

# City in motion

*Assessing the risk and experienced transport poverty in  
Rotterdam*



Master thesis

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Cover picture: Nieuwe Binnenweg Rotterdam. (PZC, 2019)

## Preface

The writing of my thesis has been a lengthy process, but it is finally complete. It is for sure a relief to finish my thesis and move on to a new chapter after graduation. It has sometimes been a difficult road but in the end, I am proud of the work that I have done. In the first place, I would like to thank a couple of people for their help during this process. I would like to thank my supervisor Nicola Cortinovis, for the guidance and support throughout this process, with feedback and brainstorming sessions that helped me to think further. Next, I my thanks are to my friends, colleagues, family, and partner for their supporting me in this process, for their feedback and extra help when I got stuck. My participants also earn their thanks for participating in the interviews and taking the time for this. Without their participation, this research could not have taken place.

## Abstract

This research focuses on the transport poverty that exists in Rotterdam and might increase when the revision plans for public transport are conducted. The concept of transport poverty ties in with social exclusion. Social exclusion is a complex issue and is conceptualized as the process that hinders individuals from full participation in society. Transport poverty contributes to this because it hinders individuals from participating in society due to a limited means of transport. Based on the found literature, the indicators that influence transport poverty are identified and the risk of transport poverty model is formed. From the analysis it is concluded that the neighbourhoods located on the outskirts of the city and the neighbourhoods with a low socioeconomic status score high on the risk of transport poverty.

To get an understanding of how transport poverty is experienced in the neighbourhood, a qualitative analysis of transport poverty and related social exclusion is investigated. The semi-structured analysis is conducted to understand the social exclusion of residents by looking at their travel features, transport choice, disadvantages of travelling, motivation for non trip making, and their travel needs. From the interviews with the participants, it is indicated that economic, spatial, physical, fear-based, and time-based exclusion exist in the neighbourhood. Exclusion of facilities is only seen by the group of participants with ability problems. This study is helping to fill the gap in an understudied area of transport poverty and related social exclusion. The qualitative analysis enhanced the theoretical research by exploring the various reasons and impacts of the travel experience and by comprehension of various aspects of social exclusion.

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# 1. Introduction

Urban areas are in full development, as the city is popular to live in, cities experience growth in residents, increasing employment opportunities, and an increasing number of tourists. This growth can only take place if people can move to their work and leisure activities. For decades, the car has been the primary mode of transportation but currently, a transition to cycling and public transport takes place since residents need to have access to different modes of transport to participate in society.

In Amsterdam, one of the four youngsters is not capable of riding a bike. Next to this not everyone can pay for a new bike or is unable to pay for the repairs. At last, not everyone has enough courage to cycle in Amsterdam because of the hectic traffic. These issues are a few examples of transport poverty in Amsterdam given by the councillor of transport and traffic (Benjamin, 2023). Transport poverty is a problem in urban areas, but it is a problem as well in rural areas (van der Bijl & van der Steenhoven, 2019). Bastiaanssen (2013) shows in his research that public transport in the urban area of Rotterdam misses the connection to certain work locations. Other socioeconomic factors are of importance, such as income, health, and knowledge of the Dutch language. This can limit the opportunities for employment and participation. As they are unable to fully participate in society, they are missing opportunities with jobs, services, and social networks (Bascom & Christensen, 2017; Bastiaanssen et al., 2013). Therefore, it is harder to reconnect with society. According to Bastiaanssen et al. (2013), the chances of social integration and personal development get lower.

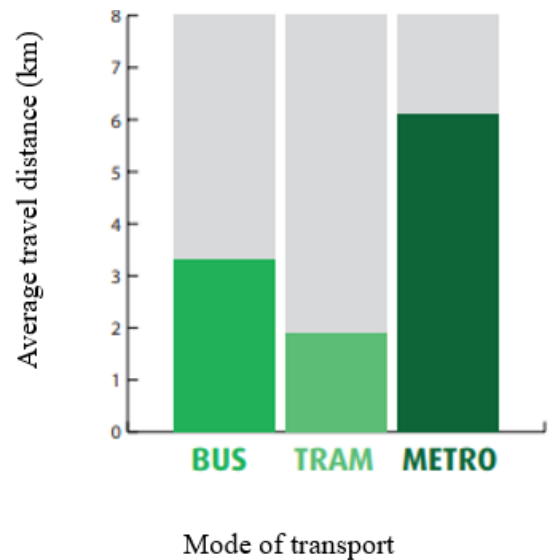
In this thesis, Rotterdam is the city to study the concept of transport poverty in an urban area. Rotterdam has the highest poverty rate of the four largest cities in the Netherlands. The population of Rotterdam has increased to 650,597 inhabitants in 2020, the forecasted population for 2035 is 694,000 inhabitants (Gemeente Rotterdam & MRDH, 2018). This growing population leads to increasing pressure on urban space and the transport system. Rotterdam faces rising visitor numbers, it is estimated that the number of hotel stays will grow from 2.04 million in 2018 to 3.4 million in 2028 (Gemeente Rotterdam & MRDH, 2018). This creates a demand for a differently designed city, with a compact environment to live, work and consume. The facilities in the city centre are not accessible to all the residents within acceptable cycling and walking distance, which makes it reliant on car use.

The municipality of Rotterdam published its vision for the future of public transport in 2018. In this vision, public transport is described as the carrier of urbanization and spatial economic development. Rotterdam and the surrounding areas are facing a huge housing task, with building 50.000 new houses. Public transport is seen as the most effective mode of transport to connect the newly built areas with the other urban areas. The municipality reckons that due to the expected growth in the number of residents, public transport will experience capacity bottlenecks between 2025 and 2030. From a financial point, the RET, which provides public transport in Rotterdam and its surroundings, earning 140 million from travellers and 200 million from the national government. This amount is not indexed but fixed, so it is not sufficient to support the expansion and extra investments in public transport. To fund future expansion of the public transport network, the municipality writes that an austerity challenge lies ahead. The



RET calculated that the travel cost per kilometre for the tram and bus are nearly the same, but for the metro, it is halved. The average travelled distance per bus is half and for the tram it is even one-third compared to the metro, as seen in figure 1. This indicated that the tram is mostly used for short travel distances. This leads to the restructuring task for the bus and tram network.

Figure 1: Average travel distance of public transport



Source Gemeente Rotterdam & MRDH (2018)

The restructuring plan is established by the MRDH (Metropool Regio Rotterdam Den Haag), in the concept vision for the future of the tram in 2030. They expect a traveller growth of 20% in 2030, at the lines that travel over long distances, to the outskirts of the city. The tram will accelerate from an average of 17 km/h to 21 km/h, as it drives over separate lanes and other technical improvements. The tram travels faster, providing better access to more jobs and services. In streets where this cannot be achieved, because the street is too small for separate lanes, the tram will be displaced.

These streets will undergo a redesign to improve road safety. As a result, the revenue created by the tram and bus will increase by 15%, because they expect that these modes of transport will attract more travellers. While the operating costs of the tram will decrease because some tramlines are cancelled. The tramlines and stops that are cancelled have a substitute by bus, tram, or metro. This is different for every line and stop, but most of the time it means that the walking distance to the alternative nearest stop increases by 200 to 800 meters, which is not a suitable substitute for everyone. The MRDH also states that cycling is an alternative to the cancelled tramlines. Because the tram tracks are removed, streets can be redesigned to be better suitable for the cyclists.

## 1.1 Societal relevance

A vital part of the urban area which enables individuals to travel around and take part in everyday activities is an extensive and robust transport network. Furthermore, a well-functioning transport system provides people access to opportunities (Lucas, Mattioli, et al., 2016). It is a means of access and participation in everyday activities like work, services, and social contacts. Upgrades of the existing facilities due through technological enhancement can improve the availability of transport. But when it comes to establishing a transport system which is pertinent to the public, it is important to realise what the desires of the public are. This should, therefore, be taken as the starting point for improvement. Research that focuses on transport experiences is important for future decisions concerning mobility and transport.

Bascom and Christensen (2017); and Bastiaanssen et al. (2013) researched the ability of residents to fully participate in society, from a transport. The research states that when the inhabitants are unable to reach their destination within time, they are socially excluded from society because they miss the connection to jobs, shops, services, and social activities. The S.E. Unit (2003) report that two out of five job seekers has difficulties with finding a job, the main obstacles are not owning a private vehicle and insufficient public transport.

The city of Rotterdam faces changes in the public transport network, which is elaborated on in the new concept plan for the tram network by the MRDH (2023). As a result, the MRDH (2023) added a remark in their concept plan for the future of the tram, this could lead to an undesired outcome for the residents as they depend on the tramline. However, it is still important for the inhabitants of the neighbourhoods that suffer from the loss of the tramline that they have good accessibility. This research will evaluate the experience of residents regarding transport poverty. Which is one of the possible effects of the changing public transport network. Therefore, this research can be used for the municipality and the MRDH to evaluate their future policy plans for the public transport network of Rotterdam.

## 1.2 Academic relevance

The research on transport poverty and social exclusion started after the 2000s (Lucas, 2012). Verhorst et al. (2023) write that over the years studies have made an effort to define transport poverty, but the terminologies in common literature are diverse and complicated. Lucas, Mattioli, et al. (2016) and Verhorst et al. (2023) address that it is complicated to appoint a single indicator of transport poverty. Because there is uncertainty whether it associates to a shortage of transport supply or the level of accessibility. Another point that Verhorst et al. (2023) make is that authors use different scale levels to measure transport poverty. Lucas, Mattioli, et al. (2016) discuss transport poverty from the perspective of an individual while Churchill and Smyth (2019) make use of the household perspective in their research.

In the studies regarding transport poverty and social exclusion, income is stated as one of the factors that contributes to this (Clifton & Lucas, 2004; Simcock et al., 2021). The main problem shown in research is that when there is not a sufficient household income. Due to this, not all transport costs can be covered, meaning that a household must make choices regarding the use of transport. Furthermore, Bastiaanssen et al. (2022); and Bastiaanssen et al. (2013) have researched the relationship between unemployment and transport poverty. They found that working locations in the periphery are not reachable by public transport and a car is needed. Giesel and Köhler (2015), Cheng et al. (2019) Van den Berg et al. (2015) have done research into the travel patterns of the elderly. Their research shows that the elderly experience a decrease in mobility because of their lower level of income and health situation. Simcock et al. (2021) and Clark and Wang (2010) describe the barriers that people with a migration background encounter with traveling. They conclude that this group is more likely to suffer from transport poverty due to lower income and language barriers. Simcock et al. (2021) identify the group of people with disabilities. Who has a higher chance of experiencing transport poverty, as walking and cycling are no viable modes of transport and public transport can be inaccessible for this group. Van der Bijl (2020) and van der Bijl and van der Steenhoven (2019) describe the low-literate people as a group that is prone to suffer from transport poverty, as they have less knowledge about the language and less digital skills to find their way into the transport system. King et al. (2022), Jeekel (2011), Bastiaanssen et al. (2013) and Bastiaanssen et al. (2022) conclude that people without a car are disadvantageous because many activities in modern society are barely possible without a private car.

In the Netherlands research on transport poverty and the consequences for the inhabitants has taken place. Bastiaanssen et al. (2013) have done research into transport poverty for the inhabitants of the urban area of Rotterdam on the south shore. Pot et al. (2020) have written about the impact transport poverty has on the inhabitants of the rural area of Zeeland in the

Netherlands. The CBS (Centraal Bureau voor statistiek) and PBL (Plan Bureau voor de Leefomgeving) have developed an indicator to measure the risk of experiencing transport poverty by collecting data about multiple indicators resulting in a calculated risk (Kampert et al., 2019). One of the recommendations that are made in this report is about the indicator that can identify the risk of transport poverty, but not the experience of transport poverty by the people, because data cannot tell how people experience it.

This research contributes to the existing research about transport poverty. The current research gives useful information about the possible factors regarding transport poverty. Which are useful for the theoretical base of this research. The current research misses knowledge about how residents experience transport poverty. It is decided to conduct further research into how residents experience transport poverty. In the KiM's (Kennisinstituut voor mobiliteitsbeleid) research on accessibility Krabbenborg and Uitbeijerse (2023) write in their recommendations for future research that a mixed method approach is recommended. The interviews are used to validate the assumptions from past research. The reason to use qualitative methods is to get a clear view of the experiences of the people regarding transport poverty to reach vulnerable groups such as the elderly and immigrants. This approach can help future policymakers to adjust their policy on transport poverty based on actual experiences instead of data based.

### 1.3 Problem definition

This thesis tries to give a theoretically grounded and empirically based insight into the expected increase in transport poverty because of the revised plans for public transport in Rotterdam. In the public transport revision plan, the MRDH (2023) stated that transport poverty might increase in certain areas, as their plans are executed. At first, the risk of transport poverty for the inhabitants of the city of Rotterdam is researched on a neighbourhood level. The risk of transport poverty on the neighbourhood level is researched with the use of several indicators derived from literature, which indicate the risk of transport poverty. The risk score of transport poverty is calculated using indicators of social- and transport disadvantage which are measured on neighbourhood level using data. The risk score model is based on the indicator developed by the CBS and PBL (Kampert et al., 2019).

Second, case study research is conducted in the neighbourhood of Bospolder Tussendijken which has a high risk of transport poverty. Krabbenborg and Uitbeijerse (2023) recommend a mixed-method approach to research the experiences of people regarding transport poverty. In this research, the case study is used to gather the actual experiences of the residents about transport poverty. Therefore, the following research question has been formulated for conducting research.

*To what extent does the downscaling of public transport lead to an increase in transport poverty in the city of Rotterdam?*

- 1. To what extent do the citizens of Rotterdam experience transport poverty?*
- 2. To what extent do the residents experience transport poverty in their neighbourhood.*

## 2. Theoretical framework

The theoretical framework addresses the key issues that appear in the central question and sub-questions. The topics to be discussed are the concept of transport poverty and social exclusion and transport justice theories. The section on defining transport poverty explores the relevant possible definition. The next part about transport poverty gives an elaboration on this topic and provides an explanation on social exclusion. The section on transport justice explores the relevant transport justice theories. The last part shows the risk factors related to transport poverty.

### 2.1 Defining transport poverty

The exact definition of transport poverty has never been given in academic literature or policy literature (Lucas, Mattioli, et al., 2016; van der Bijl & van der Steenhoven, 2019; Verhorst et al., 2023). Over the years, scholars have made an effort to define transport poverty but the terminologies used in common literature are diverse and complicated (Verhorst et al., 2023). In science, the following synonyms are used interchangeably for transport poverty, accessibility poverty, mobility poverty and transport-related social exclusion. These three synonyms are in their way related to transport poverty because definitions that emphasise the causes are more relevant to accessibility poverty and mobility poverty (Verhorst et al., 2023). Whereas definitions that mark the social impact of transport poverty are relevant to transport-related social exclusion (Verhorst et al., 2023).

Related to the concept of transport poverty are the terms, transport equity, transport equality, mobility justice and transport justice (Verhorst et al., 2023). Transport equity examines whether people have the same access to possibilities, looking at the uneven distribution of transport resources. Whereas transport equality examines how uniform transport resources are allocated across the population (Verhorst et al., 2023). Transport justice and mobility justice include the allocation component but also the process related, justice, and policy level. (Verhorst et al., 2023)

To measure transport poverty it is complicated to appoint single indicator of transport poverty. Because there is uncertainty whether it associates to a shortage in transport supply or a level of accessibility to goods, services, and daily activities. Another point that Verhorst et al. (2023) make, is that authors use different scale levels to measure transport poverty. Lucas, Mattioli, et al. (2016) discuss transport poverty from the perspective of an individual. They look at the abilities of an individual to reach their destination. Churchill and Smyth (2019) make use of the household perspective in their research. They consider the situation of the household, either if they can pay for transport, or if members of the household have difficulty finding work due to a lack of transport (Churchill & Smyth, 2019).

While there is no straight definition of transport poverty, it is hard to determine transport poverty and counteract it with policies. The definition of transport poverty mostly, is from Lucas, Mattioli, et al. (2016). In their definition, they make use of all available policies and academic literature. The definition is comprehensive and includes the negative social effects for individuals and society related to transport poverty. As a reaction to this Verhorst et al. (2023) give a basic definition of transport poverty: "*an individual's inability to fully participate in social life due to limited means of transport*". This definition briefly covers all the aspects of transport poverty and is used to revert to in this thesis.

## 2.2 Transport poverty

In the following paragraphs, the approach to transport poverty taken in this study is explained. Three perspectives on the elements causing transport poverty are presented in the next paragraphs.

In the first decade of the 21<sup>st</sup> century Lucas (2012) discussed accessibility. In the research the association between exclusion and transport is made which results in accessibility issues. The realisation for this association is triggered because, inaccessibility can be a reason, and it can be a consequence for social exclusion (Farrington & Farrington, 2005). It is concluded in the conducted research on transport-related social exclusion and transport poverty, that a part of the population has difficulties in accessing key destinations (Bastiaanssen et al., 2013).

In the previous paragraphs, transport poverty is defined by scholars with various terminologies (Verhorst et al., 2023). Mobility facilitates opportunities and access to social interactions, services, and facilities (Bascom & Christensen, 2017). The social exclusion perspective is used in this research to get a clear understanding of the consequences transport poverty might create. To provide a clear overview, the different dimensions and conceptualisations of transport poverty are explained by taking the research by Lucas, Mattioli, et al. (2016) as a base, in the following paragraphs.

