Paving the Way for a Car Free Day in Stellenbosch, South Africa

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Abstract

Social inequality affects transportation in Stellenbosch, including high usage of personal vehicles by predominantly white drivers who cause road congestion and parking shortages. Working with faculty from the Department of Logistics at Stellenbosch University, our goal was to investigate considerations for a Car Free Day in Stellenbosch to mitigate congestion issues. We developed a plan by interviewing experts and stakeholders and observing traffic. The Car Free Day involves park and rides for driving commuters, local business engagement, and options for sustainable transportation. Our findings revealed concerns with commute disruption and a racialized disparity with public transportation awareness and use, especially around minibus-taxis.

Acknowledgments

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Executive Summary

Traffic congestion caused by private motor vehicles is a problem that is experienced globally, with researchers projecting an increase to two billion motorised vehicles worldwide by the year 2020 (Sperling & Gordon, 2010). Stemming from this congestion are issues such as a higher frequency of traffic accidents, air pollution, and transport inequality (World Health Organization, 2015; Hermes, 2012; Schwanen et al., 2015). The implementation of Car Free Days is a method that has been used to address these congestion problems, with cities like Paris, France, Johannesburg, South Africa, and Cape Town, South Africa participating in their own successful car free initiatives.

The Municipality of Stellenbosch, South Africa suffers from its own congestion and transport-related issues. In 2016 alone, Stellenbosch experienced 46 road related fatalities (Stellenbosch Municipality, 2017). A heavy reliance on private motor vehicles exists in the town, as people driving their own vehicles account for 87% of motor vehicle traffic, resulting in congestion (Kgwedi & Krygsman, 2017). Transport inequality is also an issue in Stellenbosch, with most of the non-white working class making use of non-motorised and public transportation, while a large portion of the more affluent white population are private vehicle drivers. Given these problems and the success of previous car free initiatives, a Car Free Day was deemed as an effective solution for Stellenbosch. For our project, we worked with our sponsors from the Department of Logistics at Stellenbosch University to plan a Car Free Day in Stellenbosch, specifically to promote an awareness for the need to change transportation behaviour of private motor vehicle drivers and address the issue of congestion and social inequality by encouraging the use of alternative forms of transport.

To accomplish the goal of planning a Car Free Day in Stellenbosch, we identified three objectives. The objectives were to understand stakeholders' perspectives regarding a Car Free Day initiative in Stellenbosch, evaluate Stellenbosch Central's viability to host a Car Free Day initiative, and develop a strategy to formalize the use of alternative forms of transportation during the Car Free Day initiative and proposing the most practical plan for a Car Free Day initiative. To achieve these objectives, we implemented four methods: interviews with stakeholders and experts, an online survey, street observations, a presentation of the proposed plan, and a cost benefit assessment.

To understand the perspectives of stakeholders, we conducted interviews with stakeholders and sent out an email survey for the university community. The interviews with stakeholders used purposive and then convenient sampling to select the participants, as they were identified as members of our key stakeholder groups. These stakeholder groups consisted of residents (n=7), local business representatives (n=7), commuters (n=5),

students (n=6), non-motorised transport users (n=5), private vehicle drivers (n=5), and public transport users (n=5). From these interviews, we learned about the perspectives of each group regarding a Car Free Day. Overall, we found that all stakeholders had a positive reaction towards a Car Free Day, with the only opposers being a single student and two local business representatives. From the email survey, we found that the average rating of students' happiness to participate in a Car Free Day was 4.44 out of five (n=23). Our interviews revealed that nine out of the twelve businesses saw the Car Free Day as an opportunity to increase sales. We also learned about the lack of reliable public transportation in Stellenbosch, with some of the interviewees detailing the unpredictable schedule and dangers of the metrorail, safety concerns regarding the minibus-taxis, and the inaccessibility of their services. However, concerns about the use of public and alternative transport during a potential Car Free Day were racially dependent, as the concerns primarily came from white people whom had rarely or never used public transport, while 80% of public transport users that we talked to, all of whom were Black and Coloured, did not express any concern regarding the use of public transportation. Through our interviews with stakeholders, we also discovered that non-motorized transport users and sustainable transport organizations, such as the Mellowcabs and the Stellenbosch Taxi Association, see a Car Free Day as an opportunity to increase awareness of alternative transportation.

To evaluate Stellenbosch Central's viability to host a Car Free Day initiative, we performed observations on the roads and conducted interviews with representatives of past car free initiatives and sustainable transport groups based in Stellenbosch. With the observations on the roads, we measured congestion and counted pedestrians, cars, bikes, and minibus-taxis in the central business district to learn about how the roads were being used to better inform our Car Free Day plan. We found that all the roads that we observed experienced significant congestion between the hours of 7:00am to 9:00am and 3:30pm to 5:30pm, with speeds dropping by two-thirds or more compared to the speed limit. We also discovered that streets surrounding the university, such as Victoria St. and Bosman St., were not as frequented by motor vehicles and had a high number of pedestrians and cyclists. These observations informed our Car Free Day plans and influenced our decisions on road closures, with streets low in motor vehicles and high in pedestrians highlighted as roads that would be better to completely close off. From our interviews with representatives of past car free initiatives, we learned about the components of other car free events, such as methods for managing road closures and the use of a Park and Ride service to shuttle private motor vehicle commuters into the car free zone. We determined that a system of hard and soft, or movable and immovable, road closures would work best, so that businesses can still receive deliveries.

From these findings, we developed a recommended plan for a Car Free Day in Stellenbosch as well as Minimal Impact and Highly Disruptive plan should the municipality decide against our plan. The proposed plan can be found on pages 51 and 53 in Figures 24a

and 24b, while the Highly Disruptive plan can be found on page 49 in Figures 22a and 22b, and the Minimal Impact plan can be seen in Figure 23 on page 50. The recommended plan was chosen because it includes Stellenbosch's central business district, unlike the Minimal Impact plan that only includes the university, while still excluding the Eikestad Mall, unlike the Highly Disruptive plan which encompasses both. This plan is ideal due to its ability to encompass all other major parts of the central business district with the exception of the mall, who expressed major concerns with the initiative. In our recommended plan for a Car Free Day, we detail a Park and Ride shuttle service, pop-up bike shops, accommodations for road closures, and a pedestrian-friendly zone. With this plan, we also included the next steps that are necessary to implement the plan. We also found that a Car Free Day would impact the White, Coloured, and Black populations differently, as most private vehicle drivers in Stellenbosch are White and those who use public transport at Black and Coloured (Lucas, 2012; "Living conditions", 2017). The transportation habits of most of the White population would be dramatically impacted, as they would not be allowed to drive within the car free zone and instead make use of other the alternatives provided such as the Park and Rides and non-motorised transportation. Transportation habits of those who utilize public transport (i.e. Black and Coloured) would also be affected due to the minibus-taxis not having access to their routes located within the car free zone. However, this Car Free Day aims to change the transportation habits of predominantly White private vehicle drivers, not the habits of the mostly Black and Coloured public transportation users, as they live a Car Free Day everyday of their lives. We completed a cost-benefit assessment of our recommended plan as a way to describe the numerous expenses and benefits that are associated with hosting the initiative in Stellenbosch.

Given our findings and plans, we recommend some next steps to arrive at a plan that is ready for implementation. These steps include deciding a date, further considering security, exploring the Stellenbosch Smart Mobility Lab, securing funding, making a schedule for the Park and Ride service, and further considering our method for closing roads. We also offer some future considerations, as we recognise that many of our methods did not go as planned, and that there were many areas in which we could have done better. We realize that a Car Free Day is unlikely to have a significant impact on ingrained challenges related to social inequality, racism, infrastructure, and resource limitations that exist in Stellenbosch, but is a useful first step.

Authorship

Every member of our IQP team contributed to completing each section of the report. Throughout the writing process, sections of the report were divided equally amongst the team members. Each team member edited all parts of the report, so that all teammates were able to collaborate and provide input for every section. Conflicts surrounding the editing and drafting processes were resolved during meetings. The perspectives of each team member were regarded equally and with respect. This collaborative process was maintained with the submission of every draft to create a cohesive report that is representative of our group as a whole.

Pictured (from left to right) are team members: Trevor Dowd, Jason Rivers, Kailey Catyb, and Tauny Tambolleo with Reginald Kgwedi (sponsor).

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Introduction

With the total number of motorised vehicles surpassing one billion in 2010, and researchers projecting an increase to two billion motorised vehicles worldwide by the year 2020, different strategies are being explored to address the harmful effects associated with motor vehicles ("Number of vehicles," 2017; Sperling & Gordon, 2010). With such a high number of vehicles driving on roads around the globe, traffic congestion and resulting pollution has become problematic. Motor vehicles are among the world's leading contributors to pollution and emit more pollutants when idling than when moving at fast speeds (Hermes, 2012). In addition, the harmful effects of pollution and motor vehicle accidents account for 1.25 million fatalities globally each year (National Center for Injury Prevention and Control, 2016). Car free initiatives have been introduced globally to address the social, economic, and environmental impacts of the ever-expanding number of private motor vehicles in the world.

The Car Free Day initiative was first introduced at the 1994 Accessible Cities conference in Spain (Britton, 2015). Paris, France implemented the first government mandated national Car Free Day in 1998 (Britton, 2015). Since then, Car Free Days have been implemented in numerous places around the world including Nairobi, Kenya, Sandton, South Africa, Vancouver, Canada, and Paris, France.

Recognising the success of previous Car Free Days, the town of Stellenbosch is interested in hosting a Car Free Day initiative to address their transportation issues. The town of Stellenbosch is located approximately 40 km east of Cape Town and is comprised of 176,523 residents (Stellenbosch Municipality, 2017). With the town being home to Stellenbosch University, which has an enrollment of over 30,000 students, the issue of traffic congestion in Stellenbosch Central is highly pronounced during peak commute hours in the morning and evening, as a large portion of students and faculty commute into the area. Transport inequality is furthered by this congestion, as wealthy White South Africans make up much of these private motor vehicle owners (Lucas, 2012; "Living conditions", 2017). In addition, there is only one public bus route to a neighbouring town east of Stellenbosch, Somerset-West, and a train connection to Cape Town.

Acknowledging the potential of students to drive civic engagement and address issues regarding sustainability, Reginald Kgwedi and Stephan Krygsman, associated with the Stellenbosch University Department of Logistics, aim to host a Car Free Day in the Stellenbosch central business district to raise awareness of transportation issues experienced in town and alter the travel behaviour of the community. We have developed a comprehensive plan to host a Car Free Day in Stellenbosch, informed by interviews with relevant stakeholders including commuters, residents, and business managers and the advice offered from organisers of other car free initiatives.

Background

The rapid growth of private motor vehicle use has significant detrimental effects globally

In South Africa, there was a 6% increase in car ownership from 2003 to 2013, and this coincided with an overall increase in traffic congestion during the same period (as cited in Kolver, 2014). The issue of congestion continues to be exacerbated by the increased use of private motor vehicles. Congestion occurs when numerous people are pursuing the same final destinations within their city simultaneously in limited space (Taylor, 2002). Each year, the data analysis company INRIX conducts a study on traffic congestion in over 1,300 cities around the world and ranks the cities based on their time spent in traffic. According to the 2017 Global Traffic Scorecard released by INRIX, the top three cities that spent the most time in congestion included Los Angeles, Moscow, and New York City, with an average of more than ninety hours in traffic. Most of the congestion that is experienced is due to local travel, involving repetitive daily trips during peak hours, such as the commute to and from work or school (U.S. Department of Transportation Statistics Annual Report, 2017).

Congestion contributes to vehicle emissions; a major health threat for millions, particularly those living in traffic-heavy areas. When motor vehicles are stuck in traffic, they are burning more fuel and pumping more pollutants into the air due to the constant acceleration and braking that is caused by stop-and-go traffic (Hermes, 2012). Nitrogen oxides emitted from vehicle exhaust, same as those caused by cigarettes, cause short-term health issues like coughing and headaches or long-term health issues like asthma (Nitrogen oxides: Your environment, your health, 2017). Figure 1 shows the running emission rates of particulate matter (PM) 2.5 and the effect low speeds have on the generation of emissions. When vehicles are traveling at an average speed above 45 miles per hour (72 km/h), the average PM2.5 emissions (g/km) from brake wear and tire wear are nearing zero. However, this is not the case when vehicles are traveling at below average speeds, as PM2.5 emissions increase exponentially as speed decreases. Jonathan Levy (2010), an environmental health professor of the Harvard Center for Risk Analysis, conducted a study in 2010 where he and his colleagues evaluated premature deaths resulting from people breathing particles formed during periods of traffic congestion. Using models to estimate the amount of traffic congestion and motor vehicle pollution, Levy and his colleagues estimate that by 2030, 1,900 premature deaths will have been caused by emissions attributed to congested traffic.

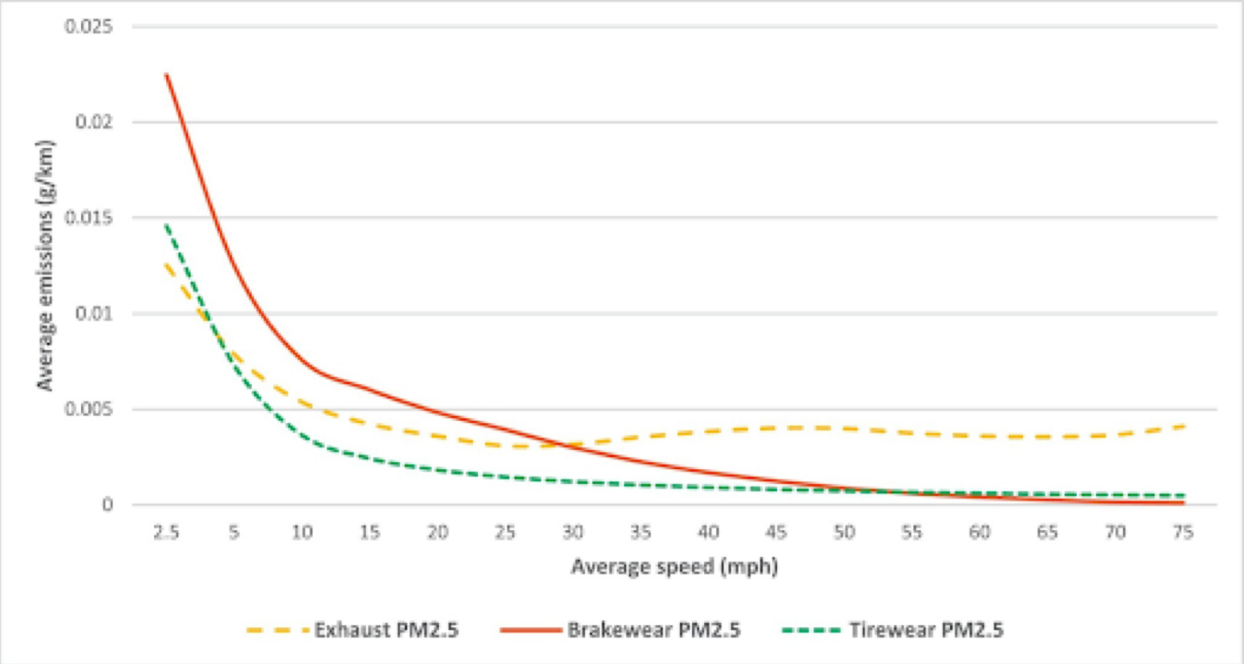

Figure 1: Inverse relationship between motor vehicle speed and average emission rates released through exhaust, brake wear, and tire wear (Requia et al., 2018).

Private motor vehicles have also become an increasing threat to the physical safety of the public. Around the world, 1.25 million people are killed on roadways each year (National Center for Injury Prevention and Control, 2016). Low and middle-income countries account for 90% of road traffic deaths globally, as shown in Figure 2 (World Health Organization, 2015). The risk of dying from a road traffic incident is highest in Africa with a rate of 26.6 (per 100,000 population), unlike in Europe which has a rate significantly below the global rate of 17.4 (per 100,000 population), at only 9.3 (per 100,000 population) (World Health Organization, 2015). The adoption of vehicle standards play an important role in determining these overall road traffic fatality rates. This is partly a result of poor maintenance standards, as many African countries only meet one or fewer of the United Nations international standards such as, soft bumpers in case of pedestrian accidents and electronic stability controls to prevent skidding and loss of control (World Health Organization, 2015).

In addition to the environmental and safety hazards of the increased use of private motor vehicles, reliance on private motor vehicle travel has resulted in social inequality. Worldwide, social exclusion is pervasive within transportation (Schwanen et al., 2015). Many forms of transportation remain off-limits due to their cost, as people that can afford to travel privately will frequently do so (Schwanen et al., 2015). In South Africa, especially in its urban centres, the majority of the low-income population, which remains primarily composed of Black South Africans, struggle to access reliable public transportation (Lucas, 2012). As a result of the discriminatory spatial planning that occurred in South Africa's

history, poorer people often have to travel relatively longer distances to work (Mokonyama, 2008). This leaves them with limited options for scheduled transport and regularly subjects them to the entire experience of roadway congestion during peak hours (Mokonyama, 2008). The United States also suffers from social inequalities that are expressed through transportation. Across the United States, "commuters driving alone to work report median earnings 4,314 USD higher than those taking public transportation" (Maciag, 2014). According to the 2012 American Community survey, a third of New Orleans residents that use public transportation to get to work live in poverty (as cited in Maciag, 2014).

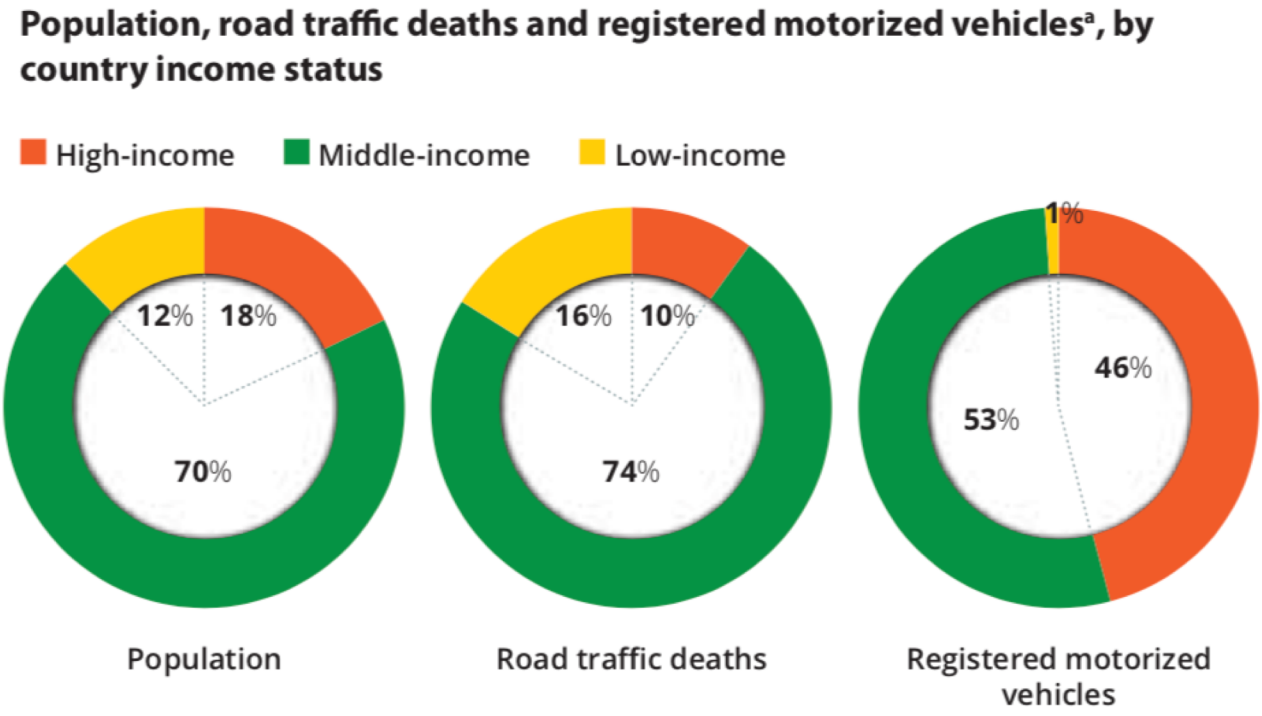

Figure 2: Population, road traffic deaths, and registered motorised vehicles, based upon country income.

