

BRT Impacts at a Neighbourhood Level

Volume 2

Perception and observation insights from Soweto's Diepkloof and Thokoza Park Stations



Acknowledgements

Authors: Maggie Tsotetsi and Niclesse Mariette (University of Pretoria)

Project Manager: Rhandzu Khoza (SACN) supported by Geoffrey Bickford (SACN)

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Disclaimer

The research findings of this report are based on ethnographic methodology capturing the views expressed by people interviewed during field visits as well as researcher observation during the time spent by researchers in the field. No interviews with any individual community members were predetermined or scheduled, as such the views are based on a random selection of what were understood to be residents, business owners or employees who live or work in close proximity to the stations under investigation who happened to be in the area on the days the research was carried out. The South African Cities Network acknowledges that this methodology is by no means comprehensive as the sample sizes of respondents were relatively small, neither are the views expressed always reflective of accurate realities on the ground. The limitations to the research method are acknowledged and outlined in the report.

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Acronyms and Abbreviations

BRT	Bus Rapid Transit
GHG	Greenhouse gas
P&R	Park and Ride
SPOT Count	Eskom SPOT Building Count
TOD	Transit-orientated development
UDF	Urban development framework
Wits	University of the Witwatersrand

Executive Summary

Background

South African cities have invested substantially in BRT systems with the aim of improving mobility and accessibility levels and catalysing the transformation of space to provide more inclusive, sustainable and productive cities. This report aims to assess the neighbourhood level impacts resulting from BRT investment in Soweto, Johannesburg. The Johannesburg BRT (Rea Vaya) Phase 1A was introduced in 2009 and was the first BRT system to be operational in South Africa. While BRT system roll out across cities in the country has not been without significant challenges it is important to assess and reflect on the impacts where investment has already taken place.

This study follows on from a 2013 University of the Witwatersrand (Wits) study, “BRT Impacts at Neighbourhood Level: Insights from Diepkloof”, undertaken to determine some of the impacts that the BRT has had on the Soweto neighbourhood. The study indicated that, although users of the system were positive about its benefits, there had not been extensive housing or commercial development in the vicinity of the bus station studied; local minibus taxi operators indicated business had been reduced; and respondents saw the development of a large shopping complex in the area as a more significant local event than the BRT system.

The data from the initial study shed some light on the effects that the system might have on other parts of Soweto (Wits, 2014). Thus, this repeat study was commissioned and conducted in November 2015, in the same month of the year in which the initial study was conducted in 2013. The purpose of the repeat study is to develop a longitudinal data series as well as to examine changes in the Diepkloof station area two years on. The primary research methods used were quantitative interviews with BRT users, a set of qualitative interviews with randomly selected community members and researcher observations. It is also applied the same methodology at another Soweto BRT station to elicit comparative insights. Thokoza Park Station, located, like Diepkloof, on the T1 trunk route, was selected. This is a further reference point for comparative data over time and space, and could serve as a basis for future longitudinal data if, as envisioned, the same station precinct is investigated in the future.

Key observations

The majority of the indicative insights from the study are similar to those found in the previous study, however the addition of wifi to both the stations and the included assessment of the broader Thokoza Park area introduced different dynamics which were not picked up in the previous study. The key observations are listed overleaf.

- As with the 2013 study, residents in both study areas believe that the BRT has had a positive travel and lifestyle effect on those using it.
- While in the 2013 study the introduction of the smartcard ticket was mentioned as a complication in using the system, in 2015 Intermittent technical problems with the smart card system seem to affect the perception and perhaps ridership of passengers of the BRT system at both stations.
- The perception of local minibus taxi operators who remain in the area is that the BRT has negatively impacted their business. These views were expressed in both areas and are consistent with the previous study. This needs to be couched in a broader discussion around transformation of the minibus taxi industry operators to form a bus operating company that now provides BRT services¹.
- There remain mixed perceptions in both areas as to how the BRT benefits businesses in proximity to the stations. Yet, business activity (informal and formal) clustered around the station in both areas remains limited. The methodology precluded establishing what the reasons for this were.
- Physical property changes and development to neighbourhoods in both Diepkloof and Thokoza Park are minimal.
- The recent Introduction of Wi-Fi (at both/all BRT stations) has altered the manner in which the area around the station is used as well as how the station is perceived by people living in the community. This co-location of service has resulted in the station attracting non passengers to the station precinct. It also provides an ease of access to online information which might result in difficult to measure socio-economic benefits.
- An informal Park and Ride (P&R) initiative at Thokoza Park, not present at Diepkloof, has facilitated BRT ridership by car owners, some of whom drive considerable distances to park and catch the bus. The P&R has created an economic opportunity for the person managing the system.
- Thokoza Park Station seems to have had a positive impact on perceptions of safety in areas surrounding the station due to maintenance, cleaning and the presence of security. The same views were not expressed for Diepkloof Station.

These observations are intended to provide food for thought on a number of potential neighbourhood impacts that can be considered and explored further. The list is not exhaustive and it is recommended that further, more in depth research is required to better test and more fully understand the impacts associated with public transport investment. This research does however provide a useful contribution to understanding how the investment and impacts are perceived by the community members who are intended to be the ultimate beneficiaries and provides a baseline set of observations on potential change in these areas. Better understanding the views of the community can assist in the nature of future interventions and the manner in which they are communicated to stakeholders. Different localities have different contextual dynamics and the impacts resulting from the same station investment and system can vary significantly. However, as is evident from this study there are certain similarities in the impacts which the investment has had in two different areas, these are also important to identify and understand more fully.

1 It should be noted that it is likely that these mini bus taxi industry members referred to are likely to be those that decided not to participate in the BRT system and are thus operating illegally (according to license agreements) due to the fact that part of the introduction of the BRT system involved ensuring that affected taxi operators were incorporated as shareholders in the Bus Operating Company offering Rea Vaya services.

1 Introduction

That “apartheid-based, inefficient and unequal spatial patterns are intrinsically linked to the state of transport in South African cities” (Wits, 2014: 18) is a theme echoed in much post-1994 research. The fragmented urban landscape not only makes South African cities inefficient in terms of transportation of people, goods and services but has also cut off access to basic services and opportunities for many South African citizens. It is therefore essential to look at the effects on neighbourhoods of post-apartheid public transport investment.

The aim of the 2013 study was to “understand the impact which the BRT infrastructure has had on a neighbourhood surrounding a BRT station in Soweto” (Wits, 2014: 24). The present research aims to expand on that study by repeating the impact assessment in Diepkloof two years later, thus creating a longitudinal data set. In addition, the study aims to understand how the system affects other areas in Soweto. For this reason, a second station was identified and studied in conjunction with Diepkloof. See Annexure A for the location and selection criteria for both stations. Using both stations, the research investigated some of the direct and indirect changes that have occurred since the establishment of the BRT system in Soweto.

The present research aims to expand on that study by repeating the impact assessment in Diepkloof two years later, thus creating a longitudinal data set.

The 2013 Wits report indicated that while public transport investment can create opportunities it can also stimulate gentrification and undermine certain local economies. It is thus crucial to investigate possible negative effects on surrounding neighbourhoods such as Diepkloof.

The 2013 study indicates that public transport investment is an important factor in creating sustainable and resilient neighbourhoods. Nel & Nel’s theory of Complex Adaptive Systems (2012) defines cities and neighbourhoods as systems that, to be resilient, require sufficient networks and efficient feedback loops. Diversifying transportation modes through systems such as the BRT can create such networks and feedback loops.

Rea Vaya (“We are going”) Phase 1A was the first BRT system in South Africa. Information about the impact of stations along its route may thus provide key insights for other South African cities. Although this was not part of the selection criteria as discussed in Annexure A, the study focuses on the start and end points of phase 1A in Soweto.²

² Diepkloof is the first station in Soweto after leaving the Johannesburg CBD. Thokoza Park is the Soweto terminus.

The 2013 study's findings included: a positive travel and lifestyle impact on the people who use the BRT system; an observed impact on users' walking behaviour from surrounding areas; loss of business for a few local taxi drivers; a lack of clearly definable change on building intensification; and no clear benefits for businesses close to the station. The development of Diepkloof Square shopping centre was found to have had a number of significant effects on the area including a reduction in population density; access for residents to more goods and services; and a negative impact on informal shops and market stalls south of the shopping centre.

Indicative findings presented in this report provide insight into a range of impacts potentially associated with BRT systems on the two study areas surrounding the Diepkloof and Thokoza Park BRT stations. These include:

- Perceived impacts expressed by those living and/or working in the area
- Observed and expressed physical impacts recorded by the researchers
- Potential socio-economic impacts inferred through the results of the research process

The report also reviews literature on the effects of BRT systems internationally and nationally. This is followed by a contextualisation of Diepkloof. The report concludes with a comparison of the changes that the previous and the current research identify.

2 Literature Review

The review of literature conducted for the 2013 study remains relevant to the current study, and is not repeated here. There has been extensive work on transport and inequality in South Africa, but there is still a lack of literature focussing specifically on the impact of BRT systems on their surroundings in South Africa, and specifically Soweto. Some concepts emerging during the course of this study were explored and assessed in terms of the available literature. The section below discusses some of the key concepts considered while conducting the research and include international examples as well as those specific to the South African BRT context. Throughout, reference is made to key points from the 2013 study that informs this report.

Globally, there is a growing body of literature on the link between urban development and public transportation. Access to people, employment, goods, services and economic opportunities is the foundation of inclusive urban development. More efficient access results in increased economic benefits through economies of scale, agglomeration effects and networking advantages. The way in which cities facilitate accessibility through their transport systems also affects livelihoods by widening the range of accessible opportunities (Rode & Floater, 2014; Carrigan et al., 2014; Wits, 2014).

2.1 International Context and Examples

Cevero states that BRT systems have been implemented in 150 cities globally, transporting about 28 million passengers each weekday. Recently, BRT systems have gained favour in developing countries, drawing inspiration from projects in Curitiba, Bogota, Mexico City, Istanbul, Ahmedabad and Guangzhou (Cevero, 2013). Brazil is a global leader in building such systems, with the Curitiba model extended to 30 other cities in the country.

Globally, the motivation for implementing BRT systems has broadened with time. Pioneers such as Ottawa and Curitiba implemented systems mainly because they were more affordable than Light Rail Transit. More recently, cities such as Seoul, Mexico City and Bangkok have invested in BRT systems to supplement pre-existing urban rail systems. In cities like Lagos, Jakarta and Ahmedabad that previously lacked viable public transport systems, BRT has provided the backbone for a new public system.

TABLE 1: Summary of the Global Impacts of BRT Systems

Impact	How BRT achieves the benefit	Empirical findings/evidence
Travel time savings	<p>Segregated bus ways separate BRT buses from mixed traffic</p> <p>Pre-paid level boarding & high capacity buses</p> <p>Traffic signal management & high frequency bus service minimise waiting times.</p>	<p>Johannesburg BRT users save about 13 minutes per journey</p> <p>In Istanbul, the typical Metrobüs³ passenger saves 52 minutes per day.</p>
Greenhouse gas (GHG) and local air pollutant emissions reductions	<p>Reduces private vehicle travelling by shifting passengers to high capacity BRT buses</p> <p>Introduction of newer technology BRT buses</p> <p>Better driver training has led to improved driving cycles which have lower fuel consumption & emissions.</p>	<p>In Bogota, the implementation of a BRT system combined with new regulations on fuel quality is estimated to save nearly 1 million t CO₂ annually</p> <p>The introduction of a BRT system in Mexico resulted in significant reductions in carbon monoxide, benzene and particulate matter.</p>
Road safety Improvements: reductions in fatalities and crashes	<p>Improved pedestrian crossings</p> <p>Reduced interaction with other vehicles by segregating buses from mixed traffic reduces accidents</p> <p>Through training, the implementation of BRT systems has changed driver behaviour by reducing on-road competition often witnessed with minibus taxis.</p>	<p>In Bogota, the BRT system has contributed to reductions in crashes and injuries on two of the system's main corridors</p> <p>On average, Latin American BRTs have contributed to a reduction in fatalities and injuries by over 40% on streets where they were implemented.</p>
Reduced exposure to air pollutants	<p>Cleaner vehicle technologies and fuels lower the concentration of ambient air pollution</p> <p>Reduces exposure by passengers to air pollution at stations or inside buses by reducing travel times.</p>	<p>Bogota recorded a 43% decline in SO₂ emissions after implementation of its BRT system</p> <p>It has been estimated that the contribution of the BRT Metrobüs Line 1 in Mexico City to reduced particulate air pollution eliminates over 6000 days of lost work, 12 new cases of chronic bronchitis and 3 deaths per year.</p>

3 Metrobüs is the name of Istanbul's BRT System

Impact	How BRT achieves the benefit	Empirical findings/evidence
Increased physical activity	BRT stations are located in areas where walking distances may be longer. This may increase physical activity in users and promote their health and wellbeing. Higher operating speeds encourage passengers to walk to and use BRT buses.	Passengers of Mexico's BRT system walk, per day, on average 2.75 minutes more than before the system was introduced Users of the Beijing BRT system walk 8.5 minutes more per day following implementation of the BRT system.

Source: Carrigan et al., 2014:11

2.2 South Africa's BRT Background

The first phase of Rea Vaya BRT system started operation on 30 August 2009. Its main route links Soweto to the centre of Johannesburg and carries 16 000 passengers per day (Adewumi, 2009; Venter, 2013). Subsequently, other BRT systems were introduced in Cape Town, Port Elizabeth and the City of Tshwane.

The motivation for transportation systems such as the BRT in South Africa is mainly their potential to connect the parts of the country's fragmented cities. Geurs and Wee (2004) define accessibility as the extent to which land use and transport systems enable individuals to reach activities or a destination. Inaccessibility results in social exclusion and diminished access to goods, services and employment opportunities. However, the BRT system in South Africa is intended to serve the larger purpose of restructuring cities, thus enhancing spatial justice in the country. Soja (2009) argues that accessibility to goods and services by individuals or groups is crucial to creating "just spaces".

However, BRT systems in South Africa have not yet had the anticipated results of increasing accessibility to areas of opportunity, reducing poverty and promoting social cohesion (Rahim, 2014; Wits, 2014). According to Cervero (2013), while transit-orientated development (TOD) should enhance pedestrian access to transportation, many factors need to be considered when investing in BRT. These include compact, mixed-use, pedestrian friendly development organised around a transit station. The predominantly mono-functional nature of township neighbourhoods accompanied by relatively low densities surrounding the BRT stations mean that the factors discussed by Cervero do not exist. Thus, in considering BRT station precincts as potential TODs, neighbourhood context is fundamental.

2.3 Newly Introduced Concepts

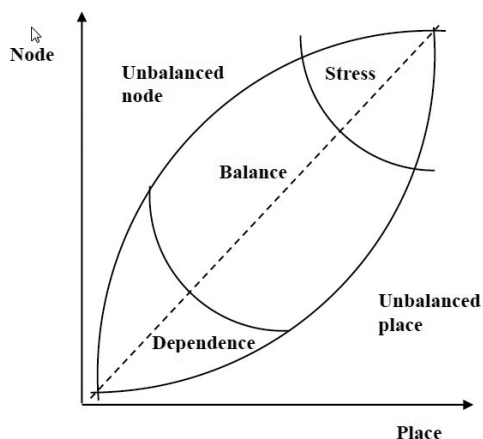
Elements in this research were not necessarily present in the initial 2013 study. This was partly because a new station, with its own circumstances, was included in the second study. The concepts below helped guide researchers in understanding the dynamics at both study stations and contributed to the recommendations.

2.3.1 *The Node-Place Model*

This and the next paragraph draw on the work of Bertolini & Chorus (2011). It is generally recognised that land use and transportation patterns are closely related. The idea of the land use transport feedback cycle is often used to illustrate this relationship, with land use and transport patterns influencing each other. Land use patterns partly determine the location of activities such as residence, working, shopping, education and leisure. The distribution of these activities requires transport systems to overcome the distance between the locations where they take place. Bertolini and Chorus's node-place model follows the reasoning of the transport land use feedback cycle and aims to further explain the underlying relationship, with a focus on

station areas. The overarching idea is that improved access to better transport creates conditions favourable to further development of the location. In turn, growth in demand creates conditions favourable to further development of transport systems

FIGURE 1: The Node-Place Model



Source: Bertolini & Chorus, 2011

The node-place model (Figure 1) identifies five ideal-typical situations. Each reflects a particular relative position of a station area on the node or place hierarchy of an urban region. The balanced areas are found along the middle line and their relative positions on either the node or place scales are roughly equal. Stressed station areas have a relatively strong position on both the node and place scales. Further development in these areas can be problematic as multiple claims on the limited amount of space can cause conflicts. In dependent areas, located beneath the line, struggle for space is minimal, with the node and place values so weak that factors other than internal node-place dynamics are necessary for sustainability. Above the middle line are “unbalanced places” where the opposite is the case. An unbalanced station area thus has a significantly strong relative position on either the node or the place scale. In simple terms the objectives of a transport station are to achieve a balance between providing for adequate transfer efficiencies between modes (node) and providing a strong attraction for people to gather and meet regardless of the need to travel (place).

2.3.2 Co-location of Services and Safety

While the node-place model highlights technical issues relating to the interaction between land use and transport patterns, in “Thinking Beyond the Station” Nelson (2015) considers the social relationship between stations and their surrounding communities. To Nelson, the concept is both “theoretical and applied ... crafted by PPS⁴ to guide the activation of stations and stops as well-connected, multi-use destinations”. This characterises stations as destinations or community landmarks that can be associated with public spaces and existing amenities: “a great station or stop adds value to the surrounding neighbourhood and increases the viability of commercial districts by connecting business to commuters and new customers”⁵.

In assessing impacts, it is clear from Nelson and from Bertolini and Chorus that integration of technical and social aspects is needed, and that social considerations should include services not necessarily related to transport such as Wi-Fi and surrounding public spaces. In this way, both transport users and non-users can be catered for, increasing the opportunity for non-users to change their perceptions towards the use of public transport. Attracting non-users also increases activity around the station. This tends to mean more ridership and promotes passive surveillance which has an impact on the safety of the area (Nelson, 2015; Kruger and Landman, 2007; Urban Landmark, n.d.).

4 Project for Public Spaces (PPS)

5 <http://www.pps.org/reference/thinking-beyond-the-station/>

A growing body of knowledge is focused on crime in public transport facilities, more of it relating to developed countries than to developing countries such as South Africa and often researching neighbourhoods in relation to transport facilities such as bus stations (Kruger and Landman, 2007). Kruger and Landman emphasise the need to “design for safer journeys”. They argue that passengers are often victimised in public transport facilities and that this can be minimised by modifying the surrounding environment to reduce the possibility of crime. Perceiving them as destinations instead of stops can lead to designing for safe journeys and effectively managing spaces around stations. As Nelson (2015) has indicated, the first trip from home is not always the route to the final destination, and safe connections between routes are necessary. Thus it is evident not only that the potential benefits of transit stations are associated with safety and security but that their effective management contributes to overall urban development and the improvement of the neighbourhoods in which they are located.

As Nelson (2015) has indicated, the first trip from home is not always the route to the final destination, and safe connections between routes are necessary.

The TOD model as discussed by Urban Landmark (n.d.) appears to present an ideal for good quality urban spaces around station areas and transit stops where travellers and pedestrians can move freely and safely. Whilst limited research has been done on the additional services appropriate for BRT facilities, the model suggests benefits that could arise from co-locating services in or around public transport nodes. According to Urban Landmark (n.d.), Kruger and Landman (2007) and Nelson (2015), possible benefits associated with the introduction of other services (transport related or not) immediately around stations include:

- Improved perceptions about the use of the system and about the station as a community asset
- Positive perceptions of public transport by residents who may not initially have considered using this form of public transport
- Optimal use of land surrounding the station through increased activity
- Increased activity around stations and thus passive surveillance for improved safety
- Promotion of partnerships and synergies between different stakeholders in developing and maintaining station precincts.

2.4 Conclusion

The literature discussed in this section describes the economic, social and environmental advantages that result from successful implementation of a BRT system and associated infrastructure. The 2013 report referred to the lack of South African studies assessing the impact of BRT on local neighbourhoods (Wits, 2014). By documenting this repeat study and incorporating newly identified elements and associated literature, this report hopes to contribute valuable insights into the BRT system in South Africa and assist in understanding the successes and weaknesses of the Rea Vaya system in Soweto.

3 Research Method

The 2013 study indicated that, “the research aimed to understand the impact which the BRT infrastructure has had on a neighbourhood surrounding a BRT station in Soweto. The research approach necessitated selecting a case study station. Perspectives of BRT users were captured through a short quantitative survey. The perspectives of residents and business owners or employees, who could be either BRT users or non-users, were captured through qualitative interviews. Ethnographic research methods capturing the general observations which were made by the authors during field work were utilised to supplement findings from the desktop analysis and field interviews. A range of secondary data sources had been drawn upon to support the research.

Methods used were applied to both Diepkloof and Thokoza Park stations. To ensure consistency, researchers gathered information from both stations simultaneously and at around the same time (in November during morning peak hours between 5:30 and 9:30) as the previous study. As with that study, a short quantitative survey was used to capture BRT users’ perspectives. Non-scheduled, qualitative interviews with randomly selected participants either believed to be living and/or working in the respective areas were conducted. The results from these interviews are represented as the views of residents and/or business⁶ owners or employees in the research. The purpose of the non-scheduled interview arrangements was to ensure that there is limited influence in predetermining the perspectives of those interviewed. This is important as part of what the research is attempting to understand is the perceived impact of the BRT station on the lives, experiences, or environments for those living and working in the area.

The 2013 study report served as the benchmark for data compilation in the 2015 study and also indicated secondary sources that might guide analysis of the primary data collected. The research method is discussed in the following sections

3.1 Quantitative Component

Quantitative methods were used in analysing and profiling BRT users alighting from and boarding buses at the two identified stations. The same survey form (Annexure B) as in the previous study was used to capture the relevant information. An additional question asking respondents about their years or months of use was included to gauge the level of commitment from users and detect any seasonal changes related to bus use. No such patterns emerged, with most respondents having used the bus since the service began. An overview of the quantitative interviewing process is given below.

