UNIVERSITY OF CAPE TOWN
IYUNIVESITHI YASEKAPA • UNIVERSITEIT VAN KAAPSTAD

UNDERSTANDING THE CONDITIONS FOR PASSENGERS TO CONSIDER ACCEPTING TRANSFERS BETWEEN MYCITI AND MINIBUS TAXI

Master's Dissertation (60 Credit)
Centre for Transport Studies
Department of Civil Engineering
University of Cape Town

Prepared by:
Kapil Singh
(SNGKAP004)

Prepared for:
Professor Roger Behrens
Professor Mark Zuidgeest

June 2023

PLAGIARISM DECLARATION

1) I know that plagiarism is wrong. Plagiarism is to use another's work and pretend that it is one's own.

2) I have used the Harvard convention for citation and referencing. Each contribution to, and quotation in, this research project from the work or works of other people has been attributed, and has been cited and referenced.

3) This study is my own work.

4) I have not, and will not allow anyone to copy my work with the intention of passing it off as his or her own work.

Name: Kapil Singh (SNGKAP004)

Signature: Signed by candidate

Date: 12 June 2023

ACKNOWLEDGEMENTS

A number of people made great contributions that made a difference not only to this dissertation but also to my own professional development.

I would like to express my heartfelt gratitude to my wife, Pravanya Pillay, for her unwavering support, love, and understanding throughout my academic journey. Her encouragement and motivation have been the driving force behind my success, and I would not have been able to complete this dissertation without her.

I would also like to thank Winston Harris, Zoe Palmer, Neeyam Gareeb, Sharne Du Plessis, Shafeeq Mollagee and Thaabit Falal who have provided invaluable input into to this dissertation.

A special thank you goes to the Sawtooth Software team for awarding me with a license to use their incredible software to design and execute the survey as well as analyze the data.

Finally, my supervisors, Professor Roger Behrens and Professor Mark Zuidgeest. As supervisors, they have been patient, thorough, critical, and knowledgeable; and provided a great deal of guidance to reach this point. I cannot thank them enough.

ABSTRACT

Cities across South Africa are constantly seeking to improve the level of public transport provision to better serve the users. Cape Town is seen as a leader in this respect; however, the existing public transport network is as fragmented as the rest of South Africa and generally offers a poor level of service in terms of safety, security, reliability, travel times etc.

Cape Town's passenger rail system has been widely recognized as the backbone of the city's public transport network. Today, some lines are operating limited services and, due to headway constraints, the service has reached its current capacity limit on critical segments of the network. Said headway constraints are the direct result of a reduction in fleet, due to vandalism and poor maintenance, ageing rolling stock and a signaling system that it outdated. The steady decline of the rail service has resulted in thousands of passengers migrating to either minibus taxi or formal bus services, and some passengers not travelling at all.

The introduction of the MyCiTi bus system was seen as a partial solution to the fragmented network as it was envisaged to replace the minibus taxi network as well as the Golden Arrow bus network by the year 2032 (CoCT, 2014). However, this approach has since been abandoned following the implementation and operation of MyCiTi Phase 1. Given the very low financial efficiencies realized with Phase 1 feeder services and expected for Phase 2A, the 2020 MyCiTi Business Plan for Phase 2A (CoCT, 2020) underlined the need to develop alternatives to the supply of feeder services for MyCiTi. As a result of the above, the MyCiTi Phase 2A System Plan was adapted to remove MyCiTi feeder services with the intention to explore mechanisms by which the existing MBT services can provide feeder services that complement MyCiTi Phase 2A operations.

The City of Cape Town aims to integrate the public transportation network within the city through a number of initiatives. These initiatives include obtaining the authority to manage the Golden Arrow Bus Services contract and exploring the devolution of rail services but these are all long-term plans. In the short-term, the City is preparing to implement Phase 2A of MyCiTi offering services to connect Khayelitsha and Mitchells Plain to Wynberg and Claremont. MyCiTi will provide direct and trunk services whilst the feeder services to the MyCiTi trunk services will be provided by the MBT industry on an incentivized basis. This will require passengers to transfer between two modes with very different standards, operating characteristics, fare structures and levels etc. raising the question of will passengers make such a transfer?

The research methodology for this study consisted of three steps. Firstly, a literature review was undertaken to better understand hybrid public transport systems, integrating public transport systems,

transfers between modes and passenger transfer experiences, amongst other topics. Secondly, a small sample of passenger interviews were conducted in order to confirm that the attributes/conditions identified in the literature review process were valid and contextually relevant, and to identify possible attributes that may not have presented themselves in the literature review. Finally, a larger scale Best-Worst Scaling (BWS) survey was undertaken where a sample on 232 respondents ranked the various attributes against each other in terms of the importance of the attributes. The BWS survey was administered using software that capture and analyzed the survey data.

This research seeks to evaluate what public transport users value most when it comes to making transfers between modes in an effort to focus on improving these situations and removing some of these barriers altogether. The study found that the three most important attributes to the passenger, in order of preference, are *Total Cost of the Journey or Cost*, *Threat of Criminal Behaviour or Safety* and, *Reliability in terms of scheduling or timetabling*. The least important attributes have been identified as *Protection from Weather, Retail Opportunities, Signage and Wayfinding and, Seating and Waiting Areas*. *Protection from Weather* was the overall least important attribute. This study recommends that the City of Cape Town continue to pursue an integrated network as a priority, however, total integration is an expensive, long-term objective. The results of this study rank the attributes that are most important to passengers when considering transferring between modes and the City of Cape Town should therefore focus resources to address these areas starting with those most important to the public transport passenger.

Table of Contents

LIST OF ABBREVIATIONS

ABT: Account Based Ticketing
BWS: Best-Worst Scaling
BRT: Bus Rapid Transit
CBD: Central Business District
CITP: Comprehensive Integrated Transport Plan
CCT: City of Cape Town
GABS: Golden Arrow Bus Service
IPTN: Integrated Public Transport Network
IRT: Integrated Rapid Transit
ITC: Information and Communication Technologies
ITP: Integrated Transport Plan
LOS: Level of Service
MaxDiff: Maximum Difference Scaling
MBT: Minibus taxi
NGT: New Generation Technologies
PTI: Public transport interchange
VOC: Vehicle Operating Company

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

1.1 Background and motivation

This is a study on "Understanding the conditions for passengers to consider accepting transfers between MyCiTi and Minibus Taxi".

Roux (2013) states that when properly planned and managed, public transportation plays a critical role in addressing passengers' mobility needs. However, most developing countries' public transportation systems are inefficient and in need of modernization (Nyarirangwe & Mbara, 2007). During the apartheid era, public transport was designed to reinforce racial segregation. It pushed non-white South Africans into rural areas and hindered them from taking advantage of urban employment opportunities. Despite the difficulty and expense of eradicating this legacy, there have been major advancements made in the field of public transportation with a focus on network integration.

In preparation for the 2010 FIFA World Cup, the City of Cape Town (CCT) introduced the BRT-based MyCiTi system with the aim of providing passengers in the city with an improved public transport service (Schalekamp and Behrens, 2009; Schalekamp et al, 2009). Furthermore, as a host city for the World Cup, the City of Cape Town had a contractual obligation to regulate and "formalize" minibus taxi operations. The favoured approach at the time was to replace minibus taxi operations with BRT, however, recent studies have proposed that transformational processes could be used to address the shortcomings of public transport systems. The present processes in South Africa are geared on integrating and complementing formal and informal services (Ferro et al., 2012; Del Mistro & Behrens, 2015; Jennings & Behrens, 2017).

The City of Cape Town is now preparing to implement Phase 2A of the MyCiTi network offering services to connect Khayelitsha and Mitchells Plain to Wynberg and Claremont. The major difference between MyCiTi in Phase 2A when compared to Phase 1 is that MyCiTi will provide direct and trunk services with the minibus taxis (MBT) responsible for the feeder services. Phase 1 proved that MyCiTi is not cost effective in the provision of feeder services, which require high levels of route diversity in order to achieve coverage but attract relatively low levels of demand. Feeder services are, however, fundamental to the attraction of passengers to the main corridor services. MBT operations are very effective in the feeder environment, offering great flexibility and requiring considerably lower passenger numbers on each trip to operate efficiently.

In the current operating environment there is little motivation for MBT operators to integrate with MyCiTi as most are already focused on providing feeder services and some may wish to retain

passengers on longer trips. For passengers, the need to transfer and pay multiple fares is a disincentive to change modes. In Phase 2A, MBTs with feeder route authorities that allow them to feed to integration points and stops of the proposed MyCiTi services will be incentivized to provide the required feeder services. The incentive approach is not limited to the MBTs as it includes incentives designed to encourage passengers to transfer between MyCiTi and MBTs, however, most (if not all) research into hybrid public transport systems focus on integrating the modes. There are various interventions that can be explored in order to achieve an integrated public transport network, however there needs to be more focus on integrated public transport interchanges (PTI) or transport hubs, and ensuring seamless transfers for passengers. Public transport interchanges allow physical integration to streamline and optimize the overall functionality of the transportation network. However, given the choice, the majority of individuals would prefer a non-stop travel, whether on foot, bicycle, or private automobile, or via a single mode of public transport. A high level of customer service (LOS) is consequently critical for encouraging commuters to take public transportation on journeys that need intermodal transfer.

Research such as Schalekamp et al. (2009), Ferro et al. (2012), Behrens (2015) and Schalekamp (2015) have begun to attempt to better understand the quality of paratransit and the need for integration. More recently, Birungi (2017) investigated paratransit feeder operations with a particular emphasis on integrating paratransit services with trunk services. However, there is very little information available to help understand the conditions for passengers to consider accepting transfers between MyCiTi and minibus taxi i.e. are passengers' willing to transfer and what may influence their decision making?

It was out of this research gap in a South African context that the motivation for this topic originated. This study will conduct a survey to better understand and rank the factors that influence public transport users' decisions to accept making a transfer. Best-Worst Scaling (BWS), a survey approach for market research, is used to gauge consumer choice and importance for a list of attributes or features. It provides a rank-ordering of the list and can be crucial in helping to understand the trade-offs that people would make. This approach will be utilized to determine the key areas to focus on improvements in an effort to improve public transport integration.

1.2 Research objective

The objective of this study can be broken down into the following research question:

- Will passengers transfer between MyCiTi (scheduled mass transit component) and minibus taxi (paratransit feeder component)?

This is a complex question to answer and while this dissertation will not attempt to provide a definitive answer to this question with all of its complexities; it will serve to contribute research on the matter by attempting to answer the following sub-questions:

1) What are the conditions for passengers to consider accepting transfers between MyCiTi and minibus taxi?

2) How do these conditions rank in comparison to one another? The general cost, elements of safety, the need to pay separate fares on each mode and uncertainty around waiting times and synchronizing the transfer are likely to feature strongly but which of these conditions are most important to the passenger?

1.3 Research approach

The research approach for this study is described below. The three main steps of the process are presented in chronological order and will be discussed in further detail in Chapter 3.

1) Literature review

   The literature review focuses on literature pertaining to hybrid public transport systems, integrating public transport systems, documentation on transfers between modes, the passenger perspectives on transfers and documentation on passenger transfer experiences.

2) Passenger interviews

   Passenger interviews were conducted in order to confirm that the attributes/conditions identified in the literature review process were valid, contextually relevant and to identify possible attributes that may not have presented themselves. Due to the Covid-19 pandemic, these interviews were conducted via email. It involved the recruitment of targeted public transport users (post pandemic). In total, 17 public transport users were interviewed. The initial

approach was to arrange focus groups for this purpose, however, the Covid-19 pandemic created additional obstacles to arrange this. In addition, focus groups have potential shortcomings which are discussed in Chapter 3.

3) Best-Worst Scaling survey

Prof. Mark Zuidgeest recommended Best-Worst Scaling (BWS), also known as Maximum Difference Scaling (MaxDiff), as an appropriate technique for the qualitative analysis required for this study. The benefit of using this technique instead of more commonly use rating scales is that BWS allows for respondents to state that multiple attributes are of similarly high importance of satisfaction/dissatisfaction (Flynn & Marley, 2014), whilst avoiding the instances where only the preferred attribute is identified. A total of 232 respondents successfully completed the survey.

1.4 Structure of the report

The report is structured in five chapters as outlined below:

Chapter 1 provides an introduction to the research topic and briefly summarizes the background and motivation for the research. The research proposal is presented, together with the research objective and questions. Finally, a description of the research methodology is provided.

Chapter 2 explains the study's theoretical foundation which intended to offer a critical review of existing research relating to this research topic. The chapter begins with an introduction to the public transport system in Cape Town, and then summarizes a review of literature on formal and paratransit services as well as their key characteristics followed by a review of the road-based public transport in developing world cities in general, and in Cape Town in particular. This is then followed by a review of approaches taken to incorporate paratransit in the formal public transport system in order to achieve integration. The chapter concludes with a focus on transfers between public transport modes and highlights the operational, psychological and policy elements to understand the passengers' perspective on transfers.

Chapter 3 describes, in detail, the methodology used in this study. The chapter begins with a brief introduction, reference to the literature review and passenger interviews undertaken to form the basis of the survey itself. This is then followed by an introduction to the survey technique, the software utilized, survey design and design parameters. The chapter concludes with the survey administration.

Chapter 4 provides the output of the survey and summarizes the results.

Chapter 5 provides a summary of the results and makes recommendations on how to improve the public transport network based on the conclusions about the study. This chapter then goes on to highlight areas for further research and development.

2. LITERATURE REVIEW

2.1 Introduction

This literature review focuses on research relevant to the research topic; "Understanding the conditions for passengers to consider accepting transfers between MyCiTi and Minibus Taxi." Cape Town, like most South African cities, aspires to integrate the public transport network but the fragmented nature of the existing network makes this a great challenge. The public transport system is dominated by paratransit services; however, the quality of the service provided is poor, largely due to the profit-making nature of their operations. As a result, the City of Cape Town is exploring the option of hybrid public transport systems whereby the formal services are complemented by paratransit services (Ferro and Behrens, 2015) in an effort to improve the quality of these services, as well as reducing the costs associated with formal feeder type systems.

Transfers are a critical component of an integrated system's successful operation. Transfers improve user access to a variety of places and opportunities and public transport interchanges (PTI) that permit and facilitate transfers should be placed strategically across the network to increasing the resilience of the network. This literature review conducts a comprehensive assessment of the research on transfers between modes, with an emphasis on the factors that influence passengers' readiness to transfer. There are two key elements to understanding the passengers' perspective on transfers i.e. operational and psychological. This review demonstrates that the majority of research on transfers has concentrated on the operational element with little focus on the psychological aspects. Furthermore, the existing research does not include developing African cities such as Cape Town, South Africa. This is a significant limitation in our existing capabilities, as transfers are unlikely to be designed successfully when designing an integrated multimodal system without a thorough understanding of the South African context and the challenges facing local public transport users.

The chapter begins with an introduction to the public transport system in Cape Town and then focuses on formal services, paratransit services and the approaches to public transport integration in the form of hybrid networks. The chapter concludes with a focus on transfers between public transport modes and highlights the operational, psychological and policy elements to understand the passengers' perspective on transfers.

2.2 Public transport services in Cape Town

Cape Town is South Africa's most congested city (Businesstech, 2021), owing mostly to a lack of significant investment in public transportation and, as a result, an excessive reliance on the private car. The city boasts a range of mobility options; however, there is a distinct lack of integration.

