

**Creating a platform for Transit-Oriented Development
(TOD) through Integrated Land Use and Transport Planning
in Cape Town: A study of Bellville Station**

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Abstract

As urbanisation trends continues and increases across the world, urban trends have seen urban growth take place horizontally, leading to undesired urban sprawl. With the global introduction of the automobile in the 1960's, urban sprawl has been exacerbated with the automobile allowing for the decentralisation of employment, residential, commercial and leisure opportunities away from the Central Business Districts of the city. Due to a multitude of negative social, environmental and economic effects associated with urban sprawl, spatial planning practices have been aimed at reversing this trend and ultimately creating a more compact urban form. In addition to undesired urban sprawl, the use of private vehicles as the dominant mode of transport has also been problematic. In an attempt to address these issues simultaneously, Transit-Oriented Development (TOD) has recently been adopted as a tool with which to achieve transformation of urban forms.

This study aims to explore TOD as a tool by assisting to (i) provide a theoretical base and historical perspective of TOD; (ii) provide insight regarding the principles and benefits of TOD that has promoted the use of TOD as a transformative tool; (iii) understand the role of land use and transport planning in providing a platform for the implementation of TOD strategies; (iv) identify cases where TOD has been adopted successfully; (v) understand the role of the legal environment in South Africa with regards to the implementation of TOD strategies; (vi) depicting how the ideal TOD environment could look and function in Cape Town; (vii) understanding how South Africa's legal environment promotes TOD at local level of government in Cape Town and; (viii) what key issues and challenges currently hinder the successful implementation of TOD strategies in Cape Town. This study makes use of a literature review, as well as an empirical study where existing documents (such as spatial development frameworks and integrated transport network plans) are analysed and qualitative and quantitative data is used to explore a number of case studies.

From the case studies and additional research it was evident that there is a need for a sound legislative platform which promotes and supports the adoption of TOD at all spheres of government. It was further found that several issues and challenges are made mention of in municipal plans and policies, but that these issues and

challenges continue to negatively influence the implementation and success of TOD in Cape Town. Existing legal tools and instruments are not necessarily capable of creating a platform for the implementation of TOD and would thus need to be amended or integrated with other local level strategies. If Cape Town is to successfully use TOD as a tool with which to rectify spatial issues, the legal environment needs to better promote the integration of land use and transport planning in order to encourage densification and to ensure that public transport becomes a viable means of transport in the city. Only once the above mentioned are addressed, can the spatial form of the city be transformed through TOD and future development can contribute to the sustainability of Cape Town.

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Thirdly I would like to thank my mother dear for the patience she bestowed upon me. This year has not been easy on either of us, but your passion for my growth is immeasurable. I am in awe of your drive and compassion. Your love and insightfulness is not only appreciated in this regard, but in all aspects of my life.

List of Acronyms and Abbreviations

BEPP	–	Built Environment Performance Plan
BoR	–	Bill of Rights
BMT	–	Bus and Minibus Taxis
BRT	–	Bus-Rapid Transit
CBD	–	Central Business District
CoCT	–	City of Cape Town
COSATU	–	Congress of Southern African Trade Unions
CTMPB-L	–	Cape Town Municipal Planning By-Law
CTMSDF	–	Cape Town Municipal Spatial Development Framework
DCITP	–	Draft Comprehensive Integrated Transport Plan
DMS	–	Development Management Scheme
DMSDF	–	Draft Municipal Spatial Development Framework
GABS	–	Golden Arrow Bus Services
IDP	–	Integrated Development Plan
IRT	–	Integrated Rapid Transit
ITDP	–	Institute for Transportation and Development Policy
ITP	–	Integrated Transport Plan
LE	–	Location Efficiency
LUMS	–	Land Use Management Schemes/Systems
MLTF	–	Municipal Land Transport Fund
MPL	–	Minister of Provincial Legislature
MSA	–	Municipal Systems Act
MSDF	–	Municipal Spatial Development Framework
NCCRP	–	National Climate Change Response Policy
NLTA	–	National Land Transport Act
NMT	–	Non-Motorised Transport
NUTP	–	National Urban Transport Program
PGDS	–	Provincial Growth and Development Strategy
PRASA	–	Passenger Rail Agency of South Africa
PSDF	–	Provincial Spatial Development Framework
RSA	–	Republic of South Africa

SDF	–	Spatial Development Framework
SPA	–	Special Planning Areas
SPLUMA	–	Spatial Planning Land Use Management Act
SPTS	–	Strategic Public Transportation Systems
TCT	–	Transport for Cape Town
TOD	–	Transit Oriented Development
TODSF	–	Transit-Oriented Development Strategic Framework
UCT	–	University of Cape Town
VC	–	Value Capture
ZAR	–	Zuid-Afrikaanse Rand (South African Rand)

List of Figures

Figure 1.1: Illustration of the research methodology of this study.

Figure 2.1: Relationship between land use, transport, travel behaviour and other external factors.

Figure 3.1: Locality Map of Curitiba, Brazil.

Figure 3.2: Map of Curitiba, Brazil.

Figure 3.3: Concept of the envisioned urban form of Curitiba, Brazil.

Figure 3.4: Image showing the BRT system in inner-city Curitiba, Brazil.

Figure 3.5: Locality Map of Medellin, Colombia.

Figure 3.6: Map of Medellin, Colombia.

Figure 3.7: Image depicting the Metrocable in Medellin.

Figure 5.1: Locality map of Cape Town, South Africa.

Figure 5.2: Map of Cape Town, South Africa.

Figure 5.3: Illustration of the 19 core transport nodes in Cape Town.

Figure 5.4: Map of Bellville station.

Figure 5.5: Map of Bellville station: Existing land use zoning.

Figure 5.6: Map of Bellville station: Transformation Plan.

Figure 5.7: Tools with which to implement and institutionalise TOD in Cape Town.

List of Tables

Table 5.1: Table depicting the transport objectives and consequent land use interventions as set out by TODSF.

Table 6.1: Table depicting the peak modal splits by income groups for Cape Town.

Table of Contents

Chapter 1: Introduction	1
1.1 Background to the study	1
1.2 Research problem	2
1.3 Problem statement	3
1.4 Research questions and aims	4
1.5 Objectives of the research	5
1.6 Research design and methodology	6
1.7 Chapter Outline	9
Chapter 2: Unpacking the layers of Transit Oriented Development (TOD)	11
2.1 Introduction	11
2.2 Contributions to the evolution of contemporary urban form	12
2.2.1 The rise of the automobile	14
2.3 Effects of transportation in contemporary cities	15
2.4 The influence of land use planning	16
2.4.1 The influence of transport on land use planning	18
2.5 The need for better integration between land use and transport planning .	19
2.5.1 Influence travel behaviour	19
2.5.2 Creating sustainable ridership	21
2.6 The introduction of TOD as an alternative to current Modernist designs	22
2.6.1 Contemporary understanding of TOD	23
2.6.2 Underlying principles of TOD	25
2.6.3 Benefits of TOD	28
2.7 Conclusion	33
Chapter 3: Case studies: Curitiba and Medellin	35
3.1 Introduction	35
3.2 Curitiba, Brazil	35
3.2.1 Policy reform in Curitiba	36
3.2.2 Integrating land use and transport planning in Curitiba	37
3.2.3 Concluding remarks	41
3.3 Medellin, Colombia	42

3.3.1	Policy leveraging in Medellin.....	43
3.3.2	The transport system of Medellin.....	44
3.3.3	Concluding remarks	47
3.4	Conclusion	47
Chapter 4: The legal environment in Cape Town, South Africa		49
4.1	Introduction	49
4.2	Laws, policies and plans	50
4.2.1	The Constitution of the Republic of South Africa.....	50
4.2.2	The Municipal Systems Act (32 of 2000)	54
4.2.3	The Spatial Planning and Land Use Management Act (16 of 2013).....	56
4.2.4	The National Land Transport Act.....	59
4.3	Conclusion	62
Chapter 5: Enabling TOD through institutional frameworks		64
5.1	Introduction	64
5.2	Cape Town, South Africa.....	64
5.2.1	Political context of Cape Town.....	65
5.2.2	Public transport in Cape Town	66
5.3	Transforming Bellville Station through TOD	69
5.3.1	Analysing the intentions of the Transformation plan for Bellville station	75
5.4	Legal Tools and Instruments for the implementation of TOD.....	76
5.4.1	The Cape Town Municipal Spatial Development Framework.....	77
5.4.2	The Cape Town Municipal Planning By-Law	79
5.4.3	The draft Comprehensive Integrated Transport Plan.....	81
5.4.4	City of Cape Town Transit Oriented Development Strategic Framework	83
5.5	Conclusion	86
Chapter 6: Issues and challenges facing the implementation of TOD		88
6.1	Introduction	88
6.2	Issues and challenges that currently affect the implementation of TOD in Cape Town.....	88
6.2.1	Global issues and challenges.....	89
6.2.2	Metropolitan scale issues and challenges.....	90
6.2.3	Precinct scale issues and challenges.....	99
6.3	Conclusion	103

Chapter 7 – Concluding the TOD debate	105
References.....	109

1 Chapter 1: Introduction

1.1 Background to the study

This study is about Transit Oriented Development (TOD) and how land use planning and transport planning needs to be integrated in order to successfully create a platform for TOD to work in the South African context. TOD is often mentioned as a goal of contemporary development in many South African documents, and thus much emphasis is placed on the promotion of this type of development. As a consequence of the potential effects of a TOD approach to development, a need exists to regulate the expansion and growth of TOD, especially in Cape Town.

In an effort to complete the course of Masters in City and Regional Planning, the researcher was required to travel significant distances on a daily basis. During this time the researcher observed that although the cost of private travel was significant, public transport was not necessarily a feasible alternative. In addition, public transport is not always readily available in various residential neighbourhoods, thus it would be sensible to reside close to transport hubs in order to make use of this public service.

After further investigation, it became apparent that these issues has long been persisting in the Cape Town region, with various levels of government aiming to address this exact issue, through the development approach called TOD. During informal conversations with various practitioners and academics in the field, the researcher became more aware of some of the associated constraints and opportunities of TOD in contemporary Cape Town. After consulting various policies and other pieces of legislation, it appeared that TOD was being given sufficient attention at the time; however, this approach to development has not impacted as far and wide as originally imagined. Having worked as a student town and regional planner for several months prior to the undertaking of this study, it became evident that there was a lack of understanding about the required interaction between land use planning and transport planning in order to create a platform for TOD to work.

Due to this gap in the literature, the researcher decided to focus on a major transport node (Bellville Station) in the Cape Town Metropolitan. With this new focus on TOD being enforced in several areas, the researcher attempts to address the shortcomings which are evident in both theory and practice.

1.2 Research problem

Due to the spatial inequalities in Cape Town caused by historical Apartheid planning practices, combined with increasing urban sprawl, employment and residential opportunities are often located far distances from each other. This requires individual to travel long distances to access such opportunities, with lower income households often spending significant percentages of their monthly income on transport (Kotze et al., 2014). With public transport being unreliable, and often inaccessible, the use of private vehicles as the main mode of transport has increased dramatically and as such the associated social, economic and environmental effects have become unsustainable (van Esssen, 2008). In an attempt to rectify the above mentioned issues, the South African government is hoping to adopt Transit-Oriented Development (TOD) as a tool with which to spatially transform the city and to make urban development more sustainable. Many academic authors have highlighted the benefits and opportunities regarding TOD (Autler and Belzer, 2002a; vanderwater, 2015); however, the South African government, specifically Cape Town municipal authorities, have faced various challenges with regards to the implementation of TOD strategies in the city.

From the implementation issues and challenges mentioned above, it has become apparent that in order to use TOD to transform the urban environment and to easy accessibility through public transport, it needs to be understood what some of these issues and challenges are and how the legal environment promotes the adoption of TOD strategies in Cape Town. After studying TOD as a tool in more detail, it is essential to understand which practices are required to create a platform for the implementation of TOD in Cape Town, seeing that although TOD as a tool is being promoted, but is not yet being effectively transformed into reality. An example is Bellville station, which is the second biggest transport node in Cape Town and is ideal for the adoption of TOD. Although various policies and plans have identified

Bellville station as a catalyst for TOD, the station is still currently viewed as ineffective and often dangerous (IOL, 2015). It is therefore pivotal that the issues and challenges hindering the implementation of TOD be better understood and that greater insight is gained into how policy and legislation promotes TOD and guides decision-makers in this regards.

1.3 Problem statement

South Africa is governed by three spheres of government (National, Provincial and Local) which all aim to co-exist; however, it is often at the local level of government where implementation takes place. Drawing from international case studies where TOD has been successfully implemented, it becomes apparent that the legal environment at local level provides the fundamental platform which allows decision-makers to align local level policies and plans to the long-term development vision for the country. In addition, TOD is dependent on the integration between land use and transport planning as is it essential that both these fields of planning cooperate and complement one another. With the legislation at all spheres of government needing to be aligned, it is important that legislation at all spheres of government is integrated and that land use and transport planning is not dealt with in silos.

Due to the structure and nature of legislation in South Africa, various Acts and policies regulate different activities. Both National and Provincial legislation has previously dealt with land use and transport planning separately, with the integration of these entities becoming more visible in local level policies and plans. In recent years, all spheres of government have started better cross-referencing and integrating land use and transport planning; however, persistent issues and challenges of land use and transport planning respectively are often being dealt with in isolation of one another. This lack of integration often means that such issues and challenges are not fully addressed and is evidently hindering the implementation of TOD in Cape Town as TOD can only be successful if land use and transport planning is fully integrated.

Low densities, urban sprawl, a lack of mixed land uses, infrastructure capacities and widespread economic opportunities are examples of land use management

challenges that are being isolated from transport planning challenges, such as the negative influence of private vehicles, unreliable and unsafe public transport, public transport ownership issues and a lack of financial capacity for the maintenance of public transport systems. For TOD to be successful, it is of vital importance to improve the theoretical knowledge of these issues and challenges, as well as to better understand how legal tools and instruments can be used at the local level of government in an attempt to provide a platform for TOD with which to ultimately improve the spatial inequalities in the city.

Due to the magnitude and sheer amounts of locations suitable for TOD in South Africa, it would be very challenging to analyse all the applicable legislation and draft TOD plans for all these locations. Therefore, this study will make use of Bellville station to depict how a TOD environment could look in the future, if land use and transport planning is integrated and if this integration is reflected in the relevant legislation. Although each TOD project would need to be uniquely suited to the relevant geographical areas, Bellville station and the accompanying TOD strategy is based on a set of principles which would be the cornerstone of TOD projects anywhere in the country. However, by focusing solely on Bellville station, this study will be better equipped to analyse local level legislations and to analyse the local context which ultimately also heavily influences municipal decision making.

1.4 Research questions and aims

The main research question this study will explore is how to create a platform for Transit-Oriented Development (TOD) through the integration of land use and transport planning in Cape Town?

In light of the above mentioned, this main research question will be supported by two subsidiary research questions which will assist in guiding the research undertaken for this study. The first of these questions will explore how the legal environment in South Africa supports and promotes the adoption and implementation of TOD strategies? With the second subsidiary research question aiming to understand what the current issues and challenges are that hinder the implementation of TOD in Cape Town?

This study will therefore:

- Identify what the definition, intentions, requirements, principles and benefits of TOD is;
- Determine how the legal environment in South Africa, specifically Cape Town, can be used to promote the implementation of TOD at the various levels of government;
- Understand the issues and challenges that affect the implementation of TOD in Cape Town.

This exploratory study aims to describe existing phenomena in more detail, with the emphasis being placed on finding real life solutions and alternatives in local areas. If sustainable and feasible mitigation or maintenance frameworks and plans can be identified, they could potentially be applied in other geographical areas. This study aims to deal with real life phenomena, while placing special emphasis on the factors that relate specifically to the city and regional planning field. This study has not specifically been undertaken to make new findings in the field, but rather to get a clearer understanding of what exactly it is that does not allow TOD to flourish in contemporary Cape Town.

1.5 Objectives of the research

It is against the above mentioned background and problems that the broad research objectives of this investigation will be to:

- Provide an understanding of what TOD is and how this approach is currently being used in both the international and local context;
- Provide an interpretive theoretical base and understanding of land use planning and transport planning in South Africa and what factors drive the need for better integration between these two types of planning;
- Identify and provide insight on the main laws, policies and plans that currently regulate this type of development in South Africa, with specific focus on the Western Cape and Cape Town;

- Provide understanding what the roles are of the different legal tools and instruments at the various scales, with which to ultimately assist in providing a plan for the adoption of TOD in South Africa;
- Provide practical examples of TOD through the use of a future plan of Bellville Station, Cape Town;
- Provide insight into how to promote TOD in Cape Town, or alternatively, which alternative approaches to development to investigate.
- Illustrate how legislation could be used to achieve TOD in and around Bellville station, Cape Town.
- Contextualise the issues and challenges that hinder the successful implementation of TOD in Cape Town.

1.6 Research design and methodology

This study will be a combination of an empirical study and a non-empirical study. The non-empirical study consists of a literature review chapter.

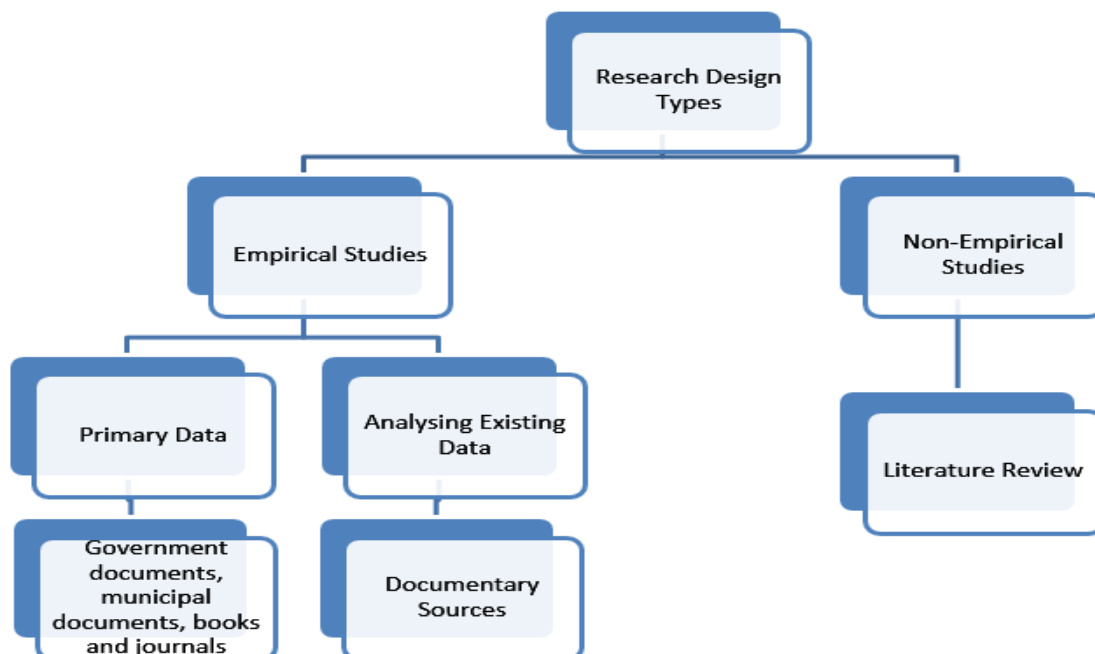


Figure 1.1: Illustration of the research methodology of this study (Authors own).

The literature review chapter will cover a range of theoretical perspectives. The literature review will provide a clear indication of what TOD, transport and land use planning is and how it is currently being used, since these elements arguably make up the preferred development types the Cape Town. The literature review will then also identify the theoretical principles, benefits and requirements related to the TOD concept and how such a development approach could transform Cape Town in the long-term.

The next part of the study will explore international case studies and examples of where TOD strategies has been successfully adopted and implemented. This section will look at Curitiba (Brazil) and Medellin (Colombia). This section will look at how both these cities used the legal environment as a platform from which to enforce the necessary actions and projects which was needed for the implementation of TOD, before unpacking which aspects of TOD was used as the backbone for TOD strategies. After analysing the benefits accrued from the respective TOD strategies, this section will aim to understand what challenges the respective cities faced during the implementation phases.

For the purpose of undertaking an informed contextual study for both the literature review and case study chapters, secondary textual data in the form of books, articles, journals and internet sources, will be examined. Secondary textual data will be used to gain greater insight into the technical aspects of TOD, as well as land use and transport planning aspects, as secondary textual data is often more legitimate than primary data. The secondary textual data analysis also provides insight from various perspective, which in turn allows for a more thorough literature study.

The following part of this study will then aim to understand what the requirements for TOD implementation is in South Africa, by analysing the legal environment. In this regards, this study will explore existing laws, policies and regulations that currently apply to TOD, and more specifically to land use and transport planning practices. This section will start with national laws and policies and will then narrow down to legislation and regulations that specifically focus on Cape Town as the local level focus, before presenting a range of legal tools and instruments with which local government authorities can enforce the required actions for the implementation of

TOD. These tools and instruments will include Integrated Development Plans (IDPs), Spatial Development Frameworks (SDFs), Municipal By-Laws and Comprehensive Integrated Transport Plans (CITPs).

The empirical research will be based on in depth case studies, making use of quantitative and qualitative data. The case studies will be explored using secondary data and analysing existing documents. The secondary data will be collected from public documents such as copies of Spatial Development Frameworks, Environmental Authorisations, and Integrated Development Plans, together with Acts, books, peer-reviewed articles, electronic journals and other relevant literature.

The following part of the study will draw from the case studies presented in previous chapters, and will consequently present a TOD plan for Bellville station. This plan will depict how Bellville station could be developed and transformed into a TOD environment, based on the principles of TOD presented in the literature review chapter of this study. Bellville station is the second largest multi-modal transport station in Cape Town and is strategically located. Therefore, TOD strategies at Bellville station could accurately depict the positive ramifications and requirements for adopting TOD elsewhere in the city. Thus, by using Bellville station as a case study, this study aims to uncover depict the required transformation in terms of land use and transport planning. Due to a lack of available data, this TOD transformation plan for Bellville station will be conceptual and will not indicate technical details and processes needed to implement such a plan. Drawing from a range of workshops and informal stakeholder meetings, this study will then aim to provide insight into how local level legislation, including the tools and instruments referred to in previous chapters, can be used to achieve the TOD transformation plan for Bellville station. In this regard, this study will examine local level plans and policies in more detail, highlighted the relevant information from these legislations.

Drawing from all sources of secondary data accrued in the study, the next part of this study will be an expression of the author's views and opinions of what the key issues and challenges are facing the successful implementation of TOD in Cape Town. Where relevant, this section will refer to secondary textual data to substantiate specified claims and to give more rigour to selected arguments.

All of the information needed for this study will be obtained from public sources. No formal interviews and personal data will be conducted or collected as part of the research, although some stakeholders will be informally contacted to help source selected documents. All the information needed to undertake this study can be obtained from public sources, deeming it unnecessary to conduct interviews, or use questionnaires.

1.7 Chapter Outline

Chapter 1 – Overview of research

Chapter 1 explores why this study was undertaken and why more research on such a topic would be needed. This chapter also indicates how this study will aim to conduct the research and what specific gaps in current knowledge must be addressed in order to better understand the required approach to the implementation of TOD in Cape Town.

Chapter 2 – Understanding TOD

Chapter 2 was done in the form of a literature review, exploring various literatures analysing the definitions, application, requirements, principles and benefits of TOD. This literature review also looked at the need for integration between land use and transport planning and how such integration can provide a platform for the implementation of TOD.

Chapter 3 – International Case Studies: Curitiba and Medellin

Chapter 3 looked at Curitiba (Brazil) and Medellin (Colombia) and how they successfully adopted TOD strategies to address urban form and transport issues in their respective cities. This chapter specifically looked at how the policy environment was used to enforce the required actions and projects needed to create a TOD environment, while simultaneously analysing the benefits and key elements of TOD strategies used during the adoption and implementation stages.

Chapter 4 – The Legal Environment in South Africa

Chapter 4 aimed to provide insight into the legal environment of South Africa and how this environment supports the adoption and implementation of TOD. This chapter looked at national, provincial and municipal laws, policies and plans that influence or promote TOD, with emphasis on legislation that deals with land use planning and transport planning respectively.

