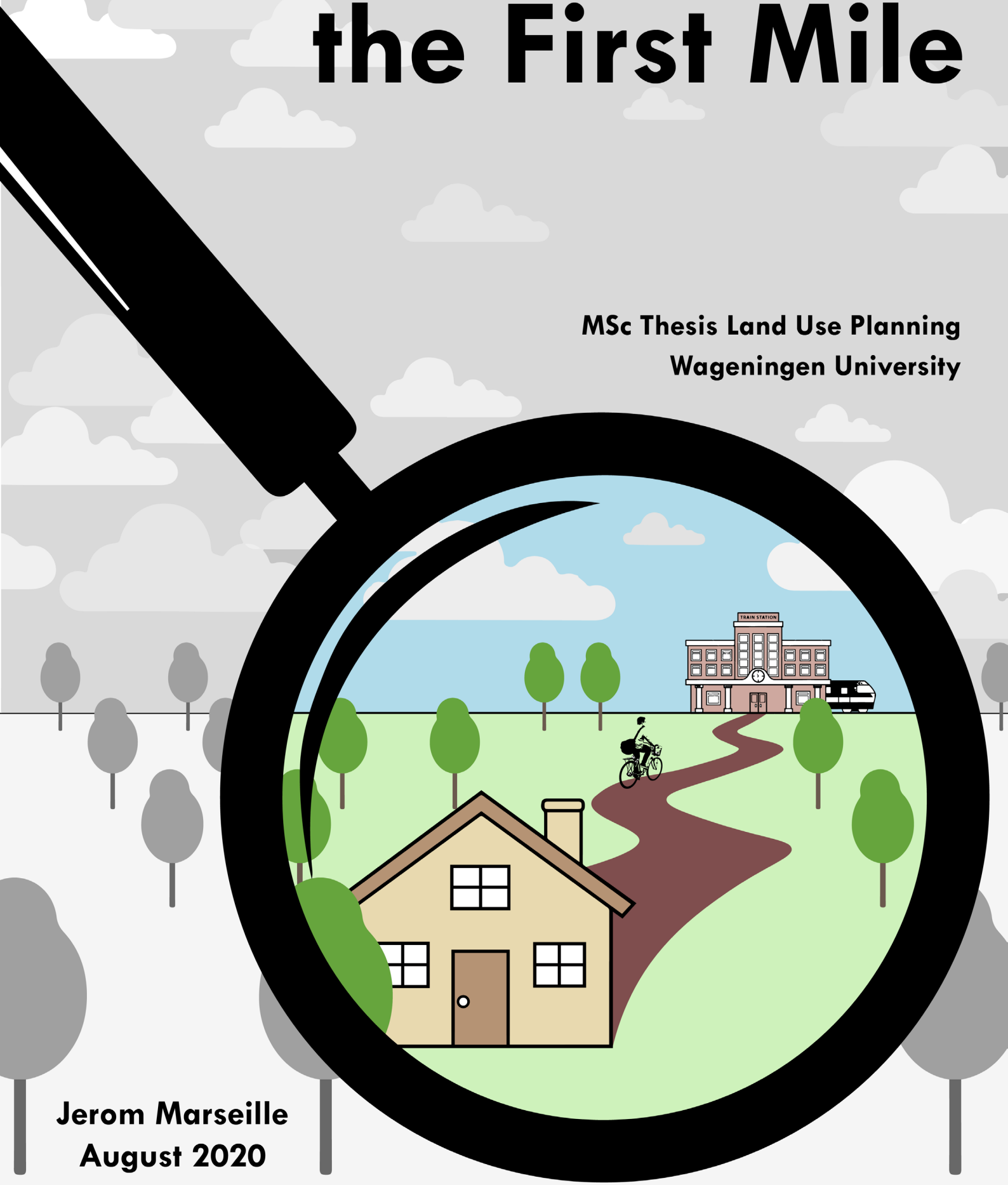
Exploring the First Mile

MSc Thesis Land Use Planning
Wageningen University



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Understanding how policy, infrastructure and usage influence first mile travel by bicycle to train stations in medium-sized cities in the Metropolitan Region of Amsterdam.

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Abstract

In the Metropolitan Region of Amsterdam, developing a competitive alternative to the car is becoming an urgent task. Medium-sized cities in this region experience a large stream of daily commuters to and from larger cities like Amsterdam, affecting the accessibility, sustainability and liveability in and around these medium-sized cities. By combining the accessibility of bicycle and the speed of the train trip, the bicycle-train combination could potentially match or even surpass the attractiveness of the same journey by car. For medium sized cities, an important and determining element of this bicycle-train combination is the first mile, the trip from the commuter's home to the train station. This thesis aims to explore how first mile travel by bicycle to train stations is influenced in medium-sized cities in the Metropolitan Region of Amsterdam, according to its policy, infrastructure and usage. By conducting a case study on two medium-sized cities in the MRA using a mixed method approach, this thesis studies the influence of each of the factors affecting First Mile travel. Policy influences first mile travel through mobility and transport policy, which concerns infrastructural interventions and regulations, influencing infrastructure and usage, respectively. Infrastructure directly influences first mile travel choices and behaviour through its accessibility, level of safety, the directness of the route, and the comfort and attractiveness of the bicycle infrastructure and parking facilities. Travel behaviour and patterns are seen in usage as influenced through personal characteristics, travel characteristics and the opinions of the city's inhabitants. Together, these factors influence each other in a feedback loop to encourage or discourage first mile travel by bicycle. The findings from this thesis provide policymakers insights into how to facilitate and improve first mile travel by bicycle with the potential to complement the public transport system for the city and promote sustainable mobility.

Keywords:
Bicycle-train Combination | Municipal Policy | Bicycle Infrastructure
Sustainable Mobility | Medium-sized cities | Metropolitan Region of Amsterdam

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Introduction

The number of daily commuters is growing

The Metropolitan Region of Amsterdam (MRA) is urbanising rapidly. Between 2017 and 2040, an additional 250.000 houses will be built within this region to meet the housing demand (Samen Bouwen aan Bereikbaarheid, 2019). It is expected that therefore several cities within the MRA will grow significantly until 2040 (Metropoolregio Amsterdam, 2020a). This also applies to the medium sized cities (75.000-200.000 inhabitants) in the MRA such as Haarlem and Hilversum, which are expected to house thousands of new inhabitants. However, most jobs in the MRA are located within Amsterdam, where – in contrast to its neighbouring cities in the region – the number of jobs is growing (Beuckens et al., 2018). Due to this trend, the number of commuters from the medium-sized cities towards Amsterdam will grow, and the demand for mobility to and from these cities will likely increase. Because it cocnerns a relevant and contemporary subject, there is a growing interest to increase the use of sustainable modes of transportation in the Netherlands. Therefore, it is starting to gain more attention as a research topic, too.

The daily commute must become more sustainable

The growing demand for mobility is expected to create problems such as increased demand on the road network surpassing its capacity leading to congestion (SBaB, 2019). This will negatively impact the economy and the sustainability goals of the government (Mobiliteitsalliantie, 2019). A critical phenomenon impeding current sustainable mobility goals is the growth of the daily commute by car (Heinen et al., 2010). The daily commute trip contributes disproportionately to traffic congestion and environmental pollution due to its non-discretionary character – in one way or the other, people must make their way to work. Therefore, introducing alternative means of commuting like walking, cycling or transit could help in reducing both congestion and pollution (Heinen et al., 2010).

However, to decrease the car use and increase the use of sustainable modes, inhabitants of the MRA need to be encouraged to choose more sustainable modes of transportation. As such, these alternatives must become attractive as compared to the journey by car (Brons & Rietveld, 2009). To make this happen, the Dutch government has heavily invested in multimodal trips and improving mobility chains by encouraging transit use with programs such as 'Beter Benutten' (Tour de Force, 2017; Rijksoverheid, 2018; PBL, 2014). The government emphasises the importance and potential of the bicycle-train combination in encouraging multimodal mobility.

	Strength	Weakness
Cycling	speed and flexibility on short distance	limited action radius
Transit	speed and efficiency on long distance	low door-to-door accessibility

Table 1: The complementary traits of cycling and transit (Table by author, based on Kager et al., 2016)

The bicycle-train combination has a lot of potential

This bicycle-train combination is a potentially competitive alternative to the journey by car (Kager et al., 2016; Shelat et al., 2018; Van Mil et al., 2020). By combining the flexibility of the bicycle with the speed and comfort of train, the bicycle-train combination presents strengths in speed and accessibility (table 1). However, whether this potentially competitive combination is realised in practice depends on the characteristics of the specific context.

The importance of the first mile

A door-to-door rail journey includes three trips: the first mile, the train trip and the last mile. These first and last miles are important, as these can make up nearly half of the total trip time (Brons & Rietveld, 2009; Van Mil et al., 2020). Additionally, the quality of the bicycle journey to the train station (first mile) is a major influencer in deciding for choosing the train as a main transport mode (Klinkenberg & Bertolini, 2014). Therefore, the first mile and the local scale are crucial in shifting mobility choices (PBL, 2014; Schaap et al., 2015).

First mile policy in medium-sized cities

The responsibility of the door-to-door rail journey on a local scale falls to the municipalities (Schaap et al., 2015). This includes policy for cycling, road infrastructure and areas around train stations crucial for the first mile. Improving the first mile and thereby stimulating inhabitants to use a more sustainable mode instead of the car when commuting can make a large contribution to realising energy neutral and climate neutral cities and are common goals on the sustainability agenda of many (medium-sized) municipalities (Tour de Force, 2017). Because of their proximity to Amsterdam and their relatively high number of daily commuters, medium-sized cities within the MRA have a high potential first mile travel by bicycle in combination with the train. Additionally, the overall cycling potential is high in medium-sized cities because internal distances are relatively short (Heinen et al., 2010).

However, a successful first mile requires more than just an acceptable distance for cycling to the train station (Van Mil et al., 2020). Although policy makers have many instruments available to prioritise the cyclist, there is insufficient knowledge on what is exactly needed to

optimise the first mile (Kager et al, 2016) as advised in various national and international literature (KiM, 2016; Scheltema, 2012; Singleton & Clifton, 2014). Actual research on the bicycle-train combination is still limited compared to other modalities and combinations (Krizek and Stonebraker, 2010; Van Mil et al., 2020), especially considering case studies on potential accessibility impacts of bicycle-train facilities and policies (Geurs et al, 2016; Kager et al., 2016).

The research

To gain more knowledge on how first mile travel (specifically with the bicycle-train combination) can be improved in medium sized cities in the MRA, this thesis studies the factors influencing travel choice and behaviour via the policies, infrastructure and usage of commuters in these cities. Utilising a combination of policy and document analysis, interviews, survey, travel survey statistical analysis and GIS analysis, this thesis asks what these factors are and what their influence is. Consequently, the relations between these factors will be researched. Finally, a mixed methods approach will be applied to explore the current state of the first mile in two case studies. By doing so, the main research question can be answered. The results of the research will be used to provide actionable recommendations that can guide policy makers of medium-sized municipalities in the MRA to create policy and design suggestions to improve their first miles by bicycle to train stations.

Research questions

Research objective:

The objective of this research is to explore how first mile travel to train stations by bicycle is influenced in medium-sized cities in the Metropolitan Region of Amsterdam.

Main Research Question:

How is first mile travel to train stations by bicycle influenced in medium-sized cities in the Metropolitan Region of Amsterdam?

Sub Questions:

1. What are the factors influencing the first mile travel by bicycle to train stations?

2. What is the relation between the factors influencing the first mile travel by bicycle?

Theory

This chapter draws the framework for first mile travel by bicycle to train stations from literature worldwide. First, a short elaboration on travel behaviour and sustainable mobility is given, to provide an insight in these overarching factors. Then, from the perspective of these themes, this chapter covers a deeper elaboration on the bicycle-train combination and the first mile. Then, the factors influencing the first mile travel by bicycle to train stations will be discussed, leading towards the conceptual framework which has been designed for this research.

Travel behaviour and sustainable mobility

The basis of this research derives from the academic debate on travel behaviour of individuals and how their travel is influenced by and influences urban space. Individual travel behaviour choices are determined by multiple intrinsic and extrensic factors. Most importantly, this concerns travel time, monetary costs and effort (Annema, 2013). It is important to understand how these and related factors influence travel behaviour, to steer individual travel behviour in the desired direction.

This desired direction can be found in the sustainable mobility paradigm. This paradigm suggests that cities should be designed in a certain quality and on a certain scale, so that people would not need to own and use a car (Banister, 2008). This implies that it is important to find ways how to design cities in such a way that the sustainable alternatives to the car are becoming more attractive.

Following from these themes, and the importance to study and understand various aspects related to these themes, this research focuses on the topics that are relevant to understanding travel behaviour in the context of the bicycle-train combination and especially first mile travel to increase sustainable mobility patterns.

The bicycle-train combination

As mentioned in the introduction of this thesis, the sustainable journey by bicycle, public transport and/or walking must become an attractive alternative to the journey by car (Brons & Rietveld, 2009). Realising this is quite a challenge, as the car is the most competitive, and therefore most used mode of transportation in the Netherlands, especially during the daily commute (Wiersma et al, 2016). To decrease the car use and increase the use of sustainable modes, inhabitants of the MRA must be encouraged to use sustainable modes of transportation.

To encourage a sustainable alternative to the journey by car, this alternative needs to be both fast and flexible, as these are the main competitive qualities of the car journey (Kager et al, 2016). However, the sustainable modes alone are unable to compete with the private car (Brons & Rietveld, 2009; Martens, 2004). Cycling and walking lack a large action radius, while the train lacks a proper door-to-door connection (Kager et al, 2016). Fortunately, there is a potential competitive alternative to the private car.

By combining cycling and the train within one trip chain, a strong synergy is created. This bicycle-train combination is both flexible (due to the bicycle) and fast (due to the train) (Kager et al., 2016; Shelat et al., 2018; Van Mil et al., 2020). As opposed to the stand-alone train trip, the bicycle-train combination has an increased adaptability to the individual demand of its users. As opposed to the stand-alone bicycle trip, the bicycle-train combination introduces the capability to fill the gap in the cycling system between cities located further apart than the

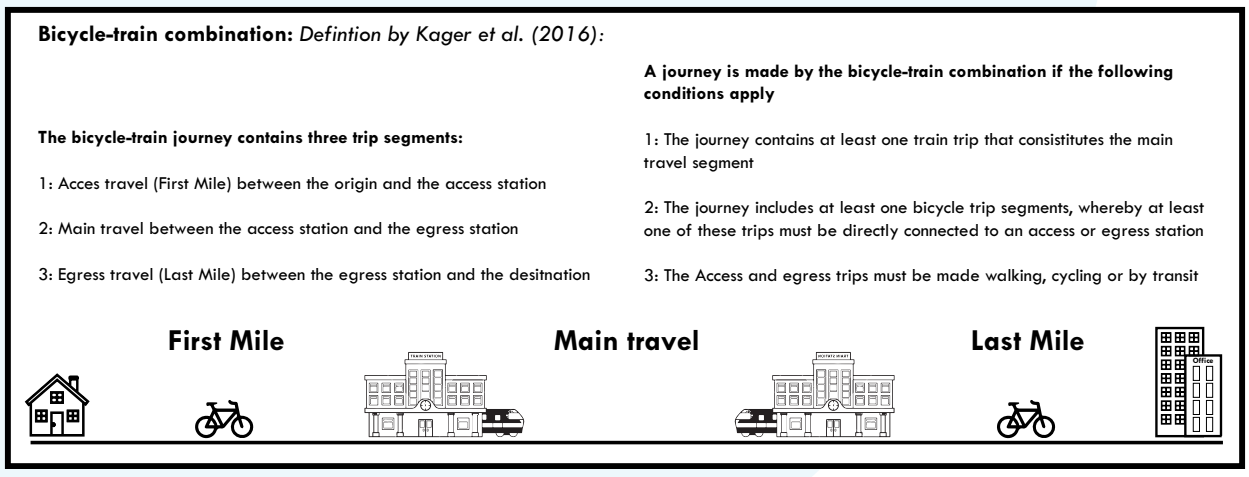


Figure 1: The definition of the bicycle-train combination according to Kager et al. (2016). Image by author.

preferred distance for cyclists (Kager et al, 2016). The complete bicycle-train journey can be split up into three trips: The access trip (first mile), the main trip, and the egress trip (last mile). Based on the combination of these three trips, Kager et al (2016) formulated a definition for the bicycle-train combination (figure 1).

Their definition states that: The main trip must contain at least one train trip, the first and last miles should consist of at least one bicycle trip, and the first and last mile trips can only be made walking, cycling, or by using transit modes (train, bus, tram or metro). Due to its unique characteristics, the bicycle-train combination is potentially competitive to the characteristics of the private car (Kager et al, 2016). An indication of its competitive position is shown in figure 2. It shows that the bicycle-train combination can potentially match the car in terms of speed and door-to-door accessibility.