Due to the unfavourable nature of the issues associated with transportation, there has been an increasing need to introduce creative solutions to combat them. With the rapid growth of private motor vehicle use in society and their impact becoming more stark, the push for more sustainable infrastructure geared around transportation such as efficient public transportation, cycling lanes, and pedestrian zones is essential.

Approaches to reduce the use and harmful effects of private motor vehicles globally

Public transportation not only reduces reliance on private motor vehicle travel, but expanding public transportation services has proven a successful approach to combat astronomical congestion caused by private motor vehicles (Miller, 2011). Public transportation is defined as a system of vehicles, such as buses and trains that operate at regular times on fixed routes, that are used by the public and are generally managed by the government. Many people rely on public transportation for their primary means of travel. In London, for example, around 46% of Londoners were found to use public transit on a daily basis according to a study completed in 2015 (Bendix & Florida, 2015). Metros are a critical form of public transport in countless urbanised cities. According to the International Association for Public Transportation Statistics Brief for 2017 (2018), at the end of the year there were metros in 178 cities, in 56 countries that were responsible for transporting an average of 168 million passengers per day. A majority of countries in regions such as Europe, Asia-Pacific, North and Latin America have metro services in select cities, as shown in Figure 3. The Middle East and North Africa (MENA) has limited metro services with only nine cities providing a service. Metro services in Sub-Saharan Africa are rare, and while it they are not shown in Figure 3, there are a few metros that service Addis Ababa, Ethiopia and the Gauteng Province of South Africa.

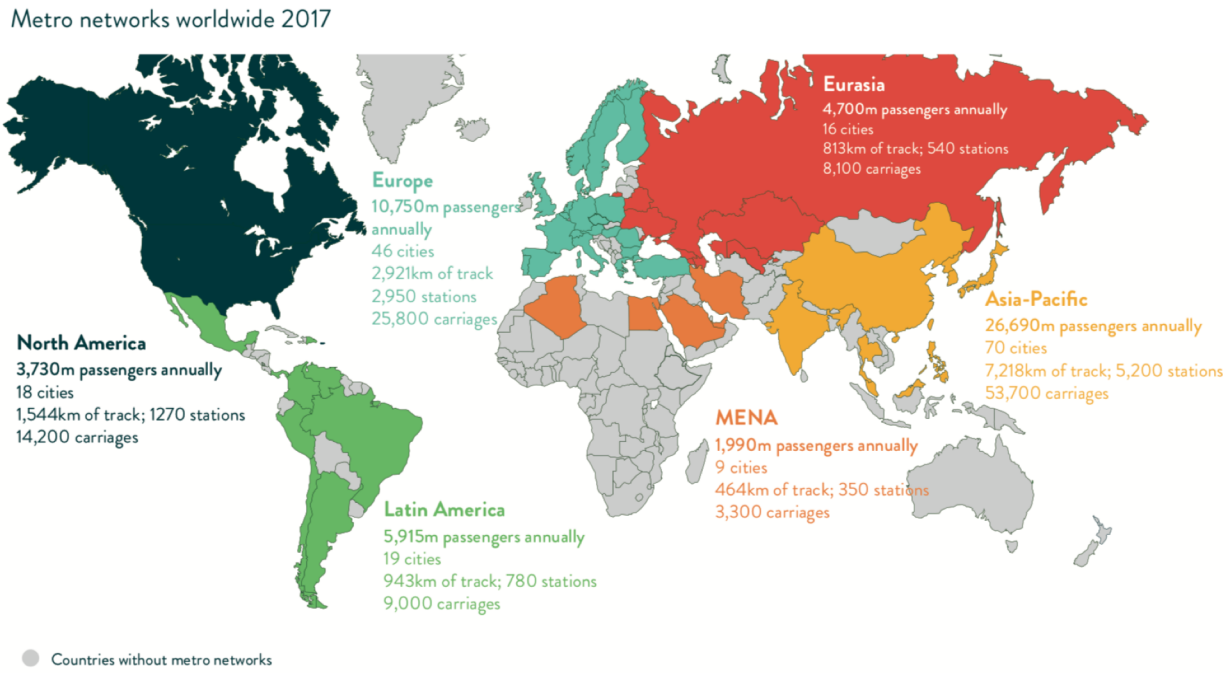

Figure 3: Commuter rail services by world region (International Association of Public Transport, 2018)

With public transportation being an important method for reducing congestion and transport-related problems, many communities have incentivised public transportation use to get private vehicles off the road. According to a 2010 study that covered over 400 urban centres in the United States, "travelers would have suffered an additional 785 million hours of delay and consumed 640 million more gallons of fuel" (Schrank et al., 2011) had there been no public transportation. During large events such as fairs and festivals, cities offer free parking at public transit locations, leading people to leave their cars at the transit stops and use public transportation to get to their desired destinations within the city (American Public Transportation Association, 2009). Estonia and Germany have recently turned to making all forms of public transport cost-free in congested cities (Morby, 2018). In a letter penned by the German government, it was stated that this zero-cost policy was made to reduce the number of private cars in densely populated urban areas (Morby, 2018). From 2010 to 2014, Seattle, Washington, one of the most congested cities in the world, experienced an increase in public bus use by implementing bus-only traffic lanes, circumventing some of the busiest roads, resulting in faster travel experiences for bus riders compared to those driving their own vehicles (Small, 2017).

If people are not willing to use public transportation, charge zones can be another incentive to not use private vehicles. Charge zones are proving an effective approach to reduce private motor vehicle use in densely populated cities. The first place to implement a congestion charge zone was Singapore in 1976 (Bradbrook, 2011). This charge led to a 44% decrease in congestion and an average car speed increase from 11 miles per hour (17 km/h) to 21 miles per hour (34 km/h) (Bradbrook, 2011). After seeing the success of this, London implemented a charge zone in 2003, shown in Figure 4 (Leape, 2006). The placement of a £5 charge (about 6.50 USD or 92 ZAR) for vehicles that drove or parked in the zone on weekdays from 7:00am to 6:30pm was instilled (Leape, 2006). These charges were implemented to attempt to relieve the area plagued with heavy traffic as well as reduce the number of accidents (Green, Heywood & Navarro, 2016). Green, Heywood, and Navarro (2016) credited the zones for reducing the amount of congestion in central London and allowing cars to move at higher speeds while in the zone. The zone led to an initial decrease of 27% in vehicles passing through the zone the year after the charge was put into effect (Leape, 2006). Not only have the zones been effective in reducing traffic, Green, Heywood and Navarro (2016) also concluded that the charges from the zone raised a substantial amount of funds (167 million USD or 2.3 billion ZAR) that could be reinvested into London's public transportation system.

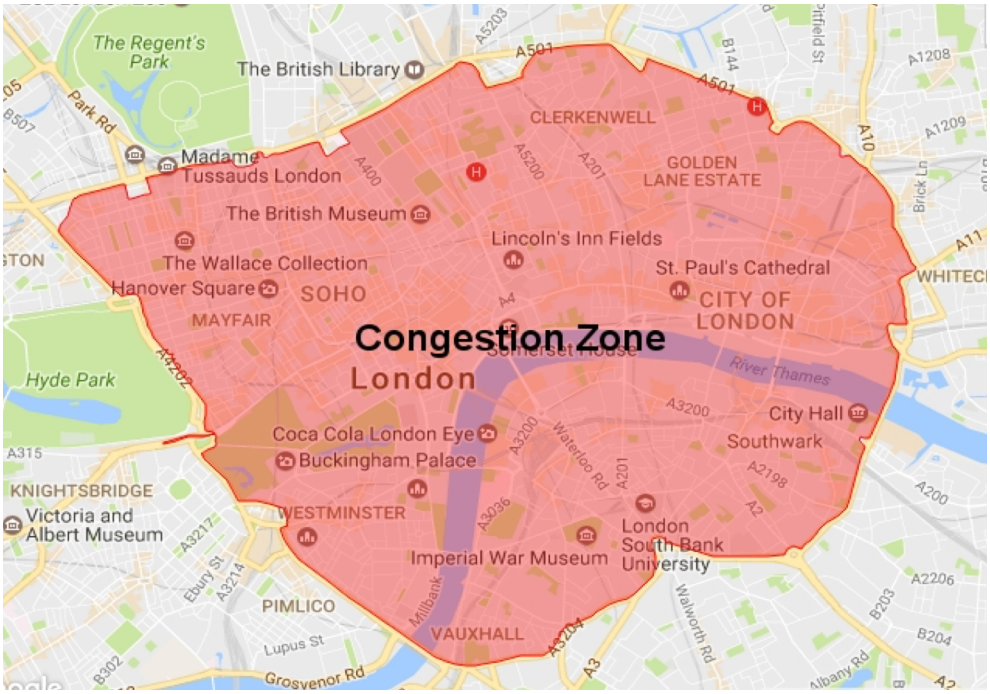

Figure 4: Map of London's Congestion Zones. The area highlighted in red shows where charges take effect (Green, Heywood & Navarro 2016).

Other cities have seen the success of the zone in London and are implementing charge zones of their own. New York City has proposed a charge on private vehicles of up to 11.52 USD (about 166 ZAR) in the heart of the city (Frishberg, 2018). This charge will be rolled out in three phases starting in 2019 (Frishberg, 2018). The hope of the charge is to clear congestion and save New Yorkers 113 million hours annually (Frishberg, 2018). These charge zones prove that monetary deterrents are an effective method for reducing vehicle congestion. While all this points to charge zones being a substantial success, Green, Heywood and Navarro (2016) also noted some concerns with the idea. There was concern that the zone would just shift the traffic from inside the zone to the area just outside. However, there was no substantial evidence of an increase in accidents in the areas just outside of the zone.

One way to reduce motorised transportation all together is to encourage non-motorised transportation such as, cycling. Encouraging cycling and developing cycling infrastructure has resulted in a shift away from any reliance on motor vehicle travel. A study done in Sweden, involving 111,000 commuters switching from car to bicycle, revealed that the switch can save approximately 449 years of life every year (Johansson et al., 2017). In Copenhagen, Denmark, infrastructure has been implemented over the past century to accommodate and encourage cycling in the city. There exists over 400 kilometers of cycle paths in Copenhagen, all of which are separated from vehicle traffic to ensure the riders' safety ("A nation of cyclists," 2018). As a result, Copenhagen has experienced a decrease

of over 100,000 private vehicle commuters and an increase of around 165,000 cycling commuters during an average morning commute since the 1970s, to the point where, in 2015, the number of bike riders (256,700) surpassed the number of private vehicle drivers (252,600) commuting into the city (Lee, 2018). Furthermore, as people continue to use this mode of transportation, it will bring awareness to those driving and walking around cities and make the roads safer for people using bicycles (Cushing et al., 2016).

Pedestrianised zones have been introduced in central business districts (CBDs) in an effort to address traffic congestion, resulting air and noise pollution, and safety concerns. The CBD is typically the city's historical centre, where development is compact, and further burdened by historical planning that did not account for motorised vehicles, rapid population growth, and urbanisation (Soni & Soni, 2016). Pedestrianisation involves making an area of the city impassable to motorised vehicles, or restricted to pedestrians only. Turkey has been working on multiple pedestrianisation projects since 2010 (Yüce, Köse, Özuslu, & Süel, 2013). With the goal of improving the quality of life in the country, the Istanbul Metropolitan Municipality began transformation projects in the Historical Peninsula, which offers a diverse range of functions as shown in Figure 5.

Figure 5: The distribution of functions of pedestrianised zones in Istanbul's Historical Peninsula (as cited in Yüce et al., 2013).

Since the pedestrianised areas in Istanbul also function as a hub for the public transportation options, there is typically a very high level of daytime population (approximately 2.5 million people), making it even more important to create walkable streets (Yüce et al., 2013). In an attempt to mitigate any negative impacts of pedestrianisation, the Transportation Coordination Centre (UKOME) passed a series of rules such as, "streets will be open only to pedestrians between certain hours during the day. Limited vehicle access will be allowed at other times" (Yüce et al., 2013). Within two years, the Istanbul Metropolitan and Faith Municipalities had pedestrianised 256 streets. As a result of the highly pedestrianised area, there was a reported overall satisfaction of 80%, a 68% increase in street safety for pedestrians according to residents, and an 80% and 42% decrease in sulfur dioxide (SO_2) and nitrogen dioxide (NO_2) levels emitted from motor vehicles respectively (Global Street Design Guide, 2018).

Car Free Days: a strategy to reduce private motor vehicle use

Car Free Days were developed to challenge the use of private motor vehicles in an attempt to alleviate the global burden that private vehicles cause. These initiatives have been used to raise awareness of and address a wide range of issues related to private motor vehicle transportation including congestion, negative effects on the environment, transport inequality, and social exclusion.

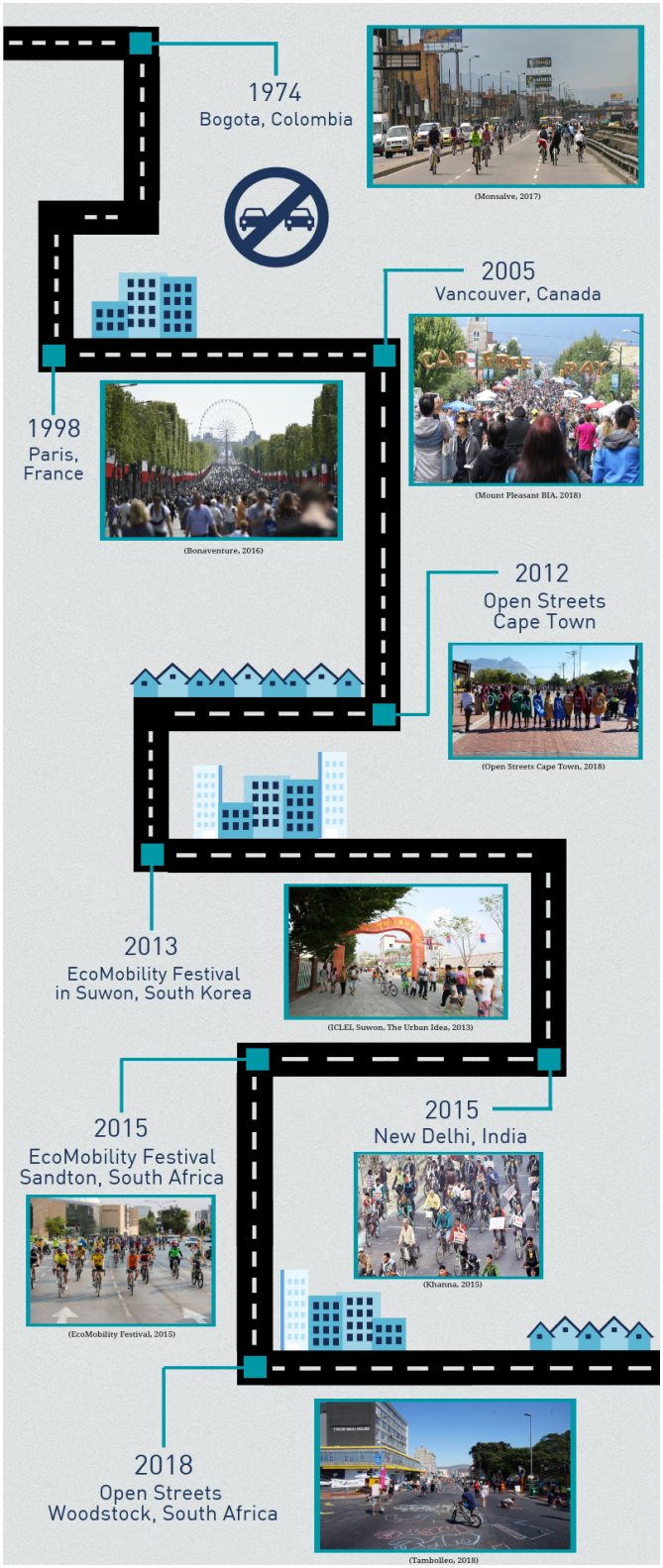

Figure 6: A timeline displaying a variety of car free initiatives.

Car Free Days take inspiration from the Open Streets initiative, which started in Colombia in 1974 (Open Streets Cape Town, 2018). Open Streets closes off busy streets to make them accessible spaces for socialising and playing (Open Streets Cape Town, 2018). Following the timeline in Figure 6, a paper, "Thursday: A Breakthrough Strategy for Reducing Car Dependence in Cities" was presented at a conference, Accessible Cities, in 1994 in Spain that challenged cities to hold days without cars (Britton, 1994). While this presented the idea of a Car Free Day, Britton, a Car Free Day archivist, says that the "first formally government mandated national Car Free Day programme was without a doubt France's '*En ville sans ma voiture*' ("In town without my car") programme, which began in 1998 and continues in various forms to this day" (Britton, 2015). Months after the French Car Free Day, other countries, like the United Kingdom, Germany, and Belgium, implemented Car Free Days of their own (Britton, 2015). While many people participate in these events, they are not without criticism. Pierre Chasseray, leader of the group "40 Million Drivers" said that this initiative is "just PR to say that cars aren't good" (Britton, 2015). Despite this, the use of a Car Free Day initiative has experienced a recent explosion after a rather slow beginning, as they are now being implemented in several countries including South Africa, South Korea, and Canada, as portrayed in Figure 6 (Britton, 2015). Detailed below, we have information regarding several of the Car Free Days that are listed in the timeline.

Paris, France

France planned its Car Free Day to encourage people to ride bikes, rollerblade, or just walk to use cleaner and slower forms of transportation (Marie, 2017). The day, which happens yearly, took place on September 16, 2018 from 11:00am to 6:00pm (Paris Convention and Visitor Bureau, 2018). Most of the city was blocked except for the Bois, a large public park on the western edge, and the inner ring circle for motor vehicles unless they were "emergency vehicles, vehicles for disabled people, taxis, public transport, BigBus and Open Tour," or hybrid bikes, which were allowed to use certain roads traveling under 30 kilometers per hour (Paris Convention and Visitor Bureau, 2018). After the conclusion of this day, the mayor of Paris, Anne Hidalgo, issued a challenge to the rest of Europe (Andre, 2018). Since Paris has held many Car Free Days, they hoped Paris would serve as an example to the other major cities in Europe as to how they too can promote sustainable transportation. Mayor Hidalgo challenged the other cities to hold Car Free Days of their own to promote eco-mobility throughout Europe and draw attention to "the urgency of climate issues and the health impact of pollution" (Andre, 2018).

