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Minor Dissertation
In Fulfillment of a Masters of Philosophy in Transport Studies

**ASSESSING THE EFFECTIVENESS OF REDUCED PARKING
REQUIREMENTS IN FACILITATING TRANSIT-ORIENTED
DEVELOPMENT:
A CASE STUDY OF “PT AREAS” IN CAPE TOWN**

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ABSTRACT

There has been a paradigm shift in thinking about parking provision, as government policy has favoured public transport and non-motorised transport (NMT), to limit and manage its supply in cities. This has been informed by sustainability principles, the understanding of “transit-oriented development” (TOD), and the “triple access” system thinking. This thinking has been applied in various ways in different cities, and its application in the literature is explored here, including case study lessons.

This dissertation aims to answer the question: Recognising the current car-centric nature of the modern city (both in the Global North and South) on the one hand, and the sustainability and social equity imperatives on the other, can reduced parking provision and improved parking management be used to support the restructuring of the city over time, in support of public transport and of transit-oriented development? Cape Town is used as a case study, by assessing the effectiveness of the implementation of a tool adopted by the City of Cape Town, called “public transport areas” (“PT areas”), which allows reduced off-street parking supply in centres which are well-served by public transport.

The research quantifies the number of parking bays not supplied as a result of the uptake of this PT offering, and locates this geographically. This was undertaken in 2 phases: the municipality conducted a pilot study of a small sample of centres, led by the author. The lessons learnt from this then informed the methodology for the full analysis, with the City providing the data to the author for analysis in her capacity as a student.

The results of the quantitative research show that there was a significant nett saving of 9 662 parking bays in all centres, resulting in the freeing up of at least 18ha of developable land for more productive use. This does not include the additional gross lettable area potential created by reduced parking requirements, specific to each erf and land use.

The research concludes that a tool such as the “PT offering” can have an impact on land use intensification, but its effectiveness is dampened if a good public transport system is not in place to enable positive travel behaviour change. It recommends that the moment is right, due to changing behaviour as a result of the COVID-19 pandemic, for authorities to take actions to reduce parking demand and supply, and related management, in support of more people- and planet-orientated cities.

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1. INTRODUCTION

“Often, cars get more space to park than humans have to live in!” warn Kodukula and Sharma (2011: 2). As the world population grows, and land is more densely developed, the floor space required for parking a vehicle may come closer in size to the floor space required to accommodate its driver and passengers (Rye, 2010: 1). This is already true for low income residents in the metropolitan areas in South Africa – the average size of an informal dwelling in Langa, Cape Town was between 6 and 20m² in 2014, with an average household size of 2,9 people (Sustainable Energy Africa, 2014: 4) – and a handful of international cities also show this relationship for place of residence¹, as illustrated below. Hong Kong’s per capita residential floor space now approximates that of a parking bay (which is 12.5m² without its circulation space); with circulation space, this is closer to 29m² according to Willson (2015)– greater than the average per capita residential floor space in China and Russia.

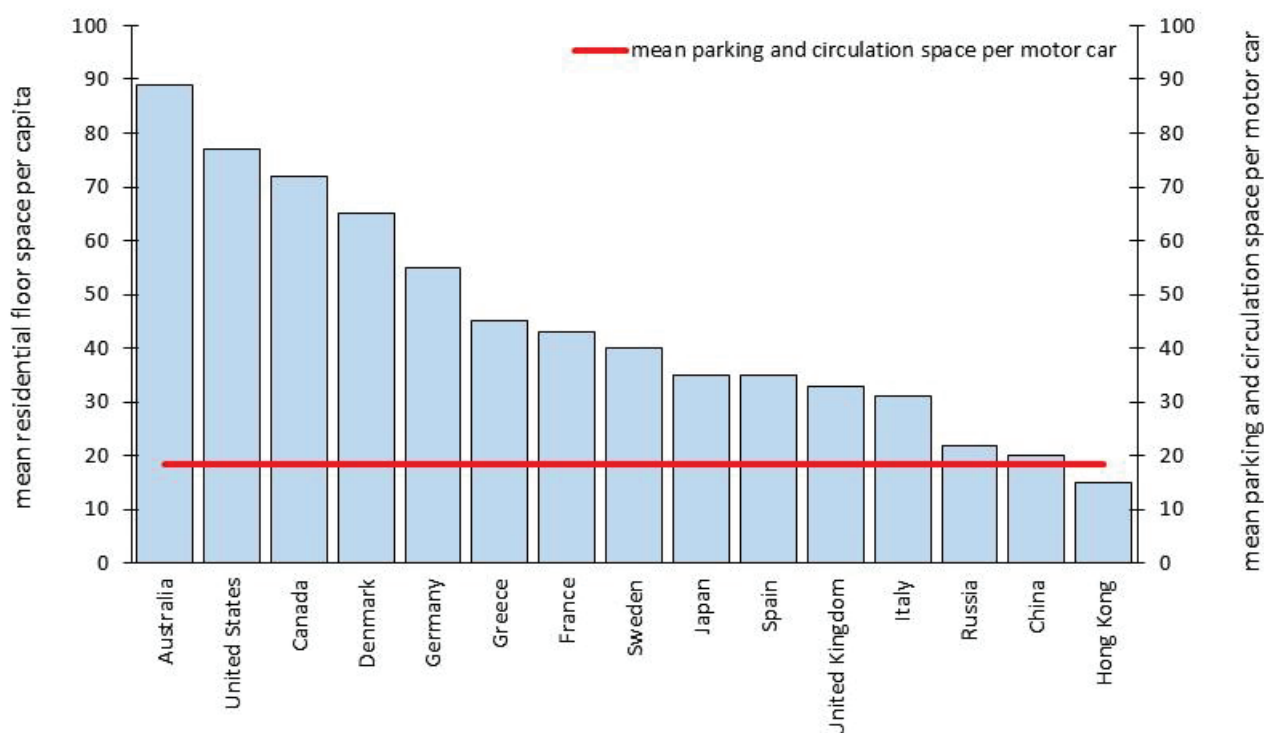


Figure 1-1 Indication of Current Residential Space Provision in Major Cities in Selected Countries

(Source: Adapted from <http://shrinkthatfootprint.com/how-big-is-a-house>, accessed 25/10/2021)

Office sizes are similarly small. The Gensler report for standard office sizes in the USA found that the average office size was 13m², and the average workstation was 4,9m² in 2012 (U.S. General Services Administration, 2012: 5). Again, more space is being allocated to the car used for commuting than to the commuter, at both the beginning and end of their trip.

But is this pattern likely to endure into the long term? Is the private vehicle likely to change size or configuration to enable significantly smaller parking requirements? The greatest change in private vehicles is currently in terms of the fuel technology. This revolution is likely to take place once a tipping point – in terms of price and acceptability – has been reached, probably in the next 13 years (Seba, 2014). These vehicles will still need to be accommodated² (parked) when idle. However, while the fuel revolution takes place, there is little evidence of it including a radical departure from the fundamental

¹ <http://shrinkthatfootprint.com/how-big-is-a-house>, accessed 25/10/2021

² Millennials are still buying cars: <https://www.bloomberg.com/opinion/articles/2016-01-04/millennials-are-buying-cars-after-all>, accessed 27 September 2021

vehicle size and shape. This change may only happen once alternative energy vehicles are mainstreamed. The growth in Mobility as a Service (MAAS) and in autonomous vehicles, as part of the “sharing economy”, may dampen the growth in private car ownership, but will it ever preclude it?

This means that the parking bay as we know it is here to stay for the foreseeable future. The implication of this is that parking as a land use, under current conditions and into the foreseeable future, is as significant as the land uses which generate the trips by these vehicles. Parking is thus one feature which is equally a transport and land use feature. As Shoup (2005: 3) observes: “parking affects both transportation and land use.” The significance of this dissertation is to bridge the understanding of parking as both a transport element and a land use element, and the part it plays in shaping urban development patterns and travel choices.

This chapter explores this role of parking provision, and the implications this has for the way that parking is approached by the two professions that traditionally address parking: transport planning, and spatial planning.

1.1. Parking Affects Both Transportation and Land Use

Shoup (2005) explains that each mode in the transport system is composed of three elements: vehicles, right of way, and terminal capacity (one can argue that the terminal capacity for walking is negligible). In automobile transport, the land demand for term capacity is “enormous”, and certainly significantly greater than for public transport. This concept is illustrated in the diagram below, for different modes of transport.

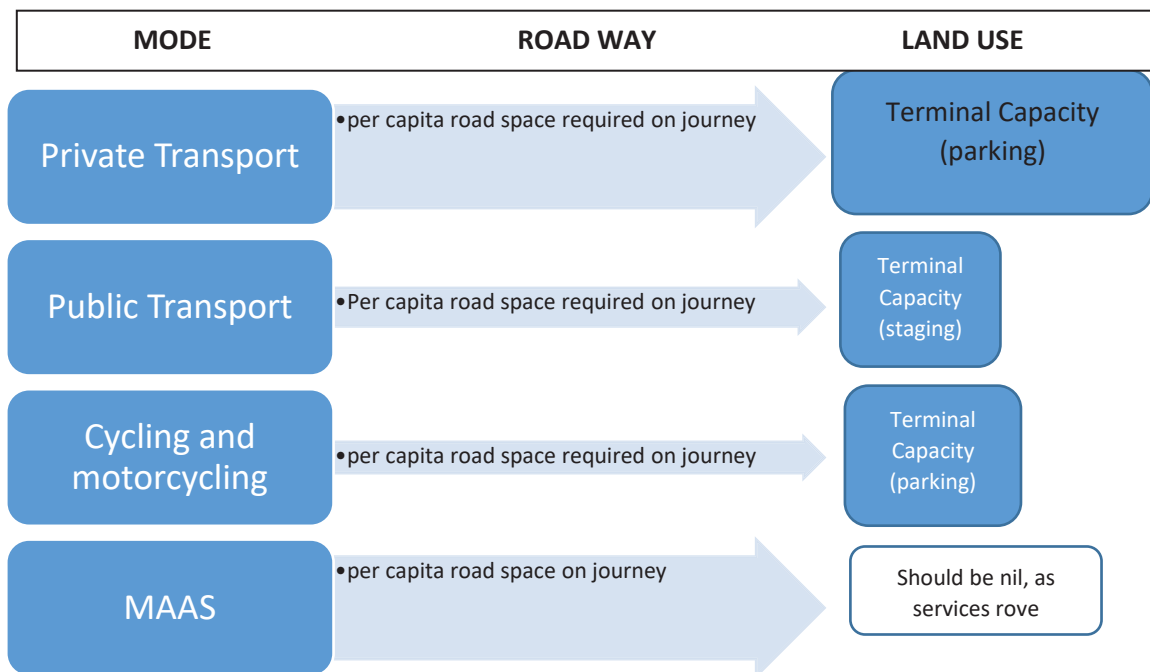


Figure 1-2 Land Requirements for a Journey Per Mode

(Source: Adapted from OECD Transport Research Centre, 2007: 76)

Considering this over time, Manville, Shoup and Bacon (2005) point out that, as city populations densify, and if zoning requirements continue to require increased parking provision as developments intensify, then congestion will inevitably result, as the street space is not easily increased.

Parking is a neglected subsystem of the transportation system, being the start- and end-point of the private journey, it is technically part of that journey. Yet it is also classified as a land use, so is often neglected by both disciplines (Manville, Shoup and Bacon, 2005). Any consideration of parking should recognize its dual “identity”. In recent times, the study of parking policy has thus shifted from the engineering to the planning discipline, as well as to the social scientists interested in behaviour change.

1.2. Transport Modelling and Land Use

Returning to transport planning, traditional transport modelling is based on the four-step model³, which is premised on future land use patterns. These land uses are categorized as either trip producers (from whence a trip begins, i.e. one’s residence, i.e. residential land uses), or trip attractors (commercial, service or education land uses). An individual’s need to move from home to work / education / service generates the majority of daily trips.

Traditional transport modelling then assigns a mode choice to each trip. This mode choice is influenced by a variety of factors, of which availability of parking is one. This will be discussed further in 2.6 below. Where trip attractors are located in transit-rich environments, travel mode choice is greater, hence less attractive parking options (through scarcity or pricing) may result in a change in travel mode. In transit-poor environments, modal shift is less likely for choice users.

Parking attractiveness (through provision and management) in areas of trip attraction in transit-rich environments should therefore be included into transport modelling. It is less significant in areas of trip production, and in transit-poor environments. This will be explored further below, in relation to different types of access, and travel behaviour.

1.3. Parking Falls Between Disciplines

The provision and management of parking provision is neglected professionally and academically: traffic planners do not see parking as part of the journey; land use planners see parking as incidental to the land use. Yet in reality, it has been observed that developers must first determine the minimum parking requirement of their proposed development, and build around that. Those who must provide parking do not give parking supply and management sufficient attention for two reasons. Firstly, because parking has similar characteristics and infrastructure to a street, it is seen as a part of the street, not the land use. Secondly because of the separation of ownership: the streets are publically provided, and the off-street parking is usually privately provided (Manville, Shoup and Bacon, 2005).

Traditionally, while spatial planners espouse land use intensification in well-located areas, transport planners have required land use zoning schemes (managed by spatial planners) to ensure that developments provide for all their parking needs on-site. However, more recent transport planning thinking has suggested that travel demand management interventions are needed to influence travel behaviour away from the single occupancy of private cars, towards greater use of public transport and non-motorised transport. The restriction of ample, free parking, or at least shifting the full cost of parking onto the user, is a significant tool to influence such behaviour.

1.4. Purpose of This Dissertation

This dissertation will explore the potential for reducing the trend of the disproportionate amount of land being made available for parking versus more productive land uses, first from a theoretical perspective, and then from a practical example, using Cape Town as a case study. It aims to answer the question:

³ Land use forecast; trip generation; modal split; measure of infrastructure capacity

Recognising the current car-centric nature of the modern city (both in the Global North and South) on the one hand, and the sustainability and social equity imperatives on the other, can parking provision and management be used to support the restructuring of the city over time, in support of public transport and of transit-oriented development? In answering this question, this dissertation intends to contribute to the body of knowledge which applies the current theoretical positions in practice, and exposes the challenges to achieving stated objectives. While it is a largely empirical study, it can be used by policy makers, practitioners and urban activists to explore context-specific solutions to transforming the modern city.

Cape Town has implemented a parking reduction “offering” to developers, which applies to areas well-served by public transport. This paper will assess the uptake of this option, paying attention to its variable uptake in different types of centres across the city. It will quantify the uptake of the reduced parking offerings; analyse this spatially; and consider the implications of the findings for transit-oriented development in Cape Town. It will therefore contribute to the discussion on the role of reduced parking in contributing to a more desirable urban form (for social, environmental and economic reasons), and the efficacy of a land use management tool in influencing the behavioural responses from both developers and travelers.

While this paper does not present evidence of a direct relationship between reduced parking provision and reduced private vehicle trips in Cape Town, the readings in the next chapter do provide some evidence of this, where reduced parking has been matched by improved public transport and non-motorised transport (NMT) options.

While it cannot be considered in isolation, the focus of this paper is on off-street parking attached to land developments, which is essentially privately-provided parking⁴.

1.5. Structure of This Dissertation

The dissertation is structured as follows: the introductory chapter introduces parking as a feature of both transport and land use, and as a result one which is sometimes neglected by both disciplines. Yet it has significant implications for the densification and intensification of land uses in areas well-served by public transport. Chapter two places the case study in a theoretical context of, on the one hand, spatial and environmental imperatives of city transport and land use planners, and, on the other hand, theories related to the users’ individual travel behaviour and behaviour change. It also explores lessons learnt from case studies, with a focus on Mexico City as an example from the Global South. Chapters three to five move into the Cape Town case study: firstly, the “PT mechanism” applied there is described, and then the research method to assess the uptake of this offering is presented. In Chapter five, the results of the assessment of the uptake are presented, and conclusions drawn. The concluding chapter reflects on the merits of such a mechanism to enable Transit-Oriented Development and travel demand management, and makes some recommendations for taking this work further in the City, in South Africa, and globally.

1.6. Assumptions, Limitations and Delimitations of the Dissertation

The main assumption is that parking provision and management matters in influencing the built form and travel behaviour. Following a travel demand management (TDM) approach, it is assumed that parking has a role to play in influencing travel decisions. Following a TOD approach, it is assumed that reduced parking provision can contribute to the intensification of productive land use. Thus a study on the impact of a parking supply tool is relevant to better understanding TOD and TDM.

⁴ For example, parking provided on-site at a public institution is essentially for the “private” use of those accessing that institution

The study is limited by the data available. It could only provide evidence of potential intensification of productive land use in identified (PT areas) in Cape Town between 2014 and 2019. It could not provide evidence of reduced private car travel.

1.7. Definitions of frequently-used features used the Dissertation

The following features are referred to throughout the document and have the following meaning in the context of this dissertation:

- **Onstreet parking:** parking in the public roadway, or a publically-provided parking facility open to the general public for general use.
- **Offstreet parking:** parking provided by private land owners for themselves or their clients, as governed by a zoning scheme / development management scheme.
- **PT Areas:** a mechanism provided by the City of Cape Town to reduce the minimum parking requirements in areas well-served by public transport.

2. LESSONS FROM THE LITERATURE

2.1. Introduction

A literature search revealed little theoretical or empirical research specific to the Global South: a few studies focus on onstreet parking challenges, specifically related to increasing congestion resulting from rapid urbanization. The broader scope of literature on the provision, management, pricing and ownership of parking, and the interrelationships between these, is largely practical and empirical, provided in the form of handbooks and manuals. It provides two useful streams of information: the theories informing parking provision; and case studies documenting the experience of particular cities.

The thinking around the appropriate provision of off-street parking provision gravitates around two fundamental questions: ***how does parking provision impact urban form? And what are the behavioural responses to parking provision?***

This chapter draws on the current thinking and practice internationally around how parking could play a role in restructuring cities away from private car dominance towards ones which enable access in all its forms. It is informed by three 21st century imperatives: the new paradigm on parking which reflects planning for people, not cars; pursuing environmental sustainability; and the more recent recognition of the triple access paradigm, which recognises the mutually supportive role of mobility, proximity and connectivity.

It starts by exploring the new paradigm for parking which is informed by the current environmental imperatives, as well as a greater understanding of “access” (beyond just travel). This leads to a deeper understanding of the relationship between transport and urban form, and the resultant policy paradigms used by city authorities to influence parking provision and management. An important aspect of this is an understanding of how policies can influence the right behavioural responses from both developers and travelers: here, two main theories of behaviour change will be presented, followed by the behaviour patterns of the suppliers of parking. The later part of the chapter will provide a description of a case study from which much can be learnt: Mexico City. This city government took bold steps to manage its parking, with significant results. The chapter will conclude with lessons learnt from the case study, and other cities, which are relevant for Cape Town.

2.2. There is a New Paradigm on Parking

The idea of willingly under-providing parking (or at least reducing parking provision for established norms and standards) has only recently been recognised in the history of the provision of transport infrastructure. Prior to this, ample parking provision (both on- and off-street) was expected, to accommodate the growing number of private cars which were being accommodated by an increase in road capacity.

Shoup (1999) has written extensively on parking provision, taking a strongly economic approach, and reflecting on the history of parking supply. The social cost of free on-street parking is the “tragedy of the commons” problem: “Cars have many external costs, but the external cost of parking in cities may be greater than all the other external costs combined.” (Shoup, 2005: 549)

He called for a paradigm shift in planning for parking in the late 1990’s and early 2000’s, addressing the over-provision of parking, and the masking of the true cost of parking through the subsidization of its pricing (p549). He pointed out how professionals in both the transport engineering and urban planning fields assumed that parking should be free (as do car owners themselves), thus requiring developments to provide for the peak parking demand. This self-reinforcing mindset resulted in lower density developments (where uncovered parking was provided), and increased development costs (where indoor

/ underground parking was provided), internalizing the cost of parking to the land owner or tenant, and ultimately passing it onto the consumer and the public. He argued for the real cost of parking to be reflected in parking pricing (both on- and off-street), and concluded boldly that “deregulating the quantity and increasing the quality of parking will improve transportation, land use and the environment.” (p570)

This new paradigm was further developed, and popularized by GTZ in their sourcebook for policymakers: see table below summarising the paradigm shift. This approach is central to this paper, although it recognises that in many instances, the new paradigm has not been fully embraced.

Table 2-1 Paradigm shift in parking policy

	Old Paradigm	New Paradigm
Parking considered as	Public good	Commodity
Demand assumed	Fixed/ Inelastic	Flexible/ Elastic
Supply should	Always grow	Be managed in response to demand
Government regulations	Set minimums and no standards	None / set maximums
Pricing maximises	Utilisation	Availability
Turnover encouraged via	Time limits	Pricing
Cost should be	Bundled with goods	Transparent to users

(Source: Rye, 2010: 22)

This paradigm shift has been influenced by mounting pressure to respond to broader environmental imperatives, which are considered below.

2.3. The Environmental Sustainability Imperative

Pursuing environmental sustainability through parking provision is a relatively recent trend (see (Weinberger, Kaehny and Rufo, 2010; Kodransky & Hermann, G., 2011). As discussed above, parking is an integral part of the transport journey spatially. In addition, its provision impacts on travel choice; and preferential parking can promote more sustainable travel modes. It can therefore make a contribution to environmental sustainability.

