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Travel behavior of people with a low income in Rotterdam

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Abstract

Rotterdam is a the second largest city in the Netherlands with many transport possibilities. The largest group in Rotterdam is the lower income group. It is therefore important to know which choices and perceptions they have towards transport. This qualitative research investigated the travel behavior of the lower income groups in Rotterdam. The results show that there are two factors that influence the behavior of the respondents, safety and price. Furthermore, it is shown that the respondents are restricted to their own residential area due to the price and safety of public transport. The characteristics of Traffic Poverty has been found which would suggest that further research in this area is necessary.

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1. Introduction

Which transport mode did you use today? This question will be the central question of this thesis. People can choose between various options for travel, such as bicycle, bus, train, metro, car. Different aspects determine people's choice in each of these options. The government has many motivations to encourage people to make use of public transport. For example, out of the (fast) transport options is public transport one of the most sustainable ways (Nicholas, 2019). Furthermore, when more people use public transport instead of the car, there will be less congestion on roads due to the less cars on the roads. As many as 77% of all the people in the Netherlands still use the car instead of public transport (CBS, 2016).

Public transport is important for the lower income groups in Rotterdam. It increases their mobility possibilities and have a higher change to participate to activities. When people are limited in the possibilities to reach activity locations, Traffic Poverty exists. In that case, social exclusion can exist for those population groups (Ministerie van Infrastructuur en Waterstaat, 2018). This research investigates the behavioral aspects of the choice of transport and whether the characteristics of Traffic Poverty can be found in Rotterdam.

Area of the research: Rotterdam

Rotterdam is the second largest city, of the Netherlands. In the past, the city was not very popular due to high crime rates (CBS, 2015), high rates of low educated people (Vasterman, 2006) and the city had an unattractive image related to the harbor activities (Fortuin & van der Graaf, 2006).

Rotterdam is now becoming more popular and is expecting a growth in population from 638,000 in 2018 to 690,000 in 2035. This is the reason for the collaboration between the municipality of Rotterdam, housing corporations and different parties to build new buildings and houses (Gemeente Rotterdam, 2018). There are more investments in infrastructure to ensure the mobility and good connections of the city. This made it even happen that Rotterdam it is one of the best connected cities in Europe according to the Financial Times fdi index (Rotterdam Partners , 2018).

Mobility is an important topic for the city of Rotterdam. The municipality of Rotterdam and the Verkeersonderneming¹ focuses on various areas, whereby one of them is the improvement is the mobility for different income groups. There is limited knowledge about the transport behavior of the group with the characteristics of low educated and living in social rental houses. There is thus a need for knowledge about the choices of transport modes of the group in Rotterdam that has a low budget.

¹ The Verkeersonderneming is a public-private collaboration between the municipality of Rotterdam, the Ministry of Infrastructure, Rijkswaterstaat and the Port of Rotterdam, which focusses on the mobility and accessibility in Rotterdam and surrounding areas. <http://www.verkeersonderneming.nl/>

Their current motives and perceptions towards public transport need to be analyzed, in order to improve their mobility in Rotterdam.

Focus of research: residents living in social rental houses and low education background

The Verkeersonderneming in Rotterdam carries out many studies related to the behavior of people related to transport choices. Their main goal is to influence people's choices, to avoid congestion and make more use of public transport. The main group that attend in their researches, is the group with the characteristics of high income and a high educational background. They have therefore much knowledge about car ownership and car use in general, but not on the specific group low educated people. Since areas that contain many social rental houses have a high residential and have a high pressure of parking places, is The Verkeersonderneming interested in the transport behavior of these people. This research will therefore be conducted to a research to mobility of people who have a very low social economic status in Rotterdam.

In total, Rotterdam has in total 310.300 houses. As much as 58% of these houses are social rental houses (which is 179.974) (huurwoning.com, 2019). One of the conditions for a social rental house is a low income. The households should not have a higher income than €38.035 a year (Rijksoverheid, 2019). Most of these people will have a low income which will be related to a low educational background. In this research, there will be controlled for students.

This research will consist of a case study of the transport behavior of people with the characteristics of living in a social rental house and low educational background. The objective of this thesis is to understand their transport behavior, whereby the focus lies on public transport. The following research question will be answered in this research:

What influences the mobility behavior of the people with a low income in Rotterdam?

An explorative research by a very specific group is done to answer the research question. Respondents who have been interviewed had a very low social economic status. Their behavior has been examined. The next chapter will consist of a review of earlier research. A general understanding of the behavior towards public transport will be discussed in this chapter. Furthermore, interviews are held with inhabitants from Rotterdam who belong to the poorest group in Rotterdam. Their characteristics are low educated and live in social rental houses. The results give an insight of the aspects of their transport behavior. Finally, recommendations and advice will be given to The Verkeersonderneming that can be used to stimulate low educated people to make more use of public transport.

2. Literature research

2.1 Introduction

Different aspects can influence the choice of the transport mode. Many studies have done research on the topic transport behavior in the economic field. The purpose of the theoretical framework is to give an overview of the research that has been done on the behavioral transport economics area. The main findings following the literature will be explained. This will be categorized by the main aspects that influences travel behavior. However, behavior can differ in different contexts (Matsumoto, 2007). As mentioned before, the residents are characterized by low-income and low-educational.

People can have multiple reasons for choosing public transport. The people, living in social rent house, are strongly characterized by low income and low educated. For them is public transport even more necessary, according to Madelaine Criden (2008). Public transport increases the mobility for this group and increases the employment possibilities (Criden, 2008). Still, people do not always choose for public transport. In this part of the research the important determinants for the choice of transport will be discussed, this will be related to the characteristics of low educated and domiciled in social rental house.

2.2 Travel time and time reliability

Following literature, time is the main aspect that influences travel behavior. This can be related to travel time, the amount of transfers and time reliability. The total travel time has a negative correlation with the probability of choosing public transport. An increase in travel time or in number of transfers leads to a lower probability of choosing for public transport (Eluru, Chakour, & El-Geneidy, 2012). The way travelers value the travel time differs depending on the characteristics of the trip and the traveler. The valuation of time is larger for the commuting trip compared to the trips with a private purpose. This is mainly due to the scarcity of time during a working day. Furthermore, income, employment status, household composition influence the valuation of travel time (Börjesson & Eliasson, 2012).

The total travel time of public transport is related with transfers and waiting time. The waiting time outside the vehicle is more weighted than the waiting time within the vehicle. Efficient transfers have a positive influence on the use of public transport (Frank, Bradley, Kavage, Chapman, & Lawton, 2007). The high valuation of out-side a vehicle waiting time is confirmed by Iseki, Taylor and Miller (2006). Waiting time outside a vehicle, walking and transfers are for many people an obstacle to use public transport. Besides to this obstacle, time reliability is an important determinant for travel choices (Iseki, Taylor, & Miller, 2006).

The significant correlation between transport behavior and time reliability is also found by the research of Noland and Polak (2002). Time reliability is the certainty of a travel schedule. Travelers prefer to be confident about the departing time and the arrival time which has all to do with reliability and variability of the transport mode. The reliability of time travel of outside the vehicle is more important than the reliability inside the vehicle. This suggests that it is more important that the vehicle arrives on time at origin where the person is waiting outside, than the vehicle arrives on time at the destination (Prashker, 1979).

As mentioned, differs the valuation of travel time among the purpose of the travel trip. The same conclusion holds for time reliability. The value time reliability for commuters is larger than the valuation of the non-commuter (Li, Hensher, & Rose, 2010). This is correlated with the schedule of the person. A person who has an inflexible schedule, the commuter, values time reliability higher than the person who has a flexible schedule. A flexible travel schedule can particularly be seen for the private related trips (Bhat & Sardesai, 2006). High income and high educational people have lower valuation of travel time reliability compared to the low income and low educational people. The high income and high educational people have more flexible working hours whereby the travel time reliability has less impact. The lower educated people have a more restricted schedule whereby the certainty of arrival time has a higher value. In addition, time savings in the morning are most valuable due to the restricted working schedule (Tseng, 2008).

2.3 Price

Price is another aspect that affects the rate of the use of public transport. When the prices of a transport mode decline people will make more use of that public transport mode. The price changes have a larger impact if they change relative to a person income. This is related to the price elasticities of transport. For a person that is sensitive to prices, the elasticity of the price is high. The price elasticity varies by type of traveler and the level of income the person has. People with low income are more price sensitive than higher income travelers, who are more sensitive to the quality of the transport (Litman, 2013).

Thereby people become more aware of the price and become more price sensitive when they have more travel options. These price changes can affect the demand of other transport mode, but as well it can affect the trip route or scheduling of a person. The price elastic related to car drivers, it can be seen that the car driver is the least sensitive to price changes (Litman, 2019). This can also be combined by the fact that wealthier people are more willing to buy a car (Litman, 2013). And as mentioned before, are high income people are less price sensitive. Contradictory, the research of Beirao et al

(2007) suggest that the cost are not that important for travelers, as they did not mention cost as their determinant in their choice (Beirao & Sarsfield Carbral, 2007).

Most researchers argue that price has thus an influence on a person choice of a specific transport mode. The total amount of all the people that choose for this type of mobility is the total demand. People can determine the value of a transport mode for themselves. This value reflects a person willingness to pay. The value for the commuting trip will be higher than a trip for leisure. The leisure trip is weighted less heavily and is less important (Litman, 2013).

From the conclusions of earlier research and the previous section it can be concluded that time (reliability) is the most important factor of choosing public transport. The willingness to pay to prevent a late arrival differs among travelers who goes often with the public transport to work and who do not. The people that work have a risk of being late when they use public transport to go to their work. The people that work, the commuters, have therefore a higher willingness to pay for time reliability of transport than the non-commuters (Li, Hensher, & Rose, 2010) . This can also be concluded the fact that non-commute trips are more price sensitive, than a person who travels a commute trip, which is argued by Balcombe (2004).

The same conclusion was found by Eboli and Mazzulla (2008), who say that the willingness to pay is high when it is related to time reliability. Next to this, they conclude that the service frequency has an even higher amount of willingness to pay. The information at the bus stops is the least important for people and has the lowest amount of willingness to pay (Eboli & Mazzulla, 2008).

2.4 Type of neighborhood

Another aspect that can influence the choice of mode of travel can be partly explained by the structure of the neighborhood at the place of living or working. The land use mix, retail density at the area around the office and the residence and the street connectivity had an increasing correlation with transit modes compared with driving the car (Frank, Bradley, Kavage, Chapman, & Lawton , 2007). The same conclusions were found in research of Cervero and Duncan (2008), whereby the land-use of a neighborhood influenced the connectivity of a neighborhood. This reduces the travel with the car and increases the use of public transport (Cervero & Duncan, 2008).

A positive correlation is also seen between the use of public transport and the job density at the trip destination. Following Lui (2017), was this effect more significant than the population density of the area of living (Liu, 2017). But Zang (2007) found that both, job density at destination and population density at origin, had a positive effect for the use of public transport in the trip related to work. This

is due to the good connectivity which encouraged the use of public transport (Zhang, 2004). Carlson (2015) confirmed that residential density has a positive influence on travel behavior, higher rates for walking and biking and lower rates for car use has been noticed in his research (Carlson & et al, 2015).

Cervero and Duncan (2008) in contrast did not found a significant relation between density and use of transport (Cervero & Duncan, 2008). Furthermore, Ewing and Cervero (2001) contradict the conclusions of the researches of above. They argue that population density itself does not influence the choice of the mode of transport. The population density influence the choice indirectly. The effect is comparable with the influence of street connectivity which also has an indirect influence on travel behavior (Ewing & Cervero, 2001).

Another research that discussed the influence of the type of the neighborhood on travel behavior was done by Erwin and Cervero (2001). They made a difference between a car oriented neighborhood and a public transport oriented neighborhood. The car oriented neighborhood had characteristics such as little transit service, connection points concentrated at a few points, low density, irregular street pattern. While the public transport oriented neighborhood has high density, connection points close to commercial users, well organized street networks, many possibilities of transit service. In all of the research that they analyzed they found consistent results. The rate of public transport use is higher in the public transport oriented neighborhood, especially in the case for the work related trips (Ewing & Cervero, 2001). The same conclusion was found by Lui (2017), who saw a positive relation between the frequency the stops of a public transport mode and the transport mode itself and the positive effect on the use of public transport (Liu, 2017).

Van Wee and Holwerda (2003) mention in their research the concept of the residential self-selection. With residential self-section is meant that people choose their residential choice based on the availability of travel mode instead assumption of the it is only neighborhood that influence travel behaviors. This can lead to different conclusions when a causal relation is examined with type of neighborhood and travel behavior. Van Wee and Holwerda (2003) saw a causal effect of the preference of transport mode on their choice of the residential area of the people (van Wee, Holwerda, & van Baren, 2002)

The availability of this effect can cause under- or overestimation when a causal relation between the urban structure and travel behavior is examined (Manauh & Ahmend M. El-Geneydy, 2015). This effect is contradicted by the study of Aditjandra et all (2011). They controlled for self-selection in their study and still saw that neighborhood characteristics had an impact on the travel behavior of the people (Aditjandra, Cao, & Mulley, 2012)

2.5 Influence of household and personal characteristics

Differences in household and personal characteristics can cause differences in behavior towards transport. There are many options to distinguish households or a person. In this section the influence of the characteristics of income, family composition, a person's perceptions on travel behavior will be discussed.

People and households are all unique, have different backgrounds and have different attitudes towards different types of travel modes. The household characteristics can have an influence on the choice of the travel mode. The first characteristics of households are related to the income level. It has been concluded that the households with a high income were unlikely to make use of the bus or bicycle. However, this negative income effect was not related to the train. Which suggest that people with higher incomes have a more positive attitude towards the train compared to the bus or bicycle (Bhat & Sardesai, 2006). The levels of a car ownership is higher for high income households compared to the low income households (Zegras & Srinivasan, 2006) (Maduwanthi, Dharmawansa, Rajapakse, & Nomura, 2015). In different researches it is showed that there a positive relation is between income and car ownership, which has indirect a negative impact on the public transport rate (Balcombe, 2004). Together with the factor of low income, does the factor of low education has a positive relation with the demand of public transport (Maduwanthi, Dharmawansa, Rajapakse, & Nomura, 2015). Together with the conclusion of the previous section, the expectation that the characteristics of social rental houses and low income have a positive relation with public transport, can be once again motivated.

Secondly, the size and composition of a household can differ. The size of the household did not show a large significant effect on travel behavior (Balcombe, 2004). By contrast, the composition of the family can have an impact. It is found by Dieleman et al (2000) that the car is more frequently used by families with children than one-person household (Dieleman, Dijst, & Burghouwt , 2002). They concluded that a car was more family friendly than public transport. The same results was seen by Lui (2017). Lui (2017) as well concluded that in addition to the family composition, the age, income and driver's license also had an influence on the choice of transport (Liu, 2017).

A more personal factor is the factor habit that influences transport behavior. A habit is specific behavior that occurs when people automatically act in a specific way under certain circumstances. People often act automatically in their transport choices. The same route is made regularly, especially when it is related to their work trip/commuting commuter commuting. The behavioral choices result from the automatic process and will not change very often (Verplanken , Aarts, & Knippenberg, 1994) These habits related to transport decision have a high correlation with personal standards and norms

and they affect parts of the decision making. The commuting trips are more regularly whereby the habit factor has a more powerful influence compared the influence of the factor habit in an irregular trip (Klockner & Matties, 2004). Changing this habitual behavior can be done by an intervention or structural change, like moving from one city to another city (Davidov, 2007). The factor habit is thus an important factor in people's travel choices. The choice of transport mode is often a result of an automatic and repetitive behavior (Verplanken , Aarts, & Knippenberg, 1994) (Davidov, 2007). Related to the habit factor of transport decisions is the factor attitude. There exists an interaction effect between habit and attitude. These factors have a negative correlation. This correlation shows, when habit is weak, the attitude behavior is stronger (Verplanken , Aarts, & Knippenberg, 1994).