Vancouver, Canada

In 2005, the city of Vancouver organised its first Car Free Day to "celebrate the vibrancy of Vancouver's diverse neighbourhoods" by taking over the streets and turning them into "community focused public spaces," (Car Free Day Vancouver, 2018).

Since 2005, several Car Free Days have been held in Vancouver every year, all of which are organised by the Car Free Vancouver Society (Car Free Day Vancouver, 2018).
These Car Free Days vary in size, with the smallest spanning 15 blocks and the largest reaching 21 blocks (Car Free Day Vancouver, 2018). Beginning as an informal protest initiated by residents upset with a proposed highway expansion plan, Car Free Days in Vancouver have morphed into festivals, honouring the culture and artists of the city. Hundreds of thousands of people come to each event, paying to enter to gain access to the many vendors and local artists that line the streets (S. Reeve, personal communication, November 16, 2018). While Car Free Days in Vancouver are enjoyed by most of the city's population, there is fear that the "car free" message of the initiative has been undermined of late, according to Sam Reeve, the Executive Director of the Car Free Vancouver Society (personal communication, November 16, 2018). With the Car Free Days increasing in popularity, more and more people are driving their cars to the events to partake in the festivities, which contradicts the car free aspect of the Car Free Day.

Cape Town, South Africa (Open Streets)

In Cape Town, Open Streets events have been dedicated to giving the streets back to the people (Open Streets Cape Town, 2018). Open Streets initiatives "work to challenge the paradigm of urban mobility by carrying out campaigns, temporary interventions, dialogues and walks that raise citizen awareness, spark public debate, and ultimately drive behaviour change around the role of streets in the life of the city" (Open Streets Cape Town, 2018). The initiative in Cape Town, founded in 2012, was "the first formal Open Streets programme in Africa, and offers a practical way to help bridge the city's social and spatial divides" (Open Streets Cape Town, 2018). The initiative has the goal of creating a more cohesive community full of social interaction with no cultural boundaries (Open Streets Cape Town, 2018). Figure 7 presents a snapshot of the community's engagement with the space offered by the closed off street during the October 2018 Open Street event that took place in Woodstock, a neighborhood in Cape Town.

Figure 7: A photograph from Open Streets Woodstock of residents enjoying the public space (Tambolleo, 2018).

Suwon, South Korea (EcoMobility Festival)

In 2013, the city of Suwon, South Korea hosted a month-long car free event called the "EcoMobility Festival" (Local Governments for Sustainability, 2013). With the festival, the city focused on promoting sustainable forms of transportation and bringing the community together (Local Governments for Sustainability, 2013). Shown in Figure 8 are the different types of areas that the city was split into, including public transport areas, pedestrian zones, and public space. During the event, around 35 different forms of "ecomobile" transportation were used, bicycle lanes were added, and walkways were expanded to help increase foot travel (Local Governments for Sustainability, 2013). Cultural events, parades, workshops, and exhibitions were organised on the streets, involving all members of the community (Local Governments for Sustainability, 2013). According to Kyeong-ah Ko, a community director in Suwon, a major takeaway from the event was "a strong social structure which will benefit their community long after the Festival has ended" (Local Governments for Sustainability, p. 9, 2013). This car free initiative succeeded not only in providing more environmentally sustainable transportation options, but also in promoting community cohesion.

Figure 8: The various components and infrastructures implemented for the EcoMobility Festival in Suwon, South Korea, including public transportation, pedestrian zones, bicycle lanes, and other modes of transport (Local Governments for Sustainability, 2013).

New Delhi, India

As a way to tackle the ongoing air pollution problem brought about by traffic congestion, New Delhi experimented with hosting a Car Free Day in their business hub of Gurgaon in October 2015. Engagement in the initiative was entirely voluntary and allowed

allowed those that wanted to participate the opportunity to do so. In April 2015, the World Health Organization (WHO) ranked New Delhi among the top five capitals with the most polluted air at an average PM2.5 level of 153 (Majumdar, 2015). The microscopic PM2.5 particles are exceptionally harmful and can cause serious health problems because they can get deep into your lungs and bloodstream (U.S. Environmental Protection Agency, 2018). In order to encourage the initiative, Delhi's government increased the number of buses on the road and ran additional shuttle services for the metro (Pasricha, 2015). As a way to assess the success of the initiative, a Delhi-based non-profit, Centre for Science and Environment (CSE), monitored the dedicated car free zone of the road that stretches between Red Fort and India Gate from 7:00am to 12:00pm noon. As shown in Figure 9, there was a dramatic decrease in the various types of particulate matter observed on the Car Free Day. CSE was able to report a drop of 60% in PM2.5 levels compared to those observed the previous day (Nasim, 2015).

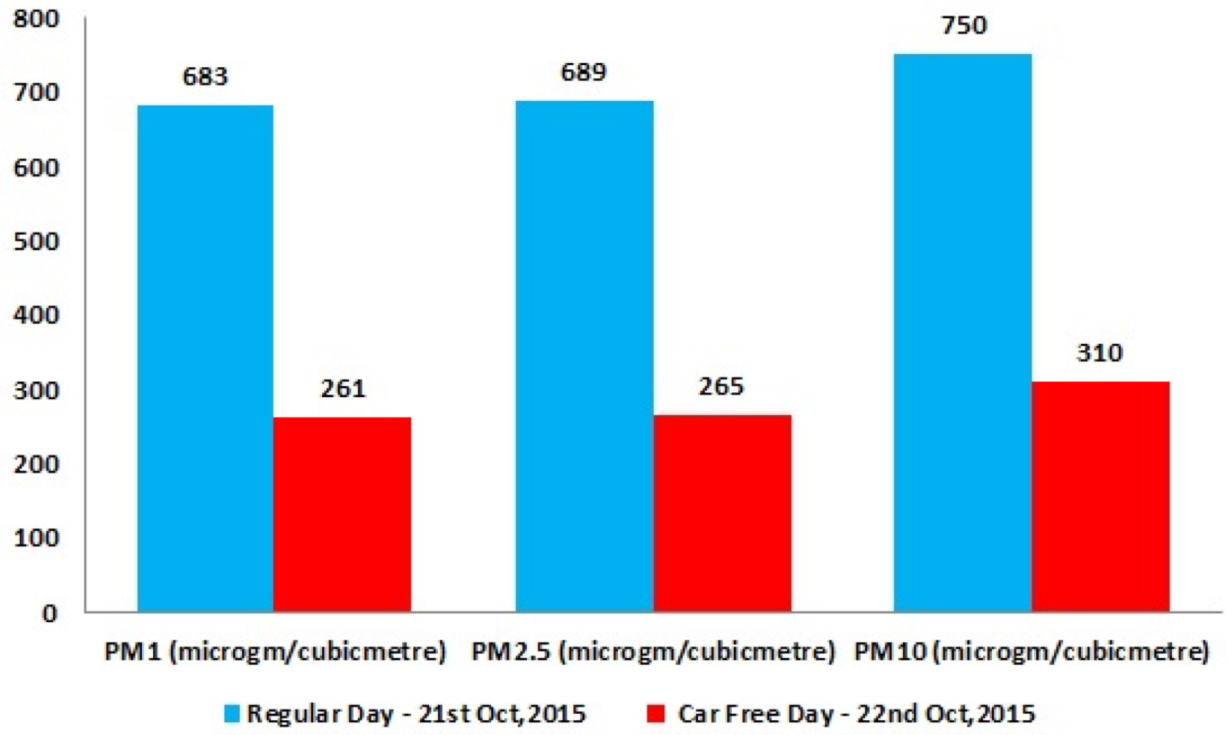

Figure 9: Particulate matter levels observed the day before the Car Free Day initiative and during the initiative in Gurgaon, India (Nasmin, 2015).

Sandton, South Africa (EcoMobility Festival)

In 2015, Sandton, South Africa, hosted its own month-long EcoMobility Festival where sustainable transportation was encouraged to reduce congestion in the area (Kodukula et al., 2015). During the initiative, private transportation was discouraged while public transport and alternative mobility networks were highlighted and made easily accessible to locals (Kodukula et al., 2015). With the festival, "the streets of Africa's most

vibrant financial hub turned into inviting green spaces that accommodated alternative modes of transport and mobility" (Kodukula et al., 2015, p.2). As a result, "the festival successfully reduced the percentage of private car use in Sandton by 22% during the month-long EcoMobility challenge according to the Gauteng City-Region Observatory" (Brislin & De Abreu, 2015, p. 554-555). In addition, the array of public transport options, including enhanced train, bus, and Park and Ride services, that were made available during the event created a more tightly knit community, as people from all socioeconomic backgrounds were using the same modes of transportation, mitigating division created by private vehicles (Kodukula et al., 2015).

Stellenbosch, South Africa investigates a Car Free Day

Stellenbosch, South Africa has expressed a need for a Car Free Day initiative in order to combat the ongoing transportation issues experienced in the Central Business District (CBD). Located in the Cape Winelands within the Western Cape Province (Figure 10) and approximately 40 kilometres east of Cape Town, Stellenbosch is the second oldest town in South Africa after Cape Town. Following its establishment in 1679, the town rapidly grew and became a centre for a flourishing wine industry, as well as an educational centre (Wine Routes, 2018). Today, Stellenbosch is home to approximately 176,523 residents (Stellenbosch Municipality, 2017). The demographic composition of the municipality of Stellenbosch is predominantly Coloured (52.2%), with Whites representing only 18.5% of the population, and Blacks 28.1% (Statistic South Africa, 2012). Afrikaans is the first language of most residents (67.7%), with 20.8% of residents speaking isiXhosa as their first language, and English being the first language of only a minority (7.2%) (Statistics South Africa, 2012).

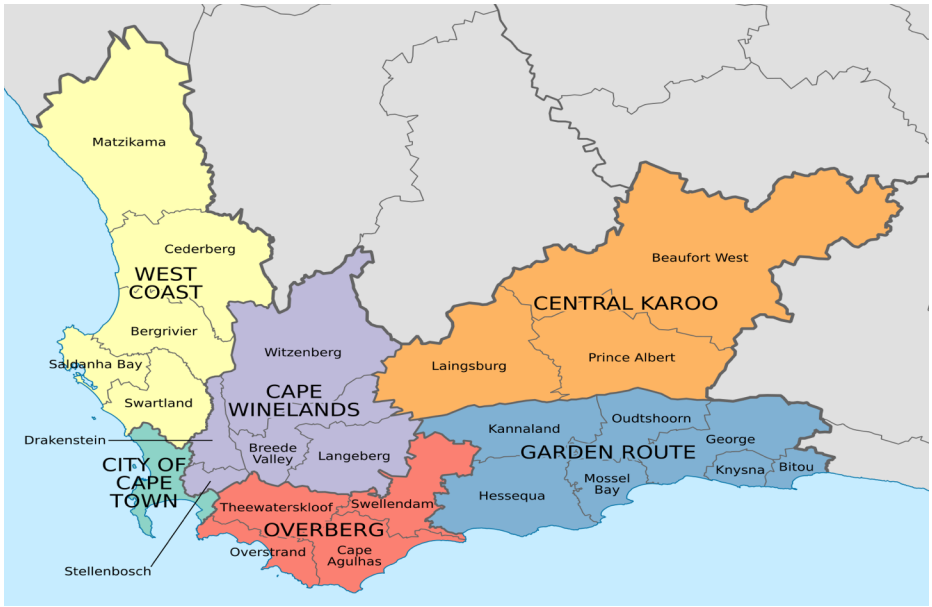

Figure 10: The Western Cape Province and the individual municipalities within the province (Htonl, 2017).

Stellenbosch University had over 30,000 students enrolled in 2017 ("Statistical Profile", 2017). The student body does not represent the demographic profile of the municipality, as 59.9% of the students are White, 19% of students are Black, 18.1% Coloured, and 3% Indian ("Statistical Profile", 2017). The transformation and diversification of the racial demographics of its students and staff has been slow, largely due to the persistence as an Afrikaans medium university (De Vos, 2013). Until 2017, the language of instruction at Stellenbosch University was Afrikaans. Under the new Language Policy implemented in 2017, "Stellenbosch University will ensure that students who are not proficient in Afrikaans or English are not excluded from lectures" and that the university will provide "equitable access to students who speak English or Afrikaans or one of the other [nine] indigenous South African languages" (Stellenbosch University, 2016).

With a wealthy, White student body making up Stellenbosch University, a central business district area and surrounding neighbourhoods have become largely unaffordable to many. The Stellenbosch Municipality is comprised primarily of farmland and suffers from a higher rate of income inequality than other towns in the surrounding region. A study conducted in 2017 by Statistics South Africa found that the average White South African makes a salary that is five times more than the average Black South African. This income inequality is manifested in transportation within and around Stellenbosch. A study conducted in 2013, found that Black South Africans spend, on average, 34 more minutes than White South Africans commuting to and from Stellenbosch (as cited in Fourie, 2015). Wealthier White Stellenbosch commuters (83% of whom have driver's licenses), are more likely to commute in a private car, while less wealthy Black commuters (only 10% have driver's licenses) make use of the minibus-taxis and other affordable public transportation options (Lucas, 2012; "Living conditions", 2017). While the White, driving population makes up only a small portion of the Stellenbosch population, private vehicles account for 87% of motor vehicle traffic (Kgwedi & Krygsman, 2017).

Given the positive impact that various car free initiatives have had on their respective communities and the current transportation challenges in Stellenbosch, Reginald Kgwedi and Stephan Krygsman from the Department of Logistics at Stellenbosch University, aimed to explore the idea for a Car Free Day in Stellenbosch. The main goal of a Car Free Day is to minimise the number of cars driving on the roads by having people use other forms of transportation including public transportation, biking, and walking. Using these other forms of transportation lessens congestion and addresses additional issues brought about by private motor vehicle use, including pollution, health concerns, and social inequity. In the case of Stellenbosch, a car free day would directly impact the many affluent White commuters and students with private vehicles, possibly raising attention to the persistent racial inequities in the municipality and university.

Methods

The goal of this project was to develop a comprehensive plan for a Car Free Day initiative in Stellenbosch Central, South Africa, to promote an awareness for the need to change the transportation behaviour of private motor vehicle drivers and address the issue of congestion and social inequality by encouraging the use of alternative forms of transport. We accomplished this goal by:

- Understanding stakeholders' perspectives regarding a Car Free Day initiative in Stellenbosch Central.
- Evaluating Stellenbosch Central's viability to host a Car Free Day initiative.
- Developing a strategy to formalize the use of alternative forms of transportation during the Car Free Day initiative and proposing the most practical plan for a Car Free Day initiative.

An overview of the methods we used for these goals is provided in Figure 11.

Figure 11: An overview of the methods that were used.

Objective 1: Understanding the perspectives of stakeholders regarding a Car Free Day initiative in Stellenbosch.

Semi-structured interviews with the stakeholders for a Car Free Day

We intended to gain a better understanding of the perspectives of stakeholders, shown in Figure 12, about a Car Free Day by performing semi-structured interviews with various groups of people such as residents, commuters, public transportation users, and local business representatives. Semi-structured interviews "provide valuable information from context of participants [and stakeholder] experiences" and the "use of predetermined questions provides uniformity" (Pritchard, 2010) throughout the process. With these semi-structured interviews, we were able to ask relevant questions and collect important information regarding the perspectives of these groups. With the semi-structured format, we had the freedom to explore topics that we didn't know were a problem or continue to explore perspectives that we didn't know were there. The general questions that were prompted are in Appendix A. The questions explore what types of transportation people use, whether they would be willing to participate in a Car Free Day and also what problems they foresee having during this event.

We interviewed 7 residents, 6 students, 5 commuters, 5 public transportation users, 5 non-motorized transport users, and 12 business representatives. The gender and racial demographics of the individuals we interviewed (see Appendix D) are strictly assumptions, as we did not ask how they identify. A majority of the interviewed participants are assumed to be White as shown in Figure 13. We selected all of these individuals through the use of purposive sampling, as they were identified as members of our key stakeholder groups. By using purposive sampling, we were able to understand the perspectives that each of the different groups offer. Once in those groups, we used convenience sampling, as we spoke with anyone that was willing to talk to us about the topics of congestion, parking, or the Car Free Day initiative.

Figure 12: Visual of stakeholders we engaged with.

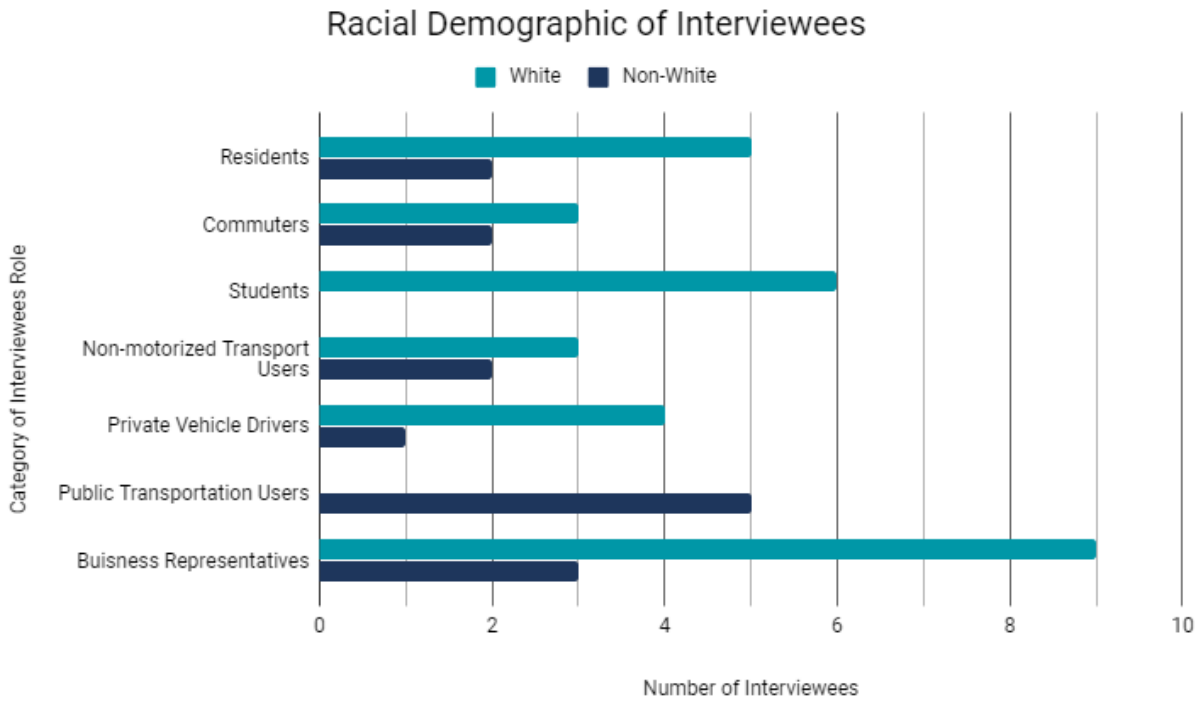

Figure 13: The racial demographic participants in the street interviews conducted.