Figure 2 also shows that there is a certain variation in its success. Figure 3 clarifies this variation below. The rather large red circle of the bicycle-train mode in this figure shows that the combined mode can be either as competitive as light rail (when contextual variables are not in favour of the bicycle-train mode) or as competitive as cars on uncongested roads (when contextual variables are very much in favour of the bicycle-train mode). This variation represents the context in which the bicycle-train combination takes place; whether the potential of the bicycle-train mode is realised in practice depends on various contextual variables. According to Kager et al. (2016), this includes the speed and frequency of the local train services, road congestions levels, the quality of bicycle infrastructure and the quality of the transfers. When the contextual variables are optimised, the competitive position of the bicycle-train combination will improve, leading to a higher use of this mode.

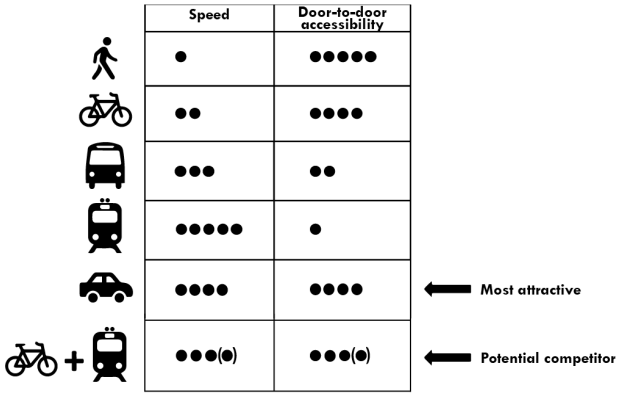


Figure 2: The speed and door-to-door accessibility of each transport mode. (Image by author, based on Kager et al., 2016)

To understand which contextual variables can be improved to strengthen the position of the bicycle-train mode, it is important to know which trips of this journey have room for improvement. As stated before, the bicycle-train journey consists of three trips: The first mile (including the access station transfer), the main trip, and the last mile (including the egress station transfer).

Although the train trip seems to be the most important element due to its ability to cover large distances at great speeds, the first and last miles are at least as important, as the bicycle leg of the bicycle-train journey can make up nearly half of the total trip time (Van Mil et al., 2020). This is also confirmed by Brons, Givoni & Rietveld (2009), who state that the dimensions related to the rail trip itself have decreased in relative importance, while other elements of the door-to-door rail journey, such as access mode and transfer, have become relatively more important for travellers. This might be the case because the latter are weaker links in the public transport chain (Krygsman et al, 2004). They can therefore be improved the most.

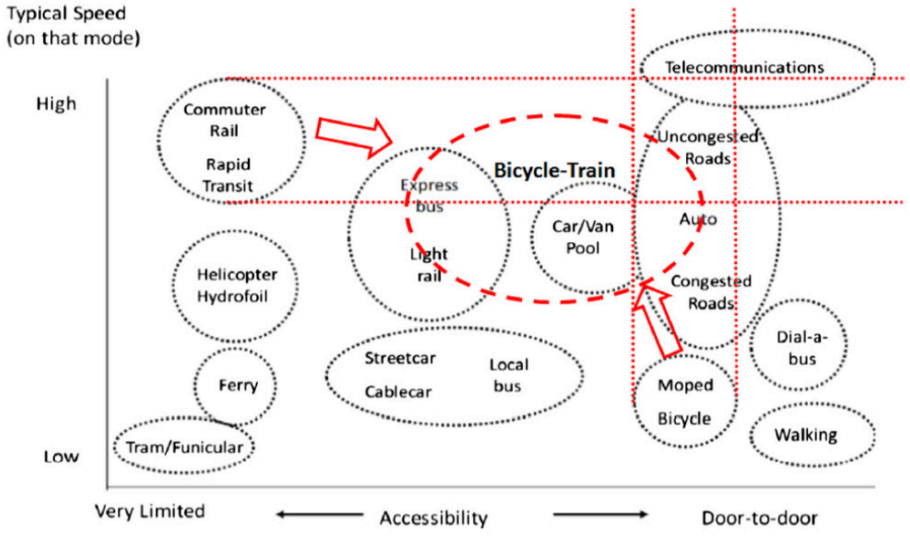


Figure 3: The synergetic benefits of the bicycle-train mode according to speed and the level of accessibility (Source: Kager et al., 2016)

Additionally, the value of cycling time is higher than the value of train time. In other words, people would rather sit in the train for a longer period than cycle longer (Van Mil et al., 2020). Improving the bicycle trip is therefore more effective than improving the train trip in terms of generating more bicycle-train trips. Moreover, improvements in the bicycle trips have the potential to significantly reduce the total bicycle-train journey time, and these improvements are relatively inexpensive in contrast to expensive infrastructure to enhance the speed of the train trip (Brons, Givoni & Rietveld, 2009; Krygsman et al, 2004). Therefore, this research focuses on the bicycle side of the bicycle-train journey.

The first mile

The bicycle side of the bicycle-train journey consists of the first mile and the last mile. According to Martens (2004) and Krygsman et al. (2004), first mile travel equals access trips towards train stations and last mile travel equals egress trips from train stations towards an activity. Considering the daily commute, the first mile is located between homes of commuters and an access train station. The last mile is located between an egress train station and work locations of commuters. That means that the first mile usually concerns travel in residential areas, and the last mile usually concerns travel in areas with high densities of jobs.

There is a large difference in the use of transport modes between the first and last mile. Although both the first and last mile are potentially bicycle trips within the bicycle-train journey, this does not necessarily mean that these trips are currently made by bicycle. While this is the case for the first mile trip, in which the cycling share is 47% of all first mile trips in the Netherlands (Figure 4), the last mile trips have a cycling share of only 12% (Kager et al., 2016). This is mostly due to the availability of bicycles: almost every Dutch citizen owns a bicycle, which means that the bicycle is always an available – and most of all free – mode of transportation on the home-side of a journey, and thus for the first mile (Jonkeren et al., 2019).

At the egress train stations, the availability of bicycles is limited, and unless commuters have a second bicycle at the egress station, using a bicycle (rental bicycles or OV-fiets) comes at a cost.

That means that in terms of ownership, the first mile by bicycle to train stations has a very large potential in contrast to the last mile. This potential, however, is influenced by more variables than just bicycle availability. The main influencers of the bicycle-train combination will be discussed in the 'Conceptual framework' section. This research will focus on the first mile due to its potential to increase the use of the bicycle-train mode. Additionally, this choice has been based on findings from several scientific articles. According to Givoni & Rietveld (2007) there is a substantial scope for improving the first mile towards train stations, and in most cases a better first mile will contribute to a higher satisfaction of travellers with the complete train journey. Klinkenberg and Bertolini (2014) state that the quality of the first mile by bicycle to train stations is a major influencer in choosing the train as the main transport mode instead of the car. La Paix Puello & Geurs (2014) confirm this, and add that especially considering first mile travel, a poor ratio of cost to time is a significant reason for not choosing the train as the main transport mode.

Considering the findings above, the researcher has found multiple incentives to further research the first mile as a part of the bicycle-train combination. However, as the amount of research on the bicycle-train journey and the first mile is relatively thin, a proper existing theory which could be used as a conceptual framework for this thesis was still absent. Therefore, the researcher created a new conceptual framework based on the scientific literature on these topics. This conceptual framework can be found in the next section.

In this research, the concept 'first mile travel' implies the trip people make from their home to a train station as part of a larger journey, which often includes the daily commute.

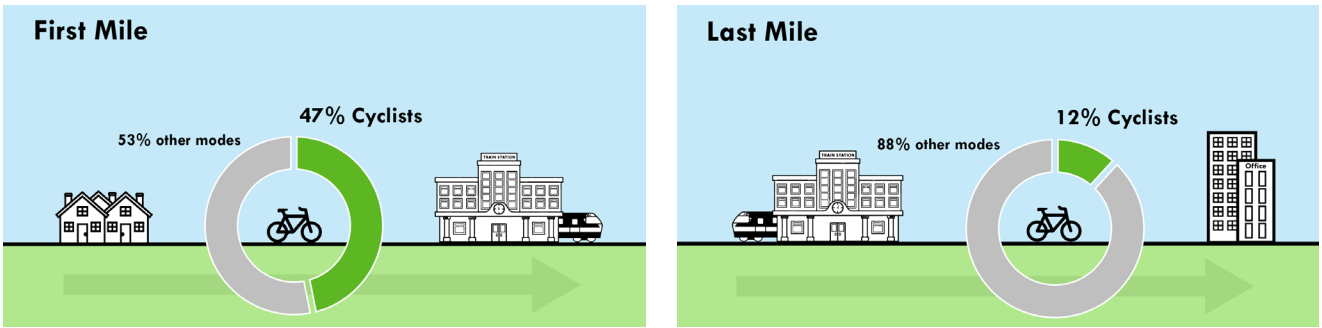


Figure 4: The current share of bicycle use during first mile and Last Mile travel in the Netherlands (Image by author, based on Kager et al, 2016)

Conceptual Framework

In this section, the factors influencing first mile travel by bicycle to train stations will be discussed, leading towards the conceptual framework which has been designed for this research. Via a qualitative literature study, the two sub questions for this research will be answered. This has been done in an early stage of the research, as this information forms the foundation of the conceptual framework which will be used as an instrument to explore the first mile by bicycle to train stations in specific case studies. First, an elaboration is given on the influence of each factor on first mile travel by bicycle to train stations. Then, the relations between the influencing factors will be discussed. To finalise the conceptual framework, the relation to the context of the MRA will be added to make the model appliccable for a case study research.

The factors influencing first mile travel

In order to explore first mile travel, its main influencing factors must be identified. In scientific literature, there is no explicit answer to the question what these factors are. However, the main factors influencing the bicycle-train combination have been identified. According to Shelat et al. (2018), the bicycle-train combination is influenced by policy, infrastructural facilities, user characteristics and travel characteristics. Since this thesis is focused on the first mile as a part of the bicycle-train combination, the researcher conducted a qualitative literature study to find out whether the same factors are also the main influencers in first mile travel by bicycle to train stations, and if so, how these factors are related.

During the qualitative literature study, many scientific articles were found which include information about first mile travel considering either policy, infrastructure or a combination of travel and user characteristics. A possible explanation for this is that these three (clusters of) subjects are usually mentioned in studies focused on one of these subjects, while including first mile travel only as a small part of the research. Another explanation is that these articles usually focus on one or two methods to collect and analyse data. Because these methods often differ, a rather large variety of data collection and analysis methods is needed to study all three subjects in one research. The figure below visualises the translation of the influencing factors of the bicycle-train combination into influencing factors for first mile travel. The factor 'usage' replaces the travel and user characteristics as these two are often combined in scientific research.

As a result of the qualitative literature study, the researcher found that there are two additional articles that include policy, infrastructure and usage as the three influencing factors of a cycling-related topic. Rietveld & Daniel (2004) used these three factors for their research to find determinants for bicycle use. Harms et al. (2016) examined Dutch cycling policies in medium-sized cities and found as a result that the three factors mentioned above indicate the effectiveness of cycling policy in these cities. The findings from the scientific articles above, in addition to the relevant scientific articles focused on the three influencing factors, together form a strong foundation to build a conceptual framework on the factors influencing first mile travel by bicycle to train stations: The Policy-Infrastructure-Usage (PIU) model

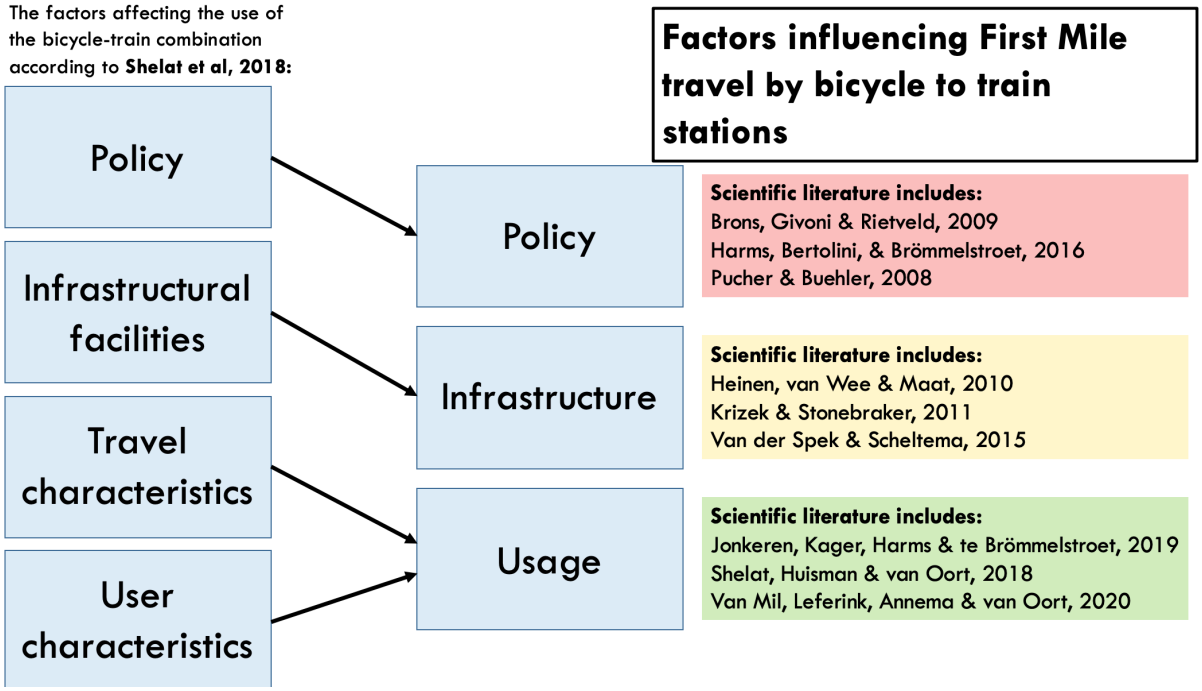


Figure 5: The translation of influencing factors for the bicycle-train combination into influencing factors for first mile travel

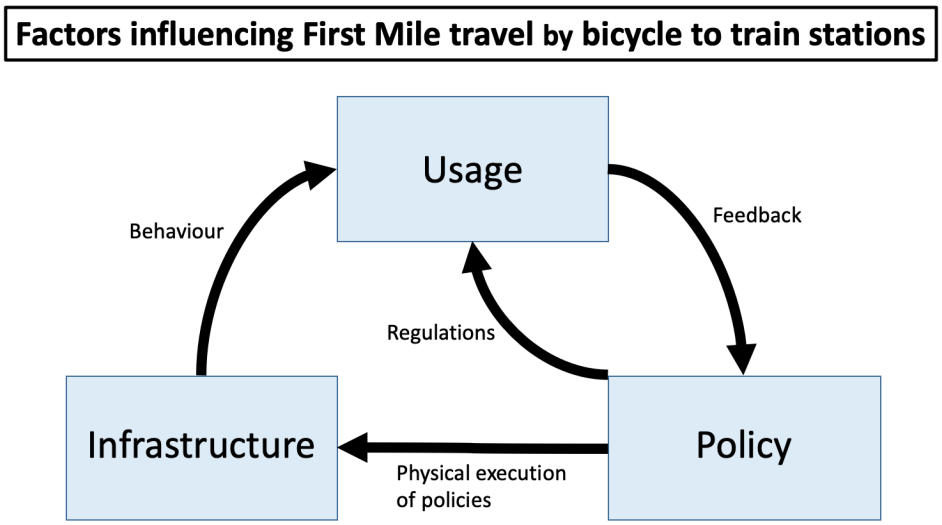


Figure 6: The Policy-Infrastructure-Usage (PIU) model: Factors influencing first mile travel by bicycle to train stations.

(figure 6). In the following sections, each of the three influencing factors of the PIU model is elaborated on based on the relevant scientific articles found in the qualitative literature study.

Policy

Policies regarding the integration of bicycle and transit have been discussed regularly throughout the last two decades. Literature includes Brons & Rietveld (2009), Harms et al. (2016) and Pucher & Buehler (2008). The responsibility of policies to improve the door-to-door rail journey on a smaller scale can particularly be found within municipalities of cities. This is due to the local, rather short-distance trips made by bicycle for this purpose (Pucher & Buehler, 2008; Schaap et al., 2015). Policy initiatives mostly concern safety, environmental, liveability and accessibility issues (Harms et al., 2016). This includes transport, land-use, urban development, housing, environmental, taxation and parking policies (Pucher & Buehler, 2008). Thus, the factor 'policy' goes beyond just cycling policy; it includes every policy that can influence cycling levels in a city.

Policy can affect first mile travel in several ways. Most importantly, by policies that improve infrastructure and public space and by policies that include regulations for cyclists, pedestrians, public transport and car drivers (Harms et al., 2016; Pucher & Buehler, 2008). These policies may include bicycle and car parking, traffic calming, separate cycling facilities and priority for certain modes at intersections. The most successful policies include a combination of both pull (making cycling more attractive) and push (making the car unattractive) factors (Brons & Rietveld, 2009; Harms et al., 2016; Rietveld & Daniel, 2004). Additionally, the effectiveness of cycling policy can be positively influenced by setting measurable and verifiable goals, including a high degree of adaptability in certain policies and allowing high levels of citizen participation in the process (Fishman, 2016; Harms et al., 2016).