The perceptions or attitude of a person towards public transport can have large consequences on the travel behavior and the choice of transport mode (Dobson, Dunbar, & Smith, 1978) (Recker & Golob, 1976). Regularly public transport users see public transport as very comfortable, while car drivers and irregularly public transport users see public transport as uncomfortable. The regularly public transport users have a way more positive attitude then the irregular public transport users. These negative attitudes can be explained by previous negative experience, opinions of friends and family. Thereby tend people to focus on the worst performance of all their public transport trip, which causes this negative attitude (Beirao & Sarsfield Carbral, 2007)

These perceptions can be related to safety and the environment. Some areas in Rotterdam have or had the image of an unsafe environment. Therefor research towards the relation between the perception of safety and travel behavior, will be further outlined. The factor perception towards safety and risk at the place of origin in travel behavior is not a broadly discussed subject in the literature. Steiner, Crider and Betancourt (2006) concluded in their research that parents chose to drive their children to school due to the fear of violence for parents (Steiner , Crider, & Betancourt, 2006). Elias and Shiftan (2012) showed that perceptions towards risk and safety had no influence on the use of public transport, but this was more related to risk during the trip inside the vehicle (Elias & Shiftan, 2012). Contrary, Delbosc and Currie (2012) showed in their research that feeling of safety influenced the rate of the use of transport. The more people felt unsafe, the less they were using public transport. (Delbosc & Currie, 2012)

There is an increasing interest in sustainability and the environment. As already mentioned before is the train the most sustainable mode of fast transport. It can be suggested that environmental awareness can have an impact on peoples travel behavior. The choice of sustainable transport depends on the travelers characteristics. Yang et all (2017) discussed the correlation between household characteristics and sustainable transport behavior. They examined that environmental

awareness had a positive impact on sustainable travel behavior. The people that are aware of the environment made significant more use of public transport compared to the car. Furthermore, the characteristics of living in rental houses and the status of low income had a positive impact on sustainable transportation. It seems doubtful that this is a consequence of environmental awareness or a result of economics capabilities of this group. Yang et al (2017) concluded that there was a positive relation between income and the carbon consumption. This is a result the possibility to increase the comfort level whereby more cars are bought (Yang, Long, Bai, & Li, 2017). Other research suggest that environmental awareness does not change the transport behavior (Tertoolen, van Kreveld, & Verstraten, 1998) (Nilsson & Kuller, 2000) (Beirao & Sarsfield Carbral, 2007)

2.6 Conclusion

In the literature review is an overview given of the research that has been done in the behavioral transport economics field. The literature can be related to the characteristics of this group of the respondents, living in social rent house, low income and low educated. Public transport is for them most important, it increases their possibilities (Criden, 2008).

It can be concluded from the literature that time reliability is important for low educated people. Time reliability is the certainty of the travel schedule. It is especially an important factor for commuters and people that have an inflexible schedule. Since the low educated respondents have a practical profession with a restricted schedule, the value of the time reliability will be high. Thereby is the willingness to pay high when it is related to time reliability, which will suggests that time reliability is a more important factor in travel decisions than the price. The expected results are thus that travel time and reliability will be the most important determinant of travel choices.

Furthermore is price an important factor for the choice of transport for the people that have a low income. For them, a price increase has a large impact. Thereby is this group less willing to buy a car compared to the more wealthier people. The expectation is thus that the respondents with a low income are price sensitive and will be influenced by the price in their choice of the mode of transport. Besides that, a not many of the respondents will be willing to buy a car or have a car.

Another aspect that influenced travel behavior was the factor: type of neighborhood. A good structured neighborhood has a positive influence on the use of public transport. The center of Rotterdam has mostly the characteristics of a public transport oriented neighborhood due to high population density, regular street patterns and multiple connection points. This would suggest higher rates of public transport use compared to the general rate in the Netherlands. The Netherlands has an average public transport use in the commuting trip of 15% (Verkeersnet, 2015). The areas of

Rotterdam South and West is less accessible, for those areas it is questioned if this has a negative effect on the use of public transport and thereby a positive effect on the car ownership.

Next to these factors, personal and household factors can also influence the behavior of transport. One of them is the factor income level, which has a positive correlation with car ownership. Since the respondents of this research will have a low income level, the expectation will be that not a many of the respondents will have a car. Furthermore has the factor income a negative correlation with public transport, whereby thus the respondents of this research will have a high rate of public transport use.

Some areas of Rotterdam can be seen as unsafe, especially in the areas of Rotterdam south and west. Since it is argued in the literature that feeling of safety can influence the use of public transport negatively, it can be the case that the respondents of this research are not using public transport due to feeling of being unsafe.

Previous research supports the findings that low educated people will be high users of transport which is influenced by different factors. This research will determine which factor is the most important determinant of the choice of people who are low educated and live in rental houses.

3. Data description and methodology

This part is focused on the description of the data. First of all, the characteristics of Rotterdam will be described. Secondly, a description will be given about the characteristics of the specific group that has been interviewed. Next to that, the methodology will be described afterwards. .

3.1 The characteristics of Rotterdam

As mentioned, Rotterdam is the second largest city of the Netherlands. In total, the city counts 644.527 inhabitants which consists of 321.691 households in 2019. Since 1995, there has been a 7 percent growth in population (Gemeente Rotterdam, 2018). Most of the people live in the center of the city, which has resulted in a high density rate of 7.948 people per km².

The population of Rotterdam can be divided in low income, middle income and high income households, whereby the average spendable income is 29.300 euro a year. The lower income households consists of 51%, the middle income of 34% and only 15% of the households has a high income (Gemeente Rotterdam, 2019). The people with lower income live mainly in the area of Charlois and Feijenoord and the higher income households are mainly located in Prins Alexander and in the city center of Rotterdam.

Compared to the rest of the Netherlands, Rotterdam has the highest percentage of unemployment since 2009. The unemployment rate of Rotterdam was in 2017 7,3% (compared to the largest city in

the Netherlands, Amsterdam is 5,2%). Since 2009, the percentage of the unemployment rate has been increased until 2014. This was mainly due to the economic crisis during these years. The percentage in 2014 was 12,6% and has now declined to 7,3% in 2017 (Gemeente Rotterdam, 2018).

The percentage of a high educational level in Rotterdam is increasing, which was in 2003 only 25% and had increased to 32% in 2016. The proportion of the lower educational level has therefor declined from 32% (2003) to 25% (2016). The largest share of the working population has a secondary educational background which stayed constant over time (approximately 40%) (Gemeente Rotterdam, 2018). Furthermore there are 179.974 social rental houses in Rotterdam, which is 58% of the households of Rotterdam (huurwoning.com, 2019) .

There are many transport possibilities in Rotterdam with good connections within the city and to other cities outside Rotterdam. The transport possibilities are metro, tram, train, bus and taxi. A new upcoming concept is the “sharing economy” whereby one scooter or car can be used by multiple people provided by a platform. An example of this is the new concept of Felyx. This concepts mainly exists in the large cities and many new policies are focusing on this new concepts. Due to these many transport possibilities, Rotterdam can be seen as a public transport oriented city. As mentioned, is Rotterdam thereby one of the best connected cities in Europe. Furthermore, wealthier people are more willing to buy a car (Litman, Transport Elasticities: impacts on travel behaviour, 2013), which makes the expectation that the target group of this research mainly uses public transport. In contrary, 51% of the inhabitants of Rotterdam has a low income and 70% of the inhabitants of Rotterdam use the car (Gemeente Rotterdam, 2019). From these people use 38% the car intensively (Gemeente Rotterdam, 2018). This would suggest that still a large number of the low income people in Rotterdam has a car. This research should indicate which factors influences this group behavior and which mode of transport is mainly used.

3.2 The interviewed people

The people that are interviewed have a low social economic status and are regularly visitors from public community centers. These centers are called “Huis van de wijk”² and are spread out over Rotterdam. The community center is meant for all citizens in the neighborhood. There are different activities on a daily basis and help is being offered by volunteers or from other residents that live in the neighborhood. Most community centers are focused on people who have lower monthly budget compared to the average inhabitant of Rotterdam. Low educated and social rental houses inhabitants can be therefor found in these community centers. For the interviews, the community centers that

² Huis van de Wijk, a neighborhood house, focusses on activities for local residents who live in the neighborhood. <https://www.rotterdam.nl/wonen-leven/huizen-van-de-wijk/>

have been visited are De Kip (Rotterdam east/center), De Nieuwe Gaffel (Rotterdam city center), Pier 80 (Rotterdam west) and 't Klooster (Rotterdam south). A mix of ages from 16 to 85 has been taken into account. The participants were asked, on the spot, if they want to participate in the interview which would take on average 45 minutes. This method is used to avoid difficulties in scheduling and planning of the interviews.

The important characteristics of this group are: low educated and living in a social rental house. There were 16 interviews held, with a total of 17 people. There is one interview that has been done by an older couple (man and female). The respondents are divided by 8 females and 9 males whereby the youngest respondent was 16 years and the oldest was 85 years old. Permission of the parents is asked for the respondent of 16 years, they approved to take the interview. The average age was 52 years old among all 17 respondents. From the 17 people, 3 respondents were already retired. Other persons, 3 males, will retire within the upcoming 3 years. There are eight people that are working and two people that work on voluntary basis to make sure they get their welfare allowance. Only one person, with the age of 16, goes to school.

Out of the 16 interviews, only 3 persons had a car. Half of the sample had a driver's license, that were 8 people. Therefore 9 out of the 17 people were not in possession of a driver's license. All the people owned an public transport card (Dutch: OV-chipkaart) and many people used an application to see the schedule and the route of the public transport. Still 6 people of the sample did not use the application and knew which transport mode to take at the station itself. The participants all live in Rotterdam, in social rental house. Only one participant is not working in Rotterdam but in The Hague. The rest of the people have their main activities in Rotterdam, which means they are working, going to school or are doing other activities within Rotterdam. The main mode of transport under the respondents was walking, which was the main transport mode for 6 persons.

The interviews, which have been taken for this research, are approved by the mentor of the Erasmus University Rotterdam. The interviews are not included in the appendix due to the privacy law. All the respondents will stay anonymous.

3.3 The interview procedure

Qualitative research is used in research to have a better understanding of the complexities of travel behavior. More importantly, a more specific knowledge about the aspects that influences travel behavior can be generated. Interviews can help to define which aspects should be taken into account when mobility decisions has to be made (Clifton & Handy , 2001). Questions of this research are partly

based on the research of Beirao and Carbal (2007) and Simons and Clarys (2013) (Beirao & Sarsfield Carbral, 2007) (Simons, et al., 2013).

The interview was pre-designed, which can be found in appendix 1. The interviews are thereby adjusted on the spot. 15 interviews have been done in Dutch and one interview has been done in English. The main goal of the interview was to identify which choices people make according to transport and what their behavior influences. The first few questions had to provide general information about the respondent and to get an idea of the person's weekly trips. After having first a few general questions, people were asked to draw in a map of their neighborhood. They had to explain what their daily trip looks-like, where they can park their bike and car, and which aspects they would like to have improved in the area. While people were drawing in the map, they had to explain why they would improve it. These drawings can be found in appendix 2. All different transport modes were mentioned during the interview. The questions combined with the drawing, gives an overview of people's attitude towards all different transport modes and how they evaluate these modes.

The interviews are recorded and transcribed. The answers of the people are categorized by bike/walking, car, and public transport. The categories can be compared whereby a pattern can be identified (Strauss & Corbin, 1998). The perceptions, arguments and motivations of the people can be labeled as advantage, disadvantage, improvement and remarkable expression. These factors give eventually insight in people's choices and the factors that influence their behavior related to transport.

4. Results

In this section the results of the interviews will be discussed. As mentioned in the previous section, the answers of the people can be categorized by walking/bike, public transport and car. The modes can be evaluated by people's perceptions and opinion of improvement area. This section will be structured as follows: the categories of walking/bike, public transport and car will be outlined, the perceptions will be given and important determinants of choices will be discussed. The gender, age and the number of interview and drawings will be mentioned behind the quotation. Furthermore improvements areas within all modes of transport will be mentioned and analyzed. Finally, there will be a discussion of the findings whereby the main determinants of people's choice are analyzed with the existing literature.

4.1 Biking and walking

Biking and walking was perceived as the most healthy and easiest transport mode for all of the respondents. Walking is even the main mode of transport under the interviewed people. The older respondents mentioned that they needed to exercise to keep them good healthy and in good shape.

The distances in the city of Rotterdam are not large, therefore many inhabitants of Rotterdam choose to walk or bike these distances. The topic of a healthy lifestyle makes people aware of the advantage of walking or biking while the distance is small. Especially the trip to the supermarket was mentioned as the trip that people prefer walking. **The respondents preferred walking in Rotterdam because all the provisions are nearby.** The following was mentioned by the respondents:

“I do everything with the bike. It is a fast transport mode, easy and then I also have had a little exercise. It is really nice to bike in Rotterdam, all the distances in Rotterdam are not large.” (Man, aged 28 (5))

“In West is everything, close to central station, close to all the shops. “...” The nice thing about living here is that you can walk within 5 minutes to the market and to all the shops.” (Women, aged 60 (4))

“I live at Mathenesseplein, there is everything. The mosque, I am there almost every day. There is also a café, I always walk to there it is really close. “...” The same holds for the weekend, I am always in this area, nothing else.” (Man, aged 43 (8))

For most of the respondents, was their job also located in Rotterdam. For them it was possible to walk or go by bike. For some of the people from the sample, work was more far away. If it is the case that the trip is above 30 minutes' walk or bike, the respondents preferred a faster mode of transport like public transport. For some of the respondents the trip to their work was not longer than 30 minutes. For them it was not possible to bike or walk, so they needed to take public transport.

“ I prefer to walk, it is easier. You feel really free, no hurry and you can look around. “...” My work is close now. In the past, I worked somewhere far away. Then it was not possible to walk, so I had to go with public transport.” (Man, aged 43 (8))

“I always go walking to the city center, that is only 5 minutes' walk. It is close. When I need to go to Schiedam, to my school, I need to take public transport.” (Boy, aged 16 (9))

Another advantage of walking and biking is the autonomy that a person has. This advantage was mentioned by multiple respondents. Two out of all the respondents disliked public areas for example the station or public transport. This was due to the fact that in public areas people stare at them,

making comments or jokes. To avoid bullying, they preferred the solitariness of the bike and walking. A women, 30 years, said (6):

“If I would live closer to the city center and my job, I would always go by bike or walking. Then you do not have people around you. People cannot stare at me or make jokes about me, people do not realize that it is hurtful, every time.”

Another benefit of the walking and biking is the low costs of this type of transport. Walking does not have any monetary costs. After people have bought a bike, costs of biking are also low. Sometimes the bike can be broken, people have to go to a bicycle repair man or repair it themselves. These costs are not perceived as annoying high costs by the respondents. Compared to other transport modes, bike and walking are the cheapest. When people have to pay for the other modes of transport, they prefer the bike and walking. Unfortunately, bicycles in Rotterdam often get stolen. 4 out of the 16 respondents mentioned that their bike has been stolen in the last couple of months. The interviewed people mentioned thereby, that the purchase of a bike was a large investment at once. This is due the combination of the high purchase costs that has to be spent in one time and the low income of this group. **Buying a new bicycle is therefore not always possible.** One man said (11):

“Can you offer me a bike? I love biking, but I need a bike. At the moment, I cannot afford a bike right now. In terms of my financial situation, I cannot buy a new bike. That is the reason that I always go walking.”

