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THE IMPACT OF COVID-19 AND POLICY MEASURES ON COMMUTING IN THE NETHERLANDS

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In the Netherlands, one of the main goals of the Ministry of Infrastructure and Water Management is to increase accessibility and, at the same time, to reduce the negative externalities created by transport, such as congestion and greenhouse gas emissions. Within the Ministry, there was a clear need for a national and integrated monitoring instrument to measure the impact of policy measures on travel behaviour. To satisfy this need, the national traveller survey was carried out in 2019 and 2020. This paper describes some of the results of the 2019 and 2020 surveys. Annual analyses include the trends in car ownership and mode choice for different purposes, with particular attention to commuting behaviour. It appears that travel time, convenience and flexibility play an important role in mode choice. Travel costs are less important and COVID-19 did not play a decisive role. In October 2019, employees travelled on average 3.8 days per week to work. In October 2020, mainly because of COVID-19, this was decreased to 2.9 travelling days. We examined the relationship between changes in car use for commuting between 2019 and 2020, and autonomous developments, changes in the level of service of different transport modes, policy measures, both by the government and employer. In addition, we investigated the influence of the COVID-19 pandemic on car use for commuting. It appears that free parking or availability of parking space has the most considerable impact on car use. In addition, COVID-19 was an important reason for changes in commuting by car. Finally, we estimated the effect of these changes in car use for commuting on congestion and CO₂ emissions.





1. INTRODUCTION

In the Netherlands, one of the main goals of the Ministry of Infrastructure and Water Management is to increase accessibility and, at the same time, to reduce the negative externalities created by transport, such as congestion and greenhouse gas emissions. Therefore, the government focuses on improving the utilisation of the available road capacity and stimulating sustainable modes of transportation. The National Climate Agreement ¹, A National Vision on the Future of Cycling ², and the Mobility-as-a-Service pilots ³ are examples of policy measures to achieve these goals. Monitoring and evaluation are essential parts of these projects. On the one hand, to analyse the achieved results and impact, and on the other hand to evaluate and adjust the adopted policies.

For decades, a system with loop detectors is available on the national highways that measures flows and speeds and is very useful, for example, for an analysis of traffic operations in normal or abnormal situations, or for the evaluation of traffic management measures (Taale, 2006). However, traffic management is only a part of the policy to deal with the problems related to transport and mobility. Also important is mobility management, for which the focus is on travel behaviour and the impact on the use of transport systems in general. Available and traditional travel surveys, such as 'En Route in the Netherlands' (CBS, 2020) or the Netherlands Mobility Panel (KiM, 2021), are limited in days, the number of travellers or the scope of the questions. Therefore, within the Ministry, there was a clear need for a new national and integrated monitoring instrument to measure the impact of policy measures on travel behaviour. Amongst others, the usefulness and necessity arose from the following three topics:

- 1. **Regional employers' approach:** the focus of the regional employer's approach is on stimulating the use of sustainable transport modes by employees, such as public transport and the bicycle, or other sustainable travel behaviour, for instance travelling outside peak hours or teleworking. Agreements about monitoring and evaluating this policy are made between the national government, regional authorities, and employers. The national government is responsible for providing insight into the effects of this approach at the national level.
- 2. In addition to existing monitoring. For existing programs and projects, such as MaaS and the themes Personal Mobility and Electric Transport from the National Climate Agreement, an adequate system for monitoring will or shall be set up. However, not all effects of policy measures can be traced back to hard figures. For some topics, there is a need for more qualitative information that supports the quantitative statistics, for instance, the motivations and barriers to use electric vehicles. An extensive national survey provides insight into objective changes in





travel behaviour and subjective perception towards mode choice and other travelrelated aspects.

3. Strengthening of the policy cycle: Monitoring and evaluation are essential parts of the policy cycle. A national and integrated monitoring instrument offers the possibility to identify (new) trends and developments. In this way, policymakers can adapt to the needs and requirements to achieve the desired behavioural changes.

To satisfy the needs, the National Traveller Survey (Landelijk Reizigersonderzoek or LRO in Dutch) was set up and carried out in 2019 (MuConsult, 2020) and 2020 (MuConsult, 2021). The aim of the survey is twofold:

- 1. To provide insight into short-term changes in commuting behaviour of Dutch employees and other travellers, their attitude towards different policy measures, and their motivations and barriers to use different transport modes for commuting.
- 2. To provide insight into the impact of changes in commuting behaviour on accessibility, liveability, and traffic safety, and the contribution of different policy measures to these changes in behaviour.