Transport is a significant contributor to carbon emissions and air pollution. In South Africa, after the electricity generation sector, it was the second greatest source of emissions in 2010, contributing 11% (Department of Environmental Affairs, no date).

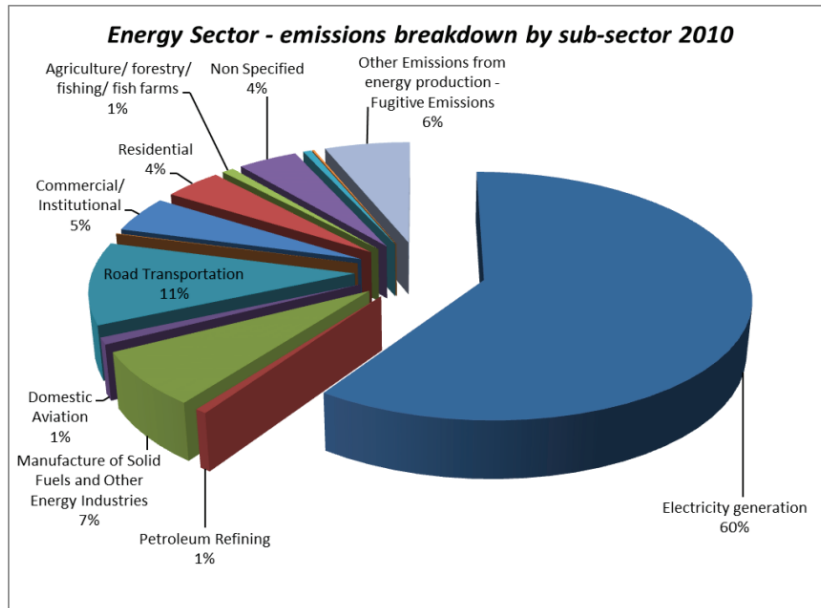


Figure 2-1 South Africa's Energy Sector Emissions (Source: DEA, undated)

According to the National Department of Transport’s Draft Green Transport Strategy: 2017-2050, of all transport modes, road-based transport accounts for 91,2% of total direct emissions (National Department of Transport, 2018: 19). To address this, it includes in its long term vision the introduction of “no-car zones”, “allowing significant areas of urban real estate currently used for parking to be repurposed for use in affordable inner-city housing and businesses.” (National Department of Transport, 2018: 28).

This is in line with the internationally accepted approach developed by GIZ and illustrated below: the “Avoid-Shift-Improve” approach to sustainable mobility. This is a useful framework by which to apply environmental principles to the transport realm in order to shift towards more sustainable mobility options.

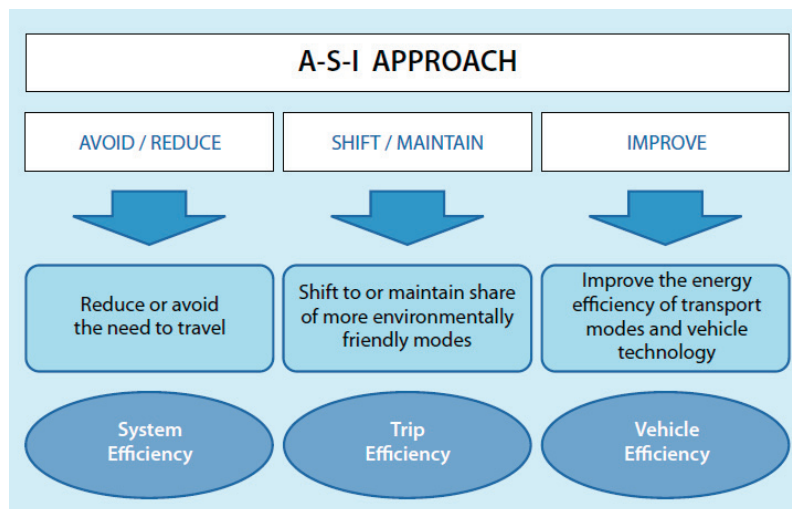


Figure 2-2 Framing Sustainable Mobility (source: GIZ fact sheet, undated)⁵

⁵ https://www.ledsgp.org/wp-content/uploads/2016/01/SUTP_GIZ_FS_Avoid-Shift-Improve_EN.pdf, accessed 30/08/2021

While these actions require multiple interventions, the management of parking can contribute to all three actions:

	Description	Current Situation	Parking Intervention
Avoid	Avoid private car travel completely through less frequent travel / digital access	Ample free parking encourages the trip	Make parking at destinations unattractive through scarcity or pricing
Shift	Shift from private car travel to shared travel, public transport or NMT	Choice users use private car	Make carpool and NMT parking more attractive than SOV ⁶ parking
Improve	Improve the environmental impact of the travel mode	A carbon tax incentive to shift to cleaner ICE ⁷ vehicles	Make parking for EVs ⁸ and low emission vehicles more attractive than private parking

Figure 2-3 Parking Contributing to Sustainable Transport Actions

2.4. The Triple Access System

There is a third influence on the future of parking which questions the meaning of the word “access”. **The triple access system paradigm** developed by Lyons and Davidson (2016) reflects the view that the role of transport in society has shifted significantly. The discipline of transport engineering since the mass production of the motorcar has focused on maximising access through maximising mobility (with its prioritization of speed and volume of traffic). TOD has emphasized maximizing access through maximizing proximity (through reducing distances between land uses, and to public transport). But increasingly, and accelerated by the restrictions on movement imposed by the Covid-19 pandemic, societies are embracing the convenience of digital access (digital connectivity) to meet consumer, service, information and social needs. They therefore argue that policy and investment decisions should recognise the role of, and interdependence between, physical mobility, spatial proximity, and digital connectivity, as illustrated below.

⁶ SOV: single occupancy vehicle

⁷ ICE: internal combustion engine

⁸ EVs: electric vehicles

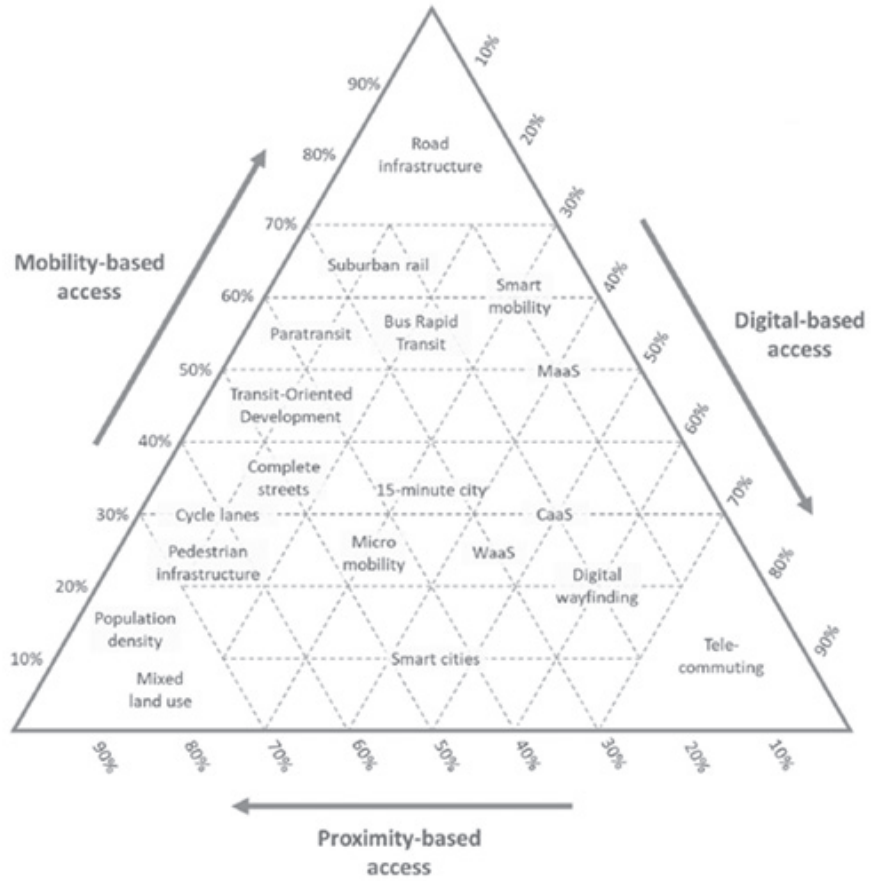


Figure 2-4 An Elaboration on the Triple Access System

(Source: Cooke, S, [forthcoming 2022] elaborating on Lyons & Davidson, 2016: 112)

Reflecting back on the interventions above towards more sustainable transport, the two concepts are strongly mutually reinforcing. Where trips are needed, reduce the environmental impacts of these through improved technology; use digital connectivity to avoid trips all together; and modal shift is made possible if land uses are appropriately placed in relation to each other, and to public transport.



Figure 2-5 The Triple Access System, With Author's Annotations Reflecting the Sustainable Transport Imperatives

Parking provision and management do impact on the attractiveness of these three forms of access. The attractiveness of mobility-based access can be reduced through restricting⁹ parking at areas of trip attraction (see 1.2 above). Reduced parking provision can enable proximity-based access, if it enables land use intensification. Digital-based access can enable reduced parking provision through apps which provide real-time information on available parking, hence enabling the more efficient use of the parking which does exist.

The two questions posed at the beginning of this chapter - ***how does parking provision impact urban form? And what are the behavioural responses to parking provision?*** - will now be examined in the next two sections in the light of these imperatives.

2.5. The Impact of Parking Provision on Urban Form

Understanding the impact of transport provision on land use is not new, but has more recently been referred to as Transit-Oriented Development (TOD). It is the targeted intensification of land use at transit nodes and along transit corridors, to support transit use and better travel choices, with the land uses in turn benefitting from greater accessibility. TOD needs a strong and improving integrated public transport network and service which attracts investment in surrounding land to benefit from the increased accessibility of these locations.

Cooke et al (2018), from the perspective of the Global South, identify four characteristics of urban form which have an impact on sustainability, efficiency and equity, gleaned from an overview of the literature. These are density, diversity (of land uses and incomes), (urban) design, and (short) distance to transit (building on Cervero and Kockelman (1997), who identified density, diversity and design as determinants in TDM). He concludes that, in the South African context, accessibility and financially viable public transport are primary considerations when addressing city form.

“Parking policy is an important element of transit-oriented development (TOD). It shapes travel behavior, community design, and development economics; it can improve the performance of both rail transit and TOD.” (Willson, 2005: 79) An important aspect of parking policy is managing parking supply.

Parking supply has two roles to play in this mix as the terminal point of a trip: it requires space and circulation space, thus putting downward pressure on development density; and if cheap and easily available, it discourages a shift to public transport, which is a prerequisite to TOD.

TOD should however result in a lower demand for parking in TOD precincts (Willson, 2015:209), as choice users shift from private car use to transit (including NMT). But there is a possibility that the increased densities could result in greater trip generation: this calls for the smart management of parking (see next section). It is also likely that the greater mix of land uses enables greater shared parking; however, park-and-ride parking needs to be protected from general parking use.

Despite this important mutually-dependent relationship, TOD policy and parking policy research have not been developed together: “developers report that parking is one of the most important issues to be resolved in proposing TODs.” While this is stated by Willson (2005: 80), it is also true for cities like Cape Town. The City’s 2020 Parking Policy (see extract from it in Annexure 3) illustrates the significant parking provision in the Cape Town CBD, partly due to historic zoning requirements, and partly due to market expectations, with parking being linked to individual developments. Willson found similar evidence in California, where parking supply and management in TOD areas seldom support shifts to public transport.

⁹ In this paper, “restricting” will be used to refer to either reducing parking provision; increasing parking price; putting a time restriction on parking; or a combination of these

Looking to more efficient ways of utilising the available of parking under this new paradigm, a recurring proposal is that the cost of parking should be made visible to the user (Shoup, 2005; OECD Transport Research Centre, 2007; Rye, 2010). This would be possible if parking provision were to be unbundled from the provision of lettable floor area (currently most zoning schemes bundle the two) (Willson, 2005). Similarly, the developer, who previously had no indication from the user of the value of parking, would be able to set the price of parking at a market-related rate (in line with its use value).

When applied to office provision, Willson (2005) found a general oversupply of parking (i.e. an underutilisation).

Gabbe and Pierce in Shoup (2018: 160) conclude from their extensive study of residential parking that “minimum parking requirements are burdensome to renters and lead to societal waste. Carless households, many of whom have low incomes, are disproportionately affected ... Eliminating minimum parking requirements in these locations will allow the market to gradually meet the latent demand for housing options with unbundled parking.”

Willson (2015) further points out that underutilized parking carries not only the direct initial and ongoing costs (land cost; construction cost; administration and maintenance), but also the opportunity costs of being unavailable for productive use; as well as generating negative externalities such as its environmental impacts, and impact on the urban environment.

He suggests that now is the time, with the technology available, to extend the concept of the “sharing economy”¹⁰ to off-street parking, as part of the emerging acceptance of shared transport resources such as MAAS, and shared onstreet parking. This is possible through recognizing that it is collectively owned, efficiently managed, and used by multiple people during the course of the day (Willson, 2015). To this end, he has developed a “typology” of parking, which can inform where shared parking would be most viable and attractive.

¹⁰ From the perspective of the sharing economy, *use* is replacing *ownership* for many aspects of day-to-day life, including transportation. The sharing economy is based on sharing physical and human resources with improved information flow and reduced transaction friction.

Willson, Richard W.. *Parking Management for Smart Growth*, Island Press, 2015. ProQuest Ebook Central, <http://ebookcentral.proquest.com/lib/uoct/detail.action?docID=3317670>.

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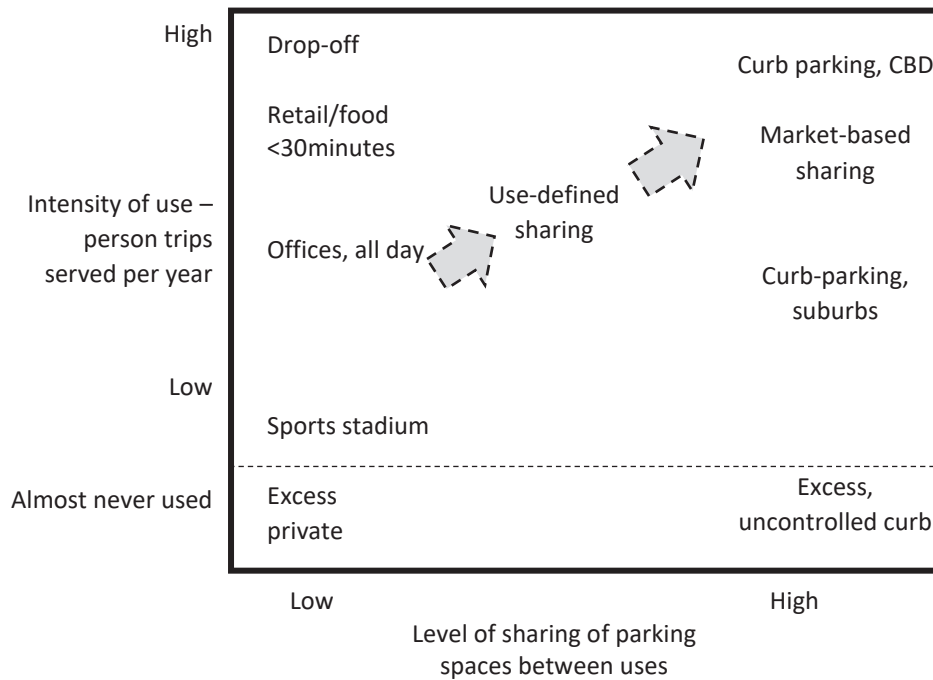


Figure 2-6 Relationship of Use Intensity and Sharing.
(Source: recreated from Willson, 2015: 5)

Willson (2015: 201) foresees that the future of off-street parking will shift to a shared parking model, driven by three trends. “Taken together, these three trends— smart growth, sharing economy, and technology— transform parking from being understood as a quantity of real estate (land or building area) devoted to a single use or person to viewing parking as a service in the accessibility “supply chain.” This new perspective incorporates consumer choice and embraces frequent real-time modifications rather than employing the “set it and forget it” mentality discussed in chapter 1. Parking services are part of a multimodal access system that supports community goals and priorities.”¹¹¹²

2.6. The Behavioural Responses to Parking Provision and Management

The measures described above impact on the behaviours of both developers (who supply parking, including its management) and travelers (the demand side of parking). Travel behaviour theory has become an important discipline in the transport planning field in recent years, as travel demand management (TDM) has become an increasingly significant form of managing integrated transport systems.

Reflecting on both supply and pricing for parking, Rye (2010) identifies the availability and cost of parking as important factors in choosing car ownership, and in choosing when to use it¹³. These are two related but separate considerations. Owning a car requires a safe, affordable and accessible place to store it at or near one’s home. Using one’s car requires a second “storage” space at one’s destination.

It can be argued that off-street parking should not be restricted in **residential** areas. This is because residences are the origin of trip generation (“trip producers”). For those who can afford, owning a car

¹¹ Willson, Richard W.. Parking Management for Smart Growth, Island Press, 2015. ProQuest Ebook Central, <http://ebookcentral.proquest.com/lib/uoct/detail.action?docID=3317670>. Created from uoct on 2021-08-16 14:08:50

¹² “set it and forget it” refers to the practice of transport and land use planners to set a generous minimum parking standard so as to avoid issues of undersupply into the future.

¹³ The flip-side of this being the presence of a quality public transport service as a viable alternative to private car use.

may make sense for many practical and aspirational reasons. However, from a travel demand perspective, the crucial question is “how often it is used?”, as that is the moment at which it contributes to negative externalities such as carbon emissions, congestion, and parking demand at destinations.

Therefore, to reduce the number of trips made, parking should be managed in such a way that it becomes a deterrent to single occupancy car use at the point of the destination, i.e. at the “trip attractor”. In the majority of regular trips generated, these are places of employment or education. This has relevance for TOD.

To better understand what influences these choices, we now turn to the theories of travel choice behaviour, followed by the thinking around how that behaviour can be changed.

2.7. Theories of Travel Choice Behaviour

It has been demonstrated (Shoup, 1999; Willson, 2005) that parking demand can be reduced through TDM measures. There are two main schools of thought with respect to how the increase in the total cost of single occupancy vehicle car use (through restricting parking) will shift travel behaviour. The first is the theory of rational choice, and the second is the theory of planned behaviour change. We will consider each one in turn.

Rational Choice Theory

Rational Choice theory, or utility maximization theory, is a useful starting point in understanding travel choices. It is rooted in the theory of classical economics, in which value is measured in terms of utility, and societal behaviours are simply the sum of all individual behaviours. Its starting point is one of consumer preference: individuals continuously make rational choices by weighing up the costs and benefits of the available alternatives, and choosing the option which maximizes their utility value. It emphasizes individual agency in decision-making.

This theory is based on the classical economic assumptions that all the necessary information exists, or is easily available, as well as the following key assumptions “1) that choice is rational; 2) that the individual is the appropriate unit of analysis on social action; and 3) that choices are made in pursuit of individual self-interest” (Jackson *et al.*, 2005: 35). In addition Adjei *et al.* (2014) point out the assumption that the ranking of alternatives to maximize utility value is repeated every time the decision must be made (i.e. habit plays no part).

This model has been challenged based on the weaknesses in its assumptions: that all information is available; that the individual makes decisions outside of any societal influence; and that it does not factor in the moral, emotional or habitual determinants in individual decision-making.

Planned Behaviour Change

However, for most individuals, travel behaviour is a frequent activity, so it is likely that habit will be an important determinant in travel choice: repeated activity requires some degree of automation once that activity has produced the required results. Ajzen’s theory of planned behaviour (in Bamberg, Ajzen and Schmidt, 2003) proposes that previous behaviour is the most accurate predictor of future behaviour, if three factors remain relatively constant. “Briefly, according to the theory of planned behavior, human action is guided by three kinds of considerations: beliefs about the likely consequences of the behavior (behavioral beliefs), beliefs about the normative expectations of others (normative beliefs), and beliefs about the presence of factors that may further or hinder performance of the behavior (control beliefs).” (Bamberg, Ajzen and Schmidt, 2003: 175).

Behavioural beliefs refer to an individual’s belief that a change in behaviour will have the desired consequence. Normative beliefs refer to an individual’s belief about what society (or those whose

opinions are valuable to them) expects from them. Control beliefs refer to the sense of agency which the individual believes they have over their choices, and the results thereof. According to this theory, a different logic is applied initially, as illustrated below.

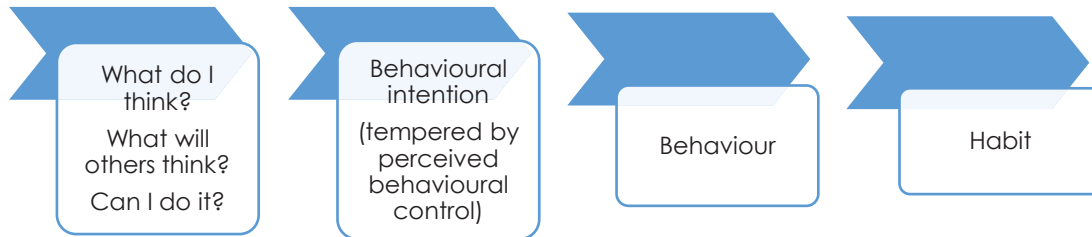


Figure 2-7 Diagrammatic Representation of Reasoning Under Theory of Planned Behaviour
(Source: Bamberg, Ajzen and Schmidt, 2003: 176)

Again, it is assumed that travel choices are “reasonable” (a softening of the strongly economic “rational” approach in rational choice theory), but that the decision making process is undertaken initially, and once acted on repeatedly, becomes automatic or habitual.