“My favorite is the bike, but it has been stolen. I cannot buy a new bike now. But biking is really nice. Only when I have to go far away then it is not nice.” (Boy, 16 years (9))

The main improvement point for Rotterdam regarding walking and biking was **safety**. The respondents mentioned the aspect safety, and also draw this on the map. Improvement points which are drawn on the maps regarding safety can be found in the appendix 2, drawing 2, 5, 10, 12, 13 and 15. Different opinions about improving the city from the respondents were mostly related to safety. As for example, mothers mentioned improving points regarding the safety of their children. **The roads are too busy and the same holds for crossing points.** For children who are not aware of all the danger and do not always watch out, this can be dangerous situations. Rotterdam has many road users should think of measures to have less traffic and more safety in the city center.

"I found safety really important. "... I live on a busy crossing point where there are camera's but apparently they do not work or they do not look at it. There are a lot of accidents happening on that crossing point. Sometimes, the stopping lights are not working. Some of the people are driving really fast through the bend." (Women, 35 years, mother of 2 children (2) – drawing 2)

"I've had an unsafe situations with my kids before. On the Mathenesseweg, that's the long road behind here [Rotterdam West]. Crossing that road has sometimes resulted in an unsafe situation with my children. You can cross over, but in the middle there is a stop and you have to cross over again, without a crosswalk. "... We had a various unsafe situation!" (Women, mother of 2 children, aged 38 (13) – drawing 13)

"Here in West, I would not cycle with my kids. I find that too unsafe. It is really too busy here! And on the Schiedamseweg there are no cycle paths. That is really unsafe. You don't have a bike path and drive on the side of the road. I would change that in the west, bike paths along the dangerous road. It is also very busy". (Women, mother of 2 children, aged 38 (13) – drawing 13)

"In front of my door, there is a roundabout. There are often accidents happening there. That could be a good improvement. "... Furthermore, there could be more bike-lines in West, it is often not safe." (man, 28 years, (5) – drawing 5)

These safety issues on the road is not only related to traffic on the road. It is thereby also related to **the speed of motorized vehicles**. Accidents can be related to this. Some of the respondents said to be afraid while they were walking or cycling. Especially in the evening when it is dark. Some people mentioned not to prefer to walk in the evening due to they cannot be seen by the car. The reason behind this is that all people are in a hurry, following the some respondents. Sometimes people want pass a bus or a tram and they do not see people crossing. Following one of the respondents, it should be prohibited to pass a bus or a tram. Another example was that people with a scooter are driving on the bike line but in the wrong direction. Because people are crossing each other on a small path, this can cause accidents. This is for some of the respondents the reasons that they feel afraid in the city center.

" People drive so fast, that's really not acceptable how people drive here. How people drive in the middle of the city, it's so fast. When I walk here in the evening after 10 pm,

and I walk on zebra path, then I prefer not to walk anymore. I have to be very careful with all the cars.” (Man, aged 67 (15) – drawing 15)

“Most of the time, here it is nice to bike, but sometimes I get an accident. For example, I bike in one direction and the other person goes in the other direction. I have to look to different sides. When the scooter is in the wrong direction, I crash. Also the deliveryman, *Thuisbezorgd*, that is really fast.” (Male, 64 years, (10) – drawing 10)

One of the reasons that people prefer biking and walking as their transport mode due to the **good health advantages**. The respondents mentioned that it is important to be in good health, therefore exercising is important. In contrary, some of the people said that they were not able to bike due to physical problems. Knee and foot injuries was mentioned three times as reason for not being able to walk or bike.

“My knees are failing, otherwise I would have used the bike.” (Women, aged 55 (16))

“I still walk, but my knees are hurting.” (Man, aged 67 (15))

Thereby having a negative experience can have large impact on the elderly people. As much as 5 people mentioned that they had a bad experience in the past, which is the reason for them to not use the bike anymore. Some of them had an accident with the bike, whereby they fell on the ground. Since that experience they were afraid to use the bicycle again. Furthermore, Rotterdam is a busy city with much traffic. The combination of the large amount of traffic, the other road users, the tram rails where they have to be aware of and the anxiety on the bicycle, made the people with the age above 60 not use the bicycle.

“I don’t really dare to bike anymore. I’ve fallen down on the ground a few times. As you get older, you become more unstable. And especially here in the city, with all those tram rails. Then you stop in front of the tram, think that you are allowed to go, and then suddenly another tram arrives! We used to cycle from the south to the city center. “...” The bike has many advantages. Look, when the weather is nice, I want to go to *Kralingse Plas*. I would get my bike but now I do that with public transport. I do not dare to bike, I feel not so secure anymore.” (Women, aged 80 (3))

“I haven’t been cycling for years. I tried it a few years ago. Back then I bought a very solid bike. In Midland, there are a lot of the youth who are driving with a scooter. If I only hear that noise already, I go out of the way for them. There I go with my steering wheel. The scooters have mirrors, those are touching you! It happened to me twice! I went back to the store and I said: ‘Sorry sir, I bought a bike from you, but I do not dare anymore. I am already two times touched by scooters.’ And then he said: ‘Yes sir, old people are afraid on the bike.’ So, he took my bike back because I was too afraid!” (Man, aged 63 (12))

Some of the older respondents named two other problems that they encounter during their walk. Which has to do with **obstacles during their walk**. One of these problems is trash on the ground and skewed tiles. These days people throw all their trash on the ground while people are walking past trash cans. The trash on the ground frustrates people and some of them think they can pass over it. Another obstacle which they come across during their walk, is that **younger people bike on the pavement** instead of the bike line. Following some of the respondents the solution for this is more polices on the street. The elderly is seriously affected by this.

“People cycle on the sidewalks, that is the worst part! That irritates me immensely. We just have to jump to the side, while there is a bike path. They have made little holes where people with a walker can get off, but still bicyclists bike on that. I do not know why they made it that way. That is for the people who have a wheelchair or a walker. But you shouldn’t go cycling on it.” (women, aged 80 (3))

Finally, some of the respondents mentioned specific provisions in the city. For example more **bicycle parking spots** at metro stations, **more waste bins** and **less stopping lights**. These improvements can be seen in drawing 2, 6, 7, 9 and 15 in the appendix. Since this did not influenced their travel behavior, this will not be discussed more in detail.

4.2 Driving by car

The next section will dive in to the perceptions of driving with the car. The convenience of the car is mainly mentioned in combination with large packages, long distances or children. From the interviewed people had only 3 out of the 17 people a car and 8 out of 17 people had a driver’s license. These 3 people mentioned that the car was **mainly for family purposes, long distances and leisure activities**. Furthermore, the car was for none of the respondents the main mode of transport. The

main activities during the week is done by foot, bike or public transport. Still, people saw many advantages of the car.

The main advantage of a car was **the convenience**. The respondents mentioned many benefits which was related to the convenience of the car. One of the respondents mentioned for example the convenience of the car associated to groceries and buying large packages. The case of the respondent was related with the purchase of a fence which was difficult to carry within the public transport. The consequence was that she had to rent a car, which made the purchase of the fence more expensive. The disadvantage of not having a car is not being able to make these kind of purchases. A women, 37 years, no car and no driver's license (1) said:

"Public transport is nice. For groceries it would be nice if I could put in the car. Not dragging with trolleys and no trolleys that break down. I had this one time "... At that moment, I had wished I had a car."

"One time, I had a problem with getting a new fence. I needed a new one, but I cannot take that in public transport. It is too big for that. So I needed to get a car. None of my friends has a car and especially not a large one. Delivery is not done for me, because as you know, I have minimum income so I do not want to spend half my income to delivery! So eventually, a friend of a friend of my had a father and he had a bus who could drive for me for 20 euros. "... If you do not have a car or a bus yourself, it is difficult to buy such things."

Another example of the convenience of the car is **the independency and the freedom**. Some respondents were more comfortable in the car because they enjoyed their own environment. This was even mentioned by people who did not had a car or driver's license. For them, it was an imagination and a wish.

"I prefer to be on myself in the car compared to the public transport. I do not like to be with people in the public transport. The whole day, I am with people. When I go home, I want to be with myself in the car" (Women, 22 years, no driving license and no car (7)).

Respondents mentioned that most of the activities during the week was within bike or walking distance. This could be concluded from the previous section. **The car would made it possible and**

easier to go to activities at a large distance and difficult to reach areas. 9 out of 17 people mentioned this advantage of a car whereby they mentioned to go more regularly to these locations. **The consequence of not having a car, is being limited to peoples own residential area.**

“ When I have my driving license and a car, I will use it a lot. We would go every weekend to a nice destination. My girlfriend would like to camp, we would do that. We would go a lot more to places that are further away.” (women, 22 years, no car, no driver’s license (7))

“I miss the convenience of a car. There is an outdoor in Bleiswijk and then I look to 9292 and then you only can come at a certain point, from that on you need to walk 30 minutes! I am not going to do that! That is something that I really miss, that areas are unreachable without a car.” (women, 55 years, have had a car (16))

“I do not miss the car. It is nice to have a car when you have to be far away and your work is for example in Belgium. At the moment I do not have a car, everything is close!” (man, 63 years (11)).

Large purchases and investments are difficult for people who have a low income. **The large purchases related to the transport area are the bike, car and driver’s license.** Low educated people have to save money in order to purchase a car or their driver’s license. 7 out of the 17 people, did not had a driving license whereby some of them started with lessons but did not finish it. **They mentioned that getting the driver’s license not only cost money, but also time and energy.** People repeatedly saved some money, took a few lessons and stopped again. A women, 37 years said (1):

“Some time ago I was working on my driver’s license and I had already many lessons. But on a certain point I had to stop because it cost me so much money. I have to put my time, money and energy in other things. So I gave up. But I wish I’d gone through with it. Then I would have it now, because I have forgotten everything now.”

“I want to have my driver’s license, but I failed my exam. I needed to stop for a while to save a little money again. Now is the theory exam expired, so I have to start all over again.” (Man, 28 years, no car, no driver’s license (9))

3 out of the 17 respondents had a car which was mainly for family purposes. **Furthermore, there were 2 respondents had to sell their car do to financial reasons. Most of the respondents mentioned that once you invested in a car, the cost of the trip is cheaper than public transport. Especially in the case of a large family. The cost of gasoline was primarily perceived as the main cost of the car.**

“When I do not have a car, I have to pay 4 euros every time for a trip. When my wife has to go somewhere, she gets gasoline for the whole month and she can drive to anywhere. If we need to go visit our kids, then we have to pay 4 euro one way. For two persons is that an expensive business. It is really expensive! It is cheaper to go by car.” (Man, 63 years, (12))

“When we go all together with the family, we take the car. It is way cheaper to go by car instead of public transport, so we prefer to take the car. It is thereby easier when we need to go back at night. There is no public transport at night, so we cannot go home.” (Man, 45 years, (14))

“If you have a family with 4 children and you want to go to the city center it is expensive! You have to pay a card twice! In that case it is better to have a car.” (Women, 60 years (4))

The car has been seen as the most family-friendly transport mode. **Next to the cost advantages which is caused by dividing the cost by multiple people, travelling with children is more convenient with the car. Furthermore, mothers mentioned that it is more safe to go by car instead of public transport when people have children.**

“Look in the car, you put your child in a seat and put the groceries on the other side and you have nothing to worry about. In the public transport, you have to place you child and the groceries. Then the child goes crying again. It is a lot of hassle.” (Women, aged 37, no car, no driver’s license (1)).

“When I start my family, I will use the car. People in public transport are not watching out for strollers and pregnant women. It is disrespectful.” (women, aged 22, no car, no driver’s license)

“When I have to drive far away with the kids, to football or family, I prefer to drive with the car. If I am going alone and not at night, I go with public transport. It’s is different with kids.” (women, 38 years, (13))

In spite of all the advantages of a car, many respondents mentioned that a car in the middle of the city was not necessary. Within the city, connections are good and shops, work and other important places are nearby. Some of the respondents mentioned that there should be less cars in the city, which they have drawn in as an improvement point on the map. **More green and less cars in the center of the city was the main point that have been drawn as an improvement point on the map.** See drawing 1, 5, 8, 12, 13 and 15 In the appendix. The congestion in the city causes poor air quality, many accidents and noise pollution of all the beepers of the car. Different respondents gave their opinion of the car in the center of the city:

“Here [Rotterdam West], we have many bridges. When a boat is coming, the bridge will open. You think, you can go to the other bridge, but that one will also go open. You need to wait everywhere. People in this area are complaining. Congestion occurs and there is a sign with turn your engine off when you are waiting. Nobody does that! All the people that are living here are complaining because of all the dust from the engine. And with the nice weather, you want to open your window but then you have noise pollution! The neighborhood is to compact for all those cars.” (Men, 63 years, car and driver’s license (12) – drawing 12)

“I would like to have more green in the city. I would take these busy roads out of the city center. I would just have everything within the city center calm and all the transport around the center of the city. Then, you can drive around the city to the place where you need to be. It will be more calm within the city center.” (women, 37 years old, no car, no driver’s license (1) – drawing 1)

“Now the Maastunnel is closed. Before it was possible to go around the city, now it gets really busy in the city. That is something the municipality is not doing well and can improve that. It should be the case that the cars can go around the city.” (man, 45 years, car owner (14) – drawing 14)

“It is always really busy here, especially when there is market. Then there is a lot of congestion here. With a car it is not very practical. There is a large school here, that is the school from our kids. There are almost 900 children. With the car there is always a blockage. There are many dangerous situations there.” (women, 38 years, (13) – drawing 13)

“In the city, you do not need a car!” (Women aged 85 (3), driver’s license, had have a car)

4.3 Public transport

This section will outline the main findings of perceptions of the public transport in the Netherlands and Rotterdam. As mentioned before, Rotterdam is a well-connected city. All parts in the city are easy to reach by metro, bus and tram. Rotterdam is thereby properly connected to other cities which is mainly executed by train. The tram was the main used mode of public transport under the respondents. The main purpose of the public transport trip was work related.

The respondents had to explain their weekly travel behavior. In the beginning, they all answered that they were satisfied with the quality of the public transport in Rotterdam. Later in the interviews there were still some areas of improvement for the public transport which will be discussed. The respondents agreed that the connections within the city and between cities are well organized. Most of the respondents were very pleased by the in-time performance.

“I especially like the fact that I have transportation. I am really spoiled because I know that at some places a bus or metro is not coming very often. There you need to wait more than two hours or something. Here in the city, you have many possibilities. Every moment of the day there is a possibility to get public transport to anywhere I want. It is ideal.” (women, 38 years (1))

“For me, it is good. Public transport is left, is right. It is everywhere. Public transport in Rotterdam is well-organized.” (Man, 63 years old (11))

“Everything is well accessible here. If you cannot take the train, you can take the tram. I do not have much to say about public transport. It is well-organized!” (Women, 38 years old (13))

Public transport is easy and comfortable, which is the opinion of all the respondents. Some of them always used the application, which is called 9292 or Google Maps, to find the way or find out which mode they have to take at what time. It is thereby very convenient to be up to date at all times about the route and work activities. Still 6 out of the 17 respondents did not use the application. The reason for this was that they only travelled within Rotterdam. They always took the same route which they knew by heart. The only struggle is that work activities are sometimes not well communicated. Sometimes people are surprised by the blockages and changes of routes. Especially older people found it difficult to deal with the unknown changes. In conclusion, the people who only have to deal with the same route every day, don't need the application 9292 but **difficulties with routes can be caused by unknown work activities along the routes**.

"The metro is always on time. Sometimes I have to change to another train or bus but it goes straight. I use the app if I need to change road or when some trams have a different route. I can all see that in the app, it is really easy." (man, 63 years old (11))

"I am not using the app, I know everything. There are only 2 metros for me. I know where to go and I do not need the application. I have never been in The Hague, maybe I will use it one at that time." (man, 43 years old(8))

"No, I do not need that [9292 application]! I know when the tram drives, I go to the tram and from there I go travelling. "... When it happened once [work activities along the route], I thought how is this possible? Nothing has been said, and then I saw some white boards which said that the tram is not driving along this route in the period of 22 May until 2th of June. The elderly people are also waiting but nothing is coming!" (man, 63 years old (12))

As mentioned before, public transport is a mode of transport available for public. **Some people see it therefor as a social area due to the fact that they are surrounded by people**. People enjoyed meeting and talking to people. Some of the respondents even mentioned that they had the desire that public transport should be an entertaining trip, or at least a pleasant and fun trip. The employees of the tram, train and bus should interact with the people and make sure people will be happy and not grumpy. **Public transport is a public area which can influence people for the whole day**.

