GAUTENG PROVINCE
Department: Roads and Transport
REPUBLIC OF SOUTH AFRICA

Household survey of the impact of COVID-19 on mobility in Gauteng Province – West Rand District

Final Report

24 October 2022

FOREWORD BY THE MEC FOR ROADS AND TRANSPORT IN GAUTENG PROVINCE

Our Smart Mobility 2030 vision requires a government that is agile and responsive to societal changes. The quality of government response is also critically dependent on evidence-led interventions. It is in this context that I requested the Department of Roads and Transport to critically look at the short to long term impact of COVID-19 on mobility in the province. The survey results show that society in Gauteng Province is indeed dynamic. In the short term, the various lockdown restrictions led to major and significant declines in travel. This had a negative impact on revenues for public transport. The demand for road space was also reduced.

The survey indicates that the province is recovering to pre-pandemic levels. The structure of the travel demand remains largely the same. However, the volume of travel for some travel purposes remains relatively subdued. The decline in the use of the high capacity public transport services is concerning. Nevertheless, it is encouraging that society in the province aspires to use higher capacity services and non-motorised transport modes. The province will continue to work with local government bodies to ensure that the results of the survey inform their responsibilities as planning authorities. Through investing in surveys such as this one, the province fulfils its constitutional mandate of ensuring that local government works as it should.

Our Smart Mobility 2030 strategy requires that the province invest in appropriate technology to enable government and society to plan and respond better to system shocks such as pandemics. A large proportion of the population remains very vulnerable to system shocks. Consequently, government needs to use the results of the survey to ensure that public transport is appropriately financed. Investment in better non-motorised transport infrastructure is absolutely necessary.

The efforts of the provincial staff and the CSIR to carry out a survey of this kind are acknowledged. I would also like to thank the many Gauteng households who welcomed us into their homes under very difficult circumstances.

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EXECUTIVE SUMMARY

The COVID-19 pandemic and the associated responses by the South African government had a major impact on household travel patterns. The report presents the results of a survey in the West Rand of Gauteng Province to help determine the short to long-term impact of the pandemic on household mobility in the province. The survey results supplement the results of the 2019/2020 household travel survey that was completed just before the initial lockdown restrictions. The report documents the survey objectives, scope of work, methodology, survey results and detailed technical discussions. Analyses of the survey results were undertaken to confirm the statistical significance of changes in mobility patterns relative to the baseline.

The overall Gauteng survey sampled 4 000 households spread throughout the metropolitan and district municipalities of the province. The survey resulted in a weighted total of 4 951 138 households. The data included information on: (i) households; (ii) people in households; (iii) trips taken by people in households; (iv) mode of transport used by individuals in households; and, (v) individual perceptions regarding future travel.

Indications are that the structure of household travel will stay mostly unchanged post-COVID-19 in the province. Cars and commuter taxis continue to be essential modes of transport. The private car remained a dominant mode of travel for all purposes both before and during COVID-19. Bus accounted for very low trips before and during COVID-19. Other modes that will be important for work, education, shopping, and medical purposes in future are the bus, commuter taxi and walking all the way.

While the structure of trips remains largely the same, travel volumes for some trip purposes have changed. The volume of recreational trips, for example, has reduced. Other trip purposes, such as seeking health services, have experienced a marginal increase. Overall, the peak intensity has reduced and off-peak travel has marginally increased. However, the recovery trajectory may soon dwarf the subdued travel demand. This requires that planning authorities in the province should continue with the implementation of road network, public transport and integrated transport plans that they had before the COVID-19 outbreak.

The table below summarises some of the key findings from the West Rand survey and their noteworthy implications.

Dimension	Findings	Implications
Travel Characteristics Before and During COVID-19	Walk all the way, private car and commuter taxi remained dominant modes of travel in the district for all purposes both before and during COVID-19. Higher capacity vehicles such as train, Gautrain and bus were less utilised and accounted for less than 1% and 4% respectively.	Spatial planning and settlement patterns in the province are not taking advantage of high capacity public transport modes. The frequency and density of higher capacity public transport modes should be continuously reviewed to respond to changing travel patterns.
	Walk all the way was the main mode of transport for education, medical and other purpose trips and was used by a significant proportion of residents in the West Rand both before and during COVID-19.	Provision of non-motorised transport infrastructure should be prioritised to improve transport service delivery in the province.
	There was no notable change in departure time and trip duration for the different trip purposes before and during COVID-19.	Morning peak, off-peak and afternoon peaks in the province will likely stay as they were prior to COVID-19.
Future Travel Perspectives	A large proportion of people will continue to work from home (about 65% of workers indicated that they are likely to continue working from home).	Long-term road network plans in the province should continue. Investment in public transport, non-motorised transport and travel demand management measures should continue.
	A large proportion of students will continue with contact classes (about 97% of students are most likely to have contact classes).	
	A large proportion of people will continue with physical shopping (about 95% of people are most likely to continue with physical shopping).	
	The commuter taxi will continue to be used as a main mode of transport for most trip purposes in the future. Other	

Dimension	Findings	Implications
	modes that will carry substantial trips for work, education, shopping, and medical purposes in future are “bus”, “commuter taxi” and “walk all the way”.	
Answering Key Research Questions	The statistical analyses confirm that the majority of people will continue to travel to work, education, shopping and medical purposes using the same method as they used prior to COVID-19. Trips generated by travel for these purposes in future will not be significantly different from trips generated before COVID-19.	Long-term road network plans in the province should continue. Investment in public transport, non-motorised transport and travel demand management measures should continue.

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LIST OF ABBREVIATIONS

CASI	Computer Assisted Self Interview
COVID-19	Coronavirus Disease 2019
CSIR	Council for Scientific and Industrial Research
EA	Enumerator Area
GDRT	Gauteng Department of Roads and Transport
GHTS	Gauteng Household Travel Survey
HHTS	Household Travel Survey
PSU	Primary Sample Unit
SANRAL	South African National Roads Agency
SSU	Secondary Sampling Units
TAZ	Transport Analysis Zone
VDS	Vehicle Detector Station
WFH	Work from Home

DEFINITIONS

Future Travel Perspectives:	Anticipated trip patterns for the period after the COVID-19 pandemic.
Household Income:	Gross monthly income of a household (including salaries, wages, pensions, and any other income of members of the household).
Household Size:	Number of persons staying in the household at least four nights per week.
Informed Consent:	The sharing of the project details with respondent before agreeing to participate in the survey questionnaire.
Low Response Rate:	Households providing limited or little information in response to the survey questionnaire.
Non-Response:	Complete refusal by households to provide responses to the survey questionnaire.
Other Trip Purpose:	Trip purpose other than for work, education, shopping and medical. These include travel to visit family and friends, recreational places, places of worship, welfare offices and government offices.
Replacement Sample:	Selection of an alternative household in the vicinity of the originally selected household due to its unavailability or refusal to participate.

1. INTRODUCTION

Following the release of the 2019/2020 household travel survey in October 2020, the Gauteng Province Department of Roads and Transport (GDRT) deemed it necessary to commission the CSIR to carry out a supplementary survey of West Rand to unravel the short to long-term impact of COVID-19 on baseline mobility in the province. The report documents the outcomes of the supplementary survey. It contains the survey objectives, scope of work, methodology, survey results and technical discussions.

2. BACKGROUND

The GDRT completed data collection for the 2019/20 household travel survey of West Rand in March 2020, just before the declaration of the national state of disaster in response to the global outbreak of COVID-19. The regulations that were promulgated in line with the state of disaster included the imposition of travel restrictions, as well as the closure of schools and minimisation of non-essential travel. The loading of passengers on public transport vehicles was also restricted. A risk-based relaxation of nationwide lockdown regulations was implemented over time, from alert level five (intensive restrictions) to alert level one (minimal restrictions).

Ordinarily, each alert level affected household travel differently. Fundamentally, the travel behaviour of households in the province may be significantly altered, temporarily and permanently, thus warranting the supplementary survey.

The 2022 Quarter 1 Labour Force Survey (Statistics South Africa, 2022) reports that, by March 2022, most workers worked from their usual place of work in both Q4: 2021 and Q1: 2022, with only 6.2% of workers indicating that they worked from home, particularly in Gauteng and the Western Cape. Nonetheless, many businesses around the world are adopting flexible work arrangements. Similar arrangements are being adopted by the education sector. Such changes may impact on land-use development, trip generation, and how infrastructure and services should be planned, designed and operated.

Table 1 summarises the different alert levels implemented in South Africa from 2020 to 2022 and the corresponding time periods.

Table 1: Lockdown alert levels in South Africa

Lockdown alert levels	Start date	End date
Level 5	26 March 2020	30 April 2020
Level 4	1 May 2020	31 May 2020
Level 3	1 June 2020	17 August 2020
Level 2	18 August 2020	20 September 2020
Level 1	21 September 2020	28 December 2020
Adjusted Level 3	29 December 2020	28 February 2021
Adjusted Level 1	1 March 2021	30 May 2021
Adjusted Level 2	31 May 2021	15 June 2021
Adjusted Level 3	16 June 2021	27 June 2021
Adjusted Level 4	28 June 2021	25 July 2021
Adjusted Level 3	26 July 2021	12 September 2021
Adjusted Level 2	13 September 2021	30 September 2021
Adjusted Level 1	1 October 2021	4 April 2022
National State of Disaster Lifted	5 April 2022	–

Restrictions relating to commuter travel by public transport for each alert level as per the regulations were as follows:

- Level 5
    - People not allowed to leave their homes except under strictly controlled circumstances such as to seek medical care, buy food, medicine and other supplies or collect social grants.
    - All passenger rail services ceased to operate.
    - Special trips, such as for funerals and essential work, require a permit.
    - Transport of passengers by bus prohibited except for the purposes of ferrying passengers rendering essential services.
    - A public transport sedan limited to carrying not more than 50% of its permissible passenger carrying capacity.
    - Minibus taxis not allowed to carry more than 70% of their maximum licensed passenger seating capacity.

- Level 4
    - Bus and minibus taxi services to not carry more than 70% percent of their licensed capacity for long distance travel (200km).
    - Bus and taxi services to only carry 100% of their licensed capacity for any trip not regarded as long-distance travel.

- Levels 1, 2 & 3
    - Long distance public transport permitted to operate.
    - Bus and taxi services to not carry more than 70% of their licensed capacity for long distance intra-provincial and permitted inter-provincial travel (200km).
    - Bus and taxi services allowed to carry 100% of their licensed capacity for any trip not regarded as long-distance travel.
    - E-hailing and metered taxis to remain at 50% loading capacity.
    - Shuttle, chauffer, and charter services to remain at 50% loading.
    - Gautrain allowed to operate at 70% capacity.

3. SCOPE OF WORK

The project to carry out the household survey of the impact on COVID-19 on mobility in Gauteng Province commenced in August 2021, and comprised the following key tasks:

- **Task 1 – Project inception**: Initiation of the project required the creation of a project execution plan that detailed the work breakdown structure, resources, project risks, project budget, and cash flow strategy. Following an inception meeting, the GDRT was presented with an inception report for adoption.
- **Task 2 – Selection of key variables**: A set of key variables were preselected by the project team as primary indicators. These included trip origins and destinations, travel cost, travel time, and modes of travel – all measured relative to the baseline.
- **Task 3 – Collation of secondary data**: The project team collated secondary mobility datasets for Gauteng Province to provide some indication of how the key variables have changed during different alert levels relative to the baseline. A report on altered mobility patterns was compiled from the secondary datasets.

- **Task 4 – Field instrument design:** The project team designed an appropriate survey instrument that incorporated key variables. The instrument was designed to allow respondents to indicate how the key variables have changed relative to the baseline. The deliverable from this task was a survey instrument in the form of a questionnaire.
- **Task 5 – Field survey design and methodology:** These preparations took the form of:
    - Formulation of a sampling strategy and survey plan. The project made use of the 2019/20 sample of 37 000 households and the original sampling frame to derive the sample for the supplementary survey.
    - Selection of an appropriate technology platform.
    - Coding/programming of the questionnaire, information and communication and firmware system design.
- **Task 6 – Obtaining research ethics clearance:**
    - The CSIR Research Ethics Clearance procedure is required when research/projects involve surveys. The application process required presenting a detailed survey methodology, Enumerator Protocol, CVs of the key project team members, a project agreement/contract, an ethics declaration by each project team member, and the questionnaire.
- **Task 7 – Procurement of specialist service provider for field surveys:** Specialist field work service providers were procured to executive the survey.
- **Task 8 – Pilot survey:** To assess the survey instrument, the service provider's operating capability, and associated logistics, a pilot survey was conducted. Each region had fifty households for the pilot survey. Based on the findings of the pilot survey, necessary changes to the questionnaire were made.
- **Task 9 – Full survey:** The target sample size for the supplementary survey was 10 percent of the 2019 sample size of 37 000 households, and amounted to 4 000 households for the province. During the COVID-19 epidemic, home visits were deemed high risk and the CSIR evaluated alternative survey approaches. The field investigation was conducted in accordance with COVID-19 safety guidelines.

- **Task 10 – Data consolidation:** Responses from the survey were instantly uploaded to the CSIR server. The quality of the data was reviewed daily, and the service provider's performance and compensation were based on data quality and the survey's proportional progress.
- **Task 11 – Data analysis:** The data were analysed and the findings presented in a narrative report with charts and tables.
- **Task 12 – Reporting:** The GDRT was provided with a draft technical report for review, followed by a final report.

3.1 Study Area

The overall survey was carried out in Gauteng Province and its municipal boundaries were used as the basis for defining the survey region. The study area is shown in Figure 1.

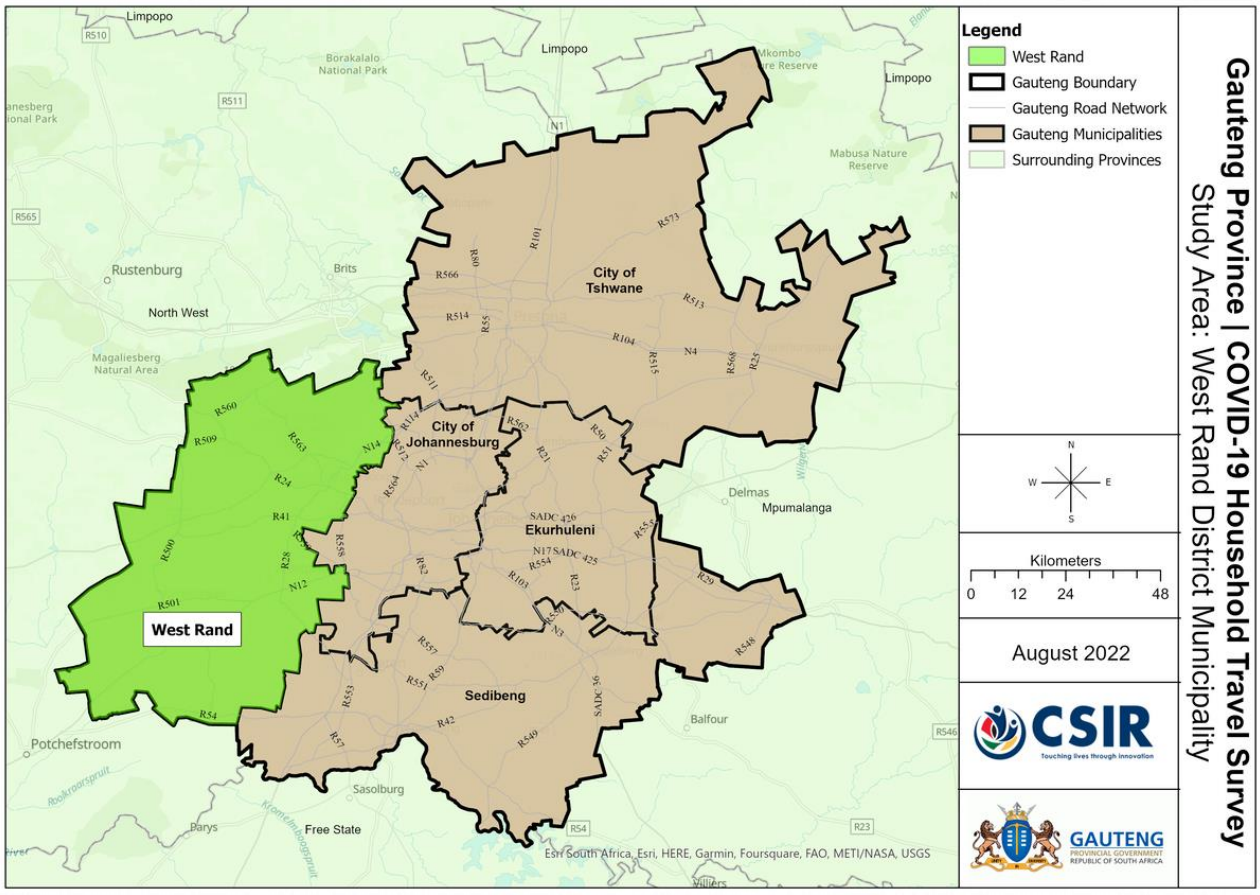

Figure 1: Study area

4. LITERATURE REVIEW

This chapter reviews published literature on the effect of the COVID-19 pandemic on travel behaviour. It is based on a synthesis of published research and empirical observations across the globe and in South Africa.

4.1 Insights from Previous Studies

Since the emergence of the global Corona Virus Pandemic in December 2019, studies have been conducted to examine the changes in mobility patterns (most notably: Abdullah, 2020; Aloi et al., 2020; Balbontin et al., 2021; Beck and Hensher, 2020; Hensher, 2020; Nurse and Dunning, 2020; Paul, Chakraborty and Anwari, 2022). These studies focus on the impact of the pandemic on transport demand and the changes in the number of trips to workplaces, retail centres, schools, and recreational centres – demonstrating changes in mobility patterns and notable reductions in the number of trips for trip purposes due to measures such as stay at home and social distancing emanating from COVID-19 regulations. For instance, after the United States of America implemented non-medical measures to restrict the spread of the virus, Lee et al. (2020) found a decline in the average number of kilometres travelled per person. Prior to and during the pandemic, researchers have focused on changes in trip purpose, mode choice, trip frequency, distance travelled, and public transit occupancy.

Recent studies on the effects of the pandemic on travel patterns and activities have revealed a correlation between household income and the frequency of teleworking. For instance, Lui et al. (2020) found that states with higher income levels in the United States of America have a bigger proportion of individuals who work from home. Despite the removal of travel restrictions, a significant proportion of persons with high incomes have continued to work from home (WFH).

Beck and Hensher (2020) examined the impact of the pandemic on household travel behaviour during the initial phases of the Australian government's implementation of extreme travel restrictions. According to Beck and Hensher (2020), the number of persons taking workplace trips decreased significantly, and most trips were for shopping.

There was a distinct shift in mode choice from public transport to private and non-motorised means of travel. According to the findings of a study conducted by Matson et al. (2022), significant shifts from traditional commutes to teleworking are occurring, as is an increase in the use of online shopping and home delivery services, an increase in the number of leisure trips by non-motorised transport, and there are significant variations across socioeconomic groups.

Notable South African mobility studies conducted during the course of the pandemic include a study by the University of Pretoria which sought to investigate the changes that are likely to happen as a result of the pandemic in South Africa (Venter et al., 2021). The study entailed a survey of 1 000 Gauteng residents to investigate the impact of the pandemic on mobility patterns. The survey was administered through an online questionnaire during the government alert level 1. Google and Apple tracking of mobility trends from January 2020 to December 2020 were also used to compare current mobility to the pre-COVID era. It was observed that stay at home activity was higher during the pandemic than before the pandemic. Work commuting declined when compared to the pre-COVID era. Venter et al. (2021) attributed the decline in work-based trips during the pandemic to the increase in WFH and job losses. “White collar” workers falling within the categories of professionals and managers preferred to work from home. This is consistent with most of the studies that indicate a similar preference among “white collar” workers.

The outbreak of the pandemic had an impact on a variety of factors relating to travel behaviour, most notably the mode of transport that people prefer. People's concerns about getting infected with the virus led to a change in their preferred means of transport. During the pandemic, mode shift was the subject of investigation in several studies. For instance, Das et al. (2021) demonstrated that the socio-economic features of commuters, such as age, gender, and monthly income, tend to have a substantial influence on the preferences for switching modes of transport. During the pandemic, it was revealed that commuters from low-income households continued to utilise public transport, while commuters from high-income households shifted from utilising public transport to using private and non-motorised transport. A study by Loa et al. (2021) in the City of Toronto, Canada examined the effect of the pandemic on mode choice and reported a decline in public transport ridership for non-essential trips.

The study further observed that most public transport users who owned a private vehicle shifted to car-based trip making. However, this was not the same for people who did not own a private car and who were observed to continue using public transport in order to fulfil their non-essential travel activities. Wang et al. (2021) reported a drop in public transport trips and an increase in public transport trips during the different periods of the pandemic.

Recent research by Transurban (2021) found that people in Brisbane, Sydney and Melbourne expect to be using public transport 21 percent less than at pre-pandemic levels, and to use private vehicles 5 percent more than pre-pandemic levels in the future. This is understood to be a direct result of a shift in preferences to avoid public transport in favour of private vehicles, even when the public health risk of active community cases has passed.

Lockdown measures have also had an impact on the frequency of trips in relation to trip purpose. Recent studies indicate that one of the trip purposes that have experienced changes in the frequency of trips was workplace commutes. Many countries experienced a sharp decline in the frequency of trips for workplace purposes at the peak of COVID-19 lockdowns when compared with pre-COVID-19 trends. For most, work trips traditionally account for a large proportion of trips on the transport network. For, example one out of five trips are work commutes. Indications from empirical studies in most countries are that COVID-19 has significantly impacted the traditional workplace commute in terms of trip frequency. These emerging shifts emanating from the COVID-19 pandemic have the potential to change the nature of transport networks. The decline in workplace trips have related mostly to office based white collar jobs, where staff and businesses have adopted WFH measures in response to the lockdown measures. These trends are having an impact on when, where, and how people travel to their workplace. Indications are that a reduction in white-collar workforce trips drove a significant decline in public transport patronage, particularly to and from CBDs during 2020 and 2021. Even after the pandemic has ceased and lockdown restrictions have been lifted, indications are that this cohort of workers has preferred to continue WFH. The assumed implications have been a reduction in work based commuting frequency after the pandemic when compared to before the pandemic (Rafiq et al., 2022; Hensher et al., 2022). Although it is unclear whether work-from-home arrangements will continue to be commonplace, it is proving to be something that workers want moving forward.

Due to the implementation of lockdowns, restrictions on out-of-home activities, and other physical distancing requirements, many cities in the world have seen an increase in the number of people adopting new methods of shopping and in particular the use of online shopping. This has in turn impacted on the frequency of traditional shopping commutes.

Jameel et al. (2022) investigated the impact of the COVID-19 restrictions on shopping trips in the urban areas of Baghdad, Iraq. The study examined changes in trip frequency, mode choice, trip distance and time of trip for shopping trips in the city. Respondents were reported to be making fewer trips to physical grocery stores.

4.2 Insights from Previous South African Household Travel Surveys

Since 2000, the GDRT has conducted three household travel surveys to better understand the mobility patterns of residents within the province. This section of the literature review attempts to provide some key findings and indicate how the previous surveys relate to the current supplementary survey.

Overall, a Household Travel Survey (HHTS) collects information on travel behaviour at a household level. The impact on travel behavioural changes since the emergence of the COVID-19 pandemic has resulted in a break in travel trends as witnessed across the globe, and South Africa is no exception. Gauteng Province now has travel survey datasets for 2000, 2014, and 2019/20 (also referred to as GHTS 2000, GHTS 2014, and GHTS 2019 respectively). The three surveys have created a reference baseline.

4.2.1 Trip Making Trends

The GHTS 2019 survey for West Rand showed that over 66% of households do not have access to a car, making public transport service delivery a basic need. Walking all the way accounted for 30% of the peak-period trips, minibus taxis accounted for 17% of all peak-period trips and private cars for just over 30%. Higher capacity trains and buses account for less than 1% of the peak-period trips. Households did not use higher capacity travel modes because of the high taxi fares, the unreliability of trains and low train speeds.

During the pandemic the government instituted measures and regulations that relate to the operations of public transport modes which required operators to reduce their licensed passenger capacity. For example, railway services of PRASA were suspended whilst Gautrain was only allowed to carry a reduced number of passengers.

Suggestions are that the pandemic and the accompanying alert levels significantly impacted the use of high-capacity modes of travel.

4.2.2 Travel Time

In Randfontein, the more rural area of the West Rand, 70% of the household members walked all the way for various trip purposes. On average, walking all the way was 50 minutes one way and accessing public transport from trip origins took 12 minutes. On the other hand, accessing destinations from public transport stops took on average 11 minutes. Such access times are among the shortest in the province.

At a provincial level, an analysis of travel time trends over the past 20 years indicates travel time has increased for commuters. On a typical working day travel time increased by 17% from 46 minutes in 2014 to 57 minutes in 2019/20. Overall, average travel time over the past 18 years has almost doubled. Associated with this, many more commuters choose to travel either earlier or later to avoid the peak. Travel times are particularly high for public transport trips and have deteriorated markedly for buses.

