). This housing initiative is a novel idea that speaks to the Just Cities normative position, and is an admirable attempt at mixed-income housing in the TOD context.

3.3.4Conclusions

The evolution of the TOD development plan in Curitiba continued through the 1980s and 1990s. During the 1990s the new 'Green Line' was introduced as a new developmental corridor, that takes full advantage of the evolved BRT concepts, such as cleaner vehicles and fuels, along with more sustainable materials being used in station constructution (Lindau et al., 2010). This change in focus along environmental ideologies, is also reflected in the zoning and development processes around the stations and trunk routes. It the Green Line will provide the basis for massive urban renovation in the city, the perceived benefit of the TOD agenda is reflected in the rising property prices along the development corridor (Lindau et al., 2010). We see that this evolution of the TOD narrative is similar to what happened in Copenhagen during the same period, thus there is a steady evolution in TOD discourse towards the end of the 20th Century. This trend has continued into the 21st Century, although it is important to note that this trend does have a worrying aspect to it, which is discussed in the limitations section of the review. To briefly mention it, this increasing trend to 'renovate' inner city areas suffering form out-migration, tends to take a neo-liberal approach, this was the case in Copenhagen as I mentioned and seems to be apparent to a limited extent in Curitiba as well. More on this in the limitations section of this review.

3.4 Singapore: Institutional Cohesion

3.4.1 Origins

Singapore is known for its highly efficient mass transit system (MRT) that has managed efficient and land use planning in conjunction with quality housing development (Curtis et al., 2009). Urban growth in Singapore has been highly influenced by a unique mode of planning and development of new towns, integrating land use with the MRT; such as the idea of a ring shaped city and the principle of TOD in new town development (Figure 7) (Curtis et al., 2009). This strategy was introduced in a city-wide plan in 1971, when levels of private car use was reaching

unsustainable levels; the rapid economic growth during the 1960s had created an aspirational society that saw public transport as undesirable and a sign of being of lower social standing (Curtis et al., 2009). The 1971 plan included three transit lines parallel to four development corridors that created links to a concentration of urban cores, regional centers, sub-centers and new peripheral towns (Curtis et al., 2009).

3.4.2 Forming the Planning Visions

The first MRT system was developed in 1987; providing Singapore with a strongly articulated density distribution, pedestrian environment and transit ridership, which had effectively integrated the practice of public transit operation, land use planning and urban design (Curtis et al., 2009). However historically this TOD plan was a long time in the making. During the economic boom of the 1950s and 60s the Singapore government was focused on providing housing and employment so public transport was put on the back burner while those issues were addressed (Curtis et al., 2009). Hence this lead to major congestion problems in the 1970s that lead to the formulation of the MRT plan in 1971 that was implemented in 1984 with the MRT system. However TOD was not introduced into the plan until the early 1990s (Curtis et al., 2009). The 1991 'Concept Plan' (Figure 7) for the realization of TOD in Singapore was drawn up that built on the 1970 MRT plan; it was at this phase that TOD was introduced and 3-line MRT system was selected and developed (Curtis et al., 2009). New town developments as well as urban density were distributed along the transit lines (Curtis et al., 2009). This new plan also realized the initial 1970 MRT plan's radial urban corridors that connected hierarchical urban development nodes of the CBD, regional centers and sub-regional centers (Curtis et al., 2009). This new concept plan in conjunction with the MRT plan of the 1970s led to the realization of TOD and the increase of housing densities in Singapore (Curtis et al., 2009). The satellite plan saw density in the CBD decrease from 418, 325 p/h in 1975 to 166 p/h in 2003 (p/h= Persons per hectare) (Curtis et al., 2009). Thus the spread out urban areas as a result of a surge in private car ridership in the 1970s was densified through the use of satellite TOD implementation through the concentric ring urban plan in the 1991 Concept Plan.

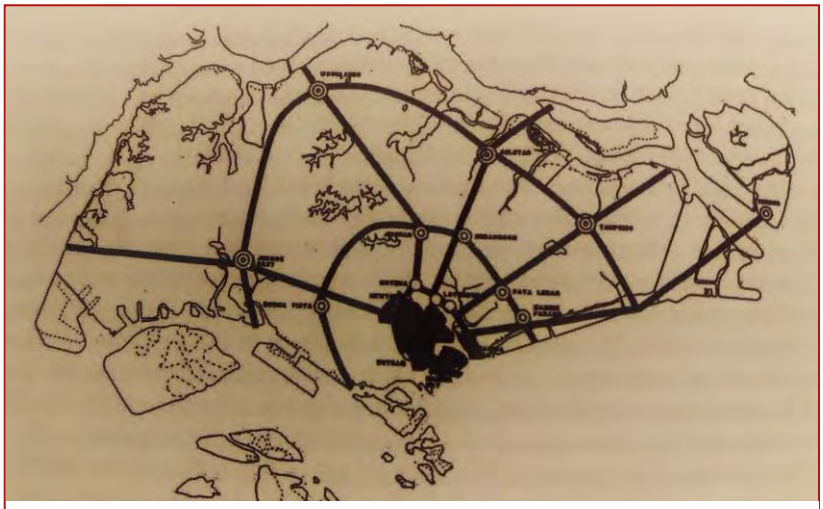

FIGURE 3.4 1991 CONCEPT PLAN FOR SINGAPORE SOURCE: (CURTIS ET AL., 2009)

However apart from changing the population densities of the satellite cities in Singapore, the Concept plan, also shaped the evolution of Singapore's CBD.

Evolution of Singapore CBD

With the focus of high density urban development being focused at the periphery, the CBD began to respond to the principles of TOD, by becoming a node of service based land uses (Curtis et al., 2009). Thus the decentralization and densification of the satellite cities had the effect of opening up the CBD for more service specific land uses, additionally the use of the MRT system meant that accessibility into the CBD was easier than ever before and the lack of congestion and private car use meant the densification was possible (Curtis et al., 2009). Additionally Singapore seems to be changing the trend of the past decade whereby TOD is facilitated by private equity groups and property developers; the recent resurgence of the CBD as a service hub was in conjunction with government incentives to repurpose the now accessible CBD (Curtis et al., 2009). The public agency known as the Housing and Development Board, is actively helping govern planning and execution of urban transportation and housing developments, (Curtis et al., 2009), offering the strong institutional and legislative backbone that influencing land use requires; Singapore being a middle income country has benefited strongly from having an organized institutional and legislative system in order to be able to facilitate and regulate TOD in its satellite cities and CBD. This is often not the case in the Global South, we have seen for example how in Brazil how Curitiba was the exception to the rule, the combination of municipal foresight and rare institutional cohesion lead to the creation of a flagship TOD program not just for the Global South but for the Global North as well.

3.4.3 Conclusions

TOD in the context of Singapore show the importance of institutional and legislative organization in order to be able to plan but most importantly to implement a program of TOD. The absence of many countries from TOD literature shows that, it is a developmental ideology that requires cooperation on so many levels which, without a coherent system the ideology would fail to flourish.

However it goes without saying that for Singapore to reach this level, other objectives had to prioritize especially through the 1950s and 1960s when providing housing and employment was a major objective.

3.5 San Francisco: Public/Private Partnership

3.5.1 Origins

In North America the concept of TOD was a result of studies conducted on its transit systems in various municipalities around the country. Boarnet et al. focus on the city of San Francisco; given the nature of its extensive transit network, during the 19th Century, with their famous tram system (Boarnet, 1998). The first transit review was carried out during the 1970s; it was used to analyze the impact of transit stations on land uses in the metropolitan areas of San Francisco (Boarnet,

1998). Given the socio-economic pressures of the decade, the municipality was looking to increase the ridership of its public transport networks, in order to decrease traffic congestion and air pollution. The investigation found that the newly developed Bay Area Rapid Transit (BART) light rail system made some optimistic assumptions about economic development around the BART stations (Boarnet, 1998). During the planning process it was assumed that stations would become hubs of activity given that they are the contact points for riders, however the reality was very different. Many of the stations were located in low density suburban areas that suffered from low ridership numbers would be left baron and relatively low in development activity (Boarnet, 1998). Stations with high volumes of foot traffic were found to accommodate mostly commercial activities with very little to know residential development (Boarnet, 1998). Furthermore private car usage was high thus most working commuters were travelling directly to work, that was situated in a transport hub, which showed that suburban residents still preferred their own private transport (Boarnet, 1998).

With the conclusion of this analysis in the 70s it was concluded that if development of transit stations was left to the market, it would leave development too vulnerable to a vast number of externalities (Boarnet, 1998). Thus a number of suggestions were made to transit stations developments in order to facilitate for more organic and balanced development; involvement of government in transit station development promotion, rezoning policies to be adjusted to focus on more mixed land use focusing in particular on residential development incentivization (Boarnet, 1998). These suggestions and proposals lead to the formation of TOD that is most commonly practiced in North America; mainly focusing on rehabilitation of light transit lines in addition to expanding existing lines, and rejuvenating failing transit districts with affordable and desirable residential developments, essentially shifting form low density residential to high density and mixed income residential (Boarnet, 1998).

3.5.2 Formulation of a Cooperative Public/Private Partnership

Despite the attempt to unify zoning practices in order to encourage a more coherent land use pattern in the San Francisco Bay Area, the mid to late 1990s saw a fragmented planning structure develop (TCRP, 2004). TOD was being implemented by different private and public agencies by different Bay Area governments, leading to extremely fragmented TOD plans. In isolation these fragmented TOD plans were successful however on a regional or city scale, there was no unified vision for connecting these effective 'islands' of TOD in the Bay Area (TCRP, 2004).

The San Francisco Bay Area is comprised of 9 county governments, more than 40 transit agencies, 100 city governments and several non-profit organizations and property developers (TCRP, 2004). Since the first attempt at a cohesive regional development strategy in the 1970s, there has been limited but never the less important strides made in terms of coordination and cooperation between all these governing and developmental bodies. What is most vital to my project is how all these agencies and governmental bodies came together to form the Association of Bay Area Governments (ABAG), an amalgamated body of governmental and developmental agencies that would attempt to form a regional transport plan for the San Francisco Bay Area (TCRP, 2004). The ABAG in its initial role provided guidelines for land use,

housing, economic development, and environmental planning for the various authorities in the Bay Area, however, the real decisions on land use and zoning were still left to the individual authorities to decide, without any considerable input from the ABAG (TCRP, 2004). This lack of input lead to the ABAG starting the Smart-Growth Initiative in the early 2000s, that looked to create a common developmental vision for the Bay Area (TCRP, 2004).

The Smart-Growth Initiative was a cooperative process between the ABAG and five other regional agencies (Bay Area Air Quality Management District, the Bay Conservation and Development Commission, the MTC, the Regional Water Quality Control Board and the Bay Area Alliance for Sustainable Communities) that approached communities and stakeholders across the Bay Area, to form a series of workshops (TCRP, 2004). These series of workshops ended up informing the key smart-growth policies for the Bay Area, that saw TOD take center stage in the developmental vision of the region (TCRP, 2004). Thus the ABAG shifted from providing rigid zoning and land use guidelines, to offering population projections, housing and commercial land use balancing and improved urbanization techniques such as preservation of open spaces and focusing urban development in transit-accessible areas (TCRP, 2004). There was essentially a platform that was created, were public, private and civil society sectors could effectively 'plug' into for ideas around TOD. Thus by orienting most of its advice towards a common developmental vision and TOD; ABAG was able to, for lack of a better word, clandestinely bring together the fractured Bay Area together under one common developmental vision.

3.5.3 TOD and the Smart-Growth Initiative

The Smart-Growth Initiative began to influence transport developments in the Bay Area, before it was even fully implemented in the year 2000. The engagements and workshops, with stakeholders and communities had already alerted the authorities of the need for a coordinated plan for the San Francisco Bay Area (TCRP, 2004). Most notably that transit agencies that run within the Bay Area, were paying close attention to the policies around TOD and mixed-land uses. The Bay Area has more than 40 transit agencies (shown in Figure 8). These agencies provide bus, light rail, cable car, streetcar, heavy-rail, commuter-rail, and ferry (TCRP, 2004).

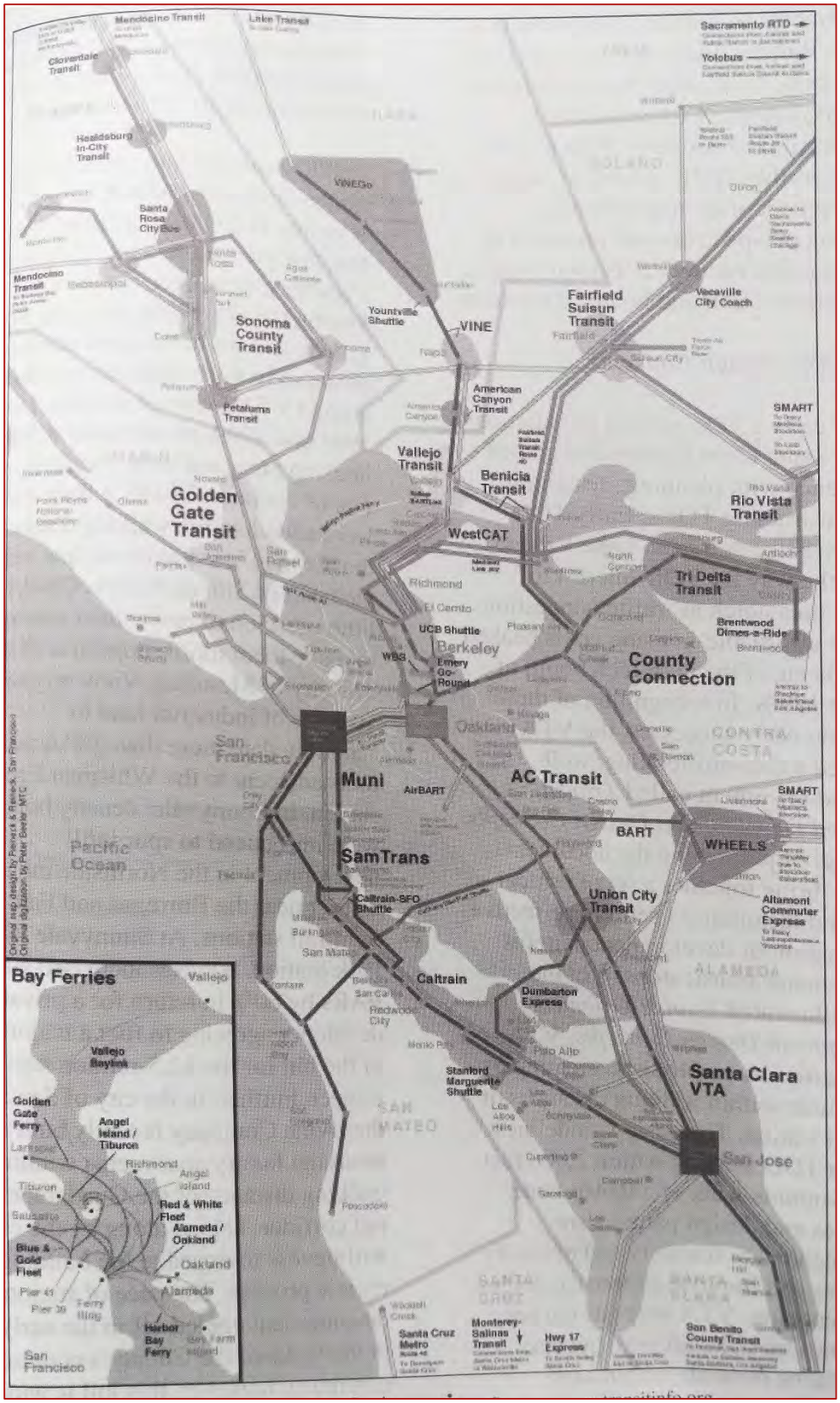

FIGURE 3.5 SAN FRANCISCO TRANSIT SYSTEM SOURCE: (TCRP, 2004)

Now having this diversity of transportation nodes, makes the San Francisco Bay Area one of the most accessible and transit oriented cities in the world, however when it comes to planning and TOD development, this complexity and variety leads to bottle necks delays and disputes. However on the other hand in terms of TOD having multiple transit services creates numerous opportunities for intensifying development close to bus and rail hubs (TCRP, 2004). Preceding the Smart-Growth Initiative, the major transit agencies in the Bay area defined their own TOD principles and guidelines (TCRP, 2004). This lead to very fragmented implementation of TOD in the Bay Area, were you had isolated pockets of successful TOD projects, that did not fit into the greater regional scheme of things, as I mentioned earlier. However with the creation of the Smart-Growth initiative that focused on TOD development, around sustainable development practices, emphasizing compact urban development with transport hubs serving as mixed use and mixed density zones to facilitate commercial and residential development. The two largest transit agencies in the Bay Area (VTA and BART), in line with the Smart-Growth Initiative began to look at more collaborative ways to develop TOD projects.

VTA and BART Collaborative Development Projects

In the early 2000s under the influence of the Smart-Growth Initiative the two largest transit agencies in the Bay Area decided to take a more collaborative approach to transit development in their respective areas. This meant that there was a radical shift, in terms of how transit routes and TOD nodes were planned in relation to each other, but also in terms of the agencies and stakeholders involved in individual projects, combining private investment and public funding.

VTA TOD

The VTA worked on a collaborative project with the city of San Jose to make use of wasted space around light rail transit stations (TCRP, 2004). This idea stems from the development design concepts that VTA created in response to the Smart-Growth Initiative; giving particular emphasis on creating mixed uses within walking distances of a transit station (TCRP, 2004). Densities and land use patterns are sued to intensify and diversify land uses and improve pedestrian access and circulation. With these principles in mind the first collaborative project saw the VTA team up with federal government to utilize a 1,100 space parking lot at a light-rail station for a housing development (TCRP, 2004). However limited private investor interest led to the project being developed by an affordable housing organization, which would allow VTA to keep the proceeds from the land sale. VTA and the affordable housing developer, at first began to experience a high amount of resistance from the NIMBYs in the area, however given the nature of the collaborative project, this was quelled through strong community involvement and support from advocacy groups that saw the potential of TOD and affordable housing (TCRP, 2004). Thus VTA was able to reach out and break down the silo nature of TOD in the Bay Area and bring interested parties together (private and public) to achieve TOD. The final development density measured in at 27 units per acre (TCRP, 2004). This shows that even in a fragmented regulatory environment collaboration and a unified vision can be achieved. The same applies for my

project site, although there is a simpler municipal structure, some of the challenges do apply, as I will discuss in the conclusion.

BART TOD

BART has taken a more conservative approach to TOD. Although its principles do not differ from VAT, BART chooses to focus more specifically on hierarchy of priorities, putting pedestrians first and foremost, then cyclists, buses then private vehicles through park-and-ride systems (TCRP, 2004). However the way BART seeks to achieve this vision, differs markedly from VAT. They cooperate more with private developers and focus on local interests rather than regional connections. BART sees TOD mainly as a means of increasing patronage of its services; this has translated to development that is focused mainly on commercial land uses rather than encouraging mixed use development (TCRP, 2004). Most of their TOD projects feature large retailers that attract pedestrian traffic, but only serve as commercial zones, thus not addressing the use of private transport directly; many of BART's TOD developments have used a one for one parking policy, which is at odds with the Smart-Growth Initiative (TCRP, 2004).

However the attempts of BART to reach some form of collaborative project, has manifested in a reactionary form of TOD planning, were BART has engaged with local government and residents to identify what they want from a TOD project, and if TOD can address and provide the services that they lack (TCRP, 2004). This is a more tentative form of collaboration that seems to be geared towards attracting investors willing to address a certain niche market, rather than looking to promote TOD and improve regional circulation and land use patterns.

3.5.4 Conclusions

We see that the sheer scale of the San Francisco Bay Area poses some unique challenges to TOD in the metropolitan area. Institutional fragmentation has plagued one of the most well connected cities in the world, which seems like the ultimate irony. However as I have shown, initiatives to mend this fragmentation have been found by creating a unified vision, that bring together the private and public interests that operate and define transportation in the city. I have shown how one transit agency choses to address TOD from a ground-up approach, choosing to stick to principles, over private investment, however still maintaining enough market attraction to promote development. While other agencies choose to rely on market forces and commuter demands in order to implement TOD. Both methods look at bridging the gap between public and private investment in TOD. With respects to the context of my project, the legislative and developmental context is not as complex, however it does suffer from its own fragmentation, through municipal, provincial and national government policy fragmentation. Examples can be taken from San Francisco to solve those issues of fragmentation not to mention, including the private sector in TOD development.

3.6 Conclusions

Some important lessons that will be carried forward will focus on the strengths of each case that was looked at. Through the analysis of the literature, there has been a clear trend in terms of certain cases excelling in different aspects of TOD implementation.

In the Curitiba example, the most vital aspect of that case looked at the sustainable transit model of BRT. The expansion of activity transit corridors in coordination with applicable high density land use planning along the transit corridors resulted in an efficient and highly accessible TOD development. In Copenhagen there was a clear emphasis on regional development of TOD and creating framework that support the expansion of the developmental technique on a regional scale. Simplifying the planning process in order for it to be implementable on a regional scale. In San Francisco public and private partnerships were forged in order to overcome the bureaucratic grid lock by collaborating to facilitate TOD. While in Singapore public institutions were streamlined, and regulations around property development and car ownership were adjusted in order to promote TOD development.

Chapter 4

4 Methodology

4.1 Case Study Research and Associated Project Work

This chapter looks at the research methods that have been used to assess the use of TOD as a developmental medium in the Bellville CBD. The methodology is based on two major methods that will relate to each other in order to create a solid methodological foundation for this research project. The research methods that will be used are as follows:

- Case Study Based Research
- Participant Observation and Interaction

These two research methods have been selected in order to gain a comprehensive spectrum of data to inform the implementation of TOD in Bellville. Each method will link into each other by building on information found or trying to fill in the gaps that appear as is common in research projects based on literature and empirical evidence. These methods have also been chosen because of the limited amount of time available for this project. The reasoning for each of the methods being selected will be based on the suitability of the type of research being conducted and the context which currently exists.

The structure of this chapter will be as follows; each research method will be briefly defined and contextualized within research methodology literature, following that the reasoning behind the choice of research method will be discussed. This will ensure that the reader is aware of the thought process and rationale behind my choice of research methods.

Each research method will be substantiated with the necessary techniques in order to attain the desired information. I will be describing the specific techniques that will be used to identify and evaluate the information that I will be seeking. Some of the techniques may overlap and be used interchangeably between the two major research methods. This is desirable as information will be layered and viewed from more than one perspective in order to give depth to the information that will be attained.