Transport affordability is discussed first in this paragraph. Litman (2016) refers to transport affordability as a financial burden households experience when purchasing transportation services. Lucas, Mattioli, et al. (2016) describe this as a narrow definition of transport poverty because it only takes into consideration the disposable income of a household. It is considered that transport poverty only takes place when a household is compelled to spend more on transportation than it can afford (Litman, 2016; Lucas, Mattioli, et al., 2016). Transport affordability is measured by taking the actual transport expenses as a share of income (Verhorst et al., 2023). Litman (2016) concludes that low-income groups suffer the most from this because they cannot afford to use their preferred mode of transport. This results in stress about the required journey time, and unsafe and uncomfortable travel conditions. A tight connection is identified between transport affordability and social exclusion, as this excludes people from access to basic activities like shopping or education (Lucas, Mattioli, et al., 2016). In the worst scenario, it can lead to sacrificing essential spending on food or medicines.

The second concept related to transport poverty is mobility poverty. Mobility poverty differs from transport poverty because this relates to a regular lack of transportation and mobility options. Mobility poverty occurs when there is a lack of transit services or infrastructures, which makes it difficult for people to travel from A to B (Lucas, Mattioli, et al., 2016). It is measured by looking at the missing infrastructure or mobility services (Verhorst et al., 2023). This concept is extended by the concept of accessibility to poverty. Accessibility poverty is considered if people cannot reach their day-to-day activities within a reasonable amount of time and costs (Benevenuto & Caulfield, 2020). Accessibility is measured by assessments of the ability to reach day to day activities and destinations such as schools, hospitals, job opportunities and services (Verhorst et al., 2023).

According to Verhorst et al. (2023), accessibility is measurable in two ways, from an objective and a subjective perspective. The objective perspective of accessibility is the degree to which transport systems allows people to access activities or locations. It is reasoned that objective

accessibility is restricted in gathering accessibility for everybody. Because the perception of objective factors like travel distances and time are observed uniquely by every person. The subjective perspective of accessibility also referred to as perceived accessibility, is based upon the travel experiences and opinions of people. Lättman et al. (2018) mention that people perceive accessibility differently, because of which travel options are known to them or have their interest. Lättman et al. (2018) introduced the concept of perceived accessibility as a concept that reflects an individual's ability to reach locations and participate in activities using the transport system. It considers the individual dimension that has been overlooked when using objective accessibility. Lättman et al. (2018) write that perceived accessibility is influenced by the concerns about safety of people. The safety concerns might influence someone's perception of accessibility. Pot et al. (2020) shares their opinion about safety. Contextual factors such as safety on the road influence the perceptions of the travel experience.

The overview of the causal factors of transport poverty provides a good starting point for this research. However, there are other ways of conceptualising transport poverty and its links with other concepts. The causal factors which are discussed in the above paragraphs overlap with the three perspectives on transport poverty that Jorritsma et al. (2018) appoints. Jorritsma et al. (2018) share in their literature review the perspectives of social exclusion, motility, and justice, which all share a common denominator of transport-related social exclusion. Social exclusion is a consequence of transport poverty. Jorritsma et al. (2018) write that transport poverty is either the result of insufficient transport opportunities, and abilities or unequal opportunities for participation for certain socio-demographic groups.

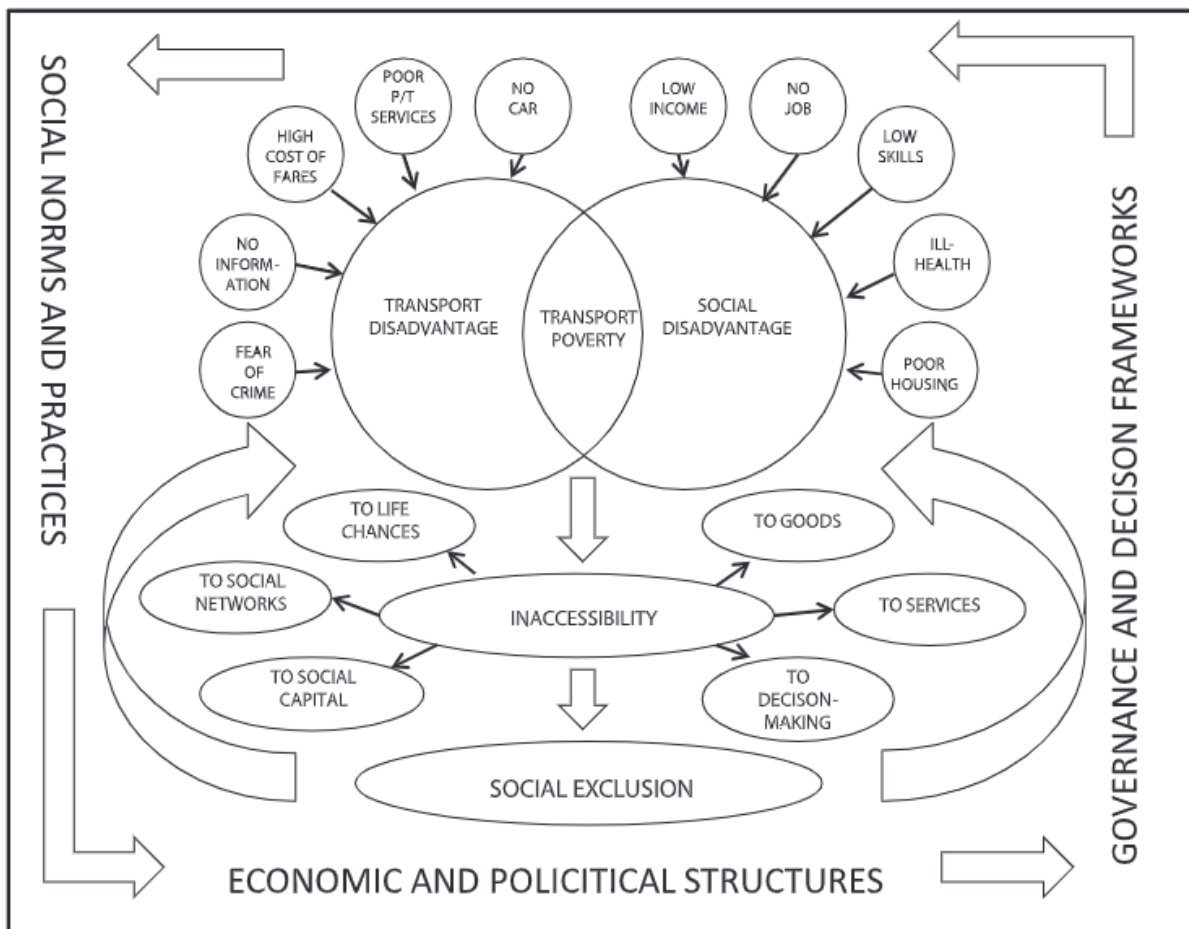
#### *Social exclusion perspective*

According to Lucas, Mattioli, et al. (2016) it helps to identify groups in society that lack resources to reach crucial activities to support life-changing events. These identified social groups miss events such as employment, health, or education. Accessibility poverty is related to social exclusion, this is discussed by Lucas, Mattioli, et al. (2016), because it excludes groups from participating in society due to the absence of transport. The overarching concept that is used in this research is the limited means of transport that prevent an individual from participating fully in social life. As a result of limited means of transport, someone is restricted from participating in society and economic activities, this is called social exclusion.

In the previous paragraphs, it is discussed that transport poverty results in social exclusion. This is displayed in figure 2, the social exclusion perspective describes a relationship between transport disadvantage, social disadvantage, and transport poverty (Lucas, 2012). Transport disadvantage is in this perspective first seen as the result of poor demand for transport options; not owning a car, and poor demand for public transport. Second, it is the result of social disadvantage, such as low income, bad health, unemployment, and low level of education. Both concepts work together, directly, and indirectly, resulting in transport poverty. This leads to the inaccessibility of essential goods, services, social networks, and social capital which can result in social exclusion (Lucas, 2012).



Figure 2: the relationship between transport disadvantage, social disadvantage, and social exclusion



Source Lucas (2012)

Church et al. (2000) describes seven characteristics of transport systems that contribute to the social exclusion of certain groups of the population. At first, the exclusion of services, the distance from home to services such as shops, schools, healthcare, or leisure is a barrier. Currie and Delbosc (2010); Giesel and Köhler (2015); Simcock et al. (2021) have found signs of vulnerable groups in society that experience difficulties in reaching certain services. Second, economic exclusion, the costs of transport limit the access to jobs or services. Clifton and Lucas (2004); and Simcock et al. (2021) confirm in their research that people with a low-income struggle with the excessive costs of transportation. Third, Church et al. (2000) describes, time-based exclusion, when the combination of work, household tasks and childcare restrict the ability to travel. Verhorst et al. (2023) write in their research about the restrictions that time has on the ability to travel. Fourth, physical exclusion, when the design of a vehicle, the absence of amenities for people with disabilities or the lack of a timetable hinders the usage of transport services. In the research from Currie and Delbosc (2010); Giesel and Köhler (2015); Simcock et al. (2021) people with physical disabilities were mentioned as a group that struggles with the usage of transport. The fifth is geographical exclusion, the residential location, at the countryside or a peripheral city location could limit access to the transport service. Bastiaansen (2012); Currie and Delbosc (2010); and Giesel and Köhler (2015) write about the people living at peripheral locations, which are not well served by transportation services. The living location influences people's ability to travel. Sixth spatial exclusion, when certain groups are hindered

from using the public space, for example, gated communities or first-class waiting areas (Church et al., 2000). At last, exclusion based on fear, when people fear for their safety, and are not likely to use public space and thus transport systems. Lättman et al. (2018); and Pot et al. (2020) have both found in their research that safety concerns influence the perceptions of accessibility.

In addition to these characteristics, van den Broeck and van Os (2015) define two extra dimensions which are seen as barriers to take part in mobility. When people have a limited social network, they have less access to help and knowledge from their social network about transport. The second addition is when people have fewer personal skills in mobility, when they for example they cannot manage all the different public transport subscriptions or check the route online.

For Stanley et al. (2011) social exclusion is not the capstone, they see that exclusion is followed by the lack of well-being. Wellbeing depends on participation in society, access to daily needs and social interaction. Currie and Delbosc (2010) agree with Stanley et al. (2011) as they argue, when the mobility of an individual is restricted the quality of life suffers. They make another sidenote to this argument; limited transport access does not mean that a person suffers from transport-related exclusion. Someone can be socially excluded and have access to transportation, or on the other hand, have limited transportation options and fully participate in society. Ziegler and Schwanen (2011) agree with this argumentation, as they write that the expectations of individuals change according to their abilities. When an individual loses the ability to drive, due to a worsening health condition, this individual might change their travel expectations and keep a positive travel satisfaction.

## 2.3 Transport justice theories

Transport poverty can be explored from a transport justice perspective. The transport justice perspective is based on the underlying idea of equal chances to access transport for everyone in society. Transport justice theories explore transport-related disadvantages and their relationship with poverty from the perspective of inequality (Jorritsma et al., 2018). Those who adhere to this vision, think that policy should be focussed on giving the biggest advantage to the least privileged in society.

The first theory that is discussed by Pereira et al. (2017) is utilitarianism, it provides the basis for the cost-benefit analysis. It is based on three assumptions, which give structure to their understating of justice. At first, human well-being is the core of justice concerns, because it is the only thing with intrinsic value. Second, the principle of equal respect, means that everybody's welfare and interest are equally important. Third, the policy judgement is solely based on its consequences, and on the following, how it maximises well-being. As a result, this theory simply chooses the policy that maximises the welfare for the greatest amount of people.

Furthermore, Pereira et al. (2017) discuss egalitarianism. This theory of justice from Rawls (Hare, 1973), states that every human should be treated equally (Lucas, Van Wee, et al., 2016; Pereira et al., 2017; Van Wee & Geurs, 2011). The first principle applies to the basic rights and liberties being applied equally to everyone. If this does not infringe on the freedom of others, individuals should have as much freedom as possible. The second principle concerns the distribution of primary goods, which are necessary for the pursuit of citizens' life plans.



Lucas, Van Wee, et al. (2016) state that although Rawls never explicitly identified accessibility as a primary social good. Lucas, Van Wee, et al. (2016); and Van Wee and Geurs (2011) think that goods such as transport and accessibility have socially constructed meanings. The use of egalitarian theories to assess the equity of different transport policies justifies moving away from travel time savings as the primary evaluation method towards accessibility to basic services. (Lucas, Van Wee, et al., 2016). (Lucas, Van Wee, et al., 2016) give an example, from this point of view the benefits of a bus service that improves the accessibility of unemployed young people to get to relevant job opportunities, are valued higher than the total travel time saved by the entire population using that bus.

Sufficientarianism is another theory that is discussed, whereas the focus of egalitarian theories is on differences between people, sufficientarianism assumes that up to a minimum threshold, everyone should be well off (Van Wee & Geurs, 2011). Which is for the satisfaction of their basic needs and the maintenance of their well-being. Concerning transport poverty Jorritsma et al. (2018) and Van Wee and Geurs (2011) state that sufficientarianism refers to a minimum threshold level of accessibility to key destinations that need to be provided. Lucas, Van Wee, et al. (2016) add to this a minimum level of transport goods, services, and accessibility to essential activities. In addition to this minimum level of accessibility Van Wee and Geurs (2011) state that this level should not get below the threshold.

In the above paragraphs, an overview is given of the transport justice theories that exist. In the last decades, the traffic and transport policy has focussed on an efficient and effective mobility system, which relates to utilitarianism, while the social effects in terms of justice are neglected (Jorritsma et al., 2018). The report from Jorritsma et al. (2018) advocated for a mobility policy focussed on guaranteeing justice, with sufficient accessibility for every citizen.

### *Motility*

Kaufmann et al. (2004) introduces the concept of motility, as a reaction to the research on mobility (Bastiaanssen, 2012). The previous research on mobility focussed on studying the movements in time and space, it does not consider the interaction between social, cultural, economic, and political processes that influence mobility. In response to this Kaufmann et al. (2004) advocates for mobility studies looking at the potential mobility, which looks at the interacting processes and structures affecting mobility. Motility includes how they interpret and act on possibilities in terms of mobility, and how they respond to them for the activities they wish to pursue. Three interrelated dimensions have an impact on motility.

Access refers to the range of movements concerning location, time, and other contextual constraints (Kaufmann et al., 2004). For example, household composition can influence the options for movement. When one of the parents must take care of a child, this restricts the movement options. Access depends as well on the spatial distribution of the population and infrastructure (Bastiaanssen, 2012; Kaufmann et al., 2004).

Competence comprises skills and abilities which can be directly or indirectly related to access and appropriation. Physical ability acquired skills and organisational skills are three factors which are central to competence (Bastiaanssen, 2012; Kaufmann et al., 2004).

Appropriation refers to how individuals act upon their perceived access and skills available to them. It is shaped by the understandings, ambitions, and plans, and relates to motives and habits. It is the action perspective of an individual. When an individual has the idea that a certain mode

of transport is not appropriate for their need for transport, he does not make use of this mode of transportation (Kaufmann et al., 2004). It depends on the compromises made between ambition, activities, and lifestyle according to (Bastiaanssen, 2012); Kaufmann et al. (2004)

Bastiaanssen (2012) used the concept of motility in his research on the effect of transport poverty on unemployment. He approached transport poverty from the perspective of motility, which meant that having not enough motility, decreased mobility and increased the risk for social exclusion for an individual. The concept of motility approaches transport poverty from the perspective of an individual who is missing the ambition to travel (Bastiaanssen, 2012). This is a new perspective that is important to take into consideration for this research.

## 2.4 Risk factors related to transport poverty

In the previous paragraphs, the different perspectives on transport justice have been examined. In the upcoming paragraphs, several risk indicators that are related to transport poverty will be discussed. The risk factors related to social exclusion are discussed by taking the different concepts of transport-related social exclusion from Church et al. (2000) as the starting point. Former research has concluded that several groups in society have a higher risk of experiencing transport poverty. Church et al. (2000) have identified seven characteristics of the transport system that contribute to and are associated with excluding certain population groups. The characteristics of Church et al. (2000) and the relation to transport-related social exclusion will be further elaborated in the next paragraphs. Different population groups are likely to experience transport poverty. A combination of factors influences this, and these factors are interrelated.

The first characteristic that Church et al. (2000) define is physical exclusion. It is related to the design of a vehicle, the absence of amenities for people with disabilities or the lack of a timetable hindering the usage of transport services. Next to physical accessibility, it is also related to the health condition of an individual. People with disabilities due to their health status, have a higher chance of experiencing transport poverty (Simcock et al., 2021). They have a more pronounced disadvantage in terms of transport. Walking and cycling are not viable modes of transport for this group. They are placed in a disadvantageous position because walking and cycling are cheap modes of transport. The use of public transport, taxi service or a specially modified private vehicles brings extra costs to it. Simcock et al. (2021) mention that people with disabilities also have problems with the running costs of a private car, particularly when special modifications are needed. In addition, they face barriers to using public transport due to the lack of accessibility and the inadequate provision of information (Simcock et al., 2021).

The health condition that is described in the previous paragraph is an example of physical accessibility. Next, other socioeconomic factors can have an impact on the mobility of an individual and hinder participation in society. Age is one of them, Giesel and Köhler (2015) conducted research in Germany, and their results show that travel patterns of elderly people differ according to their level of income and gender. Simcock et al. (2021) mention that older people are vulnerable to transport poverty due to low income and decreased mobility. This means that walking and cycling are less likely to be viable options and results in a higher reliance on public transport. This is also the case if the elderly are no longer allowed to drive a car.

One of Giesel and Köhler (2015) findings is that elderly people at risk of poverty, travel less compared to the elderly with higher income. When Giesel and Köhler (2015) looked at gender differences they noticed that elderly women made fewer and shorter trips compared to men. 47% of elderly women at risk of poverty had access to a car and only 8% had public transport season tickets. Having access to a car for older women corresponds to the low rate of 40% of having a driving licence. The S.E. Unit (2003) concludes that the elderly are not capable of reaching their destination because they are intimidated by busy and noisy roads and a lack of safe crossings. They are not capable of reaching their destination because they fear accidents.