Chapter 5 – Enabling TOD through institutional frameworks

Drawing from lessons learnt from the international case studies, this chapter presented a TOD transformation plan for Bellville station. This plan depicts the ideals of TOD and illustrates how a TOD environment could look and operate. Based on the intentions of implementing such a plan, this chapter also depicted how the legal environment can be used in carrying out the required actions needed for such a transformation of Bellville station.

Chapter 6 – Issues and challenges hindering the implementation of TOD in Cape Town

This chapter depicts the understanding and opinions of the author as to what the key issues and challenges are that currently limit the ability of government authorities to implement TOD in Cape Town. Together with highlighting the key land use and transport issues and challenges, this chapter provided recommendations as to how some of these key issues and challenges can be overcome or addressed, where relevant.

Chapter 7 – Concluding the TOD debate

This chapter aims to determine if the study achieved its intended targets, while simultaneously providing concluding remarks and giving a summary of the outcomes of the research.

2 Chapter 2: Unpacking the layers of Transit Oriented Development (TOD)

2.1 Introduction

Due to a multitude of social, economic and environmental factors and pressures that shape the way in which cities operate, development has become an immensely complex concept in contemporary times. The mismanagement of these pressures had led to clashes of interaction between the human population and the physical environment, creating what is known as 'metaproblems'¹ (Carley and Christie, 2000). In an attempt to address these 'metaproblems', urban development has adopted various forms in an attempt to make development desirable, sustainable, equitable and efficient. One of these forms is Transit-Oriented Development (TOD)(herein also referred to as TOD) (also referred to collectively as Smart-Growth).

With urbanisation and urban sprawl becoming significant 'metaproblems' in cities all over the world, transport has seen a growing dependency on private vehicle usage in recent times, thus a need exists to counter this trend in order to abate the negative environmental, social and economic effects associated with private vehicle usage. The evident need to rectify this unsustainable development trend has led to the establishment of the widely adopted TOD approach, which will form the basis of all theoretical literature discussed in this study. Consulting an array of literature, this chapter will explore TOD on a global scale, before eventually filtering the literature down to the context of Cape Town, South Africa. Although legislation and policies are currently intended to encourage TOD in Cape Town, current conditions suggest that such attempts have not been adequate.

This literature review chapter will firstly aim to understand the relationship between land use and transportation as well as the role that transportation plays in contemporary urban areas. This literature review will build on the relationship between land use and transportation by discussing two approaches to

¹ Metaproblems include issues, but are not limited to, such as unsustainable use of resources, urbanisation, urban sprawl and protests (These concepts are explained in Chapter 2).

development, namely car-centered designs and NMT focused designs. This analysis will act as a platform to analyse the history of TOD and what TOD has become in contemporary times. This chapter will also study the perceived role that TOD has to play in an effort to make urban areas more sustainable and equitable. The various principles of TOD in general will be examined, with specific emphasis on the various key features that should provide the platform for all TOD's to be successfully implemented. In addition, the benefits of TOD will be investigated to provide insight into why TOD has become a desired way of contemporary urban developments. This literature review will then conclude on the limitation and opportunities of TODs.

2.2 Contributions to the evolution of contemporary urban form

In order to better reorient the perspective towards the intentions of TOD, it is necessary to briefly identify the historical movements preceding to the contemporary urban form of modern global cities. In light of the above mentioned, it can be said that perhaps the first precedent for contemporary urban form can be traced as far back as John Nash's master planned Blaise Hamlet for estate workers in Bristol, England in 1811 (Carlton, 2007). British worker housing was located adjacent to industrial employment opportunities with the emphasis being placed on walking as the key mode of transport. Carlton (2007) further suggests that Jonathan Carr's development of Bedford Park around 1875 was the first master planned development that relates to the compact urban form evident in cities around the world today. The Bedford Park development relied on railroad for transport, being connected to Charring Cross Station in London. Relating to the modern Central Business District (CBD) concept, was the presence of a multitude of stores, hotels and schools being located around the Charring Cross Station, acting as incentive for the use of the railway. The Bedford Park development also embedded the natural environment as a key component of city centres at the time.

Subsequent developments in the late 1890's were based on utopian designs influenced by the presence of transport infrastructure; however, transport infrastructure was mainly envisioned for the conduit of goods, rather than people (Creese, 1995; Carlton, 2007). Again, these developments enforced the inclusion of public space for recreation and thus of relevance is the fact that design

components of such developments formed the basis of Ebenezer Howard's concept of 'Garden Cities' and ultimately, modern city form.

Ebenezer Howard's book, *Garden Cities of Tomorrow* (Howard, 1902), was republished in 1904, with him assisting in the construction of two physical garden cities in 1903 and 1920 respectively, to illustrate the concepts promoted in his book. Drawing on several decades of literature, Howard's idea of the Garden City would be instrumental in the creation of modern city concepts (Batchelor, 1969). Although the overall Garden City concept is influential in the evolution of urban form, what is of most importance is the fact that Howard envisioned a central city which would act as the main economic node, being linked to other suburban areas by means of road and rapid transit linkages. In addition, Howard emphasised the idea of self-sufficiency, a strong influence and presence of the natural environment, as well as public ownership of land (Batchelor, 1969; Parsons and Schuyler, 2004; Ward, 2005). Evidence of this can be seen in the nature of the satellite garden city called Wythenshawe, developed in the late 1920's, based on Howard's Garden City concept. Although the emphasis of this development was strongly placed on the inclusion of the natural environment into the built environment, this new satellite city included the development of "Princess Parkway" as a primary means of transport for residents of the areas.

The inclusion of Princess Parkway into Wythenshawe was evidence that the Garden City was adapting to the presence of the automobile and would pave the way for more transport focused developments in the late 1940's. The late 1940's saw the rise of various garden city developments, such as New Jersey and Park Forest (South of Chicago); however, these developments were ironically designed for the automobile (Carlton, 2007). As automobiles grew in presence and was deemed to be an inevitable part of future cities, post-war developments in the 1960's were still based on the ideas of the Garden City, but were now fully endorsing auto-oriented suburbs. This indicates the start of modern city planning, with a focus on modern high-rise Central Business Districts (CBD's) and outlying suburban neighbourhoods. Controversially, although latter garden cities catered for the automobile, significant increases in reliance on the automobile would eventually become the demise of the garden city urban form concept.

As illustrated above, urban form has been subject to a variety of influences which has not only changed the urban form, but which has also changed the way urban areas function and how they are used and is considered to be unsustainable in the long-term. These influences include a variety of political, social and economic factors, but has been majorly transformed through the introduction of the automobile and consequent land use changes.

2.2.1 The rise of the automobile

Since the 1960's saw a significant rise in automobile focused developments, contemporary urban forms are still manifested in the reliance on automobiles. It is estimated that globally, the number of automobiles would rise to over 2 billion by the year 2035 (Voelker, 2014; Smith, 2016). It is this rapid increase in private vehicle usage since the latter parts of the twentieth century that has caused major changes in the spatial patterns and growth of cities around the world, as affordable access to vehicles lead to urban sprawl and inner-city decline, consequently shifting the focus away from the Garden City model (Autler and Belzer, 2002; Vandewater, 2015). Roberts and Sykes (2000) argue that the increased presence of automobiles created opportunities for large percentages of urban populations to relocate away from urban centres, which in turn led to the increased popularity of peri-urban and suburban areas, as the labour force was now being rapidly mobilised through the use of automobiles.

As a consequence of increased mobility and a strong reliance on transport, social services and economic opportunities followed population trends and thus started to cluster along these mobility routes and nodes, further away from the inner-city. In other words, the way in which land was being used was now directly starting to influence the form of urban areas, driven by increased access to private vehicles. By the 1990's, the reliance on automobiles had started to create various problems, such as inner-city decay, uncontrolled and undesired urban sprawl, increased pollution, increased development of roads, increased congestion, traffic congestion and various safety issues as a consequence of a shift in the way land is being used (land uses), making urban form largely unsustainable in the long-term.

Today, spread urban form is heavily unsustainable and is still shaped around the reliance of transportation, especially the reliance on the automobile as the main mode of mobility. This reliance on the auto-mobile in contemporary times has meant that the relationships between land uses and transport has been evolved in a way that actually changes the form of cities in most countries around the world.

2.3 Effects of transportation in contemporary cities

With the astounding numbers of private vehicles in use in urban areas today, transport infrastructure is currently consuming large quantities of land surface areas in urban cities (Litman, 2012). With mobility being an essential part of urban life, urban forms had to adapt to the demands of contemporary transport infrastructures and has consequently been shaped into a car-dependent 'modernist design'.

Irrespective of the mode, transportation is seen as an essential part of contemporary cities, as transport is a key role player in providing connectivity and accessibility for people, goods and information. Therefore, urban development trends cannot be separated from the advancement of urban transport and mobility (Rode and Floater, 2014). In addition, access to people, services, information and goods provide the platform for economic development in urban areas. Therefore, it can be said that the role of transportation in urban environments is to provide access to opportunities through mobility, rather than enabling movement in itself. As previously mentioned, the mechanisation of transport has allowed cities to de-densify and expand outwards or horizontally (urban sprawl), resulting in the substitution of access by proximity with access by movement (Rode and Floater, 2014).

Recognition of this interrelationship between transport and urban form is particularly important at a time of unprecedented urban expansion. Some estimates suggest that globally, the total amount of urbanised land could triple between 2000 and 2030 (Seto et al., 2012) and urban kilometres travelled will increase three-fold by 2050 (van Audenhove et al., 2014). Such unprecedented change would bring with it enormous risks associated with locking in energy intense patterns of accessibility and urban form for decades to come (Ang and Marchal, 2013).

In addition, emissions from transport contribute a significant percentage of global emissions, which in turn lead to air pollution and climate change. Trends over recent years suggest that greenhouse gas emissions generated by the transport sector are steadily growing, despite policy interventions such as the Kyoto protocol ² (van Essen, 2008). The share of worldwide CO₂ emissions resulting from activities in the transport sector increased from about 16.5 percent in the early 1980's to about 25 percent in 2007. Projections indicate that CO₂ emissions resulting from activities in the transport sector are expected to increase by 100 percent between 2000 and 2050, unless policy interventions are used to limit such emissions (IPCC, 2007). Although most countries in the world enforce various emission restrictions, the sheer amount of vehicles (both for passenger and freight) make it difficult to conform to such emission restrictions. The effects of these emissions are not only detrimental to the natural environment, but also to human health (van Essen, 2008).

With several social, environmental and economic pressures resulting from this modernist design of urban environments, this type of auto-centred (modernist) development is not sustainable, meaning future cities would need to be less dependent on private vehicle usage and more dependent on public transport. In addition to being responsible for the shaping of unsustainable contemporary urban forms, these modernist, car-dependent designs also negatively affect other aspects of urban development.

2.4 The influence of land use planning

The Business Dictionary (2017) defines Land Use Planning as: "The process by which lands are evaluated and assessed to become a basis for decisions involving land disposition and utilization". In other words, Land Use Planning can be defined as the process of designating a specific pocket of land for an identified purpose. Land use planning has become an essential function of urban planning in recent years, with 'zoning' becoming the key planning tool for regulating the built environment and

² "The Kyoto Protocol is an international treaty which builds on the 1992 United Nations Framework Convention on Climate Change (UNFCCC), which commits state departments to reduce greenhouse gas emissions, based on the scientific consensus that (a) global warming is occurring and (b) it is extremely likely that human-made CO₂ emissions have predominantly caused it" (United Nations, 1998).

allocating a specific land use to an identified pocket of land. Countries around the world utilise different types of zoning; however, zoning generally divides land uses into several categories, namely: Residential; Industrial; Commercial; Agricultural and; Open/green Space. Although these categories have a multitude of subcategories that vary depending on geographical location, most countries in the world has reverted to the use of zoning as a tool of land use planning.

The zoning process is controlled by different levels of authority around the world, ranging from local authority such as municipalities, to national levels of governments. Beyond state control, zoning as a form of land use planning can be enforced through planning overlay schemes, zoning ordinances and zoning regulations (World Bank Group, 2015). Zoning regulations are ordinarily developed in the form of a zoning ordinance which specifies land uses of city blocks as well as individual erven within a city block. This includes regulating the erven size, density or bulk, height and floor area ratios (World Bank Group, 2015). With the rise of the automobile, zoning has been used as a key tool for increasing densities and creating mixed uses in strategic spatial locations, in order to adapt urban form to the expanding transport infrastructure (Padeiro, 2014).

With increases in private vehicle usage being accommodated with land use changes over the past few decades, urban form has become largely unsustainable, with urban sprawl and decay occurring in many cities across the globe. It is argued that the integration of land use and transport, as key determinants of urban form, has the potential to reverse negative transport impacts and by so doing, creating sustainable cities in the long term; however, the extent to which land use planning influences mobility and accessibility depends on the relationship between land use planning and transport systems. Various academics have analysed the importance of this relationship and has highlighted the importance of integrating land use planning and transport planning in order to provide a platform for the implementation of more successful modes of public transport. The next section of this literature review will thus provide insight into such debates, building on the above given understanding of 'zoning' as a key tool of land use planning, in order to understand why transport planning has had such a big influence on Land Use Planning, consequently contributing to the transformation of urban areas.

2.4.1 The influence of transport on land use planning

The connection between transport and land use is a fundamental concept in transportation planning as they are inexorably connected. Land developments, irrespective of the use, generates a need for travel, while in turn, travel generates a need for new facilities. This relates to the fact that in years prior to the automobile, mobility was attained mostly through public transport and NMT (Non-Motorised Transport), which required higher urban densities; however, increased private vehicle usage allows suburban development at far lower densities. As previously mentioned, this has allowed contemporary cities to be plagued by sprawl and inner-city decay, which is not environmentally or economically sustainable (Banai, 2014).

Private vehicle usage places great stresses on the availability of land as this transport mode needs considerably more land to operate on than most public transport modes (Rode and Gipp, 2001; Rode and Floater, 2014). For example, traveling at an average speed of 50 km/h, cars require approximately 160 m² per person, while buses require 4 m² per person when traveling at the same average speeds (Rode and Gipp, 2001). This serves as indication that more land has to be allocated to road infrastructure, depriving that land of more beneficial uses. In addition, the requirement for additional land will place further stresses on the urban environment to expand, thus indirectly adding to the sprawl already experienced in contemporary cities (Kersys, 2011; World Bank, 2014b).

Rode and Floater (2014) adds to the above mentioned by drawing attention to the conversion of land for parking facilities by stating that parking facilities in car-oriented cities such as Los Angeles, often equates to about 80 percent of the CBD land area. Globally, and based on current trends, and additional 45 000 to 77 000 km² would be needed to accommodate parking by the year 2050, indicating the enormous amounts of land being used for transport infrastructure (Dulac, 2013).

In addition to transport infrastructure requiring land suitable for other uses, “transport influences the amount of land available for development and the spatial distribution of economic activity. In turn, this has an impact on land prices, housing, affordability,

business costs, productivity, and ultimately, economic performance. At a finer level, transport infrastructure has an impact on the quality of urban realm, and, indirectly, on the economic use which is made of different places. Urban areas require transport infrastructure to function, with transport generating value by enabling some of the most productive land uses and often the highest land value" (Banister and Berechman, 2000: 112).

Important to note is the fact that most countries around the world deal with transport and land use as segregated entities and often has different government departments for these entities. This contributes to decision-making taking place in silos, consequently leading to unintentional urban sprawl caused by the influence of transport on land uses. Therefore, in order to ensure that future decision-making processes are in support of more sustainable land use and transport planning practices, there is a need for better integration between these two entities.

2.5 The need for better integration between land use and transport planning

As explained in the previous section of this literature review, regulating land uses is one way of curbing urban sprawl by creating urban environments that reduce the dependency on private vehicle usage. In order to achieve this, mobility needs to be accommodated for through a variety of transport modes, nodes and choices, supported by high density, mixed use land uses in areas surrounding these transport opportunities. It is of vital importance to move away from the current, unsustainable, spread urban forms experienced in various cities around the world, therefore future decision-making should be geared towards the creation of compact city forms. In order to move from current spread cities to future compact cities, integration between land use and transport should be utilised as key enabling factors in this process. These entities must also be used to facilitate required changes in the urban environment in order to allow for the shaping of more compact cities in the future.

2.5.1 Influence travel behaviour

One of most important objectives of integrating land use and transport that conform to the objectives of compact cities, is the need to influence travel behaviour so that

individuals rather opt to use public transport, rather than private vehicles. With private vehicle usage contributing to the spread form of cities, it is important to disincentivise private vehicle usage and alternatively incentivise the use of public transport; however, there are several aspects which influence the travel behaviour of individuals.

The costs of traveling is not only monetary, as time and convenience is also seen as a cost of traveling. Seeing that individuals normally aim to minimise these costs, the search for less expensive travel influences the consumers' choice of residence and employment location, as well as the spatial spread of other activities they take part in (Dargay and Hanly, 2003). In addition, traffic volumes and travel mode are two of the most influential factors that determine travel behaviour solely from a transport perspective; however, these factors are directly influenced by land use patterns.

Figure 2.1 below illustrates the relationship between land use, transport, travel behaviour and other external factors. What this figure indicates is that travel behaviour is influenced by various aspects of land use, transport systems as well as user characteristics (Meurs and van Wee, 2003).

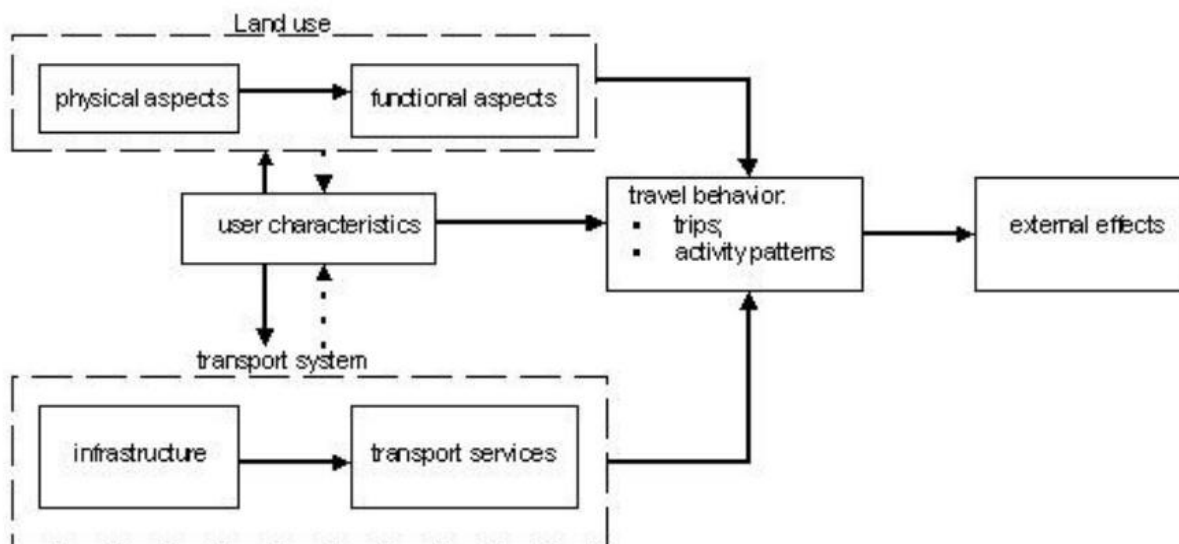


Figure 2.1: Relationship between land use, transport, travel behaviour and other external factors (Meurs and van Wee, 2003).

Land use patterns of less-densely populated areas usually facilitates private vehicle usage, whereas alternatively, public transport is often more practically and economically attractive in more densely populated areas (Dargay and Hanly, 2003; Cervero and Guerra, 2011). Although some studies suggest that high population densities do not necessarily increase public transport usage in itself Public Transport Users Association (PTUA, 2016), it cannot be ignored that physical aspects of urban areas heavily influences travel behaviour. Figure 2.1 also graphically depicts that physical aspects influences the functional aspects of urban areas, which in this case relates to the densities influencing the choice of travel mode of individuals.

High density urban areas often requires individuals to make shorter and more frequent trips, thus incentivising public transport, cycling and walking. Together with congestion and shortages of parking facilities often found in higher density areas, the attractiveness of private vehicle usage is significantly reduced. Dargay and Hanley (2003: 1) supports this notion by stating that “empirical evidence suggests that car ownership and use decline and public transport use increases with urban density”.

As becomes evident is that in order for successfully incentivise the use of public transport, urban densities need to be relatively high, which can only be achieved through effective land use planning, which in turn will then both directly and indirectly influence the travel behaviour of individuals, steering them away from private vehicle usage. Another required aspect of transport which can be influenced by land use, is the need to create a sustainable ridership base for public transport to make public transport financially viable. This is not only dependent on land uses, but also on the transport infrastructure in such areas and as suggested above, will also heavily influence the travel behaviour of individuals.

2.5.2 Creating sustainable ridership

An assumption about land use creating higher densities which in turn then ensures that more people will make use of public transport has been shown to not always be true in the section above (PTUA, 2016). However, by influencing travel behaviour, land use management practices can disincentivise the use of private vehicle usage,

with public transport then being a feasible alternative of transport. In this regard, land use management systems often make use of a term called 'density articulation' as a measure for how the strategically distribute densities over the city area in order to support public transport systems in specific locations (Cooke and Behrens, 2016). Using density articulation through effective land use planning, selected areas in a city will consist of higher densities and will consequently affect the number of individuals needed to use public transport at various times of the day (Cervero and Guerra, 2011).

In order to make public transport systems sustainable, it is important to have ridership during all times of the day in order to financially support the operations and maintenance of such transport services. During peak hours, public transport services generally experience high ridership volumes, which makes the benefits outweigh the costs; however, during off-peak hours, these services often operate at a financial loss due to lower ridership volumes (Cooke and Behrens, 2015). It is therefore imperative to increase densities to ensure that maximum peak hour ridership levels are maintained, but also to ensure that increased activities in high density areas lead to ridership during off-peak hours in order to lessen the financial losses experienced during such times.

As this section has pointed out, it is of vital importance for urban areas to become more compact in the future, as urban sprawl and inner-city decay is simply not sustainable. In order to achieve this, transport and land use planning needs to be fully integrated in order to enable environments which hold social, economic and environmental benefits to all individuals. One of the main objectives of a more compact form is to incentivise the use of public transport as an alternative to the unsustainable private vehicle usage in recent decades. In an attempt to achieve these objectives, various strategies have been identified and implemented, most notably, TOD. Various countries around the world has adopted the concept of TOD in an attempt to achieve more sustainable development.

2.6 The introduction of TOD as an alternative to current Modernist designs

With the future of global cities being unimaginable without the presence of automobiles at the time, Peter Calthorpe presented the first concept of modern transport oriented urban form, in an attempt to deal with the associated issues of increased automobile presence and mobility, in his book called 'The Next American Metropolis (1993)'. Peter Calthorpe is believed to have codified the concept of TOD by making it a fixture of modern planning when publishing his book in 1993. Calthorpe saw TOD as a neo-traditional guide to sustainable community design (Carlton, 2007) by not only focusing on rectifying the decaying urban form, but also by using TOD to address a myriad of social, economic and environmental pressures in contemporary cities. Calthorpe envisioned TOD to be a tool for future regional growth as "these TODs have the potential to provide residents with improved quality of life and reduces household transportation expense while providing the region with stable mixed-income neighbourhoods that reduce environmental impacts and provide real alternatives to traffic congestion" (Dittmar and Ohland, 2004: 76). Since Calthorpe's inception of the idea TOD, the concept has been rapidly implemented and altered in various cities around the world and in the most contemporary developments, TOD has even adopted various intentions.

2.6.1 Contemporary understanding of TOD

As the concept of TOD has grown in stature around the world, TOD is often described in various ways, with definitions often being place-specific. There is no single definition of TOD; however, the crux of TOD is that development should be focused around transport, public transport and transport nodes. Several pieces of literature aim to summarise an understanding of TOD as follows:

"the exciting fast growing trend in creating vibrant, livable, sustainable communities. Also known as TOD, it's the creation of compact, walkable, pedestrian-oriented, mixed-use communities centered around high quality train systems. This makes it possible to live a lower-stress life without complete dependence on a car for mobility and survival. Transit-oriented Development is regional planning, city revitalization, suburban renewal, and walkable neighborhoods combined. Transit-oriented Development is also a major solution to the serious and growing problems of climate

change and global energy security by creating dense, walkable communities that greatly reduce the need for driving and energy consumption. This type of living arrangement can reduce driving by up to 85%" (TOD, 2017).