“ I am enforced to go with public transport, but at one time one conductor made the trip so nice. He was so funny and the whole day after I was happy. The employees of the RET can make the trip nice! Some conductors are so grumpy, you cannot do anything. They are especially grumpy at young people. Because of that young people do not like to take public transport. They should be nice. Oh, and also one conductor started to make funny stories and jokes. He was making so much fun! That is a way to convince my friends to take public transport!” (women, 38 years (1))

“I love to travel with the tram. I like to meet people in the tram. I love to talk and I love talking to other people in the tram.” (women, 60 (4))

In spite of all the positive reactions to public transport, people could still think of **improvements**. All the improvements will be discussed one by one in the part below. The public character of public transport was thus for some of the respondents a positive factor. **Contrary, some of the respondents disliked the factor of public. In addition, all the respondents mentioned that the price of public transport was too high which made it for some of them not possible to use public transport.** The other improvements had to do with the quantity and quality of charging station of the public transport card in Rotterdam, whereby for some of the people it was sometimes not possible to charge the card with money. **Besides that people found public transport is not family friendly.** The last negative aspect was that it was not possible to go at night with public transport. The improvements will be explained more in detail in the next part.

The first improvement about public transport was the aspect of feeling uncomfortable by the amount of people within public transport. **This was mainly due to bullying or staring at them.** Other persons mentioned that it was too crowded in the public transport with many annoying people. It can be concluded that the public transport is a public and social area, which is for some people pleasant and for others it is not.

“People stare at my girlfriend and I in the metro, every day. That’s what I found annoying. People really stare and they say things as: “Look at that, it would only be your daughter”. This goes on every day.” (women, 30 years old (6))

“What I do not like about public transport is the people, 100%. People are always so negative. In the past, it influenced my day, but not anymore. When I was working in

Rotterdam and I went with the metro. At the moment I got in, I heard the conductor saying that there were pickpockets active. All the old ladies were looking at me. If I would be the pickpocket.” (women, 22 years old (7))

“The most annoying thing about public transport is that it is packed with people and it is not the best smell. You have to deal with people and that is not really fresh.” (women, 55 years old (16))

“Some of the metro’s smell like smoke. That is what I do not like about metro. And when it is really crowded. I do not like that either.” (Boy, 16 years old, (9))

The most important negative aspect about public transport which was mentioned by all of the respondents was the price. Only the couple, who were 80 and 85 years old, that had an public transport card for free were not complaining about the price. However, they mentioned that they were using the public transport more compared to the past, in the period they did not had a public transport card for free. People who are older than 65 years old have the right to travel free, except during peak hours. The same holds for students, but they are not included in this research. The high price of public transport has negative consequences for the respondents. One of the respondents said:

“Public transport is for the elite!” (man, 63 years old (11))

One of the consequences of the high price of public transport is the limited possibilities to travel, within and without of Rotterdam. People that have a low educational background and a low income, have a constrained budget. **For all the respondents, it was not always possible to take public transport.** People have been to The Hague, which can be reached by train or metro. 1 out of the 17 respondents worked outside Rotterdam, in The Hague. **She went there by metro which is the cheapest option, while the train is her desired option.**

The train is the fastest and most expensive public transportation in the Netherlands. Rotterdam is connected with other cities by train, except for The Hague which also connected by metro. None of the respondents went to other cities on a regular basis, some of them even **never go to other cities** in the Netherlands. **The reason for this is the high price of train transportation.** Some of the respondents search to the most affordable and cheapest option if they wanted to go to another city. They looked

for discount tickets and bought for example a ticket on the website Treinticketsvoordeel.nl. **These respondents mentioned that for them it was otherwise not possible to go to another city by train.**

“Yesterday we have been to Den Bosch, this only happens in the weekend and not that often. We had a deal with a sandwich and a smoothie of La Place, that is great! It was only 19 euro for retour ticket. When we want to go to another city, we always look for such deal, because you pay less. Otherwise we never come in other cities.” (women, 22 years, (7))

“When I have to go to The Hague for my work, I always buy a single card. The one from 2 hours travel, that one is 4 euros. For me that is cheaper than travelling with the OV-chip card itself. When I buy the card of 2 hours, it is 4 euro and when I do it with my OV-chip card it is 6 euro. I always search for the most cheap price” (women, 22 years (7))

“I think the public transport is really expensive. When I have to go to work, I have to use public transport, I have no other choice. For us, that is the reason why we never come outside of Rotterdam. It could be cheaper, the last years it only gets more expensive” (women, 30 years, (6))

Another disadvantage of expensive public transport is that people are limited to travel within their own residential area. Respondents mentioned that they are not always able to use public transport, especially for leisure purposes. People only go to the destinations where they can go by foot, especially in weekends. The high price of public transport results in that people only stay in the area where they live.

“In West is everything, it is close to the central station, close the shops. We do not have money to go to the city center every day. I am a volunteer to get my allowance. Everything that goes beyond my work trip, I need to pay for myself. “...” The trip from my home to my work is paid by the people here [Huis van de wijk]. Otherwise I would not be able to come here.” (women, 60 years old (4))

“I do never something in the weekend. Sometimes I go to my cousins, he lives really close. I can walk over there. Or sometimes I go to language coffee, where I can learn Dutch. I can walk over there. In the weekends I never use public transport.” (boy, 16 years old (9))

“Mathenesseplein, I am always there. There you have a café, so I drink a cup of tea there. I walk over there, from my house to there. It is really close. Even when it is raining. “...” In the weekend I also do not go far away. In the past, I did, at that time I had a discount card, than I went with public transport. Now not anymore, only to the city center, not more.”
(man, 43 years old (8))

Another consequence of the high price whereby people are **restricted to be in Rotterdam, is work related**. The people that are living in rental houses are often unemployed and want to apply for new jobs. Employment possibilities are spread out over the Netherlands and not only located in the Netherlands. **2 respondents had an interview outside Rotterdam. They mentioned that they were not able to go there because of price of the ticket**. The respondents did not dare to ask to their new employer if they could pay the ticket or the new employers did not want to pay for the ticket. One of the respondents asked if they could do the interview by phone which was denied. Regrettably, for most of the interviews, it was required to have a face-to-face interview which had the consequence for the applicants not being able to go to the interview. Furthermore, employees who have a low budget have comparable obstacles. The costs of travelling are becoming high and therefore some of the employees need to find a new job which has to be closer by. **The applicants and employees who have a low budget have a disadvantage in the employment sector because of the public transport.**

“I apply everywhere. I applied to Satébar, you know it? I was working there, but while I was working there it was also bankrupted. So I had to leave again. When I have an interview, the Gemeente call me at Delfshaven. The jobs are around the Netherlands. When the job is in another city, for the interview, I am not going there. When it is in Rotterdam I go visit, but when it is not I call them. But sometimes they say you have to visit us, but that is expensive and I cannot go there. So I prefer to call them or go to the Gemeente.” (Man, 64 years old (10))

“Because it is expensive [public transport] to come here and parking for the car also is getting more expensive, it is difficult for some colleagues to come in Rotterdam. They are now looking now for other jobs in their area [The Hague]. The employment possibilities are becoming limited for my colleagues.” (man, 45 years old (14))

“Some cleaners that I know work for 4 hours, but it costs them 8 euros to go to their work. Everybody says that you have to eat healthy. But how is that possible when you do not have any money left?” (Man, 67 years old (15))

“They told me that I would be compensated for my travel expenses, but I never got it. If I need to beg, I do not want it anymore. That is the reason why I never took public transport. But It doesn’t matter, I rather go walking then I need to beg for money for public transport. I am sometimes too proud, what my sometimes disadvantages.” (man, 67 years old(15))

One of the respondents has the age of 16 and went to school. **In line with the constraint of above, this boy was not able to go to school when he did not have enough money on his public transport card.** His school was in Schiedam which is too far to reach by foot. Since his bicycle has been stolen, he had to go by public transport. The trip to his school was paid by ‘het Jongerenloket’. When he did not have enough money on his public transport card, he had to go to this organization. **If it was the case that ‘het Jongerenloket’ did not pay for his trip to school, he was not able to go to school.**

“Before I lived in Schiedam, I moved to here in 2018. I do not have money. It was hard to go to school. Sometimes I go by bike, but my bike has been stolen and I cannot afford to buy a new bike. So I could not go to school. I talked to Jongerenloket and they gave me an abonnement.” (boy, 16 years old (9))

Next to the fact that you need money for public transport, you need a public transport card to charge it with money. This can be done by one of the charge stations at the train or metro station. It is not possible to charge the card at the tram station. This is for some of the respondents a large disadvantage of the charge stations. **Furthermore, the quantity and the quality of the charge stations can also be improved.** The quantity has to do with larges queues before the charge stations, whereby some people miss their train or metro. The quality is related to the fact that the charge stations are often broken. These factors combined is the reason for some people not to be able to go with public transport or have to ride illegal.

“Sometimes I forget to charge my public transport card. Then I needed to step out the vehicle to charge it or buy a really expensive ticket at the conductor. When I needed to get out, the vehicle was departing again, I had to wait for another vehicle. In the city there

are enough of the charge stations, but when you come in de areas around the city, there is a shortage. Sometimes I need to take the public transport to come at a charge station” (women, 37 years old (1))

“I wish there were more charge stations that are working. Sometimes I have an appointment and my card needs to be charged. Then I come at the station and the charge stations are not working, I cannot charge my card. At that point I need to go without charge it, which is not allowed and I cannot afford a fine. Sometimes it is even the case that I need to cancel my appointment because of this.” (women, 30, (6))

“The charge stations never work or there is a really long queue, because of that you can miss the metro. Sometimes I have to go illegal and go out by the next station.” (women, 22 years old, (7))

Finally, as mentioned in the sector car, **the public transport is the least family-friendly transport mode** following the respondents. People have to be extra aware if they are with their children. Especially at night feels not safe for some families. **Furthermore, it is an obstacle for people not be able to go back at night with public transport.** People have to take into account their children and the time of departing at a birthday party. This is for many reason an obstacle of public transport.

“When we have a little child, I prefer to go by car. People in the public transport do not pay attention to pregnant woman, it is really unrespect full. They push the stroller away, to make sure they go first, or they do not let pregnant women sit. No, when I have a child then we do not take public transport.” (Woman, 22 years old (7))

“Sometimes I go with my kids in public transport, I prefer to walk with the kids. When we go more far away I prefer to take the car with them. The metro at night does not feel really safe to me, especially not with my children.” (woman, 38 years old (13))

“When it is late at night, you have to wait really long for the public transport. Then you miss one thing and you have to wait for 20 minutes, after 19.00 you have to wait long. We are never going out because we live too far. Then we have to sleep at other people, the last metro is at a quarter to 1 or something. With birthday parties exactly the same. We always have to leave early.” (woman, 22 years old (7))

Since the main improvement of public transport was related to the price and not to the quality, the drawings of the people did not contain improvements for public transport. One two people mentioned to prefer a metro station closer by, which can be seen in drawing 6 and 7. Since this did not affect their travel behavior, this will not be explained further.

5. Conclusion and recommendations

5.1 Discussion of the findings

The characteristics of the respondents are low educational background and living in a social rental house. An overview of the perceptions of the respondents and the results are presented in Table 1.

Mode of transport	Influencing factors
Walking and Biking	• Provisions are nearby
	• Buying a bicycle is not always possible
	• Not safe
	• Health advantages
	• Negative experience (elderly)
	• Obstacles
Car	• Specific provisions needed
	• Family purposes
	• Convenience
	• Freedom
	• Easy for large groceries and packages
	• Possible to go to difficult-to-reach areas
	• Large investments
• Air pollution	
Public Transport	• Easy
	• Social area
	• Price is high
	• Not family friendly
	• Feeling uncomfortable
	• Restricted because of the high price
	• Restricted by feeling unsafe
• Not enough charge systems	

Table 1. Perceptions of the respondents towards different modes of transport

This part will discuss the findings combined with the literature of previous research. For this group of people public transport is most important since they have a low budget and a low percentage of car ownership (Criden, 2008). There were indeed only 3 people who had a car, which is low compared to the average of 77% of the Netherlands (CBS, 2016). For these people, the public transport increases their possibilities to different locations, which includes school and employment locations. The availability of public transport is one of the basic needs for the group with a low educational background and that live in social rental houses.

Based on the Financial Times fdi index, Rotterdam is rated as one of the best connected cities of Europe (Rotterdam Partners , 2018). All the respondents also think that the city is accessible by public transport. The characteristics of a public transport oriented neighborhood that have been examined by Erwin and Cervero (2001), are found in in the city of Rotterdam. The city has a high density, connection points close to commercial users, well organized street networks, many possibilities of transit service. Many respondents used or wanted to use public transport, which was mainly within Rotterdam. This confirmed the outcome of the research of Cervero & Duncan (2008) and Ewing & Cervero (2001) (Cervero & Duncan, 2008) (Ewing & Cervero, 2001). The main mode of transport under the respondents is walking. This can partly explained by the large amount of nearby facilities and residents which was also seen in the research of Carlson et all (2015). People were able to reach most parts of Rotterdam within 30 minutes by bike or walking, this was for them the maximum amount of travelling by foot or bike. Furthermore, respondents mentioned that the low costs of walking and biking was an important explanation. For them, the area that they could reach was limited. This can be seen as a large disadvantage for the respondents. They were only able to go to places where they could walk or go with the bicycle. Regarding transport possibilities, Rotterdam is a pleasant city to live in and has many public transport possibilities for the low-educated that live in social rental houses.

Regardless of the quality and the quantity of public transport, people were still limited in the use and the choices of public transport due to the cost. The factor of price for this group is the primary factor that influences their choices. They are highly sensitive to transport prices. Litman (2013) discussed in his research that low income and low educated people are highly sensitive for transport prices. Furthermore, he made a distinction between leisure and commuting trips. People are in general more price sensitive for leisure trips than the commuting trips (Litman, 2013). In this research it was found that people were searching for the cheapest tickets possible for the leisure related trip as well as for commuting trips, even when this was a less convenient option. In this research, costs of transport was the most important determinant for the choices of low educated people living in a social rental house.

This contradicts the studies of Eboli & Mazzulla (2008), Li, Hensher, & Rose (2010), Balcombe (2004) who found that time (reliability) was the most important factor for transport and the study of Beirao et al (2007) who was suggesting that costs was not a determinant in their choice (Beirao & Sarsfield Carbral, 2007). In this research it is found that the price is the most important determinant in the choice of transport mode.

Public transport has many possibilities in Rotterdam, but since the high prices of public transport people are limited to certain transport modes and areas. It sometimes even occurs that people are not able to go to work applications and school. As mentioned by (Criden, 2008) public transport is important for this group and for their work possibilities, is it shown in this case that the their possibilities are limited.

Most of the people were restricted within their own area or to the their daily commuting trip. Verplanken et al (1994) argued that people act automatically in transport decisions (Verplanken , Aarts, & Knippenberg, 1994). In this research, it was found that people who make the same trip every day, mostly take the same mode of transport. The only difference is that they mentioned that these decisions were not only based on their desired choice of that day, but they were sometimes limited in their choice due to the price of public transport. In this case the factor of being limited in their choice plays a more important role than the factor of habit.