When people get older, they tend to make shorter trips, as the study from Arentze et al. (2008) shows that the elderly choose a nearby destination. As the elderly get older, they stay more at home. Within the age group of 55-64 years old, 83% make a trip a day. The trip-making declines as they get older. Of the people who are 75+, only 62% make a trip. The trip-making of the elderly is different compared to other groups. Cheng et al. (2019) write that the elderly are not constrained to working commutes and are making more leisure and social trips. As their social pattern has changed, they are not bound to a specific time anymore (Van den Berg et al., 2015). Their different schedule makes that they have more freedom in choosing when to travel.

In addition to the factors of health condition and age, which are described as examples of socio-economic factors that can have an impact on the mobility of an individual and hinder participation in society, is migration background. People with a migration background are an example of a group in society that is hindered in their accessibility. This is because of several reasons, at first people with a migration background tend to have a low income (Simcock et al., 2021). In addition to this, they can face barriers to owning a private vehicle and the ability to drive (Clark & Wang, 2010; Simcock et al., 2021). Next to this use of public transport is more complicated as they experience language barriers and other taken-for-granted competencies. Simcock et al. (2021) mention that ethnic minorities live in areas with poor public transport.

Another socio-economic factor that can have an impact on the mobility of individuals and hinder participation in society is the level of education. Low-literate people and people with low education are prone to suffer more from transport poverty (Van der Bijl, 2020; van der Bijl & van der Steenhoven, 2019). Low-literate people have less access to public transport as they do not have enough knowledge about the language to find their way in the transport system. Public transport information has been digitalised over the last few years. This means that people with fewer digital skills are restricted in their possibility to access public transportation. Less digital, financial barriers to purchase a smartphone and the ability to download and install the software, all influence the access of public transport and other modes of transport.

In their research, Church et al. (2000) defines two other characteristics, geographical exclusion and exclusion from facilities. The first type of exclusion is defined as when a residential location at the countryside or a peripheral city location could limit access to the transport service. The second is defined as when the distance from home to services such as shops, schools, healthcare, or leisure is a barrier. In their research van der Bijl and van der Steenhoven (2019) write that distance and barriers to travel have an impact on the ability to move around, as they make it more difficult to get where you want to go. Verhorst et al. (2023) state that the perception of objective factors like travel distances and time are perceived uniquely by every person. To include individuals' ability to reach locations and participate in activities using the transport system, the concept of perceived accessibility was introduced (Verhorst et al., 2023). In

addition, the two characteristics described at the beginning are spatial exclusion. When certain groups are hindered from using public spaces, for example, gated communities or first-class waiting areas (Church et al., 2000).

Time-based exclusion is another characteristic that is defined by Church et al. (2000). This occurs when the time to travel is reduced by work, household, and childcare duties. It is also referred to as time poverty when an individual spends an excessive amount of time on travel. Women are more affected by this because they are more often responsible for taking care of the children and the household (Turner & Grieco, 2000).

Following this characteristic is, fear-based exclusion, when people fear for their safety, they are not likely to use public space and thus transport systems (Church et al., 2000). The feelings of safety and security depend on the perceptions of an individual (Lättman et al., 2018). Contextual factors such as safety on the road influence the perceptions of the travel experience (Pot et al., 2020).

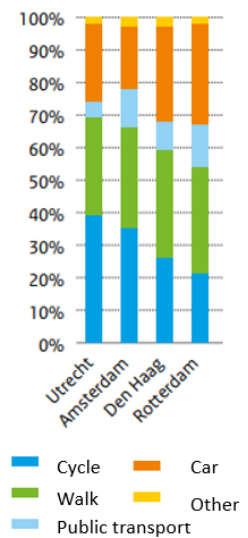
Another characteristic that Church et al. (2000) define is economic exclusion. When the costs of transport limit the access to jobs or services. This is influenced by the level of income. Clifton and Lucas (2004) state that low income influences the way people travel. People are unable to reach certain places as offices, factories, stores, or hospitals, because they cannot afford it. Simcock et al. (2021) write that low-income households are unable to afford the costs of running and maintaining a vehicle or paying for the public transport fares. This forces them to make spending sacrifices elsewhere in their budget. Trade-offs between housing and transport costs are often made by households, more central locations tend to have better accessibility and lower transportation costs, but the housing costs are higher (Isalou et al., 2014).

The lowest income groups are less likely to own a car and are designated to public transport. The costs of buying a vehicle are high and the upkeep is even as expensive. This is a burden for low-income households to buy and pay the maintenance costs of a car (King et al., 2022). It can cause accessibility problems when these areas are poorly served by public transport (Simcock et al., 2021). As people cannot access better job opportunities, they cannot earn higher incomes, which can lead to a vicious circle, which means they are trapped in the poverty circle.

A group of society that struggles with transport poverty is the unemployed. The unemployed cannot afford a car and are designated to public transport which is inadequate (Bastiaanssen et al., 2013), two out of five job seekers are having difficulties with this. Bastiaanssen et al. (2022) noticed the increased need to travel due to the organisation of firms and services in larger units to decentralised locations, partly in response to society becoming more dependent on privately owned motor vehicles. This led to an increase in services and shops located outside the city centres, such as hospitals, which merged and concentrated on the outskirts next to highways (Jeekel, 2011). Over the past decades, employment has decentralised to the outskirts of cities, and passenger transport has individualised with more privately owned vehicles, in addition to this public transport services were concentrated more in the urban centre (Bastiaanssen et al., 2022). It is concluded that activities in modern society are barely possible without a private car (Jeekel, 2011). People who own a car are in advantage compared to the carless, need to work harder and pay higher costs to get to the same destination with public transport compared to people owning a private car (King et al., 2022).

In the Dutch context, three main findings are of interest; job seekers have less chance to find a job due to limited public transport, and this research was conducted in the South of Rotterdam (Bastiaanssen et al., 2013). The second finding; people without a private vehicle are unable to visit family and friends who live in rural areas. They depend on public transport or travelling by bike, which is not an option for these places as they are not easily accessible by these means of transport (Martens, 2013). It is often thought that the risk of transport poverty is low in the Netherlands, because it is known as a bicycle country (van der Bijl & van der Steenhoven, 2019). When looking at the modal split of the four biggest cities in the Netherlands in figure 3, it is seen that a quarter of all the trips are done by bike. But for an equal or even greater proportion, the car is used. In Rotterdam, more trips are done by car compared to cycling. The maximum range of the bicycle is set at 7,5 km, which is not far enough to access all employment opportunities. In practice, the average daily cycling distance is around 3 km (Schaap et al., 2015). In the research from van der Bijl and van der Steenhoven (2019), it is stated that bicycle ownership among middle and high incomes is much higher than among low incomes. The cyclists that use the bicycle path must share their space with new users, electric bicycles, fat bikes and shared mopeds. This leads to more intense usage of the bicycle lane and creates more conflict between users. In the worst case, this leads to more accidents between the different users due to their speed differences (Schaap et al., 2015).

Figure 2 Modal Split



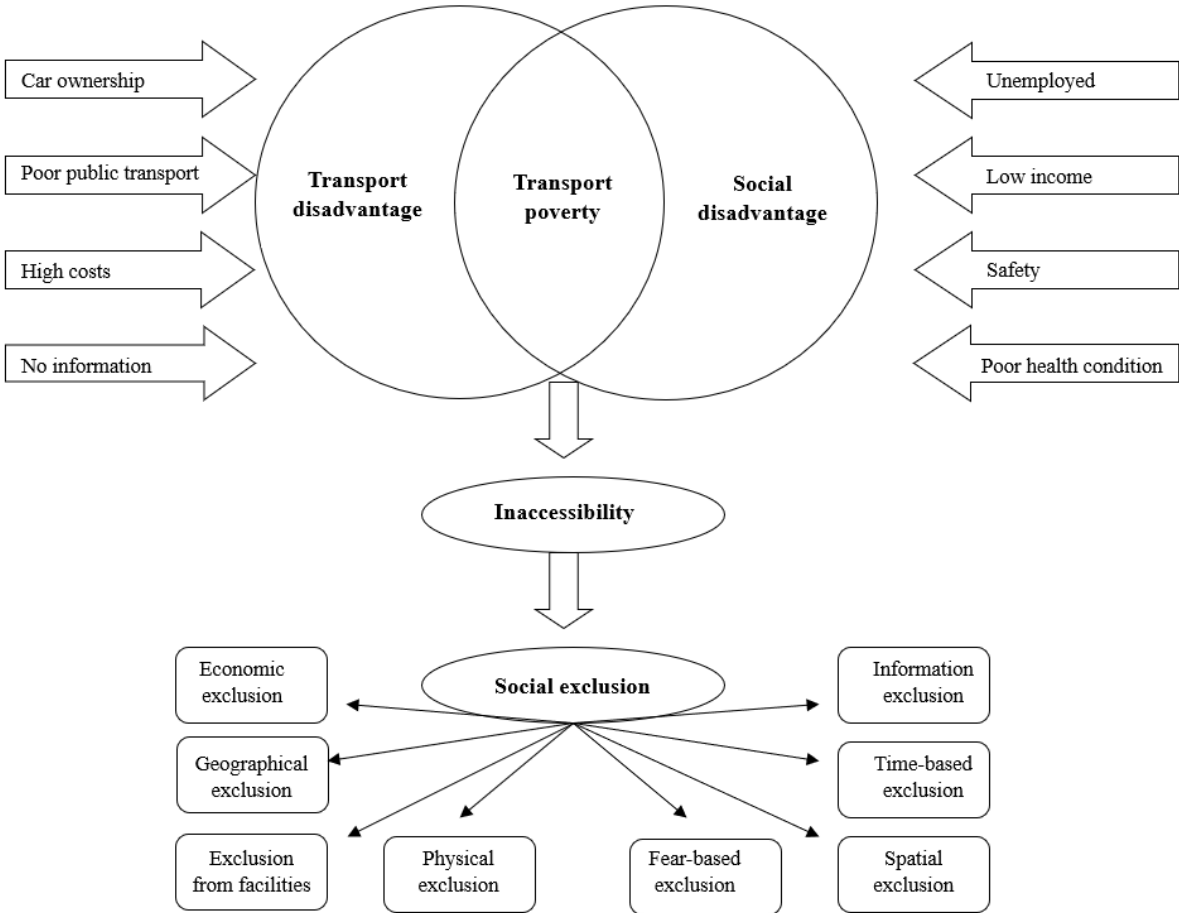
Source Schaap et al., 2015

On the other hand, Simcock et al. (2021) notice that the unemployed tend to travel less because they do not have to commute to work. Thus, they experience lower travel costs. In addition to this, Simcock et al. (2021) mention that low wage or precarious employment is a risk factor for transport poverty. In this case, people earn a low income and have higher transport costs due to commuting. This is also the case when a person has a precarious job (not a fixed location or hours) contributing to higher commuting costs.

## 2.5 Conceptual model

The most important concepts from the literature are discussed in the theoretical framework. To operationalize these concepts a conceptual model is created. The conceptual model is a visual representation of the relations between the most important concepts. The conceptual model forms the basis for further research. The first part visually displays all the indicators of transport poverty. Based on these indicators the risk of transport poverty is measured. The second part of the model displays the social exclusion that follows transport poverty. This is used for the second part of the research when interviews about the experiences of transport poverty are conducted.

Figure 4 Conceptual Model



Based on Lucas (2012)

Based on the literature review the most influential factors for experiencing transport poverty are compiled. To answer the main- and sub-questions a clear overview of all the concepts and their relations is displayed in the conceptual model. The concepts that influence transport poverty are divided into two sides, transport disadvantage and social advantage (Lucas, 2012), which can be seen in figure 4. Transport disadvantage is the result of poor availability for transport options. At first, the ownership of a car or bike is an advantage compared to the carless as King et al. (2022) describe. Poor public transport can be seen as a lack of transportation options, this is explained by Lucas, Mattioli, et al. (2016) with the concept of mobility poverty.

Costs of transportation, tie in with transport affordability that Litman (2016) and Lucas, Mattioli, et al. (2016) refer to when a household experiences a financial burden when purchasing transportation services. No information, referred to by Van der Bijl (2020) and van der Bijl and van der Steenhoven (2019), when people have less access to public transport as they experience language barriers or have less developed digital skills.

Social disadvantage is the second factor which influences transport poverty and is displayed on the right side of figure 4. At first, unemployed people are prone to suffer from transport poverty as is concluded by Bastiaanssen et al. (2013) and Bastiaanssen et al. (2022). Second, a low income can lead to a higher chance of experiencing transport poverty, as described by Clifton and Lucas (2004) and Simcock et al. (2021). Ill health is the fourth indicator that influences the risk of experiencing transport poverty, as stated by Simcock et al. (2021). All the indicators from the transport disadvantage and the social disadvantage led to transport poverty which can lead to inaccessibility and in the end to social exclusion (Van der Bijl, 2020; van der Bijl & van der Steenhoven, 2019).

In this research social exclusion is seen as the result of the inaccessibility of people which is caused by transport poverty. Social exclusion can be experienced in many ways, based on the theory eight differentiations are found. The first one, economic exclusion, occurs when the excessive costs of transport limit access to services or other destinations (Clifton & Lucas, 2004; Simcock et al., 2021). Second geographical exclusion is a result of limited access to transport services because his residential location is in the countryside or a peripheral location (Currie & Delbosc, 2010; Giesel & Köhler, 2015). Third, the exclusion from facilities occurs when the distance from home to services such as shops, schools, healthcare, or leisure is a barrier (Currie & Delbosc, 2010; Giesel & Köhler, 2015; Simcock et al., 2021). Physical exclusion can be the result of the absence of amenities for people with disabilities the lack of a timetable, or when the design of a vehicle hinders the usage of transport services (Currie & Delbosc, 2010; Giesel & Köhler, 2015; Simcock et al., 2021). Fear-based exclusion occurs when people do not use public spaces and transport systems because they fear for their safety (Lättman et al., 2018). Spatial exclusion is something that occurs when certain groups in society are hindered from using public space, for example, gated communities or first-class waiting areas (Church et al., 2000). Furthermore, exclusion based on time occurs when a combination of work, household tasks, and childcare restricts the ability to travel (Church et al., 2000). Last, information exclusion is when people are excluded from transportation systems as a result of the lack of information access, as a schedules and a map.

### 3. Methods

This research aims to gain insight into the increase of transport poverty in Rotterdam due to the revision of public transport for the urban region. To obtain a good overview of the increase in transport poverty for Rotterdam, a model is set up to measure the risk of transport poverty at a neighbourhood level. Furthermore, the indicators that are derived from the conceptual model will be clarified in this methodology. A brief description of the study area and the context is given, and afterwards, the case selection is done. The decision for qualitative research and the data gathering is explained. In the end, the interview design and validity are further elaborated on.

#### 3.1 Risk of transport poverty model

The first process of analysing transport poverty will be done by setting up the risk of the transport poverty model. With setting up the transport poverty risk model the report from Kampert et al. (2019) is used as a basis for the model. This quantitative method is using neighbourhood-specific data for all neighbourhoods in Rotterdam. To make an indication of the risk of transport poverty in every neighbourhood of Rotterdam. The data on which the model is built is retrieved from the Dutch statistical agency (CBS). This open database contains publicly available information and statistics on the level of neighbourhoods.

The datasets involved in this model comprise the Neighbourhood statistics ("Wijk- en buurtstatistieken") and the proximity services ("Nabijheid voorzieningen"). The most recent and complete data from both datasets is used. The used data is from 2021 because these datasets were complete at the moment of the research. The datasets are transformed and ordered in Microsoft Excel, afterwards the datasets are loaded in SPSS, which is used to conduct statistical analyses.

For each variable, a classification into four classes is made. The lowest class (score 1) contributes the least to the risk of transport poverty, while the highest class (score 4) contributes the most. The different classes and associated scores are visible in table 1. The classes are based on a quadruple of all the neighbourhoods of Rotterdam. The single indicator 'risk of transport poverty' was compiled by taking the unweighted average scores of the variables; residents aged older than 65, low-income households, unemployed residents, social housing, car ownership, residents with a disability, residents with a non-western migration background, distance to the nearest public transport hub, distance to the nearest, school, supermarket and general practitioner. It is decided to include all variables with equal weighting because it is unknown which variables weigh more, as this was not specified in the literature.

Five equal quantiles are created from the calculated risk scores. They are ranked from very low to very high. With the use of ArcMap, the risk scores are visually displayed on the neighbourhood map of Rotterdam. The calculated risk scores can be viewed in appendix 1.

#### 3.2 Operationalisation

To answer the main and sub-questions in this study, the concepts from the conceptual model must be operationalized. Then, by reducing these concepts to measurable indicators, the concepts are made measurable, and analyses can be performed. Each concept can be measured



from one or multiple indicators. The indicators are then incorporated into measurable units. This operationalization can be found in table 1.

#### *Residents aged older than 65.*

The elderly are at risk of experiencing transport poverty, this is concluded by Giesel and Köhler (2015). They have found that the travel patterns of the elderly differ according to their level of income and gender. Simcock et al. (2021) concluded that the elderly are vulnerable to experiencing transport poverty as they have decreased mobility and a low income. This means that walking and cycling are less viable options and results in a higher reliance on public transport. The S.E. Unit (2003) mentions that the elderly are unable to reach their destination as they are intimidated by busy and noisy roads and the lack of crossings.