Additionally, we asked business representatives about how they felt a Car Free Day would affect their business. For example, we asked if they thought it would help or hinder their sales for that day. We also asked about whether they would be willing to offer a promotion to those who participate in the Car Free Day. For writing purposes, the individuals we interviewed are identified based upon their targeted groups (resident, commuter, etc.) with the number in which they were interviewed, making the first resident identifiable as "Resident 1" and so on.

The location of the interviews changed according to the stakeholder and population that we were targeting. Both commuters and public transport users were talked to in the Eikestad Mall. To speak with residents and students, we stopped people on Plein Street, which is a main road in Stellenbosch Central, just a block away from the university. All interviews were conducted between the hours of 9:00am and 3:00pm. As a way to thank people for taking the time to speak with us we offered them coffee in return for the interview. For the business representatives, we identified our interview participants by asking employees of the businesses found inside of the car free zone if they would be willing to answer a few questions. Due to the noise and unpredictable nature of the interviews that we conducted on the streets, we had a designated note taker for all interviews to document the participants responses. The interviews typically lasted an average of 30 minutes or the amount of time it took for them to finish their coffee.

In addition to these stakeholders, we also talked to Professor Stephan Krygsman and Reginald Kgwedi. Professor Krygsman is the Head of Transport Economics at Stellenbosch University and Mr. Kgwedi is a lecturer within the Department of Logistics at Stellenbosch University. We talked to them about their perceptions for a Car Free Day in Stellenbosch and how they envision it happening. We also talked to them about the town and the traffic situation that they experience everyday as commuters who work in Stellenbosch Central every day of the work week.

We analyzed the data received from these interviews by coding them based upon the following themes: concerns with different aspects, different benefits, and overall reactions about the Car Free Day. For example, when we asked about the most attractive reason for a Car Free Day, we assigned a positive and negative coding system which we used throughout for each interview. For this coding system, two overarching themes were established--concerns and benefits. Concerns include the sub-topics of concerns with: safety, use of the minibus-taxis, walking and cycling in Stellenbosch, community participation in a Car Free Day, and their daily commute. Benefits included the sub-topics of benefits a Car Free Day can create for: the environment, the community, the economy, and personal health. These categories were given a positive mark if the person being interviewed mentioned one of these concerns or benefits and a negative mark if they did not. A final category that coded their overall thoughts on a Car Free Day was also included. If they wanted a Car Free Day, they were given a positive mark in this category while a negative mark indicated a disinterest in the initiative.

Online Survey for the students, staff, and faculty at Stellenbosch University

Students, staff, and faculty at Stellenbosch University make up a significant portion of the Stellenbosch Central community of residents and commuters. The online survey offered an opportunity to obtain a large quantity of opinions from people regarding general transportation concerns and aspects of a Car Free Day initiative. The survey did not offer the opportunity to gather a deeper understanding of the reasoning behind the responses chosen, but did offer an indication of shared interests and concerns.

The survey was distributed to the Stellenbosch University community through social media posts, word of mouth, and flyers (shown in Figure 14) placed throughout the campus. The flyers that were posted on trees and poles around the university displayed a QR code that was linked to the survey in an attempt to reach those who many not have access to social media but instead have access to a QR code reader. Representatives from the EcoMaties, a university organization focused on sustainability, posted the survey to November 17th. We aimed to achieve approximately a 1% response rate, which would result in about 350 responses. This was an attainable goal, as one example of an online survey received a response rate of close to 25% (Ramshaw, 2018).

Figure 14: Social media flyer that was posted online and throughout the university campus.

Given that all individuals connected to the university had an equal opportunity to participate in the survey, the sampling was random and we assumed that the results were representative of the university community. The survey included demographic indicators regarding the participant's role (i.e. student, staff, and faculty) in the university's community (to determine if variation in answers was dependent on certain demographics). Information regarding the survey participants' race and gender was not collected. A majority of the survey responses came from students (87%), with a few responses from staff (13%) equaling a total of 23 responses.

The survey also included questions regarding the means of transportation used by the participant, concerns around transportation, interest in and concerns regarding the Car Free Day. The complete survey is included in Appendix B.

Objective 2: Evaluating Stellenbosch Central's viability to host a Car Free Day initiative

Observe the roads in Stellenbosch to determine the number of pedestrians, bicycles, motor vehicles, and minibus-taxis are used in certain areas of the municipality

For this method, we went to specific street corners and observed traffic. The locations of the streets were determined with the feedback from the semi-structured interviews with stakeholders and are shown in Figure 15. Three team members looked for a specific type of transportation: bikes, pedestrians, private motor vehicles, and minibus-taxis, while the other team member timed cars that passed through a predetermined distance to calculate their average speed. All observations were conducted over a period of 10-15 minutes during rush hour on the afternoon of November 5th, from 3:30-5:30pm, and the morning of

November 6th, from 7:00-9:00am. We recorded the data in the tables located in Appendix C, then moved onto the next street. After all the streets had been observed, we compiled and analysed all of the data into frequency, pie, and gauge charts within Google Sheets.

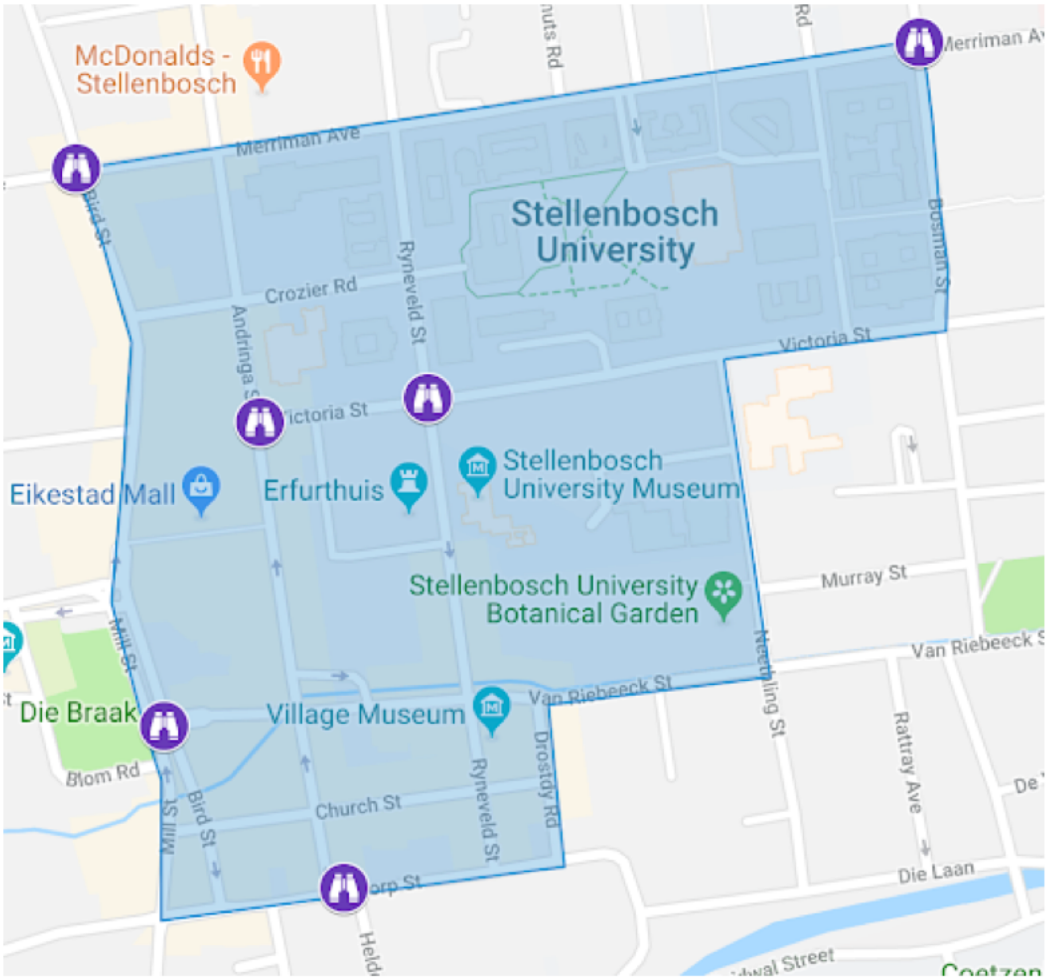

Figure 15: Map of where the observations were conducted. The purple binoculars mark the locations of the observations.

These charts showed the different types of transportation on each of the streets, so we could visually see where people are using certain kinds of transportation. From these maps, we determined how to best utilize the roads for the Car Free Day. For example, areas with high minibus-taxis could be set aside for minibus-taxi use only on the day or areas with high cycling frequency could have temporary bike lanes set up for the day.

This method provided the team with the most up to date information on motor vehicle traffic in the central area of Stellenbosch and an idea of how congested the main streets are in Stellenbosch.

Observations of the current infrastructure in the proposed car free zone

In addition to observing traffic conditions on the different roads around the proposed car free zone, we also surveyed the built environment within the car free zone. By surveying the infrastructure, we were able to get the most updated version of the area that included parking lot and bike rack locations and their respective capacities, businesses based upon the type of business (e.g. restaurant, retail), and the types of intersections (e.g. stop signs, traffic lights/robots, roundabout/traffic circles). Each member took a different aspect to record: parking, bike racks, businesses, and types of intersections. This allowed us to accurately create a plan that includes roads being half closed or used in different ways than normal. We also marked where handicap accessible parking was located so that we could use that as part of our plan.

Semi-structured interviews with representatives from other car free initiatives

Through interviewing representatives of other car free initiatives we assessed the considerations of the infrastructure for this Car Free Day initiative in Stellenbosch. We asked about the different strategies they used in order to host a successful event. Additionally, we asked questions regarding the obstacles or uncertainties they experienced, so that we could make adjustments and include considerations to our plan. Example questions that we asked are included in Appendix A.

We emailed other car free initiatives representatives to set up a time to discuss or just to send them email questions. The people that we interviewed are listed below:

Name	**Position**
Elaine Jack	Sandton EcoMobility Festival Representative
Sam Reeve	Executive Director of the Car Free Vancouver Society
Marcela Guerrero Casas	Open Streets Co-founder & Managing Director
Richard Gordge	Transport Futures Owner and Sustainable Mobility Consultant

Semi-structured interviews with minibus-taxi representatives, Mellowcabs, and cycling groups

Through conducting interviews with representatives of the minibus-taxis, Mellowcabs, and cycling groups, we further understood the role of the alternative transportation services in Stellenbosch and how they could be used during the Car Free Day initiative. The questions and our course of action for these interviews can be found in Appendix A.

For these interviews, we met with each group at different locations. With the help of our sponsor, Mr. Reginald Kgwedi, we were put into contact with Neil du Preez, the CEO and Founder of Mellowcabs. In talking with Neil du Preez, we were able to discuss how the Mellowcabs, small, electric-powered vehicles shown in Figure 16, could be used as a mode of alternative transportation for short distances within the car free zone during the Car Free Day in Stellenbosch.

Figure 16: The Director of Mellowcabs, Neil du Preez, standing with one of his Mellowcabs.

Additionally, we talked to representatives of the Stellenbosch Taxi Association at their taxi rank, located at the corner of Merriman and Bird Street, near Stellenbosch University to discuss their current position in the Stellenbosch transportation system and how we could use their services throughout the initiative. We also met with Dawid Both, the Head of Public Relations for Stellenbosch Fiestry, a cycling organisation created by

community, to discuss the current state of cycling in the community and the impact cycling could have during the Car Free Day.

To analyse the data from the interviews, we organised the responses based on the different aspects that they talked about. Their responses were grouped into topics, such as their current roles in the Stellenbosch transportation system, their thoughts on a Car Free Day, and the potential role that they would fulfill during a Car Free Day. With the information and data that we gained from these interviews, we understood how a variety transportation services could be used during the Car Free Day initiative.

Cost-benefit assessment to determine the value of the Car Free Day

In order to determine the monetary value of a Car Free Day initiative in Stellenbosch we conducted a cost-benefit assessment (CBA). The goal of the CBA was to place a monetary value on the beneficial aspects that would come from an individual participating in the Car Free Day initiative. As a way to establish the benefits, we held an hour long brainstorming session to consider all of the necessary components that would go into an individual participating in the initiative. Such components included: fuel costs, time lost or gained, vehicle maintenance, and parking fees in regards to the consumers actual behaviour. In addition to the individual CBA, we also conducted a CBA in regards to the complete initiative and the individual elements that would be impacted and those that are necessary for its success. Such elements included: business earnings, infrastructure and marketing expenditure, subsidies for temporary loss of employment, etc. We used a CBA because it allowed us to approximately quantify the major aspects of the Car Free Day and its impact on both the individual and community level.

Objective 3: Developing a strategy to formalize the use of alternative forms of transportation during the Car Free Day initiative and propose the most practical plan.

Presentation of findings with stakeholders to receive feedback

On Monday, December 3rd from 1-2pm in Stellenbosch University's Van der Sterr Building, we presented our findings as they pertained to our proposed plan. In order for us to receive feedback regarding our proposed plan, we invited a variety of stakeholders to attend. Those present included Richard Gordge (Transport Futures), Dawid Botha (Stellenbosch Fiestry), Neil du Preez (Mellowcabs), Reginald Kgwedi and Johann van Rensburg (Stellenbosch University lecturers), Katleho Bookholane (Stellenbosch University student), Nicola Bulled and Alexandrina Agloro (Worcester Polytechnic Institute professors), and Deon van Kerwel, Kurt September and Bernadine Williams (Stellenbosch Taxi Association). Food and drink were provided as a token of appreciation for their

participation and for having taken the time to join us. We presented the Car Free Day plan that we felt was the most feasible for Stellenbosch to implement and asked for feedback. Due to the complex nature of a Car Free Day initiative, it was essential that we attained broad perspectives from the individual stakeholders, as they all represented different aspects that needed to be considered in order for the initiative to be successful. The stakeholder presentation was a strong method to use because it encouraged stakeholders to express their own informed views about issues of concern and potential solutions to address them (Francisco & Schultz, 2018).

Following the presentation of our proposed plan we facilitated a discussion that lasted approximately one hour to attain the stakeholders' feedback. This allowed them a sufficient amount of time to deliberate and to "learn from others, and examine and refine their views" (Carman et al., 2014). Through this discussion we were able to address any questions/concerns the stakeholders had regarding the logistics of the proposed plan.

Findings

We have divided the findings section into two parts. In part one, we first detail the transportation issues currently present in Stellenbosch, the response of stakeholders to the Car Free Day concept, and the social implications of a Car Free Day in Stellenbosch. Considering these issues, in part two, we present three different plans detailing a Car Free Day in Stellenbosch. Each plan offers a variety of similar and different components to address different concerns that stakeholders expressed throughout our research. The third plan was presented to the stakeholders following the conclusion of our research to receive any additional feedback. Additionally, we put together a cost-benefit assessment for this plan to provide insight into the economic impact of its implementation.

Part One

Limited reliable and safe public transportation options in Stellenbosch require greater reliance on private vehicles that create congestion and parking challenges

There is a lack of reliable and safe public transportation available in Stellenbosch, resulting in limited use and a strong reliance on private motor vehicles. Currently, there is only one train line, the Northern Line, which provides rail service to Stellenbosch from Cape Town. There are only two trains per peak hour that run through the Stellenbosch Municipal area, which spans a total length of approximately 18km (Stellenbosch Municipality, 2016). According to the 2012 timetable for the Northern Line (see Figure 17), there was 71-81% capacity utilisation for the single-track section running through Lynedoch, Vlottenburg, Stellenbosch, Du Toit, and Koelenhof stations and less than 50% capacity utilisation for the line running through Muldersvlei and Klapmuts Stations during peak hours.

As part of the Stellenbosch Municipality Comprehensive Integrated Transport Plan for 2016-2020, one of their goals is to capitalise on the existing rail infrastructure to expand its capacity to increase passenger ridership. In 2017, Metrorail Northern Line commuters were left stranded at stations. Approximately half of the trains were on time in the mornings and evenings and 18% of the trains were cancelled (Payne & Washinyira, 2017). Recently, the passenger rail service for commuters in Cape Town/Western Cape Province has suffered a string of vandalisms, fires, and attacks removing more than 80 trains from service (Harding, 2018). On September 9th, 2018, there was a violent attack on nine men while they were riding the Metrorail train in the Stellenbosch area, resulting in one fatality, multiple injuries and cancellations of service for the day (Daniel, 2018; News24

Correspondent, 2018). Incidents such as these have made many private vehicle drivers weary and uncomfortable with taking public transportation, as one student who drives to the university indicated that she "would walk to university before … thinking about taking the metrorail," (student 6, personal communication, November 2, 2018).

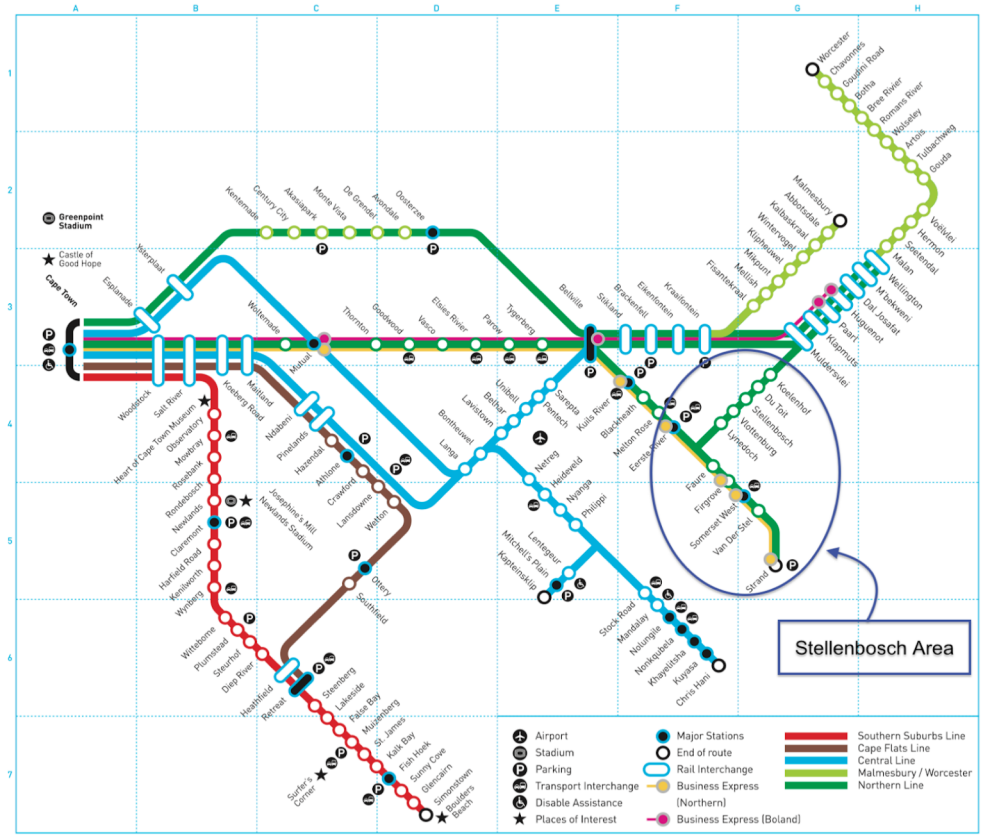

Figure 17: A map of the Cape Town A map of the Cape Town Metrorail routes with a circle around the Stellenbosch Area that is serviced by the Northern Line (Metrorail.co.za, 2018).