4.1.1 Case Study Based Research

This form of research has come to be favored in many disciplines for many reasons. The ability of one to assess their research topic against past examples and to pick out the valuable lessons learned in addition to the shirt comings of past projects, has the potential to offer insightful information about the topic being researched. This comes to the fore particularly in the planning discipline, were having precedents and past examples is the difference between a good and bad plan. Being able to compare contexts of a spatial character allow the planner to make

decisions based on past mistakes or improvements. Robert Yin states that this method allows one to maintain a holistic and real-world perspective of the research project and to keep it grounded in the past and present context (2013).

Having a holistic perspective of one's project, is especially important when it comes to the planning world. My research project looks at being solution oriented, tackling issues that exist within my project area. Thus being able to tap into past projects and research around TOD, by using the Case Study Research method is vital. I can take examples and theories from Case Studies and assess their suitability in the context of my project. Issues that arise from those case studies can be identified and assess in terms of whether they would be an issue in my context or not.

However in order to start making those connections and conclusions, we need to first look at the basics of the research method that has been chosen, following that I will be going into detail about, how case studies will be chosen, basically describing the criteria that will offer the best results for TOD.

Definition

The Case Study Research method uses the study of past examples in order to contextualize a given research topic and to provide a real world example of a particular research topic in operation. Yin uses the following working definition to define the research method,

> *"The essence of a ease study, the central tendency among all types of ease study, is that it tries to illuminate a decision or set of decisions: why they were taken, how they were implemented, and with what result."* (Yin, 2005)

Essentially what this means is that, the issue that one studies has to be explained within the spectrum of present examples. Thus looking at my project, investigating the use of TOD, there is a clear need to investigate how a decision can impact a certain area. There are many documented examples of TOD implementation around the world, thus by picking out key aspects, focusing on those "decisions" and evaluating the "actions taken" in order to have a comprehensive idea around how TOD works in the present day as well as in the past context. Reasoning being with such a broadly based project, such as TOD, there is a need to look at differing examples on a comprehensive level; with broad projects, case studies offer a best practice vision as to how TOD should be implemented, however as was discussed in the previous chapter, TOD can be very dynamic and can differ drastically from project to project.

Case Study Selection

Selecting the appropriate case study will fall within a number of criteria. There needs to be commonality between the cases that will be analyzed and the current project that is being investigated. This can be a challenging task if some form of structure is not setup to define the type of case study that I will be using to conduct my research. The main criteria are as follows:

- Common developmental context;
- Spatial commonality;
- Compatible theoretical context.

With these four criteria the selection of case studies to focus on will be streamlined and constantly compared against these criteria.

It is however important to note that, not all examples will be able to reflect the preconditions of my current project in Bellville, there will be some cases that will be looked at as best practice examples, to have examples of development that will be used as objectives or visions for development. As discussed earlier the case study method can both inform and influence the direction of the project essentially gathering information one can build on.

Common developmental context

Focusing on case studies that are based in a common developmental environment is vital in terms of maintaining a common aspect of what needs to be achieved in terms of investigating the use of TOD. There needs to be a focus on looking at examples that can relate to the topic at hand. As obvious as this may seem this is a vital point in terms of framing the research within a common understanding. There is no use at looking at cases that do not apply to the developmental context I will be working in.

This will include involving cases that are based in the global south, in addition to the use of TOD in a developmental capacity. Having commonalities in most of the cases that will be looked at will be beneficial in the sense that common challenges will have been faced thus allowing the research to produce solutions that have been tested in real world situations.

Spatial Commonality

Making sure that the cases match the spatial context of the research area that is being considered. The cases need to match the scale and developmental extent that is being investigated. Additionally focusing on transport means that are similar aids in the assessment of initiatives that can be introduced according to different transport nodes. Additionally looking at the differing levels of uses in different cases allows me to be able to get a clear picture of the needs of my particular area. There is no use in looking at a project that spans a metropolitan scale as extensively as I would look at a local plan. This is the flexibility that case study research provides, it focuses on providing the researcher with the information that is needed by maintaining a common context.

Compatible Theoretical context

As this may seem obvious enough, the cases the need to be looked at must be from the theoretical context of TOD. This is vital as conclusions and summaries that are drawn through the case studies must be assessed through this theoretical perspective. It is no good looking at cases that focus on developmental means that do not include TOD. The cases looked at need to extensively follow and be grounded in the ideals of TOD in order to be able to adequately apply information derived from these cases to the project that is being looked.

4.1.2 Participant Observation and Interaction

The second major research method is focused on observing and creating a knowledge base of the project area that is being studied. Attaining a lived experience of the chosen site allows me to have a more realistic view of the possibilities of TOD in my site. In addition to that, interacting and experiencing the project site on the ground, gives me a better idea of the interventions that need to be made. Thus in combination with information gathered via the case study method, having firsthand experience of the site allows me to combine these two research methods to produce interventions and plans that reflect the actual needs of the project site.

However observing is not enough, there needs to be interaction with the site in a number of ways. First of all, seeing as I am focusing on TOD, I need to have a good understanding of the commuter experience. What challenges are faced, journey times, convenience etc. in addition to the commuter experience I need to have firsthand experience of the economic challenges that businesses face in the project site area. I have chosen to use an open ended interview session in order to find out the nuances within the project site.

In this section I will be outlining how the participant observation and interaction will be carried out. Focusing on the reasoning behind choosing to experience the commuter experience and to interact and interview with local formal businesses and traders. Additionally I will be looking at criteria that I will use to select interview candidates, and businesses to focus on.

Commuter Experience

The principles of TOD discussed in the literature review, require that commuter experience be a focal point of implementation. The success of TOD relies on the swift and reliable commuter experience in order to foster development around transit hubs. Thus my choice to experience the reliability and speed of transit systems around the project site. Considering that the project site, Bellville Interchange, is a key multimodal transport intersection for Cape Town, these findings will be vital in terms of justifying a TOD intervention in Bellville. The major transport modes that I will be using are as follows; Train, Bus and Minibus Taxi.

I will be taking these various modes of transport from different transport intersections and hubs throughout Cape Town. This will aim to test how connected and efficient the service is. However it is important that different modes have a varying levels of efficiency and different means of operation. Thus I will be explaining what I will be assessing in each transport mode. It goes without saying that speed and efficiency is an overarching necessity for all transport nodes.

Train

I will be taking the Metro-rail line from all major station intersections. Figure () shows the Metro-rail map for the metropolitan area of Cape Town, I have highlighted the stations that I will be commuting to and from, with Bellville as my origin and destination. The basis for choosing these stations is to simulate the typical commute of Cape Town residents. These varying destinations aims to analyze the commutes of different social-economic backgrounds. Commuting from high

income areas, middle income areas and lower income areas. This will be aid me in terms of getting an idea for the kinds of commutes people have to do, to get to and from Bellville.

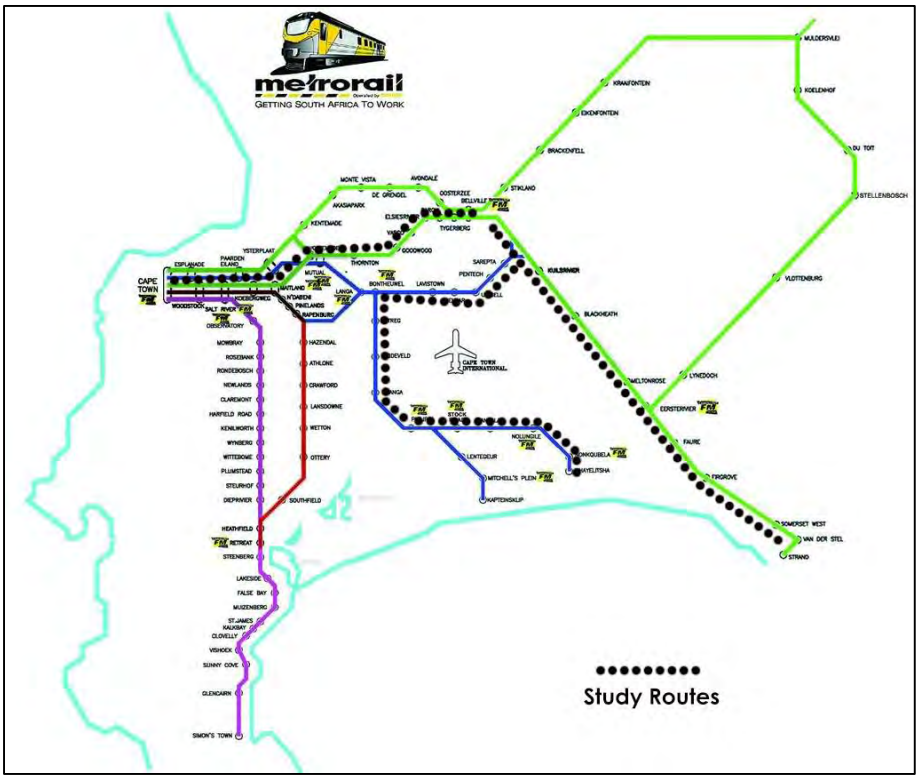

FIGURE 4.1 PROPOSED TRAIN STUDY ROUTES SOURCE: METRO RAIL

Having looked at accessibility and connectivity of the transport node, I will be looking at the speed and effectiveness of the network, in addition to the reliability. This is vital in terms of highlighting the changes that need to be made to the system in order to foster TOD growth in the Bellville region. Even though I am looking at one site, it is vital to think on systemic level in order to set the foundation for metropolitan-wide TOD.

Buses

The bus network in the CTMA is vast and covers an extensive area, with far reaching routes. Taking the available trunk routes that run into Bellville will give me an impression of the smaller areas that have high ridership to and from the Bellville interchange. Very often bus service (Golden Arrow) can be slow and unreliable, I would like to have a firsthand experience of how these buses operate, in order to ascertain how useful these trunk bus routes are. The logic behind this selection is once again to cut across the social strata of the city's population to attempt to get a feel of targeted ridership.

I will then be looking at how often the buses make stops and the flow of traffic during peak hours and whether different routes could be taken. The ridership of bus routes chosen is of major importance because this will determine the extent to which development can be supported in the Bellville area.

Mini-bus Taxis

This is by far the most complex mode to get a feel for. The dynamic nature of this mode, means that I have to have a very structured form of criteria to determine its importance to the CTMA and Bellville.

Firstly I will be looking to take taxis from major urban and commercial centers. Considering that Bellville is a commercial center, it serves as a major destination for this particular transport node. Given the dynamic and 'informal' nature of Mini-bus taxis, I will be mostly looking at the permeability potential of this mode of transport. This mode of transport very often fills gaps that the other two modes of transport do not provide, additionally incorporating this mode into a TOD system will be unique to this case, as this has not been done before.

Note: It is important to note that, the analysis of the mentioned transport modes will be looked at from a purely experiential perspective. This is as a result of the limited amount of time allocated to this research project. To try and collect quantitative and qualitative information would require time that is just not available. Thus most of the observations will be noted and added to the contextual analysis, which comes in the following chapter.

Interaction

Interaction is vital in terms of gathering information about the area one is studying and researching. In the context of my project, there is a need to interview and converse with individuals and organizations that are found in and around the Bellville area. Given the nature of TOD there needs to be input from stakeholders and residents of the area that is being developed. Thus I concluded that it is necessary to carry out open ended unstructured interviews. These interviews allow me to get a sense of what local businesses, individuals and authorities in my project site, think about the introduction of the TOD strategy in their area. Thus this section will be focusing on the interviews and discussions that I will be carrying out in order to assess how TOD can be used in Bellville.

Once again I need to formulate solid criteria that will allow me to have consistent and justifiable results from these discussions and interviews. I will be looking at who will be interviewed, in terms of businesses, authorities and individuals, and it will be all contextualized through the lens of TOD. Following that I will then focus on the method I will be using to select interview candidates. This is by far the most important part of the process, for the simple reason, that the selection criteria have to be in line with the objective of the project which is TOD.

Interview Candidates

In order to achieve TOD there needs to be an understanding of what it entails from those that will be involved and affected by the project. However these interviews are not only to inform of the planned developed but to gain information of the challenges affecting the area in addition to how businesses and individuals operate within the space. Given that TOD is an intersection of

business, residential and transit development it means that there needs to be interaction with individuals that represent all those developmental spheres.

In this section I will highlight each sphere of development that needs to be interviewed and in that I will be highlighting the criteria that will be used to choose people interview within those spheres, and to justify as to why they were chosen. The sampling method that is going to be used is purposive sampling, because of the precise nature of the parties involved. I am looking to assess and gather information from a very specific set of people thus purposive sampling is the most suitable sampling method to apply [Put a small definition square].

Authorities (CoCT, Trasnet and PRASA)
Considering which authorities to approach is not an easy task. Given that TOD can be implemented on varying scales one would have to choose which authorities to involve depending on the scale of the development. I have chosen to base my eventual plan on the local scale; this would need the input of the CoCT, since the development would be in the Tygerberg Municipal district.

In addition to The City, another authority that needs to be consulted and interviewed is Trasnet, the state rail freight operator. The most favorable site for TOD (at a glance) is the Bellville Transnet siding that has been lying idle for the past 15 years and is currently being considered for redevelopment by Transnet (City of Cape Town, 2012). Thus if any intervention is to be made, their input is vital to any development of TOD in the area.

Another key informant and stakeholder is PRASA. They control all the passenger rail stations in the country and any TOD intervention would have to have their input without fail. Additionally they have key information about passenger volumes and ridership, that if can be accessed would be invaluable to my project. Additionally any intervention that is to be suggested would have to be in line with PRASA's own developmental policy. Thus given the importance of PRASA in the transit environment it is vital that their input and opinion is evident in my work.

Businesses (Large, small and informal)
The mixed use and mixed density ideology of TOD needs the interaction of various forms of businesses and trade. In the literature review I discussed that for TOD to be successful there needs to be a vast amount of interest from local businesses to invest in the idea and base their business around the ideals of TOD. If this development is to be truly tested the input of business owners is vital in terms of the needs and requirements that they might have to ply their trade.

In terms of what types of businesses I will be interviewing, I have decided to take to differing aspects of TOD and to try and bring them together. What this means is that, I will be looking to interview and discuss with big retailers (Shoprite, PEP, etc.) in order to get a sense of what they think about TOD in the proposed site. Since they have the potential to attract vast amounts of traffic and business their input can be very illuminating and can drive forward the implementation of the project, should it come to that.

However I intend to balance out the franchise heavy large retailers and businesses by consulting with local small to medium businesses that already exist in the Bellville CBD. Seeing as my normative position stems from the 'Just Cities' perspective, I will attempt to accommodate a bit more time to this side of the business sector, along with it including the informal sector. The desire to have mixed use and mixed income developments is driven by the capacity of the plan to include small to medium sized enterprises in the developmental agenda. Informal traders paly a big role in this, and their input will be as valued as that of the large franchises, their intricate knowledge of commuters' needs and demands offers a unique insight into the place making aspect of TOD.

Residents

These interview candidates may be some of the hardest to set criteria for. Determining who in the area should be interviewed is a mammoth task. One could say that it would be easier to interact with residents associations (known as rate payers associations), however that harbors a vast array of controversial and highly politicized connotations. As a result I have decided that the input I will be receiving from residents will be derived from the interview candidates I have described above. Given that my interviews will be carried out in the immediate area around the Bellville CBD and the Transnet site, I will be asking interviewees if they are residents of the area, and thus finding out their opinions of TOD through this open ended discussion that I have chosen.

This however does not completely solve the issue of objectivity and not being able to include a large scope into the interview process. There will most likely be shortcomings in terms of getting residents opinions, but this once again falls to the limits of the time scale that this project is bound to.

4.2 Limitations of the Research

The limitations of this research is primarily the time that has been allocated to it. Additionally having an in depth understanding of the factors at play in the project site would require a lot more resources such as interviewers and data collectors. Considering that the site that I have chosen for my project is owned by a state agency, it is difficult to accurately estimate if the land will become available or not. Considering this limitation, conversations with the CoCT and the GTBP, were focused on a theoretical rather than a practical basis. Thus realization of this project is heavily based on theoretical and conceptual ideas that may not necessarily translate to the real world situation of the site.

Chapter 5

5 Contextual Analysis

5.1 Introduction

This chapter focuses on an in depth analysis of the present state of the project site. It aims to situate the project within the greater CTMA and to offer an in depth look that existing spatial and socio-economic conditions that prevail in the area. The main role of this chapter is to display and process the information that will be used in the design phase of this project. The information derived from the contextual analysis will be used in order to tray and situate this project within the theoretical framework that has been discussed in the preceding chapters. Additionally it will be used to inform the selection of relevant case studies that will be used in order to inform the design process.

The analysis will be based on two major scales, to begin with, the metropolitan scale will reveal the role that my project site, Bellville, plays in the greater metropolitan region. Understanding how the project site fits into the greater metropolitan area is vital in terms of developing a TOD strategy that works with the city as a whole as opposed to an isolated unit.

To introduce the contextual analysis of my project site, I will be first focusing on a broad outline of the CTMA, followed by a brief history of urban and public transport development in the CTMA. This is to lay the foundation for developing a clear understanding of the various factors at play in the developmental evolution of the public transport and urban development both in the CTMA and the Bellville area.

Additionally ascertaining the important role the Bellville area plays in the CTMA lays the foundation, as I mentioned earlier for the development of a coherent TOD plan for the area. Focusing on the CTMA SDF the importance of Bellville as an activity and transport hub will be abundantly clear as I will be describing in this chapter. Not only is the metropolitan significance important, but also looking at the developmental history of Bellville itself will shed some light as to the functioning and logic behind the formation of this activity hub.

5.2 The Cape Town Metropolitan Area (CTMA)

The CTMA is a one of the fastest growing metropolitan areas in South Africa. It has the second largest economy of the country and continues to grow year on year. The city is facing a rapid urbanization rate from in-migration and natural growth (CoCT, 2012). Although this increase in urbanization is seen as a positive aspect by the City, there is a need to manage and control this growth to benefit all the residents of the CTMA. The CTMA also finds itself in one of the most biodiverse regions in the world, and harbors some of the world's most unique plant life;

managing urban growth as well as population growth in this contexts has added an extra challenge to the CTMA.

This section aims to give a brief overview of the various aspects of the city in order to give a better understanding of the context within the project is being carried out.

5.2.1 Urbanization

The population of Cape Town in the last decade has expanded dramatically, between the period of 1999 and 2007 there was a 36.4% increase in the population, and growth in 2010 increased by 3% (CoCT, 2012). This growth stems from increasing rate of in-migration from rural areas and smaller metropolitan areas, and this trend is expected to continue for much of the foreseeable future. So much so that the population of Cape Town is expected to reach 5 million by the year 2030.

This steady increase in urbanization has had mixed fortunes for the CTMA. Urbanization and population growth has seen Cape Town become a very strategic metropolitan area, not only nationally but internationally as well. There have been improvements in standards of living and larger population means that the economy has benefited from a larger work force, in turn feeding into improved outlook for the CTMA. However this population growth has led to its fair share of very significant issues which the CTMA needs to deal with. Pertaining to the urbanization specifically, the increased in-migration and population has led to a shortage of housing, relatively high unemployment rates and crime (CoCT, 2012). Not to mention that the CTMAs economy being exposed to the global market has created a property boom thus making property acquisition by the City or government near impossible (Property24, 2015).

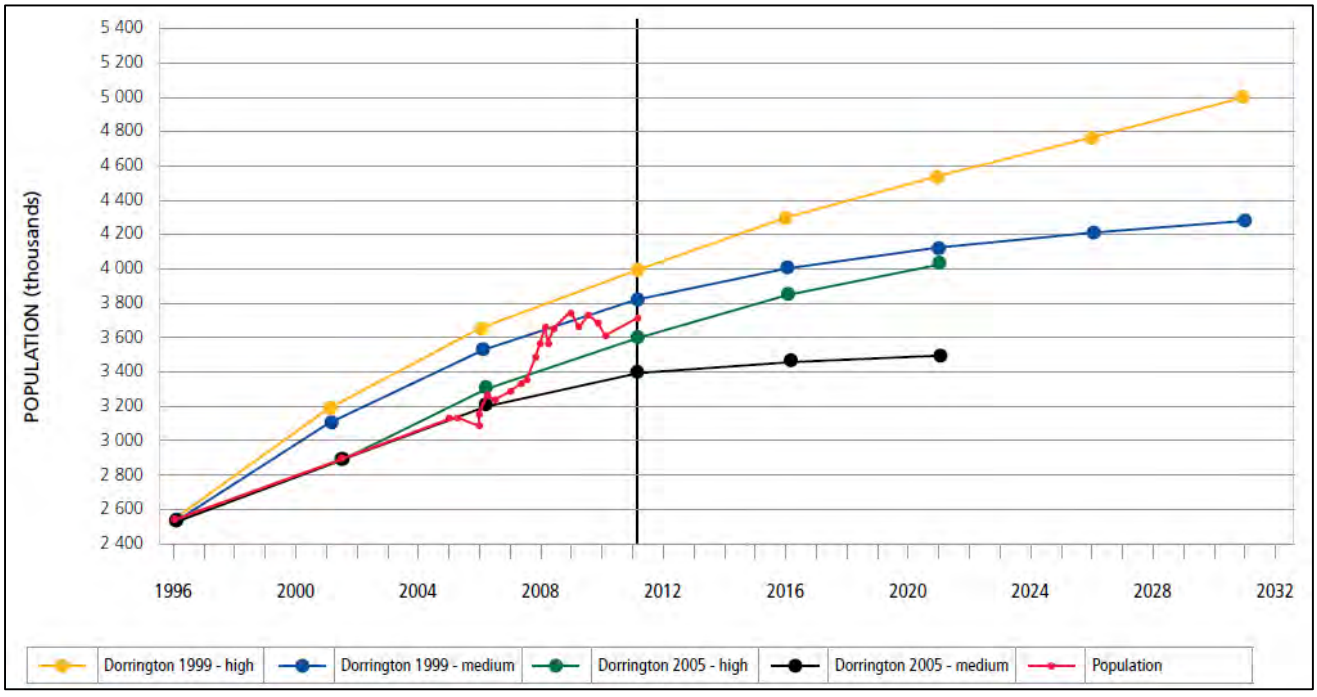

FIGURE 5.1 POPULATION PROJECTIONS FOR CTMA SOURCE: (COCT, 2102)

5.2.2 Socio-economic profile

With a predominantly young population, the CTMA finds itself in a position where the majority of the population is young and seeking employment (CoCT, 2012). The majority of people migrating into the city, come from rural areas or small towns, thus adding to the issue of unemployment and poverty, which has placed large demands on the economy of the CTMA to provide employment for this increasing influx of young and poor residents (CoCT, 2012). This in turn has put a huge strain on the City to provide, infrastructure, services, access to land and housing (CoCT, 2012).