The sizable captive public transport user population, which can be attributed to high unemployment and low income levels, has resulted in a dependency on efficient and reliable public transport (Piek, 2017). Apartheid spatial planning resulted in many low-income communities being placed on the outskirts of the city, away from opportunities such as employment, education etc. (Bruun et al., 2016), however, providing service to places with lengthy average trip times has proven costly for government and is compounded by the very peaked nature of the local demand patterns (Clark & Crous, 2002). An integrated public transport system would assist in resolving these spatial issues, however the system in Cape Town is still largely fragmented. The various modes of transport operate on separate fare structures and payment systems resulting in passengers avoiding intermodal transfers to avoid paying multiple fares (Bruun et al., 2016). As a result, operators compete along similar origin-destination pairs resulting in operational inefficiencies and contributing to the congestion issue. Additionally, the numerous levels of government involved in public transport provision create further complications and barriers for integration e.g. GABS contract managed by the Provincial Government, MyCiTi as a City of Cape Town initiative and rail as a National function.

This section explores the formal bus and paratransit (minibus taxi) modes of public transport available in Cape Town, as well as their key characteristics. It is critical to understand the characteristics of each service in order to appreciate the discrepancies that make operational compatibility difficult to achieve in the context of network integration. To help differentiate between the two modes of public transportation, the following sub-sections detail their characteristics.

2.2.1 Formal services

South African cities' formal public transport systems includes rail and road-based transport; however, this section will focus on the road-based component. The formal road-based public transport services are the scheduled buses Golden Arrow Bus Services (GABS) and the MyCiTi Bus service i.e. Cape Town's take on BRT. GABS has provided transport for thousands of daily commuters for over 100 years, through contracts with the Western Cape provincial government. The City of Cape Town's MyCiTi Bus service has been operating in city for a little over 13 years. The introduction of MyCiTi was catalysed as part of FIFA requirements for the provision of public transport for the hosting of the FIFA World Cup in 2010.

Some of the traditional BRT elements have been modified in the Cape Town concept to fit local needs. The main characteristics of MyCiTi include:

- **Dedicated lanes** – In high congestion areas dedicated lanes significantly impact bus travel speeds, reliability, and identity; and priority traffic signalling for public transport provided an added advantage.
- **Service and Operations Plan** – The service and operational plan is designed to meet the travel demand needs of passengers and to match the demand for the scheduled service. MyCiTi is not limited to high-frequency peak services but also offers scheduled services outside of the peak periods. It includes trunk, direct and feeder services allowing for greater network coverage.
- **Card-based fare system** – The payment option of MyCiTi is the myconnect smart card. This system was implemented to improve safety, security, convenience, service reliability and accessibility for the customer, as well as reduced dwell times and improved data provision for the operator.
- **Closed bus stations** – MyCiTi stations offer pre-boarding validation to significantly reduced dwell times and are generally the entry point to the MyCiTi system. Further to the operational benefits, these stations offer comfort, safety, and security, as well as universal access.
- **Intelligent Transportation Systems** – This system incorporates a wide range of technologies to improve the performance of the MyCiTi system in terms of journey times, reliability, operational efficiency etc. Bus priority, operations and maintenance management, operator communications, real-time passenger information, safety and security systems, and vehicle tracking and monitoring systems are some of the features offered by these systems.
- **Universal access** – The system makes provision for universal access through the various vehicle types as well through station and corridor design including non-motorised transport (NMT) and pedestrian access.
- **Branding** – MyCiTi has developed a brand that is now synonymous with the features describes above. The strategy for branding BRT systems sets a service standard and conveys to the users the benefits of the BRT components. (Diaz et al, 2004; Diaz, 2009; Jarzab et al, 2002; Levinson et al, 2002).

2.2.2 Paratransit

Paratransit takes on a variety of forms and can be defined in different ways depending on the context of the country in which it operates. According to Ferro (2015), “Researchers from all over the world have examined how paratransit operates and have come to describe it based on its most distinguishing characteristics”. In the South African context, Behrens et al (2016) provide the most accurate definition of paratransit as “unscheduled public transport provided by small scale private operators within a range of business formality and regulatory schemes”. Paratransit has a variety of names in different locations throughout the world including Matatu, Dalla Dalla and Jeepney (GTZ, 2010), however, in South Africa it is referred to as Minibus taxi.

Minibus taxi services have many benefits. They are often more frequent than scheduled public transportation during the peak travel periods and the smaller vehicle size allows for better manoeuvrability, especially in the densely populated low-income areas in South Africa (Cervero, 2000). Minibus taxi services are often more agile than formal services and can quickly react to changes in demand or new demand due to land-use developments. Paratransit still relies on cash fares. This is often considered a dis-benefit; however, this seems to be more attractive to passengers, especially those from low-income areas who are remunerated in cash, those who are unbanked etc.

Regardless of the benefits, paratransit quality is progressively deteriorating in South Africa (Wilkinson et al., 2012). This is largely because minibus taxi operations are not directly subsidized. As a result, they are unable to absorb the considerable increases in operational costs, which has resulted in irregular passenger arrival and departure times, infrequent or non-existent service during off-peak hours, overcrowding, aggressive driving, and poor vehicle maintenance (Cervero, 2000; McCormick et al., 2016). Additionally, minibus taxi drivers board and disembark people everywhere; they frequently exceed the posted speed limit; they occasionally violate traffic restrictions; typically only depart when the vehicle is completely full (Bruun and Behrens, 2016). Furthermore, it is challenging to regulate a public transportation system where services do not adhere to prescribed routes. Paratransit services generally lack structure, there is typically high driver turnover rates and no formal employment of drivers as in regulated public transportation, with drivers responsible for daily decision making regarding decisions on where to operate in order to earn the maximum daily income.

Despite the unconventional way that minibus taxis conduct business; there is still a great deal of reliance on them because they offer customers convenient, affordable, and flexible means of transportation.

2.3 Road-based public transport systems in developing world cities

Most developing cities around the world frequently fall short when it comes to meeting travel needs, especially those of those living in low-income areas (Palmer, 1997; Wright, 2004). Much like South Africa, other developing cities have fragmented public transport systems consisting of both formal and informal services, operating a variety of different vehicle sizes (Wright, 2004). These services are generally regarded as inadequate and of a low quality in terms of safety, security, comfort, convenience, reliability, and travel times, and low incomes contribute to issues with the cost of fares (Behrens et al, 2004; Palmer et al, 1997; Wright, 2004). Listed below are characteristics of existing services that generally receive the most complaints from public transport users (Wright, 2004).

- Low affordability for low-income households;
- Inconvenient stop or station locations;
- Inadequate service frequency;
- Limited origin-destinations links;
- Overloading of vehicles;
- Security concerns relating to crime at stops, stations and in-vehicle;
- Safety concerns relating to driver behaviour and roadworthiness of vehicles;
- Higher travel times in comparison to private vehicles, linked to the frequent stopping of public transport vehicles;
- No infrastructure except for PTIs;
- No information in terms of maps and timetables etc.

2.3.1 Cape Town's public transport system

According to Behrens et al. (2004), Clark (2000) and Schalekamp et al. (2009) Cape Town's public transport network consist of paratransit (minibus taxi), formal bus services (GABS and MyCiTi) and rail (Metrorail). These modes compete with one another for passengers and do not operate in a planned, integrated manner (CoCT, 2006; Arrive Alive, undated; Schalekamp et al, 2009) and the main disadvantages of this fragmented network are listed below:

- GABS and minibus taxi service provision is prominent in the morning and afternoon peak periods, however, their service provision outside of the peak periods is poor and often non-existent;
- Fares on GABS and rail services are generally low; however, peak services are often at or over capacity and therefore uncomfortable for passengers. In the case rail, off-peak services are inconvenient and can be unsafe;
- All modes have unique fare systems and structures;
- Safe and security issues are prevalent on rail and minibus taxi services in general;
- Regulation and law enforcement is inadequate; and
- The MyCiTi bus service, which addresses some of the disadvantages above, is only available to a very small percentage of the cape metropolitan region.

Despite significant government spending on subsidies for public transportation, the current system is insufficient and ineffectual at serving customer requirements (Clark, 2000; CoCT, 2006; CoCT, 2010). The City of Cape Town's Integrated Transport Plan (ITP) for 2006 to 2011 identified the following issues faced by passengers;

"The majority of the public transport users interviewed were dissatisfied with the current public transport system and that they felt it was inadequate. It was believed that the government was not actively improving the quality and frequency of services that also included safety and security issues, which were considered to be of huge concern by those interviewed. Other issues raised included the unreliability of services (insufficient and infrequent), overcrowding, uncomfortable and unsafe minibuses, safety and security at train stations during off-peak times, badly maintained minibus taxis that drove recklessly. Infrastructure (more bus shelters, lanes dedicated for public transport users) also required attention. Other issues that were raised included no facilities for physically disabled users, as well as no bus/ taxi routes in many areas" (CoCT, 2006: 219).

The first MyCiTi services commenced operation in 2011, following limited World Cup services, with the bulk of the services commencing in 2013/2014 in the MyCiTi Phase 1 area. The approach then was to fully replace the minibus taxis operating in the area, compensating and incorporating affected operators as shareholders in the MyCiTi vehicle operating companies (VOCs). The MyCiTi bus system was introduced in Cape Town with the goal of addressing the low quality of public transport services and radically enhancing the passenger experience (CoCT, 2008; Wilkinson, 2009). MyCiTi specifically aims to ensure that all societal groups experience fair, high-quality public transportation, notably by taking into account the unique needs of the mobility disadvantaged, which includes low-income earners (CoCT, 2010). The realization that the current public transport system is critically fragmented led to the decision to implement a new, improved system. The standard of public transport services has increased significantly but is limited to the MyCiTi Phase 1 area and the N2 Express which link parts of Khayelitsha and Mitchells Plain to the Cape Town CBD. The majority of the city still endures poor standards of public transport worsened by the collapsing rail network, increase in minibus taxis as a result and the subsequent increase in traffic congestion.

In the Comprehensive Integrated Transport Plan (CITP) for 2018 to 2023, the City of Cape Town incorporated public engagement into a Transport Needs Assessment. There is now better knowledge of the transport realities that commuters encounter on a daily basis as a result of analysing both the commuters' perceptions and the costs associated with their work journeys, when compared to previous iterations of the CITP. Some critical issues are as follows (TDA, 2018b):

- 94% of the public transport user group is in the low to low-medium income groups. This is a significant increase compared to the original assumption of 80%previously used by the City of Cape Town;
- Proximity to public transport services;
- The largest priority costs were identified as proximity, safety, direct cost and crime;
- The average ratio of direct transport cost versus income for the low-income public transport user

group is 43.1% of the individual monthly income. This is much higher than the target of 10% as stated in the White Paper on National Transport Policy 1996. Note that this includes the cost of social trips, i.e. trips other than commute trips. When the social trips are excluded the ratio reduces to 26.7%.

2.4 Approaches to public transport system integration in Cape Town

The previous sub-chapters discussed public transport in Cape Town as well as the problems experienced to date. This chapter gives a brief overview of some interventions proposed by the City of Cape to improve the public transport system and then explores the City of Cape Town's change is strategic vision for the integrated public transport network (IPTN) and MyCiTi for the next phase of implementation i.e. Phase 2A.

2.4.1 Proposed interventions

2.4.1.1 Integrated ticketing/ fare collection system

MyCiTi currently operates a card-centric system. While the technology was regarded as innovative at the time, it has proven to be very costly and inefficient. As data communications technology has improved, systems have shifted to becoming increasingly back-office centric. Back-office centric systems – referred to usually as account-based ticketing systems (ABT) – offer much greater flexibility because most of the analysing and processing of data occurs in a back-office where there is vastly more computing power than is possible on a card or validator. The shift to an account based integrated ticketing system will facilitate integrated ticketing and allow for a multi-modal approach, integrating other modes including the minibus taxis. Some notable advantages of an account-based ticketing system are:

- All modes can ultimately be integrated onto a single fare collection platform.
- Journeys made across multiple modes can be paid for utilizing the same medium.
- Allows multiple payment mediums such as smartphones and debit/credit cards.

2.4.1.2 Inter-modal route and timetable alignment

The integration of routes, timetables, and transfers is essential to improving the functionality of the network, but this is currently hampered by the fact that operational responsibility for different modes of transportation is currently fragmented among national, provincial, and metropolitan governments. The City of Cape Town intends to make better use of its function as the transport planning authority to facilitate a seamless integration of rail, bus, and minibus taxi services. The anticipated assignment

of the GABS bus contracting function from provincial government will be the first step in this process.

2.4.1.3 Improved system information

Promoting public transport relies on adequate, accurate and appropriate information being available to users and potential users. The City of Cape Town's Integrated Public Transport Network Business Plan (2017) highlighted the importance of the development of information, communication, and related technology strategies. This Business Plan introduced the term 'new generation technologies (NGT)' to denote the new types of services and improvements to existing services that are possible because of new information and communication technologies (ICT). The draft New Generation Technologies for Transport Strategic Framework (2021) sets out the City of Cape Town's perspective and current options for attaining the desired outcomes. The adoption of NGT is expected to achieve the following:

- Significantly improve efficiencies in the use of limited road network capacity by helping increase average vehicle occupancy, by enabling drivers to choose the most efficient route and passengers to choose the most effective mode for a journey based on real-time data
- Facilitate a range of Mobility-as-a-Service options such as ride sharing.
- Support improvements in the quality, safety and sustainability of MBT services.
- Strengthen MyCiTi trunk services by enabling reliable and affordable feeder and supplementary service arrangements especially as the current MyCiTi Phase 2A planning involves the provision of feeder services by NGT-enabled MBTs.
- Support the upgrade of MyCiTi platforms to support an interoperable, multimodal integrated payment and information system.

2.4.2 IPTN and MyCiTi change in strategic vision

As explained in chapter 2.2.2, the paratransit services offerings are of a poor standard and the quality continues to decline. Minibus taxi drivers board and disembark people everywhere; they frequently exceed the posted speed limit; they occasionally violate traffic restrictions; and generally do not depart until the vehicle is at full capacity. These characteristics can be attributed to the lack of law enforcement and to the inability of the government to effectively regulate them (Bruun and Behrens, 2016). Initially, the approach was to fully replace the minibus taxis, compensating and incorporating affected operators as shareholders in the vehicle operating companies contracted to run the new MyCiTi service. According to Shittu (2014) this was seen as a way of providing better quality of public transport services whilst bringing control within the public transport sector. The City of Cape Town's plan for road-based public transport was to absorb minibus taxis into the MyCiTi formal service provision thus phasing out paratransit services in favour of formal services across the city – assuming

that all planned MyCiTi phases would be implemented by 2032 (Schalekamp et al., 2010).