The above definition depicts the importance of walkability and shift away from private vehicle usage. This definition of TOD also states that development must be oriented around train systems. In addition, UTTIPEC (2012) states that:

"Transit Oriented Development is essentially any development, macro or micro, that is focused around a transit node, and facilitates complete ease of access to the transit facility, thereby inducing people to prefer to walk and use public transportation over personal modes of transport"

Here the focus is shifted from train stations as the sole provider of transport, by laying claim that development should be focused around any transit node, opening up the possibility of alternative modes of transport, such as busses and taxis. Reconnecting America (2012) again adds focus on transport, but also emphasises the importance of adjacent housing as well as the sense of place created in such spaces:

"Transit-Oriented Development or TOD is typically defined as more compact development within easy walking distance of transit stations (typically a half mile) that contains a mix of uses such as housing, jobs, shops, restaurants and entertainment. TOD is really about creating walkable, sustainable communities for people of all ages and incomes and providing more transportation and housing choices (including townhomes, apartments, live-work spaces, and lofts). These neighborhoods provide for a lifestyle that's convenient, affordable and active, and create places where our children can play and our parents can grow old comfortably".

As becomes evidence from the above provided definitions of TOD, there are a variety of aspects that need to be included in TOD's in order to make them conform

to the standards of modern TOD's. Firstly, it can be said that transit is the core function of TOD's, with an array of transit modes being suitable for the purpose of TOD's. Importantly is the fact that these developments are located in close proximity to transit services, with Non-Motorised Transport (NMT), connectivity and pedestrian orientation being emphasised in all of the above definitions. Secondly, TOD's need to be inclusive of mixed-use, high density development which focus on a variety of housing options in order to make such developments accessible, affordable and inclusive to all members of society. In conjunction with housing opportunities is the inclusion of schools, shops, public facilities and employment opportunities in order to disincentives private vehicle usage. Lastly, it becomes apparent that good urban design practices and landscape features form an essential part in creating attractive 'live-work-play' environments that create sense of place. Although TOD's operate uniquely in different geographical locations, the crux of the TOD concept remains the same. However, in order to maintain the core ideas of the concept, TOD's need to be based on principles in order to guide outputs of such developments.

2.6.2 Underlying principles of TOD

As becomes evident, successful TOD requires an array of social, economic and environmental aspects to be integrated and encompasses a multitude of complex relationships between these aspects of TOD. In aiming to provide a universal understanding of contemporary TOD concepts, Cervero and Kockelman (1997) formulated various principles of TOD which ultimately need to create a platform for TOD in order to make this concept universally implementable. These principles relate to the '3D' concept, known as: Density, Design and Diversity. With these principles acting as the overarching principles of TOD, it is generally accepted that there are additional key features of any TOD embedded within these principles, which include: Mixed land use, increased residential density, social mix, high quality pedestrian environments, and access and permeability.

2.6.2.1 Density

Over the history of city planning, density has often been linked to quality of life (Griffiths, 2009). Densities are typically measured using the dwellings per hectare

(du/ha) method; however, it is also sometimes measured as population density (people/ha) or as urban density (people + Jobs/ha) (Churchman, 1999; Griffiths, 2009). Important to note is the difference between gross and net densities. Net dwelling density only refers to the amount of land allocated to the actual residential use, whereas gross dwelling density refers to the amount of land allocated to the residential use as well as the roads required to access such services (Griffiths, 2009). In terms of TOD, it is of vital importance to promote higher, compact and dense, residential developments which in turn will allow for individuals to live close to public transport and thus also increase the ridership of public transport. Higher densities also ensures a critical mass of people needed to sustain a local economy, as low residential densities often mean that public transport, employment centres and other social facilities are not financially viable due to a lack of consumers (SACN, 2016). In addition, increasing the density in TOD areas has the potential to decrease environmental degradation (Heart Foundation, 2016). The ideal densities with which to create a sustainable population around a TOD are between 60 and 120 du/ha, which is significantly higher than the densities found in most countries of the global South (Churchman, 1999).

2.6.2.2 Diversity

Diversity in this instance, refers to having a diverse range of housing types, architectural styles, land uses and circulation within a TOD (Cervero and Kockelman, 1997; Vanderwater, 2015). In order to attract a diverse range of people to a TOD, it is essential to provide a diverse range of land uses, such as residential, commercial, industrial and open spaces. These land uses attract a range of people (young families, professionals and retirees) from various races, ethnicities, ages, incomes and genders. It is important to attract a wide range of consumers to an area in order to allow for spatial equality, economic diversity, spatial justice and good quality of life.

In terms of TOD, it is important to create a mixed use environment, consisting of various land uses in order to create a 24 hour activity zone, which in turn will assist in making transport more financially sustainable in the area. By increasing diversity in TOD areas, the issue of affordability is also largely addressed as new entrants and lower income households have a better chance to rent or buy lower income

accommodation typologies, which are located close to amenities such as public transport, employment opportunities, schools and other social facilities. This is relevant as these individuals often do not own a private vehicle and are thus reliant on public transport or walkability in order to access such facilities (AARP, 2014; Heart Foundation, 2016).

2.6.2.3 Design

Design refers to the physical form of TOD spaces, NMT infrastructure and site layouts. Design is arguably the most important principle in the successful implementation of TOD, as the design will ultimately influence the ability to increase densities, the ability to cluster a variety of land uses in various spaces, as well as create opportunities to access provided transport opportunities. In addition, it is important to ensure that design strategies hierarchize public transit systems to improve functionality, to integrate transit within the urban footprint of an area, as well as to provide access to public transit (WRI Cities Hub, 2011).

Good design of a TOD space also enables the creation of neighbourhood centres and active ground floors, the inclusion of public spaces and natural resources, the creation of community identity and heritage, accessibility and permeability, as well as the ability for TOD spaces to be resilient (WRI Cities Hub, 2011).

With the above mentioned principles in mind, it becomes apparent that TOD is an approach that seeks to create inclusive and spatially equitable spaces, with the ultimate aim of minimising private vehicle usage. Although the historical concepts of the garden city might have been lost in transition towards the TOD model, the garden city model has undeniably laid the foundation for suburban areas which are inclusive of the natural environment and large public open spaces. Unintentionally, it was this type of urban sprawl that has led to an influx of environmental, social and economic issues which TOD concepts hope to address.

In addition to the fact that TOD can be viewed as an alternative to car-dependent urban sprawl, it is envisioned that by attracting a large mix of residences, business, shops and civic activities within walking distance of transport nodes, TODs can

incentivise users to part ways with private vehicles, improve traffic congestion and consequently improve air quality, as well as contribute towards climate stabilisation (Cervero, 2016). Although this has become the main focus of modern TODs, TODs also holds a multitude of other benefits and impacts, contributing to the attractiveness of such an approach to future development. The next section of this literature review will identify these benefits in an attempt to provide clarity on why TOD has been so widely adopted and supported by government and private investors around the world in recent times.

2.6.3 Benefits of TOD

The previous section of this literature review has identified the more tangible and obvious benefits of TOD, such as minimised reliance on private vehicle usage; increased access to transport; decreased environmental pollution due to decreased usage of automobiles; equitable housing opportunities; the presence of public open spaces; increase in NMT infrastructure; increased mixed-use areas integrated with employment and social facilities and; an instilment of a sense of place in TOD environments.

Autler and Belzer (2002a) present an additional set of principles that extend beyond the more physical principles of TOD, such as density, diversity and design. These principles relate directly to the benefits of TOD, and will therefore be used to identify some of the additional benefits of TOD (Vanderwater, 2015) and will for the purpose of this study be adapted where indicated. Autler and Belzer (2002a) lists these principles (or benefits) as 1) Location efficiency; 2) financial returns and savings; 3) liveability; 4) choice; 6) efficient land use. It must be noted that the '3D' principles of TOD are evident in the below listed benefits of TOD, validating the fluidity of the TOD principles.

2.6.3.1 Location efficiency

Autler and Belzer (2002b: 55) defines Location Efficiency (LE) as the “ability to minimise automobile dependency (and more generally the need to travel long distances by any mode) by maximising the potential synergies between, on the one

hand, different land uses and, on the other hand, development and transit". As becomes evident is the fact that TOD nodes have the ability to connect surrounding urban environments with transit facilities in such a way that the location of the urban area and transit opportunities directly benefits all users of such spaces. LE can thus be quantified by parking demand, automobile ownership, transit mode-split and vehicles miles travelled. If these aspects are weighed up and there is tangible benefits for the users of such spaces, it can be said that the TOD is meaningful.

LE therefore relies on the premise that social facilities, housing opportunities, shops, restaurants and other relevant land uses are spatially located in such a way that transit can be used to easily access all of these facilities, and in so doing, removing the need to use private vehicles to access such facilities. Successful examples of TOD state that TOD should be located 0.4 to 0.8 km, or alternatively within a 5 – 10 minute walking distance, of a transit station in order for LE to be validated (Reconnecting America, 2012; NHHS Rail, 2016). LE is deemed to be one of the biggest benefits of TOD as it curbs sprawl by locating a variety of facilities in a clustered spatial location. LE thus also acts as the basis on which the TOD concept is built, making it the main criteria for the success of TOD's around the world.

2.6.3.2 Financial returns and savings

An important element that often determines the plausibility of TOD's is capital investments. Due to the significant diversity of land uses that is needed in TOD's, it is essential that such developments are financially attractive to potential investors in order to incentivise them to invest in the required infrastructure in such areas. Thus far, TOD's have become attractive investment opportunities for both the public and private sector, with residential properties within a reasonable distance of transit stations becoming prized commodities, the potential financial returns on investments must be seen as a major benefit of TOD (Cervero et al., 2004). In addition to providing financial returns for developers, TOD's can also provide financial returns for communities and households.

Cervero et al. (2004) further indicates that mixed-use developments which are pedestrian friendly, well serviced with transport infrastructure and promote high

densities, can significantly increase land values and thus makes this land attractive for private sector investors. Generally, the public sector invests in transportation, infrastructure and the creation of public spaces, with the private sector then constructing buildings to accompany the infrastructure provided by the public sector (Autler and Belzer, 2002a; Vandewater, 2015). Lately, the financial returns gained by private sector investors investing in TOD's have been above standard market returns due to a decrease in parking requirements. This allows investors to use more land for higher income generating infrastructure (Autler and Belzer, 2002a; Tumlin and Millard-Ball, 2003) and has caused increased willingness to invest in TOD.

Although private and public sector investment in infrastructure is of vital importance to the feasibility of TOD's, research suggests that for individuals, households and communities, lower transportation spending and housing costs can also mean positive financial returns. Tumlin and Millard-Ball (2003) states that if transit opportunities are plentiful and if surrounding neighbourhoods are truly mixed-use, with an abundance of facilities, many households have reduced private vehicle ownership to only one vehicle, or no vehicles in some instances. This further supports the notion of increased financial returns or savings created through TOD. In light of the above mentioned, it must also be noted that although financial gains might be incentive for occupation in TOD zones, the trade-off for financial gains will affect the liveability of an area in turn.

2.6.3.3 Value capture

This section of this literature review has thus far provided reasons why developers, communities and individuals benefit from TODs in the form of financial returns and savings. However, for the purpose of this literature review, attention needs to be drawn to a public sector benefit of TODs, known as 'Value Capture'³. Value Capture is arguably one of the most beneficial spin-offs of TODs to the private sector, as state entities can capture the value created through investments in infrastructure.

³ Transit-Oriented Development (TOD) is not necessarily a Value Capture mechanism, but rather a form of development which allows the use of Value Capture mechanisms (McGaffin et al., 2013).

Value Capture (VC) thus “refers to the recovery by the public of the land value increments (unearned income) generated by actions other than the landowner’s direct investments” (Smolka, 2015). Alternatively, Value Capture is defined by McGaffin et al. (2013: 376) as “a term used to describe the process of extracting (in different ways) the additional value that accrues to a property following some public investment such as the provision of public transport or a school. The value extracted is therefore the value over and above the value the property would have had without the public investment”. Rodrigues and Mojica (2008) adds that due to the fact that the state’s actions are often solely responsible for the creation of additional value, it is justifiable for state entities to retrieve the additional value it created.

Value Capture is generally divided into two broad types. The first type of value capture is specifically focused on mechanisms that maximises the potential of existing infrastructure in an effort to increase spatial or social outcomes in such areas. Examples of this include densification and the inclusion of low-income households in the area. Another type of value capture is the use of mechanisms that extract revenue through tax or tariffs from the increment value created, in order to ultimately finance additional infrastructure or developments in the area, or elsewhere (ULM, 2012). The VC mechanisms used to capture these created values include TOD, zoning tools (such as inclusionary zoning and density bonuses), air rights, land banking and joint development agreements (McGaffin, et al., 2013).

Although McGaffin’s (2013) definition of VC places strong emphasis on the role of the state, VC instruments or tools can be used to benefit a variety of stakeholders such as the state, developers, investors and general public households (Hendricks and Tonkin, 2010; Brown-Luthango, 2011; Huxley, 2012). In addition, the presence of infrastructure from which value is captured, means that the liveability of an area is enhanced.

2.6.3.4 Liveability

As suggested in section 3.2.2 (financial returns) above, TOD could adversely affect the quality of life for individuals and households; however, Autler and Belzer (2002a)

argue that TOD's enhances quality of life in various ways. Liveability is documented as the quality of life attained in a specific neighbourhood, which in turn is heavily influenced by the design and operational function of spaces (Jacobson and Forsyth, 2008). Although it is difficult to measure quality of life, it can be said that urban design undoubtedly influences the quality of life for individuals and households. Urban design is tasked with co-ordinating transportation types, mix land uses, and to create safe and appealing public spaces.

In terms of the operational function of a space, Bickford (2014) suggests that access to clean air, food, cultural expression and safety all contribute to the way an area operates and thus directly contributes to the liveability of an area. Ndebele and Ogra (2014) supports the above mentioned by stating that the liveability of an area can influence decision-making of transport users, and in turn, transport can influence the perception of liveability. Liveability is also often a predetermined perception, created through the advertising of a space, with emphasis being placed mainly on safety and accessibility. With liveability being subjectively determined by residents and users of space, Autler and Belzer (2002a) argues that TODs usually poses all the attributes that positively influence the perception of liveability and quality of life, thus making liveability an undeniable benefit of TODs.

2.6.3.5 Choice

Choice is one of the benefits of TOD that directly relates to the diversity principle of TOD as diversity is the factor that creates choice in an urban environment. Choice can be interpreted as an assortment of options that offer users with choice, ranging from various housing typologies to a variety of transport options. Important to note is that TODs do not necessarily replace the choice found in existing communities, but rather adds to the choice already available in non-TOD areas (Autler and Belzer, 2002a). Choice is also strongly connected to the liveability of an area, as greater choice increases the liveability of a given space.

In TODs it is important to provide choice in terms of green and open spaces, economic opportunities, land uses and social facilities, as a lack of choice would act as incentive for users to travel further in search of additional choices, minimising

the efficiency of the TOD area in question (Cervero and Day, 2008). In addition, it is important that the diversity of choice must be sustainable at all times in order for the TOD to conform to good planning principles (Autler and Belzer, 2002a; Schlossberg and Brown, 2004). With TODs being strongly founded in the idea of mixed uses, private and public sector investors are also tasked with the responsibility of providing a variety of facilities that will ultimately provide different options and choices to the users of these spaces.

2.6.3.6 Efficient land use

Efficient Land Use patterns refers to the coordination and alignment of land use policies and transportation investment with the intention of preventing urban sprawl (Autler and Belzer, 2002a). By ensuring the allocation of efficient land uses, the demand for land further away from central areas can be limited, through increasing densities and through good design. In addition, efficient land use will also ensure that traffic congestion is minimized and consequently that air quality is improved. As this chapter has emphasised on more than one occasion, land uses are fundamental to the success of TODs in various ways. Various academics also tribute the success or failures of TODs around the world to the integration between land use and transport planning processes (to be discussed in more detail in the next section of this literature review).

2.7 Conclusion

The literature discussed in this chapter briefly explored the history of urban form, illustrating that urban form has evolved dramatically over the past few decades, due to a variety of influences. As a consequence, contemporary urban forms are plagued by urban sprawl and inner-city decay, which are not only undesired urban characteristics, but which are more importantly unsustainable. The literature thus depicted transport and land use (amongst other social, economic and environmental aspects) as the two key elements which can be utilised in an attempt to reverse these trends and make urban forms more sustainable. This chapter then argued that future cities should be more compact in order to make them sustainable, presenting TOD as a strategy to make cities more compact and minimise or mitigate the negative impacts of current urban environments. The

concept of TODs hold various benefits to private and public sectors, with a range of benefits also trickling down to the environment. TODs can hold various financial and 'quality of life' benefits if it is implemented correctly, which in turn largely depends on the way that land uses are allocated and integrated with transport planning practices.

With TOD's still being a fairly new concept, the next chapter will provide various case studies through which the successes (and often failures) of TOD will be illustrated. Curitiba, Medellin and Cape Town will all be used to further investigate the concept of TOD and how it can be applied in practice.

3 Chapter 3: Case studies: Curitiba and Medellin

3.1 Introduction

In this chapter, the aim will be to analyse success cases of TOD in a couple of countries in the global South, namely Curitiba (Brazil) and Medellin (Colombia). This chapter will aim to understand what the drivers behind these shifts towards TOD was and how these city forms adopted to the implementation of TOD strategies. In addition, this chapter will aim to understand how these TOD systems currently operate as such an analysis could potentially provide insight into how TOD can be applied elsewhere in the world. In order to gain a better insight into how TOD strategies can be applied in other cities, such as Cape Town, South Africa, it is necessary to use case studies of countries or cities which share roughly the same economic and social conditions, in order to avoid creating unrealistic expectations of what is implementable. Based on these criteria, Curitiba and Medellin were selected as case studies in this chapter.

3.2 Curitiba, Brazil

Curitiba is situated in the South of Brazil (see figures 3.1 and 3.2 below) and is located south of Sao Paolo. Curitiba is the capital of the state Paraná and covers an area of 331 km² (Alsop, 2014).



Figure 3.1: Locality Map of Curitiba, Brazil (Alsop, 2014).



Figure 3.2: Map of Curitiba, Brazil (Google Images, 2017).

From the 19th century, Curitiba became home to a substantial amount of German, Italian and Polish settlers, with Syrian and Japanese immigrants moving to the area in the 20th century (Alsop, 2014). Urbanisation in Curitiba has also led to an extensive influx of internal migrants, making Curitiba one of the most rapidly expanding cities in the global south, with its population growing at approximately 10 percent per annum (Rabinovitch, 1996). In 2010, the population of Curitiba was believed to be approximately 1,760,500 people (Eltis, 2014).

One of the biggest successes of Curitiba is how the city managed to use public transport to extract the benefits of this population growth. Curitiba has been spatially reformed through the adoption of TOD. Contributing to the success of TOD in Curitiba is the preparation of a common vision and the implementation of this vision through the aid of policy formulation.

3.2.1 Policy reform in Curitiba

In 1965, the implementation of cross-sectoral economic, transport and land use planning policies was originated based on a common vision, which can ultimately be accredited to the transformation of the transport system in Curitiba. These policies were not meant to shape urban form according to a master plan, and neither for a master plan to be amended according to urban growth trajectories, but rather through a combination of the two. It is in this ideal that the adaptive nature of policy and urban growth found success (Rabinovitch, 1996).

This transformation was initiated by an urban growth plan (which was eventually transformed into a master plan), commissioned in 1965 by the public administration commission of Curitiba. This urban growth plan set out the following goals: "Decongestion of the central area and preservation of the historic centre; demographic control and management; economic support to urban development; infrastructure improvement and; changing the radial urban growth trend to a linear one" (Rabinovitch, 1996: 53). Subsequent to these goals set out in the urban growth plan of 1965, the common vision was one of integrated transport and land use

planning, which would essentially guide urban growth in a desired direction. As becomes evident, local policy was used to drive this vision towards implementation, with cooperation of various government departments.

3.2.2 Integrating land use and transport planning in Curitiba

Since the inception of the urban growth plan (master plan) in 1965, land use and transport planning was used in conjunction with one another to direct growth along identified arterial growth corridors, thus managing to direct growth out of the central city. Five arterial growth corridors was identified as part of this process, all of which would be serviced by a complex public transport system (Rabinovitch, 1996; Allen, 2003). The above mentioned corridors were characterised and defined by a multitude of arterial and feeder routes, with the reformed land use policies being used to regulate and control settlement densities along these corridors.

Important to note is the fact that Curitiba is monocentric, which is the ideal urban form for the implementation of radial transport systems. The monocentric nature of Curitiba allows for public transport to service the entire city from a single radial node, which extends outwards into the identified growth corridors. Accompanying the monocentric nature of the city, was a desired balance of urban densities at the time. Due to urban densities being heavily related to a multitude of cultural aspects, using reformed land use policies to increase densities along the 5 identified growth corridors would not be plausible in the short-term, as cultural change mostly takes place over a long period of time (Bertraud, 2002). Thus, there was a pressing need to deal with urbanisation in the short terms, while ensuring that short-term plans were in line with long-term spatial plans and policies.

As a consequence, Curitiba implemented a Rapid-Bus Transit (BRT) system, which would not only assist with mobility along the new growth corridors, but which would also allow land use policies to distribute densities evenly along these corridors, avoiding excessive peaks in inner city densities. As newly adopted and amended land use and transport planning policies were driving change in Curitiba over the next few years, the urban form of the city was being transformed according to the common vision and was being shaped in a way that would allow for decent urban

mobility. Figure 3.3 below depicts the ideal urban form of Curitiba, showing how land use was being used to regulate densities along the identified BRT corridors.

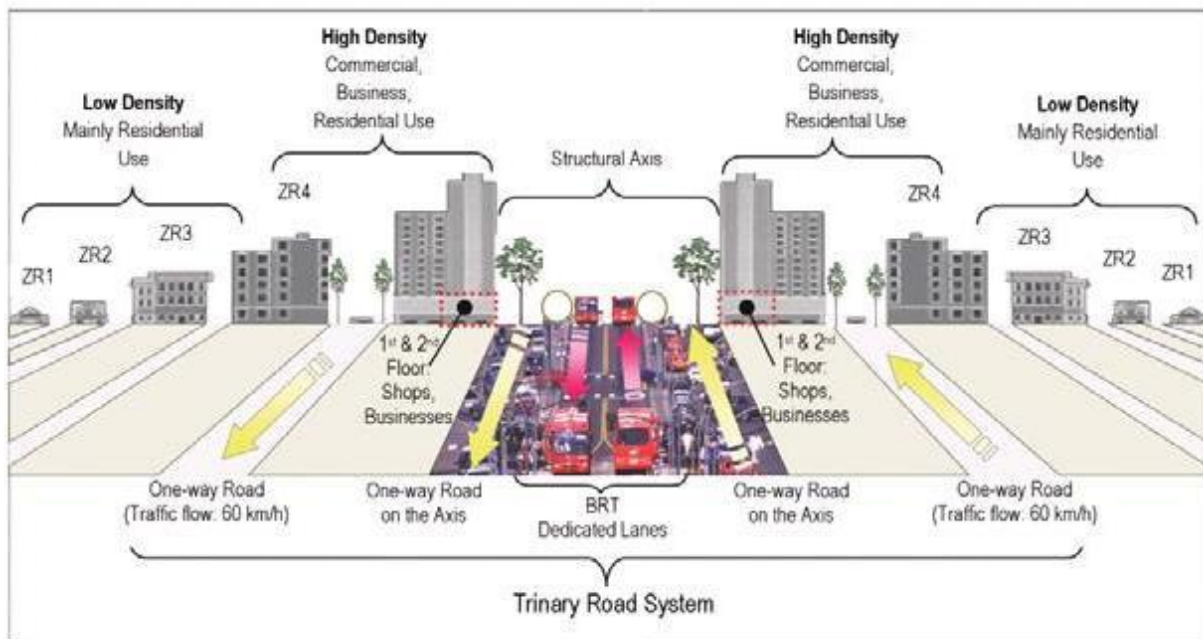


Figure 3.3: Concept of the envisioned urban form of Curitiba, Brazil (URB, 2012).