6 Business refers to all trading activity, be it informal or formal.

- Selection of respondents was random
- Alighting and boarding BRT users were identified as they were entering or exiting the station
- Each interview took approximately two to four minutes
- Interviews were tailored for BRT users.

The two main researchers and two assistants conducted interviews simultaneously in both stations on 25 November 2015 between 6:00am and 9:00am. Sixty respondents were interviewed at Diepkloof Station and thirty five at Thokoza Park Station. It was envisaged that each station would provide researchers with up to 100 respondents but factors such as access and the management of stations made this difficult. The section below describes some of the difficulties that the researchers faced in conducting the quantitative interviews.

Another set of interviews tailored specifically for P&R users in Thokoza Park was conducted on 20 January 2016 between 5:30 and 6:30 am. Twenty respondents were interviewed. The initial group of commuters (also referred to as standard BRT users) was selected at random through chance encounters with pedestrians approaching the station. This meant that they could be pedestrians, users of P&R facilities or people using any other way of reaching the station. The second group, however, was sought out in the parking lot adjacent to the station to ensure that only users of P&R facilities were selected.

3.2 Difficulty in Conducting Quantitative Interviews in Soweto BRT Stations

Researchers had initially planned to conduct interviews with BRT passengers at the Thokoza Park station entrance or on the station concourse. Upon arrival, however, they found that Rea Vaya security staff did not permit interviews on the station concourse because of the station's high pedestrian traffic volumes. The security guards only permitted interviews to take place beyond a radius of approximately 100m (Picture 1). In Diepkloof, interviews were held directly adjacent to the station concourse.

Picture 2 shows the traffic circle with multiple lanes that feed subsections of the neighbourhood in Thokoza Park. They greatly influence accessibility to the station as there are demarcated pedestrian crossings only at the far ends of the station concourses. To access the station, commuters (particularly those approaching from the west) have to cross multiple lanes of traffic (as well as the traffic circle) where there are no pedestrian crossings. Especially having to work relatively far from the station, the researchers found it difficult to distinguish between BRT commuters and pedestrians simply crossing the road. Traffic noise at this busy intersection also negatively affected the ability to carry out the surveys.

The small sample size at Thokoza Park station caused by these issues makes it difficult to generalise from the research findings. However, the information gathered does provide a sense of users' behaviour and their socio-economic profiles. It indicates the type of people that use the station, their reasons for doing so and their interactions with the station surroundings.

PICTURE 1: The Closest Point Researchers were Granted Permission to Conduct Interviews



Source: Mariette, N and Tsotetsi, M (January 2016)

PICTURE 2: The Traffic Circle with Multiple Lanes Hampering Stations Accessibility

Source: Mariette, N and Tsotetsi, M (January 2016) and Google Earth™

The researchers at Diepkloof station faced similar difficulties but the spatial configuration around the station and the welcoming attitude of the public (compared to a seemingly more rushed and tense public at Thokoza Park station) made it easier to conduct interviews. The nature of the streetscape south of the station enabled the researchers to identify BRT users from a distance and to walk with them to the station as they interviewed them.

In both stations, BRT users expressed interest in participating in the study but were generally rushing to get to their workplaces. This led the research team to question whether the 6:30 am - 9:30 am period was ideal for interviews in and around the stations. In any future research, a more suitable time may have to be investigated.

Issues such as these were limitations to research, especially at Thokoza Park. Because of this, supplementary information about aspects such as the P&R was gathered from the area, as discussed below.

3.3 Supplementary Information

Supplementary information was gathered for two main reasons. Firstly, to close some of the emerging research gaps and secondly to investigate how changes identified in the previous study have developed or dissipated in the time between the two studies. Supplementary information gathering included targeted surveying of categorised users at Thokoza Park station as well as GIS analysis to understand commuter behaviour and trends in the study areas.

A characteristic of Thokoza Park Station that had not been previously considered or explored, and that did not appear to be present at Diepkloof, was that of commuters who drove from home and parked their cars close to the station before using the BRT to their destination. This opened up a new area of investigation. A site visit was therefore scheduled for 20 January 2016 to profile P&R BRT users.

The initial survey form was modified to suit these users (Annexure C). Using this form, researchers conducted quantitative interviews between 5:30 and 6:30 am.

It was later realised that the reason why this category of users was missed in the initial profiling process was they had already gone to work by the time researchers arrived at the station on 25 November 2015. This is demonstrated by a picture of a full parking lot at the time of arrival. Why, it can be asked, do these users prefer to use the bus if they wake up early enough to drive themselves to work and beat the traffic? This question is revisited later in the report.

Why, it can be asked, do these users prefer to use the bus if they wake up early enough to drive themselves to work and beat the traffic?

To supplement the information gathered from the P&R users, a short interview was conducted with the “manager” of the P&R parking lot. He is a self-appointed custodian of the lot, looking after the cars and offering vehicle washing and cleaning services to commuters. The questions to the “manager” are attached as Annexure E. The information provided on P&R is discussed later in the report.

The use of GIS software to analyse the study areas gives a clearer picture of some of the dynamics relating to users of the BRT system in Soweto. For this reason, maps generated from a variety of GIS applications are used and discussed. These gave the researchers a deeper understanding of how BRT users access and make use of the stations and surrounding areas.

It was important to study accessibility by calculating the walking time to each station. The FlowMap⁷ spatial analysis tool was used in conjunction with GIS software to create accessibility maps. FlowMap is designed to analyse and display flows (of people, cars etc.) between defined locations. To establish proximity counts of each cell in relation to the station by using the road network (including footpaths) as the route network for accessibility, the areas surrounding the stations were divided into hexagonal tiles/grids, the most evenly dispersed centroid shapes in relation to neighbouring cells according to Stillwell and Clarke (2003: 224).

An additional site visit to Diepkloof station led to a number of impromptu discussions with residents and business owners along Immink Road. The primary goal of this visit was to track some of the major factors identified in the previous study and identify if they had changed since then. These changes are discussed later in the document.

3.4 Qualitative Interviews

Qualitative interviews were conducted on 25 November 2015 from 11:30 am to 14:30 pm. As with the quantitative interviews, researchers used questions formulated in the initial study (Annexure D). Respondents were encouraged to answer questions freely, generating a two-way conversation between researcher and respondent.

The aim was to gather data that would help researchers understand respondents' (landowners and tenants, business owners and employees) perceptions of changes that have occurred within their neighbourhoods. It was important to find out if these perceived changes were occurring or had occurred as a result of the BRT system. In the case of Diepkloof, the extent of change in respondents' perceptions had to be determined. This is discussed in more detail in the later stages of the report.

The qualitative interviewing process in summary was as follows:

- Twenty interviews were conducted at each station on the same day⁸
- Each interview took four to ten minutes
- Interviews were conducted at least 400m from the stations
- Respondents were selected randomly and included business owners, employees and residents within the neighbourhoods.
- No respondent had prior knowledge of the study or interviews.

The closest neighbourhoods to Diepkloof station include Diepkloof Zones 3 and 4. The closest to Thokoza Park Station are Dhlamini Extension 4, Moroka and Jabavu. For the purpose of this study, all three neighbourhoods surrounding the Thokoza Park station are referred to as the Thokoza Park area.

3.5 General Observations

Observations were made by researchers to verify information provided by respondents' in certain instances and develop an opinion about the dynamic in the areas of both stations. The main purpose of the site visits on 8 January 2016 was to observe activities and behaviour patterns around the BRT stations. However,

⁷ More information at <http://flowmap.geo.uu.nl/index.php>

⁸ 25 November 2015

researchers also took note of what was happening around stations as they conducted interviews on 25 November 2015 and 20 January 2016.

3.6 Secondary Data Sources

Secondary data sources, not primarily concerned with the impacts of BRT stations on the surrounding neighbourhood, are important for understanding the overall area. The 2013 report served as a solid base for secondary data collection, and this report constantly reflects on that study and uses it as its starting point. The secondary data utilised includes City of Johannesburg spatial plans and other policies relating to the two station areas. Policy interventions do not always have the expected results, and it is therefore important to investigate unexpected changes resulting from policy implementation.

Several raw data reports with statistical data were generated using MapAble™, a web-based spatial analysis and GIS tool. This generates raw data reports from various sources including government websites such as StatsSA, the Demarcation Board, municipal GIS databases and various other open source information.⁹ It is then possible to generate maps, diagrams and reports based on this information. Comprehensive census data analysis for the Diepkloof area is not provided in this report because the latest census data is from 2011; nothing further has been released since then. A full analysis of the 2011 data is available in the previous study report¹⁰.

3.7 Method Limitations

The research is limited by the relatively small sample sizes. Thus the results of the interviews cannot be understood as widely representative. The research process did not involve the verification of the accuracy of views expressed by community members. In this regard the perception based findings might not represent actual physical realities but do provide important sets of insights into the experienced and understood realities of those living and working in the respective station precincts.

Furthermore, it is acknowledged that the researchers' unfamiliarity with the respective neighbourhoods also limits the ability to make clearly observed impacts post the BRT station development. For this reason desktop research and analysis along with existing community member views on the areas is deemed important to build an understanding of the historical nature of the areas being studied. Should this research be carried out again in the future the researchers will need to engage with the relevant city officials, transit operators and community stakeholder bodies to provide a more informed contextual understanding of the study areas.

9 The Statistics South Africa website: www.statssa.gov.za, accessed 12 January 2016. The Municipal Demarcation Board website: www.demarcation.gov.za, accessed 12 January 2016.

10 Statistical analysis of the Diepkloof area can be found in the 2013 study in the "Unpacking the Census Data" subsection (Wits, 2014: 31-36)

4 Soweto in Context

Soweto is arguably South Africa's best-known formerly segregated township due to its role in the struggle against apartheid. Soweto (an abbreviation of South Western Townships) originated with the removal to Klipspruit of black mine workers living in the inner city during the gold rush in Johannesburg in the late 19th century. Part of Klipspruit became Pimville in 1934 followed by the establishment of Orlando, just to the north east, in 1935. The smaller townships were amalgamated into Soweto in 1963. Since then, it has become a part of what is now the City of Johannesburg Metropolitan Municipality (Bonner & Segal, 1998; Phillips, 2014).

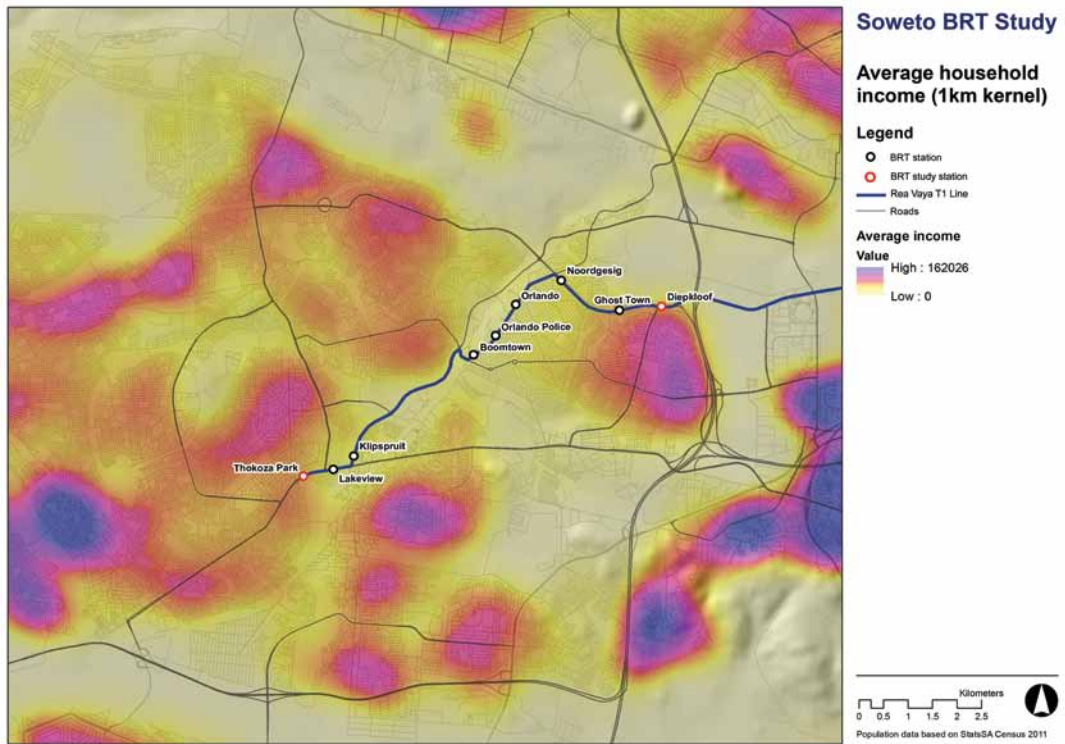
Soweto forms a major part of the City, housing around 1.3 million people within approximately 200km² (StatsSA 2011 Census data). This makes it a dense and relatively compact urban settlement. The City of Johannesburg has invested substantially in Soweto, and private sector companies have begun to locate there. The figures below indicate some settlement patterns, specifically in relation to the Rea Vaya BRT running through its core. Figure 2 illustrates average household income for the Soweto area. The clusters of higher income groups in certain neighbourhoods and specifically close to both the Diepkloof and Thokoza Park station study areas are clear.

The City of Johannesburg has invested substantially in Soweto, and private sector companies have begun to locate there.

It is evident that there is a strong base of low-income working class residents in Soweto but that the middle class is growing. According to the 2011 Census, approximately 34% of the Soweto population earns less than R1 200 per month and approximately 35% earns between R2 000 and R10 000 per month. Housing tenure in Soweto is shifting from informal and rental based tenure, with many residents now categorised as owning houses not yet paid off, a figure that rose by 8.5% between the 2001 and 2011 Census findings. Thus there are an increasing number of new home owners in Soweto (indicating a growing middle class).

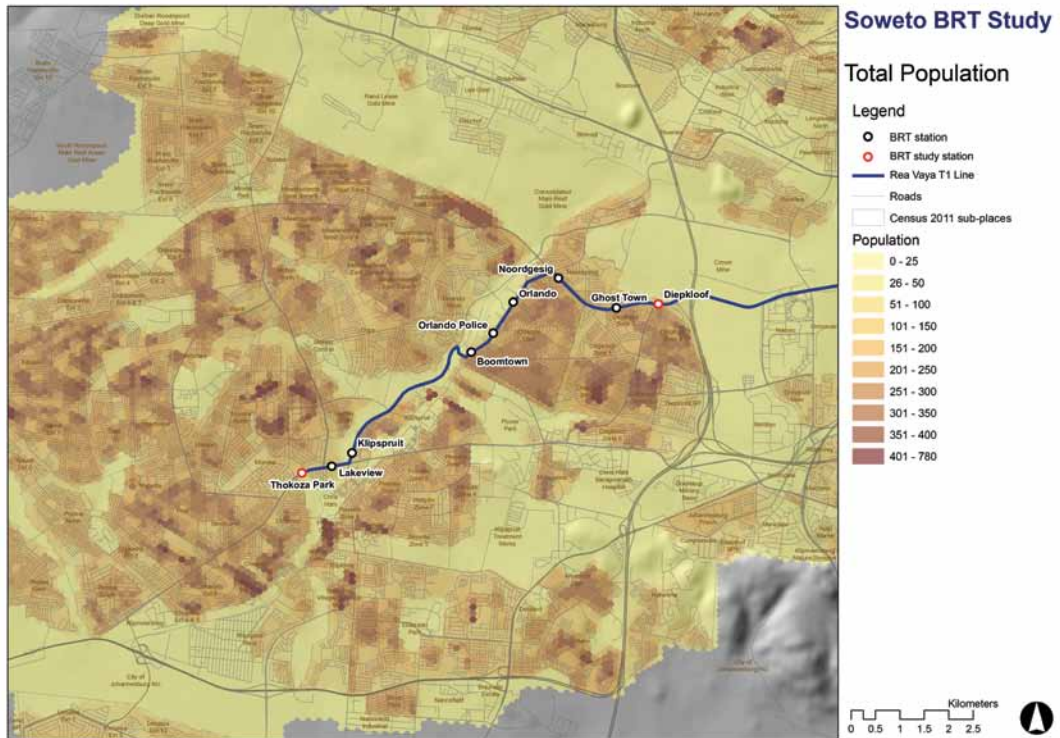
The City of Johannesburg has demonstrated a clear vision for urban planning and investment in Soweto. Significant population growth and development is projected (CoJ, 2012: 36). City planning documents, including "The Remaking of Soweto" (CoJ, 2011), mandate the upgrading and growth of public transport and related infrastructure, including the establishment of station precincts around BRT stations and support for the taxi industry. Other developments, such as shopping malls and recreational spaces, are also planned throughout Soweto.

FIGURE 2: Average Households Income Along the BRT T1 Trunk Route

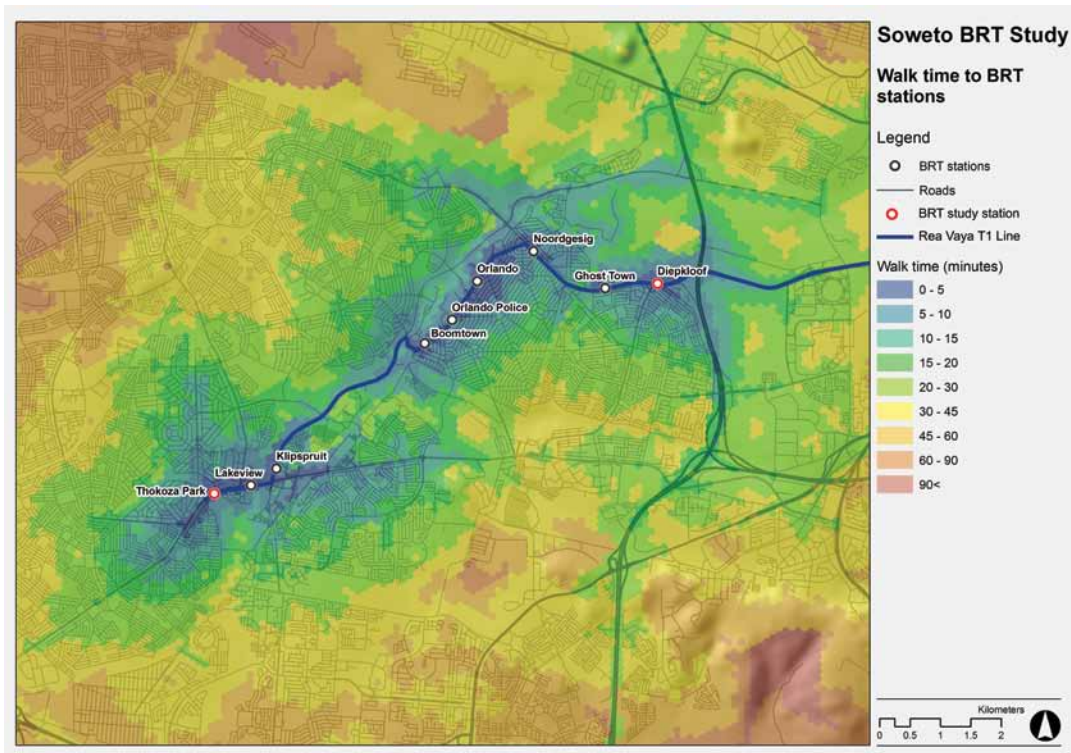


Source: Mariette, N and Tsotetsi, M, (2016)

FIGURE 3: Population Distribution for Soweto in Proximity to BRT Stations



Source: Mariette, N and Tsotetsi, M (2016)

FIGURE 4: Walking Times to Soweto BRT

Source: Mariette, N and Tsotetsi, M (2016)

The population of Soweto is quite evenly distributed, with slight concentrations in some areas. Figure 3 gives a picture of the spatial relationships with the BRT stations, which are predominantly on the periphery of the densely populated areas rather than at their core. This could contribute to issues of accessibility and ridership. As discussed in the methodology section above, calculation of walking times for areas surrounding the BRT stations would assist in understanding the movements of commuters who walk to the stations. Figure 4 indicates the accessibility pattern for the entire T1 trunk route. Those for each study station are discussed in more detail below.

5 Diepkloof Station Impacts

5.1 Diepkloof Area in Context

This research is a repeat study in the Diepkloof area, and specifically Zones 3 and 4 (7). Diepkloof was established in 1959 in line with the forced removal policies of the time, and now has seven zones. While each has its own spatial context, the area is associated with large households, many having lived in the area for a considerable time. The area also has a rich background of political activism. As families grew, extra rooms or backyard units were added to dwellings, a phenomenon influenced by previous land use policies that limited building on individual stands. Associated with this culture is the pride that Diepkloof residents have in their township. For some residents, financial problems make continued residence in the area problematic, but for others cultural and heritage considerations tie them to their neighbourhood (Wits, 2014).

Figure 5 shows the Diepkloof study area in its geographical context. The study area was delineated from distance buffers from each station as well as the information gathered through surveying the commuters. The focus area was then derived (at neighbourhood level) from origin locations reported by the respondents. Diepkloof Station respondents predominantly originated from zones 3 and 4 as was the case in the 2013 study. In line with this, the Diepkloof Station focus area remains mostly limited to these two zones. Picture 3: Diepkloof station and entrance illustrates Diepkloof Station, showing the entrance in line with Immink Drive.