#### *Low-income households*

Clifton and Lucas (2004) state that low income influences the way people are travel. People are unable to reach certain places as offices, factories, stores, or hospitals, because they cannot afford it. Simcock et al. (2021) write that low-income households are unable to afford the costs of running and maintaining a vehicle or paying for the public transport fares. This forces them to make spending sacrifices elsewhere in their budget.

Low-income groups are less likely to own a car and are designated to public transport. This can cause accessibility problems when areas are poorly served by public transport (Simcock et al., 2021). When people are unable to reach better work opportunities, they are unable to earn higher incomes. It can lead to a vicious circle which means that they are trapped in the poverty cycle.

#### *Unemployed residents*

Unemployed are a group in society that struggle with transport poverty. They are unable to afford a car and are designated to public transport, which is inadequate (Bastiaanssen et al., 2013). Because of inadequate public transport two out of five job seekers are having difficulties with finding a job (Bastiaanssen et al., 2013).

Simcock et al. (2021) notice on the other hand that the unemployed tend to travel less because they do not have to commute to work. Thus, they experience lower travel costs. In addition to this, Simcock et al. (2021) mention people with low wages or precarious employment are a risk factor for transport poverty. People earn a low income and have higher transport costs due to commuting. Whereas a precarious job (not a fixed location or hours) can contribute to higher commuting costs.

#### *Social housing in the neighbourhood*

Trade-offs between housing and transport costs are often made by households, more central locations tend to have better accessibility and lower transportation costs, but the housing costs are higher (Isalou et al., 2014). Lucas, Mattioli, et al. (2016) write that in urban areas, poor people are most likely to live in peripheral areas on the outskirts of cities, with low amenity value, few local job opportunities and where local services and basic facilities are lacking.

#### *Households without a car*

King et al. (2022) describes the poverty of the carless, the carless need to work harder and pay higher costs to get to the same destination with public transport compared to the owners of a private vehicle. The costs of buying a vehicle are high as is the upkeep, which is a burden for low-income households. Bastiaanssen et al. (2022); (Bastiaanssen et al., 2013) conclude in their research that it is harder for people to find a job when they do not own a car. Jeekel (2011) has concluded that activities in modern society are barely possible without a car, as these activities are concentrated on the outskirts of the city centres.

*Residents with a disability*

Simcock et al. (2021) write that people with disabilities have a higher chance of experiencing transport poverty, as walking and cycling are not viable for this group. In addition to this, they face barriers to using public transport, due to the lack of accessibility. Next to this Simcock et al. (2021) mention that people with disabilities experience problems with running costs of a private car, especially when modifications are needed.

*Residents with a non-western migration background*

People with a migration background are likely to suffer from transport poverty due to several reasons. At first, they tend to have a lower income (Simcock et al., 2021) and face barriers to owning and driving a car (Clark & Wang, 2010; Simcock et al., 2021). Simcock et al. (2021) mention that the use of public transport is more complicated as they experience language barriers and other taken-for-granted competencies.

*Distance to nearest public transport hub.*

Church et al. (2000) describes geographical exclusion, as when a residential location is located in the countryside of a peripheral city location this could lead to limited access to transport services. In their research van der Bijl and van der Steenhoven (2019) write that distance and barriers to travel have an impact on the ability to move around, as they make it more difficult to get where you want to go. Verhorst et al. (2023) state that the perception of objective factors like travel distances and time are perceived uniquely by every person.

*Distance to nearest general practitioner, supermarket, and school.*

Church et al. (2000) describe exclusion from facilities when the distance from home to shops, schools, healthcare, or leisure is a barrier. When a transport system is lacking to provide this, exclusion to services arises. In their research van der Bijl and van der Steenhoven (2019) write that distance and barriers to travel have an impact on the ability to move around, as they make it more difficult to get where you want to go. Verhorst et al. (2023) state that the perception of objective factors like travel distances and time are perceived uniquely by every.

*Table 1 Operationalisation*

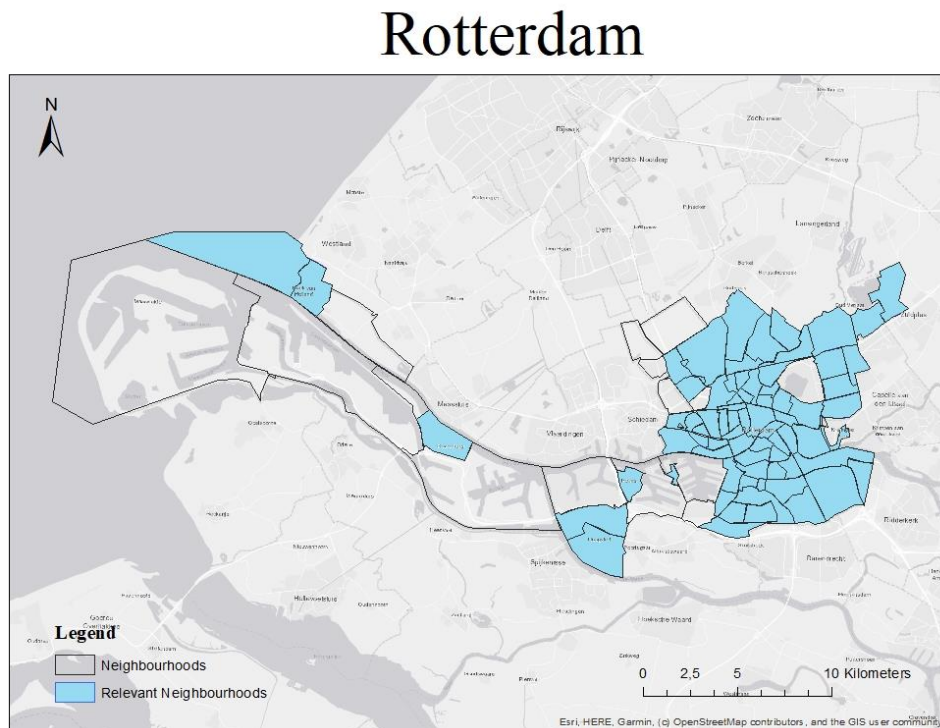
<b>Variable</b>	<b>Score</b>	
Percentage of residents aged >65.		This variable concerns the share of all residents older than 65 years old.
<11.03	1	
11.04-14.44	2	
14.45-18.10	3	
18.11>	4	
Percentage of households with low income		The variable is based upon the share of households in the neighbourhood
<10.30	1	

10.31-21.70 21.71-26.90 26.91>	2 3 4	that earn 120% of the social minimum.
Percentage of employed residents. 70.01> 70-64.01 64-60.01 <60	1 2 3 4	The variable is composed of the share of the employed labour force in the population (employed and non-employed) in a neighbourhood.
Percentage of social housing in the neighbourhood <20 20.01-47 47.01-60.00 60.01>	1 2 3 4	The variable consists of the number of rental houses owned by authorized public housing institutions per neighbourhood.
Percentage of households with a car 0.81> 0.61-0.8 0.51-0.6 <0.5	1 2 3 4	The variable is based upon all the registered motorized vehicles per household in a neighbourhood.
Percentage of residents with a disability <4.81 4.82-7.33 7.34-9.71 9.72>	1 2 3 4	The variable is compiled by looking at the households that are supported in the social support act (WMO). When a household has this indication the chance of having a member with a disability is higher.
Percentage of non-western immigrants <23.91 23.92-38.77 38.78-51.17 51.18>	1 2 3 4	The variable concerns the percentage of residents with a migration background whose group of origin is one of the countries in the continents of Africa, Latin America, and Asia (excluding Indonesia and Japan) or Turkey
Distance to the nearest public transport hub. <1.6 1.61-2.4 2.41-3.3 3.31>	1 2 3 4	The variable shows the average distance to the nearest transport hub.
Distance to the nearest GP. <0.4 0.41-0.6 0.61-0.8 0.81>	1 2 3 4	The variable shows the distance nearest to general practitioner
Distance to nearest supermarket. <0.3 0.31-0.5 0.51-0.7 0.71>	1 2 3 4	This variable shows the distance to the nearest supermarket
Distance to nearest school. <0.4 0.41-0.5 0.51-0.7 0.71 >	1 2 3 4	This variable shows the distance to the nearest school

### 3.3 Study Area

Covering an area of 324 km<sup>2</sup>, the municipality of Rotterdam encompasses 92 neighbourhoods. The city is located at the river the Nieuwe Maas, which is fed by water from the Rhine. The port of Rotterdam has been the largest in the world, but for the moment is the largest port in Europe. It is the second largest city in the Netherlands by population, with 664.311 inhabitants living in the city. Because of the port, Rotterdam has the image of a working-class city with a diverse population.

Figure 5 Map municipality of Rotterdam



Source own work.

Because several neighbourhoods are sparsely populated, it is chosen to drop the neighbourhoods with less than 350 inhabitants. The risk factor of these neighbourhoods would be invalid as insufficient data is available about these neighbourhoods. The neighbourhoods that are excluded from the analysis are in most cases industrial and harbour sites. This meant that 18 neighbourhoods have been removed from the dataset. The 75 neighbourhoods that are included, are shown in figure 5 above.

### 3.4 Qualitative research

To research the experience of transport poverty of the residents in the neighbourhood, a qualitative approach is used. Semi-structured interviews are held in the neighbourhood. Instead of just reporting the travel features, the goal is to explore the experiences and perspectives of a varied group of residents. The interview is not seen as a representation of all the residents in the neighbourhood, but it is intended to provide an understanding of their perspective on transport poverty. Therefore, participants are asked questions regarding the travel disadvantages they encounter, factors which influence their choice of transport and motivation for non trip making. Additional travel features and travel needs are asked to understand the effects of transport poverty.

Qualitative research is a helpful method for exploring behaviours and motivations as well as people's different experiences and meanings (Hay, 2016). In July and August, a total of twelve in-depth (semi-structured), face-to-face interviews were conducted held with the research population. Every interview has a length of 10 to 20 minutes and is conducted in person.

A semi-structured form is followed in this research. In every interview a topic list is used. This is an organised and orderly way of asking questions, but it allows for the interviewing to be flexible. Questions and concepts which are important to this study's central question will be in place. All the important concepts derived from the conceptual model will be mentioned during the interviewing. However, the order of topics may vary during every interview, as the interviewer is guided by the narratives told by the participant's (Hay, 2016).

### 3.5 Interview design

The interview questions are displayed in table 2. Creating the interview questions involved looking at previous research on this topic. In the research from Durmus (2022) interviews are conducted, which are used as a basis for the interview questions. The interview starts with question 1, about the travel features of the participant. To gain information about their travel features and to understand the disadvantageous travel features that exist in travelling.

In question 2, it is asked which mode of transport the participant chooses. This is to gain information about the factors which influence their choice for the mode of transport, to understand if there is mode dependency, and to see if the participant experiences mode unavailability. As stated in the literature this is one of the important aspects to experience transport poverty. It ties in with economic exclusion (Church et al., 2000; Clifton & Lucas, 2004; Simcock et al., 2021) when a participant is hindered by the excessive costs.

The third part, question 3, is about disadvantages of travelling, that participants may experience. Church et al. (2000); Clifton and Lucas (2004); and Simcock et al. (2021) described several types of exclusion, such as economic exclusion in the paragraph above. Other types of exclusion discussed are physical exclusion; when the usage of transport services is hindered (Currie & Delbosc, 2010; Giesel & Köhler, 2015; Simcock et al., 2021), geographical exclusion; when the location hinders the usage of transport, spatial exclusion; when certain groups are hindered to use certain spaces and at last exclusion based on fear when travellers fear for their safety (Church et al., 2000; Lättman et al., 2018; Pot et al., 2020). Furthermore, Broeck en van Os (2015) concluded that having a limited social network is a barrier. These concepts are related to the possible disadvantages of travelling and will be discussed in the interviews.

The fourth section, which includes questions 4 to 7, elaborates on the motivation for non trip making. This relates to the concepts discussed in the previous paragraphs of economic, physical, geographical, spatial, and fear-based exclusion. In addition to this, the exclusion from services from Church et al. (2000) and Martens (2013) is taken in regard, to when a participant unable is to go to the desired service due to the distance and time-based exclusion, when the participant is unable to travel due to a combination of work, household and childcare task restrict the ability to travel (Church et al., 2000; Martens, 2013).

Table 2 Interview design

	Questions	
Q1	Could you tell me where you are travelling too now?	Travel features
Q2	To get to these places do you always use the same means of transport?	Transport selection
Q3	Are there any obstacles or problems that you encounter when you travel?	Problems with travelling
Q4	Are you able to travel as much as you want or need?	Motivation for non trip making
Q5	Are you able to travel anywhere, anytime you want to or need to?	Motivation for non trip making
Q6	Have you ever made the decision that you would rather not travel?	Motivation for non trip making
Q7	Have you ever been prevented from participating in an activity or missed an opportunity because you were unable to get to the place?	Motivation for non trip making
Q8	Do you have any thoughts on how your travel possibilities could be enhanced?	Motivation for non trip making

### 3.6 Participants

The participants for this research are the residents of the research area the neighbourhood of Bospolder-Tussendijken. The recruitment is done on the job, the participants are recruited from public spaces such as the park (Dakpark), market (Visserijplein), community house, alongside the canal (Schie) and on the street. The non-Western immigrants were hard to reach, and most of them declined to be interviewed. The characteristics of the participants are shown in table 3. A total of 12 interviews are done in a period of 4 weeks during July and August. When there was evidence that the point of theoretical saturation has been achieved, the data collection was completed. The point of theoretical saturation is understood when there are no new insights from new data (Faulkner & Trotter, 2017). This means that when new interviews would give similar answers as in the interviews done before.

Table 3 List of participants

Participant	Gender	Age	Migration background	Car
R1	M	93	No	No
R2	F	76	No	No
R3	F	72	No	Yes
R4	F	79	No	No
R5	F	65	No	No
R6	M	25	No	No
R7	F	39	Yes	No
R8	M	32	Yes	No
R9	M	40	Yes	No
R10	M	29	Yes	No
R11	F	37	No	No
R12	M	50	No	Yes

### 3.7 Data analysis

In this research all the interviews are recorded, in this way all the input can be processed and analysed. The interview recordings are processed by transcribing the conversations. The interview audio is recorded by using a mobile phone. With the explicit consent of the participant, the interviews are recorded. The recorded and transcribed interviews are saved on the researcher's personal computer, which is protected by a password.

When the data gathering was done the analysis started. Data analysis is the process of finding meaning in data by interpreting it, decoding it and expressing it in other words (Hay, 2016). The common way of analysing qualitative data is by coding. This is a process in which the transcripts are reviewed and reflected upon. The researcher is seeking themes that are consistent with the central question. The transcripts are broken up into fragments which are labelled. According to Scheepers et al. (2016), coding consists of three parts which are iterative, open, axial, and selective coding. At first, open coding is done, by labelling text fragments. The second step is axial coding in this research the conceptual model is used, by this step all the codes are compared and merged if they are the same part of the same theme (Hay, 2016). The combination of open coding and axial coding with the existing theory resulted in the code tree, which is added in appendix 3.

### 3.8 Ethics

The data collection is done in the form of interviews with audio recordings. For ethical reasons, before each interview, it is explained what the data will be used for (Scheepers et al., 2016). Beforehand of the start of the interview verbal permission is asked to record the interview. Permission is asked for the usage of quotations from the recorded interview. The participants were made aware that they could stop or refuse to record or contribute to the interview at any time they wished. As a result, participation is strictly voluntary, participants are not offered any incentive to avoid being biased. Based on the objectives of the study purposive sampling is used in this study. For this reason, questions are asked about age, migration background and gender. For ethical reasons, it is still decided not to use the name of the participant. To ensure the anonymity of the participants, because sensitive topics are discussed and participants are easily traceable by name, place of residence and daily activities using social media.



## 4. Results

In the result chapter all the relevant outcomes from the calculated risk score of transport poverty are discussed. The risk scores are ranked from very low to very high. Each section is discussed in a separate paragraph. Next to the discussion, an overview of the results from Arcmap is added and a table with the corresponding risk scores, shown by every variable and neighbourhood. In the next chapter 5 the results of the interviews are discussed.

### 4.1 Case selection Bospolder-Tussendijken

The neighbourhood Bospolder-Tussendijken is chosen based on the results of the quantitative analysis, which can be seen in appendix 1. The neighbourhood is selected based on the outcome of the risk of transport poverty model. In the model, Bospolder-Tussendijken is measured as two separate neighbourhoods Bospolder and Tussendijken. Bospolder has a score of 2,82 (very high) and Tussendijken 2,82 (very high). Thus, both neighbourhoods have a very high risk of transport poverty score.

When looking deeper into the statistics of the model for the neighbourhoods Bospolder and Tussendijken. The risk score of the neighbourhood is 2,82 which is the same as they only have two different scores from a total of 11 indicators. The population aged older than 65 scores a 2, which means that they do not have an old population. But for migration, unemployment, car ownership and income both neighbourhoods score a 4. This means that the neighbourhoods have a high percentage of non-Western migrants living in the neighbourhoods. Furthermore, unemployment and low income are among the highest in Rotterdam. Both neighbourhoods have the same score for disability, which is a 3. For the distance to the general practitioner and school, both score a 1, which means that both neighbourhoods are near a general practitioner and school.

The scores differ for the percentage of residents with a disability and the percentage of owned cars per household. Bospolder scores a 3 for both indicators, while Tussendijken scores a 4 for these two indicators. Furthermore, there is a difference between both neighbourhoods in the number of schools within a proximity of three kilometres. Tussendijken scores a 1, which means that there are many schools in proximity and Bospolder has a score of 3 which means that there are fewer schools within a proximity of three kilometres.