Similarly to various other cities across the globe, historically, less dense neighbourhoods outside of Curitiba city centre was conventionally designed to be car-oriented, being embedded with a variety of road hierarchies; however, as indicated in figure 3.3 above, Curitiba used TOD to establish main transport routes as 'development axis' or 'spine routes' around which settlement forms and densities have been shaped (Marshall, 2001). Not necessarily envisioned at the time of the inception of the urban growth plan in 1965, this urban form holds various short and long-term benefits.

3.2.2.1 Regulating development through urban edges

As a consequence, Curitiba was also able to use policies to enforce strict urban edges, which in turn limited the demand and supply of developable land and directly contributed to the shaping of the contemporary compact urban form. With these urban edges in place, policy could enforce high density development which is

both easier to service with public transport and which is in turn needed to support the provided public transport in these areas of high density (Bertraud, 2002).

3.2.2.2 Economic growth and investment

Besides allowing for the successful implementation of urban edges and increased inner city densities, this urban form allowed authorities to enforce economic development strategies in several strategic spatial locations (often along the 5 growth corridors). Due to the focused, high density, development along these corridors, private and public sector investors were incentivised to invest in these areas as these areas were now becoming ideal spaces for the creation of 'live, work, play' environments. With economic investment being channelled to such areas, property values increased significantly in these areas and with the aid of the BRT system, economic opportunities became accessible to all residents of the city (Rabinovitch, 1996).

3.2.2.3 Well-located social housing projects

Capitalising on the focused growth along these corridors, local government departments of Curitiba again used policy to assign several pockets of state-owned land along these corridors for social housing developments, ensuring that marginalised communities were given access to valuable and well-located land as well as social and economic opportunities, directly contributing to the mitigation of inequality in the city. As a consequence, marginalised members of society were now also in a position to partake in the real estate market as social housing units were increasing in value due to its locality. Also due to being well located, recipients of social housing projects were immediately mobilised due to unrivalled access to the public transport system (Rabinovitch, 1996).

3.2.2.4 Mobility through public transport

Although the public transport system was being developed in conjunction with the reshaping of the urban form, the transport system undeniably gained the most from the adoption of TOD in Curitiba. Figure 3.4 below illustrates how the BRT system operates, illustrating that road systems give preference to the BRT system, with private vehicle usage being discouraged due to limited access.



Figure 3.4: Image showing the BRT system in inner-city Curitiba, Brazil (The World Bank, 2014a).

With the land use system supporting and promoting relevant land uses adjacent to the BRT system in the identified growth corridors, Curitiba's BRT transports 2.3 million passengers a day, with 75 percent of the population commuting to work via bus (The World Bank, 2014a). The BRT infrastructure consists of 75 km of bus-oriented corridors, with 347 tube stations and 29 urban terminals that specifically allow for integration with other feeding services (Lindau, et al., 2010). Feeding services include private vehicles, taxis, minibuses and various forms of NMT. Thus it can be seen that due to the integration of land use and transport systems, Curitiba is arguably the leading city in the world in terms of urban mobility.

3.2.2.5 Value capture

With economic opportunities being made available in plausible locations and making these opportunities accessible through public transport, the government started capturing the additional value created from state funded infrastructure provision. As already explained above, with TOD creating more housing and employment opportunities close to these transport systems, an automatic 'market' is created for the public transport system, which in turn leads to an increase in revenue stream (ADEC, 2010). Curitiba authorities made use of joint development

agreements (public-private partnerships) to originally fund public transport infrastructure in Curitiba, by often granting air rights⁴ to the developers and investors of such public transport infrastructures. Another method of value capture used by Curitiba authorities is land banking, which involved the acquisition of land near transport interchanges, prior to construction of these interchanges, and then leasing or selling this land at increased values after constructed public transport services led to an increase in property prices (Cervero, 1998). McGaffin et al. (2013: 379) further describes additional value capture methods used in Curitiba at the time as 'income generating mechanisms'. "Income-generating mechanisms include betterment taxes, business improvement districts, development charges and land value increment taxes". Irrespective of the method of value capture used by Curitiba authorities, it must be noted that Value Capture was a significant benefit resulting from the integration of land use and transport systems and that these authorities reinvested this value back into the public transport system.

3.2.3 Concluding remarks

As this case study of Curitiba illustrated, the implementation of TOD was largely driven by political will and knowledge, while using the legal environment to the benefit of all individuals. Only through the careful redesign of the policy environment, was Curitiba able to integrate land use and transport systems in order to create a sustainable and functional public transport system. As this case study has illustrated, the adoption of TOD holds a variety of benefits, ranging from increased economic investment to the provision of equitable housing opportunities, with increased mobility arguably being the greatest benefit of TOD. Although it is often incredibly difficult to replicate strategies from other cities around the world, the key factor in the successful adoption of TOD strategies in Curitiba was the fact that the legal environment supported the concept of TOD.

⁴ Air rights refer to the allowance of development above public infrastructure. Public authorities usually grant air rights in return for the provision of public amenities and infrastructure (ADEC, 2010).

3.3 Medellín, Colombia

Medellin is situated in the West of Colombia (see figures 3.5 and 3.6 below) and is located north of the Colombian capital - Bogota. Medellín is the capital of Colombia's mountainous Antioquia province and covers an area of 380.6 km² (Brand and Dávila, 2011).



Figure 3.5: Locality Map of Medellín, Colombia (Aure Blog, 2014).



Figure 3.6: Map of Medellín, Colombia (Google Images, 2017).

During the 19th century, Medellín became known as dynamic commercial centre, exporting a number of minerals and resources such as gold and coffee. Due to the cities popularity and fame as commercial centre, urbanisation led to a large number of immigrants. In 2014, the population of Medellín was estimated to be 3,731,447 people, making it the second largest city in Colombia and the 66th largest city in the world (Hylton, 2007; Population City, 2017).

Medellin has been infamously known as one of the crime capitals of the world in recent years, being named as the most violent city in the world in 1998. (Doyle, 2016). For several years, various Medellín state departments have made a variety of attempts to address these social issues, but perhaps the most notable attempt is the use of public transport to drive societal change (Madrid, 2013; Bea, 2016). This approach drew inspiration from the principles of TOD, adopted by Medellín authorities, with this public transport system being identified as one of the best systems in the world in 2012 by the Institute for Transportation and Development Policy (ITDP).

ITDP board member Holger Dalkmann stated: *“The city [of Medellin] transformed violence and despair into hope and opportunity, using sustainable transport as one of the key levers to drive change”* (Madrid, 2013).

Noteworthy is the fact that the implementation of this public transport system had to overcome a multitude of challenges over the year. As with Curitiba, Brazil, the public authorities of Medellin used the legal environment to drive change in the city and consequently create a platform for the establishment of an integrated public transport system.

3.3.1 Policy leveraging in Medellin

In 2001, Luis Perez Gutierrez won the municipal elections held in Medellin to then become the mayor of the town. Luis was encouraged by proposed transport strategies at the time and saw public transport as a driver for change in the city (Bea, 2016). With this political will, the National Urban Transport Program (NUTP) was enforced in 2002 (CCAP, 2012). The NUTP was a key element in revolutionising the public transport system in Medellin, as it created a platform for the implementation of Strategic Public Transportation Systems (SPTS), including the expansion of the BRT system in several major cities of Colombia, which consequently includes Medellin (CCAP, 2012).

Reacting to the aims and objectives of the NUTP, public authorities in Medellin used the land use and transport integration principles of TOD to align national, provincial and local government plans and strategies towards the implementation of an integrated public transport system which integrates metro, cable cars, BRT and light rail. In addition, policies was also leveraged by various political powers, to enforce urban upgrading and mixed land uses in identified key areas, eventually leading to a significant reduction in crimes in certain parts of the city (Madrid, 2013; Peterson, 2016). All of the above mentioned intensions are also reflected in the Master Plan for the city from 2006 to 2030. The Master Plan also depicts significant upgrades and expansions to all public transport systems in the city (Medellin Living, 2017). With an

intensive focus on transport, the city of Medellin has used Social Urbanism⁵ to guide policy and political inputs towards a more just and equitable city.

3.3.2 The transport system of Medellin

The main modes of transportation in Medellin are the Metro, MetroCable, MetroPlus, and public bus system (Uncover Colombia, 2013). By integrating these different transportation modes, Medellin has become greatly accessible to all the residents of the city. Through making public transport available in various forms, accessibility in the city has been greatly improved and has since allowed efficient and complementary land uses to be allocated in the relevant areas adjacent to the public transport infrastructure.

3.3.2.1 The Metro de Medellin

The Metro in Medellin, also known as Metro de Medellin, is perhaps the most efficient of all the transport systems in the city, also being the only metro system in Colombia. Medellin's metro is an urban train that runs from norther parts of the city to the south and from the centre of the city to parts of the West, consisting of two major lines (Lines A and B). These two lines service 27 stations and provides access to a variety of tourist sites in the city (Uncover Colombia, 2013). The first phase of the metro network was completed in 1996, with the growth of this metro system allowing for the operation of 77 trainsets by 2015 (Railway Gazette, 2015).

The Metro system was initially intended as an urban mobility system for the working individuals residing in the city, but has since become an important cultural symbol which aided in the development of marginalised areas of the city, allowing land uses to conform to the principles of TOD in and around metro stations. Payments for the Metro are made using the Civica card, which is a rechargeable card which offers discount and other benefits. The Civica payment system has contributed significantly to the success of the Metro system, as ease of payment acts as incentive for use of public transport in Medellin (Vides, 2017). The Metro de Medellin

⁵ Social Urbanism is a concept adopted in Medellin which aims to put monetary investments into its poorer communities in an attempt to transform itself from one of the most notoriously violent places in the world into an innovative city of the future (Milton, 2017).

system currently transports more than 160 000 000 passengers per year, while simultaneously reducing CO₂ emissions by 178 000 tons annually (Medellin Living, 2017).

3.3.2.2 The Medellin Metrocable

In conjunction with the above mentioned, the carbon offset project 'Cable Cars Metro Medellin, Colombia' was another way of using policy to create a platform for the introduction of six cable car lines as a means of public transport in Medellin (My Climate, 2012). Encouraged by the Mayor, Luis Perez, the Metrocable is arguably the most innovative form of public transport in South America and was intended to serve as a feeder service for the Medellin metro system. The Metrocable was opened in 2004, providing integration between the city centre and mountainous periphery which was previously difficult to access otherwise (Leibler and Brand, 2012; Bea, 2016). It is through making these lower-income areas on the periphery of the city accessible, that Medellin has successfully reduced the crime rates and addressed poverty issues in the city.

The Metrocable system consists of two lines (Line K and Line J). Line K services the lower-income neighbourhoods in the north-east of Medellin, connecting these areas to the main metro line, which operates adjacent to the Medellin River. Line J runs through the western sector of the city, where income diversity is greater and residential densities are lower (Davila and Daste, 2011). These Metrocable lines and the associated infrastructure is known for its novelty, low cost, low levels of disruption to the urban fabric as well as its low emissions of particulate matter (Brand and Davila, 2011). Due to its positive impacts, the local government provided more than half of the funding, with the rest being paid by the Metro Company. Currently, the Metrocable is running at full capacity on most business days, providing much needed services to the people and the public transport system in Medellin. It is the effectiveness of this service which contributes to the reputation as one of the most successful public transport systems in the world today. Figure 3.7 below illustrates one of the Metrocable stations on line K.



Figure 3.7: Image depicting the Metrocable in Medellín (Milton, 2017).

3.3.2.3 The Medellín BRT system

As part of the 2002 National Urban Transport Program (NUTP), Medellín started to establish a BRT system in the city. “The first BRT system, Transmilenio, was built in Bogotá. It was so successful that it became a model for the rest of the country. Amongst other things, it decreased the average travel time by 32%, increased property values along the main line by 15-20%, enhanced tax revenues, created jobs, and improved the health and safety of the community. Transmilenio helped galvanize support for the national plan to expand BRT systems to 8 other cities in Colombia. Through impressive leadership, strategic institutional coordination and innovative financing models that included funding from public, private, and international institutions, Colombia was able to address these barriers and build a national plan to expand Bus Rapid Transit systems across the country” (CCAP, 2012: 6).

The BRT in Medellín was launched in 2011 and currently consists of 2 bus priority corridors that span a length of 18 km, serviced by 26 BRT stations. The BRT service is used by over 60 000 passengers on a daily basis and is often seen as a feeder system for the Metro de Medellín (BRT Data, 2017). It is along the BRT corridors, along with the Metro rails, that the principles of TOD is most evident. Along the BRT corridors,

high density and mixed land uses are being encouraged and significant amounts of NMT infrastructure act as incentive to move away from private vehicle use. In addition, the BRT system in Medellin is also credited for its contribution in the reduction of CO₂ emissions (Winkelman and Kooshian, 2013).

3.3.3 Concluding remarks

As this case study of Medellin has illustrated, the principles of TOD has been used to transform the city in recent years, with public transport acting as the backbone for its success. Medellin has utilised political will and the legal environment to ensure that public transport is not only accompanied by relevant land uses, but also that public transport itself becomes a tool with which to address various social and environmental issues in the city. This case study has shown that the integration of public transport systems can directly lead to the mitigation of spatial inequalities in a city and that public transport can be a driver for social upliftment of entire communities. With the public transport system being enabled by policy changes and implementation, Medellin is a good example of how increased mobility can transform a city. Medellin has also shown that through transport innovation, the benefits of TOD can be experienced in any geographical location.

3.4 Conclusion

This chapter set out to analyse the success of TOD in Curitiba and Medellin, with the intentions of understanding which key elements contributed significantly to the success of the implementation of TOD strategies in these countries. As has been illustrated in both case studies, TOD strategies originated from political will to improve the urban form and ease mobility and accessibility in the respective cities. It was with this political will that a strong, long-term, vision could be established, which in turn was enforced through the mobilisation of the legal environment. In addition, both case studies indicated that the vision for these cities included having a functional and well-integrated transport system serving as the backbone for the respective TOD strategies.

The case study of Curitiba has illustrated that TOD strategies can be successfully implemented according to a strong vision; however, the implementation and

success of such TOD strategies will only be materialised on the long-term. Although different TOD strategies can be implemented in the short-term, the overall vision for the city was carried out over several decades, with progress still being made today. Therefore, the sustained political and public support for such initiatives is imperative in order to ensure that various shorter-term strategies conform to the greater vision over time. Medellin also established a strong vision to which all infrastructure provisions conformed. By gradually upgrading the public transport system in Medellin, subsequent land uses improved the general form and operational structure of the city, which also occurred over several decades.

With both case studies, public transport acted as the backbone for TOD strategies, with transport infrastructure being supplied if and when demand was pressing. Based on a strong vision, both these cities utilised the legal environment to ensure that all efforts was aligned with the vision for the city. Also important to note is that these cities had the necessary financial means to invest, construct and maintain these TOD systems. The necessary financial resources was also largely attained due to the political will and public sector support for such strategies. Drawing from the experiences of TOD in Curitiba and Medellin, it also becomes apparent that these cities faced several challenges over several decades; however, the desire and need for the success of such strategies proved to be the determining factor.

Therefore, with the aims of this chapter being to understand how TOD strategies operate in reality and what key aspects drove the implementation of these strategies, it can be said that TOD was made possible through political will combined with a strong long-term vision for the city. Legal environments were then used as the catalyst for support and implementation of these visions. Based on these findings, other cities such as Cape Town would need to muster up the required political support and amend the entire legal environment to ensure that a vision of spatial equality and integration can be realistically achieved through the aid of TOD strategies. With Cape Town, South Africa, also recently aiming to use TOD strategies as a means of spatial integration, the following chapter will aim to understand how the legal environment can assist in the successful implementation of TOD, as in Curitiba and Medellin.

4 Chapter 4: The legal environment in Cape Town, South Africa

4.1 Introduction

With TOD being successfully used as a strategy with which to rectify spatial imbalances in cities across the world, Cape Town has recently established a vision of creating spatial equality through integration and mobility, with the intentions being to use TOD as an enabling strategy for this vision. As previous chapters has highlighted, in order for TOD to truly improve the urban form, it is imperative to focus attentions on the integration between land use and transport practices. In addition, in order to better integrate land use and transport practices, the legal environment must be used as a catalyst for the implementation of strategies which would ultimately improve the conditions and livelihoods of all residents of the city. With Cape Town government officials realising the magnitude of this challenge, serious emphasis has been placed on aligning all resources towards the adoption of TOD as a strategy.

In South Africa, three spheres of government operate in conjunction with one another, with national, provincial and local level legislation governing both the administration and regulation of planning and development. Due to the legal standing of legislation at all spheres of government, municipal level decision-making and legislation has to be aligned with the legislation at national and provincial levels. Therefore, if TOD is to be implemented as a strategy in Cape Town, legislation at all levels of government will either directly, or indirectly, influence the ability of the Cape Town municipality to do so.

In South Africa, all municipalities have a responsibility to ensure that social, economic and environmental resources are protected and preserved and that such resources are used to improve the livelihoods of the general public, while simultaneously conforming to the principles of sustainable development. Therefore, the legal environment is used as a tool to ensure that decision-making is aligned and supportive of such environments. Decision-making then relies on the tools and instruments provided for by this legal environment to ensure that development is

approved in line with a long-term vision, which in this case is to use TOD as a strategy to improve spatial equality and mobility.

Therefore, this chapter will aim to understand what the current legal framework is in South Africa, with which to improve the interface between land use and transport planning in order to provide a platform for the adoption of TOD strategies, placing emphasis on Cape Town. Importantly, this chapter will provide an understanding of the tools and instruments that are provided by the legal environment, with which in turn to create a land use and transport environment which is supportive of TOD. In addition, this chapter will provide a greater understanding of the competencies, capacities and constraints of the local municipality in Cape Town, as this determines their ability to implement TOD strategies in the city.

4.2 Laws, policies and plans

As the previous chapters of this study has indicated, the ideals of TOD has been successfully enabled through the use of the legal environment, which needs to be aligned and unified at all levels of government. It must therefore be noted if TOD strategies are to be successfully adopted in South Africa, the legal environment must be fully utilised in decision-making and in carrying out a long-term vision. Importantly, TOD itself is not necessarily promoted in all national laws, policies and plans in South Africa; but rather promotes the ideals on which TOD is based, such as equality, choice, opportunity and growth. With regards to the requirements for the implementation of TOD, South Africa has highlighted the intentions of future development and growth, meaning that all legal documents need to be updated regularly in an attempt to align legislation with growth and development intentions in the country, with the co-operation of all spheres of government being instrumental to the feasibility of the above mentioned.

4.2.1 The Constitution of the Republic of South Africa

The Republic of South Africa's Constitution (RSA, 1996) was promulgated in 1996 with the intentions to address past injustices in the country (Tshikotshi, 2009). The Constitution is the over-arching Act that takes superiority over all other laws, Acts, policies and regulations in South Africa. Of importance to this study, the Constitution

(RSA, 1996) sets out all the rights of the citizens of South Africa, as well as the various duties and competencies of various government entities (Henrard, 2002).

In Section 9 of the Bill of Rights (BoR) it is stated that “The state may not unfairly discriminate directly or indirectly against anyone on one or more grounds, including race, gender, sex, pregnancy, marital status, ethnic or social origin, colour, sexual orientation, age, disability, religion, conscience, belief, culture, language and birth” (RSA, 1996: 7). This is highly relevant in Cape Town, with the spatial form of the city being established on the basis of exclusion in previous years. Of importance to this study, the Constitution also makes reference to the right of freedom of movement and an environment which is not harmful to their wellbeing, while also stating that everyone has the right to access to adequate housing.

In addition, Section 3 of the Constitution deals with the co-operation of Government spheres. Section 40 of the Constitution states that “all spheres of government are distinctive, interdependent and interrelated” (RSA, 1996: 25), while section 41 lists a number of principles of co-operative government and intergovernmental relations. In order for co-operative governance to work, the Constitution needs to set out these principles in an attempt to ensure that the cross-sectoral relationships between the various spheres of government operate effectively, while simultaneously not allowing one sphere of government, or the actions of this entity, to negatively influencing another.

Relating to the principles of co-operative governance as set out in the Constitution, the intentions are to “preserve the peace, national unity and the indivisibility of the Republic” (RSA, 1996: 25). Taken into consideration in conjunction with the next principle, which is to “secure the well-being of the people of the Republic” (RSA, 1996: 25), it becomes evident that the main idea of this relationship is to work towards serving the people. Subsequent principles are focused on the actual co-operation of the various spheres of government, aiming to align the various and respective tasks of these spheres in order to attain the collective goals of the constitution. Importantly, the Constitution emphasises that all spheres of government are autonomous and does not value one sphere as superior over another. This means that the Constitution instead aims to create an environment where each

sphere to perform at maximum capacity, while limiting the effects of the contributions of one sphere on another (Bronstein, 2015). This is of vital importance to this study as policy at the various levels of government must operate both independently of one another, but must simultaneously be integrated across all levels of government.

“The government machinery is made up of 3 parts: 1) The elected members (legislatures) – who represent the public, approve policies and laws and monitor the work of the executive and departments; 2) The Cabinet or Executive committee (executive) – who co-ordinates the making of policies and laws and oversee implementation by the government departments and; 3) the Departments and Public Servants – who are responsible for doing the work of government and account to the Executive” (ETU, 2009).

At National level of Government, laws and policies are approved by Parliament. Each government department is responsible for implementing the laws and policies decided on by Parliament. The Parliament also elects the Presidency, which in turn is then monitors and evaluates overall progress towards achieving government goals. In addition, the Constitution (RSA, 1996) states that provincial or local government may not act in any way that is against the laws or policies as approved by the Presidency or approved by national government (ETU, 2009).

At Provincial level of Government, there are nine provincial governments, with each province having a Legislature made up of between 30 and 90 members of the Provincial Legislature (MPL's) (ETU, 2009). The Constitution (RSA, 1996) allows for selected provincial laws to be approved by Legislatures. In each of the nine provinces there are usually at least twelve departments responsible for various entities of the state, such as: Housing; Planning and Environment; Transport; Public Works; Social Development; Health and; Education (ETU, 2009). As stated in the Constitution, each province is legally obliged to have a Provincial Growth and Development Strategy (PGDS) that sets out the way the province aims to develop the economy, as well how the province aims to improve service delivery. Provinces are also bound by the Constitution to establish a Spatial Development Framework (SDF) that indicates where development is to take place in the short and long-term

(ETU, 2009; Bronstein, 2015). SDF's are one of the key tools used as Provincial, and local, level of government that are closely linked with the implementation of TOD strategies, rendering SDF's of special importance to this study and will thus be discussed in more detail later in this chapter.

With regards to the local (municipal) level of Government, the entire geographical areas of the country is divided into various local municipalities. All municipalities are represented by a Council. The Council consists of publicly elected members who then has the authority to approve policies, development plans and by-laws for their respective areas (ETU, 2009). In South Africa, there are three kinds of Municipalities: 1) Metropolitan municipalities – which exist in the six biggest cities in South Africa. Cape Town is also under the jurisdiction of a metropolitan municipality; 2) Local municipalities – areas that fall outside of the six metropolitan municipal areas are divided into local municipalities, with a total of 231 local municipalities in existence in South Africa and; 3) District municipalities – who are made up of a number of local municipalities that fall in one district, with 3 – 6 local municipalities usually coming together in a district council (SARPN, 2010; Bronstein, 2015). Irrespective of the type of municipality, the functions of municipalities are: electricity delivery, sewage and sanitation, municipal roads, street trading, parks and recreation areas, stormwater systems, land use planning and municipal public transport services (ETU, 2009; SARPN, 2010).

By understanding the Constitution of the Republic of South Africa (RSA, 1996), it becomes apparent that of importance for this study, it needs to be understood that through the Constitution, every individual has a variety of rights and that each sphere of government has a specified competency. This is important to understand as TOD strategies operate from this platform provided by the Constitution. Government departments are not only obliged to ensure that the rights of all citizens are respected, but they must also act within the competency set out in the Constitution. Thus the competencies given to each sphere of government, provides an idea as to the limitations or capabilities with which to ultimately ensure integration between land use and transport planning, which in return will provide the basis for the implementation of TOD strategies with which to rectify the spatial inequalities and accessibility issues in the respective cities (RSA, 1996).