While this theory also assumes full agency on the side of the individual, it does recognize that they do consider societal norms, and external factors which will impact on their behaviour. A reasonable decision in this case is based, on and consistent with, their attitudes, biases and beliefs.

A useful introduction to these and other travel behaviour theories is presented by Adjei *et al.*, (2014), who point out that the different theories are not mutually exclusive, and have relevance for different planned interventions. They point out that travel behaviour is both intra-personal – informed by personal factors – and inter-personal – informed by the actions of others. The implication of this is that any TDM intervention will need to be tailored to the specific target group.

2.8. Implications for Travel Behaviour Change

Applying the Rational Choice Theory to parking interventions in order to influence travel behaviour would advocate for economic interventions such as increasing the cost of parking (through tariffs; stipulated parking periods; increasing the time to seek parking, or to walk from remote parking) as being the most effective, as long as information around these interventions is easily available.

In particular, where decisions are not primarily value-driven, pricing of parking is one of the most important factors in managing demand. Willson (2005: 85) found through extensive empirical evidence, that the provision of free, or significantly subsidized, parking to employees not only encourages single occupancy vehicle use, but even undermines their use of transit.

Applying the Planned Behaviour Change theory to parking interventions in order to influence travel behaviour, the focus would be on challenging existing behavioural, normative or control beliefs, so that the influence of past behaviour is lessened. In addition, circumstances can be changed, or interventions developed which influence attitudes, values and a sense of agency (Bamberg, Ajzen and Schmidt, 2003) towards travel choices which reduce the demand for parking. Practical examples would be to encourage and enable people to measure their carbon footprints or start a lift-club or a walking bus.

The obvious benefit of reduced travel per se is the reduction in congestion, especially if this travel is undertaken during the morning and afternoon peak periods. However, TDM is now not only in the interests of transport planning. Various social and environmental scientists have also weighed in on the

theory of travel choice. Jackson *et al.* (2005) suggest that influencing people to make more sustainable choices is complex, as their context, the society and their personal position are all contributing factors. But they do strongly advocate for government intervention, as best articulated in their own words:

“Changing behaviours – and in particular motivating more sustainable behaviours – is far from straightforward. Individual behaviours are deeply embedded in social and institutional contexts. We are guided as much by what others around us say and do, and by the ‘rules of the game’ as we are by personal choice. We often find ourselves ‘locked in’ to unsustainable behaviours in spite of our own best intentions.

In these circumstances, the rhetoric of ‘consumer sovereignty’ and ‘hands-off’ governance is inaccurate and unhelpful. Policy-makers are not innocent bystanders in the negotiation of consumer choice. Policy intervenes continually in consumer behaviour both directly (through regulation and taxes eg) and more importantly through its extensive influence over the social context within which people act.

This insight offers a far more creative vista for policy innovation than has hitherto been recognised. A concerted strategy is needed to make it easy to behave more sustainably: ensuring that **incentive structures and institutional rules** favour sustainable behaviour, **enabling access** to pro-environmental choice, **engaging people** in initiatives to help themselves, and **exemplifying the desired changes** within Government’s own policies and practices.” (Jackson *et al.*, 2005: iii)

This is a useful reminder that the different spheres of government do influence travel behaviour in their laws, bylaws and policies: they would be wise to examine where these have unintended consequences that undermine TDM. Young (2012: 25), in her very useful reference guide to cities in their planning and development process, sets out appropriate TDM strategies at three levels: that of the employer/ site, as well as the city- and the state-wide interventions. She emphasizes how these need to be mutually supportive.

This is not always straightforward, as benefits need to be locked in. The OECD Transport Research Centre (2007) outlines the need to combat congestion through a variety of measures to impact travel behaviour, of which parking is one – as long as benefits are locked in, and do not induce additional demand. Restricting parking provision is a significant measure to lock in these benefits.

Occasionally, events create the opportunity for significant shifts in travel behaviour. More recently, the health imperative of combating the COVID-19 pandemic has demonstrated how significant behaviour change was possible on a mass scale across the globe for office-based workers, where the motivation existed to stay away from their workplaces. In this case, the travel behaviour implications were incidental. In the process, parking demand in urban centres reduced to minimal levels, and congestion became a memory. This created the opportunity for cities to implement or fast-track planned TDM interventions, such as flexible working, re-assigning the road space to favour NMT and public transport, and outdoor gathering spaces (NACTO & Global Designing Cities Initiative, 2020), in the process hoping to create a “new normal” by significantly shifting travel patterns.

Only 7 months previously, at the UITP Global Public Transport Conference, experts were predicting the need for more cities to adopt congestion charging to more drastically influence travel behaviour.¹⁴ This reflected the urgency of climate action, with the need for more drastic measures to create a greater shift away from private vehicle use.

¹⁴ <https://www.forbes.com/sites/carltonreid/2019/06/10/most-cities-will-have-to-introduce-congestion-charging-say-experts-at-global-transit-conference/> accessed 11/10/2021

Considering such significant shifts in demand, we now need to turn our attention to developers, who may be responsive to the changing level of demand, or even influencing it, if enabled to by government legislation, policy and action.

2.9. Responsiveness of Developers to Changing Travel Behaviour

The decision-making around the supply of parking, while largely in the hands of landowners, is strongly influenced by local authorities through their bylaws and policies, as well as their approach to managing on-street parking. Managing the parking supply and parking management are TDM mechanisms which developers can apply to reduce or change the demand for parking. According to ECMT (2007), the focus here should be on commercial areas (CBDs).

Reflecting on the shift from the old to the new paradigm around parking supply, Shoup (2005) points out that as parking has historically been so readily available, that drivers have grown to expect it. This would be the reason that municipalities have tended to require developers to oversupply parking. ECMT (2007) note that “In many instances, urban zoning requirements require that developers provide a minimum number of parking spaces in order to receive building or development permits. This policy, originally meant to ensure that streets adjacent to these developments be swamped with parked vehicles, may work against other parking management objectives that may seek to cap or otherwise limit parking availability in urban developments. In some instances, cities have sought to change their zoning and land-use development statutes to reflect maximum, rather than minimum, parking provisions. However, such approaches require that cities ensure a high level of non-car – and in particular, public transport – access to these developments for these to avoid the original problem of cars illegally parking or otherwise crowding on-street facilities.” (p208)

Equally, Willson (2005) found that developers themselves are unlikely to “risk” applying TDM measures themselves, and cautiously oversupply parking and underprice it (based on conventional rule-of-thumb, private-transport-orientated ratios), conforming to what their competitors are supplying. However, he also notes a willingness to change: especially in areas identified as TOD (see 2.5 above), especially if presented with examples which are working successfully.

Shoup (2005) points out that parking supply requirements per land use are norms which are not tested in reality (the planners simply respond to the demand to “do something”), and they do not consider the unintended consequences. Rezéndiz and Gavaldón (Shoup, 2018) label calculations for minimum parking standards as “pseudoscientific”, often adopted from other contexts, and providing for an anticipated peak parking demand, resulting in low utilisation rates.

On the other hand, several writers warn that the result of a significant undersupply of parking will, lead to cruising (time spent searching for a free parking bay), which has been found to be a significant contributor to congestion during certain hours and in specific locations in cities such as Paris and Copenhagen. At worst, it can result in illegal parking and the resultant obstruction of the roadway for other users (ECMT, 2007: 80). In less regulated cities, informal “parking attendants” emerge to exploit parkers for their own economic gain through identifying bays and offering security (e.g. Mexico City, in Shoup, 2018: 465)

Clearly, parking (provision and management) can be an effective demand management tool, but only in the context of improved PT and NMT (Kodukula and Sharma, 2011).

2.10. Lessons from Case Studies

2.10.1. Introduction

As mentioned previously, the literature draws on the substantial experience of cities, largely from the Global North. The lessons from these cities, as well as one case study in particular, provide context in which to place Cape Town's experience of parking interventions. This section first looks more closely at Mexico City's bold interventions, as an example from the Global South which has some similarities with Cape Town, in particular its reduce offstreet parking requirements. It then provides a summary of lessons learnt from Mexico City, and other cities, with regard to how they changed their parking policies.

2.10.2. Case Study: Mexico City's EcoParq Programme

The following quote by Rezéndiz and Gavaldón (Shoup, 2018: 472) summarises why Mexico City offers a highly instructive case study which has relevance to the Cape Town municipality's aspirations with respect to parking. A "PBD" is a "Parking Benefit District", an area well-served by public transport (similar to the demarcated area in Cape Town: see chapters 3 and 4).

"There was a time when drivers controlled every inch of Mexico City's streets, and those who walk were second-class citizens. Now, in some parts of the city, PBDs have left those times behind. In fact, not only have pedestrians benefited from the PBDs, but so have residents, business owners, and the vast majority of citizens. If PBDs expand throughout the city, Mexico will be famous not only for its great size, its rich history, its food, and its culture, but also for its livability. Automobile drivers who pay their fair share for using public land will finance this enhanced livability."

The following summarises Rezéndiz and Gavaldón's description of Mexico City's experience. While it was primarily an onstreet parking intervention, there were significant implications for off-street parking.

2.10.2.1. *The Problem*

Before any intervention, Mexico City, with its population of 20 million, suffered from congestion, unregulated parking, and an informal parking marshal system in which "franeleros" appropriated public parking and other spaces so as to charge parkers a fee. This resulted in obstructions to pedestrian sidewalks and other public areas, with the main beneficiaries being the parking marshals themselves. An earlier pilot project in 2 commercial areas, in which onstreet parking was meant to be metered and charged for by a concessionaire, had failed, which stifled its expansion.

According to ITDP¹⁵, before the intervention, Mexico City had successfully introduced the "Metrobus" BRT (bus rapid transport), which is now part of a large, multi-modal and integrated network, including more than 200km of Metro rail. The first and last mile are served by the "Ecobici" bikeshare which serves 25 000 daily users on 6 000 bikes using 452 stations. It was however recognised that this public transport provision needed to be supported by interventions to disincentivise car use. The intentional provision and management of onstreet and offstreet parking is one tool to do so.

In addition, air quality had become a public concern, and private car travel was recognised by the broader public as contributing to this.

2.10.2.2. *The Intervention*

During 2008 to 2010, ITDP assisted the city government through conducting studies in order to gather evidence on problems around transport and parking in the city. These formed the basis for the intervention. In 2011, the metropolitan government ramped up its intervention with a

¹⁵ <https://www.itdp.org/2020/07/15/lessons-from-mexico-city-and-los-angeles/>, accessed 24 October 2021

coordinated, interagency approach. The three agencies each took responsibility for delineating and designating managed parking areas; installing and ensuring the operation and maintenance of parking meters; and receiving the parking meter revenues from the concessionaires. A public participation process determined how the 30% of the nett revenue was reinvested into public space improvements. The number of metered onstreet parking bays more than doubled, to 26 378 in 2014.

2.10.2.3. The Results

The most striking result was how this intervention managed the demand for parking. Areas which had suffered from “over-parking” now had parking occupancy rates of 50-85%, which significantly reduced cruising time. Liveability was increased through the protection of the public environment from illegal parking, as well as the investment of the parking revenues to the benefit of all.

2.10.2.4. The Unintended Consequences

The first unintended consequence was political. The city government, in applying managed onstreet parking tariffs, had to be more transparent in its transportation policy as a whole, to get the public’s buy-in. Even so, some neighbourhoods chose not to participate in the ecoParq programme, at least initially.

The second is more relevant to this paper. Pricing onstreet parking introduced a market-related price for parking, the value of which had till then been masked by a system of minimum parking requirements by the city government. EcoParq catalysed a conversation about comprehensive parking reform, with the support of ITDP.

2.10.2.5. Offstreet Parking Reform

As with Cape Town and many other cities worldwide, off-street parking standards were set as minimum parking requirements per land use. These minimum standards had been adopted from other cities, calculated through “pseudoscientific” methods. The intention was that parking supply should meet the maximum parking demand for free parking now and into the future, i.e. to provide for peak parking. Most developers met the minimum provisions, with little more.

The result was that a significant proportion of land use was dedicated to its associated parking – over 50% in some cases. The evidence showed that the size of a development was determined by its resultant parking requirements, as illustrated below.

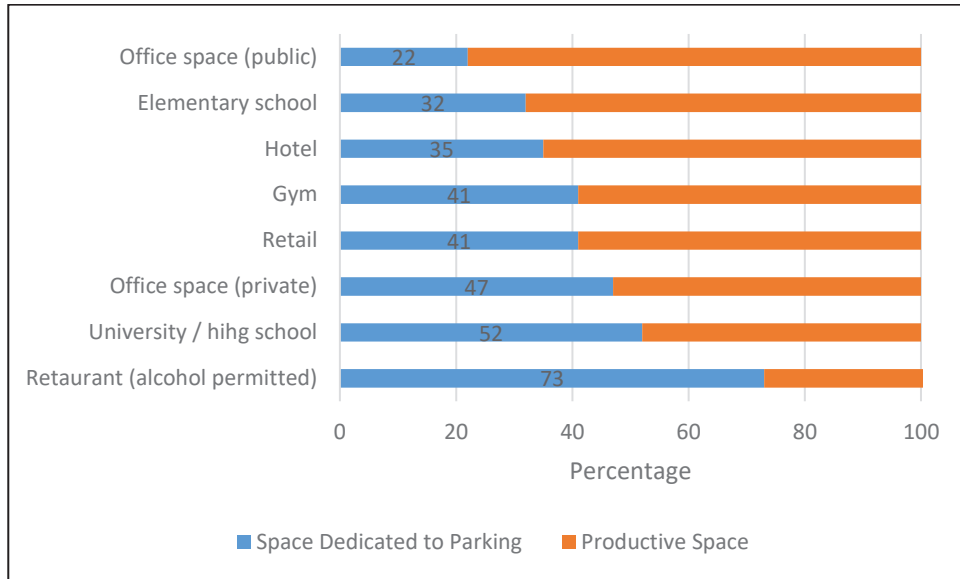


Figure 2-8 Percentage of Land Required for Minimum Parking for Various Land Uses in Mexico City Prior to the Policy Change (Source: adapted from Shoup, 2018: 184)

Rezéndiz and Gavaldón categorise the impacts of these minimum standards in three areas: economic; urban; and traffic impacts. Economically, parking can cost 30-40% of the total cost of big developments. This cost is passed on to all the customers, even those who are not driving and benefiting from the generous parking provision. The impact on the urban form is that developers have favoured peripheral developments on cheaper land, where they can provide large customer parking areas. The traffic impact of providing for the peak is that this exacerbates peak traffic and encourages car ownership and use.

This information was gathered by ITDP on developments between 2009 and 2013, resulting in the report “Less Parking, More City” (2014). It was then recognised that the conversation needed to be broadened to include all stakeholders, including the private sector and the civil society organisations. This took the form of a competition to rethink parking garages, which catalysed a broader conversation on the best use of public space.

In 2017, Mexico City took the major step of shifting from minimum offstreet parking requirements to maximum requirements, across the city. The new maximums were generally equivalent to the old minimums, but were area-specific. In addition, the intention is to charge fees (not implemented at the time of writing) to developers who provided parking in the CBD and other areas which were well-served by public transport. This revenue could then be used to improve the public transport system.

2.10.2.6. Proposed Future Interventions

Mexico City has taken an incremental approach to parking reform. It therefore has intentions for the future. It plans to regulate the building of new parking facilities, and to use technology to improve the use of existing facilities.

It also plans to strengthen on-street parking regulations by extending managed parking areas, but also by tailoring them to each area’s demographics as well as its off-street parking supply.

2.10.3. Summary of Lessons Learnt From the Case Study and Other Cities

2.10.3.1. Study the Problem and Gather Evidence

Mexico City undertook several studies over a 3 year period to inform their interventions. Cape Town has undertaken little analysis of its parking situation and intervention. A pilot study of the impact of Cape Town's offstreet parking intervention was undertaken in 2020. This paper could serve as a resource to study the uptake of this intervention across the whole city. An on-street parking management system is soon to be implemented which will enable the automated gathering of data to observe usage and trends.

2.10.3.2. Significantly Improve the Public Transport Service in Terms of Reach, Affordability and Level of Service Before Undertaking Parking Interventions

Drivers need a viable alternative to making a single-occupancy trip. This could be through improved public transport (for longer trips), or NMT or cycling for shorter trips. Even digital access is now seen as a viable alternative to making the trip altogether. This is where Cape Town falls short: the backbone of the public transport system, being the suburban rail service, has effectively collapsed since 2015. This is one of the reasons that the policy-makers have not been able to shift from parking minimums to parking maximums.

2.10.3.3. Develop a Broader Vision of Urban Development, Which is Shared by Stakeholders

Parking is a political "hot potato". Few elected officials are prepared to address it, because it is personal as well as political. Parking reform is not an end in itself: but can address transport justice; housing; social equity; and climate mitigation. Sao Paulo developed a Strategic Master Plan, of which parking was one aspect of the sustainable urban development principles. Decision-makers in Cape Town are not willing to address parking reform when their transport plans are being undermined by the underperformance of the rail service, and the volatility of the minibus taxi industry.

2.10.3.4. Apply Area-Specific Interventions for Both On- and Off-street Parking

Zurich has also applied area-specific minimums and maximums in areas well-served by public transport, while the Netherlands have differentiated between 3 location types (A, B and C) with respect to proximity to public transport, and per land use (Kodransky & Hermann, G., 2011).

Progress is being made in Cape Town to manage onstreet parking in high demand centres. This complements the offstreet mechanism of the PT areas.

2.10.3.5. Shift From Parking Minimums to Parking Maximums

While Mexico City and Sao Paulo are prime examples of this, Portland, Oregon applied a 20 year "lid" on parking ratios (up to 1995). Thereafter, more flexible ratios were applied, enabling the market to determine supply. San Francisco applied a 7% maximum of floor area to be provided per development in core areas (Willson, 2005).

While Cape Town is not ready to move to parking maximums for the reasons given above, other mechanisms are being sought to encourage more intense development and reduced parking through a base zone for identified centres.

2.10.3.6. Ensure the Interventions Serve the Greater Good, i.e. by Improving the Public Environment and Public Transport

Ringfence municipal parking revenues for improvements to the urban environment, the public transport system, and NMT facilities.

This mechanism has been investigated for Cape Town, but is not politically palatable if it is seen to concentrate resources in the more affluent areas.

2.11. Conclusions

There is much to be learnt from the successes (and failures) in other cities, as long as the context is properly understood. This chapter has highlighted the importance of parking management and provision in order to achieve broader goals of travel behaviour change, support of public transport and NMT, and the greater densification and mix of land uses towards developing more sustainable cities. It provides the valuable insights which Cape Town has also built on, through a small but significant step of reducing parking minimums in well-located areas.

Unfortunately, interventions and experiences of cities in the Global South are largely lacking in the literature. The intention of this dissertation is to help to fill this gap. A greater body of knowledge, and information sharing, needs to be built up to support policy makers, practitioners, and urbanist activists. The following three chapters describe Cape Town's intervention, and measures the impact of this intervention in terms of reduced offstreet parking provision, and the resultant freeing up of land for more productive use.

3. PT AREAS MECHANISM IN CAPE TOWN

3.1. Introduction

This chapter will describe the off-street parking supply intervention which is an offering of reduced parking which has been applied in Cape Town for the last seven years, referred to as “PT areas”. It seems to be unique to Cape Town, and was developed by City officials from both the transport planning and spatial planning disciplines. First the concept is described in the context of public transport provision in Cape Town, then the method for applying it is described and illustrated. This will introduce the reader to the offering, to lay the foundation for the next chapters, on the method for analysing the uptake of the offering, and the results thereof.

3.2. Description of the Public Transport System in Cape Town

The current public transport system is not well integrated institutionally, operationally or logistically, but has evolved a level of physical integration. There are several public transport modes in operation. An historic rail network covers some of the oldest areas of the city. A publically-subsidised bus service provides a broad-reaching service, but with a minimum level of service. A large paratransit service in the form of minibus taxis proves the greatest coverage of service geographically, and temporally, with varying prices. Public transport interchanges have evolved where these services converge on business districts. A short recent history of these services can be found in [Annexure 1](#).

As a result, as well as other factors such as the segregated nature of the city structure, and security fears, there is still a strong reliance on private vehicle use for commuter trips. This is supported by a Development Management Scheme (DMS)¹⁶ (City of Cape Town, 2017) which prescribes minimum parking requirements for all land uses, in an effort to ensure that peak parking demand generated by that land use can be accommodated on-site.

3.3. Description of the Concept

The City of Cape Town has developed a unique mechanism to “bridge the gap” between the current minimum parking requirements in areas which are suitable for transit-oriented development, without enforcing maximum parking standards. According to the CCT, “PT areas invite reduced off-street parking provision in all land uses within demarcated areas, thus supporting public transport through enabling increased development intensity, development viability, and lower private vehicle trip generation.” (City of Cape Town, 2019: i). This description is elaborated on in the same text, with some clarification from the author in the table below:

PT areas	Areas delineated on a map of the municipal area as shown in the public map viewer on the City’s website
invite	These offerings can be taken up voluntarily, they are not compulsory
reduced	They offer reduced parking requirements in identified areas below the standard parking requirements in the Development Management Scheme
off-street parking provision	They only apply to erven which are being developed (they do not apply to onstreet parking supply)
in all land uses	They are not restricted to either “trip attractors” or “trip producers”. However, different reductions are offered for different land uses

¹⁶ More commonly known internationally as a “zoning scheme”

within demarcated areas	They are demarcated along erf boundaries (where possible) approximately within a 400m radius of a transport hub, or an additional 400m from that radius
thus supporting public transport	The intention is to encourage the use of the public transport services to or from these erven
through enabling increased development intensity	Reduced parking requirement enables more productive floor area
development viability	This offering can “tip” the viability of a marginal development to become viable through increased floor area
and lower private vehicle trip generation	Less parking can generate fewer private vehicle trips, thus encouraging public transport use or walking / cycling. This can positively impact congestion and carbon emissions.