The average household size has been decreasing slowly since 1996, from 3.92 to 3.72 in 2001, however, it has levelled out at 3.75 (CoCT, 2012). This shrinking household size is a result of changing familial structures throughout social classes that has led to the atomization of family structures. This leads to households being more vulnerable to economic externalities such as intermittent unemployment since, families are becoming smaller and tend to rely on one member for financing the household.

5.2.3 Residential Growth Rate

The residential growth rate of the CTMA can be divided into three categories; private sector, government subsidized housing and informal sector (CoCT, 2012). The private sector has been delivering about 6000 to 900 dwelling units per year, however given its vulnerability to credit and market demand, the recession of the last five years will have an effect on this supply and is likely to decrease (CoCT, 2012).

In terms of government subsidized housing, the City has provided 33,200 housing opportunities since 2007, however this is not enough to cover the housing needs of the CTMA. The reason is, because that rate is well below the required delivery rate to keep up with new household formation and in-migration, not mention that there is the current housing backlog of about 380 000 units (CoCT, 2012).

The informal sector has been growing at a steady rate for the past 20 years, with backyard shack dwellers estimated at 140 000 (CoCT, 2012). The inadequate delivery of subsidized housing and the increased influx of marginalized populations means that this figure is likely to increase along with the number of informal settlements in the CTMA (CoCT, 2012). High densities in informal settlements will most likely also lead to the formation of new informal settlements, Figure 5.2 shows the population densities throughout the CTMA.

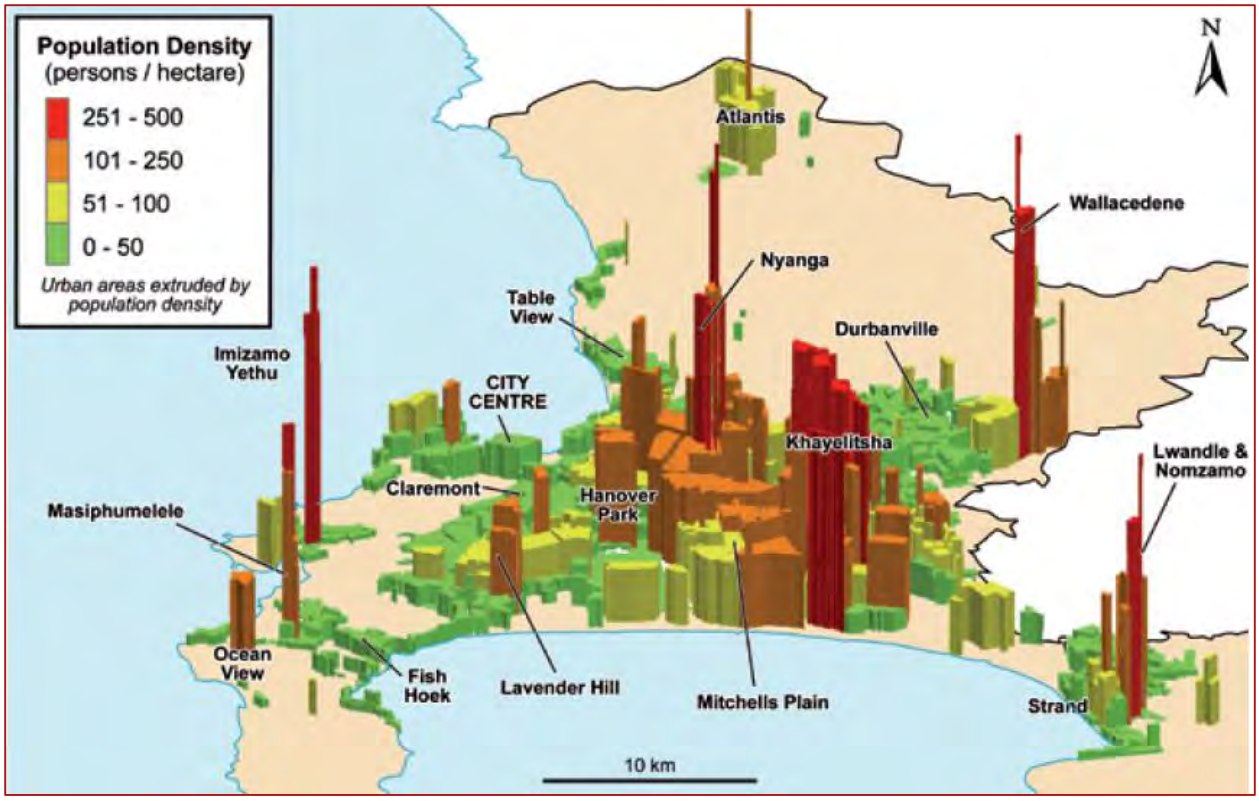

FIGURE 5.2 POPULATION DENSITIES FOR CTMA SOURCE: (COCT, 2012)

Housing development so far has been focused on green site development on the periphery of the CTMA however there has been a shift in the developmental policy of the CTMA, outlined in the SDF towards the development of brown field sites (CoCT, 2012). These brown field sites are being developed at higher densities, especially in the low to middle income markets; this has the potential for private sector and social housing to be mixed within densification corridors (CoCT, 2012).

5.2.4 The Economy

The economy of the CTMA is not limited to the municipal boundaries of Cape Town, it is a city within a region and is fed by cities and towns within a 50km radius (CoCT, 2012). The city's functional region includes Saldanha, Malmesbury, Paarl, Stellenbosch and Hermanus, with economic interdependencies including a commuting work force, shared consumer catchment area, transport infrastructure, and a second port located at Saldanha, as well as the agricultural and tourism areas surrounding the city (CoCT, 2012).

Cape Town is linked to the national and global economy through major transport infrastructure routes. The N1 and N2 highways provide linkages by land to the rest of the country. Most of the freight entering and leaving Cape Town does so along the N1 highway, moving between the Western Cape and Gauteng (CoCT, 2012). Other key infrastructure includes Cape Town Port, and the Cape Town International Airport (CTIA) (CoCT, 2012). In the past 10 years CTIA has increased its traffic and the City plans to expand the airport in order to upgrade land side

facilities in addition to adding a second runway (CoCt, 2012). This is as a result of Cape Town's tourism industry increasing and popularity among international tourists is on the rise.

In general the City's economy is shifting towards services and value-added manufacturing that is clean and can be accommodated in mixed-use areas (CoCT, 2012). The bulk of the CTMA economic activities are as follows:

- Tourism and hospitality
- Business and financial services
- Media, film and knowledge industries
- Warehousing, distribution freight logistics
- Trade (wholesale and retail)
- Food and agro processing
- Industrial/manufacturing
- Office
- Retail

Most of these economic activities are distributed spatially in specific areas. For example the finance, insurance and business services sector is clustered in the CBD and other large commercial centers, including Bellville/Tygervalley, Century City and Claremont/Newlands (CoCT, 2012).

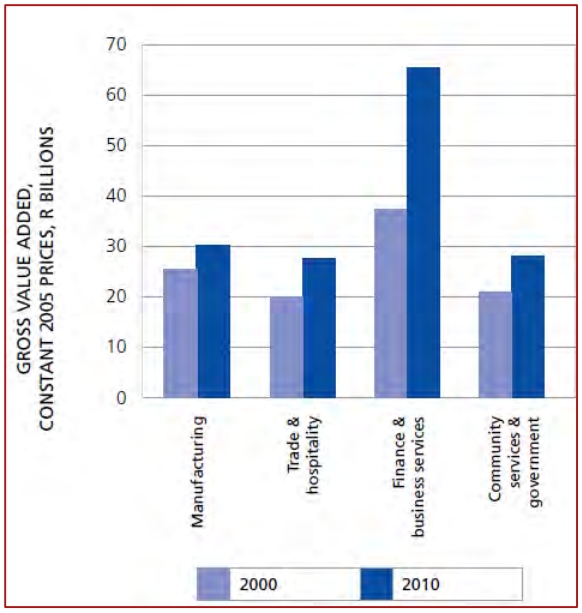

FIGURE 5.3 VALUE ADDED SERVICES T CTMA
SOURCE: (COCT, 2012)

The whole sale and retail sector is more centralized and concentrated in the Northern Suburbs, where incomes are relatively high (CoCT, 2012). Small business in the retail sector have been suffering in the CTMA, predominantly in the South-Eastern region, with shopping malls spreading into Mitchells Plain and Khayelitsha (CoCT, 2012). However this is facilitating economic growth in the area, leading to the formation of more jobs and income possibilities.

There is a large number of vacant industrial sites are available in peripheral locations, with new industrial developments occurring primarily in more peripheral areas, such as Somerset West, Saxenburg Park, Killarney Gardens and Capricorn Park, while most central areas are fully developed (CoCT, 2012). The Table 1 below shows the CTMA top value-adding sectors from the year 2000 to 2010 (CoCt, 2012).

5.2.5 Cape Town Integrated Transport Plan (ITP)

The Cape Town ITP is a five year plan that guides what needs to be done by government and other stakeholders to ensure that the City provides efficient, sustainable, and safe transport infrastructure (CoCT, 2009). The ITP is influenced by a set of goals formulated through public participation and national legislation. The ITP aims to address transport safety, congestion management, and metropolitan growth, economic growth and environmental protection (CoCT, 2009). Public transport is seen as a means of access to employment as well as the movement of tourists, it is basically seen as a means of travel (CoCT, 2009).

5.2.6 CTMA Spatial Development Framework (SDF)

The City of Cape Town aims to manage and guide the growth of the CTMA through the balancing of competing land use demands, and putting in place long term, logical development paths that will shape the spatial configuration of Cape Town (CoCT, 2012). Thus the City decided that there was a need to come up with a comprehensive spatial and legislative plan that would achieve their vision. The Cape Town Spatial Development Framework (CTSDF) is a long term +/- 20 year plan to manage growth and change in Cape Town.

Thus the CTSDF, "…provides a long-term vision of the desired spatial from and structure of Cape Town…" (CoCT, 2012: 8). Additionally it aims to align the City's development goals with strategies, policies with relevant national and provincial development legislation and policy (CoCT, 2012). Informing the direction of private investment by identifying areas that are suitable for urban development, areas where impacts of development need to managed, and areas that are not suitable for urban development (CoCT, 2012). This will occur in combination with detailed district plans that will look to guide development on the district level on a +/-10 year temporal scale (CoCT, 2012). Additionally ensuring the sustainability of urban growth through strategies that prevent indiscriminate loss and degradation of critical biodiversity areas and to ensure the necessary level of protection for remaining areas (CoCT, 2012). Table 5.1 below, summarizes in short what the CTSDF contains and how the City aims to achieve the objectives that have been mentioned above.

CAPE TOWN NOW	FUTURE CAPE TOWN	HOW WE PLAN TO GET THERE
• Strategy & policy context • Drivers of development • Trends • Spatial implications	• Vision • Spatial development goal	• Spatial principles • Spatial strategies • Spatial building blocks • Policy statements and development guidelines • Implementation approach

TABLE 5.1 CONTENT OF CTSDF SOURCE: (COCT, 2012)

Spatial Development Principles

In order to achieve the above mentioned goals, the City has come up with specific development principles that are meant to be the starting point for the CTSDF. The following principles are derived from the Development Facilitation Act including international and national best practice for successful city planning and management (CoCT, 2012):

- The public good should prevail over private interests.
- All residents should have equal protection and benefits, and no unfair discrimination should be tolerated or allowed.
- Work harmoniously with nature, reduce the city's ecological footprint, and introduce sustainable disaster risk education measures.
- Adopt a precautionary approach to the use of resources, switch to sustainable patterns of resource use, and mitigate negative development impacts.
- Encourage local, national and international connectivity.
- Improve urban efficiency, and align planned growth with infrastructure provision.
- Offer maximum access to the city's opportunities, resources and amenities, and redress spatial imbalances in this regard as far as possible.
- Be responsive to the basic needs of communities by providing a stronger link between regulatory processes (zoning schemes) and spatial plans and policies.
- Create safe, high-quality living environments that accommodate a range of lifestyles and offer a vibrant mix of land uses.
- Promote cross-sectoral planning, budgeting and growth management approaches. (CoCT, 2012: 9)

CTSDF Developmental Plan

The objectives and principles outlined above have been combined and realized in the CTSDF. The main developmental implementation that I am interested in is the ***Corridor Development*** strategy that has been plan, to reinforce and stimulate development along high activity routes and high mobility routes. These corridors are characterized by a dynamic, mutually supporting

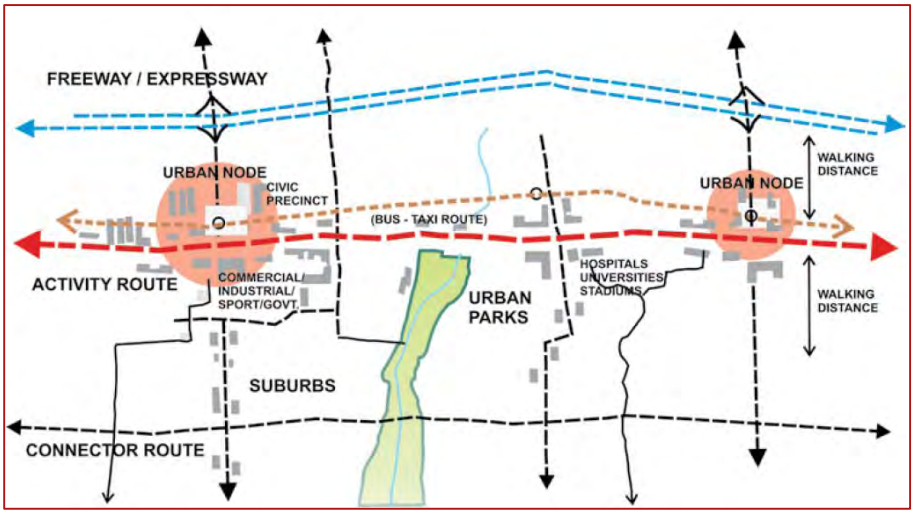

FIGURE 5.4 CORRIDOR CONCEPT FOR CTMA SOURCE: (COCT, 2102)

relationship between land use and the supporting movement system (CoCT, 2012). Development corridors are supported by varying levels of transport services that function as an integrated system to facilitate ease of movement for private and public transport users (CoCT, 2012). Corridor development is mainly oriented on activity/ development routes serviced by mass public transport services such as rail or bus rapid transport (BRT) (CoCT, 2012).

However development corridors are not one continuous band of wall-to-wall development, there are differing densities and land uses that characterize development corridors, and this is often determined by the land uses that exist in different parts of the development corridor (CoCT, 2012). Take Figure 5.3 for example, Cape Town has corridor type developments in different stages of maturity, with some corridors being more established than others; Cape Town has four pronounced development corridors (CoCT, 2012).

FIGURE 5.5 URBAN CORE CORRIDOR SOURCE: (COCT, 2012)

The western corridor has mainly been shaped by the historic development of Cape Town along Main Road which has seen; what were preciously villages become suburban nodes of activity in turn creating a development corridor (CoCT, 2012). The southern part of this corridor is mature in terms of developed considering that it is well serviced, providing good opportunities for high density mixed use development, while the northern portion of the corridor is still developing (CoCT, 2012).

The corridor with most significance to my research is the urban core corridor (See Figure 5.4) that is the most mature and accessible corridor in the city (CoCT, 2012).This corridor is concentrated

along the broad band from the CBD to Bellville CBD, attracting a range of investment and development opportunities along its length, and accommodating a significant percentage of the city's employment opportunities- with the potential to grow and intensify this role (CoCT, 2012). These two nodes play a vital role in the existing economic structure of the city and the development of the urban core area between them (CoCT, 2012). This corridor has the potential to integrate the northern and southern parts of the city. However what is of importance for my research project, is the fact that Bellville sits at the end of this development corridor, creating a pull factor for development towards the northern end of the corridor. This is ideal for the implementation for TOD considering that it is the anchoring point for the development corridor.

This leads onto the next section of the contextual analysis, where we move onto the district level, as was mentioned earlier. The CTSDF uses district SDFs to determine the growth and development of the districts within it, thus the next part of this chapter will be drawing from the Tygerberg District SDF. Tygerberg is the district that includes the Bellville CBD area, including the Transnet siding which is the area that I am interested in developing.

5.3Tygerberg/Bellville District Analysis

The Tygerberg District is centrally situated in the metropolitan area, covers approximately 18,965 ha and contains a broad spectrum of urban land uses (CoCT, 2012b). It comprises of a number of well-established, older suburbs such as Goodwood, Elsies River, Bonteheuwel, Bishop Lavis and Parow to name a few. The district includes significant land uses; a number of industrial areas, commercial development concentrated in the Goodwood, Parow and Bellville CBD's and along the Voortrekker/Van Riebeeck Road, community facilities, utility services, transport infrastructure, The Transet Marshalling Yard (Belcon), dispersed open spaces and the CTI(CoCT, 2012b).

The boundaries of the district as can be seen in Figure 5.4 are along Vanguard Drive/N7 in the west, the Urban Edge and the Tygerberg Hills in the north-east, the N1 highway in the north, the R300 Bottelary Road, The City of Cape Town municipal boundary in the east, Polkadraai Road, the R300 Blaauwberg, Khayelitsha/Mitchells Plain, and Cape Flats Districts.

This section will look at analyzing the Tygerberg District in detail in order to inform the design phase of this project. Essentially I will be attempting to get an understanding of the various characteristics that define this district. The structure of this section will build on getting a holistic perspective of the region. There are three major fields that I will be looking at, which are as follows:

- Natural Environment
- Socio-economic Environment & Profile
- Settlement Patterns

This will result in a detailed idea of the movement flows, settlement patterns, land use patterns, population densities and environmental characteristics. All these aim to inform the design section of the project, by having a nuanced understanding of all the factors affecting the

district. The section will then be concluded with a brief section looking at the opportunities and constraints to possible development of TOD in the Tygerberg District.

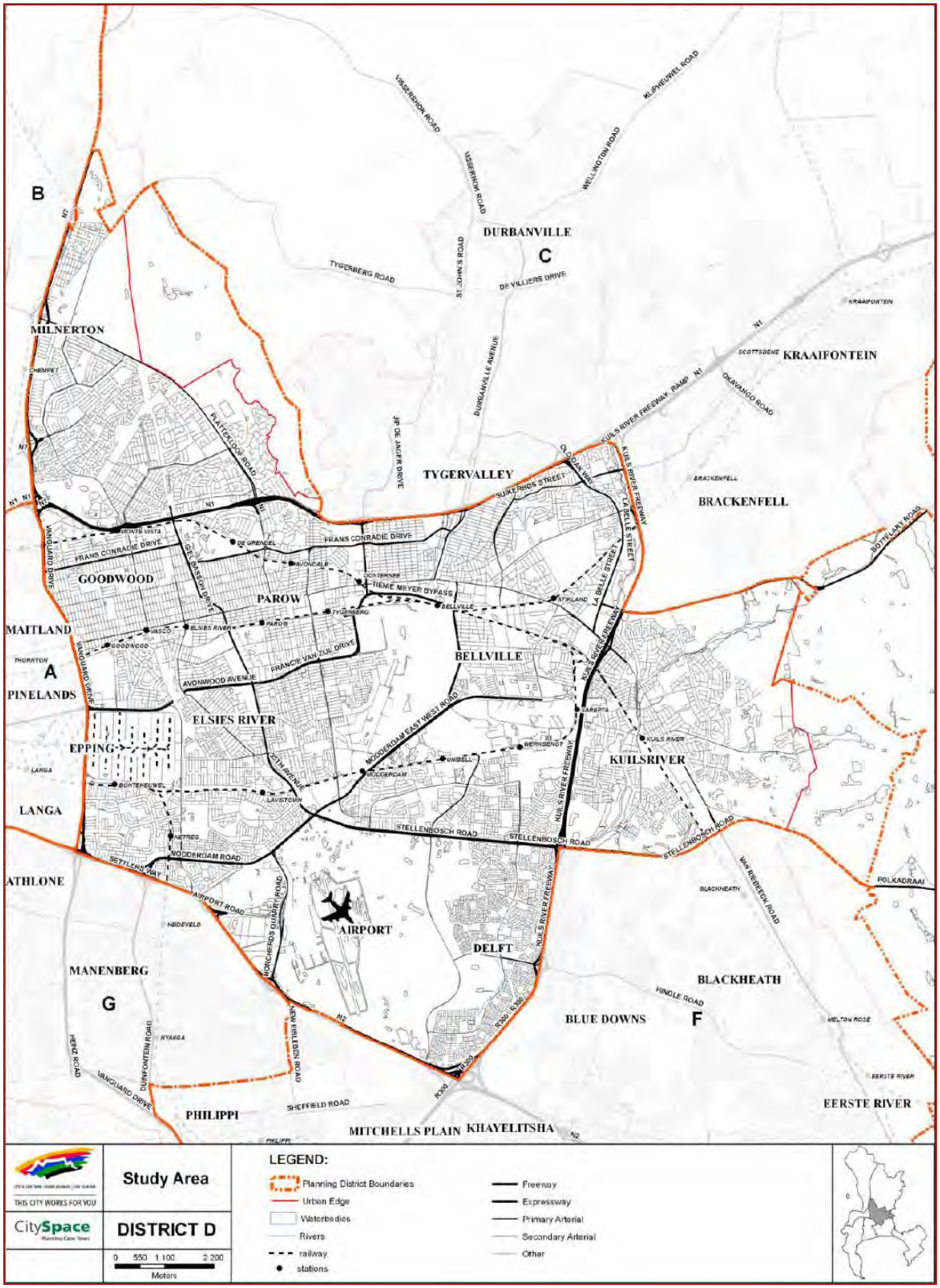

FIGURE 5.6 TYGERBERG MUNICIPAL DISTRICT SOURCE: (COCT, 2011)

5.3.1 Natural Environment

This section is aimed at assessing the natural characteristics of the district. Namely focusing on Geology & Topology, Hydrology, Bio-diversity, Heritage and Pollution & Waste.