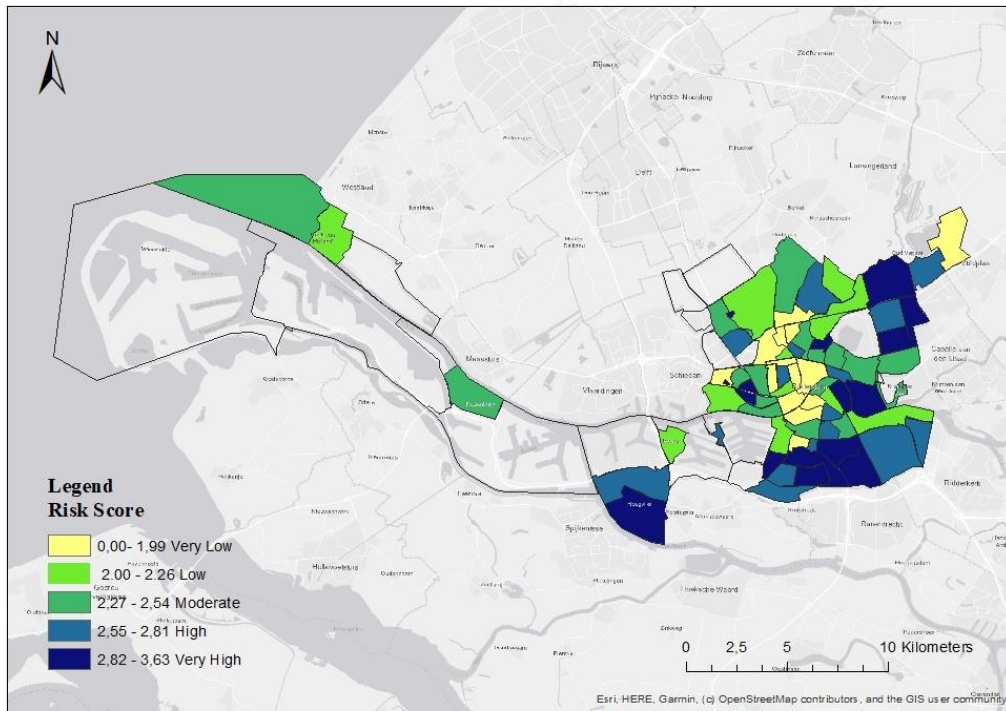
The neighbourhoods Bospolder and Tussendijken are two small neighbourhoods in Rotterdam, commonly referred to as BoTu. The area is home to over 14,000 residents and 7,000 households. Despite their small size, these neighbourhoods are densely populated and diverse, with almost 70% having a non-Western background. In addition, these neighbourhoods have a young population. With a higher share of 0–14-year-olds and a smaller proportion of residents aged 65 and older compared to the Rotterdam average.

On the other side, many households in BoTu have serious financial challenges. The neighbourhoods have high rates of unemployment and almost three-quarters of the households are classified as 'low income'. Even more, Tussendijken and Bospolder are respectively ranked second and fifth on the list of the 20 poorest postal codes in the Netherlands. More than 60% of the housing stock in the neighbourhoods is social rented housing, which is often dilapidated and neglected as it has overdue maintenance.



Figure 6 Risk of Transport Poverty

## Risk of Transport Poverty

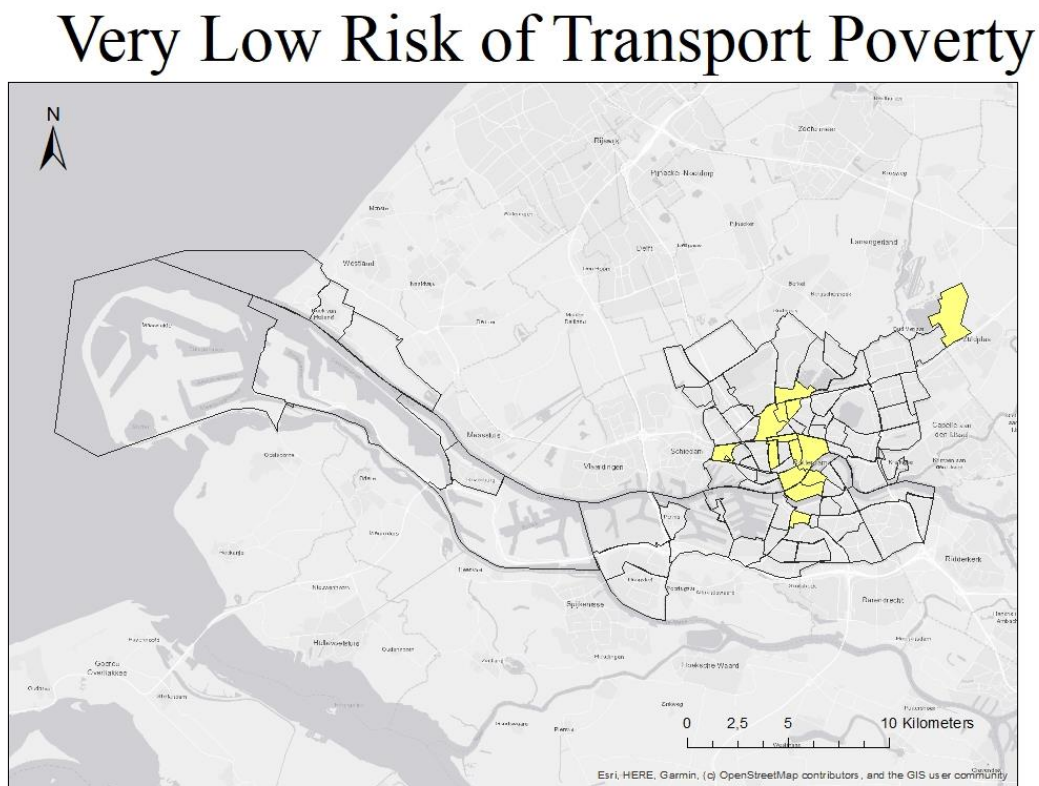


Source own work.

The risk score is calculated as described in the methods. The results from the data analysis are visible in figure 6. In figure 6 it is seen that the neighbourhoods that are located close to the city centre score very low on the risk score. The neighbourhoods with very high scores are mostly located on the south shore of Rotterdam. In the next paragraphs, every risk score ranging from very low to very high is discussed.

## 4.2 Very low risk of transport poverty

Figure 7 Very Low Risk of Transport Poverty



*Source own work.*

Figure 7 shows all the neighbourhoods with a very low-risk score of transport poverty. The neighbourhoods with a very low score are nearly all located on the north side of the river. This can be seen in figure 7. The neighbourhoods close to the city centre score low on distance indicators, as they are in proximity of the supermarket, general practitioner, transport hubs and schools. The scores for the social indicators are low as well. This is because the population living in these neighbourhoods has a higher average income and the unemployment rate is low.

A few anomalies are visible in table 4 as Nesselande, Carnisse and Oud Mathenesse. Nesselande is an interesting case because this neighbourhood is located the furthest away from the city centre. This neighbourhood has a one for population, social housing, income, disability, car ownership and unemployment, and it scores a two for migration. For the distance indicators it scores a four for GP, supermarket, and school, and a one for PT, this can be seen in table 4. Despite the location of the neighbourhood, it still has a very low risk score. Due to the low scores on the social indicators, the high scores for the distance indicators are of less importance. This is the reason the neighbourhood located further away still has a very low-risk score.

The neighbourhood Oud Mathenesse is located far away from the city centre but still has a low-risk score. This is the case because the neighbourhood only has a one for the distance indicators, the social indicators all fluctuate between a one, two or three. Despite the mixed score for the

social indicators, the neighbourhood has a total risk score that is very low. Due to the low scores on the distance indicators, the mixed scores for the social indicators are of less importance. In these cases, this is the reason that the neighbourhoods located further away still have a very low-risk score.

Table 4: Very low risk score

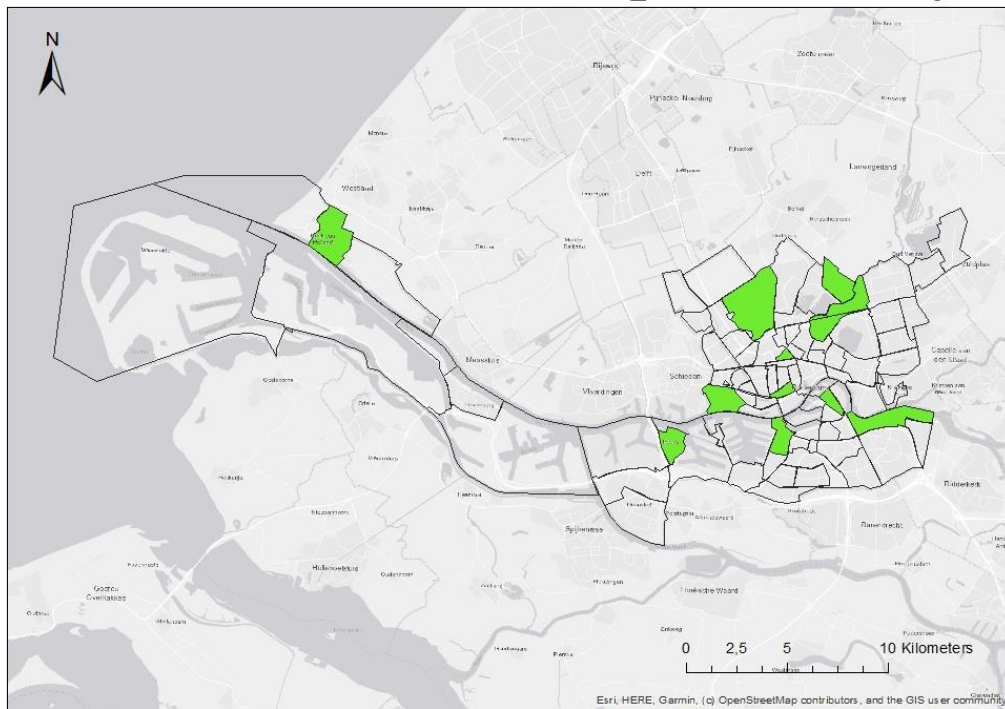
Neighbourhood	Pop_>65	Non_Western	Social_Housing	Low_Income	Disability	Household_Ownership_Car	Dist_GP	Dist_SM	Dist_School	Dist_PT	Unemployment	Risk_Score
Hillegersberg Zuid	2.00	1.00	1.00	1.00	1.00	2.00	1.00	2.00	1.00	1.00	1.00	1.27
Blijdorp	2.00	1.00	1.00	1.00	1.00	4.00	1.00	1.00	1.00	1.00	1.00	1.36
Cool	2.00	2.00	2.00	2.00	2.00	1.00	2.00	1.00	2.00	1.00	1.00	1.64
Middelland	1.00	3.00	2.00	2.00	1.00	4.00	1.00	1.00	1.00	1.00	2.00	1.73
Bergpolder	1.00	2.00	1.00	2.00	2.00	4.00	1.00	2.00	1.00	2.00	1.00	1.73
Kop van Zuid	1.00	2.00	2.00	1.00	1.00	2.00	1.00	2.00	4.00	2.00	1.00	1.73
Stadsdriehoek	1.00	2.00	1.00	2.00	2.00	4.00	2.00	1.00	3.00	1.00	1.00	1.82
Oud Mathenesse	1.00	3.00	1.00	3.00	2.00	4.00	1.00	1.00	1.00	1.00	2.00	1.82
Liskwartier	2.00	2.00	2.00	2.00	3.00	3.00	1.00	1.00	1.00	1.00	2.00	1.82
Cs Kwartier	2.00	3.00	1.00	1.00	1.00	3.00	3.00	2.00	3.00	1.00	1.00	1.91
Nieuwe Werk	3.00	1.00	1.00	1.00	1.00	2.00	2.00	3.00	4.00	2.00	1.00	1.91
Katendrecht	2.00	3.00	2.00	2.00	2.00	3.00	1.00	1.00	1.00	2.00	2.00	1.91
Nesselande	1.00	2.00	1.00	1.00	1.00	1.00	4.00	4.00	4.00	1.00	1.00	1.91
Carnisse	1.00	3.00	1.00	2.00	2.00	4.00	1.00	1.00	1.00	3.00	2.00	1.91

Source own work.

## 4.3 Low risk of transport poverty

Figure 8 Low Risk of Transport Poverty

# Low Risk of Transport Poverty



Source own work.

In the above figure 8 the neighbourhoods with a low-risk score of transport poverty are displayed. A part of the neighbourhoods is located near the city centre such as Provenierswijk, Dijkzigt and Nieuw Crooswijk. Some other neighbourhoods with a low score are more scattered around the city.

On the north side Zestienhoven, Terbregge and Molenlaankwartier are all located on the outskirts of the north of Rotterdam. All three neighbourhoods have a relatively wealthy population. When taking a closer look at the social indicators from the neighbourhoods Zestienhoven and Terbregge, it is visible in table 5 that for nearly all the social indicators the two neighbourhoods score a one (there is one exception Terbregge has a two for population). On the other side for the distance indicators the scores are higher, they vary between a three and a four.

On the south side of the city neighbourhoods such as Kop van Zuid-Entrepot, which are close to the city centre have a low score of transport poverty. These neighbourhoods score low on distance and social indicators. The second outlier Pernis is located far away from the city centre and is not well connected to the rest of the city, it has mixed scores on all the distance indicators as well for the social indicators it has mixed scores.

One other interesting outlier is Dorp, this neighbourhood is located in the far west. This part of the municipality of Rotterdam used to be the village Hoek, it was annexed by the municipality of Rotterdam in 1914 because it is located on the entrance of the harbour. This neighbourhood has a relatively old population with relatively many residents who have a disability, the scores for both indicators are a four. For the distance indicators, the scores are one or two, this is because the neighbourhood relies on the services of the village of Hoek van Holland, which is self-sufficient.

Table 5 Low risk of transport poverty

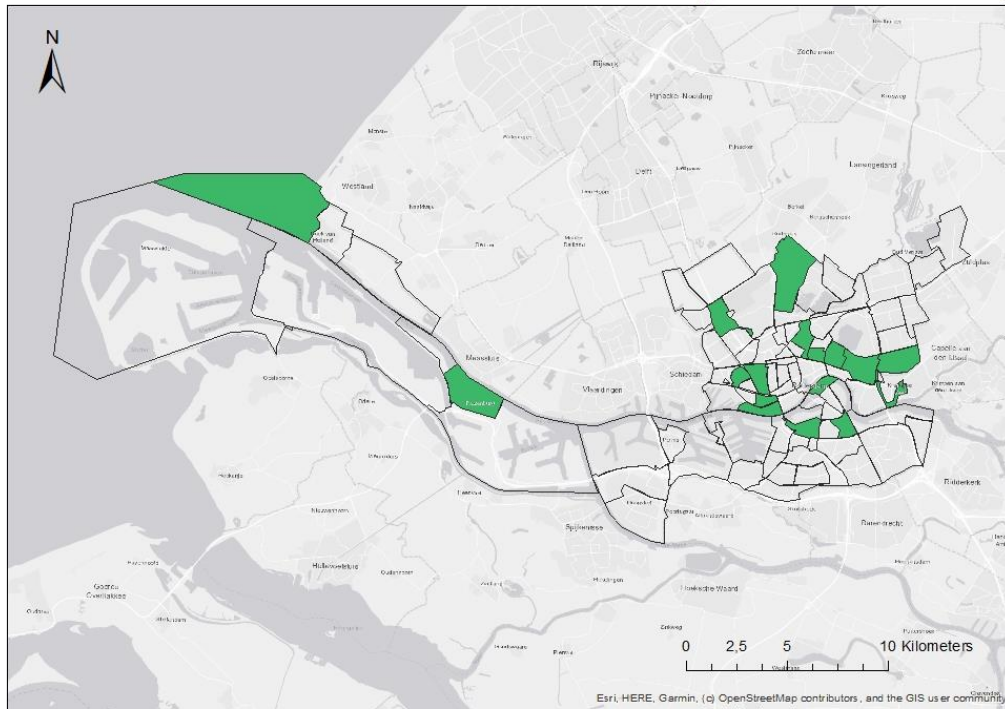
Neighbourhood	Pop_>65	Non_Western	Social_Housing	Low_Income	Disability	Household_Ownership_Car	Dist_GP	Dist_SM	Dist_School	Dist_PT	Unemployment	Risk_Score
Zestienhoven	1.00	1.00	1.00	1.00	1.00	1.00	4.00	4.00	4.00	3.00	1.00	<b>2.00</b>
Terbregge	2.00	1.00	1.00	1.00	1.00	1.00	3.00	4.00	4.00	3.00	1.00	<b>2.00</b>
Molenlaankwartier	4.00	1.00	1.00	1.00	2.00	1.00	3.00	3.00	1.00	3.00	2.00	<b>2.00</b>
Pernis	4.00	1.00	2.00	1.00	2.00	1.00	2.00	2.00	2.00	4.00	1.00	<b>2.00</b>
Dijkzigt	1.00	2.00	4.00	1.00	1.00	4.00	2.00	2.00	3.00	2.00	1.00	<b>2.0</b>
Provenierswijk	1.00	3.00	2.00	2.00	3.00	4.00	2.00	2.00	1.00	1.00	2.00	<b>2.09</b>
Kop van Zuid Entrepot	2.00	4.00	3.00	3.00	2.00	2.00	1.00	1.00	1.00	1.00	3.00	<b>2.09</b>
Nieuw Crooswijk	1.00	3.00	4.00	3.00	2.00	3.00	1.00	2.00	1.00	2.00	2.00	<b>2.18</b>
Oud IJsselmonde	3.00	2.00	1.00	1.00	1.00	1.00	4.00	4.00	4.00	2.00	1.00	<b>2.18</b>
Oud Charlois	1.00	3.00	2.00	3.00	2.00	3.00	1.00	2.00	1.00	3.00	3.00	<b>2.18</b>
Dorp	4.00	1.00	3.00	2.00	4.00	1.00	2.00	2.00	2.00	1.00	2.00	<b>2.18</b>
Nieuw Mathenesse	1.00	3.00	1.00	1.00	1.00	4.00	3.00	3.00	4.00	2.00	1.00	<b>2.18</b>

Source own work.