The geographical representation of PT areas and standard parking areas is represented below. They occur around a public transport node, usually an intermodal interchange. The PT2 area is bounded by a circle with a radius of 400m from this node, measured from the centroid of the node. A PT1 area may surround the PT2 area, and is bounded by a circle with a radius of 800m from the same centroid. Beyond that is the “Standard” parking area. Not all PT2 areas have these PT1 “haloes” (it is unclear why), and not all PT1 areas have PT2s at their centre, if this was not warranted, as explained in the next section. In theory, based on these dimensions, a PT2 is about 50ha in area; a PT1 “halo” is about 150ha.

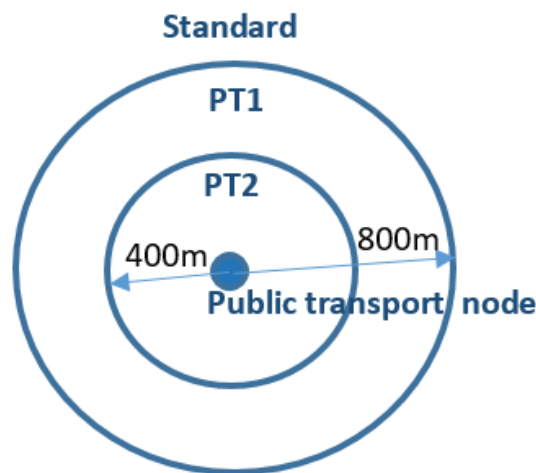


Figure 3-1 Diagrammatic Representation of PT areas

The mechanism was first developed sufficiently so as to be applied geographically in 2014, as an aid to simplifying the land development management process with respect to parking requirements in the DMS. While located in the land use management discipline, it recognises the policy shift to supporting public transport over private transport in areas where public transport exists.

The application of the PT areas requires the DMS. This contains a table of parking requirements for all land use zones, across the three parking areas: Standard, PT1 and PT2. They are defined in the DMS as shown in the adjacent box.

‘Standard areas’: areas with standard parking needs, or where public transport is not specifically promoted or available.

‘PT1 areas’: areas where the use of public transport is promoted, but where the City considers the provision of public transport inadequate or where the use of motor vehicles is limited.

‘PT2 areas’: areas where the use of public transport is promoted and the City considers the provision of public transport good, or where the use of motor vehicles is very limited.

The table under section 138 of the DMS, entitled “Minimum Off-Street Parking Requirements” stipulates the minimum required number of parking spaces for each type of land use for the 3 PT zones, and can be found in [Annexure 2](#) (the 2015 version, and the 2017 update).

3.4. Application of PT areas

The initial application (2014) required a full analysis of all public transport stops which were fixed¹⁷ in space, i.e. rail stations, and the newly-built MyCiTi¹⁸ trunk station “pods”. A tool was developed which ranked the following characteristics of every station in Cape Town according to:

- availability of public transport or areas in which public transport improvements are promoted;
- existing operational quality of public transport (in terms of frequency and capacity);
- the Level of Service (quality) experienced at stations and at precinct level (not available)
- the socio-economic characteristics of the surrounding area (indicated by car ownership levels) (City of Cape Town, 2016: 6).

A total of 156 stations were assessed: 91 qualified for PT2 status, and 65 for PT1 status. This analysis was then workshopped with the CCT officials in the development management field, and the demarcations of the zones around each station were finalised. This went live in 2014. At that stage it was already recognised that this was a first iteration which could be expanded in future. In particular, road-based, mixed traffic public transport was not included: it is understood that this was due to insufficient data on the services, and a lack of permanent stations.

An update of the first iteration was attempted in 2016. It took into account three pressing factors: the identification of number of “catalytic” sites to be developed along TOD principles and thus requiring the PT mechanism; the planning of the next phase of the roll-out of the MyCiTi system; and the success of some of the MyCiTi feeder services, establishing these routes as “high order feeder” routes, warranting the PT mechanism. Five MyCiTi trunk stations which were committed for construction were added in 2018. However, other additions could not be completed because the catalytic sites were reviewed. The high order feeder routes would inform the next iteration which was finalized in 2019, but does not form part of this study.

Another “tweak” was made to the first iteration relating to the actual parking requirements per land use zone. In 2016, the parking requirement in PT2 areas to all land use areas was reduced to zero. This included the CT CBD area, which was covered by an overlay zone rather than a PT area.

The resultant map is shown below, and forms the basis of study for this paper.

¹⁷ This factor is important. As the specific location of the station determined the exact delineation of the PT area, the station had to be a permanent feature at that location.

¹⁸ Cape Town’s bus rapid transport service

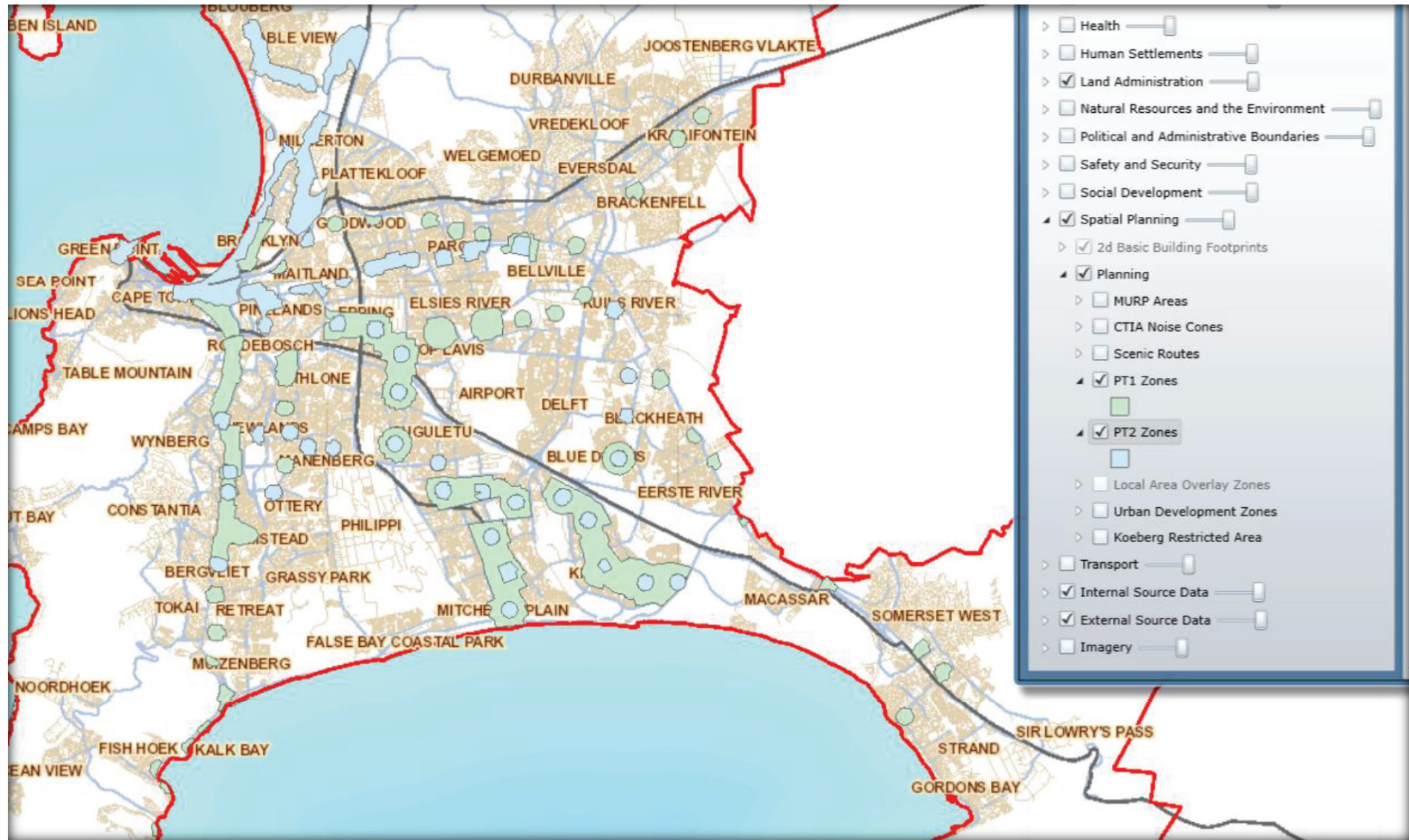


Figure 3-2 The PT Areas Map as of 2019

(Source: City of Cape Town internal CityMap Viewer, accessed 15/08/2019)

3.5. Implications for Land Development

Once the areas were delineated, reduced parking minimums were applied to each land use zone in the DMS. An unpublished study by the City (2015) explored the land development implications of the PT areas for the business zone. The results are clearly illustrated in the diagram below, using the General Business 7 zoning. The dotted line indicates the portion of a development which must be dedicated to parking in the Standard area. The red portion of the right-hand bars show the maximum practical floor factor¹⁹ for productive use. This indicates the additional floor area now available due to the reduced parking requirement. There is a saving of approximately 16% in PT1 areas, and about 33% in PT2 areas.

Parking requirements: impact on bulk & GLA

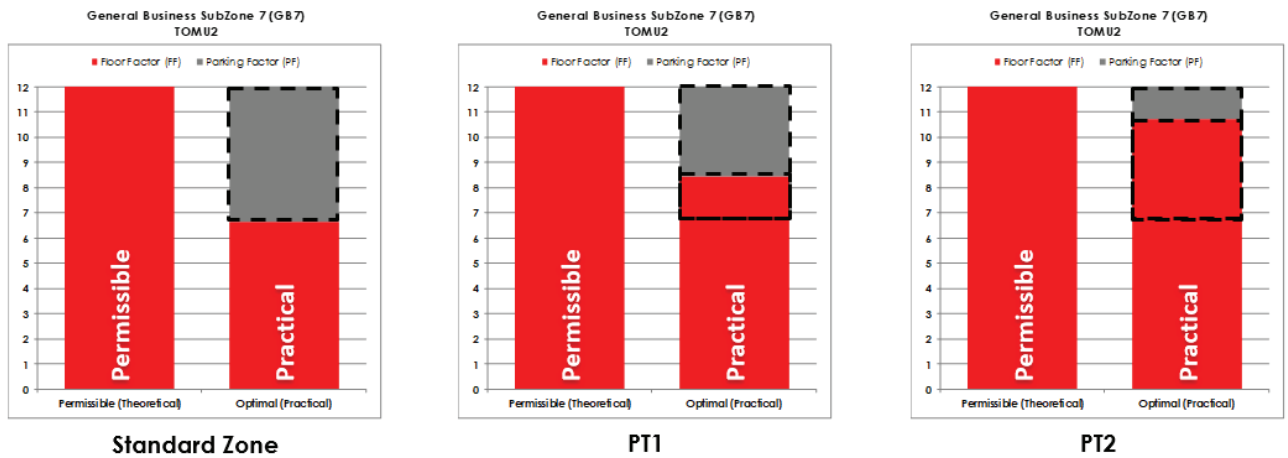


Figure 3-3 Illustration of Additional Floor Factor Gained in PT1 and PT2 Areas

Source: City of Cape Town (unpublished)

Below is a further illustration of the implications of parking provision on the city’s land development pattern. Parking accounts for 10% of developed area of all properties subject to valuations (i.e. it does not include the road network). This is the same as the share for business use, and only surpassed by residential (57%) and industrial (13%) land uses. It is expected that a significant uptake in the PT offerings would reduce the percentage of land developed for parking, in favour of more productive uses.

¹⁹ Defined as “the factor (expressed as a proportion of 1) which is prescribed for the calculation of maximum floor space for a building or buildings permissible on a land unit. If the floor factor is known, the maximum permissible floor space can be calculated by multiplying the floor factor by the area of the land unit” (City of Cape Town, 2017: 78)

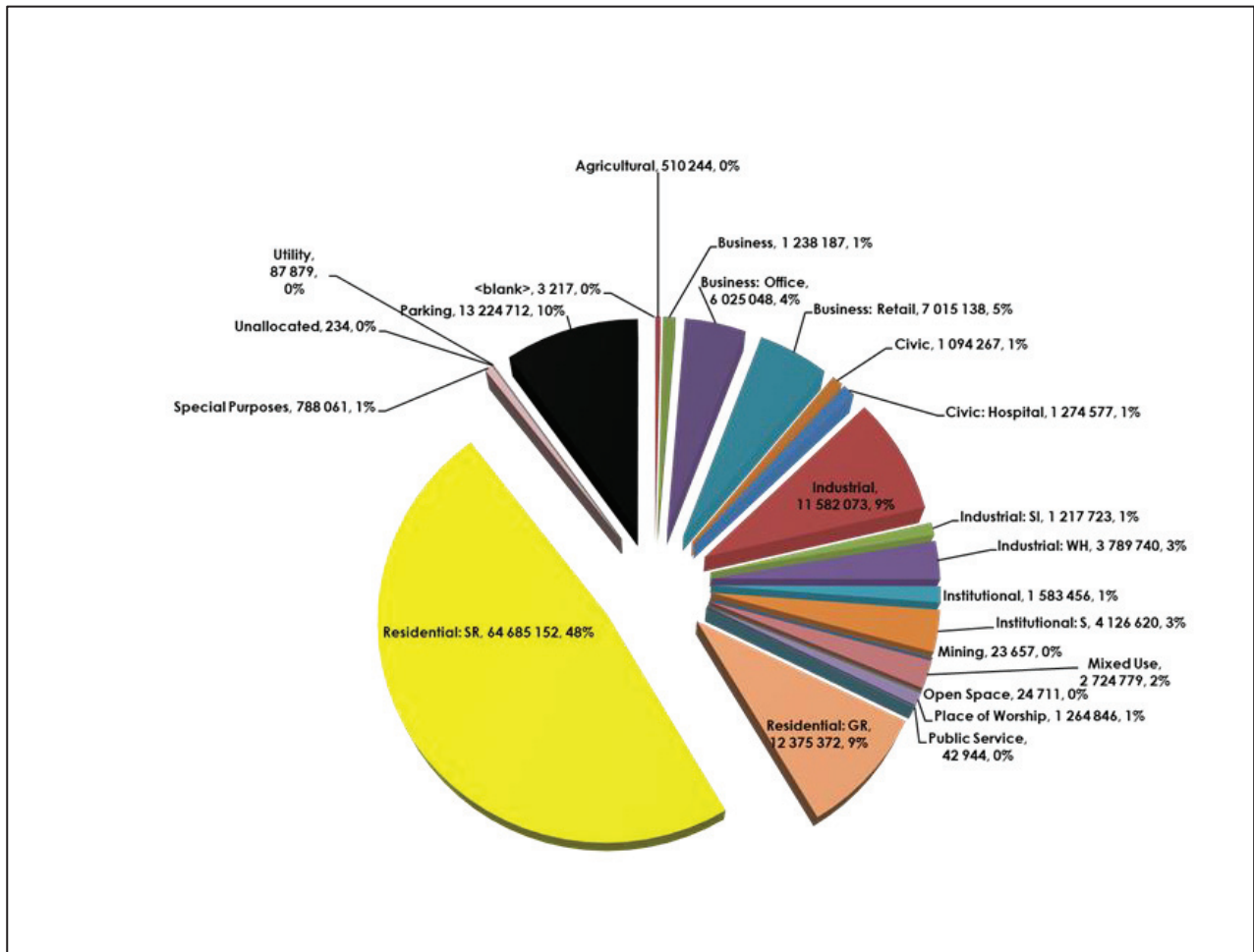


Figure 3-4 Land Use Share of the Metropolitan Area of Cape Town

Source: City of Cape Town (unpublished) based on municipal valuation data (2018)

3.6. Conclusions

The PT areas tool provides clarity and certainty to land developers as to their minimum parking requirements, which is an important informant into the development process. While the mechanism has been developed using a rigorous scientific method, which could be enhanced over time, one of the implicit conditions was that the PT “offering” could not be taken away once it had been applied. This was based on the assumption that the level of service of the public transport services would remain at that level, or be continuously improved. It would be politically unacceptable for the municipality to withdraw land rights, once these had been assigned to the affected properties.

What does not appear to have been considered is how the effectiveness of the tool would be measured over time, either in terms of number of parking bays “saved”; the extent of productive floor area released; the number of trips reduced as a result of the reduced parking supply; or the resultant change in modal split.

The next chapter sets out the method chosen in this research to quantify the impact of the offering, using data obtained from the municipality.

4. RESEARCH METHOD TO ANALYSE THE UPTAKE OF THE PT OFFERING

4.1. Introduction

This chapter sets out the research method including the research design and sampling, the data collection approach and the method of analysis. It outlines the method for sourcing and collating the data, and how challenges were addressed. It also sets out the rationale for the method for presenting the results. As this work is informed by a pilot study of five urban centres which was carried out by the City in 2020, comment is given on the pilot study method, and how it has been adapted, once the role of the author in the monitoring has been described.

4.2. Author's Role in the Research Work

The author is a senior professional in the City of Cape Town's Integrated Transport Planning Branch. In 2017 she was tasked with leading an interdisciplinary team to recommend extending the "ambit" of the PT areas mechanism. She was required to do so without first assessing the uptake or the impact of the current PT mechanism. Only once the extended ambit had been developed and a new iteration recommended, could she turn to assessing the previous iteration.

There was no automated tool to extract any data for the assessment. However, she and her colleagues developed a manual, labour-intensive method. All building plans with parking implications approved during the study period (2014-2019) would be analysed to extract the number of bays provided and required. This would also be compared against the number of bays required had there been no PT area, i.e. the standard parking requirement.

There was no conception of the quantum of data that would be generated per urban centre, as the number of building plan cases was unknown, as was the number of cases which had parking implications. Because of this, and because it was a time-consuming and cumbersome process, the author and her colleague agreed to undertake a pilot study of 5 urban centres only, to test the methodology, produce some interim results, and to learn lessons to improve the methodology if the assessment were to be extended to other PT areas across the city.

The following section describes the pilot project methodology and results because of its importance in informing this study, which is described from Section 4.6 onwards.

4.3. Research Method for the Pilot Project

The author and her colleague's research design, sampling and collection method is described briefly below, as extracted from their report on their pilot project (City of Cape Town, 2021, unpublished). The study was possible because of access to the City's online repository for all building plans.

In essence, they followed a four-step approach of progressively sifting out the relevant cases, as illustrated below:

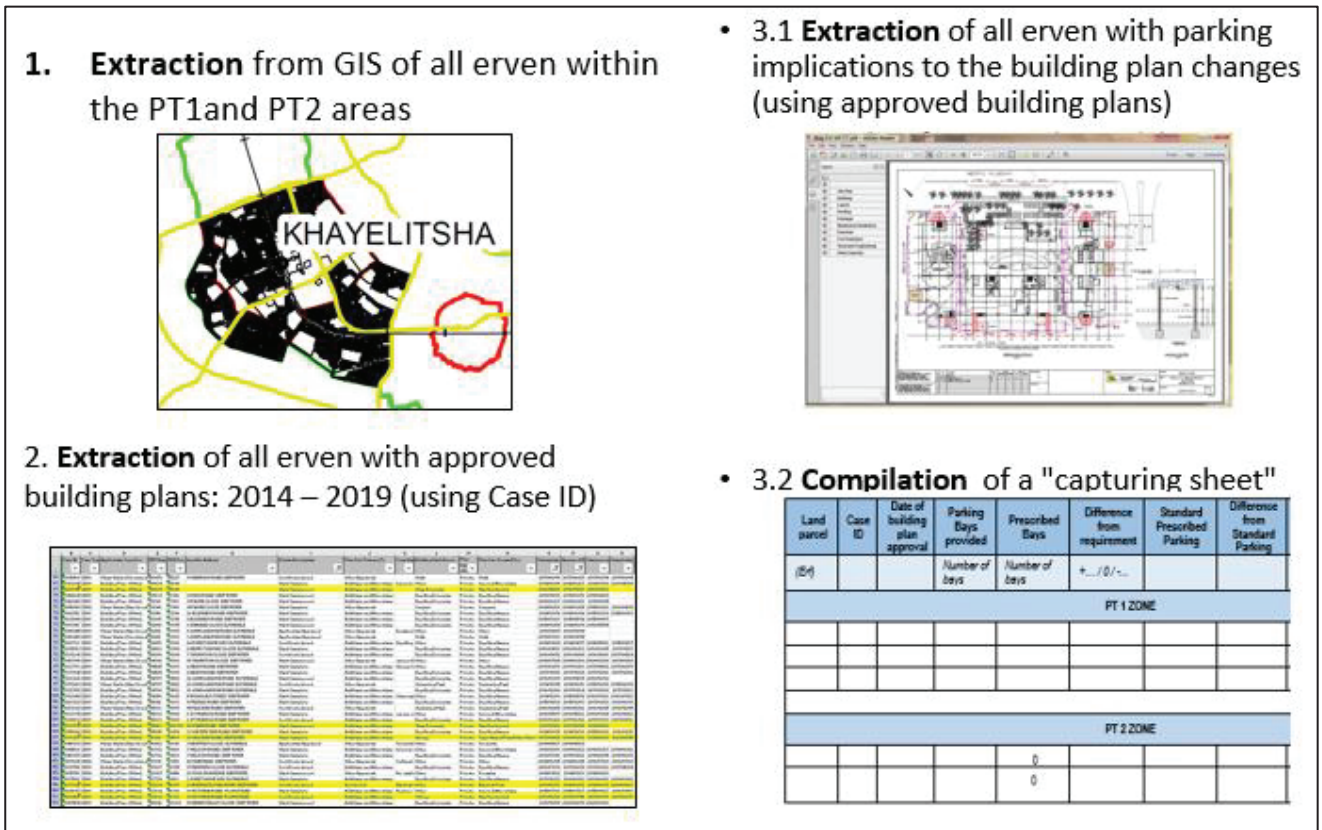


Figure 4-1 Illustration of the Data Extraction and Capture Process for the Pilot Project

4.3.1. Sampling Technique to Identify the Pilot areas: Step 1

As the quantum of the data-set was unknown when embarking on the assessment in 2019, a small sample of areas was chosen which was considered manageable with the internal resources available.