A network comprising of feeder services connecting to trunk services presents an opportunity for integrating paratransit and formal services, however, those in charge of transport planning need to begin to address the challenges of physical integration. Although full integration is a work in progress, there are four main modes of transport within the City's integrated public transport network (IPTN) plan namely:

- Passenger rail
- MyCiTi bus services
- Conventional Bus Services
- Minibus taxi services

Of these, MyCiTi, is the only one of the modes currently under the control of the City and is a core element of the overall integrated public transport network (IPTN) plan for the City of Cape Town. Physical integration requires PTIs that are planned and designed to accommodate multiple modes. It also needs to facilitate the synchronization of all services, however, in Cape Town and throughout South Africa, it is currently difficult to accomplish this largely due to vast differences in operational behaviour per mode. Formal services offer passengers reliability and predictability due to the provision of frequent, scheduled services with minimal deviations from the timetable. On the opposite side of the spectrum, paratransit operations are such that drivers do not follow fixed routes and wait until the vehicle is at capacity before they depart resulting in large variances in travel time to the destination. Depending on the revenue collected for the day, these drivers can decide on their hours of operations. (Bruun and Behrens, 2016). In many cases, minibus taxi drivers save time between trips by alighting passengers outside of designated minibus taxi ranks or public transport interchanges (PTI). Integration is a challenge to achieve partly because the unpredictability of minibus taxi operations makes it difficult to synchronize transfers between modes.

The City of Cape Town's strategy of compensating and absorbing minibus taxis into the MyCiTi formal service has proved to be costly and to continue this approach to full IPTN level will take a much longer time to achieve than originally anticipated. The City approved the implementation of an Integrated Rapid Transit (IRT) system over a provisional timeframe of 15 to 20 years (from 2012), roughly 10 years later and Phase 2 of the MyCiTi project has yet to be implemented. Based on lessons learnt and changing circumstances such as financial constraints and policy reviews, it is intended that MyCiTi trunk routes together with rail will form the core trunk network. Focusing on areas of competitive strength, namely longer routes with relatively high levels of demand where a dedicated right of way, the most direct route, and quick boarding at stations can be leveraged in the most cost-

effective manner. The remaining areas of the city will be served by a variety of direct and feeder services. Feeder services may form part of the formal MyCiTi service, however, these are more likely to be provided by other independent service providers such as minibus taxis. In Phase 1 of MyCiTi, all affected conventional bus and minibus taxi services were replaced by MyCiTi services. In subsequent phases, models will be pursued in which the different services coexist where minibus taxi operators could provide feeder services to the formal trunk services by using more appropriately sized vehicles in residential areas (Del Mistro and Behrens, 2015). In line with this thinking, the Phase 2A MyCiTi service will concentrate on trunk and direct services (however, there will be a much greater emphasis placed on direct services than there was in Phase 1), with feeder services being provided by the minibus taxi industry. The intention is to incentivize the operators to operate in the relevant areas and to offer a transfer incentive to the passenger in an effort to dictate that the feeder service integrates with the trunk service at designated integration points. Continuing with this theme, the next stage of Phase 1 MyCiTi services will be adapted to place more of an emphasis on MyCiTi's strengths. This will be accomplished by placing more of an emphasis on competition for the public transport market using a competitive tender process, while simultaneously capitalizing on opportunities to reduce the amount of illegal competition in the market.

The change in direction to make use of paratransit to perform the feeder function to trunk services is not a new concept. Many cities around the world have done similar with varying degrees of success and important lessons learned. Plano (2020) lists the following examples:

- Quito – paratransit services in Quito were allowed to compete with BRT lines and offer feeder service in outlying and residential neighbourhoods (Salazar Ferro, 2015; Salazar Ferro and Behrens, 2013). Operators continued to offer unscheduled service as independent operators licensed for specific routes despite being paid by the government a per passenger fee as an incentive to bring passengers to BRT stops (Salazar Ferro, 2015; Salazar Ferro et al., 2015). Issues around route competition began to grow, and operators eventually agreed to a concession (Salazar Ferro and Behrens, 2013).
- Jakarta – drivers had to provide discounted rates when transferring passengers. Drivers did not trust owners to pass along government reimbursement, hence the system was unsuccessful despite the owners receiving compensation and bonuses (Behrens, Salazar Ferro, et al., 2016).
- Durban – according to Schalekamp and Klopp (2018) the eThekwini municipality plans to monitor operations via tracking devices and intend to make monthly payments to drivers and owners in return for improved service standards e.g. vehicle maintenance and safe driving behaviour.
- Recife – Area licensing was implemented, which resulted in increased demand for scheduled trunk service and reduced trip times after paratransit operators were reorganized into

neighbourhood feeders (Behrens, Salazar Ferro, et al., 2016). Operators were required to sign service agreements agreeing to maximum headways and fare, however, they were not obligated to undergo formalization (Ferreira et al., 2005).

- Santiago – despite the fact that the majority of paratransit providers had already formed into operating companies, those who hadn't were granted a limited amount of time to do so in order to take part in the tendering for nine feeder areas (Salazar Ferro et al., 2015). Operating zones had a buffer zone that encouraged some competition to preserve the level of service (Salazar Ferro and Behrens, 2013). This system was adjusted to restore some of the advantages of paratransit, such as high coverage, by lowering the rigidity of the concession limits after it was discovered to be inflexible.
- Porto Alegre – as part of a sponsored concession, the municipal government paid paratransit operators in addition to collecting and holding the revenue generated from fares (Behrens, Salazar Ferro, et al., 2016).

Paratransit should be included as a feeder mode, according to a range of different researchers (Satiennam et al., 2006; Akkarapol et al., 2009; Shimazaki et al., 1996; and Okada et al., 2003). The idea is to increase mobility while making use of the available resources. However, it is important to carefully assess how people perceive paratransit and it is necessary to evaluate the service quality of the current paratransit system so that it can be enhanced.

2.4.3 Blue Dot Taxi Service

As explained in section 2.2, the quality of paratransit services is generally regarded as poor and continues to decline. Minibus taxi drivers board and disembark people everywhere; they frequently exceed the posted speed limit; they occasionally violate traffic restrictions and are often overloaded. In an effort to address these issues, and more, the Western Cape Government collaborated with the provincial minibus taxi industry to introduce the Blue Dot taxi service pilot programme. The project attempts to solve two of the industry's most difficult problems, namely illegal activities and violent conflict, as stated by the Western Cape Government (n.d.). It also aspires to achieve empowerment in and transformation.

800 participating minibus taxis were branded with a large, recognisable blue dot sticker on the outside of the vehicle and are subject to a passenger rating system, which determines the incentive they will receive. In order to participate, the Western Cape Government set the following eligibility criteria and service standards:

- Installation of on-board vehicle trackers,
- Automated monitoring of habitual poor driving behaviour such as speeding, harsh cornering, harsh breaking, and rapid acceleration,
- Automated monitoring of adherence to licensed routes,
- A requirement for minibus taxi operators to provide a minimum level of service each day,
- A requirement for vehicles to be licensed, roadworthy and pass a safety inspection, and for drivers to have a PrDP (Professional Driving Permit),
- A requirement for operators and drivers to have completed Blue Dot training,
- A requirement for minibus taxi operators to bring vehicles in for periodic vehicle inspections at the discretion of the Western Cape Government,
- Feedback from passengers, other road users and the public on driver performance, vehicle quality and COVID safety compliance, and
- A requirement to display Blue Dot branding and the required passenger information.
- Participating operators must be registered on the Central Supplier Database and, therefore, must be tax compliant, without conflict of interest and have a valid bank account.
- Participants must also sign the project's terms and conditions.

The eligibility requirements and performance standards are designed to significantly raise the level of quality and safety. Participants who do not comply will not be given an incentive payment. The minibus taxi industry is synonymous with bad driving habits and Blue Dot is intended to change this behaviour over time.

The pilot programme commenced operations in May 2021 and ended on 30 November 2022 due to a lack of funding. The provincial Department of Transport stated that it could not afford to continue the service unless the national government contributed 42 million rand in financial assistance (iol, n.d.). There is little literature on the Blue Dot taxi service pilot programme, however, the following challenges have been identified:

- Funding. As mentioned above, the pilot programme could not be extended due to a lack of funding. The national government is not willing to continue to fund the programme.
- The participating minibus taxi operators were incentivised to simply comply with the rules of the road resulting in significant criticism from the public in particular.
- Setting up the companies and driver training was a lengthy process. Higher driver turnover rates presented a further challenge.
- The relationship between the operator and driver was challenging as the incentive was paid solely to the operator and not the driver.

2.5 Transfers in public transport systems

According to Vuchic (2006), transfers are a crucial element in successful public transport networks, especially in large multimodal networks. Clever (1997) states the following “In an integrated public transport system, passengers do not board a single line, but a whole system”. In integrated public transport systems, passengers often have to transfer between different modes to reach their destinations. The role of transfers can be defined in two parts:

- Firstly, transfers unlock the benefits of the network by providing greater access to multiple destinations;
- Secondly, in order to promote network efficiency and reliability, as well as eliminate route duplication, interchanges that permit transfers must be placed strategically across the network.

Creating "seamless" transfers is one of the most important steps toward realizing the vision of an integrated transport system that is still user-friendly (Luk and Olszewski, 2003). Transfers should be seen as something that should be taken advantage of rather than something that should be avoided because they allow passengers access to the full public transport network (Maxwell, 2003). According to Hidalgo (2009), integration reduces the cost of transfers for users therefore increasing the attractiveness of public transport. Furthermore, Hutchinson (2009) concludes that commuters are willing to make transfers if there is integration between operators. Despite the operational advantages, transfers often make public transport less competitive with private cars. Transfers are often seen as a negative element from the passenger perspective and inconvenient transfers could repel potential customers (Wardman, 2001) as well as cause dissatisfaction among existing customers (Hine and Scott, 2000). According to Iseki and Taylor (2009), public transport users perceive out-of-vehicle time, such as transfer walking and waiting time, to be more onerous than in-vehicle time. This psychological factor can create the perception that the transfer within a system is unreliable or inconvenient as public transport users consider waiting time to be unproductive (Dziekan and Vermeulen 2006). According to Iseki and Smart (2011), decreasing the perceived transfer time will increase user satisfaction. A well-designed station layout, information, safety, and appropriate weather protection can minimize perceived transfer walking time (Currie and Willis 1998). McCord et al. (2006) states that the impact of transfer waiting times can be reduced by providing real-time information, as well as safety and weather protection. Ceder et al. (2013) investigated passengers' perceptions of the dangers of making transfers due to the unpredictable journey times, as well as their decision to select routes with transfers in exchange for journey time savings. Results reported by Ceder et al. (2013) showed that passengers are generally risk-averse and tend to prefer routes with longer out-of-vehicle times provided that these routes provide greater reliability.

Iseki and Taylor (2009) argues that transfers are often ignored in public transport planning, even though it is a fundamental network issue. In the context of Cape Town, the MyCiTi network was designed to include transfers between services but there is a distinct lack of integration between all modes. Transfers take place within the MyCiTi system; however, transfers in the public transport network as a whole involve multiple modes managed and operated by separate entities, making intermodal transfer extremely inconvenient. Over and above organizational synergy, other areas can be improved to enhance integration within the existing public transportation network such, physical integration as well as integrating information and fare systems. These interventions are generally well researched and documented, however, there appears to be a lack of focus on trying to understand transfer behaviour and evaluate transfer improvements. Chowdhury and Ceder (2019) gives a comprehensive evaluation of research that focus on switching from private to public transportation, with an emphasis on the factors that influence commuters' 'willingness to transfer'. The study categorized the factors into psychological, operational and policy perspectives, and is summarized in Table 1 below. This research concluded that the operational component of transfers has been the primary focal point of most of studies pertaining to transfers. Safety, reliability and out-of-vehicle time (waiting and walking time) received considerably more attention than fares, ticketing and comfort at the transfer location. Furthermore, security, travel time, cost and transfer time (out-of-vehicle) are some of the key factors identified as crucial in the decision making process to select routes with transfers (Atkins 1990; Callaghan and Vincent 2007; Iseki and Taylor 2009; Molin and Chorus 2009; Muller and Furth 2009; Sharaby and Shiftan 2012). In addition, a number of studies have found that the most sensitive variables for passenger perception of transfer routes are safety, journey time, and transfer time (out-of-vehicle) (Vande Walle and Steenberghen 2006; Zhou et al. 2007; Muller and Furth 2009; Eboli and Mazzulla 2012; Hadas and Ranjitkar 2012).

Table 1: Factors influencing willingness to transfer

PSYCHOLOGICAL	OPERATIONAL	POLICY
Public transport perception	Safety and Security	Push and Pull strategies
Marketing techniques	Reliability	Legal
Psychological factors	Transfer time (out-of-vehicle)	Economical
Cognitive models	Information systems	Information and Educational
Habit	Fare/ticketing systems	Personalized travel plans
Pro-environmental behaviour	Comfort and amenities at PTIs	
	Integration of public transport systems	

Mthimkulu (2015) states that when exploring South African solutions, it is important to rediscover the working elements of the systems that are currently available rather than developing new systems. A focus on minibus taxi characteristics indicates that they may have a seemingly efficient business model that allows them to reach where passengers are or want to be which is ideal for a feeder route to a mass transit trunk such as MyCiTi. The informal nature of minibus taxis, which enables them to meet passenger expectations for a service that is flexible by request, might be explored in light of the institutional difficulty of densities that is experienced by the more formal sectors such as MyCiTi. Mthimkulu (2015) claimed that in terms of integrated services, users have organically taken it upon themselves to interact with the different modes that are available. This is important because there are transfers taking place despite the fragmented nature of the current public transport network. A focussed effort to understand and improve the operational factors that influence passengers' willingness to transfer, should positively influence the psychological factors as well as the policy factors thereby improving the public transport network as a whole.

Davidson et al (n.d) concluded that the only true systematic change that can improve the state of the current public transport system, in Cape Town, are those changes that go beyond the academic articles and 'higher-ups' in government or regulatory bodies policies pertaining to transport. The most transformative steps will begin from the ground up by engaging with those actually using public transportation with regard to what changes need to be implemented in order to get them safely, affordably and efficiently from their starting point to their destination.

This research topic stems from the belief that by addressing the barriers experienced by passengers, in the context of making transfers, we will start to witness a change in travel behaviour and an improvement in public transport system usage in Cape Town.

2.6 Summary and conclusion

In reviewing the context of public transport in South Africa, it is evident that an improved and integrated system is necessary in order to respond to the current poor quality and regulation of certain forms of public transport. An integrated system with strategically placed interchanges and transfers not only affords commuters and users accessibility to places and opportunities but also increases the system's resilience to failure. However, with the limited research on integrated public transport and the opportunities that such interchanges and transfers are able to afford the South African context, it further limits the ability to design and implement an integrated public transport system successfully.

A contributing factor to this limitation are the fragmented spatial, operational and regulatory realities that many of Cape Town's captive public transport users experience. Without coordinated regulatory interventions between the separated spheres of authority, such fragmentation of public transport services cause congestion due to competing modes along similar routes. However, with the introduction of the MyCiTi BRT network (as well as associated operational and structural advantages), the City of Cape Town attempts to produce / depict what opportunities an integrated public transport system and network could provide to the City.

However, as realized by the City of Cape Town, a one-size fits all approach does not speak to the needs and requirements of commuters within the South African context. Therefore, an adjusted but fair approach may be necessary which includes the obvious qualities of BRT and the agility and responsiveness of the minibus taxi / paratransit. This approach may improve the standard of public transport services across all modes, however it is currently limited to MyCiTi Phase1 and the N2 Express.