Although Dutch municipalities are responsible for their local cycling infrastructure, other governmental bodies such as the state or regional governments may provide coordination, policy guiding and especially funding to contribute to the municipalities (Harms et al., 2016; Pucher & Buehler, 2008). Therefore, national and regional policies are important to take into account when improving first mile travel on a local scale.

Infrastructure

The infrastructure regarding cycling and the integration of bicycle and transit is a relatively popular topic. This factor has therefore been discussed by many scientific authors, including Heinen, van Wee & Maat (2010), Krizek & Stonebreaker (2011) and Van der Spek & Scheltema (2015). There is an abundance of sources claiming that improving both the quality and quantity of bicycle infrastructure increases cycling levels. Therefore, infrastructure can have a large impact on first mile travel, too. When looking at cycling levels regarding the bicycle-train combination, Geurs, La Paix & Van Weperen (2016) found that train ridership can be substantially increased when improving the quality of the bicycle routes and bicycle parking. That means that not only the route from home to the train station is important, but also the facilities at the station itself are important when looking at cycling infrastructure. This is supported by Brand, Hoogendoorn, Van Oort & Schalkwijk (2017), who found that people will cycle further to reach train stations when bicycle and public transport networks are well integrated.

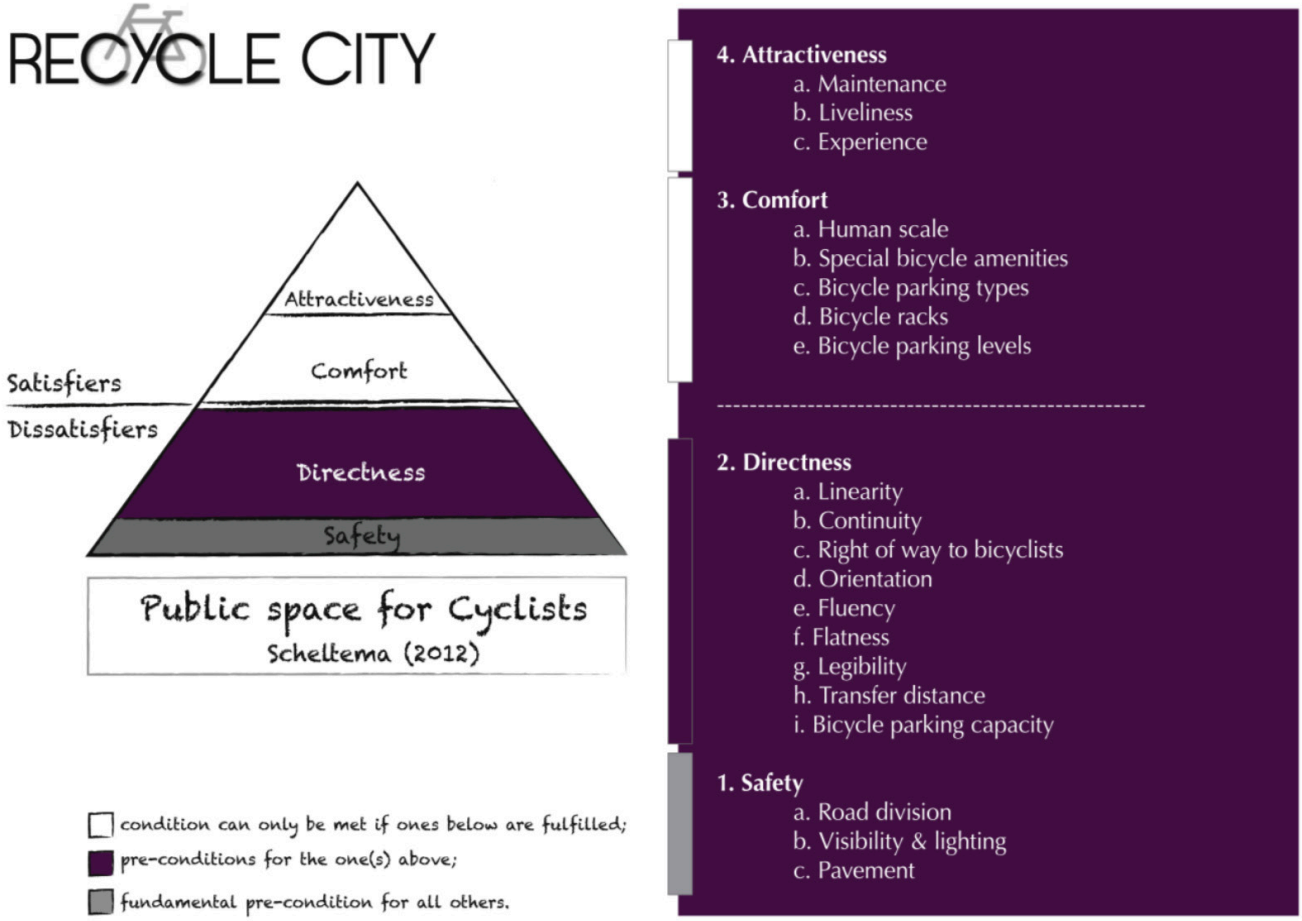


Figure 7: The pyramid for successful public space for cyclists (Source: Van der Spek & Scheltema, 2015, based on Scheltema, 2012).

In scientific literature, the quality of bicycle infrastructure and parking is determined by a large range of specific variables which can influence bicycle use in either a negative or positive way. Several authors, including Van Mil et al. (2020) and Van der Spek & Scheltema (2015), have summarised these into categories. They state that safety, directness, comfort and attractiveness are the most important themes when trying to improve bicycle infrastructure and parking. These categories were adopted from the MSc thesis of Scheltema (2012), in which she formulated the pyramid for successful public space for cyclists (figure 7). As shown in figure 7, the categories consist of several characteristics of the bicycle route. This concerns concrete characteristics such as the pavement, lighting and bicycle racks, and intangible characteristics such as legibility, human scale and liveliness. The pyramid has a specific order; safety is the most important aspect, followed by directness. These are so called 'dissatisfiers' and include necessary elements for successful cycling routes (Van der Spek & Scheltema, 2015). Comfort and attractiveness are the 'satisfiers' and indicate high-quality cycling routes. If these conditions are met as well, cyclists value a route even higher, which could lead to an increase of bicycle use on these routes Scheltema (2012).

Because her research focused on the cycling routes from residential neighbourhoods to train stations, the characteristics from the pyramid by Scheltema (2012) can be used as a list of criteria to assess the infrastructure of first mile routes by bicycle to train stations for this thesis research.

Usage

The usage of first mile travel is a relatively new concept, as these studies often include analyses of big data. This factor has been discussed by Jonkeren, Kager, Harms & te Brömmelstroet (2019), Shelat, Huisman & van Oort (2018) and Van Mil, Leferink, Annema & van Oort (2018). Usage consists of personal characteristics like age, gender, income, education and household size; and travel characteristics like mode of transportation, the goal of the trip and choice of train station (Jonkeren et al., 2019; Rietveld & Daniel, 2004; Van Mil et al., 2020). Concerning the first mile by bicycle to train stations, information about the types of travel and the (non-)users of the bicycle-train combination is likely to be valuable in creating services and policies that encourage the use of the combined mode (Shelat et al, 2018).

Although cycling in the Netherlands is a universal phenomenon (Pucher and Buehler, 2008), there are many differences between population groups, Dutch cities, and also within the cities itself (Van Mil et al., 2020). These differences can be found by identifying the user and travel characteristics of the Dutch population. For example, according to Martens (2004) and Rietveld & Daniel (2004), small- and medium-sized cities have the highest bicycle share in the Netherlands. Experienced cyclists attach more value to other aspects of the cycling route than inexperienced cyclists (Stinson & Bhat, 2003), and the same goes for frequent train travellers opposed to infrequent train travellers (Givoni & Rietveld, 2007).

Finally, changes in the demographic context, such as an increasing population in a city or a change in the average number of people per household, can have an impact on the use of cycling routes and therefore on the effectiveness on cycling policy (Harms et al., 2016). It is therefore crucial to understand that there are different groups of users with different habits and motives in traveling. Gathering information about the usage of first mile travel is mostly associated with quantitative research, as it involves a lot of numbers and statistics. However, according to Van Mil et al. (2020), some usage characteristics, like how bicycle use is perceived, can be better understood using qualitative methods. As these questions involve personal experiences, answers can vary depending on where and to whom they are asked. Therefore, it can be very useful to compare several cases when collecting qualitative usage data.

Interrelations

Some of the information mentioned in the previous sections indicates that there is a close relation between policy, infrastructure and usage. Although there is very little scientific research on the relations between policy, infrastructure and usage (especially considering first mile travel), the relations are actually evident (Van Mil et al., 2020).

The physical execution of policies

The relation between policy to infrastructure is quite clear; many cycling-related policies include the physical implementation of these policies in terms of bicycle infrastructure, public space, the layout of roads, bicycle parking, but also implementing attractive green spaces (Heinen et al., 2010; Wahlgren & Schantz, 2012). Other than the rather small impact from external effects such as damage due to extreme weather, policy is the only factor that influences the infrastructure for the first mile.

Regulations

In addition, policy can also affect the usage of first mile travel. This concerns the non-physical implementation of policy, such as regulations. This includes regulations for car parking, pricing of car and bicycle parking, altering the waiting times at traffic lights, and so on (Harms et al., 2016; Heinen et al., 2010). These regulations directly affect the way people perceive the first mile by bicycle, as these implementations often make the route faster, safer or more convenient (Harms et al., 2016).

Behviour

The usage of first mile travel is also influenced by the infrastructure on and around first mile routes. This means that there is an influence of the quality and quantity of the infrastructure on the way people move, when they move, and most importantly, who moves (Geurs et al., 2016). In other words, it changes their behaviour. As mentioned in the section 'Infrastructure', there are many physical variables that influence the usage, such as the pavement, marking for right of way for cyclists and bicycle parking. These infrastructural facilities improve the quality of the trip of the users in several ways, including continuity, legibility, visibility and experience (Scheltema, 2012; Van der Spek & Scheltema, 2015).

Feedback

The last relation concerns the impact of usage on policy. Policy can adapt to usage in two ways. First, from the perspective of policy it is crucial to understand the differences between users within a city, and most importantly the nature of the current users of the bicycle-train combination. By understanding why certain groups behave like they do, policies can be implemented to facilitate and stimulate more sustainable travel behaviour in the city (Molin, Mokhtarian & Kroesen, 2016). Second, changes in usage such as higher cycling levels in certain areas can push cycling measures on the policy agenda (Van Mil et al., 2020).

Feedback loop

Because of the relations between policy, infrastructure and usage, a complete feedback loop can be developed within a city (Kager & Harms, 2017; Van Mil et al., 2020). By implementing policy which implies improvements in infrastructure and regulations, the quality of the first mile by bicycle to the train station improves, which can result in higher cycling levels, which in turn leads to a response in policy to further develop the first mile according to the growth, and so forth (Van Mil et al., 2020). Because this feedback loop is established between the urban system, cycling system and the public transport system, eventually a stronger public transport system will emerge in the city, which offers higher availability and choice for rapid transit. This benefits all public transport travellers (Kager & Harms, 2017). On top of that, through the improved connectivity and accessibility, an increased location choice emerges for

home, work, business, education or leisure, which results in a higher use of all sustainable modes of transportation (Kager & Harms, 2017).

As stated before, the research on these relationships considering the first mile is very thin. Therefore, the feedback loops between policy, infrastructure and usage should be studied in more detail to understand these relationships better (Van Mil et al., 2020). Based on the theory mentioned above, and the final conceptual framework below (figure 8), this thesis research also aims to add information to this research gap. The contribution to this subject extracted from this thesis research can be found in the Discussion.

External variables

In the context of medium-sized cities in the MRA, there are two external variables which affect first mile travel by bicycle to train stations. These external variables have an effect on the usage of and the policy on the first mile. The two external variables are discussed shortly, after which the conceptual framework is finalised.

Growth daily commute

As mentioned in the introduction, the daily commute from medium-sized cities in the MRA towards larger cities like Amsterdam has been growing over the last years, and will it be growing even more in the future (Beuckens et al., 2018; SBaB, 2019; Metropoolregio Amsterdam, 2020a). Therefore, the usage of the first mile will change; more people will depart from medium-sized cities every day to get to their work in larger cities. This trend is crucial to take into account when researching first mile travel in the MRA, as this growth can have a large impact on the existing mobility issues if nothing changes (SBaB, 2019).

Mobility transition

At the same time, the government has many related sustainability goals, which must lead to a mobility transition (Mobiliteitsalliantie, 2019). The current mobility behaviour and its consequences have a negative impact on the economy and especially on the environment (Mobiliteitsalliantie, 2019). The way people travel during the daily commute is one of the most critical mobility aspects to tackle. Stimulating people to commute by alternative modes of transportation, including the promising bicycle-train combination, would make a great contribution to reducing both congestion and pollution (Heinen et al., 2010). The Dutch national government also recognises the importance of the bicycle-train combination and wants to invest in multimodal mobility involving public transport (Tour de Force, 2017; Rijksoverheid, 2018; PBL, 2014). Therefore, this has a major influence on the policy aspect within the PIU model.

The two external variables mentioned above each have an influence on the PIU model when adapted to the current context of the MRA. The complete PIU model (figure 8) therefore contains the three influencing factors, their relations leading to a complete feedback loop, and the external variables affecting the usage of and policy on first mile travel by bicycle to train stations in the MRA.

As these two external factors are likely to occur in other areas with multiple medium-sized cities (e.g. metropolitan tegion of London, Copenhagen), the final conceptual model may be applied to other contexts than the MRA.

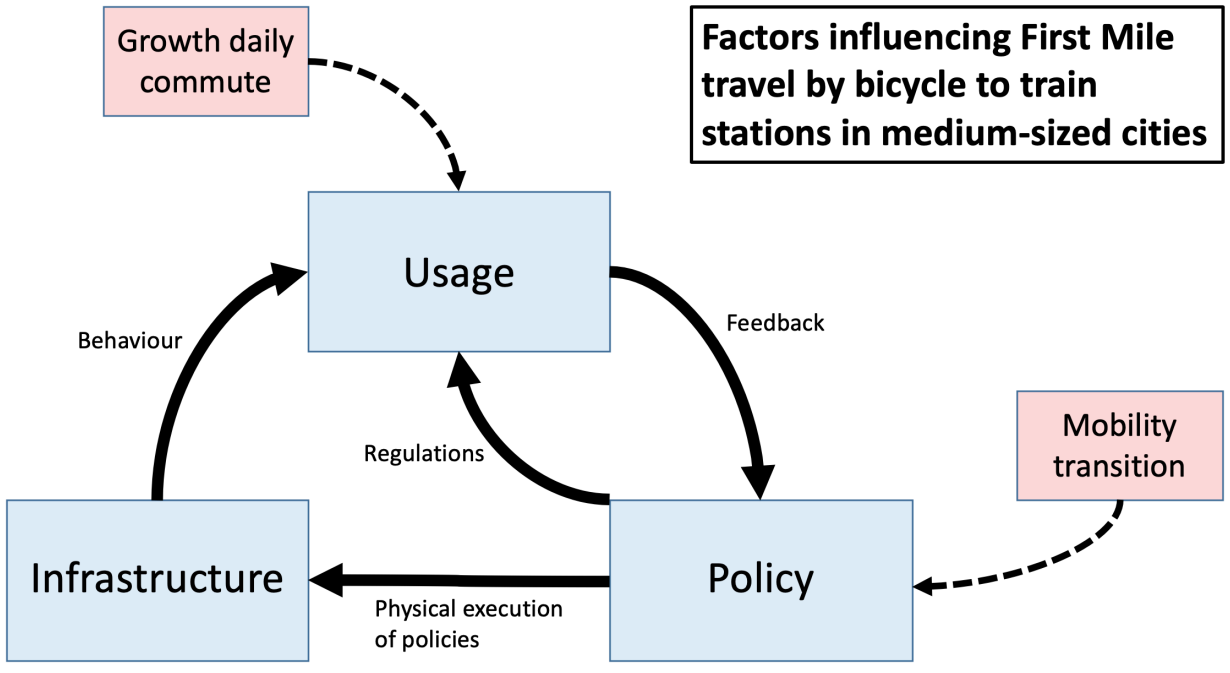


Figure 8: The adapted PIU model: Factors influencing first mile travel by bicycle to train stations in medium-sized cities

Methodology

This research explores how first mile travel to train stations by bicycle is influenced by policy, infrastructure and usage in medium-sized cities in the Metropolitan Region of Amsterdam. Based on the findings of this research, the researcher can provide actionable recommendations that can guide policy makers of medium-sized municipalities in the MRA to create policy and design interventions to improve their first miles to train stations.

In the previous chapter, the conceptual framework has been shaped to provide a perspective and to enable the researcher to study the current state of first mile travel in case study settings. This chapter elaborates on the research paradigm, discusses why this research made use of case studies, and which methods have been used to conduct the research. Additionally, this chapter discusses the methods to increase the trustworthiness of the research.

Research paradigm

This research has been conducted from the pragmatic perspective. Pragmatic researchers emphasise on the research problem and use all available approaches to understand the problem at hand (Rossman & Wilson, 1985). Therefore, the researcher can freely choose between qualitative and quantitative research methods (Creswell & Poth, 2016). This mixed methods approach can be best used to study real-world practices and problem-centred topics such as the sustainable mobility challenges for medium-sized cities in the MRA.