The sampling method for the pilot was to some extent informed by a report (City of Cape Town, 2018b) which was used to inform the City’s approach to delineating and managing on-street parking areas. It categorised the city’s main business districts into three types of “centres”: established, opportunity and emerging centres. The pilot areas were chosen to represent a spread of the type of centres: two established centres (which have high development demand and profit margins); an opportunity centre (with moderate demand and property values), and two emerging centres (with low development demand and marginal profit margins). Each centre had both PT1 and PT2 areas attached to them. They included: Woodstock to Observatory, and Claremont CBD (established centres); Wynberg CBD (an opportunity centre); and Khayelitsha and Mitchells Plain CBDs (emerging centres). Their geographical location and delineation can be seen on the map below.

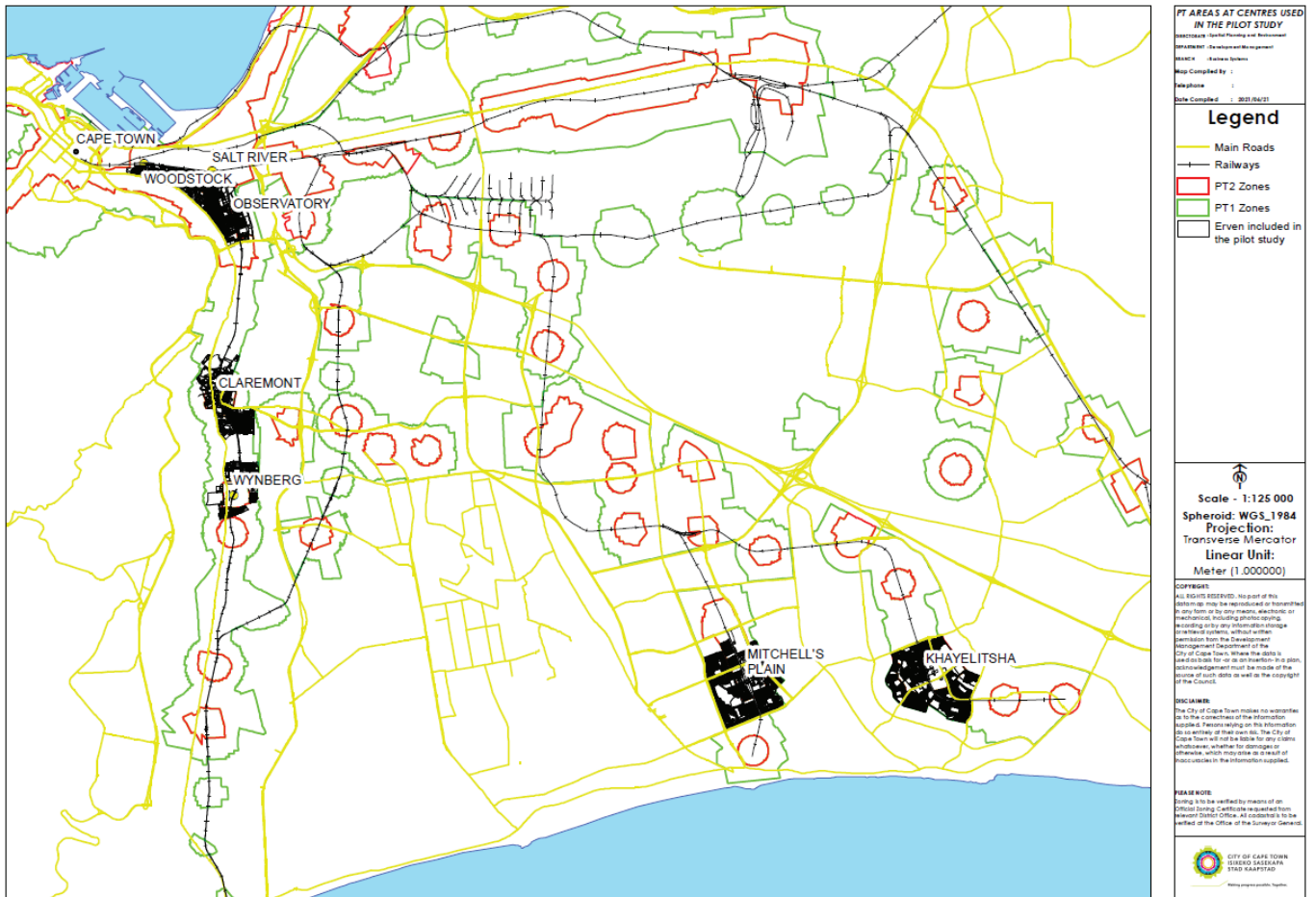


Figure 4-2 Areas Analysed in the Pilot Study
 (Source: City of Cape Town, 2021: 9, unpublished)

4.3.2. Data Collection Approach: Extracting the “Universal” Data: Step 2

Through matching the GIS demarcations of the PT areas within the pilot areas with the cadastral GIS layer, a database of all erven within each PT area could be extracted. This was a relatively simple and technical task: being automated, it left little room for human error. To check this, the extracted erven were highlighted in the map provided (see Figure 4-2).

4.3.3. Data Extraction of All Building Plans: Step 3

According to the report, data was sourced from a repository called the Development Application Management System (DAMS)²⁰, which includes a database of all approved building plans. This was considered to provide the most accurate record, as approved building plans are most likely to be executed (built) soon after approval. A list of all approved plans was extracted for each PT area in each pilot area. The extraction was also limited to the study period of 2014 to 2019 (i.e. from the application date of the PT areas, to before a new iteration was introduced).

4.3.4. Identification of Relevant Building Plans: Step 4.1

The author and her colleague then trawled through this list in order to extract only those records where there were any parking implications associated with each building plan. They referred to the relevant²¹ “Minimum off-street parking requirements” table in the DMS (see Annexure 2; City of Cape Town, 2015; City of Cape Town, 2017; City of Cape Town, 2021: 6) which indicates what triggers

²⁰ DAMS is a digital platform for processing and recording all building plan submissions.

²¹ It was updated at the end of 2016

additional parking requirements, for example, any increase in the number of units, or the GLA (depending on the land use).

The full dataset within each pilot area was used, as it emerged that these data sets were relatively small.

4.3.5. **Compilation of the Capture Sheets: Step 4.2**

All the relevant cases in each PT area in each pilot area were then captured in worksheets called “capturing sheets”. These capturing sheets were then each analysed. An example of a typical capturing sheet is shown below. The actual number of bays provided was extracted from the building plan, and the prescribed number of bays (depending on whether the development fell in a PT1 or PT2 area) was also recorded. The standard prescribed parking was then also calculated, as per the DMS.

Table 4-1 Example of a simplified capturing sheet of the data from the DAMS System

Land parcel	Case ID	Date of building plan approval	Parking Bays provided	Prescribed Bays	Difference from requirement	Standard Prescribed Parking	Difference from Standard Parking	Additional Development Data					Notes
(Erf)			Number of bays	Number of bays	+.../0/-...								
PT 1 ZONE													
PT 2 ZONE													
				0									
				0									

4.3.6. **Method of Analysis**

The report describes the next step. “It was assumed that if a development in a PT area has provided less parking than is required in a standard parking area, then this can be directly attributed to it being located in a PT area (so there are no other factors to attribute the reduced parking provision to. In exceptional cases, in PT1 areas, a departure was successfully applied for, further reducing the parking requirement, which was identified in the analysis of the data).

“In addition, more parking may have been provided than the standard minimum requirement. These different scenarios are illustrated in the diagram below:

Table 4-2 Possible parking provision, and implications

Parking Provision	In PT1 Areas	In PT2 Areas 2014 - 2016	In PT2 Areas 2017 +
1	The minimum parking requirement is considered too low		This confirms the standard minimum requirements
2 Standard Requirement	The standard parking requirement is adhered to		
3	The PT offering has been partly taken up		This confirms the PT offering
4 PT Requirement	The PT offering has been taken up	The PT offering has been taken up	
5	The PT offering has been considered too high, and a departure applied for		n/a
6 Zero	No parking provision is considered necessary		This challenges the PT offering as still too high

“This study will ‘place’ all relevant applications within this table, to give a picture of the quantum of the take-up of the PT offerings, both compared to the standard offering, as well as compared to the PT offerings themselves. For the sake of clarity, each line (1 to 6) in the table above will be called the ‘provision category’ in this paper.” (City of Cape Town, 2021: 6,7).

4.4. Moving From the Pilot Project to the Assessing the Rest of the City

While the pilot study was useful, it was not able to provide any inferences for the rest of the city. It was clear that all the PT areas needed to be assessed, but the capacity of the pilot study colleagues was limited. It was therefore agreed between the author and her Manager, that she would complete the assessment in her capacity as a student, in the form of this dissertation. It was agreed that the City would provide the sanitized data to the author, and that she would analyse the data in order to provide the completed assessment.

4.5. Implications for the Research Method in This Dissertation

The method used in the pilot study proved to be effective in generating accurate results which could be further analysed. It therefore set the basis for a full analysis of all PT areas across the city. However, only the City has access to the building plans, and is not in a position to divulge these for research or other purposes: a position only reinforced by recent application of the Protection of Personal Information Act (Republic of South Africa, 2013).

The City undertook to provide capture sheets for the rest of the PT areas throughout the city, provided that the research results from this paper would be freely available to the City, as the monitoring tool for the effectiveness of their PT areas offering, and hence inform any changes to their approach.

This dissertation was therefore dependent on receiving all sanitized data from the City. This proved to be a challenge, as the work was not prioritized by all the relevant officials, causing delays and the need for multiple briefings and clarifications.

To further protect privacy of any individual developments, only aggregated results will be presented in this paper. This does not derogate from the quality of the findings.

4.6. Research Design for the Analysis of All PT Areas Across the City

This research followed the four-stage data extraction and compilation process described above. However, the capturing sheet was simplified to only include relevant data. The analysis table was also simplified, as described below.

4.7. Sampling and Data Collection Approach (Collection and Recording)

As a full sample was required, all remaining PT areas were numbered, as per the map below). This excluded the existing pilot project areas, and the Cape Town CBD. The Cape Town CBD was analysed separately, as it has had a zero parking requirement for many years, so there was not “standard” parking requirement against which to compare actual provision.

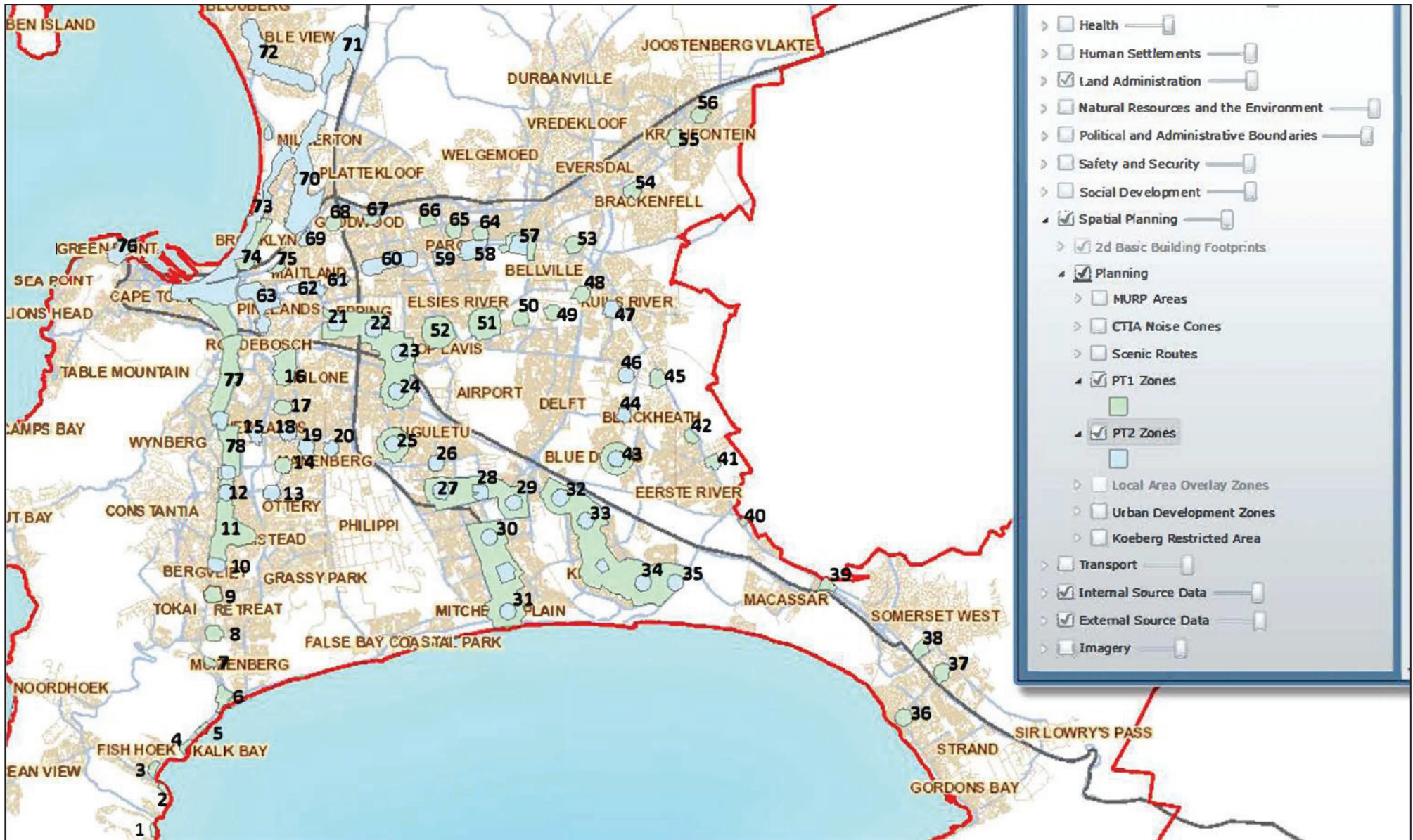


Figure 4-3 Map Used to Generate Data beyond the Pilot Project

A GIS official first extracted a list of all the erven (using their existing, unique property identification keys) in every PT1 and PT 2 area, as per the map above, using the same method as the pilot project.

Each list was then inputted by the City into the DAMS database, creating an extraction of only those building plans which were in that PT area.

This full list of all building plans per PT area was then filtered in order to extract only relevant building plans. These full lists could include any number of approved building plans from a few hundred to 3000, but most plans were not relevant. Filters excluded plans which were not approved, outside of the study period, and which contained minor works such as construction of walls, dwelling extensions, cellphone masts, water tank or gas storage installations. As this still resulted in thousands of plans, all single residential building plans were also excluded. This resulted in no findings related to the over or underprovision of parking for single residential properties.

Data was grouped into a capturing sheet for each PT area. This required the creation of four data sets: for PT1 areas, for PT2 areas, and for those areas which included both a PT1 and a PT2 area: both a PT1 and a PT2 capturing sheet area. This resulted in the following number of capturing sheets, once the pilot project data was added to the rest of the data:

Table 4-3 The Four Data Sets of the PT Areas

Type of PT Area	Number of Areas
PT1	38
PT2	21
PT2 areas with PT1 “haloes”	16
PT1 “haloes” (some around more than 1 PT2)	7
TOTAL	82

Two colleagues undertook the data collection. The author, in her capacity as a City official, oversaw the data collection method, as described above. In addition, the data gatherers cross-checked each other’s work for accuracy and omissions. The author is thus confident that the data received is of sufficient quality to provide accurate results to the research question.

All data was stored on a shared server which was only accessible to the author and her two colleagues who were undertaking the data collection.

4.8. Method of Analysis

The same method of analysis was applied as that used in the pilot project (as developed by the author and her colleague). The number of parking bays provided per building plan were compared to the PT offering, as well as the standard requirement for each development. These were aggregated for each of the PT areas.

4.9. Limitations of the Research Method

Several limitations were experienced with the data collection and analysis.

- As mentioned above, due to the high volume of cases in many areas, single residential plans were not included, as each single residential plan would potentially show an over- or under-supply of only 1 or 2 parking bays, and thus not highly significant. It is not known if there were many cases like this. This would be more significant in PT areas with large single residential areas, which are predominantly in PT1 areas of lower car ownership, eg Lentegeur to Kapteinsklip.

- In a few cases, sufficient data was not available on the plans, and the cases had to be excluded. While the cases would have been relevant, excluding them is unlikely to have significantly shifted the trends which have emerged.
- During the data gathering process, it was noticed that there was more than one case (building plan submission) during the study period for some erven. However, only the latest building plans were extracted: any earlier building plans (approved after 2014) were not captured. This would have resulted in a relevant case being excluded if earlier plans had resulted in significant changes to the parking provision. This was managed by recording the parking for the full development, where available.
- The author, in her capacity as an official, had to estimate the “standard parking requirement” using the DMS which was relevant at the time. While in most cases this was simple to apply, this may have resulted in small inaccuracies for more complex, mixed use developments.
- Some areas produced very small samples for the capturing sheets (with 31 areas containing zero cases with more than 1 parking bay change), as illustrated in the graph below. This could result in a skewing of the results when analysed at an individual PT area level.

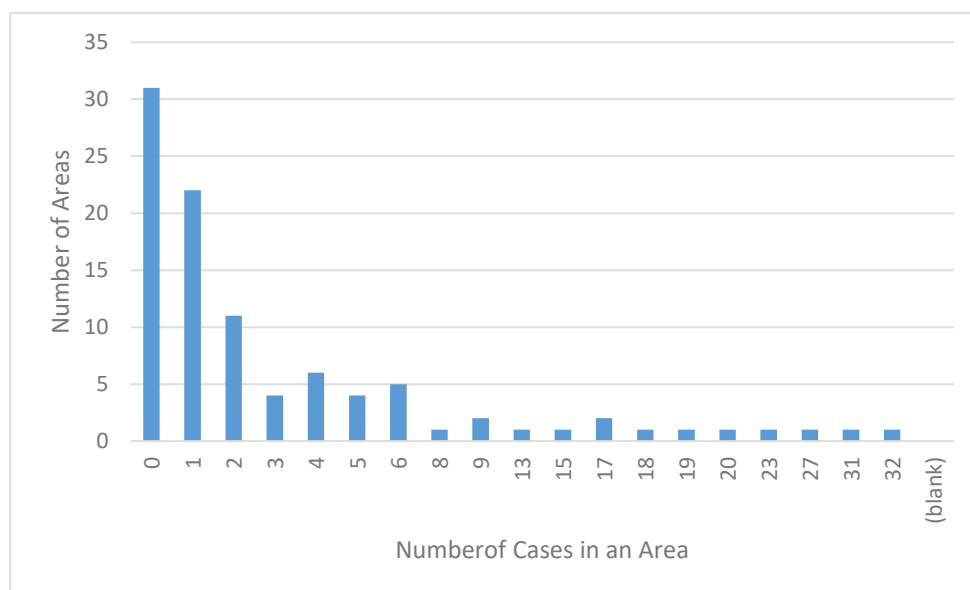


Figure 4-4 Aggregate Number of Areas by Number of Cases

- Despite efforts to cross-check work, an element of human error could have occurred and some relevant cases may have been missed.
- Century City and the V&A Waterfront, while both are in PT2 areas which require zero parking, have parking specifications related to their spatial development frameworks and related precinct plans. Both also rely on shared parking garages to meet the parking requirements of their parking “budgets”. However, some developments within these two precincts could be analysed here, and the V&A Waterfront PT2 area also includes properties in Greenpoint.
- Many of the parking calculations resulted in fractions of a bay. While in reality these would either have been rounded up or down, when adding lists of results in Excel, these fractions will all be added. This could result in slightly more additional bays in the total in some areas.

4.10. Conclusions

The pilot project undertaken by the municipality was helpful in indicating the variety in the number and nature of applicable cases to be analysed, and in refining the methodology for the analysis. However, it was too small to make any definitive statements on the impact of the PT offering.

The research method was successfully applied to all the other PT areas across the city, however, the Cape Town CBD required a different type of analysis, as a zero parking requirement had been in place for many years.