It is found in this research that some people are restricted in their transport choices because of the price. The choice for the car and bike was also be influenced by the cost factor. The purchase of a car, driver's license and a bike are seen as a large investment. For some of the respondents, this purchase was not possible, and as a result they are restricted to the use of public transport or walking. Also, some people do not feel comfortable in public transport because of bullying or disrespectful behavior. This is for some people a factor that cause them to not feel safe in public transport. Elias & Shiftan (2012) showed that perceptions of risk and safety had no influence on the public transport (Elias & Shiftan, 2012). In this research, people that feel unsafe were indeed still using public transport. However, this was mainly due the limited possibilities that they had. Since public transport was their only option, they still used public transport. They mentioned that they would rather use the bike or the car as their desired mode of transport, but could not. The people who were feeling uncomfortable in the public transport, were still restricted to the use of public transport.

People are limited in their choices due to price, but as well due to safety. Safety seems to be an important topic for the different age groups. Mothers with children prefer not to bike within the city center with their children due to the traffic and the number of accidents that happen. They feel anxious in the city. Which is the same case for the older people who do not dare to drive the bike as well. Older people have had unpleasant past experiences with traffic accidents in the crowded city. Together with the physical problems they have, they do not dare to use the bike. Since people do not feel safe on the bicycle and they do not have a car, they are limited to choice for the public transport.

As mentioned before, there were only 3 people out of 17 who own a car. A low percentage of car ownership is thus found under the group of the respondents. This is comparable with the outcome of the researches of Zegras and Srinivasan (2006) and Maduwanthi, Dharmawansa, Rajapakse, & Nomura (2015). The main reason for the low percentage of car ownership under the respondents was that they could not afford the high investment of the car and the driver's license. In the literature it was found that a car was more family-friendly than public transport (Dieleman, Dijst, & Burghouwt, 2002) (Liu, 2017). The 3 people that had a car declared it was mainly for family reasons. Other people answered that they preferred a car if they would have a family or that a car is mostly necessary for families. The car has multiple advantages for families: it is more safe and the cost can be divided by multiple persons.

The car has thus many advantages, especially for families. Still, many people prefer to have a more quiet city center and have less cars in the city. The city is busy, many accidents are happening and the air is polluted. Less cars in the city can result in better air quality, calmer streets and a more walker and biker friendly city. People will be less anxious on the bike and will use it more frequently. The safety factor is thus an important factor for people's choice in transport.

5.2 Conclusion and advice

The Verkeersonderneming, the municipality and different governmental organizations are focused on the congestion problem in the Netherlands. They want to influence peoples choices by motivate them to avoid congestion and use public transport. Their research is mainly focused on high educated people who are working in other cities, outside Rotterdam. Since the largest group, 51% of the population, of Rotterdam has a low income there is a need to investigate their travel behavior (Gemeente Rotterdam, 2019). Comparably, 58% of the houses of Rotterdam are social rental houses (huurwoning.com, 2019). The group of this research had both of these characteristics, which suggest

that these people probably belong to the poorest group of the city. Policy hardly focused on the majority of Rotterdam. This research gave an overview of the factors that influenced travel behavior of people that belong to this group, who are thus people with a very low social economic status.

The main factors that influenced the mobility behavior of people with a low income in Rotterdam are the price and the feeling of safety. This answers the research question of this research: "What influences the mobility behavior of the people with a low income in Rotterdam?" The respondents of this research, who are low educated and live in rental houses, are restricted by their choice of transport. Which can thus be explained by the factor of price and safety. Multiple organizations have spoken about Traffic Poverty, which is the case when a person cannot fully participate, beyond his control, in the society but would like to do so (Ministerie van Infrastructuur en Waterstaat, 2018). As it is shown from the findings, people in this research are restricted in their transport choices and are not always able to choose what they want. The characteristics of Traffic Poverty are found in this research. For this group of low educated and living in a social rental house the choices are limited. As the quote of one man can be repeated, this should not be the case:

"Public transport is focused on the elite!" (man, 63 years old (11))

The advice for The Verkeersonderneming is based on the result of this research. First of all, a shift of focus is necessary. The focus of the municipality and The Verkeersonderneming should be more on the people on people that have a lower budget. Mobility and public transport increases the work and leisure possibilities for this group.

Safety is an important topic within the city of Rotterdam. The importance of this topic is confirmed in this research. Many projects in Rotterdam are already focused on the topic of safety, like the NPRZ (NPRZ , 2018). In this research, especially families and older people mentioned that safety restricted their mobility. More research can be done by The Verkeersonderneming or the municipality of Rotterdam to the topic safety focusing on families and older people. The use of public transport for older people and families can be increased by increasing the sense of security.

People mentioned that most of their activities were located in their own neighborhood. The area was reachable by bike or by foot. This restrict the area which they can visit. The area can be even more limited due to the fact that some people do not have a bicycle. Large investment was hard for the group that has been interviewed and bicycles have been stolen on a regularly basis. The

Verkeersonderneming already helps people by offering a bicycle via De Fietsenbank (De Verkeersonderneming, sd). This project now only targets the area Feijenoord, in the south of Rotterdam. The project can expand to other areas in Rotterdam, like more areas in the south and in the west of Rotterdam.

After this problem of the investment of a bicycle has been tackled, one other problem still exists. Bicycles are often stolen in Rotterdam, research can be done to the best bicycle parking. Furthermore, bicycles that are from a sharing platform and recognizable seem to be less stolen due to the fact that the bicycles are easily to trace. Research can be done in order to see if this really is the case. If research can confirm this assumption, the bicycles from De Fietsenbank should be characterized by The Verkeersonderneming and the municipality.

The respondents were not able to afford a car which restricts their mobility. The main restriction was related to difficult-to-reach activities and large packages and groceries. This problem will not be an important problem which The Verkeersonderneming needs to take into account. A car that can be shared within the neighborhood, would be a solution. There already exists sharing cars, which are all expensive and not affordable for the lower income group. This could be done via Het Huis van de Wijk, for a low price.

Based on the results of this research, people are restricted by the price of transportation. For this, a program whereby people get a reward in terms of transportation if they do something for the neighborhood, on voluntary basis, would motivate them to use public transportation. All the people that have been interviewed are in the "Huis van de wijk" on a regularly basis. They all eager to work and give something back to the city. A program whereby people work for "het Huis van de wijk" and they will get a reward in terms of transportation in return, will increase the transportation possibilities for them while they do something back. A reward could be a budget for the public transport card, a bike or a train ticket to another city.

Furthermore, unemployed people who are not able to go to an interview due to the price of public transport should be helped. People who have welfare support can apply for a free transport ticket when they have a job interview (Gemeente Rotterdam, sd). This regulation should expand for more people within the lower income group.

Furthermore people were limited by the fear of insecurity. Extra attention for the older people and families is necessary in this case. A program which is focused on getting the older people on the bike would be helpful. Bike lanes or bike areas for families, especially in the west of Rotterdam, can help decline the insecurity for families and for the older people. Furthermore, public transport has been seen as less family-friendly than a car, which is many due to the convenience of a car. The costs can thereby be divided by multiple people of the family. Promoting the group ticket or making the group ticket more easy to buy via an application for families would help for the people in this case.

5.3 Limitations

This research is a qualitative research whereby the focus thus lays on insights of the perceptions of people. Further research could be based on the results of this research. Quantitative research can be done to investigate if the results hold for a larger group of people in Rotterdam. The limitation of this research is therefore the limited amount of people, whereby it is not possible to make general conclusions for the targeted group. If the outcomes of this research can be confirmed for a larger amount of people, the suggestions for The Verkeersonderneming of above can be further investigated.

Next to the small group of this research, the average age was high compared with the rest of the population of Rotterdam. Since most of the people are within the range of age 25 to 45, the average age of 52 is quite high. This was mainly due to the fact that 3 people were retired and 3 other people were almost retired. Most respondents had thereby a migration background. A broader and more diverse group can be investigated in further research.

Results of this research show that characteristics of Traffic Poverty are found. Broader and more research should investigate if Traffic Poverty is indeed found within Rotterdam. Furthermore, can the same type of research be done in another city of the Netherlands, for example Amsterdam. This research is only focused on Rotterdam. It could give a general advice of the city of Rotterdam, but it is unknown if the results would be comparable with the situation of another city.

Bibliography

- Aditjandra, P. T., Cao, X. J., & Mulley, C. (2012). Understanding neighbourhood design impact on travel behaviour: An application of structural equations model to a British metropolitan data. *Elsevier*, 46 (1) pp 22-32. doi:<https://doi.org/10.1016/j.tra.2011.09.001>
- Balcombe, R. (2004). *The demand for public transport: a practical guide*. United Kingdom: TRL Limited. Retrieved from http://discovery.ucl.ac.uk/1349/1/2004_42.pdf
- Beirao, G., & Sarsfield Carbral, J. (2007). Understanding attitudes towards public transport and. *Elsevier*, 478-489.
- Bhat, C., & Sardesai, R. (2006). The Impact of Stop-Making and Travel Time Reliability on Commute Mode Choice. *Transportation Research Part B*, Vol. 40, No. 9, pp. 709-730. doi:<https://doi.org/10.1016/j.trb.2005.09.008>
- Börjesson, M., & Eliasson, J. (2012). Experiences from the Swedish Value of Time study. Stockholm: Centre for Transport Studies. Retrieved from <http://www.transportportal.se/SWoPEc/CTS2012-8.pdf>
- Carlson, J. A., & et al. (2015). Association between neighborhood walkability and GPS measured walking, bicycling and vehicle time in adolescents. *Elsevier*, 1-7. doi:<https://doi.org/10.1016/j.healthplace.2014.12.008>
- CBS. (2015). *Verschil criminaliteit stad en land gedaald*. Retrieved from Centraal Bureau van de Statistiek : <https://www.cbs.nl/nl-nl/nieuws/2015/48/verschil-criminaliteit-stad-en-land-gedaald>
- CBS. (2016). *Transport en mobiliteit 2016*. Den Haag : Centraal Bureau voor de statistiek.
- Cervero, R., & Duncan, M. (2008). Which Reduces Vehicle Travel More: Jobs-Housing Balance or Retail Housing Mixing. *Journal of the American Planning Association*, 72:4, 475-490. doi:10.1080/01944360608976767
- Clifton, K., & Handy, S. (2001). *QUALITATIVE METHODS IN TRAVEL BEHAVIOUR RESEARCH*. Kruger National Park, South Africa: the International Conference on Transport Survey Quality and Innovation. Retrieved from http://www.des.ucdavis.edu/faculty/handy/Qualitative_paper.pdf
- Criden, M. (2008). Recognizing the Importance of Public Transportation for Low-Income Households. Washington: National Association for State Community Services Programs. Retrieved from <https://nascsp.org/wp-content/uploads/2018/02/issuebrief-benefitsofruralpublictransportation.pdf>
- Davidov, E. (2007). Explaining habits in a new context. *Rationality and Society*, 19(3): 315-334. doi:10.1177/1043463107077392
- De Verkeersonderneming . (n.d.). *De Fietsenbank Rotterdam: iedereen een fiets!* . Retrieved from De Verkeersonderneming : <http://www.verkeersonderneming.nl/fietsenbank/>
- Dieleman, F., Dijst, M., & Burghouwt, G. (2002). Urban Form and Travel Behaviour: Micro-level Household Attributes and Residential Context. *Carfax Publishing*, 39 (3) 507-527. doi:10.1080/0042098022011280
- Dobson, R., Dunbar, F., & Smith, C. (1978). Structural Models for the Analysis of Traveler Attitude - Behavior relationships. *Elsevier*, 351-363. Retrieved from <https://link.springer.com/article/10.1007%2FBF00168036>

- Eboli , L., & Mazzulla, G. (2008). Willingness-to-pay of public transport users for. *European Transport* , 107-118.
- Elias , W., & Shiftan, Y. (2012). The influence of individual's risk perception and attitudes on travel behavior. *Elsevier*, 1241-1251. doi:<https://doi.org/10.1016/j.tra.2012.05.013>
- Eluru, N., Chakour, V., & El-Geneidy, A. (2012). Travel Mode Choice and Transit Route Choice Behavior in Montreal: Insights from McGill University Members Commute Patterns. *Public Transport: Planning and Operations*, 4(2) 129-149.
- Ewing, R., & Cervero, R. (2001). Travel and the Built Environment. *Transportation Research Record*, No. 01-3515. doi:10.3141/1780-10
- Fortuin, C., & van der Graaf, P. (2006, Februari). *De stad verhaalt van de stad - Rotterdamse Lokale identiteit en cultuur als hulpbron*. Utrecht : Verwey-Jonker Instituut.
- Frank, L., Bradley, M., Kavage, S., Chapman, J., & Lawton , T. (2007). Urban form, travel time and cost relationships with tour complexity and mode choice. *Springer Science+Business Media B.V*, 35: 37-54. Retrieved from <https://link.springer.com/content/pdf/10.1007%2Fs11116-007-9136-6.pdf>
- Gemeente Rotterdam. (2018). *Bouwmaatregelen woningbouw Rotterdam 2018-2021*. Retrieved from Persberichten Rotterdam : https://www.persberichtenrotterdam.nl/uploads/20181221-Bouwmaatregelen%20Woningbouw%20Rotterdam%202018-2021_18bb010972.pdf
- Gemeente Rotterdam. (2018). *De staat van de stad 2018*. Rotterdam: Gemeente Rotterdam.
- Gemeente Rotterdam. (2018). *Informatie Gemeente Rotterdam* . Retrieved from allecijfers.nl : <https://allecijfers.nl/gemeente/rotterdam/>
- Gemeente Rotterdam. (2019). *Databank van Rotterdam in Cijfers*. Retrieved from Buurtmonitor: https://rotterdam.buurtmonitor.nl/jive?cat_open=Beleidsthema%27s/Inkomen%20en%20sociale%20Zekerheid/Inkomen
- Gemeente Rotterdam. (n.d.). *Reiskostenvergoeding*. Retrieved from <https://www.rotterdam.nl/loket/reiskostenvergoeding/>
- huurwoning.com. (2018). *Minder sociale huurwoningen in Rotterdam*. Retrieved from <http://www.huurwoning.com/sociale-huurwoningen-in-rotterdam/>: <http://www.huurwoning.com/sociale-huurwoningen-in-rotterdam/>
- huurwoning.com. (2019). *Minder sociale huurwoningen in Rotterdam, huurwoningen in Rotterdam dunder*. Retrieved from [huurwoning.com: http://www.huurwoning.com/sociale-huurwoningen-in-rotterdam/](http://www.huurwoning.com/sociale-huurwoningen-in-rotterdam/)
- Iseki, H., Taylor , B., & Miller, M. (2006). The Effects of Out-of-Vehicle Time on Travel Behavior:Implications for Transit transfers. California Department of Transportation. Retrieved from <https://www.its.ucla.edu/wp-content/uploads/sites/6/2014/06/Appendix-A.pdf>
- Klockner , C. A., & Matties, E. (2004). How habits interfere with norm-directed behaviour: A normative decision-making model for travel mode choice. *Elsevier* , 24 (3) 319-327. doi:<https://doi.org/10.1016/j.jenvp.2004.08.004>
- Li, Z., Hensher, D., & Rose, J. (2010). Willingness to pay for travel time reliability in passenger transport: A review and some new empirical evidence. *Elsevier*, 46 (3) 384-403. Retrieved from <https://www.sciencedirect.com/science/article/pii/S1366554509001550>
- Litman, T. (2013). *Transport Elasticities: impacts on travel behaviour*. Germany : Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. Retrieved from