## 4.4 Moderate risk of transport poverty

Figure 9 Moderate Risk of Transport Poverty

# Moderate Risk of Transport Poverty



Source own work.

In above figure 9, the neighbourhoods with a moderate score of transport poverty are displayed. The neighbourhoods on the north side, most of them are located at a close distance from the city centre. On the east side Rubroek, Kralingen West, Kralingen Oost and 's-Gravenland. Rubroek and Kralingen West have low scores (one or two) on the distance indicators but score relatively high (two, three or four) on the social indicators. It is the other way around for Kralingen Oost and 's-Gravenland, which both score relatively high (two, three or four) on the distance indicators and relatively low (two, three or four) on the social indicators.

Neighbourhoods located on the west side of the city are Nieuwe Westen, Spangen, Delfshaven, and Schiedmond. These neighbourhoods have low scores (one or two) on distance indicators compared to the social factors, which are more mixed and are in the range between one and four, this can be seen in table 6. On the other hand, the neighbourhood Overschie is located in the west as well, but far away from the city centre on the outskirts of the city. It has a high score (three or four) on distance indicators and had relatively low scores (one, two or three) for the social indicators, and therefore got a moderate risk level.

Looking at the map from figure 7, Strand en Duin is located very far away from the city centre. This part of the municipality of Rotterdam used to be the village Hoek, it was annexed by the municipality of Rotterdam in 1914 because it is located on the entrance of the harbour. This

neighbourhood has a relatively old population, the score is a 3. For the distance indicators, the score is a 4, because the neighbourhood is located far away from the services of the city centre.

*Table 6 Moderate risk of transport poverty*

Neighbourhood	Pop_>65	Non_Western	Social_Housing	Low_Income	Disability	Household_Ownership_Car	Dist_GP	Dist_SM	Dist_School	Dist_PT	Unemployment	Risk_Score
Nieuwe Westen	1.00	4.00	2.00	4.00	2.00	4.00	1.00	1.00	1.00	2.00	3.00	2.27
Schiemonnd	2.00	4.00	2.00	3.00	2.00	2.00	1.00	1.00	2.00	3.00	3.00	2.27
Kralingen West	2.00	3.00	3.00	3.00	2.00	4.00	1.00	1.00	2.00	1.00	3.00	2.27
Kralingen Oost	3.00	1.00	1.00	1.00	1.00	3.00	2.00	3.00	3.00	3.00	4.00	2.27
Hillesluis	1.00	4.00	2.00	4.00	2.00	3.00	1.00	1.00	1.00	2.00	4.00	2.27
's-Gravenland	3.00	1.00	2.00	1.00	1.00	1.00	4.00	3.00	4.00	4.00	1.00	2.27
Strand en Duin	3.00	1.00	1.00	1.00	1.00	1.00	4.00	4.00	4.00	4.00	1.00	2.27
Overschie	3.00	1.00	2.00	2.00	1.00	1.00	4.00	4.00	3.00	3.00	2.00	2.36
Schiebroek	3.00	2.00	3.00	3.00	3.00	2.00	2.00	2.00	1.00	2.00	3.00	2.36
Noordereiland	3.00	2.00	2.00	2.00	2.00	3.00	4.00	1.00	4.00	1.00	2.00	2.36
Kralingseveer	3.00	1.00	1.00	1.00	1.00	1.00	4.00	4.00	4.00	4.00	2.00	2.36
Tarwewijk	1.00	4.00	2.00	3.00	2.00	4.00	1.00	1.00	1.00	4.00	3.00	2.36
Delfshaven	1.00	3.00	3.00	3.00	3.00	4.00	2.00	2.00	1.00	3.00	2.00	2.45
Spangen	1.00	4.00	4.00	4.00	2.00	3.00	1.00	2.00	1.00	2.00	3.00	2.45
Oude Noorden	2.00	3.00	3.00	4.00	3.00	4.00	2.00	1.00	1.00	1.00	3.00	2.45
Rubroek	3.00	3.00	3.00	3.00	4.00	4.00	1.00	1.00	1.00	1.00	3.00	2.45
Rozenburg	4.00	1.00	2.00	1.00	3.00	1.00	4.00	2.00	3.00	4.00	2.00	2.45

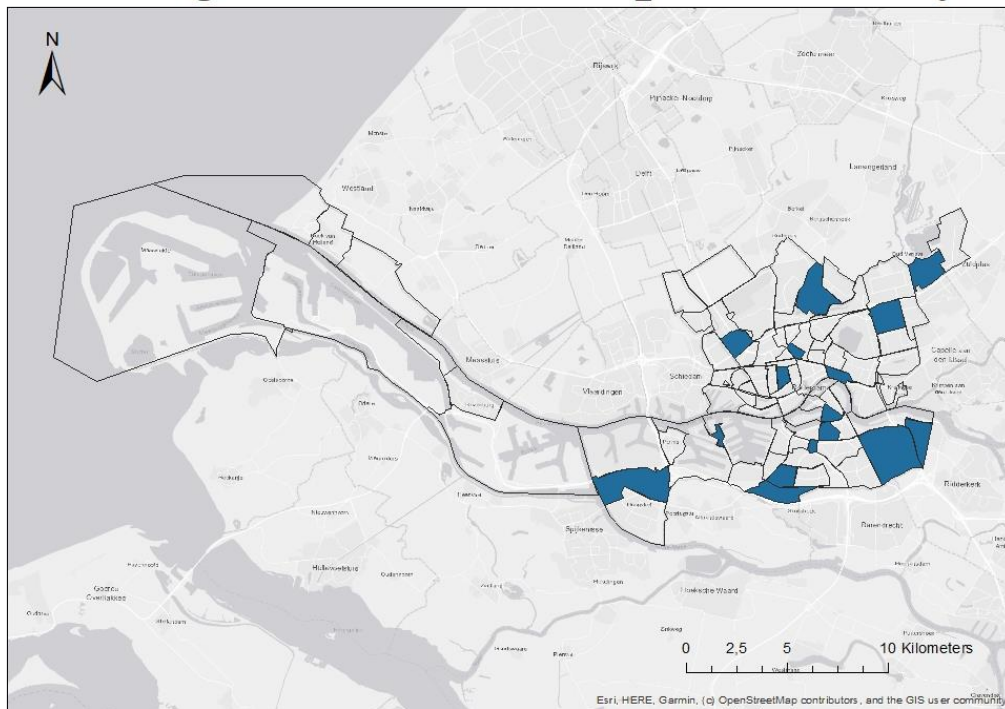
*Source own work.*



## 4.5 High risk of transport poverty

Figure 10 High Risk of Transport Poverty

# High Risk of Transport Poverty



Source own work.

In figure 10 the neighbourhoods with a high-risk score of transport poverty are displayed. Half of them is located on the north side of the river. The neighbourhood Oude Westen is located in the city centre, but it has a high score of transport poverty. This is because the neighbourhood has high scores for the social indicators between three and four. In contrast to this, the scores for the distance indicators are all very low, all are one. Another neighbourhood that is located close to the city centre is Agnieszbuurt, it has a high score of transport poverty. The social indicators are all high between three and four (only the population of 65+ is a two). The distance indicators are all low between one and two, which can be seen in table 7. It is interesting that these two neighbourhoods located next to the city centre score a high score of transport poverty.

The neighbourhoods, Kleinpolder, Hillegersberg Noord, Lage Land and Ommoord, are all located in the north, far away from the city centre and score high on the risk of transport poverty. These four neighbourhoods all score on average high for the social and the distance indicators, ranging between a one and four.

The neighbourhoods located on the south shore of the river that have a high-risk score of transport poverty are, Bloemhof, Beverwaard, Afrikaanderwijk, Zuidplein, Pendrecht, Groot IJsselmonde, Charlois Zuidrand and Heijplaat. The neighbourhoods are located far away from the city centre and score relatively high on the distance indicators, ranging between a one and



four. These neighbourhoods also score relatively high on the social indicators, ranging between one and four. Charlois Zuidrand has a specific score, it scores very high on the distance indicators, all a four, and on the social indicators the scores vary between one and four. Which makes it an interesting case with very high outliers.

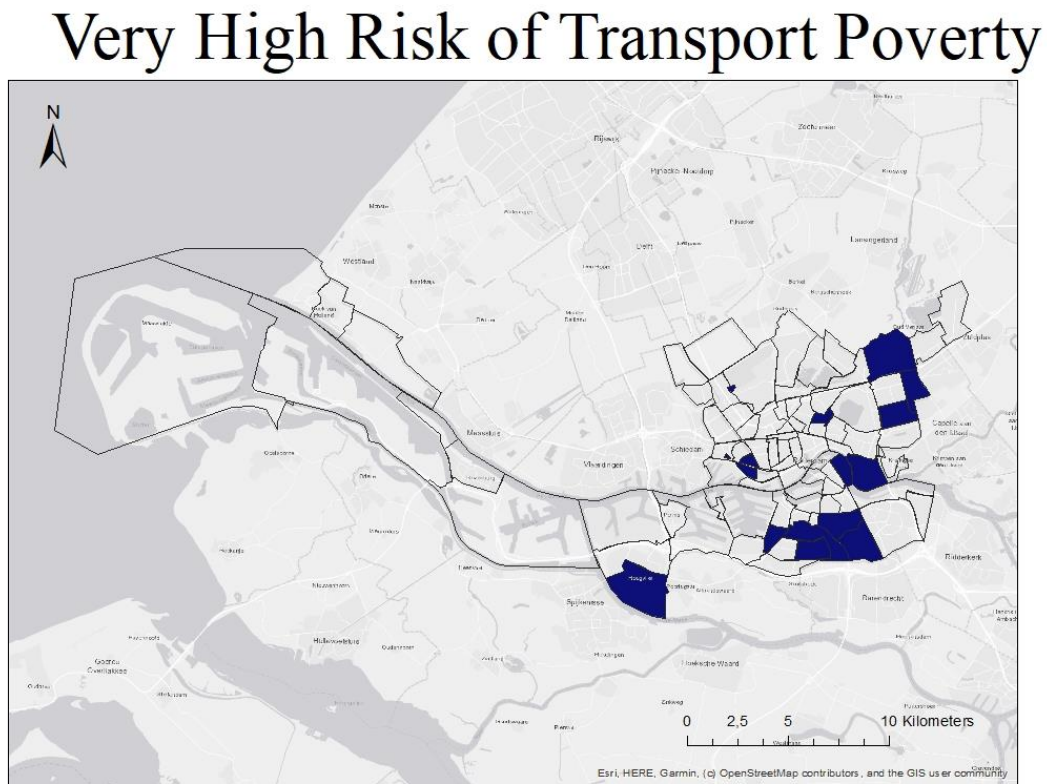
Table 7 High risk of transport poverty

Neighbourhood	Pop_>65	Non_Western	Social_Housing	Low_Income	Disability	Household_Ownership_Car	Dist_GP	Dist_SM	Dist_School	Dist_PT	Unemployment	Risk_Score
Agniesebuurt	2.00	4.00	3.00	3.00	3.00	4.00	1.00	2.00	2.00	1.00	3.00	<b>2.54</b>
Hillegersberg Noord	4.00	1.00	2.00	2.00	4.00	1.00	3.00	3.00	3.00	2.00	3.00	<b>2.54</b>
Bloemhof	1.00	4.00	3.00	4.00	3.00	3.00	1.00	1.00	1.00	3.00	4.00	<b>2.54</b>
Beverwaard	2.00	4.00	3.00	3.00	2.00	2.00	2.00	3.00	2.00	2.00	3.00	<b>2.54</b>
Hoogvliet Noord	3.00	3.00	2.00	2.00	3.00	1.00	3.00	4.00	1.00	4.00	2.00	<b>2.54</b>
Oude Westen	3.00	4.00	3.00	4.00	3.00	4.00	1.00	1.00	1.00	1.00	4.00	<b>2.64</b>
Afrikaanderwijk	2.00	4.00	4.00	4.00	3.00	4.00	1.00	1.00	1.00	1.00	4.00	<b>2.64</b>
Het Lage Land	4.00	2.00	2.00	2.00	4.00	2.00	2.00	2.00	3.00	3.00	3.00	<b>2.64</b>
Zevenkamp	3.00	2.00	2.00	3.00	4.00	2.00	3.00	3.00	1.00	3.00	3.00	<b>2.64</b>
Zuidplein	4.00	3.00	1.00	2.00	3.00	4.00	2.00	1.00	3.00	4.00	2.00	<b>2.64</b>
Pendrecht	2.00	4.00	3.00	3.00	3.00	2.00	2.00	2.00	1.00	3.00	4.00	<b>2.64</b>
Kleinpolder	4.00	3.00	4.00	3.00	4.00	2.00	1.00	2.00	1.00	3.00	3.00	<b>2.73</b>
Struisburg	3.00	2.00	2.00	2.00	1.00	4.00	4.00	3.00	4.00	1.00	4.00	<b>2.73</b>
Groot IJsselmonde	4.00	3.00	3.00	3.00	4.00	2.00	2.00	3.00	2.00	1.00	3.00	<b>2.73</b>
Charlois Zuidrand	4.00	2.00	1.00	1.00	4.00	0.00	4.00	4.00	4.00	4.00	2.00	<b>2.73</b>
Heijplaat	3.00	2.00	4.00	2.00	2.00	1.00	4.00	2.00	4.00	4.00	2.00	<b>2.73</b>

Source own work.

## 4.6 Very high risk of transport poverty

Figure 9 Very High Risk of Transport Poverty



*Source own work.*

Figure 9 shows the neighbourhoods with a very high risk of transport poverty. The neighbourhoods are located on both sides of the river. They all have in common that they are located outside the city centre. These neighbourhoods tend to share some influencing factors. At first, all neighbourhoods score a three or four on social housing, which means that relatively most rental houses are owned by authorized public housing institutions. At the second the score of disability is a three or four for the neighbourhoods, meaning that the percentage of disabled is highest in these neighbourhoods relatively compared to the other neighbourhoods. Third the percentage of unemployed is highest in these neighbourhoods because they all score a three or four on that indicator. Regarding the other indicators, the scores are relatively high, but more mixed as they range between one and four, this can be seen in table 8.

### *Conclusion*

In this study, the factors involved in transport are examined through a literature review. On these grounds, an attempt is made to make the risk of transport poverty measurable through an indicator. The concept of transport poverty is quantified in this study by using 11 variables. The 11 variables are a population of 65+, percentage of non-western migrants, percentage of social housing, households with low income, percentage of population with a disability, car ownership

by household, percentage of unemployment and four distance to service/facilities variables. Using these 11 variables the neighbourhoods of Rotterdam were compared.

Concerning the transport poverty risk scores, the variables related to the social indicators were of most importance. Neighbourhoods that have a low socioeconomic status have a high risk of transport poverty score. For example, this can be seen in table 8, all the neighbourhoods that have a very high risk of transport poverty score a three or four for unemployment, disability, and income (except Ommoord and Hoogvliet Zuid). In the literature study it is concluded that these indicators coincide with transport poverty. Church et al. (2000) defines economic exclusion, when the costs of transport limit the access to jobs or services. This is influenced by the level of income and ties into unemployment. In the research of Bastiaanssen et al. (2013); and Bastiaanssen et al. (2022) noticed the unemployment struggling with transport poverty. From the literature study it is concluded that people with disabilities due to their health status, have a higher chance of experiencing transport poverty (Simcock et al., 2021).

When looking at the outcomes of the risk scores of transport poverty, the variables related to distance are of less importance. The neighbourhoods in the far west, in the north and the neighbourhood Ommoord in the east are located far from the city centre but have very low and low risk scores. This means the distance indicators are of less importance because all the essential facilities are easily reachable in these neighbourhoods. In the case of Rotterdam, it was expected that the neighbourhoods located in the peripheral area of the city 4 This is mentioned in the literature, geographical exclusion is mentioned when a peripheral location could limit access to services (Church et al., 2000) and exclusion to facilities, when distance from home to services is a barrier (Church et al., 2000). After the risk scores are calculated, there is a mixed outcome of neighbourhoods located at peripheral locations with mixed scores ranging from very low to very high.