In order to improve on the current standards of public transport provision, a multifaceted approach with demonstrated interventions is necessary. These interventions are demonstrated through either case studies of other public transport systems attempting modal integration, or pilot projects that are able to inform us on the means and extent poorly regulated operations could be incentivized. These interventions may include an incentivized integrated account based ticketing and fare collection system, and route and timetable alignment of all modes to ensure seamless transferability.

Therefore, considering the literature reviewed above, the factors influencing the transfer of commuters between modes are not only based on the level of physical integration. The ability to transfers also includes psychological, operational and political decision making factors that contend with one another when users are faced with making their trip choices.

The following chapter considers these decision making factor as it influences the manner in which research for this investigation will be undertaken.

3. RESEARCH METHODOLOGY

3.1. Introduction

The research methodology is a crucial aspect of a research study as it provides a systematic approach for collecting, analyzing, and interpreting data. This chapter outlines the methods, techniques, and procedures used to gather information, including the selection of participants, data collection tools, and data analysis method employed to understand the preferences of public transport users with respect to transferring between modes when asked to rank a predetermined list of attributes. The objective of using a rating scale method is to identify key areas for improved services with the ultimate objective to encourage public transport use and take a step towards public transport integration. This research method is divided into three key sections i.e. literature review and work experience, passenger interviews and a Best-Worst scaling (BWS) survey.

3.2. Literature review

Chapter 2 systematically reviews both local and international literature in an effort to identify attributes or conditions that influence the passenger's choice of transferring between modes. There are many factors that passengers consider when deciding to transfer or not, some more relevant in the South African context than others. The outcome of the literature review was a draft list of attributes for inclusion in the BWS survey.

3.3. Passenger interviews

Based on the reviewed literature and the results of 10 years of experience working in the public transport planning field, a draft list of attributes was developed for this study. Passenger interviews were conducted in order to confirm that these attributes were valid, contextually relevant and to identify possible attributes that may not have presented themselves during the literature review. The initial thought was to arrange focus groups for this purpose, however, the Covid-19 pandemic created additional obstacles to arrange this. Furthermore, focus groups have potential issues where individuals have pre-existing relationships and for this process the target audience comprised work colleagues. Due to the lack of participant privacy during the conversation and the possibility of disagreeable viewpoints, being accidentally or purposefully released after the discussion is over, ethical concerns arise (Krueger & Casey, 2015; Liamputtong, 2011). This is referred to as the 'halo' effect. The halo effect is a social-psychology phenomenon that causes people to be biased in their judgments by transferring their feelings about one attribute of something to other, unrelated, attributes. Individuals may be discouraged from

speaking honestly during group conversations if doing so would imply going against the consensus position (Liamputtong, 2011). This is referred to as the 'bandwagon' effect, which is a phrase used to explain the propensity for people to adopt particular habits, styles, or attitudes because others are doing so.

Due to the Covid-19 pandemic, these interviews were conducted via email. It involved the recruitment of targeted public transport users (post pandemic). In total, 17 public transport users were interviewed. The number of interviewees per public transport mode is shown in Table 2 below. To assure research ethics, participants were informed in writing about the study's goals, how their responses would be put to use, and how any data gathered during the interview process would be reported anonymously.

Table 2: Number of passengers per public transport mode

PUBLIC TRANSPORT MODE	NUMBER
Golden Arrow Bus Service (GABS)	5
Minibus Taxi (MBT)	4
MyCiTi	4
Metrorail	4

The outcome of the interviews resulted in no change to the draft list of attributes developed through the literature review process. It confirmed that these attributes were an accurate representation of the factors passengers take into consideration when deciding to transfer or not. The list of attributes is shown in Table 3 below.

Table 3: Draft list of conditions that could influence the decision to transfer

No	ATTRIBUTE	DESCRIPTION
1	Pricing/cost	Total cost of the journey
2	Fare integration	Integrated fare structure across all modes
3	Waiting time	Average time spent by a passenger at the transfer
4	Riding time	Time required to complete the journey
5	Reliability of connection	Taking into account cancelled trips or next vehicle arriving
6	Situational safety	Threats like muggings, hooliganism, rough behaviour
7	Comfort of travel	Uncrowded, clean vehicles, seats available, good ventilation
8	Easy wayfinding	Good, intuitive wayfinding comprising of signs, maps etc.
9	Seating and waiting areas	Seating is important for the elderly if waiting times are long
10	Weather protection	Protection from weather in cities with a harsh climate
11	Retail opportunities	Retail is a welcome amenity to customers at PTIs
12	Cleanliness	Waiting areas should be clean and well maintained
13	Personal safety	Safety when crossing roads and protection from traffic
14	Integrated ticketing	One ticket/card for travel on all modes

3.4. Best-Worst Scaling survey

Best-Worst Scaling (BWS), also known as Maximum Difference Scaling (MaxDiff), was recommended by one of my supervisors. BWS was selected as the method of choice because it delivers greater item discrimination and precision than conventional rating scales, while avoiding scale usage bias. However, a list of attributes needed to be developed and verified for inclusion in the BWS survey itself. The draft list of conditions shown in Table 3 above, drafted through the literature review and verified through the interview process formed the basis for the BWS survey.

3.4.1. Introduction to BWS surveys

BWS analysis is a technique for doing market research that measures the preference and value customers place on a set of items or features. It plays a crucial role in evaluating the trade-offs that individuals would make and ultimately produces a list ranking. It is generally applicable to listings of a product's attributes. Developed by J.J. Louviere (Louviere 1991), it is frequently referred to as Best-Worst Scaling or maximum difference scaling.

Participants in a BWS analysis are given subsets of an item list and asked to rank the best and worst or most and least important items from that list. This method was chosen since it can be difficult for respondents to score seven or more things in a survey experience. BWS breaks down the process into a more manageable number of items and makes use of human ability to select the best and worst items from a list. Typically, a respondent will see 5 to 15 questions with 3 to 5 items each, and they will be asked to choose the best and worst options from the list. Since it is a more manageable effort for survey participants than displaying the complete list at once, this produces extremely reliable results.

A BWS analysis is generally conducted by following the steps below:

1. Identify the attributes to be tested.
2. Generate the experimental design.
3. Configure the questionnaire/survey.
4. Collect data.
5. Analyze results.
6. Report findings.

Each of these builds upon the previous action in working toward the end goal of understanding the preferences of the customer base.

BWS is divided into three variants: Case 1, Case 2, and Case 3. Case 1 BWS creates a number of alternative subsets of the items from the list using the experimental design after listing the items (objects) rated by respondents. Respondents are given a choice set for each of the subsets and asked to pick the best (or most important) and worst (or least important) items in the set. This question is repeated until all of the subsets have been assessed. BWS lists qualities and their levels in Cases 2 and 3. Case 2 (the profile case) invites respondents to rank each of the attribute levels that BWS has created, asking them to select the best and worst values for each profile. In Case 3 (multi-profile), the BWS asks participants to rank the best and worst profiles from each choice set that includes three or more profiles. In a Case 2 BWS question, alternatives are levels that are offered in a choice set, but a Case 3 BWS question offers profiles that are offered in a choice set.

3.4.2. BWS for this research

Research supervisor, Professor Mark Zuidgeest, recommended BWS and upon further research into the survey method, it was established that Case 1 BWS was the most appropriate variant for this study. It was also recommended that Sawtooth Software be approached to enquire about the potential use of their online survey platform which handles traditional survey questions, but is best known for Choice Analysis. My application to become a grant recipient was successful and I was awarded a license to use Sawtooth Software products for this research. My interest was in the web-based application for programming and analyzing surveys called Discover. Using this software one is able to design the survey, configure the layout, customize the parameter settings, administer the survey using mobile devices, capture and analyze the data.

3.4.2.1. Survey design

The list of attributes was developed through a decade of professional experience, review of the literature and through interviews with public transport users. Once the list of attributes and the method to conduct the survey was established, the process to design the survey began.

It was important to design a survey appropriate for a population where respondents have varying levels of literacy. Instead of using text only, the Sawtooth Software BWS survey includes the use graphical representations of options. However, according to Arentze et al. (2003), a study comparing text and visual representation of options discovered that there was minimal impact by the use of visual aids, indicating that the effort needed to create a visual questionnaire is not justified. It was therefore decided that a text-based survey would be acceptable.

The complexity and the attributes themselves were the subject of several specific design considerations

for the final study, which are discussed under design parameters. However, attribute dominance was a particular concern for this study as there was an expected dominance of the cost attribute due to the significantly large low income population. According to Kjaer et al. (2006), price sensitivity increases by a factor of 1.42 regardless of whether a monetary attribute is listed first or last in the list of attributes. Thankfully, all attributes in the software do not appear more than once in a specific position in an attempt to reduce dominance.

3.4.2.1.1. Layout of the survey

In order to ensure that this survey was presented in a professional manner, the layout included an introduction, purpose, brief explanation of what is required from the respondent and a conclusion to confirm that the survey has been completed as shown in Figure 1 and 2 below.

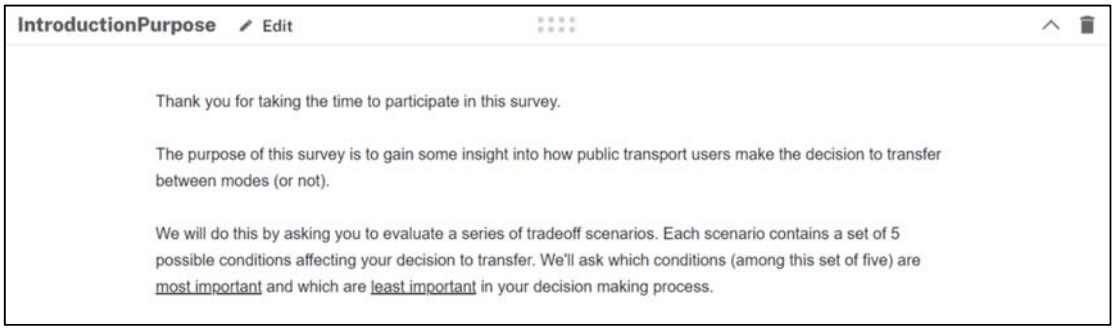

Figure 1: Introduction page used in the survey.

Figure 2: Conclusion page used in the survey.

The software offers various options for the layout of the sets as well as editable labels. The layout for this survey is shown in Figure 3 below.

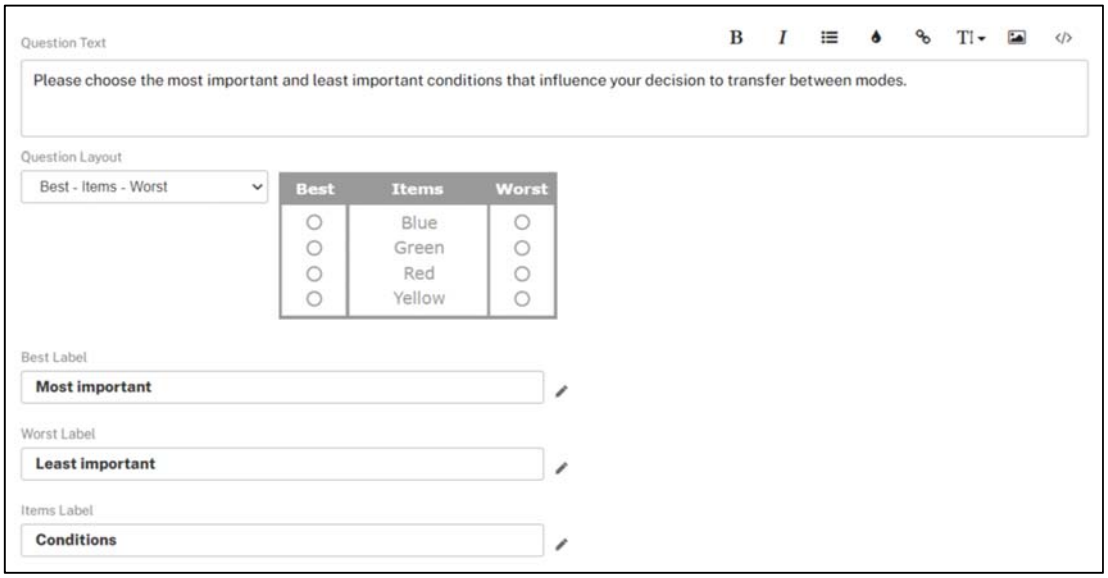

Figure 3: Customized layout settings.

3.4.2.1.2. Design Parameters

The software programme suggested asking between 9 and 14 sets and displaying each item an average of 3 to 5 times per response across all sets. With 14 attributes identified for this study, the number of sets to display so that each item is shown on average 5 times per respondent is equal to:

3(K/k), where K is the total number items in the exercise, and k is the number of items per set.

Therefore, it was determined that I would need to ask each respondent a minimum of 5(14/5) = 14 sets. It was estimated that each set will take about 12-15 seconds to complete, therefore, using 15 seconds the total average interviewing time will be 3.5 minutes. However, if each set takes 45 seconds to complete, the total average interviewing time will be 10.5 minutes. This was accepted as an acceptable time range for potential respondents. In order to keep respondents engaged and working successfully throughout the survey, the program provided the option to incorporate a progress bar and a countdown message indicating how many sets remained. This was deemed unnecessary as the survey was short and respondents would be informed about the number of sets when approached by the surveyors. The design parameter input settings is shown in Figure 4 below.

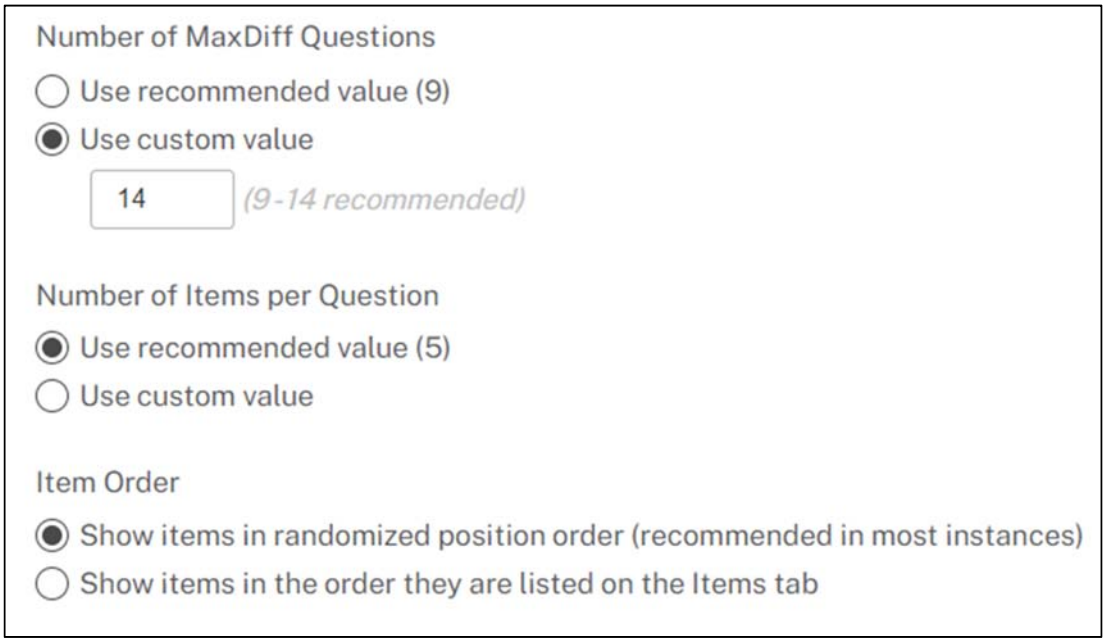

Figure 4: Design parameter input settings.

