Changing commute behavior in the region Venlo, Weert, Roermond due to COVID-19

What have the constraints around COVID-19 meant for the transportation system of this region?

Nijmegen School of management
Master thesis for the Spatial Planning program
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Master thesis for the Spatial Planning program - Urban and Regional mobility

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provincie limburg

Preface

In front of you is the master thesis "Changing commute behavior in the region Venlo, Weert, Roermond due to COVID-19". This thesis investigated how the commuting behavior of the region, located in North and Central Limburg, has changed during COVID-19. The research and thesis were conducted as part of my graduation from the master's program in Spatial Planning at the Radboud University in Nijmegen. Within the program I followed the specialization Urban and Regional mobility and did the Dual Mode Program. Besides the Radboud University, this research was commissioned by the Province of Limburg, where I was an intern at the time, I wrote my thesis (from September 2021 to January 2022).

The thesis focused on the commuter, which according to the Province is a small part of the public transport passengers. However, it appears difficult to get them to return to public transport after the COVID-19 measures. By examining whether and how their travel behavior has changed, the aim was to help the Province to find leads to increase the use of the network by the commuter population.

At the time of writing the thesis, the COVID-19 outbreak is still ongoing. This made the internship more difficult than estimated beforehand. Of the 4 months that I did my internship, I spent a maximum of 5 days at the provincial government building in Maastricht. This made getting to know the province and colleagues within the team more difficult. However, with the help of my main supervisor René Pijpers and second supervisor Dennis Jongen, I certainly felt at home within the province. For this, I would like to thank them very much. Not only for making us feel at home within the organization but also for all the help you have given over the past few months Together with them, and the supervisor from the study, Sander Lenferink, I put together the research design and when I had questions I could always go to Dennis, René and Sander.

I would also like to thank all the officials of the different municipalities in the region for distributing my survey. In addition, I would also like to thank all the respondents who took the time to fill out the survey. Thanks to them, it was possible to carry out a good analysis and to complete the thesis.

Before I could hand in the thesis, it was read by Kaily and Ruben and I received feedback from them, as well as from my supervisors, on how I could bring the thesis to a higher level. I would like to thank them especially for all the time they have put into this.

The final thanks go to my parents who have supported me immensely in every way possible during the past four and a half years to complete the studies. I am extremely grateful to them for this and will always remain grateful for this.

Enjoy reading this master thesis!

Jeroen Louwinger
Wageningen
14-01-2022

Summary

In the last two years, a lot has happened in the world that may have changed the commuter's travel behavior. The main reason for this is COVID-19. About this pandemic, measures were proclaimed that made it impossible for the commuter to go to work, if at all. It was indicated that if one could work at home, one should work at home. In addition, it was also indicated that public transportation could only be used by commuters who performed essential occupations. In this thesis this was investigated in the region Venlo, Roermond, Weert in the province of Limburg using the following main question: How can the Province of Limburg respond to the changed situation in travel behavior of commuters in the region Venlo, Roermond and Weert, considering the effects of COVID-19 on digital accessibility and other factors like low population density in the region, especially in the field of public transport?

The study used a survey that was distributed among residents and/or employees in the Venlo, Roermond, Weert region. After completing the survey, with the help of policy makers from the Province of Limburg, we looked at what stood out in the results. Based on this, it was examined where possible connections could be found. These connections were then further investigated by means of an SPSS analysis.

The study showed that the modal split did not change much, if at all. The number of commuters who use the car most often remained stable at 48%. It does show, however, that respondents are thus going to the office 1.3 days less on average: 39% go to work 4 to 5 days as opposed to 71% before the measures. This also changes the transportation accessibility because the commute time and distance changed because of this. The 118 respondents commuted a total of 229 hours and 43 minutes per week less commuter kilometers and traveled 14,359 kilometers less. Thus, on average, 1.3 days less were spent at work, and this resulted in almost 118 minutes less commute time per week and 123 kilometers less traveled per person.

As indicated in the previous paragraph, travel behavior has changed when it comes to time and distance traveled. However, the fact that commuters travel less but use the car just as much suggests that the car is parked outside the door for several days without being used. A possible response to this could be for the Province to use a campaign to emphasize the benefits of public transport-network. This could also include highlighting the advantages of getting rid of the second car. A commitment to high quality public transport (H-OV or BRT) would also be a possibility to get the commuter to use public transport more often.

When it comes to the limitations of the research, it is mainly about the period in which the research takes place. This is because the investigation took place while the pandemic was not quite over. A few days before the end of the opening of the survey, new measures were announced by the government. In addition, since the COVID-19 pandemic has not ended (yet), there is no major scientific practice research available yet. The literature that is present is mainly policy documents and expectations. There is not yet enough comparative material to compare this study with. The Province of Limburg and other agencies, when it comes to follow-up studies, might consider: Repeating this study when the pandemic has been over longer and a better picture can be formed about what the long-term consequences are, conducting such a study with other target groups and conducting it in other areas.

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1. Introduction to the research

Research problem statement

Travel behavior of commuters consists of several components. Those components have changed from several different interests and events in recent years. In the first part of this chapter these components will be explained, then in the next part the research questions will be asked and finally in the last part the relevance of this research will be discussed.

Housing shortage

It has been going on in Amsterdam for years, but now the rest of the Netherlands also seems to be having problems with it: housing shortages (Koops, 2021). The topic of housing shortage was mentioned because, in combination with the topic of the thesis, it is part of the bigger picture. Whereby by changes to travel behavior could also take place changes to the housing preferences of working people. This resulted in a record increase in the average asking price in July of last year (2021), the average house price rose by 16.3% compared to the year before. Compared to the price of homes at the lowest point in 2013, the price has even increased by 74%. In more rural provinces such as Limburg, house prices have also been rising by an average of 10% in recent quarters (Koops, 2021). The fact that the national housing market is becoming increasingly inaccessible due to these price increases is bad news, for example for single households who have not yet built up sufficient wealth, but also think of students and starters. Money lender De Hypotheker calculated that this group of (potential) buyers is now virtually do not stand a chance, which is underlined in an article by Olaf Heyblom (2020), which states that with an average income it is becoming increasingly difficult to find a house. Around five percent (4,7%) of the total housing supply is still available for this target group, compared to 6.3% a year earlier. According to housing market expert Gert Jan Bakker (Koops, 2021), the expanding housing market crisis will hopefully force policymakers of the national government, who are currently working on a new coalition agreement, into action, for example to reduce buying up by investors who have much more to spend than the groups currently searching for housing. Bakker said that “a new government can no longer ignore this. There are fiscal measures that a new cabinet can take right away to curb the worst of the madness. Think of taxing rental income, or fixing rents” (Koops, 2021).

An analysis by ABN Amro from 2019 (Buijs, 2019) shows that a housing shortage is not only expected in the Randstad before 2030, but that this will affect almost all parts of the country except Friesland and Zeeland. When the provinces are compared, the following numbers came out:

Provinces	*Housing shortage (number of houses, a positive number indicates a housing surplus)*
Noord-Holland	-67.461
Zuid-Holland	-37.084
Utrecht	-21.492
Gelderland	-14.984
Noord-Brabant	-7.240
Groningen	-5.265
Overijssel	-3.032
Limburg	-2.849
Drenthe	-1.488
Flevoland	-906
Friesland	588
Zeeland	3.802

Table 1: Housing shortages per province (Buijs, 2019)

In the above table, it was notable that there were only two provinces where the expectation in 2019 was that there would be a surplus of housing in 2030. However, it seems to be outdated by 2020. A lot has happened in the meantime, in a report on the 'The condition of the housing market' from 2020 by the Ministry of the Interior and Kingdom Relations (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2020) states that by 2025 there will be a shortage throughout the country. This is illustrated in Figure 1. It is noticeable that the deficit in Central Limburg is the lowest, together with Zeeland. Since the Netherlands is a small but densely populated country, it may offer opportunities for Limburg and other rural provinces to target people who cannot find a home in the Randstad or who are looking for a home outside the Randstad. This is only possible when digital accessibility does not play a constraint. A potential solution may be working from home. A term that was mentioned long before the emergence of the COVID-19 pandemic in March 2020. In 1973, there was talk of digital accessibility in America. Here, digital accessibility was still being discussed in relation to people with disabilities, who needed to have access to government services through electronic means (Sapega, 2021). Now, the meaning has changed in recent years due to COVID-19. As a result, mobility trends have accelerated.

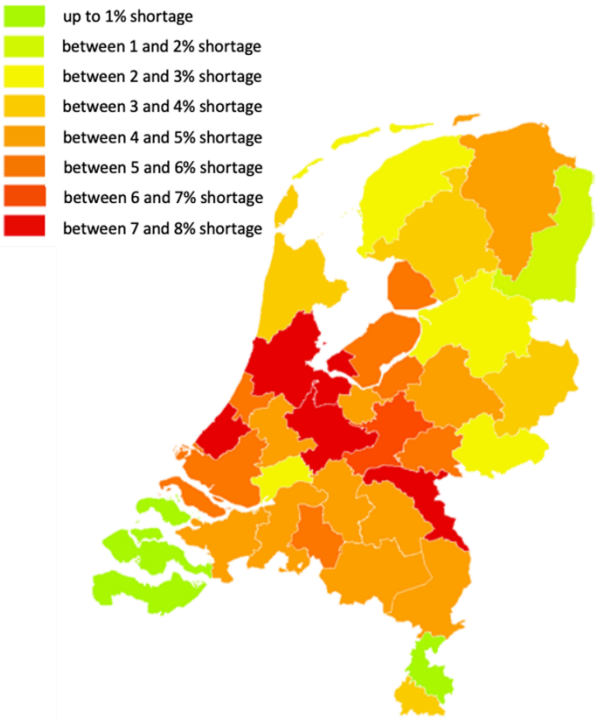

Figure 1: Expected housing shortage in 2025 (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2020)

Mobility trends: Digitalization and working from home

The COVID-19 pandemic came as a shock: Companies and institutions were demanded to encourage employees to work from home more frequently. This was the message from Prime Minister Mark Rutte at the start of the COVID-19 crisis in early March 2020 (AD, 2020). Not only in the Netherlands people started working from home, but also in almost all other countries. A major challenge arose in ensuring that employees and students could continue working from home within a few days and in ensuring that the companies did not come to a standstill. This combination has ensured that working from home will continue to be the norm after COVID-19. An article by the NOS (2021) shows that in six months, the number of companies that offered work-from-home compensation increased from 1 in 5 companies to half of all companies in the Netherlands. Employers' organization AWVN also sees many other advantages of the new way of working for many employees (NOS, 2021). This involves working more productively, being more involved and being able to better align their private life with work. In addition, employees are less stuck in traffic and employers have to pay less money too. Another advantage suggested is that people who can work from home more often can live further from work and companies can look for staff outside the region in which they normally look for their employees. This improves the situation for companies as there are currently more vacancies in the Netherlands than job seekers (106 vacancies on 100 job seekers), so the labor market is very competitive (Centraal Bureau voor de Statistiek, 2021). The living-work situation of employees has changed significantly due to COVID-19 and so the work has also changed through digitalization. The employees will therefore be able to ensure that different travel patterns can occur in the future, which in turn can have an effect on locations and use of transport concepts.

The above-mentioned mobility trends were also discussed in the integrated mobility analysis carried out on behalf of the Dutch Ministry of Infrastructure and Environment. The Integrated

Mobility Analysis 2021 (IMA2021) has been drawn up based on two scenarios from the Future Outlook on Welfare and Living Environment (= Toekomstscenario's Welvaart en Leefomgeving, WLO), briefly referred to as WLO-Hoog and WLO-Laag. Scenario WLO-Hoog, combines relatively high population growth with high economic growth of about 2% per year. In scenario WLO-Laag, limited demographic development goes hand in hand with moderate economic growth of about 1% per year (Centraal Planbureau & Planbureau voor de Leefomgeving, 2015). This analysis also included analyses about working from home for the Netherlands as well as specified for the Southern region of the Netherlands (The province of Noord-Brabant and the province of Limburg). Between 2005 and 2018, the reduction in the number of commuting trips due to working from home was approximately 8%. For the WLO-Hoog scenario, the starting point is that the same reduction will take place again between 2018 and 2030. The starting point for the WLO-Laag scenario is a very moderate growth of working from home, and thus a reduction of 2% in the number of commuting trips due to working from home compared to the level of 2018. In the WLO-Laag scenario, the level is therefore largely back to the level of working from home before the COVID-19 pandemic. No further growth of working from home is assumed after 2030 (Ministerie van Infrastructuur en Waterstaat, 2021).

The increase in working from home in the WLO-Hoog scenario is in line with the future expectations for working from home that were published during the pandemic. In WLO-Laag, more working from home as a result of the COVID-19 crisis could lead to a further reduction in the number of commute journeys. If people remain cautious with regard to public transport and less concentrated urbanization occurs (due to different housing requirements), this will lead to a decrease in bus, tram and metro (BTM) use in the large cities, in favor of the bicycle. In addition, part of the mobility in the metropolitan regions will move to regions beyond. Due to this combination of factors, the effect of the COVID-19 crisis on total mobility growth in kilometers is expected to be limited in the longer term (Ministerie van Infrastructuur en Waterstaat, 2021).

The above mentioned trends are not the only mobility trends. Due to COVID-19, there are many trends that affect mobility. The most important trends are mentioned in a study by the management agency Arthur D. Little (van Audenhove et al., 2021) and summarized in the diagram below (Figure 2).

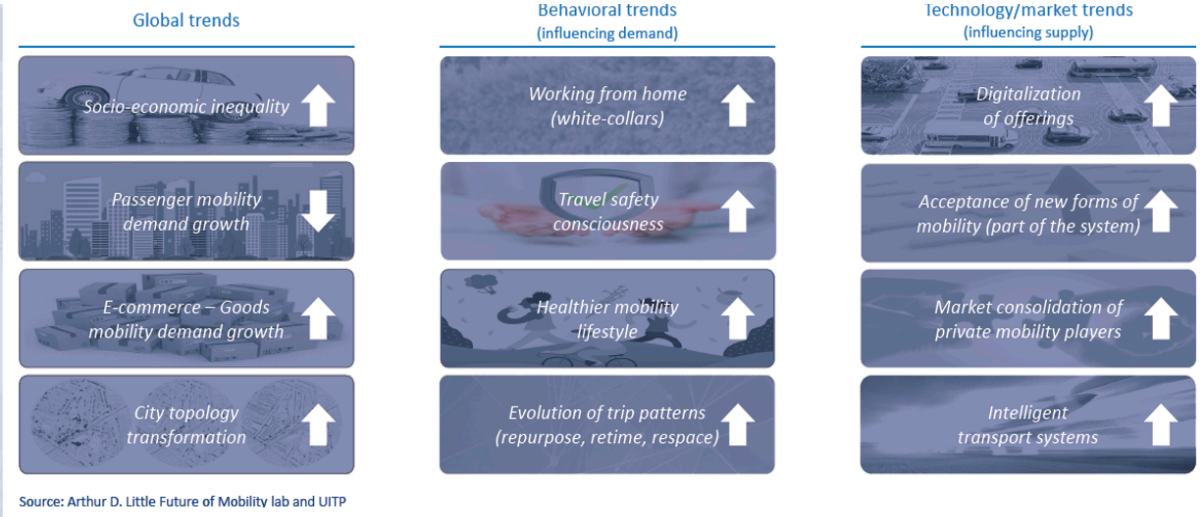

Figure 2: Impact of COVID on affected urban mobility trends

This research also shows that due to COVID-19, the proportion of people using individual means of transport has increased and will continue to increase. This could even be a growth of 50%. The increase in these means of transport is due to the fact that people are more aware of hygiene and the practice of social distancing. The growth of these means of transport indicates that mass transit, such as the bus, metro, tram and train, will attract far fewer users in the short term. However, it should be noted that there are people who have fewer options

for choosing another mode of transport. As mentioned above, these results are part of a study conducted by management agency Arthur D. Little (van Audenhove et al., 2021). It is also depicted in figure 3 below.

The fact that for public transport it is expected that there will be considerably fewer users in the short term is something in which there are opportunities but also challenges. Due to less use, larger adjustments can be made, because it affects fewer users when unexpected problems occur. However, less money is coming in and it is more difficult to achieve the goals from the concessions. It is therefore of great importance to respond well to the (new) wishes of the user.

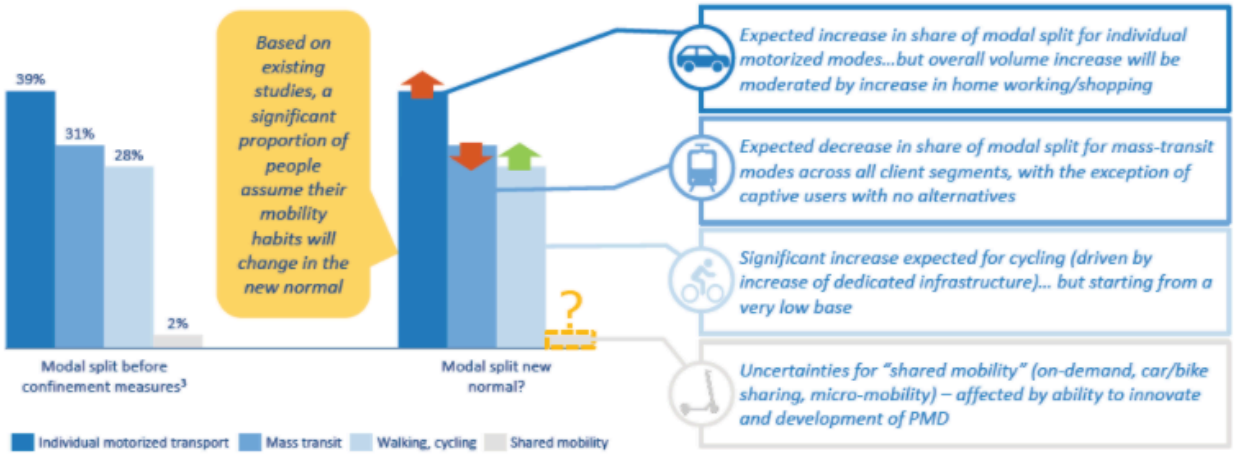

Figure 3: Surveys on expected impact of COVID-19 on mobility patterns (van Audenhove et al., 2021)

The Integrated Mobility Analysis also contains uncertainties regarding the future of mobility. An important part of this is the future mobility policy of cities. If the cities continue to grow, which in accordance with the Housing Deals (woondeals) and Urbanization strategies will be the case, urban mobility will face difficulties. The Housing Deals were concluded in 2019 and 2020 by the Ministry of the Interior and Kingdom Relations (BZK) with six regions. These six regions are Groningen, the Eindhoven region, the Southern Randstad, the Utrecht region, the Amsterdam Metropolitan Area and the Arnhem/Nijmegen region. The aim of the housing deals is to enter renewed and long-term cooperation between the central government and regional parties on how to tackle the main challenges in the housing market. Five deals are the main focus of the Housing Deals (Andersson Elffers Felix (AEF), 2021):

1. Accelerate housing construction in the short term
2. Sufficient planning capacity in the medium and long term
3. Qualitative improvement of the housing market and tackling excesses
4. Integral area development and quality of life
5. Urbanization and accessibility

In combination with the above two policy documents, also the car-free policies and stimulating policies for public transport and bicycles in the cities will continue, this can lead to greater growth of BMT and bicycles. This will also reduce car traffic coming into/in the cities. An equally great uncertainty is the speed at which the share of electric vehicles is increasing. This is important for emissions, tax revenues for the government and for the size of the traffic jams. An increase in the variable costs of the car or a change towards more environmentally conscious travel behavior can have major effects on the number of trips by car, and in particular on the number of kilometers driven (Ministerie van Infrastructuur en Waterstaat, 2021).

As the mobility trends described in the previous section are indicating, it is expected that there will be more working from home in the future. This has taken off due to the COVID-19 pandemic and has made offices more accessible to employees via digital means so that they can work from home. This creates a changed mobility demand, especially if this would remain in the

future and become the 'new normal'. In combination with the current housing shortage, this can lead to a shift in mobility demand, where other modalities are used or where people want to work or live in a different place because employees can also work more often from home or on the go while commuting. This research focuses on the travel behavior of commuters in the province of Limburg with a focus on the region of Noord- and Midden-Limburg in particular the area between Roermond, Weert and Venlo. The province of Limburg was an evident choice since the research is conducted with the cooperation of this province. The choice for the case of the area Roermond, Weert and Venlo was made because this area is characterized by three large cities that divide a large outlying area in which some larger and smaller towns are located. By focusing on this area, it can be clearly seen whether living in the countryside or in the city, among other factors, makes a difference to the choice of modalities. Besides Venlo trying to put itself on the world map (Spiegel crossmedia communication, 2021) with among others 'Region Greenport Venlo' as a spearhead, Roermond has developed into a destination where many people from the Netherlands, Germany and Belgium go shopping, partly due to the designer outlet center in this city. Weert is also known as the 'gateway to Limburg'. In addition to two of these three cities trying to build a strong international character, the area between these three cities is full of agriculture combined with smaller villages. These smaller cores often do not have all the facilities that are considered necessary, so they are often dependent on one of the cities mentioned above. The connection between the cities and the inner area is therefore of great importance. An additional advantage of this area is that due to the varying size of places, it is easy to see whether this aspect plays a role in potentially changing travel behavior. In addition, it is important for the province since they can ensure through this research that they also get more insight into the travel behavior in this area, also because the area is completely different from South Limburg. In the next section, the research purpose and research questions will be discussed.

Research aim and research question(s)

The aim of the research is to investigate how digital accessibility, which has been greatly improved in the last two years due to the COVID-19 pandemic. This can lead to a change in travel behavior in the province of Limburg and how the Province of Limburg can improve public transport in the province to better provide commuters with public transport in this potentially different situation. This has resulted in the following main and sub-questions.

Research Question: *How can the Province of Limburg respond to the changed situation in travel behavior of commuters in the region Venlo, Roermond and Weert, considering the effects of COVID-19 on digital accessibility and other factors like low population density in the region, especially in the field of public transport?*

Sub question 1: What does the public transport system currently look like in the region ‘Venlo, Roermond and Weert’?

Sub question 2: What has changed in the digital accessibility of the region ‘Venlo, Roermond and Weert’ as a result of the COVID-19 crisis?

Sub question 3: How does changed travel behavior (as a result of the COVID-19 crisis) affect different values of transportation accessibility in the region ‘Venlo, Roermond and Weert’?

Sub question 4: What opportunities and challenges does the Province of Limburg face regarding the public transport system and keeping it accessible and effective for commuters?

Scientific and societal relevance of the proposed research

The research proposal has scientific relevance and social relevance for the Province of Limburg and other regions with the same challenges.

Scientific

In the field of digital accessibility, a reasonable amount of research has already been done. However, this research is often about the policies to ensure that digital accessibility is going to be improved (Lazar et al., 2015) and what the opportunities and challenges of digital accessibility are (Kulkarni, 2019). In addition, there is research done on indicators to measure digital accessibility (Tranos et al., 2013). Nevertheless, no scientific research can be found on exactly what kind of influence digital accessibility has on the travel behavior of the inhabitants of a country, or region. During the COVID-19 pandemic, the perfect situation arose to investigate this as everyone was required to work from home as much as possible, which meant that digital accessibility in the form of working from home had to make a big leap in order to keep the economy going from home.

When it comes to public transport in regions of low population density where also a decline in population is expected, some research has already been done at the scientific level. This research has been done in areas of low population density in the Netherlands. In this research, the factors that could enable successful public transport in regions with low population density are mainly considered (de Jong et al., 2011). In the field of COVID-19 and mobility, several studies have been conducted that use data from transport companies (van Audenhove et al., 2021) and expectations that the KiM (Knowledge Institute for Mobility Policy) was able to analyze using data from the Mobility Panel Netherlands and from an employer survey for the whole of the Netherlands (Hamersma et al., 2021).

The results of this last study show that between 48% and 58% of the commuters who had to work at home because of COVID-19 expect and wish to continue working at home on average about 1 or 2 days a week. As a result, the group that would work at home to some extent grows from 33% before COVID-19 to 44% after COVID-19 (Hamersma et al., 2021). This study also looked at what the consequences would be for changes in travel time and distance. For commuting, it is expected that the increase in working from home could result in 10 to 13 percent fewer commuting trips. The effect on distance, on the other hand, seems to be stronger, as it is expected that commuters who live further away from work, will work at home more often and that the number of kilometers will decrease by 14.5 to 21.5 percent.

The study by Hamersma et al. (2021) shows mainly that the commuter has less intention to travel when the COVID-19 measures are relieved. The largest decrease is seen for the train (5 to 7%) and 4 to 5.5% for Bus, Tram and Metro. The other group, schoolchildren and students, who are also included in the study by Hamersma et al. (2021), appear to have a lot less consideration for the fact that they will frequently study at home in the future. The study makes it clear that frequent home study is not desirable. The modalities that are most often rejected in this research remain the public transport possibilities. However, this is a much smaller percentage, respectively the train: 1.5 to 3% and bus, tram and metro: 2 to 4%.

The work of De Jong et al. (2011) indicates that 48% of the people who choose public transport are schoolchildren and students. This is partly because they have no other choice as they are often too young or have too little budget to drive a car. This picture is also supported by experiences of employees of the province of Limburg and Arriva who indicate that most people who use their services fall into this category. In combination with the research of Hamersma et al. (2021), it is expected that schoolchildren and students will for the most part return to public transport after the measures are lifted. This does not apply to the commuter. This group seems to have more difficulty finding public transport again.

The gap in these previous studies regarding digitalization, COVID-19, and rural public transportation is a study combining these three topics and applying them to a particular region. The research conducted in this thesis contributes to bridging this gap this by investigating the travel behavior of commuters who live in a characteristic area, where large areas with smaller villages and countryside are connected through larger villages to the cities. These areas are

unique to the Netherlands and by conducting the research in this area it can be useful in several places in the country.