This paper describes some of the results of the 2019 and 2020 surveys. Annual analyses include the trends in car ownership and mode choice for different purposes. Also, for commuting behaviour, we show the most important factors that influence mode choice for commuting and the perception of the commuting trip. The relationship between changes in car use for commuting between 2019 and 2020, and autonomous developments, changes in the level of service of different transport modes and policy measures, both by the government and employer, is examined. Furthermore, the influence of the COVID-19 pandemic on car use for commuting is investigated. Finally, the impact of these changes in car use for commuting on congestion and CO_2 emission is estimated.

2. RESEARCH DESIGN

To conduct the research, the approach of the clustered impact method was chosen. This method takes into account both the policy measures and the external circumstances. In this way, a possible overlap in the separate effects is avoided and possible synergy between measures can be found. To model the changes in travel behaviour, a conceptual design was used which is shown in figure 1.





Influence on travel behaviour	Choice process	Behavioural change	Impact
Measures Government Employers Service providers Change in external conditions Location of living Family situation Income Job COVID-19 Etc.	Unintentional Personal characteristics Emotions Habits Social context Intentional Attitude Subjective norm Intentions	Travel choices Different transport mode Different departure time Different route Travel together Don't travel Travel more sustainable	Accessibility Modal spirt Number of trips Delay Reliability Sustainability Emissions Safety Accident risk Deaths and injured

Figure 1: Conceptual model for changes in travel behaviour

The conceptual model was used to design a questionnaire that takes all these aspects into account. Between 10,000 (2019) and 13,000 (2020) respondents were invited to fill in this online questionnaire. The sample was drawn from an existing and large panel in the Netherlands, controlling for age, gender, education, residential location, car ownership and household composition. Both the 2019 and 2020 surveys were conducted in October. In the COVID-19 year 2020, the government imposed stricter measures in late September. Next to several other measures, employees were again advised to work at home as much as possible. Therefore, in 2020 additional questions were asked about teleworking and the data for 2019 was acquired for this topic through retrospective questions.

After the raw data was collected, three steps were needed for the analyses. First, the data was cleaned by checking it for completeness and if the respondent had taken the questionnaire seriously. After that, the data was weighted for age, gender, education, job sector and residential location. The selected sample was representative for the Dutch working population aged over 17. Finally, the data was scaled up from the sample to the population. For 2020 there were 12,887 respondents. On a population of 13,541,079 adults that meant an incremental factor of about 1,092. The results shown in the next paragraph are all weighted and scaled up.

In April 2020, at the beginning of the COVID-19 pandemic, MuConsult also conducted a research on the travelling behaviour of the Dutch commuters. Since the survey questions are mostly similar, it is possible to compare the results with the LRO 2020. Therefore, for some results a comparison with April 2020 is also possible.

3. RESULTS

The results of the LRO can be divided into two parts. First, we aim to describe the travelling behaviour of the Dutch citizens. How often do they travel? By which means





of transport? And what motivations lie underneath these choices? The second part is meant to describe and analyse the differences found in commuting travel by car.

3.1 Descriptive analysis

Before addressing the actual travel behaviour, this paper explores the trend in car ownership as well as the different travel motives. These, and the following results, will help us to understand the explanatory analyses of car travelling choices.

The year 2020 has been a peculiar year: the COVID-19 pandemic has demanded people to travel less, to work from home as much as possible and even to avoid public transport. These circumstances have influenced both the amount of travel as well as the preferred means of transportation. In January 2021, de Dutch news flashes stated the following: "Corona boosts used car sales: 2 million in a year". However, because the sales of new cars was in 2020 less than in 2019 (-20%), the total number of cars sold decreased with 1.4%. This is consistent with the results of the LRO, because from the questionnaire it became clear that the number of cars in the Dutch households have decreased by 1.3%.

The COVID-19 pandemic and the corresponding regulations have led to a massive reduction in the amount of travel days for working activities. But also, the LRO has found that fewer people tend to travel for shopping and to do groceries (-3%) and visiting family or friends (-13%). The largest decrease, however, is the amount of people travelling for leisure activities, such as sports and going out (-19%). In comparison, in 2019 we also found a decrease in people moving for these activities but in a much smaller proportion (-3%).

This paper mainly focuses on the trends in commuting behaviour. What has become apparent is that employees are more capable of working from home than we could have ever imagined beforehand. In 2019 44% of the respondents claimed that their work is not suitable for working from home. In 2020 this percentage has decreased to 40%. In accordance with the regulations, we saw a massive increase in the amount of employees working from home. In October 2019, 25% worked from home for at least one day a week and in October 2020, this share equalled 42%. This naturally has led to fewer travelling days amongst the Dutch employees (figure 2). In October 2019, employees travelled on average 3.8 days per week to work, in April 2020, this decreased to a low of no less than 1.7. In October 2020, employees started to travel more to work again, with an average of 2.9 days per week. However, this average is still much lower than in 2019.