4.2.3 Cost of Transport

About 46% of West Rand households spent more than 10% of their household income on public transport, which was one of the lowest levels of expenditure in the Gauteng Province.

Provincially, the proportion of household income spent on public transport has increased. Nearly 60% of households spent more than 10% of their income on public transport in 2019, up from 55% in 2014.

4.2.4 Number of Working Days

Provincial findings of the 2019 household travel survey indicate that more people are working fewer days a week. The number of persons per household working the typical five days a week decreased from 68.7% in 2014 to 62.5% in 2019/20.

The emergence of the pandemic possibly exacerbated this situation with people making fewer trips to their workplaces due to the restrictions imposed. In most cases, it has been observed that businesses, especially those with white-collar employees who are permitted to work from home, have adopted the model of remote work. This could further impact the number of people traveling to work.

4.2.5 Trip Purpose

In the West Rand region, work trips accounted for about 40% of total morning peak-period trips, and education-related trips about 13%. It is, however, possible that education trips were underreported by households, resulting from ethical considerations associated with reporting on minors.

The COVID-19 pandemic has led to changes in the types of trips that travellers make and their frequency in the province. A total of 54.2% of the estimated morning peak-period trips in Gauteng province were reported to be for work and education purposes in the 2019/20 household travel survey.

4.2.6 Public Transport Trips

In the West Rand region, users were generally more satisfied than dissatisfied with bus services and with the distance of bus stops from their workplace.

According to the provincial trends in the GHTS 2014 and GHTS 2019, provincial indications were that the total number of public transport trips showed a decline between 2014 and 2019. Train and bus trips have declined significantly compared to minibus taxi trips.

5. TRENDS IN TRAFFIC VOLUME AND FUEL SALES

The COVID-19 pandemic impacted transport and travel patterns in South Africa and around the world due to restrictions on moving implemented during different lockdown alert levels. This chapter aims to discuss the changes in traffic patterns that occurred in Gauteng Province during the different lockdown alert levels by examining data collected by SANRAL using Vehicle Detector Stations (VDS) on freeways in the province, on the one hand, and trends in retail fuel sales on the other.

The traffic data consists of traffic volumes of three classes of vehicles namely:

- Class 1: Light vehicles and motorbikes;
- Class 2: Small goods vehicles and minibus taxis; and
- Class 3: Medium and large vehicles.

The different lockdown alert levels required residents to restrict travel and a question has emerged as to whether a "new normal" will arise that puts South Africa on a radically different path from that before the COVID-19 pandemic. The lockdown alert levels implemented in South Africa from 2020 to 2022 are summarised in Table 1. During 2020, five alert levels were implemented in South Africa from 26 March 2020 to 28 December 2020. In 2021, "adjusted" alert levels were implemented in South Africa. During adjusted alert levels, restrictions on movement of people were eased compared to the restrictions implemented during the same "non-adjusted" alert level.

5.1 Data Sources

Traffic patterns in the province were studied pre-COVID-19, during COVID-19, and post-COVID-19. In this report, "pre-COVID-19" refers to 1 March 2019–25 March 2020, "during COVID-19" refers to 26 March 2020–30 September 2021, and "post COVID-19" refers to the period commencing on 1 October 2021.

SANRAL was approached to provide traffic data for the province for the period 2019 to 2021. The traffic data was provided in the form of MS Excel databases to facilitate analysis thereof. For each VDS station, the data provided included the station name, date, and time the data was collected, vehicle class, vehicle count and vehicle speed.

Fuel Sales Volumes were accessed from the Department of Mineral Resources and Energy's published fuel sales volumes. To obtain a representative assessment period, the analysis period used was 2013 to 2022 (Quarter 2 sales). Data for Quarter 2 of 2022 was not available.

5.2 Data Cleaning

The analysis used a traffic trends experimental design with traffic volume as the primary variable of study. During the data cleaning process, it was observed that there were stations with significant amounts of data missing. This may be attributed to VDS devices that are no longer in operation or that are new and thus would not provide true historical traffic counts or were not operating for some time during the analysis period.

Only devices with reliable samples of data for the entire analysis period (1 March 2019 to 31 December 2021) were used. The selected stations provide a reasonable representation of the major freeways in the province as summarised in Table 2.

Table 2: Location of VDS stations

Freeway	GP VDS Station	X Co-ordinates	Y Co-ordinates
N1 North Midrand	GP_DS VDS 029 North	-25.9826	28.1258
N3	DS VDS 314 North	-26.1978	28.1337
N12	DS VDS 410 East	-26.1810	28.2100
N1 South	DS VDS 638 South	-26.2765	27.9466
R21A OR Tambo	DS VDS 813 North	-26.0741	28.2725
R24 OR Tambo	DS VDS 906 East	-26.1563	28.1629
R21B OR Tambo	DS VDS 821A South	-26.1455	28.2195
N17	DS VDS 502 West	-26.2518	28.1413
N4	DS VDS 103 East	-25.7412	28.2809

Figure 2 shows the location of the VDS stations that were used in the analysis.

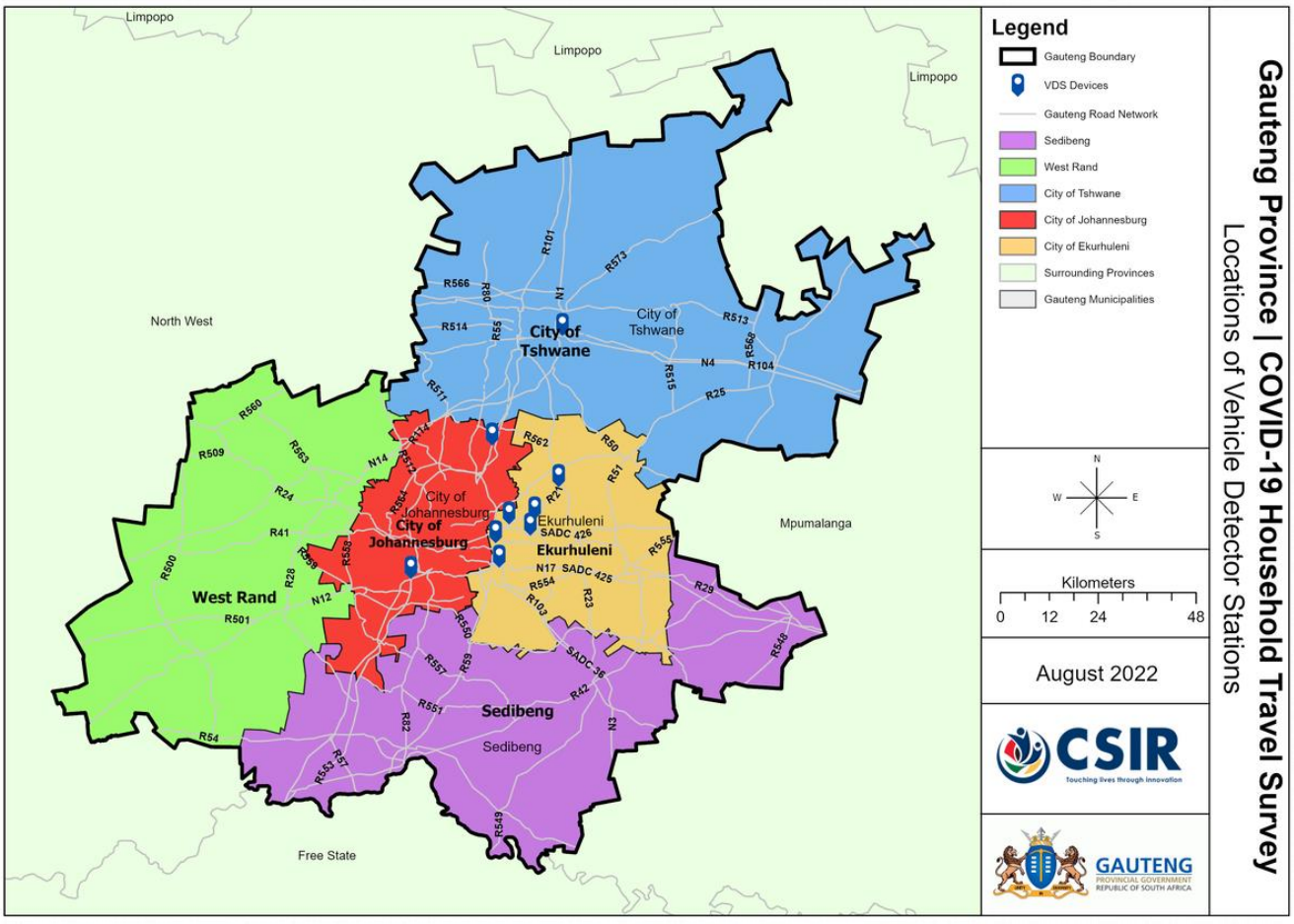

Figure 2: Location of VDS Stations

5.3 Assessment of Travel Patterns

5.3.1 Total Traffic

To understand how traffic volumes changed due to COVID-19, the total traffic pre-COVID-19 was compared to the total traffic during COVID-19 and post COVID-19.

Figure 3 shows the total traffic volume along the freeways analysed. The trends in total traffic volume are similar for all the freeways analysed.

At the height of lockdown alert level 5 (26 March 2020–30 April 2020), the total traffic significantly decreased (e.g. total traffic on the N3 reduced from an average 80 000 vehicles a day to an average of 21 000 vehicles a day). However, as the lockdown restrictions were eased gradually from level 5 to level 1 (May 2020–December 2020), total traffic on the freeways gradually rose again albeit below pre-COVID-19 volumes. There was a significant drop in total traffic in December due to the December holidays.

During 2021 when adjusted lockdown levels were implemented, the total traffic volumes were very similar to the volumes recorded in 2020 after the lifting of the level 5 restrictions. This suggests that the significant drop in total traffic due to the severe lockdown alert levels was relatively short-lived. It should be noted that no VDS data was available for the period from 2021/06/02 to 2021/06/22; hence, the dip shown on Figure 3 is because the month of June 2021 was not included in the analysis.

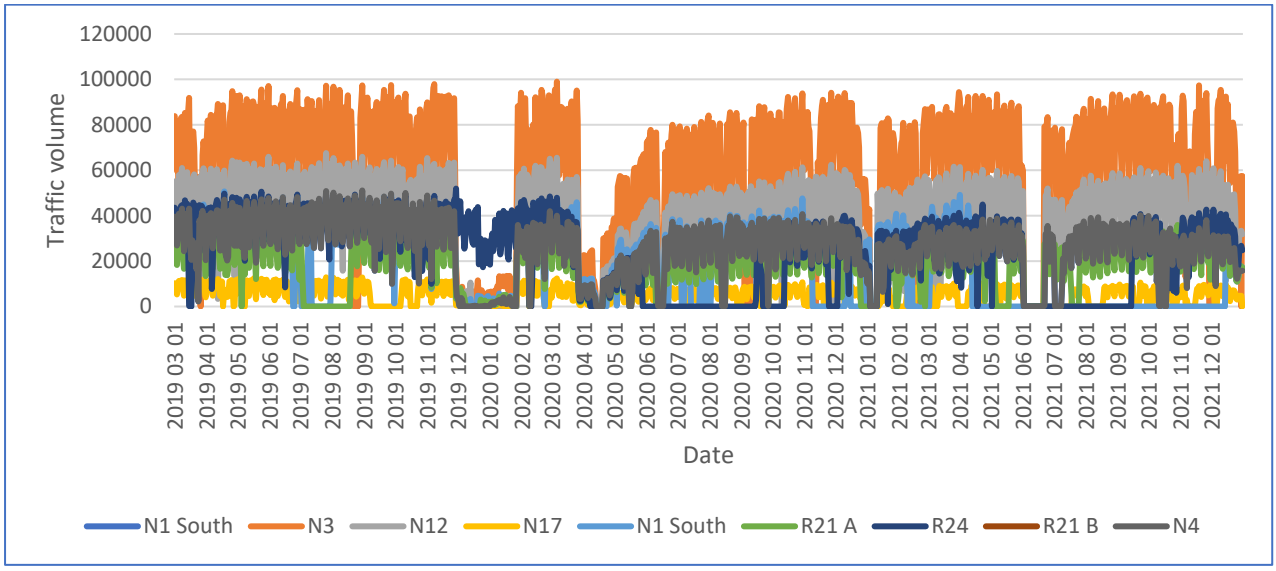

Figure 3: Total traffic volume on major freeways in Gauteng (2019–2021)

5.3.2 Different Vehicle Classes

To understand how the lockdown affected different vehicle classes, the classified traffic volume pre-COVID-19 was compared to the classified traffic volume during COVID-19 and post-COVID-19.

Figure 4 to Figure 7 show the classified traffic volume along the N1, R21, N3 and R24 freeways. The general trends in traffic volume are similar on all the freeways analysed with significant dips during December holidays and during lockdown level 5. At the height of lockdown alert level 5 from 26 March 2020 to 30 April 2020, the total traffic significantly decreased across all vehicle classes. The total traffic gradually rose again for the different vehicle classes as lockdown restrictions were eased, albeit below pre-COVID-19 volumes. When level 2 lockdown restrictions were implemented in August 2020, Class 2 and 3 recovered to normal traffic levels particularly on the N3 and R24 freeways. This suggests that transportation of goods by small, medium and large vehicles was mainly interrupted during lockdown alert level 5 to lockdown alert level 3.

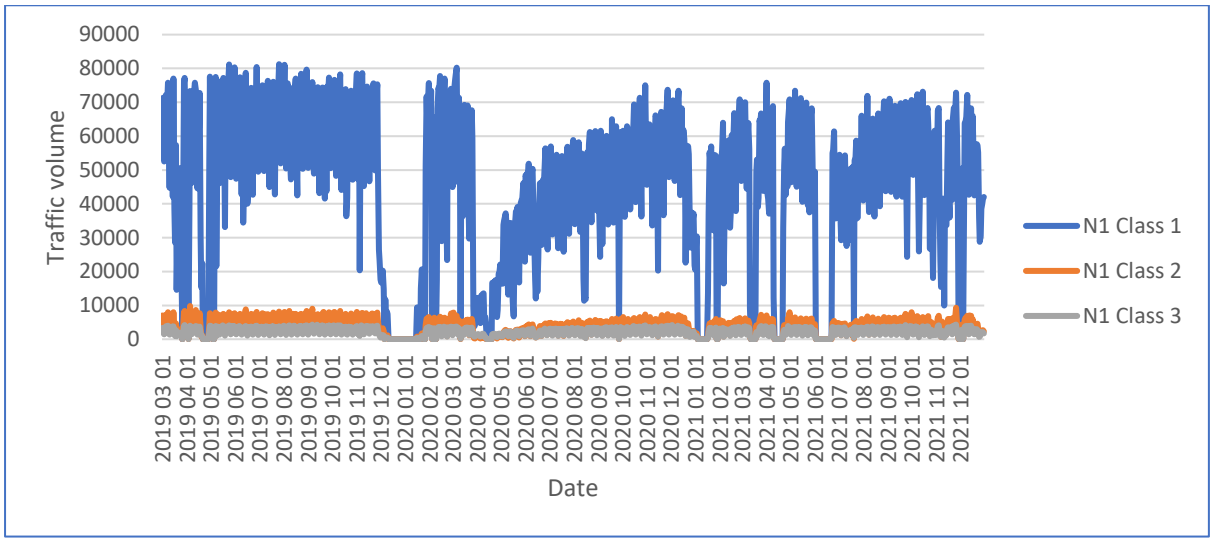

Figure 4: Classified traffic count, N1

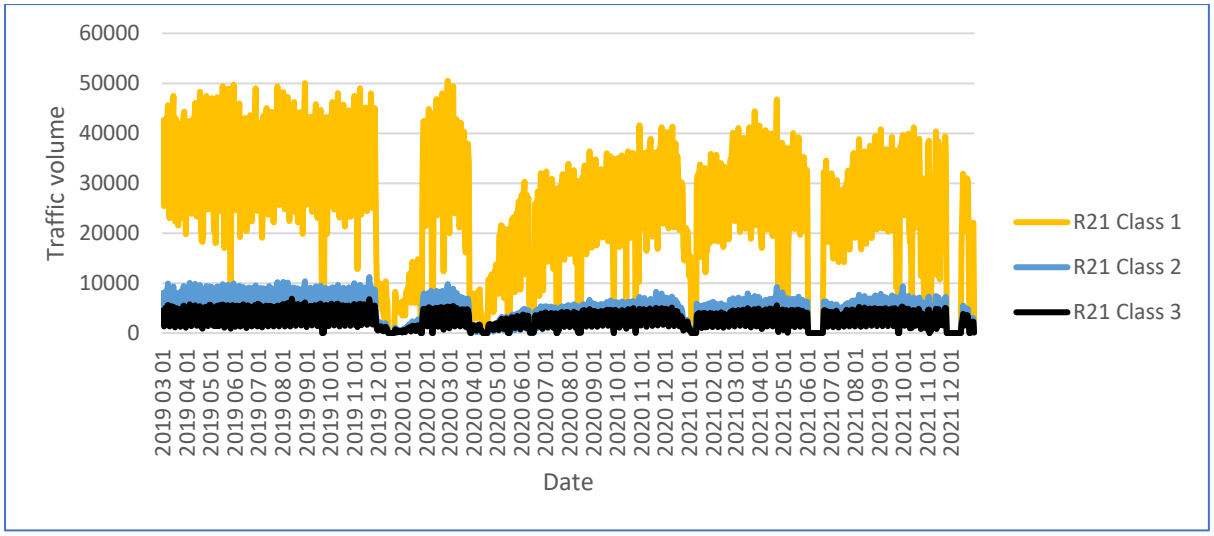

Figure 5: Classified traffic count, R21

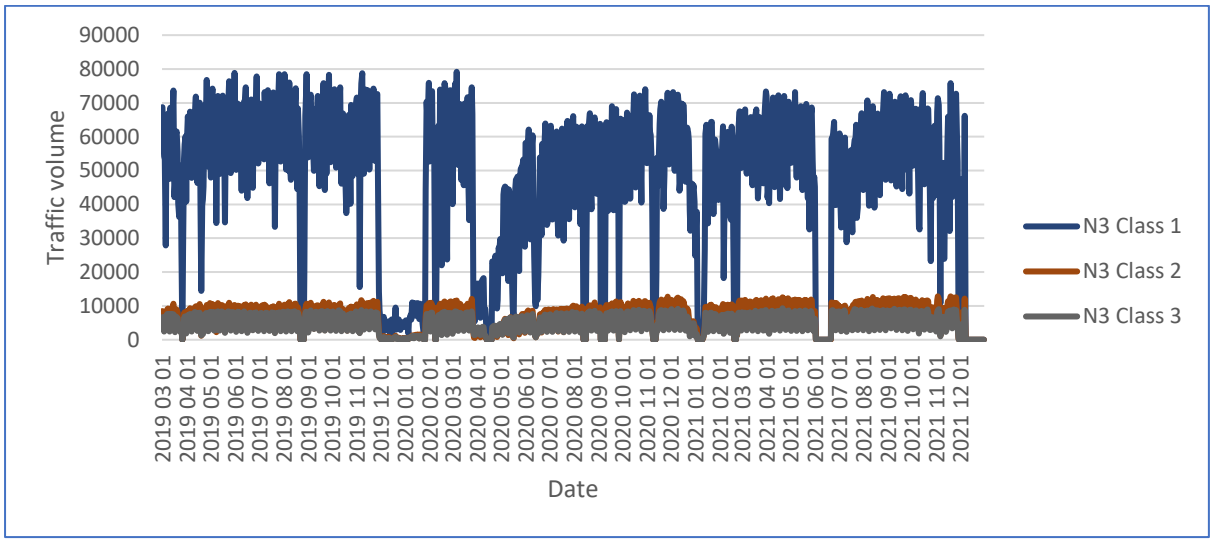

Figure 6: Classified traffic count, N3

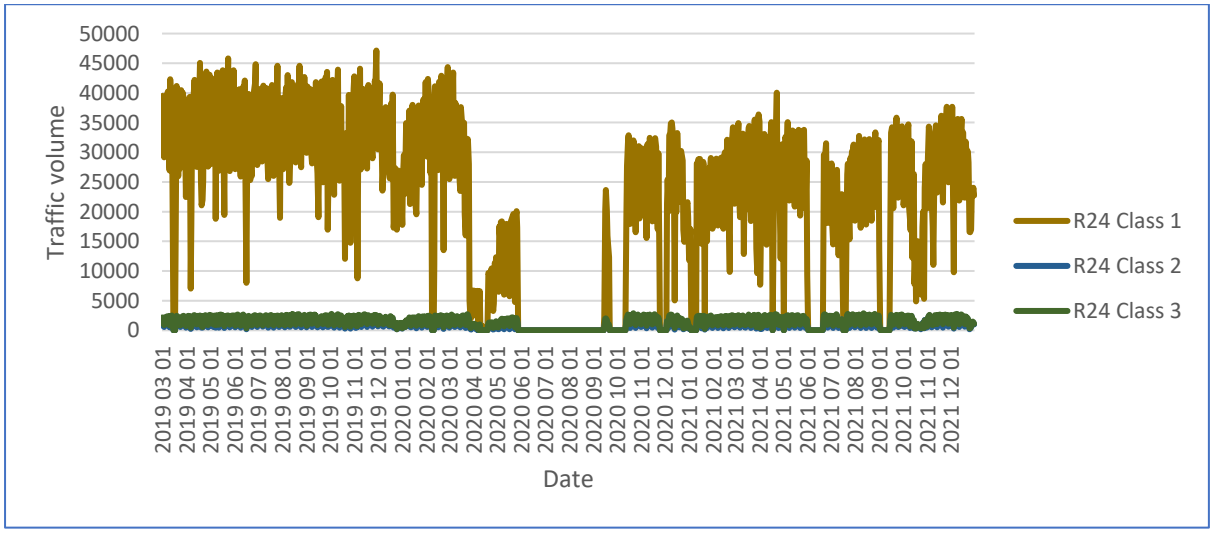

Figure 7: Classified traffic count, R24

Table 3 shows that during 2020 the total traffic volume reduced by 15% compared to 2019, after which it gradually increased by 12.3% in 2021. Between 2019 and 2021, there has been an overall reduction in total traffic of 4.4% on the four freeways.

Table 3: Traffic counts for N1, R21, N3 and R24

Vehicle class	2019	2020	2021	Percentage change (2019–2020)	Percentage change (2020–2021)	Percentage change (2019–2021)
1: Light vehicles and motorbikes	53 163 606	44 739 133	50 094 031	-15.9%	12%	-5.8%
2: Small goods vehicles and minibus taxis	5 759 522	5 013 733	5 861 242	-13%	17%	1.8%
3: Medium and large vehicles	4 112 095	3 912 891	4 321 007	-4.9%	10.4%	5.1%
TOTAL	**63 037 242**	**53 667 777**	**60 278 301**	**-14.9%**	**12.3%**	**-4.4%**

5.4 Assessment of Fuel Sales Volume

Figure *8* provides an overview of petrol and diesel sales over the past nine years (2013–2022) in the second quarter of the year (April to June). The petrol sales have mostly been much higher than the diesel sales at an almost constant rate from 2013 till 2019. A significant dip in both petrol and diesel sales was recorded in the second quarter of 2020. The significant dip in fuel sales can, amongst other things, be attributed to the impact of the COVID-19 pandemic and the travel restrictions that were in place during that period. Thereafter, a significant rise leading to the second quarter of 2021 was recorded and can be attributed to the ease of travel restrictions and a return to "normal" economic activity.

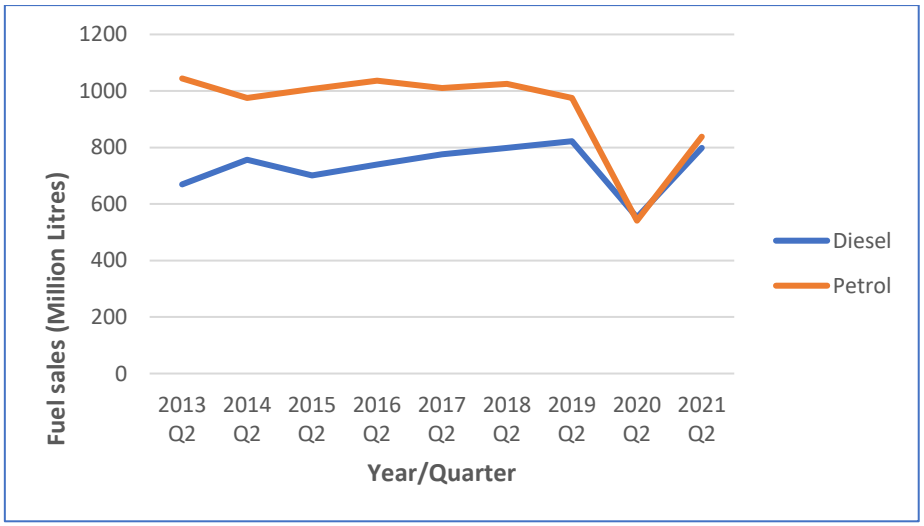

Figure 8: Gauteng fuel sales (Source: Statutes & Practices | Department: Energy | REPUBLIC OF SOUTH AFRICA)

5.5 Conclusion

The analysis presented in this chapter shows that the COVID-19 pandemic and lockdown restrictions had a considerable impact on traffic volumes on the major freeways in Gauteng. This was particularly the case at the start of the pandemic when level 5 lockdown restrictions were in place. The recovery of the traffic volumes was gradual and depended on the government orders restricting movement in South Africa. Overall, as the lockdown restrictions were eased the traffic on the freeways gradually rose again albeit below pre-COVID-19 volumes.