Social
The province of Limburg faces a challenge to keep public transport vital while the population is aging and the population size is decreasing. With the increasingly scarce space in other parts of the country, places such as Limburg could provide an opportunity to take advantage of this. Partly due to COVID-19, there is now an opportunity to restructure the entire living-work relationship. The question is which transport concepts could meet the needs of the changing world and future users. The province has also drawn up a document for this purpose, this is called the Development Plan Public Transport Limburg (Ontwikkelplan OV Limburg). This plan is an attempt to strengthen the public transport network during the COVID-19 situation and its aftermath and make the public transport network ready for the future. The plan considers the mobility transition, which, according to the creators of the Limburg Public Transport Development Plan, is a necessity in the long term. According to the Province of Limburg, the mobility transition is about connecting separate modalities and systems into one attractive, powerful, sustainable, efficient and flexible mobility system. The plan is intended to help take advantage of opportunities (e.g., the possibilities offered by advancing digitalization) and be able to adequately deal with threats (e.g., the long-term consequences of demographic developments). By looking at the network in this situation with COVID-19 now, the province wants to:

1. Respond to trends and developments
2. Shape the Mobility Transition within the context of Limburg
3. Give structural substance to the 'living concession' with Arriva. Meaning: developing the public transport system together with the operator.

The research carried out in this thesis contributes to forming a picture about the use of mobilities in the area between Roermond, Weert and Venlo and how these have changed due to a pandemic that has gripped the entire country. In addition, it can help decision makers understand why choices are being made in this area. As their development plan shows, the province of Limburg has many expectations about the situation regarding the travel behavior of commuters in this area but would like to see these confirmed in another way.

2. Literature review and theoretical framework

In this literature review and theoretical framework, the core concepts of this thesis; digital accessibility, location factors and the integral mobility analysis will be discussed first. Following this, various theories of travel behavior are considered and described.

Critical review of the academic literature and the policy context

Digital accessibility

> *"Digital accessibility can reduce the number of trips by bringing a service to one's current place, or to a location close to the user. It could also be achieved through "batching" household activities so that e.g., several errands can be run at once. This leads to fewer and/or shorter trips, which means a lesser environmental impact. As for the traveling that does take place, the environmental impact per traveled kilometer should be reduced" (Ringenson et al., 2018).*

As mentioned in the above quote from Ringenson et al. (2018), digital accessibility can ensure that the number of travel movements is handled in a more sustainable way. Travel movements can be combined or even not happen at all. An example of the latter is working from home, which has increasingly become the norm due to the COVID-19 crisis in the past two years. As became clear in the introduction, the crisis has increased the progress of the digital accessibility of employees. In combination with this description from the scientific article by Ringenson et al. (2018), it can be stated that people may also have less need to live close to their work when the digital accessibility is higher. This creates opportunities for a province such as Limburg, where population decline will take place in the coming years. According to CBS expectations, the municipality of Beesel, for example, may lose 6% of its population between 2019 and 2035 (Centraal Bureau voor de Statistiek, 2019). Limburg could become a province with a residential as well as a recreational function from which people use public transport and other green modalities to go to work in other parts of the country, while also working at home for several days a week.

Location factors

Rymarzak and Siemińska (2012) write about the meaning of the word location in their article on factors that are affecting the location of real estate of companies. In their study, they use the scientific literature of Stryjakiewicz (1988). According to Stryjakiewicz (1988) the meaning of location in the literature is twofold, namely: the process of making location decisions (choosing the type of investment and its site) and the result of that process. In addition to the fact that this applies to companies, this also largely applies to individuals. The outcome of this is the location of a given business activity that is tied to a given site. Making location decisions is a dynamic system (Rymarzak and Siemińska, 2012) because when companies make decisions of strategic importance, they must consider not only the present situation (location seen statically), but also future needs. According to Rymarzak and Siemińska (2012) the choice to start a business somewhere is therefore not a one-off act, but a process that allows for adjustments according to changes in the environment and inside of the company. This can also be said about the choice to live or work somewhere.

In Guo and Peeta (2020), four main categories are distinguished when it comes to location factors: The property's physical characteristics (e.g., availability of garage and lot size), neighborhood environment (e.g., land use mix and crime rate), transportation accessibility (e.g., work commute time, distance, and costs), and a decisionmaker's sociodemographics and preferences (e.g., gender and race). As mentioned as an example in 'transportation accessibility', with regard to settlement factors, the time, costs and distance to work are also seen as an important factor in moving to live somewhere. Due to the changing home-work situations and the fact that more people are working from home, research by TNO (2021)

shows that even 25% of employees would like to largely continue to work from home after the COVID-19 rules have been lifted. Considering this TNO research, it seems quite possible that these factors have changed and that the factors that fall under transportation accessibility have become better because people have to travel less often and thus less long to their work

When it comes to transportation accessibility, it is especially important to explore public transportation policies as well. The Dutch national government has written the following in their approach to population decline: “It is important for the quality of life and the economy that an area is easily accessible. The decline in the population may mean that public transport no longer runs through small villages or is even abolished. As a result, important facilities, such as schools or hospitals, may be less accessible. For example, the government is looking at alternative forms of transport" (Ministerie van Algemene Zaken, 2021). The supply of public transport in regions with population decline is changing in various ways due to the population decline. A first consequence is that regular bus services are (partly) converted into demand-dependent public transport, this is also called demand-responsive transport or DRT ((Mageean & Nelson, 2003). This mainly happens in the small centers to 7,500 inhabitants. The regional taxi, as demand-dependent public transport is called, is often more expensive than normal scheduled services due to expensive operating costs. The caveat that must be made is that concessions of public transport differ per region and that this leads to different agreements about bus transport. In Limburg there are initiatives that are equivalent to a dial-up bus, these are the Omnibus and the ‘Wensbus’, both of which will be further explained as part of the public transport network in Chapter 4. However, there is no additional provincial policy in addition to the aforementioned policy of the national government about public transportation in areas with less density.

Integral mobility analysis
The IMA 2021 has already been partially discussed in the previous chapter. However, this will additionally be discussed in conjunction with the research conducted in this thesis. For public transport, the same network is used for both scenarios. For rail, this concerns a network based on the full realization of the High Frequency Rail Program (PHS) and other MIRT projects: The Dutch national government wants to promote the accessibility, safety and spatial planning of the Netherlands. Projects and programs selected for this purpose are listed in the Multi-Year Program Infrastructure Space and Transport (MIRT) (Ministerie van Verkeer en Waterstaat, 2021). For urban and regional transport, the 2018 timetable forms the basis, including as far as possible concrete changes from the current timetables and hardened measures for the coming years. The public transport student card will remain in existence until 2030-2040-2050 according to the current formula. The costs of public transport have increased in 2018 as a result of the change in the VAT rate from 6% to 9%. No real price increases are assumed for the vision years 2030-2040-2050 (Ministerie van Infrastructuur en Waterstaat, 2021). The parts of the integral mobility analysis that are useful in this study are discussed further in combination with the results of the survey in the policy part of the results.

Expected relationship between the components
The expectation is that there is a relationship between the travel behavior of the commuter and the place where they live in relation to their work. Here, digital accessibility is expected to ensure that the transportation accessibility, as written by Guo and Peeta (2020), of their place of residence changes. As mentioned by Ringenson et al. (2018), digital accessibility can ensure that the number of travel movements is handled in a more sustainable way. This could manifest itself in, for example: commute time, distance, and costs.

Theoretical framework

In order to make good use of the findings from research and observations, it is important to describe the applicable theories that can be found in the scientific literature and deal with the phenomena that are observed in this research.

Settlement theory

Christaller (1933) states in his central place theory that there are hierarchies of settlement sites to explain the hierarchical relations between nuclei. In identical marketplaces, the consumer chooses the nearest provider. The supplier of a product or service is a monopolist in a circular market area, at a sufficient distance from competitors. The radius of the minimum market area (= threshold value) signifies what is needed to cover at least the fixed costs. The radius of the maximum market area marks the boundary of the area beyond which the surplus value is insufficient to justify transport. Since circular market areas are never opaque and because they cannot overlap, since a consumer will always choose a market area, Christaller (1933) made use of hexagonal market areas. A consequence of this is the emergence of equal hexagonal market areas. Supply places do not necessarily coincide, but it is assumed that for various reasons, products and suppliers cluster as much as possible, then the 'optimal' solution applies to a hierarchy of cores. In a hierarchical system, only market areas are found that differ in size by a factor of three, while all threshold values can occur, as long as the size of the market area is between the maximum value and the threshold value.

In the case of this study, there are two ways how this can be interpreted. In this case, the consumer can be the employee looking for all the jobs he could get. Suppose he gets two offers. The offer with the highest wages, from employer A (provider), is further away, he spends more time traveling, A different offer, from employer B, will result in less wages, but because the job is closer, he does not have to travel as far. In this trade-off, there is a greater chance that he will choose employer B. The value of time (see mobility constraints) is then higher than the extra revenues that the further travel time will entail. The hexagonal market areas of the employee and employer therefore do not overlap. However, with the digitization and the normalization of working from home, it is possible that this overlap does arise, since with more working from home, people will have to travel less and the commuter will be willing to travel further.

Time-space theory

The theory where time geography is built on is Hägerstrand's time-space theory. In his theory, Hägerstrand assumes three types of constraints: 'capability' (biological, mental and instrumental), 'coupling' (coming together of people and objects to perform activities) and 'authority' (physical, social, economic and government regulations) (Hägerstrand, 1970). Hägerstrand is convinced that time geography is based on the fact that people, and other objects, that are moving through time and space follow an unbroken path (Dijst, 2006). Hägerstrand (1970) is convinced that these uninterrupted paths are limited by the limitations mentioned above.

Capability constraints are the limits to what a person or object can do when it comes to the way they build and what tools they can use. Examples that Hägerstrand (1970) cites are: “the necessity of sleeping a minimum number of hours at regular intervals and the necessity of eating…”. The second limitation that Hägerstrand talks about is coupling constraints. This is about where, when and for how long the person needs to be with other people to produce or consume, this could be, for example, having to go to the office to attend meetings there, for this you have to travel to the office, have meeting time and have to go home again. The third and final limitation is authority constraints. This is a limitation that has to do with power that the government, the environment, or some other mechanism can exercise on an individual. It also has to do with ownership of an area.

Hägerstrand uses this theory to indicate that there are only a maximum number of possibilities. If a person does not own a car, he is not in the power to use a car and is thus dependent on other modes of travel and there is a limit to this as a person cannot cycle or walk more than certain number of kilometers per hour. If the person in question therefore has to travel to work less often, it is possible that he will live closer to other needs and further away from his work.

Today, what Hägerstrand described about travel behavior can be better investigated with digital innovations. The work of Wang et al. (2018) elaborates on this. Their work looks at literature on the use of mobile phone data in determining travel behavior. This shows that dynamics in travel patterns are mainly explored in two ways: intra-personal dynamics and inter-personal dynamics (Dharmowijoyo et al., 2014). When it comes to Intra-personal dynamics, Pas and Sundar (1995) include: short-term dynamics in travel behavior during day and night or on weekdays and weekends; medium-term dynamics in travel behavior, such as before and after residential relocation, change of jobs, owning a car, etc.; and long-term dynamics in travel behavior in different stages of life, including marriage, giving birth, retirement (Pas and Sundar, 1995). When it comes to inter-personal dynamics, the following have been extensively identified as influential factors: gender, race, occupation, education level, income, lifestyle, and household structure (Senbil and Kitamura, 2009; Kang and Scott, 2007, 2011).

According to Wang et al. (2018), it is important to take into account a wide range of influencing factors to properly map out the underlying 'rules' of travel behavior. The literature shows that mainly demographic and socio-economic attributes of travelers are key determinants of their travel behavior (Mauch and Taylor, 1997; Lu and Pas, 1999; Ryley, 2006; Marquet and Miralles-Guasch, 2014; Boarnet and Hsu, 2015). In addition, built environment (such as land use, urban planning and infrastructure) (Boarnet and Crane, 2001; Ewing and Cervero, 2001, 2010; He, 2011), lifestyle, attitudes, perception and preference (Lanzendorf, 2002; Chen et al.,2009; Etminani-Ghasrodashti and Ardeshiri, 2015; Van Acker et al., 2016) are seen as other important factors affecting human travel behavior.

Accessibility

Geurs (2006) defines accessibility as the extent to which the spatial-infrastructural configuration enables people to carry out space-related activities at different locations at different times (persons' perspective). In addition, accessibility indicates to what extent the spatial-infrastructural configuration enables companies, facilities and other places of activity to receive people, goods and information at various times (perspective of locations of activities). In addition to the ''difficulty" of getting around, this definition also explicitly includes the scope for spreading activities and people.

The spread of these activities is usually linked to the amount of time one has left in the day, in addition to the time spent on work and other appointments required in the day. For this reason, many people often live within 15 to 35 kilometers of their work (Central Bureau of Statistics, 2018). The average distance is 22.2 kilometers (Central Bureau of Statistics, n.d.). Due to the findings reported by the employers' organization AWVN in a NOS news article (2021), these numbers could change if employees actually start living further away. Kilometers, however, do not give the full picture, which becomes visible when kilometers are translated into time. When someone walks 5 kilometers, he or she is on the road for an hour, but when the 5 kilometers are covered by car, he or she arrives within 15 minutes. It is therefore important to see this in perspective and to include it in this study/in research.

Movement resistance

For the definition of accessibility, Hakkesteegt (1993) also takes as the starting point that every relocation to develop activities elsewhere requires a sacrifice: overcoming the movement resistance (verplaatsingsweerstand). A movement to a certain activity space only takes place if the (subjectively judged) surplus yield of the activity there outweighs the (subjectively judged)

movement resistance. So, a person can only use those activity spaces which are reachable, and which are within acceptable movement resistances. Although each person assesses the usefulness of an activity and the magnitude of movement resistance in their own way, it can generally be stated that as movement resistance increases, activity areas become less accessible. Central to this definition is the travelers' "difficulty" of being able to move. This has been further elaborated by Schoemaker (2002) and Van Wee & Anjema (2014). The concept of movement resistance includes three qualitative or quantitative criteria:
1. Travel time
2. Travel costs
3. Travel comfort

With regard to travel time, the time it takes to get from A to B, it refers to more than just the driving time of the train and bus. There is also time that is often forgotten but does in fact count mentally as part of the journey. Analyses of travel chains by Van Nes et al. (2014) show that the train journey between stations takes up only about half of the total travel time. The table below shows the components that belong to a trip, and which weighting or fixed fine applies (Van der Waard, 1988).

Part	Weight or fixed fine
Ride time	1,0
Walking time	2,2
Actual waiting time	1,5
Hidden waiting time	0,75
Transfer time	1,3
Transfer (fixed fine)	330 seconds

Table 2: weight of the different parts of traveling (Van der Waard, 1988)

As an example, consider the following. Person X lives near Venlo and has to travel to work at the provincial government building in Maastricht by public transport. The actual travel time is one and a half hours (93 minutes), in terms of feeling this also weighs 1x. The first part of the journey is a 10-minute walk (walking time = time x 2.2). However, he does not want to be late, so he also makes sure he leaves 10 minutes earlier (hidden waiting time = time x 0.75). At the station, he finds out that he also has to wait 7 minutes before the train arrives (actual waiting time = time x 1.5). At Roermond, Person X must also change trains (330 seconds fixed fine) this change is 2 minutes walking time (walking time = time x 2.2) and the waiting time is 3 minutes (transfer time = time * 1.3). By now Person X has arrived at Maastricht station. In Maastricht, he takes the bus (transfer = fixed fine of 330 seconds) to the provincial government building. Before getting on the bus, he has to walk for two minutes and wait for 13 minutes. When he gets off, he has to walk another two minutes. So, in total the weight of the journey is 182 and a half minutes while in reality it is only 93 minutes.

Time is scarce and therefore an economic good, which can be monetized. This is done on the basis of the Value of Time (VoT). VoT is defined as the social benefit of the decrease in the average travel time, such as with a new metro line, or the social costs of the increase in the average travel time due to congestion, for example (Baggen et al., 2019) An example is that a businessperson is more likely to want to pay a surcharge to save 20 minutes, by traveling on a high-speed train, than a student will do. The Kennisinstituut voor Mobiliteitsbeleid (KiM) developed the following table in 2013 with the travel time ratings for car, train and bus/tram/metro for different travel motives. The higher the value the more the traveler is willing to pay for an hour of travel time gain.

Travel motive	*Car*	*Train*	*Bus/tram/metro*
Commuting	9,25	11,50	7,75
Business	26,25	19,25	19,00
Other	7,50	7,00	6,00

Table 3: Travel time rating

The last but no less important category is travel comfort. This is especially significant for the disabled traveler, but research also shows that comfort becomes more and more important with increasing journey length and increasing income. However, for the travel motive 'commuting', this is not a big deal breaker, they look primarily at cost and time.

The concept of movement resistance is important in this research because, when components of the trip change due to altered travel behavior caused by digitalization, this will have consequences for the valuation of the three components of this concept. Due to the fact that people are now more aware of hygiene and how diseases can spread because of the COVID-19 pandemic, it is possible that users judge comfort in a different way than before the COVID-19 pandemic and that they prefer to have more social distance. Working from home may also mean that people estimate travel time differently and realize that you can also work on the road by using public transport.

Operationalization of theoretical concepts: Conceptual and analytical framework

The visual version of the conceptual framework is shown in Figure 5 on page 18. In this figure, the main concepts of this research can be seen. The research is based on three main topics, of these three (digital accessibility, housing shortage and population decline), digital accessibility has changed significantly over the past year and a half due to the fact that working from home has become the norm after the world entered a pandemic. The use of public transport has changed as a result of this, and other human behavior may also change. The question is why and how these have changed.

In the conceptual framework, several components are visible: Personal preferences, Current transportation system and Land use system. For personal preferences below, the choices of the commuter are meant. This can include questions such as: Do they choose to live close to work? By what modality do commuters travel to work? For what reason do they choose this mode of transport? This study will look at how this may have changed before and after COVID-19 and the consequences of this for digital accessibility.

The travel behavior that manifested before the COVID-19 pandemic used the current transport network. This makes it important to look at the current transportation system. This is also why this is the next component in the conceptual model. Without the current transportation system, the entire travel behavior would be different than it is today. Thus, this factor in the conceptual model is a fixed point. There will be recommendations at the end of this study that deal with changes to the transportation system. This is because the changes of digital accessibility may cause changes to be needed to increase the use of the network again.

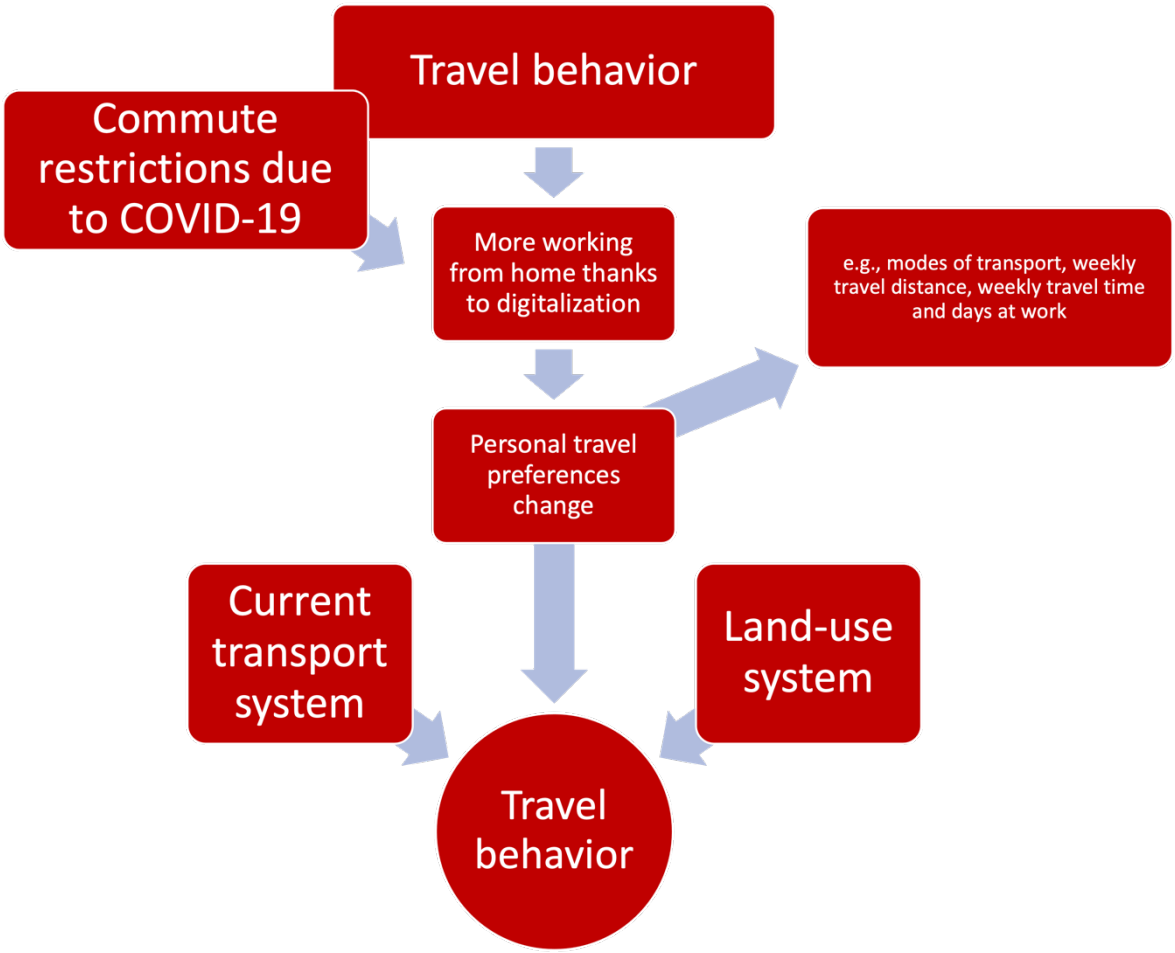

Figure 4: Conceptual framework of the thesis

The last is the land-use system. This aspect has been added because travel behavior is related to the location or the activities which the commuter wants to reach. It is important to see how the home location relates to the work location and whether differences may occur because digital accessibility could affect commuters who live close to work differently than the group of commuters who live further from work.

Digital accessibility consists mainly of two different elements: working from home and working on the go. Working from home means that people are able to do their work from the place where they live. This is possible because the data they need to do their work correctly, and to have consultation and contact with colleagues is made available online. This requires a secure and stable connection. Working from home means less travel which has been necessary since COVID-19 to avoid contacts. When it comes to working on the go, this means that one already uses the trip to work to work making time more efficiently spent. This requires the same system as for working at home, however, the place in public transport must also be suitable for this.

The study uses various theories and studies/statistics available to the Province of Limburg and other organizations. Based on the points that emerge from this, a quantitative study is performed. Residents of the region Roermond, Weert, Venlo are asked by means of a survey what and whether their travel behavior has changed. This is further explained in a section on research strategy. The results of the research are used to identify possible solutions and opportunities by means of interviews with decision-makers and the processing and comparison of data.

The way this research is done will be visible in the analytical framework, which is visualized in Figure 5. In the second chapter the literature and the theory were reviewed. The how and what regarding the drafting of the research/survey is addressed in chapter three. The processing of the results of the survey, and the analyses takes place in chapter four. This includes looking at interpretation and possible outcomes. The latter two are also reflected in the conclusion and discussion.

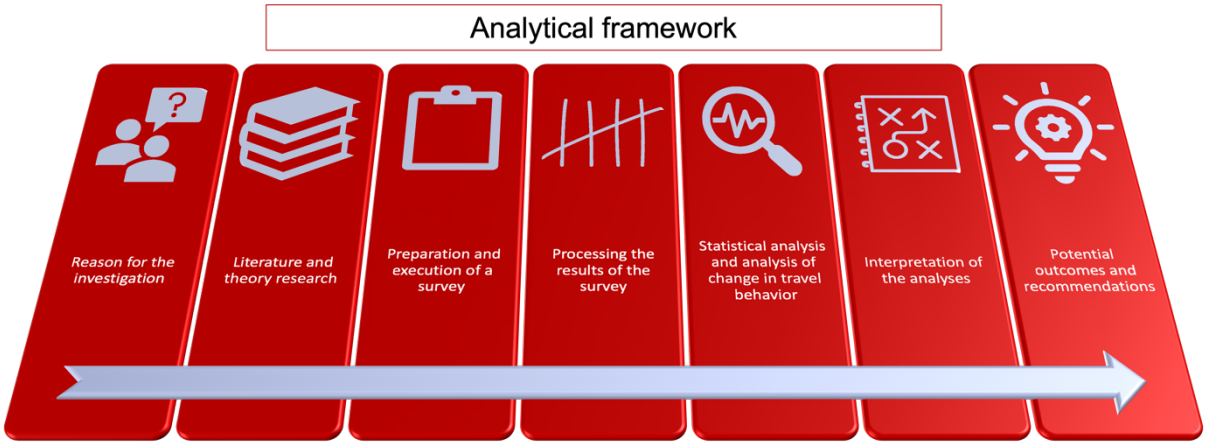

Figure 5: Analytical framework

3. Methodology

To answer the question of how travel behavior has changed over the past two years research is needed. To do this in the right way it is necessary to establish certain things. This part of the thesis will cover philosophy, strategy, quality, analysis and ethics.