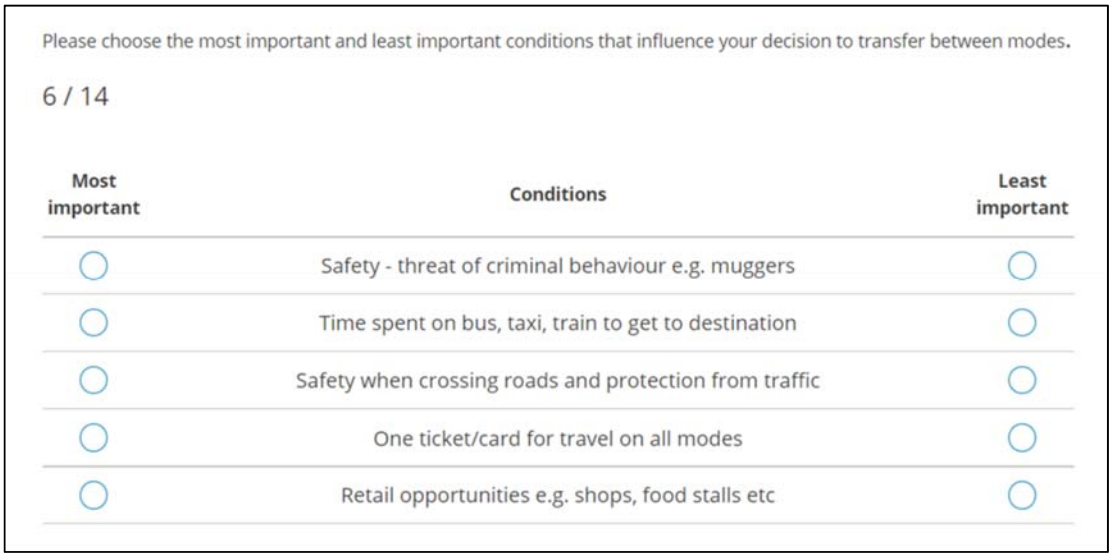

Figure 5: A set from the survey showing five attributes.

3.4.2.1.3. Consultation and testing

Professional surveyors were hired to carry out the survey. The team consisted of a team leader and four surveyors. Prior to the administering of the survey, the team leader and the survey team was consulted in order to get their professional comments and suggestions on the survey layout, parameters and the envisaged survey administration process. This was an important step in ensuring a successful survey.

Because a text-based approach was chosen, it was necessary to carefully craft the terminology to make sure respondents grasped the concepts as intended (Mangham, Hanson, & McPake, 2009; Venter & Venkatesh, 2010). The draft list of attributes was wrongly assumed to be simple enough possibly due to the use of colleagues working in the transport planning industry for the pilot interview process. The survey team immediately advised that the attributes were too technical and needed to be simplified as commuters are generally time sensitive and quickly lose interest if they need to spend time trying to understand a survey. The survey needs to be as simple and as quick as possible. The revised list of attributes is shown in Table 4 below.

Table 4: Final list of conditions that could influence the decision to transfer

No.	ATTRIBUTE
1	Pricing/cost
2	Same way to charge fares on bus, taxi and rail
3	Time spent waiting to transfer
4	Time spent on bus, taxi, train to get to destination
5	Reliability - will the next vehicle arrive on time
6	Safety - threat of criminal behaviour e.g. muggers
7	In-vehicle comfort - clean, uncrowded, seats available etc.
8	Signs, maps and other travel information
9	Seating and waiting areas
10	Protection from the weather
11	Retail opportunities e.g. shops, food stalls etc.
12	Cleanliness of the waiting areas e.g. stations, ranks etc.
13	Safety when crossing roads and protection from traffic
14	One ticket/card for travel on all modes

The survey team also recommended the afternoon peak period over the morning peak period as commuters are less time sensitive when on their way home as opposed to the rush to get to work on time.

The list of attributes was updated in the software and a link was created to access the survey for training and testing. The link was shared with the team leader and the surveyors were trained, by myself, on how to successfully administer the survey using a mobile phone or tablet. This proved a crucial stage of the process, as the surveyors had not previously been exposed to a BWS, computer aided survey. After testing, the survey was reset so that the test runs did not form part of the analysis sample.

3.4.2.2. Survey administration

The survey was administered as an intercept survey over two days, on a Monday and a Tuesday in

mid-December before businesses closed for the end-of-year break. Surveyor approached public transport users during the afternoon peak period, from approximately 3:30pm until 6:30pm at the following Public Transport Interchanges (PTI):

- Bellville PTI
- Mitchells Plain Town Centre PTI
- Cape Town PTI
- Wynberg PTI

The PTIs listed above are four of the busiest PTIs within the Cape Metropolitan area and therefore offered the best opportunity to achieve the sample size of 200 public transport users in the shortest possible period.

On Monday, 13 December 2021, surveys took place at Bellville and Mitchells Plain Town Centre PTIs with two surveyors stationed at each PTI. Similarly, on Tuesday, 14 December 2021, surveys took place at Cape Town and Wynberg PTIs with the same four surveyors distributed equally per PTI. The objective was to secure a minimum of 50 respondents per PTI. To ensure complete understanding by respondents, the surveyors employed were bilingual, fluent in both English and Afrikaans (Van Zyl et al., 2001), and although some respondents preferred Afrikaans, most respondents chose to interact in English.

The general feedback from the surveyors was that the administering of the survey was simple and effective. The respondents who took the survey gave verbal consent and generally showed an interest in the research topic, however, the following challenges were noted:

- Many potential respondents were rude to the surveyors and did not give them the opportunity to explain the purpose of the survey.
- Many respondents were in a hurry; however, this situation would have been worse in the morning peak period.
- Some respondents were frustrated that the same attributes appeared more than once during the survey.
- Some respondents found it difficult to select the best and worst options, which resulted in longer time to complete the survey.
- Some respondents found it difficult to understand the attribute descriptions.

4. RESULTS

4.1 Introduction

A total of 249 respondents started the survey. Figure 6 below shows that there were no disqualified surveys but 17 of the respondents had incomplete surveys. Furthermore, eight respondents progressed beyond the introduction page with only three of these respondents making any best-worst selections. The survey team reported that in these instances the respondents had agreed to undertake the survey only to change their minds soon after. The remainder of the incomplete surveys were because of the surveyor initiating the survey process by clicking the link, however the browser timed-out before a respondent was successfully approached. Figure 7 shows the summary of the incomplete surveys, specifically showing the last question seen by the respondents e.g. one respondent (respondent number 6) made a best-worst selection for the third question and therefore the software automatically showed the next question, at which point that particular respondent decided to abandon the survey. Figure 8 below shows the incomplete survey record for respondent number 6 to demonstrate the manner in which the information is displayed.

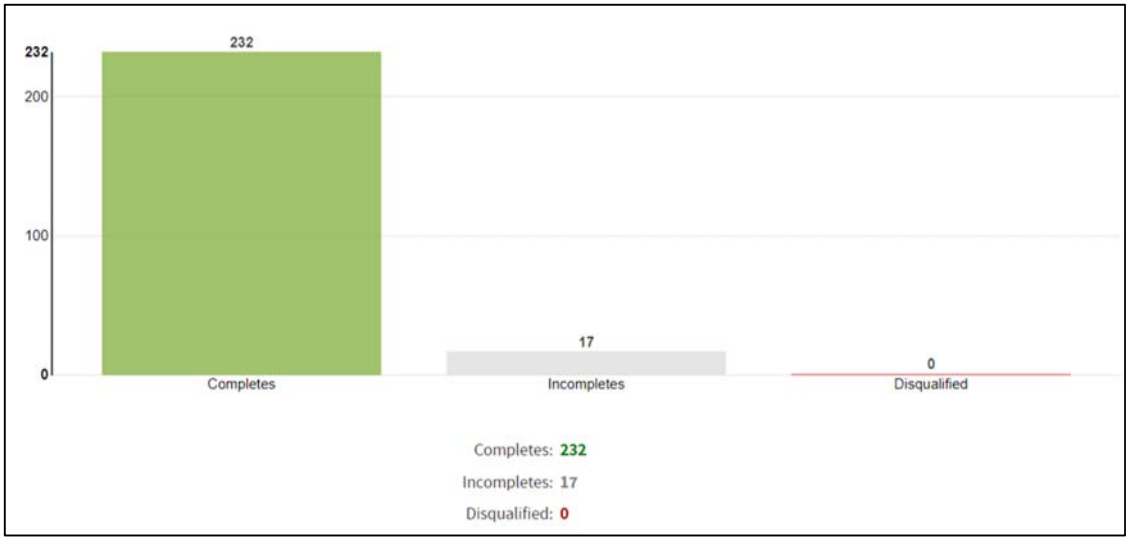

Figure 6: Number of complete, incomplete and disqualified surveys.

Last Question Seen	Incompletes	% of Respondents
IntroductionPurpose	9	3%
BestWorstScaling_1	5	2%
BestWorstScaling_2	2	0%
BestWorstScaling_4	1	0%

Figure 7: Summary of the incomplete surveys.

General Information	
Internal Respondent Number	6
Status	Incomplete
Respondent Computer	Browser = Chrome 96.0.4664.45 Screen Width = 360 JavaScript = Yes Operating System = Android 10 I.P. Address =
Time Interview Began	13 Dec 2021 - 06:39:59 SAST
Time Interview Finished	13 Dec 2021 - 06:45:00 SAST
Elapsed Time	0h 5m 1s

Question	Response
BestWorstScaling_1_b	
	10 (One of the most important features of a successful transportation terminal, especially in cities with a harsh climate)
BestWorstScaling_1_w	
	8 (No amount of online information makes up for good, intuitive wayfinding comprising of signs, maps, and directories listing the transport services prov...)
BestWorstScaling_2_b	6 (Threats like muggings, hooliganism, rough behavior)
BestWorstScaling_2_w	14 (One card/ticket for all modes)
BestWorstScaling_3_b	5 (Taking into account cancelled trips or next vehicle arriving late)
BestWorstScaling_3_w	11 (Retail is a welcome amenity to customers at PTIs)
BestWorstScaling_4_b	
BestWorstScaling_4_w	

Figure 8: Incomplete survey record for respondent number 6.

As per Figure 6 above, a total of 232 respondents successfully completed the survey. The City of Cape Town's Comprehensive Integrated Transport Plan (CITP) for 2023 to 2028 reports 1 215 000 daily public transport users based on a 2020 estimate. The margin of error, also known as the confidence interval, describes how closely survey results should be taken to represent the opinions of the entire population. The margin of error for this study was calculated to be 6.4% for a 95% confidence level by using the formula below. An acceptable margin of error used by most survey researchers typically falls around 5% at the 95% confidence level.

$$\text{Margin of error} = z \times \frac{\sigma}{\sqrt{n}}$$

where z is the z-score, σ is the population standard deviation and n is the sample size.

Figure 9 below shows the results of the survey. The results are presented as utility scores indicating positive ratings for each attribute or condition, the sum of which equals 100. The scores are ratio scaled, so an item with a score that is twice as a high as that of another item is considered to be twice as

important. The most common method for displaying data is to list the items from highest to lowest score for the entire sample.

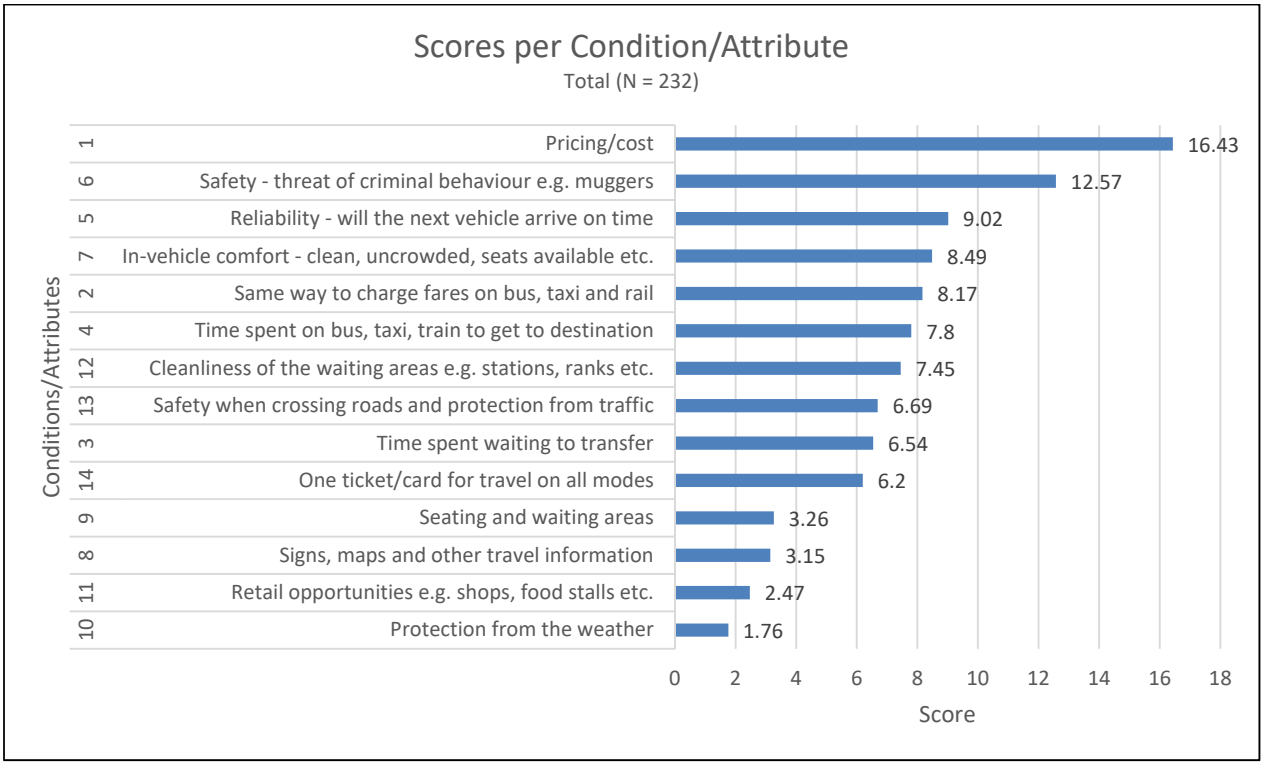

Figure 9: Results of the survey.

MaxDiff Analysis (n.d.) explains that BWS or MaxDiff is comparable to a "beauty contest" between the attributes. The utility scores are derived based on the relative comparisons among the attributes in the study. On the other hand, there is no evidence that can be found to indicate whether or not an individual finds all the items to be very much liked or very much disliked. There is simply a relative scale used for the scores. For this reason, it is beneficial for the researcher to include a wide range of items, ranging from things that are more important to those that are less important. In this study, the final list of conditions that could influence the decision to transfer consisted of 14 items. According to Green et al. (2001), there are numerous ways to transform scores from a discrete choice experiment (such as this BWS study) into comparable utility scores. The MaxDiff Analysis tool from Sawtooth Software uses the Empirical Bayes method for score estimation. When one follows the software's suggestions for the amount of questions asked of each respondent, Empirical Bayes is incredibly fast and generates high-quality results. Method description is beyond the scope of this paper.