Geology & Topography

Geology

The underlying rock formations of an area comprise the foundation of its physical environment (CoCT, 2012c). The geology of an area is shaped by hydrological and weathering processes, which create the topography of the area. The underlying geology also gives rise to various soil types, which influence the indigenous fauna and flora of an area, as well as human agricultural practices (CoCT, 2012c). The geology of the district is separated into two major groups; Malmesbury Group shales and Sandveld Group sands (CoCT, 2012c).

Topography

Geology determines topography by influencing the slopes and soils in an area. A number of different morphological units, classified on the basis of slope, rock type and surface material, are recognized within the Tygerberg district (CoCT, 2012c).

The district is characterized by flat plains, which cover most of the area. The most significant topographical feature in the district is the Tygerberg Mountain, which runs in a north-south direction from the northern extreme of the district to approximately the N1 at Plattekloof (CoCT, 2012c).

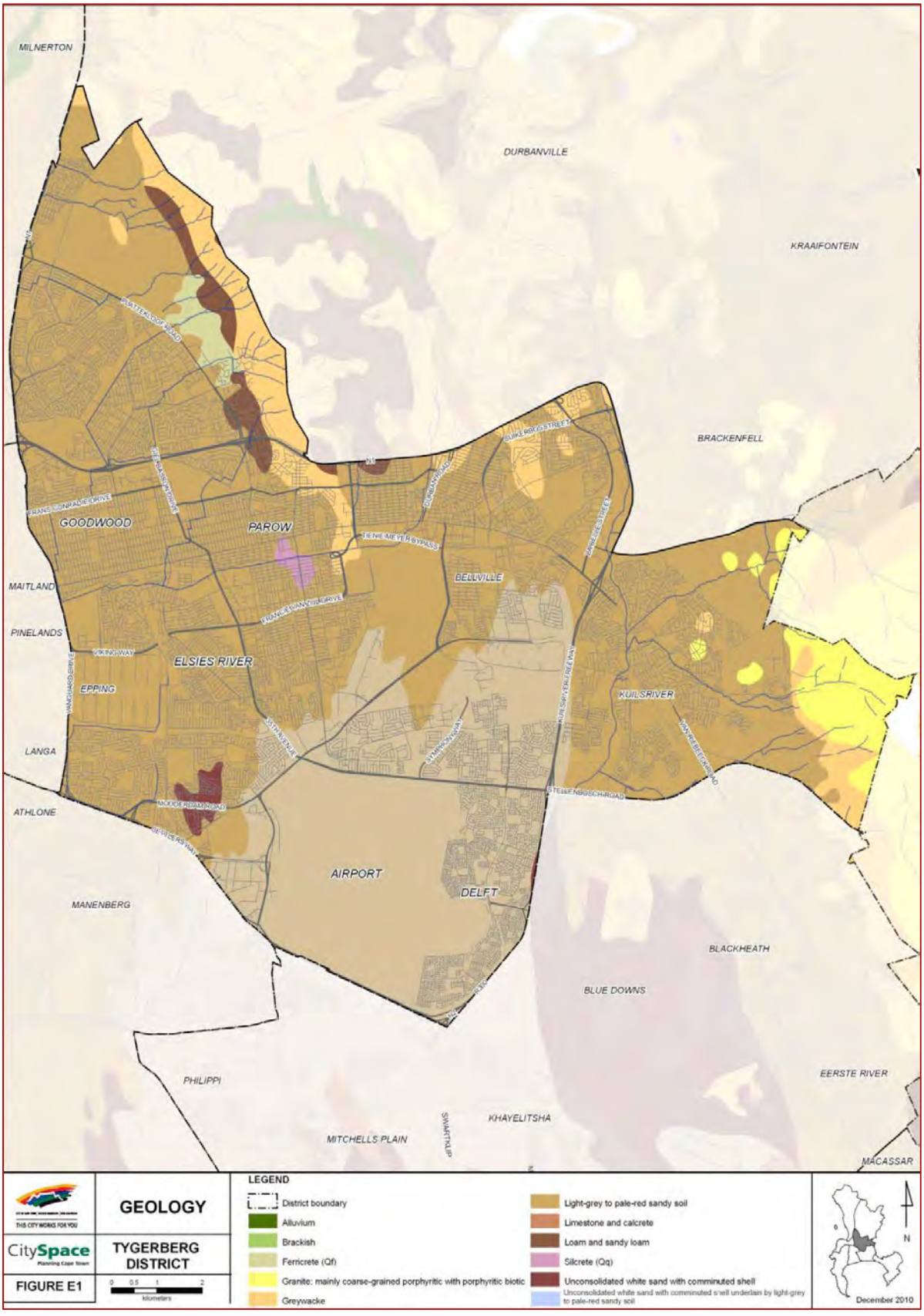

FIGURE 5.7 GEOLOGY ANALYSIS SOURCE: (COCT, 2011)

Hydrology

The Tygerberg district lies within a winter rainfall region of the Western Cape. The district records 760mm of mean annual precipitation and 1400mm of mean annual evaporation (CoCT, 2012c).

Rivers

The Elsiekraal is the only significant river flowing through the district (CoCT, 2012c). A very small portion of the Kuils River also falls within the district along its north-eastern border. The rivers flowing through the district are in poor condition, mostly because they flow through heavy industrialized and urban areas (CoCT, 2012c). Additionally 65% of the entire Elsieskraal is canalized, and canalization leads to habitat loss and severely reduces the rivers' ecosystem functioning and ability to attenuate floods (CoCT, 2012c). Further information on the pollution of the river will be provided in the pollution & waste section.

Biodiversity

The City of Cape Town falls within a unique and globally important biodiversity hotspot.

Vegetation

The natural vegetation that occurs within the district are the Cape Flats Sand Fynbos, Swartland Shale Renosterveld, Swartland Silcrete Renosterveld; and Cape Flats Dune Strandveld (CoCT, 2012c).

The Cape Flats Sand Fynbos occurs mainly on deep, leached acid sands at altitudes of 20-200m. It is characterized by typical Fynbos families such as proteas, ericas, restios, buchu and geophytes (CoCT, 2012c). In the Tygerberg district the Cape Flats Sand Fynbos occur in relatively small patches of remaining natural vegetation in the lower-lying areas at the foot of the Tygerberg Hills (CoCT, 2012c).

Swartland Shale Renosterveld is the most widespread type of Renosterveld and occurs in large areas of the Swartland, Boalns and the West Coast lowlands on clay soils derived from Malmesbury Group Shales. In the Tygerberg district, the vegetation occurs in the moderately undulating plains and valleys of the Tygerberg Hills (CoCT, 2012c).

Swartland Silcrete Renosterveld occurs on remnants of silecrete layers over the Malmesbury groups Shale and Cape Granite (CoCT, 2012c). The vegetation type is highly fragmented and occurs in small patches embedded within Swartland Shale and Swartland Granite Renosterveld (CoCT, 2012c). In the district it occurs in small elevated areas moderately undulating lowlands at the foot of the Tygerberg Hills (CoCT, 2012c).

Cape Flats Dunes Strandveld occurs on flat slightly undulating dunes consisting of alkaline sand of marine origin (CoCT, 2012c). The vegetation is dominated by broad-leaved shrubs and small trees such as taaibos and qhwarrie. In the district this vegetation occurs in its south-eastern corner, between the CTIA and Delft (CoCT, 2012c).

Conservation Areas

The Tygerberg nature Reserve is a 278 ha Local Authority Nature Reserve where some of the last remnants of the Swartland Shale Renosterveld are protected (CoCT, 2012c). Approximately 460

different plant species occur in the Reserve, of which three are endemic to Tygerberg. Twelve species of plants that occur in the Reserve are threatened with extinction and 8 are endemic to Cape Town.

The Cape Flats Nature Reserve is a private reserve under the management of the University of the Western Cape (UWC) (CoCT, 2012c). The 32 ha Reserve, located on the UWC campus, was created to conserve patches of Cape Flats Dune Strandveld and Cape Flats Sand Fynbos, but is also used for environmental education and research. There are over 220 indigenous plant species in the Reserve.

A 25 ha area at Symphony Way near Delft is an area with high biodiversity conservation value currently not under active management, but protected from development by a condition of the environmental authorization of the N2 Gateway housing project (CoCT, 2012c).

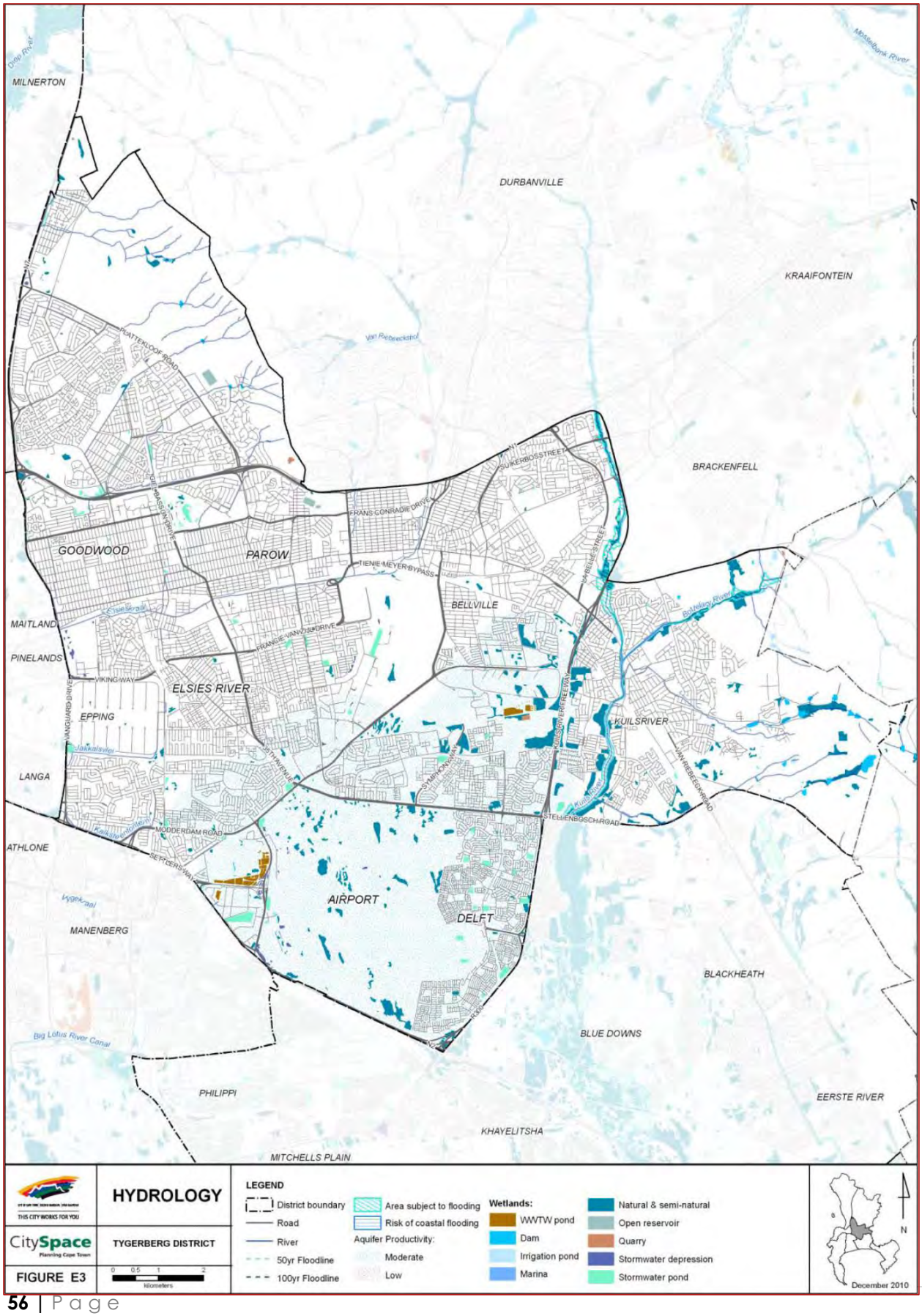

FIGURE 5.8 HYDROLOGY ANALYSIS SOURCE: (COCT, 2011)

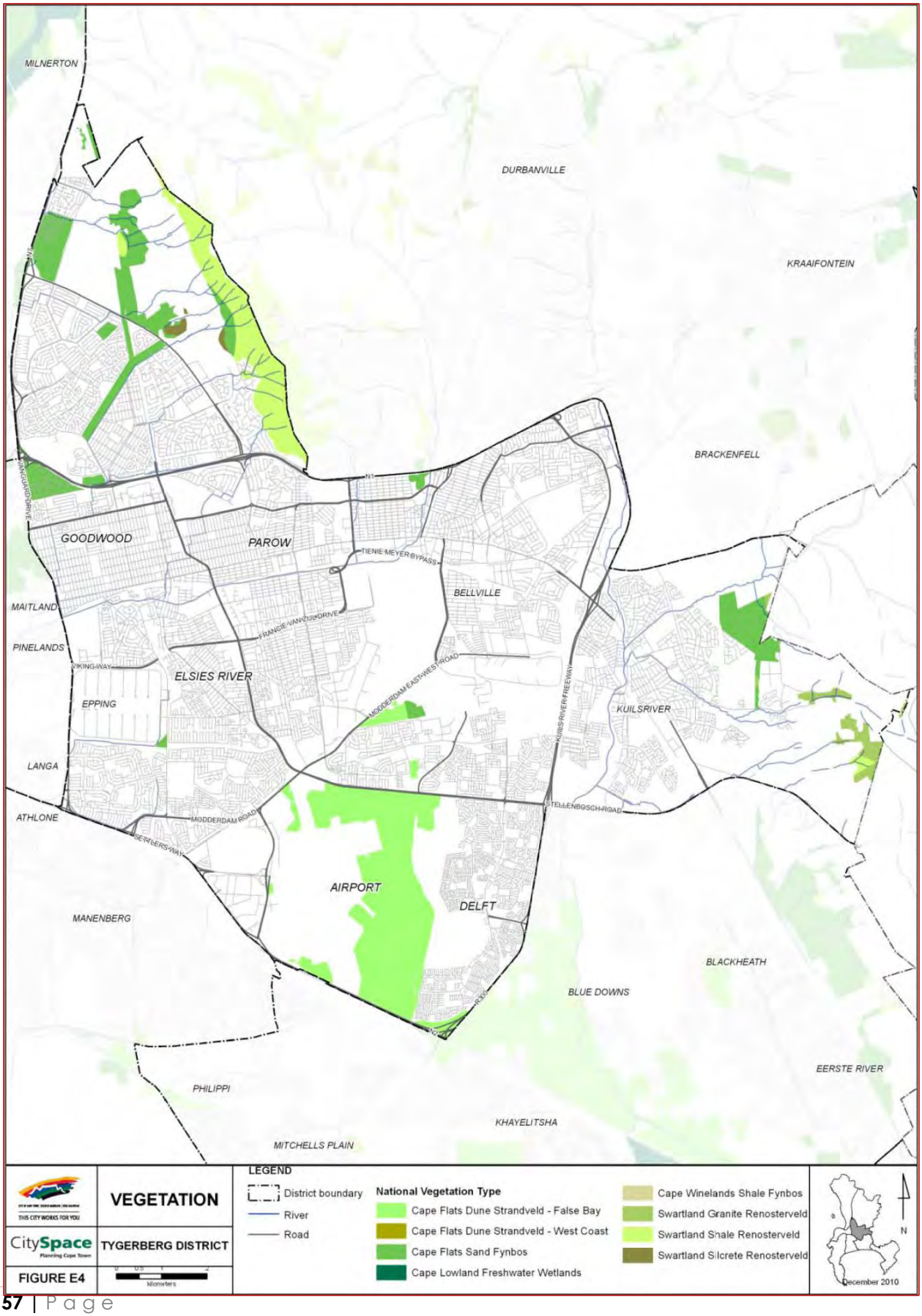

FIGURE 5.9 VEGETATION ANALYSIS SOURCE: (COCT, 2011)

Heritage

The district is characterized by post World War II urban expansion and Apartheid Era town planning (CoCT, 2012c). Most of the residential areas in the district were founded as colored areas, while Goodwood, Parow and Bellville were developed as white residential areas (CoCT, 2012c). Other major heritage sites include World War II era aircraft hangars linking to coastal World War II defenses (CoCT, 2012c). Table 1 outlines the heritage resources of the Tygerberg district.

TABLE 5.2 HERITAGE RESOURCES SOURCE: (COCT, 2011)

Heritage Resources	Characteristics	Heritage Significance	Heritage Issues and comments
Youngsfield WWII aircraft hangers	• A number of hangers dating to WWII	• Link with WWII coastal defenses to be found around the Cape Peninsula e.g. Hout Bay	• Potential unknown • Adaptive reuse desirable
Durbanville Hills Cultural landscape (proposed heritage area)	• Vineyards • Landscape settling among the rolling foothills of the Tygerberg • Classic Cape Dutch architectural style • Historical tree plantings	• Some degree of intactness of landscape • Cultural continuity • Concentration of conversation worthy homesteads	• Unsympathetic additions and alterations to wine estates
Voortrekker Road Urban Corridor (Proposed special area)	• Highly impacted especially during the last decade and along Voortrekker Road • Post WII period • Consistent Scale	• Isolated conservation worthy buildings; mostly Grade 3	• Commercial areas along Voortrekker Road have degenerated. New development may enhance economic situation Potential for enhancing desirability of the area for formal business

Hardekraaltjie camp site	• Camping site just off Voortrekker Road	• Previously major outspan along Voortrekker Road which was the major entry into Cape Town from the farmlands around the Tygerberg	• Relic of an earlier period • Possibly under further development

Pollution and Waste

Air Pollution

The City of Cape Town has 13 air monitoring stations of which three fall within the Tygerberg district (CoCT, 2012c). The district generates a relatively high level of air pollution due to the large number of industrial sites in the district, as well as CTIA (CoCT, 2012c). Residential areas near industrial sites and the airport have been identified as pollution hotspots, with the primary pollutant being exhaust emissions as a result of transportation (which happens to be the biggest polluter in Cape Town) (CoCT, 2012c). Figure 5.10 below shows the exceedance of particulate matter (PM10) for 3 air quality stations, Goodwood (Tygerberg district) City Center and Khayelitsha (CoCT, 2012c).

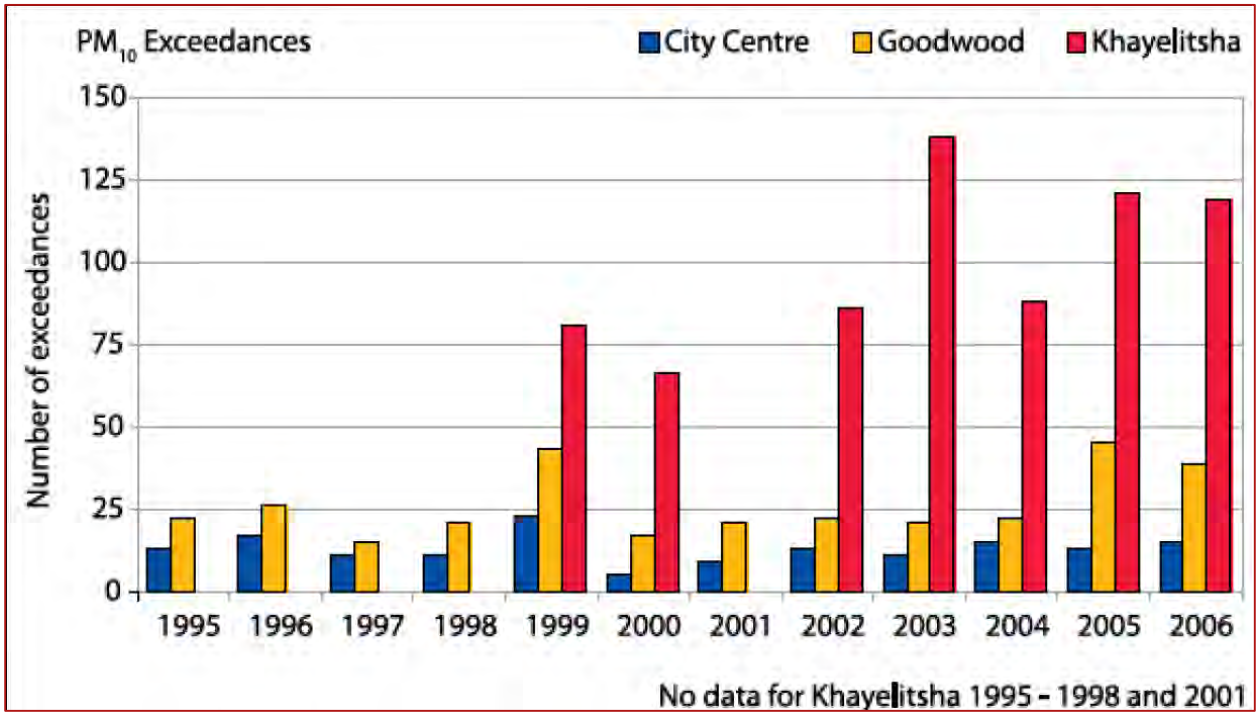

FIGURE 5.10 EXCEEDANCE OF PARTICULATE MATTER (PM10) FOR 3 AIR

Solid Waste Management

The Tygerberg District is confronted with waste management challenges driven by increasing waste generation and limited suitable space for disposal and treatment (CoCT, 2012c). There is an expected increase in the volume of waste that is outstripping population growth by 5% (CoCT, 2012c). In the district 1.21% of households have no regular formal refuse removal service by the local authority, which is significantly lower than the city average (CoCT, 2012c). The district is home to one of the land fill sites that serve the City of Cape Town, the Bellville South Landfill with a size of 75ha (CoCT, 2012c). This landfill site has a remaining airspace of 4.6 million m^3, which basically means an effective life span of another 5.5 years at current disposal rates (CoCT, 2012c).

5.3.2 Socio-economic Environment and profile

This section looks at analyzing the population, economy, housing and urbanization patterns along with human and social development (CoCT, 2012c). This is to get a better understanding of the condition of the human characteristics of the Tygerberg District.

Population

The Tygerberg District has a total population of 554 945 people (2001), latest census data shows that the population has increased to 699 217 (2011), which is line with the overall population growth for Cape Town during that period (2001-2008) (CoCT, 2012c). Tygerberg district makes up 19% of the total population of the CTMA (CoCT, 2012c).