However, the individual lockdown levels being repealed did not immediately lead to higher traffic volumes. Instead, traffic volumes gradually increased from the lowest point in April 2020. By October 2020 traffic volumes had stabilised on the freeways analysed. This suggests that although COVID-19 restrictions played a role in traffic reduction at the start of the pandemic, shifts in travel patterns may have been short-lived.

The trends in both diesel and petrol sales are related to the general travel patterns hence, the travel restrictions that were in place due to the COVID-19 pandemic had a direct impact on the sales thereof. The road traffic and retail sale recovery patterns are similar.

It is, however, acknowledged that traffic patterns for low order roads were not assessed and these could have differed from those on high order roads. In addition, there are other factors that play a role in retail fuel sales that were not considered in the analysis.

6. SURVEY DESIGN AND METHODOLOGY

6.1 Introduction

To adequately answer the key questions about the potential changes in trip making choices and patterns, that might have been introduced by the COVID-19 pandemic, the questionnaire was designed such that pre-COVID-19 travel information as well as travel during the pandemic was gathered from the same group of households. This was done because directly comparing the current results to the GHTS 2019 results would have been challenging given that: (1) the 2019/20 survey was designed to better understand typical weekday travel patterns so respondents provided answers based on their (exact) most recent travel details; and, (2) too much time had passed for respondents to recall their exact mobility patterns.

Therefore, this survey asked for generic travel details from the past, during the pandemic, and for respondents' future travel perspectives.

The study was designed to collect data for the three relevant time periods of interest (before, during and after COVID-19), from the same sample. As a result, the within-sample analysis provides the best comparative framework for assessing the effects of the pandemic on household travel in the province.

6.2 Assessment of Survey Methods

Owing to the impact of the non-pharmaceutical interventions that had been implemented to minimise the spread of COVID-19, which necessitated reduction of extensive mobility and person-to-person contact, the team considered the associated limitations and made attempts to find alternative methods to carrying out this study. The requirements of this study involve obtaining a representative sample and administering a comprehensive questionnaire within a relatively short time limit of about 15-minutes. Because the study was conducted as a supplementary study for the 2019/20 Household Travel Survey, considerations were made to maintain a methodology similar to that applied to the main survey for comparative purposes.

As a result, the proposed survey approach was based on a randomly selected sample of households in West Rand. To minimise person to person contact, a sampled household was visited to obtain consent from the head of the household to complete the online survey. This process was carried out by a contracted research survey company. Engagement was minimised whilst maintaining COVID-19 safety protocols.

Figure 9 provides a schematic view of the process that was followed to obtain information from respondents. The medium used to conduct the survey was Computer Assisted Self Interview (CASI).

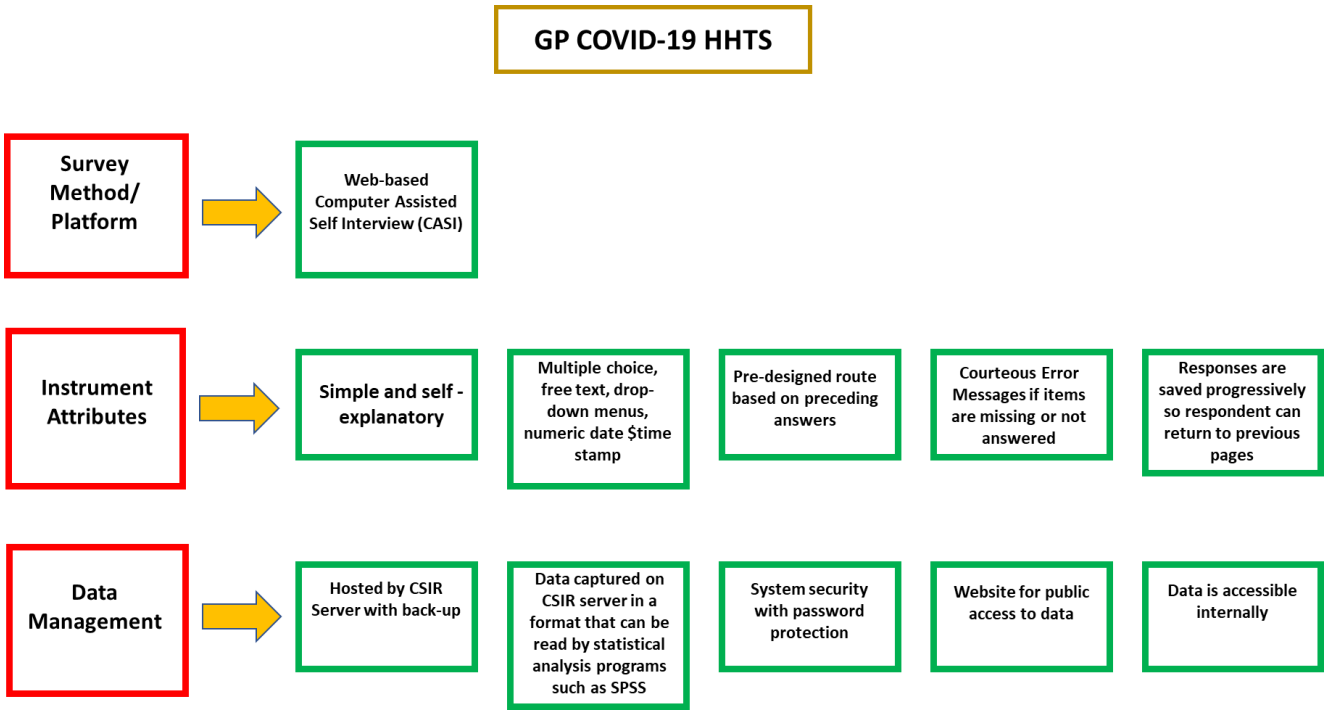

Figure 9: Survey approach

6.3 Selection of Key Variables

The problem statement addressed the following:

- Fundamentally, travel behaviour of households in the province may have been significantly altered, either temporarily or permanently. Assess travel behaviour 'Before, During & After COVID-19'.
- Assess the extent to which travel behaviour changed during the lockdown period.
- Assess how travel in West Rand region is likely to change into the future.

The sub-problems or questions of interest were as follows:

- Which demand and supply led changes will persist?
- What proportion of WFH will continue as a new normal?
- What proportion of learners and students schooling from home will continue?
- Will public transport see a sustained reduction in patronage?

- Will the reduction in traffic congestion be sustained?
- Will traffic congestion increase due to uncertainties with public transport hygiene and crowding concerns in context of COVID-19 infections?
- Is there an increased interest in online shopping?
- Will employers encourage options such as WFH, staggered working hours, flexible working hours, compressed work weeks, etc.?

Therefore, the design instrument was designed to address the following specific questions:

- What was the purpose of travel: Home to work? Home to School? Home to Shop? Home to other?
- What was the mode of transport used?
- What was the mode of transport before COVID-19?
- Departure and Arrival times – travel changed due to specified curfew times?
- Will the traveling public continue using public transport at lower alert levels or post-COVID-19?
- Will the traveling public change the mode of transport during COVID-19 due to the restrictions?
- Did the public transport fares increase during COVID-19?
- Did the cost of travel during COVID-19 increase or decrease or stay the same compared to before COVID-19?
- Will the public continue using online shopping platforms after COVID-19?
- Will the public continue working from home?
- Will the public continue schooling from home?
- Will the public return to the original mode of travel?
- Did the trip origin change?
- How did employment status before and during COVID-19 change?

- Did income during COVID-19 increase or decrease or stay the same compared to before COVID-19?
- Did place of work change during COVID-19?

6.4 Limitations of Secondary Data

There was missing data in the traffic data received from the National Roads Agency for national roads on the Gauteng Freeway Management System network. However, the traffic data for a reasonable sample was available and this was used to indicate traffic volumes before and during the lockdown. This data is simply a proxy for changes in traffic levels.

6.5 Information Collected

The head of the household provided information on behalf of all household members. If there was no adult head of household, then that household was replaced by another household. The primary information collected included travel patterns and mode of travel mode before and during the COVID-19 period.

The survey also obtained travel perceptions post-COVID-19 lockdown. Some demographic information which is necessary to align the current survey with the 2019 survey was also collected.

Interviewing the same households that took part in the 2019/20 Household Travel Survey would have been ideal and cost–effective. However, the POPI Act's limitations on contacting former participants through their previous contact information made this impossible.

6.6 Survey Instrument

A copy of the questionnaire is included in Appendix A. Enumerators administered the questionnaire, which had a completion time requirement of 15 to 20 minutes. The survey asked about respondents' travel habits prior to and during the COVID-19 alert level as well as their perceptions of changes in travel habits following the COVID-19 or more relaxed alert levels such as levels 3, 2, and 1.

The questionnaire was written in English. An effort was made to simplify the phrasing, sentence structure, and selection choices. A pilot survey of 50 households per region was conducted to evaluate the questionnaire and the service providers' logistical capacity.

The pilot survey was undertaken prior to the main survey and lessons learnt from the pilot survey were used to revise the survey instrument and execution. Subsequently, the questionnaire was refined as necessary. The CSIR also developed an online questionnaire and software application to use during the survey. The questionnaire was accessed by the enumerators via a smartphone/tablet.

6.7 Sample Framework

This project adopted the original probability sampling strategy from the GHTS 2019 in order to ensure alignment for the purpose of comparing travel patterns and trends before and after COVID-19. Stratification was in terms of average income and type of dwelling in a particular enumerator area (EA), including an urban and semi-urban area split within each region. Each subgroup in the total population is statistically referred to as a stratum. Furthermore, based on historic approaches to reporting and analysis units, the project maintained a Transport Analysis Zone (TAZ) level of analysis and reporting. For instance, TAZs represent an explicit stratification variable with the number of households per zone as a measure of size.

EAs were considered as primary sample units (PSUs), whilst households were correspondingly considered as the secondary sampling units (SSUs). Households in all communities were included. However, institutions such as hospitals, schools and prisons, as well as industrial areas, and recreational areas, were excluded.

6.8 Sample Distribution

The supplementary survey sample of 4000 households (approximately 10% of the 37 000 household sample used in the GHTS 2019) was used. A random probabilistic selection of households was used, with households distributed by municipal area and TAZ.

Table 4 shows the population and sample distribution across municipalities (with West Rand highlighted) in the province based on the 2016 Statistics South Africa Community Survey. The sample distribution is consistent with previous surveys in the province.

Table 4: Population and sample distribution

Municipality	Population	Total number of households	Target sample size (households) 2019/20	Target sample size (households) 2022
Ekurhuleni	3 379 104	1 299 490	8 000	1 091
Johannesburg	4 949 347	1 853 371	9 000	1 198
Sedibeng	3 275 152	330 828	8 000	363
Tshwane	957 528	1 136 877	6 000	1 075
West Rand	838 594	330 572	6 000	273
Total	**13,399,725**	**4 951 138**	**37 000**	**4 000**

West Rand

Figure 10 shows the randomly selected wards in the West Rand region where the pilot and main COVID-19 Household Travel survey were conducted. Six wards were selected for the pilot survey and eight wards for the main survey.

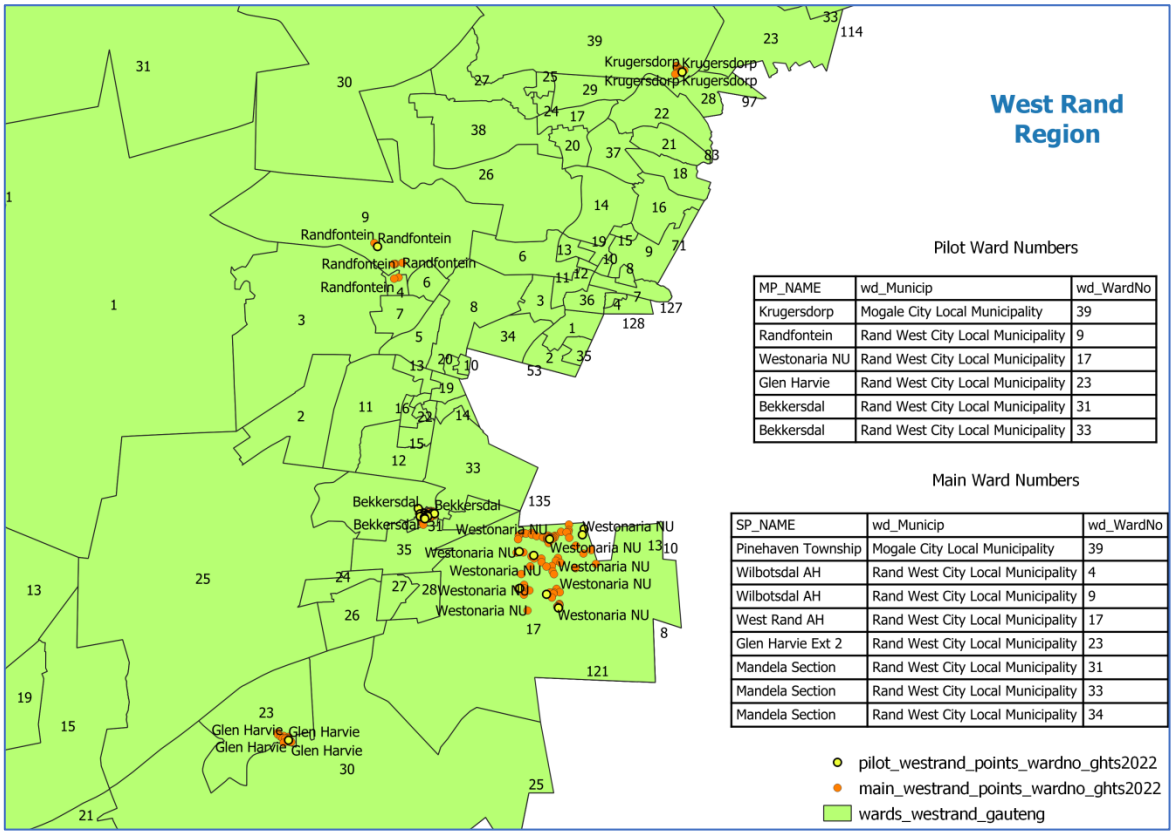

Figure 10: West Rand household distribution

6.9 Management of a Low Response Rate or Non-Response

A second, smaller sample, called a replacement sample, was selected with a similar proportional stratified sampling method to address potential low response rates or non-response households. If the originally targeted household did not qualify, then the enumerator randomly selected another household within walking distance. The following criteria were applied to substitute a household:

- A household refuses to participate
- Head of the household (adult) is not present
- Nobody is present

- The property has changed status (e.g. house rezoned to a shop)
- Child-headed households
- Restrictions of access to gated communities
- The head of the household is physically unable to engage

7. SURVEY EXECUTION

7.1 Introduction

The following section provides an overview of how the survey was carried out. It details the steps that were taken to ensure the successful execution of the survey, beginning with the conception of the supplementary survey, and continuing through the development of the questionnaire, the implementation of the pilot survey and the main survey, and the quality control measures that were taken to ensure compliance with the project methodology and scope.

7.2 Field Work Inception

In line with the project plan, an inception meeting was held with the competitively procured field work contractor teams in order to orientate them on various aspects of the surveys. The session addressed the project execution plan, including training of the enumerators, health and safety requirements, security requirements, comprehension of the questionnaire, data capturing, resource planning, scheduling, and quality management.

7.3 Logistical Planning

The contractors prepared a plan for the project's execution which included a resource schedule and programme. The contractors also arranged personal protective equipment (PPE), managed COVID-19 health and safety protocols, arranged identity tags, transport and branded bibs for the enumerators. Tablets or smartphones pre-loaded with the necessary templates were also provided to the enumerators.

7.4 Occupational Health and Safety, and Security

For safety and security reasons, enumerators operated in teams of two. Preferably, a female enumerator was paired with a male enumerator. A customised Standard Operating Procedure to manage COVID-19 related risks was developed and implemented.

Enumerators were trained on health and safety with a specific emphasis on safety and security and COVID-19 Safety protocols. The contractors and every enumerator were also required to sign the statement of agreement to comply with ethical principles and the minimum safety and security requirements.

7.5 Informed Consent

Before beginning the interview, the enumerators introduced the survey to members of the household, obtained their consent to participate, and displayed their enumerator identification card. The enumerator made it clear to the participants that the participation of the household in the survey was voluntary, that all information was confidential, and that no responses would be linked to the participant's identity. The participants were able to verify the enumerators' details on the enumerator verification system provided by the CSIR. Ideally one of the following members of the household would be interviewed:

- The household head, spouse or any adult residing in the household. No person below the age of 18 was interviewed.
- The main respondent (adult) was required to provide the travel information pertaining to household members under the age of 18.

7.6 Replacement Sample (Enumerator Protocol/Manual)

According to the field work survey protocol enumerators were expected to replace a dwelling if the original household did not qualify. The enumerator was required to randomly select another household within walking distance to replace the original targeted sampled dwelling unit.

For households that chose not to take part in the face-to-face questionnaire interview, an alternative to complete the survey online at their own convenience was provided by a link to the survey.

7.7 Questionnaire

The digital questionnaire was designed to compel the enumerators to obtain answers to questions accurately and correctly. The survey could not be completed with missing data; all questions had to be answered before the questionnaire was submitted or uploaded to the database. The CSIR oversaw and managed the data collected during the field work using established protocols and approaches.

7.8 Recruitment and Training of Enumerators

The contractors were responsible for the recruitment and training of enumerators and other personnel such as supervisors, administrators, and project managers. The CSIR provided initial training to the service providers (Train the Trainer). The training focused mainly on the digital questionnaire, data capturing, and data quality. The service providers were required to train the enumerators in terms of:

- Safety and Security Requirements
- COVID-19 Protocols
- Engagement with Participants
- Interviewing skills and etiquette
- Data capturing and data quality
- Daily debriefing
- Record keeping
- POPIA
- Privacy and Confidentiality
- Responsibility and Accountability in context of all the above.

7.9 Pilot Survey

A pilot survey was carried out in each region on the basis of 50 households in West Rand region. The aim of the pilot survey was to test the questionnaire's completeness and suitability, the logistics, and the capacity of the service providers. The questionnaire was adjusted based on the lessons learned from the pilot survey. The pilot survey was conducted from 10 to 17 February 2022 during lockdown adjusted level 1.

7.10 Main Survey

Once the lessons learnt from the pilot survey were addressed, the full survey was undertaken. Each region and the corresponding service provider were managed by a CSIR regional supervisor. The main survey was conducted from 1 March 2022 to 27 May 2022 during lockdown adjusted level 1.

Table 5 shows the survey samples obtained relative to the planned sample.

Table 5: Achieved sample vs planned sample

Survey Region	Planned Sample	Achieved Sample
Ekurhuleni	1 091	949
Johannesburg	1 198	1 085
Sedibeng	363	368
Tshwane	1 075	1 222
West Rand	273	277
Total	**4 000**	**3 901**

Figure 11 shows the location of the pilot and main survey households.

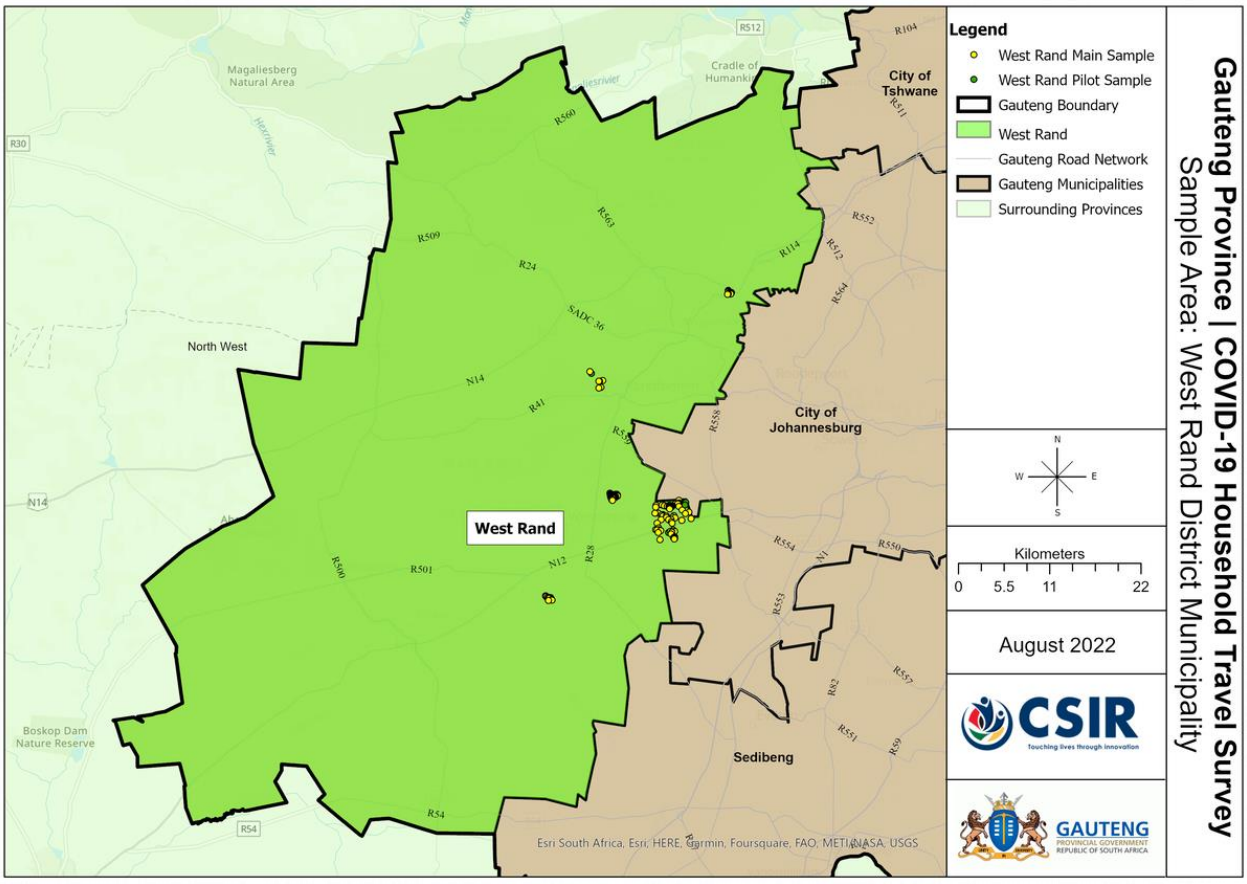

Figure 11: Location of pilot and main survey households

7.11 Data Capturing, Management and Quality Control

The data capturing was intended to be online and in real time. The service provider was not permitted to upload the responses later due to security risks. The data was uploaded almost instantaneously on the CSIR server. The CSIR team monitored the quality of the data daily and addressed queries with the respective teams.

Owing to the COVID-19 circumstances, the enumerator either carried out the interview on his/her device or assisted the participant on their own device. Different team members were assigned to supervise and monitor the enumerators and the community members/respondents.

Some team members that were responsible for the development of the survey platform monitored the data on the dashboard as it was submitted by enumerators. Once the data was received, a thorough process of pre-data cleaning was performed which included the following: enumerator photograph; time intervals between consecutive surveys per enumerator; consistency of the household member number inputs and general trends of data inputs per enumerator. The discrepancies found were insignificant and did not affect the integrity of the data. The data analysis team proceeded with the data analysis and data processing once the integrity of the collected data was confirmed.

7.12 Challenges and Lessons Learnt

Throughout the GHTS 2019 project, various challenges were experienced and documented for inclusion in the final report. At the commencement of the COVID-19 HHTS supplementary study, these challenges informed the approach of the supplementary study. However, due to the impact of COVID-19 and the period during which the supplementary study was done, new challenges were encountered across the Gauteng province and reported (see Table 6).