This research has been conducted through a hybrid exploratory sequential mixed methods approach. In this approach, the researcher starts with a qualitative research phase which analyses information which is used to build into a second research phase (Creswell & Poth, 2016). Rather than using only quantitative methods in the second research phase, the researcher used both quantitative and qualitative methods in this second research phase, which makes it a hybrid approach. The first phase is used to build an instrument to specify variables that need to go into the next research phase (Creswell & Poth, 2016).

The first research phase of this research can be found within the 'Theory' chapter. A qualitative literature study explored what the influencing factors in first mile travel are, and how they are related. This qualitative literature study resulted in an 'instrument', which is the PIU model (figure 8). This instrument formed the basis for the second phase (figure 9), as this determined a clear perspective and the factors (policy, infrastructure and usage) which need to be researched. Studying these specific variables in the context of the research topic has been done by using a variety of both qualitative and quantitative methods. By doing so, the researcher can answer the main research question:

How is first mile travel to train stations by bicycle influenced in medium-sized cities in the MRA?

The methods used in this research are described in detail later on in this chapter.

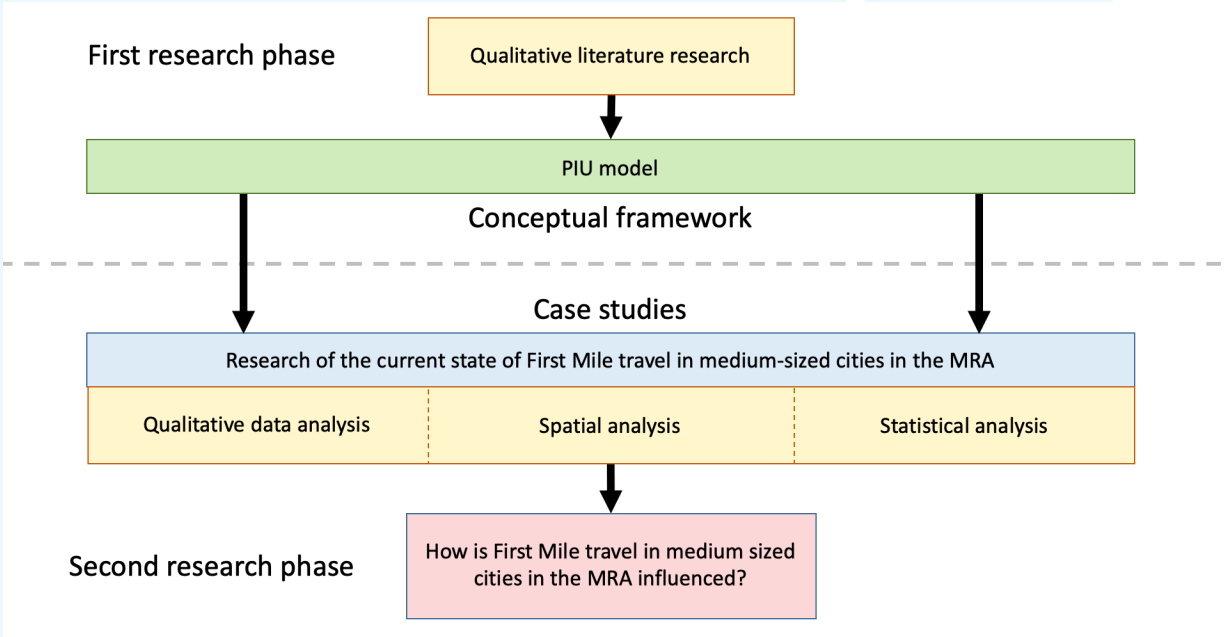


Figure 9: Visualisation of the hybrid exploratory sequential mixed methods approach used in this research

Case study research

The goal of this research is to explore how first mile travel to train stations by bicycle is influenced in medium-sized cities in the MRA. The MRA has been chosen for three reasons. First, it is located in the Netherlands, which implies that there is enough data available concerning first mile travel. Second, The MRA consists of multiple medium-sized cities in a relatively small area, which makes it more feasible to gain information about the subject for multiple cities or the region as a whole. Third, the urge of the modal shift is high in the MRA, as the current and fitire mobility issues will have a large impact on the economy and sustainability goals in this area. That makes it a relevant subject for this area, which also increases the chances of finding relevant documents and interviewees for this research. In the conceptual framework, the basis for this research has been shaped. In order to gain knowledge on the first mile in the specific context, this framework must be applied to medium-sized cities in the MRA. Therefore, a case study research was necessary. This also fits the nature of the research well, as case studies are very suitable for exploratory research (Gerring, 2007).

To get a clear picture of the current state of first mile travel in medium-sized cities in the MRA, a case study with two embedded cases has been conducted. This has been done to get an insight in medium-sized cities in general, but it also allows the researcher to dive deeper and study the local city context in more detail. Additionally, using multiple cases can improve the external validity of the research (Verschuren & Doorewaard, 2010). Because the two embedded cases must contribute useful information for all medium-sized cities within the MRA, it is important to use cases that are different from each other. By doing so, the researcher can make sure that the results found during the researcher are more easily appliccable to the other cities in the MRA.

Embedded case selection

All available case study settings have been listed in Table 2. These cities all have 75.000-200.000 inhabitants and are located within the MRA. To pick two different cases, two variables are involved: the size of the city in number of inhabitants, and the level of ambition regarding sustainable mobility. When looking at the number of inhabitants, the most reasonable option is to pick one of the three larger cities (around 160.000 inhabitants), and one of the four smaller cities (around 80.000-90.000 inhabitants) from Table 2. The level of ambition regarding sustainable mobility for each city has been based on a quick scan of vision documents of these cities and prior knowledge of the researcher, which was acquired from the Mobility programme of the MRA

Medium-sized city	Number of inhabitants	Level of ambition
Haarlem	163.000	High
Zaanstad	157.000	Low
Haarlemmermeer	156.000	Medium
Amstelveen	92.000	Medium
Hilversum	91.000	Low
Purmerend	81.000	High
Lelystad	78.000	Medium

Table 2: The number of inhabitants and the level of ambition regarding sustainable mobility of the medium-sized municipalities in the MRA. (Source: CBS Statline)

(SBaB). When looking at these ambitions, it seemed that Haarlem had already developed a proper vision, while Hilversum is still exploring how to incorporate sustainable mobility within their policy. Therefore, these municipalities were the most 'extreme' cases, which are most suitable for gaining a deeper understanding of a phenomenon (Flyvbjerg, 2006).

The two cases are embedded in the context of the MRA. Because this research aims to explore first mile travel for all medium-sized cities in the MRA, the results of both cases have been generalised into results that apply for all medium-sized cities in the MRA. Even though each city is different, it is possible to generate conclusions from the two cases and apply them to others. Because Hilversum and Haarlem are opposites in terms of number of inhabitants and their ambition regarding sustainable mobility, it is possible to generalise the results for cities with a comparable number of inhabitants (e.g. Purmerend compared to Hilversum), and to generalise the results for cities with a level of ambition between Haarlem and Hilversum.

Data collection and analysis

Due to the hybrid exploratory sequential mixed methods approach, this research has been conducted in two phases. In the first phase, a qualitative literature study has been conducted to enable the researcher to create an instrument (the PIU model) which can be used for the second phase of the research, which includes a large variety of methods and means of data collection. In this section, a short elaboration is given on the data collection and analysis of the first research phase, and thereafter the data collection and analysis of the second research phase will be discussed, including the operationalisation framework for this phase.

Qualitative literature study

The researcher conducted a qualitative literature study in the first research phase to explore what the influencing factors in first mile travel are, and how they are related. The aim of this qualitative literature study was to create a scientific foundation to construct an 'instrument' for the second research phase, which is the conceptual framework; the PIU model (figure 8).

A selection of scientific articles was made based on the relevance to the research topic, the publish date (preferably 2010-2020, older only if necessary) and should cover at least the policy, infrastructure or usage of cycling, preferably in the Netherlands and in combination with public transport. To generate all relevant scientific articles to create this scientific foundation, the researcher conducted an online search via Google Scholar. He searched for the terms below in various combinations to get as many results as possible:

- *First mile/last Mile*
- *Public transport/transit*
- *Access travel/egress travel*
- *Policy/policies*
- *Sustainable mobility*
- *Infrastructure*
- *Netherlands/Dutch*
- *Use/users/usage*
- *Bicycle/cycling/bicycling*
- *Commute/daily commute*
- *Train/train station*

An example query following from this list could be: *"First Mile" AND "Policy" AND "Netherlands"*. All relevant scientific articles were filtered based on the abstract and the conclusion of the article. When an article was found relevant, snowballing took place; by searching through the cited literature of the relevant articles, other articles which had not been found via Google Scholar had been discovered, extending the collection of relevant scientific articles.

The scientific articles were analysed by reading the introduction, results and conclusions line by line. When the methodology was found relevant during the scanning of the chapter, this was read line by line as well. All relevant information from the articles was highlighted and thereafter collected in a collection document concerning either policy, infrastructure, usage or general information. Through this method, the researcher could easily combine the various findings per topic into a coherent and compact text. The results of these findings can be found in the 'Theory' chapter.

Operationalisation second research phase

According to the conceptual framework, first mile travel is influenced by policy, infrastructure and usage. To explore how first mile travel to train stations by bicycle is influenced by these factors in medium-sized cities in the MRA, both qualitative and quantitative methods have been used in the second phase of this research.

First, qualitative data analysis was used to explore the influence of policy on first mile travel. This qualitative data analysis has been executed by conducting policy document analyses and semi-structured interviews. Second, spatial analysis was used to explore the current state of the first mile infrastructure in the two case cities. This spatial analysis has been executed by conducting observations and GIS analyses. Third, statistical data analysis was used to explore the influence of usage on first mile travel. The statistical data analysis has been executed by conducting surveys and analysing data from the ODiN 2018 research*. The subdivision of the methods into means of data collection is shown in figure 10.
The operational framework (figure 11) shows how the data for this research has been collected. The starting point of the research are the factors affecting the first mile travel, which is in line with the hybrid exploratory sequential mixed methods approach. In both cases, all factors have been researched. The factors included in each step are highlighted. The means of data collection used in this research are further described below.

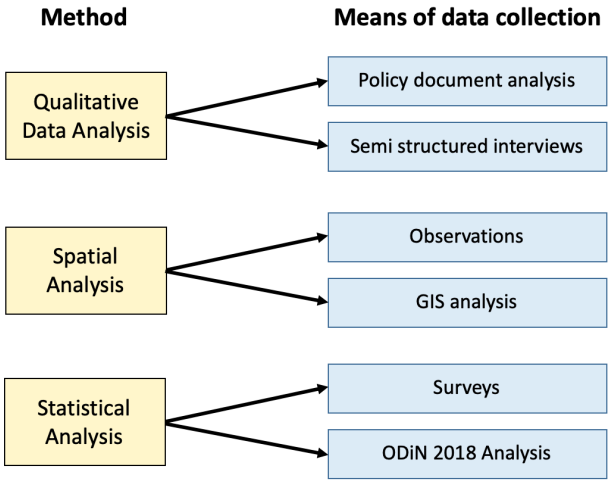


Figure 10: Methods and means of data collection used for this research

Policy Document analysis

To get an insight in the current policies on cycling, public transport, the first mile and the overall level of ambition towards sustainable mobility, document analyses of the relevant policy documents concerning mobility in the context of the case studies have been conducted. The analysed documents are open access documents of the case study municipalities, the Regional partnership organisations, the Province of Noord-Holland and the national government.

** The ODiN (Onderweg in Nederland) 2018 research is a study to provide useful information about the daily mobility of the Dutch population. More information can be found on page 22 in the section "Analysis statistics ODiN 2018".*

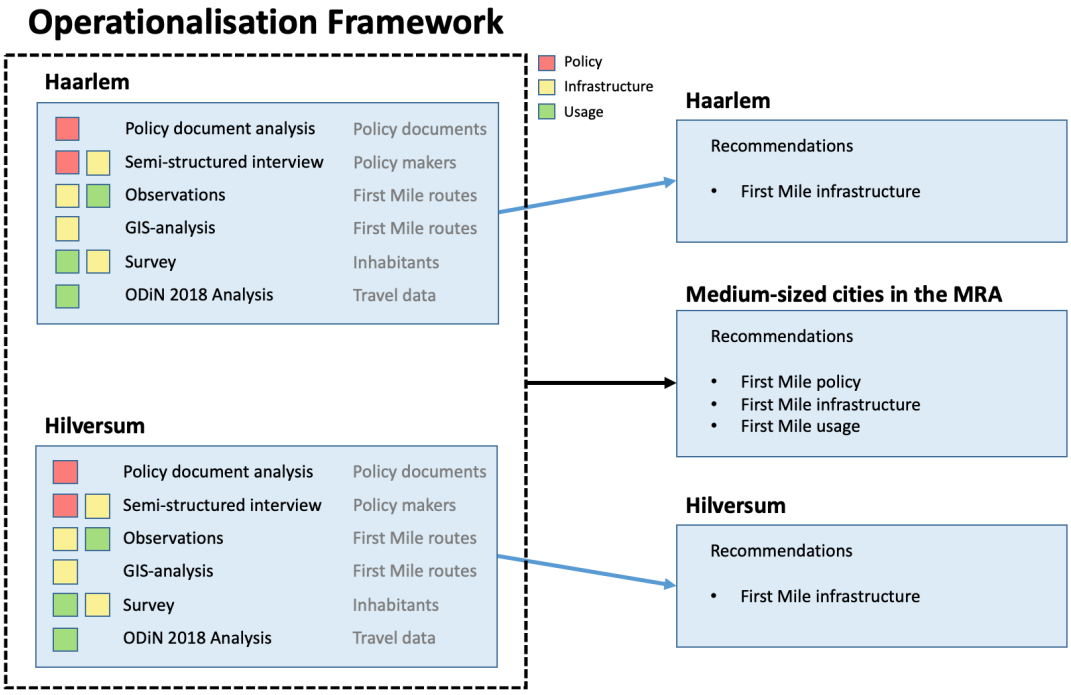


Figure 11: The operationalisation framework, based on the three factors influencing first mile travel.

An overview of the 22 analysed documents can be found in Appendix 1. A selection of documents was made based on the relevance to the research topic, the publish date (policy/vision in place during the research period) and should cover at least bicycling, public transport stations or the door-to-door journey. To collect all the relevant policy documents, and to make sure similar documents for both cases were found, the following methods were used.

In an online search via Google, the researcher searched for the terms below. In the bracket *organisation* each of the relevant organisations stated above has been inserted in a search query to get as many similar documents as possible.

- *Vision mobility *organisation**
- *Vision bicycle *organisation**
- *Vision cycling *organisation**
- *Policy mobility *organisation**
- *Station area *case study municipality**
- *Station area *case study municipality**
- *Coalition agreement *case study municipality**
- *Structure vision *case study municipality**

Consequently, the results of these search queries would sometimes lead to finding new relevant literature via snowballing. In addition, some relevant policy documents had been advised to review by interviewees during the semi-structured interviews.

To analyse the policy documents, open coding took place in which the data was read intensively, assigning the relevant data in the transcripts into categories. This has been done for each policy document. The categroies used during coding include:

- *General policy for cycling*
- *Bicycle parking*
- *General policy for train*
- *Priority for cyclists*
- *General policy for bus*
- *Low-car city centre*
- *Policy for car traffic in relation to cycling*
- *Travel time*
- *Trends in relation to cycling or the multimodal journey*
- *Cycling routes*
- *Station area*
- *Multimodal journey*

After assigning the categories, separate documents were created for Haarlem and Hilversum (both including documents from the Regional partnership organisations), in which the documents could be summarised. Hence, the researcher used focused coding to compare and combine the gathered themes in the open coding and summarise them into the general document per city. Therefore, new categories were formed during the focused coding. These categories include:

- *Policy for the first mile by bicycle*
- *The main focus of the policy documents*
- *Attention for aspects which are beneficial for first mile travel*

Semi-structured interviews

To get a grip on the role of policy in the current state of the first mile in medium-sized cities in the MRA and specifically the two cases, interviews were conducted with several senior advisors who work on mobility-related topics within different governmental organisations. This included the Ministry of Infrastructure and Water Management, the Province of Noord-Holland, the Regional partnership organisations and the case study municipalities. In addition, an interview with two employees of the NS (Dutch railway company) has been conducted. These interviews were conducted to get a better understanding of the role of the different organisations within first mile policy, previous and current policies concerning sustainable mobility, the door-to-door journey and specifically first mile-related topics such as cycling and station areas.

The selection of interviewees was primarily based on their function related to (sustainable) mobility within the MRA, and secondly on the availability of the interviewees. Several interviewees were already familiar to the researcher, while others had been reached out to through snowballing. All interviewees were playing a role in policymaking concerning mobility at the time execution of the research. Six interviews were held in a period of two months. All interviews were held in a semi-structured fashion with open-ended questions to allow the interviewees to express themselves as much as possible while still collecting the necessary information. The interview format which the researcher used to guide his interviews can be found in appendix 2. In each interview, the questions asked were adjusted to the organisation of the interviewee and the context of the conversation. Therefore, not all questions of the interview format have been asked in each interview. The interviews were held in Dutch, as all of the interviewees speak Dutch as their mother tongue.