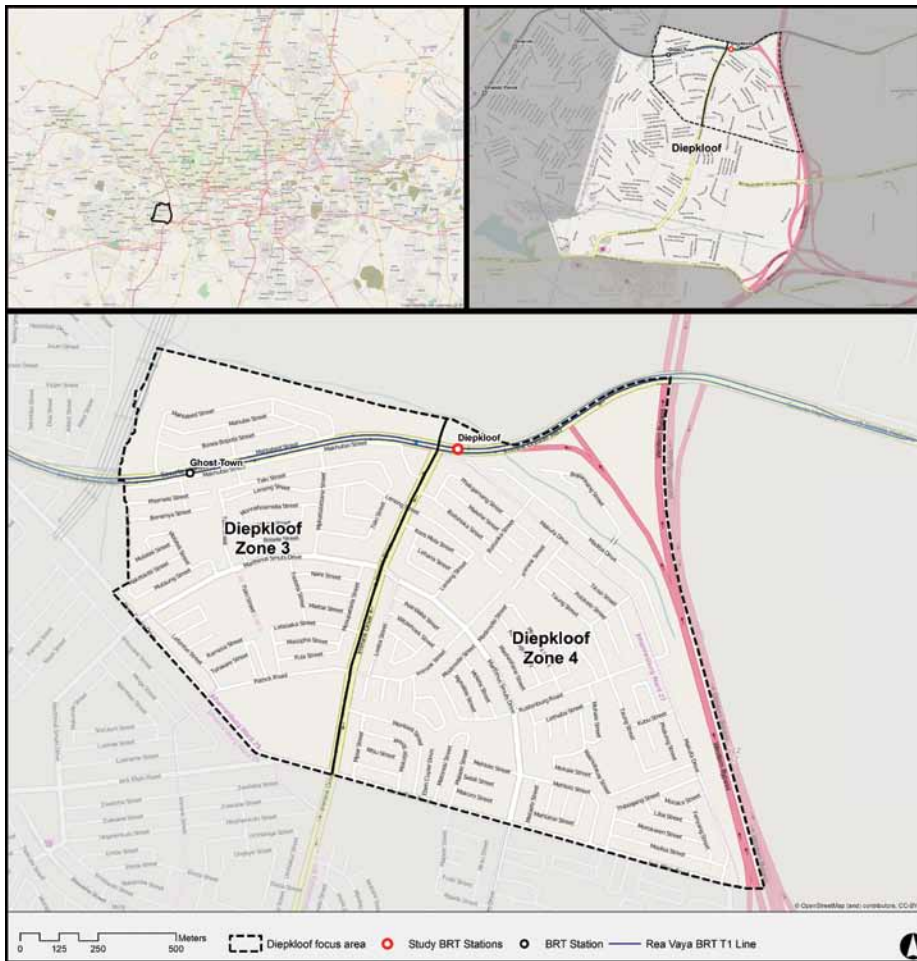
5.2 Presenting 2015/16 Information

This section presents information gathered in the repeat study, crucial because it makes possible comparisons between 2013 and 2015 and enables insights into how the BRT system has affected the Diepkloof area.

5.2.1 Understanding passengers' interactions around the station

The repeat study area remains the same as that of the initial study. It concentrates largely on the housing stands located to the south of the station. Vibrant Immink Drive is the main road. Most respondents were seen walking down this road and into the station. Although the area is predominantly residential, within a 750m radius the single most prominent land use is a filling station. There are a considerable number of bottle stores, advertisements (on pavements, rocks, walls, billboards etc.), many barbers in semi-fixed structures and some food outlets along Immink Drive. Approximately 750 meters from the station is Diepkloof Square, and behind it the taxi rank currently being upgraded (Picture 4), and trading stalls. As Picture 5 shows, land use in the study area has not changed significantly since the previous study was carried out.

FIGURE 5: Geographic Context of Diepkloof and Focus Areas



Source: Mariette, N and Tsotetsi, M (2016)

PICTURE 3: Diepkloof Station and Entrance



Source: Google Earth, Graphics and Photos by Mariette, N and Tsotetsi, m (January 2016)

PICTURE 4: The Taxi Rank Currently Being Upgraded



Source: Mariette, N and Tsotetsi, M (January 2016)

PICTURE 5: Diepkloof Study Area Spatial Analysis



Source: Wits, (2014)

5.2.2 *Unchanging land use: site analysis*

The removal of the informal settlement and the development of the shopping centre in its place has formalised land use on this stand (Figure 6). The centre is the most recent and most noticeable spatial change since the development of the BRT system in the area; no other significant changes in land use have been made since 2013.

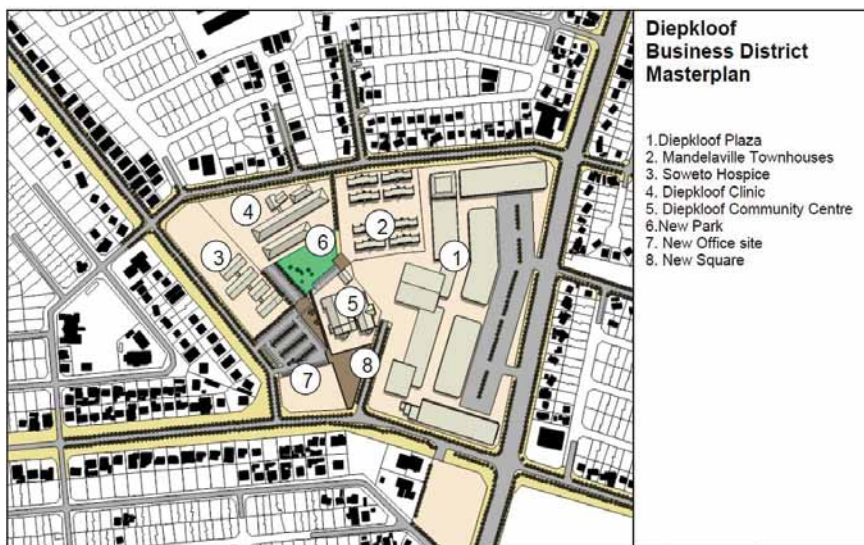
Changes are, however, envisioned within the study area. According to the Diepkloof Business District Master Plan, several other development plans have been prepared. Figure 7 shows the shopping centre as one of the planned business district developments. The Eskom spot count (Figure 8) specifies that development number 3 (Figure 7) was completed in 2009, whilst the shopping centre was completed in 2012. The timeline aerial photos in Figure 6 confirm this and Figure 7 also show buildings still to be constructed.

FIGURE 6: Arial Photos Showing the Biggest Changing Land Use Context in Diepkloof Since 2000



Source: Wits, (2014)

FIGURE 7: Future Land Use Changes at Diepkloof Square Shopping Centre



Source: HSRC (n.d)

FIGURE 8: Eskom SPOT Building Count 2012



Source: Eskom SPOT Counting, graphics by Mariette, N and Tsoetsi, M (2016)

The importance of documents such as the Master Plan is that they indicate the local authority's ability to align public and private sector investment opportunities, channelling them towards areas that show potential for real transformation of local communities. As indicated in the previous report, the opportunity for building the square taking into account land uses introduced by the BRT station went unnoticed (Wits, 2014).

From site visits, aerial photographs and the Master Plan, it can be seen that integration of the shopping centre with the station and the other land uses along the main road is still pending. It is hoped that the process introduced by the Johannesburg Development Agency to develop precinct plans for areas around the BRT will address this and introduce more integrated uses along this road. Unaligned private-public sector investments such as the square and the BRT system run the risk of operating in an uncoordinated and wasteful manner (Toffa, 2015). Intergovernmental and departmental coordination is a pre-requisite for ensuring that government-owned land around stations is used to promote compatibility and integration of land use.

The BRT station and Diepkloof Square could have contributed not only to "re-stitching" the apartheid city but also to transforming the lives of the community. Toffa (2015) argues that the local level impact of public and private sector investments should be as important as at city level. At city level, the square can be seen as a job creation opportunity that also upgraded community services. However, the previous study highlights a number of impacts of the development of Diepkloof Square Mall: It contributed towards changing local transport dynamics in Diepkloof, displaced residents that previously resided on the land and forced local traders to change their product offerings and sometimes to close down completely (Wits, 2014; Toffa, 2015).

5.2.2.1 Land use along Immink Drive

The previous study found very limited changes in land use along the main road between 2009 and 2013. It showed that several local businesses, mostly operating from containers on residential stands, had invested in their expansion and renovation (Wits, 2014). No movable tables with produce were identified during the current research.

Some of these businesses remain closed in the morning and on certain days. However, the co-owner of the business shown in Picture 6 indicated that opening at specific times is part of the business model of pubs and taverns, and that they are reaching their targeted profit.¹¹ In the previous study, the business in Picture 6 was identified as the most successful along Immink Drive. This appears still to be the case.

PICTURE 6: One of the Fastest Growing Businesses Along Immink Drive



Source: Mariette, N and Tsotetsi, M (January 2016)

Land use along Immink Drive generally remains unchanged, as site visits and analysis of Google Street View photos since 2013 demonstrate. Following the construction of the shopping centre, many food shops along the street have ceased to operate (Wits, 2014). Functional changes are apparent: for example, one of the containers that were closed at the time of the previous research has, according to neighbours, changed from a telephone booth to an internet café.¹² However, this container was closed when researchers were on site. Street advertising seems to be flourishing along this thoroughfare which gives good visibility to billboards, wall paintings and graffiti (Picture 7).

¹¹ Explanation by business co-owner during impromptu discussion on 8 January 2016.

¹² Impromptu discussion with neighbour conducted on 8 January

PICTURE 7: Some of the Few Street Advertisements Along Immink Drive

Source: Mariette, N and Tsoetsi, M (January 2016)

Other businesses that have developed close to the station in the past two years include a pizza place, a hair salon, a motor workshop and an arts and entertainment hub (Picture 8 and Picture 9). These newly established businesses compete with services and products already provided in the Diepkloof Square such as the pizza (typically sold by large franchises). Their colourful semi-permanent structures reflect the tastes of the market they serve. Shipping containers are located close to each other within a 500m radius as illustrated in Picture 9.

PICTURE 8: Night Activities Provided within a 500m Radius from the Diepkloof station Along Walkways

Source: The Hub Way Arts and Entertainment Company, (2016)¹³

PICTURE 9: Businesses that have Located near Diepkloof Station in the Past Two Years

Source: Pictures and graphics by Mariette, N and Tsotetsi, M (January 2016)

5.2.3 Concluding remarks

The area surrounding Diepkloof station seems to be relatively busy with activity. This is a positive indicator, however it is uncertain if it is the result of the BRT system. The emerging activities have to be further investigated in order to determine the reason behind the mushrooming of these activities along Immink Drive.

Further positive indicators noticed by the researchers included the relative cleanliness and tidiness of the areas surrounding the station. In general, the residents seem to take pride in their neighbourhood, maintaining and improving their homes and businesses. Informal traders operate businesses on the sidewalks, where present, are also kept relatively well, especially along Immink Drive.

5.3 Perspectives on Change in the Neighbourhood around Diepkloof Station

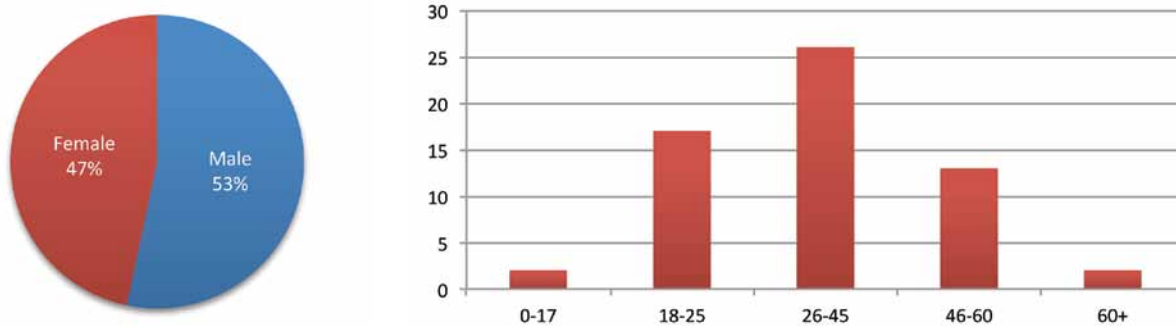
5.3.1 A comparative assessment of changes from 2013-2015: a quantitative insight

This section presents, analyses and compares findings of the previous and current research. Firstly, quantitative interviews conducted at Diepkloof Station are analysed, followed by analysis of qualitative interviews. Lastly, researcher observations are used to supplement the analysis. This information not only indicates comparative user perceptions between 2013 and 2015 but also reflects how users have been interacting with the built environment around the BRT station since 2013.

5.3.1.1 Interviewed commuter profiles

A basic profile of BRT users interviewed on 25 November 2015 was derived from quantitative interviews. As with the previous study, more males were interviewed than females (Figure 9), though the difference is small, perhaps indicating that there are no gender related issues associated with utilising the system. None of the interviewees indicated unwillingness to use the system and none reported unsafe conditions on the BRT system. It seems to cater for people of all genders and ages as well as people with disabilities. There are designated, clearly marked seats in the buses for people with special needs.

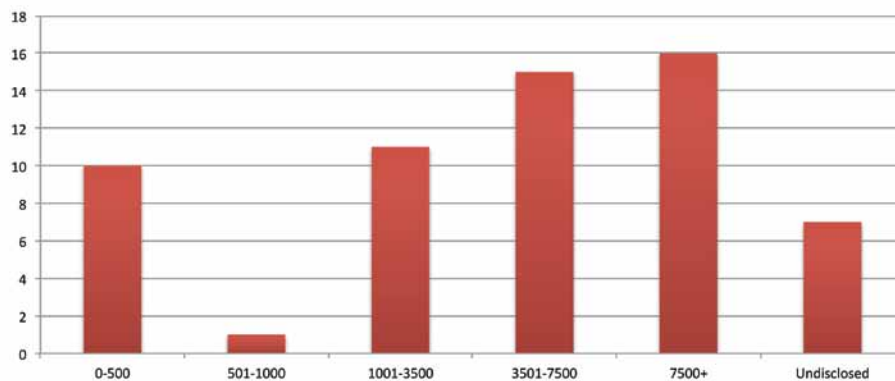
FIGURE 9: Interviewed Commuter Gender and Age Profile



Source: Data extracted from research surveys conducted for this paper on 25 November 2015, Graphics by Mariette, N and Tsotetsi, M (2016).

The majority of the sixty respondents interviewed in Diepkloof were between the ages of 18 and 45; 3.3% of respondents were over 60 (Figure 9). 11% of respondents were unwilling to disclose their income. A slight difference with the previous study is the income profile; this shows a decrease between 2013 and 2015 of 13% in respondents earning more than R7 500. This does not necessarily reflect a decrease in income but may indicate that the system is used by people of varying economic backgrounds. Half of the people interviewed (and willing to disclose income) stated that they earned more than R3 500 per month (Graph 1). This resonates with the 2013 finding that Diepkloof is not only a middle-income community but it is one of the highest earning neighbourhoods in Soweto, with the study area (Zones 3 and 4) the highest earning in Diepkloof.¹⁴

GRAPH 1: Interviewed Commuter Income Profile

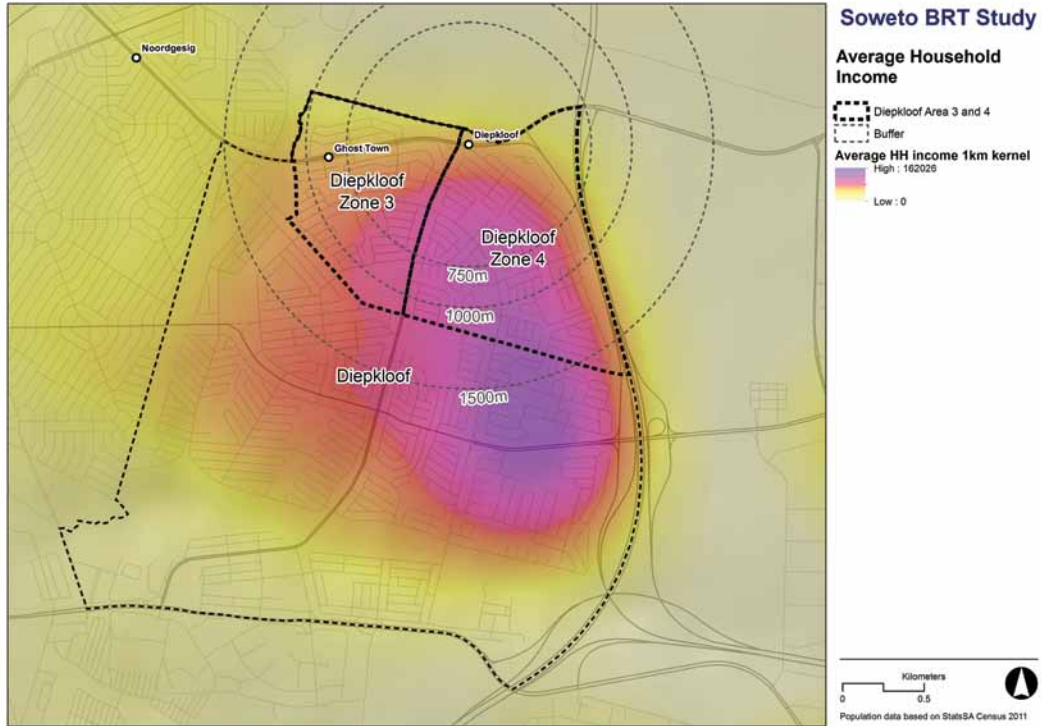


Source: Data extracted from research surveys conducted for this paper on 25 November 2015. Graphics by Mariette, N and Tsotetsi, M (2016).

¹⁴ As shown in Figure 13 of the previous study: Comparative household income for Soweto, Diepkloof and Diepkloof Zones 3 and 4 (Wits, 2014: 38).

Figure 10 indicates average household incomes around the station compared to those of greater Soweto. With such a young, middle-income commuter profile, it is not surprising to see more newly established businesses such as “The Hub Way” and “The Pizza Oven” (Picture 9) located near the station.

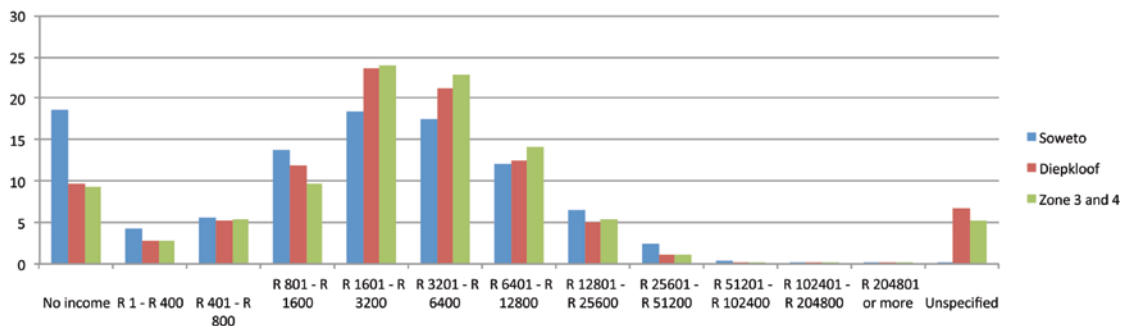
FIGURE 10: Average Household Income around Diepkloof Station



Source: Mariette, N and Tsotetsi, M (2016)

The information in Figure 10 correlates with the discussion in the 2013 study where average household income for Diepkloof zones is compared. From this, one can see (Figure 11 below) that Diepkloof Zones 3 and 4 are at the higher end of the greater Soweto and Diepkloof income groups.

FIGURE 11: Average Household Income: Diepkloof in Context of Soweto



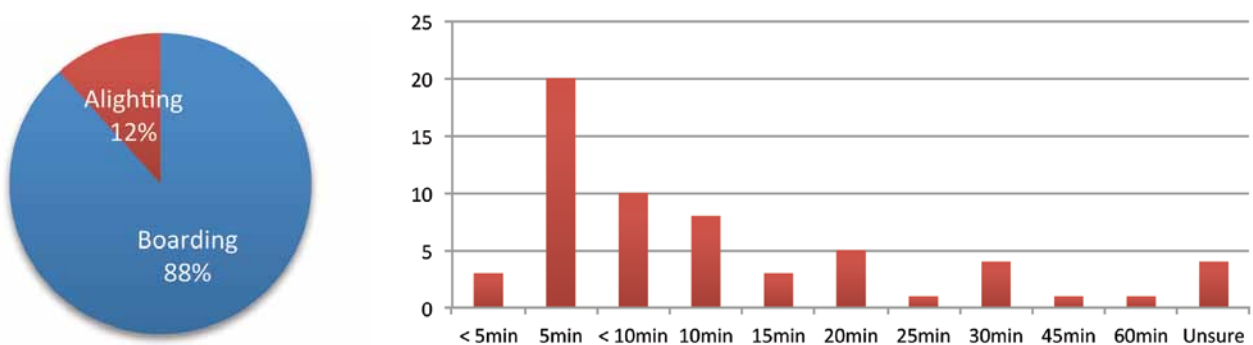
Source: Wits (2014)

5.3.1.2 Understanding BRT users and how they interact with the built environment: a snapshot from Diepkloof Station.

More than 85% of respondents were boarding at the station (Figure 12). Alighting passengers predominantly originated from other parts of Soweto, using the BRT to get to Diepkloof. The reasons for their commute were mostly for work (although more service based, such as cleaning or gardening) as well as some who were unemployed and/or job seekers.

Over 55% of respondents live near the station and said it takes them less than 10 minutes to walk there. Similarly to the previous research, nearly all BRT users profiled on 21 November 2013 walked rather than drove to the station.¹⁵

FIGURE 12: Interviewed Commuters Boarding and Alighting at the Station and Time Taken to Reach Station



Source: Data extracted from research surveys conducted for this paper on 25 November 2015. Graphics by Mariette, N and Tsoetsi, M (2016).

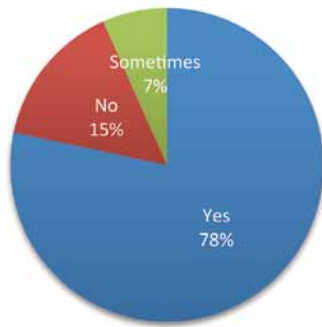
Very few commuters are seen parking at the filling station opposite the BRT station. From observation, it is not clear if such a P&R service is in demand in Diepkloof. The garage has limited parking but vehicles were not seen parking elsewhere. Respondents walked on their return trips, with 15% saying they use taxis (Figure 13). Taxis do not have restricted stops; stopping is negotiated with the driver and this generally means alighting at the closest street to home.