Table 6: Challenges and solutions

Category	Challenge	Solution
Replacement Sample	Replacement of tokens with no reasons provided	Enumerators should provide reasons for replacement tokens
Questionnaire	Fast paced interview	Enumerators to be trained to use own discretion in observing respondent's interaction
	Introductory paragraph was misleading because survey was almost occurring during "post-COVID-19" period	Wording was adjusted to describe "During COVID-19" as the 3rd wave era of COVID-19 in South Africa was occurring (with strict restrictions between June and September 2021)
	Questions too long and the introductory paragraphs lack readability	Incorporation of UPPERCASE for main keywords
	Non-compatibility of subcontractors' devices with the survey app	Subcontractors procured compatible devices to proceed with the survey

Category	Challenge	Solution
Recruitment and Training Enumerators	Enumerators not familiar with the technical aspects of the survey	Proper interactive training of enumerators
	Enumerator protocol and introduction	Proper interactive training of enumerators
	Lack of comprehension of the term “e-hailing” by enumerators and respondents seemed to contribute to skewness of data	Add example terms such as “Uber” and “Bolt” in questionnaire as these are more familiar
	Challenges with recruiting surveyors from the local communities	Maintain continuous contact with the ward councillors
Pilot Survey	Server issues during first week of the pilot survey	CSIR Team contacted the server service provider to resolve the issues
	Coordination with the monitoring team and subcontractors	The project managers, supervisors, and enumerators must be accessible on their mobile phones
	Some of the replacement points were a bit further apart than the chosen points in City of Tshwane	The replacement samples need to be as close as possible to allocated points otherwise it makes it difficult to judge if a point should be accepted or not
	The survey only captures coordinates once	To capture coordinates twice while the enumerator is capturing the questionnaire
	There were some points that were outside the survey area (especially with Ekurhuleni)	All devices will have to submit a "test survey" during the training in order to check if there are no GPS issues on any of them
	Some councillors not informed in advance about survey	Follow up with the MMC’s offices on informing the affected councillors prior to main survey
	Gated communities not interested in taking part in the survey due to time and security constraints	Arrangements should be put in place to allow them to do survey online and to be informed in advance (e.g. via MS teams meetings)
	Communities rejecting survey due to political and service delivery issues	Councillors should explain project to communities and emphasise that it is not related to service delivery
	Survey too slow	Some of the functions were removed, e.g. GPS function, to improve survey speed
	Non-display of token number and “successful submission” of survey	A page that indicates that the survey has been submitted is activated
Main Survey	Poor communication and logistics monitoring	CSIR field team increased to ensure proper site monitoring
	Unresponsive ward councillors	CSIR team requested direct contacts of unresponsive ward councillors and requested signed letters
	Survey too long and too many repetitive questions with little skip logic built in	In future, add ‘Information same as Member X’ button
	Gaining access to gated communities, flats and complexes	Obtain signed letters from councillors

8. HOUSEHOLD CHARACTERISTICS

The characteristics of the households used in the survey, for example household income, number of people per household, employment status, are discussed in this chapter. The 2016 Community Survey estimates of the household attributes were used in weighting the sample to the known household estimates.

8.1 Number of Households

Table 7 presents the distribution of the estimated households per municipality. The West Rand municipality accounted for 7% of the households in Gauteng. The 7% translates to the sample of 277 households representing an estimated 330 572 households in the West Rand Municipality (Figure 12).

Table 7: Number of households per municipality vs sample size collected

Municipality	Number of households	Percent (%) of weighted households	Planned Number of Households to be interviewed	Number of Households interviewed	(%) interviewed of planned	(%) interviewed of total
Ekurhuleni	1 299 490	26	1 091	949	87	24
Johannesburg	1 853 371	37	1 198	1 085	91	28
Sedibeng	330 828	7	363	368	101	9
Tshwane	1 136 877	23	1 075	1 222	114	31
West Rand	330 572	7	273	277	101	7
Gauteng	**4 951 138**	**100**	**4 000**	**3 901**	**98**	**100**

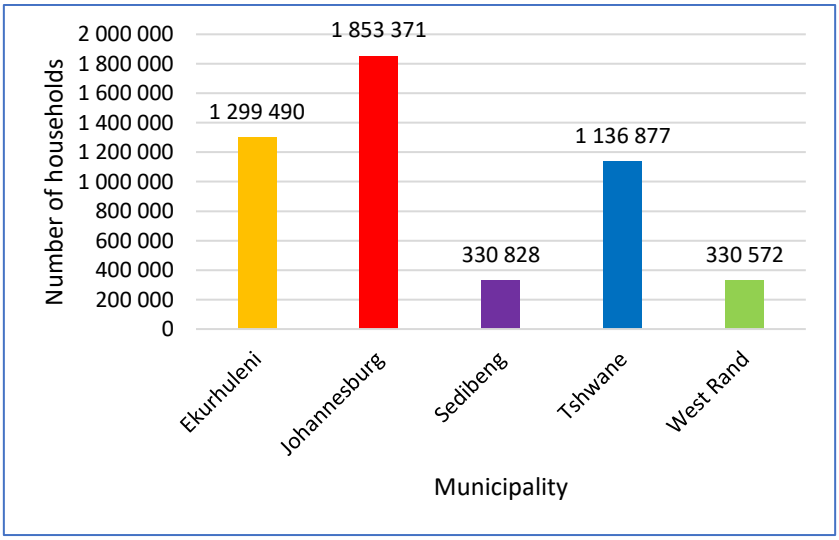

Figure 12: Weighted household distribution

8.2 Household Income

Table 8 depicts the income distribution for households in the West Rand municipality. As many as 34.2% (63 053) of households refused to answer or responded as “not sure” of their household income. As stated in the previous report, disclosed household income is becoming a less reliable statistic – Figure 13 reflects that this statement remains true. Nonetheless, 31.2% (103 244) of the households indicated that they had no source of income, and almost 2% (5 871) of the households in West Rand municipality earn between R 8 000 and R 16 000.

Table 8: Household income distribution

Income group	Number of households	Percent (%)
No income	103 244	31.2%
R 201 – R 500	7 203	2.2%
R 501 – R 1000	21 609	6.5%
R 1 001 – R 1 500	18 008	5.5%
R 1 501 – R 2 500	7 203	2.2%
R 2 501 – R 3 500	16 793	5.1%
R 3 501 – R 4 500	7 189	2.2%
R 4 501 – R 6 000	7 182	2.2%
R 6 001 – R 8 000	10 659	3.2%
R 8 001 – R 11 000	2 394	0.7%
R 11 001 – R 16 000	3 477	1.1%
R 16 001 – R 30 000	5 857	1.8%
R 30 001 or more	6 703	2.0%
Not sure	49 096	14.9%
Refuse to answer	63 953	19.4%
Total	**330 572**	**100.0%**

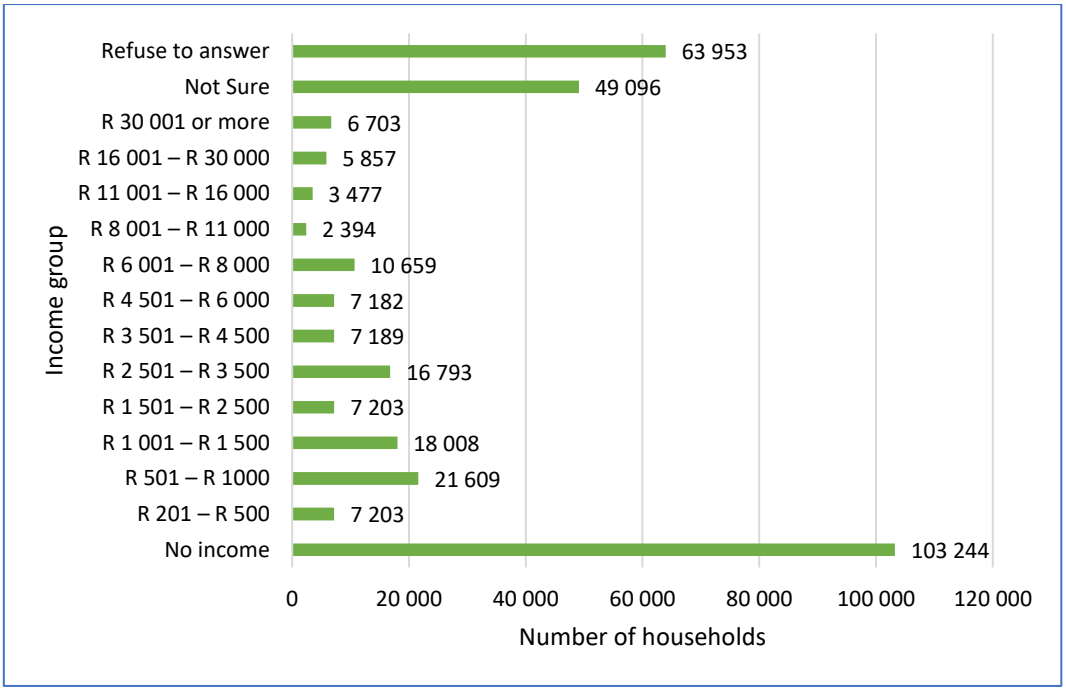

Figure 13: Household income distribution

8.3 Household Trips

Table 9 shows the proportion of the number of people making trips per household – the majority of households in West Rand have at most two people making trips per household, and 1.1% of the households have more than four people making trips.

Table 9: Number of people making some trip per household on a typical day

Number of people making trips	Number of households	Percent (%)
1	114 451	34.6%
2	126 477	38.3%
3	78 963	23.9%
4	7 078	2.1%
5	3 602	1.1%
Total	**330 572**	**100.0%**

8.4 Household Size

Table 10 shows the distribution of the number of persons per household. About 89% of households had four or fewer persons. Only a small number of West Rand households have more than five persons per household (12%).

Table 10: Household size

Household size	Number of households	Percent (%)
1	72 982	22.1%
2	109 920	33.3%
3	83 641	25.3%
4	25 773	7.8%
5	22 650	6.9%
6+	15 607	4.7%
Total	**330 572**	**100.0%**

8.5 Number of Employed People per Household

Table 11 below shows the distribution of the number of people employed in a household, with 44% of the households having one person employed, and 3.3% of households having at least three to five persons employed. A total of 43.9% of households have no employed members.

Table 11: Employed people per household

Number of employed people per household	Number of households	Percent (%)
0	145 006	43.9%
1	145 387	44.0%
2	29 381	8.9%
3	5 996	1.8%
4	3 602	1.1%
5	1 201	0.4%
Total	**330 572**	**100.0%**

8.6 Number of Unemployed People per Household

Table 12 illustrates the distribution of unemployed people per household. The highest percentage of 36.9% represents households with one unemployed person, followed by 36.6% households with no unemployed person. Households with four unemployed persons make up 1.5% of households.

Table 12: Unemployed persons per household

Number of unemployed persons per household	Number of households	Percent (%)
0	120 502	36.6%
1	121 655	36.9%
2	57 222	17.4%
3	21 595	6.6%
4	4 795	1.5%
5	1 201	0.4%
6+	2 401	0.7%
Total	**329 371**	**100.0%**

8.7 Number of Scholars per Household

Table 13 shows the number of scholars per household. The table indicates that more than half of households (53.8%) do not have any scholars present. And the table indicates that 26.8% of households only have one scholar per household and only 1.5% of households have more than 5 scholars.

Table 13: Scholars per household

Number of scholars per household	Weighted number of households	Households (%)
0	177 843	53.8%
1	88 540	26.8%
2	46 306	14.0%
3	10 680	3.2%
4	2 401	0.7%
5+	4 802	1.5%
Total	**330 572**	**100.0%**

9. POPULATION CHARACTERISTICS

The population characteristics discussed in this chapter include gender, age and education level. Similarly, the 2016 Community Survey estimates of the population were used for weighting the sample.

9.1 Gender

Table 14 shows the gender distribution of the West Rand captured through this survey and the comparison with the 2016 Community Survey. The district has a larger proportion of females (52.7 %) than males.

Table 14: Population distribution by gender

Gender	Weighted Population size	Population (%)	Community Survey 2016 (%) population
Female	442 092	52.7	50
Male	396 503	47.3	50
Total	**13 399 725**	**100**	**100**

9.2 Age

Table 15 shows the high-level population age distribution in West Rand. The district is characterized by a population with a large proportion of young people in the age group 25 to 44 years, mostly economically active, and middle-aged persons make up 18% of the population. Younger people tend to be more mobile, implying that the district should ordinarily gear itself to providing demand-responsive services.

Table 15: Age distribution of population

Age	Weighted Population size	Population (%)
0–6	48 388	5.8
7–13	109 837	13.1
14–15	35 572	4.2
16–18	40 223	4.8
19–24	72 726	8.7
25–34	154 183	18.4
35–44	184 164	22.0
45–54	92 028	11.0
55–65	61 403	7.3
66 years and over	40 071	4.8
Total	**838 594**	**100**

9.3 Education Level

Table 16 categorizes the West Rand weighted population in terms of level of education status. The table shows that 28% of the population had completed high school. Only about 11% of the population had some tertiary education qualification.

Table 16: Education level of population

Education Level	Weighted population	Population (%)
Day-care/crèche	7 737	0.9%
Degree or Diploma with Grade 12	59 300	7.1%
Diploma without Grade 12	17 021	2.0%
High school complete (Grade 12 or Standard 10)	232 052	27.7%
No formal education	44 874	5.4%
Not applicable	24 275	2.9%
Post-graduate degree	3 095	0.4%
Pre-school	21 019	2.5%
Primary school complete (Grade 7 or Standard 5)	69 614	8.3%
Some high school	205 729	24.5%
Some primary school	137 680	16.4%
Some university/college	16 198	1.9%
Total	**838 594**	**100.0%**

9.4 Employment Status

Table 17 illustrates the distribution of employment status across the weighted population in the West Rand. A large proportion of people in the district are unemployed and looking for work (30%). The table shows that 23% of people did not specify their employment status – this could be because they did not want to disclose this information.

Table 17: Population distribution by employment status

Employment Status	Weighted Population size	Percentage (%)
Retired	29 400	3.5%
Unspecified	193 797	23.1%
Employed	165 847	19.8%
Not applicable	15 474	1.8%
Retired	38 201	4.6%
Self-employed	72 985	8.7%
Still Studying	58 791	7.0%
Unemployed looking for work	247 401	29.5%
Unemployed not looking for work	16 699	2.0%
Total	**838 594**	**100.0%**

10. TRAVEL CHARACTERISTICS BEFORE AND DURING COVID-19

Although the survey was conducted when the COVID-19 restrictions had been relaxed (adjusted level 1) and “normal” travel for most economic activities had resumed, the questionnaire was designed to determine respondents’ travel patterns “during COVID-19”. The term “during COVID-19” was defined as the period between June 2021 and September 2021 when the third wave of "COVID-19 variant Delta" spiked in South Africa and strict COVID-19 restrictions were implemented.

In order to adequately answer the key questions raised about the potential changes in travel choices and patterns that might have been introduced by the COVID-19 pandemic, the questionnaire was designed so that pre-COVID-19 travel information as well as travel during the pandemic were gathered from the same group of households sampled for this study.

This was done because directly comparing the current results to the GHTS 2019 results would have been challenging given that: (1) the 2019 survey was designed to better understand typical weekday travel patterns, so respondents provided answers based on their (exact) most recent travel details; and, (2) too much time had passed for respondents to recall their exact mobility patterns. Therefore, this survey asked for generic travel details from before COVID-19, during COVID-19, and for respondents’ future travel perspectives. For example, respondents were asked to consider a “typical weekday before COVID-19” or a “typical weekday in the past 7 days” for a specific purpose.

Rather than directly comparing different groups of households subjected to different conditions and questioning, the study was designed to collect data for the three relevant time periods of interest (before COVID-19, during COVID-19 and after COVID-19) from the same sample. As a result, the within-sample analysis provides the best comparative framework for assessing the effects of the pandemic on household travel in the province and the results of this survey should not be directly compared with the results of another survey.

10.1 Travel to Work

10.1.1 Main Mode of Transport

Table 18 represents the modes used and the number of trips for work purposes in the West Rand. The table shows that the commuter taxi is the most used mode of transport before COVID-19 (35.3%) and during COVID-19 was still mostly used at 32.1%. Car as a driver followed with about 31.4% using this mode but this decreased to 26% during COVID-19. Bicycles and e-hailing were little used during COVID-19 (together only making up 4.2% of trips) and before COVID-19 were not reported to be used at all.

Table 18: Mode of transport for work

	Before COVID-19		During COVID-19	
Modes used for Work	**Number of Trips***	**(%) trips**	**Number of Trips***	**(%) Trips**
Bicycle	-	-	1 201	1.4%
Bus	4 774	3.7%	5 968	6.9%
Car, as the driver	40 595	31.4%	22 505	26.1%
Car, as the passenger	9 590	7.4%	4 795	5.6%
Commuter taxi/minibus taxi	45 613	35.3%	27 605	32.1%
Company transport	4 795	3.7%	2 394	2.8%
Lift club as a passenger	1 194	0.9%	-	-
Train	2 401	1.9%	-	-
Walk all the way	20 409	15.8%	19 208	22.3%
e-hailing service (e.g. Uber, Bolt)	-	-	2 401	2.8%
Total	**129 371**	**100.0%**	**86 077**	**100.0%**
**One-way trips. The number of trips is based on a household weight.*				

10.1.2 Departure Times

Table 19 shows the departure times and number of trips for work in the West Rand. The results show that before COVID-19 most trips (42.1%) were taken between 06:00 and 09:00 – this percentage has slightly increased by 1.2%, compared to during COVID-19. Households that leave between 09:00 and 23:59 have slightly increased from 17.8% to 19%.

Table 19: Departure times for work.

	Before COVID-19		During COVID-19	
Departure Time for Work	**Number of Trips***	**Percentage (%)**	**Number of Trips***	**Percentage (%)**
00:00 – 05:59	50 325	40.0%	31 117	37.7%
06:00 – 09:00	53 010	42.1%	35 752	43.3%
09:01 – 23:59	22 435	17.8%	15 607	18.9%
Total	**125 770**	**100.0%**	**82 475**	**100.0%**
**One-way trips. The number of trips is based on a household weight.*				

10.1.3 Trip Duration

Table 20 and Figure 14 show work trip duration. The results show that most of the West Rand residents (29.4%) took 30 to 60 minutes to travel to work before COVID-19 and that the percentage decreased slightly to 27% during COVID-19; perhaps due to more people working from home. Eleven percent of work trips took more than 1.5 hours and people in this district seem to experience long traveling hours.

Table 20: Trip duration for work purposes

	Before COVID-19		During COVID-19	
Work trips duration	**Number of Trips***	**Percent (%)**	**Number of Trips***	**Percent (%)**
0–5 minutes	3 602	2.8	1 201	1.4
5–10 minutes	10 791	8.3	7 176	8.3
10–15 minutes	23 698	18.3	17 973	20.9
15–30 minutes	28 535	22.1	21 568	25.1
30–60 minutes	38 035	29.4	22 803	26.5
1–1.5 hours	11 755	9.1	5 878	6.8
1.5–2 hours	5 753	4.5	3 477	4.0
2–3 hours	6 003	4.6	3 602	4.2
More than 3 hours	1 201	0.9	2 401	2.8
**One-way trips. The number of trips is based on a household weight.*				

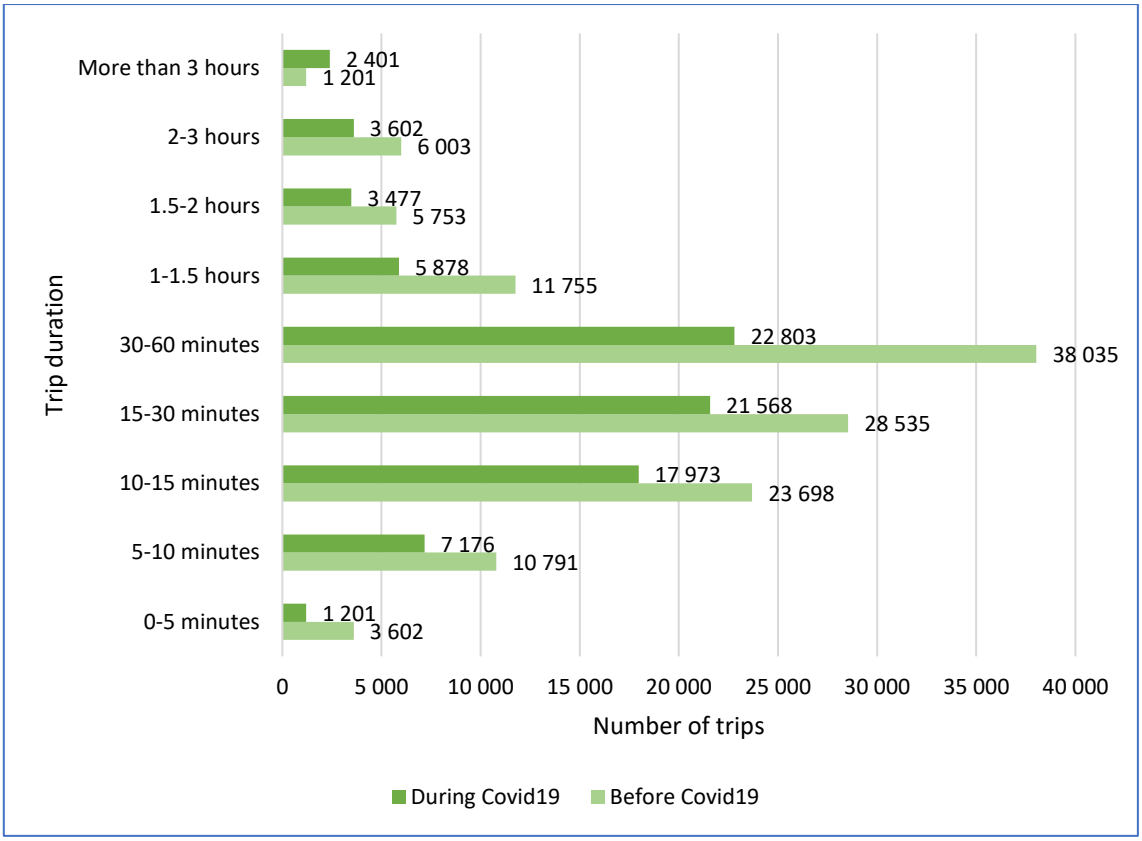

Figure 14: Trip duration for work trips

10.2 Travel to Educational Institution

10.2.1 Main Mode of Transport

Table 21 shows the number of educational trips per mode before COVID-19 relative to during COVID-19 in the West Rand. The number of trips has reduced during COVID-19 compared to before COVID-19. Walking all the way is the mode most used by people before COVID-19 (57%) and was still the most preferred mode during COVID-19 (63.2%). Gautrain bus, lift club as a driver and motorcycle were not modes used before COVID-19 but during COVID-19 some slight use was made of these modes. Rail transport was the least used before COVID-19 and during COVID-19 it was not used at all.

Table 21: Mode of transport for education

	Before COVID-19		During COVID-19	
Modes used for education	**Number of Trips***	**% Trips***	**Number of Trips**	**% Trips***
Bus	4 802	2.7%	2 401	1.7%
Car, as the passenger	11 130	6.2%	9 229	6.5%
Commuter taxi/minibus taxi	20 409	11.3%	14 399	10.1%
Gautrain bus	-	-	1 201	0.8%
Gautrain	1 201	0.7%	-	-
Lift club as a driver	-	-	2 401	1.7%
Lift club as a passenger	18 008	10.0%	1 201	0.8%
Metered taxi	2 387	1.3%	2 387	1.7%
Motorcycle	-	-	2 401	1.7%
School bus	15 579	8.6%	16 787	11.8%
Walk all the way	102 044	56.6%	90 039	63.2%
Train	1 201	0.7%	-	-
e-hailing service (e.g. Uber, Bolt)	3 602	2.0%	-	-
Total	**180 362**	**100.0%**	**142 445**	**100.0%**
**One-way trips. The number of trips is based on a household weight.*				

10.2.2 Departure Times

Table 22 shows the number of trips departing for educational purposes at different time intervals before COVID-19 compared to during COVID-19 in the West Rand. Before COVID-19, 84% of departures occurred during the 06:00 to 09:00 time period. This number then decreased with 79% of trips occurring during the 06:00 to 09:00 time period during COVID-19. The lowest percentage of trips was made during the 00:00 to 05:59 time period before COVID-19 (0.7%) and during COVID-19 no trips were made during that time period. Trips during the 09:01 to 23:59 time period increased by almost 7% during COVID-19 compared to before COVID-19.

Table 22: Departure times for educational purposes

	Before		Current	
Departure Time for Education Trips	**Number of Trips***	**Percentage (%)**	**Number of Trips***	**Percentage (%)**
00:00 – 05:59	1 201	0.7%		
06:00 – 09:00	153 950	84.8%	113 633	78.5%
09:01 – 23:59	26 411	14.5%	31 213	21.5%
Total	**181 562**	**100.0%**	**144 846**	**100.0%**

**One-way trips. The number of trips is based on a household weight.*

10.2.3 Trip Duration

Table 23 and Figure 15 show the trip duration and the number of people thereof, before and during COVID-19, for education trips. The majority of education trips took 10 to 15 minutes both before and during COVID–19 (i.e. 33% and 47% respectively). Overall, there was no significant change in the duration of education trips before COVID-19 compared to during COVID-19.