The average age of the population is 27 years of age, and the dependency ratio (measure of the number of people in the potential labor force in the relation to those in the "dependent groups", the youth and aged expressed per 100) 22 (CoCT, 2012c). In terms of average household size, the district is almost 4, over half of the households have either 3-4 or 4-6 people, which is the third largest percentage of households of 7 or more people of any district in the city

PLANNING DISTRICTS (2010)	2001 AVERAGE HH SIZE
TABLE BAY DISTRICT (A)	2.94
BLAAUWBERG DISTRICT (B)	3.44
NORTHERN DISTRICT (C)	3.31
TYGERBERG DISTRICT (D)	3.97
HELDERBERG DISTRICT (E)	3.24
MITCHELL'S PLAIN/KHAYELITSHA DISTRICT (F)	4.04
CAPE FLATS DISTRICT (G)	4.26
SOUTH PENINSULA DISTRICT (H)	3.05
CITY OF CAPE TOWN TOTAL	3.72

TABLE 5.3 AVERAGE HOUSEHOLD SIZE TYGERBERG DISTRICT SOURCE: (COCT, 2011)

(CoCT, 2012c). Considering the proportion of larger household sizes in this district it is important that housing opportunities cater sufficiently for these households (CoCT, 2012c).

Economy

Large areas in the district consist of industrial areas, it has the greatest amount of industrial property in the city in absolute terms (31% of all industrial property) (CoCT, 2012c). These areas include Epping Industrial, Airport Industrial, Sacks Circle, Bellville, Parow, Stikland and Elsies River industrial areas (CoCT, 2012c). There is a continuing commercial investment in the district with the value if commercial property accounting for 18.2% (CoCT, 2012c). Epping and Goodwood commercial zones have a turnover of R19.3 million (CoCT, 2012c). The economically active people are the majority in the district at 77.5% while unemployment levels sit around the national average of 22.5% (CoCT, 2012c). Table 4 below compares the Tygerberg district to the other CTMA district in terms of the works status of the Economically Active Aged 15 to 65 in 2010 (CoCT, 2012c).

TYGERBERG DISTRICT (D)	187455	77.5	54276	22.5	241731	100
HELDERBERG DISTRICT (E)	49896	74.5	17081	25.5	66977	100
KHAYELITSHA MITCHELLS PLAIN DISTRICT (F)	233583	57.2	174665	42.8	408248	100
CAPE FLATS DISTRICT (G)	152625	69	68729	31	221354	100
SOUTH PENINSULA DISTRICT (H)	104680	86.6	16213	13.4	120893	100
CAPE TOWN TOTAL	939207	70.8	387315	29.2	1326522	100

TABLE 5.4 COMPARISON OF ECONOMICALLY ACTIVE RESIDENTS SOURCE: (COCT, 2011)

Housing and urbanization patterns

In terms of the 2001 census figures the district has the largest of formal dwellings at over 93% and the lowest number of informal dwellings in the city (CoCT, 2012c). However, more up to date estimates indicate that this split has changed significantly, the updated dwelling type estimates for 2008 provide further insight to the housing trends in the district (CoCT, 2012c). In terms if these figures:

- An overall increase of 45 124 households is evident between 2001 and 2008;
- This figure reflects major increase in the number of both formal and informal dwellings, inclusive of backyarders.
- Informal dwellings have grown more significantly as a percentage of additional households with almost 20% of households being classed as informal in 2008.
- A significant proportion of the growth in informal settlement has been in the form of backyarders. In 2008 there were an estimated 29161 backyard dwellings in Tygerberg, up from only 4 908 in 2001.
  (CoCT, 2012c).

Human and Social Development

The most socio-economically deprived areas in the district are Leonsdale, Roosendal, The Haque, Towns 1-6, Delft, Bonteheuwl, Valhalla Park and Uitsig (CoCT, 2012c). Figure 5.11 displays the socio-economic distribution according to a scale, green showing better off, yellow middle and red worst off (CoCT, 2012c).

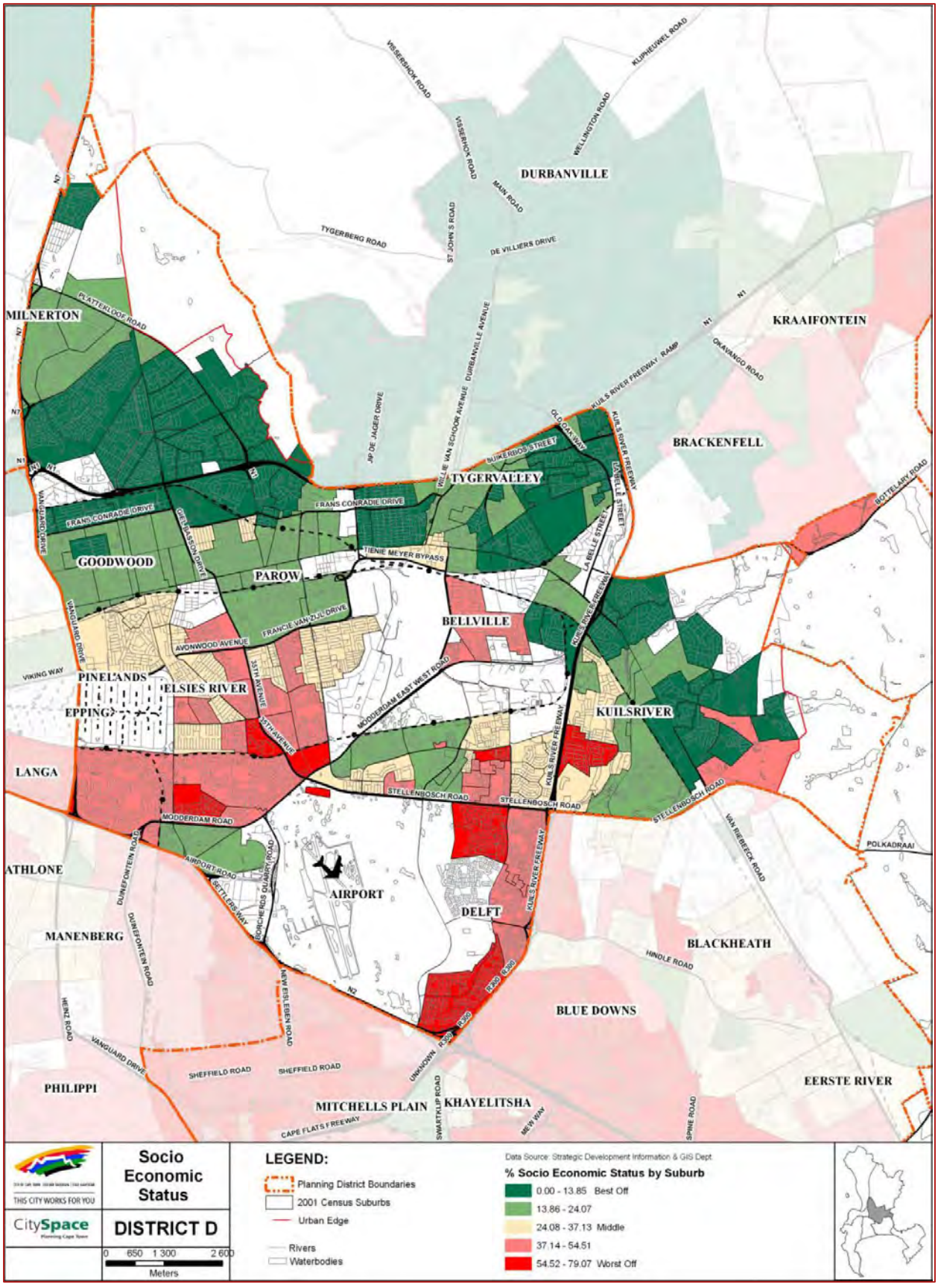

FIGURE 5.11 SOCIO-ECONOMIC STATUS OF TYGERBERG SOURCE: (COCT, 2011)

5.3.3 Settlement Patterns

This section looks at the land use patterns, public facilities, and movement systems that exist within the Tygerberg district.

Land use patterns

Tygerberg District presents a developed urban structure that contains a broad spectrum of urban land uses: residential development, industrial areas, commercial development, Voortrekker Road corridor, community facilities, natural areas and open spaces and significant land uses. The district also incorporates the urban core - a concentration of residential, industrial and commercial uses (CoCT, 2012c).

Historical urban development and the land use pattern, reflect the following Figure 5.12:

- Residential areas consisting of well-established, older suburbs such as Goodwood, Elsies River, Bonteheuwel, Bishop Lavis, Parow and Bellville, as well as newer suburbs such as Delft, Belhar, Bothasig, Panorama, Ridgewood, Edgemead;
- Residential development ranging from low to high density and low to high income;
- Commercial development concentrated in the Goodwood, Parow and Bellville CBD's and along Voortrekker Road;
- Voortrekker Road corridor reinforced by road and rail transport; Bellville CBD with several corporate head offices: Eskom, Sanlam, Vodacom;
- Industrial areas: Epping West, Parow Industria, Sacks Circle, Airport Industria, Stikland, Elsies River, Bellville South;
- Significance land uses: Cape Town International Airport (CTIA), University of the Western Cape (UWC), Cape Peninsula University of Technology (CPUT), Tygerberg Hospital and Karl Bremer Hospital; Transnet Marshalling Yards (Belcon);
- Government offices: City of Cape Town offices, magistrate courts, Department of Home Affairs, South African Revenue Services (SARS);
- Community facilities: schools, sport, libraries, clinics, hospitals;
- Transport infrastructure: roads, rail, stations, interchanges;
- Natural areas and open space: Tygerberg Hills Nature Reserve, Elsieskraal River. (CoCT, 2012c)

Although Tygerberg District fulfils an important economic role, high levels of poverty and unemployment prevail, particularly south of the Cape Town-Bellville rail line:

- Many impoverished families reside in backyard shacks, low cost housing (Delft area) and state provided rental housing. Many of these areas are degraded and contribute to the ongoing degradation of local living environments;
- Disadvantaged communities and areas are marginalized by a lack of service provision and the absence of quality and accessible community facilities. Concentrations of poverty are coupled with a sense of abandonment, hopelessness and destitution (Delft area);

- The spatial structure is fragmented and does not effectively facilitate social and economic development.
  (CoCT, 2012c)

Public Facilities

The northern areas of Tygerberg District are characterized by affluent low density suburbs exhibiting well maintained networks of public spaces and relatively good access to a range of facilities, institutions and commercial opportunities (CoCT, 2012c). In contrast, the landscape and character of the areas south of the Cape Town-Bellville rail line is substantially degraded:

- Typically, the southern areas consist of lower income, medium density living environments which lack basic/ adequate community services and facilities. These areas are characterized by vast expanses of poorly maintained public spaces and a disproportionate land use distribution in relation to the northern areas;
- The areas reflect a lack of investment in public facilities and improved health, education and safety are key public services required in the area;
- The areas seem to be underserviced in terms of a number of functions. This will be tested and given additional content in terms of specific types of facilities and related shortfalls on an area basis through new modelling based on work completed as part of the CSIR facilities study reflecting on existing demand and access to the hierarchy of public facilities.
  (CoCT, 2012c)

Movement Systems

In terms of broad movement patterns, Tygerberg District reflects significant demand for movement: within the district, to areas outside of the district and through movement. Private vehicle movement and congestion is significant due to high car ownership levels in parts of the district. There is also a strong reliance on public transport (rail, bus and taxi) for work and non-work travel (CoCT, 2012c). Pedestrian movement is a significant mode movement for work and non-work trip making with high foot movement zones located around the transport interchanges and along the Voortrekker Road (CoCT, 2012c).

Public transport infrastructure

Tygerberg district is well served by passenger rail and stations, which includes the Cape Town-Bellville, Monte Vista and Sarepta lines. Bellville Station is a significant transport interchange (rail and road) where several rail lines divert (CoCT, 2012c). Several stations form significant interchanges with road based public transport: Bellville, Tygerberg, Parow, Elsies River, and Vasco Station. The main road based public transport networks are concentrated on higher order routes. Minibus-taxis operate frequently along Voortrekker Road and provide transport to stations, commercial and retail areas and employment areas (CoCT, 2012c).

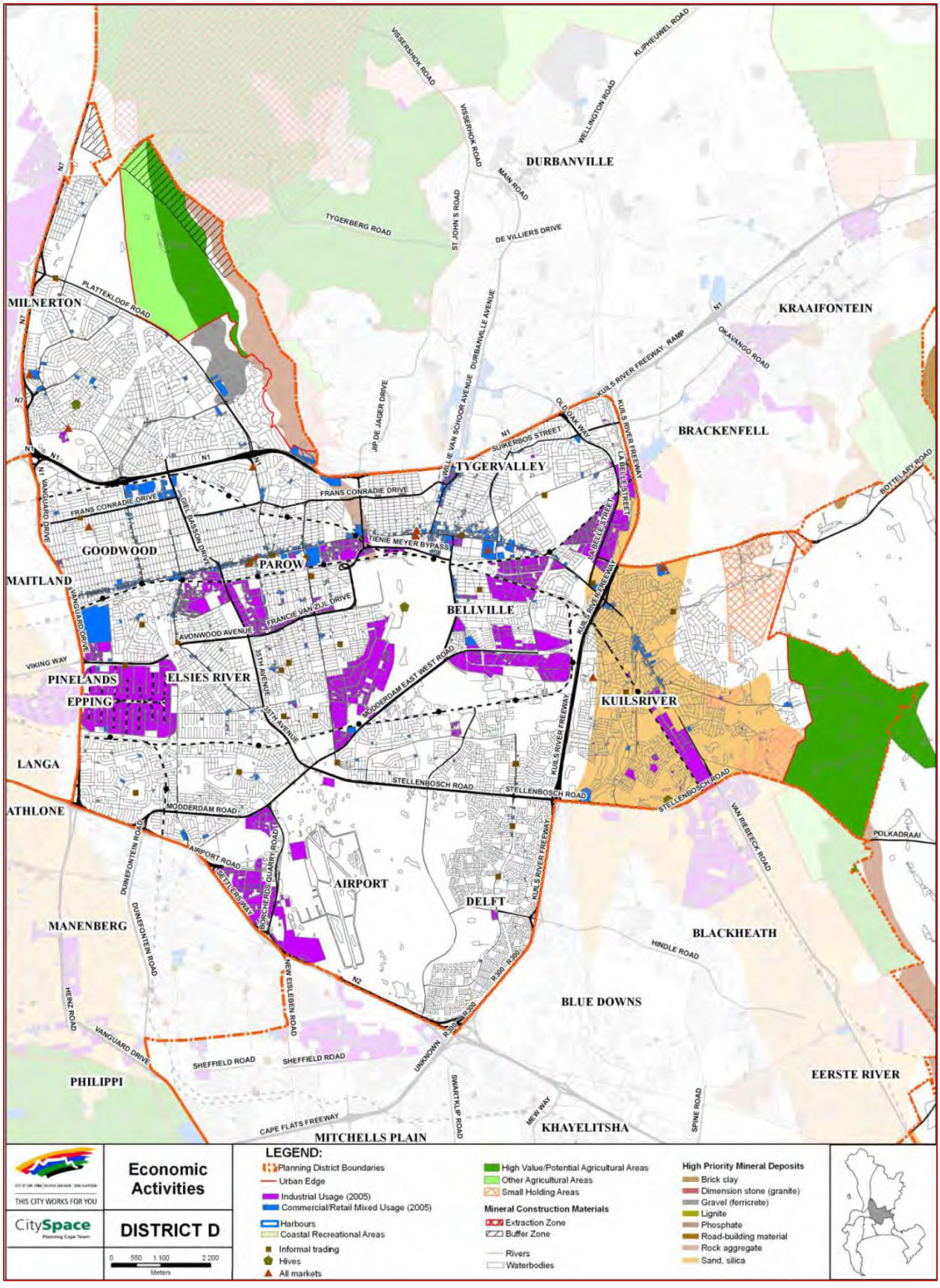

FIGURE 5.12 ECONOMIC ACTIVITIES SOURCE: (COCT, 2011)

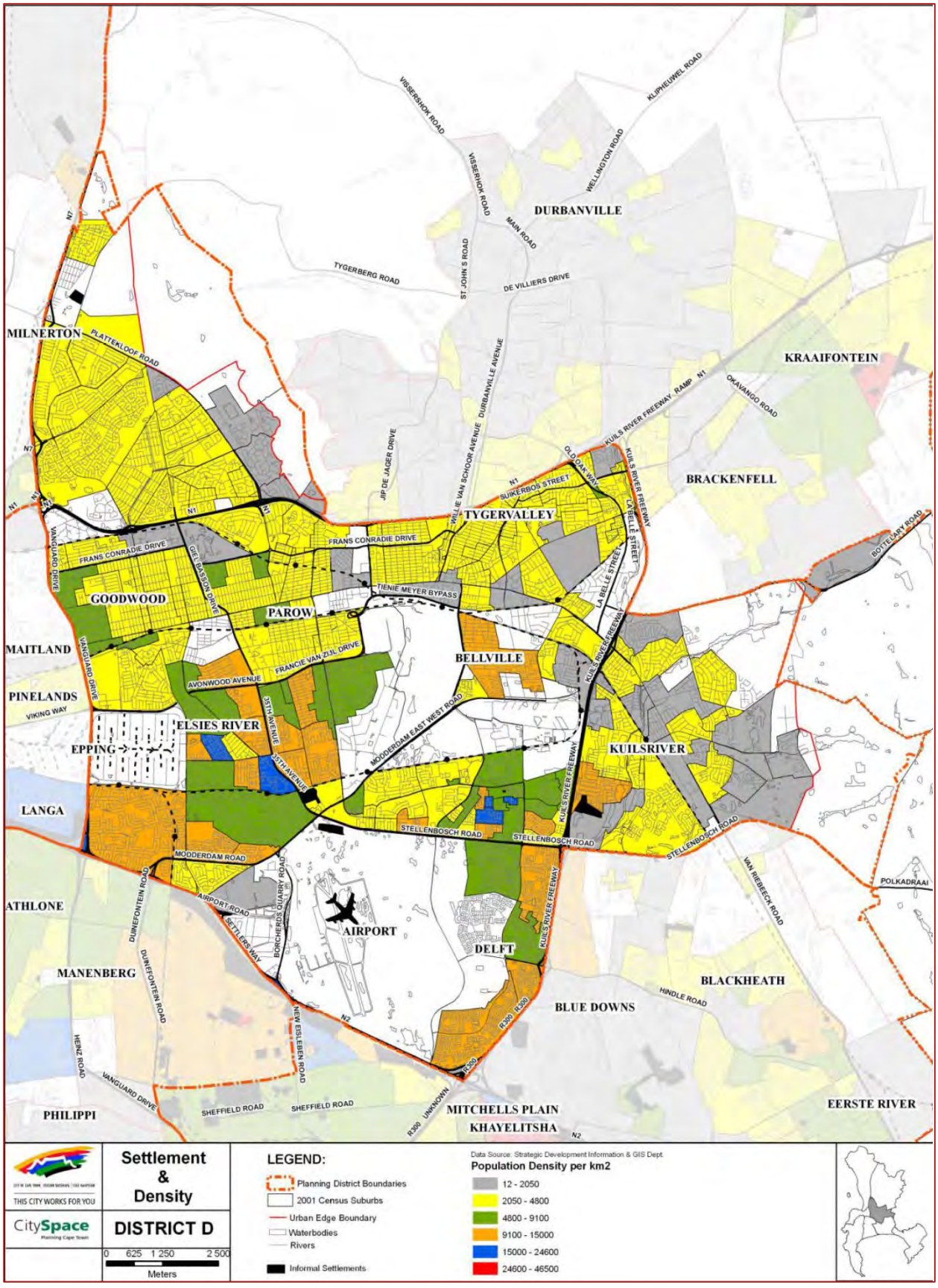

FIGURE 5.13 SETTLEMENT DENSITY SOURCE: (COCT, 2011)

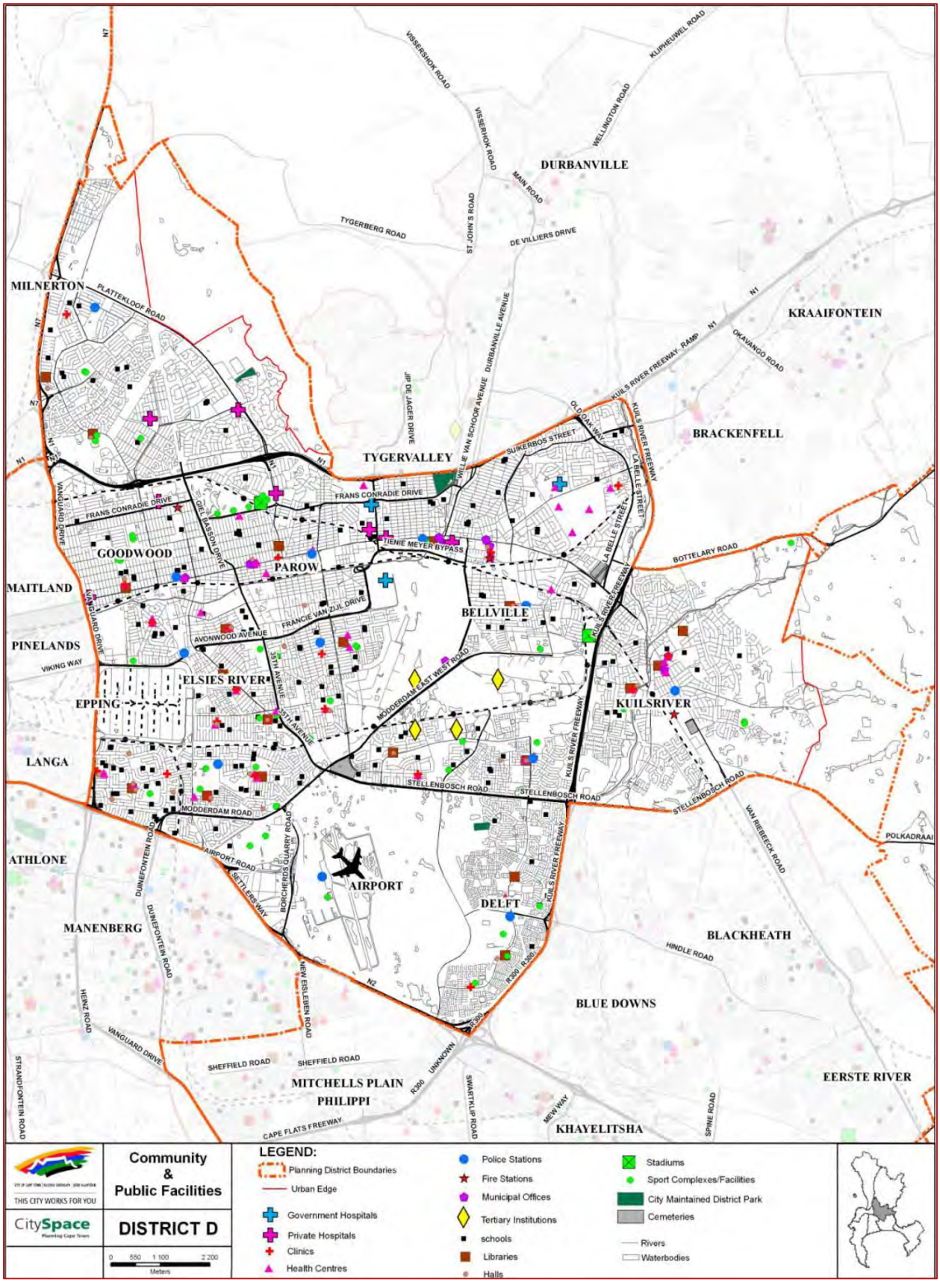

FIGURE 5.14 COMMUNITY & PUBLIC SERVICES SOURCE: (COCT, 2011)