Taxis do not have restricted stops; stopping is negotiated with the driver and this generally means alighting at the closest street to home.

People working in town generally return between 6pm and 8pm. Respondents indicated that by this time it is dark and their major goal is to walk straight home. This gives BRT users limited time to interact with the station's surrounding area. However, the 30% of interviewed commuters using the system during the week as well as over the weekend (Graph 2) suggests that there is an opportunity for increased utilisation of the stations. Introducing attractive land uses around the station might increase the level of activity around the station area.

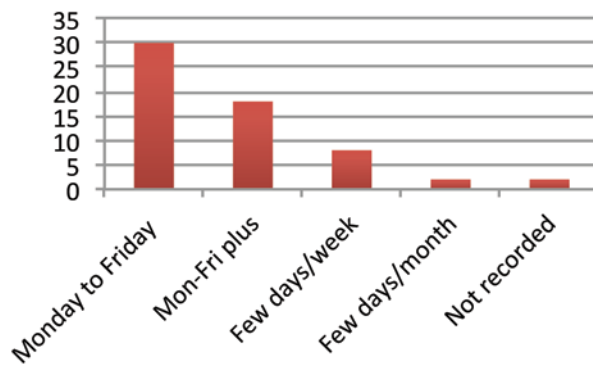
¹⁵ Commuters surveyed were all on foot according to the previous study (Wits, 2014: 39).

FIGURE 13: Interviewed Commuters Using the BRT System to Return Home from Destinations



Source: Data extracted from research surveys conducted for this paper on 25 November 2015. Graphics by Mariette, N and Tsetetsi, M (2016).

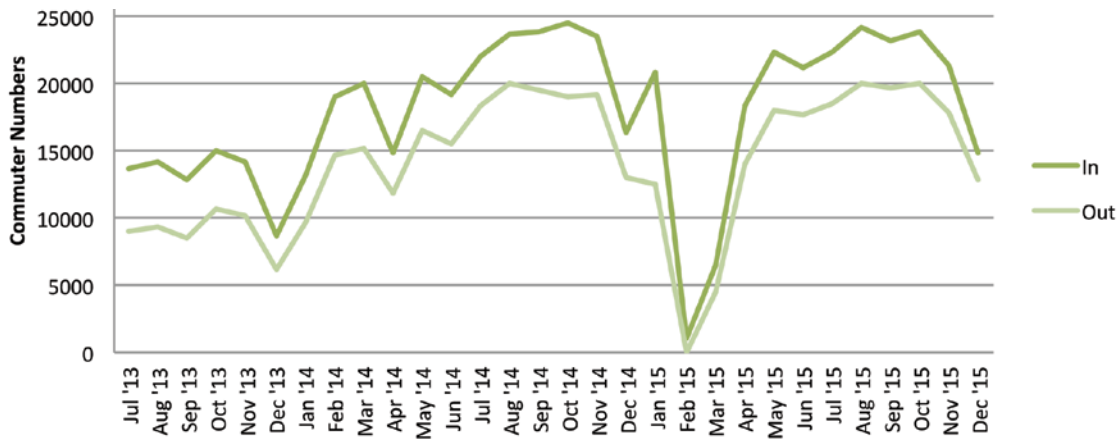
GRAPH 2: Interviewed Commuters Weekly Use of the BRT System



Source: Data extracted from research surveys conducted for this paper on 25 November 2015. Graphics by Mariette, N and Tsetetsi, M (2016)

Graph 3 and Figure 14 illustrate a small upward trend in ridership numbers for Diepkloof station since 2013, the exception being February 2015 when the BRT experienced a service interruption for most of the month. There was a delay in returning to pre-February figures, resulting in a loss of revenue. Although not mentioned by any of the individuals surveyed, it must also have impacted on the image of the system. From the same figures, it can be seen that tap-out figures are consistently lower than tap-in figures, corroborating the survey findings that a percentage of users opt not to use the BRT for their return journeys. The figures for Tuesday 24 November 2015 tap-outs and Wednesday 25 November tap-ins are uncharacteristically low. This may be attributable to the system being offline, which many respondents report as a frequent occurrence.

GRAPH 3: Tap-In/Out Graph for Diepkloof Station

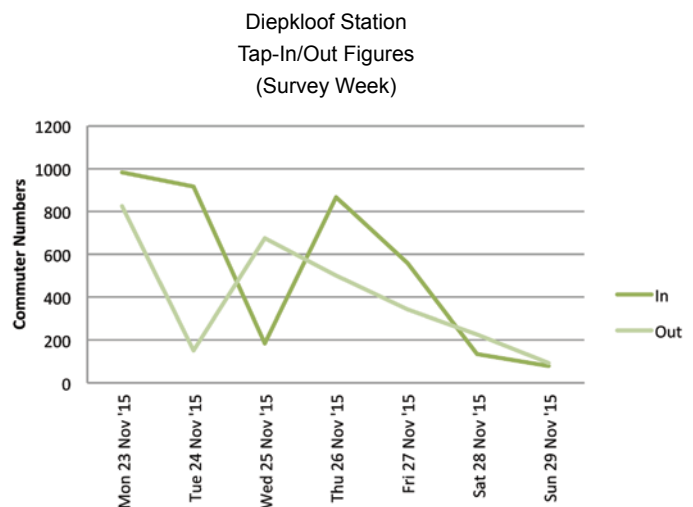


Source: CoJ Transport Department (Jan 2016), Graphics by Mariette, N. and Tsotetsi, M.

FIGURE 14: Tap-In/Out Data for Diepkloof Station

Month	In	Out
Jul '13	13661	8936
Aug '13	14145	9399
Sep '13	12769	8442
Oct '13	14967	10735
Nov '13	14116	10149
Dec '13	8697	6119
Jan '14	13127	9684
Feb '14	18951	14679
Mar '14	20050	15142
Apr '14	14841	11824
May '14	20508	16513
Jun '14	19266	15500
Jul '14	21994	18295
Aug '14	23746	20007
Sep '14	23834	19455
Oct '14	24560	19102
Nov '14	23527	19164
Dec '14	16375	12937
Jan '15	20918	12440
Feb '15	1052	5
Mar '15	6560	4556
Apr '15	18339	14042
May '15	22290	18022

Month	In	Out
Jun '15	21203	17685
Jul '15	22416	18445
Aug '15	24147	20084
Sep '15	23247	19742
Oct '15	23867	20086
Nov '15	21376	17833
Dec '15	14851	12836



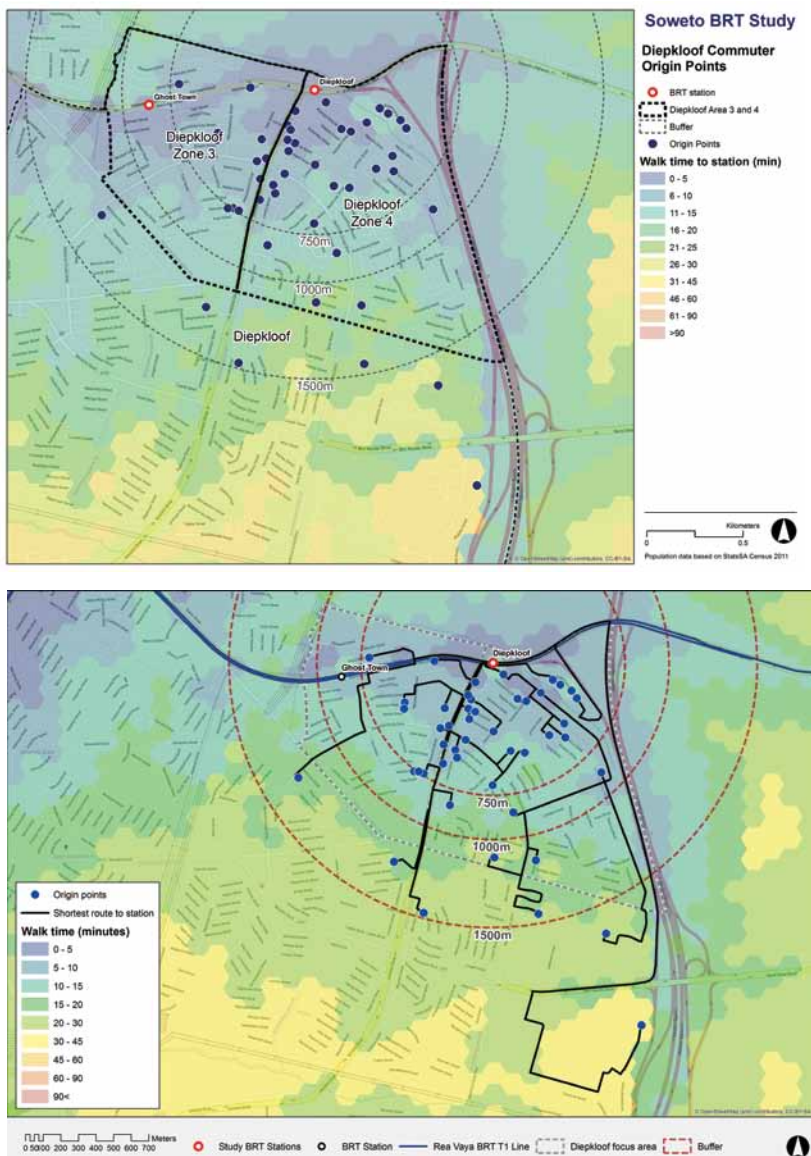
Source: CoJ Transport Department (Jan 2016), Graphics by Mariette, N. and Tsotetsi, M

A map was generated to illustrate where most respondents came from and their projected movements (Figure 15). Information for Figure 15 was provided by respondents. Capturing the correct street name was emphasised to avoid technical difficulties experienced in the initial study. Origin points were generated from commuters' responses to the questionnaire. House numbers were kept anonymous for confidentiality.

The map points indicate commuters' home locations, by street. The shortest distances to the station are then calculated by GIS software, taking into account the vehicular and pedestrian movement network. It is apparent that some commuters are willing to travel more than a kilometre to access the system. For areas to the west of Diepkloof station, it is unclear why some commuters choose to go past Ghost Town station and use Diepkloof as their boarding point.

The routes projected by the GIS software are calculated as the shortest that are viable from the origin point to the BRT station. They do not take into account user preference and undefined routes, such as cutting through properties. They will thus not be 100% accurate but form a representation of the routes commuters may use to the station and help researchers to identify possible peak key flow areas. This allows for better planning and correct allocation of infrastructure to the areas.

FIGURE 15: Origin and Routes of Commuters



Source: Mariette, N and Tsotetsi, M (2016)

5.3.1.3 Concluding remarks

The demographic elements surveyed assist researchers to determine a profile of commuters using the BRT system. The discussion above also points to some key factors relating to Diepkloof station, including the preference by some commuters to travel further to make use of this station instead of using the station nearest to them. This is mentioned to highlight the fact that simple computer modelling cannot be the only means of understanding use of a system as there will always be outliers and exceptions.

The user profile of Diepkloof station is consistent with the previous study as well as with that of Thokoza Park. This indicates broad consistency and correspondence between the stations' profile over time. This is important in the development of longitudinal data now and in the future.

It is clear that the BRT system has become an integral part of many Diepkloof (and Soweto) residents' lives. At an approximate average of 1 000-1 500 trips per day, or 40 000 per month, the system caters for a substantial number of commuters (Figure 14) from Diepkloof alone, providing a much needed service not previously available and which has become vital and ingrained in the neighbourhood.

5.3.2 Perspectives on change in the neighbourhood around Diepkloof Station: some qualitative insights

The purpose of this section is to analyse and discuss information gathered through qualitative interviews and to gain insight into the effects of the BRT system in Diepkloof as perceived by the respondents. It also investigates whether Diepkloof residents' perceptions are similar to those captured in the 2013 research.

5.3.2.1 BRT Wi-Fi connectivity is the most recent development in the Diepkloof study area

The introduction of Wi-Fi in and around BRT stations addresses a local need and is perceived as increasing the value of the BRT system to the neighbourhood. An article posted on 29 April 2015 on the Rea Vaya website indicated that the internet connection was to be made available to commuters. When asked to discuss changes in the neighbourhood, most respondents mentioned the Wi-Fi and not necessarily the BRT system itself. One respondent, the youngest amongst those interviewed, said the only change he noticed in the past few years is the Wi-Fi. It is evident that the internet connection speaks to certain issues faced by young people within the study area. They were seen using the BRT Wi-Fi to connect to various sites providing information about jobs, school work, entertainment and even religion.

One respondent, the youngest amongst those interviewed, said the only change he noticed in the past few years is the Wi-Fi.

Older respondents also stated that they appreciated the connection. When asked about the impact of the BRT in the community, one said "There is a lot of change, some of the things I have not been paying attention to; but the BRT brought convenience because a lot of students who travel in the BRT have Wi-Fi so they travel to school with their laptops and do their assignments at the parks."¹⁷

A substantial number of young people were seen using the free Wi-Fi in a small park situated near Diepkloof Station (Picture 10). Others sought a better signal by sitting on road barricades and pavements closer to the station. One of the BRT cleaning staff was seen picking up litter in the park.¹⁸ When asked about his job description, he stated that his responsibility was to keep both the station and the "Wi-Fi zones" clean.¹⁹ He also mentioned that to some extent he also provides security for people using their devices to connect to the internet.

Some respondents indicated that using these devices at certain times of the day is not safe, especially when there are only a few people in the park. Judging by the way that people concentrate under trees, or any shade available, it is clear that these spaces have the potential to attract more users if they offered adequate seating and better security. This concentration has changed the way in which the station surroundings are occupied and how the station is perceived by neighbourhood residents. The station precinct is no longer used only by public transport users but by people looking to access wifi services and socialize while doing so. This has changed manner in which people interact with and perceive the station and has led to a different usage of the areas immediately surrounding the station.

¹⁷ Response provided by respondent 14 on 25 November 2015

¹⁸ Impromptu discussion with cleaning staff conducted 8 January 2016

¹⁹ A name generated by the author to refer to areas where residents were seen gathering in numbers to connect to the BRT Wi-Fi system.

PICTURE 10: Wi-Fi Zones in Diepkloof

Source: Mariette, N and Tsotetsi, M (January 2016)

5.3.2.2 Perceived impacts on the local minibus taxi industry in Diepkloof

Representatives of the local taxi association, most likely not absorbed into the BRT bus operating company, indicated that they still feel the impact of the BRT station through the loss of commuters and income since the BRT came into operation in 2009. However, from the point of view of respondents, they no longer have to wait in long queues and struggle to get into the earliest taxi to arrive.

“Taxis are the ones that now queue up for people to arrive”

Some taxi owners/operators were apprehensive towards researchers. There are plans to strengthen the taxi business through renovations taking place at the taxi rank, although discussions with two taxi association members revealed pessimism about the potential of a renovated rank to improve the status of current business.

5.3.2.3 Perceptions of the public environment

Another impact that respondents mentioned was cleanliness around the station. One respondent’s comment on the look and feel of the area was that “The area used to be a mine dump so since the BRT trees have been planted, there is no longer as much dust.”²¹

The trees were part of the 2010 Soweto Greening Programme which aimed at planting 200 000 trees in the township.

The trees were part of the 2010 Soweto Greening Programme which aimed at planting 200 000 trees in the township. Because the trees were planted at around the same time as the development of the station, Respondent 1 assumed that they were part of the BRT system. The connection here shows that aligning investments can have a transformative impact on peoples’ minds.

The development of the BRT station in Diepkloof changed the identity of the space. However, respondents also mentioned that the development has decreased the road mass, causing traffic congestion for private vehicles:

*“Well there are more movements on the streets. People are moving from the stations to their homes; we feel that the BRT has decreased the road size...”*²²

*“The roads have improved, since I grew up here there were no roads and back then I was a taxi driver from the 80s T. The BRT came as an advantage because it brought more options, but now the roads for other vehicles have been narrowed.”*²³

20 Informal discussion with two members of the local taxi association 8 January 2016.

21 Respondent 1 interviewed 25 November 2015

22 Respondent 19 interviewed 25 November 2015

23 Respondents 6 interviewed 25 November 2015

5.3.2.4 The use of the BRT system in Diepkloof

The main aim of introducing the system in townships is to connect them with areas of opportunity, such as the city centre. Respondents mentioned that the BRT system gives them access not only to the city centre, but also to other parts of Soweto.

Although there was confusion around the introduction of the smart card in 2013, some respondents indicated that they enjoyed using it.

“For us young people it has been good. We now have the City of Johannesburg Wi-Fi, so it helps us in finding new opportunities out there, the BRT is efficient, the card system is good because we avoid walking with money and the BRT gets us anywhere.”²⁴

In contrast to 2013, most commuters are now comfortable in using the smart cards. However when the system is offline it causes frustration for the commuter. Thus commuters are unable to tap-in and load their cards. The cards need to be tapped and loaded on machines that use electricity and an internet connection. When load shedding occurs, these systems shut down forcing commuters to buy paper tickets or use other modes of transport. To avoid carrying cash, some users load their entire monthly transportation fee on their smart cards. Yet, when the system is offline they may be forced to return home or to borrow money to purchase paper tickets.

5.3.2.5 Diepkloof Junction no longer takes centre stage

Only one respondent said he had not noticed any change in the neighbourhood for the past few years. The majority mentioned the infrastructure that was “brought through the World Cup”; this includes the BRT system and the roads around it. As in the 2013 study, respondents bundled together events within the study area and mentioned them in no apparent order of importance.

“New roads, water, our dustbins are collected, and other new buildings.”²⁵

“Infrastructure, improved roads, FNB Stadium, Diepkloof Square mall and convenient shops.”²⁶

The mall was never mentioned in isolation; it was identified as one of the perceived changes similar to the BRT and the Wi-Fi. The effects of the shopping centre, however, are still felt and it was one of the factors mentioned when respondents spoke about positive and negative changes. Local traders near the centre are still struggling to keep their businesses afloat. Some of the food retailers that closed in 2013 remain closed. Residents displaced to accommodate the mall were mentioned by one respondent who did not seem interested in elaborating further on the issue.

“In 1999, this area had squatter camps where the mall is and now we have proper roads, square/mall, traffic has declined in peak hours, we also find people coming to live here and since there is a lot of development we can get jobs.”²⁷

5.3.2.6 Changes to the built environment

Questions related to physical changes to the built environment revealed little consciousness of any major impacts. Respondents did not report any structural changes or major developments, particularly not in the two years since the previous study.

The researchers also perceive no significant changes to the area. Small-scale modifications to houses and the addition of backyard dwellings are common but are not taking place at a rate that influences the perception of neighbourhood residents. The 2013 study highlighted the major Diepkloof Square shopping centre development, but subsequently there has been no major change to the neighbourhood. As reported above, there were some changes to businesses close to the station but these were mostly within existing structures and/or were superficial, not impacting substantially on the physical structure of the area.

24 Respondents 16 interviewed 25 November 2015

25 Respondent 11 interviewed 25 November 2015

26 Respondent 6 interviewed 25 November 2015

27 Respondent 11 interviewed 25 November 2015

5.3.2.7 Concluding remarks

The qualitative interviews greatly assisted the researchers in understanding perceptions of the area and the effect of BRT on daily lives. The station and its Wi-Fi have made a definite impression on the area and have resulted in the station becoming a centre of social, educational activity and assisting people in finding employment by giving residents access to information. The public space around the station is starting to take on a different character, especially with the youth utilising it more frequently.

The continued perceived economic impact on the local taxi industry as expressed by local operators perhaps indicates the impacts of a transformation process. The approach of the BRT system was to maximise inclusion of existing minibus taxi operators affected and through the formation of PioTrans, a minibus taxi industry owned bus operating company, there were many beneficiaries of the system from within the industry (McCaul and Ntuli, 2011). So while the minibus taxi mode activity is visibly reduced in the area many from the industry are now involved in BRT operations. Perceptions of the neighbourhood environment remain positive due to the cleaner and safer spaces attributed by residents owed to the influence of the BRT system. The favourable environmental impact of the system greatly influences the general perception of the neighbourhood, something that the researchers also noted. Variation in uses of the system also seems to be increasing, with respondents reporting some inter-township trips rather than purely trips to the City CBD for work. This has also been influenced by the use of the smart cards, though the downtime experienced frequently impacts economically on those who have spent money to load their cards and then have to pay cash for trips or use alternative transport methods.

Residents have now become accustomed to the services offered by the Diepkloof Square shopping centre and, in contrast to 2013, do not feel that it takes centre stage any more. Physical impacts on the built environment are not prominent, as no major developments have taken place since the previous study.

6 Thokoza Park Station Impacts

6.1 Thokoza Park Area in Context

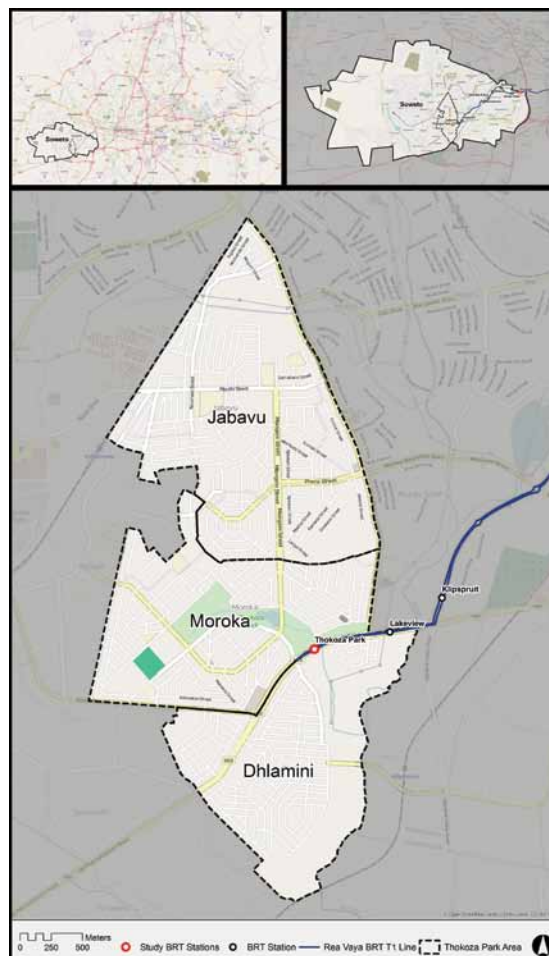
The area around the Thokoza Park Rea Vaya BRT Station (henceforth the “Thokoza Park Study Area”/“Thokoza Park Area”), was identified for this study taking into account information gathered in surveying commuters and residents in the area. The area has been delineated in relation to the concentration of origin points - discussed later - of BRT users. It includes the Dhlamini, Jabavu and Moroka neighbourhoods around the station, as shown in Figure 16 which illustrates the study area in the context of Soweto and greater Johannesburg.