The interviews with the senior advisors of the municipalities had an extra purpose. During these interviews, the researcher asked questions about first mile routes within the cities to gain insight in locations of current first miles. Additionally, questions were asked about the quality of these routes, and specific plans for these routes. By doing so, the researcher could get primary ideas about which routes to investigate more thoroughly during the observations and the GIS analysis. The interviews were recorded, and the researcher took notes about specific information when necessary. After conducting the interviews, the recordings were transcribed literally as soon as possible. After filtering out the parts of the interviews that were not valuable for the research, for example when an interviewee side-tracked, the recordings were coded by the researcher. First, open coding took place in which the data was read intensively, assigning the relevant data in the transcripts into categories. The categories used during coding include:

- *Sustainability*
- *Mindset*
- *Policies*
- *Money*
- *Housing*
- *Train*
- *Politics*
- *Bus*
- *Infrastructure/public space*
- *Car*
- *Behaviour of travellers*
- *Bicycle*
- *Cooperation between organisations*
- *Pedestrians*

Consequently, the themes above were categorised into ‘Kinds of policies’, ‘Collaboration’ and ‘Barriers’.

By coding the transcripts of the interviews, the researcher was able to explore the role of policy in the MRA and both cases specifically, concerning the first mile, transit nodes, cycling and the door-to-door journey.

Observations

Through an analysis of the policy documents, the researcher identified the main cycling routes within each city towards the train stations located in these cities. Additionally, by interviewing the senior advisors of the two case study municipalities, the routes which should be improved most and several additional routes which are frequently used by cyclists were identified. To explore the current state of the first mile infrastructure in both case cities, the most relevant cycling routes needed to be assessed. Therefore, observations were needed. The main focus of the observations was the quality of the cycling routes (e.g. quality of the surface, width of the path), the safety on the cycling routes (e.g. distance from cars, feeling safe while cycling) and the speed of the cycling trip on these routes (e.g. waiting times at traffic lights, directness of the route).

The observations were carried out by the researcher himself on may 31st (Haarlem) and june 2nd (Hilversum) 2020. This was during the Covid-19 pandemic. The researcher therefore had to be etra careful when conducting the observations. In addition, the observed behaviour may be different than the ‘normal’ situation without a pendemic. The observations were conducted by slowly cycling the most relevant cycling routes according

to the policy documents and the municipal senior advisors. The routes of the observations can be found in Appendix 4. By cycling, the researcher could also experience what it is like to cycle on first mile routes as an inhabitant of both case study cities. Therefore, this experience is also included in the analysis of the observations. The observations were recorded by taking pictures of the spatial situation. This has been done in a qualitative manner; rather than taking a picture every 100 meters, the researcher took a picture every time the spatial situation for the bicyclist changed. This included traffic lights, intersections, changes in the width of the path, changes in the surface quality, changes in the context (e.g. parking spaces or sidewalks next to the cycling path) and changes in usage (e.g. busier roads, more cyclists on the path).

By analysing the observations, the researcher was able to get a better understanding of the current state of first mile infrastructure in the case study cities.

GIS analysis

In addition to the observations, GIS analyses of both case study cities have been conducted to explore the current state of the infrastructure of the first mile routes within the two case studies. The addition mainly concerns information about travel time towards the various stations and provides an insight in the potential catchment areas of the train stations located in the case cities. Other information that could have been extracted from GIS maps, such as the locations of cycling routes, has been deduced from observations, as these give a clearer and more reliable image of the quality, location and safety of the cycling routes.

QGIS has been used to enable the researcher to produce isochrones of 5, 10 and 15 minutes of cycling around each of the train stations located in both case cities. This has been done by using the isochone by point tool from OSM Tools in maps by OpenStreetMaps. By doing so, the researcher could point out which station is reached the fastest from any location in the city, which locations in each city are located out of the 15-minute range of any station, and on which locations people could profit from presence of several stations. In addition, the researcher was able to 'score' the accessibility of the train stations in Haarlem and Hilversum: based on the availability of one or more stations within 5, 10 or 15 minutes, any place in these cities can be given a score. 9 would be the best score, indicating that there are three train stations available within a 5-minute cycling trip. 1 would be the lowest score, indicating that only one train station is available within a 15-minute cycling trip. These analyses also provided input for the surveys, which are described below.

Surveys

To explore the usage of first mile routes, cycling and the train, the researcher conducted surveys in both case cities. The surveys were especially conducted to get a clear image of local inhabitants' opinion of the current state of the first mile routes, the cycling infrastructure overall and the bicycle parking facilities. Additionally, the surveys generated data about the characteristics of the respondents. The researcher matched these data with the opinion the respondents gave in the rest of the survey. Therefore, the researcher was able to make general assumption about the usage and users of first miles and bicycle facilities, but more importantly, the researcher could further analyse the routes that lacked safety, quality, speed or presence according to the respondents. These data were matched with the data generated from the observations, which gives a more reliable indication of the routes that need to improve in both cities.

The surveys consisted of 19 questions that were exactly the same for each case city. First, questions were asked about the characteristics of the respondent. This included age, sex and residential location. Then, questions about the usage of the bicycle and train facilities were asked. This included the frequency of use, the goal of the usage, their satisfaction of the facilities, the importance of facilities and the most frequently used train station. Additionally, questions were asked to find out which incentive would make the respondents use the train more often. Lastly, open questions were asked about locations where the cycling facilities lacked quality, safety, speed or presence.

Due to the lockdown of the Netherlands during the Covis-19 pandemic, the researcher was unable to physically conduct surveys at local train stations. Therefore, the surveys were constructed through SurveyHero and distributed through online Facebook pages ('*Je bent Haarlemmer als...*' and '*Je bent Hilversummer als...*') that were focused on people from either one of the case cities. This was done to enlarge the chance that the respondents were inhabitants of one of the case cities. Additionally, spreading the surveys online was the only viable option for the researcher at the time, as physically questioning people nearby train stations in the case cities was impossible due to the Covid-19 restrictions of the Dutch government. Therefore, the researcher has less influence on the number of respondents. Eventually, the survey about Hilversum generated 52 responses, of which 44 were valid. The survey about Haarlem generated 37 responses, of which 36 were valid. Invalid responses include responses from respondets who failed to answer at least half of the survey. Finally, the collected data were transferred into an excel file, in which the data could be analysed.

By combining the data of the observations, the interviews, the GIS analyses and the surveys, the researcher was also able to identify the first mile route that needs to improve most urgently for both case cities. These routes have been chosen by the researcher as sub-cases on which the researcher will apply the knowledge gained by this research in the form of recommendations.

Analysis statistics ODiN 2018

To get a better understanding of the first mile usage in the MRA and the two case study cities, and to explore a broader perspective on user profiles and mobility choices in the MRA, the research data of ODiN 2018 have been analysed by the researcher. A description of the ODiN 2018 research is given below.

Since 1973, the Central Bureau of Statistics (CBS) studies the mobility of people in the Netherlands. The latest edition of this research has been published in 2018, under the name of ODiN; Onderweg in Nederland. The goal of the ODiN research is to provide useful information about the daily mobility of the Dutch population for the Dutch Ministry of Infrastructure and Water management, other policy- and research institutions and the society (CBS, 2018).

ODiN consists of a basic research on national level. This basic research is a continuous study on the daily mobility behaviour of the Dutch population. For one day of the year, the respondents are asked to keep track of everywhere they go, with what goal they go, what mode of transportation they use, and how long each of their trips take. Additionally, several questions are asked about their personal characteristics, such as societal position, level of education and other personal facts. Based on this study, information has been generated about all daily mobility of Dutch inhabitants in the Netherlands (CBS, 2018).

By analysing the results of the travel statistics from the ODiN 2018 research, the researcher could extract information about the usage and users of the first mile. This information includes, among other information, the personal characteristics of the commuters who use the first mile by bicycle, the share of commuters using the first mile by bicycle to take the train in comparison to other modes and what distances the commuters travel to get to the train station. These analyses highlight the differences between the cities, and also show the potential of the first mile by bicycle for both case cities. The focus of this section is put on the situation in medium-sized cities in the MRA compared to the rest of the Netherlands. That is to clearly show the differences between data concerning medium-sized cities and data for a whole country.

The collection of the relevant data has been conducted through SPSS. To obtain relevant data on first mile travel on national level, the following selection criteria have been applied:

- *The data only concerns unique respondents (OP = 1)*
- *The location of departure is the home of the respondent (VertLoc = 1)*
- *The maximum distance of the trip is 7,5km (KafstR <=6)*
- *The main mode of transportation for the journey is the train (KHvm = 3).*

To obtain data specifically for medium-sized cities in the MRA, the same selection criteria have been used. In addition, all respondents living in medium-sized municipalities with at least one train station in the MRA are selected. As the city of Amstelveen does not have a train station, it has been left out of this sample. To obtain specific data for Haarlem and Hilversum, only the respondents from either one of these cities have been selected. By doing so, the data of Haarlem and Hilversum can be compared to medium-sized cities in the MRA and the whole country.

By selecting respondents based on the described variables, a sample of the total population is extracted. For the Netherlands this concerns a sample of 384.040 of 15.934.134 respondents. For medium-sized cities in the MRA, this concerns 30.914 of 655.501 respondents. For Haarlem, this concerns 6,989 of 144.806 respondents. For Hilversum, this concerns 5.681 of 83.528 respondents.

Trustworthiness of the research

To ensure the trustworthiness, several methods have been applied to improve the internal and external validity and the reliability of this research. Therefore, member checking, triangulation and a thick description of methods and context were applied. Additionally, the researcher reflected on his positionality within the research, to clarify how his personal background influenced the process of this research.

Internal validity

To increase the internal validation of the semi-structured interviews which were conducted during the research, the researcher applied member-checking. This means that all interviewees were send the transcription of their personal interview to check whether all that had been said during the interviewed had been interpreted in a proper way.

Another method which the researcher applied to improve the internal validity was triangulation. This implies that the researcher has used multiple methods and sources of

data while studying a phenomenon. The use of multiple methods has had various advantages for this research, but in the context of triangulation, it applies to the cross-checking of findings by using various methods. Within this research, this mostly applied to the use of observations; by personally experiencing the first mile routes, the researcher could check the findings from the semi-structured interviews, the surveys and the GIS-analysis. By doing so, the researcher has gained a greater confidence in the findings, as they were found twice. The findings that did not overlap (e.g. a survey respondent pointed out a problem which was not recognised by the researcher during the observations) were therefore left out of the final findings of this research. Additionally, conducting surveys was a way to check the findings from the analyses from the ODiN 2018 data. By doing so, the researcher could check whether the finding from both data sources were in line with each other. By applying both triangulation and member-checking, the researcher could make sure that the research gives an accurate representation of the studied topics.

External validity

In qualitative research, the external validity is usually low due to the fact that specific cases are used making it hard to generalise the findings into other settings (Gerring, 2007). However, in this research a mix of both qualitative and quantitative methods has been used. This improves the external validity, due to the use of a large data set (ODiN 2018) which compares the two case studies with other medium-sized cities in the MRA. Additionally, several interviews were conducted with people working on the research topic on a national or regional scale, and several policy documents were analysed which apply to the same larger scales. Therefore, a better view of all medium-sized cities in the MRA could be generated by the researcher to take into account while generalising the results.

Reliability

In this research, as many procedures and steps as possible are documented to improve the reliability of the research. By doing so, the researcher makes sure that readers are able to follow the researcher's line of reasoning and each step the researcher took during the process (Schwartz-Shea & Yanow, 2013). The idea is that by thickly describing the methodology and the research context, other researchers who would follow the same steps would come close to the same conclusions. This is important, as a large part of this research contains qualitative research; this makes the outcome of the research prone to elements such as the interview setting, the background of the researcher or the weather during the observations.

Positionality of the researcher

As stated in the previous paragraph, the background of the researcher can have an impact on the reliability of the research, as it influences the way the research has been conducted. To clarify what this background is, and in what way it has affected the conduction of the research, the positionality of the research is shortly described below.

Already from a young age, the researcher was fond of cycling and has therefore been using the bicycle daily as well; when going to school, friends, the supermarket or just to ride for fun. This has not changed over the years, and the bicycle is still his main mode of transportation. Even though the researcher does own a car, he frequently takes the train for his travel at longer distances. This is due to his ideal that using the bicycle and the train is better for the environment and himself. Therefore, during this research, his position regarding the bicycle-train combination is very positive; he believes that it's the best mode of transportation for individuals over longer distances, especially during the daily commute. This might have affected the interviews when questioning the interviewees, or when providing his own perspective on the research.

The researcher did an internship at the Mobility programme of the MRA, which is part of the Ministry of Infrastructure and Water Management. During this internship, he has dealt a lot with medium-sized cities in the MRA, and the mobility-related problems in these cities. The internship has therefore been the trigger for the researcher to combine this experience with his fascination for cycling into a research focused on the first mile by bicycle in medium-sized cities in the MRA.

Due to his internship at the Ministry of Infrastructure and Water Management, the researcher was acquainted with several people working on mobility-related issues in different governmental organisations. Therefore, it was relatively easy for the researcher to get in contact with relevant interviewees for the semi-structured interviews. Three of the interviewees had already been in contact with the researcher before, others were put into contact via the network from the internship. Two of the acquainted interviewees had mentioned the first mile in a meeting that took place before the interview. Therefore, these interviews may have been influenced by previous knowledge of the researcher on the perspective of the interviewee on the subject. The other interviews were not influenced by the background of the researcher, as the topic of the research had not been discussed before the interview itself.

Application of methods

In the conceptual framework, the factors influencing first mile travel have been explored. This resulted in the PIU model, which states that policy, infrastructure and usage influence first mile travel, while also creating a feedback loop through their interrelations. In the conceptual framework, the model has already been adapted to the context of the MRA (figure 8 on page 15). To conduct the research, the PIU model for the MRA has been applied to Haarlem and Hilversum. Through conducting semi-structured interviews, GIS-analyses, observations, surveys and analyses of the ODiN 2018 data, the results of this application are displayed in the 'Results' chapter. For each city, the influencing factors are discussed separately:

Policy

To explore how policy influences first mile travel in Haarlem and Hilversum, semi-structured interviews have been conducted with multiple senior advisors working for various (governmental) organisations. The list of interviewed parties can be found in Appendix 3. In the MRA, policy concerning the first mile, transit nodes, cycling and the door-to-door journey is influenced by various governmental organisations on different levels. This includes the state (especially the Ministry of Infrastructure and Water Management), the Provinces (Noord-Holland and Flevoland), regional organisations (including the MRA, Regio Gooi & Vechtstreek) and the municipalities. To get an insight in what the influence of these organisations is on policy, what these policies are, how the different organisations are collaborating, and what the barriers are to first mile policy, semi-structured interviews have been conducted. The results extracted from the interviews concerning the MRA, Haarlem and Hilversum can be found in the sections 'MRA policy', 'Haarlem policy' and 'Hilversum policy'.

Infrastructure

To explore how infrastructure influences first mile travel in Haarlem and Hilversum, GIS analyses, observations, semi-structured interviews and surveys have been conducted. The routes of the observations and the survey questions can be found in Appendices 4 and 5, respectively. The GIS analyses were mainly used to get a sense of the influence of the size of the city and the locations of the train stations on the accessibility of the train stations by bicycle. Because gathering a sense of the most current state of the quality and the quantity of the bicycle infrastructure in cities cannot be done through GIS analyses, the researcher conducted observations. These focused on the characteristics to assess the bicycle infrastructure according to the pyramid by Scheltema (2012): Safety, directness, comfort and attractiveness. However, the findings of the researcher during the observations might not be enough to draw strong conclusions. Therefore, the researcher has used semi-structured interviews and surveys to gather the opinions of the local inhabitants and policymakers. The assessment of these characteristics based on these three methods can be found in the sections 'Haarlem infrastructure' and 'Hilversum infrastructure'.

Usage

To explore how usage influences first mile travel in Haarlem and Hilversum, surveys and analyses of the ODiN 2018 data have been conducted. The aim of these surveys and analyses is to get an insight in the current personal characteristics and travel characteristics of first mile travellers to train stations in Haarlem, Hilversum, the MRA and the Netherlands. To analyse the usage of the medium-sized cities in the Netherlands, the MRA and to a lesser extent the two case cities, both personal characteristics and travel characteristics have been extracted from the ODiN 2018 dataset. The ODiN 2018 analyses enabled the researcher to compare the medium-sized cities in the MRA to the Netherlands as a whole. The list of analysed variables in the ODiN 2018 dataset can be found in table 3. For Haarlem and Hilversum, complementary analyses of personal characteristics and travel characteristics have been extracted from the surveys, in addition to the opinion of the local inhabitants on the bicycle infrastructure and parking on their route towards the train station. The list of analysed variables in the surveys can be found in table 4. For this influential factor, the sections have not been divided per city/region, as the comparison between the different areas is an important element in the analysis of the generated data. Therefore, the results will be discussed per method and can be found in the sections 'Usage ODiN 2018' and 'Usage surveys'.

