MEASURING THE IMPACT OF COVID-19 ON MOBILITY IN GAUTENG PROVINCE, SOUTH AFRICA

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ABSTRACT

The COVID-19 pandemic and the associated lockdown restrictions by the South African government had an Impact on household travel patterns in Gauteng Province. 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.

In this paper, the authors present the results of a household travel survey undertaken in Gauteng Province. The impacts of the pandemic on household mobility in the province are analysed and recommendations are provided on how the results of this research can guide decision making in the province.

Although the restrictions put in place to curb the spread of COVID-19 played a role in the reduction of travel in the province at different stages during the pandemic, shifts in travel patterns may have been short-lived. The authors conclude, therefore, that people in the province will return to pre-COVID-19 ways of travelling for work, shopping and education. Furthermore, the trends in traffic patterns that were established by previous household travel surveys in the province will mostly remain intact.

1.   INTRODUCTION

1.1   Background

Over the years, the Gauteng Department of Roads and Transport (GDRT) has conducted surveys to determine demand for transport and trends in travel patterns of households within the province. The GDRT completed data collection for the 2019/20 household travel survey 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 and minimisation of non-essential travel. The number of passengers allowed to board public transportation was also reduced. Based on risk, relaxation of nationwide lockdown regulations were implemented over time, from alert level five to alert level one. Table 1 provides a summary of the different alert levels implemented in South Africa.

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Table 1: Lockdown levels implemented 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	–

1.2 Objective of this Paper

This paper aims to present the results of a household travel survey undertaken in Gauteng Province, and to determine the short to long-term impacts of the pandemic on household mobility in the province. The paper covers the methodology that was followed, the results & discussion of results and conclusions drawn from the study.

The findings from the survey will guide improved strategic transport planning in Gauteng Province.

2. METHODOLOGY

2.1 Literature Review

Several studies conducted during 2020 and 2021 on the impact of COVID-19 on mobility and travel behaviour provided useful insights to this study. Studies conducted by Abdullah, 2020; Aloi et al., 2020; Balbontin et al., 2021; Beck and Hensher, 2020; Hensher, 2020; Nurse and Dunning, 2020; Paul, Chakraborty & Anwari, 2022 focussed on the impact of COVID-19 on travel demand and demonstrated changes in mobility patterns and notable reductions in the number of trips for different trip purposes due to measures such as stay at home and social distancing emanating from COVID-19 regulations. For instance, Bech and Hensher (2020) investigated the impact of COVID-19 on household travel behaviour during the initial phases of the Australian government's implementation of extreme travel restrictions and found that the number of persons taking workplace trips decreased significantly, and most trips were for shopping. The preferred mode of choice shifted from public transport to private vehicle and non-motorised transport.

Indications from empirical studies in different countries were that COVID-19 had significantly impacted the traditional workplace commute in terms of trip frequency. These emerging shifts emanating from the COVID-19 pandemic had the potential to change the nature of transport networks as a result of decline in public transport patronage, and an increase in the use of online methods of working, shopping, and education.

A study that provided some insights on the impact of COVID-19 in the south African context was conducted by the University of Pretoria (Venter et al., 2021). The study investigated the likely changes in travel as a result of the pandemic in South Africa by administering an online questionnaire to 1000 residents of Gauteng. The study found that commuting for work declined during COVID-19 due to an increase in work from home and job losses. Stay at home activity was found to be higher during the pandemic.

2.2   Survey

A survey questionnaire was designed 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 collected travel information for three relevant time periods of interest i.e., pre-COVID-19, during COVID-19 and travel perceptions after COVID-19. The information was collected from the same group of households. This enabled a within-sample analysis to be undertaken thus providing the best comparative framework for assessing the impact of COVID-19 on household travel in the province.

A random probabilistic selection of households was used, with households distributed by municipal area and Transport Analysis Zone (TAZ). The survey targeted 4000 households. 3901 households were interviewed, which provided a 98% response rate. The 2016 Community Survey estimates of the household attributes were used to weight the sample to the known household estimates. The project maintained a TAZ level of analysis and reporting. TAZs represent an explicit stratification variable with the number of households per zone as a measure of size. Enumerator Areas were considered as primary sample units, whilst households were correspondingly considered as the secondary sampling units. Households in all communities were included, however, institutions such as hospitals, schools, and prisons, as well as industrial and recreational areas were excluded. The sample distribution was consistent with previous surveys in the province.