4.2 Discussion of Results

The following results are derived from the 232 successfully completed surveys. Figure 9 above shows the utility scores for each attributed of the survey. *Pricing/Cost* has the highest score of 16.43, while *Protection from Weather* comes out with the lowest score of 1.76. The second highest score of 12.57 was for *Safety (threat of criminal behaviour)* and this together with *Pricing/Cost* were clearly the outliers in terms of importance when compared to the twelve other attributes. Perhaps this is somewhat unsurprising in the South African context but provides some comfort in the form of confirmation from the public transport user. As it can be seen from Figure 9, the respondents believe that the next eight attributes are much closer to each other, in terms of importance with *Reliability* (9.02) being the most important and *One Ticket* (6.2) the least important of the eight.

The ranking of *time spent in-vehicle* (7.8) is perhaps the most interesting as this study indicates that there are five attributes considered to be more important with a significant gap to *Pricing/Cost* (16.43) and *Safety* (12.57) suggesting that planning authorities place too much importance on in-vehicle time. Thereafter, there is a significant drop in importance with *One Ticket* considered almost twice as important as *Seating and Waiting Areas* (3.26) and *Signage/Maps/Travel Information* (3.15).

The overall rank position of *One Ticket*, 10th place out of 14, is lower than expected. Alhassan et al. (2022) states that the users' preference and willingness-to-pay for integrated ticketing systems is mostly unexplored and thus presents an opportunity for further research. Alhassan et al. (2022) also states that there has been success with integrated ticketing in some countries and uses the Movingo smartcard in Maardalen, Sweden as a case study where the national Swedish railways reported a 24% increase in ticket sales one and a half years after the implementation of the Movingo scheme. It could well be that public transport users in South Africa do not understand the concept of one ticket for various modes and its associated benefits, and the idea of an integrated ticket, given the fragmented nature of the local public transport networks, seems impossible.

According to the survey results, the least important attributes are *Retail Opportunities* (2.47) and *Protection from Weather* with the lowest utility score of 1.76. The City of Cape Town's Comprehensive Integrated Transport Plan (CITP) for 2023 to 2028 states that 95% of public transport users in Cape Town are in the low to low-middle income brackets and that, particularly for low-income households, transportation costs account for a very high percentage of disposable income. In Cape Town in particular, high on having efficient and reliable public transport (Piek, 2017) and it is therefore understandable that attributes such as *Retail Opportunities* and *Protection from Weather*, while still somewhat important factor when it comes to decision making, rank the lowest in terms of importance.

5. CONCLUSION AND RECOMMENDATIONS FOR FUTURE RESEARCH

5.1 Conclusion

A sizeable portion of South Africa's population utilizes public transportation; however, literature highlights inefficiency and travel time as key characteristics of the existing public transport system. Further research reveals that these characteristics of the local system is largely due to the absence of integration between modes. In general, public transportation is organized as a trunk-feeder system, with minibus taxis serving as feeders from residential areas to PTIs, while buses and rail offer trunk service from the PTIs to various destinations. Once again, the absence of integration and coordination between modes is the key problem with this system. These modes often interact at PTIs and sometime complement each other, but they are run by separate authorities and have different service structures. The informality of minibus taxi services is therefore one of the biggest obstacles to achieving integration within the public transportation system.

This was a study about "Understanding the conditions for passengers to consider accepting transfers between MyCiTi and Minibus Taxi" and this chapter summarizes the major findings thereof. It concludes that there are various conditions passengers take into consideration when faced with decision to transfer between modes; however, when ranked against each other certain conditions are considered more important than others are. An integrated network should remain a priority for the City of Cape Town, and this long-term objective can be achieved by addressing various barriers in the network, however, a significant step in the right direction is to work towards improving transfers by removing the barriers discussed in this study according to the results presented. The focus, of course, should be on those identified as being the most important to the passenger.

This study implemented the BWS technique using Case 1 type of analysis to obtain meaningfully comparable data regarding transfers between public transport modes and the priority needs for passengers. The list of attributes was developed through experience; review of the literature and through interviews with public transport users. Interviews were conducted via email due to the Covid-19 pandemic. Seventeen public transport users, spread across the four main modes, were interviewed. The outcome of the interviews confirmed the list of attributes developed through the literature review process. These 14 attributes were used in the BWS survey. Interviews were conducted with 249 participants of which there were no disqualified surveys but 17 incomplete surveys. The data of the interviews was analyzed using Sawtooth Software's MaxDiff Analysis tool, which uses a type of individual-level score estimation called Empirical Bayes, to make useful comparisons of the most important attributes ascertained by the BWS survey.

The study found that the three most important attributes to the passenger, in order of preference, are Total Cost of the Journey or Cost, Threat of Criminal Behaviour or Safety and, Reliability in terms of scheduling or timetabling. The least important attributes have been identified as Protection from Weather, Retail Opportunities, Signage and Wayfinding and, Seating and Waiting Areas. Protection from Weather was the overall least important attribute.

It is not surprising that Cost and Safety are the two most important attributes given the low income levels, high unemployment levels and well-documented crime statistics in Cape Town and in South Africa. As mentioned in Chapter 4, the City of Cape Town's Comprehensive Integrated Transport Plan (CITP) for 2023 to 2028 states that 95% of public transport users in Cape Town are in the low to low-middle income brackets and that a very high proportion of disposable income is spent on transport costs in Cape Town, particularly for low-income households. An integrated public transport system would assist in resolving these issues; however, the system in Cape Town is still largely fragmented. The various modes of transport charge different fares, operate on separate fare structures and payment systems resulting in passengers resisting intermodal transfers to avoid paying multiple fares (Bruun et al., 2016), using different fare media and the difficulty of understanding the total fare payable across multiple modes.

Likewise, integrated infrastructure such as public transport interchanges (PTI), in its current form, offers very little to passenger in terms of offering a safe environment in which to make transfers. Personal safety and security is, as expected, a primary concern at all interchange points. Technical solutions such as CCTV can aid in lowering feelings of insecurity, but there is no alternative for personnel who can integrate their safety and security responsibilities with customer service and passenger information. Design elements can play a significant role in decreasing security concerns by enhancing lines of sight, ensuring areas are well lit, and creating a pleasant environment. In order to maintain and enhance standards, routine cleaning, maintenance, and general management are also essential. However, in South Africa, a variety of stakeholders, including public transportation operators, infrastructure providers, government agencies, local governments, commercial developers, and landowners, contribute to the passenger experience at PTIs. Each stakeholder has differing perceptions, visions, values and agendas, which creates organizational barriers.

Reliability is the next highest ranked factor. MyCiTi is a reliable; all day service with timetables available online and at stops as well as consistent travel times along the trunk routes due to dedicated bus lanes. However, MyCiTi is only accessible to a small percentage of the city. Golden Arrow Bus Services operate in general traffic lanes and even though they have timetables, they operate mostly in the peak periods offering little to no services outside of the peak periods. Rail services offer the best travel times, however, the quality of this service has experienced a rapid decline. There is a lack of

rolling stock, damage to infrastructure etc. that has resulted in stranded passengers due to cancelled trips and suspended services. Minibus taxis are on-demand services and have therefore do not have timetables, however, they are frequent and available during peak periods, seldom found outside of the peak periods, but there reliability is compromised by sudden increases to fares, poor quality vehicles resulting in breakdowns; and impounding by authorities due to illegal activities such as operating without permits.

Based on the key findings discussed above, there are potential implications on the success of the City of Cape Town's pursuit of a hybrid network for Phase 2A and beyond. The intention is that MyCiTi trunk routes together with rail will form the core trunk network while independent service providers such as minibus taxis will provide the feeder services. The minibus taxi companies will receive incentive payments to provide feeder services to the MyCiTi trunk route network, however, similar to the Blue Dot taxi service; this may not be as financially sustainable as expected. Not only will the feeder service operator be incentivized to meet certain minimum service standard but the passenger will receive an incentive for transferring between the two modes. It is still unknown as to what value of incentive will be sufficient for the passenger to accept the transfer. Furthermore, if the feeder service does not offer passengers an affordable fare, an acceptable level of safety and a reliable service, especially in terms of availability and synchronized transfers, then the chances of success will not be high. Contrary to the above, carefully determining the level of incentive paid to the passenger could have a major positive impact on the success of the Phase 2A approach.

This chapter does not discuss the remaining attributes, however, the recommendations below include possible interventions that not only address the highest ranks attributes but also those attributes that are ranked lower but could have a positive impact on the public transport passenger experience

5.2 Recommendations

The pursuit of an integrated network should remain a priority for the City of Cape Town; however, total integration is a long-term objective that cannot be achieved overnight. The road to total integration is also an expensive one. The results of this study rank the attributes that are most important to passengers when considering transferring between modes. A significant step in the right direction is to work towards improving transfers by removing the barriers discussed in this study with priority given to those most listed as being most important to the passenger. Instead of attempting to solve every problem at once, it is recommended that an incremental approach be adopted. This is a practical way to remove barriers by focusing funds and other resources on the most important issues first, granted that there would be interventions that may address multiple issues at the same time.

Transfers must be managed and optimized to give passengers a well-connected, synchronized, and accessible service in order for public transportation to be appealing. For those who use public transportation, the entities that operate the system, and the authorities, well-coordinated transfers can have a variety of advantages, including fewer missed connections and shorter wait times for transfers, as well as, in some cases, lower operating costs and higher ridership. The City of Cape Town is pursuing a hybrid network going forward based largely on the drive to reduce operational costs. It is recommended that the City of Cape Town ensure that the hybrid network is affordable to the passenger and that there is a significant increase in passenger safety and reliability especially given the negative characteristics associated with typical minibus taxi services. Contractual agreements can be put into place to achieve this however, there needs to be a degree of monitoring and enforcement. Furthermore, applying the same fare structure to the feeder and trunk modes should be explored as there could be significant cost benefits for the passenger.

A further recommendation to improve the appeal of the network is to investigate the possibility of creating a PTI management entity responsible for interchange issues across the various modes. The goal would be to provide a consistent, coordinated approach and a platform for all relevant organizations to collaborate at individual PTIs. To this point Mostert (2011) concluded the following "A special purpose agency should be created to oversee the coordination of all formal public transport". This notion refers to all spheres of the public transport, however, given the fragmented nature of the network, focusing on the public transport interchange would be more achievable in a shorter space of time and at a lower cost. Whilst there may not be a direct impact on cost reduction, there can be a major improvement on all safety aspects at interchanges. Furthermore, this body can also address many of the other issues that rank lower in the results i.e. wayfinding, cleanliness and perhaps even reliability to some degree through wayfinding such as published timetables. However, funding and other resources should be prioritized to address the top concerns first in order to make the biggest positive change for passengers.

Lastly, it is recommended that additional research be conducted to expand on the findings of this study, as outlined in 5.2.1 below.

5.3 Areas for further research

1) This study made use of interviews to verify that the attributes were valid and contextually relevant, and to identify possible attributes that may not have presented themselves during the literature review. However, the use of focus groups, which shares many common features with less structured interviews, will likely yield more detailed insight, from a smaller sample size, through discussion, which is guided, monitored and recorded by a facilitator.

2) There are three variations of BWS viz. Case 1, Case 2, and Case 3. The most appropriate variant for this study was Case 1, however, for a more in-depth assessment of the attributes and their attribute levels a Case 2 (profile case) or Case 3 (multi-profile) BWS analysis could be explored. This could include scoring across sub-groups e.g. the same attributes but for different modes.

3) The study has confirmed that public transport users in Cape Town are very sensitive to price and therefore it can be assumed that price is a major factor when it comes to transferring between modes, especially in a network that is not integrated where passengers are required to pay a fare per mode. The public transport service levels examined in this study have seen an improvement due to the introduction of MyCiTi, however, further research should be undertaken to assess the level of sensitivity if passengers are offered a discount or incentive for transferring between modes.

4) The perception of cost needs further research especially in the context of the public transport passenger in South Africa. Planners often refer to the cost of public transport per kilometer as a measure as a measure of affordability but how much does this really mean to the passenger. It is my hypothesis that the 'out of pocket' cost has a greater impact on low income passengers especially, however, this requires further research and surveys or interviews to support my hypothesis and draw reasonable conclusions. Similarly, the perception of cost to the passenger requires further research to better understand the true impact of interventions such as integrated fare structures and fare media.

5) The current thinking in Cape Town is that MyCiTi feeder services are financially unsustainable to operate and as a result, minibus taxis as feeders to mass transit trunk services is the way of the future. Further research on the nature of hybrid networks and operational structure of paratransit component as a feeder to the mass transit component is necessary. This study shows that reliability or confidence that the next vehicle will arrive or depart on time is only outweighed by price and safety, therefore the unreliable nature of the current minibus taxi operation could present a significant challenge to achieving integration and promoting transfers. Chowdhury et al. (2013) concludes that passengers' willingness to use transfer routes increases when attributes of the connections are planned or perceived to be planned.

6) A PTI management entity responsible for public transport interchange issues, across all modes, could resolve many of the transfer related issued identified in this study. Issues of safety, security, cleanliness and wayfinding could be addressed thereby removing some of the

obstacles faced by passengers and making transfers less unattractive. Further research into integrated precinct management initiatives would be useful even if just to identify where these exist and the success thereof, especially in cases involving a mix of formal and informal public transport.

REFERENCES

Akkarapol T., and Fumihiko N., T. O. (2009). Influences of Paratransit as A Feeder of Mass Transit System in Developing Countries Based on Commuter Satisfaction, Journal of the Eastern Asia Society for Transportation Studies, Vol.8

Alhassan, I.B., Matthews, B., Toner, J.P. and Susilo, Y.O. (2022). Public transport users' willingness-to-pay for a multi-county and multi-operator integrated ticket: Valuation and policy implications. https://doi.org/10.1016/j.rtbm.2022.100836

Arentze, T., Borgers, A., Timmermans, H., and Del Mistro, R. (2003). Transport stated choice responses: Effects of task complexity, presentation format and literacy. Transportation Research Part E: Logistics and Transportation Review, 39(3), 229–244. https://doi.org/10.1016/S1366-5545(02)00047-9

Bus Rapid Transit System [BRT] and road safety (no date) Arrive Alive. Available at: https://www.arrivealive.co.za/bus-rapid-transit-system-brt-and-road-safety (Accessed: October 10, 2022).

Atkins, S. T. (1990). Personal security as a transport issue: A state-of-the-art review. Transportation Reviews, 10(2): 111-125.

Behrens, R., Diaz Olvera, L., Plat, D. and Pochet, P. (2004). Meta-analysis of travel of the poor in West and Southern African cities, In: 10th World Conference on Transport Research, July 4–8, Istanbul.

Behrens, R., McCormick, D., and Mfinanga, D. (2016). An introduction to paratransit in Sub-Saharan African cities. In R. Behrens, D. McCormick, & D. Mfinanga (Eds.), Paratransit in African Cities: Operations, Regulation and Reform (pp. 1–26). Routledge.

Behrens, R., and Salazar Ferro, P. (2016). Barriers to comprehensive paratransit replacement. In R. Behrens, D. McCormick, & D. Mfinanga (Eds.), Paratransit in African Cities: Operations, Regulation and Reform (pp. 199–220). Routledge.