Analysed variables: ODiN 2018
Personal characteristics
Age
Gender
Income
Education
Household structure
Origin
Trip characteristics
Mode of transportation
Goal of the trip
Distance First Mile trip
Time First Mile trip
Time total journey
Modal split for commuters

Table 3 (left): The analysed variables in the ODiN 2018 dataset

Analysed variables: Surveys	
Personal characteristics	
Age	
Gender	
Home address area	
Cycling frequency	
Frequency train use	*
Trip characteristics	
Mode of transportation	*
Goal of the trip	*
Choice of train station	*
Opinion on bicycle infra	
Reason using mode of transportation First Mile	*
Reason choosing train station	*
Satisfaction availability of cycling infrastructure	
Satisfaction quality of cycling infrastructure	
Satisfaction safety of cycling infrastructure	
Satisfaction speed of cycling infrastructure	
Importance availability of cycling infrastructure	
Importance quality of cycling infrastructure	
Importance safety of cycling infrastructure	
Importance speed of cycling infrastructure	
Satisfaction quantity of bicycle parking	*
Satisfaction quality of bicycle parking	*
* This variable has a reduced number of respondents	

Table 4 (right): The analysed variables in the surveys.

Case study descriptions

Before diving into the results, a description is given of the context of the case study research. As stated in the Methodology, the cities of Haarlem and Hilversum have been chosen as embedded cases. That means that the researcher studied the current state of the first mile policy, infrastructure and usage in these cities. The aim of this research, however, is to explore how these factors influence first mile travel to train stations by bicycle in medium-sized cities in the MRA. It is therefore important to understand the context of the MRA as well, and to look at the two case cities from the perspective of the MRA. Therefore, an elaboration on the MRA is given in this chapter, in addition to the case descriptions of Haarlem and Hilversum. The descriptions contain general information about the MRA and the case cities and give an insight in the relevant policy documents of the Dutch state, the Province of Noord-Holland and the two case municipalities.

The Metropolitan Region of Amsterdam

The Metropolitan Region of Amsterdam (MRA) is a partnership between the Provinces of Noord-Holland and Flevoland, 32 municipalities and the Vervoerregio Amsterdam. It is located in and around the city of Amsterdam, stretching from Haarlem to Lelystad and from Hilversum to Purmerend (figure 12). The MRA is generally seen as the economic heart of the Netherlands; it even belongs to the top-5 economically strong regions in Europe (Metropoolregio Amsterdam, 2020b). The main economic centre is Amsterdam, in which 46% of the total amount of jobs in the MRA can be found. When including Schiphol airport, it even covers 60% of all jobs (OIS Amsterdam, 2018). Although the jobs are mainly located around Amsterdam, the population is spread all over de MRA. The MRA can be seen as a polycentric system; it consists of a relatively large number of cities, located on short distances from each other (figure 12) which together can form a strong area that is internationally competitive (Tan, Koster, & Hoogerbrugge, 2013). Seen its top-5 economic position in Europe, this polycentric system appears to be a great success.

However, this economically thriving area comes with two great challenges: Housing and mobility. The MRA is home to more than 2.5 million people and due to its economically attractive character, the demand for housing is very high (Metropoolregio Amsterdam, 2020a). To meet the demand, an additional 250.000 houses will be built within this region between 2017 and 2040 (SBaB, 2019). Due to this housing programme, several cities within the MRA will grow significantly until 2040 (SBaB, 2019; Metropoolregio Amsterdam, 2020a). This also applies to the medium sized cities (75.000-200.000 inhabitants) in the MRA, which will house thousands of new inhabitants. At the moment, a third of all inhabitants of the MRA live in medium sized cities (75.000-200.000 inhabitants). When including Almere (just larger than 200.000 inhabitants), this is even more than 40% (OIS Amsterdam, 2018).

At the same time, most of the 1.5 million jobs in the MRA are located within Amsterdam, where – in contrast to its neighbouring cities – the number of jobs is growing (Beuckens et al., 2018). This trend is a real challenge for the mobility in the MRA; the already large number of commuters from the medium-sized cities towards Amsterdam will grow even more, which increases the

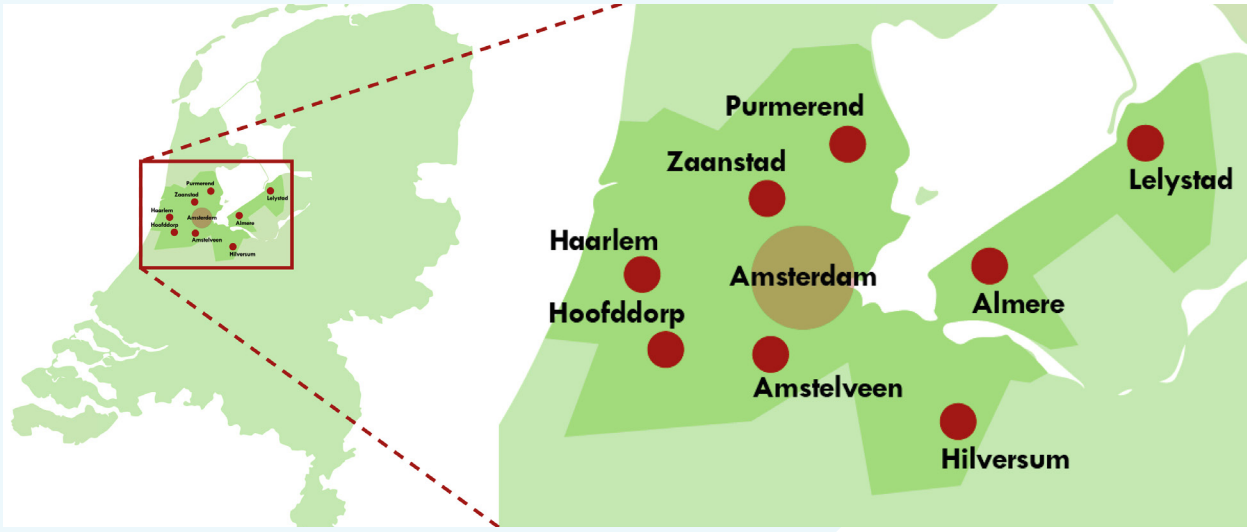


Figure 12: The MRA in the context of the Netherlands (left) and the cities located in the MRA (right)

demand for mobility in these cities (Provincie Noord-Holland, 2019). Therefore, the road network is surpassing its capacity, which leads to congestion on roads (SBaB, 2019). This has a negative impact on the economy and especially on the sustainability goals of the government (Mobiliteitsalliantie, 2019). A critical phenomenon obstructing these goals is the growth of the daily commute, which contributes disproportionately to traffic congestion and environmental pollution due to its non-discretionary character (Heinen et al., 2010). Therefore, people living in the MRA must be stimulated to commute by alternative means like cycling or transit, as it would make a great contribution to reducing both congestion and pollution in the MRA (Heinen et al., 2010; Tour de Force, 2017).

Policy documents concerning first mile travel from the state and the Province

See Appendix 1 for the list of documents used for the policy document analysis.

To get an insight in the national and regional policies and ambitions regarding cycling, the bicycle-transit mode and the first mile, this section evaluates policy from the state and the Province of Noord-Holland. First, both the state and the Province recognise that a growth in bicycle use has large societal benefits, such as accessibility, liveability, sustainability and health (SD1; NHD3). Therefore, both organisations are willing to contribute to this growth.

The state has set several concrete goals regarding the growth of cycling. The most important for the short term is to get 200.000 extra commuters from the car on the bicycle, or the bicycle-train combination (SD1). To make this happen, the state wants to invest in cycling so that cycling and transit will become an attractive alternative to the car. Therefore, 100 million euros is reserved for the construction of fast cycling routes and the improvement of bicycle parking facilities at transit nodes (SD1). In addition, the state promises to spend another 75 million euros on bicycle parking through the climate agreement of June 2019 (SD2). This will be done under the condition that a strong regional effort is made to stimulate cycling. Lastly, the state is especially challenging the 35 largest municipalities (90.000+ inhabitants) to list goals to improve bicycle use, because there is a lot of potential to make a switch in the mobility system in these cities (SD3). This is a direct message to many cities located in the MRA to improve their cycling policy and infrastructure.

The Province of Noord-Holland wants the bicycle to play a more important role in the regional mobility. Therefore, a complete, recognisable and safe network of bicycle routes must be realised. This also concerns the routes towards the transit nodes (NHD1). Concerning investments, the priority of the Province lies at the network of fast cycling routes and the bicycle in the chain journey (NHD3). Transit nodes are seen as important elements in the fast cycling routes, as improvements would enlarge the number of inhabitants cycling towards the train station (NHD3). Improvements mostly concern bicycle parking (NHD2; NHD3), but improvements in the routes are also necessary, as the bicycle plays a significant role as a feeder mode up to 7,5km from the station (NHD2). Concerning the municipalities, the Province states that the municipalities have the control and responsibility regarding bicycle investments, and that the amount of investments differ per municipality, as there is a difference in the ambition concerning cycling between different municipalities (NHD3). Finally, the Province thinks that the experience of the bicycle journey is essential (NHD2). Therefore, governmental organisations need to think from the mind of the traveller (NHD3).

Haarlem and Hilversum

Haarlem and Hilversum are both medium-sized cities located in the MRA. Although there are many similarities, such as their location in the province of Noord-Holland, the presence of an intercity train station and the large number of commuters, these cities are quite different from each other. As stated in the Methodology, these two cases have been chosen due to their differences in population size and the level of ambitions regarding sustainable mobility. In this section, these differences are discussed in more detail.

City characteristics

Haarlem is located about 15 kilometres west from Amsterdam (figure 12) and houses a little over 160.000 inhabitants. The city has a dominant north-south orientation (figure 13). Therefore, the most northern and southern parts of the city are quite far away from the central station. The residential areas in the city can roughly be divided into three parts: North of the central station, south of the central station, and east of the river Spaarne. There is a lot of terraced housing with several parks in between for people to recreate.

Hilversum is located about 20 kilometres southeast of Amsterdam (figure 12) and houses a little over 90.000 inhabitants. The shape of the city can be seen as a large circle with a diameter of about 5 kilometres (figure 13). Therefore, everyone can get anywhere in the city within a 5-kilometre range, including the city centre and train stations. Although a large part of the housing is quite dense with terraced housing, there is a part in the northwest which mainly includes detached houses in a

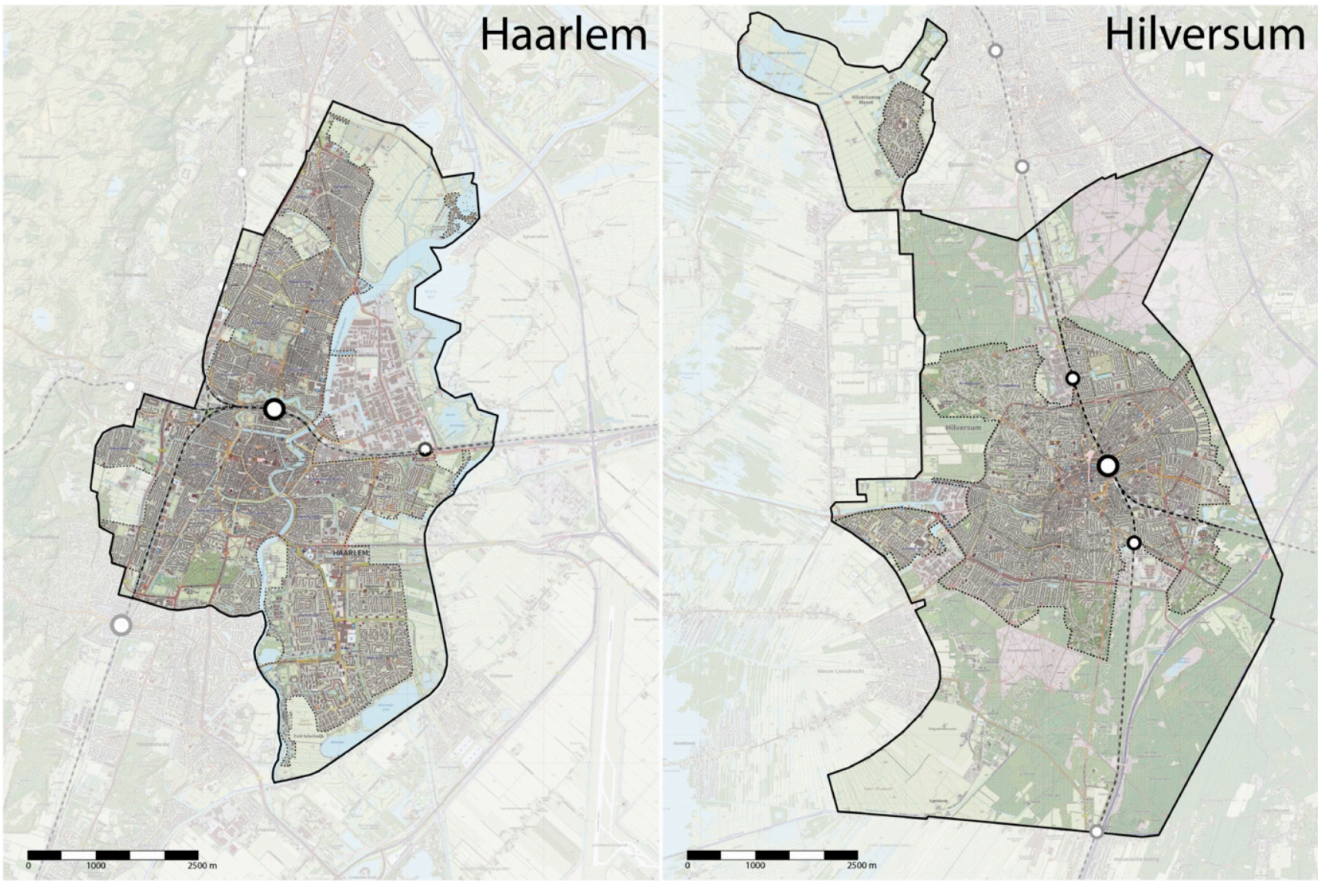


Figure 13: The municipalities of Haarlem (left) and Hilversum (right). The maps are presented on the same scale.

spacious setting. The city only has a few parks, which is mainly due to the accessible nature all around the city, with forests and heathlands.

Ambitions regarding sustainable mobility

To emphasise the differences in the ambitions regarding sustainable mobility between the two case municipalities, and to introduce the policy setting of both cities, the researcher analysed various relevant policy documents from the municipalities and regional partnership organisations of Haarlem and Hilversum. The results of this analysis can be found below, and include the specific policies considering the first mile, and a summary of the main focus of all analysed document per city. The list of documents used for the policy document analysis can be found in Appendix 1.

Policy documents concerning first mile travel in Haarlem

Policy on the first mile

In all analysed policy documents of Haarlem, the first mile is mentioned implicitly. In several cases, it is mentioned explicitly: There is a growing use of the bicycle in the first mile of the train journey, and the municipality is finding some opportunities to respond to this trend (HaD3; HaD4). Therefore, the municipality is actively trying to find answers to the question how the growing number of cyclists can be accommodated, both on the cycling routes as within the bicycle storages near the stations (HaD3). The municipality invests in cycling routes with very little delay and proper bicycle storages, especially if cyclist want to continue their journey by train (HaD1). The municipality want to improve to complete door to door journey for its inhabitants, decreasing the travel time in this journey (HaD2). Therefore, the commuter must be given the smartest, most comfortable and fastest cycling route towards its destination, regardless of where they live in the city (HaD2; HaD4).

Focus of the policy documents regarding mobility

Within all policy documents, there is an explicit focus on sustainable mobility, especially regarding the daily commute (HaD4). Because the number of commuters is growing in Haarlem, the municipality wants to strengthen the networks towards the locations where the inhabitants work, especially around Amsterdam (HaD2). Within the daily commute, the car-share for the main streams is between 60% and 80%, which should decrease (HaD4). However, the congestion on the highways (e.g. A9, A200) is increasing, which favours the competitive position of PT with respect to the car (HaD5). Therefore,

the PT connections towards Amsterdam and the work locations around the city (like Schiphol) will become more important (HaD3).

Because the roads are becoming more congested, but also because Haarlem has the ambition to decrease their carbon emission by 30% through mobility, it is necessary that the municipality invests in sustainable mobility (HaD1; HaD3). Within the city, the pedestrians, cyclists and PT are prioritised. Therefore, the car must make place for its more sustainable alternatives (HaD1). According to the municipality, sustainable mobility will only become a proper alternative for the car when both the bicycle and PT are more attractive, which helps in shifting the modal split. In and around the city centre, the car use is already decreasing (HaD2).

Haarlem is investing in the multimodal journey, which will be accomplished by connecting accessible PT and bicycle networks to strategic nodes. PT stops and stations will have central places within this multimodal journey (HaD2; HaD4). Therefore, the main cycling routes towards the city centre from each direction will be improved, which will make the first mile accessible for everyone. It should be possible to reach a train station within 15 minutes by bicyle from every neighbourhood in Haarlem (HaD3). The multimodal journey must also be improved in the station area (HaD5). The increasing number of cyclists, pedestrians and busses which move from and to the station area will put more pressure on the public space and crowded cycling routes and storages. Apart from this pressure, the station area is described by inhabitants as sad, boring and deficient, and it has a poor orientation towards the city centre. The appearance, liveability and social safety within the station area must therefore be improved (HaD5).