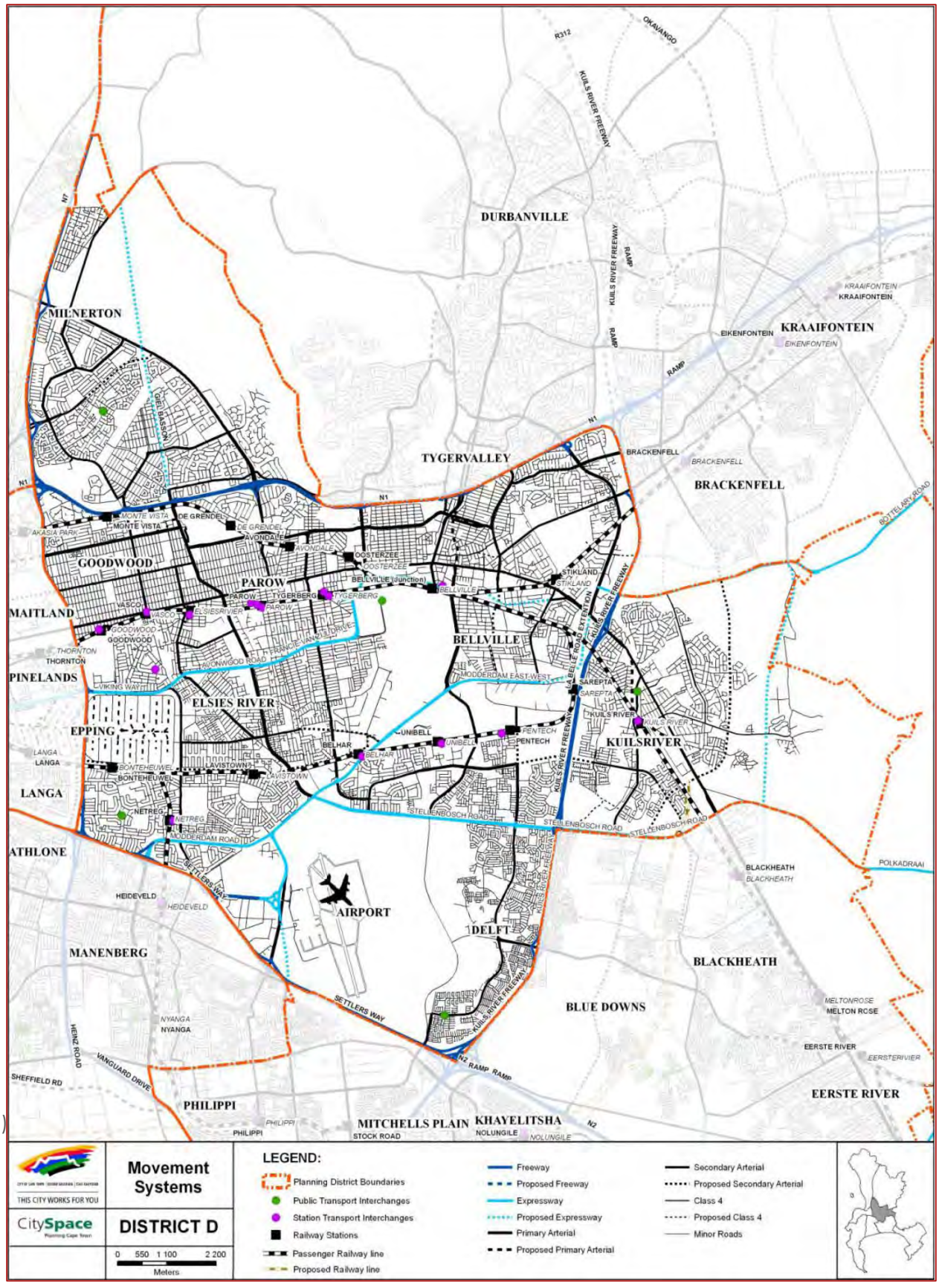

FIGURE 5.15 MOVEMENT SYSTEMS SOURCE: (COCT, 2011)

5.4 Conclusion (Opportunities & Constraints)

In conclusion to this contextual analysis, I have formulated a map (Figure 6.6) that has been influenced by the analysis of the Tygerberg District. This map is meant to map the opportunities and constraints for development within the Tygerberg district. The opportunities are based on the suitability for TOD development in the district, informed by the principles that were outlined in the Literature Review and Precedents chapter.

[See Figure 6.6]

Chapter 6

6 Design

6.1Introduction

This chapter will look at the design phase of the project. This is the culmination of the research that has been done and discussed in the previous chapters and serves to display the use of TOD in the Bellville Area. This chapter is the combination of the case studies that were looked at earlier, in addition to the contextual realities that were highlighted by the contextual analysis. The aim of this chapter is to give the reader a clear idea of how TOD is to be envisioned in the Bellville area using detailed maps and diagrams to illustrate my vision for TOD in this area.

Illustrating the design interventions is a vital part of this chapter and seeks to bring a strong visual aspect to the project. By illustrating the theoretical concepts and presenting a coherent design, this chapter will tie together all the aspects of TOD that have been discussed in previous chapters.

The design phase will be based on two scales: one that focuses on the importance of my site on a district level, and one that looks at the Bellville Transnet site in detail. This blueprint will help formulate a block plan for TOD development by focusing on master block structure and movement systems, in addition to proposed land uses and densities.

6.2 Principles

The design informants are derived from the Precedents chapter. However, given that the four case studies analyzed exceed different aspects of TOD development, it is necessary to look at the various design informants. These stem mainly from the cases of Curitiba and Copenhagen, for the simple reason that they have excelled in the spatial design element of TOD, as opposed to the institutional and implementation strengths of Singapore and San Francisco.

This section will look at the crucial spatial interventions, predominantly focusing on the design interventions used by the two design based case studies that were looked at. Having a basic and in-depth understanding of the interventions used in the case studies allows for a broader understanding of how these techniques will be used on the project site. Each design intervention will be looked at in relation to the case study that used it.

6.2.1 Linear Corridor Development (Copenhagen)

Linear development in Copenhagen is focused around creating a multicenter metropolis. Corridors are defined by high mobility routes, mainly trunk train lines that spread out from the center of the city. Along these high mobility corridors, urban nodes and centers are formed by intersections and transit hubs (Cervero, 1998). Along these linear corridors, there is high density mixed use urban developments, running the length of the corridors. However, the densest

development occurs at the points of intersection between development corridors; this is a characteristic of 'Adaptive Cities', which have a strong core development of rail trunk routes that facilitate most of the movement within the city (Cervero, 1998). This means that Copenhagen is able to guide growth through the use of its urban rail infrastructure, by focusing mixed use urban development around rail nodes on existing trunks (Cervero, 1998). The design of these kinds of cities is focused around regional transit development, as opposed to a single development node or center (Cervero, 1998). The clustering of development at nodes along the railway, as well as the resulting confinement of trips along the radial axes, are what make the arrangement efficient from a mobility perspective (Cervero, 1998). The combination of long radial links and concentrated mixed-use development around outlying stations and hubs is what makes the adaptive city's formula successful (Cervero, 1998).

On a regional scale, the Adaptive City model of TOD suits the Cape Town context quite appropriately – considering the City's established rail infrastructure running along major development corridors (mainly Voortrekker Road, Lansdowne corridor, and Main Road). All three of these development corridors are anchored to the CBD with high mobility routes; Voortrekker and Main Road are connected with both rail and road, with strong linear corridor urban development running along the corridor. Dense activity nodes exist within the two most development activity corridors (Voortrekker Road and Main Road). According to the CTOCT SDF, the most important development corridor in terms of the City's development for the next 20 years is the Voortrekker Corridor (CoCT, 2012). This corridor has two major nodes, the Cape Town CBD being the primary node and the Bellville CBD/area being the secondary node. The rail linkage on this corridor is the Cape Town/ Stellenbosch line that has a major intersection in the Bellville CBD area.

Hence one can clearly see that Cape Town has the characteristics of an 'Adaptive City', in the pure sense of the word. The reason being that although the trunk route and high mobility route exist, the City has not managed to foster high and mixed density urban development along the corridor. Hence, as using the 'Adaptive Cities' design model is suited in terms of the regional planning scale, this will help inform the district level plan for the secondary node that is Bellville.

[See Attached Map 6.1]

Synergy between Transport and Land Use Features

When it comes to transport intersections and developmental nodes, there needs to be a synergy between land uses that exist within that node. Figure 3.2 illustrates the way in which transport and land use can complement each other. In the Copenhagen case, there is a hierarchy to the transport nodes that are linked to the development nodes. Hence the land uses have to reflect the needs of the transport mode hierarchy. Certain nodes deal with interregional links while others deal with exclusively urban transit linkages; however, all nodes are connected on a regional level.

In Cape Town, this hierarchy of transport modes does exist; however, this project is limited to focusing on the metropolitan and district scales, thus catering to land uses that serve metropolitan and district linkages. In the Bellville CBD area, the linkages with highest priority are the metropolitan and district level linkages. Voortrekker Road, Robert Sobukwe, and the Metro rail line (Cape Town/Stellenbosch) are the metropolitan linkages. District level linkages are De La Rey Street, Francie Van Zilj Drive, and Randor Street.

6.2.2 Radiating Urban Density (Curitiba)

Given the use of linear corridor development, it would not be complete without considering the importance of radiating urban density within the aforementioned urban and transport intersection nodes. This design informant applies to the district scale and looks at how urban nodes can be structured in a land use hierarchy, which focuses the densest and activity intense land uses in the core of the development node, fronting a major transport linkage or mobility route. Figure 6.1 below illustrates this idea. Considering that transit links offer a high level of

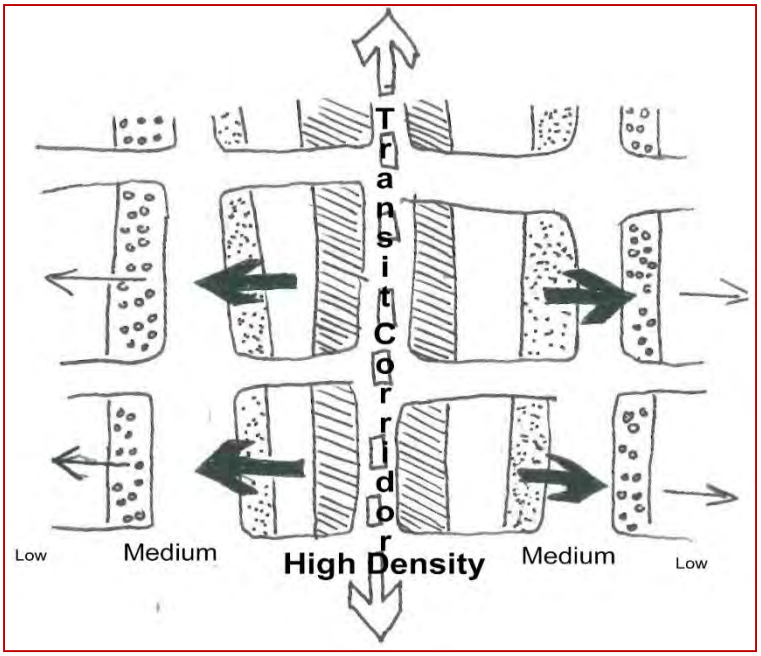

Figure 6.1 Diagram of radiating urban density

activity along their length, commercial development is focused on fronting these transport links so that commuters can efficiently, consistently, and quickly access commercial activities while either in transit or waiting to transit. Radiating outwards, the land uses and density change emphasizing, slower movement and a more pedestrian friendly environment, connected by small feeder routes to the trunk transport linkages. Moving further out, predominantly low density residential development with isolated commercial zones for convenience stores and pedestrianized zones is increased.

This design informant is described in further detail in a later section of this chapter. The radiating density design stems from the extensive IRT network that was implemented in Curitiba. This radiating density was focused along BRT transit links as well as transit intersections facilitating a denser urban fabric around high mobility and activity corridors. Cervero classifies this kind of TOD development as being a 'Hybrid' city design. This refers to striking a middle ground in terms of adapting landscapes and transit services (Cervero, 1998). The balance means that development is partly transit oriented with transit services being adapted to the structure of the city, which in Cape Town's case is very true. The current planning environment has had to adapt and change apartheid era planning and most transit services have not changed (except MyCiti BRT). Thus, this can be seen as transit services having adapted to a fragmented and divided city, while the exiting corridor developments having been in turn shaped by the very barriers that once were meant to segregate the city. Most development corridors and nodes in the CTMA have come into maturity in the post-apartheid planning period (CoCT, 2012).

Thus, the characteristics of hybrid cities – which will inform the design of the project site – are characterized by a dominant center or CBD, along with secondary and tertiary centers. The centers comprising multiple land uses and pedestrian friendly design form potential building blocks of a highly integrated regional transit network, with links existing through rail or busways (BRT) (Cervero, 1998). Diagram 2 below illustrates the idea of the 'Hybrid' TOD city.

6.3 Spatial Design Elements (Techniques)

This section looks at the spatial design elements that have been used in the design of the project area. These spatial design elements, are derived from the principles and contextual informants that were looked at in the previous section.

Based on the precedents that have been looked at extensively in this project, the following design elements have been chosen for the simple reason that they meet the principles that have been set for the design of a high density TOD development in Bellville. With the use of these spatial design elements, TOD can become a reality, and this metropolitan node will be able to achieve affordable and accessible urban development with high density.

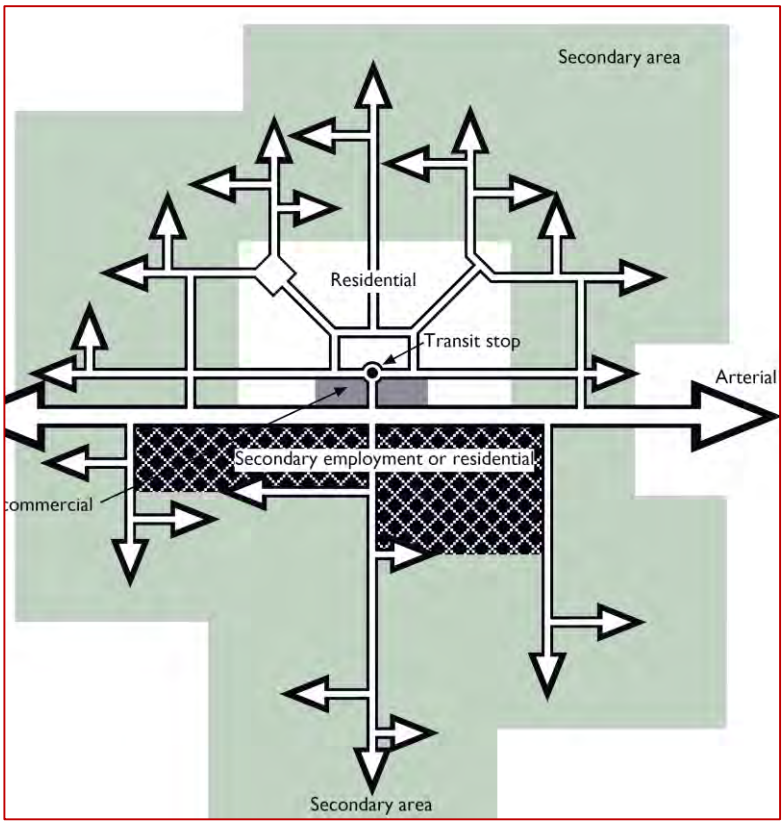

Figure 6.2 TOD CONCEPT

6.3.1 Transit Oriented Development (TOD)

Urban development is to be focused around transportation and accessibility. Shaping urban land uses to work with transit systems and modes to provide a sustainable growth model is based on limiting private vehicle traffic and reinforcing pedestrian movement and public transport. The diagram below offers a conceptual illustration of the principles of TOD and the way in which it shapes urban land uses and development.

The design that will be shown in the next section reflects heavily on this type of relationship between transit nodes and land use.

6.3.2 Radiating Urban Density

This technique was extensively looked at in the Curitiba case, where high density mixed use development was focused along transit corridors, with lesser densities radiating outwards, creating a peeked density profile. Offering all high activity and density intensive activities a front to transit corridors. This enhances accessibility for commuters and businesses along the transit corridor.

Additionally, in terms of providing housing along transit corridors, developers prefer this model of density distribution. The reason is that the radiating densities offer something for almost every prospective property buyer. For those seeking close access to public transport and commercial zones, the high density core along transit routes offers just that. Lower densities are still within 600 to 800m of transit hubs, thus making it possible for commuters who want a quitter environment,

while still being offered quick and efficient public transport, once again limiting private vehicle use.

Trinary Road System

The primary method of employing radiating density, which has been extensively been used in this project, is the Trinary Road System – most notably used in Curitiba. The figure below illustrates how this radiating density is achieved through a hierarchy of transport modes and land use type and density. Perhaps the most vital part of this technique is its ability to activate the street of a high mobility environment such as a transit route. In the case of this project, activating the streets fronting the transit corridor is vital to the functioning of the project area. See Figure7.

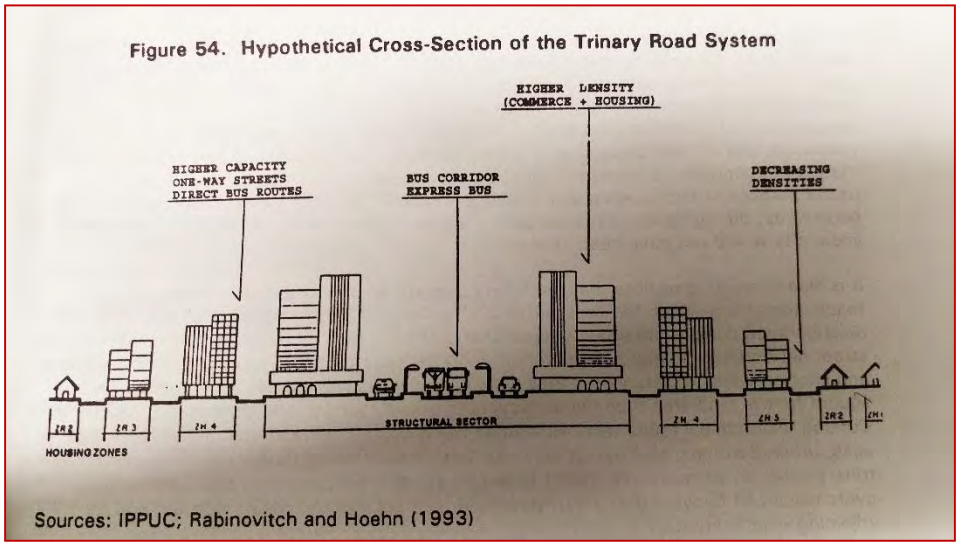

Figure 6.3 Trinary road system

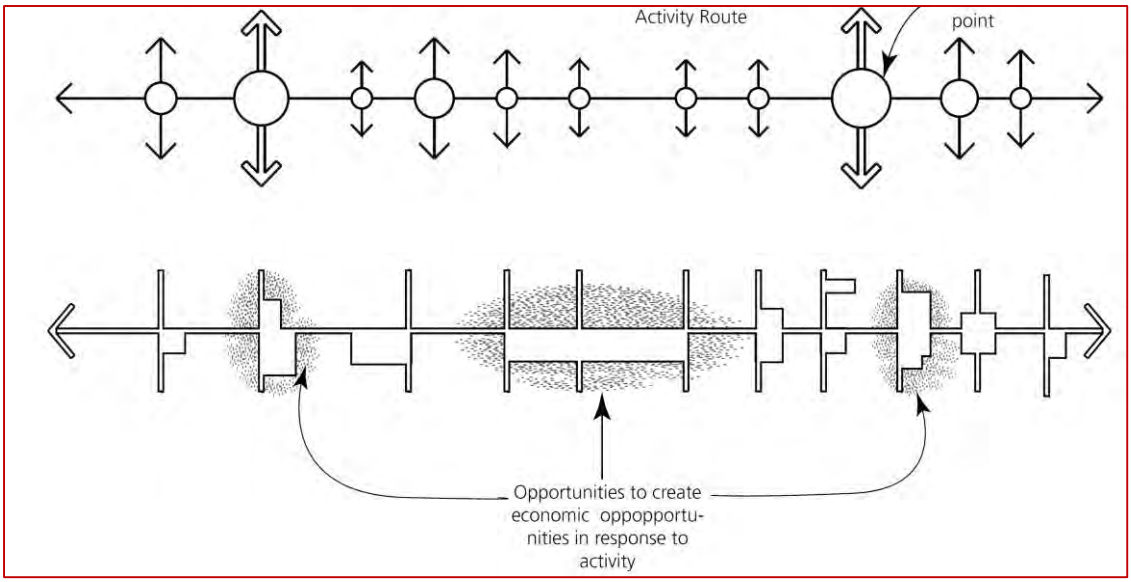

Figure 6.4 transit corridor growth development

6.3.3 Mixed Land Use

Creating a diversity of land uses fosters the nature of accessibility and inclusivity when it comes to TOD development (UN Habitat, 2004). Mixed land uses also foster urban diversity, bringing in much needed social diversity in respect to income, ethnicity and age. If anything, this is one of the most vital aspects of mixed use (UN Habitat, 2004). One often becomes divorced from the true sense of mixed land use and tends to focus only on commercial and residential development. Within that it is vital to have mixed income and mixed social groups, especially considering the need to transform South African cities in the post-apartheid context.