In addition, Stellenbosch has only one formal scheduled bus service with limited service hours, run by Golden Arrow Bus Services which provides transportation from Somerset West to Stellenbosch (Kgwedi & Krygsman, 2017). Golden Arrow Bus Services initially serviced high-income areas in the Western Cape Province, but from the 1950s onwards, as car ownership became increasingly prevalent in these areas, there was a gradual shift towards servicing lower income areas (Thomas, 2008). These lower income areas surrounding the outskirts of Stellenbosch and Cape Town are predominantly comprised of Black and Coloured South Africans that supply labour to wealthy residents and the municipality, as a result of the social inequities caused by spatial apartheid (Beukus et al., 2015). Crime and insecurity have had a lasting impact on Golden Arrow Bus Services, as they do operate in high risk areas almost all day and night. One passenger in 2014 fell victim to a stabbing and robbery on her way home from work (Sefali, 2014). In April of 2018, there was a national one-month bus strike, resulting in no bus services to

Stellenbosch. These incidents have contributed to the unreliable and dangerous reputation that has formed around public transportation in Stellenbosch.

Minibus-taxis are a unique form of shared public transportation that is continuously the most popular mode of transport in urban areas. Minibus-taxis primarily service a majority of South Africa's population, as the majority is poor and dependent on public transport that is inexpensive ("Minibus Taxis and Road Safety", 2018). Of the public transport total, minibus-taxis account for approximately 65% of the market share (Kgwedi & Krygsman, 2017) and are comprised of individual vehicle owners and various associations. While there have been many attempts to formalise the minibus-taxi industry, most continue to operate informally. In Stellenbosch, minibus-taxis are an underutilised form of transport. The main taxi rank is located only a few streets away from the university, but there is a clear divide that can be seen between the Black and Coloured population and the more affluent White population. This being said the people in and around the taxi rank are primarily Black and Coloured people and they are the main users of the minibus-taxis. While conducting our observations during morning peak hours in Stellenbosch, the minibus-taxis accounted for less than 10% of the vehicles on the road and only 2.1% of the vehicles during the evening (observations, November, 2018). Due to the informality of the minibus-taxi industry in Stellenbosch, there is no central source of information on the fares, routes, and frequency of trips (Kgwedi & Krygsman, 2017), hindering its use by new customers. Some argue that it is important that the industry remains informal, as this is the only way they are able to provide inexpensive transportation (Fobosi, 2013). Additionally, the type of vehicles used currently do not meet the required standards for universal accessibility, not allowing for use from disabled persons (Stellenbosch Municipality, 2016). The control and execution of official regulations are limited and "renowned for being lax in most instances" (Mhlanga, 2017). Ultimately, this results in vehicles that may not be in good condition, not roadworthy and unsafe; drivers may not be properly licensed or trained, as they frequently operate in a way that is abusive to passengers by travelling at speeds higher than the speed limit in an attempt to cut time between trips ("Minibus Taxis and Road Safety", 2018). In a survey conducted by the Stellenbosch Municipality in 2016, there was a high proportion of unlicensed minibuses operating on the designated routes in Stellenbosch.

The unreliability of the public transportation to and within Stellenbosch has resulted in many of those who can afford to opt out of using public transportation to use their private vehicles instead. Students, for example, travel in their private motor vehicles to campus (Sinclair, Bester, & Van Dyk, 2012). A private vehicle commuter indicated that he was worried about his commute into Stellenbosch during a Car Free Day, explaining how the public transport options in the town are "limited, unreliable, and hard to access" (commuter 5, personal communication, November 2, 2018). Stellenbosch carries a disproportionately high number of vehicles on its roads and parking areas (Sinclair, Bester,

& Van Dyk, 2012). A large number of workers (90% of commuters) travel into the central business district every day by car (Kgwedi & Krygsman, 2017). Considering most of the public transportation options researched are primarily located in lower income areas servicing the Black and Coloured population, this Car Free Day would mainly be impacting the White population, who tend drive their own private motor vehicles every day. A study aimed to quantify congestion in Stellenbosch found that traffic has been steadily increasing on the roadways used by commuters to enter Stellenbosch at a faster rate than experienced by other Western Cape Province communities (Swilling, Sebitosi, & Loots, 2012). This becomes especially apparent when the university is in session (Ter Huurne et al., 2014), with students, staff, and faculty increasing the city's population by 35,068 people ("Statistical Profile," 2017). Related to the issue of traffic congestion caused by too many private vehicles, Stellenbosch has an increasing problem with parking. With not enough places to park, drivers resort to parking illegally, which exacerbates the traffic congestion issues (Sinclair, Bester, & Van Dyk, 2012).

A high number of private motor vehicle commuters is contributing to the congestion and parking problems in Stellenbosch Central. Based upon the survey responses we received for question 2 (see Appendix B), 38% of participants live more than 5km from campus and tend to use a drive a private motor vehicle an average of five days out of the week. Observations of Dorp Street, Mill Street, Andringa Street, Merriman Avenue, Bosman Street, and Victoria Street revealed that driving speeds were reduced by two-thirds or more, as compared to the posted speed limit of 60 km per hour, during major commuting hours of 7am to 9am and 3:30pm to 5:30pm. The average speeds ranged from 11 to 18 km per hour in the morning and 11 to 25 km per hour in the evening along roads we were informed were the primary routes for commuters (see Figure 18). All five of the private vehicle drivers that we interviewed mentioned the challenging parking in Stellenbosch as well. Finding parking in Stellenbosch is "a massive headache" according to a commuter (commuter 3, personal communication, November 2, 2018).

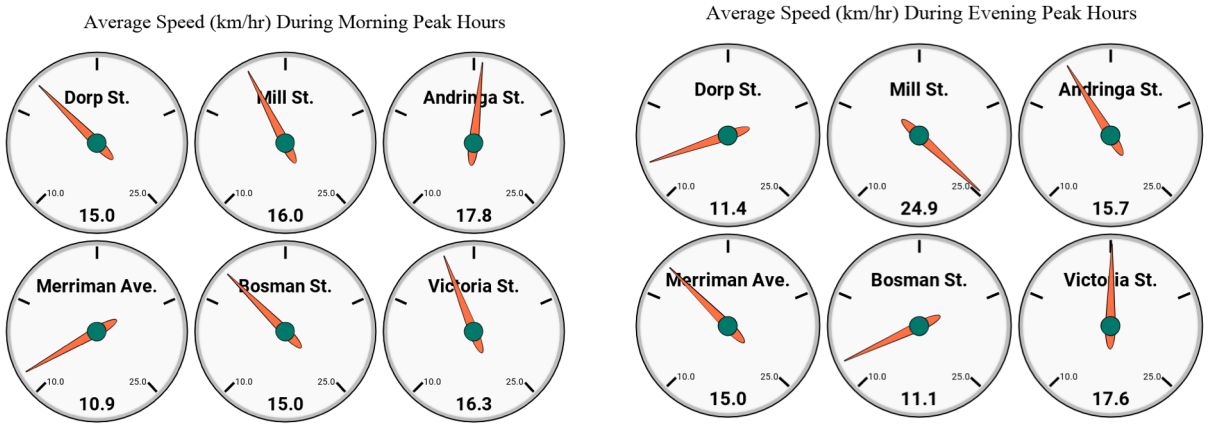

Figure 18: Average speed on the streets on the evening of 11/5 and the morning 11/6.

Biking offers another transportation option in Stellenbosch

Another underutilised form of transportation in Stellenbosch is cycling. During the observations we conducted on key travel routes, bicycles accounted for only approximately 3% of the modal split (observations, November, 2018). The Stellenbosch Municipality actively works to maintain the roads as can be seen by the many workers sweeping and cleaning the streets, but they have yet to implement infrastructure for cycling. According to the Capital Expenditure Report for the 2016/2017 fiscal year, the Stellenbosch Municipality budgeted approximately 5.3 million ZAR (371,347 USD) for pedestrian and cycle paths, but none of the money was spent that year. There are a few roads that do have designated cycling lanes, but they are largely ignored by motor vechiliststs. Dawid Botha, the Head of Public Relations at Stellenbosch Fiestry, indicated that given the limited space on roads and designated areas for cyclists, he has ridden into the doors of vehicles as people get out of their cars, sending him over his handlebars. We observed many cyclists on the sidewalks and they have to navigate around pedestrians, bumps, and cafe tables.

Despite this, cycling has the potential to be well established in the city as access to bicycles is improving. Dawid Botha indicated that the town used to be very much a cycling town where everyone biked. From our observations, we found that there are approximately 50 bike racks located throughout the car free zone, with about 380 racks located throughout the university alone, but very few were in use (observations, December 2018). Stellenbosch University has implemented their own bikeshare programme, Maties Bikes, which allows students and staff to rent a bicycle for the school year. Students pay 2500 ZAR (180 USD) at the beginning of the year to receive their bike and upon the bike's return, they are refunded their deposit of 1500 ZAR (108 USD) (Systemic Sustainability, 2018). It should be noted also that these bikes were being used by students, since we observed them during our observations. According to Dawid Botha, the university's bikeshare programme made cycling trendy. The Maties Bikes are, however, only available to the university community, but the town of Stellenbosch of has recently introduced a public bikeshare known as Poynt Bikes. According to IntoCycling.com (2018), "Poynt Bikes are Stellenbosch's very first bike sharing system that is revolutionary, innovative, sustainable and a fun way to rent and ride bicycles in and around Stellenbosch." Poynt Bikes are currently still in its pilot phase with limited stations that are all centrally located. To use the Poynt Bikes, one simply has to download the application and unlock the bike from the rack and return the bike when finished. The bikes can be rented on either a daily (90 ZAR or 6.31 USD), weekly (210 ZAR or 14.70 USD), monthly (350 ZAR or 24.50 USD), or yearly basis (2900 ZAR or 203 USD) (Poynt Bikes, 2018).

Residents, students, and commuters are eager to participate in a Car Free Day, but are concerned about alternative transportation options

Residents are eager to participate in a Car Free Day because of the increasingly negative effects that congestion and parking have on their lives. Of the seven residents that we interviewed, all expressed a positive reaction to the idea of a Car Free Day and felt that it would be very beneficial for the community. In an interview, a resident described how he thought a Car Free Day could bring "many benefits, especially with getting people active and healthy" and how "at first, people might not like the idea, but once they do it, they will realize how easy and useful it is," (resident 4, personal communication, November 2, 2018).

The students at Stellenbosch University are excited about a Car Free Day. Through our interviews and our survey, we discovered that almost all of the students questioned were interested in participating in a Car Free Day. Of the 20 responses from students from our survey, there was an overall positive reaction to participating in a Car Free Day, as the average rating among students was 4.44 on a scale of one (very unhappy) to five (very happy), as shown in Figure 19. We received positive comments regarding street closures and promoting sustainable forms of transportation. One student mentioned how "if the streets were closed off, I would feel safe cycling anywhere," also adding that they were "very keen on the idea" of having private vehicle commuters use a Park and Ride service to shuttle into the car free zone (student 1, personal communication, October 30, 2018). Out of the six students that we interviewed, only one expressed that they were not interested in a Car Free Day. A student run social media page expressed a similar sentiment saying that they "don't think students want a Car Free Day to be quite honest" (personal communication, November 2, 2018). The student responding to the message might have only considered the negative aspect of not being able to drive on the day and may not have considered the benefits that a Car Free Day can have in a community. It is also possible that the student did not understand what was meant by a Car Free Day and reacted how they felt the rest of the university community would if they only saw "Car Free Day" without any context.

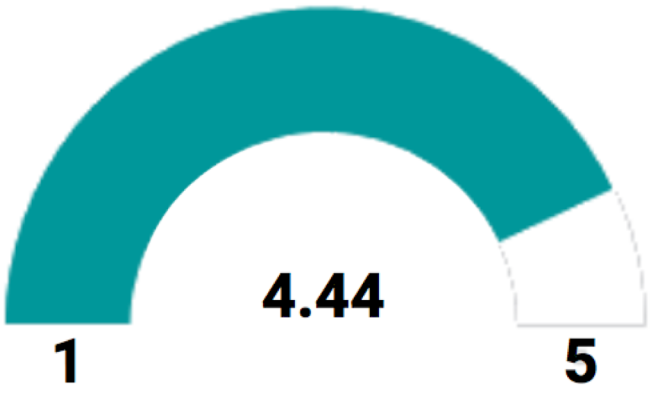

Figure 19: Average rating of students' happiness to participate in a Car Free Day (1 being very unhappy, 5 being very happy).

Commuters see a Car Free Day as a way to alleviate the stress of the daily commute. All five commuters interviewed expressed excitement for a Car Free Day. One commuter indicated that they "could spend up to thirty minutes looking for a parking space" (commuter 2, personal communication, November 8, 2018). Most commuters expressed parking as a major issue in their lives and most said that they would be willing to try another system.

Both residents and students expressed concerns regarding use of the minibus-taxis. Four out of seven of the residents that we interviewed revealed concerns with using the service. It should be noted that all four of these residents were white, and most likely do not use public transportation. Since the minibus-taxis are a staple of transportation in Stellenbosch, some residents have been forced to use them as an alternative to their private vehicle, but they were not fond of their experience. A minibus-taxis user said that, "I feel uncomfortable using them because the drive can be crazy" but she recognises that they are effective and cost efficient (public transportation user 5, personal communication, November 15, 2018). Students expressed concern regarding the idea of using minibus taxis as a shuttle for a Park and Ride service during the Car Free Day. One student described how they felt that "[the minibus-taxis] are not safe in the slightest, and the drivers are crazy" (student 3, personal communication, November 1, 2018). Another student said, "If I knew where they were, what time they came, and how much they cost, I would definitely use minibus-taxis, but I don't even know where I would find that" (student 4, personal communication, November 15, 2018). Five out of the six students that we interviewed said that they were concerned about using the minibus-taxis. Figure 20 displays the concern expressed by a large portion of students (83%) compared to other stakeholders. It should be noted that all students interviewed were white and none had prior experiences riding in a minibus-taxi. Of the eight Black and Coloured South Africans that were interviewed, only two were concerned with using the minibus-taxis, compared to the nine out of thirteen white South Africans that were concerned. A large reason the minibus-taxis are underutilized is that people do not know how to use them and have safety concerns that are racially driven. While a few people we interviewed said they would not use them no matter what, most people interviewed expressed that they would be open to using them, but they do not know how they operate.

Four out of five commuters questioned how they would be able to commute into the city. When we explained the Park and Ride Services that we plan on utilizing, commuters responded very positively. One commuter stated that "a place where [he] knew [he] could park and then be shuttled near to where [he] needed to go would be ideal" (commuter 2, personal communication, November 1, 2018). Four out of five commuters also expressed concern for safety. During big events, people are easier to target for crimes such as pickpocketing. According to Christopher Higgs, an owner of a private security company, "unsavory characters could take advantage" of a heavily used Park and Ride service, targeting people that seem confused by the change to their commute.

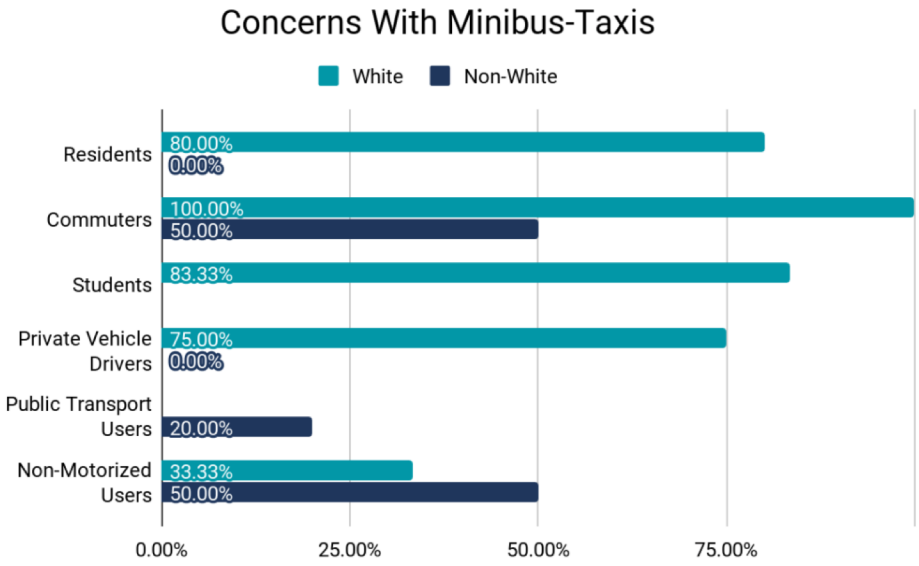

Figure 20: Frequency of interviewed stakeholders indicating concerns with minibus-taxi use by race. For racial categories not interviewed there is no estimate offered. For example, there were no non-White students interviewed, therefore we did not indicate 0%. While 0% of non-White drivers indicated concerns with the minibus-taxis.

Non-motorised transportation users and sustainable transport organizations see a Car Free Day as an opportunity to increase awareness of alternative transportation

Non-Motorised Transport (NMT) users hope a Car Free Day can educate the public of how easy biking and walking is in Stellenbosch. NMT users are very comfortable using roads to bike or walk. Four out of five NMT users interviewed said they feel completely safe walking or biking around Stellenbosch while only one-third of students and two-fifths of commuters expressed similar feelings. One cyclist mentioned that, “If people just biked once, they would see how safe it is Stellenbosch. I let my three children bike everywhere” (NMT user 5, personal communication, November 19, 2018). Overall, the NMT users expressed great excitement for this idea. One cyclist gave us his contact information to obtain more information on how he could get involved. While there is a great excitement in this group, the reasoning of this excitement must be investigated. The demographics of the people interviewed consisted of three White, one Coloured, and one Black. Of the five interviews, the first four used cycling or walking as their only forms of transportation, while NMT user 5 had a car that he would use on occasion. By having a car, it could mean that he views NMT as more of a hobby than as a sustainable and affordable form of transportation. This must be considered when reviewing our plan as our goal was to promote alternative forms of transportation and not to create a private track for cycling enthusiasts.

The Stellenbosch Taxi Association is interested in being a part of the Car Free Day as an alternative form of transportation. Representatives felt that this would be a great, profitable opportunity to change people's perceptions of the minibus-taxis. Deon van Kerwel, a representative of the Stellenbosch Taxi Association, explained how congested the streets of Stellenbosch have gotten, and how the state of congestion in the town could not be allowed to worsen (personal communication, October 22, 2018). He added that a Car Free Day could be the first step to decongesting roads and promoting forms of transportation different than driving a private motor vehicle, such as using the minibus-taxis (personal communication, October 22, 2018).