Research philosophy
Saunders et al. (2012) states that the term research philosophy refers to ‘a system of beliefs and assumptions about the development of knowledge'. Structuralism will play a major role in this research. To understand a phenomenon completely, in addition to understanding the phenomenon, you also need an understanding of the environment of the phenomenon in order to fully understand why it occurs and why it is possible to make something possible elsewhere. This is where constructivism comes in. According to this movement, an individual interprets the reality around him in his own way. This interpretation depends on his own knowledge and history. Knowledge is thus constructed, as it were, by the individual himself: he brings together parts of a complex idea in order to arrive at a certain concept (Bednar et al., 1991).

Research strategy
The research will mainly consist of quantitative research in the form of a survey. This survey will be distributed in the region Roermond, Weert, Venlo in the province of Limburg. The survey will examine the location factors, which are mentioned in the literature analysis section (Chapter 2) and how much they played a role in the choice of the current place of residence. Transportation accessibility plays a major role in this. The participants will be asked how they rate the factors in this. The survey also pays attention to the fact that digital accessibility will play an increasingly important role and whether people are also thinking about this. The participants are also asked whether they have a wish to move, and why. This may be due to things such as changes in travel time due to more working from home. The factors that will be central to this will be chosen from factors that have emerged in scientific research and in collaboration with the Province of Limburg. The aim is to investigate whether there is a difference in interpretations of places where people live and how people use mobilities. With the research results, a qualitative study will be conducted with decisionmaker’s, working at the Province and possibly also with representatives of transport companies to see how they could possibly use the wishes in the future and adapt the network. In addition to surveys and a few interviews, desk research will also be conducted. This desk research is done with figures and other information that the mobility cluster of the Province of Limburg has on the subject (e.g., the average number of commuting kilometers) and with figures and information that is available online and from other organizations (for example KiM or ProRail).

Survey
The survey asked for people's opinions on the subject in various ways. The survey consisted of a general part about the general questions, a specific part (about the respondent's travel behavior) and a second more general part (about public transport in general). In order to ensure that the phrasing of the questions was clear and that the questions in the survey are concrete, clear and not confusing, two weeks were spent on checking, supplementing and improving the questions and the order of the questions in the survey. This happened together with two policymakers from the Province of Limburg. One of them was already involved in the thesis as a supervisor and, by looking critically, suggested additions and looked at possible ambiguities. Later in the process, the survey was presented to another policymaker from the Province. She had done her own research for several years before she started working for the Province and she mainly looked at the form of the question and the form of the answer options and how this could possibly be adjusted. After this was done, subjects from each age and education group were examined to see how the survey came across to the layperson on this subject. This group of people was not from the region. In this way it was prevented that the

potential group of respondents was reduced. From this came a number of remarks about questions and follow-up questions not being clear and about small issues related to the survey software. This has been critically looked at and was adjusted where necessary. However, it is not realistic to think that afterwards the questions of the survey would be clear for everyone. Everyone looks at and interprets questions in a different way, so everyone would find some questions clearer than others. That is why it was decided to make the question as clear as possible but as short as possible and to provide an so extensive range of answers possible for the multiple-choice questions.

Question and answer options
As outlined above, a careful look was taken at how questions are asked and how the respondents could answer them. It was decided to use a combination of closed and open questions. Open-ended questions are an important part of web surveys, as the responses to such questions provide researchers with valuable additional information for their research. However, the nonresponse rate has been found to be much higher for open-ended questions than for closed-ended questions in many web surveys because of the need for more cognitive resources or processing from the respondent (Fan and Yan, 2010; Keusch, 2015). Because of this, and to make categorization easier, it was decided to ask several variants of closed questions in addition to a number of open questions. The following types were used for the survey:

1. Close-ended questions where one answer can be given
2. Close-ended questions where more answers can be given
3. Closed-ended questions on a rating scale
4. Closed-ended questions on a Likert-scale
5. Closed-ended questions in a matrix
6. Open-ended questions

In addition to these six different types of questions, it was decided to divide the questionnaire into 14 different sections. In this way, more specific follow-up questions could be asked when a respondent gave a certain answer. In addition, this also reduced potential frustration of the respondents if they had to answer questions that would not apply to them. This would not improve the response rate. It was also set that respondents could only send one form and that they could see the progress in the meantime in a bar so that they approximately knew what percentage they were in the questionnaire. The questionnaire is attached as Appendix 1

Sampling strategy
Together with decisionmakers at the Province, it was decided to opt for the area between and around the cities of Roermond, Venlo and Weert. This choice was made because this area has a completely different dynamic than South Limburg, where there is also more scrutiny and cooperation with Germany and Belgium. There is also a big difference in the region that the research focuses on between the public transport network in the cities and in the countryside. In addition, the choice has been made to choose to look at the commuters. The choice to opt for the commuter has to do with the fact that the commuter was hit hard when it comes to measures during the COVID-19 crisis, and that they have several options to travel, which means that people stop using public transport earlier. In addition, Arriva and the Province of Limburg indicated that commuters are the first to disappear from public transport and that they are also less easy to get back to public transport. An attempt is made to get the best possible picture of the population. This has been attempted with the aid of multiple means of reaching people. These can be divided as follows:

1. Social media

An attempt was made to reach people by using social media. This has happened in several ways. First, it was shared through Facebook and LinkedIn personal channels. After which it was shared by several people. It may have subsequently been re-shared by connections of these people. In this way an attempt was made to create a snowball effect, which is described

in Baltar and Brunet (2012) with the help of Boyd and Ellison (2008, p.1). Boyd and Ellison (2008) define social networking sites, like Facebook or LinkedIn, as “web-based services that allow individuals to construct a public or semi-public profile within a bounded system, articulate a list of other users with whom they share a connection, and view and traverse their list of connections and those made by others within the system”. Baltar and Brunet (2012) indicate that given these characteristics, the emergence of the social network sites has transformed the Internet into an efficient tool for snowball sampling. This is also observed by Brickman-Bhutta (2009, p.1), “online social networking sites offer new ways for researchers to run surveys quickly, cheaply, and single- handled, especially when seeking to construct snowball samples of small or stigmatized subsets of the general population”.

It is clear from the research of Baltar and Brunet (2012) that traditional snowball sampling, as it was previously presented, can be seen as a biased sampling technique because it is not random. However, as stated in Baltar and Brunet (2012), virtual networks incorporate random elements (the random selection of the virtual groups, the contact to every member inside them, etc.) to be considered in the analysis of representation bias. This is therefore also applied in groups on Facebook. These groups were selected based on location in the region of the study, in this way an attempt was made to get responses from all parts of the region. In addition to social media, the news about the survey was also picked up by the provincial daily newspaper and digital medium 'De Limburger' and was distributed via the Nederweert24 news site. The message in De Limburger was a surprise to all parties since it had not been addressed. This is because the newspaper is a news medium for the whole of Limburg and an attempt was made to establish as many contacts as possible within the selected region, it was decided to start within the region. It shows that the snowball effect did work, and that eventually even the provincial media were reached. However, because the survey was designed to exclude people interested from other regions, the survey result was not manipulated by this.

2. Municipalities, Provinces and implementing bodies

By using the intranet of the Province of Limburg, the contacts with the relevant municipalities and implementing organizations and the largest public transport operator in the region (Arriva), an attempt was made to distribute the survey among employees and companies as widely as possible. The municipalities were also asked whether they could distribute the questionnaire among the residents in other ways. Unfortunately, there is no insight into this because this went through other departments within the municipality than the one that has been contacted. Since not every agency responded, it is not possible to say with certainty which agencies distributed the survey. Ultimately, the researcher distributed the survey to:

- Municipality of Venlo
- Municipality of Beesel
- Municipality of Leudal
- Municipality of Maasgouw
- Municipality of Nederweert
- Municipality of Peel en Maas
- Municipality of Roerdalen
- Municipality of Roermond
- Municipality of Weert
- Arriva
- Roermond bereikbaar
- Trendsportal

Qualitative part

The qualitative part of the research consists of discussing the results of the research with employees of the cluster mobility of the Province of Limburg. They make policy together with the local authorities which is adopted by regional/local politicians. This qualitative part of the thesis is mainly meant to see what these decisionmakers think about the results and how they

think these results can lead to a better transport system with the emphasis on public transport. This emphasis is because the participants in this conversation are all part of the public transportation team of the Province and this thesis is also written with the intention to help the public transportation team further. This conversation will take place online via Teams because if COVID-19 measures. The researcher will show the results of the survey during the interview, after which a free discussion will take place to look at striking outcomes and possible connections they think they see. Finally, the outcome of the thesis will be discussed. The researcher will make notes during the interview in order to work this out after the interview. The interview is informal, and no recording will be made, to check if what is written is correct to the conversation itself, it will be read and checked by the employees.

Data analysis
Data analysis will be done using Excel and SPSS. Using Excel, the answers to several questions were visualized and then described. This descriptive analysis looked at the results of the survey. It then looked at where possible relationships become apparent that could be further explored using an SPSS analysis. Since four people see more than one, it was decided to also include three county officials to see how they interpreted the descriptive analysis. After which, for the expected relationships, SPSS was used to see if these relationships are also statistically significant and thus can be proven. In addition, based on the survey results, the changes in distance (in kilometers) and time (in minutes) per week were examined. This was done on the basis of the respondent's place of residence, the respondent's place of work, the number of days they work at the office (before and after COVID-19) and the means of transport the commuter uses. The distance and time change are part of the factors of transportation accessibility as described by Guo and Peeta (2020).

Research quality
Internal validity, external validity and reliability are important in quantitative research (Bryman, 2012). With reliability it is important to check whether the research is repeatable. By using a digital platform to conduct the research, everyone will answer the same questions. Important concepts are explained, and an attempt is made to make the questions as clear as possible. In addition, it is set that everyone can only send one answer, which prevents a skewed outcome in case someone fills in the questions multiple times.

Triangulation will be used to enhance internal validity. By using the theories and information available through desk research and by comparing one's own research, it is ensured that the research is internally valid. The dangers of internal validity are also tried to counteract by approaching respondents in several ways and not choosing a way in which only certain groups of people could respond. An attempt is made to word the questions in the survey in such a way that no socially desirable answers will be given. To counteract this, it is also stated that the survey is anonymous and that answers cannot be traced back to the respondent.

In order to improve the external validity, research will be conducted beforehand into the characteristics of the target group. In this way it can be checked later whether the results later meet the characteristics of the entire group. The study takes place with commuters who are interviewed in their own area, about their own travel behavior the study is easily replicable making the results generalizable to other regions as well. However, many regions have a different character, and the results cannot be taken over completely. However, the research can also be carried out in other regions to compare the results afterwards.

Research ethics
The research takes into account the fact that information is shared that may be sensitive. Therefore, no name, direct address data will be collected. In this way it is prevented that the respondents can be traced back. In addition, the research will meet the standards set by Radboud University for conducting ethically responsible research.

4. The transportation network

In order to properly identify differences in respondents' travel behavior, it is important to know how the transportation system in the Venlo, Roermond, Weert region is structured. The public transport network and the road network were examined. For the public transport network, information has been used, that was shared with the researcher through conversations with the Province of Limburg and which is also publicly available in apps from Arriva and NS, about the frequency of trains and buses.

The public transportation network

The public transport network in this area consists of the train and the bus. In the next part, the timetable of the area will be set.

Train

The trains in this area are operated by two parties, the NS and Arriva. There are three train routes in the area, with the train enclosing the area from Weert to Roermond, from Roermond to Venlo and between Venlo and the border with North Brabant. This concerns the train from Venlo to Eindhoven. In the diagram below, the connection, frequency and type of train operating in the area are shown:

Trajectory	Connection	Frequency	Other remark
Weert – Roermond	Weert - Roermond	During daytime: 4x Late evening: 2x	NS intercity
Roermond – Venlo	Roermond - Nijmegen	Whole day: 2x	Arriva stoptrein
Venlo - Eindhoven	Venlo - Eindhoven	Whole day: 2x	NS Intercity
	Venlo – Deurne	During daytime: 2x Evening and Sunday: 1x	NS Sprinter

Table 4: Train connections in the region

Bus

As for the bus, there is a fairly comprehensive system. With this bus system, which is operated by Arriva, all major centers in the Roermond-Venlo-Weert area are connected to each other. The table of bus lines in the region can be found in Appendix 2.
The image below (Figure 6) shows the Arriva network map, including the train connections. In addition to the train and the bus, there are two other types of special passenger transport in Limburg, namely the Wensbus and the Omnibuzz.

Omnibuzz provides transport for specific groups in Limburg, specifically for people with a mental or physical disability. This mental or physical disability makes it difficult or impossible for these persons to travel independently by public transport. To use Omnibuzz, you need a Social Support Act (WMO) indication. You can request this from the municipality and the municipality will then assess whether you qualify. Omnibuzz is active throughout the area of this thesis.

The Wensbus (or 'Wish Bus') is organized by volunteer organizations in areas with little or no public transport; this with the aim of improving accessibility and quality of life in small towns. The foundation that facilitates the Wensbus has a defined target area, within which it drives (either door-to-door or door-to-stop). In principle, all residents of a small village, where the Wensbus travels, may also use it. In practice, we see that it is mainly used by the elderly. These are the active wish buses in the area:

Foundation Wensbus Leudal
Foundation De Bekkerie-Boekend-Venlo

Foundation Uw Wijkbus (Tegelen)
Foundation Vrijwillig Dorpsvervoer Baarlo Maasbree
Foundation Wensbus Maasgouw- Oost
Foundation Wensbus Maasgouw- West
Foundation Dorpsvervoer Grashoek Beringe Koningslust

As indicated in the previous paragraphs, the Omnibuzz is only available with a Social Support Act (WMO) indication from the municipality, so the number of commuters using it is not very great. The same also applies in a different way to the Wensbus, which may be used by everyone, but is still often used by the elderly. These forms of transport will therefore not be included as separate answer options in the survey.

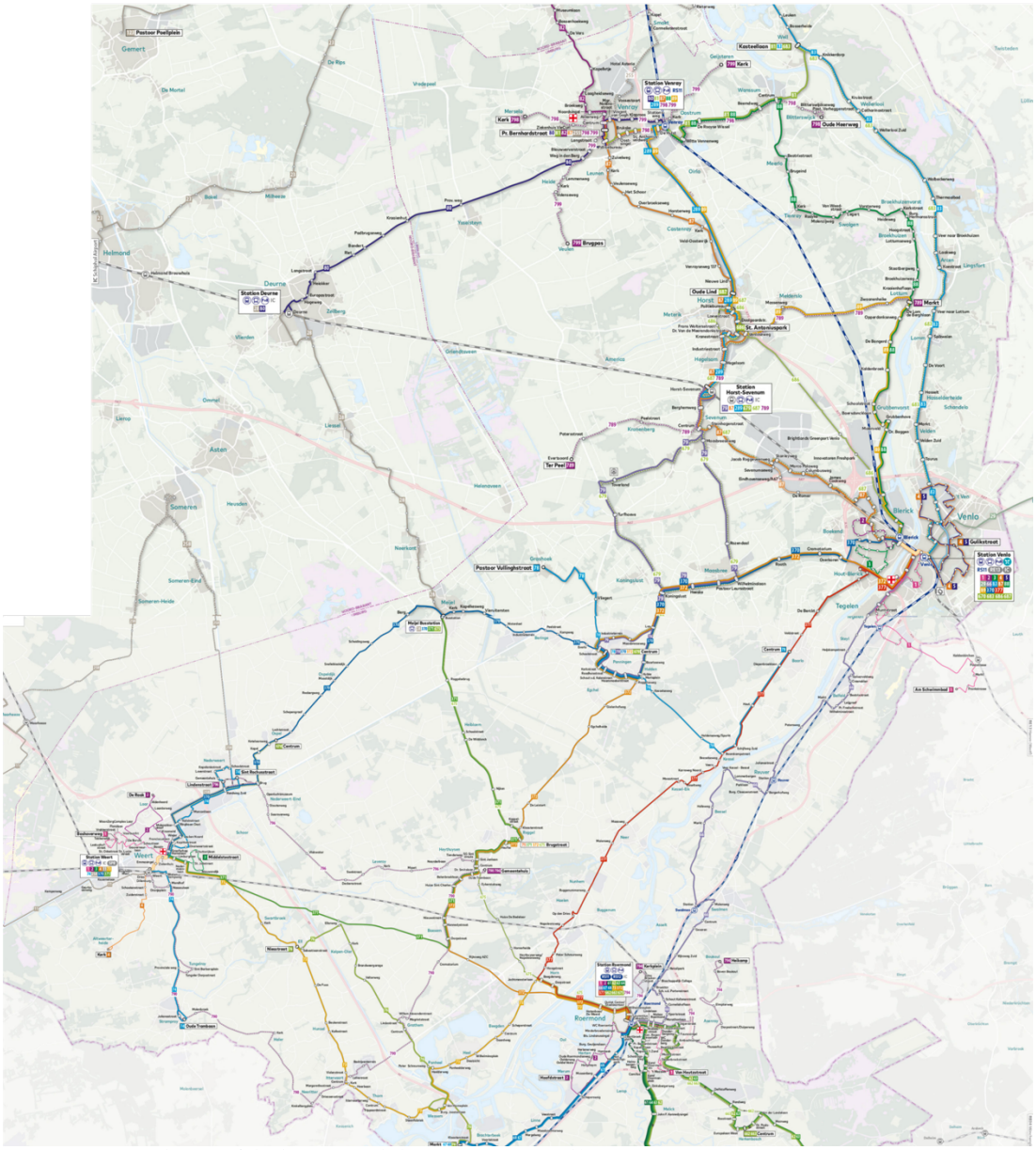

Figure 6: Network map of the bus network (source: Arriva, n.d.)

Agility scenarios

Due to the COVID-19 pandemic, the use of public transport in Limburg and throughout the Netherlands has fallen sharply. This was also reflected in a sharp drop in passenger revenues. The expectation for 2021 and the first few years thereafter, is that passenger numbers and revenues will not recover (quickly) to the previous level. One of the control measures being

taken, concerns the adjustment of the services to current passenger demand. The agility scenarios (in Dutch: wendbaarheidsscenarios) provide a flexible yet predictable interpretation of these measures. The agility scenarios consist of four scenarios that function in layers. Figure 8 below shows the most important measures of the scenarios. Almost all changes only concern the Arriva bus lines. For trains, no changes to the timetable are expected in advance, only in extreme situations such as a lockdown (scenario D). However, the length of the train is adjusted in the meantime to the current occupancy figures (Jongen, 2021).

Agility scenario C+ is currently in operation. This means that public transport drives as agility scenario C is described in the visualization, with supplements where necessary. In the coming year, the Province expects to continue towards agility scenario B. As described earlier, this depends on restrictions and needs of the passengers.

	Baseline 2021	Agility scenarios 2021				Reference previous scaling down in 2020
	Transportation plan 2021	A	B	C	D	Vacation schedule 2020
Current passenger occupancy rate *Occupancy (number of passengers) compared to the number in the same period in 2019*	100%	> 90%	70-90%	50-70%	< 50%	> 50%
Buses end one (half) hour earlier *Phase-out from 23:00 (exceptions: city network Maastricht = 00:15 / Parkstad = 23:30)*		x	x	x	x	
Buses start an hour later on Saturday *Starting at 8:00*		x	x	x	x	
Buses start an hour later on Sunday *Starting at 9:00*		x	x	x	x	
Fewer or no OV-Lijntaxi (dial-up bus) rides in the (late) evening and weekends *Norm: less than 1 in 5 trips is reserved*		x	x	x	x	
Public transport shuttle with very low transport demand does not operate *Norm: less than 8 passengers a day*		x	x	x	x	
(Rural) bus lines run less frequently during off-peak hours (9am-14pm) *Every hour instead of every half hour*			x	x	x	x
(Rural) bus lines run less often during the day *Every hour instead of every half hour*				x	x	x
(Urban) bus lines run less often during the day *Every half hour instead of every fifteen minutes*				x	x	x
Sunday schedule as basis for bus *Hourly schedule as a basis with local supplementation*					x	
Possible train schedule adjustments *In scenario A-B-C, no changes in train schedules are foreseen. However, the rolling stock is adjusted to current occupancy levels.*					x	

Figure 7: Agility scenarios (Jongen, 2021)

(Main) roads
As far as roads in the area are concerned, the area is mainly connected by highways on the same corridors as where the train connections are. The A73 runs along Venlo and follows the Maas in the direction of Roermond, Maasbracht where the road becomes the A2 which branches off from Maastricht at Maasbracht in the direction of Weert and Eindhoven. From Venlo there is also the A67 in the direction of Eindhoven. These roads are shown in Figure 7 below by the red lines.

Through the area there are also several N-roads that connect the cores in the area. N-roads are numbered main roads that do not have the characteristics of a freeway (A-roads), so there may be level crossings and often lack a median. These roads are indicated on the image below with black lines. It can be seen that the area west of Heythuysen does not have an N-road to Nederweert and Weert, which slightly decreases the accessibility of the outlying area. However, the road that connects Heythuysen with Nederweert and Weert is of such a high quality that it is not inferior to the N-road between Weert and Roermond.

Figure 8: A- and N-roads in the region (Source: Google Maps and own visualization)

5. Data and findings

After two weeks of preparatory work, the most important parts of which were testing and adapting the questions, the survey was first distributed on 20 October 2021 and closed on 20 November 2021. During this time, 143 respondents completed the survey. In this chapter, the data collected with the survey will be described and processed. First, the data will be descriptively analyzed, after which it will be discussed in more detail and also compared with expectations from the Integral Mobility Analysis 2021 (Ministerie van Infrastructuur en Waterstaat, 2021) and figures from the Province/Arriva. Appendix 3 contains additional graphs on the descriptive analysis.

Descriptive findings questionnaire

General information

In order to find out the background of the respondents, a number of general questions were asked at the beginning of the survey. The first of these was about the age of the respondents. Respondents could choose from 10-year categories, as can also be seen in Figure 9. Figure 9 also shows that most of the respondents (88.8%) fall into the working age categories (21-70). When this is compared with the percentage of the population in Central and North Limburg who is in the category 20 to 65, this is 57.2% of the population (Centraal Bureau voor de Statistiek, n.d.-b). A possible answer to this difference is that the research is aimed at commuters and therefore mainly gets this group as respondents. In that case, the survey succeeded in finding a representative group of the different ages within these workers. In addition to the age, the gender was also asked. This shows that the respondents are well distributed across the sexes. Of the respondents, 53% were of the female gender, 45% said they were of the male gender, and 2% said they preferred not to say which gender they identify with. In comparison with the figures from the CBS (Centraal Bureau voor de Statistiek, n.d.-b) which indicate that 49.75% of the total population of Central and North Limburg is female. The survey thus appears to have attracted a slightly larger percentage of women than men. An explanation for this could be that women spend longer on social media (van Beuningen & Kloosterman, 2018). The respondents were also asked about the education level of the respondents. This shows that 88.1% of the respondents continued on to secondary school at either MBO, HBO or WO.

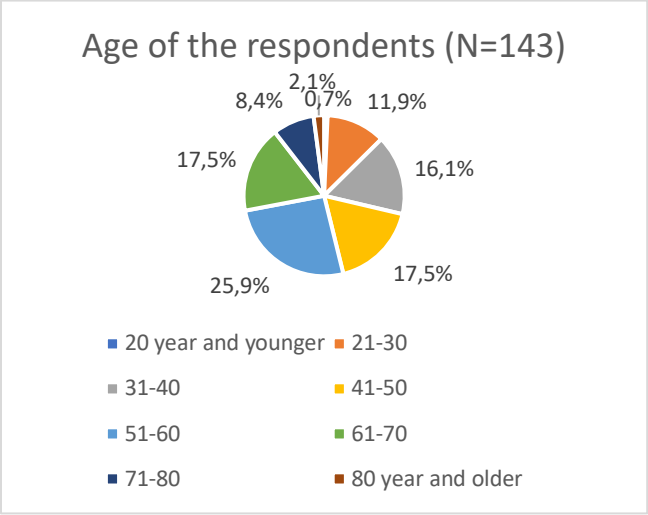

Figure 9: The age of the respondent of the survey

The next question for the respondents was about the place of residence and the place where people work. This resulted in the visualization (Figure 9) below. It becomes clear that apart from the people who work outside the region, the workplaces seem more concentrated than the places where people live. This could be a sign that the area is less of a working region and more of a residential region. Of the 143 people who responded to the survey, 44 worked outside the region shown in Figure 10. These respondents mainly worked in Maastricht (17), Geleen (3), Nijmegen (2), Eindhoven (2), Helmond (2), other locations in Brabant (6) and North Holland (3).