6.2 A Brief Historical Perspective

The area surrounding Thokoza Park BRT station is rich in historical significance. At the centre of the study area is the open space known as Thokoza Park, which includes the Moroka Dam (formerly Soweto Dam) named after Dr James Moroka, a prominent ANC leader during the 1950s. The park has become a tourist attraction and is popular among local residents.

The building of the dam in 1960 and the surrounding open space created a key recreational area in Soweto but the decline and degradation of the space during the 1980s encouraged criminal and anti-social behaviour in the park, leading to further deterioration. In the early 2000s, a large restoration and upgrading project was undertaken. This

FIGURE 16: Thokoza Park Study Area in Context



Source: Mariette, N and Tsotetsi, M (January 2016)

concluded in August 2002 and was a Mayoral “Showcase Project” for the World Summit of Sustainable Development in the same year (CoJ, n.d. (a)).

The neighbourhoods in the station area were established in the 1950s to house black people moved from what were to become exclusively white areas. The township of Dhlamini (sometimes referred to as Dlamini) is located immediately to the south-west of the BRT and was established in 1954 (CoJ, n.d. (b)). The famous Regina Mundi Church, a popular gathering place before, during and after the anti-apartheid movement, is located near the BRT station, adjacent to the P&R area north-east of the station. Respondents in the area indicated deep pride in their neighbourhoods. They distinguish the different parts of the neighbourhood they come from, highlight the importance of the area and take pride in its growth and development.

Thokoza Park Station was established as part of the Phase 1 Rea Vaya BRT system which commenced operations in 2009. It is the terminal station on the T1 route and so is of regional significance, attracting commuters from a wider catchment area than most other stations.

6.3 Current Context of the Thokoza Park Area

A prominent feature around Thokoza Park Station is the green open space of Thokoza Park. As discussed above, the park has long been a prominent feature of the area. Its upgrade and maintenance have greatly improved the safety of the area. Also, the introduction of the BRT system has attracted commuters, many of whom walk through the park to the station, thus increasing passive surveillance. The maintenance of the station and surrounding areas and the visible security on site has also contributed to the perception of safety and security. The safety of the park and the station vicinity are interlinked; they both impact on each other positively.

Street vendors and tuck-shop owners around the park said they were pleased to be located around this facility as they do not have to travel to the CBD to sell their goods.

Picture 11 shows a soccer match organised by community members where the community came out in numbers in support of their young local soccer players. An impromptu discussion with the soccer coach indicated that the park serves as a resource for soccer matches and training.²⁸ Different events were observed in the

park including a picnic of a local stokvel. Policing is visible in the park and surrounding areas, including the BRT bus station. Street vendors and tuck-shop owners around the park said they were pleased to be located around this facility as they do not have to travel to the CBD to sell their goods. Although there are still some safety concerns regarding undesirable individuals, these have subsided due to increased security visibility, use and good maintenance of the park and the station area.

PICTURE 11: A Soccer Match Organised by Community Members



Source: Mariette, N and Tsetetsi, M (January 2016)

²⁸ Impromptu discussion with a resident 8 January 2016

6.4 Study Area Spatial Analysis

The study area was delineated from distance buffers around the station as well as from information gathered through surveying the commuters. The focus areas were then derived at neighbourhood level from origin locations reported by respondents. Thokoza Park Station is the T1 Rea Vaya terminus and attracts commuters from a wide area; the functional area the study revealed for the station is significantly larger than the functional areas observed around Diepkloof station.

The access issue was exacerbated by the fact that Thokoza Park BRT Station is not pedestrian-friendly. As can be seen in Picture 12, access is not easy. There are two BRT bus lanes on each side of the station

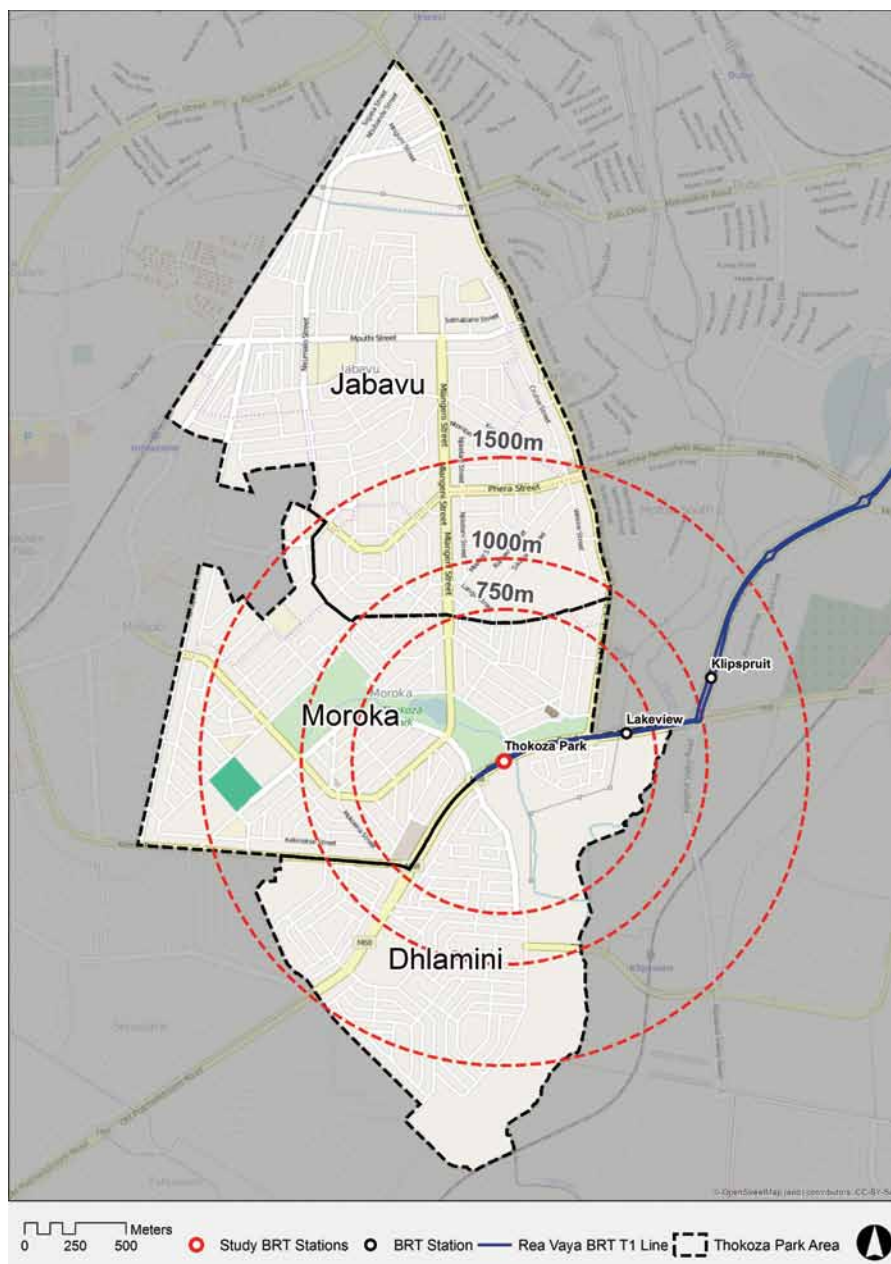
separated by kerbs from the rest of the road. Private vehicle traffic flows in the same direction as the buses on both sides of the station. Just after the 'security radius' is a traffic circle that splits traffic in different lanes, resulting in several road kerbs that make road crossing difficult for pedestrians.

PICTURE 12: Thokoza Park Station Entrances and Accessibility



Source: Google Earth™; Graphics and Photo by Mariette, N and Tsetetsi, M (January 2016) Source: Mariette, N and Tsetetsi, M (2016)

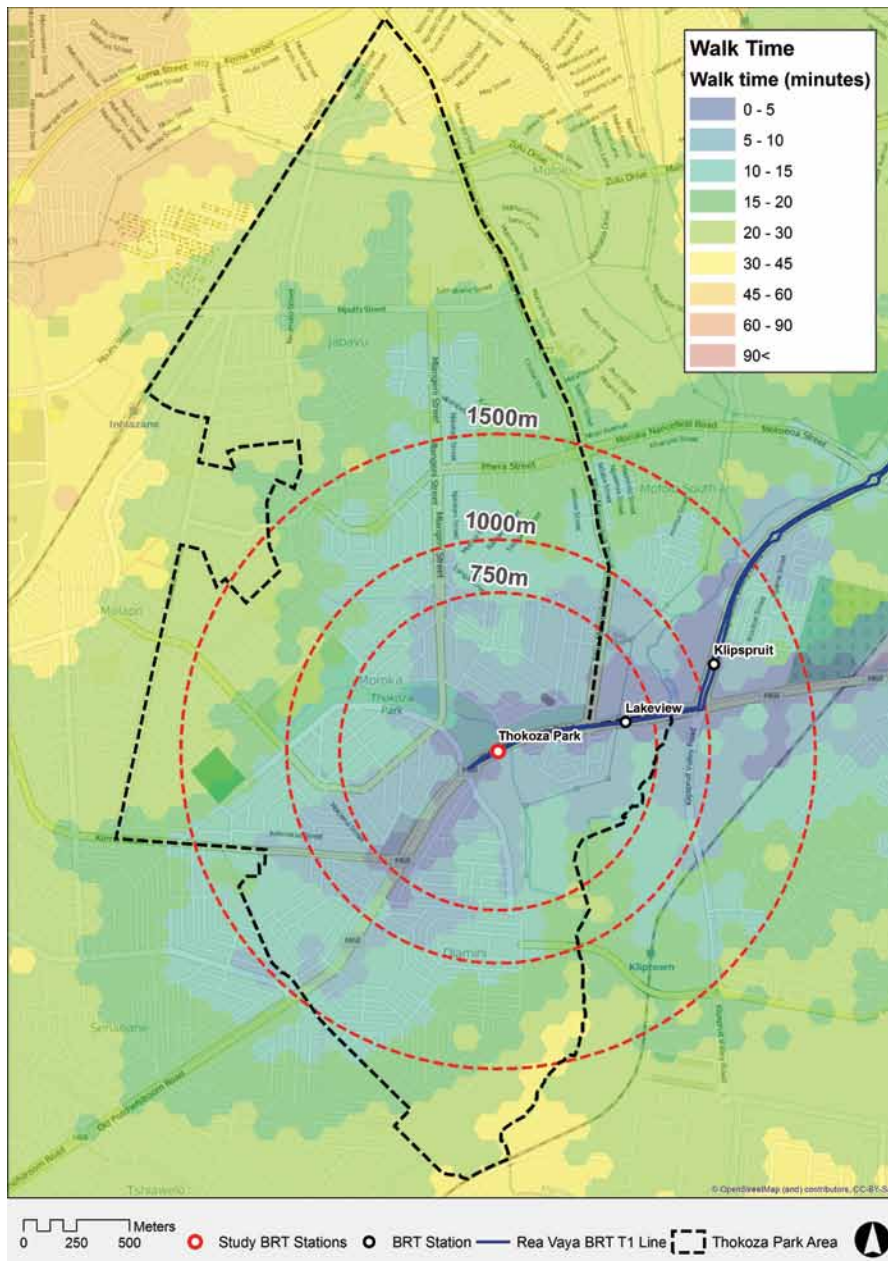
FIGURE 17: Distance Buffers around Thokoza Park Station



Source: Mariette, N and Tsotetsi, M (2016)

The distance buffers surrounding the station limited the research to a reasonable area surrounding the station. The area to the east of the station which falls within the distance buffer indicated is also served by two additional BRT stations (on the same route as Thokoza Park study station) and the impact and reach of the study station does not appear to extend into this area. Qualitative interviews were mainly limited to within the 1km buffer around both stations although the Thokoza area is much larger. In contrast to the Diepkloof Study Area, the Thokoza Park Study Area extended well outside the 1.5km buffer.

FIGURE 18: Walking Times around Thokoza Park Station



Source: Mariette, N and Tsotetsi, M (2016)

Figure 18 shows the calculated walking times for commuters around Thokoza Park Station. Most of the study focus area involves a walking time of less than 20 minutes. This is corroborated by survey information shown in Table 2, with most commuters within the 20 minute travel window but slightly more weighted toward 10-15 minutes than at Diepkloof Station.

TABLE 2: Table of Travel Times to Thokoza Park Station

Thokoza Park	
Travel Time to Station	Number of people
less than 5	2
5 minutes	12
less than 10	2
10 minutes	10
15 minutes	6
20 minutes	1
25 minutes	0
30 minutes	0
45 minutes	1
60 minutes	1
Not sure	0
Total	35

Source: Data extracted from research surveys conducted for this paper on 25 November 2015, Graphics by Mariette, N and Tsotetsi, M (2016).

The data collected is consistent with models of pedestrian behaviour in accessing public transport as indicated in the relevant literature. A few outliers, however, indicate the need for support services to enable access within reasonable timeframes.

6.4.1 The changing physical context and major developments in the Thokoza Park area

The Thokoza Park Study area has experienced infrastructural change over the years. There have been major upgrades to roads and sidewalks, development and improvement of public transport to the inner city, in particular the Rea Vaya, as well as revitalisation of Thokoza Park itself, largely financed by public investment, as also mentioned in the previous study.²⁹ Major events in the City seem to have given rise to additional public investment. Many upgrades and major projects were undertaken in support of the World Summit of Sustainable Development in 2002 and the FIFA World Cup in 2010, creating tangible benefits for the area.

The revitalisation of the park in 2002 and the building of the BRT station were accompanied by other upgrades and improvements. Figure 19 shows the changes in the area over time. The redevelopment of the park, circled in yellow, from 2001 to 2004, and the addition of the BRT station, circled in blue, can be seen from the 2007 to 2011 images. The 2015 image in Figure 19 shows the current, mostly unchanged, setting.

The changes are felt at ground level and were echoed in the qualitative interviews. One respondent reported: "There were a lot of changes made after the World Cup. I mean, we saw a lot of improvements in our roads and the BRT is also here now."

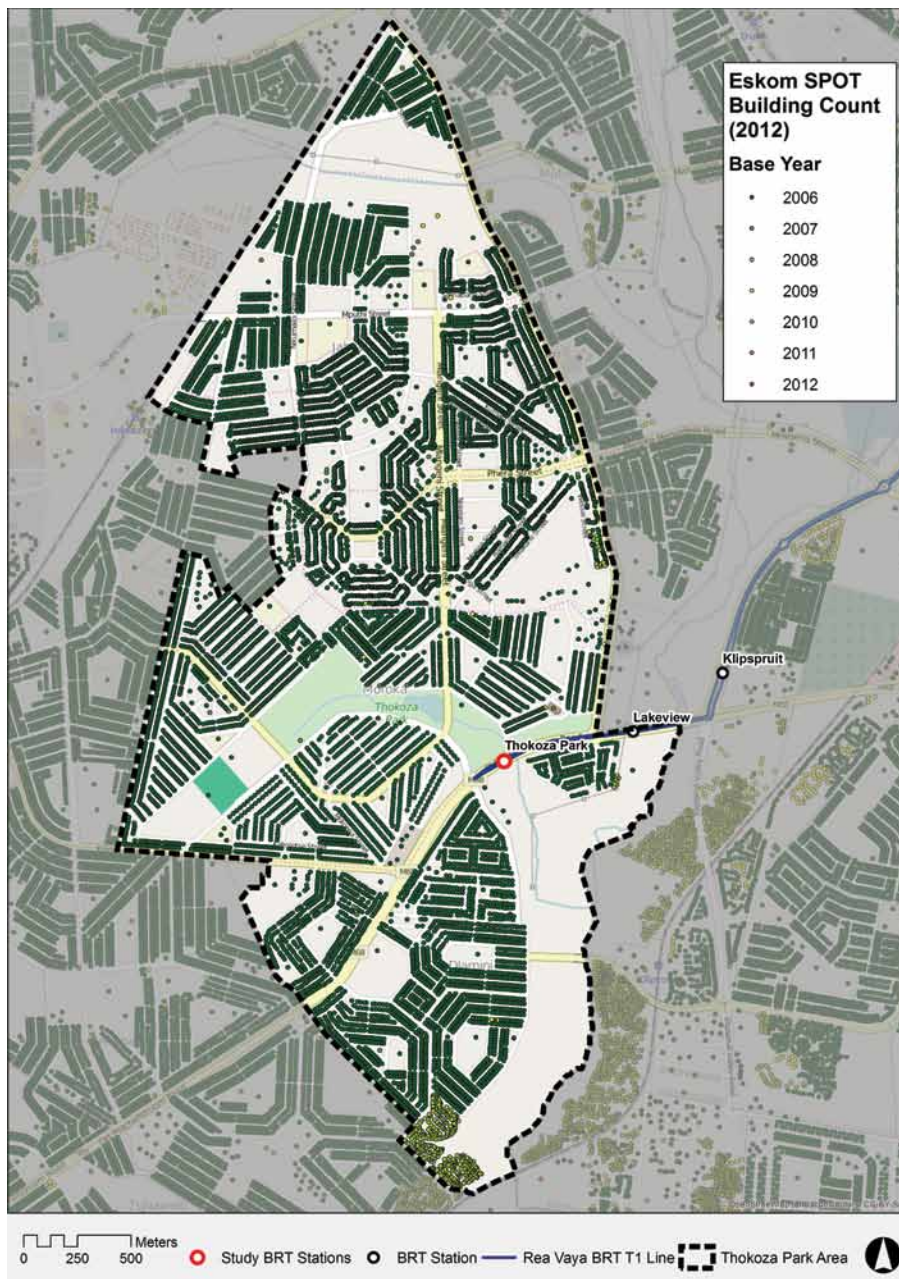
Source: Google Earth™, graphics by Mariette, N and Tsotetsi, M (2016) 35 Formal housing stand densification

FIGURE 19: Thokoza Park Over Time

29 As mentioned in the station selection investigation (Wits, 2014: 51)

Due to the location of the station near the wetland area surrounding it, major changes have been limited to the upgrading of roads and improvement of transport services. The neighbourhoods have remained largely unchanged as no major land use developments such as the Diepkloof Square shopping centre have taken place. The area remains largely residential in nature and is now well linked to nearby areas with shopping malls and other commercial activities.

FIGURE 20: Eskom SPOT Building Count for the Thokoza Park Area



Source: Mariette, N and Tsotetsi, M (2016)

A valuable source of information on new structures in the Thokoza Park Study Area is the Eskom SPOT Building Count (SPOT Count).

Figure 20 shows the annual SPOT Count to illustrate levels of development in the area. The SPOT Count is unfortunately only available to 2012, newer data not having yet been released. However, it provides valuable information on changes during and after the construction of the station in 2009.

Figure 20 shows the annual building count. The information lacks depth and with such a small study focus area does not contribute as substantially as had been hoped. For this reason, geo-imagery analysis was conducted to assist in visualising and interpreting spatial and physical changes at neighbourhood level. Table 3 shows changes visible from the Google Earth™ aerial photography similar to that shown by the 2013 study of the area around Diepkloof Station.

Eskom SPOT Counts use 2006 as a base year as this is when surveying started in the area. From this data, it is apparent that a drastic spike in development took place in 2008 in the Thokoza Park area, with a nearly tenfold increase in new structures compared to the other years shown. Possible contributors are public investment as well as the inception phases of the BRT. There was however no major increase in population (see figures below) corresponding with this increase in building. To validate this data, an account of change based on aerial photography was undertaken which helps give a clearer picture of changes on the ground.