Table 23: Trip duration for education

	Before COVID-19		During COVID-19	
Education trips duration	**Number of Trips***	**Percentage (%)**	**Number of Trips***	**Percentage (%)**
0–5 minutes	9 354	5.2%	3 602	2.6%
5–10 minutes	35 738	19.7%	23 983	17.0%
10–15 minutes	61 226	33.7%	66 028	46.8%
15–30 minutes	48 021	26.5%	33 240	23.5%
30–60 minutes	21 234	11.7%	12 005	8.5%
1–1.5 hours	4 788	2.6%	2 387	1.7%
2–3 hours	1 201	0.7%	-	-
**One-way trips. The number of trips is based on a household weight.*				

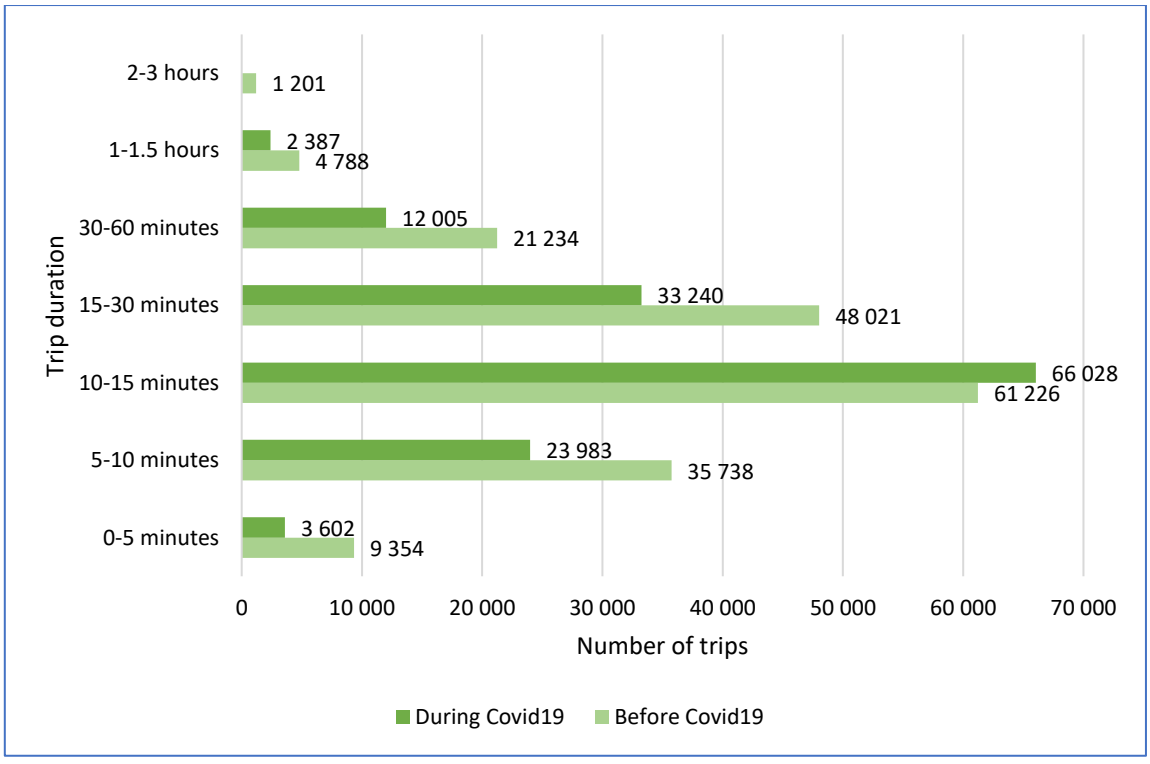

Figure 15: Trip duration for education trips

10.3 Travel for Shopping

10.3.1 Main Mode of Transport

Table 24 shows the number of shopping trips per mode type before COVID-19 compared to during COVID-19 in the West Rand. The number of trips has remained similar. The most predominant modes of travel for shopping both before and during COVID-19 were commuter taxi/minibus taxi and car as the driver accounting for 77.2% of shopping trips before and during COVID-19. There was no significant change in the main mode of transport used to travel for shopping before COVID-19 compared to during COVID-19. The results indicate that no shopping trips were made using train or lift club as passenger during COVID-19.

Table 24: Mode of transport for shopping

	Before COVID-19		During COVID-19	
Modes used for shopping	**Number of Trips***	**% Trips**	**Number of Trips***	**% Trips**
Car, as the driver	60 740	12.8%	59 540	13.0%
Car, as the passenger	40 679	8.6%	39 478	8.6%
Commuter taxi/minibus taxi	304 890	64.4%	295 286	64.3%
Company transport	1 201	0.3%	1 201	0.3%
Lift club as a passenger	1 194	0.3%	-	-
Metered taxi	1 194	0.3%	2 387	0.5%
Train	2 401	0.5%	-	-
Walk all the way	58 825	12.4%	58 825	12.8%
e-hailing service (e.g. Uber, Bo	2 401	0.5%	2 401	0.5%
Total	**473 524**	**100.0%**	**459 118**	**100.0%**
**One-way trips. The number of trips is based on a household weight.*				

10.3.2 Departure Times

Table 25 shows the number of trips departing for shopping at different time intervals before COVID-19 compared to during COVID-19 in the West Rand. The majority of West Rand households made most of their shopping trips between 09:00 and 23:59 before and during COVID-19 (i.e. 80.4% and 71.4 % respectively). The least number of trips were made between 00:00 and 05:59, before and during COVID-19, because most shopping facilities are not operational during that time.

Table 25: Departure times for shopping

	Before COVID-19		During COVID-19	
Departure Time for Shopping Trips	**Number of Trips***	**Percentage (%)**	**Number of Trips***	**Percentage (%)**
00:00 – 05:59	5 975	1.6%	11 978	3.3%
06:00 – 09:00	67 076	18.0%	92 287	25.3%
09:01 – 23:59	299 775	80.4%	260 151	71.4%
Total	**372 826**	**100.0%**	**364 416**	**100.0%**
**One-way trips. The number of trips is based on a household weight.*				

10.3.3 Trip Duration

Table 26 and Figure 16 show trip duration for shopping trips. Most shopping trips took 10 to 15 minutes before and during COVID-19. Overall, there was no significant change in the duration of shopping trips before COVID-19 compared to during COVID-19.

Table 26: Trip duration for shopping

	Before COVID-19		During COVID-19	
Shopping trips duration	**Number of Trips***	**Percentage (%)**	**Number of Trips***	**Percentage (%)**
0–5 minutes	17 383	3.6	16 307	3.6
5–10 minutes	82 440	17.1	78 714	17.1
10–15 minutes	157 698	32.8	159 398	34.7
15–30 minutes	104 167	21.7	87 478	19.1
30–60 minutes	93 481	19.4	92 412	20.1
1–1.5 hours	15 454	3.2	10 652	2.3
1.5–2 hours	1 076	0.2	3 352	0.7
2–3 hours	9 479	2.0	8 404	1.8
More than 3 hours	-	-	2 401	0.5
**One-way trips. The number of trips is based on a household weight.*				

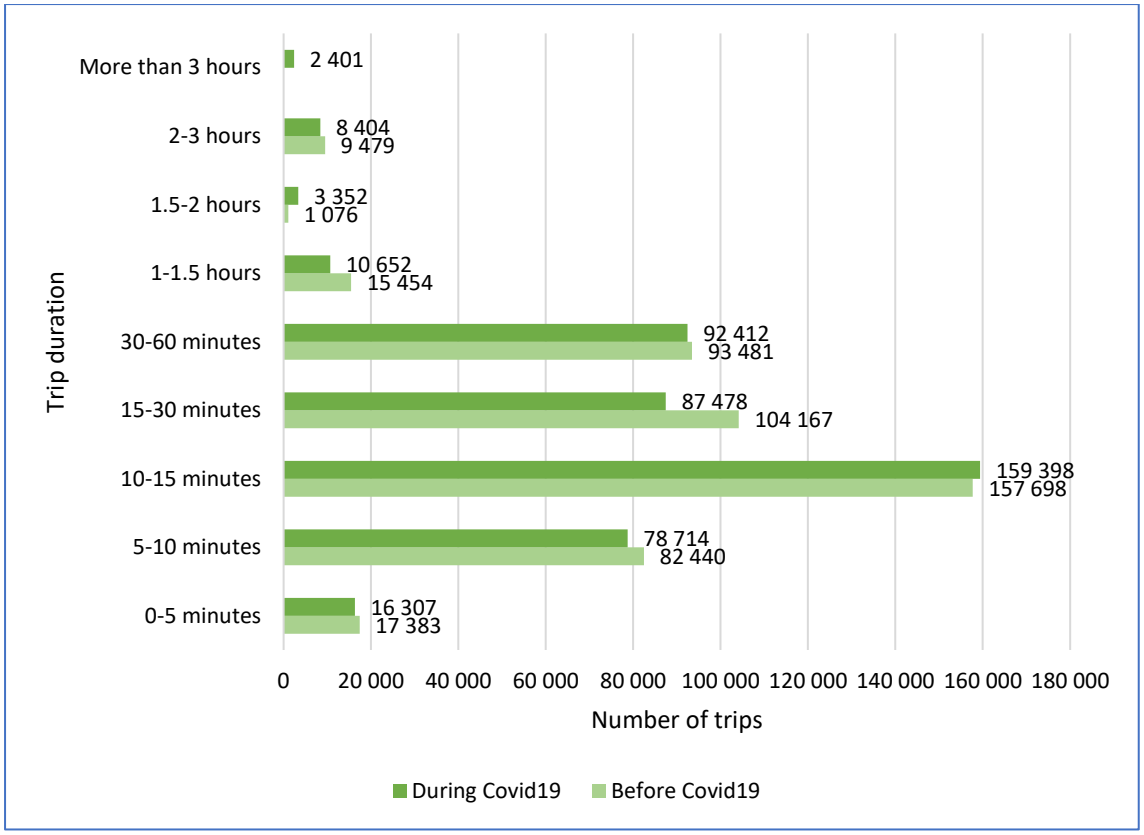

Figure 16: Trip duration for shopping

10.4 Travel for Medical Purposes

10.4.1 Main Mode of Transport

Table 27 shows the number of trips per mode type for travel for medical purposes before COVID-19 compared to during COVID-19 in the West Rand. The number of medical trips increased slightly. The most predominant mode of travel for medical purposes both before and during COVID-19 was walking all the way (76% before and 78% during COVID-19). Overall, there was no significant change in the main mode of transport used to travel for medical purposes before COVID-19 compared to during COVID-19. The results indicate very few medical purpose trips made using the Gautrain, even before COVID-19. The selected sample may have contributed to the results – as such the data is inconclusive with respect to travel by the Gautrain.

Table 27: Mode of transport for medical trips

	Before COVID-19		During COVID-19	
Modes used for medical	**Number of Trips***	**% Trips**	**Number of Trips***	**% Trips**
Car, as the driver	11 603	6.8%	11 603	5.9%
Car, as the passenger	10 791	6.3%	9 583	4.9%
Commuter taxi/minibus taxi	14 399	8.5%	14 399	7.3%
Company transport	2 401	1.4%	2 401	1.2%
Gautrain	1 201	0.7%	-	-
School bus	-	-	2 401	1.2%
Train	-	-	1 201	0.6%
Walk all the way	129 656	76.2%	152 466	77.6%
e-hailing service (e.g. Uber, Bolt)	-	-	2 401	1.2%
Total	**170 050**	**100.0%**	**196 455**	**100.0%**
**One-way trips. The number of trips is based on a household weight.*				

10.4.2 Departure Times

Table 28 shows the number of trips departing for medical purposes at different time intervals before COVID-19 compared to during COVID-19 in the West Rand. The majority of trips (65%) were made between 06:00 and 09:00 during COVID-19; the percentage has increased compared to before COVID-19 by 4%. Thirty-five percent of trips were made between 09:01 and 23:59 before COVID-19 and during COVID-19 this decreased by 5%.

Table 28: Departure times for medical purposes

	Before		Current	
Departure Time for Medical Trips	**Number of Trips***	**Percentage (%)**	**Number of Trips***	**Percentage (%)**
00:00 – 05:59	7 176	4.5%	9 563	5.0%
06:00 – 09:00	97 214	60.6%	124 840	65.1%
09:01 – 23:59	56 049	34.9%	57 250	29.9%
Total	**160 439**	**100.0%**	**191 652**	**100.0%**
**One-way trips. The number of trips is based on a household weight.*				

10.4.3 Trip Duration

Table 29 and Figure 17 show the trip duration and the number of people thereof, before and during COVID-19, for medical purposes. The majority of medical purpose trips took 10 to 15 minutes before and during COVID-19 with a slight increase in the proportion of trips, from 39% before COVID-19 to 46% during COVID-19. Overall, there was no significant change in the duration of medical purpose trips before COVID-19 compared to during COVID-19.

Table 29: Trip duration for medical purposes

	Before COVID-19		During COVID-19	
Medical trips duration	**Number of Trips***	**Percent (%)**	**Number of Trips***	**Percent (%)**
0–5 minutes	6 003	3.5	6 003	3.1
5–10 minutes	44 419	25.9	39 617	20.2
10–15 minutes	67 229	39.3	90 039	45.8
15–30 minutes	28 687	16.8	37 077	18.9
30–60 minutes	18 903	11.0	16 516	8.4
1–1.5 hours	1 201	0.7	1 201	0.6
1.5–2 hours	3 602	2.1	4 802	2.4
2–3 hours	1 201	0.7	1 201	0.6
**One-way trips. The number of trips is based on a household weight.*				

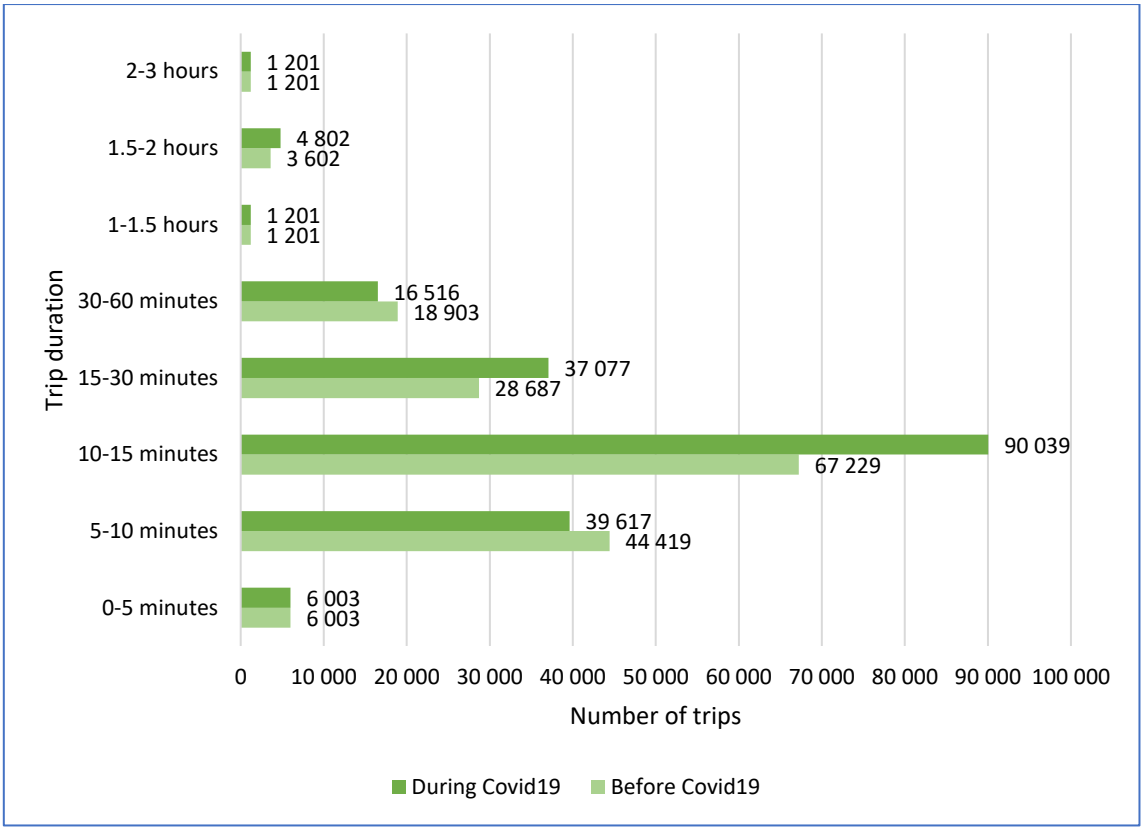

Figure 17: Trip duration for medical trips

10.5 Travel for Other Purposes

This section provides a comparison of the main modes of transport for all other purposes besides work, education, shopping and medical purposes before and during COVID-19. These include travel to visit family and friends, recreational places, places of worship, welfare offices and government offices.

10.5.1 Main Mode of Transport

Table 30 shows the number of trips per mode type for travel for other purposes before COVID-19 compared to during COVID-19 in the West Rand. The number of "discretionary trips" for most trip purposes reduced significantly. The most predominant modes of travel for other purposes were commuter taxi/minibus taxi 34% (before COVID-19) and 36% (during COVID-19) and walk all the way 39% (before COVID-19) and 24% (during COVID-19).

Table 30: Mode of transport for other purposes

	Before COVID-19		During COVID-19	
Modes used for other trips	**Number of Trips***	**% Trips**	**Number of Trips***	**% Trips**
BRT bus (e.g. Rea Vaya, A Re Yeng)	1 201	0.3%	-	-
Bus	-	-	11 998	12.4%
Car, as the driver	55 695	13.3%	7 051	7.3%
Car, as the passenger	47 382	11.3%	16 419	17.0%
Commuter taxi/minibus taxi	141 647	33.9%	34 815	36.1%
Lift club as a passenger	2 276	0.5%	-	-
Metered taxi	1 194	0.3%	1 194	1.2%
School bus	1 194	0.3%	1 201	1.2%
Train	4 802	1.1%	-	-
Walk all the way	162 729	38.9%	22 810	23.6%
e-hailing service (e.g. Uber, Bolt)	-	0.0%	1 076	1.1%
Total	**418 119**	**100.0%**	**96 562**	**100.0%**
**One-way trips. The number of trips is based on a household weight.*				

11. FUTURE TRAVEL PERSPECTIVES

This chapter presents the likelihood of West Rand residents adopting different travel patterns in the future for work, educational, shopping, and medical purposes.

11.1 Likelihood to Change Working Arrangements

Respondents were asked about the likelihood of their changing their work arrangements to:

- Work from home full time
- Work some days at work and some days at home
- Work full time at place of work
- Work a compressed work week (e.g. work longer hours for three or four days, and get a day off)
- Work staggered working hours (e.g. start early and end the day early); and,
- Work flexible hours (work anytime, anywhere as long as the job gets done to the employer's satisfaction).

Figure 18 shows the percentage of people and their likelihood of working from home full-time in the future. About 34% indicated that they are unlikely to WFH full-time in the future while 65% are likely. About 2% indicated that they were unsure whether they would continue to WFH full-time in the future.

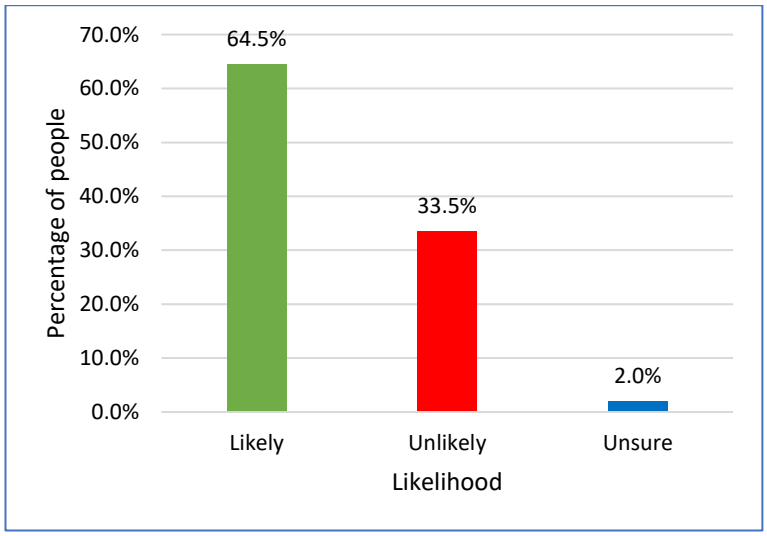

Figure 18: Likelihood to WFH full-time

Figure 19 shows the percentage of people and their likelihood of partially working from home and at the workplace in the future. About 54% indicated that they are likely to continue to work some days at work and some days at home in the future. About 44% indicated that they were unlikely to do so.

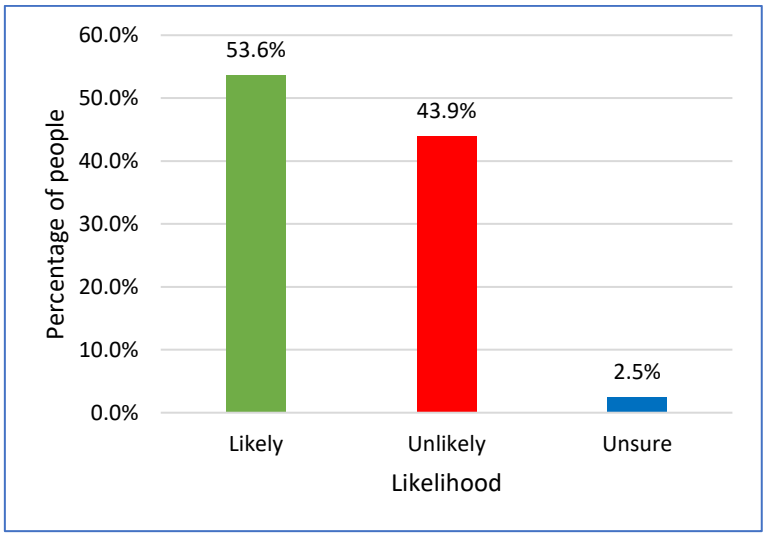

Figure 19: Likelihood to partially WFH

Figure 20 shows the percentage of people and their likelihood to work full-time at the workplace in future. About 50% are likely to work full-time at the workplace in future while 49% indicated that they were unlikely.

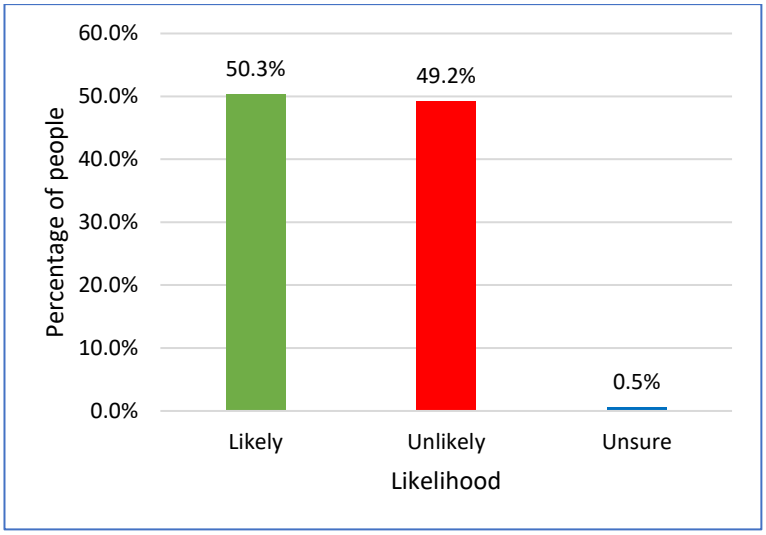

Figure 20: Likelihood to work full-time at the workplace

Figure 21 shows the percentage of people and their likelihood to continue to work a compressed work week. The table shows that slightly more West Rand households (49%) are likely to work a compressed work week than not, while 6% of households indicated that they were unsure.

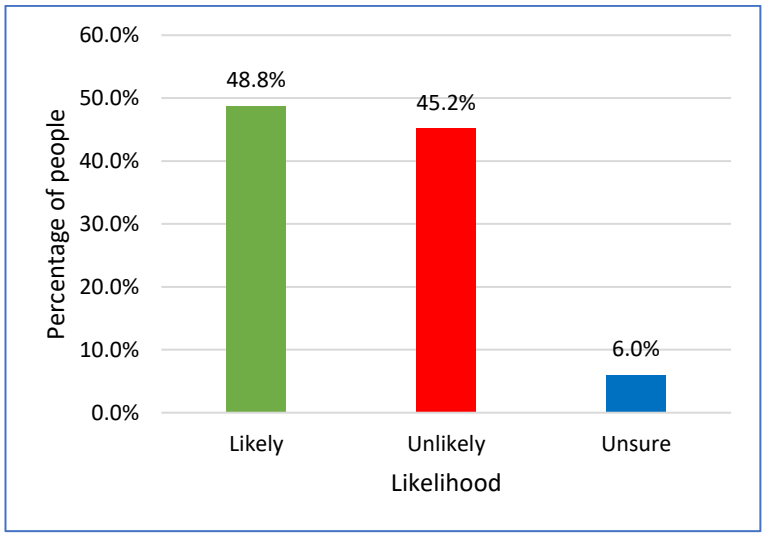

Figure 21: Likelihood to work a compressed work week

Figure 22 shows the percentage of people and their likelihood to work staggered hours in future. About 68% are likely to work staggered hours in the future while 29% are unlikely.