The next chapter will detail the analysis of the uptake of the PT offering across the municipal area, so that conclusions can be drawn with greater confidence.

5. SURVEY RESULTS AND CONCLUSIONS ON THE TAKE-UP OF THE PT OFFERING

5.1. Introduction

In this chapter, the results of the monitoring of the uptake of the offering are presented in aggregate because of the generally small sample sizes. First, the quantum of the data gathered is examined. Then, the results per the four PT area types are described, followed by the Cape Town CBD results. Lastly, the implications of the results in terms of land use intensification are discussed, by considering what the implication of the number of bays “saved” is for TOD.

5.2. Quantum of Data Gathered

The table below lists each of the 95 PT areas (the pilot project areas plus the remaining areas), and shows the number of relevant cases found in each. The small number of cases in most areas was surprising, considering the large “universal” population size for most areas. The fact that only developments with parking implications greater than 1 were extracted may influence this. For ease of reference, the number of cases greater than zero is indicated in grey in on the table, and PT2 areas are highlighted in blue; where a PT1 “halo” spans several PT2 areas, that is also indicated in grey. Pilot project areas are numbered in red.

Table 5-1 Tabulation of the Quantum of Data Gathered

PT Area No.	PT Area Name	PT	No of Relevant Cases
1	Glencairn	PT1	0
2	Sunny Clove	PT1	0
3	Fish Hoek	PT1	6
4	Kalk Bay	PT1	0
5	St James	PT1	0
6	False Bay	PT1	2
7	Lakeside	PT1	1
8	Steenberg	PT1	0
9	Retreat	PT1	0
10	Heathfield	PT2	0
11	Plumstead	PT1	13
12	Wittebome	PT2	1
13	Ottery	PT2	1
14	Wetton	PT1	4
15	Kenilworth	PT2	0
16	Athlone	PT1	1
17	Crawford	PT1	2
18	Lansdowne	PT2	5
19	Pinati	PT2	1
20	Hanover Park	PT2	0
21	Langa	PT2	3
22	Bonteheuwel	PT2	5
23	Netreg	PT2	0
24	Heideveld	PT2	2
21-24	Langa-Heid	PT1	15

PT Area No.	PT Area Name	PT	No of Relevant Cases
25	Nyanga Junction	PT2	0
	Nyanga Junction	PT1	1
26	Emms Rd	PT2	0
27	Philippi	PT2	0
28	Stock Road	PT2	1
29	Mandalay	PT2	0
27-29	Philippi-Mandalay	PT1	6
30	Lentegeur	PT2	1
30A	Mitchells Plain CBD	PT2	0
31	Kapteinsklip	PT2	0
30-31	Lentegeur-Kapteinsklip	PT1	1
32	Nolungile	PT2	1
33	Nonkqubela	PT2	1
33A	Khayelitsha CBD	PT2	2
34	Kuyasa	PT2	0
35	Chris Hani	PT2	0
32-35	Nolungile –Chris Hani	PT1	8
36	Strand	PT1	3
37	Van Der Stel	PT1	1
38	Somerset West	PT1	4
39	Firgrove	PT1	0
40	Faure	PT1	0
41	Eerste River	PT1	2
42	Melton Rose	PT1	0
43	Mfuleni	PT2	1
43	Mfuleni	PT1	1
44	Blue Downs	PT2	1
45	Blackheath	PT1	0
46	Blackheath Industria	PT2	9
47	Kuilsriver	PT2	1
48	Sarepta	PT1	1
49	Pentech	PT1	1
50	Unibell	PT1	4
51	Belhar	PT1	6
52	Lavistown	PT1	0
53	Stikland	PT1	2
54	Brackenfell	PT1	1
55	Eikenfontein	PT1	0
56	Kraaifontein	PT1	2
57	Bellville	PT2	3
57	Bellville	PT1	2
58	Tygerberg	PT2	1
59	Parow	PT2	2
60	Goodwood	PT2	3
61	Thornton	PT2	0
62	Mutual/ Woltemade	PT2	0
63	Koeberg/ Ndebeni/ Pinelands	PT2	9
64	Oosterzee	PT1	0
65	Avondale	PT1	2

PT Area No.	PT Area Name	PT	No of Relevant Cases
66	De Grendel	PT1	1
67	Monte Vista	PT1	0
68	Acacia Park	PT1	0
69	Century (Kensington side)	PT2	0
70	Century City	PT2	23
70A	Milnerton	PT2	17
71	Killarney/ Dunoon	PT2	17
72	Table View	PT2	31
73	Paarden Eiland area	PT2	18
74	Brooklyn	PT1	4
75	Kentemade	PT1	2
76	V&A and Greenpoint	PT2	6
77	Rondebosch	PT1	32
78A	Claremont	PT1	6
	Claremont	PT2	5
78	Harfield	PT1	19
79	Wynberg	PT1	5
	Wynberg	PT2	1
80	Woodstock to Observatory	PT1	27
	Woodstock to Observatory	PT2	6
81	Cape Town CBD	Zero parking overlay	20

The small number of cases does indicate a low level of significant investment in many of the PT areas. Focusing on the areas with the greatest number of cases, each area has a unique development potential:

- Woodstock to Observatory (33): mixed use of office and residential as part of a gentrification process
- Rondebosch (32): developments here predominantly serve the student residential demand
- Table View (31): middle income flats development
- Century City (23): mixed use offices, commercial and high income residential development
- Cape Town CBD (20): office and commercial redevelopment, with some residential.

The more important results are however the parking provision in these cases, which is examined in the next section.

5.3. Parking Provision in Relation to the PT Offerings and the Standard Requirements

The tables below show the aggregated parking provision for all cases in a PT area. Firstly, the number of cases analysed is shown, then the total number of bays required for that PT area. Total bay provision under three categories is then given: the number of bays in developments which underprovided parking; those which provided exactly what was required; and then those which overprovided. Then the more darkly shaded column shows the total overprovision or underprovision (a negative number) in that PT area. The same method is used to compare provision against the standard (Std) parking requirement. The last column therefore shows the total overprovision or underprovision (a negative number) if there had been no PT area demarcation.

The first table shows all PT2 areas, the second PT1 areas, and the third those areas which have both a PT2 and a PT1 area attached to them. Finally, data from the Cape Town CBD is represented in a table and graph.

Table 5-2 PT2 Areas

PT area Number	PT area Name	No of cases	Required	Under-provided	Matched required	Over-provided	Total Difference		Std Required	Under-provided	Matched required	Over-provided	Total Difference
				total no. of bays	total no. of bays	total no. of bays	total provided - total required			total no. of bays	total no. of bays	total no. of bays	total provided - total required
12	Wittebome	1	0		0		0		4	0			-4
13	Ottery	1	0			9	9		12	9			-3
18	Lansdowne	5	44			95	51		162	55		40	-67
19	Pinati	1	0		0		0		7	0			-7
44	Blue Downs	1	0			30	30		22			30	8
46	Blackheath Ind	9	241	68	32	157	16		276	106	0	151	-19
47	Kuilsriver	1	0			4	4		4		4		0
58	Tygerberg	1	0			300	300		952	300			-652
59	Parow	2	16			57	41		236	57			-179
60	Goodwood	3	3	2		112	111		417	112		2	-303
63	Koebg_Ndab_PInd	9	318		65	378	125		683	302	65	76	-240
70	Century City	23	1017	113	109	3407	2612		3861	1514	109	2006	-232
70A	Milnerton	17	376	27	8	1870	1529		2292	840	37	1028	-387
73	Paarden Eiland	18	183	0	29	209	55		419	196	9	33	-181
71	Killarney Dunoon	17	435	114	146	255	80		788	376	13	126	-273
72	Table View	31	142			595	453		929	517		78	-334
76	V&A Greenpoint	6	0			213	213		217	147	6	60	-4
	TOTAL	144	2775	324	389	7691	5629		11281	4531	243	3630	-2877

Table 5-3 PT1 Areas

PT area Number	PT area Name	No of cases	Required	Under-provided	Matched required	Over-provided	Total Difference		Std Required	Under-provided	Matched required	Over-provided	Total Difference
				total no. of bays	total no. of bays	total no. of bays	total provided - total required			total no. of bays	total no. of bays	total no. of bays	total provided - total required
3	Fishhoek	6	84	5	24	10	-45		143	29	10		-104
6	False Bay	2	89	29			-60		143	29			-114
7	Lakeside	1	34			76	42		61.103			76	15
11	Plumstead	13	393	21	82	468	178		706	486		85	-135
14	Wetton	4	42	5	13	45	21		49	18	6	39	14
16	Athlone	1	11	10			-1		18	10			-8
17	Crawford	2	22	15			-7		40	15			-25
36	Strand	3	52	5		75	28		79	11		69	1
37	Van der Stel	1	14			24	10		22			24	2
38	Somerset West	4	48	1	29	18	0		62	30		18	-14
41	Eersteriver	2	14	4			-10		24	4			-20
48	Sarepta	1	93			108	15		108		108		0
49	Pentech	1	368			385	17		368			385	17
50	Unibell	4	1631	725			-906		2608	725			-1883
51	Belhar	6	1089	0	3	1448	362		1347	0	3	1448	104
53	Stikland	2	16	11		25	20		24	11		25	12
54	Brackenfell	1	3			4	1		3			4	1
56	Kraaifontein	2	50		20	37	7		80	57			-23
65	Avondale	2	29	10		10	-9		39	10	10		-19
66	De Grendel	1	8		8		0		8		8		0
74	Brooklyn	4	90	52	26		-12		143	78			-65
75	Kentemade	2	24	11	8		-5		33	19			-14
77	Rondebosch	32	1446	382	231	741	-92		2342	1040	2	312	-988
78	Harfield	19	630	134	20	536	60		998		641	49	-308
	TOTAL	116	6280	1420	464	4010	-386		9448	2572	788	2534	-3554

Table 5-4 PT2 Areas with PT1 "Haloes"

PT area Number	PT area Name	No of cases	Required	Under-provided	Matched required	Over-provided	Total Difference		Std Required	Under-provided	Matched required	Over-provided	Total Difference
				total no. of bays	total no. of bays	total no. of bays	total provided - total required			total no. of bays	total no. of bays	total no. of bays	total provided - total required
21-24 PT1	Langa - Heideveld	16	625	88		790	253		810	417		461	68
21 PT2	Langa	3	63		12	76	25		87	59	12	17	1
22 PT2	Bonteheuwel	5	358	191		71	-96		427	190		71	-166
23 PT2	Netreg	0					0						0
24 PT2	Heideveld	2	0			48	48		62	48			-14
25 PT1	Nyanga Junction	1	11			15	4		15		15		0
25 PT2	Nyanga Junction	0					0						0
27-29 PT1	Philippi - Mandalay	6	178	109		23	-46		200	109		23	-68
27 PT2	Philippi	0					0						0
28 PT2	Stock Rd	1	30	23			-7		34	23			-11
29 PT2	Mandalay	0					0						0
							0						0
30-31 PT1	Lentegeur - Kapteinsklip	1	51	32			-19		82	32			-50
30 PT2	Lentegeur	1	1	0			-1		3	0			-3
	Mitchells Plain TC	0					0						0
31 PT2	Kapteinsklip	0					0						0
32-35 PT1	Nolungile - Chris Hani	8	190	102		12	-76		223	102		12	-109
32 PT2	Nolungile	1	0		0		0		16	0			-16

PT area Number	PT area Name	No of cases	Required	Under-provided	Matched required	Over-provided	Total Difference		Std Required	Under-provided	Matched required	Over-provided	Total Difference
33 PT2	Nonkqubela	1	18			23	5		30	23			-7
	Khayelitsha CBD	2	52		52	6	6		178	58			-120
34 PT2	Kuyasa	0					0						0
35 PT2	Chris Hani	0					0						0
43 PT1	Mfuleni	1	14			17	3		14			17	3
43 PT2	Mfuleni	1	3			8	5		8		8		0
57 PT1	Bellville CBD	2	21	0		14	-7		30	0		14	-16
57 PT2	Bellville CBD	3	9	0	0		-9		191	0			-191
78A PT1	Claremont CBD	4	1584	855		598	-131		1846	1453			-393
78A PT2	Claremont CBD	5	158			740	582		978	517		223	-238
78B PT1	Wynberg CBD	5	382	206		32	-144		615	206	32		-377
78B PT2	Wynberg CBD	1	34			35	1		67	35			-32
81 PT1	Woodstock – Observatory	27	2161	532	349	1320	40		3165	1865	5	331	-964
81 PT2	Woodstock – Observatory	6	680		675	462	457		1787	1003	117	17	-650
	TOTAL	103	6623	2138	1088	4290	893		10868	6140	929	1186	-3353

Below is a useful summary table in which all PT2 areas and all PT1 areas have been aggregated:

PT Area Type	No of cases	Required	Under-provided	Matched required	Over-provided	Total Difference		Standard Required	Under-provided	Matched required	Over-provided	Total Difference
PT2	178	4 181	536	1 130	9 160	7 320		15 149	6 487	382	3 956	-4 324
PT1	187	11 497	3 344	813	6 831	-509		16 448	6 756	840	3 392	-5 460

5.3.1. Results for the PT2 areas

5.3.1.1. *Provision in Relation to the PT offering*

For all the PT2 areas, 5 629 bays were provided above the PT2 offerings: this was a three-fold overprovision. 92% of all parking provision was in developments which overprovided. However, there were examples of areas with an underprovision below the PT2 offerings, totaling 324 bays. Only in Wittebome and Pinati was the actual provision the same as the PT2 offering. There was also one case where 96 bays in a shopping centre carpark were replaced by a futsal (mini-soccer) facility.

While this overprovision seems large, it is significant to note that the total PT2 offering for all the areas was only 25% of the standard requirement.

5.3.1.2. *Provision in Relation to the Standard Requirement*

While most of the areas showed a tendency to overprovide against the PT2 offerings, they all underprovided against the standard requirements (except for a government building in Blue Downs). In total, this underprovision was 2 877 bays. However, 43% of all provision was in developments which overprovided, while 54% of all provision was in developments which underprovided.

5.3.1.3. *Number of Bays "Saved" by the PT Offering*

In total, in the 17 areas, 2877 bays were "saved" through the PT offering, plus 96 lost through the redevelopment of a portion of the shopping centre parking for recreational purposes.

5.3.1.4. *Impact on Land Use Intensification*

Conservatively estimating that each bay is approximately 5 x 2.5m in size, and the average circulation space needed to access it is about another 50% of this size, then each bay "consumes" 18.75m² of land (or potential floor space).²² Hence, the total land saving in these PT2 areas was at least 53 944m², or 5.39 hectares.

5.3.2. Results for the PT1 Areas

5.3.2.1. *Provision in Relation to the PT Offering*

For all the PT1 areas, 386 fewer bays were provided than the PT1 offerings: this was a 6% underprovision compared to the requirements. This was largely due to a massive underprovision at Unibell totaling 725 bays, where student accommodation was underprovided in all four developments by 906 bays. This offset the overprovision in Belhar of 362 bays – an industrial area.

Sixty-eight percent of all parking provision was in developments which overprovided, with only 24% of all parking provision being in developments which underprovided. In development requiring may parking bays, most overprovided (excepting Unibell). While 15 developments in Rondebosch underprovided, 12 overprovided. This could be an indication of the mix of development for both students (with low car ownership levels), and private developments.

The difference between the total PT1 offering and the standard requirement is far less than for PT2: the PT1 offering is 66% of the standard requirement.

5.3.2.2. *Provision in Relation to the Standard Requirement*

In total, there was an underprovision of 3 554 bays in all these PT1 areas. As with the PT2 areas, most of the areas showed a tendency to overprovide against the PT1 offerings. However, they did not all underprovide against the standard requirements. Ten areas underprovided, all by 14 or

²² The same assumptions were made in the pilot study

more bays. Those that overprovided did so by a small margin, except Belhar (an industrial area) which overprovided by 7%. 44% of bays were in developments which overprovided, and 44% were in developments which underprovided (with the remainder actually matching the standard PT offering).

Here, both Unibell and Rondebosch significantly underprovided a nett total of 2 871 bays.

5.3.2.3. Number of Bays “Saved” by the PT Offering

In total, for the 24 areas, at least 3 554 bays were “saved” through the PT1 offering, as well as through departures over and above this in some cases (evidenced by provision below the PT1 offerings).

5.3.2.4. Impact on Land Use Intensification

Conservatively estimating that each bay “consumes” approximately 18.75m² of land (or air rights), the total land saving in these PT1 areas was at least 66 638m², or 66,6 hectares.

5.3.3. Results for the Areas with Both PT1 and PT2 Areas: the PT2 Centres

5.3.3.1. Provision in Relation to the PT Offering

For all the PT2 areas, 1 691 bays were provided above the PT2 offerings: this was an overprovision by a factor of 1.7. Sixty-one percent of all parking provision was in developments which overprovided, totaling 1 469 bays. A minority of areas matched the PT offering, except in Woodstock to Observatory, where 675 bays were in developments where the provision matched. There were only four areas with an underprovision below the PT2 offering, totaling 214 bays. Claremont CBD is another outlier in this sample: it overprovided 740 bays, with a nett overprovision of 582 bays. A sports stadium and a large private hospital may have helped to skew these results.

While this overprovision against the PT2 requirement seems large, it is significant to note that the total PT2 requirement for all the areas was only 36% of the standard requirement.

5.3.3.2. Provision in Relation to the Standard Requirement

As with the stand-alone PT2 areas, while most of the areas showed a tendency to overprovide against the PT2 offerings, there was a nett underprovision against the standard requirements of 1 447 bays. Eighty-one percent of all provision was in developments which underprovided. Bellville requires special noting here. While there was little relevant development here (only 3 cases), zero parking was provided in all three, resulting in an underprovision of 191 bays against the standard requirements. All three developments were for student accommodation. The vast majority of bays provided in Woodstock to Observatory were also part of an underprovision (88%).

5.3.3.3. Number of Bays “Saved” by the PT Offering

Woodstock to Observatory is noticeable in the total size of developments there: 1 127 bays were provide to support only six developments – an average of 188 bays per development. Despite this, in total, in the 21 areas, 1 447 bays were “saved” through the PT offering.

5.3.3.4. Impact on Land Use Intensification

Using the same assumptions as above, it can be conservatively estimated that the total land saving in these PT2 areas was at least 27 131m², or 2.7 hectares.

5.3.4. Results for the Areas with Both PT1 and PT2 Areas: the PT1 “Haloes”

5.3.4.1. *Provision in Relation to the PT Offering*

For all the PT1 “halo” areas, 123 fewer bays were provided than the PT1 offerings: this was a 2% underprovision compared to the standard requirements (this is small, as with the other PT1 areas). This was largely due to a significant underprovision at Claremont resulting in a nett underprovision of 131 bays there, and in Wynberg with a nett underprovision of 144. This was countered to some extent by 790 bays being provided in developments which overprovided in the Langa area (the relevant cases being in Epping Industria).

Fifty-five percent of all parking provision was in developments which overprovided, with only 38% of all parking provision being in developments which underprovided.

Again, the difference between the total PT1 offering and the standard requirement is far less than for PT2: the PT1 offering is 75% of the standard requirement.

5.3.4.2. *Provision in Relation to the Standard Requirement*

There was a total nett underprovision of 1 906 bays against the standard requirements. 82% of all bays were in developments which underprovided against the standard requirements. All the bays provided in Claremont (1 453) were in developments with an underprovision. Woodstock to Observatory mainly provided in developments which underprovided (1 865), with 331 bays provided in developments which overprovided. The Langa to Heideveld “halo” experienced a significant number of bays in developments which both underprovided (417), and overprovided (461).

5.3.4.3. *Number of Bays “Saved” by the PT Offering*

A nett number of 1 906 bays were “saved” through the PT offering here.

5.3.4.4. *Impact on Land Use Intensification*

Using the same assumptions as above, it can be conservatively estimated that the total land saving in these PT1 areas was at least 35 738m², or 3.6 hectares.

5.4. Summary Results for All PT2 Areas

As the results for the PT2 areas which are stand-alone, and those which are surrounded by PT1 “haloes” are similar, some common results can be drawn:

- Comparing the actual provision against the PT2 offering, there was a general significant overprovision in all the PT2 areas: this was more muted in the PT2 areas with PT1 haloes in terms of both the number of bays in developments which underprovided, as well as the factor of underprovision.
- In both types of PT2 areas, the PT2 offering was significantly lower than the standard requirement, at 28%.
- There was significant underprovision against the standard requirements.
- Major centres such as Woodstock to Observatory, Claremont and Bellville were “outliers” in this set. Woodstock to Observatory was the largest sample, with the majority of developments matching the PT2 offering, and largely underproviding against the standard requirement. Claremont contained developments which significantly overprovided against the PT2 offering, as well as developments which largely underprovided against the standard requirement, as did Langa and Bonteheuwel on a smaller scale. Bellville provided no parking in its 3 developments.
- In total, 4 324 bays were saved in all the PT2 areas.
- This equates to 8 1075m² of developable land “saved” for more productive land uses.
- There is a strong correlation between the parking provision and the standard requirement, as shown in the graph below.