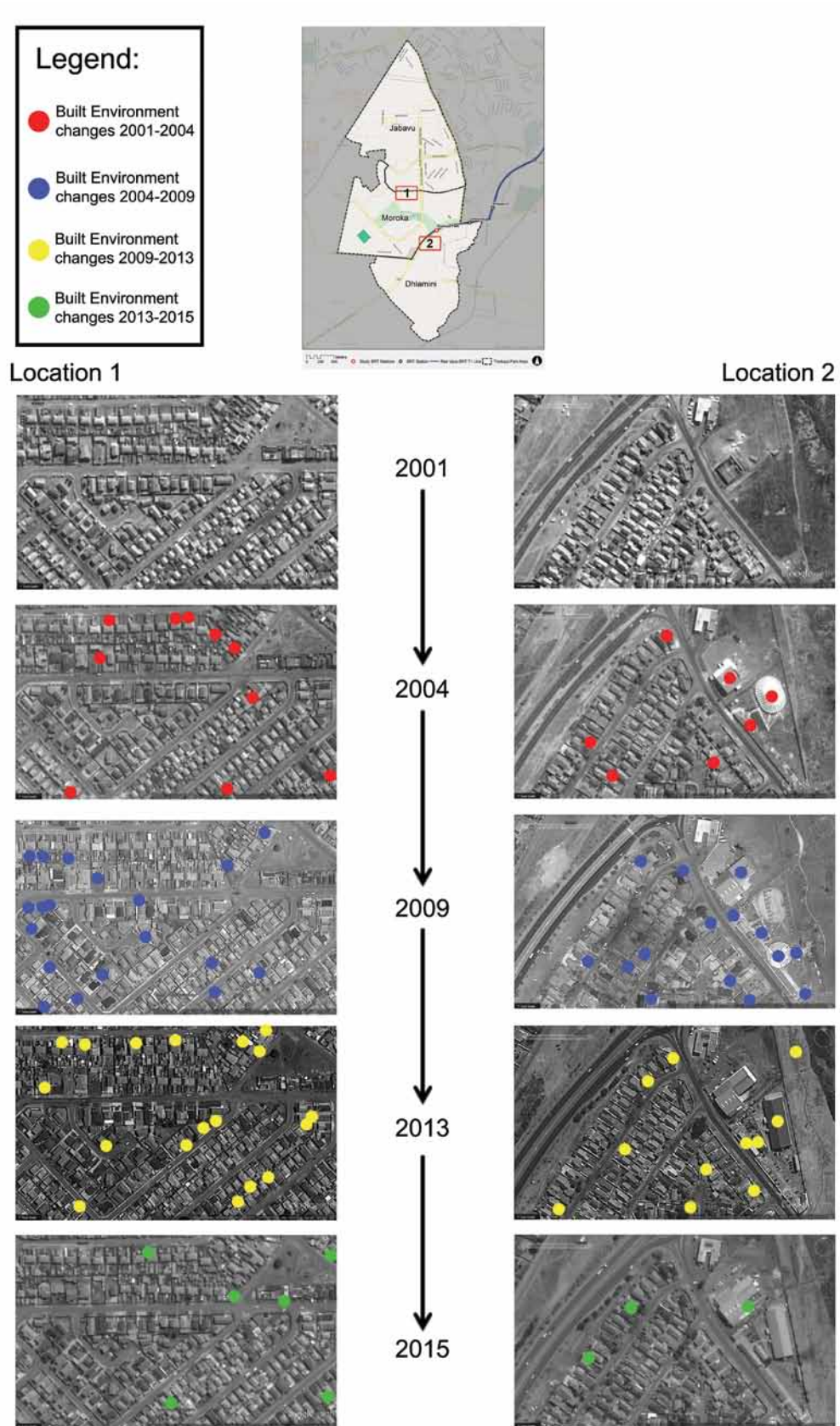
The Thokoza Park Study Area is quite built up, with most densification, as in Soweto as a whole, due to the increase in backyard dwellings and additions to existing houses. Figure 21 shows where visible additions have taken place between 2001 and 2015. The analysis shows an increase in new structures in 2009, corresponding to the building count discussed above, but not enough to justify the figures in the count.

TABLE 3: Figures for the SPOT Count in the Thokoza Park Area

Thokoza Park Station SPOT Building Count		
YEAR	Building Count	Compound Count
<2006	12220	12220
2007	46	12266
2008	361	12627
2009	13	12640

Source: Eskom SPOT Building Count

FIGURE 21: Densification Analysis of the Thokoza Park Area



Source: Google Earth™, graphics by Mariette, N and Tsotetsi, M (2016 Land use context

6.4.2 Land use context

Land Use in the Thokoza Park Study Area is predominantly residential. There is extensive informal trade in terms of street vendors, informal spaza/tuck shops on residential erven and shebeens/taverns. Many other commercial activities also operate from residential areas, including vehicle repair, day-care/crèches, driving instruction and hair/beauty salons located along the main pedestrian routes on the way to the BRT Station (see Picture 13).

PICTURE 13: A tuck shop on a residential stand in the Thokoza Park area



Source: Mariette, N and Tsotetsi, M (January 2016)

Formal and informal businesses in the area help make the neighbourhoods around the station vibrant and active, with a wide variety of services close to the station. Owners were interviewed on changes since the inception of the Rea Vaya. One business owner made a typical comment on how the BRT has affected his tavern business near the BRT station:

“It used to [impact my business] but not anymore. I believe that it could still make a huge impact in my business only if it could operate the way it used to. Before the World Cup the BRT used to operate for longer hours and brought me a lot of customers coming from the Stadium. I believe that then it had an impact on my business and also the night life of the neighbourhood as well as the tourism of the area.”

6.4.3 Unpacking census data

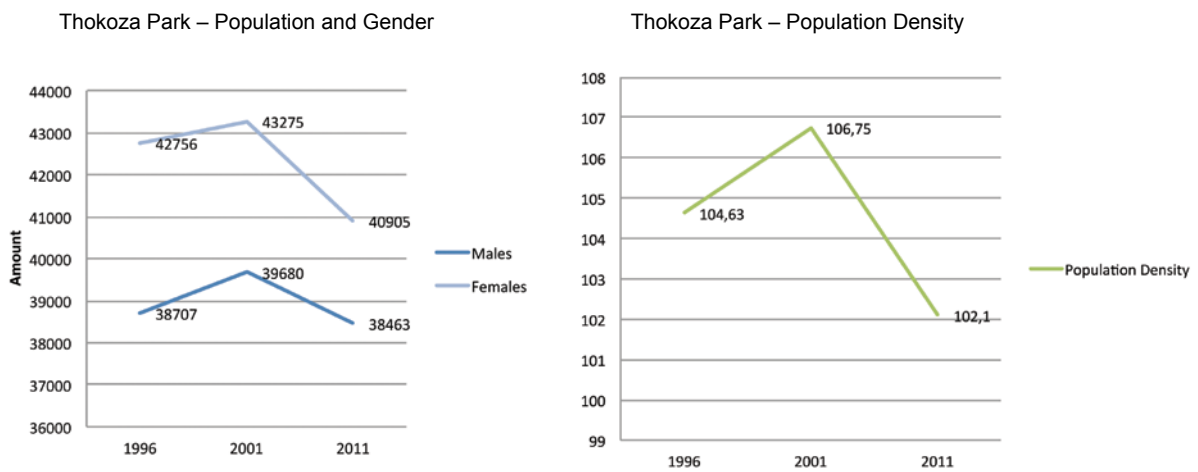
Census data on the Thokoza Park Study Area was processed using the MapAble™ tool. Data from 1996, 2001 and, the newest available, 2011, were used to create a picture of demographic trends in the study area.

For reasons that are not clear, the population of the area rose and then fell more sharply over the three census periods.

For reasons that are not clear, the population of the area rose and then fell more sharply over the three census periods. Graph 4 shows how the male and female population has changed, with the female population growing by just over 1.2% (42 756 to 43 275) from 1996 to 2001 and then declining by slightly over 5.4% (43 275 to 40 905) from 2001 to 2011. Male population trends were similar, with a growth of approximately 2.5% (38 707 to 39 680) from 1996 to 2001 and a decline of 3.1% (39 680 to 38 463) from 2001 to 2011. Population density showed the same trend, with a sharp decline between 2001 and 2011. This is not in line with greater Soweto, however, which experienced population growth of more than 8% from 1996 to 2001 and further growth of around 13% from 2001 to 2011.

Graph 4 indicates age groups, demonstrating that the age demographics have remained relatively consistent over time. There is a high proportion of working age (20-65 years) people with a balanced male/female ratio. This corresponds with trends in the rest of Soweto.

GRAPH 4: Thokoza Park Area Population Graphs



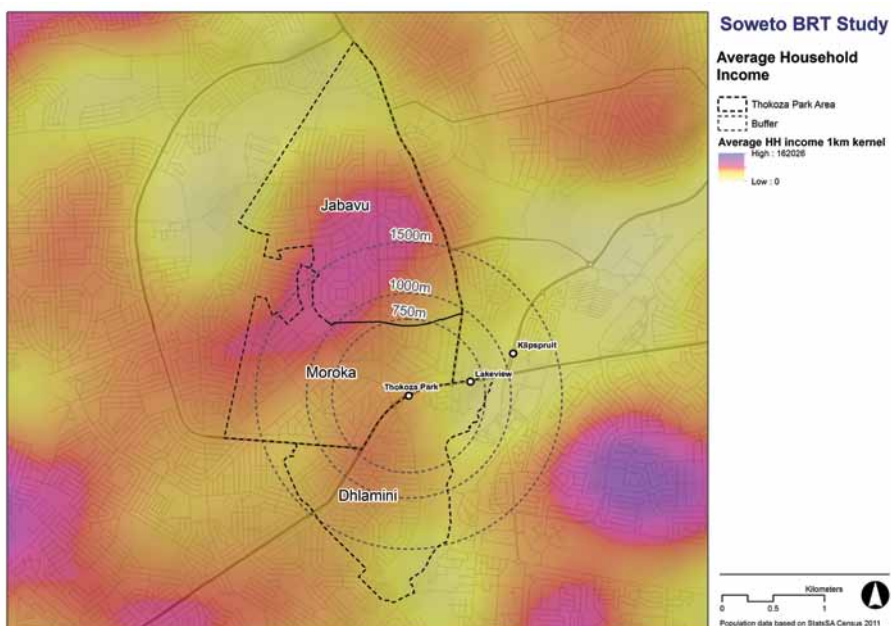
Source: MapAble™ report compiled from StatsSA Census Data; Graphics by Mariette, N and Tsotetsi, M (2016)

TABLE 4: Thokoza Park Area Age Group Distribution

Thokoza Park – Age Groups						
	1996		2001		2011	
	Male	Female	Male	Female	Male	Female
<5y	3743	3882	3329	3290	3921	3756
5y-20y	11037	11688	10468	11070	9210	8955
20y-65y	22257	24214	24464	25945	24009	25164
>65y	1468	2820	1329	3060	1416	3027
Total	38505	42604	30590	43365	38556	40902
	81109		82955		79458	

Source: MapAble™ report compiled from StatsSA Census Data

FIGURE 22: Income Groups around the Station and Study Area



Source: StatsSA Census 2011 data; Graphics by Mariette, N and Tsotetsi, M (2016)

Figure 22 shows a similar picture to that around Diepkloof Station: income groups around the station and study area are similar in scale and prevalence, with predominantly middle income residents with a cluster of higher income residents to the north of the station near the borders of Moroka and Jabavu. This cluster is however located further from the station than at Diepkloof. Lower income earners, earning below R2 000 per month and accounting for approximately 47% of the area population, predominate, as in Diepkloof (Table 5), but with more middle income earners (between R2 000 and R20 000 per month), constituting around 46% of the population.

The comparative income levels in Table 5 show that in real terms, when 1996 and 2001 figures are adjusted for 2011 values, there has been a notable shift in income groupings and that the population is now more in the middle income group than in previous census years.

TABLE 5: Table of Household Income in Thokoza Park Area for 1996, 2001 and 2011

Thokoza Park — Household Income			
Income (R/month)	1996	2001	2011
<1200	2927	4710	6920
1200-2000	82	154	2728
2000-5000	297	576	3692
5000-10 000	933	1267	3711
10 000-20 000	1992	3645	2018
20 000-50 000	5715	5370	697
>50 000	5331	5629	796
Total	17277	21351	20562

Source: MapAble™ report compiled from StatsSA Census Data

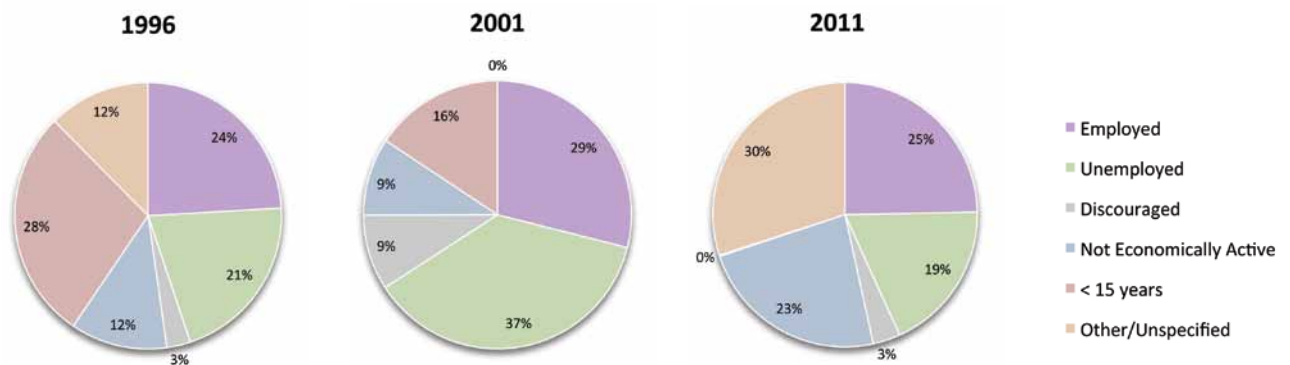
Housing trends in the Thokoza Park area are revealing. Total households grew by 23% (17 372 to 21 350) from 1996 to 2001, followed by a decline of 7.2% (21 350 to 19 797) from 2001 to 2011. This spike in household numbers is coupled with a sharp drop in average household size which fell from 4.68 to 3.89 people per household in 1996 to 2001 and then rose slightly to 4.01 people per household in 2011, showing the inverse relationship of these figures.

Housing types are shown in Figure 23 and tenure types in Figure 24³⁰. In all census periods, the largest category continues to be brick buildings which grew proportionally from 1996 to 2001, declining slightly from 2001 to 2011. A sharp fall in the “Multiple Dwelling” category in 2001 and a sharp rise in 2011 can probably be attributed to issues of classification and clarity when conducting the survey. An interesting trend is the relative consistency of informal backyard dwellings which stayed relatively stable at 6%, 7% and 8% in 1996, 2001 and 2011 respectively.

Ownership and tenure have become more diverse. Information from 2001 indicates a nearly equal division between rental and fully paid ownership (40% and 44%) and 15% rent-free occupation. The 2011 data shows much more diverse tenure, with an increased proportion of fully paid ownership (44% to 50%), a decline in rental (40% to 31%), a slight decline in rent-free tenure (15% to 12%) and a substantial rise (from less than 1% to around 4%) in the “Owned but not yet paid off” category. This may indicate new residents moving into the area and purchasing property, and confirms the increased proportion (relative to total population decline) of the working age population in the area. This may be an indication of revitalisation and growth.

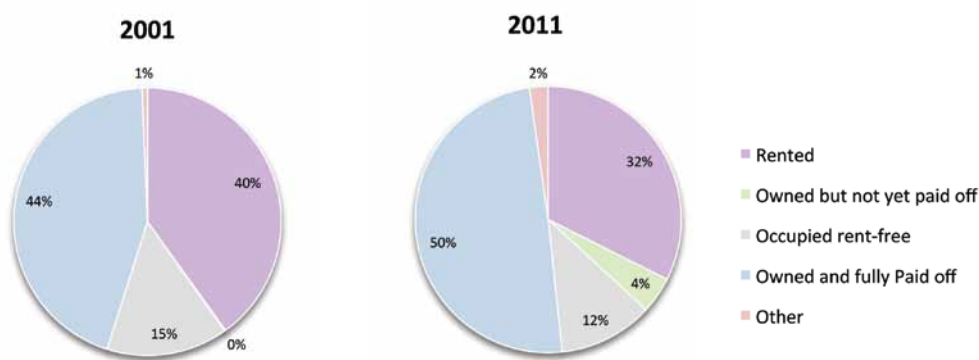
³⁰ No data is available on tenure in 1996 so only 2001 and 2011 are presented.

FIGURE 23: Dwelling Types in the Thokoza Park Area



Source: MapAble™ report compiled from StatsSA

FIGURE 24: Dwelling Ownership (Tenure)



Source: MapAble™ report compiled from StatsSA Census Data

6.4.4 Concluding remarks

Providing a baseline analysis of the broader areas surrounding the station is valuable for future studies on impact and change in the area. This report provides a first look at the area surrounding this station and gives researchers the opportunity to compare responses and experiences with Diepkloof. The ownership and tenure arrangements highlighted above appear similar to those in the 2013 Diepkloof study.³¹

The social history of the Thokoza Park area differs from that of Diepkloof but they share a broader context and comparable profile. Much of the user experience of the Rea Vaya system is the same at Thokoza Park and Diepkloof, and is likely to be similar at other stations.

6.5 The Quantitative Profile of Thokoza Park

Due to the difficulties experienced in the Thokoza Park area, general observations made by researchers played a significant role in supplementing data collected during surveys and interviews. At Diepkloof, BRT users were willing to participate but their time constraints in the early mornings often made this difficult. BRT users in Thokoza Park were reluctant to participate in the survey either because they did not know the intention of the researchers or they were rushing to catch the bus. To understand the variety of BRT users at this station, an additional day was scheduled for quantitative interviews with P&R BRT users in Thokoza Park Station on 20 January 2016.

31 Housing typology and tenure presented by Wits (2014:34-36)

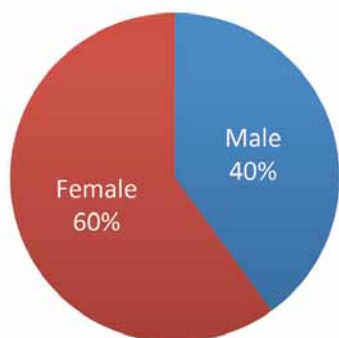
6.5.1 Understanding BRT users and how they interact with the built environment: a snapshot from Thokoza Park Station

6.5.1.1 BRT user profiles

As shown in Figure 25, male and female users are in approximately the same proportions as at Diepkloof. Due to the small sample size at Thokoza Park Station, it is difficult to generalise from the surveyed commuters, thus in addition visual observation is used to support arguments made below. Also similar is that, of the interviewees in both stations, 11% chose not to disclose their income.

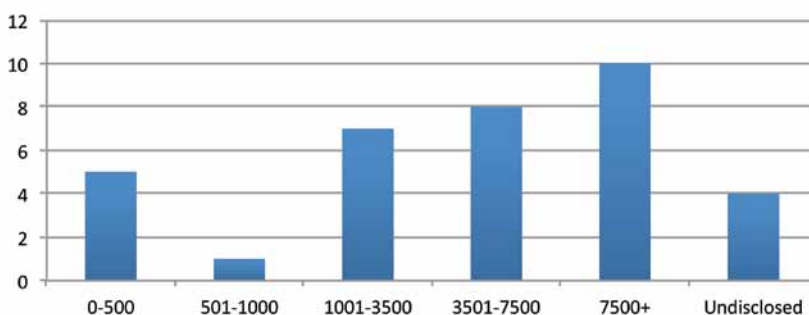
Nevertheless, the findings indicate that Thokoza Park is a middle income earning community, and this is confirmed by the 2011 Census data which provides more accurate data on the matter. What this means for the station is that there “are people with a higher spending capacity congregating close to the station on a daily basis” (Wits, 2014). This is important in property economics logic that indicates value is determined by access and spending capacity. So in theory there is evidence of BRT user profiles that can stimulate potential ‘land development or redevelopment, where developers and businesses [may] attempt to capitalise on the higher concentrations of spending capacity which station areas generate’ (Wits, 2014). However, these outcomes typically take longer to manifest and are influenced by a number of other property investment fundamentals.

FIGURE 25: Profiled Gender of Respondents



Source: Data extracted from research surveys conducted for this paper on 25 November 2015, Graphics by Mariette, N and Tsotetsi, M (2016)

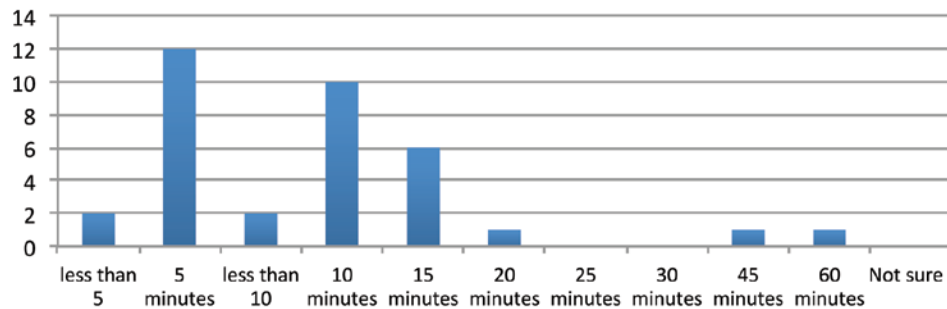
GRAPH 5: Profiled Monthly Income of Respondents



Source: Data extracted from research surveys conducted for this paper on 25 November 2015, Graphics by Mariette, N and Tsotetsi, M (2016)

Graph 6 shows that walking times for commuters in the Thokoza Park focus area are almost all 20 minutes or below, similar to Diepkloof. This is corroborated by information that most of the commuters surveyed originate from within the study focus area.

GRAPH 6: Travel Time to Station



Source: Data extracted from research surveys conducted for this paper on 25 November 2015, Graphics by Mariette, N and Tsotetsi, M (2016)

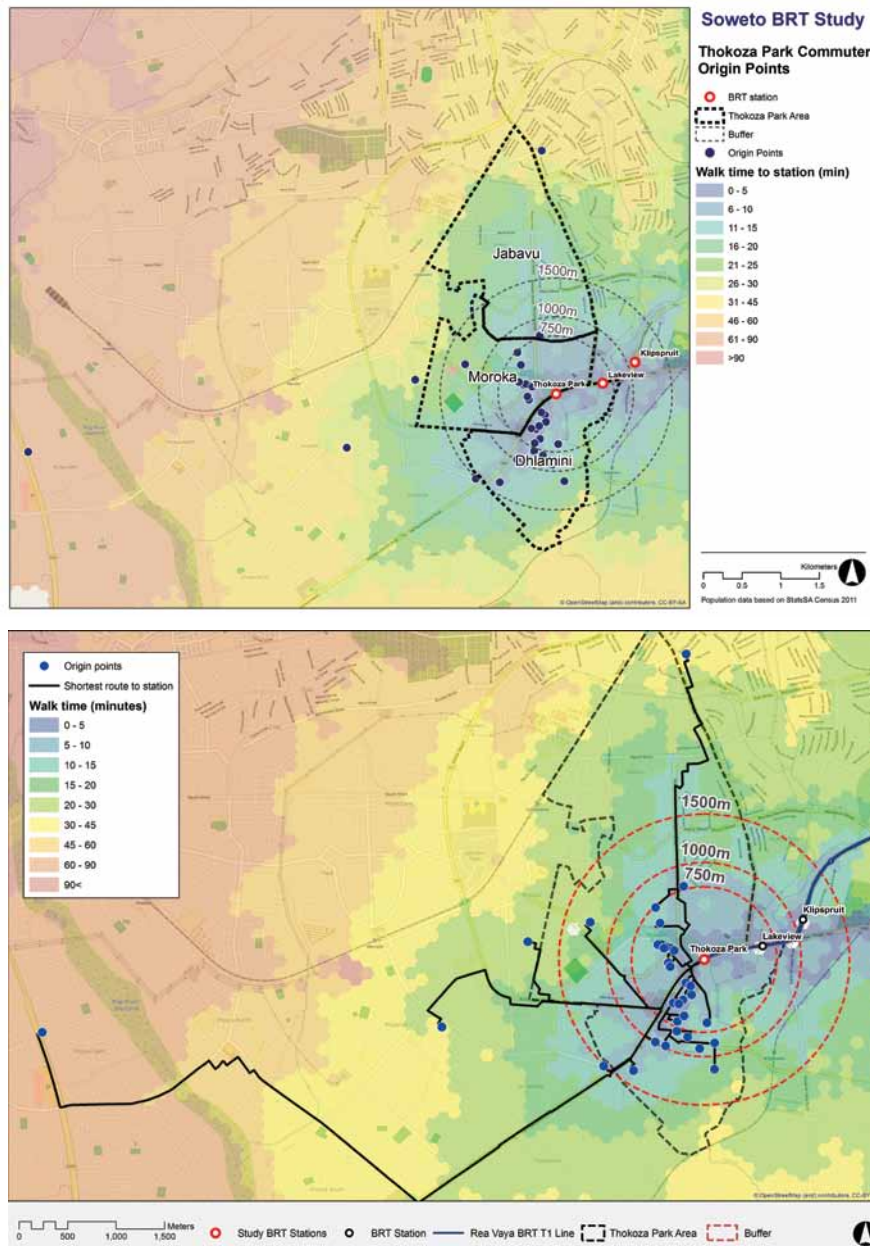
Although the study focus area around Thokoza Park Station is more extensive than that around Diepkloof Station, walking times are similar, perhaps indicating that Thokoza Park Station is more accessible for pedestrians than Diepkloof. This can be attributed to the routes that exist through Thokoza Park and the extended reach that this affords the station. That Diepkloof Station is only accessible from the south (as the station itself is located on the northern boundary of the suburb) limits the area it serves.