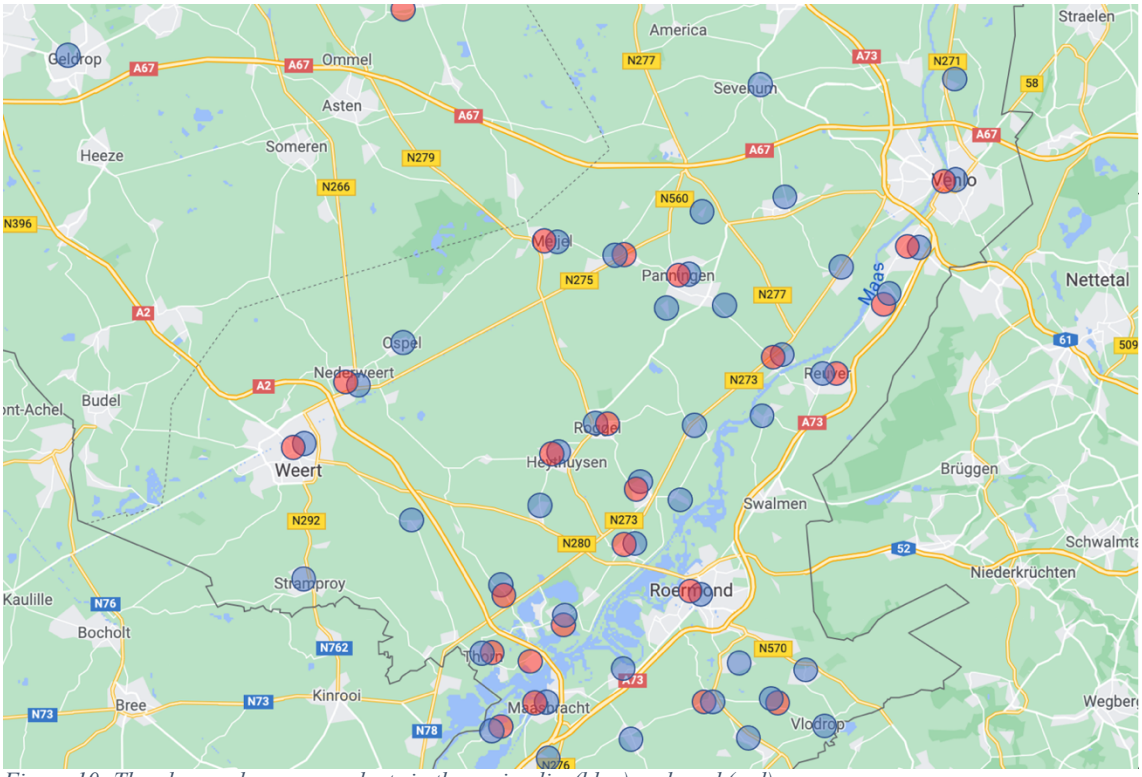

Figure 10: The places where respondents in the region live(blue) and work(red)

The fact that many of the people live in the region of interest is additionally reinforced by the following question. Of the 143 respondents, 126 live in the area, of the remaining 17, 11 people live in the region, so the survey attracted 6 people for whom the survey was not intended. The manner of dissemination of the survey has thus led to a good number of respondents from the target group. It is important to know why people have chosen their place to live. That is why this question was also asked in the survey, visualized in figure 11. It followed that 29.4 percent of the respondents (126) who live in the area live here because they were born and/or raised in the area. Another common reason is that the location is beautiful, 19% of respondents chose this option. However, this choice is somewhat subjective as everyone has a different definition of beautiful. Important to note is that respondents were asked about the main reason. It is therefore possible that they were born and raised in the place where they live but judge another aspect as more important.

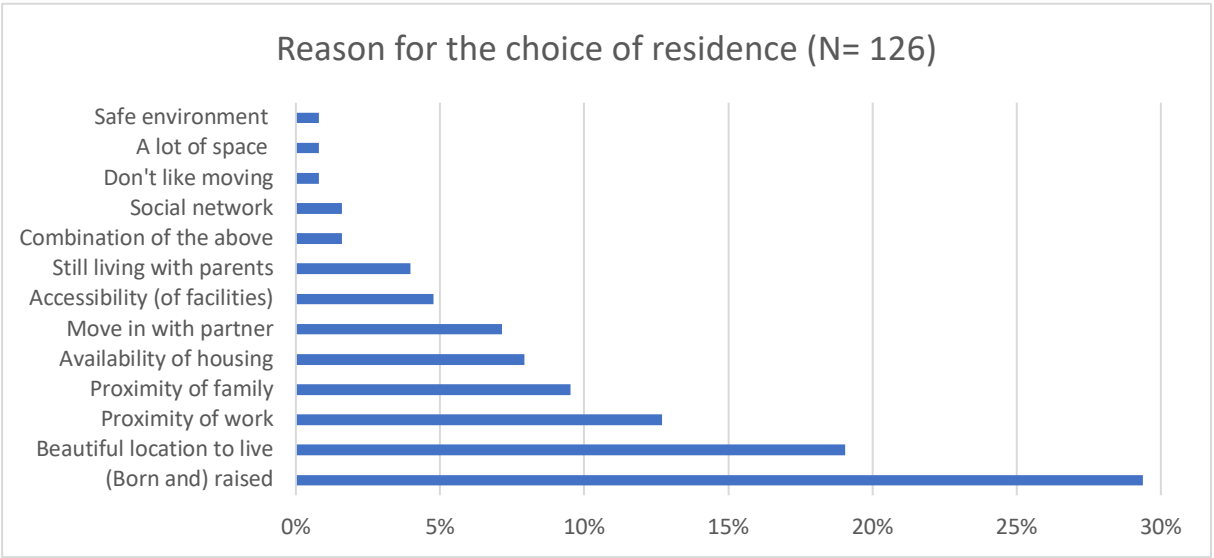

Figure 11: Reason for the choice of residence

Specific

In addition to the general questions in the survey, the survey mainly focused on the respondents' living-work situation. An important first question is how many days a week people go to work. The difference between before and after/during COVID-19 is clearly visible. Before the COVID-19 pandemic, the majority of people went to work 4 or 5 days a week, while this is now more spread over 0 to 5 days. A limitation that should be noted here is that while the survey was being conducted, there were still restrictions on working in the office and that these became even stricter at the end of the response period.

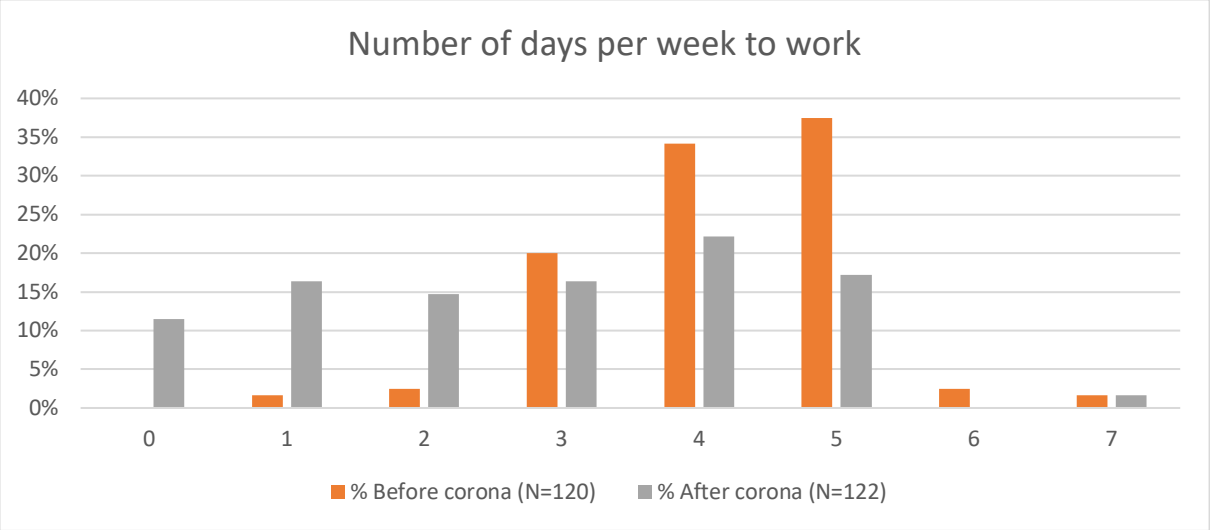

Figure 12: How many days do respondents go to work?

Modalities

As can be seen in the visualization below, there is a great preference for a means of transport. Of the 120 respondents who answered this question, almost half (48%) of the respondents say that they always went to work by car before the COVID-19 pandemic. It is also noticeable that of the five other options, the train is used the most and the bus is a lot less popular. While in the area the bus predominates in public transport. The existing train connections run from Weert to Roermond and from Venlo to Roermond. The main reasons for using the car are comfort (58%), the shorter travel time (55%) and the flexibility (43%) that the use of the car entails.

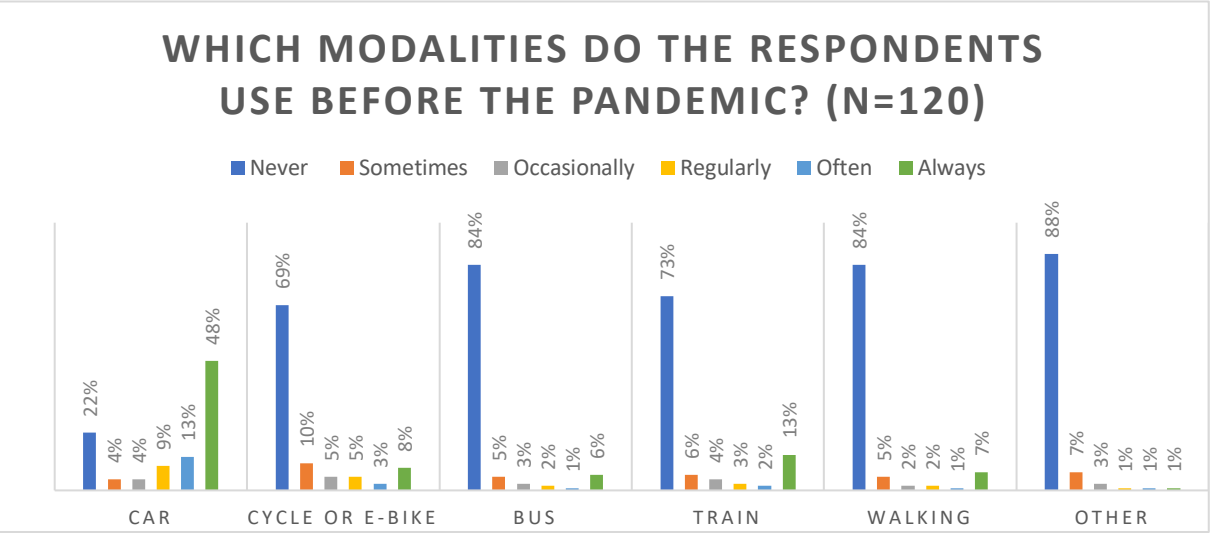

Figure 13: Which modalities do the respondents use?

During the pandemic, government regulations have been imposed on travel movements. This also applied to commuters. Two restrictions that were imposed and that affected commuters were whether or not they were required to work from home (where possible) and the closure of public transport for unnecessary journeys. The first of these is also clearly reflected in the respondents' answers to the question whether they (partly) worked from home during this period. 71% percent of the respondents who answered this question indicate that they have worked from home partially or even completely (25%). This can also be seen in the pie chart in Figure 14. Of the people who (sometimes) traveled for commuting during all restrictions (90 respondents), more than 73% even opted for the car, as can also be seen in the pie chart (Figure 15). This is in line with the news during the pandemic that the demand for second-hand cars has risen sharply and that there are almost no second-hand cars available (Oldegbers & Liefbroer, 2021). What is striking is that public transport (bus and/or train) still occurs in 11% of the trips, while 12% of the people choose to use the bicycle and even 20% when all trips with a bicycle component are included. The fact that the use of public transport was so low during the restrictions may be due to the lack of good connections or the fear of contracting an infection on public transport. As figure 12 shows, fewer people did totally work from home after scaling down the measures, but it has become clear that the degree of working in the office is less than before COVID-19. As indicated there, it is clear that working from home has become more the norm in business.

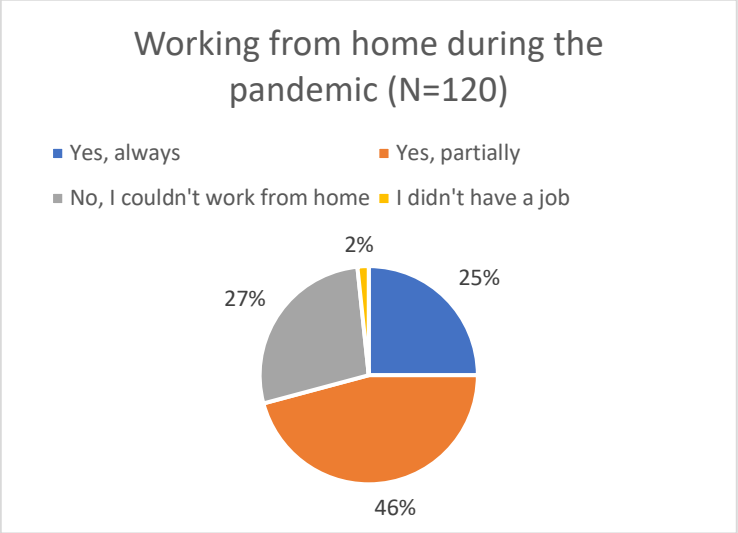

Figure 14: Working from home during the pandemic?

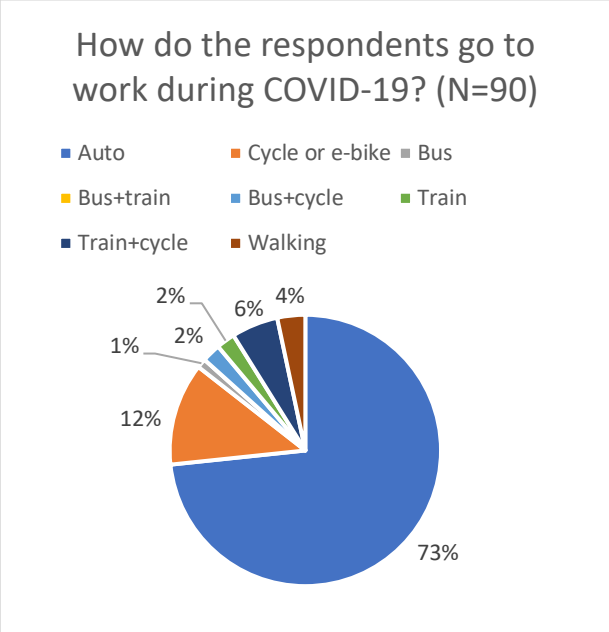

Figure 15: How do the respondents go to work during COVID-19?

After the question whether the respondents of the previous question (partly) work in the office again, to which 84% of the 90 respondents answered 'yes', the obvious question was whether this also had an influence on the mode of transport used. The same question as in figure 12 was asked to the people who answered 'yes' to the question whether they were working (partly) at the office again and to the people who indicated that they could not work from home. This showed that the influence on the use of the various modes of transport has changed only minimally. Compared to figure 12, the use of the car has remained more or less the same.

The use of the bus among commuters, which in this region as can be seen from figure 16, appears to have declined even further in this region, just as is the case to a lesser extent for the use of the bicycle, walking to work and the use of the train. The habits that became visible

during the measures are not to a large extent reflected in the answers of the respondents after the measures have been scaled down. When asked whether one would like to change means of transport, it can also be seen that 60% would not consider another means of transport. On the other hand, 19% indicate that they would like to do this and 21% indicate that they would like to think about it.

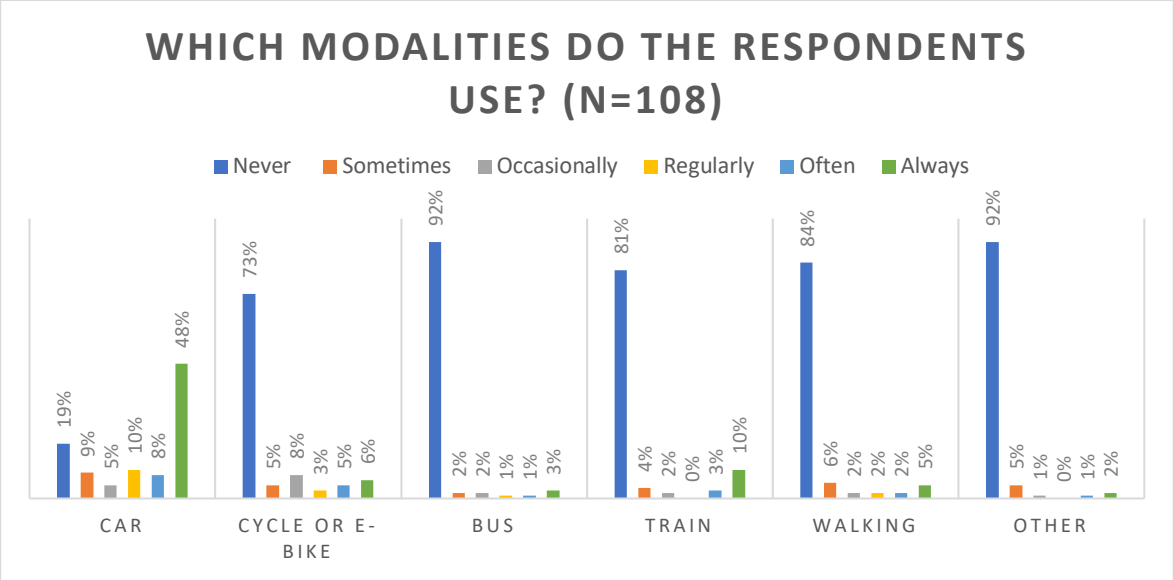

Figure 16: Which modalities do the respondents use (after the crisis)?

The 40% who did say they wanted to consider a switch were then asked which means of transport they would like to switch to. It was possible to give several answers here, but it is clear that the car is a lot less indicated as a means of transport that people would like to switch to. More than half (51%) of the respondents would go to work more often by bicycle or e-bike, as seen in figure 17, after which 43% of the people indicate that they also want to take the train more often. The fact that the group that would like to switch to the car is small could be due to the higher fuel prices, the fact that the group that already uses the car regularly is already large or the fact that Limburg experienced the climate changes itself last year in the form of major floods, making them want to do more for the environment.

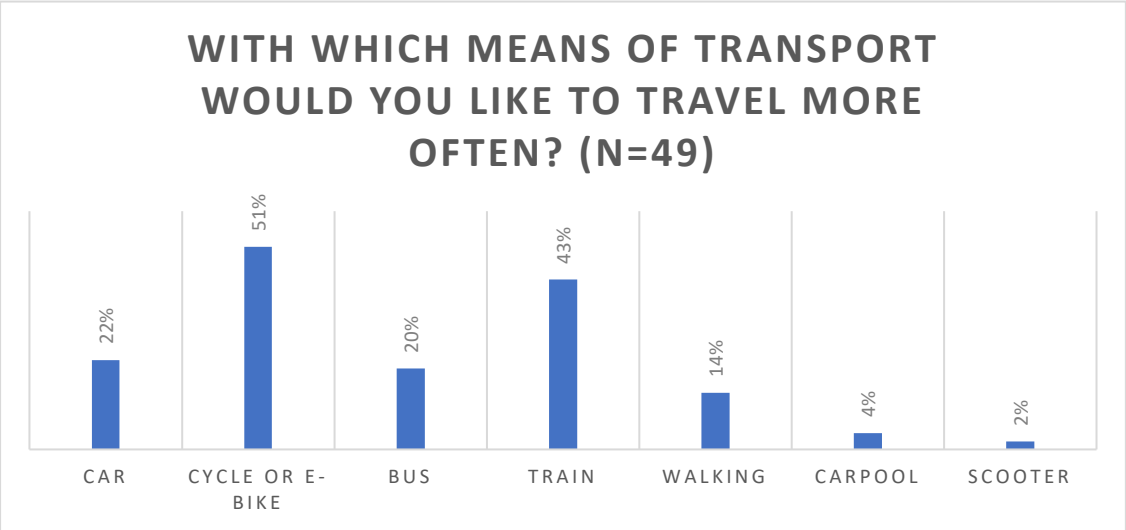

Figure 17: With which means of transport would you like to travel more often?

When asked what the reason is why people want to use the train and bicycle more, they indicate that they want to work more on the road (train: 22%), want to see the travel time more as time for relaxation, whereby in addition to the bicycle (35%) the train (12%) and walking (14%) also clearly stand out. Finally, the reason: preferring a more climate-friendly way of travel is often chosen, with the train (18%) and bicycle (20%) having the largest share.

Looking at the previous results, it might be expected that the perception of where people live in relation to work has changed. This is therefore also asked on the basis of statements, as shown in Figure 18. 85% of the respondents agree (somewhat) with the statement that the way they go to work is related to the distance between their place of residence and their work. However, 60% of people indicate that they (partially) disagree with the statement that the distance between their hometown and their work has become less important because of working from home. A special observation is that of these 143 respondents, 52% would certainly not want to work if they are traveling to work. Possible reasons for this could be the short distances or the fact that they see the journey to work as relaxation. The first is supported by the fact that the average travel distance is below 50km, while the second is supported in the previous paragraph.

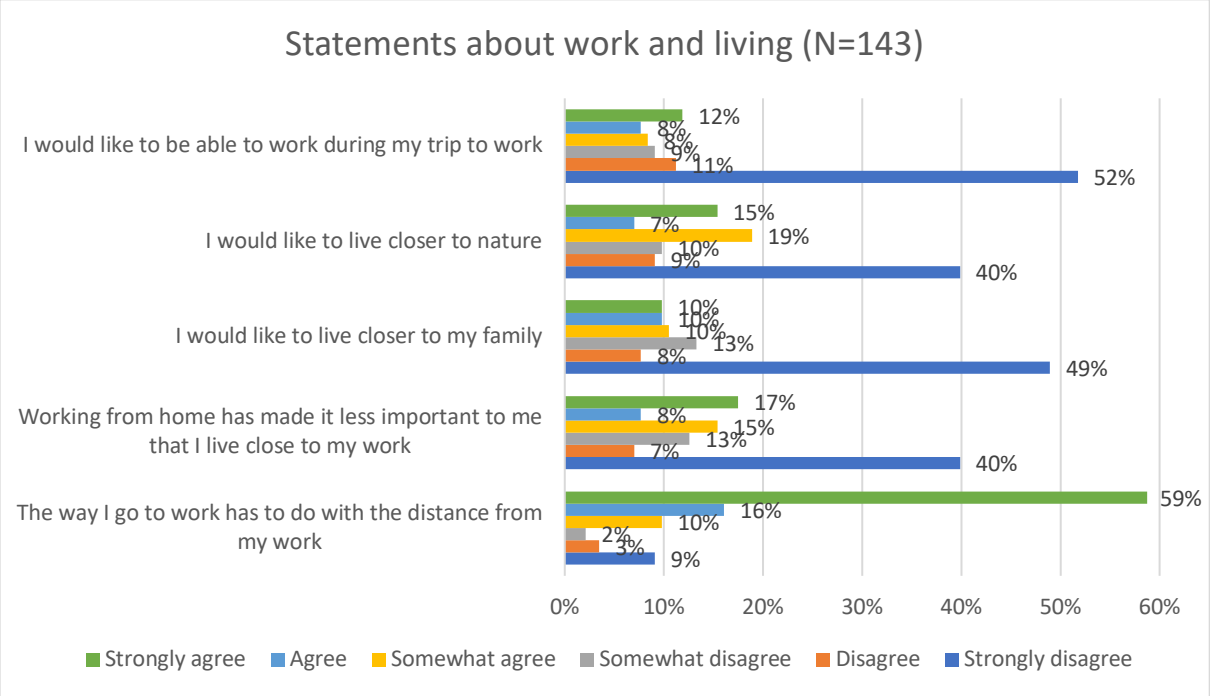

Figure 18: Statements about working and living

Public transport

The focus in this study is on the use of public transport and people who do not yet use it, but who might want to. This brought us to the next question. The respondents were asked whether they would like to use public transport more often. This shows that 27% of the respondents indicate that they would like to make more use of the public transport network. 13% of the respondents think that they already use public transport a lot, while 60% say they would not want to make additional use of public transport.

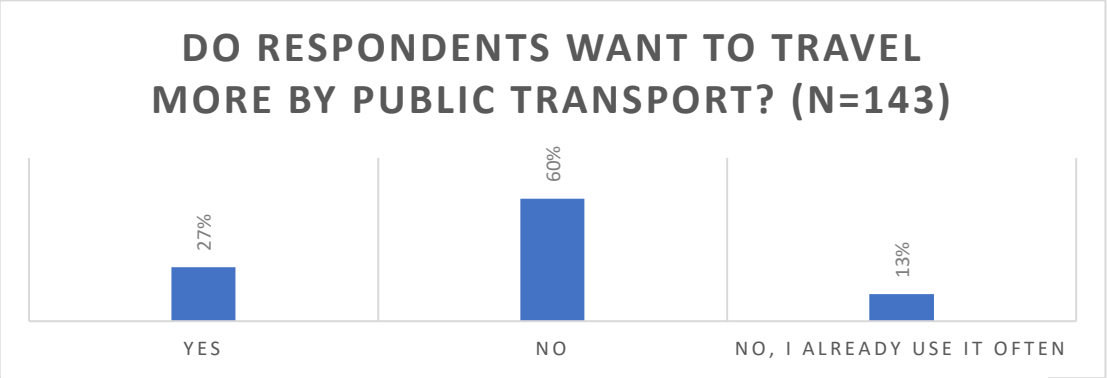

Figure 19: Do respondents want to travel more by public transport?

Of the 27% who indicated that they wanted to make more use of public transport, follow-up questions were asked about public transport. The first question that was asked was about the

different modalities of public transport and which one they would like to use. This showed that 84% would like to use the train more often and 45% more often the bus. It is striking that the 'old-fashioned' bus and train are therefore much more preferred in this area than the new modalities such as a shared scooter or shared bicycle. There is probably too little knowledge or familiarity with shared mobility among commuters. There may be an opportunity here for the Province of Limburg, the municipalities and a market party to create more awareness in the area of shared mobility.