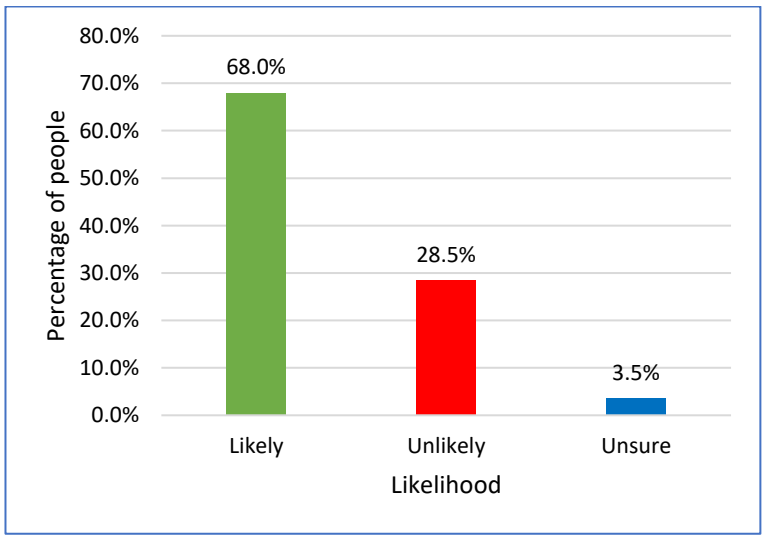

Figure 22: Likelihood to work staggered work hours

Figure 23 shows the percentage of people and their likelihood of working flexible working hours in future. About 32% are unlikely to work flexible working hours in the future while 64% indicated that they are likely.

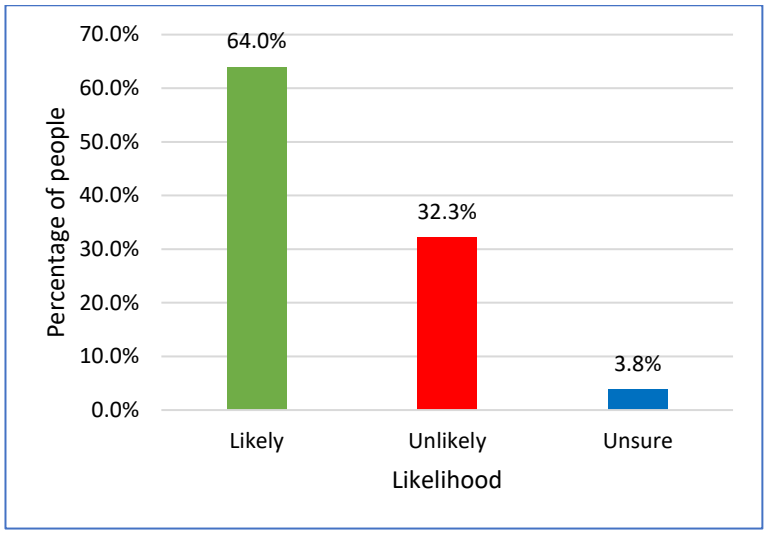

Figure 23: Likelihood to work flexible hours

Table 31 illustrates the perceptions of people towards future changes to travel cost for work trips. About 29% of people believe that the travel cost will stay the same while 30% believe it will decrease.

Table 31: Perceptions on future travel cost for work trips

Change in cost of travel to work	Number Of People	Percentage (%)
Decrease	51 872	30%
Increase	71 397	41%
Stay the same	50 623	29%
Total	**173 892**	**100%**

Table 32 illustrates the perceptions of people towards future changes to travel time for work trips. About 66% of people believe that travel time for work will stay the same in the future, while 17% believe that it will increase.

Table 32: Perceptions on future work trip duration

Change in travel time for Work Trips	Number Of People	Percentage (%)
Decrease	30 087	17%
Increase	29 764	17%
Stay the same	114 041	66%
Total	**173 892**	**100%**

11.2 Likelihood to Change Education Arrangements

Figure 24 shows the percentage of people and their likelihood to continue with contact educational classes in the future. About 97% indicated that they are likely to continue with contact classes in the future while only 3% indicated that they were unlikely.

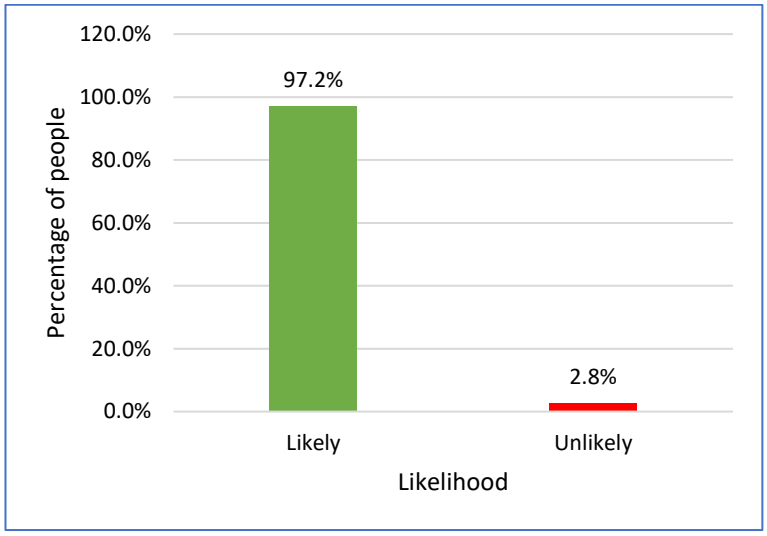

Figure 24: Likelihood to continue with contact educational classes

Figure 25 shows the percentage of people and their likelihood to continue with online educational classes in the future. About 94% indicated that they are unlikely to continue with online classes in the future while 5.4% are likely.

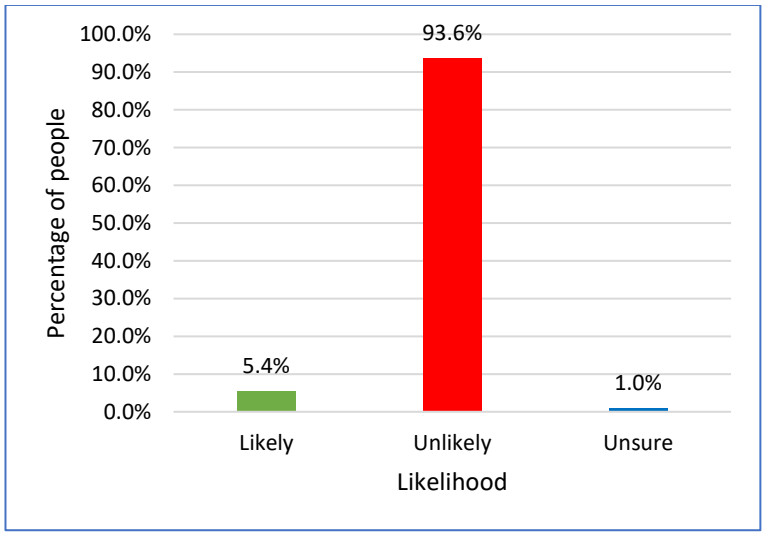

Figure 25: Likelihood to continue with online educational classes

Figure 26 shows the percentage of people and their likelihood to continue with a combination of contact and online classes in the future. About 88% indicated that they are unlikely to continue with a combination of contact and online classes in the future while 11% are likely.

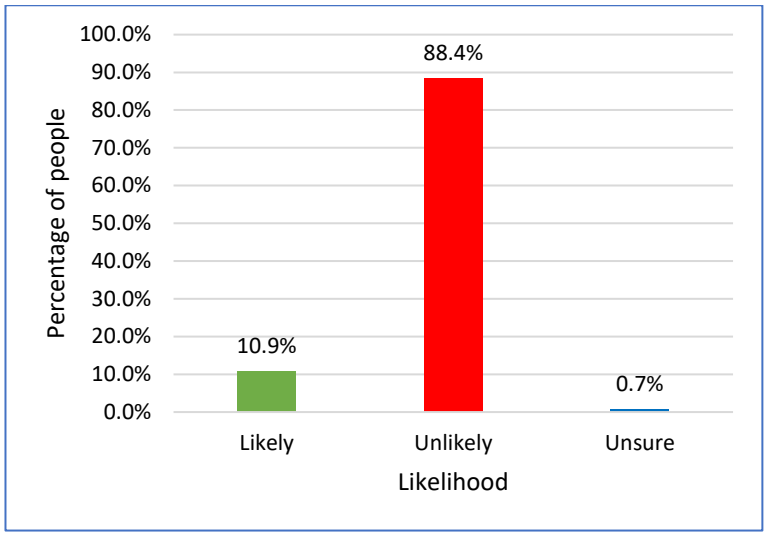

Figure 26: Likelihood to continue with a combination of contact and online

Table 33 illustrates the perceptions of people towards future changes to travel cost for educational trips. About 49% of people believe that the travel cost will decrease while 31% believe it will stay the same.

Table 33: Perceptions on future travel cost for education trips

Change in cost of travel for Educational Trips	Number Of People	Percentage (%)
Decrease	93 788	49%
Increase	37 507	20%
Stay the same	59 078	31%
Total	**190 373**	**100%**

Table 34 illustrates the perceptions of people towards future changes to travel time for educational trips. About 81% of people believe that travel time for education will stay the same in the future, while 9% believe that it will decrease.

Table 34: Perceptions on future educational trip duration

Change in travel time for Education Trips	Number Of People	Percentage (%)
Decrease	17 642	9%
Increase	19 115	10%
Stay the same	153 616	81%
Total	**190 373**	**100%**

11.3 Likelihood to Change Shopping Arrangements

Figure 27 shows the percentage of people and their likelihood to continue with physical shopping in the future. About 95% indicated that they are likely to continue with physical shopping in the future while only 5% indicated that they were unlikely.

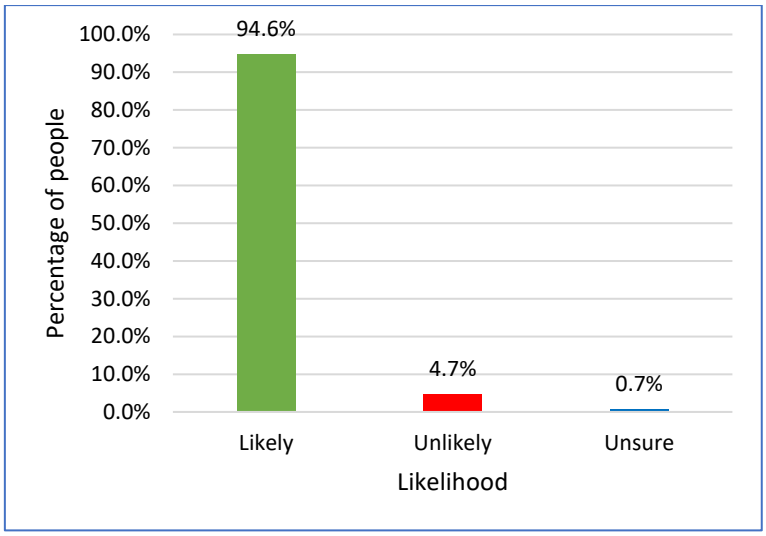

Figure 27: Likelihood to continue with physical shopping

Figure 28 shows the percentage of people and their likelihood to continue with online shopping in the future. About 90% indicated that they are unlikely to continue with online shopping in the future while only 9% are likely to continue.

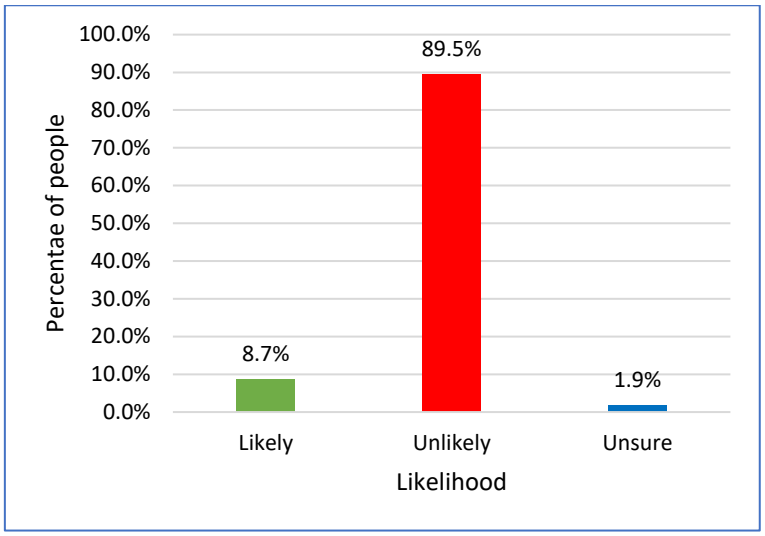

Figure 28: Likelihood to continue with online shopping

Figure 29 shows the percentage of people and their likelihood to continue with a combination of physical and online shopping in the future. About 80% indicated that they are unlikely to continue with a combination of physical and online shopping in the future while 13% are likely.

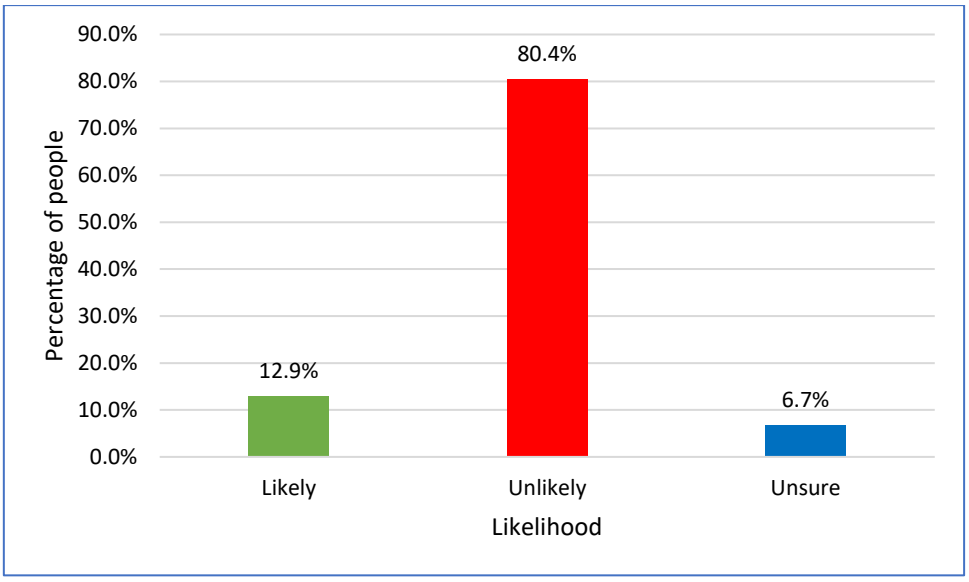

Figure 29: Likelihood of future physical and online shopping

Table 35 illustrates the perceptions of people towards future changes to travel cost for shopping trips. About 16% of people believe that the travel cost will stay the same while 60% believe it will increase.

Table 35: Perceptions on future travel cost for shopping trips

Change in cost of travel for Shopping Trips	Number Of People	Percentage (%)
Decrease	143 043	24%
Increase	353 893	60%
Stay the same	97 617	16%
Total	**594 553**	**100%**

Table 36 illustrates the perceptions of people towards future changes to travel time for shopping trips. About 63% of people believe that travel time for shopping will stay the same in the future, while 14% believe that it will decrease.

Table 36: Perceptions on future shopping trip duration

Change in travel time for Shopping Trips	Number Of People	Percentage (%)
Decrease	81 914	14%
Increase	140 740	24%
Stay the same	371 899	63%
Total	**594 553**	100%

11.4 Perspectives on Medical Trip Cost and Duration

Table 37 illustrates the perceptions of people towards future changes to travel cost for medical purpose trips. About 81% of people believe that the travel cost will stay the same while 7% believe it will decrease.

Table 37: Perceptions on future travel cost for medical trips

Change in cost of travel for Medical Trips	Number Of People	Percentage (%)
Decrease	18 086	7%
Increase	30 721	12%
Stay the same	211 690	81%
Total	**260 497**	**100%**

Table 38 illustrates the perceptions of people towards future changes to travel time for medical purpose trips. About 48% of people believe that travel time for medical purpose will stay the same in the future, while 27% believe that it will increase.

Table 38: Perceptions on future medical trip duration

Change in travel time for Medical Trips	Number Of People	Percentage (%)
Decrease	63 798	24%
Increase	70 573	27%
Stay the same	126 125	48%
Total	**260 497**	**100%**

11.5 Perspectives on Other Purpose Trip Cost and Duration

Table 39 illustrates the perceptions of people towards future changes to travel cost for other purpose trips. About 66% of people believe that the travel cost will increase while 14% believe it will stay the same.

Table 39: Perceptions on future travel cost for other purpose trips

Change in cost of travel for other trips	Number Of People	Percentage (%)
Decrease	23 713	20%
Increase	77 756	66%
Stay the same	16 751	14%
Total	**118 221**	**100%**

Table 40 illustrates the perceptions of people towards future changes to travel time for other purpose trips. About 63% of people believe that travel time will stay the same in the future, while 12% believe that it will decrease.

Table 40: Perceptions on future other purpose trip duration

Change in travel time for other trips	Number Of People	Percentage (%)
Decrease	14 662	12%
Increase	29 273	25%
Stay the same	74 286	63%
Total	**118 221**	**100%**

11.6 Modes of Transport Likely to be Used Going Forward

Table 41 shows the different modes selected as potential travel modes for work and the number of people for each in the future. Most trips for work (28%) in West Rand are likely to be by commuter taxi/minibus taxi. The modes that people indicated they were not likely to use at all for future work trips are bus (other), Gautrain bus and train, lift clubs and motorcycles.

Table 41: Modes for future work trips

Future Mode for Work Trips	Number Of people	Percentage (%)
Commuter taxi/minibus taxi	52 823	27.5%
Car, as the driver	48 492	25.2%
Bus	43 219	22.5%
Car, as the passenger	13 199	6.9%
Walk all the way	10 805	5.6%
School bus	7 169	3.7%
Company transport	5 996	3.1%
e-hailing service (e.g. Uber, Bolt)	3 477	1.8%
Metered taxi	2 394	1.2%
BRT bus (e.g. Rea Vaya, A Re Yeng)	1 201	0.6%
Gautrain	1 201	0.6%
Bicycle	1 201	0.6%
Other	1 201	0.6%
Bus (other)	0	0.0%
Gautrain bus	0	0.0%
Train	0	0.0%
Lift club as a driver	0	0.0%
Lift club as a passenger	0	0.0%
Motorcycle	0	0.0%
Total	**192 374**	**100%**

Table 42 shows the different modes selected as potential travel modes for education and the number of people thereof in the future for West Rand. Almost half (49.4%) of future educational trips will by commuter taxi/minibus taxi; followed by bus at 15.1%. The modes people indicated that they were not likely to use at all for future educational trips are train, company transport and lift club as driver, e-hailing service and other.

Table 42: Modes for future educational trips

Future Mode for Education Trips	Number Of people	Percentage (%)
Commuter taxi/minibus taxi	105 645	49.4%
Bus	32 414	15.1%
Car, as the passenger	21 935	10.3%
Lift club as a passenger	18 008	8.4%
Bus (other)	13 178	6.2%
Walk all the way	10 805	5.0%
Gautrain bus	7 203	3.4%
Metered taxi	3 588	1.7%
Bicycle	1 201	0.6%
School bus	0	0.0%
BRT bus (e.g. Rea Vaya, A Re Yeng)	0	0.0%
Train	0	0.0%
Gautrain	0	0.0%
Company transport	0	0.0%
Lift club as a driver	0	0.0%
Car, as the driver	0	0.0%
Motorcycle	0	0.0%
e-hailing service (e.g. Uber, Bolt)	0	0.0%
Other	0	0.0%
Total	**213 976**	**100%**

Table 43 shows the different modes selected as potential travel modes for shopping and the number of people thereof in the future for West Rand. About 59% of shopping trips is predicted to be by bus, followed by commuter taxi at 15%. Gautrain bus, lift club as a driver, and train are likely to carry low shopping trips in future.

Table 43: Modes for future shopping trips

Future Mode for Shopping Trips	Number Of people	Percentage (%)
Bus	315 687	59.0%
Commuter taxi/minibus taxi	78 034	14.6%
Car, as the driver	70 670	13.2%
Car, as the passenger	51 483	9.6%
e-hailing service (e.g. Uber, Bolt)	8 279	1.5%
Walk all the way	6 003	1.1%
Gautrain	2 401	0.4%
Bus (other)	1 201	0.2%
Metered taxi	1 194	0.2%
School bus	0	0.0%
Gautrain bus	0	0.0%
BRT bus (e.g. Rea Vaya, A Re Yeng)	0	0.0%
Train	0	0.0%
Company transport	0	0.0%
Lift club as a driver	0	0.0%
Lift club as a passenger	0	0.0%
Motorcycle	0	0.0%
Bicycle	0	0.0%
Other	0	0.0%
Total	**534 951**	**100.0%**

Table 44 shows the different modes selected as potential travel modes for medical purposes and the number of people thereof in the future for the West Rand. Commuter taxi/minibus taxi is the highest at 43% and about 31% of the trips for medical purposes will be by walking all the way followed by a bus at almost 9%. The Gautrain, train, and BRT bus are likely to carry low medical purpose trips in future.

Table 44: Modes for future medical trips

Future Mode for Medical Trips	Number Of people	Percentage (%)
Commuter taxi/minibus taxi	292 926	43.3%
Walk all the way	211 208	31.2%
Bus	57 611	8.5%
Car, as the driver	51 483	7.6%
Car, as the passenger	49 269	7.3%
e-hailing service (e.g. Uber, Bolt)	3 477	0.5%
Company transport	2 401	0.4%
Lift club as a driver	2 401	0.4%
Lift club as a passenger	2 401	0.4%
Gautrain bus	1 201	0.2%
Bicycle	1 201	0.2%
Other	1 201	0.2%
School bus	0	0.0%
Bus (other)	0	0.0%
BRT bus (e.g. Rea Vaya, A Re Yeng)	0	0.0%
Train	0	0.0%
Gautrain	0	0.0%
Metered taxi	0	0.0%
Motorcycle	0	0.0%
Total	**676 778**	**100%**

12. ANSWERING KEY RESEARCH QUESTIONS

12.1 Introduction

In this chapter, the travel patterns for work, education and shopping are compared over the three periods i.e., before COVID-19, during COVID-19 and into the future (after COVID-19) by employing statistical analyses.

12.2 Testing hypotheses about potential shifts in travel patterns

The previous chapters have shown that there were some changes in travel patterns of West Rand residents due to restrictions on movement due to COVID-19. The key question is whether the observed shifts are statistically significant, and relevant tests were performed to determine whether these shifts are statistically consistent.

The generic hypothesis under consideration in this section is as follows:

NULL hypothesis: $\mathbf{H_o}$ = As a result of the COVID-19 pandemic, there have been changes in work, education, and shopping methods, resulting in altered travel patterns.

Alternative hypothesis: $\mathbf{H_a}$ = No significant changes were brought about by COVID-19 in terms of work arrangements, education, or shopping habits. Therefore, previous travel patterns will remain going forward.

The level of significance**, alpha (α)**=0.05 or 5%. The probability of rejecting the NULL hypothesis when it is true is represented by the value of alpha.

A Chi-square test was used to evaluate the relevant hypotheses and its measures to examine the degree of association or dissimilarity between the activities undertaken in the different time periods. The relevant measures used specifically included Phi (φ), Cramer's V (ϕ_c) and Lambda (λ).

Phi is similar to a correlation coefficient and its values range between –1 and 1, where –1 indicates a perfect negative association between variables, while zero signifies no relationship and 1 shows a perfect positive association. Phi is appropriate for use when not more than two variable categories are compared. In cases where there are more than two categories, Cramer's V becomes relevant and for two categorical variables, Phi and Cramer's V produce similar results.

Cramer's V values range between 0 and 1, where 0 corresponds to no association whereas 1 shows perfect association between variables. Since the values range between 0 and 1, they can be viewed as a percentage of the maximum possible variation between two variables that are compared.

Lambda investigates the relationship between variables by evaluating the predictive capacity of each variable on the basis of the other. It computes the amount of error that would be reduced by conducting such a prediction. Lambda ranges between 0 and 1 and reflects a percentage reduction in error when predicting one variable from another.

12.3 Work

12.3.1 Observed Work Travel Patterns

Table 45 provides a summary of work-related travel in the three periods. Considering the people who commuted to work prior to the COVID-19 pandemic, 64% of them indicated that they continued to commute to work during COVID-19. Meanwhile, only 36% of those who commuted to work prior to COVID-19 began working from home during COVID-19. These results generally show that most people continued to work in the same manner during COVID-19. However, a considerable shift (about 36%) to working from home can have an impact on work-related trips.