- https://www.sutp.org/files/contents/documents/resources/B_Technical-Documents/GIZ_SUTP_TD11_Transport-Elasticities_EN.pdf
- Litman, T. (2019). *Understanding Transport Demands and Elasticities*. Victoria Transport Policy Institute. Retrieved from <http://www.vtpi.org/elasticities.pdf>
- Liu, C.-P. (2017, September). Understanding the Factors Influencing Public Transport Mode Choice in Taiwan. University College London. Retrieved from http://discovery.ucl.ac.uk/1575564/1/Liu_PhD%20Thesis-Revised-Chien-Pang-Sept-2017.pdf
- Maduwanthi, M., Dharmawansa, A., Rajapakse, R., & Nomura, S. (2015). Factors influencing to travel behavior on Transport mode choice. ResearchGate. doi:DOI: 10.5057/ijae.IJAE-D-15-00044
- Managh , K., & Ahmend M. El-Geneidy. (2015). The importance of neighborhood type dissonance in understanding the effect of the built environment on travel behavior. *The Journal of Transport and land use*, vol 8 no. 2 pp. 45–57. doi:<http://dx.doi.org/10.5198/jtlu.2015.718>
- Matsumoto, D. (2007, December). *Culture, context and Behavior* . Blackwell Publishing .
- Nilsson, M., & Kuller, R. (2000). Travel behaviour and environmental concern. *Elsevier*, 211-234. doi:1361-9209/00
- Noland, R., & Polak, J. (2002). Travel time variability: A review of theoretical and empirical issues. *Transport Reviews*. Retrieved from file:///C:/Users/Administrator/Downloads/Travel_time_variability_A_review_of_theoretical_an.pdf
- NPRZ . (2018). *NPRZ - Activiteiten*. Retrieved from <https://www.nprz.nl/activiteiten/?categories=6>
- NRC. (2019, February). *Ook in regio Rotterdam minder sociale woningen*. Retrieved from [nrc.nl: https://www.nrc.nl/nieuws/2019/02/07/ook-in-regio-minder-sociale-woningen-a3653141](https://www.nrc.nl/nieuws/2019/02/07/ook-in-regio-minder-sociale-woningen-a3653141)
- NRPZ . (2019). *Nationaal Programma Rotterdam Zuid* . Retrieved from NPRZ : <https://www.nprz.nl/over-nprz/nprz/over-ons>
- Prashker, J. (1979). Direct analysis of the perceived importance of attributes of reliability of travel modes in urban travel. *Elsevier*, 329-346. Retrieved from <https://link.springer.com/content/pdf/10.1007%2F01677987.pdf>
- Recker, W., & Golob, T. (1976). An attitudinal modal choice model. *Elsevier*, 299-310. doi:[https://doi.org/10.1016/0041-1647\(76\)90109-X](https://doi.org/10.1016/0041-1647(76)90109-X)
- Rijksoverheid. (2019). *Hoe kom ik in aanmerking voor een sociale-huurwoning?* Retrieved from <https://www.rijksoverheid.nl/onderwerpen/huurwoning/vraag-en-antwoord/sociale-huurwoning-voorwaarden>
- Roodenburg, H. (2016). *SCP-rapport bevestigt: Marokkanen en Antillianen oververtegenwoordigd in criminaliteit* . Retrieved from Rotterdam vandaag & morgen: <http://www.vandaagemorgen.nl/opinie/6337-scp-rapport-bevestigt-marokkanen-en-antillianen-oververtegenwoordigd-in-criminaliteit.html>
- Rotterdam Partners . (2018, Februari 14). *Rotterdam scores first in connectivity in Financial Times*. Retrieved from Rotterdam Partners : <https://en.rotterdampartners.nl/rotterdam-scores-first-in-connectivity-in-financial-times/>
- Simons , D., Clarys, P., de Bourdeaudhuij, I., de Geus, B., Vandelanotte, C., & Deforche, B. (2013). *Factors influencing mode of transport in older adolescents: a qualitative study*. Belgium: BMC. Retrieved from <https://bmcpublichealth.biomedcentral.com/articles/10.1186/1471-2458-13-323>
- Steiner , R., Crider, L. B., & Betancourt, M. (2006). *Safe ways to school - the role in multimodal planning*. Gainesville: University of Florida, Dept. of Urban and Regional Planning. Retrieved

- from
<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.602.1321&rep=rep1&type=pdf>
- Strauss, A. L., & Corbin, J. M. (1998). *Basics of Qualitative Research : Techniques and Procedures for Developing Grounded Theory*. Thousand Oaks: Sage Publications, Inc.
- T., N. (2019). *What Are the Most Earth-Friendly Transportation Methods?* Retrieved from Greenliving : <https://greenliving.lovetoknow.com/low-impact-living/what-are-most-earth-friendly-transportation-methods>
- Tertoolen, G., van Kreveld, D., & Verstraten, B. (1998). Psychological resistance against attempts to reduce private car use. *Elsevier*, Vol. 32, No. 3, pp. 171-181, 1998. doi:0965-8564/98
- Tseng, Y.-Y. (2008). *Valuation of Travel Time Reliability in passenger transport*. Vrije Universiteit Amsterdam. Retrieved from <https://research.vu.nl/ws/portalfiles/portal/42177868/8539.pdf>
- van Wee, B., Holwerda, H., & van Baren, R. (2002). Preferences for Modes, Residential Location and Travel Behaviour: the Relevance for Land-Use Impacts on Mobility. *European Journal of Transport and Infrastructure Research*, no. 3/4, pp. 305-316. Retrieved from http://www.ejtir.tbm.tudelft.nl/issues/2002_03-04/pdf/2002_03-04_08.pdf
- Vasterman, J. (2006). *NRC checkt: 'Opleidingsniveau R'dam is nu hoger dan het landelijke'*. Retrieved from NRC: <https://www.nrc.nl/nieuws/2016/11/17/opleidingsniveau-rdam-is-nu-hoger-dan-het-landelijke-5338015-a1532359>
- Verkeersnet . (2015). *Transport en mobiliteit in cijfers* . Retrieved from Verkeersnet : <https://www.verkeersnet.nl/mobiliteit-en-ro/15816/transport-en-mobiliteit-in-cijfers/?gdpr=accept>
- Verplanken , B., Aarts, H., & Knippenberg, A. (1994). Attitude versus General Habit: Antecedents of Travel mode Choice. *Journal of Applied Social Psychology*, 285-300. Retrieved from <https://onlinelibrary.wiley.com/doi/epdf/10.1111/j.1559-1816.1994.tb00583.x>
- Vries, d. C. (n.d.). *Analyses mobiliteit Rotterdam*.
- Yang , R., Long, R., Bai, Y., & Li, L. (2017). The Influence of Household Heterogeneity Factors on the Green Travel Behavior of Urban Residents in the East China Region. *Sustainability MDPI*, 1-17. doi:10.3390/su9020237
- Zegras, P., & Srinivasan, S. (2006). Household Income, Travel Behavior, Location and Accessibility: Sketches From Two Different Developing Contexts. Retrieved from http://web.mit.edu/czegras/www/Zegras_Srinivasan_TRB07.pdf
- Zhang, M. (2004). The Role of Land Use in Travel Mode Choice: Evidence from Boston and Hong Kong. *Journal of the American Planning Association* , 70 (3) 344-360. doi:<https://doi.org/10.1080/01944360408976383>

Appendix 1 – research design

Research design

Purpose: understand the mobility behavior of people that are low educated and living in social rental houses. What can influence their behavior?

The hypothesis based on literature research:

1. *H0: Travel time and time reliability are important determinants for the transport choices of low educated people that live in rental houses.*
2. *H0: Price is another determinant for the choice of the transport mode.*
3. *H0: The percentage of the travelers, living in rental houses and have low income, that use public transport will be higher than the general rate in the Netherlands (15% of the people uses public transport)*

Following the literature, low educated and low income people are assumed to be regularly public transport users. The rate of the use of public transport within the target group is expected to be high.

Possible types of interviews

The 3 possible types of interviews can be combined to first have a general understanding of people's behavior whereby after test if the observations are correct.

Research format

1. Evaluation of current mobility behavior

1. General information
 - Age
 - Gender
 - Income range
 - Educational background
 - Occupation
 - Location of occupation and amount of time to go to job
 - Car ownership,
 - Driving license,
 - Household characteristics
2. What aspect of transportation do they found most important?
3. Which transport mode do they use for short/long distances?
 - Differs within purpose of the trip?

- Different perceptions for short/long distance?
4. Perceptions of public transport
 - Advantages and disadvantages of public transport
 - Motivations and barriers to use public transport
 - Which words do they associate with public transport
 5. Perception of the car
 - Advantages and disadvantages of the car
 - Motivations and barriers to use the car
 - Which words do they associate with the car
 6. Perceptions of walking/cycling
 - Advantages and disadvantages of walking/cycling
 - Motivations and barriers to walk or cycle
 - Which words do they associate with walking/cycling

2. How to influence people?

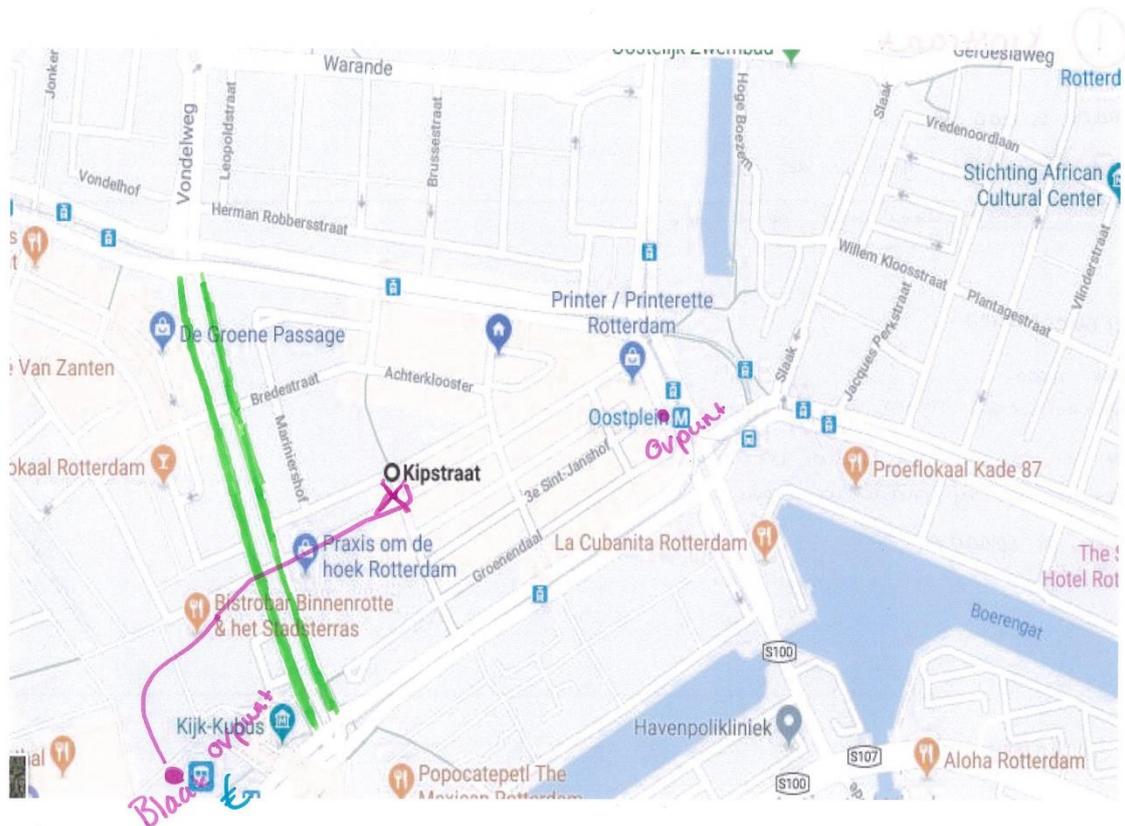
1. Which determinants influences their choice in transport?
 - What is the main determinant that influences their decision of transport the most
 - What do they found more important, being on time or price reduction
2. What will improve the barriers of the use of public transport or cycling?
3. How would they advise policies to encourage people make use of public transport/walking/cycling.
4. Improving facilities to improve transport use?

Appendix 2 – Drawings

Drawing 1

Definitions of the collars:

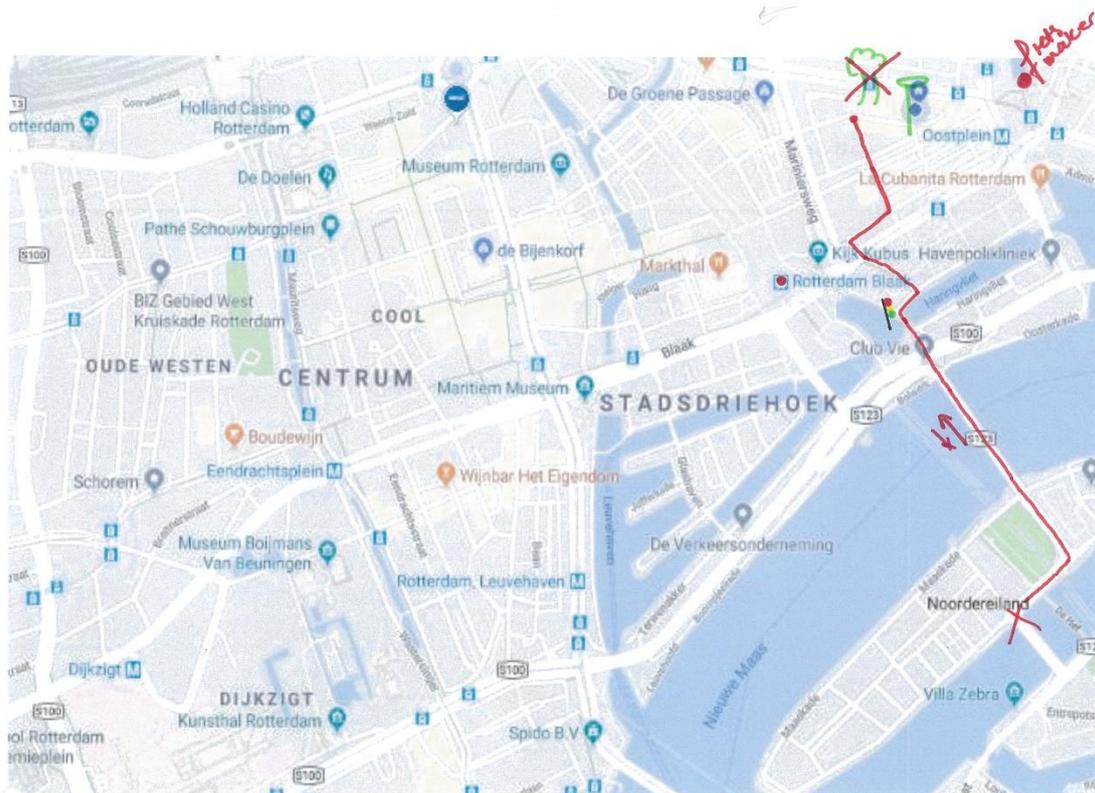
- Green: more green in the
- Purple line: walking route from the metro station to work
- Purple dots: public transport stations
- Purple cross: busy and unsafe point



Drawing 2

Definitions of the collars:

- Red line: bike route from house to work
- Red dot: her bicycle repair man (far away from her house)
- Red cross: dangerous crossing
- Red arrow: prefers a two way at the bridge at both side
- Green tree: do not park your bike under a tree, then you will have bird poop
- Red light: disliked the red light on her road to work



Drawing 3

Definitions of the collars:

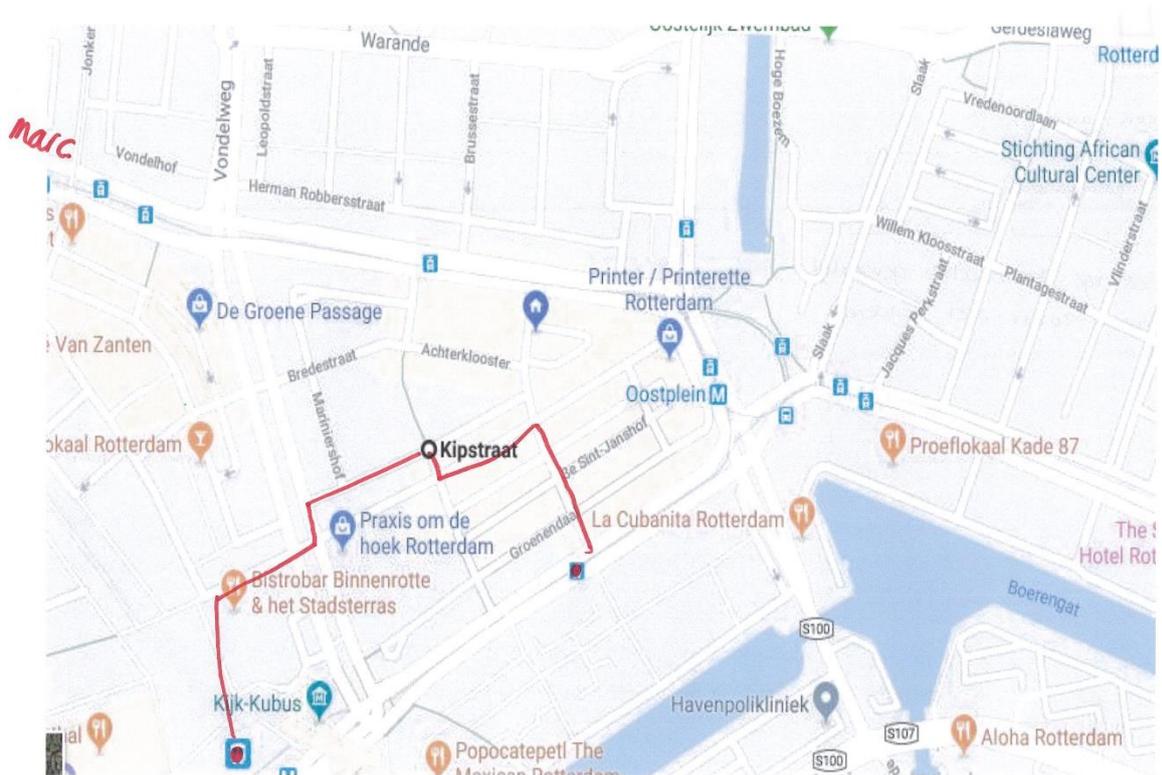
- Blue lines: parking possibilities
- Blue cross: house
- Bike: Bike parking (but they do not bike, so a cross through it)
- Red circles: the public transport they take



Drawing 4

Definitions of the collars:

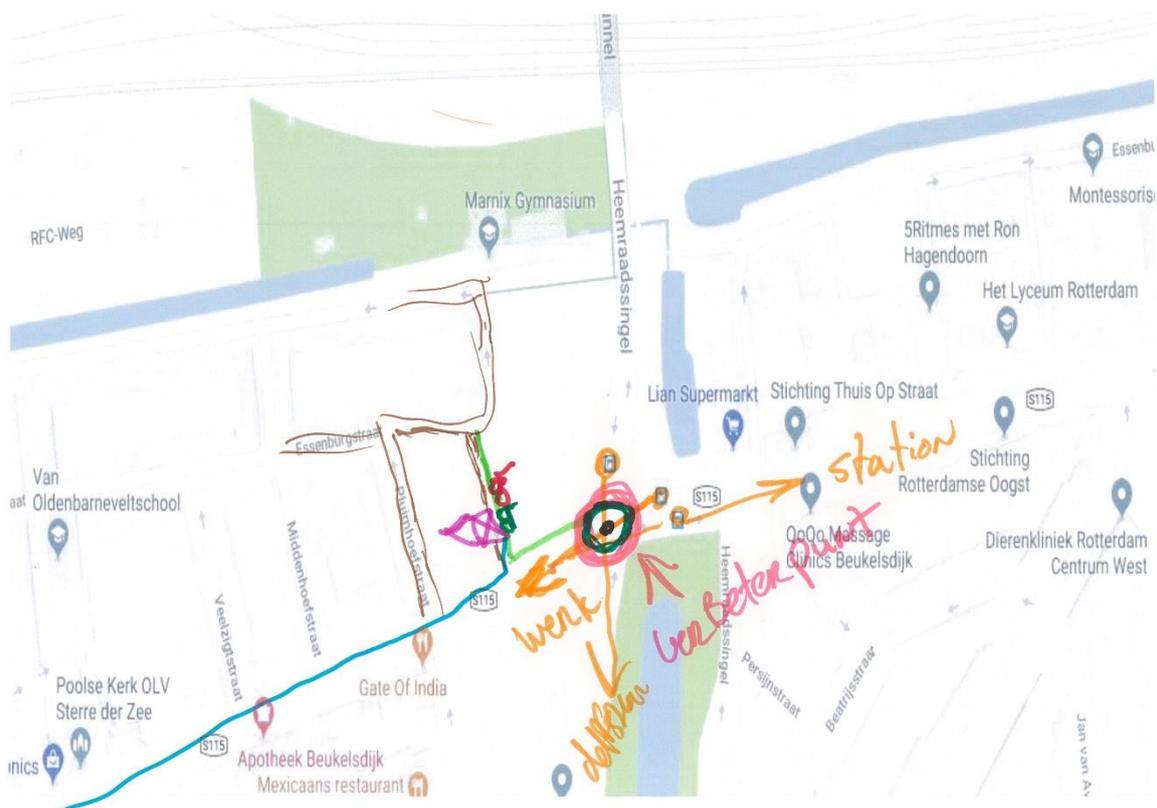
- Red line: the walk route from the metro and the tram
- Red Marc: Marconiplein where she lives



Drawing 5

Definitions of the collars:

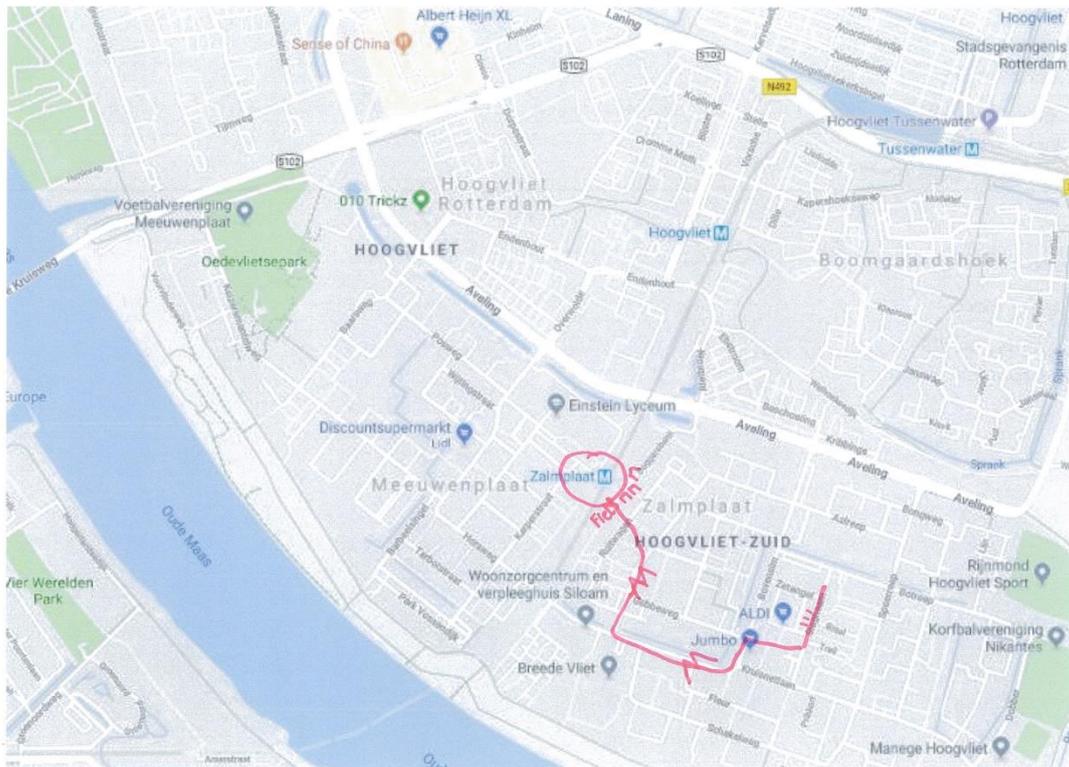
- Brown: option to park the car
- Blue: the route to his work (with the bike)
- Orange: routes to work, the station and Delfshaven
- Red: bicycle parking
- Purple: house
- Pink: dangerous crossing, which is an improvement point of the neighborhood



Drawing 6

Definitions of the collars:

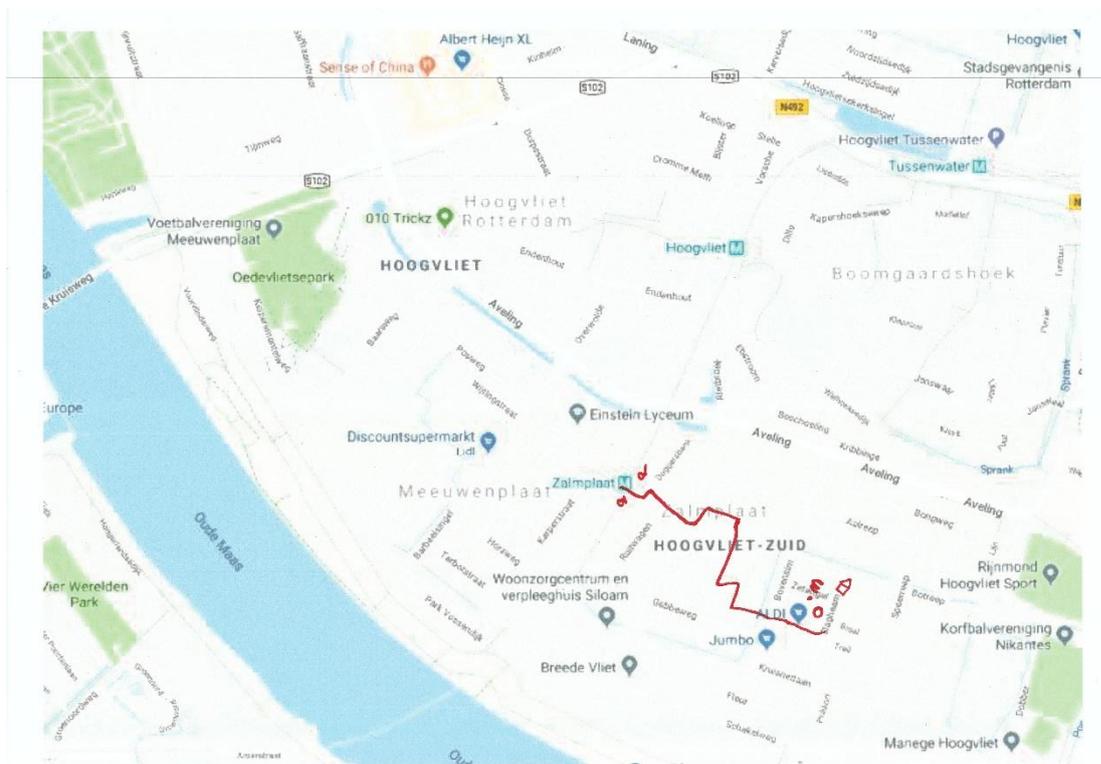
- Pink circle: metro station
- Pink “fiets”: bicycle parking at metro station (there are more needed)
- Pink M: preferred metro stations (improvement points)
- Pink line: route to the metro station (both with bike and foot)



Drawing 7

Definitions of the collars:

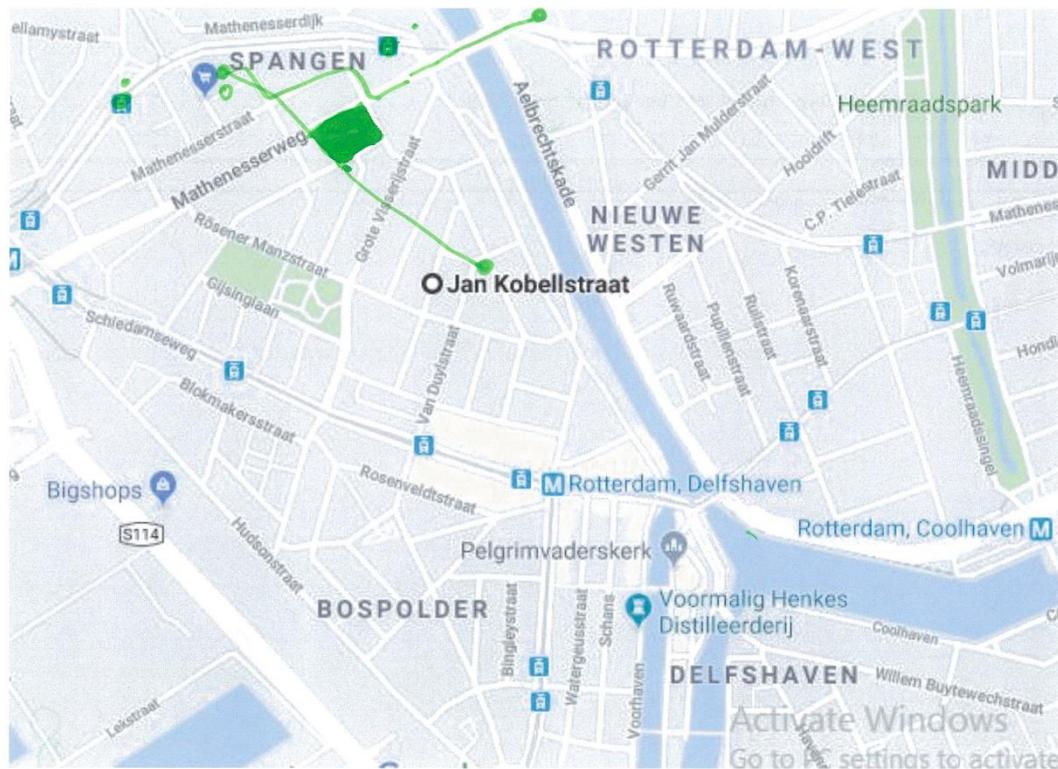
- Red line: route to the metro station
- Red house: house
- Red m: metro station (nearby the house)
- Red dots nearby metro stations: more charge stations (improvement points)



Drawing 8

Definitions of the collars:

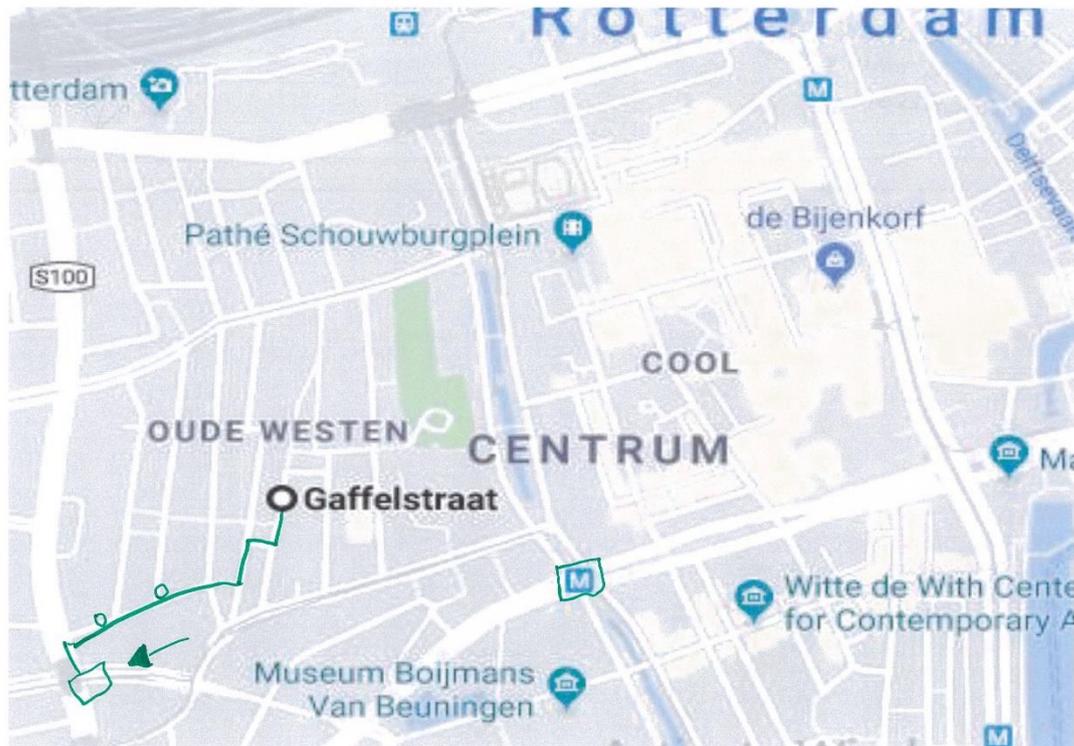
- Green square: more green in the city
- Green dots: the public transport stations
- Green lines: the walk routes during the week
- Jan Kobell straat: work
- Green dot after the bridge: the mosque and café