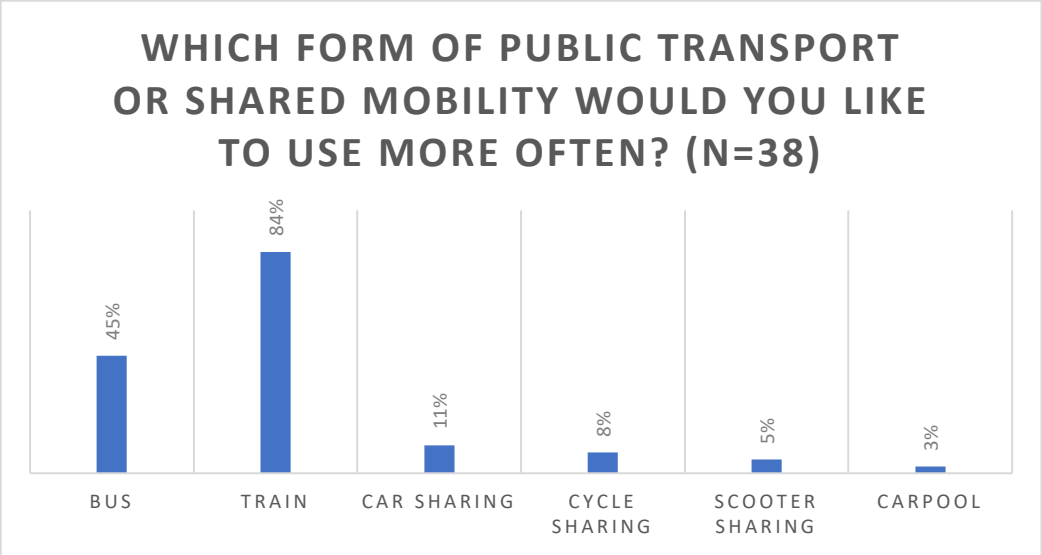

Figure 20: Which form of public transport or Shared Mobility would commuters like to use more often?

They were then asked for what motive they would like to use public transport more often and for what reason. When asked about the motive, it emerged that this is mainly due to commuting (73%) and travel for family and friends (47%). It should be noted here that the group that was the focus of this survey was the commuter, which may distort this picture. When looking at the reason why people would prefer to travel by public transport, several reasons were given. These are shown in the figure below (Figure 21). The respondents who would like to travel more by public transport, mainly want to do this for the climate, to relax and to pay less attention while travelling.

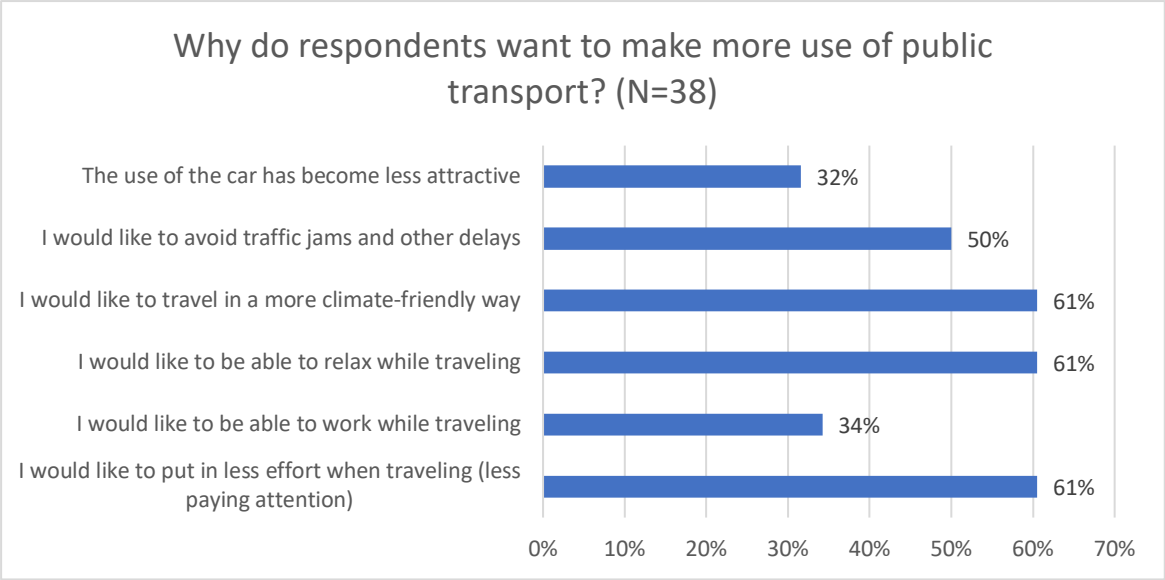

Figure 21: Why do respondents want to make more use of public transport?

Finally, the question was then asked why people do not use public transport more often. What becomes visible from the answers of the respondents is that the main reason why people who want to use public transport more often do not do it now, is that more than 40 percent of these respondents currently think the travel time is too long. This reason seems to indicate that it may have something to do with the absence of the train in this region, as they are only on the outskirts of the region. To view this, the in-depth analysis will look at the places where the respondents live, whether a train station is present in these cities and in what type of place they live. In addition, almost 20% say they find public transport too expensive or that the timetable does not match their wishes.

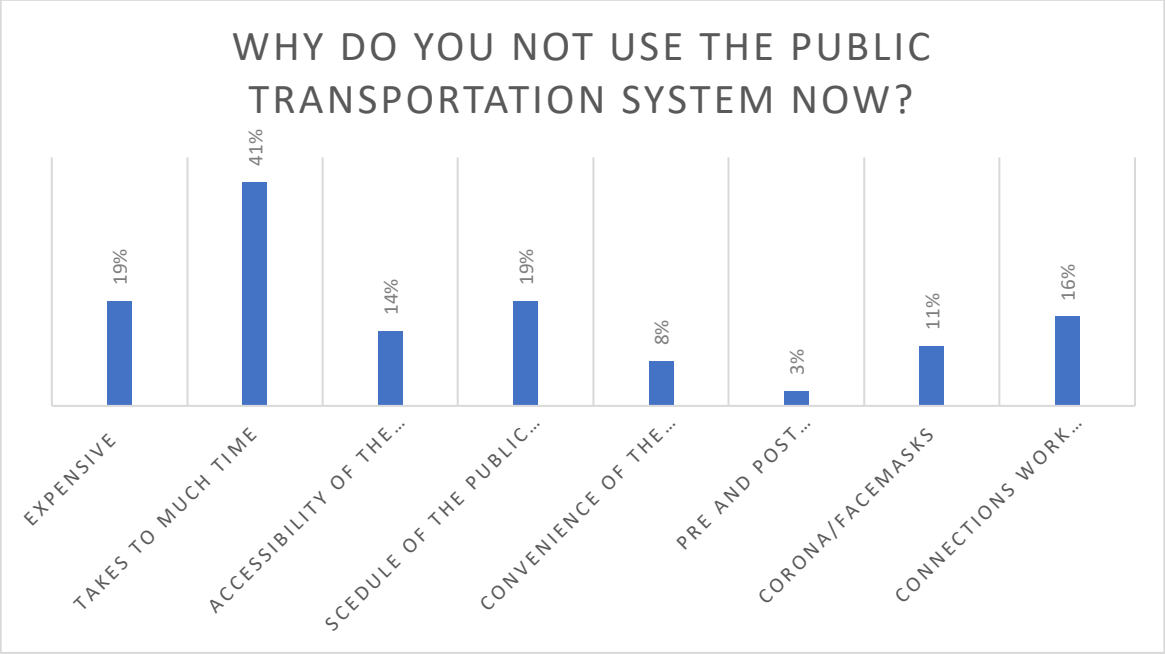

Figure 22: Why do you not use the public transportation system now?

The above-mentioned analysis shows that the study was conducted with a group of respondents that is representative of the population of the region. However, the group is too small to be able to mirror the results to the entire group of commuters in the area. The descriptive analysis shows that among the respondents the car is the preferred means of transportation before and after the COVID-19 pandemic. When it comes to why people choose a mode of transport it appears that distance is the biggest reason for choosing a mode of transport (59% strongly agree). Of the public transport modes, the train seems to have more appeal. It also appears that 71% of the respondents have always or partially worked from home during the restrictions. In addition, it is clear that more and more work is done at home. Whereas previously 72% of the respondents worked 4 to 5 days on location, this percentage dropped to 39% after the COVID-19 measures.

Qualitative part – interpretation of the results

To find out what the results of the survey really mean, after analyzing the survey, a focus meeting was held with three policymakers from the Province of Limburg. These employees of the Province of Limburg are all members of the mobility cluster and have knowledge of the subject.

In the first part of the conversation the results were discussed, it became clear that the results of the survey were actually not very unexpected and that they mainly confirm the expectations that were already circulating within the Province. After which the conversation further focused on the possible elaborations and connections in which the research could support.

Connections
The possible and most important connections in the survey have already been examined in the previous chapter. A number of these connections have been investigated as a result of this conversation with policymakers. During this conversation, the expectation was expressed that age could play a role when it comes to possibly wanting to change means of transport. However, this turned out not to be the case from an SPSS analysis, because the significance was too high, making the chance too great that it could be a coincidence. They also indicated that they expected the length of the journey to contribute to how much people would now work at home and how they would like to travel. These possible connections were therefore examined in the previous part of this chapter.

Results
The participants in this discussion were also asked what they thought of possible elaborations. During the discussion, the participants and the researcher agreed that the survey says a lot but not much at the same time. Clarity has come about regarding the modal split for commuters, the reasons why commuters choose a mode of transport and the influence that the advice to work at home has had on the number of days people have worked in the office when the advice to work at home had been abolished, however, during the writing of this part of the research, a lockdown was again imposed in the Netherlands. However, the number of respondents is too small to say with 100% certainty that the values found apply to the entire population of commuters in the region. Nevertheless, possible leads have been found from the research.

The possible effects of the results of this survey and the study could lead to recommendations and follow-up studies. According to the participants in the discussion, humans are creatures of habit, and it is important to look at how to force a change in behavior further without compromising trust. Due to the differences found in the number of days that people go after work before and after COVID-19 and the visible percentages that would like to switch, it is clear that the car could therefore remain stationary for more respondents. In the conversation it also emerged that, in combination with the fact that the respondents indicate that they do not make their choice for complicated reasons, it would be good to set up a campaign to encourage people who work less often in the office to (possibly extra) car to get rid of and for those times that they do have to go to work to use public transport. It is thought that such a campaign will focus on the basics of public transport, a financial push or making use as easy as possible. The latter includes being able to pay by telephone, being able to book via an app and being able to find travel information properly and correctly.

Analytical findings questionnaire

Statistical analyses were performed to prove whether there is a relationship between the various factors. Other in-depth analyzes were also performed, which are discussed later in this chapter. With regard to the statistical analyses, various possible connections were put forward by decisionmakers of the Province and researcher in advance. These possible connections were:

1. Whether the respondent's place of residence (city or countryside) influences the mode of transport.
2. Whether the age category influences which choice one wants to make
3. Whether the age category influences the reason for which one wants to travel
4. Whether distance affects modality choice
5. Whether the mode of transport used affects the number of days people go to work

The above-mentioned possible relationships have been examined in the study below.

Since some categorizations are arbitrary, a choice has been made to explain these subjective choices.

The place of residence and the place where the work is located is divided into three different categories: city, village and countryside. In literature, a city is understood to mean the following: “The city is then a complex community of which the geographic localization is especially limited in relation to the city's size (volume), of which the amount of territory is relatively small with reference to the number of human beings” (Maunier, 1910). Using the definition, it has been decided to use a population of more than 10,000 for a city. A large village has a population of between 5000 and 10,000 and a population of up to 5000 for rural areas. When it comes to the age categories, these categories are those that respondents filled out in the survey. When it comes to the distance between home and work, it was decided not to divide these numbers into categories, but to use this on the rational scale. In this way it is better to look at the direct relationship rather than between categories. An initial analysis showed that the relationship appeared to be weaker when categories were used.

Means of transport

In the survey, the respondents were asked what means of transport they use to get to work. To find out exactly what this is due to, we looked at various factors that could underlie this. These are:

a. Is there a train station in the respondent's place of residence?
b. What kind of place does the respondent live (city, village or countryside)?
c. What is the distance to work?
d. What is the number of days that the respondent goes to work after COVID-19?
e. What is the difference in the number of days to work before and after COVID-19?
f. What kind of place does the respondent work (city, village or countryside)?
g. Is there a train station where the respondent works?
h. What is the weekly distance to work?

From an ANOVA analysis with SPSS comes the below SPSS table:

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Is it a city, a village or a countryside?	Between Groups	3.114	2	1.557	2.372	.098
	Within Groups	75.496	115	.656		
	Total	78.610	117			
Is there a trainstation in the living city/village/place?	Between Groups	2.128	2	1.064	4.678	.011
	Within Groups	26.152	115	.227		
	Total	28.280	117			
How many km to work?	Between Groups	6576.877	2	3288.438	2.369	.098
	Within Groups	159657.450	115	1388.326		
	Total	166234.327	117			
How many days are you going to work?	Between Groups	1.881	2	.940	.312	.733
	Within Groups	346.729	115	3.015		
	Total	348.610	117			
Difference between going to work before and after COVID-19	Between Groups	.105	2	.052	.021	.979
	Within Groups	290.650	115	2.527		
	Total	290.754	117			

Workplace in a city, a village or a countryside?	Between Groups	.563	2	.282	.568	.568
	Within Groups	57.030	115	.496		
	Total	57.593	117			
Is there a trainstation in the working city/village/place?	Between Groups	.606	2	.303	1.476	.233
	Within Groups	23.598	115	.205		
	Total	24.203	117			
Weekly amount of km (after COVID-19)	Between Groups	122302.831	2	61151.415	1.814	.168
	Within Groups	3877358.874	115	33716.164		
	Total	3999661.704	117			

Table 5: ANOVA analysis SPSS

This table shows that (a) having a station in the place of residence (sig. below 0.05) and to a slightly lesser extent (sig. below 0.10) (b) the size of the place and (c) the distance between place and location of the work shows a strong connection with the choice for which mode of transport the respondents choose. When we also look at what role having a train station in the place of residence plays in the use of public transport, it becomes clear that this relationship is even stronger (sig. is 0.005), this is also visible in the table below, Table 6. this provides reasonable certainty that a train station in the place of residence ensures a higher use of the public transport network. It follows from this that having a train station in the place of residence has a strong relationship with the choice of a mode of transport. Conversely, it can be said from the foregoing two conclusions that with a reasonable degree of certainty that having a train station causes commuters to use public transport more often.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.471	1	1.471	8.362	.005
Within Groups	20.402	116	.176		
Total	21.873	117			

Table 6: ANOVA table: having a train station in the city of residence and using the public transportation

The fact that the place where one lives, city, village or countryside, plays a role in the choice of using a certain mode of transport, may be related to this, as a larger city has a greater chance of having a train station. However, that will not be the full reason for the connection and it could also be that the other connections or the distance to work play a role here. The exact explanations behind this could be a good follow-up study.

The fact that distance seems to play a role in the choice of a mode of transport could be explained by the fact that the greater the distance is considered more important, the more flexible the mode of transport can be. Based on this, it could be thought that time also plays a major role in the choice of a mode of transportation. This expectation was examined by means of an ANOVA analysis in SPSS but was not substantiated. This analysis revealed a significance of 0.209. Which is well above the threshold for a significant relationship.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2368.707	2	1184.354	1.586	.209
Within Groups	85885.632	115	746.832		
Total	88254.339	117			

Table 7: ANOVA one way table: travel time by used mode of transport

The other possible relationships mentioned in Table 5:

a. What is the number of days that the respondent goes to work after COVID-19?
b. What is the difference in the number of days to work before and after COVID-19?
c. What kind of place does the respondent work (city, village or countryside)?
d. Is there a train station where the respondent works?
e. What is the weekly commute distance to work?

However, these (possible) connections have all not been found to be significant from the SPSS analysis and therefore do not play a role in the commuter's choice of mode of transport.

Travel time and travel distance

It is also possible to calculate how many kilometers and minutes people traveled on average before and after COVID-19. This is possible because the following questions were asked in the survey:

a. How many days did the respondents go to work before and after the COVID-19 rules?
b. In which way did the respondents travel?
c. In which place did the respondent live and work?

The comment that must be made with this calculation is that this is not entirely accurate since, for privacy reasons, only the home and place of work and the full address of the respondents are known. The results will therefore differ slightly from reality but are expected to provide a good picture of the changed situation.

By the distance, times two; assuming that each respondent goes home every day, multiplied by the number of days they go to work before the COVID-19 crisis, the number of kilometers the respondent travels per week is obtained. By also doing this for the time, which is calculated by using Google Maps and using the indicated means of transport of each respondent, the total time spent per week in traffic as a commuter is also obtained.

By then also multiplying the distance, times two; assuming that every respondent also goes home every day after the COVID-19 crisis, multiplying by the number of days they go to work after the COVID-19 crisis, the number of kilometers that the respondent travels per week after the COVID-19 crisis is obtained. By also doing this for the time, which is calculated using Google Maps and using the indicated means of transport of each respondent, the total time that the respondents spend per week in traffic as a commuter is also obtained.

The table below shows the difference before and after COVID-19, the total and the average difference. This makes it clear that the 118 respondents commuted a total of 229 hours and 43 minutes per week less commuter kilometers and traveled 14,359 kilometers less.

Means before the COVID-19 crisis		
Week travel time	*263,2*	*minutes*
Week travel distance	*283,7*	*km*
Means after the COVID-19 crisis		
Week travel time	*145,4*	*minutes*
Week travel distance	*160,9*	*km*

Table 8: Average time and distance before and after measures for COVID-19

Total differences (118 respondents)		
Total difference in time	*-13783*	*minutes*
Total difference in distance	*-14358,8*	*km*
Mean difference per respondent		
Difference in time	*-117,8*	*minutes*
Difference in distance	*122,7*	*km*

Table 9:Total and average difference in time and distance

On average, the respondents started working from home a total of 129 days a week, which is equivalent to 1.3 days per respondent. To see what possible reasons are for those who have started working fewer or more days. An SPSS ANOVA analysis was performed for this with three different possible reasons. It is clear from this that the number of kilometers to work is significantly related to the number of days the respondents have worked less at the office. Respondents who live further away from work also go to work less often. This can provide opportunities for the region and for public transport, which is discussed in the Qualitative Interpretation and will be discussed in the Discussion. The other two possible reasons are in any case not significant with a significance of 0.70 and 0.187 respectively, although it seems that there is some connection between the size of the place and the number of days that people started working at home.

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Which modalities did you use?	Between Groups	1.620	7	.231	.661	.704
	Within Groups	38.490	110	.350		
	Total	40.110	117			
Is it a city, a village or a country side?	Between Groups	6.704	7	.958	1.465	.187
	Within Groups	71.907	110	.654		
	Total	78.610	117			
Amount of km to work	Between Groups	22315.229	7	3187.890	2.437	.023
	Within Groups	143919.098	110	1308.355		
	Total	166234.327	117			

Table 10: ANOVA table about less days at work and three possible relations

Revealed and stated preference

In the survey, they were asked three times why they made or would like to make the choice. For the first time, the group consists of 120 respondents who worked for COVID-19 and had to travel for that. The second time, the group consists of 108 respondents who worked after COVID-19 and had to travel (occasionally) before that. The third time, the group consisted of 49 respondents who indicated that they would like to change mode of transport. In these twelve graphs, as visible in Appendix 4, four things stand out in the graphs:

1. Hygiene

In the graph on the hygiene motive, it is striking that the COVID-19 is not a major driver for the choice of a means of transport. The individual means of transport, except for the bicycle, are not chosen for hygiene benefits. Before the COVID-19 pandemic, this was even higher for the car than after the home working measures and the respondents who would switch. It is striking, however, that if one were to change means of transport, a small part would then switch to cycling and walking. However, it is not possible to deduce from the answers of the respondents why this choice was made.

2. Able to work on the go

Among the respondents who would like to change means of transport, it appears that a reasonable percentage (22%) would also like to change to the train as a means of transport. However, when this is compared with the statement requested in the survey: 'I would like to be able to work during my commute to work', there does not seem to be a clear connection. This could be explained by the fact that people often respond differently to a survey than they do in real life. This is also referred to in the literature as revealed and stated preference (Mark & Swait, 2004). In that case, people say different or desired answers while doing something else or there is currently no good opportunity to work while traveling, so that they are forced not to do this or currently do not want to.

3. Relaxation and exercise

With regard to 'relaxation and exercise', it is striking that 35% of the people who would like to change means of transport would like to use the bicycle all the time or at least a few times a week. This is based on the fact that the people who would like to switch do not have to deal with a long distance between their place of residence and the place where the respondent works. However, it is not being done much at the moment. Where, as indicated above, 35% of the respondents who would like to switch use the bicycle for that reason, but in the entire respondent group only 17% of the people use the bicycle for this reason. A possible reason for this is the fact that the weather in the Netherlands is very changeable, while there is not always the possibility to change after cycling.

4. Climate friendly way

It is clear from the graphs on page 39 that, for climate-friendly reasons, bicycles and the train are also popular among people who would like to switch mode of transport. It is only clear that this is happening much less at the moment. The percentage currently using the means of transport for this reason is three times smaller (7.4% and 6.5% respectively) than the number that would like to use them (20.4% and 18.5% respectively). 4%).

What becomes clear from these observations is that the bicycle and the train are certainly modalities that can compete with the car, if the preconditions are right. However, it is difficult to say what the precise preconditions will be under which people would certainly want to take this step. This could be asked as a question in a follow-up study. What emerges from this and previous analyzes and what can be included for the province from this is described in the Chapter 5 and the conclusion and discussion.

Academic/policy findings

As indicated earlier in this thesis, the Ministry has carried out an integrated mobility analysis (IMA 2021) in recent years. In this analysis, we looked at the situation regarding mobilities and what trends are in the field of mobility. In this part of the thesis, the results of the survey will be combined with the expectations from the integral mobility analysis.

The IMA 2021 includes a modal split of MIRT region of the South of the Netherlands, which consists of North Brabant and Limburg. In the WLO-Laag scenario, the number of inhabitants (+3%) and the number of jobs (-2%) are fairly stable in the southern Netherlands. In the WLO-Hoog scenario, the number of jobs (+8%) and inhabitants (+12%). The development of mobility in the Southern Netherlands is comparable to the national average. Car use will remain approximately stable in WLO-Laag until 2040. In WLO-Hoog there is growth of 20%. The number of kilometers traveled by train grows by 12% in WLO-Laag and by 32% in WLO-Hoog. The use of bicycles (including e-bikes) is growing in both scenarios. Mobility by bus is still growing in WLO-Hoog light, while there is a contraction in WLO-Laag.

When looking at the modal split, as in the visualization below from the IMA 2021 of the number of passenger transport movements in 2018, it becomes clear that this corresponds to a reasonable extent with the modal split found in the survey done for of this research. The differences could be explained in several ways. First, the target group from which the modal split is obtained. In the IMA it is about the general picture, which consists of more than just commuters, while commuters were the target group that this research was aimed at. Secondly, the region could also play a role, other parts of the MIRT region of the South Netherlands may have a different network of means of transport, which means that the distribution there could be different.

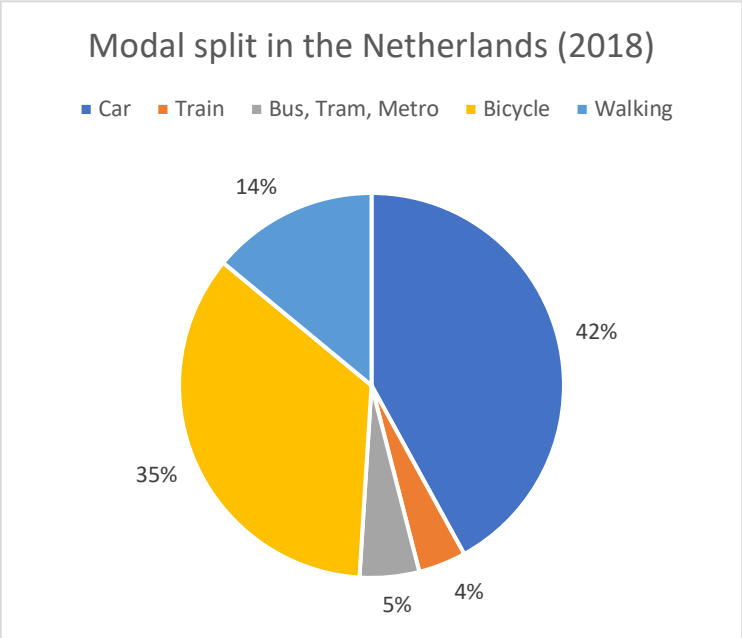

Figure 24: The modal split of the number of passenger transport trips in 2018 (source: CBS; Ministerie van Infrastructuur en Waterstaat, 2021)

When looking at the accessibility of the number of jobs in Limburg in the IMA, it is clear that the accessibility of the number of jobs in Limburg is lower than the national average. This could also be the reason why the modal split in the Roermond-Weert-Venlo region tends more towards car and train than bus, bicycle and walking, as the distance to work is longer than in other parts of the Netherlands. country.

According to the IMA, this will decrease further in almost all of Limburg in WLO-Laag due to the fall in the number of jobs. This also applies to the largest cities in Limburg, such as Maastricht and Venlo. In WLO-Hoog the number of jobs is stabilizing, but the saturation of the car network causes a decrease in accessibility. The increase in the number of inhabitants and jobs in the cities, and with it the increasing demand for mobility, leads to tasks on the various mobility networks and negative effects on road safety and the living environment.

6. Combining empirical results with theory

To determine the extent to which digital accessibility influences travel behavior, it is important to compare the results of the survey with the theories described in chapter 2.

One of the most important findings from the analysis of the study is that it appears that commuters who live further from their jobs are more likely to continue working from home after the measures against COVID-19 were lifted (Figure 24). Reasons for this may be that the travel time they would otherwise spend traveling can now be used differently. This can be traced back to the theory of Hägerstrand (1970) and Dijst (2006). They reason that there are three different constraints that limit people to a certain number of activities per day: "capability" (biological, mental and instrumental), "coupling" (coming together of people and objects to perform activities) and "authority" (physical, social, economic and governmental regulations) (Hägerstrand, 1970). The outcome of the survey actually aligns with all three constraints. Before COVID-19, there were capability constraints since a person living far from work has to travel further and thus spends more time, while she would actually like to use that time for other activities (sports, relaxation, etc.). There were also coupling constraints since one often had to be at work to be able to work together. When the measures against COVID-19 were taken, the authority constraints came: people had to work at home. However, during the first weeks the coupling constraints were such that people could not do their work properly at home, but with the improved digital accessibility of their work from their homes, these coupling constraints disappeared. The result was that people got more possibilities to work at home even after the rules about COVID-19 changed. An advantage of this is that the capability constraints changed. Because of the digital accessibility, people have less time to travel and can fill this time with other activities that were not possible in the previous situation because of the capability constraint.