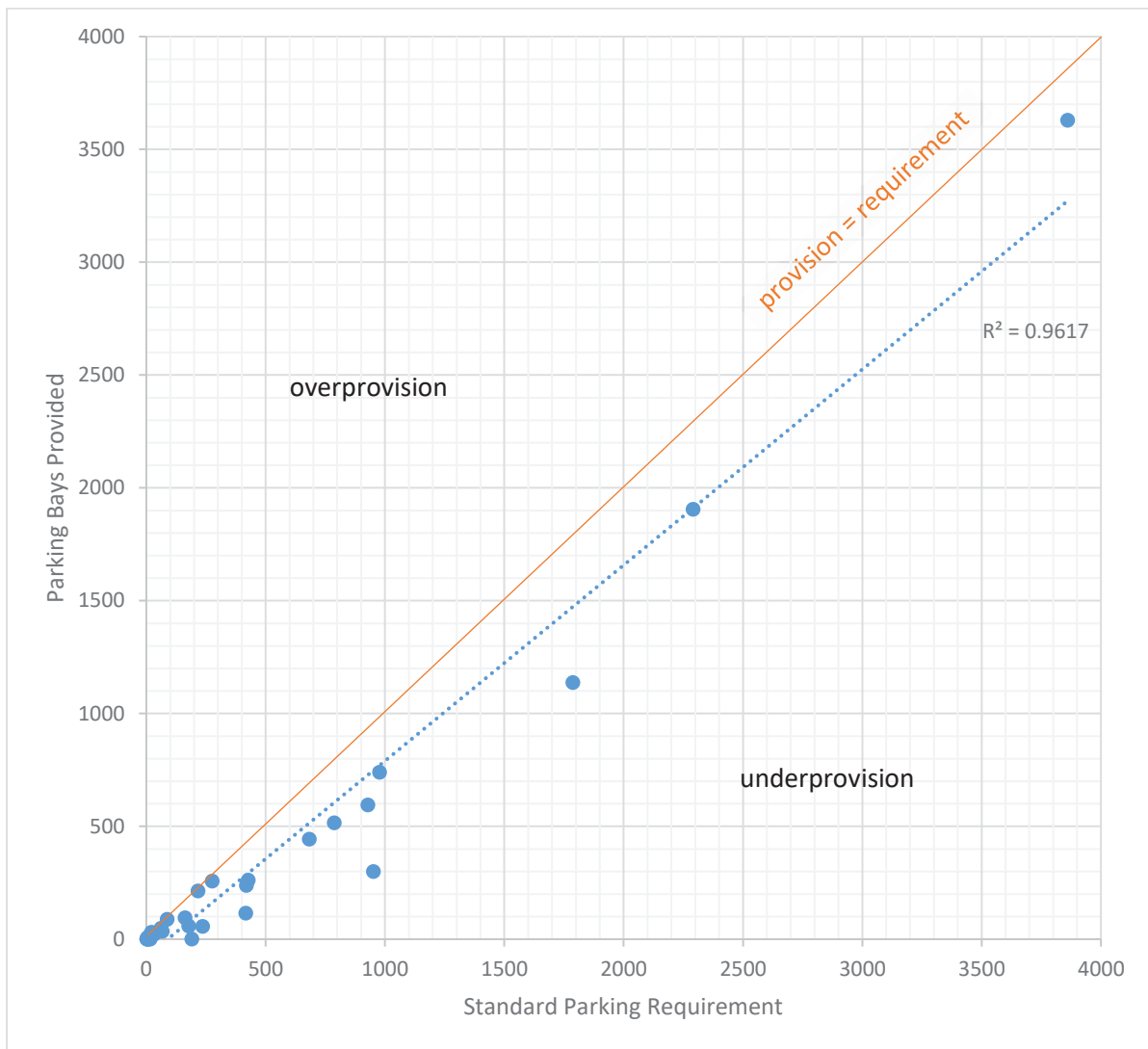


Figure 5-1 Relationship Between Provision and Standard Requirement in PT2 Areas

5.5. Summary Results for All PT1 Areas

As the results for the PT1 areas which are stand-alone, and those which are PT1 “haloes” are similar, some common results can be drawn:

- There was a general underprovision in all the PT1 areas, even against the PT1 offering: this was more muted in the PT1 areas with PT1 haloes in terms of the percentage of underprovision (2%, versus 6%).
- Despite this, the majority of all parking provision was in developments which overprovided.
- Results were influenced by two big centres: Woodstock to Observatory, and Claremont, as well as significant student accommodation provided at Unibell.
- The majority of areas underprovided against the standard requirement. While the quantum of bays is greater in the PT1 stand-alone areas, the trend of underprovision was stronger in the PT1 “halo” areas. Unibell and Claremont underprovided in all their developments. Rondebosch, Woodstock to Observatory, and Langa to Heideveld had more mixed responses.
- In total, 5 460 bays were saved in all the PT1 areas.
- This equates to 102 375m² of developable land “saved” for more productive land uses.
- There is a strong correlation between the provision and the standard requirement, as shown in the graph below.

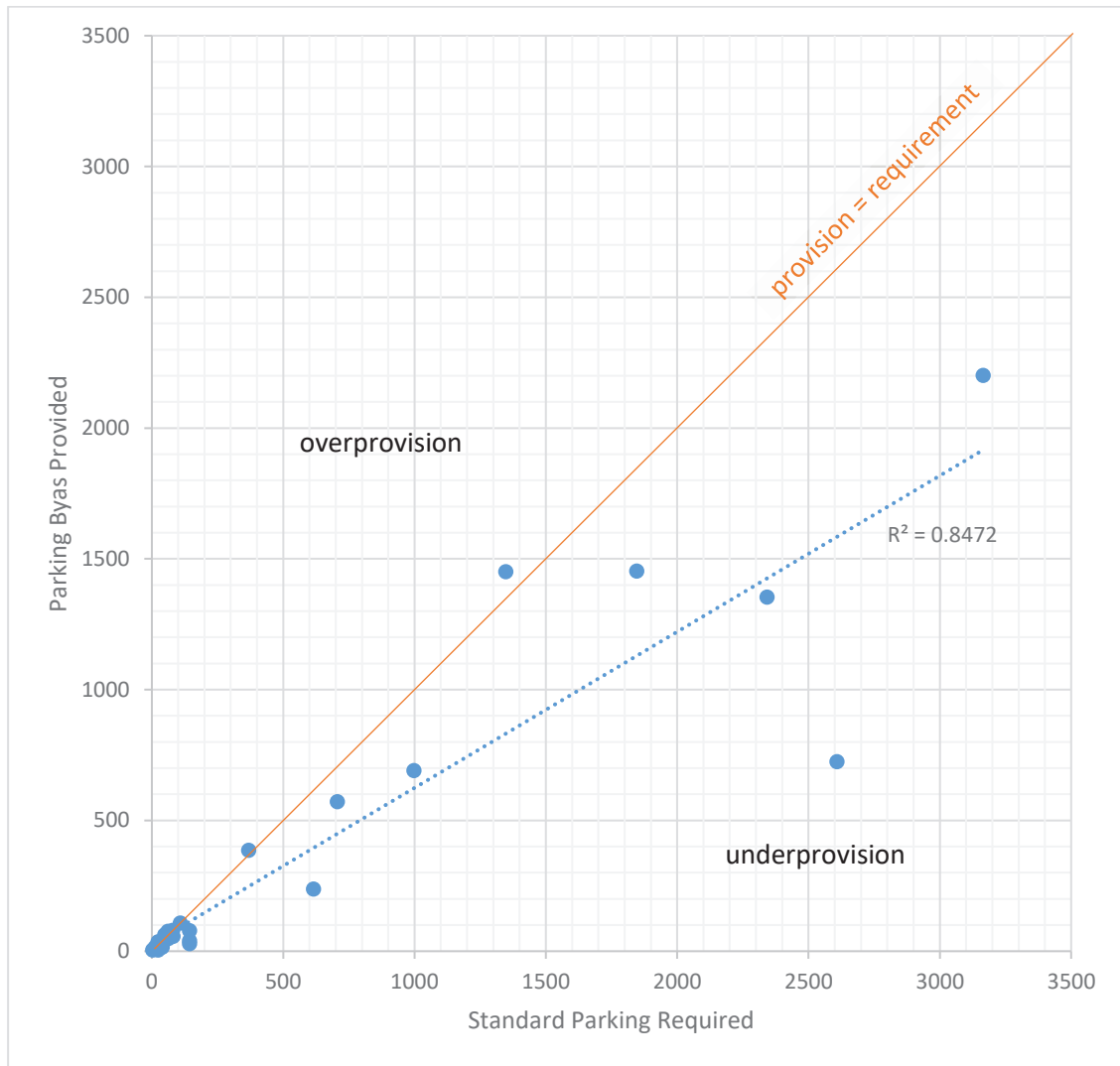


Figure 5-2 Relationship Between Provision and Standard Requirement in PT1 Areas

5.6. Results for the Cape Town CBD

The results for the overlay zone here are far simpler because there is no “standard parking requirement” against which to compare the provision, because the area has had a zero parking offering for decades. There are also other factors which do not encourage the reduction in parking supply for multi-storey developments, such as the policy that parking is not included in the floor factor limit. There was evidence on some building plans of a recommended parking provision based on a traffic impact assessment (TIA).

Table 5-5 Parking Provision in the Cape Town CBD

Number of Cases in Overlay Zone	Number of Bays Provided	Number of Bays Required	Difference
20	8619	0	8619

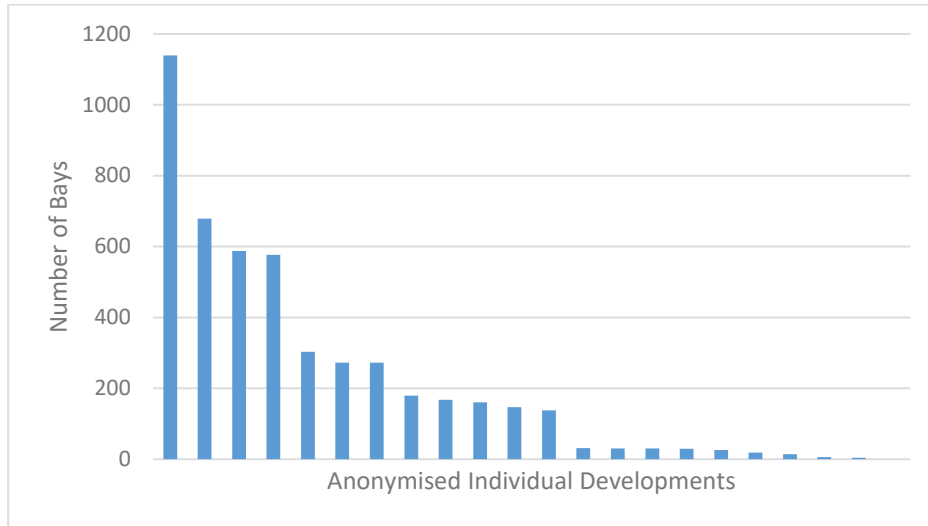


Figure 5-3 Number of Parking Bays Provided by Developments in the Cape Town CBD

The overprovision in the CBD of 8 619 bays results in an opportunity loss of 161 606m², or 16,2ha of developable area. One could argue that this is an over-estimation, as many of these bays are basement parking. However, even reducing this figure by a factor still results in a significant opportunity cost.

What is also hidden in these results is the number of cases where only minimal parking has been provided.

5.7. Geographical Spread of Parking Bay “Savings”

The map below shows the location of the centres with the greatest nett savings of bays. The more intense the colour, the greater the number of bays saved against the Standard parking requirement.

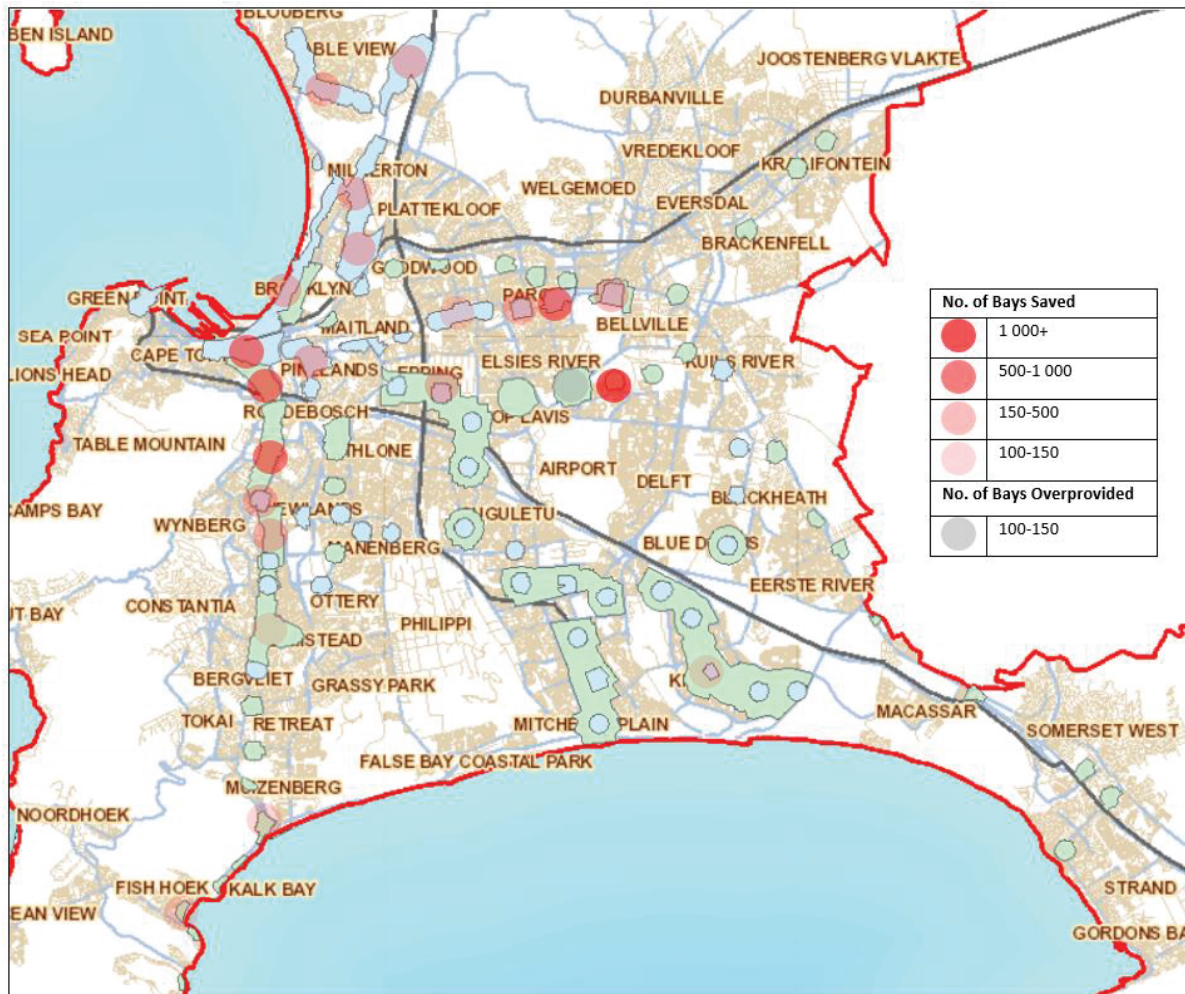


Figure 5-4 Centres With the Greatest Parking "Savings" (and Oversupply) Against the Standard Requirement

The centre with the greatest savings was providing significant student accommodation for the University of the Western Cape. From here, students are able to walk to campus.

The other areas with significant savings were in the inner city adjacent to the Cape Town CBD, as well as the area accommodating students from the University of Cape Town (Woodstock to Rondebosch). The industrial area at Tygerberg station also made significant savings. All these centres are on existing rail lines, with the Woodstock to Rondebosch area also benefiting from significant road-based public transport. From a land development perspective, Woodstock to Rondebosch has high (or rapidly rising) land values, putting pressure on developers to maximize the productivity of their land.

Other areas with significant savings are along the northern and southern transport corridors. However, all areas served by the MyCiTi Phase 1 (Table View, Milnerton, Century City and Paarden Eiland) showed significant savings. This included both old, established areas such as Paarden Eiland and Milnerton, but also the growth area of Table View, Parklands and Dunoon.

Belhar was the only centre where there was significant overprovision, attributed to industrial developments.

5.8. Aggregated Results for All Areas

Table 5-6 Aggregated Results for the Whole City

	Under provision	Overprovision	Nett underprovision
PT2	-4324		
PT1	-5460		
CT CBD		8619	
TOTAL	-9 784	8619	-1 165

A total of 9 784 bays have been saved in PT1 and PT2 areas (i.e. 183 450m², or 18.3 hectares). However, with the overprovision in the CT CBD, the underprovision is reduced to a nett 1 165 bays, or 21 844m² of developable area saved, potentially available for productive use.

5.9. Conclusions

The results in this chapter show that virtually all PT areas (86) experienced a nett underprovision of parking against the standard parking requirement, i.e. that they did not take up the PT offerings to a greater or lesser extent. Of those that did not, three areas matched the standard requirement, and five exceeded it slightly.

This resulted in a significant land saving in areas which are by definition well-located. In addition, and what cannot be calculated at this scale, is the opportunity the reduced parking created for developing additional productive floorspace due to reduced parking offerings, sometimes for multiple floors. This calculation is site- and land use-specific.

Specific centres need to be singled out for conclusions specific to them.

5.9.1. CBD Areas with Managed Onstreet Parking

The literature shows that on- and off-street parking provision and management should be coordinated. The table below demonstrates that there is tenuous coordination for the few centres with onstreet managed parking.

Table 5-7 Relationship between Onstreet and Offstreet Parking Provision and Management

Business District	No. of Onstreet Managed Bays	PT Area Status
Cape Town	2 080	Overlay zone with zero parking requirement
Bellville	544	PT2 with PT1 halo
Sea Point	352	No PT area
Claremont	261	PT2 with PT1 halo
TOTAL	3 237	

(Source: Adapted from City of Cape Town, 2020: 17 [unpublished])

As mentioned above, the Cape Town CBD is a more complex area to understand. While the City manages the onstreet parking, it allows the private sector to provide and price parking offstreet with no restriction (parking is not included in floor factor). Thus the cost of parking is absorbed by developers and passed onto tenants and ultimately customers. It is recommended that a method be

developed to measure where developments have limited their parking provision, and the reasons for this, including interviews with developers and users of these buildings.

The Bellville CBD demonstrates a strong take-up of the PT offerings, despite offstreet parking management. This could indicate an existing over-supply of affordable publically-available offstreet parking.

Interestingly, Sea Point has not been designated a PT area, while there is a need for managed parking there. The roll-out of the substantial MyCiTi feeder services to this area does make it a candidate for future PT area roll-out, so as to manage the on- and offstreet parking provision together.

Claremont CBD's significant overprovision of parking compared to the PT offering in the heart of the centre (PT2) may reflect, as with the Cape Town CBD, a trend by developers to provide A-grade offices and retail space with plentiful parking. However, its underprovision against the standard requirement in both its PT2 and PT1 area demonstrates a positive response to the PT offering, and a balancing of the private (offstreet) and public (onstreet) response to parking demand.

5.9.2. Other Established Centres

The City's Parking Management Business Plan (City of Cape Town, 2018b) referred to in the pilot project methodology identified established, opportunity and emerging centres. Apart from the centres above, Woodstock to Observatory, and Rondebosch were identified as established centres (which are also PT areas). Both these areas showed fairly significant take-up – generally providing less than the standard, with Rondebosch providing less than the PT offering as well. It can be concluded that the PT offering met a market demand here.

5.9.3. Opportunity Centres

Opportunity centres benefitted from the PT offering. Wynberg CBD responded well to the PT offering, even providing less than it. Table View, with more developments, still overprovided against the PT2 offering.

5.9.4. Emerging Centres

Emerging centres which are PT areas include Paarden Eiland, Brooklyn, Mitchells Plain CBD, Kuils River, Stock Rd, Nolungile, Athlone CBD, Khayelitsha CBD, Retreat, Milnerton and Ottery. Most of these areas had small samples or zero cases. Paarden Eiland showed some activity, and responded to some extent to the PT2 offering. Milnerton demonstrated the same response to the PT2 offering, but with a much larger sample. There is therefore no evidence to suggest at this scale that the PT offering assisted developments in marginal centres to become viable.

There is a final observation which does not relate to the centres studied, which were based on the "trunk" services only of the full public transport system, which are the rail and MyCiTi trunk routes. This offering is thus missing a major component of the public transport offering. It would be appropriate to extend the PT offering to areas well-served by road-based public transport, which carries 35% of all trips, and includes the minibus taxis, conventional buses, and MyCiTi feeder services. This is supported by the evidence above showing that there has been good take-up of the offering in Phase 1 of MyCiTi.

6. CONCLUSIONS: REFLECTIONS ON REDUCED PARKING OFFERINGS AS A MECHANISM TO ENABLE TOD AND TDM

The evidence from this primary research shows that significant developable land could be “saved” for more productive use in the most valuable and intensely developed areas of this city, through simply offering reduced parking requirements. Developers took up these offerings over time and were able to more easily provide developments requiring less parking such as student accommodation and inner-city, mixed use developments. There is some evidence to show that areas served by the (BRT) MyCiTi bus system responded positively to this offering.

Returning to the research question, whether parking provision and management can be used to support the restructuring of the city over time, in support of public transport and of transit-oriented development, this study provides quantitative evidence of this, in the case study of Cape Town, and in support of the literature.