Following a successful independent research ethics review, a pilot survey was undertaken and lessons learnt from the pilot survey were used to refine the survey instrument and execution. Enumerators administered the questionnaire which was on in a mobile application and took approximately 15 to 20 minutes to complete. Engagement was minimised while maintaining COVID-19 safety protocols.

The collected data was monitored in real time on a dashboard as it was submitted by enumerators. The integrity of the data was confirmed prior to processing and data analysis.

2.3   Secondary Data

Traffic patterns pre-COVID-19, during COVID-19 and after COVID-19 were analysed using traffic data recorded on major freeways in Gauteng. The analysis used a traffic trends experimental design with traffic volume as the primary variable of study. Traffic data for the province for the period 2019 to 2021 was obtained from SANRAL. For each Vehicle Detector Station, the MS Excel databases included the station name, date and time the data was collected, vehicle class, vehicle count and vehicle speed.

To further understand the impact of COVID-19 on traffic volume, the volume of fuel sales in Gauteng was analysed. 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).

It is acknowledged that traffic patterns on low order roads were not analysed and could have differed from those on higher order roads. In addition, other factors that play a role in retail fuel sales were not considered in the analysis.

3.   RESULTS

The results of the study indicate the impact of COVID-19 on different trip purposes i.e., travel to work, educational institution, and shopping purposes. The impact was assessed through a comparison of the number of unidirectional trips per mode per day before COVID-19 to that during COVID-19. The future travel perspectives of respondents were also considered.

3.1   Work

The total trips to work declined significantly at the peak of COVID-19, with the private car having the most decline when compared to other modes. The private car however remained the predominant mode of transport to work both before and during COVID-19. Contrary to the trend observed in some countries, in Gauteng province, walking or cycling did not increase as a result of people's concerns about getting infected with the virus while in crowded places. Similarly, there was no notable decline in the use of public transport ridership for work trips. The results are summarised in Table 2.

Table 2: Main mode of travel to work

| Modes used for travelling to work	Before COVID-19		During COVID-19	
	No. of Trips*	(%) Trips	No. of Trips*	(%) Trips
Bicycle	12 763	0.5	12 122	0.6
Bus (BRT)	17 028	0.6	17 270	0.9
Bus (Other)	5 520	0.2	5 175	0.3
Car, as the driver	1 742 815	62.8	1 055 288	52.8
Car, as the passenger	51 422	1.9	29 150	1.5
Commuter taxi/minibus taxi	714 857	25.7	681 574	34.1
Company transport	62 116	2.2	58 351	2.9
Gautrain bus	-	-	1 707	0.1
Lift club as a driver	2 635	0.1	6 233	0.3
Lift club as a passenger	19 182	0.7	9 188	0.5
Metered taxi	4 470	0.2	2 291	0.1
Motorcycle	13 352	0.5	10 683	0.5
Other	3 628	0.1	952	0.0
Train	2 401	0.1	2 320	0.1
Walk all the way	117 116	4.2	104 947	5.2
e-hailing service (e.g., Uber, Bolt)	6 848	0.2	2 401	0.1
Total	**2 776 153**	**100.0**	**1 999 650**	**100.0**
*One-way trips. The number of trips is based on a household weight.				

There was a marginal increase in off-peak travel for work with a slight decrease in the percentage of work trips made during the traditional peak period (06:00 - 09:00). The results are summarised in Table 3.

Table 3: Departure time for work

Departure Time for Work	Before COVID-19		During COVID-19	
	Number of Trips*	Percentage (%)	Number of Trips*	Percentage (%)
00:00 – 05:59	482 785	17.6	413 687	20.9
06:00 – 09:00	2 178 976	79.7	1 470 505	74.2
09:01 – 23:59	73 802	2.7	98 094	4.9
Total	2 735 564	100.0	1 982 286	100.0
*One-way trips. The number of trips is based on a household weight.				