In terms of work-related travel patterns **during the relaxed COVID-19 alert restrictions compared to future travel**, 66% of those who travelled to work during this period indicated that they would continue to travel to their places of employment in the future, while 74% of those who worked from home during COVID-19 indicated that they would continue to work from home in the future. Therefore, most people are expected to continue with their current working method in the future. Further, a smaller proportion of people (26%) are expected to shift from "working from home" to "travelling to a place of work" in the future.

About 59% of individuals who commuted to work **before COVID-19** indicated that they would continue to commute, **post-pandemic**, while 72% of those who worked from home prior to COVID-19 indicated that they would continue to work from home in the future.

These results suggest that majority of people will continue to work in the same way in the future and only a relatively smaller percentage of people are likely to shift to a different method of work between these two periods.

Table 45: Work-related travel in the three periods

Before COVID-19	During COVID-19	Estimated number of people	Percent (%)	Row percent (%)	Column percent (%)
Travelled to a place of work	Travelled to a place of work	82 805	54	**64**	100
Travelled to a place of work	Worked from home	45 694	30	**36**	64
Worked from home	Travelled to a place of work	0	0	0	0
Worked from home	Worked from home	26 065	17	100	36
Total		**154 564**	**100**		
During COVID-19	**Future**	**Estimated number of people**	**Percent (%)**	**Row percent (%)**	**Column percent (%)**
Travelled to a place of work	Travelled to a place of work	53 690	36	**66**	75
Travelled to a place of work	Worked from home	27 066	18	34	35
Worked from home	Travelled to a place of work	17 590	12	26	25
Worked from home	Worked from home	49 904	34	**74**	65
Total		**148 250**	**100**		
Before COVID-19	**Future**	**Estimated number of people**	**Percent (%)**	**Row percent (%)**	**Column percent (%)**
Travelled to a place of work	Travelled to a place of work	71 235	47	**59**	90
Travelled to a place of work	Worked from home	49 534	33	41	70
Worked from home	Travelled to a place of work	8 286	6	28	10
Worked from home	Worked from home	21 068	14	**72**	30
Total		**150 123**	**100**		

12.3.2 Test of Association Between Methods of Working in Different Periods

To understand whether the observed shifts in travel patterns for work are statistically significant, the following NULL hypotheses were tested:

- Work methods before and during COVID-19 pandemic are independent or not associated.
- Work methods During COVID-19 pandemic and in future are independent or not associated.
- Work methods before COVID-19 and in future are independent or not associated.

Table 46 shows the results obtained when these hypotheses were tested.

Table 46: Test of association for work travel

Work method/ arrangement	Chi-Square value	P-value	Phi Coefficient (ϕ)	*Lambda* (λ)
Before vs During COVID-19	36 179	<.0001	0.48	0.27
During COVID-19 vs Future	24 066	<.0001	0.40	0.36
Before COVID-19 vs Future	8 967	<.0001	0.24	0.13

The findings show a stronger positive relationship between work methods used during the pandemic and those that would be used after COVID-19 than the methods used between other time periods.

Before Vs During COVID-19

The NULL hypothesis tested was that *"work methods prior to and during COVID-19 pandemic are independent or not associated*". The null hypothesis is rejected at 5% (or 0.05) level of significance because the p-value (<.0001) in Table 46 is less than 5%, and we conclude that the work methods used between the two periods are associated. As a result, the number of people who switched from one work method before the pandemic to another during COVID-19 is insignificant. This implies that work-related trips prior to COVID-19 would be no different from the trips generated for work purposes during COVID-19.

During COVID-19 Vs Future

The NULL hypothesis tested was that *"work methods During COVID-19 pandemic and in future are independent or not associated"*. The findings show that the work arrangements in place during the COVID-19 relaxed restrictions are not statistically different from the work methods expected in the future. Therefore, the observed future shift in the number of people from one work method to another during COVID-19 is insignificant. Furthermore, the trips generated by work-related travel during COVID-19 would not be significantly different from future work trips.

Before COVID-19 Vs Future

The NULL hypothesis was that *"the methods of work before COVID-19 and in future are independent or not associated"*.

The study results show that the number of people switching from one work method used prior to COVID-19 to another in the future is insignificant; suggesting that work-related trips prior to COVID-19 would not be significantly different from future work trips.

12.3.3 Test of Association Between Methods of Working Based on Income Level

To understand whether the observed shifts in travel patterns for work were statistically significant for different income levels, the following NULL hypotheses were tested:

- Work methods before and during COVID-19 pandemic are independent or not associated for persons in low, medium, and high-income households.
- Work methods During COVID-19 pandemic and in future are independent or not associated for persons in low, medium, and high-income households.

Work methods before COVID-19 and in future are independent or not associated for persons in low, medium, and high-income households.

Table 48 and Table 49 show the results obtained when these hypotheses were tested for persons from low income, medium income, and high-income households respectively. The income levels are defined as follows:

- Low income: Households falling in R4 500 per month and below income category-typically from poverty line and below.
- Medium income: Households earning between R4 501 and R11 000 per month.
- High income: Households earning R11 000+, corresponding to households with at least 1 vehicle on average.

Table 47: Test of association for work travel (Low Income)

Work method/ arrangement	Chi-Square value	P-value	Phi Coefficient (φ)	Lambda (λ)
Before vs During COVID-19	17 872	<.0001	0.45	0.24
During COVID-19 vs Future	6 140	<.0001	-0.30	0.15
Before COVID-19 vs Future	261	<.0001	0.06	0.00

Based on Table 47, people living in low-income households believed that their work travel habits during COVID-19 may contradict with future habits.

Table 48: Test of association for work travel (Medium Income)

Work method/ arrangement	Chi-Square value	P-value	Phi Coefficient (φ)	Lambda (λ)
Before vs During COVID-19	13 240	<.0001	0.36	0.14
During COVID-19 vs Future	8 371	<.0001	0.30	0.09

Before COVID-19 vs Future	73	<.0001	-0.03	0.00

Table 48 indicate that people living in medium-income households are not expected to experience any significant changes in their work travel patterns. The level of association remains stable for the before vs during COVID-19 and During COVID-19 vs Future comparison.

Table 49: Test of association for work travel (High Income)

Work method/ arrangement	Chi-Square value	P-value	Phi Coefficient (φ)	Lambda (λ)
Before vs During COVID-19	14 792	<.0001	0.33	0.00
During COVID-19 vs Future	9 553	<.0001	0.29	0.02
Before COVID-19 vs Future	23	<.0001	0.01	0.00

Table 49 shows that work travel patterns stay the same as before for the high-income households.

12.3.4 Observed Education Travel Patterns

Table 50 provides a summary of education-related travel in the three periods. About 90% of school learners or students who engaged in contact classes **before COVID-19** indicated that they continued with physical classes **during the COVID-19** pandemic, while 100% of those who used the hybrid method before COVID-19 used the hybrid schooling method during COVID-19. A smaller percentage of learners switched from contact classes to hybrid schooling (8%) or contact classes to online classes (2%).

In terms of education-related travel patterns **during COVID-19 compared to future travel**, 96% of those who engaged in contact classes during this period indicated that they would continue with contact classes in the future.

69% of those who used hybrid schooling during COVID-19 indicated that they would shift to contact schooling in the future and only 31% of those who used hybrid schooling during COVID-19 will continue with hybrid schooling in the future. 48% of those who used online classes during COVID-19 will shift to contact classes in the future while 52% of those who used online classes during COVID-19 will shift to hybrid classes in the future.

Considering learners who had physical contact classes **before COVID-19**, 92% of them indicated that they will be likely to continue with physical classes **in future**.

100% of those who used the hybrid methods of learning before COVID-19 will likely shift to physical schooling in future.The results indicate that, a large proportion of learners or students will mostly continue with contact schooling with a significant shift from hybrid or online schooling to physical schooling methods.

Table 50: Education-related travel in the three periods

Before COVID-19	During COVID-19	Estimated number of people	Percent (%)	Row percent (%)	Column percent (%)
Physical contact classes	Physical contact classes	160 173	85	**90**	100
Physical contact classes	Hybrid schooling	14 293	8	8	56
Physical contact classes	Online classes	3 080	2	2	100
Hybrid schooling	Physical contact classes	0	0	0	0
Hybrid schooling	Hybrid schooling	11 224	6	**100**	44
Hybrid schooling	Online classes	0	0	0	0
Total		**188 770**	**100**		
During COVID-19	**Future**	**Estimated number of people**	**Percent (%)**	**Row percent (%)**	**Column percent (%)**
Physical contact classes	Physical contact classes	153 401	83	**96**	91
Physical contact classes	Hybrid schooling	6 772	4	4	46
Physical contact classes	Online classes	0	0	0	.
Hybrid schooling	Physical contact classes	14 203	8	**69**	8
Hybrid schooling	Hybrid schooling	6 503	4	**31**	44
Hybrid schooling	Online classes	0	0	0	.
Online classes	Physical contact classes	1 476	1	**48**	1
Online classes	Hybrid schooling	1 603	1	**52**	11
Online classes	Online classes	0	0	0	.
Total		**183 958**	**100**		
Before COVID-19	**Future**	**Estimated number of people**	**Percent (%)**	**Row percent (%)**	**Column percent (%)**
Physical contact classes	Physical contact classes	203 021	89	**92**	97
Physical contact classes	Hybrid schooling	16 482	7	**7**	100
Physical contact classes	Online classes	1 603	1	**1**	100
Hybrid schooling	Physical contact classes	6 413	3	**100**	3
Hybrid schooling	Hybrid schooling	0	0	0	0
Hybrid schooling	Online classes	0	0	0	0
Total		**227 519**	**100**		

12.3.5 Test of Association Between Methods of Education in Different Periods

To understand whether the observed shifts in travel patterns for education are statistically significant, the following NULL hypotheses were tested:

- Methods of schooling used before and during COVID-19 are independent or not associated.
- Methods of schooling used during COVID-19 and those to be used in future are not related.
- Methods of education employed before COVID-19 and those that would be used in future are not associated.

Table 51 shows the results obtained when these hypotheses were tested.

Table 51: Test of association for Education travel

Education method	Chi-Square value	P-value	Cramer's V	*Lambda (λ)*
Before COVID-19 vs During COVID-19	76 347	<.0001	0.64	0.28
During COVID-19 vs Future	26 366	<.0001	0.38	0.00
Before COVID-19 vs Future	570	<.0001	0.05	0.00

Before Vs During COVID-19

The NULL hypothesis tested was that *"methods of schooling used before and during COVID-19 are independent or not associated".* The null hypothesis is rejected at 5% significant level because the p-value (<.0001) in Table 51 is less than 5% and we conclude that the methods of schooling used in the two periods are associated. Consequently, the observed shift in the number of learners moving from one learning method to another, during COVID-19, for instance, is insignificant. Therefore, school trips generated before COVID-19 would not be significantly different from the school-related trips generated during COVID-19.

During COVID-19 Vs Future

The NULL hypothesis tested was that *"the methods of schooling used during COVID-19 and those to be used in future are not related".* From the results, this hypothesis is rejected, and we conclude that there is an association between the methods of schooling used between the two relevant periods.

Therefore, the shift in the number of people moving from one method of learning during COVID-19 to another in future is insignificant. The education trips generated during COVID-19 would not be significantly different going forward.

Before COVID-19 Vs Future

The NULL hypothesis was that *"education methods employed before COVID-19 and those that would be used in future are not associated".* Based on the results, a similar conclusion is derived that the methods of schooling used before the pandemic are not different from the future methods and that the shift in the number of people moving from one method of schooling before COVID-19 to another in future is insignificant. Hence the education trips yielded before COVID-19 would largely be similar going into the future.

12.4 Shopping

12.4.1 Observed Shopping Travel Patterns

Table 52 provides a summary of shopping-related travel in the three periods. Considering people who did physical shopping **before COVID-19**; 97% of them indicated that they continued to do shopping in a similar manner **during COVID-19**, while 100% of those who used online method of shopping before COVID-19, continued with online shopping during COVID-19 and 91% of those who used hybrid shopping methods before COVID-19 still used hybrid shopping method during COVID-19. Generally, most people continued with their method of shopping in the two relevant time periods. A small percentage of people shifted from shopping physically before COVID-19 to hybrid (2%) or online shopping during COVID-19 (1%).

Looking at people who went to a physical shop for their shopping requirements **during COVID-19**, approximately 92% of them indicated that they would continue to do physical shopping **in future**. 100% of those who those who used the online method during COVID-19 will continue to use the online method in the future. About 80% of those who used hybrid shopping during COVID-19 said that they would likely continue to use both online and physical shopping methods in the future. The majority of people continued to shop in the same way. A smaller percentage of people switched from hybrid to physical shopping in the future (20%).

When examining those who did physical shopping **prior to COVID-19**, 90% indicated that they will continue to do so in the **future**, while all those who used online shopping before COVID-19 indicated they will shift to hybrid shopping in the future. 100% of those who used hybrid shopping before COVID-19 will continue to use hybrid shopping in the future

Table 52: Shopping-related travel in the three periods

Before COVID-19	During COVID-19	Estimated number of people	Percent (%)	Row percent (%)	Column percent (%)
Physical shopping	Physical shopping	576 387	96	**97**	100
Physical shopping	Online/internet shopping	5 479	1	1	61
Physical shopping	Both online and physical shopping	11 383	2	2	76
Online/internet shopping	Physical shopping	0	0	0	0
Online/internet shopping	Online/internet shopping	3 116	1	**100**	35
Online/internet shopping	Both online and physical shopping	0	0	0	0
Both online and physical shopping	Physical shopping	0	0	0	0
Both online and physical shopping	Online/internet shopping	369	0	9	4
Both online and physical shopping	Both online and physical shopping	3 576	1	**91**	24
Total		**600 310**	**100**		
During COVID-19	**Future**	**Estimated number of people**	**Percent (%)**	**Row percent (%)**	**Column percent (%)**
Physical shopping	Physical shopping	496 194	88	**92**	99
Physical shopping	Online/internet shopping	17 972	3	3	100
Physical shopping	Both online and physical shopping	26 588	5	5	57
Online/internet shopping	Physical shopping	0	0	0	0
Online/internet shopping	Online/internet shopping	0	0	0	0
Online/internet shopping	Both online and physical shopping	8 964	2	**100**	19
Both online and physical shopping	Physical shopping	2 800	0	20	1
Both online and physical shopping	Online/internet shopping	0	0	0	0
Both online and physical shopping	Both online and physical shopping	11 421	2	80	24
Total		**563 939**	**100**		
Before COVID-19	**Future**	**Estimated number of people**	**Percent (%)**	**Row percent (%)**	**Column percent (%)**
Physical shopping	Physical shopping	511 776	88	**90**	100
Physical shopping	Online/internet shopping	17 972	3	3	100

Physical shopping	Both online and physical shopping	41 515	7	7	85
Online/internet shopping	Physical shopping	0	0	0	0
Online/internet shopping	Online/internet shopping	0	0	0	0
Online/internet shopping	Both online and physical shopping	3 116	1	**100**	6
Both online and physical shopping	Physical shopping	0	0	0	0
Both online and physical shopping	Online/internet shopping	0	0	0	0
Both online and physical shopping	Both online and physical shopping	3 945	1	**100**	8
Total		**578 324**	**100**		

12.4.2 Test of Association Between Methods of Shopping in Different Periods

To understand whether the observed shifts in travel patterns for shopping are statistically significant, the following NULL hypotheses were tested:

- Methods of shopping used before and during COVID-19 are independent or not associated.
- Methods of schooling used during COVID-19 are unrelated to those that will be used in the future.
- Methods of shopping which were used before COVID-19 and those that are likely to be used in future are independent.

Table 53 shows the results obtained when these hypotheses were tested.

Table 53: Test of association for Shopping travel

Method of shopping	Chi-Square value	P-value	Cramer's V	*Lambda (λ)*
Shopping Before COVID-19 vs Shopping during COVID	336 171	<.0001	0.53	0.22
Shopping during COVID-19 vs Future shopping	203 415	<.0001	0.42	0.20
Shopping Before COVID-19 vs Future shopping	77 958	<.0001	0.26	0.10

Before Vs During COVID-19

The NULL hypothesis tested was that "*methods of shopping used before and during COVID-19 are independent or not associated*". The null hypothesis is rejected at 5% significant level because the p-value (<.0001) in Table 53 is less than 5% and we conclude that they are associated. Therefore, the shift in the number of people doing shopping using certain shopping method before COVID-19 to another shopping method during COVID-19 is insignificant. This implies that the shopping generated trips before COVID-19 would not be significantly different from the shopping-related trips generated during COVID-19.

During COVID-19 Vs Future

The NULL hypothesis tested was that "*The shopping methods used during COVID-19 are unrelated to those that will be used in the future*". The shift from one shopping method during COVID-19 to another in future, is insignificant. This suggests that the trips generated for shopping purpose during COVID-19 would not be significantly different from the future shopping trips.

Before COVID-19 Vs Future

The NULL hypothesis was that "*methods of shopping which were used before COVID-19 and those that are likely to be used in future are independent*". The change from one shopping method used before COVID-19 to another shopping method in future is insignificant. This implies that the trips generated through shopping before COVID-19 would not be significantly different from the future shopping trips.

12.5 Perceptions About Future Methods for Work, Educational and Shopping

In this section, hypotheses pertaining to the respondents' perceptions about the likely change to working arrangements, methods of schooling and shopping were tested. Table 54 shows how the scoring of the perceptions is set-up with the larger scores learning towards the likely scenarios while the lower scores (from 3 downwards) indicate the unlikely scenarios.

Table 54: Scoring of people perceptions in the Likert scale

Perception	Very Unlikely	Unlikely	Unsure	Likely	Very likely
Score or rating	1	2	3	4	5

- H_o: The mean (average) score=3, The working population will be unlikely to return to full-time employment following the COVID-19 pandemic, traditional education methods are unlikely to continue post COVID-19 pandemic and physical shopping is unlikely to continue after the pandemic.

- H_a: The mean score > 3, The workforce will most likely return to full-time employment after COVID-19, traditional education methods are most likely to continue post COVID-19 pandemic and physical shopping is most likely to continue after the COVID-19 pandemic.

Table 55 shows the results on perceptions about future methods of work, education, and shopping.

Table 55: Perceptions about the future methods of work, education, and shopping

Method of activity	DF (n-1)	t Value	P-value (2-tailed)	P-value (1-tailed)	Mean	95% LCL Mean	95% UCL Mean
Working full-time	131	1.7	0.1011	0.2022	3.24	2.95	3.54
Working from home	142	6.1	<.0001	<.0002	3.84	3.57	4.12
Contact education	154	33.3	<.0001	<.0002	4.83	4.72	4.94
Physical shopping	391	41.3	<.0001	<.0001	4.73	4.65	4.82

Work

With respect to methods of work shown in Table 55 the NULL hypothesis that was tested was "The working population will be unlikely to return to full-time employment following the COVID-19 pandemic". The null hypothesis is rejected at 5% (or 0.05) level of significance because the p-value (<.0001) in Table 55 is less than 5%. Even though the mean score is larger than 3, presumably favouring working from home, the lower limit of the confidence interval around this average value is lower than 3. Hence, this result appears to be at odds with the earlier comparisons.

Education

With respect to the future methods of education, the NULL hypothesis that was tested was "*Traditional education methods (contact classes) are unlikely to continue post COVID-19 pandemic*". Since the results in Table 55 show lower p-values (1-tailled) of about 0.0002 and they are less than 5%, we reject the NULL hypothesis and conclude that education is likely to be delivered using contact learning methods in the future.

Shopping

For shopping, the NULL hypothesis that was tested was "*Physical shopping is unlikely to continue after the pandemic*". The results indicate that physical shopping is likely to continue into the future.

13. CONCLUSIONS

This report has provided the findings of a supplementary household travel survey undertaken to understand the impact of COVID-19 on household travel choices and patterns in Gauteng province. Information on trends in traffic, household and population characteristics, travel characteristics before and during COVID-19, future travel perspectives, and answers to key research questions are included in the report.

Although the survey was conducted when the COVID-19 restrictions had been relaxed (adjusted level 1) and "normal" travel for most economic activities had resumed, the survey was designed to obtain respondents' travel patterns before COVID-19, during COVID-19 and into the future.

The following findings are noteworthy:

1. COVID-19 restrictions played a role in traffic reduction at the start of the pandemic. However, as the lockdown restrictions were eased the traffic on the road network gradually got close to pre-COVID-19 volumes.
2. Walk all the way, private car and commuter taxi remained dominant modes of travel in the district for all purposes both before and during COVID-19. The low use of the higher capacity modes (i.e. bus and train as a main mode for work, education, shopping, and other purposes) both before and during COVID-19 is concerning.
3. A significant proportion of residents in the West Rand used walk all the way as the main mode of transport for education, medical and other purpose trips both before and during COVID-19.
4. The results indicate low trips made using the Gautrain, even before COVID-19. The sample selection may have contributed to the results – as such the data is inconclusive with respect to travel by the Gautrain.
5. The majority of trips for work, education and medical purposes occurred in the 06:00 to 09h00 time period before and during COVID-19. The majority of trips for shopping purposes occurred in the 09:01 to 23:59 both before and during COVID-19.
6. Education, shopping and medical trips generally took 10 to 15 minutes both before and during COVID-19. Work trips took longer (30 to 60 minutes) both before and during COVID-19.

7. With respect to travel perspectives, the majority of people indicated that they are unlikely to change their working, education, and shopping arrangements from what they were pre-COVID-19.
8. Indications are that the car and commuter taxi will continue to be used as main modes of transport for all purposes in the future. Other modes that will carry substantial trips for work, education, shopping and medical purposes in future are bus and walk all the way.
9. Work-related trips, education-related trips and shopping trips generated before COVID-19 were not significantly different from the trips generated for work, education, and shopping purposes during COVID-19.
10. The trips generated by work-related travel, education-related travel and shopping travel during COVID-19 will not be significantly different from future work, education, and shopping trips.
11. People in the different income groups in the district (low, medium, high) are not expected to experience any significant changes in their work travel patterns.
13. Education is likely to be delivered using contact learning methods in the future.
14. Physical shopping is likely to continue into the future in the West Rand.

Although the COVID-19 pandemic impacted travel patterns of West Rand residents, indications are that people will return to the travel patterns that they used before COVID-19 for work, education, shopping, and medical purposes. This is supported by the trends in traffic volume on selected freeways, and fuel sales in the province.

Therefore, the WRDM should continue with the implementation of road network, public transport, and integrated transport initiatives that it had planned before COVID-19.

14. RECOMMENDATIONS

Several challenges were encountered during the survey execution, as documented in section 7, which impacted on the quality of responses. In particular, a refusal to participate in the survey; lack of access to gated communities, flats, and complexes; and respondents withdrawing from the survey during the course of the interview citing that the questionnaire was too long and had many repetitive questions.

A project of this nature requires an intensive awareness as it involves a large number of respondents from different backgrounds. It is recommended that in future creating awareness and engaging gated communities should be made a priority to avoid loss of time once the surveys commence. Ward Councillors should be engaged early in the project with a clear mandate on what kind of assistance is expected from them.

The use of mobile technology improved the quality, versatility, and quantity of responses. It is recommended that in future, the questionnaire should be shortened by, for example, building in skip logic and eliminating repetitive questions. An online version of the questionnaire should be created for residents who would otherwise not participate in the in-person interviews.