Another notable finding was that having a train station in one's hometown results in more use of public transportation. One reason for this could be that the train provides a more direct and faster connection, which means a shorter travel time and one could be less bothered by waiting time or changing trains. Since with a bus one incurs waiting time every time the bus stops, as also became visible after analyses of travel chains by Van Nes et al. (2014). They show that the train journey between stations takes up only about half of the total travel time. This fits with the theory of moving resistance as described by Schoemaker (2002) and Van Wee & Anjema (2014). In addition, this also fits in the picture of Travel Cost, as shown in Table 3 (Baggen et al., 2019) where a commuter would be willing to pay almost 70% more for the train than for the bus (€11.50 versus €7.75).

When looking at the group who would like to use public transport more often (27% of the respondents) it becomes clear that the main reason why people who want to use public transport more often do not do it now, is that more than 40 percent of these respondents currently think the travel time is too long. When looking at the theory, this fits with Hägerstrand's (1970) time space theory and also the theory of movement resistance (Schoemaker, 2002; Van Wee & Anjema (2014). Because one finds it takes a long time, the resistance to use it also becomes higher. However, this may be more of a psychological element than the elements mentioned in Table 2 (Van der Waard, 1998). When it comes to the time space theory, this indicates that the authority and capability constraints when using public transport are too high so that not all the activities that the respondents want to do can be performed when they use public transport.

This shows that digitalization reduces the need for mobility as derived mobility. As the Cambridge Dictionary defines mobility: Mobility is the ability to move freely or be easily moved. Geurs (2014, p. 15) additionally describes it as follows: Mobility is the direct result of covering

distances between spatially dispersed locations. And the locations where people live and businesses are located also depend on how accessible they are.

Mobility often becomes a derived from demand. Derived mobility means to travel only because it is necessary. According to Rodrigue (2020), mobility is as a directly derived demand movements that directly affect economic activities, without which they would not take place. For instance, work-related activities commonly involve commuting between the place of residence and the workplace. There is a supply of work in one location (residence), and a demand for labor in another (workplace), transportation (commuting) being directly derived from this relationship. Due to the digitalization described by COVID-19 in the previous paragraphs and chapters, and the resulting increase in working from home, there will be less derived demand mobility for commuting. The time this frees up can be spent on other activities. However, it is possible that part of the mobility that is not used for commuting will be used for other forms of derived demand mobility.

In addition to mobility, accessibility also plays a major role. The Cambridge dictionary gives the definition of this: the fact of being able to be reached or obtained easily. With the above in mind, the accessibility of various better available and accessible. This will allow the time space theory of Hägerstrand (1970) to work differently as the capability constraints Hägerstrand wrote about. There is a lesser constraint because the reachability has thus become greater. Therefore, one might also choose to no longer make a choice of where to live because of where they work but for some other reason.

7. Conclusion

This thesis attempts to answer the question: '*How can the Province of Limburg respond to the changed situation in travel behavior of commuters in the region Venlo, Roermond and Weert, considering the effects of COVID-19 on digital accessibility and other factors like low population density in this large region, especially in the field of public transport?'*
In order to answer this question, a quantitative study was conducted by means of an online survey. This survey was discussed with officials from the Province of Limburg and a literature search was used. This conclusion will initially provide an answer to the four sub-questions formulated at the start of the study. An answer to the main question is then formulated with the help of these sub-questions.

Sub question 1: What does the public transport system currently look like in the region 'Venlo, Roermond and Weert'?

In the Venlo, Roermond and Weert region there is a train network that mainly connects the major cities. There is also an extensive bus system between the smaller cores and the cities on the edge of the region. However, COVID-19 has led to significant cuts to the bus schedules as they have been used less than before the pandemic. With the help of the agility scenarios, an attempt was made to solve the problem together with the transport company, Arriva, in such a way that one still has a closed public transport network without Arriva having to run with empty buses.

Sub question 2: What has changed (as a result of the COVID-19 crisis) in the digital accessibility of the region between 'Venlo, Roermond and Weert'?

In the survey conducted for this thesis, residents from the region were asked how travel behavior has changed in the last two years of having to work more at home. This survey showed that like in the rest of the country, people started to work at home on a large scale since they were not allowed to work at the office due to restrictive measures. The study showed that 71% of the respondents worked (partially) from home while these measures were in force. It also showed that people started working at home more often than before the pandemic. Before COVID-19 72% of the respondents worked 4 to 5 days on location, this percentage dropped to 39% after the corona measures. That this percentage has dropped so much indicates that much has changed in terms of the region's digital accessibility. It may suggest that working from home is going to be permanent.

Sub question 3: How does changed travel behavior (as a result of the COVID-19 crisis) effect different values of transportation accessibility in the region 'Venlo, Roermond and Weert'?

Working from home does not appear to have directly changed the commuter's travel behavior aside from the fact that people have started to travel less because they have started to work more from home. Van Audenhove et al. (2021) described that mass transit, such as the bus, metro, streetcar and train, will attract far fewer users in the short term, as a result of the measures taken as a result of the pandemic. In addition, that study also made clear that the modal split was expected to turn towards even more individual motorized modes, but that the number of additional kilometers would not increase that much. The research carried out in this thesis shows that the modal split has changed very little, only the bicycle is generally used more than before COVID-19. However, parts of the transportation accessibility have changed. As also indicated in sub question 2, commuters go to work less often. This also changes the commute time and distance. The 118 respondents commuted a total of 229 hours and 43 minutes per week less commuter kilometers and traveled 14,359 kilometers less. Thus, on average, 1.3 days less were spent at work, and this resulted in almost 118 minutes less commuting time per week and 123 fewer kilometers traveled per person.

Sub question 4: What opportunities and challenges does the Province of Limburg face regarding the public transport system and keeping it accessible and effective for commuters?

It seems to be clear from the research that it is difficult to get the commuter back into public transport, even though this was already a small proportion of public transport users before COVID-19. The time between the lock down measures and the research is not yet long enough to see whether more drastic decisions will be made, for example getting rid of a car when it is only used a few days a week. However, there is an opportunity here for the Province. The Province should stimulate less care use and to sell any second car that will now be used less and use public transport for those days. This can possibly be combined with an incentive scheme. In any case, the research shows that the train and the bicycle can play a major role in the new image regarding travel behavior, as long as the preconditions are good enough.

Research Question: How can the Province of Limburg respond to the changed situation in travel behavior of commuters in the region Venlo, Roermond and Weert, considering the effects of COVID-19 on digital accessibility and other factors like low population density in this large region, especially in the field of public transport?

The survey shows that commuters have started to travel less since the number of days they go to work has decreased due to digital accessibility. However, the modal split has hardly changed. The group that uses the car is stably high at 48%. However, the use of trains and buses seems to have decreased further. The fact that people travel less but use the car just as much suggests that the car is parked outside the door for several days without being used. A possible response to this could be for the province of Limburg to use a campaign to emphasize the benefits of public transport. This could also include highlighting the advantages of getting rid of the second car. Another possibility could be to enable bus rapid transit (BRT) between suburbs and the major cities, making the rural areas of this region more accessible. Indeed, this research currently indicates mainly short-term effects, given that currently (January 2022) the working from home advice is back in place. The long-term effects of the changes that have surfaced in this study and are related to changes that were needed to by the effects of COVID-19, are not yet identifiable. This will require further research.

8. Discussion

For this research, three different ways were used to look at what the COVID-19 pandemic has brought about with the mobility needs and digitization in the Roermond-Weert-Venlo region. The first way was with the help of a survey, followed by the second and third way a policy/desk review and a small qualitative focus meeting. The survey was distributed across the region using social media, communication with municipalities and news sites and ultimately resulted in 143 respondents. In combination with policy research, the integral mobility analysis carried out by the Ministry of Infrastructure and the Environment, as well as the knowledge of a number of colleagues that were used to investigate what the results mean, we looked at what ultimately led to the conclusion, in Chapter 6. In the discussion, the following parts are discussed successively: validity, interpretation, limitations, implications and follow-up research. To conclude, the discussion will end with a number of recommendations

Validity
In terms of validity, there are three different topics to look at, the first of which is: Was what was supposed to be measured? When looking at the results of the analyses that have been made, clear connections appear to be visible. This would probably have been less transparent if the questions had not been clear. In addition, an attempt was made to structure the survey in such a way that the respondent does not get the idea that she has to give a desired answer. This is also the reason that there were no direct questions in the survey about the pandemic itself. The expectation was that people would then be less inclined to give their own answers and more that the sentiment surrounding the COVID-19 pandemic would play a role. However, this means that in retrospect it is not possible to say with 100% certainty whether the pandemic is the only reason for the change to occur or whether this is the result of several other reasons as well.

Another important question is whether the results are generalizable also called the external validity (Van Thiel, 2014). When looking at the population validity, a good representative group of respondents was found during the survey. The focus in this survey was on commuters and the general questions showed that this group was well represented among the survey respondents. This is partly due to the different ways in which the survey was distributed. The caveat to be mentioned is that the results will only be generalizable for the group of commuters living in the same type of area. Since the mobility network is different in each environment, public transport may be used more or less in other areas. The analyses in this study also show that the presence of a train station in the place of residence has a significant relationship with the use of public transport. However, it should be noted that 143 respondents are a fairly small proportion of all commuters who travel in the area and throughout the Netherlands. Therefore, this survey mainly provides a first step and shows the direction in which improvements and changes should be considered. There is no assurance that the conclusions from this study would have the same outcome on a larger scale. Due to the strong connections, it seems that clear directions have been found for the province of Limburg to look further into. When it comes to ecological validity, it is deemed high because respondents were asked about their actions in their own environment.

Using the survey through an online system ensures that the same questions are always asked of each respondent. As Van Thiel (2014) described, a consistent way of collecting data ensures better reliability. In addition, the sources used in the research all seem to reinforce each other, creating the impression that the sources are reliable. The integral mobility analysis shows the same expectations as the respondents, and these are also similar to the expectations expressed in advance by the province and the researcher.

Interpretation of the results
In this study it was deliberately chosen to focus on commuters. This is partly due to the fact that the province of Limburg and the transport company Arriva indicated that the most difficult

thing to convince the commuter to do is to return to public transport. This is because the commuter often has several options for traveling and they often have a car. Students have fewer options in this regard and will return to public transport more quickly. Tourists will also return to public transport, partly because it is not logical for them to have a car in the area or to cycle a long distance. Due to the fact that the research is aimed at the commuter, the results must therefore also be seen as part of this focus (on the commuter). The results showing that there is a strong relationship between the use of public transport and having a train station in the place of residence can therefore be relevant for this group but could be a lot less relevant for another population group. Therefore, the relationships that emerge from the analyses cannot be adopted uniformly for the entire population or the entire region. This is, because it is possible that this applies only to commuters and that the entire group of passengers from a new train station is too small to make it profitable, so that it is not immediately logical for the implementing parties to set up a station there.

Limitations of the research

The investigation took place while the pandemic was still ongoing. A few days before the end of opening of the survey, new measures were announced by the national government. This may have resulted in a slightly different picture in later responses, mainly because stricter measures may have been taken into account. For the earlier respondents, it may be that they were used to the rhythm before it was rule-free again. Another limitation was also mentioned earlier in the discussion: the survey had 143 responses, which is a reasonable amount but is less than 1% of the regional populations and commuters in this area. According to the sample calculator, to get a survey with a confidence level of 95%, there should have been about 375 respondents to properly represent the area given its population.

Another limitation linked to the survey is the response rate of the relevant authorities. Efforts have been made to reach the municipalities, provincial authorities, public transport operator and the newspapers in a direct manner and through, for example, informal conversations with the researcher or direct colleagues of the researcher. However, not every registered platform responded or provided insight into what they would do next. It was often indicated that they would come back to it, but this in turn does not always happen. In future research, an attempt could be made to send more frequent follow-up e-mails so that people would be reminded more often. However, the question is whether this really would works. The province has indicated that they notice that municipalities, and certainly the smaller municipalities, have fewer and fewer officials in the field of mobility in-house, making it more difficult to contact them.

In addition to the limitations related to the survey, there is also one related to the literature. In this area, policies documents and analyses have been written that provided useful for this research. However, this is not scientific, peer-reviewed research, which would be the best way to substantiate the study. This is however not currently possible and with regard to research it will mainly be compared with policy and analyses/expectations. In future research, this issue may resolve itself as more research will have been done on mobility and COVID-19 by then.

Implications

This study will result in more clarity on how and why people behave with regard to mobility and how this has changed in recent times. It has also made it clearer how this behavior could be encouraged. As was also clear from the session with the officials of the Province of Limburg, there is mainly an urge to try to get the (extra) car away, so that more commuters will use public transport. People appear to make choices for simple reasons, such as the distance to work, the presence of the train station, but also that distance to work does not play a role in choosing a place of residence.

Suggestions for further research
Research does not end with the end of this study. The people within the province of Limburg indicated that they see this research as part of a larger body of research into the changes in mobility needs due to the pandemic. A similar study is envisaged when all restrictions have been lifted. About the same questions would then be asked, so that it could be compared with the results from this study.

A second study that could be a follow-up is expanding the research area to cities or to other rural areas in the Netherlands that are suffering from population decline and where facilities may be moving away. It could be that if the train station continues to be present in that area, the population decline will be less than if this connection is no longer present in the area. It seems to be the case that the train plays an important part in the public transport network for the commuter.

The commuter plays a major role in this research, but it can also be interesting to do similar research with students, elderly or the entire population of an area. This provides a picture of the changes across the entire population. A link could therefore be made with the other motives for the use of certain means of transport.

Recommendation
The study has provided insight on travel behavior after two years of COVID-19. The pandemic has led to several changes in travel behavior, particularly when it comes to distance, and mileage. After doing the research, there are five recommendations for the province.

1. Repeat the survey several times at different times with multiple audiences in the region. In this way a broader and clearer picture emerges on how the pandemic/lockdown measures have caused travel behavior to change across the population. Measures or changes to the network can then be better substantiated.

2. As a government, it may be wise to consider which target group the public transportation network is focused on. How can you get the highest possible occupancy rate while still making the network profitable? The research seems to indicate that the commuter in this area seems to barely use the bus network. Are there any minor adjustments that can be made to make it more attractive to the commuter?

3. A campaign aimed at the commuter to get rid of the car and use public transport more is advised. The campaign should mainly focus on the comforts and basics of public transport. The research clearly shows that humans area creatures of habit and the threshold must be kept as low as possible to facilitate use of the system. This could also include a subsidy for pre- and post-transportation (transportation to and from the stop or station) or a task for shared mobility and implement them in a good and easy way in the region.

4. To tie in with the third recommendation, the commuter certainly seems to want to use the bicycle when it comes to traveling to and from work. This can certainly be a positive thing if it is coupled with healthy living. To promote it even more, improving facilities at bus and train stations could be considered. The Province is already working on this with the 'Basis op orde' (Basics on point) program.

5. Finally, some form of bus rapid transit could also be a possibility. People seem to think that taking the bus will make the trip extra-long. By running, in addition to the neighborhood buses, rapid transit buses (BRT or High-quality OV) from Weert to Venlo, from Venlo to Roermond, and from Roermond to Weert, which make few stops and may have their own lanes in some places, the attractiveness of the buses is increased. This will require some additional research as to whether this could be profitable enough.

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Appendix 1 – Survey

Thesisonderzoek woon-werkreizen Noord- en Midden-Limburg

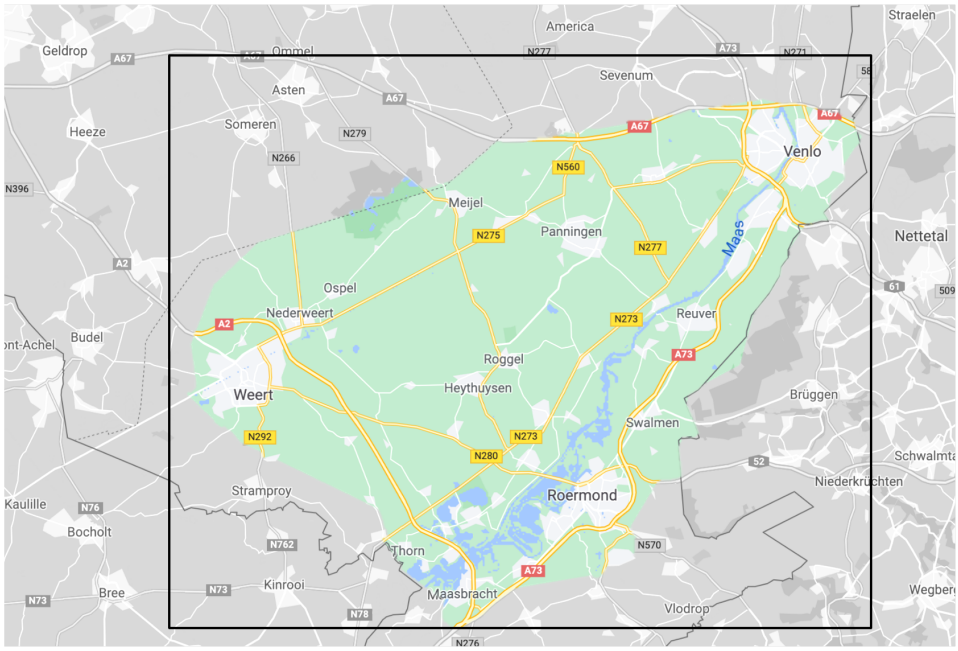
Beste mensen,

Voor mijn afstudeerstage bij de provincie Limburg, als onderdeel van de Master Ruimtelijk planning in Nijmegen doe ik een onderzoek naar hoe de bereikbaarheid in de stedelijke driehoek Venlo, Weert, Roermond de afgelopen tijd is veranderd.
De enquête bestaat uit open en meerkeuze vragen en zal naar verwachting ongeveer 10 minuten van uw tijd vragen. De enquête is opgedeeld in verschillende onderdelen, enkele onderdelen zijn afhankelijk van het gegeven antwoord op een voorgaande vraag.
De enquête is anoniem en antwoorden zullen ook niet terug te leiden zijn naar u. Er zullen geen naam en specifieke adresgegevens opgeslagen worden.

Alvast hartelijk dank,
Jeroen Louwinger
Contact: jeroen.louwinger@ru.nl

*Vereist

De focus van dit onderzoek ligt op het gekleurde gebied tussen Weert, Roermond en Venlo. Inwoners of mensen die werken in plaatsen binnen het zwarte kader zijn ook van harte welkom om de enquête in te vullen.



1. Wat is uw leeftijd? *

Markeer slechts één ovaal.

- ◯ 20 jaar en jonger
- ◯ 21-30
- ◯ 31-40
- ◯ 41-50
- ◯ 51-60
- ◯ 61-70
- ◯ 71-80
- ◯ 80 jaar en ouder

2. Wat is uw geslacht? *

Markeer slechts één ovaal.

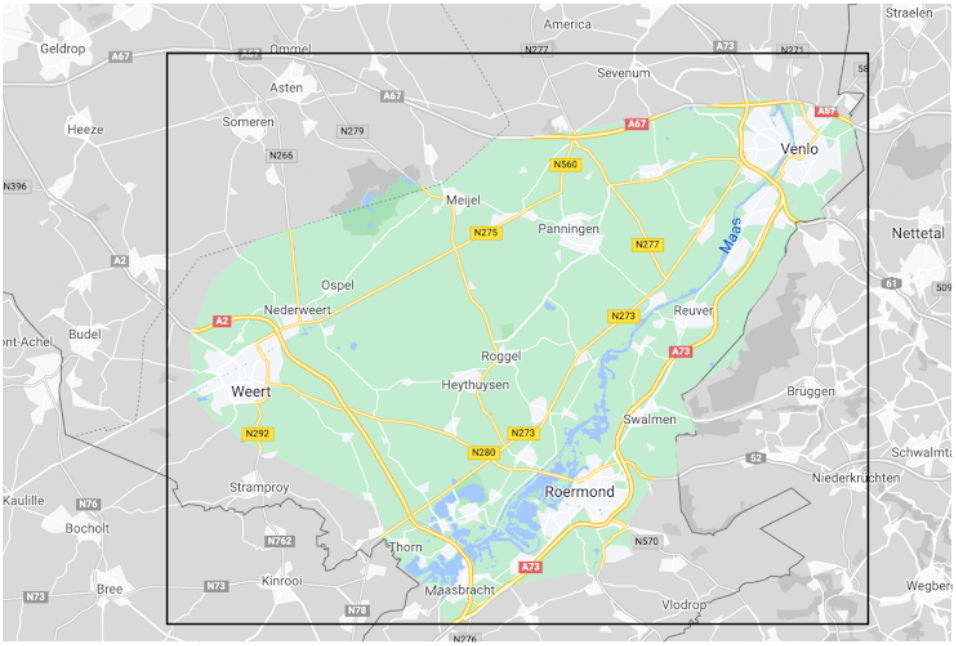
- ◯ Man
- ◯ Vrouw
- ◯ Zeg ik liever niet
- ◯ Anders: _____

3. Wat is uw hoogst genoten opleiding? *

Markeer slechts één ovaal.

- ◯ Basisschool
- ◯ Middelbare school (denk aan vmbo, havo, vwo)
- ◯ MBO
- ◯ HBO
- ◯ WO

4. Woont u in Midden-Limburg? (het gebied binnen het zwarte kader) *



Markeer slechts één ovaal.

- ◯ Ja *Ga naar vraag 5*
- ◯ Nee *Ga naar vraag 8*

(2) Wonen in Midden-Limburg

5. In welke plaats woont u *

Markeer slechts één ovaal.

- ◯ Roermond
- ◯ Weert
- ◯ Nederweert
- ◯ Ospel
- ◯ Swalmen
- ◯ Heythuysen
- ◯ Roggel
- ◯ Panningen
- ◯ Reuver
- ◯ Meijel
- ◯ Maasbracht
- ◯ Venlo
- ◯ Tegelen
- ◯ Beesel
- ◯ Anders: _____

6. Wat is de voornaamste reden waarom u gekozen heeft voor uw huidige woonplaats? *

Markeer slechts één ovaal.

- ◯ Bereikbaarheid van voorzieningen
- ◯ Nabijheid van familie
- ◯ Nog wonend bij ouders
- ◯ Beschikbaarheid van woningen
- ◯ Nabijheid van werk
- ◯ Mooie locatie om te wonen
- ◯ Ingetrokken bij partner
- ◯ Goed openbaar vervoer
- ◯ Veilige omgeving
- ◯ Sociale controle
- ◯ Geboren en getogen
- ◯ Anders: _____

7. In welke plaats is uw werk (betaald/onbetaald/vrijwilligerswerk) gevestigd? Staat de vestigingsplaats van uw werk niet in deze lijst vult u deze alstublieft in bij 'Anders'. Bent u tussen maart 2020 en nu van baan veranderd en veranderde daardoor de vestigingsplaats van uw werk, kies dan voor deze mogelijkheid. *

   Markeer slechts één ovaal.

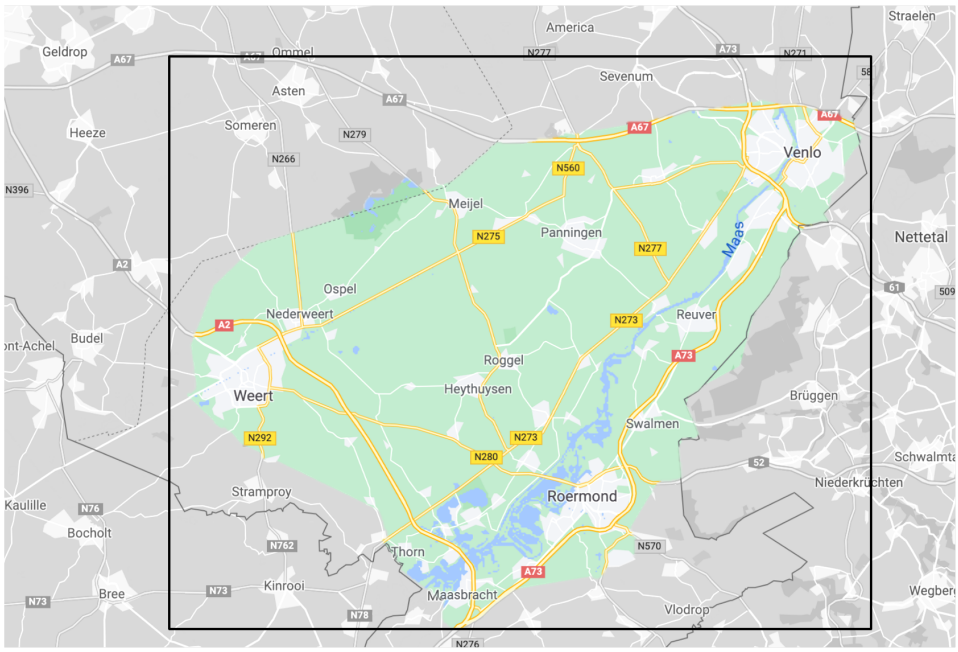
   - ◯ Ik heb geen werk *Ga naar vraag 42*
   - ◯ Ik ben tussen maart 2020 en nu van baan veranderd en heb hierdoor een andere werkplaats gekregen *Ga naar vraag 9*
   - ◯ Roermond *Ga naar vraag 15*
   - ◯ Weert *Ga naar vraag 15*
   - ◯ Nederweert *Ga naar vraag 15*
   - ◯ Ospel *Ga naar vraag 15*
   - ◯ Swalmen *Ga naar vraag 15*
   - ◯ Heythuysen *Ga naar vraag 15*
   - ◯ Roggel *Ga naar vraag 15*
   - ◯ Panningen *Ga naar vraag 15*
   - ◯ Reuver *Ga naar vraag 15*
   - ◯ Meijel *Ga naar vraag 15*
   - ◯ Maasbracht *Ga naar vraag 15*
   - ◯ Venlo *Ga naar vraag 15*
   - ◯ Tegelen *Ga naar vraag 15*
   - ◯ Beesel *Ga naar vraag 15*
   - ◯ Anders: _____

Ga naar vraag 15

(3) Werken in Midden-Limburg

Onder werken vallen in deze enquête alle mogelijke manieren van betaald, onbetaald of vrijwilligerswerk.