The duration of work trips however did not display any significant changes and majority of trips took 30 to 60 minutes both before and during COVID-19 as shown in Figure 1.
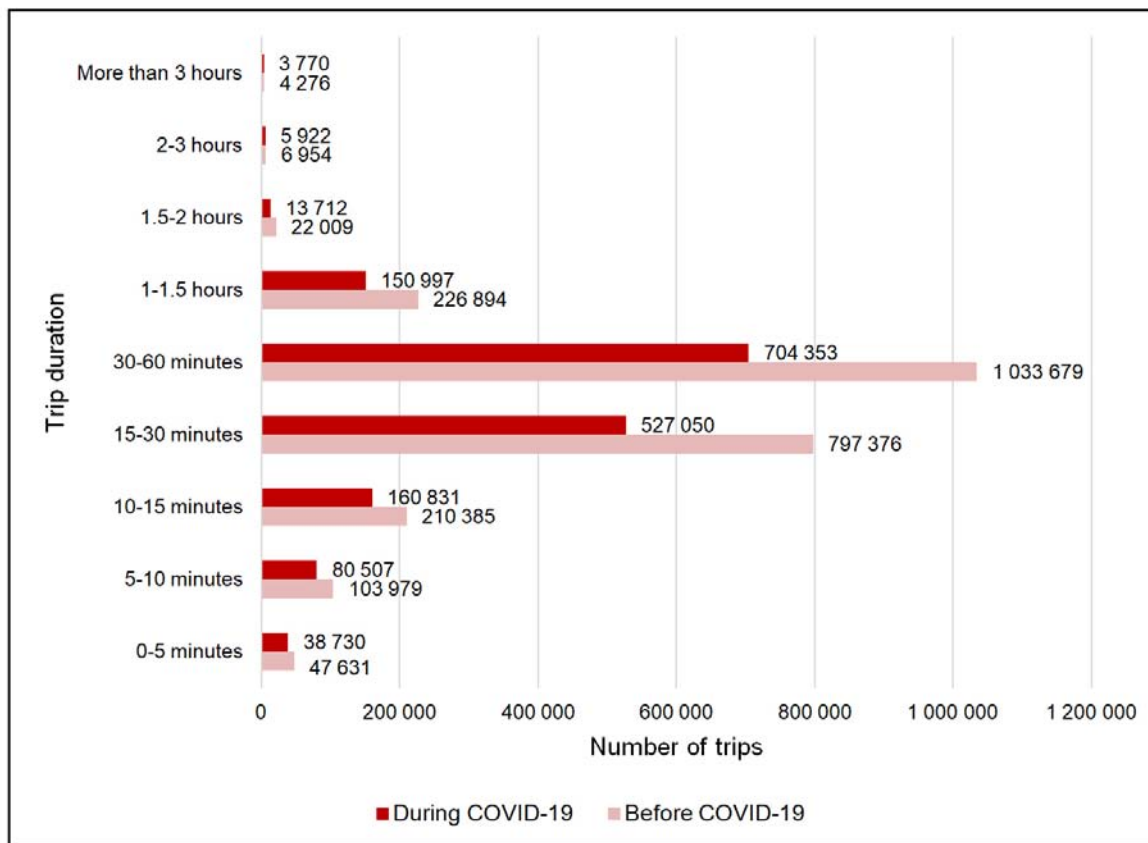
Figure 1: Trip duration for work trips

3.2   Educational Institution and Shopping

There was no significant change in the split across modes of transport used for educational, and shopping purposes. Car as a passenger, school bus and walking remained the main modes of travel for education purposes both before and during COVID-19. Private car and commuter taxi remained the main modes of travel for shopping both

before and during COVID-19. There was no significant change in the departure time and trip durations for educational and shopping purposes.

3.3   Future Travel Perspectives

Respondents were asked about their likelihood to change their working 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).
- Work flexible hours (work anytime, anywhere as long as the job gets done to the employer's satisfaction).

Respondents provided answers to multiple questions indicating whether they were "likely", "unlikely" or "unsure". The responses were analysed separately for each working arrangement.