6.3.4 Bus Rapid Transit (BRT)

This forms the basis of many TOD interventions around the world, mainly in the developing world; Curitiba is one such case, as was looked at in the precedents chapter. Given the developmental context in South Africa, the use of BRT is paramount in this project. Given the

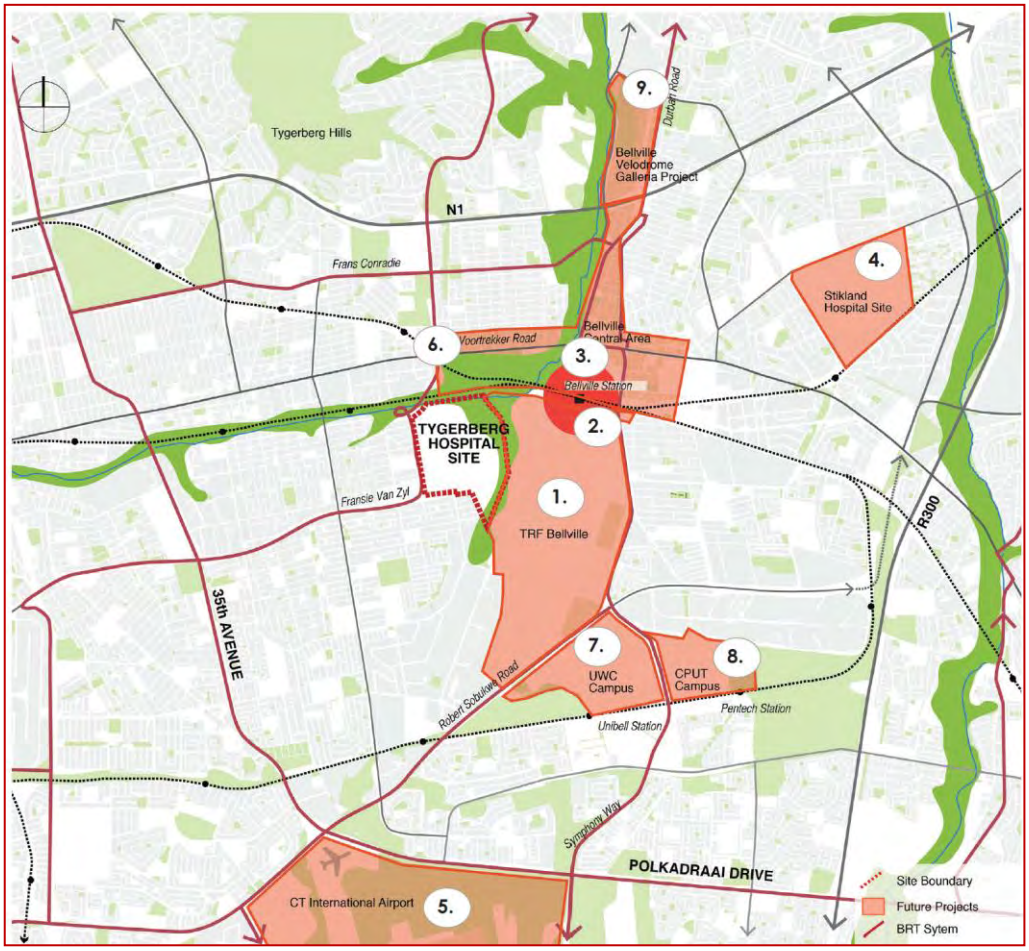

Figure 6.5 BRT Roll out In Bellville

current phase 2 roll out of the MyCIti BRT project in Cape Town, this aligns perfectly with the City's integrated transport plan for the next 20 years. Figure 6.5 illustrates the future roll out of BRT in the area, providing a perfect precondition for BRT being the main mode of transportation through the site.

Segregated bus lanes are a dominant feature of BRT and will be used on the main route through the project site. However, those are not the only interventions required; BRT stops will be intersections between primary and secondary lines, which will feed into the rest of the site.

6.4 Current Situation

The project site sits in a very central location in terms of the greater CTMA region. Figure below shows the location of the project site in relation to the CTMA. It is located in the area of the Bellville CBD, which is located within the Tygerberg District Municipality. The Bellville CBD is the second largest in the CTMA, only coming second to Cape Town CBD. According to the CTMA SDF, it is a vital metropolitan node and is situated on the end of the Voortrekker corridor (CTMA 2012). In the contextual analysis we looked at how corridor development is a priority for the CTMA and the Voortrekker has been given the highest developmental priority. Map 6.1 of the CTMA, highlighting the current urban development corridors and metropolitan nodes.

The Bellville CBD sits at the intersection of a major North/South and East/West metropolitan link and is a transportation hub for Metro Rail, Golden Arrow, and Minibus taxis. It is additionally a big center of employment for the surrounding low density urban areas.

This section aims to add to the contextual information about the project site by adding additional spatial information about it. The flows and movements through the site will be looked at, such as the barriers to potential development and finally the planned developments in the area, which includes the roll out of the BRT system.

[See Map 6.1 Attached]

6.4.1 Flows

This sections refers to Map 6.2. The Bellville site contains a number of flows and routes. The focus of this section will be the flows around the site of interest: the Transnet site (hereby referred to as 'the site'). The highest flow of vehicular and pedestrian traffic occurs on the Voortrekker Corridor north of the of the Transnet site. This is the end of the metropolitan corridor and leads into the major metropolitan node of the CBD.

Bordering the site to the east is another major metropolitan link: the major North/South link connecting Khayelitsha and Mitchells Plain to the Bellville CBD. This North/South link is along Symphony Way and Robert Sobukwe Road leading into the CBD. It is a major taxi and bus route with pedestrian traffic.

Along the west side of the site, there is a high concentration of industrial developments. As one can see in Figure, it is Parow Industrial along with the low density residential area of Ravensmead. The predominant flows in this area are pedestrian and taxi, owing to the proximity of Tygerberg Hospital. Major pedestrian routes in this area run from the CBD train station along the northern boundary to the Tygerberg Hospital.

On the northern edge of the site there are the UWC and Technical College campuses, which form the educational hub of the area. Most of the flow here is predominantly vehicular traffic (buses, taxis and private transport) running along Robert Sobukwe Road, south to Cape Town International Airport (CTIA) or north towards the metro- North/South link to the CBD.

On the northern side of the site we have the Bellville CBD and Metro Rail station, along with the transport intersection. Flows in this area are a dense combination of pedestrian traffic, public transport and private transport. The Bellville Transport Interchange offers commuters access to a number of transport nodes – mainly taxis, Golden Arrow Bus service and the Metro Rail train line to Cape Town CBD or Stellenbosch.

[See Attached Map 6.2]

6.4.2 Barriers

Analyzing the barriers of the site requires a change of scale. Map 6.3 drops down to this scale in order to get a better understanding of the Transnet Site and how it relates to its immediate surroundings.

Along Robert Sobukwe Road on the east side of the site, large medians between the road and the boundary of the site limit the amount of interaction between the road and the site. It is of course a fenced off site with limited access. However, potential future integration into the urban fabric is limited by the old rail infrastructure that runs along the eastern border of the site.

To the north of the site, Bellville train station has a direct link – albeit pedestrian – that leads into empty open space, with desire lines leading to a private road used by Transnet that links up to Robert Sobukwe Road (See dotted arrow on Map 6.3).

Within the site itself we have certain immovable barriers, mainly infrastructure or buildings that would be too costly to move or destroy. The Transnet Industrial Park is one of those immovable barriers that will have to be repurposed once the new development is implemented. This will be expanded in the implementation chapter.

To the north-west side, the site borders Tygerberg hospital. This poses an immovable barrier considering that it is a hospital and that it also has its own developmental plans of expansion under way. It would be very beneficial to the site for it to integrate with the hospital; however, issues around access and security pose an immovable and impermeable barrier that would need further investigation, and is beyond the scope of this project.

[See Attached Map 6.3]

6.4.3 Potential Developments

This section refers to Figure 6.5 on the previous page. There are a number of potential developments around the site which have been identified by Western Province Government and CoCT. The Bellville Transport Interchange (2) is being considered for the upgrading and improvement of taxi ranks (CoCT, 2012a). The Transnet site (1) is along being considered for sale and redevelopment by Transnet (CoCT, 2012b).

The rollout of the BRT MyCiti route system (6) in the area is of paramount importance to this project since the main transit mode of the proposed activity corridor will be BRT. The current implementation of the BRT system in the district is focused on creating North/South linkages to Tygervalley, CPUT and the CTIA (CoCT, 2012b). This fits in perfectly with the proposed plan, as will be shown.

The final potential development that promotes the implementation of a TOD plan is the expansion of UWC and CPUT Campuses (7)(8). These two institutions will both be focusing on new academic and residential buildings (CoCT, 2012b). This links in vitally with TOD and could potentially be vital for the implementation of the proposed plan.

6.5 Opportunities and Constraints

Although many of the opportunities were covered in the potential developments section, there are a few more that need to be looked at to get a sense of the challenges in the area. The table below summarizes some of the most challenging constraints and promising opportunities.

Opportunities	Description	Constraints	Description
Flexible Movement Systems	• Much of the pedestrian movement is dynamic and flexible from my observation over a few days. • The site is centrally located in the district with roads ending at its boundaries, offering possible connections (see Figure).	Urban Degradation	• Bellville CBD faces an issue of urban degradation. • Broken window effect is starting to set in, considering many high rise buildings are laying vacant. • Mostly street level activity. • Lack of jobs in the area.

Compatible Urban density	• The urban density around the site is conducive to high density in-fill development within the site.	Fragmented transit system	• Conflicting transport services, considering future plans are a serious limitation. • The Bellville Transit interchange is severely flawed with no clear access to the train station.
Institutional Presence	• The CoCT is heavily investing in planning for future development of the area. • Property development in Tygervalley is booming, making Bellville CBD and the Transnet Site the next logical step. • The Tygerberg Partnership is actively interested in TOD planning and development, informing the general public of its benefits.	Transnet	• The project site is located on land that belongs to the parastatal Transnet. • Discussions with what to do about the mostly vacant site have been dragging on for 15 years. (CoCT, 2012a) • Contact with them has been hard to achieve.
Metropolitan Node	• With 2 major metro development corridors and links converging in the area (Voortrekker &		

	Robert Sobukwe North South Link), this urban node is ripe for future development. • Proximity to the airport is an appeal for office and commercial retail developers. • Transit hub intersection means that residents can use a multitude of public transport modes.		

6.6 Proposed District Plan

This section looks at the proposed planning intervention in the Bellville Transnet site to foster TOD development. The plan will be comprised of a district level layout plan that will focus on promoting mixed use, mixed density, and mixed income commercial and residential development, through the use of transit oriented design and developmental techniques.

6.6.1 Vision

The vision for the site is to have an urban development that speaks to itself and to the district as a whole. Contributing to the compact and relatively dense nature of the district. Fostering mixed income and mixed use developments, by expanding the public transport infrastructure and taking advantage of the opportunities available to create sustainable urban nodes within the Metropolitan city context.

However, it is not enough to only foster mixed use and mixed income development for new residents; the site must speak to the surrounding areas, be accessible to those areas, and amalgamate (as much as possible) to the current movement circulations – if not improve on them.

Facilitating the development of an active transit route with street level activities focusing on what commuters' need, with a focus on creating a walkable and livable urban environment that caters for needs of all its residents and for those of surrounding areas.

6.6.2 Concept Plan

The main concept for this development is accessibility and connectivity. Making sure that the project site speaks to its surrounding areas, by taking a leading role in the development of the area. Centering the most dense development on a central core transit route while radiating development outwards.

Taking advantage of the North/South Metropolitan linkage that exists to the east of the site, and transferring it through the center of the proposed site development (See Figure). Taking advantage of the district level nodes is vital, as well. Figure 6.6 shows, for example, various nodes circling the development, taking cognizance of the fact that they play a vital role in the development of the project. We have UWC and CPUT on the south end of the site offering an educational hub with the potential to influence student housing developments within the development site. Or offering efficient connectivity for commuters who would want to access the industrial zones of Parow or Sacks Circle.

The concept looks at expanding the nodal significance of the site on a metropolitan level, creating the precedent for TOD development in the city and indeed the country. The urban densities surrounding the site as can be seen in the concept illustration, are predominantly low, with very few breaching the 23 du/ha barrier. This offers an opportunity for high density in-fill development within the Transnet site, and will be the conceptual focus of this TOD design.

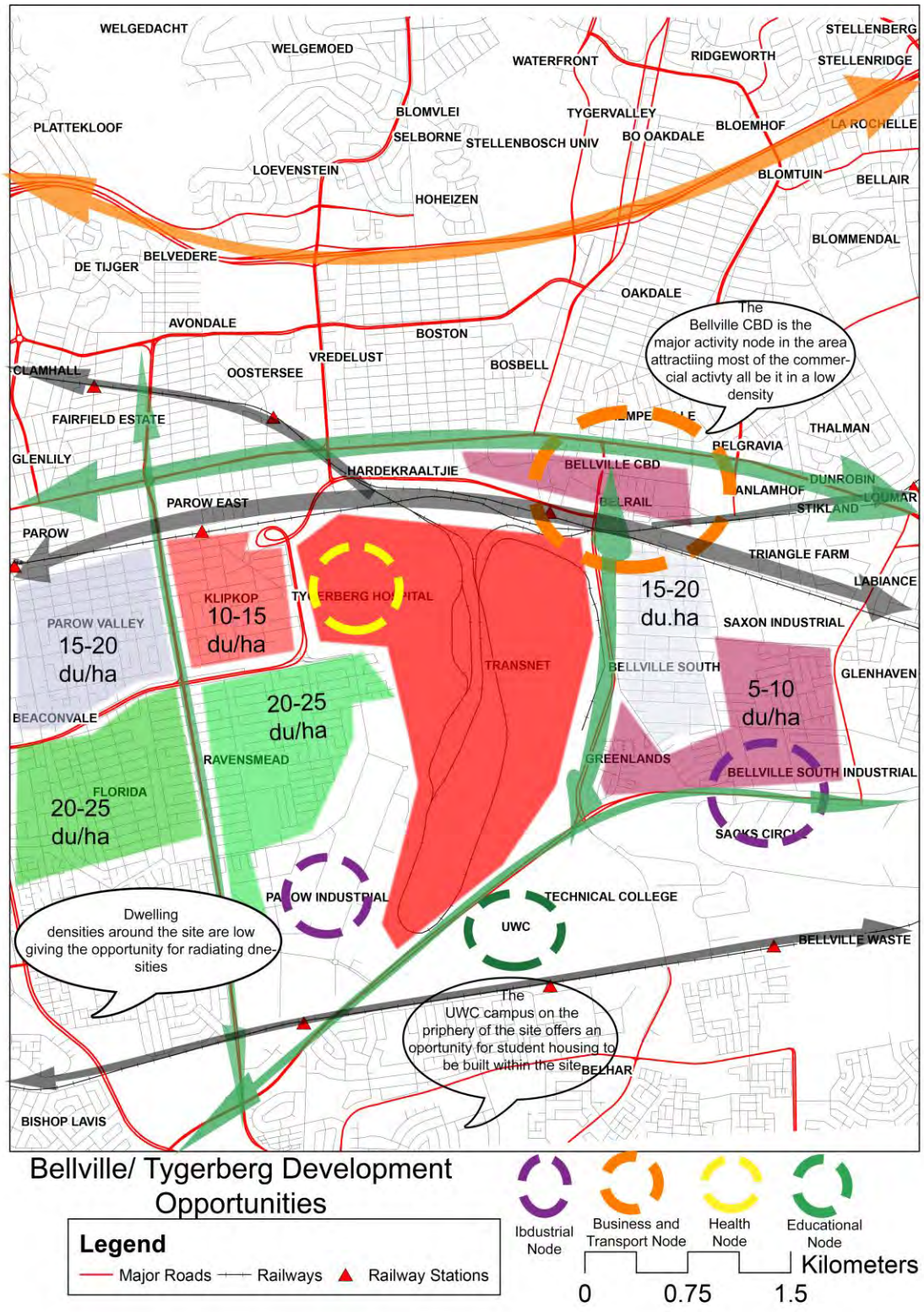

Figure 6.6 Concept Plan

6.6.3 Urban Fabric

The current urban fabric of the development site is almost nonexistent. The number of buildings within the site does not offer a substantial urban footprint that can be considered a characteristic of the site. However, looking at the surrounding areas, there is a distinct fine grained urban fabric that is characteristic of a low density urban environment.

Map 6.4 shows the proposed urban fabric for the Transnet site, illustrating an urban fabric that reflects high density urban development. The fabric is mainly shaped by the mobility corridors that run through the site. The central mobility corridor that will accommodate the BRT system provides the basis for this urban fabric. The use of the radiating density technique has allowed there to be bigger, denser blocks fronting the transit corridor while becoming distinctively finer grained as they radiate outwards to merge with the exiting urban fabric around the site.

On the eastern side of the site, the blocks are bigger mainly because the site is fronting a current busy activity route. However, the introduction of the new main transit route through the site will change that. Nevertheless, Robert Sobukwe Road will still remain relevant as it is a key access point for industrial traffic heading to Sacks Circle industrial park.

[See Attached Map 6.4]

6.6.4 Land Use

The current land use is quite limited, and is categorized as general industrial. The proposed land uses that are proposed by the new plan reflect the principles of a TOD development, especially the linear development model used in Curitiba. The hierarchy of land uses is facilitated through this system of radiating densities, with the most dense and diverse land uses focused on the central transit route; this will be discussed further in the urban densities section. (See Map 6.5)

Commercial Mixed Use

As mentioned in the spatial design elements section, the areas fronting the main transit route running through the length of the site will be the core of all activity on the site. In order to facilitate this, the land use needs to be commercial to mixed use, in order to have activity intensive developments fronting the transit route. Allowing for commercial developments to front the transit corridor commuters have better access to the services that they need. These commercial activities will be denser surrounding the transit intersections as depicted in Map 5. This is due to the simple fact that there will be more commuter traffic in these intersections, thus making intensifying land uses around these transport intersections vital.

Mixed Use

This land use zone is used predominantly for mixed use, focusing equally on residential development and commercial development. Residential developments in this zone will be high rise 7 to 8 story apartment blocks with the first 3 to 4 stories being offices and administrative buildings.

High Rise Residential

This zone will be exclusively reserved for residential development, with the exception of the East/West connector route intersections; these will have some commercial development to offer residents of these areas, with some form of commercial activity such as grocery stores and entertainment centers.

General Residential

This area will be reserved for less activity rich residential areas. Most residential units will not exceed 3 stories and there will be more pedestrian friendly zones in these areas.

[See Attached Map 6.5]

6.6.5 Transportation and Movement

The new movement map (Map 6.6) focuses on the core transit link running through the center of the site. This new transit route will be a BRT segregated only transit link, offering a direct link for commuters wanting to travel from the site area to the rest of CTMA or the district. This BRT link will also double as the new North/South Metropolitan linkage, thus promoting its development.

Transit Intersections

The major transit intersections depicted in Map 6 are meant to offer an exchange between the high capacity and high speed access of the main transport link, with the slower and lower capacity routes highlighted by the orange lines. These exchanges will be hubs of activity, given the high volumes of commuter traffic expected. Figure below depicts what these interchanges

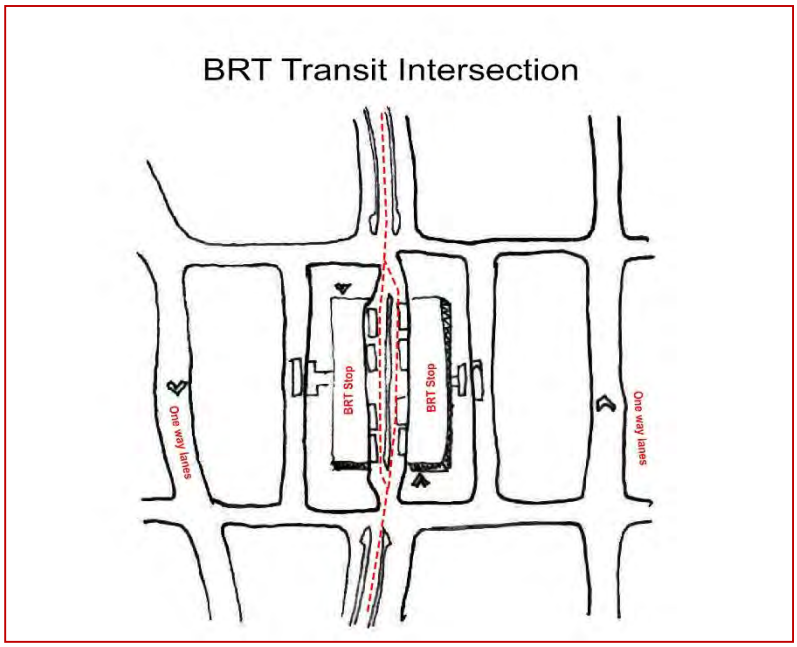

Figure 6.7 BRT Intersection

will look like. The new transit link will be the segregated bus lanes, and local buses will use the stops to distribute commuters around the site leading to increased connectivity of the area.

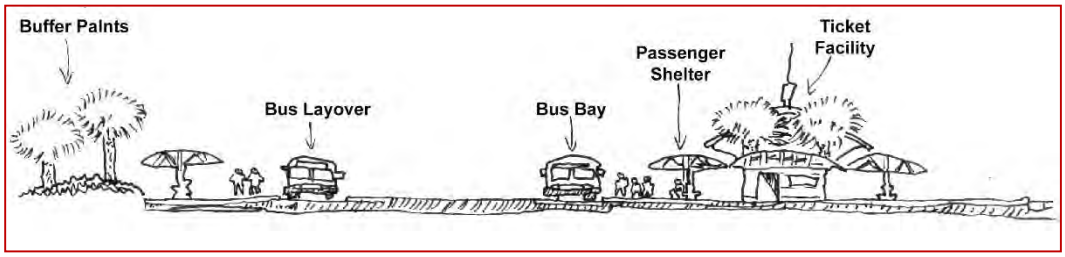

Figure 6.8 BRT stop cross section

Movement Types

As depicted in Map 3, this project site has been divided into various movement hierarchies. The first and most vital is the BRT transit route, which is a high mobility zone. Then we have the intersecting BRT routes that look to link the surrounding low density urban areas by providing direct access to the TOD development site, considering that it is above the standard 800m walking distance for effective commuter appeal.