Origin points were generated from commuter responses. As in Diepkloof, capturing formal and correct street names was stressed. Figure 26 shows points of origin and the shortest distance to the station. Responses from commuters correlate with the study focus areas as do the associated walking times to each station. That Thokoza Park Station is an origin/termination station helps to explain the outliers who need to travel much further and longer to access the Rea Vaya. One outlying commuter used a taxi from home to the BRT station, taking approximately 20 minutes to get to the station. The P&R profile below gives a clearer explanation of these outliers. Their origins indicate their reliance on alternative means of accessing the BRT system. Some BRT users come considerable distances to the station by car, taxi and sometimes by foot. This supports the notion that the taxi industry could play an increased role in enabling commuters to access the BRT

That Thokoza Park Station is an origin/termination station helps to explain the outliers who need to travel much further and longer to access the Rea Vaya.

Figure 26 indicates the origin points on the average walking time map. These data were processed with a GIS application to calculate the shortest accessible distance to the station. This does not take into account user preferences and unidentified routes that they may take to get to the station. It simply represents the shortest routes.

FIGURE 26: Walking Time Analysis Map



Source: Mariette, N and Tsetetsi, M (2016)

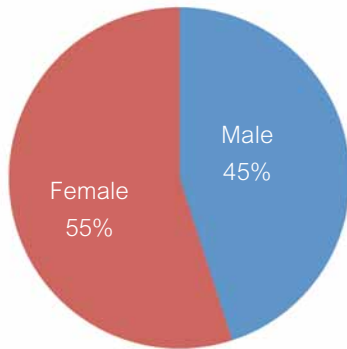
6.5.1.2 P&R user profile: perspectives on a different category of users in Thokoza Park Station

The parking lot that is now used by BRT passengers as a Park and Ride facility was never designed for such a purpose. It was initially developed to accommodate visitors to the park. According to the P&R “manager”, numbers using the service are increasing as is the demand for more permanent infrastructure.³²

Figure 27 shows that the split between male and female users is relatively equal. Due to the small sample size, it is difficult to generalise accurately but the figures are corroborated by researcher observation. Respondents use the bus predominantly for work purposes; of 20 respondents, only one said her bus trips included activities such as shopping over the weekend. This is validated by the fact that 95% of these users catch the bus only on weekdays (Figure 28).

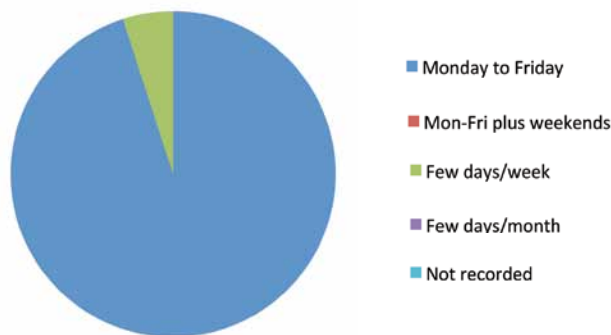
³² Interview held 20 January at the parking lot where most BRT users park

FIGURE 27: Profiled Gender of P&R BRT Users



Source: Data extracted from research surveys conducted for this paper on 20 January 2016, Graphics by Mariette, N and Tsotetsi, M (January 2016).

FIGURE 28: Number of Days that Vehicle Owners Use the BRT System

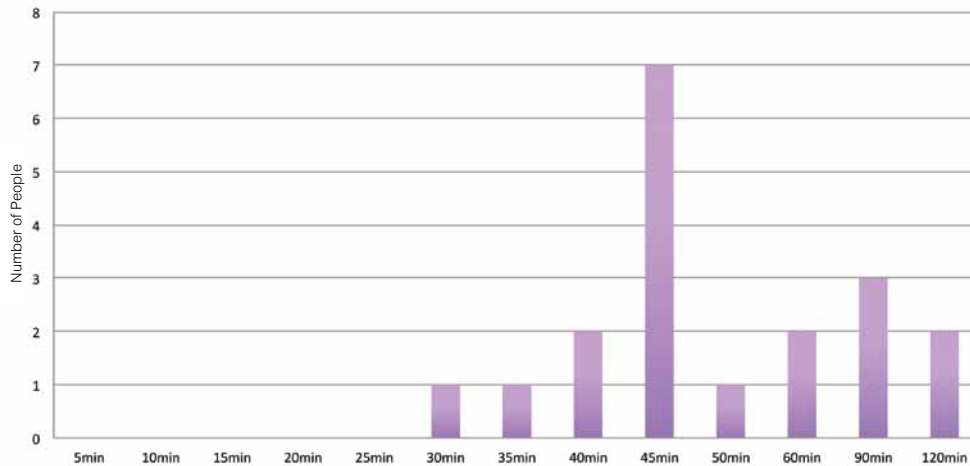


Source: Data extracted from research surveys conducted for this paper on 20 January 2016. Graphics by Mariette, N and Tsotetsi, M (2016)

Most respondents said they utilised the informal P&R service when they took the bus to work. Only one said he either uses the service or parks at the closest filling station from his home. Even including travel to the station early in the morning, P&R commuters still experienced the BRT as the fastest and most convenient way to reach their destinations. This does not necessarily mean that “the bus is faster than my car”, as one respondent put it, but separate bus lanes mean BRT buses are not generally caught up in traffic from townships to the CBD. Graph 7 shows that it takes commuters on average 45-50 minutes to reach their destinations using the BRT. They consider this the fastest time to get to their destinations; when using their own cars, they sit frustrated in traffic. Researchers left the parking lot around 6:30 am after conducting interviews with BRT P&R users. This is the time that most users catch their buses from Thokoza Park Station. The researchers encountered the severe traffic congestion and experienced what it feels like to drive daily to the CBD. Commuting by car to the CBD at 7:00 am took almost two hours (Graph 7).

Even including travel to the station early in the morning, P&R commuters still experienced the BRT as the fastest and most convenient way to reach their destinations.

GRAPH 7: Park & Ride – Time Spent to Final Destination



Source: Data from research surveys conducted for this report on 20 January 2016, Graphics by Mariette, N and Tsoetsi, M (January 2016).

As mentioned early in this report, the parking lot is full and begins to overflow onto walkways on adjacent streets before 7:00 am. Demand for parking forces commuters to arrive early to ensure a parking space. According to the P&R “manager”, between the two adjacent parking lots about 88 cars are accommodated in formal parking bays, whilst the rest use pedestrian walkways around the parking lots (Picture 1). From this account and researcher observations, there are approximately 100-120 cars per day (114 counted). Researchers observed cars entering the lot from as early as 5:30 am on 20 January 2016.

PICTURE 14: Occupied Parking Lot and Cars Parked on Pedestrian Walkways



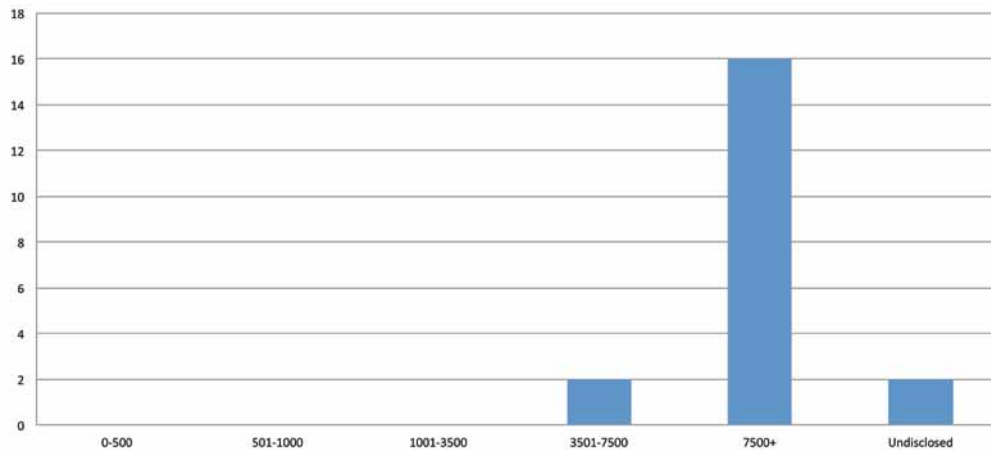
Source: Mariette, N and Tsoetsi, M (January 2016)

From the P&R users surveyed, it is evident that their incomes are markedly higher than those of standard BRT users. Comparing information in Picture 14 and that of Graph 8, the great majority of P&R users are middle- to higher-income earners, with salaries of over R7 500 per month. The use of P&R facilities currently costs commuters R6 per day (R30 per week).³³ This indicates that they have the flexibility to use the P&R system without having to rely on alternative means of transport, such as taxis, to access the station.

From the P&R users surveyed, it is evident that their incomes are markedly higher than those of standard BRT users.

³³ As stated by the P&R Manager and administrator.

GRAPH 8: Profiled Monthly Income of Park & Ride Users



Source: Data extracted from research surveys conducted for this paper on 20 January 2016, Graphics by Mariette, N and Tsetetsi, M (2016)

It takes approximately 10-15 minutes for most respondents to reach the station by car (Graph 6). Some drove from neighbourhoods to the west of the station: Protea Glen, Naledi, Pimville and Chiawelo, a drive of approximately 15km (Figure 29). Whilst this indicates that P&R infrastructure near the station is needed, it also suggests that more stations should be built in or near these neighbourhoods.

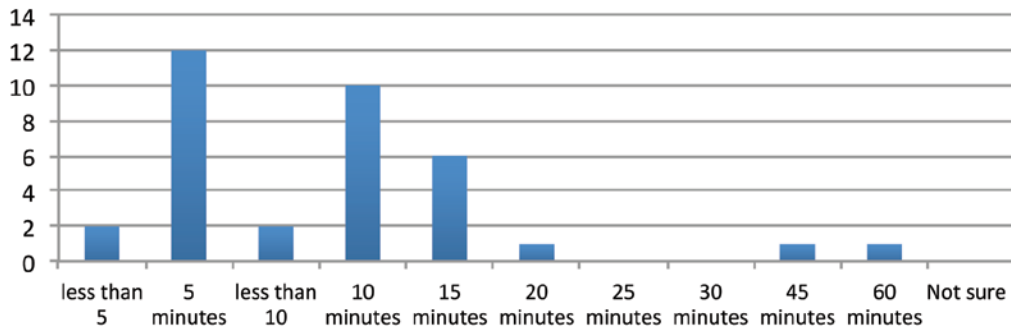
Researchers observed full Rea Vaya feeder-route buses driving in to Thokoza Park station to transfer commuters to T1 trunk buses. This is a clear indication of the need that exists for access to the station from suburbs located to the west. To be fully understood, this requires additional research. The development of additional stations along an expanded trunk route into the western neighbourhoods could eliminate the need for commuters from these neighbourhoods to catch multiple buses and would alleviate some of the demand for P&R infrastructure around the station. Commuters would also be able to walk rather than drive to the nearest station.

FIGURE 29: Neighbourhoods Feeding into P&R Relative to BRT Feeder Routes



Source: Google Maps™, Graphics by Mariette, N and Tsetetsi, M (2016)

GRAPH 9: Time Taken to Drive to Station



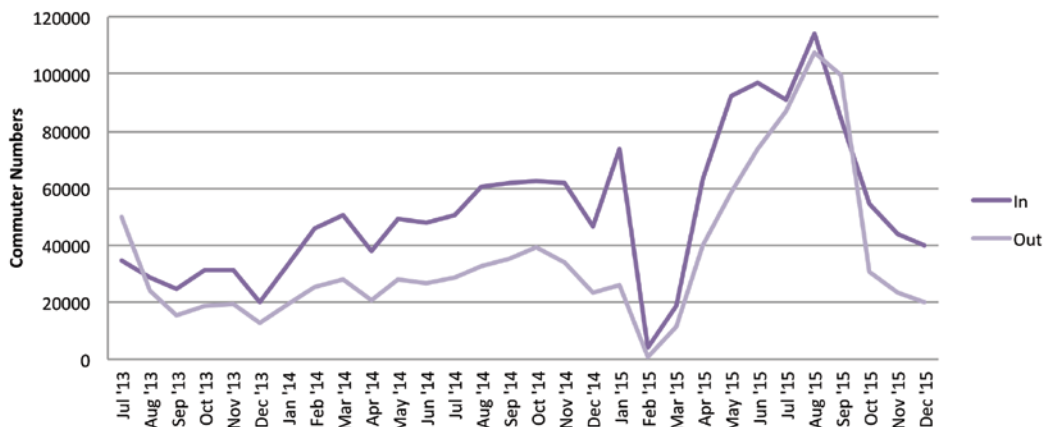
Source: Data extracted from research surveys conducted for this paper on 20 January 2016, Graphics by Mariette, N and Tsotetsi, M (2016)

6.5.2 Ridership trends for Thokoza Park Station

Graph 10 and Figure 30 indicate the number of commuters making use of Thokoza Park Station every month. As with Diepkloof, ridership numbers have been increasing since 2013 but by a much higher increment. Many more commuters board the BRT at Thokoza Park than at Diepkloof. Thokoza Park currently services around 80 000 commuter trips a month, compared to approximately 40 000 in Diepkloof, reaching a peak in August 2015 (Graph 10). The same sharp drop as in Diepkloof can be seen in February 2015, attributable to the service interruption.

The high commuter figures in Thokoza Park can be attributed to the fact that it is an anchor station serving a large area. Interestingly, compared to Diepkloof (Figure 14), the trends illustrated in Graph 10 show a much sharper increase from pre-February commuter figures, in fact far exceeding them. This is perhaps indicative of the important role that the BRT plays in the wider Thokoza Park area. What the comparison with Diepkloof passenger data illustrates is perhaps BRT provides the most favourable mode for accessing the Johannesburg inner city. Whereas in Diepkloof, due to the relatively closer proximity to the inner city, other transport options are possibly more feasible, thus passengers are less reliant on the BRT service.

GRAPH 10: Tap-In/Out Graph for Thokoza Park Station

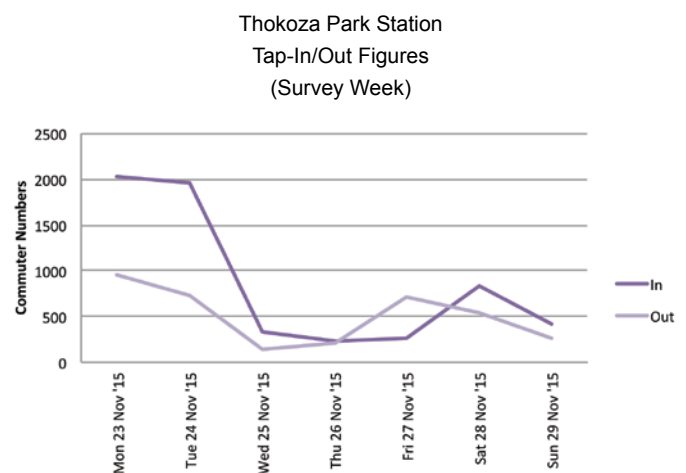


Source: CoJ Transport Department (Jan 2016), Graphics by Mariette, N. and Tsotetsi, M.

FIGURE 30: Tap-In/Out Data for Thokoza Park Station

Month	In	Out
Jul '13	34565	49806
Aug '13	28917	23987
Sep '13	24732	15416
Oct '13	31362	18942
Nov '13	31520	19451
Dec '13	20052	12576
Jan '14	33495	19541
Feb '14	46090	25547
Mar '14	50762	28193
Apr '14	37823	20691
May '14	49234	27943
Jun '14	47572	26489
Jul '14	50536	28789
Aug '14	60597	32715
Sep '14	61947	35010
Oct '14	62366	39219
Nov '14	61980	33623
Dec '14	46429	23311
Jan '15	73436	26204
Feb '15	3971	548
Mar '15	18909	11255
Apr '15	62973	39940
May '15	92181	58219

Month	In	Out
Jun '15	96764	73613
Jul '15	90798	86780
Aug '15	114000	107402
Sep '15	84039	99787
Oct '15	54432	30830
Nov '15	43705	23213
Dec '15	39610	19769



Source: CoJ Transport Department (Jan 2016), Graphics by Mariette, N. and Tsotetsi, M

6.6 Perspectives on change in the Thokoza Park neighbourhood: qualitative insights

The following sections discuss specific effects of the BRT system and respondents' perceptions on change in their neighbourhoods.

6.6.1 Effect of BRT on nearby businesses

Particularly being an anchor station with high ridership figures, the BRT system has had a direct environmental and economic impact on the Thokoza Park neighbourhood as it had in Diepkloof.

The informal P&R system in Thokoza Park that built on the system established during the 2010 Soccer World Cup seems to have magnified the effects of the BRT system in surrounding neighbourhoods. A businessman in Dhlamini indicated that the P&R was not the only temporary service introduced around the same period:

“BRT used to operate for longer hours and brought me a lot of customers coming from the Stadium. I believe that then it had an impact on my business and also the night life of the neighbourhood as well as the tourism of the area” ³⁴

34 Respondent 3 in Dhlamini interviewed 25 November 2015

Thus, the benefits of activities which encourage use of the BRT system for longer periods of the day, such as during the festivities associated with the World Cup, seemed to increase activity hours around the station, invigorating the neighbourhood by introducing opportunities for people to interact with the environment around the station and use the services later in the evening. However, such activities need to be considered carefully as they are not always associated with community benefits. Some respondents indicated that the neighbourhood, was associated with drugs, alcohol and crime. This is how one of the respondents described it during the World Cup:

“This place was a very busy place and not in a good way. It had a lot of wild parties especially in the park across the station. There was just this funny and wild vibe about it but I think things have toned down a bit”³⁵

There are mixed feelings about the impact of increased activities around Thokoza Park Station. A business woman in Jabavu said that BRT users are not part of her customer base. She noted that the street where her business is located has foot traffic from the station especially in the evenings but people do not necessarily stop and buy her products. Responses from BRT users confirm this. When asked if they stopped at shops or restaurants on their way home, most indicated that they did not.

6.6.2 Effect of the BRT on its surroundings and physical changes in the neighbourhood

Dhlamini, Moroka and Jabavu have experienced major physical changes in recent years, especially, like the BRT system itself, stemming from public investment in the 2010 World Cup period. This study asks which developments occurred as a result of the BRT and whether these developments would have happened if the BRT system had never been introduced.

(Re)development of parks and pedestrian walkways are mentioned when people are asked to discuss changes in their immediate surroundings.

Major physical developments in the Thokoza Park area have mostly been public investment projects and major spatial changes have not yet occurred as policy directives envisaged. (Re)development of parks and pedestrian walkways are mentioned when people are asked to discuss changes in their immediate surroundings. Spatial changes seem limited to small scale residential upgrades and nothing on the scale of Diepkloof Square, as discussed in the 2013 study, has taken place in the Thokoza Park vicinity.

While it is difficult to identify tangible BRT impacts, the introduction of services such as Wi-Fi via the BRT system plays a considerable role in the surrounding area.

6.6.3 Wi-Fi connection in Thokoza Park

The Wi-Fi connection introduced in several Rea Vaya stations seems to have impacted on the lives of young people in both Diepkloof and Thokoza. Thokoza Park generally has a strong Wi-Fi signal which allows users to spread casually through the park with, unlike in Diepkloof, enough shade and sufficient comfortable seating areas for users to sit freely and not clustered in small groups as in Diepkloof (figure 28).

Many school goers in uniform were seen sitting near the parking lot, connecting through their phones. Judging by the noise and movement on the day of the visit, it was clear that the connection was used mainly for entertainment. It was observed that Thokoza Park has more users than Diepkloof but there is also more sitting spaces, although a much older group of users was noticed in Diepkloof sitting in small, quiet, groups, possibly because they had different reasons for using the internet. No Thokoza respondents disclosed why they were connecting to Wi-Fi, but a number of Diepkloof respondents indicated that it assists them in looking for jobs.

6.6.4 Safety and Security around Thokoza Park Station

As mentioned, since the 1980s Thokoza Park has been notorious for security risks to residents. As a result of the good management of Thokoza Park itself and its station security, incidents around the station have decreased. Police officers responsible for the parks indicated that cases such as theft and rape have decreased since the constant activity during the 2010 World Cup. Though this is good news for the entire community, Wi-Fi users do not seem to appreciate the notion of not visiting the park after certain hours.