Behrens, R., Salazar Ferro, P., & Golub, A. (2016). International case studies of hybrid public transport system regulation and complementarity. In R. Behrens, D. McCormick, & D. Mfinanga (Eds.), Paratransit in African Cities (pp. 221–243). Routledge.

Blainey, S., A. Hickford and J. Preston (2012). Barriers to passenger rail use: A review of the evidence. Transport Reviews. Vol: 32 (6). pp. 675-696.

Bruun, E., Del Mistro, R., Venter, Y., and Mfinanga, D. (2016). The state of public transport systems in three Sub-Saharan African cities. In R. Behrens, D. McCormick, & D. Mfinanga (Eds.), Paratransit in African Cities: Operations, Regulation and Reform (pp. 26–56). Routledge.

Bruun, E., and Behrens, R. (2016). Paratransit in Sub-Saharan African cities: Improving and integrating informal services. Cape Town, South Africa.

Callaghan, L., and W. Vincent. (2007). Preliminary evaluation of Metro Orange Line Bus Rapid Transit Project. Transportation Research Record 2034: 37-44.

Ceder, A., S. Chowdhury, N. Taghipouran and J. Olsen (2013). Modelling public-transport users' behaviour at connection point. Transport Policy. Vol: 27. pp. 112-122.

Cervero, R. (2000). Informal Transport in the Developing World. UN-HABITAT.

Cheng, Y. H. (2010). Exploring passenger anxiety associated with train travel. Transportation. Vol: 37 (6). pp. 875-896.

Chowdhury, S. and A. Ceder. (2016). Users' willingness to ride an integrated public-transport service: A literature review. pp. 1-23.

Chowdhury, S., A. Ceder and R. Sachdeva. (2013). The effects of planned and unplanned transfers on public-transport users' perception of transfer routes. Transporation Planning and Technology. Vol: 37 (2). pp. 154-168.

City of Cape Town (2006). Integrated Transport Plan (ITP) for the City of Cape Town (2006 To 2011), City of Cape Town, Cape Town, South Africa.

City of Cape Town (2008). Putting Policy into Practice, Enviroworks, Biannual Environmental Newsletter of the City of Cape Town, Volume 2/08, City of Cape Town, Cape Town, South Africa.

City of Cape Town (2009). Cape Town's Integrated Rapid Transit: A Better Way of Moving People. [Online].
Available:www.capetown.gov.za/en/irt/Documents/Commuter%20pamphlet%20ENG%200806.pdf

City of Cape Town (2010a). Integrated Rapid Transit Project: Phase 1A Progress Report No 8 – September 2010, City of Cape Town, Cape Town, South Africa.

City of Cape Town (2010b). Integrated Rapid Transit: Frequently Asked Questions (FAQs). [Online]. Available: www.capetown.gov.za/en/irt/Pages/FAQs.aspx

City of Cape Town (2010c). Business Plan: Phase 1A of Cape Town's MyCiTi Integrated Rapid Transit System – October 2010, City of Cape Town, Cape Town, South Africa.

City of Cape Town (2014). Integrated Public Transport Network Plan 2032 (IPTN), City of Cape Town, Cape Town, South Africa.

City of Cape Town (2017). Integrated Public Transport Network (IPTN) Business Plan,, City of Cape Town, Cape Town, South Africa.

City of Cape Town (2020). 2020 MyCiTi Business Plan for Phase 2A, City of Cape Town, Cape Town, South Africa.

City of Cape Town (2021). The draft New Generation Technologies for Transport Strategic Framework, City of Cape Town, Cape Town, South Africa.

City of Cape Town (2022). Draft Comprehensive Integrated Transport Plan 2023-2028 (CITP), City of Cape Town, Cape Town, South Africa.

Clark, P. (2000). The influence of Public Transport on Spatial Development in Metropolitan Cape Town: Past, Present and Future, Paper presented at the Southern African Transport Conference (SATC) 2000, Pretoria, South Africa.

Clark, P., Crous, W. (2002). Public transport in metropolitan Cape Town: Past, present and future. Transport Reviews, 22(1), 77–101. https://doi.org/10.1080/01441640110052092

Clever, R. (1997). Integrated timed transfer. Transportation Research Record 1571:109-115.
Currie, G. and D. Willis (1998). Melbourne bus rail interchange strategy. 22nd Australasian Transport Research Forum, Sydney, Australia.169-186

Currie, G. and A. Delbosc (2013). Factors influencing young peoples' perceptions of personal safety on public transport. Journal of Public Transportation. Vol: 16 (1). pp. 1-19.

Davidson, K., Stoffberg, F., Thiel, R., and van der Lecq, M. (n.d). The failing public transport system in Cape Town. Perpetuating the racial class divide and injustices of the past.

Del Mistro, R., Behrens, R. (2015). Integrating the formal with the informal. An estimate of the impacts of a shift from paratransit line-haul to feeder service provision in Cape Town. Case studies on transport policy, Volume 3, No 2 pp271-277.

Diaz, R.B. (editor), Chang, M., Darido, G., Chang, M., Kim, E., Schneck, D., Hardy, M., Bunch, J., Baltes, M., Hinebaugh, D., Wnuk, L., Silver, F. and Zimmerman, S. (2004). Characteristics of Bus Rapid Transit for Decision Making, Federal Transit Administration (FTA), United States Department of Transportation (U.S. DOT), Washington, DC.

Diaz, R.B. (editor) (2009). Characteristics of Bus Rapid Transit for Decision-Making, Federal Transit Administration (FTA), United States Department of Transportation (U.S. DOT), Washington, DC.

Dorbritz, R., M. Luthi, U. Weidmann and A. Nash (2009). Effects of onboard ticket sales on public transport reliability. Transportation Research Record. No. 2110 pp. 112-119.

Dziekan, K. and A. Vermeulen (2006). Psychological effects of and design preferences for real-time information displays. Journal of Public Transportation. Vol: 9 (1). pp. 71-89.

Eboli, L., and G. Mazzulla. (2012). Performance indicators for an objective measure of public transport service quality. European Transport, 51, 1-21.

Ferreira, T., Brasileiro, A., & Orrico Filho, R. D. (2005). Regulation of alternative transport in Brazil: An assessment of bus/minibus integration in Recife. Thredbo 9: International Conference on Competition and Ownership in Land Transport.

Ferro, P. S., Behrens, R., and Golub, A. (2012). Planned and paratransit service integration through trunk and feeder arrangements: An international review. Conférence SATC. Juillet. Pretoria, Afrique du Sud.

Ferro, P. S., Behrens R. (2015). From direct to trunk-and-feeder public transport services in the Urban South: Territorial implications. The journal of transport and land use. http://jtlu.org Vol. 8 No. 1 pp. 123–136.

Ferro, P. S. (2015). Paratransit: A key element in a dual system. Agence Francaise & Development. www.codatu.org.

Green, P E., Krieger, A M., and Wind, Y. (2001). Thirty years of conjoint analysis: Reflections and prospects. Interfaces, 31(3): 56–73.

Hadas, Y., and P. Ranjitkar. (2012). Modeling public-transit connectivity with spatial quality-of-transfer measurements. Journal of Transport Geography, 22: 137-147.

Hidalgo, D. (2009). Citywide transit integration in a large city: The Interligado system of Sao Paulo, Brazil. Transportation Research Record 2114: 19-27.

Hine, J., and Scott, J. (2000). Seamless, accessible travel: users' views of the public transport journey and interchange. Transport Policy 7, 217–226.

Hiscock, R., S. Macintyre, A. Kearns and A. Ellaway (2002). Means of transport and ontological security: Do cars provide psycho-social benefits to their users? Transportation Research Part D. Vol: 7 (2). pp. 119-135.

Hutchinson, T. D. (2009). The customer experience when using public transport: A review. Institution of Civil Engineers: Municipal Engineer, 162(ME3): 149-157.

Payi, B. (2022) WC Government Scraps Blue Dot Taxi Programme, Independent Online. IOL | News that Connects South Africans. Available at: https://www.iol.co.za/weekend-argus/news/wc-government-scraps-blue-dot-taxi-programme-4c8a2e76-3e46-4b6a-91cf-751c60b042db (Accessed: January 2, 2023).

Iseki, H. and B. D. Taylor (2008). Style versus service? An analysis of user perceptions of transit stops and stations in Log Angeles. Transportation Research Board 87th Annual Meeting, Washington D.C., USA

Iseki, H., and Taylor, B.D. (2009). Not all transfers are created equal: towards a framework relating transfer connectivity to travel behaviour. Transport Reviews 29 (6), 777–800.

Jarzab, J.T., Lightbody, J. and Maeda, E. (2002).Characteristics of Bus Rapid Transit Projects: An Overview, pp. 31-46, In Gary L. B (editor) – Journal of Public Transportation, Volume 5, No. 2, 2002, Center for Urban Transportation Research, University of South Florida, Florida.

Jennings, G., and Behrens, R. (2017) The case for investing in paratransit strategies for regulation and reform. Volvo Research and Educational Foundations (VREF). May 2017

Kjær, T., Bech, M., Gyrd-Hansen, D., and Hart-Hansen, K. (2006). Ordering effect and price sensitivity in discrete choice experiments: Need we worry? Health Economics, 15(11), 1217–1228. https://doi.org/10.1002/hec.1117

Krueger, R. A., and Casey, M. A. (2015). Focus Groups: A Practical Guide for Applied Research (5th ed.). SAGE.

Kumar, P., S. Y. Kulkarni and M. Parida (2011). Security perceptions of Delhi commuters at metro-bus interchange in multimodal perspective. Journal of Transport Security. Vol: 4 (4). pp. 295-307.

Levinson, H.S., Zimmerman, S., Clinger, J. and Rutherford, S. (2002). Bus Rapid Transit: An Overview, pp. 1-30, In Gary L. B (editor) – Journal of Public Transportation, Volume 5, No. 2, 2002, Center for Urban Transportation Research, University of South Florida, Florida.

Liamputtong, P. (2011). Focus Group Methodology: Principles and Practice. Sage Publications Ltd

Louviere, J. J. (1991), Best-Worst Scaling: A Model for the Largest Difference Judgments, Working Paper, University of Alberta.

Luk, J., and P. Olszewski. (2003). Integrated public transport in Singapore and Hong Kong. Road and Transport Research, 12(4): 41-51.

Mangham, L. J., Hanson, K., and McPake, B. (2009). How to do (or not to do) … Designing a discrete choice experiment for application in a low-income country. Health Policy and Planning, 24(2), 151–158. https://doi.org/10.1093/heapol/czn047

MaxDiff Analysis (no date) Discover - help. Available at: https://www.sawtoothsoftware.com/help/discover/manual/index.html?maxdiff_analysis.html (Accessed: November 17, 2021).

Maxwell, R. R. (1999). Intercity rail fixed-interval, timed-transfer, multihub system: Applicability of the Integraler Taktfahrplan Strategy to North America. Transportation Research Record 1691: 1-11.

McCormick, D., Schalekamp, H., and Mfinanga, D. (2016). The nature of paratransit operations. In R. Behrens, D. McCormick, & D. Mfinanga (Eds.), Paratransit in African Cities: Operations, Regulation and Reform (pp. 59–78). Routledge.

McCord, M. M., J. Wirtz and R. G. Mishalani (2006). Passenger waiting time perceptions at bus stops. Journal of Public Transportation. Vol: 9 (2). pp. 89-106.

Molin, E., and C. Chorus. (2009). The need for advanced public trasnport information services when making transfers. European Journal of Transport and Infrastructure Research EJTIR, 4(9): 397-410.

Mostert, V. (2011). Commentary on South African public transport policy, with reference to the Gautrain scheme.

Mthimkulu, N. (2015). Southern African Solutions To Public Transport Challenges. Southern African Transport Conference, Pretoria.

Muller, T., and P. Furth. (2009). Transfer scheduling and control to reduce passenger waiting time. Transport Research Record 2112: 111-118.

Nyarirangwe, M., and Mbara, T. (2007). Public transport service modal choice, affordability and perceptions in an unpalatable economic environment: the case of an urban corridor in Harare, Zimbabwe.

Okada H., Doi K., Gaabucayan, Ma.S.A., and Hosomi A. (2003). Quantification of Passengers' Preference for Improvement of Railway Stations Considering Human Latent Traits: A Case Study in Metro Manila, Journal of Eastern Asia Society for Transportation Studies, Vol. 7, 1806-1819.

Piek, J. (2017). Affordability and subsidies in urban public transport: Assessing the impact of public transport affordability on subsidy allocation in Cape Town [Thesis, Stellenbosch University]. https://scholar.sun.ac.za:443/handle/10019.1/102760

Plano, C E. (2020). Towards evening paratransit services to complement scheduled public transport in Cape Town: Exploring alternative policy interventions from the minibus-taxi industry's perspective. [Doctoral Thesis, University of Cape Town].

Roux, Y. (2013). A Comparative study of Public Transport systems in Developing Countries. Cape Town, South Africa.

Salazar Ferro, P. (2015). Paratransit: A Key Element in a Dual System. CODATU, Agence Française de Développement.

Salazar Ferro, P., and Behrens, R. (2013). Paratransit and formal public transport complementarity: Imperatives, alternatives, and dilemmas. World Conference on Transport Research, Rio de Janeiro.

Salazar Ferro, P., Muñoz, J. C., & Behrens, R. (2015). Trunk and feeder services regulation: Lessons from South American case studies. Case Studies on Transport Policy, 3(2), 264–270. https://doi.org/10.1016/j.cstp.2014.10.002

Satiennam, T., Fukuda, A., and Oshima R. (2006). A Study on the Introduction of Bus Rapid Transit System in Asian Developing Cities: A Case Study on Bangkok Metropolitan Administration Project, Journal of International Association of Traffic and Safety Sciences, Vol.30, No.2, pp. 59-69.

Schalekamp, H. (2015). Paratransit operators' participation in public transport reform in Cape Town: a qualitative investigation of their business aspirations and attitudes to reform. Cape Town, South Africa.

Schalekamp, H., and Behrens, R. (2009). Engaging Paratransit on Public Transport Reform Initiatives in South Africa: A Critique of Policy and an Investigation of Appropriate Engagement Approaches, Paper presented at the 11th Conference on Competition and Ownership in Land Passenger Transport, Delft University of Technology, the Netherlands.

Schalekamp, H., & Klopp, J. (2018). Beyond BRT: Innovation in minibus-taxi reform in South African cities. Southern African Transport Conference, Pretoria. http://hdl.handle.net/2263/69575

Schalekamp, H., Behrens, R., and Wilkinson, P. (2010). Regulating mini-bus taxis: A critical review of progress and a possible way forward. Southern African Transport Conference. Pretoria, South Africa.

Schalekamp, H., Mfinanga, D., Wilkinson, P., and Behrens, R. (2009). An International Review of Paratransit Regulation and Integration Experiences: Lessons for Public Transport System Rationalisation and Improvement in African Cities, 4th International Conference on Future Urban Transport: Access and Mobility for the Cities of Tomorrow, Göteborg.

Sharaby, N., and Y. Shiftan. (2012). The impact of fare integration on travel behavior and transit ridership. Transport Policy, 21: 63-70.

Shimazaki, T and Rahman, Md.M. (1996). Physical characteristics of paratransit in developing countries of Asia: Transportation in Asia-Pacific Countries. (Volume 1), Journal of Advanced Transportation, Vol.30, No.2, pp. 5-24.