To conclude, Haarlem does not have all the answers to the question how the modal shift can be facilitated: “The vision on public space asks for a follow up on how to accomplish the modal shift together with the whole city” (HaD2).

Policy documents concerning first mile travel in Hilversum

Policy on the first mile

The first mile is mentioned in two of the analysed policy documents of Hilversum. In both cases there is attention for a few aspects of the first mile, which are mentioned implicitly. It mainly concerns the transformation of main cycling routes within the city (HiD2; HiD3), but detailed information about how and where this transformation will take place, is lacking.

Focus of the policy documents regarding mobility

Hilversum is located between Utrecht, Amsterdam, Almere and Amersfoort and many inhabitants work in the neighbouring cities. The number of higher and medium educated commuters originating from Hilversum is becoming larger towards the larger surrounding cities (HiD5). Because car drivers are more frequently being stuck in traffic, the use of transit and the bicycle is increasing (HiD3; HiD6). However, there is a lot of room for improvement considering these sustainable alternatives (HiD3).

The public transport use is relatively low, which means effort is needed to promote the network of the train and bus. The goal is to reach a growth in the number of transit travellers. However, Hilversum will only invest in the preservation and reinforcement of the transit supply, while a proper connection from door to door requires a lot more than only investing in transit (HiD3).

Because the distances within Hilversum are relatively short, the city is potentially a cycling city. However, that is not the reality yet. There are many problems to be solved for cyclists, especially at busy intersections. The main concerns are unsafety and additional unnecessary travel time (HiD3). Partly because of this, there is a negative image around mobility in Hilversum, which makes it a critical point of attention for the municipality (HiD1; HiD2). Furthermore, mobility is an important theme among residents of Hilversum (HiD6).

Hilversum does have ambitions considering cycling policy, for example to have excellent physical accessibility for all modalities (including the bicycle) by 2030. However, these ambitions are often not concrete (HiD1; HiD2). The ambitions concerning the station area do have a concrete character (HiD1). Here, the municipality wants to invest in better parking facilities for bicycles and a liveable public space. A lot of attention goes to measures within the city centre (HiD4). For example, the accessibility of the train station will be improved for cyclists coming from all directions (HiD2; HiD3). However, this only concerns the space directly around the station itself. Outside of the city centre there is much less attention for cyclists.

In Hilversum, public transport must be able to compete with the car. That applies to the areas near train stations up to areas which are a 10-minute cycling trip away from the station (HiD6). Considering the small size of the city, this applies to a large part of Hilversum. However, to increase the use of public transport the municipality only wants to invest in the network of the busses and trains itself (HiD2); there is no attention for the first mile, and thus for this 10-minute cycling trip to the station.

This is in line with the structure of most policy documents; there is often a main focus on the car, before mentioning transit or cycling. Sometimes a document even lacks specific policy for the bicycle (HiD2). Hilversum wants to both prioritise motorised traffic and cycling, which is at odds with each other (HiD3). Therefore, choices need to be made. Within the city centre, the municipality often chooses the bicycle over the car. Outside the city centre, this priority is lacking. Moreover, some policy documents even mention measures which prioritise motorised traffic over the cyclist (HiD2).

Concluding

All medium-sized cities in the MRA have the same challenge for the coming years: facilitating the growth of the daily commute in a sustainable manner. This is a challenge that is endorsed by the state and the Province. Although the mission is the same for all cities, every city will have its own challenges based on the city size, shape, population, usage, policies and infrastructure. Based on the context provided above, the two case cities are quite different from each other when it comes to these factors. In the next chapter, the researcher dives deeper into the influence of policy, infrastructure and usage on first mile travel in these two cities, which will be discussed according to the conducted research.

Results

In this chapter, the results of this thesis are discussed. First, this concerns the factor policy on First Mile travel, zooming in on the MRA, Haarlem and Hilversum. Then, the factor infrastructure is discussed, elaborating on the specific contexts of Haarlem and Hilversum. Lastly, the usage of First Mile travel is discussed. The elaboration on the results of the analysis of the ODiN 2018 data mainly focus on the MRA, while the results of the surveys focus on the characteristics and opinions of the local citizens.

MRA policy

The national climate discussion that has been going on for a few years, has had influence on many parties; the state, Provinces, but also locally on municipalities and citizens (IPNH; IRGV). The mindset has changed for many of these organisations (IPNH). **Due to the new goals concerning the reduction of CO2 pollution, which is especially a concern in the MRA, the mobility-related pollution must be reduced as well** (IPNH). These goals are also endorsed by the government, which means that the MRA needs to take action to reach the climate goals concerning mobility. At the same time, the potential to improve the sustainability concerning mobility is quite high; there are many people still taking the car, even when the distances are short (INS; IIW; IHa; IHi). The bicycle-train combination can be a solution; about 50% of the train users in the province of Noord-Holland comes to the station by bicycle, which means that the combination already makes sense for many people (IPNH). But there are still many people who must be stimulated to travel by bicycle and train (IIW).

Kinds of policy

Stimulating cycling in the city

Municipalities in the MRA can do a lot to stimulate cycling more by investing in infrastructure and behaviour (IIW; INS). They can look at the bicycle network, the fast cycling routes, and especially at how people cycle towards the train station. That includes more than only the part around the train station; the part further away from the station should also stimulate people to use the bicycle (INS). When improving the bottlenecks on cycling routes, for example by adjusting the traffic lights in favour of cyclists, the influential area of the train station for first mile users will expand, so more people will come to the station by bicycle (IRGV). **An important aspect considering first mile routes is that it does not only concern the directness of the route, but also the attractiveness of the route and therefore the experience of the cyclist.** If the traveller experiences the route as convenient and pleasant, it is not experienced as a time-consuming trip. This also determines the route choice and the number of cyclists (IPNH). Financial measures can also determine the behaviour of people. For example, the lease bicycle is easier to get now, and the state notices that more people are making use of that option (IIW). There is also the possibility to experiment; municipalities can close off a road for a certain time: If it does not work, it can be turned back. If it works, it can be made into a permanent intervention (IPNH).

First mile routes

There is a lot more attention for the bicycle within the Province lately, especially considering the fast cycling routes (IPNH). While choosing for a fast cycling route along a main car road is often the easiest option, choosing for a route that does not go along a main car road improves the safety and the speed of the route, as there are less busy intersections to cross (IRGV). **The most important part of the fast cycling routes is the part through the city, where most people use the routes** (IPNH). This part requires a lot of attention from municipalities.

Bicycle parking

The influence of bicycle parking is clear: According to several interviewees, **a proper bicycle storage stimulates people to use the bicycle** (IIW; IPNH; INS). Therefore, improving the quality and quantity of the bicycle parking is an important element of increasing the bicycle use to train stations. A part of the bicycle parking problem is caused by bicycles that are parked around the station for a very long time, because a new user cannot take that spot (INS). An example of how to solve this is an intervention at station Driebergen-Zeist, where the 24-hour-free guarded bicycle parking is the only available parking. Therefore, there are no bicycles in sight anymore, and the 'orphan bicycles' are also gone. These kinds of policies can change the behaviour of people (INS).

Transit and stations

All trains on trajectories between the cities in the MRA are driving on green energy and are therefore very sustainable (INS). At the same time, the Province is working on zero-emission busses; all busses should be 100% electrical by 2030 (IPNH). The frequency and capacity of the trains is constantly being improved. Between Amsterdam and Utrecht, 6 trains per hour or riding between these cities, which will happen on more trajectories (INS). Several organisations, such as the NS and regional governments, are collaborating with municipalities to make station areas more attractive (INS).

The NS has also made improvements in the services and facilitation of the trains and stations, which has made the train a more attractive mode of transportation (IRGV).

Car

It is important to promote the bicycle, and to discourage car use (IPNH). Therefore, cyclists should have priority over the car. **People call it 'bullying the car', but to make through traffic vanish, it really is necessary** (IPNH; IIW). A helpful intervention to decrease car use is by removing car parking lots, which proved to be very helpful in multiple cities. Especially when combining it with giving more space to the cyclist to make it attractive to use the bicycle. An example is Amsterdam, where many roads have been painted red. That means that the cyclist is the 'boss' and the car is the 'guest'. This low-traffic design could be a great option for medium-sized cities in the MRA, especially in and around the city centre (IPNH).

Housing

When densifying the city in terms of housing, interventions will be done in public space and infrastructure. **That gives the opportunity to tackle other issues like climate adaptation and mobility at the same time** (IRGV). When building houses around transit nodes, the people who come to live there are stimulated to take the train as their main mode of transportation on longer distances due to the proximity of the train station (IPNH; IRGV). Another benefit of new housing near transit nodes is that it enables cities to influence the demand for travel by train, which can influence the frequency of the trains on the local trajectory. Especially when done in collaboration with other municipalities along the same train line, building houses can have a substantial effect in the availability of trains (IPNH).

Barriers

Politics

The political 'colour' of an organisation really makes a big difference in the level of ambition regarding cycling (IIW; IPNH). This applies to municipal city councils, but also to Provinces and the National government. Within the Province, chain mobility and cycling are getting way more attention under the current board (PvdA) than before, as the previous board (VVD) thought that municipalities had to tackle this task on their own, stating that it was not a problem of the Province to solve (IPNH). When focusing on the municipalities, the 'green' councils are investing a lot in the bicycle and liveability of the city (IIW). But even then, **the city council must be convinced that mobility-related interventions are beneficial for the city on multiple levels**, and other elements such as car parking and the local shop owners must be taken into account as well (IPNH; IRGV). Therefore, combining these interventions with housing developments can be a strategic move. Because there is a large project, choices must be made considering public space and mobility, which provides a better argumentation to convince the council that the sensitive interventions are necessary to make the whole project work. Such developments are chances to make a faster transition in mobility through policy (IRGV). Political sensitivity is also relevant concerning residents, for example when introducing more strict policies on car parking (IRGV). **It can be a challenge to make residents accept the new interventions. Therefore, it is important to provide them a perspective.** By making sure that the residents understand that they get something in return, like more greenery, playgrounds, or space for cycling, the 'negative' intervention is less confronting. When framed well, many residents will be okay with new interventions (IPNH).

Mindset

Another phenomenon that plays a role in stimulating cycling is the mindset of residents and council members. The biggest challenge is to make sure that people are willing to use the bicycle (IIW). The transformation of their mobility behaviour is a big challenge (IIW). Since the new coalition of the Province has switche their mindset, a lot of municipalities have switched their mindset, too. There is a much larger focus on the development of transit nodes now (IPNH). On the other hand, there still is a long way to go. **Municipalities should think of the challenges of sustainable mobility more as a chance rather than a tedious task** (IIW).

Money

Money is another barrier to overcome when implementing first mile-related policy in the MRA. This is especially the case concerning the improvement or expansion of bicycle storages (INS; IRGV; IIW; IPNH). A high-quality bicycle parking can be quite an investment, especially when it concerns a location within the city centre (INS). On these locations, there is often no space to build the storage which means that it must be facilitated underground, which makes it more expensive. However, this is not the only reason why underground facilities are popular; the users of the bicycle parking prefer a spot as close to the platform as possible (IIW; IPNH). When building parking facilities further away from the station, many travellers will not use it; they rather push their bicycle in an overcrowded rack, than walk a little longer to have it stored safely (IIW). The crowded space can also be a barrier for cycling routes within the city. Due to the limited space and the complex context, it may be hard to create an attractive cycling route (IPNH).

Collaboration

Although municipalities are responsible for its implementation, policy for the first mile includes more parties than just the municipality. Various national and regional (governmental) organisations are each playing a different but vital role in the policy-making process. The role of these organisations is discussed in the section below.

Province

The Province of Noord-Holland collaborates with the municipalities on corridor-level (IPNH). That means the governmental parties located in an area around a certain train trajectory are working together with the involved parties. This also helps the municipalities to connect with each other (IPNH; INS). Within these corridors, **the Province can stimulate sustainable choices regarding mobility with funding, regional collaborations and knowledge** (IPNH). Municipalities can ask the Province for subsidies regarding bicycle investments (IHa; IPNH). With these subsidies, the Province, but also the state and the MRA can make sure that certain developments are executed first. This concerns the construction of houses near transit nodes, for example. A lot of municipalities find that these subsidies are the last push they needed to start developing their station area (IPNH).

However, to receive the subsidies, municipalities need a good and concrete plan, and often a regional agreement is needed to receive the subsidies (IPNH). For example, concerning a fast bicycle network, a strong regional plan and collaboration is needed to generate higher subsidies. This is especially the case when a project crosses the territory of multiple municipalities (IRGV). In addition, it is very important for the Province that the municipalities asking for subsidies have a high ambition regarding cycling (IPNH).

The Province, Vervoerregio and the MRA are frequently lobbying for investments at larger organisations such as the NS and the state. If municipalities are trying to lobby on their own, it will not have any effect; it must be done jointly, because when you plan for an investment together it will stand stronger, and the NS and ministries are more likely to listen (IPNH).

State

The state makes agreements with municipalities of medium-sized cities about bicycle parking and cycling routes (IIW). For investments like bicycle parking, the Ministry contacts municipalities, notifying them that 75 million euros will be invested in bicycle parking. Then, a list of criteria is made, and the proposals from the municipalities are assessed, which decides whether or not the state will invest in their bicycle parking (IIW). Especially bicycle parking is an issue that concerns money. **The municipalities invest in the parking themselves, but the state can invest as well, to help the municipality to realise the project** (IIW). Next to the Ministry of Infrastructure and Water management, other ministries such as Finances and Internal affairs are working on sustainable mobility as well, to provide funding and knowledge about land use.

Although there are national guidelines on the design of infrastructural facilities provided by the CROW, **it is completely up to the local municipalities to see what kind of infrastructural interventions they will do** (IIW). They have the freedom to execute their own intervention; by looking at the local situation, they can decide to make up an infrastructural solution that might fit better than the options provided by guidelines (IIW).

Every three years, ProRail, which is owned by the state, counts the number of bicycles parked around the train stations in the Netherlands and analyses these numbers (INS). Therefore, ProRail can forecast the bicycle parking demand for 2030 and 2040, and the corresponding shortages. According to the forecasts by ProRail, the state can invest in improving the bicycle storage. So, if there is a large shortage, municipalities can be informed to apply for subsidies to expand their bicycle storages (INS).

NS

NS is responsible for the national train network. NS can stimulate municipalities to start up projects to tackle certain problems around the train station, such as overcrowded bicycle storages (INS). NS also actively contributes to municipal visions, to see how the train station can be well connected to the bicycle network. This connection should be designed well, so that the traveller can arrive easily and safely at the train station. NS also facilitates the exploitation of the bicycle storages (INS).

Regional partnerships

Regional partnerships are collaborations between several municipalities within a certain area. Regional partnerships, such as the Regio Gooi & Vechtstreek (RGV), are working together with all municipalities in the area to figure out what the different parties want to achieve as a region, and how to facilitate that (IRGV). This also concerns cycling, transit and the door-to-door journey. The RGV makes sure that many themes are worked on in collaboration with the relevant parties, including the Province and the MRA. There is a regional collaboration agenda, in which the parties are looking what has to be done in the region considering various themes, such as mobility, climate and housing. It does not only concern collaboration, it also concerns funding for the region; **by working together as a region, there is a better lobby to get things done** (IRGV).

Haarlem policy

As stated in the case description, there is an explicit focus on sustainable mobility in Haarlem (HaD4). The number of commuters is growing, and the municipality therefore wants to strengthen the sustainable mobility networks towards the locations where the inhabitants work, especially around Amsterdam (HaD2). However, the car-share during the daily commute originating from Haarlem is still between 60% and 80%, which should decrease (HaD4). Within the city of Haarlem, there is a lot of potential for an increase in bicycle use. There are many short distances (up to 7,5 kilometres) which are still often covered by using the car (IHa). Considering the potential for a proper transit connection, the potential for the bicycle on short distances towards the transit stations, and the ambitions regarding sustainable mobility, Haarlem seems to have all the ingredients to create proper policy regarding first mile travel. The policies and barriers to these policies in Haarlem are discussed below.

Kinds of policies

Sustainability

Haarlem is quite ambitious when it comes to climate-related issues, which is also one of the main topics of the coalition agreement. There is a lot of enthusiasm within the municipality for this topic. **In the vision on mobility, Haarlem wants to invest in minimising the car use and changing the infrastructure and mobility behaviour.** Then, the part that needs to become energy-neutral, which is expensive, can be as small as possible. Theoretically, you could reach your climate ambitions by making everything climate-neutral, but then the other goals concerning mobility are neglected: using space efficiently and creating space for climate-adaption and greenery. Those are very important to take into account, too (IHa).

Stimulating cycling

On policy level, the situation concerning cycling has improved because the structure vision has been established, in which a clear choice has been made for the cyclist and pedestrian. This helps to improve the position of these sustainable modes in all kinds of projects. Haarlem is now working on mobility policies that will look into how exactly we are going to make that happen. **It starts with a vision, but the most important thing is that the vision is translated into policy and a plan of execution** (IHa).