15. REFERENCES

1. Abdullah. M., Dias. C., Muley. D., Shahin.Md-19 on travel behaviour and mode preferences, Transportation Research Interdisciplinary Perspectives, Volume 8, 2020, 100255, ISSN 2590-1982, https://doi.org/10.1016/j.trip.2020.100255.
2. Aloi. A., Alonso. B., Benavente. J., Cordera. R., Echaniz.E., Gonzalez. F., Ladisa. C., Lezanna-Romanelli. R., Lopez-Parra. A., Mazzei. V., Perrucci. L., Prieto-Quintana. D., Rodriguez. A.,& Sanudo. A, 2020, Effects of the COVID-19 Lockdown on Urban Mobility: Empirical Evidence from the City of Santander (Spain), Sustainability, 2020 (12) (2020), p. 3870, 10.3390/su12093870.
3. Astroza, S., Tirachini, A., Hurtubia, R., Carrasco, J. A., Guevara, A., Munizaga, M., Figueroa, M., & Torres, V. (2020). Mobility Changes, Teleworking, and Remote Communication during the COVID-19 Pandemic in Chile. Findings. https://doi.org/10.32866/001c.13489
4. Balbontin, C., Hensher, D., Beck, M., Giesen, R., Basnak, P., Vallejo-Borda, J. and Venter, C., 2021. Impact of COVID-19 on the number of days working from home and commuting travel: A cross-cultural comparison between Australia, South America and South Africa. Journal of Transport Geography, 96, p.103–188.
5. Beck, M. J., & Hensher, D. A. (2020a). Insights into the impact of COVID-19 on household travel and activities in Australia – The early days under restrictions. *Transport Policy*, *96*(May), 76–93. https://doi.org/10.1016/j.tranpol.2020.07.001
6. Beck, M. J., & Hensher, D. A. (2020b). Insights into the impact of COVID-19 on household travel and activities in Australia – The early days of easing restrictions. *Transport Policy*, *99*, 95–119. https://doi.org/10.1016/j.tranpol.2020.08.004
7. Beck, M. J., Hensher, D. A., & Wei, E. (2020). Slowly coming out of COVID-19 restrictions in Australia: Implications for working from home and commuting trips by car and public transport. Journal of Transport Geography, 88, 102846. https://doi.org/10.1016/j.jtrangeo.2020.102846
8. Bonacini, L., Gallo, G., & Scicchitano, S. (2021). Working from home and income inequality: risks of a 'new normal' with COVID-19. Journal of Population Economics, 34(1), 303–360. https://doi.org/10.1007/s00148-020-00800-7

9. Harden, C. 2011: Get transit-orientated, http://www.transit-orientated.com (accessed 31 February 2022).
10. World Bank Blogs. 2022. *Tips for collecting surveys of hard-to-reach populations*. [online] Available at: <https://blogs.worldbank.org/impactevaluations/tips-collecting-surveys-hard-reach-populations> [Accessed 21 February 2022].
11. Lee M, Zhao J, Sun Q, Pan Y, Zhou W, Xiong C, 2020. Human mobility trends during the early stage of the COVID-19 pandemic in the United States. PLoS ONE 15(11): e0241468. https://doi.org/10.1371/journal.pone.0241468.
12. Liu, L., Miller, H.J., Scheff, J., 2020. The impacts of COVID-19 pandemic on public transit demand in the United States. PLoS One 15 (11), e0242476.
13. Marsland, L. 2011: Transit Media Guide 2011, *Advantage Magazine*, http://www.cityenergy.org.za/files/transport/resources/newsletters/entrasnitjuly07.pdf(Accessed 31 February 2022).
14. Nurse. A & Dunning. R, 2021, Is COVID-19 a turning point for active travel in cities? Cities and Health, 5. sup1, S174-S176, DOI: 10.1080/23748834.2020.1788769.
15. Paul. T., Chakraborty.R., & Anwari. N, 2022, Impact of COVID-19 on daily travel behaviour: A literature review, Transportation Safety and Environment, Volume4, Issue 2, June 2022, tbac013, https://doi.org/10.1093/tse/tdac013.
16. Shaw, A. 2006: Achieving a pro-public transport agenda in South Africa- the challenge for middle income countries, *WIT Transactions on the Built Environment,* 89: 805–815.
17. Statistics South Africa, 2017. Community Survey 2016: Provincial Profile Gauteng.
18. Statistics South Africa, 2022. Quarterly Labour Force Survey, Quarter 1: 2022. Statistical Release P0211. Pretoria, South Africa.
19. University of Johannesburg, 2012. Past and present travel patterns in the Gauteng City-Region. Johannesburg: Gauteng City Region Observatory.
20. Vallejo-Borda, J. A., Giesen, R., Mella Lira, B., Basnak, P., Reyes, J. P., Ortúzar, J. de D., Hensher, D. A., & Beck, M. J. (n.d.-a). Characterising public transport shifting to active and private modes in Brazil during the COVID-19 pandemic. Transportation Research Record (under Review).
21. Vallejo-Borda, J. A., Giesen, R., Mella Lira, B., Basnak, P., Reyes, J. P., Ortúzar, J. de D., Hensher, D. A., & Beck, M. J. (n.d.-b). Characterising public transport shifting to active and private modes in South American capitals during the COVID-19 pandemic.

Transportation Research Part A: Policy and Practice (under Review), Special Issue on COVID-19 (edited by Hani Mahmassani and Patricia Mokhtarian).

22. Venter. C., Van Zyl. N., & Cheure, N., 2021, 'Will the COVID-19 Pandemic lead to Lasting Changes in Travel Patterns?', Civil Engineering, January/February, pp. 26–31.

16. LIST OF APPENDICES

16.1 Appendix A: Survey Questionnaire

GAUTENG COVID-19 HOUSEHOLD TRAVEL SURVEY QUESTIONNAIRE

This survey is from the Gauteng Provincial Government. The purpose of this survey is to assess the impact of COVID-19 on travel patterns, travel choices, and access to transport by households, and possible changes in travel behaviour in the future.

Participation in this survey is voluntary and all information provided shall be kept confidential and anonymous; your name is not required.

Questionnaire Number: 0001

Enumerator Information – Sign In

Username

Take a photo of the enumerator

[Date and Time of survey auto-generated by system]

Household Travel Survey 2021 (COVID-19)

Enter Token

Is a replacement token being used (Y/N)

Consent Form

Are you the head of the household or has the head of household consented to participate in the survey? (Y/N)

Is the person being interviewed OLDER THAN 18 YEARS? (Y/N)

Both questions need to be answered as Yes for the survey to continue

SECTION 1 - PARTICULARS OF THE HOUSEHOLD

1.1 Locality of Household

1.1.1.1 Region: *(Drop down menu)*

1.1.1.2 City/Town: *(Drop down menu)*

1.1.1.3 Suburb: *(Drop down menu)*

1.2 Household and Person Attributes

1.2.1 How many people in your household in total (including yourself) usually stay in this house for at least four nights per week?

1.2.2 How many people in your household are WORKING? *

1.2.3 How many people in your household are SCHOLARS (learners)? *

1.2.4 How many people in your household are NOT WORKING (excluding scholars)? *

1.3 Attributes of Household Members

Number of household members? (Built-in calculation)

CONFIRM Number of household members' travel patterns that will be captured for this survey? *

Enter the number to confirm (Opens all following sections according to the number of people confirmed)

SECTION 2 – HOUSEHOLD ATTRIBUTES

Start of input for household member's trip patterns

2.1 Attributes of Household Members

Enter First name (or "known as" name)

2.1.1 Gender

Drop down list

Male

Female

other

2.1.2 Age (in completed years)

Drop down list

00 - 06 years

07 - 13 years

14 - 18 years

19 - 24 years

25 - 34 years

35 - 44 years

45 - 54 years

55 - 65 years

66 years and over

2.1.3 Education Level

Drop down list

No formal education

Day-care/creche

Pre-school

Some primary school

Primary school complete (Grade 7 or Standard 5)

Some high school

High school complete (Grade 12 or Standard 10)

Some university/college

Diploma without Grade 12

Degree or Diploma with Grade 12

Other post-matric qualifications (specify)

Other (Specify)

2.1.4 Physical Disability (Y/N)

2.1.5 Employment Status

Drop down list

Employed

Self-employed

Still studying

Unemployed looking for work

Unemployed not looking for work

Retired

Other (Specify)

SECTION 3 - HOUSEHOLD TRAVEL PATTERNS BEFORE COVID-19

3.1 Travel to Work – Thinking of your typical weekday before COVID-19, describe each household member's travel patterns to Work.

3.1.1 Place of Work

Drop down list

Not applicable

Travelled to a place of work

Worked from home

Other (Specify Other)

3.1.2 Main mode of travel to work

Drop down list:

Not applicable

Walk all the way

Commuter taxi/minibus taxi

Bus (BRT/Rea Vaya)

School bus

Bus (other)

Gautrain bus

Train

Gautrain

Company transport

Metered taxi

Lift club as a driver

Lift club as a passenger

Car, as the driver

Car, as the passenger

Motorcycle

Bicycle

Other (Specify Other)

3.1.3 Type in Departure Time

3.1.4 Trip Duration

Drop down list:

0-5 minutes

5-10 minutes

10-15 minutes

15-30 minutes

30-60 minutes

1-1.5 hours

1.5-2 hours

2-3 hours

More than 3 hours

3.2 Travel to Educational Institution – Thinking of your typical weekday before COVID-19, describe each household members' travel patterns to Educational Institution.

3.2.1 Method of Schooling

Drop down list

Not applicable

Physical contact classes

Online classes

A mix of both (some contact classes and some online classes)

3.2.2 Main mode of transport to Educational Institution

Drop down list:

Not applicable

Walk all the way

Commuter taxi/minibus taxi

Bus (BRT/Rea Vaya)

School bus

Bus (other)

Gautrain bus

Train

Gautrain

Company transport

Metered taxi

Lift club as a driver

Lift club as a passenger

Car, as the driver

Car, as the passenger

Motorcycle

Bicycle

Other (Specify Other)

3.2.3 Type in Departure Time

3.2.4 Trip Duration

Drop down list:

0-5 minutes

5-10 minutes

10-15 minutes

15-30 minutes

30-60 minutes

1-1.5 hours

1.5-2 hours

2-3 hours

More than 3 hours

3.3 Travel to Shopping – Thinking of your typical weekday before COVID-19, describe each household members' travel patterns for Shopping.

3.3.1 Method of Shopping

Drop down list

Not applicable

Go to the shop/mall

Online/internet shopping

A mix of Going to the shop/mall and online/internet shopping

3.3.2 How many times did this member of the household go shopping (BEFORE COVID)?

Drop down list:

Daily

Average 3 times a week

Once a week (weekend)

Once in two weeks

Once a month

3.3.3 Main mode of transport for main grocery shopping purposes (BEFORE COVID)

Drop down list:

Not applicable

Walk all the way

Commuter taxi/minibus taxi

Bus (BRT/Rea Vaya)

School bus

Bus (other)

Gautrain bus

Train

Gautrain

Company transport

Metered taxi

Lift club as a driver

Lift club as a passenger

Car, as the driver

Car, as the passenger

Motorcycle

Bicycle

Other (Specify Other)

3.3.4 Type in Trip Departure Time

3.3.5 Trip Duration

Drop down list:

0-5 minutes

5-10 minutes

10-15 minutes

15-30 minutes

30-60 minutes

1-1.5 hours

1.5-2 hours

2-3 hours

More than 3 hours

3.4 Travel for MEDICAL Purposes – Thinking of your Regular trips for MEDICAL purposes BEFORE COVID-19, describe this household member's travel patterns for MEDICAL purposes.

3.4.1 Have you had REGULAR trips for MEDICAL PURPOSES (doctor, pharmacy etc.) (BEFORE COVID) *?

Yes/No

3.4.2 Main mode of transport for MEDICAL purposes (BEFORE COVID)

Drop down list:

Not applicable
Walk all the way
Commuter taxi/minibus taxi
Bus (BRT/Rea Vaya)
School bus
Bus (other)
Gautrain bus
Train
Gautrain
Company transport
Metered taxi
Lift club as a driver
Lift club as a passenger
Car, as the driver
Car, as the passenger
Motorcycle
Bicycle
Other (Specify Other)

3.4.3 Type in Trip Departure Time

3.4.4 Trip Duration

Drop down list:

0-5 minutes
5-10 minutes
10-15 minutes
15-30 minutes
30-60 minutes

1-1.5 hours

1.5-2 hours

2-3 hours

More than 3 hours

3.5 Travel to OTHER PLACES – Thinking of your Regular trips to OTHER PLACES BEFORE COVID-19, describe this household member's travel patterns to various Other Places EXCLUDING Work, School, Shopping and Medical purposes.

"OTHER PLACES" refer to visits to family and friends, worship, municipality, etc. (REGULAR trips to OTHER PLACES)

3.5.1 Choose one other frequent trip purpose? (BEFORE COVID) *

Drop down list

Visit to Family & Friends

Recreational place

Place of worship

Welfare offices

Government offices

Other (specify other)

3.5.2 Mode of Transport for Other Trip Purposes

Drop down list:

Walk all the way

Commuter taxi/minibus taxi

Bus (BRT/Rea Vaya)

School bus

Bus (other)

Gautrain bus

Train

Gautrain

Company transport

Metered taxi

Lift club as a driver

Lift club as a passenger

Car, as the driver

Car, as the passenger

Motorcycle

Bicycle

Other (specify other)

SECTION 4 – HOUSEHOLD TRAVEL PATTERNS DURING COVID-19

HOUSEHOLD TRAVEL PATTERNS DURING COVID-19 RESTRICTIONS (this was when the third wave of "COVID-19 variant Delta" spiked in South Africa between June 2021 and September 2021 and strict COVID-19 restrictions were implemented)

4.1 Travel to WORK – Thinking of your regular trip to WORK during July - September 2021 COVID-19 Restriction (Delta Variant), describe this household member's travel patterns to WORK.

4.1.1 Place of Work

Drop down list

Not applicable

Travelled to a place of work

Worked from home

Other (Specify Other)

4.1.2 Main mode of travel to work

Drop down list:

Not applicable

Walk all the way

Commuter taxi/minibus taxi

Bus (BRT/Rea Vaya)

School bus

Bus (other)

Gautrain bus

Train

Gautrain

Company transport

Metered taxi

Lift club as a driver

Lift club as a passenger

Car, as the driver

Car, as the passenger

Motorcycle

Bicycle

Other (Specify Other)

4.1.3 Type in Departure Time

4.1.4 Trip Duration

Drop down list:

0-5 minutes

5-10 minutes

10-15 minutes

15-30 minutes

30-60 minutes

1-1.5 hours

1.5-2 hours

2-3 hours

More than 3 hours

4.1.5 If you compare the household COST OF TRAVEL to WORK from BEFORE COVID-19 to DURING COVID, how did the household COST OF TRAVEL to WORK change? *

increase	decrease	Stayed the same

4.1.6 If you compare the household TRAVEL TIME to WORK from BEFORE COVID-19 to DURING COVID, how did the household TRAVEL TIME to WORK change? *

increase	decrease	Stayed the same

4.2 Travel to SCHOOL/EDUCATIONAL INSTITUTION – Thinking of your regular trip to SCHOOL/EDUCATIONAL INSTITUTION during July - September 2021 COVID-19 Restriction (Delta Variant), describe this household member's travel patterns to EDUCATIONAL INSTITUTIONS.

4.2.1 Method of Schooling

Drop down list

Not applicable

Travelled to a place of work

Worked from home

Other (Specify Other)

4.2.2 Main mode of transport to Educational Institution

Drop down list:

Not applicable

Walk all the way

Commuter taxi/minibus taxi

Bus (BRT/Rea Vaya)

School bus

Bus (other)

Gautrain bus

Train

Gautrain

Company transport

Metered taxi

Lift club as a driver

Lift club as a passenger

Car, as the driver

Car, as the passenger

Motorcycle

Bicycle

Other (Specify Other)

4.2.3 Type in Departure Time

4.2.4 Trip Duration

Drop down list:

0-5 minutes

5-10 minutes

10-15 minutes

15-30 minutes

30-60 minutes

1-1.5 hours

1.5-2 hours

2-3 hours

More than 3 hours

4.2.5 If you compare your household COST OF TRAVEL to SCHOOL/EDUCATIONAL INSTITUTIONS from BEFORE COVID-19 to DURING COVID, how did your household COST OF TRAVEL to EDUCATIONAL INSTITUTIONS change?*

increase	decrease	Stayed the same

4.2.6 If you compare your household TRAVEL TIME to SCHOOL/EDUCATIONAL INSTITUTIONS from BEFORE COVID-19 to DURING COVID, how did your household TRAVEL TIME to EDUCATIONAL INSTITUTIONS change?*

increase	decrease	Stayed the same

4.3 Travel for SHOPPING – Thinking of the household MAIN GROCERY SHOPPING during July - September 2021 COVID-19 Restriction (Delta Variant), describe this household member's travel patterns to SHOPPING

4.3.1 Method of Shopping

Drop down list

Not applicable

Go to the shop/mall

Online/internet shopping

A mix of Going to the shop/mall and online/internet shopping

4.3.2 How many times did this member of the household go shopping (BEFORE COVID)?

Drop down list:

Daily

Average 3 times a week

Once a week (weekend)

Once in two weeks

Once a month

4.3.3 Main mode of transport for main grocery shopping purposes (BEFORE COVID)

Drop down list:

Not applicable

Walk all the way

Commuter taxi/minibus taxi

Bus (BRT/Rea Vaya)

School bus

Bus (other)

Gautrain bus

Train

Gautrain

Company transport

Metered taxi

Lift club as a driver

Lift club as a passenger

Car, as the driver

Car, as the passenger

Motorcycle

Bicycle

Other (Specify Other)

4.3.4 Type in Trip Departure Time

4.3.5 Trip Duration

Drop down list:

0-5 minutes

5-10 minutes

10-15 minutes

15-30 minutes

30-60 minutes

1-1.5 hours

1.5-2 hours

2-3 hours

More than 3 hours

4.3.6 If you compare your household COST OF TRAVEL for MAIN GROCERY SHOPPING from BEFORE COVID-19 to DURING COVID, how did your household COST OF TRAVEL for SHOPPING change? *

increase	decrease	Stayed the same

4.3.7 If you compare your household TRAVEL TIME for MAIN GROCERY SHOPPING from BEFORE COVID-19 to DURING COVID, how did your household TRAVEL TIME for SHOPPING change? *

increase	decrease	Stayed the same

4.4 Travel for MEDICAL Purposes – Thinking of your Regular trips for MEDICAL purposes during July - September 2021 COVID-19 Restriction (Delta Variant), describe this household member's travel patterns for MEDICAL purposes.

4.4.1 Have you had REGULAR trips for MEDICAL PURPOSES (doctor, pharmacy etc.) (BEFORE COVID) *
?

Yes/No

4.4.2 Main mode of transport for MEDICAL purposes (BEFORE COVID)

Drop down list:

Not applicable

Walk all the way

Commuter taxi/minibus taxi

Bus (BRT/Rea Vaya)

School bus

Bus (other)

Gautrain bus

Train

Gautrain

Company transport

Metered taxi

Lift club as a driver

Lift club as a passenger

Car, as the driver

Car, as the passenger

Motorcycle

Bicycle

Other (Specify Other)

4.4.3 Type in Trip Departure Time

4.4.4 Trip Duration

Drop down list:

0-5 minutes

5-10 minutes

10-15 minutes

15-30 minutes

30-60 minutes

1-1.5 hours

1.5-2 hours

2-3 hours

More than 3 hours

4.4.4 If you compare the household COST OF TRAVEL for Regular trips for MEDICAL purposes change from BEFORE COVID-19 to DURING COVID, how did the household COST OF TRAVEL for MEDICAL purposes change?*

increase	decrease	Stayed the same

4.4.5 If you compare the household TRAVEL TIME for Regular trips for MEDICAL purposes change from BEFORE COVID-19 to DURING COVID, how did the household TRAVEL TIME for MEDICAL purposes change?*

increase	decrease	Stayed the same

4.5 Travel to OTHER PLACES – Thinking of your Regular trips to OTHER PLACES during July - September 2021 COVID-19 Restriction (Delta Variant), describe this household member's travel patterns to various Other Places EXCLUDING Work, School, Shopping and Medical purposes.

"OTHER PLACES" refer to visits to family and friends, worship, municipality, etc.

4.5.1 Have you had REGULAR trips to OTHER PLACES (DURING COVID)*

Drop down list

Visit to Family & Friends

Recreational place

Place of worship

Welfare offices

Government offices

Other (specify other)

4.5.2 Mode of Transport for Other Trip Purposes

Drop down list:

Walk all the way

Commuter taxi/minibus taxi

Bus (BRT/Rea Vaya)

School bus

Bus (other)

Gautrain bus

Train

Gautrain

Company transport

Metered taxi

Lift club as a driver

Lift club as a passenger

Car, as the driver

Car, as the passenger

Motorcycle

Bicycle

Other (specify other)

4.5.3 Travel to OTHER PLACES – If you compare your household COST of TRAVEL to OTHER PLACES EXCLUDING work, school/educational institution, shopping, and medical purposes from BEFORE COVID-19 to DURING COVID, how did your household TRAVEL COST for travelling to OTHER PLACES change?*

increase	decrease	Stayed the same

4.5.4 Travel to OTHER PLACES – If you compare your household TRAVEL TIME to OTHER PLACES EXCLUDING work, school/educational institution, shopping, and medical purposes from BEFORE COVID-19 to DURING COVID, how did your household TRAVEL TIME to OTHER PLACES change?*

increase	decrease	Stayed the same

SECTION 5 - TRAVEL PERSPECTIVES GOING FORWARD

5.1 Based on this household member's WORK arrangements DURING COVID, how likely is the WORKING household member to change their WORK arrangements to the following?

5.1.1 Work from home full time

Very Unlikely	Unlikely	Unsure	Likely	Very Likely	Not Applicable

5.1.2 Work some days at work & some days at home

Very Unlikely	Unlikely	Unsure	Likely	Very Likely	Not Applicable

5.1.3 Work full time at place of work

Very Unlikely	Unlikely	Unsure	Likely	Very Likely	Not Applicable

5.1.4 Work a compressed work week (e.g., work longer hours for 3 or 4 days, and get a day off)

Very Unlikely	Unlikely	Unsure	Likely	Very Likely	Not Applicable

5.1.5 Work staggered working hours (e.g., start early and end the day early)

Very Unlikely	Unlikely	Unsure	Likely	Very Likely	Not Applicable

5.1.6 Work flexible hours – work anytime, anywhere as long as the job gets done to the employer's satisfaction.

Very Unlikely	Unlikely	Unsure	Likely	Very Likely	Not Applicable

5.2 Based on your household member's current Education arrangements, how likely are your household members to change their Education arrangements to the following?

5.2.1 Continue with Contact Classes

Very Unlikely	Unlikely	Unsure	Likely	Very Likely	Not Applicable

5.2.2 Continue with Online Classes

Very Unlikely	Unlikely	Unsure	Likely	Very Likely	Not Applicable

5.2.3 A combination of Contact Classes and Online Classes

Very Unlikely	Unlikely	Unsure	Likely	Very Likely	Not Applicable

5.3 Based on this household member's MAIN GROCERY SHOPPING arrangements DURING COVID, how likely is the household member to change their SHOPPING arrangements to the following?

5.3.1 Continue with Physical Shopping

Very Unlikely	Unlikely	Unsure	Likely	Very Likely	Not Applicable

5.3.2 Continue with Online shopping only

Very Unlikely	Unlikely	Unsure	Likely	Very Likely	Not Applicable

5.3.3 Mix of Physical Shopping and Online Shopping

Very Unlikely	Unlikely	Unsure	Likely	Very Likely	Not Applicable

5.4 Based on this household member's transport options DURING COVID, which MODES of transport is the household member likely to use GOING FORWARD?

Multiple Modes can be selected

5.4.2 To School/Educational Institution

Walk all the way ☐	Commuter taxi/minibus taxi ☐	Bus ☐
School Bus ☐	Bus (other) ☐	Gautrain Bus ☐
BRT Bus (Rea Vaya, Areyeng) ☐	Train ☐	Gautrain ☐
Company Transport ☐	Metered Taxi ☐	Lift Club as a driver ☐
Lift club as a passenger ☐	Car, as the driver ☐	Car, as the passenger ☐
Motorcycle ☐	Bicycle ☐	e-hailing services (e.g Uber, Bolt) ☐
Other ☐	Not Applicable ☐	

5.4.3 To Shopping

Walk all the way ☐	Commuter taxi/minibus taxi ☐	Bus ☐
School Bus ☐	Bus (other) ☐	Gautrain Bus ☐
BRT Bus (Rea Vaya, Arey…g) ☐	Train ☐	Gautrain ☐
Company Transport ☐	Metered Taxi ☐	Lift Club as a driver ☐
Lift club as a passenger ☐	Car, as the driver ☐	Car, as the passenger ☐
Motorcycle ☐	Bicycle ☐	e-hailing services (e.g Uber, Bolt) ☐
Other ☐	Not Applicable ☐	

5.4.4 For Medical Purposes

Walk all the way ☐	Commuter taxi/minibus taxi ☐	Bus ☐
School Bus ☐	Bus (other) ☐	Gautrain Bus ☐
BRT Bus (Rea Vaya, Arey…g) ☐	Train ☐	Gautrain ☐
Company Transport ☐	Metered Taxi ☐	Lift Club as a driver ☐
Lift club as a passenger ☐	Car, as the driver ☐	Car, as the passenger ☐
Motorcycle ☐	Bicycle ☐	e-hailing services (e.g Uber, Bolt) ☐
Other ☐	Not Applicable ☐	

5.4.5 To other places

Walk all the way ☐	Commuter taxi/minibus taxi ☐	Bus ☐
School Bus ☐	Bus (other) ☐	Gautrain Bus ☐
BRT Bus (Rea Vaya, Arey...g) ☐	Train ☐	Gautrain ☐
Company Transport ☐	Metered Taxi ☐	Lift Club as a driver ☐
Lift club as a passenger ☐	Car, as the driver ☐	Car, as the passenger ☐
Motorcycle ☐	Bicycle ☐	e-hailing services (e.g Uber, Bolt) ☐
Other ☐	Not Applicable ☐	

SECTION 6

Gross Monthly Household Income

What is the estimated total monthly income in a typical month for this household (add the salaries, wages, pensions, and other income for all members of the household before deductions)? *Drop-down list:*

Nothing

R 1 – R 200

R 201 – R 500

4.R 501 – R 1000

R 1 001 – R 1 500

R 1 501 – R 2 500

R 2 501 – R 3 500

R 3 501 – R 4 500

R 4 501 – R 6 000

R 6 001 – R 8 000

R 8 001 – R 11 000

R 11 001 – R 16 000

R 16 001 – R 30 000

R 30 001 or more

Refuse to answer