In terms of supporting public transport, the case study of Cape Town was not able to draw any evidence-based conclusions on any shift in travel mode to public transport. However, it is significant that the greatest savings in parking were made in areas accommodating students, who generally have high mobility needs, with limited access to private cars, but are also able to walk to campus. This has not required a behaviour change in students, but may have prevented them from acquiring cars, i.e. maintaining positive travel behaviour. It is also significant that all the areas served by the MyCiTi service experienced notable reduced parking provision. It would require further research to determine any reduction in car ownership or car use by residents and workers in these areas. The lack of improvement in the broader public transport system over the last decade has in turn had a dampening effect on the transformation of urban centres in Cape Town towards transit-oriented development.

In terms of supporting transit-oriented development through intensifying land use, the experience of the uptake of the PT offering for offstreet parking reduction in Cape Town demonstrates that there was a reluctance by developers in many instances to take it up completely. This could well be because of the lack of a combination of approaches to travel demand management. Key among these has been the lack of improvements to the overall public transport system, as the rail system continues to decline. Reduced parking supply follows reduced parking demand (or potential demand) which requires quality public transport network and services: rapid, reliable, safe, ubiquitous and affordable, with an expectation of continuous improvement to enable modal shift to public transport. This is summarized well in one of the OECD’s key message in *Managing Urban Traffic Congestion* (ECMT, 2007): “Transport authorities will inevitably need to employ a combination of access, parking and road pricing measures to lock in the benefits from operational and infrastructure measures aimed at mitigating traffic congestion.” (p7). Here Mexico City proved to be a good example of an integrated approach.

Despite this, outside of the Cape Town CBD, more than 18ha of developable land has been saved for more productive purposes in urban centres, with the benefit to intensify land use, and economic development spin-offs. This does not include the additional gross lettable area potential created by reduced parking requirements, specific to each erf and land use.

The PT area offering is a significant tool which can be adopted by other cities in the Global South which are wanting to shift towards a more strategic approach to parking provision and management in an effort to move towards transit-oriented development. It can also be adapted to a maximum parking requirement.

It is therefore recommended that this study be shared with other cities, especially those in South Africa, so that they can use the Cape Town experience and apply parking reduction offerings in identified

centres. These cities, including Cape Town, should consider applying it in such a way that the uptake can be easily and accurately measured.

The following recommendations to the national government could flow from this study:

- Create enabling legislation for delinking parking provision from land uses, to enable shared parking provision
- in the face of limited improved public transport improvements, develop policy to encourage alternative measures to reduce parking demand through travel demand management, such as green travel plans
- review the assumptions behind the current minimum parking standards, particularly for trip attractors.

Further research could build on this knowledge base, addressing the following questions. What is the impact of this reduced parking provision on the public environment (e.g. “spill-over” parking on the street)? What has the community pushback been to the uptake of PT areas for occupants of these developments, and for surrounding residents? What similarities and differences are there between different centres where it has been applied? To what extent have PT areas stimulated additional productive floor space? Can any correlation be drawn between reduced parking provision and increased use of PT and NMT?

Globally, this is an opportune time, as the role of many CBDs and urban centres is being redefined by the changes in work and travel imposed by the COVID-19 pandemic, for city governments to enable reduced parking provision, as part of locking in the gains made in travel behaviour change, in support of less car-centric cities, towards more people- and planet-friendly ones.

Annexure 1

A short and very simplified history of public transport supply in Cape Town as it impacts on the PT areas

(Source: City of Cape Town, various pers comm, 2021)

1990's: The suburban and regional commuter rail service was adequate to meet commuter needs where it existed. Elsewhere, deregulation and rapid growth of the minibus taxi industry, reinforced competition, particularly with the state-supported privately-run bus service (Golden Arrow Bus Service, or "GABS")

2000's: Increasing competition between the MBT industry and GABS resulting in violent confrontation and the reduction in the GABS service.

2010: Phase 1 of MyCiTi trunk and feeder infrastructure and services in place for the 2010 World Cup, serving a segment of the city not served by the rail system (as well as the CT Airport). Major road upgrades were completed also in support of the World Cup.

2010's: The modal share for public transport in 2012 was 56%. However, the decade saw a rapid decline in the rail system (service and infrastructure) leading to its functional collapse. There was a roll-out of MyCiTi feeder services in the CT CBD, West coast area of the city as far as Atlantis, and the Atlantic Seaboard— this included a mix of income areas, which were not serviced by rail. An express MyCiTi service was in place to cover for the collapse of the rail service linking 2 large dormitory townships - Mitchells Plain and Khayelitsha – to the CT CBD.

Public transport services were further hampered by a Golden Arrow Bus Services (GABS) strike between April and May 2018, a minibus taxi strike in August 2018, and a MyCiTi bus strike in October and November 2018, further eroding confidence in the public transport services.

By 2018 the public transport modal share was reduced to 50%.

2020: Rail service dysfunctionality exacerbated by its closure during the lockdown resulting from the COVID-19 pandemic. On the demand side, there was a large-scale reduction in office occupation in the major CBDs, with related reduction in off-street parking demand.

Annexure 2

Section 138 of the DMS (2017)

Minimum off-street parking requirements

Land use	Standard areas	PT1 areas	PT2 areas
Main dwelling house (SR1 Zoning)	2 bays per dwelling unit (1 bay per dwelling for erven < 350 m ²)	1 bay per dwelling unit	Nil
Main dwelling house (SR2 Zoning)	1 bay per dwelling unit (Nil per dwelling for erven < 100 m ²)	Nil	Nil
Second dwelling	1 bay per 2 nd dwelling unit	1 bay per 2 nd dwelling unit	Nil
Group dwelling	1,75 bays per dwelling unit, plus 0,25 bays per dwelling unit for visitors	1 bay per dwelling unit, plus 0,25 bays per dwelling unit for visitors	Nil
Flats	1,75 bays per dwelling unit, plus 0,25 bays per dwelling unit for visitors	1 bay per dwelling unit, plus 0,25 bays per dwelling unit for visitors	Nil
Bed & breakfast establishment	1 additional bay per guest room	1 additional bay per guest room	Nil
Boarding house, guest house	1,25 bays per bedroom	0,75 bays per bedroom	Nil
Backpackers lodge	1 bay per 6 beds	1 bay per 8 beds	Nil
Hotel	0,75 bays per bedroom, plus 20 bays if licensed	0,75 bays per bedroom, plus 20 bays if licensed	Nil
Retirement home, orphanage	0,5 bays per bedroom	0,3 bays per bedroom	Nil
Crèche	1 bay per 10 children, plus stop & drop facility	1 bay per 10 children	Nil
School	1 bay per classroom and office, plus stop & drop facility	1 bay per classroom and office, plus stop & drop facility	Nil
Place of instruction (post-school level)	0,4 bays per student, plus 1 bay per classroom and office	0,4 bays per student, plus 1 bay per classroom and office	Nil
Library, museum	2 bays per 100 m ² GLA	1,5 bays per 100 m ² GLA	Nil
Place of assembly, place of worship, place of entertainment, funeral parlour	1 bay per 6 seats or persons, calculated at 1,4 m ² floor space = 1 person	1 bay per 8 seats or persons, calculated at 1,4 m ² floor space = 1 person	Nil
Sport stadium	1 bay per 4 seats or persons (or as per transport management plan)	3 bays per 20 seats or persons (or as per transport management plan)	Nil
Recreation or sports complex	1 bay per 8 seats or persons	1 bay per 10 seats or persons	Nil
Gymnasium, health club	10 bays per 100 m ² GLA	8 bays per 100 m ² GLA	Nil
Hospital (general and private)	1 bay per bed, plus 3 bays per consulting room	1 bay per bed, plus 2 bays per consulting room	Nil

Land use	Standard areas	PT1 areas	PT2 areas
Clinic, medical consulting rooms, veterinary practice	4 bays per consulting room	3 bays per consulting room	Nil
Shops (excluding supermarket)	4 bays per 100 m ² GLA	2 bays per 100 m ² GLA	Nil
Supermarket, shopping centre	6 bays per 100 m ² GLA	4 bays per 100 m ² GLA	Nil
Restaurant	2 bays per 25 m ² GLA	1 bay per 25 m ² GLA	Nil
Offices	4 bays per 100 m ² GLA	2,5 bays per 100 m ² GLA	Nil
Conference centre	6 bays per 10 seats	4 bays per 10 seats	Nil
Motor showroom	3 bays per 100 m ² GLA	3 bays per 100 m ² GLA	Nil
Motor repair garage, service station	4 bays per service bay, plus 4 bays per 100 m ² GLA, minimum 8 bays	4 bays per service bay, plus 4 bays per 100 m ² GLA, minimum 8 bays	Nil
Motor fitment centre	2 bays per service bay	2 bays per service bay	Nil
Industry	2 bays per 100 m ² GLA	1,5 bays per 100 m ² GLA	Nil
Warehouse, storage building	1 bay per 100 m ² GLA	1 bay per 100 m ² GLA	Nil

[Table substituted by s. 53 of City of Cape Town: Municipal Planning Amendment By-Law, 2016]

(Source: City of Cape Town, 2017, 147-148)

Section 138 of the DMS (2015)

Minimum off-street parking requirements

Land use	Standard areas	PT1 areas	PT2 areas
Main dwelling house (SR1 Zoning)	2 bays per dwelling unit (1 bay per dwelling for erven < 350 m ²)	1 bay per dwelling unit	Nil
Main dwelling house (SR2 Zoning)	1 bay per dwelling unit (Nil per dwelling for erven < 100 m ²)	Nil	Nil
Second dwelling	1 bay per 2 nd dwelling unit	1 bay per 2 nd dwelling unit	1 bay per 2 nd dwelling unit
Group dwelling	1,75 bays per dwelling unit, plus 0,25 bays per dwelling unit for visitors	1 bay per dwelling unit, plus 0,25 bays per dwelling unit for visitors	0,75 bays per dwelling unit, plus 0,25 bays per dwelling unit for visitors
Flats	1,75 bays per dwelling unit, plus 0,25 bays per dwelling unit for visitors	1 bay per dwelling unit, plus 0,25 bays per dwelling unit for visitors	0,75 bays per dwelling unit, plus 0,25 bays per dwelling unit for visitors
Bed & breakfast establishment	1 additional bay per guest room	1 additional bay per guest room	Nil
Boarding house, guest house	1,25 bays per bedroom	0,75 bays per bedroom	0,5 bays per bedroom
Backpackers lodge	1 bay per 6 beds	1 bay per 8 beds	1 bay per 10 beds
Hotel	0,75 bays per bedroom, plus 20 bays if licensed	0,75 bays per bedroom, plus 20 bays if licensed	0,5 bays per bedroom, plus 10 bays if licensed
Retirement home, orphanage	0,5 bays per bedroom	0,3 bays per bedroom	0,2 bays per bedroom
Crèche	1 bay per 10 children, plus stop & drop facility	1 bay per 10 children	1 bay per 30 children
School	1 bay per classroom and office, plus stop & drop facility	1 bay per classroom and office, plus stop & drop facility	1 bay per classroom, plus stop & drop facility
Place of instruction (post-school level)	0,4 bays per student, plus 1 bay per classroom and office	0,4 bays per student, plus 1 bay per classroom and office	1 bay per classroom and office
Library, museum	2 bays per 100 m ² GLA	1,5 bays per 100 m ² GLA	1 bay per 100 m ² GLA
Place of assembly, place of worship, place of entertainment, funeral parlour	1 bay per 6 seats or persons, calculated at 1,4 m ² floor space = 1 person	1 bay per 8 seats or persons, calculated at 1,4 m ² floor space = 1 person	1 bay per 10 seats or persons, calculated at 1,4 m ² floor space = 1 person
Sport stadium	1 bay per 4 seats or persons (or as per transport management plan)	3 bays per 20 seats or persons (or as per transport management plan)	3 bays per 40 seats or persons (or as per transport management plan)
Recreation or sports complex	1 bay per 8 seats or persons	1 bay per 10 seats or persons	1 bay per 15 seats or persons
Gymnasium, health club	10 bays per 100 m ² GLA	8 bays per 100 m ² GLA	6 bays per 100 m ² GLA
Hospital (general and private)	1 bay per bed, plus 3 bays per consulting room	1 bay per bed, plus 2 bays per consulting room	1 bay per bed
Clinic, medical consulting rooms	4 bays per consulting room	3 bays per consulting room	2 bays per consulting room

Land use	Standard areas	PT1 areas	PT2 areas
Shops (excluding supermarket)	4 bays per 100 m ² GLA	2 bays per 100 m ² GLA	1 bay per 100 m ² GLA
Supermarket, shopping centre	6 bays per 100 m ² GLA	4 bays per 100 m ² GLA	2 bays per 100 m ² GLA
Restaurant	2 bays per 25 m ² GLA	1 bay per 25 m ² GLA	1 bay per 25 m ² GLA
Offices	4 bays per 100 m ² GLA	2,5 bays per 100 m ² GLA	1 bay per 100 m ² GLA
Conference centre	6 bays per 10 seats	4 bays per 10 seats	2 bays per 10 seats
Motor showroom	3 bays per 100 m ² GLA	3 bays per 100 m ² GLA	3 bays per 100 m ² GLA
Motor repair garage, service station	4 bays per service bay, plus 4 bays per 100 m ² GLA, minimum 8 bays	4 bays per service bay, plus 4 bays per 100 m ² GLA, minimum 8 bays	4 bays per service bay
Motor fitment centre	2 bays per service bay	2 bays per service bay	1 bay per service bay
Industry	2 bays per 100 m ² GLA	1,5 bays per 100 m ² GLA	1 bay per 100 m ² GLA
Warehouse, storage building	1 bay per 100 m ² GLA	1 bay per 100 m ² GLA	1 bay per 100 m ² GLA

(Source: City of Cape Town, 2015, 144-145)

Annexure 3

Extract from the City of Cape Town's Parking Policy (2020: 6-9)

1.2.1 Parking in Cape Town

Historically, parking in Cape Town was not seen as a problem because it was accepted that drivers could park vehicles wherever they needed to, for as long as they wanted. With increased pressure on the road network, leading to increased competition between different parking functions, and between parking and movement functions, the City approved its first Parking Policy in 2014.

With reference to Table 1, the City managed 3 237 on-street parking bays in four business districts of Cape Town. While the majority of on-street disabled bays are provided in the CT CBD, they are also provided in Strand, Sea Point, Claremont, Somerset West and Bellville CBDs.

Table 1: On-street Managed Parking in 2018²³

BUSINESS DISTRICT	NUMBER OF BAYS	AV. PARKING TIME (MINS)	SITE OCCUPANCY
Cape Town	2 080	42	50%
Bellville	544	41	47%
Sea Point	352	43	48%
Claremont	261	31	38%
TOTAL	3 237		

The vast majority of the supply is however off-street. It was estimated that there were a total of 45 122 off-street parking bays in the Cape Town CBD in 2015, largely provided by the private sector for their employees and customers, or for public use. This covered more than 1,128 km² in land and air rights in the Cape Town CBD.²⁴

The diagram below shows the highest provision of parking being 1 300 bays or more (e.g. the CTICC, and the Portside Building), with several buildings providing 600 bays or more.

There have been several new developments since then, and approvals (the largest being Harbour Arch), which would increase these figures.

²³ City of Cape Town, 2016, *Assessment of Parking Tariffs for Managed Parking Bays within the City of Cape Town (unpublished)*

²⁴ City of Cape Town, 2015, *Inner City Parking Inventory (unpublished)*

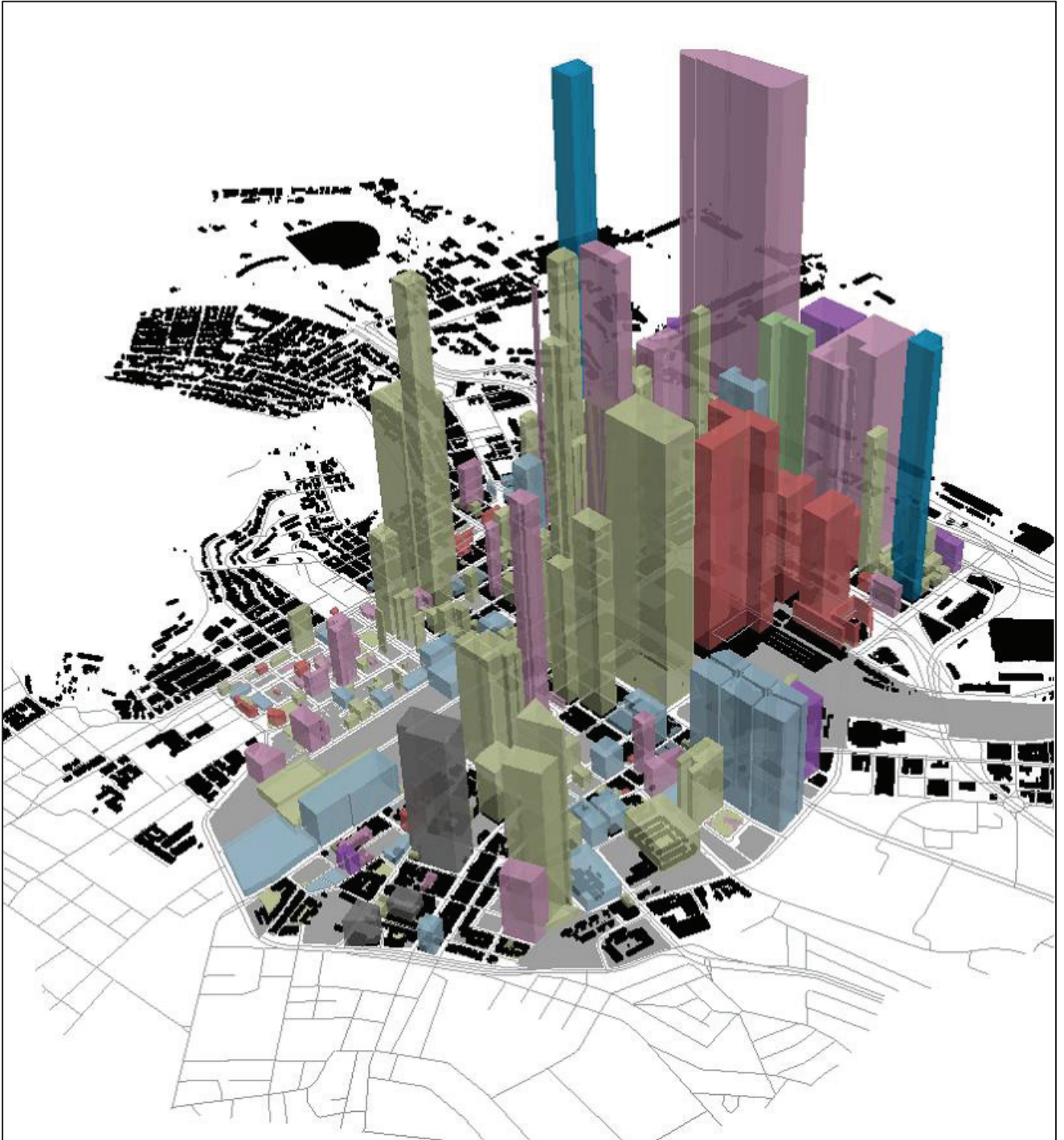


Figure 1: Location of privately provided parking in the Cape Town CBD (2015)

Parking utilisation is more difficult to measure. However, the City does undertake surveys from time to time to measure off-street utilisation per land use, in order to inform updates to the Development Management Scheme requirements.

Of those who used motorised transport (about 84% in 2009-2014), the balance tipped from the majority (51%) using public transport in 2009²⁵, to the majority (52%) using private transport in 2012²⁶. This is counter

²⁵ City of Cape Town, 2016: *Parking Levy: A Research Project into the applicability of a parking levy for Cape Town (unpublished)*

²⁶ City of Cape Town, 2019: *Development of an Urban Development Index (UDI)*, unpublished

to the City's intentions for modal shift to favour public transport (40:60 split by 2014) as set out in the City's Comprehensive Integrated Transport Plan (2013).

The City's Parking Policy, 2014, is now requiring substantial revision in order to align it with the new strategic objectives of the City, and the changing conditions of transport in Cape Town.

Annexure 4

Ethics Approval

Application for Approval of Ethics in Research (EIR) Projects
Faculty of Engineering and the Built Environment, University of Cape Town



ETHICS 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/ebe/research/ethics1>

APPLICANT'S DETAILS		
Name of principal researcher, student or external applicant	Nicola Sasman	
Department	Transport Studies	
Preferred email address of applicant:	nicola.sasman@capetown.gov.za	
If Student	Your Degree: e.g., MSc, PhD, etc.	M PHIL IN TRANSPORT STUDIES
	Credit Value of Research: e.g., 60/120/180/360 etc.	60
	Name of Supervisor (if supervised):	Assoc Prof Roger Behrens
If this is a research contract, indicate the source of funding/sponsorship	n/a	
Project Title	Assessing the Effectiveness of Reduced Parking Requirements in Facilitating TOD in CT	

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.

APPLICATION BY	Full name	Signature	Date
Principal Researcher/ Student/External applicant	Nicola Anne Sasman		6/3/2021
SUPPORTED BY	Full name	Signature	Date
Supervisor (where applicable)	R Behrens		24 Oct 2021

APPROVED BY	Full name	Signature	Date
HOD (or delegated nominee) Final authority for all applicants who have answered NO to all questions in Section 1; and for all Undergraduate research (Including Honours).	ALPHONSE ZINGONI		24/3/2021
Chair: Faculty EIR Committee For applicants other than undergraduate students who have answered YES to any of the questions in Section 1.			

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