With the intentions of ultimately enabling TOD strategies through the use of the legal environment in Cape Town, it is important to further understand what legal tools provide a platform for the integration between land use and transport planning. As is evident from the functions of national and provincial spheres of government, implementation is mostly left for the local sphere of government, therefore it is essential that local government has tools available at its disposal with which to enable the implementation of policies and plans. As this section has highlighted, the Constitution is the over-arching Act in the country; however, various other Acts at national level operate alongside the Constitution and directly guide land use and transport planning activities. Although not limited to the below mentioned Acts, the Spatial Planning and Land Use Management Act (SPLUMA) (16 of 2013) (RSA, 2013), The Municipal Systems Act (MSA) (32 of 2000) (RSA, 2000) and the National Land Transport Act (NLTA) (5 of 2009) (RSA, 2009) are of high importance to this study as these Acts provide tools with which local municipalities can ultimately integrate land use and transport planning.

4.2.2 The Municipal Systems Act (32 of 2000)

The Municipal Systems Act (32 of 2000) (RSA, 2000) was promulgated in 2000 with the intentions of the Act being: *"To provide for the core principles, mechanisms and processes that are necessary to enable municipalities to move progressively towards the social and economic upliftment of local communities, and ensure universal access to essential services that are affordable to all; to define the legal nature of a municipality as including the local community within the municipal area, working in partnership with the municipality's political and administrative structures; to provide for the manner in which municipal powers and functions are exercised and performed; to provide for community participation; to establish a simple and enabling framework for the core processes of planning, performance management, resource mobilisation and organisational change which underpin the notion of developmental local government; to provide a framework for local public administration and human resource development; to empower the poor and ensure that municipalities put in place service tariffs and credit control policies that take their needs into account by providing a framework for the provision of services,*

service delivery agreements and municipal service districts; to provide for credit control and debt collection; to establish a framework for support, monitoring and standard setting by other spheres of government in order to progressively build local government into an efficient, frontline development agency capable of integrating the activities of all spheres of government for the overall social and economic upliftment of communities in harmony with their local natural environment; to provide for legal matters pertaining to local government; and to provide for matters incidental thereto" (RSA, 2000: 2).

With the roles of the MSA (RSA, 2000) explained above, it becomes apparent that the MSA can be viewed as a framework document which intends to cater for municipalities at the local level. In order to hold municipalities to the principles of co-operative governance, the MSA in conjunction with the Constitution, grants the various organs of state different executive and legislative powers. In turn, municipalities are then subject to certain conditions and the minimum standards for municipalities. As a consequence, these municipalities then have the right to govern themselves and to establish legislation for their areas, known as 'by-laws'. These 'by-laws' are then considered as a tool with which municipalities can influence development and similar activities.

Although the MSA makes provision for the establishment of legislation such as by-laws, municipalities only have the authority to exercise their powers in their area of jurisdiction, unless the said municipality enters into agreement with another municipality (OSS, 2015). Of further importance is the fact that the MSA (RSA, 2000) previously acted as the overarching framework which inscribed the various elements which needed to be included in the Integrated Development Plans (IDP's) of all municipalities. The IDP documents of municipalities in itself is another tool at the municipalities' disposal with which to influence land use and transport planning, which is arguably largely enabled through the MSA.

4.2.2.1 Integrated Development Plans (IDP's)

Integrated Development Plans (IDP's) are key tools used by local municipalities to plan future developments in spatial locations under its jurisdiction. It can be said that

the IDP is a plan for an area that “involves the entire municipality and its citizens in finding the best solutions to achieve good long-term development. IDPs aim to co-ordinate the work of the different spheres of government into one coherent plan” (ETU, 2015). The IDP document does not only take into account the available financial resources for development, but also analyses the economic and social conditions of the area, while also indicating what land uses, infrastructure and services are required in the area of jurisdiction.

The main functions of a municipal IDP document is to assist in the allocation and use of scarce resources; to increase the speed of service delivery; to strengthen democracy and public participation; to attract investment and funding and to promote co-ordination between the different spheres of government. IDP documents have a lifespan of five years, which is directly linked to the term of office for local councillors. After every election, the new councillors can either adopt the existing IDP or develop a new IDP (ETU, 2015). For the purpose of this study, it is worth noting that IDP's can be used to drive municipal agendas in terms of land use and transport planning and is therefore seen as a useful tool at the disposal of local government.

4.2.2.2 Municipal by-laws

A by-law refers to a municipal law or ordinance, which is legally passed under the jurisdiction or authority of state law and specifies what things may be regulated by the municipality in question (Drakenstein, 2017). A by-law is passed and enacted by a Municipal Council and is used as a regulatory tool for the regulation of any affairs, services or functions the municipality provides within its area of jurisdiction. Municipal by-laws have the same force of law as other national or provincial legislation and ordinances, thus making by-laws effective tools with which to devolve the powers of the state to the city level (Memeza, 2000). In South Africa, all municipal by-laws has to give effect to the minimum requirements of SPLUMA and has to be consistent with the principles set out in SPLUMA.

4.2.3 The Spatial Planning and Land Use Management Act (16 of 2013)

The Spatial Planning and Land Use Management Act (SPLUMA), (16 of 2013) (RSA, 2013) was enforced on the 1st of July 2015 and directly influences any decisions regarding land use in South Africa. SPLUMA operates as a framework Act that regulates spatial planning and land use management legislation at all three spheres of government. The key purposes of the Act are “to provide for inclusive, developmental, equitable and efficient spatial planning” and “to address past spatial and regulatory imbalances” (RSA, 2013: 2).

What makes SPLUMA important to this study is that it sets out five principles which guide: “(a) the preparation, adoption and implementation of any spatial development framework, policy or by-law concerning spatial planning and the development or use of land; (b) the compilation, implementation and administration of any land use scheme or other regulatory mechanism for the management of the use of land; (c) the sustainable use and development of land; (d) the consideration by a competent authority of any application that impacts or may impact upon the use and development of land and; (e) the performance of any function in terms of this Act or any other law regulating spatial planning and land use management” (RSA, 2013: 14).

These 5 principles mentioned above can be viewed as principles directly aiming to ensure spatial justice, spatial sustainability, efficiency, spatial resilience and good administration. With these principles in place, SPLUMA provides legal standing for the rectification of historical spatial and development injustices through legislating the provision of opportunities and benefits to individuals who were previously disadvantaged in South Africa. In addition, these principles emphasise that any future development must be sustainable, resilient, and flexible and that infrastructure and resource use must be efficient. All of the above mentioned principles are crucial to the successful implementation of TOD strategies and should serve as platform for motivating the approval of such TOD strategies. It then becomes evident that the principles and intentions of TOD, as mentioned in the literature review of this study, are closely aligned to the principles and intentions of SPLUMA. Of further interest is that SPLUMA aims to be a tool for spatial transformation, with SPLUMA placing strong emphasis on Spatial Development Frameworks and Land Use Management Systems as tools with which to implement such spatial transformation strategies.

4.2.3.1 Spatial Development Frameworks

Spatial Development Frameworks (SDFs) “are frameworks that seeks to influence the overall spatial distribution of current and future land uses within a municipality in order to give effect to the vision, goals and objectives of the municipal Integrated Development Plan (IDP)” (Department of Rural Development and Land Reform (DRDLR), 2017: 67). Through SPLUMA, all spheres of government are legally obliged to prepare an SDF, with the scale of the SDF adapting according to the level of government. Thus, SDFs are implemented at national, provincial, regional and municipal level, with more detailed plans at municipal level taking the form of precinct plans. At provincial level, SPLUMA requires that all provinces prepare a Provincial Spatial Development Framework (PSDF) to give spatial expression at a provincial level of government and to align municipal planning in the province (DRDLR, 2017). The Municipal Systems Act (MSA) (32 of 2000) (RSA, 2000) first introduced the concept of Municipal Spatial Development Frameworks (MSDFs), establishing the core features of an MSDF, while SPLUMA adds detailed provisions to the relevant MSDFs.

Of most importance to this study is that it is at municipal level that delivery takes place. MSDFs serves to give spatial direction to municipal IDPs in conjunction with other municipal spatial planning tools such as Land Use Management Schemes (LUMS). In relation to this, an MSDF should aim to show the joint spatial effect of the policies of all of the city's departments. One of the benefits of having an MSDF is that significant structuring and restructuring elements of the spatial form of a city region is identified spatially in the MSDF, which in turn then more effectively informs land use and transport decision-making. In addition, MSDFs need to indicate selected areas for the allocation of public and private operational and capital resources, thus effectively identifying areas most suited for interventions such as TOD. It is also important that LUMS are aligned with the MSDF of a city in order to ensure that spatial transformation strategies, such as TOD, is implementable in the identified spatial locations.

4.2.3.2 Land Use Management Schemes/Systems

Chapter 5 of SPLUMA deals with Land Use Management and states that “A municipality must adopt and approve a single land use scheme for its entire area within 5 years from the commencement of the Act” and that “Land use scheme must be consistent with the Municipal Spatial Development Framework” (RSA, 2013: 35). Thus, Land Use Management Schemes/Systems (LUMS), are viewed as a legal tool for the use of municipalities at local level of government. LUMS are a legal set of documents that consist of scheme clauses and regulations, while simultaneously providing information of land use rights, with the overall intentions of determining and regulating the use of land (Berrisford and Kihato, 2008).

LUMS are “used to regulate land use in a municipality, including a town planning or zoning scheme or policies related to how land is used on a plot-by-plot basis” (DRDLR, 2014: 6). LUMS documents indicate the allocated use of land through a variety of zoning maps, making it of vital importance to be aligned with the spatial intentions of the MSDf. LUMS are not only used as a tool to regulate land uses, but also plays a pivotal role in regulating densities and administering land use changes. Thus for the purpose of this study, if land use and transport planning is to be better integrated, LUMS are effective tools with which to increase densities and allocate the required land uses to identified pockets of land in order to allow for TOD to transform such areas. If LUMS are successfully aligned with MSDfs, these tools could play key roles in the implementation of spatial visions at local levels of government.

With the Constitution, the MSA and SPLUMA providing legal standing for the use of spatial planning tools such as IDPs, SDFs, LUMS and By-laws, it can be assumed that there is sufficient clarity on government competencies and land use management. This chapter of this study has also placed emphasis on the integration between these different tools and how they can be used to transform the urban form and land use patterns of a city. However, in order to integrate land use and transport planning in a way that enables TOD, it is important to understand how transport is regulated and which tools are enabled for transport planning at city level.

4.2.4 The National Land Transport Act

The National Land Transport Act (Act 5 of 2009) (RSA, 2009) was assented to in April 2009. The National Land Transport Act (NLTA) aims to further the process of transformation and restructuring in South Africa. In an attempt to do so, the NLTA regulates and monitors the transportation of public passengers only and does not apply to the transport of goods or of passengers when no fee is charged for transportation services. The purpose of the NLTA is to give effect to other national policies and “prescribe national principles, requirements, guidelines, frameworks and national norms and standards” (RSA, 2009: 16). Therefore the NLTA operates as a framework Act that holds all spheres of government legally liable to ensure that transport policies and plans are established and that all land transport functions are consolidated at the relevant levels of government. In this regard, the Act provides various institutional arrangements for land transport, while also emphasising the importance of integration between transport and land use legislation at all spheres of government.

Although the NLTA sets out a variety of functions which are to be executed at national and provincial levels of government, the Act recognises that implementation mostly occurs at municipal level and states that: “*Land transport planning must be integrated with the land development and land use planning processes, and the integrated transport plans required by this Act are designed to give structure to the function of municipal planning mentioned in Part B of Schedule 4 to the Constitution⁶, and must be accommodated in and form an essential part of integrated development plans, with due regard to legislation applicable to local government, and its integrated transport plan must form the transport component of the integrated development plan of the municipality*” (RSA, 2009: 44). In light of this statement, the NLTA also states that all municipalities must develop land transport policies and strategies which is not only aligned to its spatial vision, but which is also

⁶ Part B of Schedule 4 of the Constitution refers to functional areas of concurrent national and provincial legislative competence and reads: “The following local government matters to the extent set out in section 155(6)(a) and (7): Air pollution; building regulations; child care facilities; electricity and gas reticulation; firefighting services; local tourism; municipal airports; municipal planning; municipal health services; municipal public transport; municipal public works only in respect of the needs of municipalities in the discharge of their responsibilities to administer functions specifically assigned to them under this Constitution or any other law; pontoons, ferries, jetties, piers and harbours, excluding the regulation of international and national shipping and matter related thereto; stormwater management systems in built-up areas; trading regulations; water and sanitation services limited to potable water supply systems and domestic waste-water and sewage disposal systems” (RSA, 1996: 67).

incorporated in the municipalities' spatial development policies. In addition, the NLTA holds municipalities responsible for the use of land use planning as a tool with which to densify urban environments, in an attempt to create ridership for land public transport systems in cities. Although the intentions are promote densification, the NLTA makes it clear that intensification of land uses cannot be justified based on transport plans and must thus still be approved by the relevant planning authority. This is done in an attempt to better integrate land use and transport planning, allowing the opportunity for planning authorities to co-operate with other government departments during the planning process.

A great concern with regards to the implementation of transport plans and the resultant infrastructure requirements, is that such activities are very costly. In addition, the availability of funds often determines the feasibility of transport plans at all spheres of government, also ultimately influencing the competencies of government entities. In an attempt to avoid a lack of finance leading to a lack of implementation of transport policies and plans, the NLTA sets out a chapter (Chapter 3) which deals specifically with the allocation of funds for land transport. In this regard, the NLTA again realises the need for implementation at local level and legally binds local municipalities to establish a Municipal Land Transport Fund (MLTF). All funds appropriated for land transport in the relevant area must be paid into the MLTF, including money accrued from public transport user charges.

Remaining chapters of the NLTA deal largely with the contracting for public transport services and the regulation of road-based public transport. In these chapters, the NLTA again places emphasis on local level of government to ensure that a sufficient number of public transport operators are present in a given geographical location and that all public transport operators are fully licensed. With the NLTA promoting integration between land transport and land use planning, the overall aims are to achieve specified densities and to ensure that land transport systems are represented and implemented at all spheres of government. In order for local government to deal with all the requirements set out in the NLTA, the NTLA uses integrated transport plans as a tool with which local government can implement its vision and ensure that public transport remains a key function of the state.

4.2.4.1 Comprehensive Integrated Transport Plans

As mentioned above, Section 36 (1) of the NLTA (RSA, 2009) holds local municipalities responsible for submitting an Integrated Transport Plan which applies to the entire geographical area under the jurisdiction of the relevant municipality. Once approved, a municipalities Integrated Transport Plan (ITP) encapsulates the design and the operational objectives of urban transport networks of the mentioned municipality (Dawood and Mokonyama, 2016).

The Department of Transportation best describes ITPs as: *“a plan relating to the regulation, provision and management of transportation infrastructure (roads, rail, stations, terminals and public transport facilities). This plan is also aimed at regulating public transportation operations/services and the use of infrastructure by both operators of public transportation and private travellers. Because of the spatial relationship between residential and economic activities that result in the demand for travel, it is essential that an integrated transportation plan should be developed in the context of a land use plan which is supportive of efficient public transportation. Details that must be included in a transportation plan are public transportation operations, circulation or movement and mobility needs, vehicles and rolling stock, depots/equipment and human resources”* (Department of Transportation, 2009: iii). Therefore, if ITPs are fully integrated and aligned with municipal IDPs, SDFs, LUMSs and municipal by-laws, they can serve as an effective tool with which local government can implement and regulate land transport in urban environments.

4.3 Conclusion

This chapter has set out to understand the legal framework in South Africa, with emphasis on Cape Town, in terms of what legislation is available with which to better integrate land use and transport planning in order to provide a better platform for the implementation of TOD strategies. As this chapter has illustrated, the Constitution (RSA, 1996) grants all citizens with fundamental human rights and sets out the competencies of all spheres of government to ensure that the relevant levels of government undertake the given functions in an attempt to ensure that these human rights are met. Of importance to this study is that the Municipal Systems Act

(32 of 2000) (RSA, 2000), the Spatial Land Use Management Act (6 of 2013) (RSA, 2013) and the National Land Transport Act (5 of 2009) (RSA, 2009) all operate in conjunction with the Constitution and regulates over the various sphere of government, guides land use planning and provides a platform for transport planning. Although there are copious amounts of other legislation that influence land use and transport planning in South Africa, these Acts were deemed the most important due to the spatial planning tools that they provide.

With government authorities in South Africa realising that the implementation of visions, policies and plans mostly occur at the local level of government, both national and provincial level legislation provide a platform and a variety of tools with which to enable implementation at municipal level. This chapter has depicted that through the above mentioned national Acts, Integrated Development Plans (IDPs), Spatial Development Frameworks (SDFs), Land Use Management Schemes (LUMS) and Municipal By-Laws action as tools and instruments with which the City of Cape Town, as well as all other municipalities, can address spatial issues in the city. These tools provide a legal platform from which local government can implement the necessary actions needed to ultimately create an environment suitable for TOD.

By understanding the roles and impacts of these various legislations better, it becomes possible to analyse how these legislations enable TOD in cities such as Cape Town. Therefore the next chapter will provide a vision of what TOD around one of Cape Town's biggest transport hubs, Bellville station, could look like. Because it won't be sufficient to simply indicate what TOD could look like in the long-term, the next chapter will also aim to understand how the legal tools and instruments discussed in this chapter, can assist in the implementation of TOD at Bellville station in the future and thus ultimately ensuring that the spatial vision for the city is brought to fruition.

5 Chapter 5: Enabling TOD through institutional frameworks

5.1 Introduction

In this chapter, the aim will be to understand the current context of Cape Town, South Africa, in terms of the spatial layout of the city and the associated issues with this layout. Building on this, this chapter will make use of a couple of plans to indicate how a TOD precinct could look at one of the largest transport hubs in the city, known as Bellville station. Once these plans have indicated which type of TOD environment the city should aim for, this chapter will show how the legal tools and instruments identified in the previous chapter, can be used to achieve such an environment. These tools will include the latest Draft Municipal Spatial Development Framework for Cape Town, the Cape Town Municipal By-Law, the Draft Comprehensive Integrated Transport Plan and the TOD Strategic Framework for Cape Town. One of the main aims of this chapter will be to illustrate how TOD can be implemented in a specified location in Cape Town, ultimately acting as an example for future projects across the rest of the city, while also illustrating how the benefits of specified TOD interventions can spread across the city.

5.2 Cape Town, South Africa

Cape Town is situated in one of the nine provinces of South Africa, known as the Western Cape (see figures 5.1 and 5.2). Cape Town is the second most populous city in the country, after Johannesburg, with a metropolitan population of 3.74 million people. The city covers an area of 2 455 km² and has a population density of 1 530 people per square kilometre (StatsSA, 2017).



Figure 5.1: Locality map of Cape Town, South Africa (Adriftskateshop, 2017).



Figure 5.2: Map of Cape Town, South Africa (Google Images, 2017).

5.2.1 Political context of Cape Town

In 1948, the National Party (the national government of South Africa at the time) enforced its policy of racial segregation, which would later be known as apartheid⁷. One of the main aims of this apartheid policy, amongst various other intentions, was to legally ban non-whites from owning land in certain areas of the country. This policy led directly to spatial segregation based on race, while other subsequent effects was the deprivation of economic, social and environmental opportunities to selected race groups (Field et al., 2007; Cape Town Partnership, 2009). Several waves of forced removals took place, displacing thousands of non-whites to less-serviced neighbourhoods, where infrastructural services and economic opportunities were minimal and the land was overcrowded (Swilling et al., 1991). After an array of violent marches and strikes leading up to the 1994 democratic elections, Nelson Mandela was inaugurated as the President of the Government of National Unity. Together with Nelson Mandela's appointment as president came the end of the apartheid era in South Africa (Seekings, 2010). Although the apartheid era has been abolished since 1994, the ramifications of this unjust political system is still evident throughout the country today, with Cape Town being no exception.

⁷ "Apartheid was a political and social system in South Africa while it was under white minority rule. This was used in the 20th century, from 1948 to 1994. Racial segregation had been used for centuries but when the new policy started in 1948 it was strict and more systematic" (Wikipedia, 2017).

Under apartheid, Cape Town was highly ordered spatially. "The historic city centre, the 'Southern Suburbs' stretching down the Cape Peninsula and the 'Northern Suburbs' curving along low hills inland to the north-east were almost entirely set aside for white settlement. African settlements were successively removed eastwards, away from the city centre. The coloured population was the primary victim of forced removals from the 1960s through to the 1970s, subjected to relocation from what became uniformly white areas to more distant areas, especially on the sandy 'Cape Flats' to the south-east" (Seekings, 2010: 3).

Although several attempts by the National, Provincial and Local levels of government have been made to rectify the spatial inequality in Cape Town, the city is still largely divided by the actions of the apartheid government. As a consequence of the city being spatially segregated with the intentions of denying access to identified races, mobility and accessibility are still considered amongst the biggest issues in the city in 2017. State authorities have been aiming to rectify the spatial form of the city for the last two decades, understanding the vital role of access and mobility in achieving greater social, economic and environmental integration. In an attempt to rectify these issues and improve the spatial form of the city, Cape Town has recently adopted the concept of TOD. Government officials have emphasised that public transport in Cape Town will form the backbone of TOD strategies in Cape Town, therefore it is necessary to understand the way in which public transport currently operates in the city.

5.2.2 Public transport in Cape Town

Public transport in the City of Cape Town is currently provided by a network of services consisting of Rail passenger services (Metrorail); Conventional bus services; MyCiti bus services (trunks and feeders); minibus taxi services and; metered taxi services (Transport for Cape Town, 2014).

Ownership of the rail service in Cape Town is dominated by PRASA (Passenger Rail Agency of South Africa) and Metrorail SA, with TFR (Transnet Freight Rail) taking ownership of the rail lines to Malmesbury and Worcester. The PRASA passenger rail

network servicing the Cape Town region is made up of 9 different routes which all converge and diverge to and from the Cape Town station. This network amounts to 610 km of rail, serviced by 118 different stations. Approximately 622 000 passenger trips are made on a normal weekday, with 81 percent of users making use of the Metro Class (Transport for Cape Town, 2014). These railway lines serve the trunk routes, with other modes of public transport servicing the feeder routes.

One of the most prominent feeder services in Cape Town is provided by the minibus taxi industry. Minibus taxis service approximately 565 routes in the metro, with these routes often linking taxi ranks, public transport interchanges and employment opportunities. This taxi service operates on-demand and is unscheduled and unsubsidised. Various route based services can be found along major arterials and highways, with a variety of area based services generally servicing residential areas, transporting users to route based taxi ranks (Transport for Cape Town, 2014; Morris, 2017). In conjunction with the minibus service, conventional bus services also play a significant part in the public transport system in Cape Town, servicing 245 000 passengers per day. The conventional bus services are privately owned by GABS (Golden Arrow Bus Services) and Sibanye Pty (Ltd). These companies have a combined 1134 buses in operation. Cape Town has 134 formal bus stops and various dedicated BMT (Bus and Minibus Taxi) lanes spread out across the metro. These buses serve the same function as the minibus taxi and thus operates largely on the same system (Transport for Cape Town, 2014).

A more regulated mode of the Cape Town public transport system is the MyCity Integrated Rapid Transit (IRT) bus system, which is based on the BRT (Bus Rapid Transit) trunk and feeder concept as developed in South America (Transport for Cape Town, 2014). Initially developed in preparation for the 2010 FIFA World Cup held in Cape Town, the MyCiti began operations in May 2010. By November 2015, the MyCiti service was operating on 36 different routes, using 42 bus stations and more than 600 bus stops, also providing approximately 60 000 daily passenger journeys⁸ (MyCiti, 2016). Together with the expansion of the MyCiti BRT system, the

⁸ "A passenger journey is defined by Transport for Cape Town (TCT) as the number of individual passengers travelling from origin to destination, for one way travel. It is not the number of 'boardings', so it does not count passengers again when they transfer to a new bus" (TCT, 2015).

integration of the above mentioned public transport modes is aimed at providing access to all citizens of Cape Town, with the aims of reducing private vehicle usage. Although the current public transport system contains all the elements needed to function as an integrated public transport network, public transport in Cape Town has been in decay for several years.

The above mentioned modes of transport service the city in a multitude of ways and each play a significant role in the way public transport operates in various parts of the city. With CoCT adopting new practices and approaches to integrated transport, the above mentioned modes of transport are heavily supported in selected development corridors⁹ throughout the city in order to ease movement. These corridors are mostly shaped around BRT and rail systems and are often functional between different transport nodes. In terms of transport nodes, there are 19 core transport nodes in the city (see figure 5.3 below). These transport nodes (often referred to as hubs or stations) play a pivotal role in the connection between different modes of public transport and have thus become places of intense and diversified activity, making them ideal locations for the implementation of TOD strategies. One of these stations which have been identified by the City is Bellville station.