Table 8 Very high risk of transport poverty

Neighbourhood	Pop_>65	Non_Western	Social_Housing	Low_Income	Disability	Household_Ownership_Car	Dist_GP	Dist_SM	Dist_School	Dist_PT	Unemployment	Risk_Score
Bospolder	2.00	4.00	4.00	4.00	3.00	4.00	1.00	1.00	1.00	3.00	4.00	<b>2.82</b>
Tussendijken	2.00	4.00	3.00	4.00	3.00	4.00	1.00	2.00	1.00	3.00	4.00	<b>2.82</b>
Lombardijen	3.00	3.00	3.00	3.00	4.00	2.00	1.00	3.00	2.00	3.00	4.00	<b>2.82</b>
Ommoord	4.00	1.00	3.00	2.00	4.00	2.00	4.00	3.00	2.00	2.00	4.00	<b>2.82</b>
Vreewijk	4.00	2.00	4.00	4.00	4.00	3.00	2.00	2.00	1.00	2.00	4.00	<b>2.91</b>
Feijenoord	2.00	4.00	4.00	4.00	3.00	4.00	3.00	2.00	1.00	1.00	4.00	<b>2.91</b>
Oud Crooswijk	3.00	4.00	4.00	4.00	4.00	4.00	1.00	2.00	1.00	2.00	4.00	<b>3.00</b>
Oosterflank	4.00	3.00	3.00	4.00	4.00	2.00	2.00	2.00	2.00	3.00	4.00	<b>3.00</b>
Hoogvliet Zuid	4.00	2.00	3.00	2.00	4.00	1.00	4.00	3.00	3.00	4.00	3.00	<b>3.00</b>
Witte Dorp	3.00	4.00	4.00	4.00	3.00	2.00	4.00	3.00	1.00	2.00	4.00	<b>3.09</b>
De Esch	4.00	3.00	3.00	3.00	3.00	2.00	3.00	4.00	3.00	3.00	3.00	<b>3.09</b>
Prinsenland	4.00	2.00	3.00	3.00	4.00	2.00	4.00	4.00	1.00	4.00	3.00	<b>3.09</b>
Zuidwijk	3.00	4.00	4.00	4.00	4.00	3.00	2.00	2.00	1.00	4.00	4.00	<b>3.18</b>
Wielewaal	4.00	1.00	4.00	4.00	3.00	3.00	3.00	4.00	3.00	4.00	4.00	<b>3.36</b>
Landzicht	4.00	1.00	4.00	4.00	4.00	2.00	4.00	4.00	4.00	4.00	4.00	<b>3.55</b>
Zuiderpark	4.00	2.00	4.00	4.00	4.00	4.00	3.00	4.00	3.00	4.00	4.00	<b>3.64</b>

Source own work

## 5. Results interviews

This section discusses the results from the interviews. As previously explained in Chapter 4, the data is analysed using NVIVO. When analysing data, existing theory and new insights are juxtaposed; when necessary new theory is sought to support these insights (Tracy, 2019). The conceptual model in chapter 3 is used to apply structure to this chapter. The findings that fit these parts of the conceptual model are explained and illustrated using one or more quotes and literature. The relationship between different components of the conceptual model is then discussed.

### 5.1 Travel features

When looking at the travel features of the participants, their main purpose for travelling is taking a walk, going to the city centre, shopping, doing groceries, visiting friends and family, going to other cities, or doing activities. How to get there for the participants is quite different but all modes of transport were mentioned, walking, biking, driving the car, and using public transport. When travelling to other cities participants relied on public transport or the car.

Some participants are dependent on a particular mode of transport, some rely on public transport. Because they are unable to drive or are unable to afford a car. Another reason that a participant relies on public transport, is because she is unable to cycle because of her poor health condition. As R5 says in the interview they are dependent on public transport because they cannot afford a car and due to the harsh conditions of her knees, she is unable to make long walks.

From the interviews, it is derived that some participants are dependent on others to travel. To get to their destination they need a family member or a friend who is willing to drive them. In most cases, it is someone who owns a car and can drive the participant to his destination. In the case that the participant is unable to find someone to drive, they get stuck at home. R1, R5 and R11 both mention that a family member needs to give them a drive to travel to certain places. As R5 says *"With birthdays, for example, you still have to make arrangements with family to ride along with a car"*.

Some participants experience that they have a limited range to travel, because of several factors. When they are dependent on public transport, R1 says that he is only able to walk short distances in the neighbourhood and needs a driver when the destination is beyond reach by public transport. R9 also mentions this *"Places outside the city are difficult, where there is no public transportation"*. Other participants are limited in their travel range, because of their health conditions, as is R2. She mentions that the distance of walking to the metro station is too far. Another disadvantage of being dependent on public transport is being back on time in the evening, R9 mentions this *"If I stay somewhere late, I always have to be careful to catch the last metro or tram home"*.

The travel features of the participants show that they experience some disadvantages in their travels. Which are based on the inability to drive and not owning a car. When this is the case, they are dependent on others to drive them. This results in a limited travel range for the participants, as they are unable to reach all their destinations without any help.

## 5.2 Transport choice

In the interviews, the participants are asked about their transport choice. The transport choice differs per participant, and it depends on their preferences. In the interviews, all the transport modes are mentioned by the participants, on foot, by bike, by public transport and by car.

Almost every participant that is interviewed, says that they go on foot in the neighbourhood for short distances. Two participants mentioned that they still walk on foot but are unable to walk long distances. R4 says that she uses her walker, and due to this is unable to walk for long distances. This applies as well for R2 and R5, they are unable to walk for long distances, because of their health conditions. They complain about their bad knees and bad hips which limit their mobility. R4 says, that she has bad eyesight, which means that she must use a walker for her stability.

The usage of the bike is not common for the participants. R8 is positive about using the bike for transport, he says *"By bike, you get there nice and fast, you don't have to wait long"*. R5 mentions that they use electric bikes for their transport. R3 is using her bike again after she has had an accident, but it has taken her a year to find the confidence. Every participant who cycles, as for the participants who are not cycling, complains about the safety on the roads. R3 says *"The Nieuwe Binnenweg is cycling not so great"*. She says that she has to use a different route and avoid the Nieuwe Binnenweg. R5 says, that she sees more speed bikes and fat bikes which makes her stay alert during cycling. R1 and R7 are afraid to cycle and therefore they do not cycle anymore. R1 says *"I am in doubt whether to go or not. I do not cycle anymore; it is too dangerous."* This depicts that he finds it too dangerous to cycle.

The opinion of the participants about public transport is positive. The metro, bus and tram are used for trips in the city, and for travelling to other cities the train is used. The participants who are aged 67 or older and have retired, can use public transport offered by the RET for free. The participants are positive about this policy. Although R5, R7 and R9 have complaints about the high price of public transport, it is still used a lot by the participants. R1, R4 and R5 are complaining about the public transport being too crowded.

The participants that own a car R2, R3 and R12 all drive. They are positive about how easy it is to travel by car, as R12 says *"I find this all easier by car"*. The car owners use their cars for out-of-the-city trips. On the other hand, other participants are depending on family or friends to pick them up and drive them. As they are unable to afford a car or are unable to drive the car as they have no driver's license.

The transport choice consisted of the trip that the participant planned to make. The decision is based on the availability of transport modes, the distance of the travel and their ability to make this trip. The overall conclusion is that the participants are positive about public transport, yet for the older participants the timing is important. The participant that cycle is not positive about road safety and use alternative routes to get to their destination. The car owners are content with travelling by car but do not use it to get to the centre. The participants that rely on family or friends to drive them by car, only make use of this when the destination is unreachable by public transport.

### 5.3 Disadvantages of travelling

The participants are asked about their experiences about disadvantages they encounter when travelling. A distinction is made between hard barriers relating to physical and design issues, and soft barriers relating to management and capacity issues.

The participants experience some hard barriers, the physical inconvenience of public transport. In the interview with R4, it emerged that the doors of the metro and tram closed too fast. As she says, "*I had it once at Leuvenhaven, my friend gets off and I want to get off and the door closes, and they didn't open again.*" She comments on the bus making a stop too far from the sidewalk, which makes it hard for her to get off the bus with her walker. Because the entry of the bus is not at the same height as the sidewalk. In the same interview, she mentions, the elevators or the escalator that is out of service, which makes it hard for her to reach the platform. Another barrier for R1 and R4 is the crowding in the public transport. They are old of age, and they need a seating place to rest during their travels. R1 says "*If it is crowded somewhere I do not go there.*"

In the interview with R7, she mentions the barrier of travelling with the tram. When the tram shares the road with the car, the car parks on the tram tracks, blocking the tram from moving. A remark in the same trend is made by cyclists, that they are unable to use the road to cycle on as it is occupied by trams and cars on the bike path. As there is no separate bike path, they are not using this road because they feel unsafe to cycle.

In the interviews, some participants experience soft barriers with travelling. In the interviews, participants have safety concerns when travelling by bike. R3, R5, R7 and R8 have concerns about safety on the bike paths, they feel unsafe due to electric bikes and motorized vehicles driving at high speeds. As said by R8 "*There are always scooters and delivery drivers tearing across the bike lane, you just have to watch out for that*".

Participants experience in some cases a lack of services at specific moments. R2, R7 and R9 mention the removal of line 4 on the Schiedamseweg. They are frustrated because of their longer travel times to the city centre. The walking distance to the nearby neighbourhood has increased when they want to go to the Nieuwe Binnenweg for shopping. Participants complain about the timetable of public transport during the vacation period and in the late evening. R7 needs public transport to get to work, but during her nightshifts, it is hard to get there as she says, "*Same goes for night shifts, I have to pay close attention to that so I can always still get to work*".

The barriers that arise during the travels of the participants show that older participants experience the physical inconvenience of public transport. Due to their physical condition, they have more problems with the use of public transport. The quality of the biking paths is forcing participants to use other roads, to bypass the unsafe situations. Participants who are dependent on public transport have difficulties with the timetable at certain moments of the day, at the start or end of their work shifts. Participants that use the tramline 4 experience an increased travel time and distance to the next stop because the tramline is removed. At last, the safety on the bike paths as of the increase of usage by electric bikes and delivery mopeds, gives the participants a feeling of unsafety when cycling on the bike paths.

## 5.4 Motivation for non trip making.

The participants have several different motivations for not making a trip. In multiple situations it is their own decision whether not to travel, in other cases, they are limited by external factors, but they are willing to travel. In multiple cases, the health conditions of a participant limit their travels. In his interview R1 says "*Well I have a stoma, and of course, that is a bit tricky all around. I do not go on holiday; I just stay at home. If I must go somewhere they come and get me*". He is fine by staying at home and being picked up by his relatives to get around. R3, R4 and R11 all have health difficulties and therefore are unable to travel large distances on foot or by bike. They rely on public transport to get to their destination. R4 has difficulty with transfers at train stations because she has bad eyesight and is not confident enough to transfer to a different train. She only uses public transport for the routes she knows by heart.

Another note that is made in the interviews, is the motivation not to make a trip due to crowding. R1 and R4 both comment about the public transport being too crowded for them because they are afraid to fall. In the interview with R11, she expresses the notion not to travel on public transport as she finds it disgusting to sit in a seat that is been used by other people. Whereas R7 is afraid to travel by bike because of the unsafe roads and in these cases chooses to go on foot or by public transport. In the interviews, a few participants acknowledged, they are dependent on others to go somewhere as they do not own a car. In the interview with R5 she says, "*With family birthdays, you still must make arrangements to ride along in the car once in a while*".

It can be concluded that the participants have several varied motivations not to make a trip. At first, the group that is willing to travel but is unable as of their health condition and therefore dependent on others for transport. The second group is participants who are not willing to travel as they have personal issues concerning certain modes of travel.

## 5.5 Travel needs

In the interviews, the participants express their future travel needs. At first, participants make comments about how the accessibility can be improved. R4 finds that public transport should become more accessible for people of age. When entering or leaving the tram of the metro the doors should close slower and more space is needed for walkers in the tram. R2 and R5 worry about the future of the public transport network because it is scaled down. They pointed out the increase in walking distance to the closest stops and the corresponding increase in travel time.

In the interviews, several participants address the issue of safety during their travels. In the interview with R8, he mentions that the cycling infrastructure needs to be improved to increase safety. As bikes and cars share the same space on the roads, this leads to the feeling of unsafety. To tackle this, a separate bike lane should be added, says R8. Another issue that is addressed is the costs, R11 says that he would like to have his car back, but the costs are too high, according to him they should be lowered. In the interviews with R4 and R9, they say that the price of public transport must be lowered to make it more affordable.

The travel needs derived from the interviews are in the first place about the accessibility that needs to be improved. In the second place, participants are not in favour of the plan of downscaling the public transport network. In the third place, they worry about the unsafety of the cycling lanes and see this as an opportunity to improve the bike infrastructure. At last, the costs of transport should be lowered to keep it affordable for everyone soon.



## 6. Discussion

In the discussion, the discrepancies between the literature and the findings are discussed. Secondly a reflection on the limitations of the research will be given. At last recommendations for further research are provided.

When the results from chapter 5 are investigated, some indications of economic exclusion are visible. In the study area, the costs of public transport are a major problem for the participants. However, the groups who have a discount or can use public transport for free (only when travelling with the RET), such as the elderly, are satisfied with the prices and do not experience problems with traveling with public transport. However, all the participants still have the problem of high travel costs by trips out of the region. Furthermore, problems regarding excessive costs are experienced with owning and using a car due to the high fuel prices.

As a result, most participants face problems regarding the costs of transportation which is seen as economic exclusion. Economic exclusion is a day-to-day problem for people who suffer from high inflation. As said by Clifton and Lucas (2004) and Simcock et al. (2021), people with low income suffer from accessibility problems. Since they are unable to pay the fares or to maintain and drive a vehicle. This issue is not solved and keeps getting worse, because of today's rising inflation. Resulting in increased fuel prices and higher fares in public transport. Economic exclusion will be a critical issue to keep in mind as it will affect more people's lives and their travel behaviour.

Another form of exclusion that is found in this study is physical exclusion. Based on the outcomes of the interviews in the study area physical exclusion is present. From the interviews, it is observed that participants have different physical disabilities to cope with. The disabilities that are reported relate to mobility difficulties, low vision, and diseases. These disabilities all bring their difficulties concerning travelling. Thus, physical exclusion, because participants are dependent on others to travel or participants are dependent on a specific mode of transport, and they experience a smaller travel range. The participants have adapted to their disabilities and have changed their travel patterns. Which enables them to reach all essential facilities. In the case when there is no one to drive them, or when they are unable to make use of their specific mode of transport it causes problems. When this occurs, they experience exclusion from facilities because they are unable to reach their destination. The relation between physical exclusion, and the disabilities of individuals that is found in the results is already mentioned in several studies, by Simcock et al. (2021), Giesel and Köhler (2015), Currie and Delbosc (2010).

In the above paragraph exclusion from facilities is seen for a certain group of participants with a poor health condition, who are unable to walk long distances. They rely on other people to drive them, and because of this dependency, they experience exclusion from facilities, when there is no one to take them. This is seen in the research from Simcock et al. (2021), Giesel and Köhler (2015), and Currie and Delbosc (2010). Due to the removal of the tramline, they are unable to use this mode of transport to get to the facilities at the Nieuwe Binnenweg

On the other hand, a group of participants who is facing accessibility issues. They are comfortable with their actual experience of travelling and participating in activities. This may be an indication that these participants' assumptions are in line with reality. Therefore, when looking at their travel experiences no exclusion problem exists under current circumstances. However, in the research from Ziegler and Schwanen (2011), it is said that the expectations of



individuals change according to their abilities and resources. This would mean that the participants changed their expectations according to their abilities and resources.

The results show that exclusion from facilities is rarely seen in the neighbourhood. Only seen for the participants with poor health conditions. This is because all the facilities are close by, and the city centre is easily reachable by bike or public transport. The group that relies on public transport has difficulties with visiting family and friends who live in rural areas. These places are not connected to public transport and are only easily reachable by car. The group with poor health condition and the other group that relies on public transport are dependent on others to drive them to these places. otherwise, they are unable to get there, which means that they are experiencing exclusion. Martens (2013) stated in his research that participants have difficulties staying connected with family and friends living in rural areas. As these places were too far to reach by cycle and the public transport to these places is often inadequate.

The context of Rotterdam's geographical and spatial exclusion is hard to explore. Because the city features an extensive public transportation network, this means that every part is connected to the public transport system and therefore geographical exclusion is not present. In the study area there are no public spaces that are hindered to use and therefore spatial exclusion is not present. Because there are no gated communities or other forbidden places observed in the study area. On the other hand, it is seen that some participants stated that they avoid certain streets by their trips on bicycle, because of the unsafe roads and bike paths. This prevents specific groups from accessing areas as they please, despite it does not limit access to a particular area, this has more connections to fear-based exclusion.

The results showed that exclusion based on fear is present in the study area. It relates to unsafe feelings during the trip. On various trips, cyclists have feelings of unsafety because the bike shares the same road as the car. This leads to unsafe situations with cars exceeding the speed limits and driving past the cyclist. The participants pointed out that they experience feelings of unsafety due to speed- and fat bikes driving fast. It led to avoiding unsafe roads or in the extreme scenario not to cycle anymore. These outcomes are examples of fear-based exclusion and tie into the found literature. Pot et al. (2020) writes about the contextual factors such as safety on the road that influence the perceptions of the travel experience. Lättman et al. (2018) emphasise the safety concerns, they view that safety concerns might influence the perceptions of accessibility.

Exclusion based on time has been found in the study area. The first limitation to travel based on time is the rush hour. The group of elderly that participated mentioned the rush hour in public transport as a moment to avoid travelling. They plan their trips outside the rush hour to avoid the crowdedness. The elderly have already retired which means that they do not have a fixed schedule. It is not a problem for them to reschedule their trip. Cheng et al. (2019) write that the elderly are not constrained to the working commute and are making more social and leisure trips. They are not bound to specific times anymore because their social pattern has changed (Van den Berg et al., 2015). It must be kept in mind that the avoiding the rush hour could have consequences, it can be a trigger for exclusion. When the elderly are unable to commute during rush hour, they can be excluded from certain facilities or activities that have their opening hours at that time. Another limitation that is found, is the dependency on the schedule of the public transport to plan the trip. As in the early morning and the late evening the public transport does not run that often or it does not run at all. Participants mentioned that they must make choices

when to travel and experienced the schedule as a barrier. This has also been stated by Martens (2013) when the transport services do not match the working hours in the late evening or at night.

## 6.1 Reflection

At first, the reflection starts by looking at the risk of the transport poverty model. In the current model, all the indicators have the same weight. To improve the model for further research, it is needed to determine whether certain indicators have a greater influence on transport poverty than others. Because someone with a heavy disability is unable to use the public transport stop in front of his house, the data would suggest otherwise.