Mellowcabs are another sustainable transport organization that is interested in the idea of a Car Free Day. Mellowcabs are small, electric-powered, and eco-friendly vehicles that we had envisioned being a part of the Car Free Day. The Director of Mellowcabs, Neil du Preez described how the service is looking to expand very soon, saying that the people in Stellenbosch have been eager catch a ride in one of the colorful, unique vehicles. When asked about his opinion of a Car Free Day in Stellenbosch, Neil du Preez responded that he "absolutely love[s] the idea," (personal communication, October 22, 2018).

Local businesses see a Car Free Day as an opportunity to increase revenues

Local businesses are willing to participate because they see a Car Free Day as an opportunity to increase sales, as long as concerns regarding deliveries are addressed. Twelve business managers and owners were interviewed and the overall reactions were positive. Nine out of 12 businesses anticipate a Car Free Day would increase sales while one said that it would have no effect on sales, but was still excited about a Car Free Day. With this increase in sales, many businesses expressed that they would be willing to run promotions through the day whether it be a bike shop partnership or a store discount for the day, though some store managers mentioned they would have to check with the owner first to give the exact details of the discount. If non-restaurants were given a couple months' notice, they would not have any problems with deliveries. However, there is a still a large portion of businesses (63.6%) that need deliveries. This would require the inclusion of accommodations in the plan, so delivery vehicles could make it to the store front. If this is able to be solved, businesses would be very willing to participate in the day. The mall is also excited to participate, but require a letter that is signed by the head engineer at the municipality before they make any plans (K. Retief, personal communication, November 20, 2018). With the municipality's support and a strong plan for deliveries, the mall and other local businesses would support and participate in the day.

Stellenbosch's White commuters, students, and residents will be most impacted by the Car Free Day, as the majority of the Black and Coloured population already live car free

With 83% of White South Africans owning a driver's license compared to only a 10% of license ownership among Black South Africans (Lucas, 2012; "Living conditions", 2017), a Car Free Day will dramatically impact the transportation habits of White South Africans. They disproportionately contribute to congestion and parking challenges in Stellenbosch, as four out the five private vehicle drivers that we spoke with were White individuals.

For private vehicle drivers, alternative transportation options must be provided for a Car Free Day to be successful. Of the twenty-four White South Africans that we spoke with, none reported using public transportation on a regular basis. This supports data describing how most vehicle owners driving to, from, and within Stellenbosch are White. Ultimately, by implementing a Car Free Day, the White private vehicle drivers will have their normal transportation routines disrupted. This however is necessary because the private vehicle drivers, who are primarily White, are the people that need to change their transportation habits.

Comparatively, all public transportation users that we interviewed were non-White (n=5). The majority of Black and Coloured South Africans use non-motorised and public transportation on a daily basis. This demonstrates that, the majority of Stellenbosch already lives car free, as non-White individuals make up 80.3% of the municipality population (Statistic South Africa, 2012). When one public transport user was asked about her thoughts on a Car Free Day, she responded positively with "that sounds like a great idea," as she did not see her commute "changing in any way" since she always uses the metrorail and then the minibus-taxis to get to work (public transport user 3, November 6, 2018). The transportation habits of Black and Coloured commuters and residents of Stellenbosch are already using sustainable transport, since they are already taking the metrorail and using the minibus-taxis. These habits should be encouraged and do not need to change for a Car Free Day. This being said, there is the potential of impacting the Black and Coloured public transport users with road closures. Depending upon the predetermined routes for the minibus-taxis, road closures may affect the normal routes of the minibus-taxis as it could prevent them from dropping off and picking up a rider at their normal locations. These changes would negatively affect the minibus-taxi users, by forcing them to walk or use another form of non-motorised transportation to get to their destination.

Stakeholders are supportive of the Car Free Day plan, but they are primarily individuals who are already enthusiastic about sustainable transport

The overall response from the stakeholders in attendance at the findings presentation are very supportive of the proposed plan. However, it is important to note that a majority of those who attended the presentation are white males who are already interested or involved with some aspect of sustainable transport, which could have influence on their opinions as a result of biases. One stakeholder in particular that has wholeheartedly supported the idea of a Car Free Day in Stellenbosch is Dawid Botha, the Head of Public Relations for Stellenbosch Fiestry. While Dawid Botha does want to progress the town of Stellenbosch by improving the use of non-motorized transport, he potentially also has a personal interest in the Car Free Day as an avid cyclist. For Dawid Botha, the Car Free Day would be of great value for him, as he would be able to ride his bicycle freely throughout the area without being concerned about sharing the road with private motor vehicles. In addition to Dawid Botha's support, both the Mellowcabs and Stellenbosch Taxi Association are interested in being a part of the Car Free Day and would like to see it implemented in the near future.

As a result of the stakeholders being so supportive of the plan, they expressed to us that we should have engaged with the Stellenbosch Municipality and presented our proposed plan to them. The Stellenbosch Taxi Association, strongly encouraged our engagement with the Stellenbosch Municipality, but this may be a result of them feeling underrepresented in the municipality and seeing our project as a way to receive that representation, as both an essential part of the transportation network in Stellenbosch and as non-White individuals. We were advised not to engage too heavily with them until we had a completely detailed plan and we had made multiple attempts to engage with the municipality prior to the presentation, but they were not responsive. However, the stakeholders have encouraged us to engage with the municipality in regards to our Car Free Day plan because they see this as something that needs to happen.

Part Two

Planning a Car Free Day

In order to have a Car Free Day, there are two key measures that need to be in place: certain roads need to be blocked off and alternative forms of transportation need to be provided in a coordinated fashion.

Road Closures

A system of soft road closures and hard road closures appears to be the most effective way of managing a car free zone, granting commercial and emergency vehicles access to streets when necessary. During the Car Free Days in Vancouver, "center lanes on the streets are kept clear and street blockades can be moved for emergency vehicles," according to Sam Reeves, the Executive Director of the Car Free Vancouver Society (personal communication, November 16, 2018). Also during these Car Free Days in Vancouver, several side streets leading to restaurants and other delivery-heavy businesses are blocked off with soft road closures, where traffic attendants allow commercial vehicles to complete their deliveries.

In Stellenbosch, closing off certain roads will affect different groups of people. For example, closing off roads around the university will affect more students and staff at the university than other residents of Stellenbosch. For several reasons, all the streets inside the car free zone cannot be blocked off with hard closures. There are certain people who will need access to the area at certain points. This includes emergency vehicles, possibly some delivery drivers, and those with disabilities who may need to drive their own car. From our observations and engagement with stakeholders, we were able to determine which streets in the car free zone could not be closed off completely. The streets we observed as having the most congestion during rush hour were Merriman Ave. and Dorp St. (observations, november, 2018). We counted 201 cars on Dorp St. and 329 cars on Merriman Ave. during 15-minute time intervals during the evening rush hour commute. This suggests that vehicle drivers depend on Merriman Ave. much more than they depend on Dorp St. Merriman Ave. is too essential to be fully closed, as it is a main access route to the R310.

Alternative Transportation Options

A Park and Ride service is a proven and successful method for dealing with motor vehicle drivers commuting into a car free zone. During the EcoMobility Festival in Sandton, minibus-taxis were used to shuttle commuters in and out of the car free zone. According to Elaine Jack, the City Improvement District manager of the Sandton Central Management

District, the festival runners used large, pre-existing parking lots for the Park and Ride locations, which "resulted in a great success," (personal communication, November 6, 2018). With commuters parking in the Park and Ride lots, they were then able to jump on public transit to get to where they needed to go while minimising traffic congestion in the festival zone (E. Jack, personal communication, November 6, 2018).

In Stellenbosch, the Taxi Association has participated in Park and Rides before and they have been successful, leading them to believe that these Park and Ride services would also be successful as a feature in a Car Free Day. Representatives of the Stellenbosch Taxi Association also added that a Park and Ride service involving many white students and residents would be a dramatic change, as they are not typical users of the minibus-taxis (personal communication, October 22, 2018). Near the CBD, the following areas depicted in Figure 21 have been identified as possible Park and Ride locations. All locations are large, pre-existing parking lots that are underused. The four Park and Ride locations can accommodate approximately 420 cars in total.

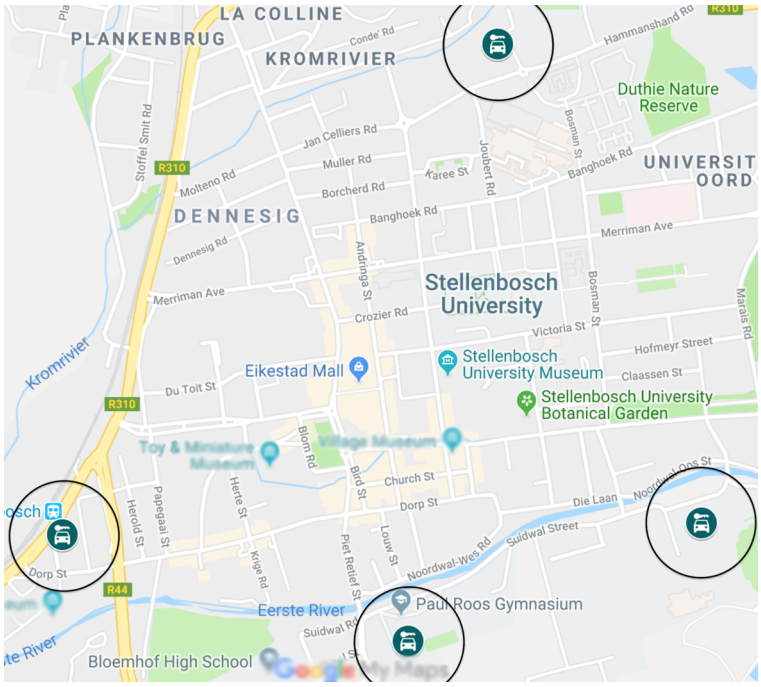

Figure 21: A map showing potential locations for Park and Ride Services.

Mellowcabs will also be used during the Car Free Day to shuttle people short distances within the car free zone. We interviewed the Director of Mellowcabs, Neil du Preez, to learn more about Mellowcabs' potential involvement in the Car Free Day. Neil du Preez described how his vehicles could be used to shuttle people short distances within the car free zone (personal communication, October 22, 2018). He also included that he would definitely be willing to offer a discount or promotion for the service during the Car Free Day to incentivize its use. According to Neil du Preez, Mellowcabs is working to create handicap-accessible vehicles, so that the people that cannot walk around during the day will have a

viable and sustainable option in terms of transportation (personal communication, October 22, 2018). With the Mellowcabs making trips throughout the car free zone, there will be a convenient and environmentally friendly transportation option for those that do not want to or cannot use other forms of non-motorized transport.

Cycling is another form of alternative transportation that will be encouraged during the day. There will be pop-up bike rental areas near the drop off locations of the Park and Ride locations. Mason's Bike Inn, located near the Eikestad Mall, has expressed interest in renting out their bikes for this purpose at a discounted price (local business representative 4, personal communication, November 15, 2018). A representative of Flandria Cycles, located outside of the car free zone on Andringa St., communicated that they would be interested in setting up makeshift bike repair shops in the zone, selling equipment such as bike locks at a discounted rate (personal communication, November 15, 2018). This will allow people to rent a bike, as well as a bike lock, when they get dropped off and be able to ride it during the day and drop if off when they leave to go back to the Park and Ride. In order for the Car Free Day to be successful, Richard Gordge, Director of Transport Futures, suggests to sell the benefits of NMT and since Stellenbosch is very flat, it is a perfect place for cycling (personal communication, October 30, 2018).

A Highly Disruptive Car Free Day Plan

A highly disruptive plan is the most aggressive option to raise awareness about congestion, the harmful effects of private vehicles, and the availability of alternative transportation options. This plan involves the area pictured in Figure 22 which includes the Mall on Andringa St. and a lot of restaurants and businesses located on Dorp St., Church St., and Plein St. This plan includes both hard and soft closures to address the issue of businesses needing deliveries on the Car Free Day. There are four Park and Ride locations for this plan because there are approximately 1400 parking spots displaced and these Park and Ride locations account for around 500 of those spots. This plan also involves bike rental programmes at the drop-off locations of the Park and Rides. The Mellowcabs will be available for use inside this car free zone as well, since it is a fairly large area. This plan involves a pedestrian only zone shown by the black line centered at the University since those roads won't be disrupted by possible deliveries.

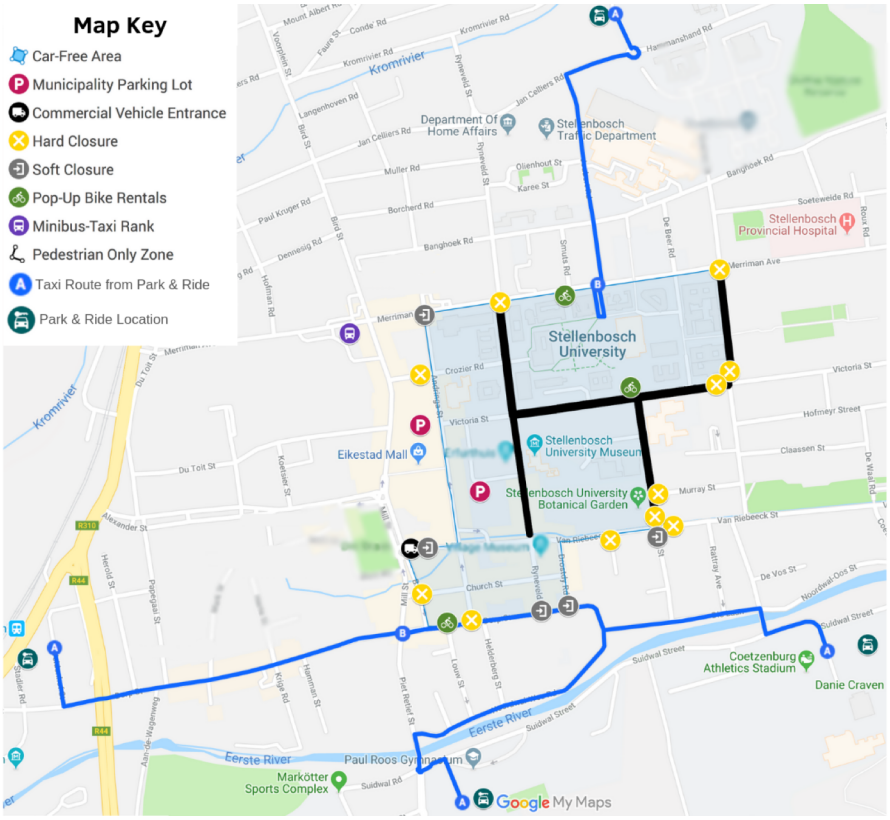

Figure 22a: Highly disruptive plan for a Car Free Day in Stellenbosch.

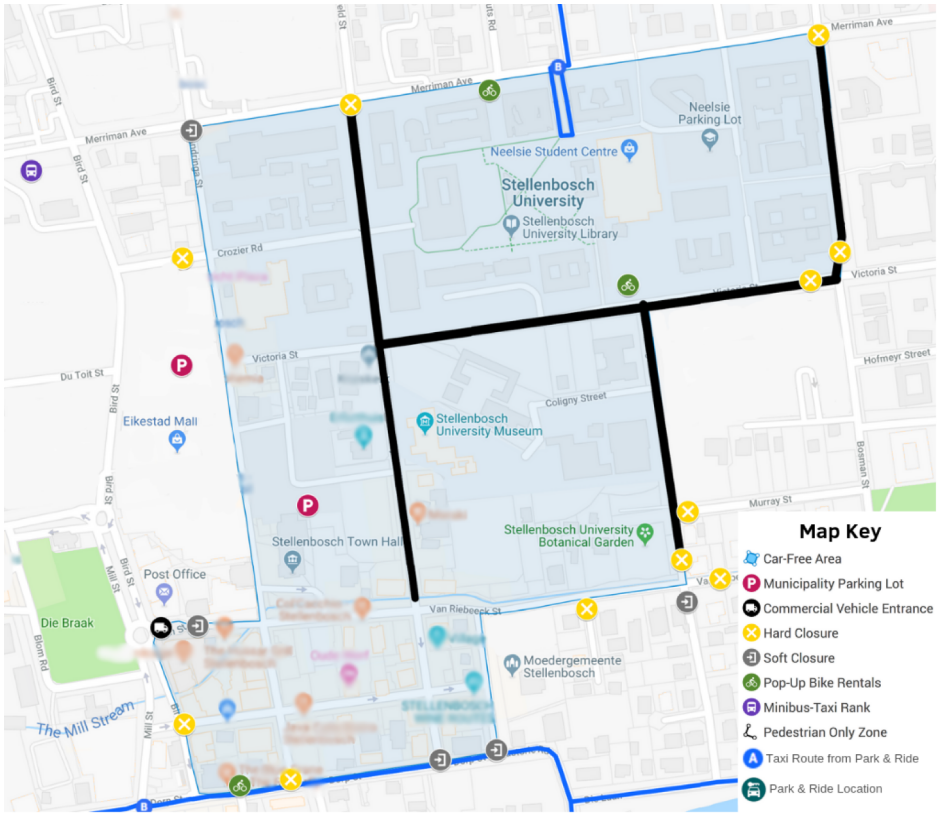

Figure 22b (zoomed in): Highly disruptive plan for a Car Free Day in Stellenbosch.

A Minimal Impact Car Free Day Plan

The minimal impact plan is highly focused around Stellenbosch University. The university community is the only group involved in this plan. This plan involves only one Park and Ride location at the parking lot next to Coetzenburg Athletics Stadium (see Figure 23). With the area being significantly smaller, the amount of parking that needs to be replaced is less. All of the closures would be hard closures, such as plastic jersey barriers as there is no need for businesses to receive deliveries. Due to the small area that is involved, if there were restaurants or stores that needed deliveries, it would be easier to organize an exception if necessary. The advantage of the minimal impact plan could be that it would allow the university to show that they are committed to bringing sustainable transport to Stellenbosch and show the municipality that a day like this is possible. The university can demonstrate how they can play a powerful role in the push for change to the congestion issues in Stellenbosch.