Focusgebied



8. Werkt u in de regio? *

Markeer slechts één ovaal.

- ◯ Ja *Ga naar vraag 12*
- ◯ Ja, ik ben na maart 2020 begonnen *Ga naar vraag 25*
- ◯ Ja en ik ben tussen maart 2020 en nu van baan veranderd *Ga naar vraag 9*
- ◯ Nee *Ga naar vraag 42*
- ◯ Nee, ik heb geen werk *Ga naar vraag 42*

(4) Veranderde werksituatie

U heeft aangegeven dat u tussen maart 2020 en nu van baan bent veranderd, de volgende vragen gaan over uw werk en de verandering

9. In welke plaats werkte u voordat u van baan wisselde? Staat de vestigingsplaats van uw werk niet in deze lijst vult u deze alstublieft in bij 'Anders'. *

Markeer slechts één ovaal.

- Roermond
- Weert
- Nederweert
- Ospel
- Swalmen
- Heythuysen
- Roggel
- Panningen
- Reuver
- Meijel
- Maasbracht
- Venlo
- Tegelen
- Beesel
- Anders: _____

10. Om welke reden bent u van baan veranderd? *

Markeer slechts één ovaal.

- Dichterbij huis
- Minder last van files
- Betere verbinding met het openbaar vervoer
- Hoger salaris
- Betere werksfeer
- Meer doorgroeimogelijkheden
- Betere werkomstandigheden
- Meer flexibiliteit

11. In welke plaats werkt u tegenwoordig? Staat de vestigingsplaats van uw werk niet in deze lijst vult u deze alstublieft in bij 'Anders'. *

Markeer slechts één ovaal.

- Roermond
- Weert
- Nederweert
- Ospel
- Swalmen
- Heythuysen
- Roggel
- Panningen
- Reuver
- Meijel
- Maasbracht
- Venlo
- Tegelen
- Beesel
- Anders: _____

Ga naar vraag 15

(5) Werken in Midden-Limburg (2)

Onder werken vallen in deze enquête alle mogelijke manieren van betaald, onbetaald of vrijwilligerswerk.

12. In welke plaats werkt u? Staat de vestigingsplaats van uw werk niet in deze lijst vult u deze alstublieft in bij 'Anders'. *

Markeer slechts één ovaal.

- ◯ Roermond
- ◯ Weert
- ◯ Nederweert
- ◯ Ospel
- ◯ Swalmen
- ◯ Heythuysen
- ◯ Roggel
- ◯ Panningen
- ◯ Reuver
- ◯ Meijel
- ◯ Maasbracht
- ◯ Venlo
- ◯ Tegelen
- ◯ Beesel
- ◯ Anders: _____

13. Waar woont u? *

_____

14. Wat is de voornaamste reden waarom u gekozen heeft voor uw huidige woonplaats? *

Markeer slechts één ovaal.

- ◯ Bereikbaarheid van voorzieningen
- ◯ Nabijheid van familie
- ◯ Nog wonend bij ouders
- ◯ Beschikbaarheid van een woning
- ◯ Dichtbij werk
- ◯ Mooie locatie om te wonen
- ◯ Ingetrokken bij partner
- ◯ Goed openbaar vervoer
- ◯ Veilige omgeving
- ◯ Sociale controle
- ◯ Geboren en getogen
- ◯ Anders: _____

Ga naar vraag 15

(6) Verplaatsingen voor maart 2020

Om een goed beeld te krijgen van de verandering over de afgelopen paar jaren wordt eerst gevraagd naar de situatie hoe deze voor maart 2020 was. Bij de volgende vragen wordt het voor- en natransport buiten beschouwing gelaten. Een voorbeeld van Voor- en natransport is de korte wandeling van huis naar de bushalte

15. Hoeveel dagen per week ging u voor maart 2020 gemiddeld naar het werk? *

Markeer slechts één ovaal.

- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ 6
- ◯ 7

16. Voor maart 2020: Hoe vaak ging u met de auto naar uw werk? Op een schaal van 0 (= nooit) tot 5 (=altijd) *

Markeer slechts één ovaal.

	0	1	2	3	4	5	
Nooit	◯	◯	◯	◯	◯	◯	Altijd

17. Voor maart 2020: Hoe vaak ging u met de fiets naar uw werk? Op een schaal van 0 (= nooit) tot 5 (=altijd) *

Markeer slechts één ovaal.

	0	1	2	3	4	5	
Nooit	◯	◯	◯	◯	◯	◯	Altijd

18. Voor maart 2020: Hoe vaak ging u met de bus naar uw werk? Op een schaal van 0 (= nooit) tot 5 (=altijd) *

Markeer slechts één ovaal.

	0	1	2	3	4	5	
Nooit	◯	◯	◯	◯	◯	◯	Altijd

19. Voor maart 2020: Hoe vaak ging u met de trein naar uw werk? Op een schaal van 0 (= nooit) tot 5 (=altijd) *

Markeer slechts één ovaal.

	0	1	2	3	4	5	
Nooit	◯	◯	◯	◯	◯	◯	Altijd

20. Voor maart 2020: Hoe vaak ging u lopend naar uw werk? Op een schaal van 0 (= nooit) tot 5 (=altijd) *

Markeer slechts één ovaal.

	0	1	2	3	4	5	
Nooit	◯	◯	◯	◯	◯	◯	Altijd

21. Voor maart 2020: Hoe vaak ging u op een andere manier naar uw werk? Op een schaal van 0 (= nooit) tot 5 (=altijd) *

Markeer slechts één ovaal.

	0	1	2	3	4	5	
Nooit	◯	◯	◯	◯	◯	◯	Altijd

22. Waarom ging u voor maart 2020 met deze vervoersmiddelen naar uw werk? (bij geen gebruik selecteert u de keuze 'niet van toepassing')

Vink alle toepasselijke opties aan.

	Auto	Fiets of e-bike	Bus	Trein	Lopen	Anders
Financiële keuze	☐	☐	☐	☐	☐	☐
Gemak	☐	☐	☐	☐	☐	☐
Hygiene	☐	☐	☐	☐	☐	☐
Kunnen werken onderweg	☐	☐	☐	☐	☐	☐
Ontspanning en beweging	☐	☐	☐	☐	☐	☐
Gebrek aan passend openbaar vervoer	☐	☐	☐	☐	☐	☐
Geen parkeerplek op het werk	☐	☐	☐	☐	☐	☐
Vergoeding van werkgever	☐	☐	☐	☐	☐	☐
Flexibiliteit	☐	☐	☐	☐	☐	☐
Gebruik van een leaseauto	☐	☐	☐	☐	☐	☐
Reistijd	☐	☐	☐	☐	☐	☐
Klimaatvriendelijke manier	☐	☐	☐	☐	☐	☐
Om een andere reden	☐	☐	☐	☐	☐	☐
Niet van toepassing	☐	☐	☐	☐	☐	☐

23. Als u bij de vorige vraag 'om andere reden' ingevuld heeft, kunt u vertellen welke reden dit is?

24. Heeft u tijdens de corona situatie thuisgewerkt? *

Markeer slechts één ovaal.

- Ja, volledig *Ga naar vraag 28*
- Ik heb gedeeltelijk thuis gewerkt *Ga naar vraag 25*
- Nee, ik kon niet thuiswerken *Ga naar vraag 25*
- Ik had geen werk *Ga naar vraag 28*

(7) Werken tijdens corona (na maart 2020)

De onderstaande vragen gaan over het vervoer naar uw werk tijdens de Corona pandemie.
Onder werken vallen in deze enquête alle mogelijke manieren van betaald, onbetaald of vrijwilligerswerk. Bij de volgende vragen wordt het voor- en natransport buiten beschouwing gelaten. Een voorbeeld van Voor- en natransport is de korte wandeling van huis naar de bushalte

25. Op welke manier ging u tijdens corona naar uw werk? *

Markeer slechts één ovaal.

- ◯ Auto
- ◯ Fiets of e-bike
- ◯ Bus
- ◯ Bus + trein
- ◯ Bus + fiets
- ◯ Trein
- ◯ Trein + fiets
- ◯ Lopen

26. Waarom ging u tijdens corona met dit vervoersmiddel naar uw werk? (meerdere antwoorden mogelijk) *

Vink alle toepasselijke opties aan.

- ☐ Financiële keuze
- ☐ Gemak
- ☐ Hygiëne
- ☐ kunnen werken onderweg
- ☐ Ontspanning
- ☐ Beweging
- ☐ Gebrek aan passend openbaar vervoer
- ☐ Geen parkeerplek op het werk
- ☐ Vergoeding van werkgever
- ☐ Flexibiliteit
- ☐ Gebruik van een leaseauto
- ☐ Reistijd
- ☐ Klimaatvriendelijke manier

Anders: ☐ _____

27. Werkt u tegenwoordig (gedeeltelijk) op locatie? *

Markeer slechts één ovaal.

- Ja *Ga naar vraag 28*
- Nee *Ga naar vraag 38*

(8) Woon-werk na corona

Om te kunnen onderzoeken hoe het woon-werkreisgedrag van nu veranderd is ten opzichte van voor de Coronacrisis is het van belang te weten hoe vaak en op welke manier u nu naar het werk gaat Bij de volgende vragen wordt het voor- en natransport buiten beschouwing gelaten. Een voorbeeld van Voor- en natransport is de korte wandeling van huis naar de bushalte

28. Hoeveel dagen per week werkt u momenteel weer op locatie? *

Markeer slechts één ovaal.

- 1
- 2
- 3
- 4
- 5
- 6
- 7

29. Hoe vaak gaat u momenteel met de auto naar uw werk? Op een schaal van 0 (= nooit) tot 5 (=altijd) *

Markeer slechts één ovaal.

	0	1	2	3	4	5	
Nooit							Altijd

30. Hoe vaak gaat u momenteel met de fiets naar uw werk? Op een schaal van 0 (= nooit) tot 5 (=altijd) *

Markeer slechts één ovaal.

	0	1	2	3	4	5	
Nooit	◯	◯	◯	◯	◯	◯	Altijd

31. Hoe vaak gaat u momenteel met de bus naar uw werk? Op een schaal van 0 (= nooit) tot 5 (=altijd) *

Markeer slechts één ovaal.

	0	1	2	3	4	5	
Nooit	◯	◯	◯	◯	◯	◯	Altijd

32. Hoe vaak gaat u momenteel met de trein naar uw werk? Op een schaal van 0 (= nooit) tot 5 (=altijd) *

Markeer slechts één ovaal.

	0	1	2	3	4	5	
Nooit	◯	◯	◯	◯	◯	◯	Altijd

33. Hoe vaak gaat u momenteel lopend naar uw werk? Op een schaal van 0 (= nooit) tot 5 (=altijd) *

Markeer slechts één ovaal.

	0	1	2	3	4	5	
Nooit	◯	◯	◯	◯	◯	◯	Altijd

34. Hoe vaak gaat u momenteel op een andere manier naar uw werk? Op een schaal van 0 (= nooit) tot 5 (=altijd) *

Markeer slechts één ovaal.

	0	1	2	3	4	5	
Nooit	◯	◯	◯	◯	◯	◯	Altijd

35. Waarom gaat u met deze vervoersmiddelen naar uw werk? (bij geen gebruik selecteert u de keuze 'niet van toepassing')

Vink alle toepasselijke opties aan.

	Auto	Fiets of e-bike	Bus	Trein	Lopen	Anders
Financiële keuze	☐	☐	☐	☐	☐	☐
Gemak	☐	☐	☐	☐	☐	☐
Hygiene	☐	☐	☐	☐	☐	☐
Kunnen werken onderweg	☐	☐	☐	☐	☐	☐
Ontspanning en beweging	☐	☐	☐	☐	☐	☐
Gebrek aan passend openbaar vervoer	☐	☐	☐	☐	☐	☐
Geen parkeerplek op het werk	☐	☐	☐	☐	☐	☐
Vergoeding van werkgever	☐	☐	☐	☐	☐	☐
Flexibiliteit	☐	☐	☐	☐	☐	☐
Gebruik van een leaseauto	☐	☐	☐	☐	☐	☐
Reistijd	☐	☐	☐	☐	☐	☐
Klimaatvriendelijke manier	☐	☐	☐	☐	☐	☐
Om een andere reden	☐	☐	☐	☐	☐	☐
Niet van toepassing	☐	☐	☐	☐	☐	☐

36. Als u bij de vorige vraag 'om andere reden' ingevuld heeft, kunt u vertellen welke reden dit is?

37. Staat u er voor open om een ander vervoersmiddel te gebruiken? *

Markeer slechts één ovaal.

- Ja *Ga naar vraag 40*
- Nee *Ga naar vraag 42*
- Misschien *Ga naar vraag 40*

(9) Wanneer u wel naar het werk zou gaan

38. Wanneer u nu in de situatie zou komen dat u wel naar werk op locatie zou moeten, met welk vervoersmiddel zou u naar het werk gaan? *

Markeer slechts één ovaal per rij.

	Nooit	Soms	Altijd
Auto			
Fiets of e-bike			
Bus			
Trein			
Lopend			
Anders			

39. Staat u er voor open om een ander vervoersmiddel te gebruiken? *

Markeer slechts één ovaal.

- ◯ Ja *Ga naar vraag 40*
- ◯ Nee *Ga naar vraag 42*
- ◯ Misschien *Ga naar vraag 40*

(10) Gebruik van ander vervoersmiddel na corona

40. Met welk(e) vervoersmiddel(en) zou u graag vaker willen reizen? (Meerdere antwoorden mogelijk) *

Vink alle toepasselijke opties aan.

- ☐ Auto
- ☐ Fiets of e-bike
- ☐ Bus
- ☐ Trein
- ☐ Lopend
- Anders: ☐ _____

41. Om welke reden(en) ? (bij geen gebruik willen maken van een van de vervoersmiddelen, selecteert u de keuze 'niet van toepassing')

Vink alle toepasselijke opties aan.

	Auto	Fiets of e-bike	Bus	Trein	Lopen	Anders
Financiële keuze	☐	☐	☐	☐	☐	☐
Gemak	☐	☐	☐	☐	☐	☐
Hygiene	☐	☐	☐	☐	☐	☐
Kunnen werken onderweg	☐	☐	☐	☐	☐	☐
Ontspanning en beweging	☐	☐	☐	☐	☐	☐
Gebrek aan passend openbaar vervoer	☐	☐	☐	☐	☐	☐
Geen parkeerplek op het werk	☐	☐	☐	☐	☐	☐
Vergoeding van werkgever	☐	☐	☐	☐	☐	☐
Flexibiliteit	☐	☐	☐	☐	☐	☐
Gebruik van een leaseauto	☐	☐	☐	☐	☐	☐
Reistijd	☐	☐	☐	☐	☐	☐
Het is klimaatvriendelijker	☐	☐	☐	☐	☐	☐
Om een andere reden	☐	☐	☐	☐	☐	☐
Niet van toepassing	☐	☐	☐	☐	☐	☐

(11) Woonplaats

In dit deel van de enquête staan een aantal stellingen waarbij geldt dat een 0 totaal oneens betekent en 5 totaal eens.

42. De manier waarop ik naar mijn werk gaat heeft te maken met de afstand tot mijn werk *

Markeer slechts één ovaal.

	0	1	2	3	4	5	
Totaal oneens							Totaal eens

43. Thuiswerken heeft ervoor gezorgd dat ik het minder belangrijk vind dat ik dicht bij mijn werk woon *

Markeer slechts één ovaal.

	0	1	2	3	4	5	
Totaal oneens							Totaal eens

44. Ik zou dichterbij mijn familie willen wonen *

Markeer slechts één ovaal.

	0	1	2	3	4	5	
Totaal oneens							Totaal eens

45. Ik zou dichterbij de natuur willen wonen *

Markeer slechts één ovaal.

	0	1	2	3	4	5	
Totaal oneens							Totaal eens

46. Ik zou graag tijdens mijn reis naar het werk al kunnen werken *

Markeer slechts één ovaal.

	0	1	2	3	4	5	
Totaal oneens	◯	◯	◯	◯	◯	◯	Totaal eens

47. Als u zou willen verhuizen, in welke plaats zou u willen wonen?

_____

(12) OV

Door de veranderingen van gebruik van vervoersmiddelen is het mogelijk dat de vraag naar openbaar vervoer veranderd is. Een onderdeel van het onderzoek is om te kijken wat mogelijke aanpassingen zouden kunnen zijn.

48. Zou u vaker met het openbaar vervoer willen reizen? *

Markeer slechts één ovaal.

- ◯ Ja *Ga naar vraag 49*
- ◯ Nee *Ga naar vraag 54*
- ◯ Nee ik ga al vaak met het OV *Ga naar vraag 54*

(13) OV (2)

Door de veranderingen van gebruik van vervoersmiddelen is het mogelijk dat de vraag naar openbaar vervoer veranderd is. Een onderdeel van het onderzoek is om te kijken wat mogelijke aanpassingen zouden kunnen zijn.

49. Met welke motief zou u het Openbaar Vervoer willen gebruiken? (meerdere antwoorden mogelijk) *

Vink alle toepasselijke opties aan.

- ☐ Woon-werkreizen
- ☐ Sport en recreatie
- ☐ Familie of vrienden bezoeken
- ☐ Reizen naar opleiding

Anders: ☐ _____

50. Met welke reden zou u het Openbaar Vervoer willen gebruiken? (meerdere antwoorden mogelijk) *

Vink alle toepasselijke opties aan.

- [ ] Ik wil graag minder inspanning hoeven te leveren tijdens het reizen (minder opletten)
- [ ] Ik wil graag kunnen werken tijdens het reizen
- [ ] Ik wil graag kunnen ontspannen tijdens het reizen
- [ ] Ik wil graag op een meer klimaatvriendelijke manier reizen
- [ ] Ik wil graag files en ander oponthoud vermijden
- [ ] Het gebruik van de auto is minder aantrekkelijk geworden

Anders: [ ] _____

51. Wat is de reden waarom u momenteel niet vaker gebruik maakt van het openbaar vervoer? *

_____

_____

_____

_____

_____

52. Welke vorm van Openbaar vervoer of deelmobiliteiten zou u graag vaker willen gebruiken *

Vink alle toepasselijke opties aan.

- [ ] Bus
- [ ] Trein
- [ ] Deelauto
- [ ] Deelfiets
- [ ] Deelscooter

Anders: [ ] _____

53. Welke verbeteringen zou u graag zien in het Openbaar Vervoer? *

(14) Een laatste vraag

Hartelijke dank voor het invullen van de vragen. Onderstaande vraag kunt u gebruiken als u nog een laatste opmerking kwijt wilt. Eventuele vragen of opmerkingen mag u ook sturen naar: jeroen.louwinger@ru.nl

54. Heeft u nog opmerkingen of ideeën die in de enquete niet aanbod zijn gekomen maar volgens u wel belangrijk zijn?

Appendix 2 - Table bus network of the Region Venlo, Roermond, Weert

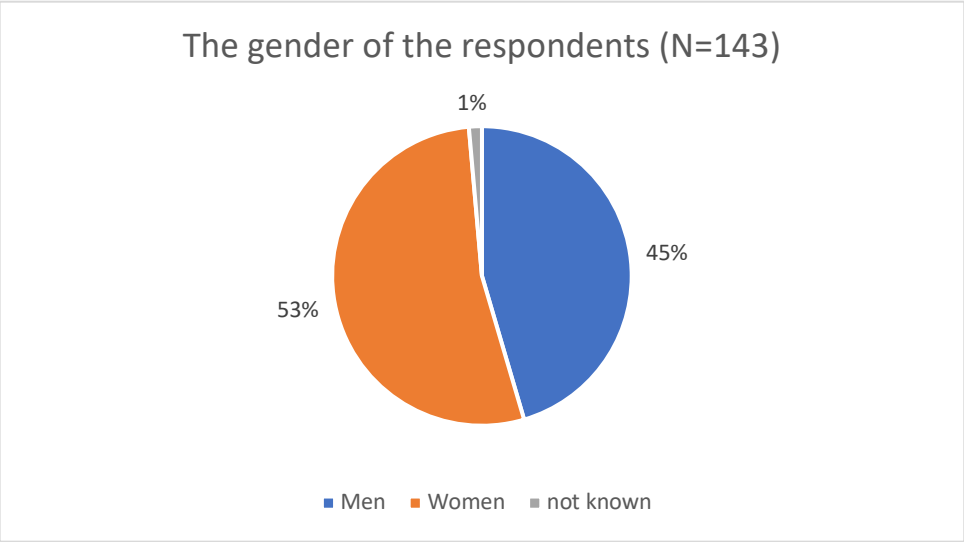
Stadsdienst Venlo			Overdag	Avond en weekend
1	Venlo: Station - Hagerbroek - Ziekenhuis - Tegelen: Station - Heide - Nettetal: Kaldenkirchen		2x	Nee, zie Avondvlinder 6+7
2	Venlo: Station - Blerick: Centrum - Klingerberg		2x	Nee, zie Avondvlinder 6+7
3	Venlo: Station - Blerick: Centrum - Vossener		2x	Nee, zie Avondvlinder 6+7
4	Venlo: Station → Vogelhut → Stalberg → Tichelarie → 't Ven → Veegtes → Noorderpoort → Genooi → Centrum → Station		2x	Nee, zie Avondvlinder 6+7
5	Venlo: Station ← Vogelhut ← Stalberg ← Tichelarie ← 't Ven ← Veegtes ← Noorderpoort ← Genooi ← Centrum ← Station		2x	Nee, zie Avondvlinder 6+7
6	Blerick: Klingerberg [→ Vossener] - Centrum - Venlo: Station - Hagerbroek - Ziekenhuis - Tegelen: Station - Heide	Avondvlinder	2x	
7	Venlo: Station - Centrum [→ Vogelhut]/[← Tichelarie] - Stalberg	Avondvlinder	2x	
Stadsdienst Roermond				
1	Roermond: Station - Donderberg - Kitskensberg		2x	
2	Roermond: Station - Centrum - Herten: [← Dorp] - Merum		2x	
Stadsdienst Weert				
1	Weert: Station - Sint Jans Gasthuis [← Vrakker] - Boshoven		2x	2x
2	Weert: Station - Sint Jans Gasthuis - Biest - Molenakker [← Hushoven] - Laar: Dorp		1x	1x
3	Weert: Station - Sint Jans Gasthuis - Groenewoud - Leuken		1x	1x
4	Weert: Station - Keent - Altweerterheide: Dorp		1x	1x

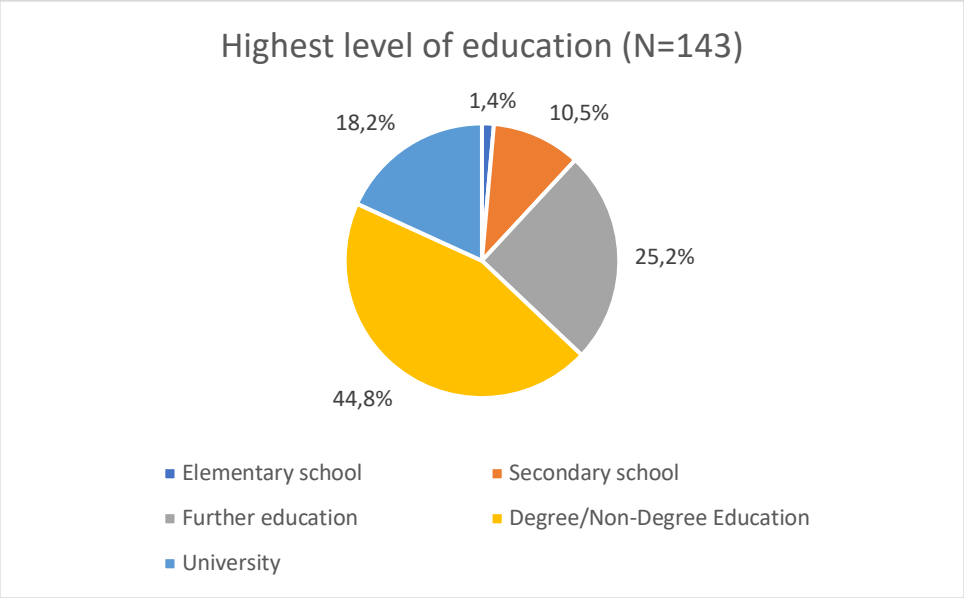
Streeklijnen				
61	Roermond - Melick - Sint Odiliënberg - Montfort - Sint Joost - Hingen - Pey - Echt		1x	1x
62	Roermond → Herkenbosch → Vlodrop → Posterholt → Sint Odiliënberg → Melick → Roermond		1x	1x
63	Roermond ← Herkenbosch ← Vlodrop ← Posterholt ← Sint Odiliënberg ← Melick ← Roermond		1x	1x
66	Venlo - Tegelen - Belfeld - Reuver - Beesel - Swalmen - Roermond		2x (spits) 1x (dal)	1x
67	Roermond - Linne - Maasbracht - Echt		1x	1x
68	Roermond - Linne - Maasbracht - Stevensweert - Ohé en Laak - Echt		1x	1x
73	Roermond - Horn - Beegden - Heel - Panheel - Wessem - Thorn - Ittervoort - Hunsel - Ell - Swartbroek - Weert		2x	1x
74	Nederweert - Weert - Tungelroy - Stramproy		2x	1x
76	Maasbracht - Wessem - Panheel - Grathem - Kelpen-Oler - Ell		1x	1x
78	Baarlo - Kessel - Helden - Panningen - Grashoek		1x	1x
83	Nijmegen - Malden - Molenhoek - Mook - Plasmolen - Milsbeek - Ottersum - Gennep - Heijen - Afferden - Nieuw-Bergen - Well - Wellerlooi - Arcen - Lomm - Velden - Venlo	Deels Limburgliner, i.s.m. Breng	2x	2x
370	Venlo - Blerick - Maasbree - Helden - Panningen - Beringe - Meijel - Ospeldijk - Ospel - Nederweert - Weert		1x tot 2x	1x
371	Weert - Kelpen-Oler - Baexem - Heythuysen - Roggel - Heibloem - Meijel		2x	1x
372	Roermond - Baexem - Heythuysen - Roggel - Egchelheide - Egchel - Helden - Panningen - Maasbree - Venlo	Gewone streekbus	2x	1x
377	Roermond - Horn - Haelen - Nunhem - Neer - Kesseleik - Kessel - Baarlo - Hout-Blerick - Venlo	Gewone streekbus	2x	1x
662	Roermond → Herkenbosch		Incidentele ritten of lijnvoering (scholierenlijn)	
663	Roermond ← Herkenbosch		Incidentele ritten of lijnvoering (scholierenlijn)	
674	Ospel → Nederweert → Weert		Incidentele ritten of lijnvoering (scholierenlijn)	