The violet movement routes (see Figure) represent local vehicular traffic for access to residents who still use private transport, or for utilities and services access. These routes are placed between high and medium density blocks for better functionality of both the high density commercial and office spaces. Finally, there is a massive emphasis on the green pedestrian routes (see Figure). These routes run through pedestrianized pathways through the site, and are often located in areas of low to medium density residential and commercial land uses. Each pedestrian route will be optimized for cyclists, and intersections of pedestrian routes will be used as both open green spaces and recreational areas.

[See attached Map 6.6]

6.6.6 Proposed Densities

The proposed densities (See Map 6.7) for the project site have been derived from the Curitiba case, as well as proposed densities for TOD developments proposed by the UN Habitat report on Sustainable Housing. The table below outlines some suggested densities for TOD developments in relation to sustainable urban form.

[See Attached Map 6.7]

Chapter 7

7.1 Implementation Framework

This section focuses on looking at ways to put the designs created for the site into practice. Creating a standard set of policies and criteria will allow planners and practitioners to one day implemented the plans that have been put forward.

This chapter will be drawing heavily on the two cases looked at earlier – Singapore and San Francisco – in order to influence the implementation of this project. So to begin with, this chapter will draw parallels between the two cases and the project site.

Therefore, this chapter will be focusing on ways to essentially achieve the design that has been put forward. It will look at policy formulation and how the existing policy can be shaped to adapt with the principles of TOD. Secondly, it will look at community engagement in terms of providing a structured method of engaging with all the stakeholders in the area in order to have as much representation as possible. The chapter will also develop a framework for land use management that will essentially inform the way land uses will be developed and determined. Finally, the chapter will end off with phasing of the project.

7.1.2 Precedents

In the Precedents chapter, there were two cases that were looked at that; these provided two very good guiding examples of how to achieve efficient and successful TOD implementation. The cases of San Francisco and Singapore take two varying approaches to implementation, which combined can be the perfect framework for an implementation program in the Bellville Area.

Institutional Cohesion

In the Precedent chapter, we looked at the example for Singapore – especially for the successful implementation of TOD on a regional scale. A varying set of contributing factors resulted in the smooth and efficient implementation of the TOD master plan formulated in 1971.

The most striking feature of TOD implementation in Singapore was institutional cooperation and cohesion. When implementing TOD, there is a great need to have high levels of cooperation between various stakeholders and actors. This is simply because of the multifaceted nature of TOD; mixed use development, land use and transportation planning requires various experts and planners to be able to work together in order to efficiently and effectively implement TOD.

Singapore was uniquely placed both spatially and institutionally to offer this cohesive environment. As was discussed in the Precedent chapter, most of Singapore's success with the implementation of TOD stems from the stable political and institutional environment it is situated in. Early investment in mass rail transit and the recognition and foresight of curtailing private vehicle use allowed the Singapore authority to come up with a coherent and consistent transit plan (The 1971 Concept Plan).

However, to understand the forces at play, it is important to note why this institutional cohesion and foresight – which allowed the connection to the Bellville context to be made – was able to occur in the first place. The first major point is that Singapore, during its years of growth (1960s-70s), had a

relatively stable and consistent government with little opposition and a vast amount of respect and approval from the population. It was thus able to form institutions with strong foundations and implement legislation without much resistance. One such example was the Land Acquisition Act of 1957 that allowed the state to obtain private land if it was deemed to be in the interest of the country. This meant that Singapore could heavily invest in expanding the state's property, ultimately allowing it to roll out major infrastructure projects without having to go through costly settlements with residents. This was closely tied with the fact that increasing public land ownership made it easier for Singapore authorities to begin providing social housing. This development was especially crucial given the fact that the country was facing a severe housing shortage and an ever-increasing population in the 1960s. Effectively run as a one party state, the Singapore government was able to focus on creating a long-term vision for transportation and TOD development with little to no opposition.

The second major contributing factor to Singapore's massive success in implementation is its size. Given that it is essentially a city state, the developmental plans for Singapore were effectively all encompassing regional TOD development plans. TOD became the national development plan, and not many countries have that convenience. It meant that the planning process could be streamlined – a factor that Cape Town is lacking in its transport planning, as will be discussed later in this chapter.

Now, this chapter will look at the point on streamlined government structures a bit more extensively. Considering Singapore's most pressing issues in the 1960s were of a spatial nature, the government focused its energy on creating an institution that would be able to plan and implement TOD in the city state. Thus, the state formed the Housing Development Board, which was given a large input in government planning. The Board facilitated legislative and design-based interventions that allowed the planning process to be harmonized within government structures. Such is the clout of the Board that it hires transport, property, and land use planners, and determines to a very large extent the central planning process in the country.

Application

The strong institutional backbone of the Singapore context is on the most important drivers of TOD. A streamlined state and efficient implementation system, along with a stable political system and high respect for governance, have put Singapore as one of the leading examples of regional TOD implementation in the world.

However, one cannot ignore the fact that during these major advances in infrastructure and institution building, the state remained stable by harshly silencing critics and running the country in a relatively autocratic environment – with little room for critique or dialogue. A simple example would be the Land Acquisition Act that effectively gave the government the right to any land as long as it could prove it was of importance to the greater good of the state, which was always the case.

However, what we can learn from this context is that there is great need for institutional cohesion when it comes to implementing regional TOD and land use development plans. In terms of this project, the need for institutional cohesion rings very true. Given the size of the CTMA municipality, many departments are shielded from each other. Despite the fact that there is a National Development Plan, along with a provincial development framework and a Metropolitan Spatial Development Framework that provides for a District Plan, implementation between all these tiers of planning is very fragmented and inefficient. Thus, in terms of implementing the suggested changes to the project area, all these plans need to be brought under a streamlined institutional body that will manage implementation and planning. This will be discussed a bit more extensively in a following section.

Private-Public Partnerships

When it comes to Private TOD development, the United States is the leader. TOD is suggested by authorities but implemented by private developers. As was discussed in the Precedents chapter, the San Francisco authorities chose to create a unified vision for the Bay Area in terms of TOD.

Association of Bay Area Governments (ABAG)

This organization was formed as part of the realization of a unified implementation agency that would aim to bring TOD implementation under one institutional body. The agency is comprised of governmental and developmental organizations that have a key interest in developing the Bay Area. Initially, the agency was used as a tool to guide land use, and economic and residential development. However, the adoption of the Smart-Growth initiative in the early 2000s gave the agency a more active role in terms of directing TOD implementation in the Bay Area. The initiative saw the induction of more institutional and non- governmental bodies, which aided the implementation process by having a stronger presence among stakeholders – such as local residents and businesses. This allowed the authorities to be in touch with residents on the ground and also provided a direct link of communication between local residents and government and planning authorities.

Collaborative Development Projects

The ABAG set the framework for a coordinated approach to TOD in the Bay Area; the links to stakeholders had been created and the collaborative process was enforced. However, TOD planning remained hindered by the influence of private developers and local governments. Even though the planning had been done on collaborative level, there were still bottlenecks in terms of a unified implementation method. This lead to two of the largest Bay Area transit agencies (VTA & BART) forming collaborative development projects that included the ABAG in the implementation process. This effectively meant that existing spaces set up by local governments and private developers were put up for development, leading to the repurposing of parking spaces into affordable housing and sustainable TOD environments. This process included private developers through the ABAG framework.

7.1.3 Application to the Project Site

Public/Private Collaboration and Institutional Cohesion

With respect to the context of the project site, there are a number of agencies and stakeholders that are directly involved and interested in the development of the district. Private development in the district has increased substantially in the last five years, according to the COCT Junior Planner for the Tygerberg district, Jason Juries. The Greater Tygerberg Improvement District and the City of Cape Town are looking to roll out an urban regeneration program in the Bellville CBD area. Seeing as there multiple stakeholders and organizations operating within the project area, there is a need to form a collaborative approach when it comes to improving the district. So far, private developers have not been extensively included; if one is to succeed, especially in facilitating housing developments, there need to be coordinated levels of interaction and planning between private and public actors.

An effective component for the project area in terms of public and private collaboration are the three major organizations already interested in developing the area. The largest is the CoCT, which already possesses the planning infrastructure and resources to implement the proposed plan. The Greater Tygerberg partnership is a civil society organization that works on improving the district with urban regeneration initiatives. The third is a large grouping of private developers, which have

already developed up-market office space in the Tygervalley region that would be very interested in expanding development on the project site according to Jason Juries, Junior Planner for the CoCT Tygerberg district.

Focusing on CoCT as the biggest stakeholder in the district, collaboration with the above mentioned non- governmental entities will allow for a coordinated implementation of the proposed plan. This is especially the case given the extensive knowledge that the Greater Tygerberg Partnership holds in terms of issues facing the community, especially in the Bellville CBD. Property developers in the Tygerberg region are well placed to determine the amount of commercial development that might be needed in the proposed project site. So just like the ABAG, these organizations can come together and form a unified body that will implemented the proposed TOD in the project site. All stakeholders involved would have to go through this amalgamated organization that would coordinate and drive the implementation of the proposed TOD in the area.

7.1.4 Guidelines for Land Use Management

This section looks at providing guidelines to influence the creation of appropriate land uses within the site.

These guidelines will be derived from the proposed layout plan for the site, shown in the Design chapter. The guidelines will aim to develop the appropriate land use regulation to facilitate the required growth within the project site. Additionally, a land use management guideline to bring proposed developments in line with current legislation is required as per the Spatial Land Use Management Act of 2012.

Aims

Land use within the project site should reflect the urban fabric of the surrounding areas, but should additionally have a hierarchy of land uses that aims to reflect the needs of the development. Land uses must correspond to the relevant transport modes that they interact with; intensification of land uses will be achieved along transit routes. Matching land uses with proposed density is key to creating a well- functioning and accessible TOD development.

Land Use Management Guideline

Commercial	Mixed Use	High Rise Residential	Low Rise Residential
Commercial property fronting high activity transit route	Office and high density residential developments fronting a medium activity transit route	High and Medium Density Residential fronting low to medium activity transit route	Medium to low density residential fronting low activity transit route
Development can be up to 10 stories; With the first 3 stories being used for commercial development and office space. Remaining 7 can be used for high density residential apartments	Development in this zone is limited 6 to 8 sorties; First 3 floors to be mostly office space and commercial development Remaining floors to be High to medium density residential units Utilities and shopping complexes	15 to 10 story high density residential high rises; 30% of high rise developments must be social housing Permeable block structure for ease of access Pedestrianized routes Small nodes of commercial activity allowed for basic services	5 to single plot residential developments; Low density to fit into the surrounding pre-existing urban fabric Permeable block access
Large block structure development, permeated by pedestrian routes and fronted by a major transit corridor			Commercial developments limited to corner stores and basic amenities
Services with high demand should be situated on ground floors to ease commuter access.			Green spaces and parks to surround major transit intersections leading into the TOD site

TABLE 7.1 LAND USE MANAGEMENT GUIDE SOURCE: AUTHOR

7.1.5 Phasing

Given the complexity of implementing TOD in such a large area (250 ha), the project needs to be split into

5 distinct phases of implementation. This is in order to allow for adequate timing in terms of carrying out the relevant developmental procedures for the plan to become a reality. There needs to be coordination between the different phases and a realization of a suitable timeline in terms of actually implementing the changes. The implementation of phasing will be done non-programmatically considering the nature of TOD that is based on the demand and developmental capabilities and resources available for the project. Additionally, all phases of this project are strongly dependent on the completion of the preceding phases. Considering phasing will be done non-programmatically, the timeframes that are suggested in Table 1 will be assessed based on interviews and estimated projections; they are not to be taken as fact.

The phases will be described as follows and refer to Table 1:

- Phase 1: Land Acquisition and Institutional Formation
- Phase 2: MyCiti BRT Roll out
- Phase 3: Transport Infrastructure Changes
- Phase 4: Property Development
- Phase 5: Future Expansion

Phase	Purpose	Action	Time Frame	Stakeholders
Phase 1	Institutional Formation Land Acquisition	Institutional formation: Combination of all relevant stakeholders with authority over the project site PRASA, CoCT, GTBP, TRANSNET, UWC, Tygerberg Hospital Coordination of assigned roles in development (PRASA deals with rail infrastructure changes, CoCT policy etc) Land Acquisition: Final decisions need to be made by TRANSNET to whom the land belongs Once it has been attained, it needs to be divided in terms of the proposed plan.	1 to 2 years	CoCT GTBP TRANSNET PRASA BCID
Phase 2	MyCiti BRT Roll Out	Extension of the existing MyCiti BRT system along the proposed transit routes	2 to 3 years	CoCT MyCiti
Phase 3	Transport Infrastructure Changes	Facilitating the new high transit corridor through the project site. Achieved by developing the two core transit hubs at UWC and the Bellville CBD	3 to 4 years	PRASA CoCT MyCiti GTBP
Phase 4	Property Development	Once transit infrastructure is in place development of commercial and residential zones can begin. This will be done on a demand basis, and development zones around transit hubs will be given priority.	4 to 7 years	Private property Developers CoCT GTBP
Phase 5	Future Expansion	With the growth of demand, radiating development will be encouraged around initial developments. The proposed plan accommodates for this growth	None	CoCT GTBP TRANSNET PRASA BCID Private Developers

TABLE 7.2 PHASING GUIDELINES SOURCE: AUTHOR

7.2 Conclusion and Closing Remarks

This section aims to summarize the findings that have been made in this project, as well as the theories and ideas that were used. It will be used as a lens into the author's personal reflections about the outcome of the project.

To begin with, it is important to note that TOD and its implementation is a process that cannot be simplified to a single document and a single example; it is an ever changing dynamic urban development technique that can always be improved and adjusted to the context that it is being implemented in. This research project began with two very simple questions that guided the investigation the whole way through; it has been the aim of this project to specifically address those two broad questions by investigating, analyzing, and finally implementing this developmental technique.

> "*To what extent can transport hub infrastructure development foster mixed use and mixed density urban development?*
>
> "*How could TOD influence the built environment along with the socio-economic landscape of the Bellville CBD area?*"

Investigating to what extent transport hubs can foster a more dense urban form along with a greater diversity of land uses could be done by just looking at various examples around the world, which is what was done. This question was asked in order to be able to gather the knowledge required to try and adapt a developmental technique to this need of a compact urban form and denser development. Thus, the second question was posed to look at the use of TOD as a means of achieving that objective through the South African urban context of Bellville CBD and surrounding areas.

These two fundamental questions aimed to provide as much scope as possible without leaving the project open ended and without direction. The first objective in achieving a definite answer to these questions was to investigate how mobility is a relevant force in urban planning for growing and ever-expanding urban environments, particularly in the Global South. Through extensive investigation of the literature, it was found was that mobility is proportionally linked to development. Where urban environments grow, there is need for efficient transport and movement systems. It was found that authorities during times of growth chose development policies that favored private vehicle use instead of public transport, which led to sprawling and congested cities. Towards the tail end of these booms, many cities found themselves having to deal with huge circulation and transit issues. Thus, it was discovered that by linking development and growth to transport design and implementation one can get a compact urban form in addition to increased densities. Thus, TOD was seen as a viable developmental technique for increasing mobility and addressing density and diversity of land uses.

The next logical step for this project would be to evaluate the use of TOD in other contexts in order to determine what would best suit the Bellville area. The Precedents chapter focused on investigating a variety of cases that were as broad as possible given the time constraints and the scope of the project. The cases chosen (Singapore, San Francisco, Copenhagen, and Curitiba) offered a wide scope of TOD implementations that were successful in varying degrees and on different scales. It was revealed that TOD can be used as a means of realizing various goals other than dense growth and mixed land use. Increase in ridership, commercial property development,

social housing and pedestrian environments are some of the examples of the wide ranging benefits of using TOD as a developmental medium. Once all this information had been collected and analyzed, framing it within the Bellville and Cape Town context became crucial. It was found that not only did the project area possess the demand for this type of development, there was a lot of preexisting infrastructure and contextual realities that would justify the use of TOD in the area. Thus, TOD was an achievable developmental goal for the Bellville Area. The proximity of high mobility transit routes, such as the Cape Town/Stellenbosch metro rail line and the Voortrekker Road development corridor, meant that the metropolitan node of Bellville was perfectly placed for the use of TOD. The vacant Transet site provides the perfect opportunity for the first stage of this development, considering the copious amount of open space that is available.

In terms of implementing the plan of radiating densities and the high activity transit corridor through the Bellville site, it falls more to the institutional readiness of authorities in Cape Town and around the country. In the cases that were looked at, there always was a form of institutional unity that was needed for them to succeed in one way or another. Authorities have to come together to streamline governmental and regulatory structures in order to be able to have a coherent and implementable developmental plan. However, a lot is going to depend on the ability of all stakeholders to agree on releasing the vacant land that the proposed site is located on. It is very often the case in the South African context that institutional and bureaucratic barriers get in the way of legitimate development.

As a final comment, the biggest constraint of this project has been the amount of time available to carry out this research. There is so much potential for TOD development in this area, that it would be very interesting to develop a more extensive precinct plan that includes the surrounding areas. TOD could have far reaching benefits for the whole district of Tygerberg, and the proposed project site has shown what is possible through the implementation of TOD.

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Cape Town Metropolitan Area

Legend

- Major_Roads
- Railways
- Development Corridor
- Urban Consolidation
- Urban Node
- Project Site

N

SELBORNE
PLATTEKLOOF
LOEVENSTEIN
HOHEIZEN
STELLENBOSCH UNIV
OAKDALE
LA ROCHELLE
BLOMTUIN
N1
Highway
BLOMMENDAL
DE TIJGER
OAKDALE
CHRISMAR
AVONDALE
BOSTON
BOSBELL
Durban Rd
THALMAN
KEMPENVILLE
Voortrekker Corridor
BELGRAVIA
HARDEKRAALTJIE
Bellville CBD
SANLAMHOF
PAROW
TRIANGLE FARM
Tygerberg Hospital
PAROW VALLEY
SAXON INDUSTRIAL
BELLVILLE SOUTH
GLENHAVEN
Transnet Site
RAVENSMEAD
GREENLANDS
BELLVILLE SOUTH INDUSTRIAL
FLORIDA
De La Rey Street
SACKS CIRCLE
Symphony Way
UWC
ELSIES RIVER
Robert Sobukwe Rd
BELHAR
BISHOP LAVIS
AIRPORT

Legend

Metro-pol North/ South Link
National Highway (N1)
Sub Metro-pol Links
Connector Routes
Rail Link (Metro Rail)
Activity Corridor (Voortrekker)
Potential Connecting Links
Train Stations & 800m walking radius
Main Roads
Access Streets

Bellville Site Flows Map

N

0 0.5 1 Kilometers

BOSBELL
OAKDALE
CHRISMAR
BOSTON
OOSTERSEE
VREDELUST
KEMPENVILLE
BELGRAVIA
Bellville CBD/Station
BELLVILLE CBD
HARDEKRAALTJIE
PAROW EAST
BELRAIL
TRIANGLE FARM
SAXON INDUSTRIAL
KLIPKOP
Kasselsvlei Rd
BEACONVALE
SAXON INDUSTRIAL
Frans Van Zyl Dr
RAVENSMEAD
TRANSNET STORAGE
Yellowwodd Rd
Stoker st
TRANSNET INDUSTRIAL PARK
CKS CIRCLE
PAROW INDUSTRIAL
Robert Sobukwe intersection
BELLVILLE WASTE
TECHNICAL COLLEGE
UWC
UWC entrance/Rober Sobukwe Rd
BELHAR

Legend

Permiable barrier

Non- permiable barrier

Potential access points

Project site barriers

N

0 0.4 0.8 Kilometers

BOSBELL
OAKDALE
CHRISMAR
BOSTON
OOSTERSEE
VREDELUST
KEMPENVILLE
BELGRAVIA
B LLVILLE CBD
HARDEKRAALTJIE
PAROW EAST
BELRAIL
TRIANGLE FARM
SAXON INDUSTRIAL
KLIPKOP
TYGERBERG HOSPITAL
BELLVILLE SOUTH
SEACONVALE
SAXON INDUSTRIAL
RAVENSMEAD
GREENLANDS
SACKS CIRCLE
PAROW INDUSTRIAL
BELLVILLE WASTE
TECHNICAL COLLEGE
UWC
BELHAR

Legend

Urban Fabric/ block structure

Transport inter-section nodes

Train sations

Proposed Urban Fabric

N

0 0.4 0.8 Kilometers

BOSBELL
OAKDALE
CHRISMAR
BOSTON
OOSTERSEE
VREDELUST
KEMPENVILLE
BELGRAVIA
B LLVILLE CBD
HARDEKRAALTJIE
PAROW EAST
BELRAIL
TRIANGLE FARM
SAXON INDUSTRIAL
KLIPKOP
TYGERBERG HOSPITAL
BELLVILLE SOUTH
SAXON INDUSTRIAL
RAVENSMEAD
GREENLANDS
SACKS CIRCLE
PAROW INDUSTRIAL
BELLVILLE WASTE
TECHNICAL COLLEGE
UWC
BELHAR

Legend

Mixed Use | Commercial | High rise residential | General residential | Transit inter-section

Land Use

N

0 0.4 0.8 Kilometers

BOSBELL
OAKDALE
CHRISMAR
BOSTON
OOSTERSEE
VREDELUST
KEMPENVILLE
BELGRAVIA
B LLVILLE CBD
HARDEKRAALTJIE
PAROW EAST
BELRAIL
TRIANGLE FARM
SAXON INDUSTRIAL
KLIPKOP
TYGERBERG HOSPITAL
BELLVILLE SOUTH
SAXON INDUSTRIAL
RAVENSMEAD
GREENLANDS
SACKS CIRCLE
PAROW INDUSTRIAL
UWC

Legend

- New North/South metro link
- East/West Connector routes (BRT and private transport)
- Transit Nodes/BRT Interchanges
- District leve transport (BRT feeder routes)
- Local motrized routes
- Local non-motorized routes

Transportation and Movement Systems

N

0 0.4 0.8 Kilometers

BOSBELL
OAKDALE
CHRISMAR
BOSTON
OOSTERSEE
VREDELUST
KEMPENVILLE
BELGRAVIA
B LLVILLE CBD
HARDEKRAALTJIE
PAROW EAST
BELRAIL
TRIANGLE FARM
SAXON INDUSTRIAL
KLIPKOP
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BELLVILLE SOUTH
SAXON INDUSTRIAL
RAVENSMEAD
GREENLANDS
SACKS CIRCLE
PAROW INDUSTRIAL
UWC

Legend

93 du/ha

17 du/ha

40 du/ha

22 du/ha

Urban Density

N

0 0.4 0.8 Kilometers