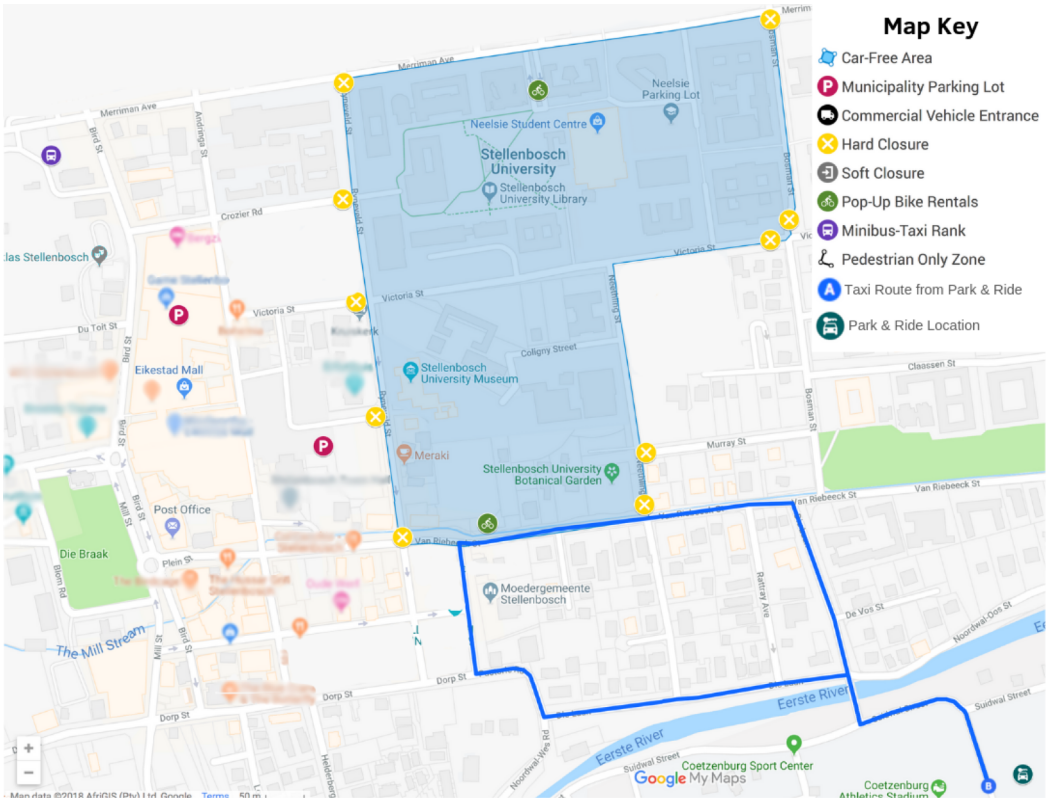

Figure 23: Minimal impact Car Free Day plan that is centered around Stellenbosch University.

This plan was developed to address concerns that emerged from engaging with businesses on Andringa St., as we were told that there was "no chance of closing down this road with the mall being here," (local business representative 4, personal communication, November 15, 2018) and that we would receive "a ton of resistance from the businesses in Stellenbosch Central," (local business representative 8, November 17, 2018). Several other businesses on Andringa Street expressed concerns with receiving deliveries, even with soft,

movable road closures. This plan is designed to address these concerns by excluding the majority of businesses in the Stellenbosch CBD, so they are not disrupted. The minimal impact plan is a great way to introduce the community to the idea of a Car Free Day, but the limited scope of the plan inhibits the ability for it to create lasting and sustainable change across the municipality.

The Proposed Plan for a Car Free Day in Stellenbosch

The proposed plan, pictured in Figure 24, is a compromise between the highly disruptive Car Free Day plan and the minimal impact Car Free Day plan. With this plan, the car free zone expands beyond the university to involve more of the community. Similar to the highly disruptive plan, there are four proposed Park and Ride locations, with pop-up bike shops and bike repair shops located near to the drop off points. This plan involves businesses on Church St. and Dorp St., both of which are highly pedestrianized (observations, November, 2018). All but one of the businesses that we talked to in this zone reacted positively to the idea of a Car Free Day (personal communication, November, 2018). Since this proposed plan would include about 62 restaurants and stores that could possibly need deliveries, there will be soft and hard closures surrounding the area (observations, December, 2018). The delivery routes that we have found to be most efficient, includes the most restaurants and stores but also the shortest route, as to make disruption to the rest of the area as limited as possible.

In Figure 24, the roads highlighted in black display a zone in which no cars are allowed (save for emergency vehicles), surrounded by hard closures, similar to the highly disruptive plan. The roads at the bottom of the zone are business-heavy streets, so soft closures are in place to allow commercial vehicles to perform their deliveries. Pop-up bike shops are located by the Park and Ride drop off points, with an additional bike shop located on the corner of Van Riebeeck St. and Drostdy St.

This plan addresses concerns regarding pushback from businesses in and around Eikestad Mall on Andringa St., as that section of the road is kept out of the car free zone, minimizing any delivery disruptions for those businesses. Unlike the minimal impact plan, this ideal plan would involve the Stellenbosch community outside of the university, which would provide a greater and more meaningful impact.

Following the presentation that we held with our stakeholders, we made some adjustments to our proposed plan to include the feedback we received. We found that those who would experience the most impact those who commute from outside of Stellenbosch, for instance, from Cape Town. When developing this plan we did not consider how minimal of an impact nearby Park and Ride facilities have on the commuter's travel. Hence, for this group of people, they would have already driven most of their commute to reach the Park and Ride locations, lessening their effectiveness. In order for the Park and Ride

effective, they would need to be located further from town. Johann van Rensburg, a lecturer in the Department of Logistics at Stellenbosch University and attendee of the proposed plan presentation, suggested that the facilities be located at various vineyards on the way into the CBD. By having the Park and Ride locations at vineyards, there is a potential for increased business for the vineyards' and other businesses that may have pop-up locations on property. With that being said, the proposed plan should be adjusted to include these further away Park and Ride facilities in order to have a great impact on the commuter.

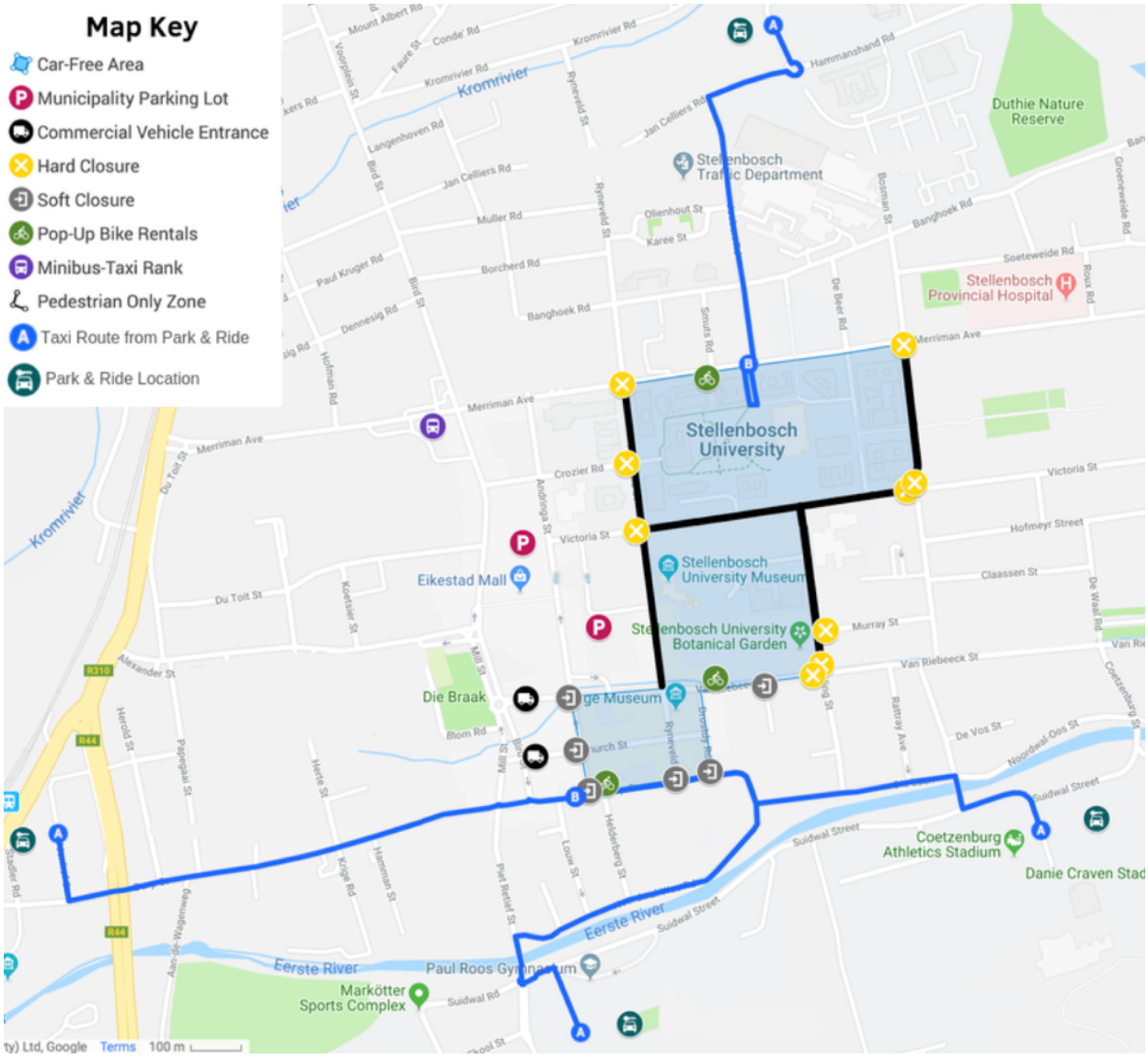

Figure 24a: The proposed plan for a Car Free Day developed as a combination of aspects from the highly disruptive and minimal impact plan.

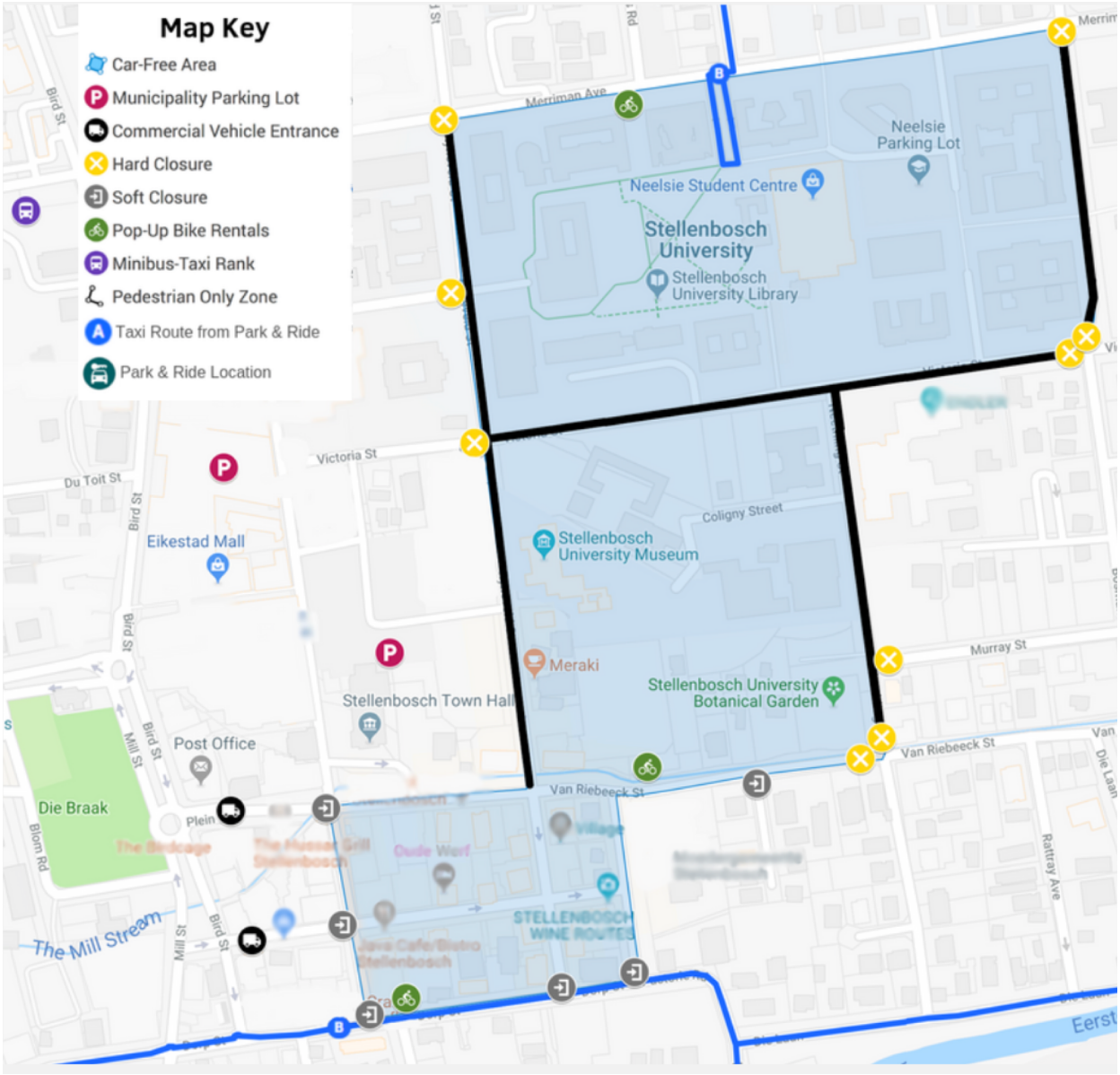

Figure 24b (zoomed in): The proposed plan for a Car Free Day developed as a combination of aspects from the highly disruptive and minimal impact plan.

A Cost-Benefit Assessment of a Car Free Day in Stellenbosch

Estimates from other Car Free Days indicate a range of 300,000 ZAR (21,019 USD) (Open Streets Cape Town) to 625,000 ZAR (43,790 USD) (Vancouver Car Free Day). These costs include road closures, security, alternative transportation, and lost income from parking.

Road closures

Road closure costs include traffic cones, plastic road barriers, and traffic signage. We estimate needing 30 traffic cones for the event, that cost around 150 ZAR (10.51 USD) each to purchase (Alsafe Traffic Cones, 2018) and an additional 45 plastic road barriers

that cost around 650 ZAR (45.45 USD) each to purchase (Armco Plastic Barriers, 2018). Considering necessary signage to divert traffic, we estimate 15 traffic signs are needed at a cost of 480 ZAR (33.63 USD) each (Traffic Signs, 2018). We have determined the total cost for infrastructure to be 40,950 ZAR (2,869 USD) for this Car Free Day.

Security

Representatives from the Vancouver Car Free Day indicated that security is a significant cost for their event, accounting for about 50% of their budget. In Stellenbosch, security is important to assist in the closing of roads, ensuring the commuters are safe in the minibus-taxis, and that cars are safely parked in the Park and Ride facilities. We assumed that the police of Stellenbosch will serve as the additional security needed for the day. Given average annual salaries of Stellenbosch police officers, we estimate a daily rate of 692 ZAR (48.49 USD) per work day (South African Police Services, 2018). With 15 road closures requiring one guarding officer, an officer stationed at each Park and Ride facility, and eight additional officers for patrol duties, we estimate a total cost for security of 17,310 ZAR (1,212 USD).

Minibus-taxi subsidies

We calculated the amount of money that a minibus-taxi earns each day at 1,750 ZAR (122.61 USD), based on estimates from 2016 ("How much money taxi drivers", 2016). With our proposed plan, we detailed four Park and Ride locations, with each having three minibus-taxis acting as shuttles. With twelve total minibus-taxis we arrived at the total cost of 21,000 ZAR (1,466 USD) needed to subsidise the use of the minibus-taxis at the Park and Ride locations.

Displaced parking

In the zone, there are approximately 1,400 street parking spots (observations, November, 2018). To park on the street, it costs 6 ZAR (0.42 USD) per hour (Stellenbosch Municipality, 2016). Given a Car Free Day that has a duration of 10 hours and assuming that most, if not all, of street parking is used on a normal day, the money lost from the displaced parking in the car free zone is equal to around 84,000 ZAR (5,885 USD). Parking attendants make roughly 164 ZAR a day, and around 21 parking attendants are employed on a daily basis (Average Parking Attendant Salary, 2018; Stellenbosch Municipality, 2016). We estimate that 3,465 ZAR (242.78 USD) will be lost from parking attendants in the zone losing work.

Additional cost considerations

Along with these costs come the legal costs associated with this Car Free Day, which we have estimated at a value of 2,500 ZAR (175.16 USD). This is an estimate based on liability event insurance that has been charged to similar events (Event Insurance, 2018).

In terms of an advertising campaign, we concluded that it could be done with minimal to no costs. The radio station MFM 92.6 agreed to have an on-air interview for free, and there are many social media pages, like EcoMaties and Stellenbosch University, that would be willing to advertise the day for free. However, an outside firm could be hired to handle the advertising of the day. The company Pretty Social will conduct a social media advertising campaign with packages ranging from 4350 ZAR (304.79 USD) and 8150 ZAR (571.03 USD) (Pretty Social, 2018).

Benefits

Benefits are more difficult to monetise. As indicated, there are social benefits to a Car Free Day, allowing people who ordinarily would not engage with one another to share an experience; reduced traffic congestion; exposure to sustainable transportation options; reduced traffic accidents; the health benefits of walking; reduced stress from traffic either while driving, walking, or riding a bike; cleaner air; and less noise. Estimates from other Car Free Days suggest that business within the zone can benefit from a 30% increase in sales given the increase in pedestrian and cyclist traffic (Khreis & Nieuwenhuijsen, 2018).

In terms of personal benefits for a commuter during a Car Free Day, an individual can save money on petrol, parking, and wear and tear on a vehicle as well as time saved by the commute. The average price of petrol in South Africa is 17.00 ZAR (1.19 USD) and the average car gets 6.3 litres per 100 kilometres (MyBroadBrand, 2018). If a Park and Ride was just 2 kilometres outside of the zone, a commuter could save 4.30 ZAR (0.30 USD) on the day. If the Park and Ride was increased to include the last 10 kilometre of their commute, the commuter can save 21.40 ZAR (1.50 USD) on the day. A car in South Africa loses 4.00 ZAR (0.28 USD) per kilometre driven (AA Rates and Costs, 2008). That means a 2 kilometre Park and Ride would save 8.00 ZAR (0.56 USD), and a 10 kilometre Park and Ride would save 40.00 ZAR (2.80 USD). Assuming the commuter has an annual parking pass therefore not paying for parking on a daily basis, participating in the Car Free Day would save the commuter between 12.30 ZAR (0.86 USD) and 61.40 ZAR (4.30 USD). Assuming the commuter pays for parking daily at 6.00 ZAR (0.42 USD) per hour for a nine-hour day (which would assume an eight-hour workday and lunch), a commuter would save an additional 54.00 ZAR (3.78 USD) on the day.

Conclusion

Recommendations

For a Car Free Day in Stellenbosch, we suggest using the proposed plan explained in the previous section. This plan allows the mall to remain largely unaffected while allowing the businesses in Stellenbosch Central to participate in a day they are excited for. The plan is also large enough to affect the university and the other areas of Stellenbosch, but it is not too large that people would be scared of participating. For these reasons, we have come to the conclusion that this plan is the most effective for the first Car Free Day in Stellenbosch. The next section below will go into the next steps to take to implement this plan.

Next Steps

Car Free Days have extensive considerations that are beyond what can be accomplished by students in a seven week term. We have outlined considerations and next steps for a Car Free Day in Stellenbosch.