The results indicate that there is a desire for change in ways of working:

- 36% indicated that they are likely to work from home full time in future.
- 36% anticipate partially working from home in future.
- 44% of respondents anticipate working a compressed work week in future.
- 46% anticipate working staggered hours in the future.
- 37% anticipate working flexible hours in future.
- 71% anticipate working full-time at their usual workplace in future.

Although it is unclear whether work-from-home and flexible work arrangements will continue to be commonplace, it is proving to be something that workers in the province want moving forward.

Similarly, respondents were asked about their likelihood to change their education and shopping arrangements to:

- Physical/ contact education or shopping.
- Online education or shopping.
- A combination of physical and online.

Respondents provided answers to multiple questions indicating whether they were "likely", "unlikely" or "unsure". The responses were analysed separately for each education or shopping arrangement.

Unlike work travel, respondents did not anticipate much change with respect to education arrangements. 93% indicated that they are likely to continue with contact classes in the future. Only 13% anticipate continuing with online classes and 18% are likely to continue with a combination of both. Similarly with shopping, respondents anticipate continuing mainly with pre-COVID methods of shopping. 94% anticipate continuing with physical shopping in the future. 25% anticipate continuing with online shopping and 40% anticipate continuing with a combination of both.

3.4 Traffic Volume and Fuel Sales

An analysis of the total daily traffic volume on major freeways in Gauteng between 2019 and 2021 revealed that total traffic on the freeways significantly decreased at the height of the lockdown (26 March - 30 April 2020). However, as the lockdown restrictions were eased gradually from level 5 to level 1, total traffic on the freeways gradually rose again albeit below pre-COVID-19 volumes. The transportation of goods by small, medium, and large vehicles was mainly interrupted during lockdown alert level 5 to lockdown alert level 3. Figure 2 shows the total traffic volume along the freeways analysed.
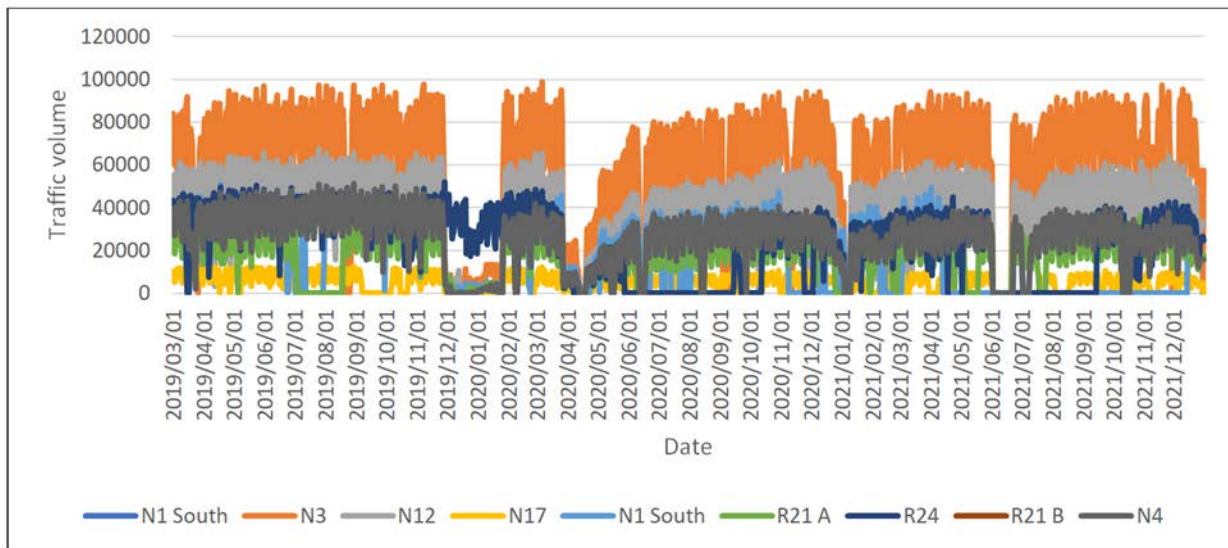
Figure 2: Total traffic volume on major freeways in Gauteng (2019-2021)