Figure 2: Average amount of travelling days a week

Besides the change in travelling days, we also see that the individual transport modes have increased in popularity. In figure 2, also a distinction is made between the different modes used for travelling. Even though the average amount of travelling days by car has decreased, the share of the car in the total modal split had increased. The same trend is visible for travellers by bike. After doing some further research it can be concluded that commuters did not travel more often by car or by bicycle, but those who previously used these kinds of travelling modes were simply more likely to keep on traveling to work.

But which aspects determine which transport mode is chosen by our commuters? The most important factors that influence mode choice for commuting are convenience, travel time and flexibility, as is shown in figure 3.



Figure 3: Aspects in deciding transport mode choice





Travel costs are less important and also COVID-19, as an additional aspect in 2020, did not play a decisive role. These motives can also be detailed by transport mode. After making this distinction, it can be concluded that especially commuters by car and by public transport are basing their decision largely on the facilities at their working place. Car commuters are mentioning the ownership of a lease car and the availability of (free) parking places as decisive factors in their choice to travel by car. Employees that travel by public transport state that a good and solid connection is key as well as a station or bus stop near their working location. Commuters by bike, on the other hand, base their mode choice on more intrinsic motivations such as the fact that travelling by bike is relaxing. The results mentioned here are found in both studies of 2019 and 2020.

3.2 Explanatory analysis

Model specification

In addition to the descriptive analyses, an explanatory analysis was performed. A multinomial regression was conducted with as dependent variable the difference between the two years in the number of days per week the car was used for commuting. The explanatory analysis was conducted both for the 2019 as the 2020 study. Explanatory variables consist of several types:

- Changes in commuting characteristics between the two years. For instance, a change in the number of working days a week, or the work or residential location.
- Changes in the characteristics of the means of transport that can be used for commuting. For instance, a change in the parking situation on the work location, in the frequency of public transport or the cycling route.
- Changes in arrangements offered by the employer for (the costs of) commuting. For instance, arrangements for working at home, compensation for travel expenses for the means of transport that is used for commuting, or compensation for buying an (e-)bike to be used for commuting.
- Participation in national, regional of employer related programs to stimulate the use of other means of transport than the car for commuting (sustainable travel behaviour).

In most cases these variables are defined as 0-1 dummy variables (e.g. has moved or participated in a program is "1"), or as "-1, 0, 1" variables, were a "-1" means that something became worse, "1" that it improved and "0" that it did not change since last year, or it was not applicable. In the questionnaire, the participants in the study had to determine which situation was applicable for them. So, all these variables are "filled" with subjective data. The same holds for the difference in car-commuting days, the dependent variable. The number of days the car is used in the current year ("last week") and previous year ("a similar week in October last year") were asked in the





same questionnaire, so the observation for the previous year is determined retrospective.

Furthermore, (dummy-)variables were added for the sector people work in, their commuting distance and household characteristics. In the 2020 study, several additional variables were added to cover for the COVID-19 situation that led to major changes in commuting compared to 2019. This are variables that measure to what extend people do or do not use the car for commuting due to COVID-19 and reasons to work (more) at home (e.g.: "Imposed by the government" or "Imposed by my employer" or "I don't like to travel anymore"). In total, dozens of variables were tested for their explanatory power. In the final 2020 model 47 variables were included.

Model results

In this section we focus on 2020, since this model also shows what impact the COVID-19 related variables had on the (relative big) changes in the number of days people used their car for commuting in 2020 compared to 2019. The model was estimated on 5.511 observations (people that use their car for commuting at least 1 day in 2020 or 2019). In the final model the adjusted R^2 had a value of 0,421.

We do not show all the individual estimates here, but present the results of two impacts. These are the effect in the average days per week the car is used per person and the effect on the total number of commuting trips and total distance the car is used, by the total (working) population, for each "class" of variables in the analysis. For the latter two (trips and distance), we have to emphasize that these are *indicative* results. Originally, the LRO study was intended to give representative results for the whole year in which the study was conducted. Therefore, a normal, "average" month for travel behaviour (October) was selected for the data collection. But, obviously, 2020 was a far from average year and October 2020 was not an average month in this year. The year 2020 was characterized by many (big) changes in travel behaviour during the year, as a result of the COVID-19 pandemic and the associated (government) measures on travel in general and commuting in particular.

The results for the analysis are shown in table 1. On average, employees used the car about one trip per week less in 2020 compared to 2019. Changes in work or residential circumstances account for 0.41 trip of this change and a decrease of 0.20 is the result of changes in employer related arrangements. COVID-19 related variables have, as expected, a relative big impact on car travel. People who use their car more than in 2019 due to COVID-19 (e.g., because they are afraid to travel by public transport) use their car on average 0.53 trips a week more often. The recommendation to work from home by the government or because the employer required it, also had a relative big impact. These factors account for 0.52 respectively 0.40 less car trips per week. The impact of the other (combined) factors is relatively low.