Drawing 9

Definitions of the collars:

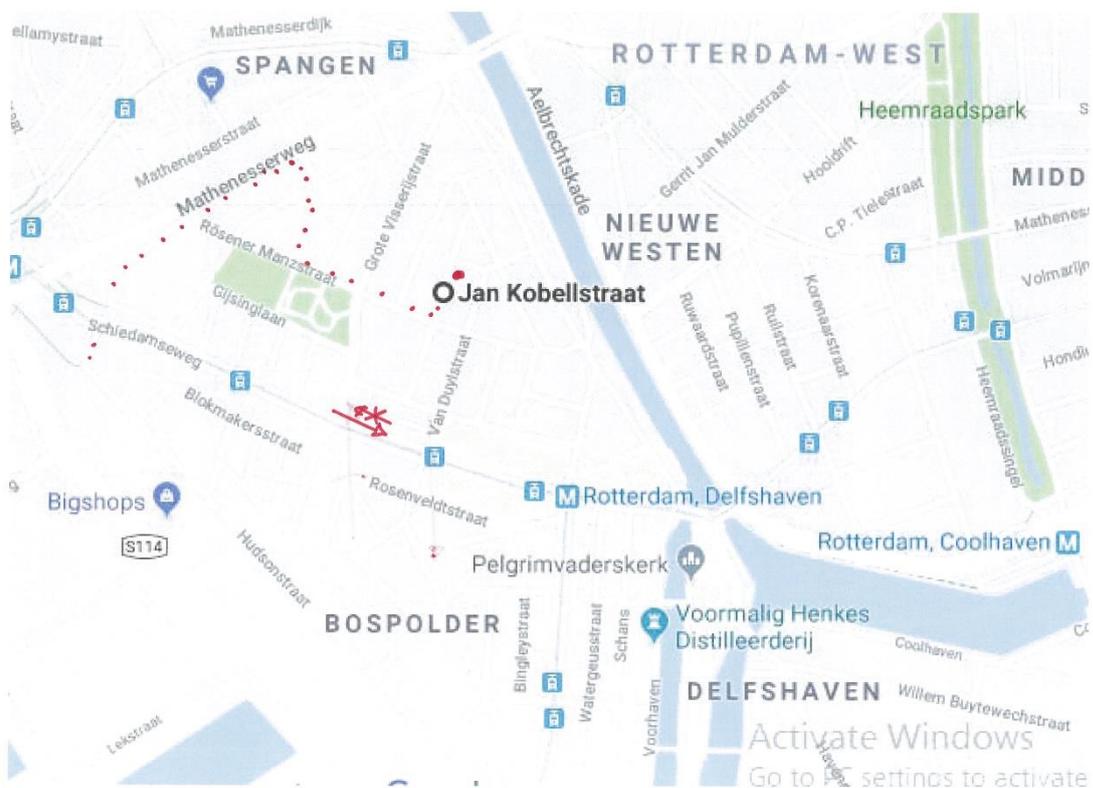
- Green: route to the public transport station
- Green rounds: trash bins
- Arrow: public transport station



Drawing 10

Definitions of the collars:

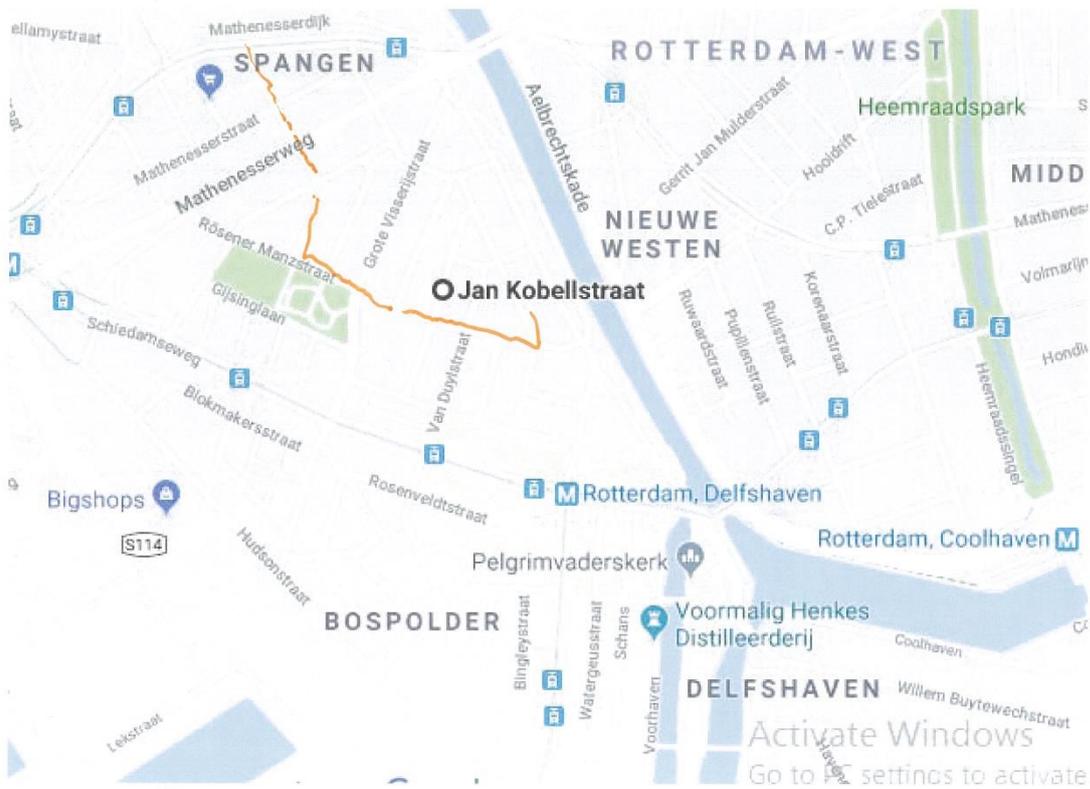
- Green: more green in the
- Purple line: walking route from the metro station to work
- Purple dots: public transport stations
- Purple cross: busy and unsafe point



Drawing 11

Definitions of the collars:

- Orange: route walking to Huis van de wijk



Drawing 12

Definitions of the collars:

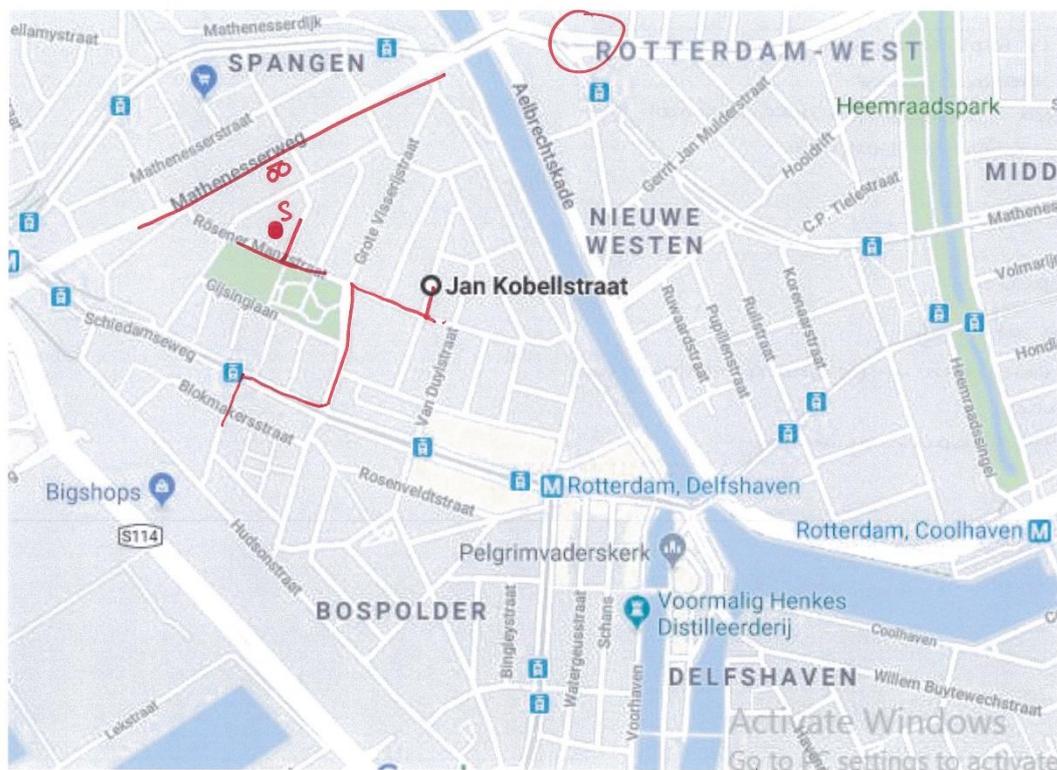
- Orange line: route from the public station to Jan Kobellstraat
- Red cross and lines: congestions at crossings
- Red dot: house



Drawing 13

Definitions of the collars:

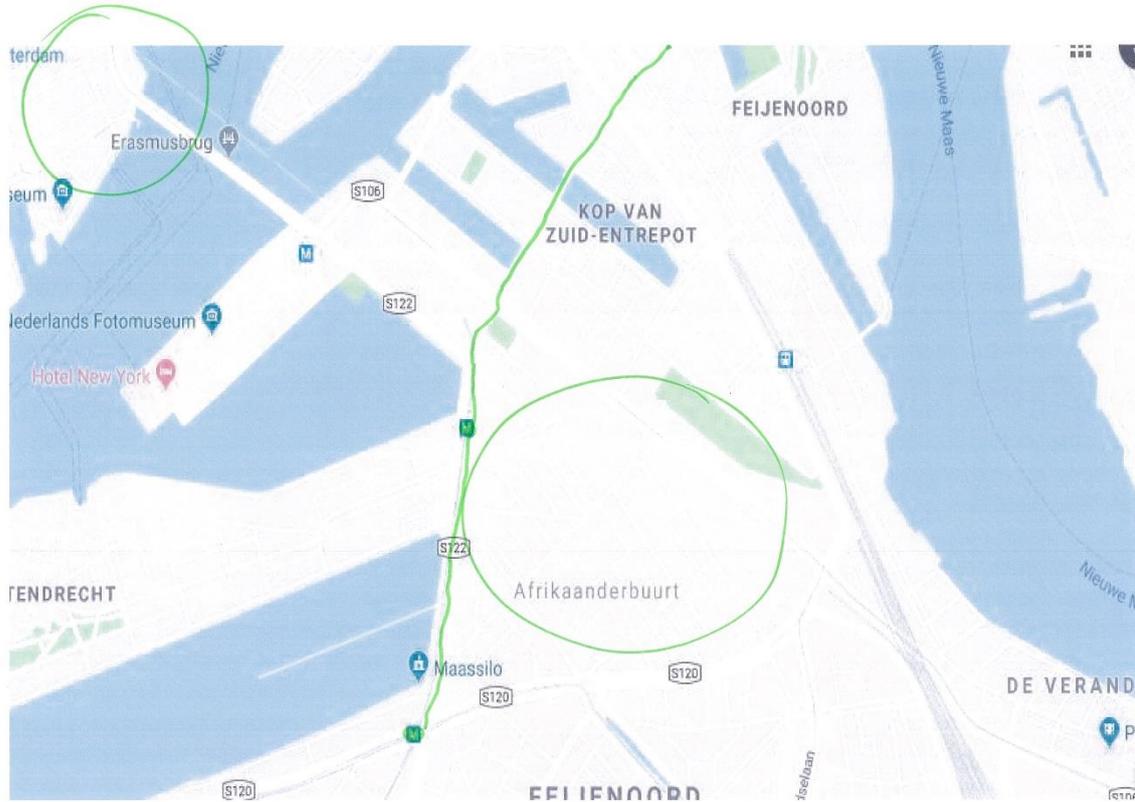
- Red S: School
- Red T-split: congestion around the schools
- Red line, Mathenesseweg: dangerous route to bike with children
- Red circle: dangerous situation at a crossing with children
- Red line, Jan Kobellstraat: route to Huis van de wijk



Drawing 14

Definitions of the collars:

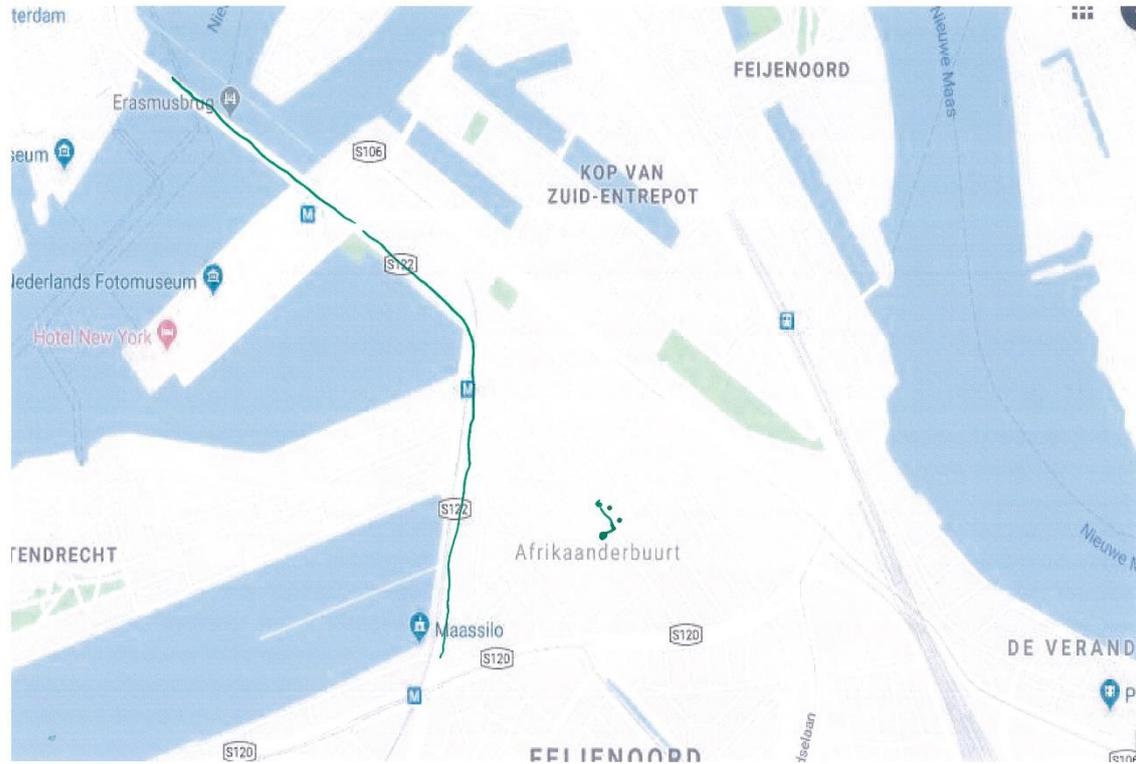
- Green line: biking route
- Green circles: busy areas in the city (improvement point)



Drawing 15

Definitions of the collars:

- Green line: fast cars, dangerous rote
- Green dots:



Drawing 16

Definitions of the collars:

- Orange: More parking spots needed
- Cross: Huis van de Wijk