Similarly, fuel sales volume in the province recorded a significant dip in the second quarter of 2020 but rose again in the period thereafter and into the second quarter of 2021. Figure 3 provides an overview of petrol and diesel sales over the past nine years (2013-2022).
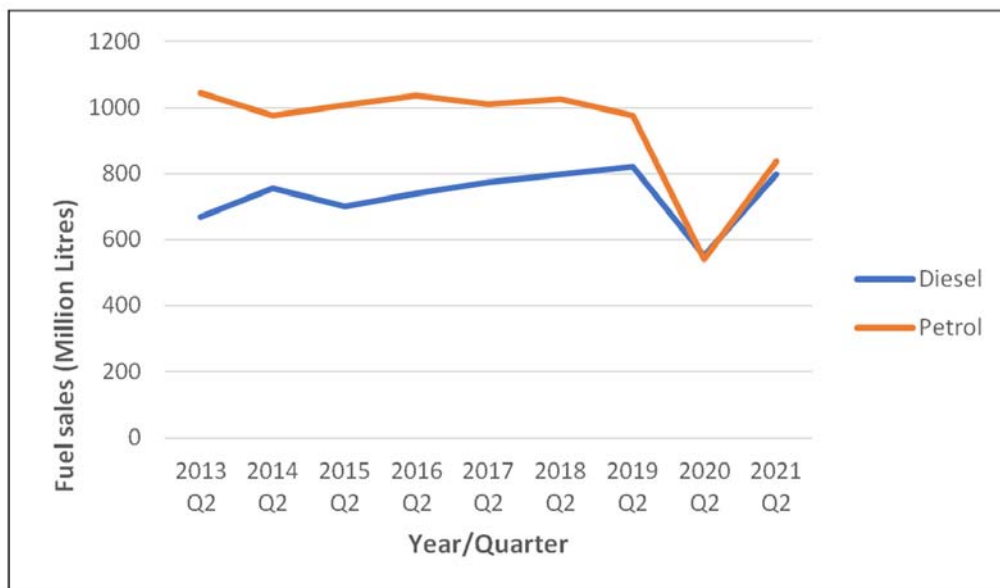
Source: Department: Energy: http://www.energy.gov.za/files/energyStats_frame.html

Figure 3: Gauteng fuel sales

4.   DISCUSSION OF RESULTS

The observed shifts in methods of working, education and shopping were subjected to statistical significance tests to determine whether they were statistically significant.

The results indicate that majority of people in the province will continue to work in the same way in the future and only a relatively small percentage of people are likely to shift to a different method of work. The working population in the province is most likely to return to full-time work. The trips generated by travel to work prior to COVID-19 will not be significantly different from future work trips.

Majority of students will mostly continue with the method of schooling that they used prior to COVID-19 and only a relatively smaller percentage are likely to shift to a different method of schooling. Education in the province is likely to be delivered using contact learning methods. The trips generated by travel for education prior to COVID-19 will not be significantly different from future education-related trips.

Similarly with shopping, the shift in number of people using a certain method of shopping before COVID-19 to another method during COVID-19 was found to be insignificant. Physical shopping methods are likely to be used by Gauteng residents in the future. The trips generated through shopping prior to COVID-19 will not be significantly different from future shopping trips.

The recovery of traffic volume on freeways and fuel sales were close to pre-COVID-19 values by mid-2021, further supporting the above results.

5.   CONCLUSIONS AND RECOMMENDATIONS

The results of a household travel survey undertaken in the province have demonstrated that although the restrictions put in place to curb the spread of COVID-19 played a role in the reduction of travel in the province, at different stages during the pandemic, shifts in travel patterns may have been short-lived.

The shifts that were observed in methods of working, education and shopping were found to be statistically insignificant. It is concluded therefore that people in the province will return to pre-COVID-19 ways of travelling for work, shopping and education. As such, the trends in traffic patterns that were established by previous household travel surveys in the province will mostly remain intact.

There is however an appetite for change towards new methods of doing things, particularly methods of working. It is recommended that employers, policy makers and planners should take more advantage of the disruption opportunities created by COVID-19. Working methods including working partially from home, compressed work weeks, working staggered hours and working flexible hours should be further investigated and implemented where possible.

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