Step 1: Decide a Date

The first thing that must be considered is deciding a date. A helpful strategy for starting a new initiative is to pair it with an already existing event. World Car Free Day is September 22nd. By pairing Stellenbosch's Car Free Day with this global day, the day becomes a part of a bigger picture. Stellenbosch would join the likes of Paris, France, Vancouver, Canada and New Delhi, India in showing that it is committed to promoting sustainable transport. Also, there is a cycling event in March that could be a great opportunity to pair with because a lot of people come into Stellenbosch and cause a greater amount of congestion than normal. Our recommendation for a date is in the month of October as it is transport month in South Africa. During the month of October, the South African government encourages "the Department of Transport and its entities [to] showcase transport infrastructure services" (Government of South Africa, 2018).

Step 2: Security Considerations

Security is a top priority during car free initiatives, as maintaining safety is a potential obstacle. During the Vancouver Car Free Days, security is the biggest cost for every event, as the safety of everyone involved is most important (S. Reeve, personal communication, November 16, 2018). During big events, people are easier to target for crimes such as pickpocketing. According to a Christopher Higgs, an owner of a private security company, "unsavory characters could take advantage" of a heavily used Park and Ride service, targeting people that seem confused by the change to their commute. Police

will need a strong presence in the car free zone as well as the Park and Rides to ensure the safety of the participants of the Car Free Day. If the safety of the participants cannot be ensured then a Car Free Day will cannot be successful. Before any plans for a Car Free Day can be continued, a detailed plan for the security of people, possessions, and cars must be developed.

Step 3: Stellenbosch Smart Mobility Lab Exploration

In February of 2019, the Stellenbosch Smart Mobility Lab at Stellenbosch University will be opening a traffic simulation model of Stellenbosch. This model will use historical data to show how vehicles will react to changes in road conditions including road construction, accidents or road closures. The model will be able to show how the Car Free Day plan will affect the traffic and show the routes people will take with the closures in effect. The data gathered from the lab will be invaluable in helping to understand how the day will work in Stellenbosch.

Step 4: Secure Funding

Car Free Days require large amounts of funding. Our recommended plan will require a budget to pay for security, the infrastructure to close off the streets, the attendants managing the barriers, the minibus-taxi service, and other expenses. Other Car Free Days have secured funding for their initiatives through grants, partnerships, and vendors (S. Reeve, personal communication, November 16, 2018). The most natural partners for a Car Free Day in Stellenbosch are the municipality and the university. Partnering with either of these two entities can help secure funding as well as influence. For grants, the Ecomobility Festival in Sandton had worked with ICLIE-Local Governments for Sustainability which helps local governments secure funding for sustainability initiatives (E. Jack, personal communication, October 29, 2018). Vendors can be any of the local businesses in Stellenbosch. Vancouver's Car Free Day uses the sale of street stalls to retail shops and restaurants to fund most of their day. With enough interest from local businesses, a large portion of funds could be raised from vendor stall sales.

Step 5: Schedule for Park and Rides

For the Park and Rides, a schedule must be agreed to with the Stellenbosch Taxi Association. Discussions with the Association must lead to an agreement on the number of taxis servicing each stop, the cost to run these, and the frequency that each stop will be serviced. Once these are agreed upon, the schedule must be placed online, so the people using the Park and Rides can know when the taxis will be operating.

Step 6: Blockade Considerations

To block off the roads, two considerations must be made. First the road block devices must be purchased, rented, or procured from the municipality. Our

recommendation is that jersey barriers are used for the hard closures and cones for the soft closures. The second is paying the municipality parking attendants to man the barriers and make sure only appropriate vehicles are entering the zones at the appropriate entrances.

Future Considerations

We recognize that the methods for our project have limitations, and through reflecting, we see that there are some things that we should have done differently. These considerations should be taken into account moving forward.

The stakeholder interviews were conducted by our two White male group members, Trevor and Jason, which may have had an influence on who was interviewed and the perspectives we received. The convenience sampling used for the interviews resulted in some shortcomings, as all of the interviews were conducted during weekdays between 9:00am and 3:00pm and in locations, which were next to coffee shops in the Eikestad Mall and on Plein Street, that were not representative of the total Stellenbosch population. This time frame also could have excluded people who work all day and don't leave for a lunch break. It is possible that there were unintentional biases made as the interviews were conducted, as a large portion of the people we spoke with looked similar to us, which may have contributed to a sense of comfort and mutual understanding. For example, all of the students interviewed were White females, which presents a complete lack of diversity within that stakeholder group. This was a consequence of the locations where our interviews took place. There is also some potential biases that existed among us and in the people that we talked to. Business owners proved very challenging to interview. Originally, we set out to interview business owners, but we had to expand our search beyond just owners to include managers as it was often unlikely for the owners to be available. Since we were interviewing from 9:00am to 3:00pm, many managers and owners did not have a lot of time to talk to us. In an attempt to accommodate for this, we shortened our interviews from the originally intended time of thirty to forty-five minute discussions to short five minute interviews with the business representatives. While this allowed us to reach more businesses, it limited the depth of answers that the owners and managers could give to us.

While we attempted to interview a variety of individuals about their perspectives of the Car Free Day, we did not make a sufficient effort to speak with more Black and Coloured individuals. With that being said, the information that we received from our interviews is not an entirely accurate representation of the Stellenbosch population. Since a large portion of those who commute into Stellenbosch without a vehicle for work are Black and Coloured individuals, it would be unethical to implement a Car Free Day without sufficiently providing them the time and ability to share their perspectives, as they are

impacted as well. In some ways, by not speaking with more of working class, Black and Coloured individuals, it is as though they did not have a voice in our plan. As a result, it is quite possible that there are certain aspects of the Car Free Day plan that do not adequately address their concerns.

Our survey did not work out as planned, as we were unable to send it out using Stellenbosch University's listserv. To combat this, we decided to make flyers that we placed around the university campus and also on social media that we thought would help us get the flyer out to the students and staff at the university. We only received 23 responses which is approximately 0.066% of the whole audience that it was aimed towards ("Statistical Profile," 2017). This was significantly less than our goal of around 350 responses. Contrary to our belief, the survey did not effectively serve the purpose of getting more quantitative data from those at the university. Ensuring that there is an adequate amount of time for a survey to be approved, sent out and taken is crucial. Finding other effective methods of distributing the survey is also important to get as many responses as possible.

With the road observations, we were limited to the number of streets we could observe during rush hour and so we picked the six locations shown in Figure 15. Looking back, we should have conducted another day or even days of observations both within the zone and on the streets just outside the zone. This would have helped to give us a more accurate picture of the congestion in Stellenbosch Central. With better observations, we could have witnessed a more accurate representation of where the minibus-taxis drive, as we didn't see many inside the zone during our observations. A larger area also could have been observed for the assessment of current infrastructure. While we made our best attempt to get the most accurate data from our observations as possible, there is certainly the potential of human error causing inaccuracies in our data.

We attempted to interview several representatives from other car free initiatives, but we may not have selected the appropriate methods to communicate. We contacted representatives from Car Free Days in Nairobi, Kigali, Ethiopia, and India through social media and email. These methods of communication, however, were not effective and did not result in us gathering any information about the components of their initiatives. Additionally, we did not send many follow-up emails or messages, as we felt it was best to just get the most information as possible from the Car Free Day representatives that were willing to answer our questions. If we had spent some more time looking for more contact information, we may have found different ways to reach the representatives, which could have helped us obtain more information about these Car Free Days.

Regarding the interviews with Mellowcabs, the Stellenbosch Taxi Association, and Stellenbosch Fiestry, we could have met with these individuals or groups to discuss our

plans throughout our time in Stellenbosch, as we did with our sponsors and advisors, to receive their feedback as we worked to develop our proposed plan. Especially since we did not have much knowledge and understanding as to how we were going to plan the Car Free Day when we first conducted these interviews because they took place on our first day of arriving in Stellenbosch.

Our cost-benefit assessment is based solely on assumptions that we made regarding information we found as it relates to the different components for the Car Free Day to be implemented. Initially, we planned on including a complete cost-benefit analysis, but our lack of familiarity and understanding of a cost-benefit analysis kept us from being able to achieve this. We did try to get in contact with an expert to possibly help us with conducting an analysis, but we were unsuccessful. We attempted to discuss a cost-benefit analysis with members of the Department of Logistics, but our inquiries were unsuccessful. We suggest that a detailed cost-benefit analysis should be completed for the Car Free Day and that an expert should be consulted.

While we received useful feedback from the stakeholders after our presentation, we did not host a true group forum, which was our initial intention. None of the team members had ever hosted a group forum before, thus impacting our ability to effectively create a dynamic environment for everyone to speak freely with each other. Unfortunately, we did not take the necessary steps to provide a sense of open communication, such as having everyone introduce themselves and explain their role in being present beforehand. As a result of our inability to create a setting for a group forum, we ended up with a presentation followed by comments and questions from the stakeholders. By not understanding how to host a group forum, we may have missed out on valuable feedback that would have been shared in a more open environment.

During our presentation to the stakeholders, it was suggested that we should have engaged more with the Stellenbosch Municipality officials. While we were hesitant to communicate with the municipality officials before creating a solid plan, we now recognise that establishing some form of communication would have been helpful, as the municipality owns a lot of data that could have benefited our plan. However, if students are to continue with this project, direct communication with the municipality is not recommended. We suggest that communication should be facilitated by individuals with an established relationship with the municipality, as students are more likely to be dismissed.

Johann van Rensburg suggested at the presentation that carpooling may be an option to help decrease congestion. Looking into the option, we found that it is a promising method in reducing congestion. According to a study at the Massachusetts Institute of Technology, carpooling “can reduce the number of cars on the road by a factor of three without increasing travel times” (Connor-Simons, 2017). While they are effective, we did not have time to work them into our plans. Carpooling could be a great service for Stellenbosch,

especially with large groups of faculty, staff, and students commuting from the same areas. A carpooling system could be implemented as a regular service in Stellenbosch, with a possible starting date coinciding with the Car Free Day and it would be worthwhile to explore implementing it for just one day.

Closing Remarks

A Car Free Day in Stellenbosch could help lead to a decrease in congestion, but it would only be a first step. It would cause private drivers, which is mostly the affluent White population, to step out of their comfort zones. In our recommended plan, we have private vehicle commuters making use of a Park and Ride service run by the minibus-taxis. With this, a lot of White commuters will be using a minibus-taxi for this first time. Since our recommended plan will utilize the minibus-taxi services and disrupt some of the normal routes, the regular, Black and Coloured users of the service would have their normal routes disrupted. This would be unfair to them as they are already living car free lives. While these changes are important, a Car Free Day is not guaranteed to fix the issue of social inequality between a racially segregated population. Our goal with the Park and Ride service was to get people to start using the minibus-taxis because it would be their only option. We later realized that if all the White people drive to the Park and Ride locations and the minibus-taxis are full of White people, this would not be an accurate representation of the day-to-day minibus-taxis.

There are also aspects that we may have missed completely because we still do not realize that they needed to be considered. However, we put forward our best efforts in developing a plan for a Car Free Day. The hope is that a day like this could bring awareness to the issues of congestion and transportation inequality, but it would not be an effective way of reversing the ingrained problems. While we accomplished our physical goal of planning a viable Car Free Day in Stellenbosch, we realize that there are social, less tangible goals of changing transport inequality and reducing congestion that are unattainable with this plan. A Car Free Day can help make progress in these areas, but it has its limitations. All in all, a Car Free Day alone is not likely to have a significant impact on ingrained challenges related to social inequality, racism, infrastructure, and resource limitations that exist in Stellenbosch. But, it is an important start to addressing these major issues.

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Appendix A: Semi-structured interview questions

We are a group of students from Worcester Polytechnic Institute in Massachusetts. We are conducting a survey of people's transportation habits and attitudes towards programs that address the challenges of private motor vehicle transportation, including Car Free Day initiatives. We believe this kind of research will ultimately highlight some of the burdens of transportation in the Stellenbosch area and identify approaches to alleviate these challenges.

Your participation in this survey is completely voluntary and you may withdraw at any time. Please remember that your answers will remain anonymous. No names or identifying information will be collected.

This is a collaborative project between the Stellenbosch University and WPI, and your participation is greatly appreciated. If interested, a copy of our results can be provided at the conclusion of the study. Please contact us at gr-CptCarFree2018@wpi.edu if you have any questions or concerns.

Interview Questions for Objective 1 - Commuters/Residents

- Are you a resident of Stellenbosch?
    - If not, do you commute into the town? How far is your commute into Stellenbosch?
    - What form(s) of transportation do you use around Stellenbosch?
- Do you regularly use any forms of public transportation in Stellenbosch?
    - How comfortable are you using public transportation? Walking? Cycling?
    - Do you use the local minibus-taxi service?
        - Why have you not used the minibus-taxi service?
        - If no, would you be open to ever using the service?
- Are there any streets that you view as problematic to your commute?
- What problems does congestion cause for you?
- Would you be willing to participate in a Car Free Day?
- What benefits do you see for the community from a Car Free Day?
- What are your biggest concerns about a Car Free Day?

Interview Questions for Objective 1 - Local Businesses

- What are your thoughts on a Car Free Day? For your business?
- Do you see any benefits for your business with a Car Free Day?
- Do you have any concerns for your business with a Car Free Day?
- Does your business get deliveries?
    - If yes… When?
    - Can you plan your deliveries around a Car Free Day?

Interview Questions for Objective 2 - CFD Reps

- What was your role in the Vancouver Car Free Day?
- How large of an area did your Car Free Day cover?
- How did you involve public transportation?
- Were forms of non-motorized transportation made available for the days?
- Was there a loss of parking on the closed roads?
    - If so, how do you make up for the displacement of parking?
- Did you use Park and Ride services that involved shuttling people into the car free zone?
    - If so, can you provide some details on how the service is run?
- What methods did you use to encourage participation?
- Were sidewalks altered for the days? If so, how?
- Which stakeholders expressed the most concern about the Car Free Day?
    - How were these concerns addressed during the Car Free Day?
- Has the initiative created an increase in sustainable transport since its conclusion?
- How were the days promoted prior to their beginning?
- What were the biggest obstacles that you encountered before and during the Car Free Day?
- What was your budget for a Car Free Day?
    - What are the largest expenses?
    - How are the Car Free Days funded?

Interview Questions for Objective 2 – MBT, Mellowcabs, Cycling Groups

- How do you feel about a Car Free Day for your organization?
- How can we make the minibus-taxis available to everyone in Stellenbosch?
- How comfortable are people using this form of transportation?
- How can this form of transportation be expanded upon?
- How could we incentivize this form of transportation during this initiative?
- How can negative perceptions of this form of transportation be mitigated?

Appendix B: Online Survey Questions

We are a group of students from Worcester Polytechnic Institute (WPI) in Massachusetts, USA. We are conducting a survey on people's transportation habits and attitudes toward programs that address the challenges of private motor vehicle transportation, including Car Free Day initiatives. We believe this kind of research will ultimately highlight some of the burdens of transportation in the Stellenbosch area and identify approaches to alleviate these challenges.

Your participation in this survey is completely voluntary and you may withdraw at any time. Please remember that your answers will remain anonymous. No names or identifying information will be collected. For filling out this survey, you can choose to enter yourself into a raffle for one of four gift cards valued at R100 by entering your email at the end of the survey. Your email will be used solely for the purpose of the raffle should you choose to enter.

This is a collaborative project between Stellenbosch University and WPI, and your participation is greatly appreciated. Our group can be contacted via email: gr-cptcarfree2018@wpi.edu

Question 1 - Are you a student, staff or faculty?

- Student
- Staff
- Faculty

Question 2 - Where do you live?

- Residential School Housing/On Campus
- Less than 5km from campus
- 5-15km from campus
- 15-25km from campus
- More than 25km from campus

Question 3 - How often do you use each of the different forms of transportation per week? (You may repeat numbers if necessary)

- Walking insert # (0-7 Days)
- Biking insert # (0-7 Days)
- Drive Private Motor Vehicle insert # (0-7 Days)
- Rideshare/Ride as passenger insert # (0-7 Days)
- Minibus-Taxi insert # (0-7 Days)
- Carpool insert # (0-7 Days)
- Other – (please write in answer) insert # (0-7 Days)

Question 4 - Use the scroll on the right to indicate how happy you would be to participate in a Car Free Day.

Question 5 - Rank your interest in these aspects of a Car Free Day
(Very Uninterested, Uninterested, Neutral, Interested, Very Interested)

- Reducing Traffic and Congestion
- Improving Safety
- Promoting Public Transportation Use

Question 6 - How likely would the following incentives influence your participation in a Car Free Day?
(Much Less Likely, Less Likely, Neutral, More Likely, Much More Likely)

- Discount/Coupon from local business
- Free Transportation around the town (shuttle service, minibus-taxis, etc).
- Free Bike Rental
- Activities or local artist performances

Question 7 - Is there a way for you to get to campus without driving your own vehicle?

- Yes
- No
- Don't Know

Question 8 - If you are not able to bring your private vehicle into the CBD of Stellenbosch, which mode of transportation would you most likely use to get around town?

- Minibus-Taxi
- Walking
- Biking (own or rental)
- Shuttle
- Other - (please write in answer)

Question 9 - Are there any streets that you see as essential to your commute?
Type in a short answer response

Question 10 - What is your biggest concern about a Car Free Day?

- Finding parking outside the car free zone
- Finding an alternative mode of motorized transportation
- Finding an alternative mode of non-motorized transportation
- Other - (please write in answer)

Question 11 - Enter your email below if you would like to enter the raffle for one of the four gift cards valued at R100.
Type in a short answer response

Link to the survey: http://wpi.qualtrics.com/jfe/form/SV_aVvg6xl6MLk4c17

Appendix C: Observations

Evening Observations (PM)

Street Name	Intersection of Bird & Dorp	Intersection of Plein, Bird & Mill	Cnr. Andringa & Victoria to Cnr. Andringa & Crozier	Merriman & Bird	Merriman & Bosman	Intersection of Victoria & Ryneveld
Time Interval	3:27-3:43	3:53-4:08	4:14-4:29	4:36-4:51	5:02-5:17	5:20-5:35
# Cars	201	122	116	329	93	91
# Bikes	7	2	5	10	13	8
# Pedestrians	82	107	118	168	123	88
# MBT	5	2	3	18	8	0

Morning Observations (AM)

Street Name	Intersection of Bird & Dorp	Intersection of Plein, Bird & Mill	Cnr. Andringa & Victoria to Cnr. Andringa & Crozier	Merriman & Bird	Merriman & Bosman	Intersection of Victoria & Ryneveld
Time Interval	7:09-7:19	7:23-7:33	7:39-7:49	8:09-8:19	8:29-8:39	7:52-8:02
# Cars	50	130	75	91	92	104
# Bikes	1	4	4	4	12	6
# Pedestrians	27	37	36	68	181	32
# MBT	13	20	1	38	8	1

Appendix D: Gender and Race of Street Interviewees

Identifying Tables of Interviewees

		Gender		Race		
Interviewees	**N**	**Male**	**Female**	**White**	**Black**	**Coloured**
Residents	7	3	4	5	1	1
Local Business Representatives	12	7	5	9	2	1
Commuters	5	3	2	3	0	2
Private Vehicle Users	5	3	2	4	0	1
Public Transportation Users	5	2	3	0	1	4
NMT User	5	3	2	3	1	1
Students	6	0	6	6	0	0