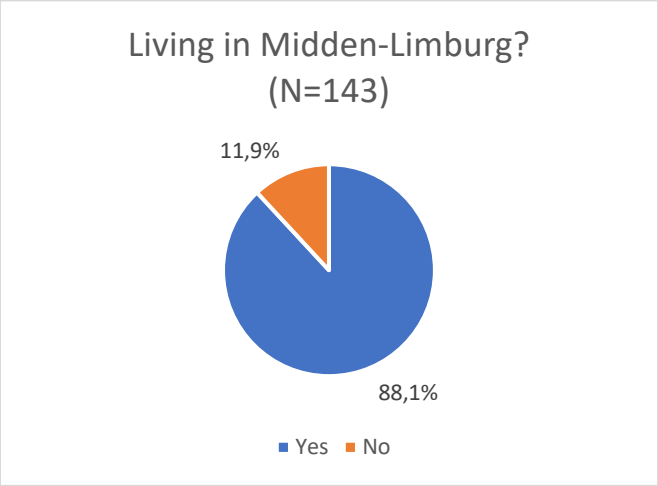
675	Roermond - Horn - Heythuysen - Roggel - Heibloem - Meijel		Incidentele ritten of lijnvoering (scholierenlijn)	
679	Panningen [- Helden - Maasbree]/[- Toverland] - Sevenum - Station Horst-Sevenum		Incidentele ritten of lijnvoering (scholierenlijn)	
Buurtbus				
790	Weert - Tungelroy - Stramproy - Haler - Neeritter - Ittervoort - Grathem - Baexem - Heythuysen		1x	
794	Boukoul - Maalbroek - Asenray - Roermond Station - Roermond Leeuwen		1x	
796	Heythuysen - Leveroy - Eind - Nederweert		1x	

Appendix 3 – Figures descriptive analysis

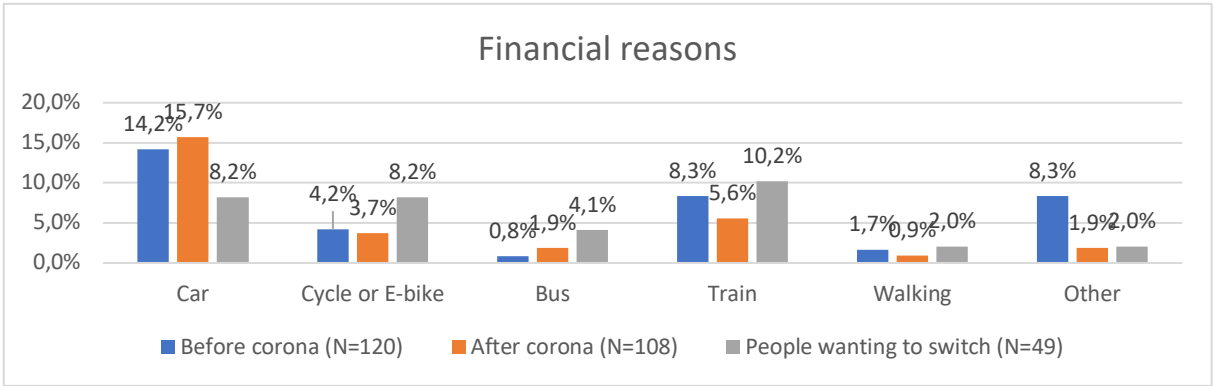
To complement the graphs and text in Chapter 5, 3 additional graphs are provided in this appendix.

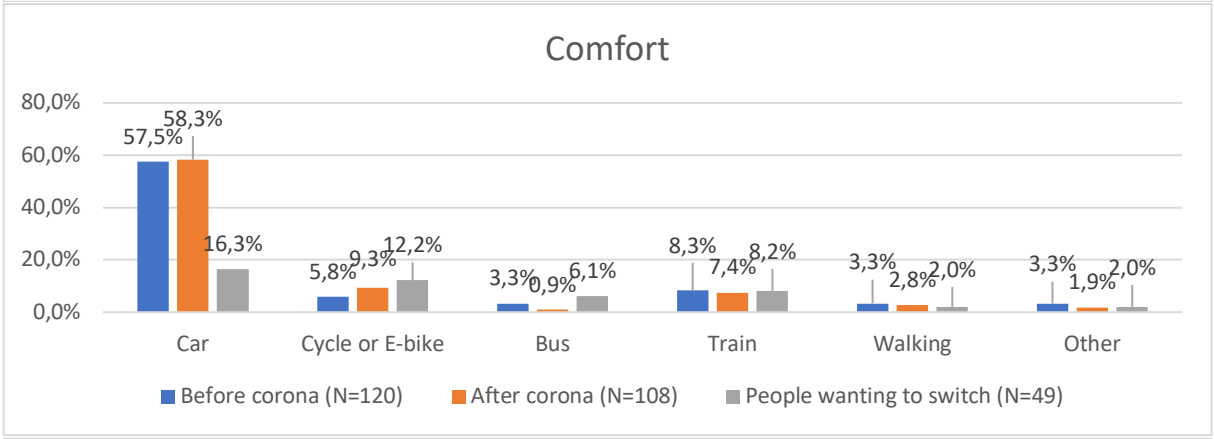


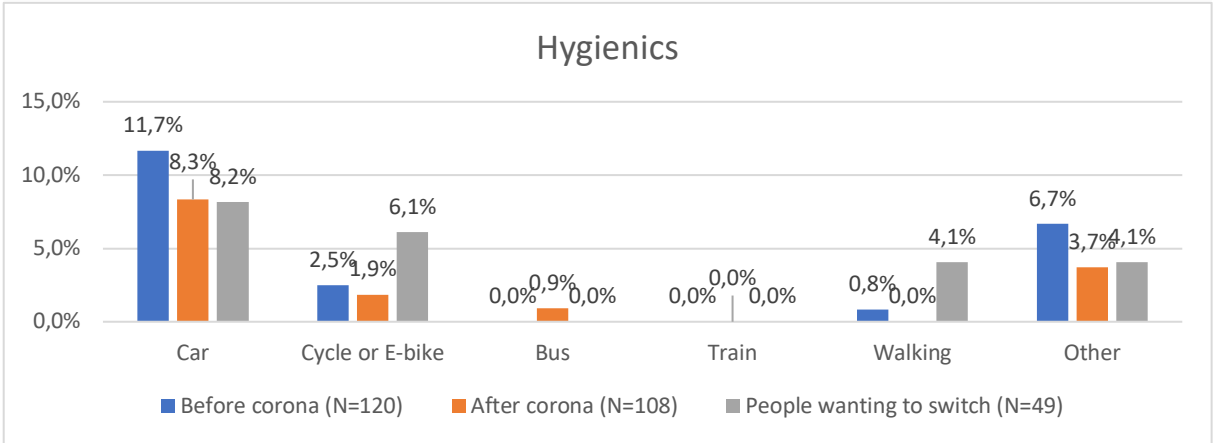


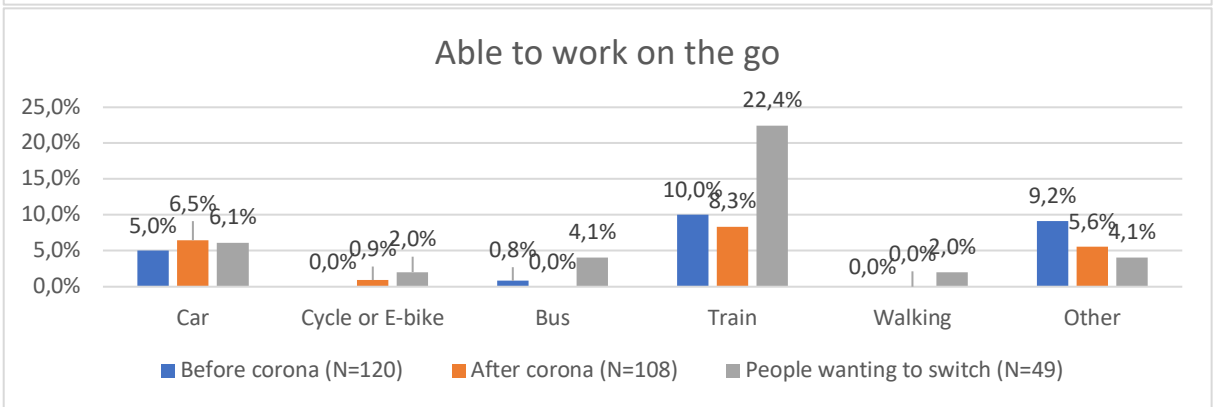


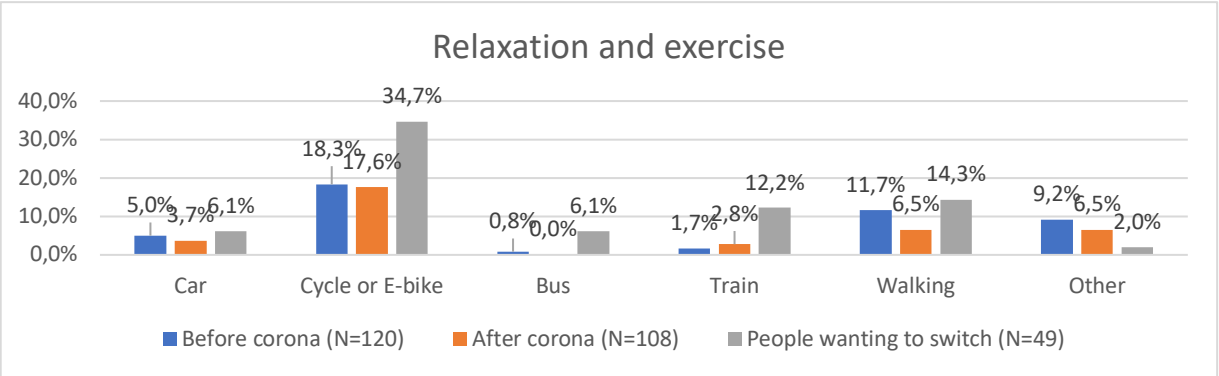
Appendix 4 – Figures about revealed and stated preference

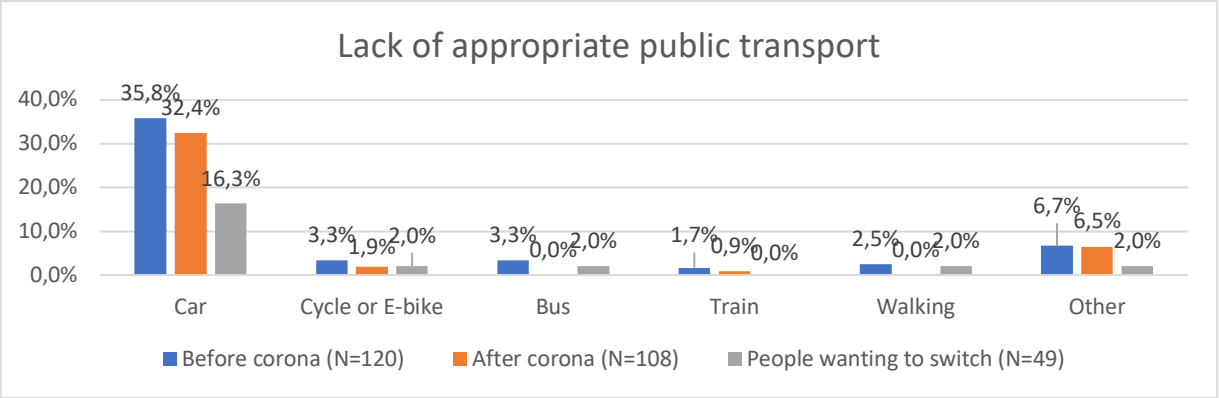


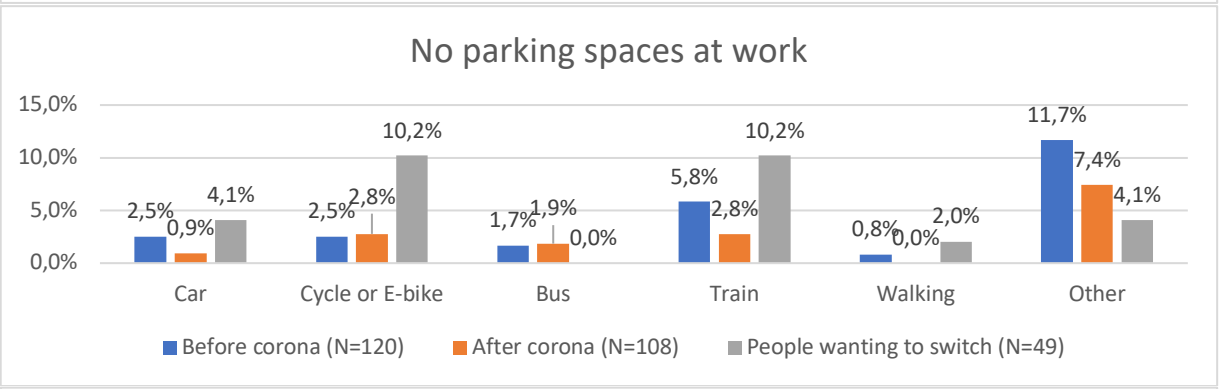


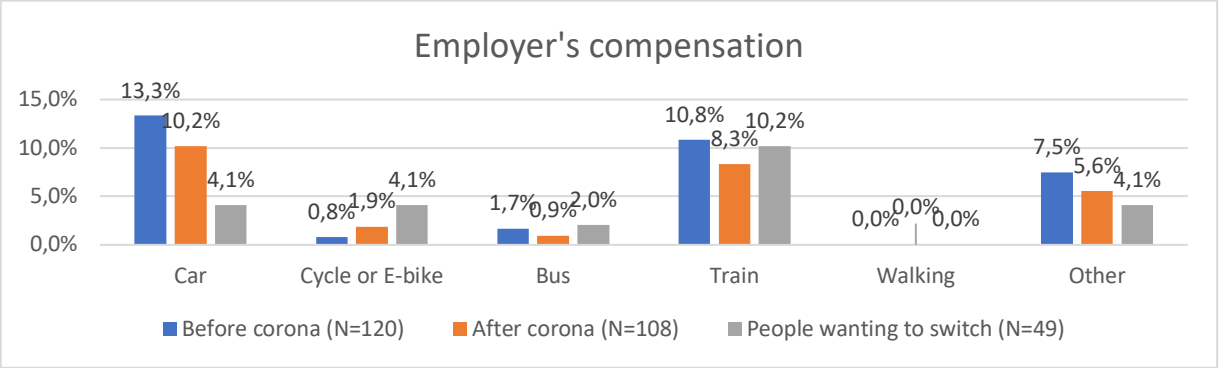


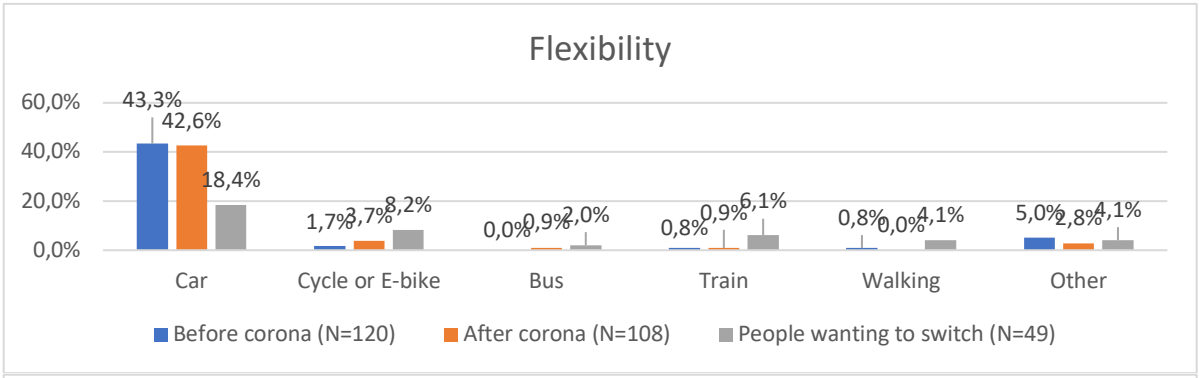


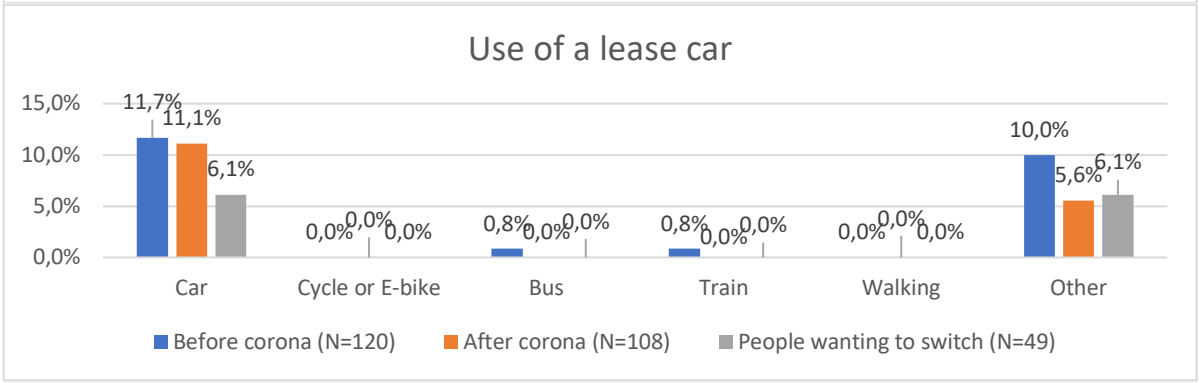

Relaxation and exercise
40,0%
30,0%
20,0%
10,0%
0,0%
5,0%
3,7%
6,1%
18,3%
17,6%
34,7%
0,8%
0,0%
6,1%
1,7%
2,8%
12,2%
11,7%
6,5%
14,3%
9,2%
6,5%
2,0%
Car
Cycle or E-bike
Bus
Train
Walking
Other
Before corona (N=120)
After corona (N=108)
People wanting to switch (N=49)

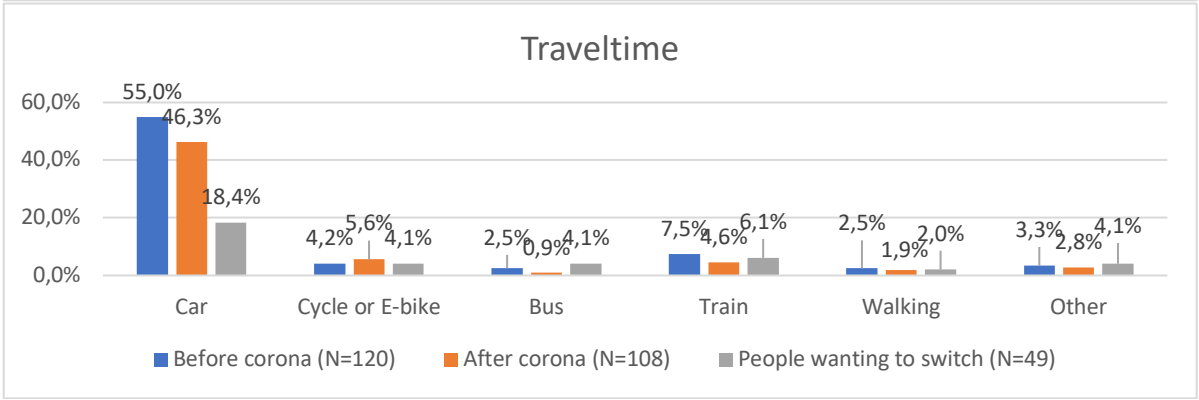

Lack of appropriate public transport
40,0%
30,0%
20,0%
10,0%
0,0%
35,8%
32,4%
16,3%
3,3%
1,9%
2,0%
3,3%
0,0%
2,0%
1,7%
0,9%
0,0%
2,5%
0,0%
2,0%
6,7%
6,5%
2,0%
Car
Cycle or E-bike
Bus
Train
Walking
Other
Before corona (N=120)
After corona (N=108)
People wanting to switch (N=49)

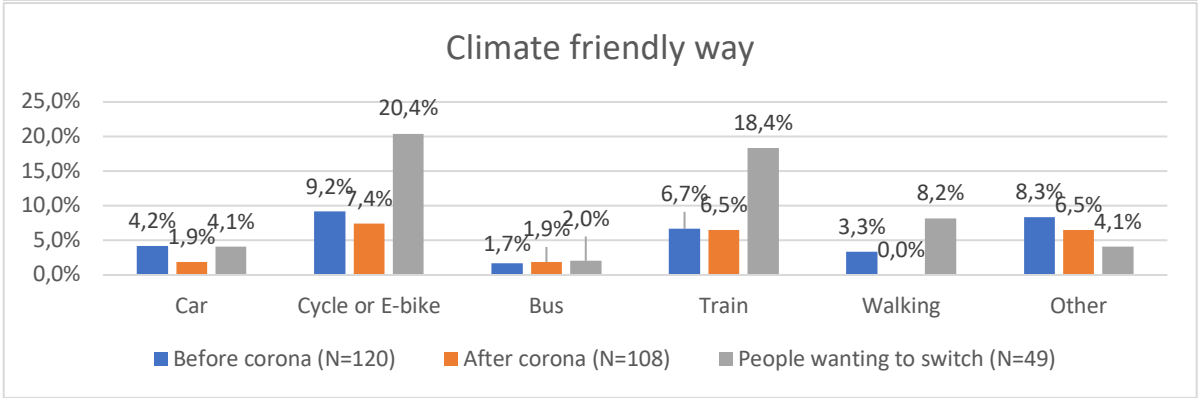

No parking spaces at work
15,0%
10,0%
5,0%
0,0%
2,5%
0,9%
4,1%
2,5%
2,8%
10,2%
1,7%
1,9%
0,0%
5,8%
2,8%
10,2%
0,8%
0,0%
2,0%
11,7%
7,4%
4,1%
Car
Cycle or E-bike
Bus
Train
Walking
Other
Before corona (N=120)
After corona (N=108)
People wanting to switch (N=49)


Employer's compensation
15,0%
10,0%
5,0%
0,0%
13,3%
10,2%
4,1%
0,8%
1,9%
4,1%
1,7%
0,9%
2,0%
10,8%
8,3%
10,2%
0,0%
0,0%
0,0%
7,5%
5,6%
4,1%
Car
Cycle or E-bike
Bus
Train
Walking
Other
Before corona (N=120)
After corona (N=108)
People wanting to switch (N=49)


Flexibility
60,0%
40,0%
20,0%
0,0%
43,3%
42,6%
18,4%
1,7%
3,7%
8,2%
0,0%
0,9%
2,0%
0,8%
0,9%
6,1%
0,8%
0,0%
4,1%
5,0%
2,8%
4,1%
Car
Cycle or E-bike
Bus
Train
Walking
Other
Before corona (N=120)
After corona (N=108)
People wanting to switch (N=49)


Use of a lease car
15,0%
10,0%
5,0%
0,0%
11,7%
11,1%
6,1%
0,0%
0,0%
0,0%
0,8%
0,0%
0,0%
0,8%
0,0%
0,0%
0,0%
0,0%
0,0%
10,0%
5,6%
6,1%
Car
Cycle or E-bike
Bus
Train
Walking
Other
Before corona (N=120)
After corona (N=108)
People wanting to switch (N=49)


Traveltime
60,0%
40,0%
20,0%
0,0%
55,0%
46,3%
18,4%
4,2%
5,6%
4,1%
2,5%
0,9%
4,1%
7,5%
4,6%
6,1%
2,5%
1,9%
2,0%
3,3%
2,8%
4,1%
Car
Cycle or E-bike
Bus
Train
Walking
Other
Before corona (N=120)
After corona (N=108)
People wanting to switch (N=49)


Climate friendly way
25,0%
20,0%
15,0%
10,0%
5,0%
0,0%
4,2%
1,9%
4,1%
9,2%
7,4%
20,4%
1,7%
1,9%
2,0%
6,7%
6,5%
18,4%
3,3%
0,0%
8,2%
8,3%
6,5%
4,1%
Car
Cycle or E-bike
Bus
Train
Walking
Other
Before corona (N=120)
After corona (N=108)
People wanting to switch (N=49)