Shittu, A. O. (2014). Towards, quasi: Formal management of paratransit in informal transport dependent cities in Nigeria. Journal of humanities and social sciences (IOSR – JHSS) Volume 19. Isuue 12. Version IV. Pp. 75 -80.

TDA. (2018b). Comprehensive Integrated Transport Plan 2018-2023. City of Cape Town, Transport and Urban Development Authority.

The cities with the worst traffic in South Africa (2021) Businesstech. Available at: https://businesstech.co.za/news/motoring/545018/the-cities-with-the-worst-traffic-in-south-africa-and-where-the-most-dangerous-roads-are/ (Accessed: June 9, 2023).

Vande Walle, S., and T. Steenberghen. (2006). Space and time related determinants of public transport use in trip chains. Transportation Research Part A, 40: 151-162

Van Zyl, N., Lombard, M., and Lamprecht, T. (2001). The success of stated preference techniques in evaluating travel options for less literate transport users in a developing country with reference to South Africa. International Conference on Transport Survey Quality and Innovation, South Africa.

Venter, Christo, and Venkatesh, A. (2010). Test and application of stated preference and mixed logit modelling techniques for travel behavior research in a rural context. Southern African Transport Conference, Pretoria. http://hdl.handle.net/2263/14794

Volinski, J. and O. Page (2006). Developing bus transfer facilities for maximum transit agency and community benefit. Transportation Research Record. No. 1955 pp. 3-7.

Vuchic, V.R. (2006). Urban Transit Systems and Technology. John Wiley & Sons, Hoboken, NJ.

Wardman, M. (2001). The value of travel time: a review of British evidence. Journal of Transport Economics and Policy 32 (3), 285–316

Blue Dot Taxi Service (no date) Western Cape Government. Available at: https://www.westerncape.gov.za/tpw/blue-dot-taxi-service (Accessed: January 3, 2023).

Wilkinson, P. (2009). The Regulatory Cycle Stalled? An Assessment of Current Institutional Obstacles to Regulatory Reform in the Provision of Road-based Public Transport in Cape Town, South Africa, Paper Presented at the 11th Conference on Competition and Ownership in Land Passenger Transport, Delft University of Technology, Netherlands.

Wilkinson, P., Golub A., Behrens, R., Ferro, S. P., and Schalekamp, H. (2012). Transformation of urban public transport systems in the Global South. In H.S. GEYER (ed) / International handbook of urban policy: Issues in the Developing World, Vol.3. Edward Elgar Publishing. Cheltenham, Royaume Uni. pp. 146-174.

Zhou, X., X. Yang, and Y. Lao (2007). Public transport service level influence on travel mode choice. International Conference on Transportation Engineering, Chengdu, China.

Annex A: Ethics Approval

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

ETHICS APPLICATION FORM

Please Note:
Any person planning to undertake research in the Faculty of Engineering and the Built Environment (EBE) at the University of Cape Town is required to complete this form **before** collecting or analysing data. The objective of submitting this application *prior* to embarking on research is to ensure that the highest ethical standards in research, conducted under the auspices of the EBE Faculty, are met. Please ensure that you have read, and understood the **EBE Ethics in Research Handbook** (available from the UCT EBE, Research Ethics website) prior to completing this application form: http://www.ebe.uct.ac.za/ebe/research/ethics1

APPLICANT'S DETAILS		
Name of principal researcher, student or external applicant		Kapil Singh
Department		Civil Engineering
Preferred email address of applicant:		kapz983@gmail.com
If Student	Your Degree: e.g., MSc, PhD, etc.	M. Eng
	Credit Value of Research: e.g., 60/120/180/360 etc.	60 credit
	Name of Supervisor (if supervised):	A.Prof. Roger Behrens and Prof. Mark Zuidgeest
If this is a researchcontract, indicate the source of funding/sponsorship		N/A
Project Title		Understanding the conditions for passengers to consider accepting transfers between MyCiTi and minibus taxi

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

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

APPLICATION BY	Full name	Signature	Date
Principal Researcher/ Student/External applicant	Kapil Singh		18 June 2021
SUPPORTED BY	Full name	Signature	Date
Supervisor (where applicable)	Roger Behrens		22 Sep 2021

APPROVED BY	Full name	Signature	Date
HOD (or delegated nominee) Final authority for all applicants who have answered NO to all questions in Section 1; and for all Undergraduate research (Including Honours).	Prof. Alphose Zingoni		05/10/2021
Chair: Faculty EIR Committee For applicants other than undergraduate students who have answered YES to any of the questions in Section 1.			

Page 1 of 1

Annex B: Participant Information Sheet

UNIVERSITY OF CAPE TOWN
IYUNIVESITHI YASEKAPA • UNIVERSITEIT VAN KAAPSTAD
ENGINEERING & THE BUILT ENVIRONMENT

CfTS
Centre for Transport Studies
Department of Civil Engineering
Private Bag X3, Rondebosch, 7701
SOUTH AFRICA
email: roger.behrens@uct.ac.za
website: www.cfts.uct.ac.za

Dear Prospective Participant

PARTICIPANT INFORMATION SHEET

My name is Kapil Singh and I am studying towards a Master's degree in Transport Studies at the University of Cape Town. I am inviting you to participate in a study entitled "Understanding the conditions for passengers to consider accepting transfers between MyCiTi and minibus taxi." This letter gives you information about the purpose of the research you are participating in.

The City of Cape Town is investigating the opportunity to integrate the minibus taxi system with the MyCiTi bus system whereby the minibus taxi provides the short trips to and from the MyCiTi bus. The MyCiTi bus then provides the longer trip. Passengers will be required to transfer between the two systems.

The purpose of this study is to collect important information that could help understand if passengers are willing to transfer between minibus taxi and MyCiTi and what may influence their decision making. Public transport serves passengers, so I want to learn from you, the passenger.

The information you share during this interview/discussion will be used to design a survey. All information will be kept confidential and will not be shared with anyone.

Thank you for participating in my research. Please contact me, or my supervisors, should you have any questions or queries.

Kind regards,

Kapil Singh
Email: sngkap004@myuct.ac.za

Supervisor: Roger Behrens
Email: roger.behrens@uct.ac.za

Supervisor: Mark Zuidgeest
Email: mark.zuidgeest@uct.ac.za

Annex C: Interview Consent Form

CONSENT TO PARTICIPATE IN THIS STUDY

I, _____ (participant name), confirm that the person asking my consent to take part in this research has told me about the nature, procedure, potential benefits and anticipated inconvenience of participation.

I have read (or had explained to me) and understood the study as explained in the information sheet.

I have had sufficient opportunity to ask questions and am prepared to participate in the study.

I understand that my participation is voluntary and that I am free to withdraw at any time without penalty (if applicable).

I am aware that the findings of this study will be processed into a research thesis, but that my participation will be kept confidential unless otherwise specified.

I agree to the recording of the focus group study.

Participant Name & Surname..... (please print)

Participant Signature.....Date.....

Researcher's Name & Surname.....(please print)

Researcher's signature.....Date.....

Annex D: Interview Questionnaire

Introduction

To complete your journey in a public transport system, you may have to make a transfer. That is, you may have to get off one vehicle and onto another. You probably do not like doing this but it has its advantages.

For example, a system with direct routes can have low frequencies so if you miss you train, bus or taxi you may have to wait a long time for the next one. A system with transfers can be faster, even though it imposes a transfer, because of the much higher frequencies that it can offer.

Let us begin the interview.

General Public Transit Guiding Questions

1. What is your primary method of travel? (personal car, train, bus, taxi, bike, walk, etc.) What do you typically do when that method is unavailable?

2. What is your overall perception of the quality of the transportation system in Cape Town?

3. How do you feel about MyCiTi? This operates slightly differently than other bus systems. Sometimes there is a dedicated lane for the bus. Is this something you would be interested in using?

4. Of the public transportation options that we've talked about – bus, BRT and rail – what type is most appealing to you? Why?

5. How do you feel about transferring between vehicles or modes? Is it something that you already do?

6. If you already make transfers, tell me about your positive and negative experiences.

7. If you don't make transfers, what elements of making a transfer are obstacles for you?

8. We have discussed many forms of transportation and talked about transfers. If you could set the conditions, what would address to improve transfers between taxi and MyCiTi? What should be the priorities?

9. Think again about transfers between taxi and MyCiTi. Are there any options or features you would like to see that are not currently available?

10. Are there features on the taxi that you would like to see on MyCiTi?

11. Are there features on MyCiTi that you would like to see on the taxi?

Annex E: Final List of Items Included in BWS Survey

Final list of conditions that could influence the decision to transfer

1. **Pricing/cost:** Total cost of the journey
2. **Same way to charge fares on bus, taxi and rail:** Fare integration - One card for all modes or similar
3. **Time spent waiting to transfer:** Waiting time - average time spent by a passenger at the transfer stop/station
4. **Time spent on bus, taxi, train to get to destination:** Riding time - time required to complete the journey
5. **Reliability - will the next vehicle arrive on time?** Reliability of connection - taking into account cancelled trips or next vehicle arriving late
6. **Safety - threat of criminal behaviour e.g. muggers:** Situational safety - threats like muggings, hooliganism, rough behaviour
7. **In-vehicle comfort - clean, uncrowded, seats available etc:** Comfort of travel - uncrowded and clean vehicles, seats available, good ventilation, appropriate driver's behaviour, and appearance
8. **Signs, maps and other travel information:** Easy wayfinding - No amount of online information makes up for good, intuitive wayfinding comprising of signs, maps, and directories listing the transport services provided etc.
9. **Seating and waiting areas:** Providing seats is important for the elderly and if waiting times are long
10. **Protection from the weather:** Weather protection - One of the most important features of a successful transportation terminal, especially in cities with a harsh climate.
11. **Retail opportunities e.g. shops, food stalls etc.:** Retail is a welcome amenity to customers at PTIs.
12. **Cleanliness of the waiting areas e.g. stations, ranks etc:** Cleanliness - It is important that the waiting areas are clean and well maintained
13. **Safety when crossing roads and protection from traffic:** Personal safety
14. **One ticket/card for travel on all modes:** Integrated ticketing

Annex F: Sample of BWS Survey

Please choose the most important and least important conditions that influence your decision to transfer between modes.

1 / 14

Most important	Conditions	Least important
○	Reliability - will the next vehicle arrive on time?	○
○	Seating and waiting areas	○
○	Pricing/cost	○
○	Time spent on bus, taxi, train to get to destination	○
○	One ticket/card for travel on all modes	○

Please choose the most important and least important conditions that influence your decision to transfer between modes.

2 / 14

Most important	Conditions	Least important
○	Retail opportunities e.g. shops, food stalls etc	○
○	Safety - threat of criminal behaviour e.g. muggers	○
○	In-vehicle comfort - clean, uncrowded, seats available etc	○
○	Protection from the weather	○
○	Same way to charge fares on bus, taxi and rail	○

Please choose the most important and least important conditions that influence your decision to transfer between modes.

3 / 14

Most important	Conditions	Least important
○	Time spent waiting to transfer	○
○	Safety when crossing roads and protection from traffic	○
○	Signs, maps and other travel information	○
○	Cleanliness of the waiting areas e.g. stations, ranks etc	○
○	In-vehicle comfort - clean, uncrowded, seats available etc	○

Please choose the most important and least important conditions that influence your decision to transfer between modes.

4 / 14

Most important	Conditions	Least important
○	Time spent waiting to transfer	○
○	Retail opportunities e.g. shops, food stalls etc	○
○	Pricing/cost	○
○	Protection from the weather	○
○	Reliability - will the next vehicle arrive on time?	○

Please choose the most important and least important conditions that influence your decision to transfer between modes.

5 / 14

Most important	Conditions	Least important
○	Same way to charge fares on bus, taxi and rail	○
○	Cleanliness of the waiting areas e.g. stations, ranks etc	○
○	One ticket/card for travel on all modes	○
○	Signs, maps and other travel information	○
○	Seating and waiting areas	○

Please choose the most important and least important conditions that influence your decision to transfer between modes.

6 / 14

Most important	Conditions	Least important
○	Safety - threat of criminal behaviour e.g. muggers	○
○	Time spent on bus, taxi, train to get to destination	○
○	Safety when crossing roads and protection from traffic	○
○	One ticket/card for travel on all modes	○
○	Retail opportunities e.g. shops, food stalls etc	○

Please choose the most important and least important conditions that influence your decision to transfer between modes.

7 / 14

Most important	Conditions	Least important
○	Time spent waiting to transfer	○
○	Seating and waiting areas	○
○	Safety - threat of criminal behaviour e.g. muggers	○
○	Pricing/cost	○
○	Same way to charge fares on bus, taxi and rail	○

Please choose the most important and least important conditions that influence your decision to transfer between modes.

8 / 14

Most important	Conditions	Least important
○	Safety when crossing roads and protection from traffic	○
○	Reliability - will the next vehicle arrive on time?	○
○	Cleanliness of the waiting areas e.g. stations, ranks etc	○
○	Protection from the weather	○
○	Time spent on bus, taxi, train to get to destination	○

Please choose the most important and least important conditions that influence your decision to transfer between modes.

9 / 14

Most important	Conditions	Least important
○	In-vehicle comfort - clean, uncrowded, seats available etc	○
○	Seating and waiting areas	○
○	Retail opportunities e.g. shops, food stalls etc	○
○	Signs, maps and other travel information	○
○	Reliability - will the next vehicle arrive on time?	○

Please choose the most important and least important conditions that influence your decision to transfer between modes.

10 / 14

Most important	Conditions	Least important
○	Time spent on bus, taxi, train to get to destination	○
○	Time spent waiting to transfer	○
○	One ticket/card for travel on all modes	○
○	In-vehicle comfort - clean, uncrowded, seats available etc	○
○	Pricing/cost	○

Please choose the most important and least important conditions that influence your decision to transfer between modes.

11 / 14

Most important	Conditions	Least important
○	Protection from the weather	○
○	Signs, maps and other travel information	○
○	Safety - threat of criminal behaviour e.g. muggers	○
○	Cleanliness of the waiting areas e.g. stations, ranks etc	○
○	Pricing/cost	○

Please choose the most important and least important conditions that influence your decision to transfer between modes.

12 / 14

Most important	Conditions	Least important
○	Safety when crossing roads and protection from traffic	○
○	Same way to charge fares on bus, taxi and rail	○
○	Reliability - will the next vehicle arrive on time?	○
○	Safety - threat of criminal behaviour e.g. muggers	○
○	One ticket/card for travel on all modes	○

Please choose the most important and least important conditions that influence your decision to transfer between modes.

13 / 14

Most important	Conditions	Least important
○	Cleanliness of the waiting areas e.g. stations, ranks etc	○
○	Retail opportunities e.g. shops, food stalls etc	○
○	Time spent waiting to transfer	○
○	Seating and waiting areas	○
○	Safety when crossing roads and protection from traffic	○

Please choose the most important and least important conditions that influence your decision to transfer between modes.

14 / 14

Most important	Conditions	Least important
○	Signs, maps and other travel information	○
○	Time spent on bus, taxi, train to get to destination	○
○	Same way to charge fares on bus, taxi and rail	○
○	Protection from the weather	○
○	Seating and waiting areas	○