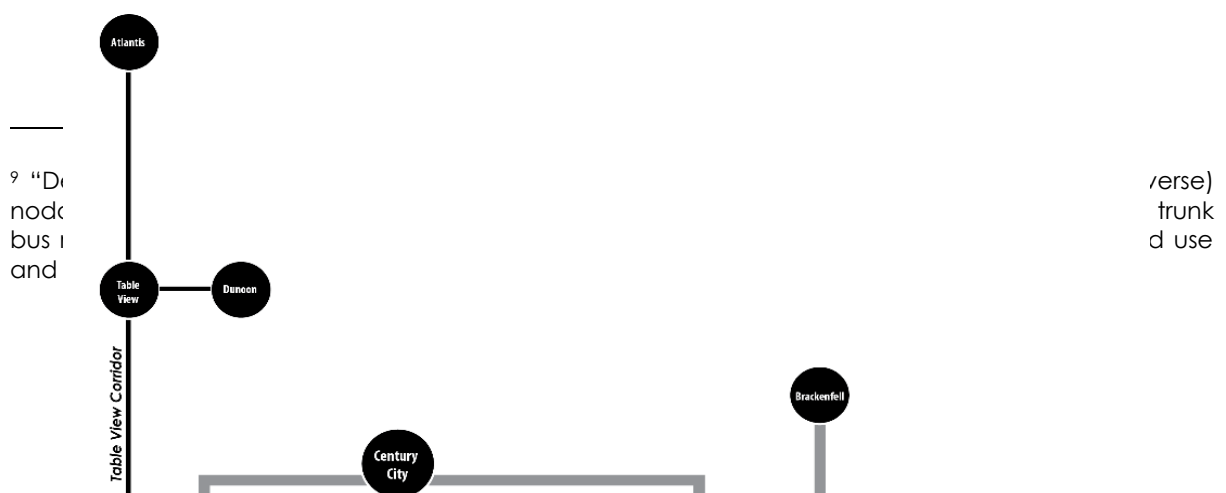


Figure 5.3: Illustration of the 19 core transport nodes in Cape Town (TDA, 2017b).

5.3 Transforming Bellville Station through TOD

Bellville railway station is a railway station in the town of Bellville, Cape Town. Bellville station is the second biggest station in Cape Town, after the Cape Town terminus. All trains on Metrorail's northern line pass through Bellville station. In addition to being a major railway station, Bellville station is also a major terminus for Golden Arrow busses and functions as one of the biggest minibus taxi ranks in the city. Figure 5.4 presents a map of Bellville station. Noteworthy is the fact that a large area of land to the

south of the station is Transnet Freight Rail's main marshalling yard for the Cape Town area. This land has therefore not been allocated for development and is currently a major barrier to growth and TOD strategies around the station. Conversely, this area can be viewed as a major opportunity considering that pockets of this land can be rezoned and allocated for more beneficial land uses that conform to the principles of TOD.



Figure 5.4: Map of Bellville station (Authors own).

As illustrated in figure 5.4, the station building is on the northern side of the railway tracks, attached to a side platform. Surrounding the station is the Bellville civic centre, the Bellville sports grounds, Northlink College and Tygerberg Medical campus. With these facilities in close proximity to the station, it adds to the argument that the station is the ideal location for the implementation of TOD strategies. In addition, Voortrekker road runs to the north of the station, with Durban road being located directly to the west of the station. The Tienie Meyer bypass road runs directly to the south of the station, with the Modderdam North road running to the east of the station. With these roads being identified as major access routes, it can be said that the station is well serviced with road structures, making it possible for various modes of transport to access the station at all times of the day.

With the presence of multi-modal transport services at the station being adequate for the adoption of TOD strategies, it is now important to understand what the current land uses in and around the station are in order to make suggestions as to how these need to be amended in order to assist the operations of public transport in the area. Figure 5.5 below illustrates what the existing land uses in and around that station are, according to the records of the City of Cape Town. As becomes evident from figure 5.5, is the fact that current land uses in and around the station already largely appear to conform to the principles of TOD. Currently, the Bellville station is surrounded by a variety of uses such as industrial, commercial, residential, open space and transport. This means that the basics of TOD strategies are already in place and that no major changes would be required to make this area truly mixed use and integrated, making the transformation plan for Bellville station (see figure 5.6) more realistic and implementable.

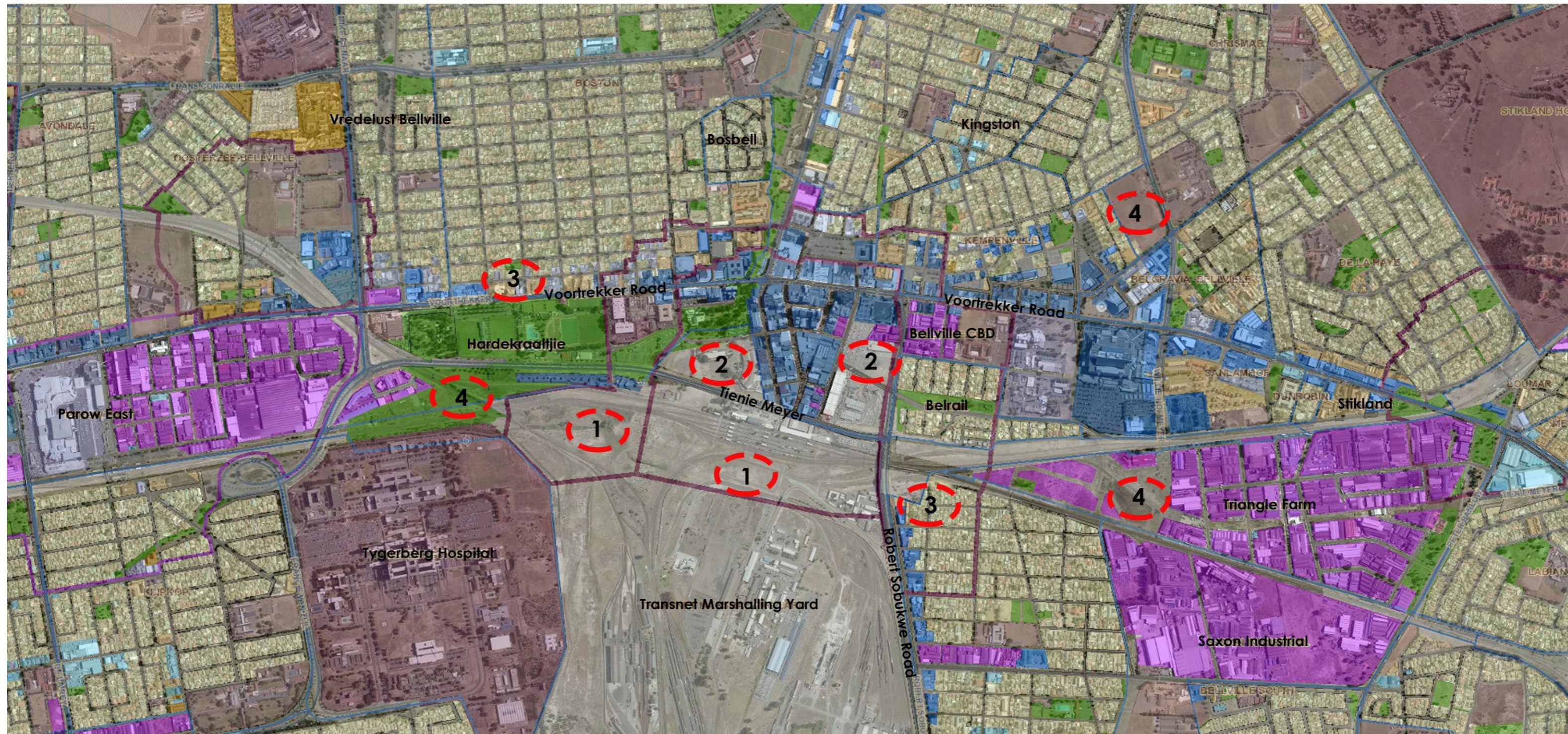
As illustrated in figure 5.5 below, there are a variety of land uses that function as constraints, although these constraints can be easily turned into opportunities through changing the land uses in the identified areas. Firstly, figure 5.5 illustrates that large quantities of land are currently zoned as transport use, with the Transnet Marshalling yard owning significant pieces of well-located land. In addition, key pieces of land are currently zoned as transport use, because they are being used as parking lots. With the intentions of TOD being to minimise parking and land used for transport, figures 5.5 and 5.6 suggests that various areas around Bellville station be rezoned for uses such as residential, commercial and open space. Rezoning such areas will not only allow for better use of these areas, but it will also contribute to densification needed for the functionality of the station and associated public transport systems. In addition, with less land being used solely for transport, a greater mix of land uses could be enabled and the liveability of the area would be significantly improved.

Bellville Station - Existing Land Use Zoning (Parent Zones)

1:25000



- General Residential
- Industrial
- Commercial
- Open Space
- Single Residential
- Transport Use
- Community



1
Transport Use:
 Currently zoned as Transport use, this land could potentially be rezoned to mixed use, which would allow for the construction of high density buildings which accomodates a variety of uses, such commercial and residential. The presence of mixed land uses in this area would create increased accessed to the station at hours of the day. This in turn would contribute to the integration of land uses between the south and north of the station.

2
Parking Lots:
 These areas are currently zoned as Transport use and is operating as parking lots. This use acts as a constraint to the development of more beneficial land uses. With the intentions of TOD being to reduce parking, this land could be used for other more beneficial land uses in the future, thus becoming an opportunity instead of a constraint. Parking could still be provided for in the form of basement parking under the newly proposed buildings.

3
Single Residential:
 These areas are currently zoned as single residential, with thousands of people inhabiting these areas. However, with TOD requiring that densities are increased, this land use would need to be transformed into higher density residential land uses where possible. With the same land area having the potential to house exponentially more people, these areas are identified as opportunities as future developments could significantly increase residential densities.

4
Open Space:
 These areas are currently zoned as open space or they are often areas which have not been allocated a land use by the City. Although it is imperative that open space is included in TOD environments, often there are land uses that would be more beneficial. Based on extensive studies, these areas could hold development potential for other relevant land uses, such as commercial, industrial or residential. These areas could also be used for land banking.

Figure 5.5: Map of Bellville station: Existing land use zoning (Authors own).













Figure 5.5 above indicates a variety of constraints and opportunities in and around the Bellville station. Relating back to the principles of TOD (Density, Diversity and Design), it becomes evident that the current land uses in and around Bellville station currently provide a good platform from which to transform this area in order to truly make it a TOD area. The currently land uses as indicated in figure 5.5, indicate that a mix of commercial, residential, industrial and open space uses are present. However, there are several improvements that can be made in this regard. Firstly, figure 5.5 indicates that residential zoning around the station occurs in the form of single residential. Single residential allows for free standing residential units, which are not conducive to densification. Therefore, future land uses needs to promote higher density residential uses. Secondly, the existing land uses are not necessarily well integrated, with commercial, residential and industrial land uses often being separated geographically. This not only negatively affects the need for travel, but also affects the diversity potential in the area. Lastly, the design of the station and the surrounding area was not initially done with the intentions of TOD in mind. This has resulted in an urban form which does not necessarily promote pedestrian movement and which does not make transport the backbone of other activities in the area.

In order to create a platform for TOD, various land use and transport changes are required. These changes must conform to the principles of TOD in order for the benefits of TOD to be extracted in the future. As indicated through case studies in previous chapters, these changes happen incrementally and in the long-term. However, important to note is that TOD strategies cannot necessarily be retrofitted and adopted ubiquitously in other cities. As becomes evident from figure 5.5, the needs and challenges of Bellville station are vastly different to the needs and challenges experienced in other geographical locations. Therefore, TOD strategies have to be informed by the local context of the selected city. Although the principles and concepts of TOD are universal, issues and challenges occur on a global scale, metropolitan scale and precinct scale. Therefore, if TOD strategies are duplicated and applied elsewhere, TOD will not necessarily be able to address the specific issues and challenges in the applied city. In this regards, figure 5.6 below merely adopted the principles and concepts of TOD and consequently makes suggestions in the form of a transformation plan.

Bellville Station - Transformation Plan

1:25000



- | | | | |
|---|---------------------|---|--------------------|
|  | General Residential |  | Railway Line Stops |
|  | Industrial |  | Road Based Stops |
|  | Commercial |  | Major/key Roads |
|  | Open Space |  | Railway Lines |
|  | Single Residential |  | Mixed Use |
|  | Transport Use | | |
|  | Community | | |



Mixed Use:
Mixed use land uses refer to a land use that allows a mix of uses. For the purpose of this map, mixed use areas mostly refer to areas where both commercial and residential land uses are present in the same area. In cases where these mixed use land uses are placed over areas previously used as parking lots or other transport uses, these transport uses are accommodated for in this mixed use zone via basement parking or similar.

Densification:
With TOD strategies being heavily reliant on surrounding areas accommodating high densities, this map aims to increase densities significantly. Most evident is the increase of residential densities, with general residential land uses implying high density residential areas. Densification takes place mostly along major transport routes or railway lines, as these roads and railway lines have been serviced with public transport.

Integration:
With railway lines and roads acting as barriers for integration, this plan aims to place various land uses on either side of roads and railway lines in an attempt to remove these barriers. The increased activities on either sides of the roads and railways means that these roads and railways would be crossed regularly in order to access other opportunities. The intentions of this plan is thus to slow transport movement in an attempt to prioritise NMT movement and integration.

Rezoning:
As this map suggests, in order to make this area adaptable to TOD, various pockets of land would need to be rezoned. As this map also indicates, pockets of land that have been allocated a new land use could make use of the 'package of plans' approach in order to gain approval for the rezoning of larger pockets of land as an alternative to rezoning approvals for specific erven. This would make this plan more implementable and realistic.

Figure 5.6: Map of Bellville station: Transformation Plan (Authors own).

5.3.1 Analysing the intentions of the Transformation plan for Bellville station

Again relating to the principles of TOD, the first intentions of this transformation plan for Bellville station (figure 5.6 above) was to create a dense and diverse environment through the use of good design, while simultaneously making transport the backbone of this TOD strategy. Therefore this plan is heavily focused on densification in and around the station and other major transport routes in the area. This plan places a lot of emphasis on residential densification, due to Cape Town having a significant housing shortage as well as the fact that increased residential densities are needed to support the other land uses in the area. In order to create a liveable environment, this plan seeks to promote a strong mix of integrated land uses which complement each other and the public transport system. As such, the design of the area heavily promotes NMT and pedestrian orientated streets. This plan also encourages land use and transport planning to integrate the different land pockets around the station, by focusing attention on slowing transport movement and removing the barriers in the area.

By focusing on integrating the above mentioned principles into the design and layout of this transformation plan, this plan encourages government officials to use Bellville station as a catalytic project which places emphasis on public transport usage, densification, mixed land uses, spatial integration, economic growth and restricted urban sprawl. Thus if this plan is adopted and successfully implemented, a variety of benefits could trickle down to the local community, as well as the community of Cape Town as a whole.

Although this transformation plan intends to create a TOD environment which portrays the principles of a good TOD environment, which will ultimately allow the benefits of TOD to be spread across the city, it must be noted that this plan is based on a few assumptions. Firstly, this transformation plan assumes that the public transport system is of a high quality. This means that the public transport system would need to be safe and punctually sound, with maintenance and restoration operations taking place regularly. In this regards, the plan assumes that the government has the financial capacity and political will to ensure that the public

transport system operates effectively. Secondly, this plan assumes that the relevant government authorities has the capacity and ability to acquire the necessary pockets of land and that rezoning approvals are granted where applicable. Only if the rezoning of land does not pose a problem, will this plan be able to guide government authorities in terms of rezoning and other land use changes.

Lastly, this plan assumes that future transport is provided in the same manner and forms that it is today. With technological advances in the transport sector rapidly transforming the industry, this plan does not make provision for such future technological changes. This plan does however place emphasis on NMT as a key future mode of mobility, although for NMT to be realistic in itself, this plan again assumes that the area is safe for pedestrians and that the necessary urban design principles are in place at a precinct scale. Only once the relevant government authorities ensures that the above mentioned requirements are in place, can this plan begin to spatially transform Cape Town through the use of such catalytic TOD projects. In this regards, the previous chapter of this study has highlighted a variety of legal tools and instruments which can assist the relevant local government authorities to implement and adopt not only this transformation plan for Bellville station, but also other TOD strategies elsewhere in Cape Town.

5.4 Legal Tools and Instruments for the implementation of TOD

With the legal environment better explained in chapter 4 of this study, it became apparent that the legal environment provides a variety of tools and instruments with which local government can ensure better integration between land use and transport planning in an attempt to address spatial inequalities in the city, as well as to provide a platform for the implementation of TOD strategies. With figure 5.6 above depicting how Bellville station could function as a TOD project in the future, it is imperative to understand how this plan can be achieved in the short and longer-term. Therefore, the next part of this chapter will aim to understand how the legal tools and instruments identified in chapter 4, can assist in achieving the transformation depicted in the transformation plan above. It is also important to note that although this chapter focuses attentions on Bellville station, these tools and

the principles contained in them can be used for all future TOD strategies in Cape Town. The first tool which can be used is the Municipal Spatial Development Framework (MSDF) of Cape Town.

5.4.1 The Cape Town Municipal Spatial Development Framework

According to section 24 of the Municipal Systems Act, Section 20 of SPLUMA and Sections 5(1), 6, 7 and 10 of the City of Cape Town Municipal Planning By-Law, the 2012 Cape Town Municipal Spatial Development Framework (CTMSDF) has to be reviewed in the year 2017. Therefore, the City of Cape Town (governing authority) has released a Draft Municipal Spatial Development Framework review document which has been put out for public comment, prior to finalising and enforcing the changes to the existing MSDF for the years 2017 to 2022. With this review process currently ongoing at the time of writing of this study, the next section will focus on the intentions and how this document can be used to transform Bellville station into the depiction set out in Figure 5.6.

The vision for the city as stated in the MSDF Review Draft document is as follows: *"The City is intent on building a more inclusive, integrated and vibrant city that addresses the legacies of apartheid, rectifies existing imbalances in the distribution of different types of residential development, and avoids the creation of new structural imbalances in the delivery of services. Key to achieving this spatial transformation is transit-oriented development (TOD) and associated densification and diversification of land uses"* (TDA, 2017a).

What stands out from the new vision for the city, and of high importance to this study, is the fact that the MSDF now aims to achieve spatial transformation through TOD strategies, such as the proposal of Bellville station. In addition, the MSDF retains 3 other spatial strategies: 1) Building an Inclusive, Integrated, Vibrant City; 2) Managing urban growth and create a balance between urban development and environmental protection and; 3) Planning for employment and improve access to economic opportunities (TDA, 2017a). Looking at these spatial strategies, it becomes evident that the MSDF draft document still aims to reform the city by making it more inclusive; however, with the focus being placed on TOD as the enabler, the

document is also forced to place emphasis on aspects of TOD such as densification and investment areas. In this regards, the MSDF review draft places emphasis on creating a mix of income groups and land uses, accompanied by an equitable provision of social and recreational spaces. These intentions are reflected by the high densities and mixed land uses envisioned for future Bellville station.

Important to note is that this MSDF review draft does not make use of an urban edge to limit development on the periphery of the city, but instead focuses development attention on the urban core of the city, making Bellville station an ideal location for urban growth and expansion. In addition, the document identified the use of development corridors within the urban core, where investment can be encouraged and public transport can be used as a tool for integration. By promoting growth along these corridors, the document aims to use land and natural resources more sustainably, while simultaneously lowering carbon emissions. It is also along these corridors that the city aims to provide economic opportunities, which could then be accessed by the public transport in operation along these corridors. With such high focus on activity corridors, the proposed transformation of Bellville station remains in line with the city's vision for existing development corridors, while simultaneously conforming to the required characteristics for development corridors in the city.

Further, the MSDF review draft document places emphasis on the SDF being the highest enforcer with regards to decision-making, with the intentions of the MSDF being to transform the priorities of the IDP into a spatially implementable framework. As such, the MSDF review draft document also aims to place greater focus on the financial viability and sustainability of infrastructure provision in the long-term, while recognising the role of informality as a driver of urban growth.

Thus it can be said that with the MSDF review draft document placing emphasis on TOD as a means with which to achieve the new spatial vision for the city, this document aims to be more concept and vision driven, as opposed to previous MSDFs which were largely cadastrally defined, thus in turn promoting the implementation of concepts such as the new Bellville station. By being more vision driven, this document eliminates a lot of the red tape which previously surrounded development approvals and can thus be said to have the required characteristics

for the creation of TOD environments. As the MSDF lays a platform for the spatial development of the city, it is important to understand that accompanying documents are needed to ensure the land use and transport functions are aligned with the aims of this document, in order to allow for the implementation of land use and transport planning activities, which in turn will ultimately play an essential role in the feasibility of TOD in the city.

5.4.2 The Cape Town Municipal Planning By-Law

Seeing that a given municipality can have a variety of by-laws, each regulating a specific function of the given municipality, the Cape Town Municipal Planning By-Law, 2015 (CTMPB-L), is of high importance to this study as it is this by-law which regulates land uses and other related planning aspects. As mentioned in the previous section, the spatial vision and the development desires are listed in the MSDF, therefore the CTMPB-L is important as it sets out a multitude of criteria which need to be met prior to approving development proposals. To assist with regulation, the CTMPB-L includes a Development Management Scheme (DMS) which is used in conjunction with a zoning map to determine which land use is allowed on which pocket of land in the city.

The Cape Town Municipal Planning By-Law deals with several important aspects of land use planning, which in turn would influence the ability of the CoCT to transform Bellville station as proposed in figure 5.6. Firstly, the CTMPB-L states the CoCT has the authority to determine a zoning for land which does not have a zoning and that the CoCT must follow a rezoning process if the lawful zoning of land cannot be determined (CoCT, 2015). This is of significant importance as the CoCT may choose to make land registered in their name, available for the provision of housing or commercial space. Also, if the CoCT needs to purchase land in order to enforce a specific land use which conforms to the proposed TOD strategy, the CoCT is then legally obliged to configure a land use to that specific pocket of land. The CoCT may also rezone land which does not give effect to approved SDFs and other city level policies (CoCT, 2015). This clause in the by-law will play a pivotal role in pertaining the necessary land use rights needed for the radical transformation of the station itself, as well as the adjacent lands. In this regard, the CTMPB-L also provides

numerous regulations for the rezoning of land by any party, public or private. If the CoCT is to transform Bellville station into a TOD node, this by-law would need to play a pivotal role in allowing land uses to change in a desired manner and in order for this TOD strategy to be legally implementable, while simultaneously ensuring that land uses are desired in the given locations.

Of further importance to this study is the fact that the CTMPB-L states that the CoCT is responsible for the "(a) provision of an external engineering service; and (b) installation of a bulk engineering service if it is installed when planned according to the City's service master plans and capital budget" (CoCT, 2015: 37). With the MSDF encouraging development in the urban core, it is important that the necessary infrastructure is provided by the CoCT, in order for new infrastructure to connect to such services. If the city does not have the capacity to provide such engineering services, private sector investment would be discouraged as development would ultimately be impossible.

With this TOD strategy requiring the transformation of a large land area, this transformation can become a tedious and costly exercise, due to the requirements of all the relevant rezoning and subdivision applications as well as the amendment of all the levels of plans required for approval. This process might also act as discouragement for private sector investors and developers. Therefore, the CTMPB-L makes provision for such cases by introducing the possibility of a "package of plan" approval. "The general purpose of a package of plans is to provide for a mechanism to plan and manage the development of large or strategic urban development areas. It is a phased process of negotiation, planning and approvals, whereby increasing levels of planning detail are approved together with conditions for such approvals. Areas where the package of plans approach is used are referred to as Special Planning Areas (SPA)" (CoCT, 2015: 140). By applying for a package of plans approval, various components are required, such as: Contextual framework; development framework; precinct plans; subdivision plans; site development plans and; building plans. This ensures that a variety of components are considered during decision-making and also ensures that the land under consideration is put to good use, not simply for the benefit of the developer. However, it must be noted that the package of plans process can be a controversial process if the relevant

stakeholders are not consulted appropriately. Nonetheless, if the transformation of Bellville station is intended to stretch over a number of years, a package of plans approval could be hugely beneficial to all stakeholders involved.