35 Respondent 1 in Dhlamini interviewed on the 25th of November 2015

“The parks have been improved big time and the BRT. The place has been revamped. Even though the parks now have some stupid and ridiculous rules! I hate those rules”³⁶

The BRT system in Thokoza Park attracts commuters, non-commuters and Wi-Fi users which has resulted in an increase in passive surveillance and the perception of safety in the area. Most respondents were impressed by the BRT not only as a transportation system but as a factor contributing to safety and cleanliness:

“I found things like this but these days you see more cars across the station. The area is nice and clean now, a little bigger as well.”³⁷

“Well yes and I think it is a good and powerful impact. Even though we hear people complaining about the [smart card] system and the management but we do see that their parks have become more safe and transport is more convenient. People [previously took] multiple taxis to get to a place and now BRT takes them there with only one trip.”³⁸

“This whole place here [pointing at the park and parking area] was a mess. The BRT opened this place up for parking. Now there is less crime because of more visibility. We are even able to walk at night without any fear. Bad things used to happen to people here but not anymore. The place is very clean it also increases our pride in the area as residents”³⁹

The motivations for P&R users to utilise the BRT system are informative. During winter, it is usually dark when commuters arrive at the station. This not only raises the issue of safety but also that of the comfort and convenience of public transport vis-a-vis that of a private car. For this reason, P&R travellers were asked why they preferred the bus over their own cars to reach their workplaces. Respondents indicated that the bus provided the comfort and convenience they needed and that safety was not a major concern.

6.6.5 The P&R system in Thokoza Park

The P&R arrangement at Thokoza Park is unique in the BRT system. It has allowed one individual to harness an economic opportunity presented by the BRT station by enabling him to take on the role of custodian of the parking lots, offering commuters security and cleaning services as they leave their cars. When asked how the parking lot functions the “manager” said users can either pay R6 per day or R30 per week. The system is informal as he has no legal right to operate in the lot.⁴⁰ Though the P&R service is an additional cost, most users said the arrangement is affordable because they spend less than what they would have to pay to drive their cars to their ultimate destination. This group of individuals mostly earns more than R7 500 per month and their higher spending capacity gives them access to other informal services in the parking lot. The “manager”, who is also the security guard, charges an additional R20-R30 to commuters who wish to have their cars washed whilst they are at work. Researchers saw a number of cars with their doors open as he cleaned the interior. When asked about car owners’ response to safety issues, he said:

“Yes ... the system is very informal so there are no laws to force them to even pay but because they know that I keep their cars safe they pay. There is only a few that do not pay and I do not really take care of their cars but since I am here it is highly unlikely that you see thieves trying their luck on any of these cars so all of these cars benefit from my presence, whether they pay me or not”

However, cars now block sidewalks where pedestrians access the area around the station and they now have to walk on the road. Because traffic is light in the street, this does not greatly impact movement.

6.6.6 The impact on the Thokoza Park taxi industry

According to respondents of the local taxi industry, the remaining taxi drivers from the area regard the Rea Vaya system as having had an adverse effect on their business, with taxi operations competing with the BRT

36 Respondent 18 interviewed 25 November 2015

37 Respondent 19 interviewed 25 November 2015

38 Respondent 20 interviewed 25 November 2015

39 Respondent 12 interviewed 25 November 2015

40 Information provided by the P&R “manager” in Thokoza Park area

on the same routes⁴¹. In the Thokoza Park area, some operators/owners showed their hostile feelings towards the system:

“They brought the BRT system which is now taking our clients. We can no longer support our families as we did and now our wives are leaving us. I hate the system! They promised to make us bus drivers but only took a few of us. The rest of us are left in the taxi industry and we are struggling to make ends meet. We do not think that the system is benefiting anyone.”⁴²

As indicated previously these are perhaps typical outcomes of a transformation process whereby some people feel aggrieved with the outcome, as it does not favour them. However, there are many people from the minibus taxi industry who have benefited extensively from the introduction of BRT. As a minibus industry owned bus operating company was formed which ensured many industry representatives are involved in the operations of the BRT system (McCaul and Ntuli, 2011).

6.6.7 General issues raised about the BRT system

Another aspect of the BRT that some respondents criticised was the smart card system. As mentioned previously, the system tends to be offline frequently, resulting in travel disruptions and frustration among users. One elderly woman complained about the heat, and the time and energy she had used to get to the station only to find the system was offline. This was a repeated occurrence, with many commuters complaining. BRT employees are aware of the unhappiness created by the smart card system, with difficulties seemingly more pronounced in Thokoza than in Diepkloof. The extent to which these issues have resulted in a loss of customers is not clear from the research, however the frustrations expressed from those interviewed could be cause for deterring existing and potential customers from using the system and finding alternatives

6.6.8 Concluding remarks

The P&R commuters at Thokoza Park Station add a dimension not found at Diepkloof station. P&R users tend to be in the upper income band, and obviously all own cars, which is not necessarily the case with standard BRT commuters. The fact that people in Soweto who are able to afford a car and choose to ride the BRT system is an important insight into the functional benefits of the system.

Issues surrounding smart cards and the perceived impact of the BRT system on the remaining local minibus taxi services, are still evident as they were in the previous study. However, the specifics around the smart card challenges have shifted to the system offline issues. These impacts are to be understood in a context of transformation, whereby systems will gradually adapt and evolve over time. Similar to the incites from Diepkloof many people choosing to use the system (and non-users speaking about system) indicated that they perceive the system to have improved overall travel experiences. This is perhaps supported by the growth in passengers who are parking and riding.

Thokoza Park, across from the station, is a dynamic element which may bring opportunities for tourism and leisure activities for residents. It also brings challenges with regards to the “nyaope” drug problem and the perception that undesirable elements create a safety issue for some BRT users who access the station via the park. The area remains beneficial to the community however, with the positives seeming to outweigh the negatives. Public investment in upgrading and maintaining the park, and increased surveillance by BRT commuters and security, seems to be assisting in improving the general level of safety. Through continued support of the community and involvement in their neighbourhoods, this is likely to remain the case. The BRT system can contribute to ensuring that the park remains an attraction in the area.

41 The municipal transport operations plan however would render these competing minibus taxi services competing on the BRT route as illegal

42 Local taxi driver interviewed 25 November 2015

7 Comparative experiences: Diepkloof and Thokoza Park stations

Comparison of the profiles of those using Diepkloof and Thokoza Park stations assists in understanding the BRT system as a whole. Similarities shed light on common issues and perceptions by commuters and residents and will deepen understanding and the ability to plan for future initiatives.

An aspect recorded during the 2013 study that has remained constant is the positive attitudes of Diepkloof residents towards the BRT system. In both areas minibus taxi activity seems to have diminished and there are clear views from the remaining local minibus taxi operators that BRT has impacted their business negatively. However, it is assumed that there are likewise beneficiaries of the BRT who live the neighbourhoods and this research was unable to capture their views.

Perceptions about benefits for local businesses remain mixed around both stations. An opinion from one respondent indicated that the activity associated with the Fifa Soccer World Cup meant that BRT was generating increased customers for his business and this has not been sustained. Some respondents believe that the system has brought customers but not at any significant rate or scale; for others their view is that there has been no impact or a negative one. It is not clear why some newly established businesses have located close to the Diepkloof station; however, these business operators did seem to indicate when asked about the impacts of the BRT that they believed the system has a positive impact on their businesses. These newly established businesses are located within 500m of the station and are clustered on the south side, where most BRT bus users pass.

The impact of the introduction of Wi-Fi in and around BRT stations since 2013 by the City of Johannesburg is far reaching and has attracted non-bus users to both Diepkloof and Thokoza Park stations. The concentration of young people using the internet connection introduces an additional use for the station's surrounding space. The added service also allows passengers to connect to the internet while waiting for the bus. A less tangible impact is the planning process for BRT station precincts that the City of Johannesburg has embarked on. Implementation of plans developed through this process will enhance land uses around station areas and hopefully promote the optimal use of station precincts, including those around Diepkloof and Thokoza Park stations.

The informal P&R service at Thokoza Park is not evident in Diepkloof. It is fuelled by the demand from vehicle users to the west of the station area. Further research is required to determine whether formal infrastructure for this service might be required to ensure pedestrian movement around the park and to the station is not compromised should the park and ride function grow significantly.

8 Observations and Reflections

The objectives of this study were (1) to repeat a study conducted in 2013 to develop longitudinal insights into change over time; and (2) to expand the study to an additional station area to gain comparative insights. The research suggests that overall the BRT has had predominantly positive impacts in the two neighbourhoods studied in Soweto. While it is perhaps still too soon (only 7 years since operations began) to investigate the many intended outcomes of BRT investment associated with the restructuring of the built environment and local socio- economic development, this study has provided the beginnings of a longitudinal assessment of changes that are observed to be occurring in the study areas and which display some connection to the arrival of the BRT system. The suggested findings of the research have been arrived at through capturing the views of a small sample of randomly selected residents or/and business owners and employees, researcher observation and aerial photography and mapping analysis. Thus, the findings are by no means comprehensive but some of the observations and views expressed do however provide important insights for municipal transport, economic development and urban planning officials to consider. The deliberate neighbourhood and community based focus of the study attempts to build a narrative of how people are understanding the impact of the BRT systems. The following observations are worth reflecting on in this regard:

- 1) In both of the studies there has been a general view expressed from residents (both BRT users and non-users) that the system has improved travel experiences for those able to make use of the system. This is an important overall insight to consider in that despite some of the technical payment and ticketing challenges the service is generally perceived favourably.
- 2) The frustration users experience as a result of ongoing technical difficulties in ticketing and fare payment is potentially damaging to the image and perception of the system. The reality is that these issues have real cost and time implications for users. While this study is not able to provide an in-depth analysis on what the extent of the impact on ridership has been it is an important area for the BRT operator to monitor and manage.
- 3) In both studies researchers have interacted with people from the local minibus taxi association, with offices and ranking facilities. The view of these community members is that they feel the BRT has negatively influenced their business. There is a fairly persistent view that they were not included in the BRT as promised. Yet, it is well documented that many others from the industry operating in these localities have benefited from the development of the BRT system- now part of the bus operating company PioTrans operating the BRT line in Soweto. In any transformation process where significant change is realised there are those who benefit and those who lose out. This study does not go into these dynamics is

detail but rather captures the views of people presenting themselves as minibus taxi operators in the neighbourhoods.

- 4) The extent to which business activity (informal as well as formal) has improved as a result of the BRT system is unclear. In theory, the high concentrations of people generated by public transport stations is one of the drivers for businesses to locate in close walking proximity to stations, and thus drive land use and urban form shifts in these locations. However, the findings from the research indicate that such opportunities are not being taken up by business (informal or formal). Besides a few newly identified business in Diepkloof there was very limited indication that potential trading opportunities had resulted in the establishment of businesses. The reasons for this are perhaps many and need to be further investigated but could include land use policy and regulations, land ownership dynamics and entrenched behaviour patterns of potential consumers.
- 5) Coupled with the previous point, significant land use changes and property development activity- both large scale and small scale are not evident in either of the station precincts. The City of Johannesburg's Transit Oriented Development (TOD) approach to transforming the spatial patterns of the city is listed as one of the core objectives for BRT investment. While this is an impact that has a longer term horizon and the city is involved with extensive planning processes, the lack of evident small scale changes on the ground are concerning. Such small scale (perhaps experimental) interventions could provide the insight and catalyst in the short term to informing and realising longer term objectives on a larger scale.
- 6) The addition of wifi has demonstrated the potential that co-locating services can have in transforming the use of station areas. In both study areas the area surrounding the station has become occupied throughout periods of the day by people other than BRT passengers. This has a number of impacts in the area. People begin to perceive and understand the station to be more than for only accessing a bus service. There are higher levels of activity surrounding the station, which many studies internationally indicate contributes to safer public environments (see point 8 below). Then there are the less tangible impacts of providing people with access to information that would have previously been more difficult to obtain. Thinking through the additional role that station areas could play in community life is thus important for the design of station precincts. This highlights the importance of co-ordination between departments responsible for various aspects which make up station precincts.
- 7) The park and ride operation which has developed in Thokoza Park organically is an important indication of how impacts of the same service can manifest differently across the variety of localities transport systems traverse. The fact that people are able to afford private vehicles but choose to use the bus in Soweto is significant. The informal facility has also provided an economic opportunity for the person who has taken responsibility (informally) for managing the park and ride. The research has provided some indicative insight around where people are driving from to access the BRT service, but more research is required to understand how the city could best intervene. Is it a question of feeder services or a matter of comfort? Park and Ride services are often most in demand at terminal stations and this example in Thokoza Park provides useful insight for those planning public transport services and the role nearby parking space could provide in growing ridership levels, especially at terminal stations.
- 8) The perception from some respondents that safety has improved in and around Thokoza Park since the introduction of the BRT system is significant. This finding shares links to a global discourse around safety benefits of increased public activity in areas. In the case of Thokoza Park it is evident that the BRT operators have deployed security for surveillance and safety in the park for passengers who might walk through the park to access the system. However, this has also perhaps had an impact on general perceived safety. The research was unable to verify if safety in the park has in fact improved statistically, but highlights the ongoing monitoring of the public safety benefits of public transport station areas as important.

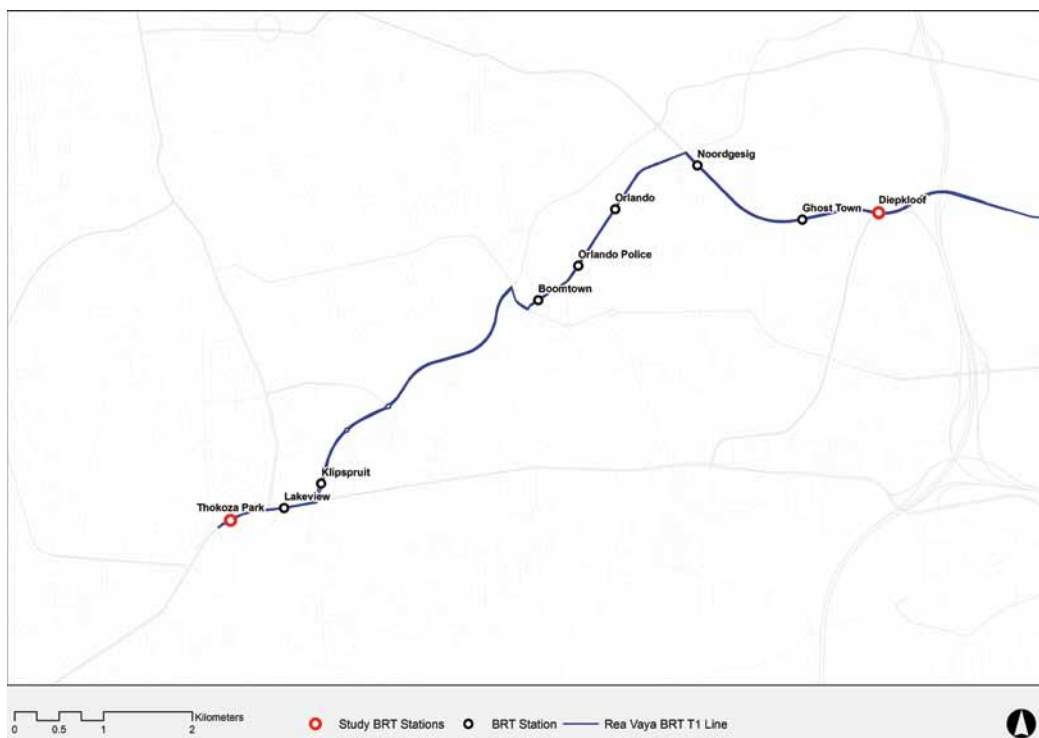
These observations and reflections are intended to provide food for thought on a number of potential neighbourhood impacts that can be considered and explored further. The list is not exhaustive and it is recommended that further, more in depth research is required to better test and more fully understand the impacts associated with public transport investment more broadly. This research does however provide a useful contribution to understanding how the investment and impacts are perceived by the community

members who are intended to be the ultimate beneficiaries and provides a baseline set of observations on potential change in these areas. Better understanding the views of the community can assist in the nature of future interventions and the manner in which they are communicated to stakeholders. Different localities have different contextual dynamics and the impacts resulting from the same station investment and system vary significantly. However, as is evident from this study there are certain similarities in the impacts which the investment has had in two different areas, these are also important to identify and understand more fully.

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Annexure A: Station location and selection criteria



Selection criteria

The main aim of developing selection criteria is to ensure that selected stations can provide information that will make it easy to identify clear linkages “between the development of the station and changes to the surrounding context” (Wits, 2014). The selection criteria used were adopted from the previous study, which selected Diepkloof Station for the following reasons;

- It is situated near a residential area
- It had less public-sector investment compared to the shortlisted Thokoza Park and Orlando stations
- There is diverse land use around it

The first step in selecting an additional station for this study was to identify one located along the same BRT trunk route as the previous study. Researchers visited all stations along the T1 route and shortlisted suitable stations. Prior to this shortlisted stations from the previous study were discussed and shortlisted again based on the selection criteria above.

Shortlisted stations for this study were consequently:

- Thokoza Park
- Orlando Park
- Boomtown
- Noordgesig
- Ghost town

Initially, Thokoza Park and Orlando stations were not selected for the same reasons as the initial study; both experienced substantial public-sector investment in previous years, the effect of which is more evident in Orlando than Thokoza Park. Investment in the stadium and Orlando Police Station spilled over into the Orlando Station area.

Boomtown station met all requirements for the study. Nevertheless, its function as an exchange station made it difficult for researchers to collect raw data from respondents. Most of its users are people from other parts of Soweto. Its relationship with the rest of Soweto makes it impossible to develop a clear link between changes to the hosting neighbourhood and its actual development.

Noordgesig on the other hand has very limited access. It is located on a high order road where access to the station is via a pedestrian bridge. There is ample space for informal trading along the station but due to the low foot traffic no street vendors are evident. The closest residential dwellings face away from the station thus creating a wall that cuts off any relationship between the station and the neighbourhood. This problem was also faced at Boomtown station. If the station has no relationship with the neighbourhood it will be difficult to identify any changes occurring as a result of the BRT system.

Ghost Town Station is situated too close to Diepkloof Station. It has similar characteristics to Diepkloof and is within more or less the same neighbourhood and was therefore eliminated.

With no other options researchers revisited Thokoza Park Station and re-assessed the level of public-sector investment in the area. After seeing that most of the investment actually occurred around the same time as the BRT station was built the researchers decided to study the station and see if these developments have had any impact in the neighbourhood. On the other hand, careful identification of BRT-led and public-sector investment changes had to be made prior to the study.

Annexure B: Standard BRT User Survey Form

Rea Vaya Diepkloof BRT impact study survey

1	Gender?	Male		Female	
2	Boarding or alighting?	Boarding		Alighting	
3	What mode of transport did you use to get here?	walk	bicycle	Putco bus	taxi
5	Where did you come from (street and suburb)?				
6	What is your Occupation?				
7	Monthly Income?	0-500	501-1000	1001-3500	3501-7500
8	Age	0-17	18-25	26-45	46-60
					7500+
					60+

9	How long did it take you to get here from your home?			mins	
10	Do you stop at shops on route to BRT stations?	Y	What type?		N-Why?
11	Do you use the Rea Vaya on your return trip?	Y	N	N- why?	
12	If yes do you sometimes stop at shops or restaurants on your way home from the station?	Y	What type?		N-Why?

13					
14	How frequently do you use the BRT?	Mon-Fri	M-F + wknds	few days/wk	few days/mnth
15	How long have you been using the BRT?			Months/Years	
16	Where is your final destination this morning (suburb)?				
17	How long do you think it will take you to get to your final destination from here?			mins	
18	What modes of transport will you use to get to your final destination when you exit BRT?	Walk	Metrobus	Metrotrain	Gautrain
					Taxi
					Other

19	What is the purpose of your trip?	Work	Shopping	Education	Job seeking	Other
20	Why do you choose to use the BRT?	Faster	Comfortable	Convenient	Affordable	Safety
						Other

Annexure C: Qualitative interview questions

1. How long have you been living / owned a business / working / operating in the area?
2. For what reasons have you located in the area?
3. What kind of change have you noticed over the past few years?
4. How has the BRT system impacted the area?

Annexure D: P&R survey form

Rea Vaya Diepkloof BRT impact study survey

1	Gender?	Male		Female	
2	Boarding or alighting?	Boarding		Alighting	
5	Where did you come from (street and suburb)?				
6	What is your Occupation?				
7	Monthly Income?	0-500	501-1000	1001-3500	3501-7500
8	Age	0-17	18-25	26-45	46-60
				7500+	60+

9	How long did it take you to drive here from your home?			mins
10	Do you use the Rea Vaya on your return trip?	Y	N	N- why?

11	How frequently do you use the BRT?	Mon-Fri	M-F + wknds	few days/wk	few days/mnth
12	How long have you been using the BRT?	Months/Years			
13	Where is your final destination this morning (suburb)?				

14	How long do you think it will take you to get to your final destination from here?			mins
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15	What modes of transport will you use to get to your final destination when you exit BRT?	Walk	Metrobus	Metro rail	Gautrain	Taxi	Other
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16	What is the purpose of your trip?	Work	Shopping	Education	Job seeking	Other
17	Why do you choose to use the BRT?	Faster	Comfortable	Convenient	Affordable	Safety
18	When you use the BRT, do you always park here?	Yes		No		Other

Annexure E: Interview with the P&R manager at Thokoza Park Station

1. When did you start operating in the parking lot?
2. How did the whole system come about? Tell us about its history and purpose.
3. How does the system work? Tell us about pricing or packages.
4. Do you get any support from BRT? If not then where do you get support?
5. How many parking bays do you have?
6. Are there any costs involved in maintaining the areas? How do you cover these costs?

NOTES





Tel. +27.11.4076471 | Fax. +27.11.4035230
P.O. Box 32160 Braamfontein 2017
www.sacities.net