To get to an improved model, some indicators need to be added. In the data bike usage is not available, this could not be added to the model. In future research, this indicator should be added as it is important to understand transport poverty in the Dutch context. In the current model travel distance to facilities and nearest public transport is measured but another indicator that would be an improvement to the indicator is the travel distance to friends and family. Visiting friends and family is an important travel motive for participants.

The data that has been used to indicate the health condition of a person could be improved. The current data does not tell which health condition the person suffers from. It depends on the type of health condition if a person can travel. To improve this indicator new data should be gathered about the connection between the health condition and the ability to travel.

The twelve street interviews that are held in the BospolderTussendijken neighbourhood are not a representative image of the neighbourhood, because not all residents of the neighbourhood are interviewed. The interviews show individual perceptions and experiences, they are highly subjective because they are based upon personal interpretation. The analysis that has been made is not generalizable as the sample size is limited. This research aims to examine the reasons behind the barriers experienced in everyday travel, not to provide to a comprehensive image of transport poverty, which is not assumed to be an issue. A limitation that could occur during an interview is that participants may be reluctant to discuss delicate issues such as not being able to travel to certain activities as a part of social exclusion.

## 6.2 Recommendations

In the next paragraphs, recommendations are made for future research. To conduct future research the transport poverty model should be adjusted. The model can be made more extensive by adding new indicators if data becomes available. By adding the indicators of bike ownership, distance to family/friends and nearest public transport stop. When these indicators are added and optimised the model is more accurate.

The second point to improve the model is by changing the weight of the indicators. The model that is used in the research contains indicators that all have an equal weight. Therefore, in future research, it is recommended to establish a relevant weight factor for each indicator. The interaction effects between the indicators could be used to establish the weight factor. For example, should distance to facilities be as important for someone with means to own a vehicle as for someone without?

In addition to comparing neighbourhoods, the indicator can also be used to investigate potential groups in society that suffer from transport poverty. By looking at transport poverty for specific groups in society, for example, elderly people, people with a low income, or people with a migration background. Target group research can be done by considering certain groups such as jobseekers, lonely elderly or people living in poverty.

## 7. Conclusion

The conclusion discusses the main findings from the discussion chapter. Furthermore, an answer will be given on the research question: *'To what extent does the downscaling of public transport lead to an increase in transport poverty in the city of Rotterdam?'* First the sub questions will be discussed, with connecting the results and the literature study. Second the policy implications will be provided.

The first sub-question: *'To what extent do the citizens of Rotterdam experience transport poverty?'* is explained using theory and data analysis. First, the concepts of transport poverty and social exclusion are defined. Transport poverty is the limited means of transport that prevent an individual from participating fully in social life. Social exclusion is a complex issue and is conceptualised as the process that hinders individuals from full participation in society. Transport poverty contributes to social exclusion because transport poverty hinders individuals from participating in society. Based on the found literature the indicators that influence transport poverty are identified and the risk of transport poverty model is formed. From the analysis it is concluded that the neighbourhoods located on the outskirts of the city and the neighbourhoods with a low socioeconomic status score high on the risk of transport poverty.

To get an understanding of how transport poverty is experienced in the neighbourhood with a substantial risk the second sub-question is answered; *'To what extent do the residents experience transport poverty in the neighbourhoods Bospolder Tussendijken?'* By using qualitative analysis transport poverty and related social exclusion is investigated. Semi-structured analysis is conducted to determine the social exclusion of the residents by looking at their travel features, transport choice, disadvantages travelling, motivation for non trip making and their travel needs. In the neighbourhood, the participants experienced different types of social exclusion which are: economic, spatial, physical, fear-based, and time-based exclusion. Exclusion of facilities is only seen by the group of participants that has ability problems.

This study is helping to fill the gap in an understudied area of transport poverty and related social exclusion. Even though this concept of transport poverty and social exclusion has already been studied in the Netherlands, this study adds to the existing research. The study demonstrates the importance of using both quantitative and qualitative methods, as many existing studies are solely quantitative. The qualitative analysis enhanced the theoretical research by exploring the various reasons and impacts of the travel experience and by comprehension of various aspects of social exclusion. The qualitative analysis adds a deeper understanding of the results of the quantitative approach.

Public transport is a social amenity that has as its purpose to transport people. It is the responsibility of the public transport operator to provide an adequate network for people to travel to their destinations. The idea behind public transport is to improve society as a whole. This may cost money, but it brings significant social and economic benefits that are difficult to measure in the short and long term. Cutting back on public transport that are not profitable is not an adequate solution. Some depend on it because they have no other means of transport. Transport poverty can have negative economic and social consequences that should not be neglected. These negative consequences could ultimately be more damaging to society as a whole than the benefits of cost savings.

In terms of future policy, it is important to understand the travel behaviour and dependency on public transport of the people. Institutions need to take the travel behaviour into consideration before the decision is made to downscale public transport. This is especially important for the public transport lines travelling through neighbourhoods that have a low socioeconomic population and which are located on the outskirts of the city. People are dependent on the stop close to their homes and in some cases are not able to afford alternative transport. Therefore, before changes are made the users should be consulted in the earlier stage of the decision-making process. To conduct research into the consequences it has for the people that rely on the specific public transport stop. Otherwise, the people it affects might suffer from different types of social exclusion. The public transport should be looked at a social amenity that should not be profitable. The decision for the plans of restructuring the public transport network in Rotterdam has already been made, but a sufficient alternative should be provided for the people who are missing out on their means of transport.

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# Appendix 1

Neighbourhood	Pop_>65	Non_We stern	Social_Housin g	Low_Inc ome	Disabilit y	Unemplo yment	Household_Ownership_Car	Dist_GP	Dist_SM	Dist_Sch ool	Dist_PT re	Risk_Sco re
Hillegersberg Zuid	2.00	1.00	1.00	1.00	1.00	1.00	2.00	1.00	2.00	1.00	1.00	1.27
Blijdorp	2.00	1.00	1.00	1.00	1.00	1.00	4.00	1.00	1.00	1.00	1.00	1.36
Cool	2.00	2.00	2.00	2.00	2.00	1.00	1.00	2.00	1.00	2.00	1.00	1.64
Middelland	1.00	3.00	2.00	2.00	2.00	1.00	2.00	4.00	1.00	1.00	1.00	1.73
Bergpolder	1.00	2.00	1.00	2.00	2.00	1.00	4.00	1.00	2.00	1.00	2.00	1.73
Kop van Zuid	1.00	2.00	2.00	1.00	1.00	1.00	2.00	1.00	2.00	4.00	2.00	1.73
Stadsdriehoek	1.00	2.00	1.00	2.00	2.00	1.00	4.00	2.00	1.00	3.00	1.00	1.82
Oud Mathenesse	1.00	3.00	1.00	3.00	2.00	2.00	4.00	1.00	1.00	1.00	1.00	1.82
Liskwartier	2.00	2.00	2.00	2.00	3.00	2.00	3.00	1.00	1.00	1.00	1.00	1.82
Cs Kwartier	2.00	3.00	1.00	1.00	1.00	1.00	3.00	3.00	2.00	3.00	1.00	1.91
Nieuwe Werk	3.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	3.00	4.00	2.00	1.91
Katendrecht	2.00	3.00	2.00	2.00	2.00	2.00	3.00	1.00	1.00	1.00	2.00	1.91
Nesselande	1.00	2.00	1.00	1.00	1.00	1.00	1.00	4.00	4.00	4.00	1.00	1.91
Carnisse	1.00	3.00	1.00	2.00	2.00	2.00	4.00	1.00	1.00	1.00	3.00	1.91
Zestienhoven	1.00	1.00	1.00	1.00	1.00	1.00	1.00	4.00	4.00	4.00	3.00	2.00
Terbregge	2.00	1.00	1.00	1.00	1.00	1.00	1.00	3.00	4.00	4.00	3.00	2.00
Molenlaankwartier	4.00	1.00	1.00	1.00	2.00	2.00	1.00	3.00	3.00	1.00	3.00	2.00
Pernis	4.00	1.00	2.00	1.00	2.00	1.00	1.00	2.00	2.00	2.00	4.00	2.00
Dijkzigt	1.00	2.00	4.00	1.00	1.00	1.00	4.00	2.00	2.00	3.00	2.00	2.09
Provenierswijk	1.00	3.00	2.00	2.00	3.00	2.00	4.00	2.00	2.00	1.00	1.00	2.09
Kop van Zuid Entr	2.00	4.00	3.00	3.00	2.00	3.00	2.00	1.00	1.00	1.00	1.00	2.09
Nieuw Crooswijk	1.00	3.00	4.00	3.00	2.00	2.00	3.00	1.00	2.00	1.00	2.00	2.18
Oud IJsselmonde	3.00	2.00	1.00	1.00	1.00	1.00	1.00	4.00	4.00	4.00	2.00	2.18
Oud Charlois	1.00	3.00	2.00	3.00	2.00	3.00	3.00	1.00	2.00	1.00	3.00	2.18
Dorp	4.00	1.00	3.00	2.00	4.00	2.00	1.00	2.00	2.00	2.00	1.00	2.18
Nieuw Mathenesse	1.00	3.00	1.00	1.00	1.00	1.00	4.00	3.00	3.00	4.00	2.00	2.18
Nieuwe Westen	1.00	4.00	2.00	4.00	2.00	3.00	4.00	1.00	1.00	1.00	2.00	2.27
Schiemond	2.00	4.00	2.00	3.00	2.00	3.00	2.00	1.00	1.00	2.00	3.00	2.27
Kralingen West	2.00	3.00	3.00	3.00	2.00	3.00	4.00	1.00	1.00	2.00	1.00	2.27
Kralingen Oost	3.00	1.00	1.00	1.00	1.00	4.00	3.00	2.00	3.00	3.00	3.00	2.27
Hillesluis	1.00	4.00	2.00	4.00	2.00	4.00	3.00	1.00	1.00	1.00	2.00	2.27
's-Gravenland	3.00	1.00	2.00	1.00	1.00	1.00	1.00	4.00	3.00	4.00	4.00	2.27
Strand en Duin	3.00	1.00	1.00	1.00	1.00	1.00	1.00	4.00	4.00	4.00	4.00	2.27
Overschie	3.00	1.00	2.00	2.00	1.00	2.00	1.00	4.00	4.00	3.00	3.00	2.36
Schiebroek	3.00	2.00	3.00	3.00	3.00	3.00	2.00	2.00	2.00	1.00	2.00	2.36
Noordereiland	3.00	2.00	2.00	2.00	2.00	2.00	3.00	4.00	1.00	4.00	1.00	2.36
Kralingseveer	3.00	1.00	1.00	1.00	1.00	2.00	1.00	4.00	4.00	4.00	4.00	2.36
Tarwewijk	1.00	4.00	2.00	3.00	2.00	3.00	4.00	1.00	1.00	1.00	4.00	2.36
Delfshaven	1.00	3.00	3.00	3.00	3.00	2.00	4.00	2.00	2.00	1.00	3.00	2.45
Spangen	1.00	4.00	4.00	4.00	2.00	3.00	3.00	1.00	2.00	1.00	2.00	2.45
Oude Noorden	2.00	3.00	3.00	4.00	3.00	3.00	4.00	2.00	1.00	1.00	1.00	2.45
Rubroek	3.00	3.00	3.00	3.00	4.00	3.00	4.00	1.00	1.00	1.00	1.00	2.45
Rozenburg	4.00	1.00	2.00	1.00	3.00	2.00	1.00	4.00	2.00	3.00	4.00	2.45
Agniesebuurt	2.00	4.00	3.00	3.00	3.00	3.00	4.00	1.00	2.00	2.00	1.00	2.55
Hillegersberg Noor	4.00	1.00	2.00	2.00	4.00	3.00	1.00	3.00	3.00	3.00	2.00	2.55
Bloemhof	1.00	4.00	3.00	4.00	3.00	4.00	3.00	1.00	1.00	1.00	3.00	2.55
Beverwaard	2.00	4.00	3.00	3.00	2.00	3.00	2.00	2.00	3.00	2.00	2.00	2.55
Hoogvliet Noord	3.00	3.00	2.00	2.00	3.00	2.00	1.00	3.00	4.00	1.00	4.00	2.55
Oude Westen	3.00	4.00	3.00	4.00	3.00	4.00	4.00	1.00	1.00	1.00	1.00	2.64
Afrikaanderwijk	2.00	4.00	4.00	4.00	3.00	4.00	4.00	1.00	1.00	1.00	1.00	2.64
Het Lage Land	4.00	2.00	2.00	2.00	4.00	3.00	2.00	2.00	2.00	3.00	3.00	2.64
Zevenkamp	3.00	2.00	2.00	3.00	4.00	3.00	2.00	3.00	3.00	1.00	3.00	2.64
Zuidplein	4.00	3.00	1.00	2.00	3.00	2.00	4.00	2.00	1.00	3.00	4.00	2.64
Pendrecht	2.00	4.00	3.00	3.00	3.00	4.00	2.00	2.00	2.00	1.00	3.00	2.64
Kleinpolder	4.00	3.00	4.00	3.00	4.00	3.00	2.00	1.00	2.00	1.00	3.00	2.73
Struisenburg	3.00	2.00	2.00	2.00	1.00	4.00	4.00	4.00	3.00	4.00	1.00	2.73
Groot IJsselmonde	4.00	3.00	3.00	3.00	4.00	3.00	2.00	2.00	3.00	2.00	1.00	2.73
Charlois Zuidrand	4.00	2.00	1.00	1.00	4.00	2.00	0.00	4.00	4.00	4.00	4.00	2.73
Heijlplaat	3.00	2.00	4.00	2.00	2.00	2.00	1.00	4.00	2.00	4.00	4.00	2.73
Bospolder	2.00	4.00	4.00	4.00	3.00	4.00	4.00	1.00	1.00	1.00	3.00	2.82
Tussendijken	2.00	4.00	3.00	4.00	3.00	4.00	4.00	1.00	2.00	1.00	3.00	2.82
Lombardijen	3.00	3.00	3.00	3.00	4.00	4.00	2.00	1.00	3.00	2.00	3.00	2.82
Ommoord	4.00	1.00	3.00	2.00	4.00	4.00	2.00	4.00	3.00	2.00	2.00	2.82
Vreewijk	4.00	2.00	4.00	4.00	4.00	4.00	3.00	2.00	2.00	1.00	2.00	2.91
Feijenoord	2.00	4.00	4.00	4.00	3.00	4.00	4.00	3.00	2.00	1.00	1.00	2.91
Oud Crooswijk	3.00	4.00	4.00	4.00	4.00	4.00	4.00	1.00	2.00	1.00	2.00	3.00
Oosterflank	4.00	3.00	3.00	4.00	4.00	4.00	2.00	2.00	2.00	2.00	3.00	3.00
Hoogvliet Zuid	4.00	2.00	3.00	2.00	4.00	3.00	1.00	4.00	3.00	3.00	4.00	3.00
Witte Dorp	3.00	4.00	4.00	4.00	3.00	4.00	2.00	4.00	3.00	1.00	2.00	3.09
De Esch	4.00	3.00	3.00	3.00	3.00	3.00	2.00	3.00	4.00	3.00	3.00	3.09
Prinsenland	4.00	2.00	3.00	3.00	4.00	3.00	2.00	4.00	4.00	1.00	4.00	3.09
Zuidwijk	3.00	4.00	4.00	4.00	4.00	4.00	3.00	2.00	2.00	1.00	4.00	3.18
Wielewaal	4.00	1.00	4.00	4.00	3.00	4.00	3.00	3.00	4.00	3.00	4.00	3.36
Landzicht	4.00	1.00	4.00	4.00	4.00	4.00	2.00	4.00	4.00	4.00	4.00	3.55
Zuiderpark	4.00	2.00	4.00	4.00	4.00	4.00	4.00	3.00	4.00	3.00	4.00	3.64

## Appendix 2

### Interview

- Q1. Could you tell me where you are travelling now?
- a. Which places do you visit often?
  - b. How do you travel to these places?
- Q2. To get to these places do you always use the same means of transport
- c. Why do you use this mode of transport?
  - d. Do you use other modes of transport? Why not?
  - e. Are you able to use other modes of transport? For which travels?
  - f. Do you have other modes of transport at your availability? (Car, bike, public transport, shared transport)
  - g. Do you get help while travelling?
- Q3. Are there any obstacles or problems that you encounter when you travel? (With different modes of transports)
- h. (Costs, availability, public transport schedule, stairs,)
- Q4. Are you able to travel as much as you want or need?
- i. Why not?
- Q5. Are you able to travel anywhere, anytime you want to or need?
- j. Why not?
- Q6. Have you ever made the decision that you would rather not travel?
- k. Can you describe the reason and situation?
- Q7. Have you ever been prevented from participating in an activity or missed an opportunity because were unable to get to the place
- l. Can you describe this situation?
- Q8. Do you have any thoughts on how your travel possibility could be enhanced?

### Personal characteristics?

1. Age
2. Gender
3. Migration background

## Appendix 3

### codebook

Code folder	First level code	Second level code
<b>Travel features</b>	Costs	
	Dependency on mode	
	Dependency on others	
	Limited travel range	
<b>Transport choice</b>	Ability	
	Availability	
	Mode	<i>Bike</i>
		<i>Car</i>
		<i>Public transport</i>
<i>On foot</i>		
Traffic hinders		
<b>Disadvantages of travelling</b>	Hard barriers	<i>Costs</i>
		<i>Crowding</i>
		<i>Distance</i>
		<i>Inaccessibility</i>
		<i>Physical inconvenience</i>
	Soft barriers	<i>Lack of service</i>
	<i>Safety</i>	
<b>Motivation for non trip making</b>	Costs	
	Crowding	
	Health condition	
	No transport available	
	Safety	
	Skills	
	Transfers in public transport	
<b>Needs for travelling</b>	Improved accessibility	
	Improved safety	
	Lower costs	