The CTMPB-L also enables TOD environments by listing various regulations relating to parking lots and parking bays. Part of this strategy for Bellville station is to severely limit parking, both in the short and long-term, as it consumes large areas of land that could be used for other land uses. The availability of parking also acts as encouragement for private vehicle usage. Although parking is currently a big requirement in Cape Town, if TOD strategies are to materialise in the long-term, the provision of parking has to be limited accordingly. The CTMPB-L is set up in a way that limits the provision of parking bays, both off-street and in alternative locations; however, parking is often seen as integral to the feasibility of proposed developments. Irrespective of how parking is allocated, the presence of parking will eventually influence the operations of public transport in Cape Town and thus needs to be dealt with in conjunction with local level comprehensive integrated transport plans for the city. As is depicted in figure 8 above, the large parking lots in the immediate vicinity of the station is significantly reduced and the implementation thereof would depend on the ability of the CTMPB-L to enforce such parking restrictions effectively and consistently. With the MSDF review draft document and the CTMPB-L enabling various required land use and spatial transformations needed for the implementation of this vision for Bellville station, it is pivotal to ensure that the transport aspect of this plan is made feasible through the use of a local level comprehensive integrated transport plan.

5.4.3 The draft Comprehensive Integrated Transport Plan

The Draft Comprehensive Integrated Transport Plan, 2017 to 2022 (DCITP), is a new five year statutory plan prepared in terms of Section 36 (1) of the National Land Transport Act, No. 5 of 2009. The plan aligns with the new term of Office IDP 2017-2022, and integrates with the Municipal Spatial Development Framework review draft document (TDA, 2017b). In order to ensure integration, in determining its approach to integrated transport, the City used the following documents: IPTN

Network Plan 2032; IPTN Operational Plan 2015; IPTN Implementation Plan 2017 and; the IPTN Business Plan 2017.

In light of the above mentioned, the DCITP for 2017 to 2022 aims to set out how the CoCT will build on progress it has made in the provision of public transport in recent years. This DCITP thus holds the intentions of enabling the City to create an integrated, intermodal and interoperable transport system with which to “create and drive equality based on equal society, economic inclusion and access to opportunities” (TDA, 2017b: 14). However, it must also be noted that: “The City does not see integrated transport as its only goal. Instead, it regards transport as the key driver for addressing Cape Town’s spatial reality, with all its urban inefficiencies and social inequality” (TDA, 2017b: 14).

The above mentioned relates to the proposed plan for Bellville station, as this plan aims to use public transport as the backbone for upgrades to the surrounding areas. In terms of the DCITP, this document reinforces the importance of the rail system in Cape Town and emphasises that the City is aiming to focus attentions on upgrading the rail system. With the proposed TOD plan for Bellville station, the requirements for a well-functioning rail system is echoed by the City and the potential benefits of having a well-functioning rail system in this area is reflected in the DCITP. In addition, the DCITP document can be used to motivate budget allocations for the proposed TOD project at Bellville station as this proposed plan is in fully aligned with the vision for public transport as set out in this document.

Therefore the DCITP could be seen as a pivotal tool with which local government can enforce and implement the changes needed to bring the above mentioned plan for Bellville station to fruition. It is worth noting that the DCITP makes several suggestions as to how transport should be integrated with urban developments in the future; however, of importance to this study is the fact that the DCITP document promotes TOD strategies such as the one proposed in the plan for Bellville station. The DCITP also draws attention to the City's approach to TOD by making reference to the TOD framework document throughout. Therefore, the TOD framework for Cape Town is another tool which must be used in conjunction with the DCITP in order to achieve the necessary changes around Bellville station in the future.

5.4.4 City of Cape Town Transit Oriented Development Strategic Framework

"The TOD Strategic Framework for the City of Cape Town is seen as a policy mechanism to implement TOD in Cape Town. It identifies the tools and mechanisms to be employed by various role players who have a collective impact on development to ensure that they move progressively toward the new TOD vision for the City. Ultimately the TOD Strategy must trigger a paradigm shift through direct public and private sustainable investment into the built form" (CoCT, 2016: 14).

The above mentioned statement indicates that the TOD Strategic Framework (TODSF) is a tool directly aimed at the implementation of TOD projects, such as the proposed Bellville station plan presented earlier in this chapter. Importantly, the focus area of this document is the sustainable integration of land use and transport, which ultimately requires that this document is in line with the other tools and instruments set out in chapter 4 of this study. Other key objectives of this document is to ensure that land use planning decisions, as well as public investment, will ensure that future developments in Cape Town are strategically located; will have a good mix of land uses; will be located in close proximity to employment opportunities and social amenities; that public spaces are located and designed in ways that promote the use of public transport and NMT; that the City uses property attained through land banking for the promotion of TOD and; that the City partners with private sector investors in order to encourage these investors to invest in the relevant infrastructures needed for TOD (TDA, 2016). In addition to these objectives, the TODSF presents three specific transport interventions and indicates how land use interventions can be used to achieve these three transport objectives. Table 5.1 below depicts these three objectives.

What becomes evident from the objectives illustrated in table 5.1 below, is that a good TOD environment will have the ability to address all of these objectives simultaneously. The transformation plan for Bellville station indicates a higher density, mixed use environment, with a variety of housing options, informal trading and commercial property developments, accessed through NMT and multimodal public transport infrastructure. Once these uses are present in the area, individuals will be

encourages to use public transport and thus the operational viability of public transport will be improved. This plan for Bellville station also indicates how travel distances between different land uses will be minimised as a consequence of the intensification and diversification of development in adjacent locations.

Table 5.1: Table depicting the transport objectives and consequent land use interventions as set out by TODSF (Adopted from TDA, 2016).

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

As mentioned earlier in this chapter, the City of Cape Town has identified Bellville station as a key TOD project in a number of policies and plans. The TODSF again makes reference to this project by providing an extensive plan for the implementation of such a TOD project. This plan includes a variety of actions, such as civil society participation, institutional alignment, integrating business models and private sector collaboration. In order to achieve these actions, the TODSF refers to NMT, Value Capture and Development Incentives (amongst others) as levers with which to make these actions feasible (TDA, 2016). Together with stating how various activities should be implemented across Cape Town, this document gives strong indication as to where developments must be located in order to maximise the benefits of TOD and ultimately be an effective development strategy with which to spatially transform the city. Together with the IPTN for 2032 and the CTSDf, spatial locations are identified for catalytic interventions, with Bellville station being listed as one of the key areas for the implementation of a catalytic TOD strategy. As such, this

document proves to be a key tool at the local level of government with which to implement the proposed TOD transformation plan for Bellville station.

Therefore, as depicted thus far in this chapter, the relevant authorities at local level of government can use the CTSDF review draft document, the CTMPB-L, the DCITP and the TODSF as key tools to drive decision-making and to argue for development which would ultimately lead to implementation of the transformation plan for Bellville station over both the short and long-term. However, it must be noted that although this study has highlighted these tools and instruments as the most pivotal, various other tools and instruments must be used and integrated in conjunction with these tools, in order to ensure that a holistic approach is taken towards achieving the vision of spatial transformation enabled through TOD in Cape Town. Figure 5.7 below depicts a few of the important policies and plans (also tools and instruments) with which to implement the TOD transformation plan for Bellville station.

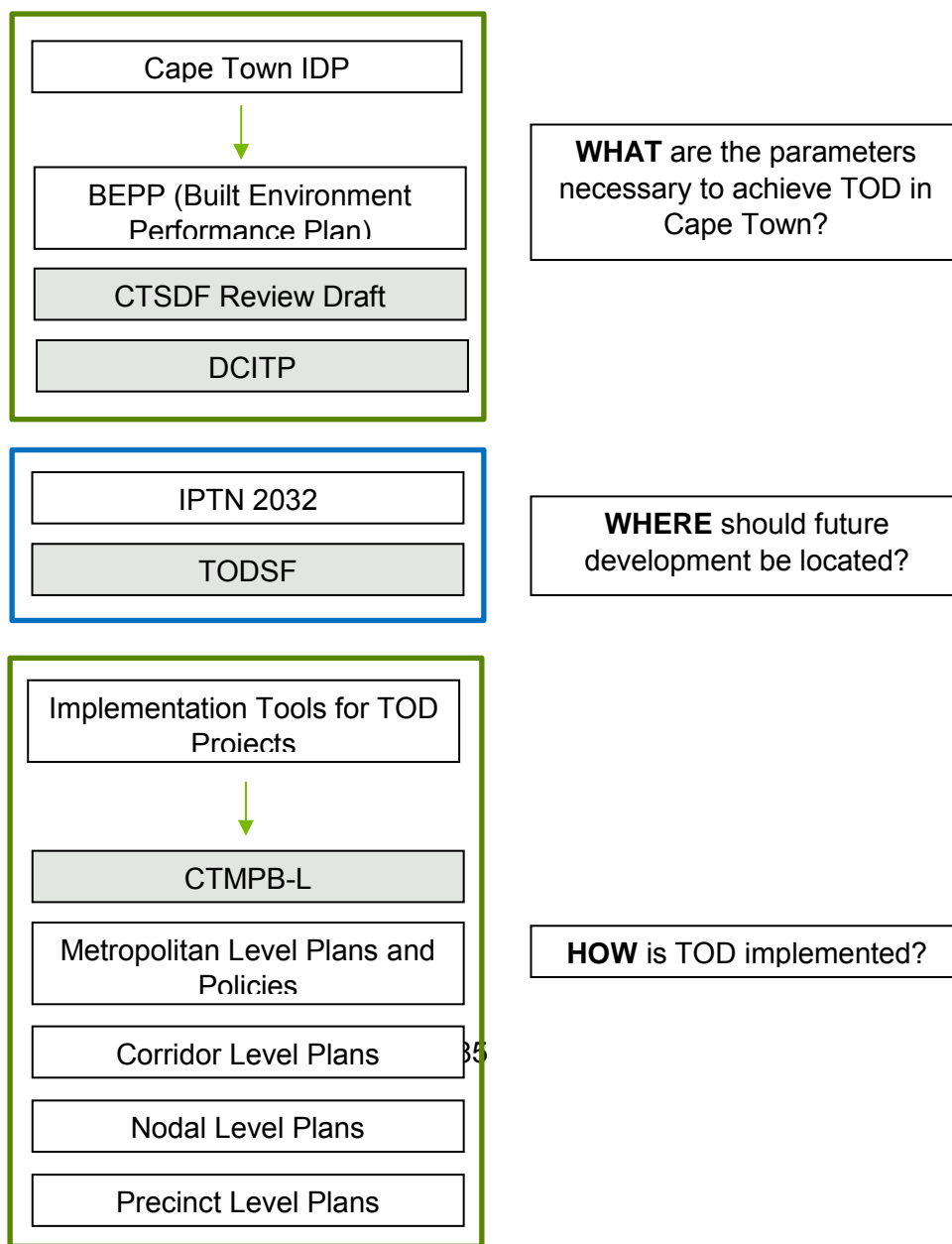


Figure 5.7: Tools with which to implement and institutionalise TOD in Cape Town (Adopted from TDA, 2016).

5.5 Conclusion

This chapter set out to understand the current spatial and historical context of Cape Town, South Africa and has indicated that the city experiences spatial inequality as a consequence of historical planning practices during the Apartheid regime. In an attempt to rectify this spatial inequality, as well as associated issues, the city has opted to use TOD as a strategy with which to address these issues. In an attempt to better understand how a TOD strategy might look, this chapter then provided a transformation plan for Bellville station, built on the concept of TOD. Bellville station has a major influence on the operations of the city and has thus been deemed to be the ideal location for TOD interventions.

Building on the proposed transformation plan for Bellville station, this chapter analysed the tools and instruments which local government can use to achieve this plan in the short and longer term. In this regard it becomes evident that the legal environment is already geared towards the implementation and adoption of TOD strategies in Cape Town, providing a platform for land use and transport planning interventions at the local level of government. The CTSDP review Draft document, the CTMPB-L, the DCITP and the TODSF are all aligned, each dealing with different aspects of TOD. Important to note is that this chapter emphasised that in order to successfully integrate land use and transport planning, additional policies and plans would need to be leveraged; however, the above mentioned tools and instruments were deemed to be of critical importance as they act as framework documents dealing with the essential elements needed to successfully implement TOD in Cape Town, and specifically achieve the transformation vision for the Bellville station as a catalytic project.

As illustrated in figure 5.7 above, local level of government has a variety of tools and instruments at its disposal with which to implement TOD in Cape Town. The tools and

instruments mentioned in this chapter also provide great insight into the statistics and context of the social, economic and environmental issues and environments in Cape Town, which it then ultimately aims to transform. Therefore, by simply stating that these tools and instruments could be leveraged by local government authorities in an effort to implement the proposed TOD transformation plan for Bellville station (as well as other TOD strategies in Cape Town) would be insufficient. It is therefore important to understand the current existing issues and challenges that hinder the implementation of TOD in Cape Town, so that policy reviews and amendments in the future can aim to address these issues and challenges. Therefore the next chapter will aim to better understand these issues and challenges, while simultaneously making recommendations as to how these identified issues and challenges can be addressed so that the transformation plan for Bellville station can be implemented, along with other TOD strategies across the city.

6 Chapter 6: Issues and challenges facing the implementation of TOD

6.1 Introduction

With the legal tools and instruments with which local government can implement TOD strategies in Cape Town being discussed in the previous chapter, it is now necessary to understand which issues and challenges currently hinder the implementation of such TOD strategies. Therefore, this chapter will provide insight into a number of issues and challenges regarding land use and transport, which needs to be addressed in order for local government to successfully implement TOD in Cape Town, and simultaneously transform Bellville station as set out in the relevant plan in the previous chapter. In conjunction with identifying such issues and challenges, this chapter will also aim to make recommendations, where applicable, as to how the City could address the given issues and challenges. It must also be noted that this chapter will merely aim to highlight the biggest issues and challenges faced by government authorities; however, the issues and challenges hindering the implementation of TOD are not limited to the issues and challenges set out in this chapter.

6.2 Issues and challenges that currently affect the implementation of TOD in Cape Town

With the intention of government authorities being to use TOD as a spatial planning tool with which to address an array of spatial, social, economic and environmental issues, several challenges facing the implementation of TOD in Cape Town need to be overcome. A variety of such issues and challenges occur at a global scale, while other issues and challenges are mainly evident at a metropolitan and precinct scale. This chapter therefore divides these issues and challenges into global, metropolitan and precinct scale issues and challenges. In addition, it must be noted that although most issues and challenges affect spatial planners and their decision-making, spatial planners in turn often have limited ability to address these issues and challenges.

Although this chapter will set out these issues and challenges separately, it must be remembered that these issues are integrated and cannot necessarily be dealt with in isolation. These issues and challenges also do not necessarily relate directly to TOD; however, these issues and challenges will affect the operational and functionality of TOD systems in the future, and must thus be given the necessary attention.

6.2.1 Global issues and challenges

In a world where rapid urbanisation is changing the way cities function, a variety of issues and challenges will arise over time. Although these issues and challenges do not always present itself as urban planning issues, the practice of spatial planning is more often than not affected, either directly or indirectly. As previously mentioned, spatial planners have a varying degree of ability with which to address these issues and challenges, often depending on the scale at which these issues and challenges present itself. Arguably, at a global scale, spatial planners do not have a lot of power with which to address these issues and challenges; however, it then becomes the combined responsibility of planners across the world to ensure that urban growth does not worsen these issues and challenges. One of the main global issues and challenges that affect all planners is the worsening levels of energy consumption and greenhouse gas emissions.

6.2.1.1 Energy consumption and greenhouse gas emissions

As mentioned in chapter 2 of this study, the transport sector dominates energy consumption on a global scale, with Cape Town being no exception to this statistic. Environmental degradation and pollution is thus one of the biggest issues and challenges faced globally and in Cape Town as “an astounding 91% of all liquid fuel relating to passenger transport is consumed by private cars, with an associated annual cost of R10-R12 billion (ZAR in constant 2005 terms). Public transport such as Metrorail, buses and minibuses, on the other hand (which transports nearly half of all city passengers daily) consumes only 9% of all liquid fuel relating to passenger transport” (TDA, 2016: 9). With all of humankind having a social responsibility to reduce energy consumption and greenhouse gas emissions, the City of Cape Town needs to ensure that these issues and challenges are addressed locally.

Firstly, it can be said that one of the benefits of TOD strategies is that energy consumption and greenhouse gas emissions are reduced, due to private vehicle usage being severely limited. Therefore, by merely adopting TOD strategies, the City is already assisting in addressing this global issue. However, due to public transport usage reducing energy consumption and greenhouse gas emissions, it is crucial that TOD strategies are fully supported by public transport systems.

With current energy consumption and greenhouse gas emissions from the transport sector not being sustainable, the City faces great challenges in its reduction. It is therefore suggested that policies be used to better regulate such emissions. At national level, the South African government as recently introduced the National Climate Change Response Policy, which aims to limit the biggest polluters in the electricity and liquid fuel sectors. In addition, local governments should also take responsibility for reducing emissions at a local scale. As carbon emissions are regulated in industrial sectors, the City could impose greenhouse gas emissions on private vehicle and public transport producers at a local scale. This will force such producers to transform current technologies and promote products that produce less emissions. In this regard, relevant actors in these sectors should be held liable for excess emissions.

Energy consumption and greenhouse gas emissions are not the only global issues and challenges faced in urban areas as private vehicle usage and urban sprawl are also global issues that present equally great risk around the globe. With this in mind, it must be noted that such issues and challenges are arguably best addressed at a smaller scale, such as metropolitan and precinct scale.

6.2.2 Metropolitan scale issues and challenges

As mentioned above, various issues and challenges relating to urban planning occur at a variety of scales and levels. With the previous section of this chapter discussing a key global issue, the rest of this chapter will focus on issues and challenges that need to be addressed more locally, as the influence and benefits of TOD strategies

are arguably felt at a local scale. In addition, it is at metropolitan scale that spatial planners begin to have more influence and control over such issues and challenges.

Considering the spatial layout of Cape Town, it has been well documented that the City faces similar mobility issues as many other cities around the world. Together with spatial inequalities, suburbanisation and urban sprawl, public transport in Cape Town is not servicing enough people in an efficient and integrated manner, which in turn places stress on the public transport system in the city. As a consequence, public transport in Cape Town has not been able to address inequalities or contribute successfully to growth in the city.

6.2.2.1 Private vehicle usage

One of the key contributing factors to the deficiencies of the public transport system is a heavy reliance on private vehicle usage by the Cape Town population. Table 6.1 below indicates that private vehicle usage (37%) outweighed public transport usage (34%) in the year 2014. In Cape Town, 789 099 cars was registered in the year 2015, with vehicle ownership estimated at 306 cars per 1000 people, amounting to 1 228 450 passengers that makes use of private vehicles on a daily basis (Transport for Cape Town, 2015; MyCiti, 2016).

Table 6.1: Table depicting the peak modal splits by income groups for Cape Town (Transport for Cape Town, 2014).

Main Mode	Low Income (% Population)	High Income (% Population)	All Persons (% Population)
Walk	33%	4%	21%
Private Car	15%	82%	37%
Train	15%	4%	11%
Bus	9%	2%	8%
Minibus Taxi	20%	2%	15%
Other (bicycle, trucks, etc).	8%	6%	8%

Together with a multitude of issues associated with excess private vehicle usage, as discussed in chapter 2 of this study, such high percentages of private vehicle usage

requires significant quantities of road infrastructure, thus placing significant pressure on government budgets in terms of maintenance. In the year 2013, all roads in Cape Town was valued at approximately R78 billion and would require another R12 billion over the next 15 years to remove the backlog in road maintenance (Transport for Cape Town, 2015).

In addition, several plans and policies at all levels of government are aimed at providing public transport to lower-income areas, as individuals in the lower-income brackets spend up to 35% of their monthly salaries on transport (Venter, 2011; Transport for Cape Town, 2015). Therefore, attempts to provide these users with more affordable transport options is fully justified; however, as table 6.1 above indicates, it is the higher income groups that make use of private vehicles as their main mode of transport. This being said, spatial plans do not yet indicate planned expansion of public transport services to the more affluent areas, giving several communities no other option but to make use of private vehicles as the main mode of transport. As long as areas are not being serviced with well-functioning public transport, private vehicle usage will continue to pose problems to the feasibility of public transport usage. This being said, expanding the public transport systems will require exponential amounts of financial support, which is currently not looking possible in Cape Town.

In an attempt to lessen the use of private vehicles and increase the use of public transport, there are several strategies that could be implemented by the municipality. Firstly, as mentioned in previous chapters, limiting parking availability would encourage the general public to rather make use of public transport. Further, strategies could potentially see private vehicle usage restricted in the CBD or in areas where public transport is prominent. This could be enforced through increased taxes for car ownership in such areas or through charging the general public an exponential fee for the use of selected roads, such as with the E-Toll system in Johannesburg¹⁰. The legal environment in South Africa already makes provision for the use of such strategies with which to discourage private vehicle usage, although such strategies have been subject to extreme public opposition in recent years. The

¹⁰ E-Toll is a system that operates on the Electronic Toll Collection (ETC) processes employed by South Africa's roads agency, SANRAL. E-Toll is a system whereby road users are charged with predetermined amounts when using specified roads in selected cities in South Africa. Johannesburg is one of the cities most famous for the E-Toll system (OUTA, 2017).

implementation of such strategies will not only discourage private vehicle usage and encourage public transport usage as an alternative, but will also have the means of accruing financial capital which could be used to improve the public transport system. Irrespective of the strategies used in this regard, it is of vital importance that private vehicle usage is discouraged in both the short and longer-term.

6.2.2.2 Budget deficiencies

As indicated above, private vehicle usage not only negatively influences the ridership of public transport in Cape Town, but also requires the allocation of large percentages of government budgets to the provision and maintenance of road infrastructure. In addition, government subsidies for the provision and operation of public transport has been severely constrained and mismanaged, with subsidies being adopted ubiquitously (Serebrisky et al., 2009; Clark and Crous, 2010). With government subsidies and revenue generation from ticket sales being the global means of funding public transport systems, it is imperative that subsidies are correctly allocated for public transport spending in Cape Town. With government budgets and ticket sales being influenced by private vehicle usage, the feasibility of funding public transport largely through government subsidies has to be questioned.

In addition, local government is often allocated with an annual budget. From this budget, various state responsibilities need to be covered, including the provision of public transport. In this regard, local municipalities often do not have the financial means with which to ensure that the public transport system is maintained and operates effectively. There is also a lack of financial plans which assist municipalities with budget allocations. Although the IDP includes an annual budget plan, it is felt that if there were financial sections and responsibilities included in other spatial plans and policies, such as the CTSDP and DCITP, it would allow the relevant municipalities to implement these spatial plans based on what is financially possible. This would ensure that spatial plans and policies do not set unrealistic targets which cannot be supported with the available municipal budget. Creating and sustaining a public transport is one of the most expensive items on the municipal budget and thus needs to be properly accounted for in the relevant plans and policies.

6.2.2.3 High operational cost of public transport

With public transport in Cape Town being largely dependent on government subsidies, it is imperative that sufficient revenue returns are generated in an attempt to stay within a reasonable level of subsidisation (TDA, 2016). However, the operational costs of public transport is severally affected by, 1) the need to provide transport over long distances and, 2) tidal flows and extremely limited seat renewals during off-peak hours. This makes it even more crucial for land use management practices to strictly enforce more compact and integrated development in order to lessen the above mentioned costs. With public transport operating for most hours of the day and operating seven days a week, it is important to attract as much users as possible over all operational hours. Currently, peak hours are serving a sustainable amount of users; however, strategies are needed to ensure that trains and busses do not travel with a shortage of users during off-peak hours or in undesired directions, so as to avoid financial losses. This will be difficult to achieve, as public transport needs to serve the needs of users during all times of day. Thus again placing pressure on land use activities to ensure that land use mixes are achieved in an attempt to lessen to need for travel over long distances.