 Table 1:
 Results of explanatory analysis on commuting car trips per person per week, total commuting car trips per week and total car kilometres per week

Variable type	Trips/person	Total trips ^a	Total kms ^b
Autonomous (living and working)	-0.41	-2,420	-39,480
Employer arrangements	-0.20	-1,180	-35,040
Travel route	0.00	-20	-1,170
Sustainable travel behaviour	0.02	100	1,580
COVID-19 related (directly)	-0.41	-2,440	-93,260
Using the car due to COVID-19	0.53	3,160	78,200
Working from home recommended by the government	-0.52	-3,060	-90,720
Working from home mandatory by employer	-0.40	-2,380	-76,290
Other COVID-19	-0.03	-160	-4,450
Total	-1.01	-5,980	-167,370

a: per week x 1,000 trips

b: per week x 1,000 km

For total commuting this means a decrease of almost 6 million car trips and over 167 million car kilometres for commuting a week in the Netherlands in 2020. These numbers correspond remarkably well with another national survey conducted yearly (CBS, 2021). This survey records in detail one day of travel of a respondent through a travel diary. For 2020 almost 50,000 respondents filled in this diary. For this survey in 2020 about 5.9 million less trips were made for commuting and about 190 million less car kilometres. So, the number of trips is almost the same for both surveys, but there is difference in distance travelled.

For our survey over 40% of the number of trips and 55% of the kilometres are a direct result of the COVID-19 pandemic. But part of the effect for the employer arrangements can also be addressed to COVID-19, since many companies have made it easier to work from home or to allow having more flexible working hours. Furthermore, some people decided to move in 2020, since living close to the work location has become less necessary when working from home became more accepted and common. Finally, some people started working somewhere else, because they lost their yob due to COVID-19. So, here also is an (indirect) effect of the pandemic.

In total, we estimated that the number of commuting car-kilometres decreased with 18% compared to 2019 and that this led to a reduction of 20% in CO_2 emissions from commuting car-kilometres in 2020.





3.3 Analysis of main road traffic

Also from other sources we know that less car trips has led to less kilometres driven and also to less congestion. From the loop detectors on the Dutch main roads we have derived the distance travelled in vehicle kilometres and the delay, measured in vehicle hours lost. If we compare the years 2019 and 2020, we get figure 4.



Figure 4: Distance travelled and delay for the main roads (source: Rijkswaterstaat)

From the graphs it is clear that a relatively small amount of traffic less gives a lot less delay. In total there was 17% less traffic on the main roads in 2020 compared with 2019, but there was 70% less delay. This trend continues in 2021: for the first seven months there were 20% less vehicle kilometres driven and 73% less delay. Of course, things could change in the fall of 2021, because of less restrictions and removing of the COVID-19 measures. It is necessary to keep a finger on the pulse to see what happens and to take measures if needed.





4. Conclusion and discussion

Since the COVID-19 pandemic, we have seen major changes in our commuting behaviour. In 2020, teleworking increased, and there was a significant decrease in commuting trips. There is a higher potential for teleworking than previously thought. In 2019, 25% of the working population worked one day or more from home. Right after the first lockdown, April 2020, this increased to 69% and in October 2020, it was 42%. These developments have increased the opportunities for teleworking in different professions. Almost half of the employed population expressed they want to keep working from home. However, there is no guarantee that this intention will lead to structural changes in our commuting behaviour. Stimulating and facilitating working from home, both by the government and employers, remains necessary to ensure the positive impact of teleworking relating to accessibility and sustainability. Now that we have not yet returned to the situation pre-COVID-19, this is the right moment for national and regional authorities and employers to act.

The large reduction of commuting trips, mainly during the peak hours, resulted in 17% less vehicle kilometres and 70% congestion reduction on the main road network (expressed in lost vehicle hours), as measured by the loop detectors on the main roads. An important conclusion we can draw from this is that a slight decrease in traffic during peak hours leads to a substantial reduction of congestion on the main road network.

Therefore, the Ministry of Infrastructure and Water Management continues to improve the accessibility and spreading mobility during the day and avoiding peak hours can contribute to this. Therefore, an effort is made to keep the current momentum by supporting and stimulating the possibilities for hybrid working (partially at home and partially at the office). This is done in cooperation with other governmental entities, umbrella organisations for employers and employees and educational institutes. On a regional level, also other large organisations using road and public transport will participate.

However, the increasing share of teleworking also has negative consequences. The decrease in the total number of commuting trips, and therefore also the use of active transport modes (i.e., cycling and walking), implies that employees more often do not meet the norms for sufficient exercise. To ensure healthy and fit personnel, it is essential to focus on additional activity among employees, for instance, cycling and walking for recreational purposes.





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