In addition, with revenue being accrued mainly through ticket sales, copious amounts of tickets needs to be sold in order to balance the exponential infrastructure and other operational costs, due to tickets for public transport needing to be cheap in order to not discourage the use of public transport. It is also imperative that public transport and the associated infrastructures are protected against decay and demolition in order to limit unnecessary spending on the provision and maintenance of such infrastructure, as well as to ensure that the use of public transport is not further discouraged. In Cape Town, the unreliable nature of public transport, especially the rail system, is often the main reason for destruction by the general public. The destruction of public transport infrastructure has been well documented in recent years and needs to be given serious attention if these services are to be made financially sustainable.

6.2.2.4 Safety and punctuality concerns

Together with the aim of integrating public transport in Cape Town, various policy documents have set objectives of making public transport safer to its users. This

serves as evidence that there is various safety concerns relating to public transport in Cape Town (Thomas, 2016). In 2015, 394 incidents of crime on trains in the Western Cape was recorded. Tony Ehrenreich, provincial secretary of the Congress of Southern African Trade Unions (Cosatu) has often been recorder stating his dissatisfaction of safety on trains in Cape Town and has been recorded saying: "We are losing lives on overcrowded and dangerous trains" (Daily Maverick, 2017). Together with safety concerns on trains is a growing lack of punctuality, with trains often being late or absent. This is due to a lack of technology that allows for more trains to travel at more regular intervals, as well as fleet stock often being subject to vandalism. Train punctuality dropped from 80% to 60% in 2015, with train cancellations increasing from 3% to over 15% in the same period (Lepule, 2017; Town Press, 2017). The punctuality issues with rail services is also directly leading to public transport users making use of the more reliable minibus taxi service.

The minibus taxi industry has also been known to be fairly unsafe in Cape Town, as most deaths from public transport originates in this industry. Robberies and assault cases on minibus taxis has also been well documented; however, due to this industry being private owned, the government has less control over such safety concerns. Illegal operators have also contributed to violence in the industry, including a multitude of violent protests initiated by minibus taxi drivers and owners, which ultimately further endangers the lives of passengers (Arrive Alive, 2017). The safety and punctuality issues with public transport in Cape Town is directly contributing to the negative perception of public transport, which in turn leads to the increased use of private vehicles as preferred mode of transport in Cape Town, and would urgently need to be addressed in the near future. If TOD strategies are to be affective, the safety and punctuality of the public transport needs to be addressed in conjunction with all stakeholders responsible for providing public transport services in Cape Town; however, getting all these stakeholders to cooperate is often a challenge in itself.

6.2.2.5 Ownership issues

With the City of Cape Town aiming to ensure that public transport in the city is provided in an integrated manner, the city must overcome specified issues with ownership. With a variety of public transport modes in operation comes a variety of

service providers. One of the key limitations to the integration of these transport modes is that public transport service providers have co-existed rather than actively worked together (MyCiti, 2016). With various tiers of government being responsible for the funding and maintenance of certain public transport infrastructures, together with the coalitions of several other stakeholders, the politics of public transport will be dynamic and difficult to manage (Oxford, 2013; Milson, 2016).

With the implementation of public transport often being a municipal function, it is imperative that local government is given the authority to enforce cooperation between all stakeholders involved. With this challenge at hand, strategies are needed to formalise the more informal modes of public transport, such as the minibus taxi industry. By formalising the informal modes of public transport, government entities will be able to more effectively regulate such services and ensure that such services serves the required functions needed to successfully implement and maintain transport strategies in Cape Town. It has also been recorded that although the City of Cape Town has strategies in place for the integration of public transport modes, other stakeholders, such as PRASA, often do not deliver the services they are legally required to (PRASA, 2014; Ground Up, 2017).

In an attempt to create an integrated, interconnected and sustainable public transport system in Cape Town, the City has been experimenting with strategies to formalise the minibus taxi industry, by getting minibus taxis to act as feeders for the MyCiti bus systems. The IPTN Business Plan sets out the intentions of this strategy, illustrating that users will be able to use mobile phones to access minibus taxis operating on specified feeder routes situated along MyCiti bus corridors (TDA, 2014; Bizcommunity, 2017). By essentially making minibus taxi operators partners of the City's transport plan, it will encourage minibus taxi drivers to conform to the requirements of such a strategy and in turn will allow the city to use such stakeholders in achieving an integrated public transport system. It is such strategies that need to be further developed and implemented in an attempt to turn current public transport ownership issues and challenges into new opportunities in Cape Town.

6.2.2.6 Curbing urban sprawl

Urban sprawl directly affects the ability of land use planning to increase urban densities; a problem which is dramatically evident in Cape Town. Urban sprawl increases travel distances and the viability of NMT, further adding pressure on the government to expand the provision of public transport infrastructure. In addition to negatively affecting the ability of increasing densities, urban sprawl also affects the catchment areas of public transport services (Cook and Behrens, 2015b). As a way of curbing urban sprawl, land use planning practices makes use of an urban edge, which limits or disallows certain land uses outside of urban areas; however, current spatial patterns in Cape Town suggests that the urban edge as a land use planning tool has not been very effective (Wylie, 2016).

Regardless of the efficiency of the urban edge as a tool with which to regulate urban sprawl, this tool is well-established and has been serving a purpose for several years in Cape Town. With the new CTSDF review Draft document indicating that the city will no longer make use of an urban edge to limit future development to the inner-core of the city, the City faces further challenges with regards to limiting urban sprawl. As long as urban sprawl is allowed to continue, the City will struggle to increase urban densities over the entire city, which in turn will mean that it will be difficult to create urban environments that are suitable for the implementation of TOD in the longer-term. Therefore it is important for spatial plans, such as the CTSDF to ensure that increased densities are encouraged in specified spatial locations, such as around Bellville station, and that urban sprawl is curbed simultaneously in an effort to both increase urban densities and to allow for land use planning to create a better land use mix.

6.2.2.7 Infrastructure capacity

Arguably the biggest issue and challenge for the City of Cape Town is infrastructure capacity. It would not be possible to increase densities, curb urban sprawl, create mixed land uses or create environments suitable for the implementation of TOD strategies if there are infrastructure capacity constraints. Unfortunately, the City does currently not have the necessary infrastructure capacity to provide new developments with access to the water, sewage and electrical systems of the city,

thus making development impossible in certain areas. It is useless to promote densification and inner-city development if there is not capacity for new developments to connect to such services.

The CTSDF makes brief reference to the required infrastructure needed to implement future spatial growth; however, this mention is inadequate and inefficient. It is therefore suggested that the tools and instruments described in the previous chapter, all include a section which specifically deals with infrastructure supply. These sections should be written by engineers as engineers would be best equipped to deal with such issues. Only when these tools and instruments provide adequate insight into the required infrastructure services that must be made available by local government, will spatial plans and policies be able to encourage development in a realistic way.

Another option would be for the City to allocate more of its budget for the provision of such services and capacities, with accrued income from future developments, rates and taxes being used to expand the sewage, electrical and water systems and to make up budget deficiencies caused by the reallocation of municipal budgets. With the provision of such services and infrastructures being a key responsibility of the City, it is imperative that such infrastructure constraints are rectified by all means possible, as the ramifications of a lack of such capacity could be detrimental to the urban growth and local economy of Cape Town.

With the above mentioned metropolitan issues and challenges in mind, it becomes evident that the City of Cape Town, together with other relevant stakeholders, must aim to assist with the alleviation of such issues by using all means possible to create environments which ensure that such issues and challenges are addressed. With the success of TOD strategies being reliant on these issues and challenges being addressed at municipal level, additional issues and challenges are presented and are more applicable at the precinct scale. This means that precinct issues and challenges might not necessarily affect TOD strategies as a whole, but would rather affect the implementation of specific TOD strategies at precinct scale.

6.2.3 Precinct scale issues and challenges

With the City of Cape Town realising the need and importance of a well-functioning integrated public transport network, land use planning needs to provide a variety of functions in order to provide support to such a public transport system, as well as to create a successful TOD environment at a precinct scale. In this regard, land use planning must be used to balance population density, density distribution, land use mix and corridor catchment size in Cape Town in order to support future transport planning practices (Renne and Ewing, 2013; Cook and Behrens, 2016). The current land use management system in Cape Town has thus far arguably failed to carry out these functions successfully, thus severely affecting the ability and feasibility of TOD strategies to rectify the spatial inequality issues in the city.

Land use planning in Cape Town faces several challenges in an attempt to create a TOD environment. Some of the greatest challenges include the need to more regularly take public transport into consideration during land rezoning applications in order to guide urban growth in ways that are aligned with the basic requirements for TOD strategies. In addition, land use management practices in Cape Town does not yet ensure the provision of balanced densities which would allow for the operation of the current public transport system. In this regards, the next section of this chapter will make mention of such issues and challenges that would arguably be easiest to address at a precinct scale.

6.2.3.1 Balancing patronage demand through controlled densities

Land use planning in Cape Town does not necessarily base land use decisions on the threshold ridership¹¹ together with the catchment area for a specific public transport system, thus contributing to the necessary densities within these catchments not being achieved on a regular basis (Cook and Behrens, 2015a). Densities in Cape Town are significantly lower than other major urban areas around the world, making the implementation of TOD strategies very difficult. Therefore, land use planning in Cape Town needs to ensure that urban densities are increased in

¹¹ Wang (2008) terms the threshold ridership as the minimum level of patronage required to achieve financial viability of a specific public transport system.

strategic spatial locations, in order to conform to the thresholds of TOD in the long-term.

Another challenge faced by the City in this regards is that various residents in Cape Town wish to reside in less dense areas, often located outside of the urban edge. With capacity constraints with regards to infrastructure provision, the City is often forced to allow development outside of the urban edge, as the developers of developments outside of the urban edge are responsible for the provision of sewerage, electricity and water infrastructure, in turn relieving the burden on government budgets. In addition, the rates and taxes accrued from such development are often used to cross-subsidise other government expenditures, further forcing the City to consider the option of approving development outside of the urban edge. However, if urban densities are to be increased, the City cannot allow for low density developments outside of the urban edge, as this contributes to both urban sprawl and to a reduced demand of higher density developments in the inner-core of the city.

Another challenge is that it is often not sufficient to simply increase residential densities based on the assumption that if these densities are provided, individuals will simply occupy such spaces. Instead, the City should encourage private sector investors and developers to increase densities across all future developments. Local level policies could provide development incentives for projects that meet a certain density in an attempt to make it more profitable, and thus desirable, for private sector investors and developers to construct higher density infrastructures in desired locations. The City must also ensure that sufficient research is undertaken prior to enforcing spatial plans indicating where densities should be increased, as there is currently no available evidence to suggest that increased densities will necessarily lead to more people using public transport in such locations. Although it is fair to assume that increased densities will most likely assist in providing a balanced patronage demand for public transport, development decision-making cannot be based simply on assumptions. Irrespective of such assumptions, a key limitation to increasing urban densities through land use planning practices in Cape Town is the sprawling nature of development patterns on the periphery of the city.

6.2.3.2 Creating a better land use mix

In order for TOD to be successful, the integration of residential, commercial and industrial land uses is essential. With a combination of historical spatial planning practices and contemporary urban sprawl displacing several commercial and industrial opportunities in the city, the City of Cape Town faces a great challenge in creating a good land use mix which clusters these land uses in a way that creates the necessary mixed use environments needed in for TOD (Turok, 2013). Creating areas with mixed land use will also ensure that these areas experience increased activities during various hours of the day, which in turn will increase the demand for public transport inside as well as outside of peak hours, thus increasing the chances of attaining the sustained ridership needed for the financial sustainability of public transport systems in such areas.

In Cape Town, employment opportunities are currently located far away from the areas which experience the highest residential densities. This is not only problematic in that it forces individuals to travel long distances in order to access employment opportunities, but it also indicates a trend of separating employment and residential land uses in the city. If TOD is to become the main tool with which to rectify spatial injustices in the city, it is imperative that the City incentives private sector investors and developers to create better land use mixes across the city, including in lower-income areas. This in itself will be a challenge, as private sector investors cannot retain the same returns on investments in lower-income neighbourhoods, thus they are currently not willing to develop in such areas. However, in order to accurately identify areas for the allocation of mixed use development, decision makers need to understand property markets in order to guide zoning and investment in the desired spatial locations.

6.2.3.3 Understanding the property market

In order to accurately guide zoning and investment in a way that would encourage the development of TOD environments, it is of vital importance that decision makers understands the property market in Cape Town. In the past, low-income households were displaced to areas with low property values, perpetuating the growing inequality in Cape Town at the time. In order to avoid this in the future, authorities

can allocate higher value land for the provision of social and low-cost housing TOD projects. Therefore it is also of vital importance to understand the property market in order to identify land with potentially higher land values, making use of land banking to ensure that social housing is well-located in the future (McGaffin, 2013).

Predicting and understanding the trends in the property market will be a significant challenge in Cape Town due to the volatile nature of the development industry in contemporary times. Another associated challenge faced by state authorities is thus that TOD strategies often assumes that there will be a demand for specified land uses in TOD nodes and that by providing the infrastructure for the allocated land uses will mean that consumers will simply occupy these infrastructures and spaces. This is not necessarily the case, thus the City of Cape Town faces the challenge of balancing the supply and demand of various land uses. An example of such an assumption would be that if the City were to provide housing in close proximity to TOD areas, the general public would simply occupy these housing units. Thus the City must have a good understanding of the property market in order to guide investors to areas where demand is sufficient to sustain the thresholds of TOD (McGaffin, 2013).

In addition, it is important for spatial planners to have a good understanding of the property market seeing that it is the responsibility of urban planners to balance the demand and supply of residential, commercial, industrial, agricultural and open space land uses in the city. With the aims being to address the spatial inequalities currently evident in Cape Town, it is important to use the property market to guide urban growth in a way that conforms to spatial plans and visions for the city. One challenge in this regard is the ability of urban planners to control externalities. By clustering a variety of land uses, various positive and negative externalities occur. Understanding the property market might not assist in regulating these negative externalities; however, by having a good understanding of the property market, decision making could be informed in terms of which externalities occur in which instances, giving decision makers a platform from which to undertake the necessary actions and projects, such as TOD.

6.3 Conclusion

This chapter has set out to provide insight into the existing issues and challenges faced by the City of Cape Town which hinder their ability to implement and adopt TOD strategies. With the previous chapter indicating how the legal tools and instruments enabled through South Africa's legal environment can be used to provide a platform for the implementation of TOD in Cape Town, specifically Bellville station, this chapter has further identified other key issues and challenges which needs to be addressed by the City. Although the tools and instruments identified in previous chapters are all based on the assumption that these issues are resolved, this chapter has identified what the exact issues and challenges are and has given suggestions as to how these key issues and challenges can be addressed.

As the issues and challenges presented in this chapter has indicated, most of these issues and challenges directly relate either to transport or land use practices. Firstly, it is of vital importance that the City addresses transport issues and challenges, as transport would become the backbone of future TOD strategies in Cape Town. Currently, private vehicle usage is significant and without focused intervention, this trend is unlikely to be addressed. Private vehicle usage hinders the ability to promote public transport usage and severely constrains the municipal budget. Therefore, private vehicle usage needs to be discouraged in order to increase the ridership of public transport, which in turn is needed to financially sustain public transport. However, public transport is currently not necessarily safe, available, reliable or sufficient enough to encourage the users of private vehicles to rather make use of public transport. With public transport in itself being subject to high operational costs and budget deficiencies, it is in turn important for land use management practices to direct urban growth in a way which will lessen the financial demands of public transport in Cape Town.

With land use management being a key tool with which to shape the urban environment, the issues and challenges of land use management itself must first be addressed prior to land use management being used to assist in addressing the inefficiencies of transport in the city. Existing land use management issues in the city are low densities, urban sprawl, a lack of a good mixed land uses and infrastructure capacity constraints. In this regards, this chapter has highlighted the need to curb

urban sprawl in an attempt to assist with densification in the city, which in turn is crucial in order to balance patronage demand for public transport systems. With a good understanding of the property market, the City will be able to increase densities in the correct locations and will thus be able to conform to the principles of TOD strategies.

In light of the above mentioned, this chapter has structured these issues and challenges according to the scale at which they appear and at which they are most likely to be addressed. By structuring this chapter according to scale, rather than by dividing these issues and challenges into transport and land use issues and challenges, it becomes apparent that these issues need to be addressed in conjunction with one another instead of in silos. The nature of these issues and challenges also emphasised the importance of integrating transport and land use planning in an attempt to address these issues and challenges in a holistic manner, which in turn would allow the use of legal tools and instruments to assist with the provision of urban environments which are conducive to the implementation of TOD strategies in the city, and ultimately allow for the adoption of the transformation plans, such as the one presented for Bellville station in the previous chapter.

Although this chapter has also provided a variety of suggestions with which to address the identified issues and challenges at a global and local scale, it is suggested that further research be done in this regard, due to the fact that solutions for such issues and challenges cannot be adopted ubiquitously and must be properly understood in the context in which they appear. Only once these issues and challenges are truly understood, can government authorities at the relevant scale begin to address these issues and challenges in an attempt to provide a platform from which TOD can begin to alter the spatial formation of the city.

7 Chapter 7 – Concluding the TOD debate

Due to rapid urbanisation experienced in cities around the world, urban growth has led to a variety of undesirable and unsustainable trends, such as decentralisation and urban sprawl. As such, the urban form of cities around the world are largely undesirable, with Cape Town in South Africa being no exception. Cape Town is plagued with spatial inequalities and extensive urban sprawl, which have a variety of social, economic and environmental consequences. In an attempt to address the above mentioned, the City of Cape Town has adopted Transit-Oriented Development (TOD) as a tool with which to redirect future urban growth. However, the City of Cape Town has not been successful in implementing TOD strategies in the city, thus private vehicle usage and horizontal urban growth has yet to be curbed.

This study has aimed to provide an interpretative theoretical base and historical perspective of TOD, both on a global and local scale, by depicting the history, principles, benefits and intentions of TOD as development tool. Furthermore this study explored the urban requirements needed for the implementation of TOD, which in all cases led to the understanding that in order for TOD to be plausible, it is imperative that transport and land use planning be integrated. A plethora of academic literature supports the notion that transport and land use planning should be undertaken in conjunction with one another as these two fields of study are heavily reliant on support from each other.

Although it has been determined that TOD strategies cannot necessarily be retrofitted and adopted ubiquitously, the principles of TOD ensure that the key elements of TOD environments are universally implementable. In order to contextualise the above mentioned, this study looked at two international case studies (Curitiba and Medellin) of where TOD has been successfully implemented and how TOD strategies were adopted to suit the needs and demands of the different cities respectively. Although it was found that both Curitiba and Medellin used public transport as the backbone for their respective TOD strategies, perhaps most notably was the fact that both these cities enlisted the aid of their legal environments to assist with the adoption and implementation of TOD strategies.

Therefore, this study then had to unfold the current South African laws, policies and plans at national, provincial and local level of government, in an attempt to better understand how the legal environment in South Africa would promote the adoption and implementation of TOD strategies in the country. Although a multitude of laws, policies and plans relate to the various elements needed to adopt a holistic TOD strategy, this study instead focused its attentions on a carefully selected set of laws, policies and plans which address transport and land use planning activities and projects as the integration between land use and transport planning is crucial in providing a platform for the implementation of TOD strategies. In this regard, this study identified legislation that will assist decision makers and authorities in enforcing the adoption of TOD strategies at all levels of government. With this study focusing on specifically on Cape Town, together with the fact that implementation mostly occurs at local level of government, various metropolitan scale frameworks, by-laws and development plans were discussed as tools and instrument which local government authorities can use to support the enforcement of TOD in Cape Town.

As mentioned above, retrofitting TOD strategies are extremely challenging due to varying social, economic and environmental conditions across cities; however, if the principles of TOD are strictly enforced, TOD strategies are likely to succeed. To emphasise this and to show how an ideal TOD environment should look, this study presented a transformation plan for Bellville station which indicates the transport and land use requirements, as well as how land use and transport should be integrated in

such environments. This transformation plan was heavily focused on creating mixed land uses, densification and design which in turn was all developed and shaped around a well-functioning public transport system. Not only does this plan depict the principles and intentions of TOD, but it also illustrates an environment where the benefits of TOD are allowed to trickle-down to surrounding areas and further across Cape Town.

Combining the findings and illustrations of this study, this study focused heavily on describing how the previously identified laws, policies, plans, tools and instruments can assist in implementing this TOD transformation plan for Bellville station, as well as other catalytic TOD strategies across Cape Town. Knowing the limitations of legislation, this study discussed other issues and challenges that hinder the implementation of TOD strategies in Cape Town. Due to varying degrees of control over these issues and challenges, this study made suggestions with regards to the scale at which these issues and challenges appear and consequently should be addressed at. Although some of the issues occur globally, the City of Cape Town has a responsibility to address most of these issues and challenges as most of these issues and challenges occur at metropolitan and precinct level.

Lastly this study in its entirety aimed to ultimately use TOD as a tool with which to guide development in a way which would mitigate a multitude of spatial, social, economic and environmental issues in Cape Town, South Africa. TOD as a concept has been discussed, together with what is in place and what is required in South Africa to make the adoption and implementation of TOD feasible. When looking at the legal environment in South Africa, it must be said that the current legal environment is adequate to support TOD strategies at all spheres of government; however, the urban form of Cape Town is largely problematic and must be transformed in order to be conducive to TOD strategies and in turn to alleviate many serious social, environmental and economic issues in the city.

Due to this study being theoretically focused according to defined aims and objectives, further research is needed in an effort to better understand the issues

and challenges that directly and indirectly influence the success of TOD in Cape Town. Although this study has discussed a variety of issues and challenges, it is felt that if these issues and challenges are to be addressed effectively, and in the short-term, specialised research and knowledge is required in this regard. In addition, future research should be undertaken to ensure that decision makers stay up to date with the ever-changing social, economic and environmental conditions in Cape Town, with the intentions of adapting TOD strategies to address these changing conditions in the future.

Only if an integrated and holistic platform is created on which TOD principles can be built, can the legal environment start to assist decision makers in bringing the long term spatial vision of the city to fruition, through the use of TOD as a development tool. However, in order to extract the benefits of TOD, land use and transport planning practices have to be better integrated in order to provide a public transport system that acts as the backbone for a quality, compact, mixed use and diverse surrounding urban environment. Only once this is achieved, can urban development absorb the pressures of urbanisation and become sustainable, not only in Cape Town, but in all cities across the world.

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Appendix A – Ethical Clearance

APPLICATION FORM

Please Note:

Any person planning to undertake research in the Faculty of Engineering and the Built Environment (EBE) at the University of Cape Town is required to complete this form before collecting or analysing data. The objective of submitting this application prior to embarking on research is to ensure that the highest ethical standards in research, conducted under the auspices of the EBE Faculty, are met. Please ensure that you have read, and understood the EBE Ethics in Research Handbook (available from the UCT EBE Research Ethics website) prior to completing this application form: <http://www.ebe.uct.ac.za/ugr/ebe/research/ethics.pdf>

APPLICANT'S DETAILS		
Name of principal researcher, student or external applicant		Carlu van Wyk
Department		Architecture and Planning and Geomatics
Preferred email address of applicant:		Vwycar014@myuct.ac.za
if a Student	Your Degree e.g., MSc, PhD, etc.;	MCRP (Masters in City and Regional Planning)
	Name of Supervisor (if supervised):	Nancy Odendaal
If this is a research contract, indicate the source of funding/sponsorship		N/A
Project Title		Creating a platform for Value Capture through Integrated Land Use and Transport Planning: A study of Belville Station

I hereby undertake to carry out my research in such a way that:

- there is no apparent legal objection to the nature or the method of research; and
- the research will not compromise staff or students or the other responsibilities of the University;
- the stated objective will be achieved, and the findings will have a high degree of validity;
- limitations and alternative interpretations will be considered;
- the findings could be subject to peer review and publicly available; and
- I will comply with the conventions of copyright and avoid any practice that would constitute plagiarism.

SIGNED BY	Full name	Signature	Date
Principal Researcher/ Student/External applicant	Carlu van Wyk	signature removed	21 Jun 2017

APPLICATION APPROVED BY	Full name	Signature	Date
Supervisor (where applicable)	Nancy Odendaal	signature removed	21 Jun 2017
HOD (or delegated nominee) Final authority for all applicants who have answered NO to all questions in Section I; and for all Undergraduate research (Including Honours).	TAIN LOW	signature removed	21/6/17
Chair: Faculty EIR Committee For applicants other than undergraduate students who have answered YES to any of the above questions.	G SITHOLE	signature removed	24/7/2017