First mile routes

There is quite a lot of potential for the bicycle on short distances in Haarlem, especially towards the train stations and bus stops. These routes are getting more attention. Therefore, **Haarlem does have policy concerning the first mile, also concerning the bicycle parking, which is part of the first mile**. First mile routes are part of the city-wide cycling network. In the structure vision, the cycling network is indicated, in which the municipality looked for a logical structure. That includes the so-called 'city streets' (figure 14), but also the main cycling network. The ambition is to connect all of the local and regional routes on a cycling ring around the city centre. By doing so, Haarlem tries to prevent cyclists from going through the centre, which should be mainly the domain of the pedestrian (IHa).

For the mobility policies, the locations with the highest bicycle use have been analysed, to see where attention from the municipality is needed. The Rijksstraatweg, stretching from the central station to the north city border is the route that needs attention most urgently. Here, but also along other roads where cars can drive 50km/h, the cycling paths are very narrow, which jeopardises the safety of cyclists. Cycling safety in Haarlem is one of the focus points of the traffic safety policy, and this is a point of attention regionally, too. Therefore, there is a lot to improve considering the design of the bicycle routes in Haarlem (IHa).

Bicycle parking

There is a big shortage of bicycle parking in Haarlem, both in the city centre as at the transit nodes. It is something the municipality looks at, especially concerning the two train stations. At station Haarlem, another 4000-5000 places must be added to meet the demand for the coming years, so that is a big task. So big, that it is not possible to fix the bicycle storage issue on the short term due to the large size of the investment. Therefore, the state provides a subsidy to invest in double-layered racks

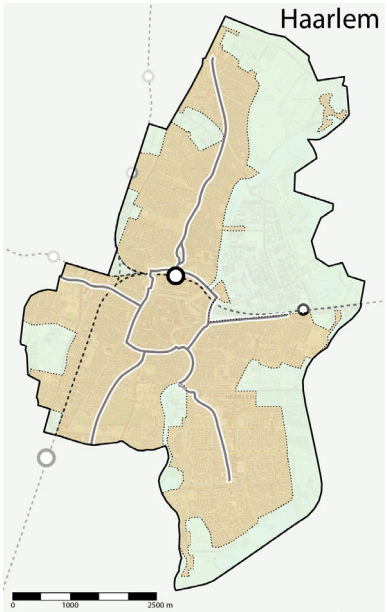


Figure 14: The 'city streets' in Haarlem. These routes will be mainly designed for cyclists and pedestrians.

which can be moved to the underground storage when it is ready. **So, it is important to be creative with the money you can spend as a municipality** (IHa).

Transit and stations

The 'R-net' bus lines are highly frequent lines between Haarlem and neighbouring cities with only a few stops on each line. That works really well, because there is a high demand and it is growing rapidly. Especially from the medium-sized cities towards the larger cities (IPNH). **Haarlem does support this growth in transit use, but not at the cost of liveability.** Therefore, not all busses should drive through the city centre. The municipality wants the busses to have a more equal spreading around the city (IHa).

Car

Reducing car use is something Haarlem is mainly working on by investing in the alternative modes, such as cycling and transit. However, **it remains very hard to really say 'no' to the car and to really make radical choices to prioritise the cyclist.** For now, the municipality focuses on the alternative modes and hopes that people will change their behaviour (IHa).

Barriers

Priority

Haarlem has got a lot of ambitions regarding sustainable mobility, but sometimes the actual realisation of these visions is lacking. A main element jeopardising the realisation of the ambitions is the prioritisation of different themes. It may concern several things, such as the chopping of trees, shop owners who are afraid to lose customers due to an alternative route, or inhabitants who want to keep their public parking spots in front of their house. When considering all of these different interests, **improving the bicycle infrastructure is often not the main priority within Haarlem according to the council and inhabitants** (IHa).

Reducing car use is something that has been put high on the list of ambitions in Haarlem. However, it remains very hard to really say 'no' to the car. Therefore, another barrier is the physical priority issue of the cyclist. At the moment, cyclists do often not have right of way when crossing the street, which is an issue that is a barrier to multiple cycling routes in Haarlem. A solution could be to adjust the traffic lights. Currently, the car route is part of the dynamic traffic management system, so that cars can keep driving due to the adjustments of the traffic lights. That is a decision which could be taken the other way around, so that the cyclists are prioritised, and the cycling trip will become more convenient (IHa).
To improve the situation concerning sustainable mobility, the municipality should really stand for their ambition, even when there are other interests. At the same time, that is hard to accomplish, and will not always be possible. **A solution can be to compromise over the whole city and not per situation.** That means choosing for mobility on a certain street and choosing for green or climate adaptivity somewhere else. To combine these themes is what Haarlem strives for, but that is not always a possibility (IHa).

Politics

The consequences of the priority issue stated above can be found in another barrier: political friction. The question is, will you stand firm as municipality and make sure to execute the ambitions concerning sustainable mobility when other priorities are involved? This may cause friction on municipal level, or among the inhabitants. Although inhabitants can be hard to deal with in some cases, 'the inhabitant of Haarlem' does not exist. Of course, some people call those interventions 'bullying the car', and they feel like they really need the car to get to work. But other people think that the sustainable mobility must be prioritised over the car and want to introduce car-sharing initiatives (IHa).

There is enough knowledge about first mile travel within the municipality. However, this **knowledge is only available through a small number of people**. This knowledge must be shared to make sure that it can be used to improve the situation for cyclists. The partners hired to execute the assignments need this knowledge as well, and that is where it goes wrong sometimes.
So, within the policymaking division, the knowledge is available, but the communication of this knowledge must be improved (IHa).

Money

Money is definitely one of the biggest barriers to invest in sustainable mobility in Haarlem. A lot of money is 'stuck' in a certain maintenance programme, which mostly focuses on where the road needs to be improved. It has a limited focus on the ambitions considering sustainable mobility. Therefore, not a large amount of money is available to invest in sustainable mobility. **The ambition to invest in cycling is there, and there is a certain amount of money available, but not the amount that would facilitate a complete transition on the short term.** Due to the lack of money, it is not possible to fix the bicycle storage problem on the short term. Even when the Province provides subsidies that cover 70% of the costs for including bicycle safety in maintenance programs, we cannot pay the remaining 30% to make the investment happen. However, there is a positive perspective: The investments in the car infrastructure are becoming less over the coming years, so that more money can be spent to invest in sustainable modes such as transit and cycling (IHa).

Hilversum policy

The main message that came across in the case description of Hilversum is that there is a lot of room for improvement considering sustainable mobility in this city (HiD3). This has been confirmed by multiple interviewees, and it may not come as a surprise that Hilversum has always been more of a car-city (IHi; IPNH; IRGV). As lots of other cities are becoming low-traffic and are prioritising pedestrians and cyclists over the car, Hilversum still has to make that step (IPNH). However, the municipality recently made the switch to look at the possibilities concerning sustainable mobility. This was inevitable, as the city council accepted a proposal which states that Hilversum must be climate-neutral by 2050 (IHi). To accomplish this mission regarding mobility, Hilversum is facing quite a challenge to implement policy regarding sustainable mobility. The policies and barriers to these policies in Hilversum are discussed below.

Kinds of policies

Sustainability

A shift in policy is coming concerning sustainability, which is partly due to the problems such as air quality, emissions, pollution which are getting in the picture more and more (IHi). Therefore, **the modal split of the city should change, and a focus on sustainable mobility is needed**. Another sustainability issue that is relevant for Hilversum is climate adaptation. The Province has analysed that Hilversum station area has problems concerning climate adaptation, including heat stress and flooding during heavy rainfall (IRGV). This is an issue that might be able to benefit from improvements in cycling infrastructure in the city.

Stimulating cycling

The potential to stimulate cycling in Hilversum is quite high; the car is still the main mode of transportation and even for distances up to 7,5 kilometres, 33% is still using the car (IHi). At the same time, Hilversum is a rather small, compact city, which means that the distances to cover within the city are always a cycling distance. The municipality is starting to realise that this potential is available, and now wants to further stimulate cycling. **Stimulating cycling concerns more than giving the cyclists a piece of asphalt; it's about picking the bicycle over the car, it is about giving them right of way,** especially on the inner and outer ring. In other words, Hilversum should prioritise the cyclist. But that thinking process has only started recently. Therefore, **the policies are not written down on paper yet** (IHi).

First mile routes

Hilversum does not have specific policy regarding the first mile (IHi). However, the regional fast cycling routes, which will be constructed through a collaboration of the local municipalities, the RGV and the Province, may very well serve as first mile routes from the residential neighbourhoods towards station Hilversum. The fast cycling routes are supposed to connect residential areas, work- and shopping areas, educational institutions, transit nodes and recreational areas with each other within the Gooi area (IHi; IRGV). Because Hilversum is the central place in this plan, **the city will have '8 spokes in the wheel' which can also function as routes from Hilversum's residential neighbourhoods to the central station** (figure 15).

However, the Province and the MRA are mainly thinking from a regional perspective, in which they see a chain of towns. Therefore, **some local issues have not been taken into account yet. This includes missing routes, but also the experience, speed and safety of the routes within the city** (IHi). The routes which we would like to maintain for through traffic are quite the same as the ones which are now designated as fast cycling routes. Those are the same routes that have been pointed out as main traffic roads in 1996, that has never been changed. That is a fine option according to the local traffic experts who praise its efficiency, but the local spatial planners state that this strategy does not adapt to the current usage. Even though the information is lacking, they think that cyclists would rather be cycling on a different first mile route (IHi). **The question is: how do people cycle from their neighbourhoods to the train station?**

Bicycle parking

At the moment, the bicycle parking at station Hilversum is being expanded to 7000 places. Before, the situation at station Hilversum was quite bad in terms of quality and

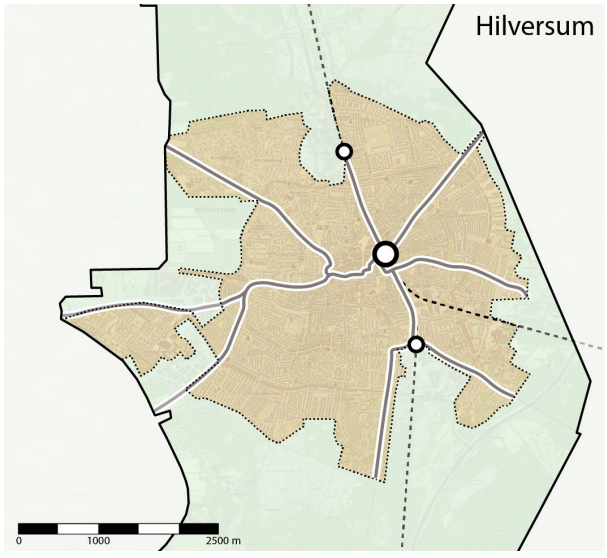


Figure 15: The planned fast cycling routes within Hilversum.

quantity. The other two stations do not have problems, there is enough capacity to store bicycles (IHi).

Transit and stations

For the busses in the region, the same strategy is applied as in the South tangent near Haarlem; a separate bus lane will be constructed which connects all surrounding municipalities with station Hilversum. In addition, all busses in Hilversum will be 100% electric by 2022 (IHi). **Station Hilversum is located within the city centre and therefore has only limited space to expand.** The other two stations can be endlessly expanded due to their location on the edge of the city. When looking at potential for the future, it is interesting to look at the options for the two smaller stations (IHi).

Car

The car has always been a popular mode of transportation in Hilversum. However, the pressure on the roads within Hilversum and especially on the highways around Hilversum is very high (IHi; IRGV). **Instead of investing in the roads, which proves to be unprofitable in the long term, the pressure should be taken off the roads by investing in transit** (IHi; IRGV). The problem is that the car is an attractive mode of transportation in the city due to its priority at almost every intersection. Therefore, Hilversum should urgently start to 'bully' cars (IHi): **Stop investing the car and invest in the bicycle, as a modal shift to the bicycle would relieve the whole system** (IHi). An example of this could be to transform current car roads that have a relatively low car use into green corridors for pedestrians and cyclists (IHi). This would also solve another issue; main cycling routes in Hilversum are often located along routes with a lot of cars and busses, while separating these structures is more convenient for the cyclist (IRGV). Solutions like this can increase the use of sustainable modes, but it asks for radical choices, and those choices are still to be made in Hilversum. Another option for Hilversum is to introduce parts of the city where the car is the 'guest'. Interventions like these are necessary, because **Hilversum needs to change the way it is using the space** (IPNH; IRGV).

Housing

Due to the Covid-19 pandemic, people seem to be capable of making different choices concerning mobility. So, something rather radical must take place for people to change their behaviour (IRGV). One of these radical plans is the ambition to build an additional 10.000 houses in Hilversum during the coming years (IHi; IRGV). The housing locations are planned near the three existing train stations. By having this ambition, it automatically means that Hilversum wants people to travel in a different way (IRGV). Therefore, this development is a unique chance to improve the way Hilversum facilitates mobility; **investing in the train and its accessibility is crucial to shape the housing development, and the other way around, too** (IRGV). The additional housing is needed to justify the mobility-related measures; there is not enough space to keep facilitating the car as the main mode of transportation when building this number of houses (IHi; IRGV). That is a line of reasoning that needs to penetrate into the politics as well (IRGV).

Barriers

Priority

Almost everywhere, apart from several – not all – roundabouts, cars have priority over cyclists in Hilversum. This concerns both the right of way and the adjustment of traffic lights in favour of the motorized traffic (IHi). On the outer ring of Hilversum, this priority is partly an environmental issue, because the trucks driving on this road do not have to stop, which lowers the pollution. On the long term, this actually has an environmental downside, as people are stimulated to drive by car, instead of the bicycle (IHi). Additionally, **by giving the car priority in many places in the city, it remains attractive to keep using the car**.

In Hilversum, everything that is non-motorised traffic is having a hard time. Almost all sidewalks have parked cars on it and there is no policy to make sure that the bicycle paths are kept free. In the physical design, it is always more important that the car has enough space and not the cyclist. On every policy level, the municipality has never focused on solving these issues for the cyclist (IHi). There have a been lot of car counts to figure out where problems for motorised traffic occur, but t**here have never been counts for bicycle use. Therefore, Hilversum has very little information about the movements on the bicycle in the city, which makes it hard to justify interventions that improve travel by bicycle** (IHi). In addition, cyclists choose their own first mile routes; they do not behave according to the societal view of the traffic experts. Therefore, the cycling investments are likely to go to the wrong places (IHi).

Politics

The implementation political sensitive interventions such as the chopping of trees, is always an issue considering protests of inhabitants (IHi). Therefore, the municipality uses a lot of participation to make sure that interventions are accepted by the inhabitants. However, as the bicycle always has to stop for cars on the route towards the train station and the bicycle paths are parked full with cars, the municipality already knows that people will not have a very positive opinion on cycling right now. According to them, there is already a lot to work on by figuring out what to do themselves (IHi).

MindsetConcerning the design of the cycling infrastructure and public space, Hilversum still has a long way to go. A lot of people still have the idea that it is not necessary to make a choice. **Hilversum claims that they can stimulate the car and the bicycle, even though that is impossible.** It is a matter of mindset; cyclists will never arrive at the train station in a fast and sustainable way if the car traffic is still supported (IHi). If the mindset does not change within the municipality, it will not change for the inhabitants; many people in Hilversum are willing to use the car for only 200 meters (IRGV). Although there are ambitions for cycling and the municipality wants to facilitate the modal shift, that can only be realised in practice when there is enough capacity to turn these ambitions into reality (IHi).

Findings policy

Policy is a crucial element to make sure that first mile travel can be improved. There are three elements to tak into account when looking at policy: The actors in policy, the kinds of policy, and the barriers in policy.

Actors

There are several actors that play a role in these developments. Municipalities are in the lead but can collaborate with regional partners, the NS and the Province. The Province and the state can also provide subsidies to stimulate improvements in bicycle parking and infrastructure which contribute to national goals.

Kinds of policy

There are a lot of different policies that can be used to improve first mile travel. Some are obvious, like policy on bicycle routes and the station area, but other themes, such as sustainability and housing can have a large impact on first mile travel on policy level, as they offer the opportunities to improve bicycle infrastructure for a larger goal than just improving the mobility or accessibility.

Barriers

Apart from the chances policy offers, there are barriers that can stand in the way of developing the right policies. While the lack of money is a barrier that involves many actors such as the state and the Province, politics, mindset and especially priority are barriers that must be overcome on municipal level. The mindset is very important. The municipality and the inhabitants of the city must understand that a modal shift is needed to keep the mobility system running and to make the city more liveable. Therefore, improvements through bicycle policy are very much needed. When it comes to priority, municipalities really need to stand behind their ambition to stimulate cycling and the bicycle-train combination. Other priorities, such as giving cars right of way or maintaining a tree standing in the way of an infrastructural improvement for cycling can make sure that bicycle-related improvements are postponed or even cancelled.

In short, policy is a very complex element (figure 16), which has the power to make or break the success of first mile travel by bicycle in medium-sized cities.

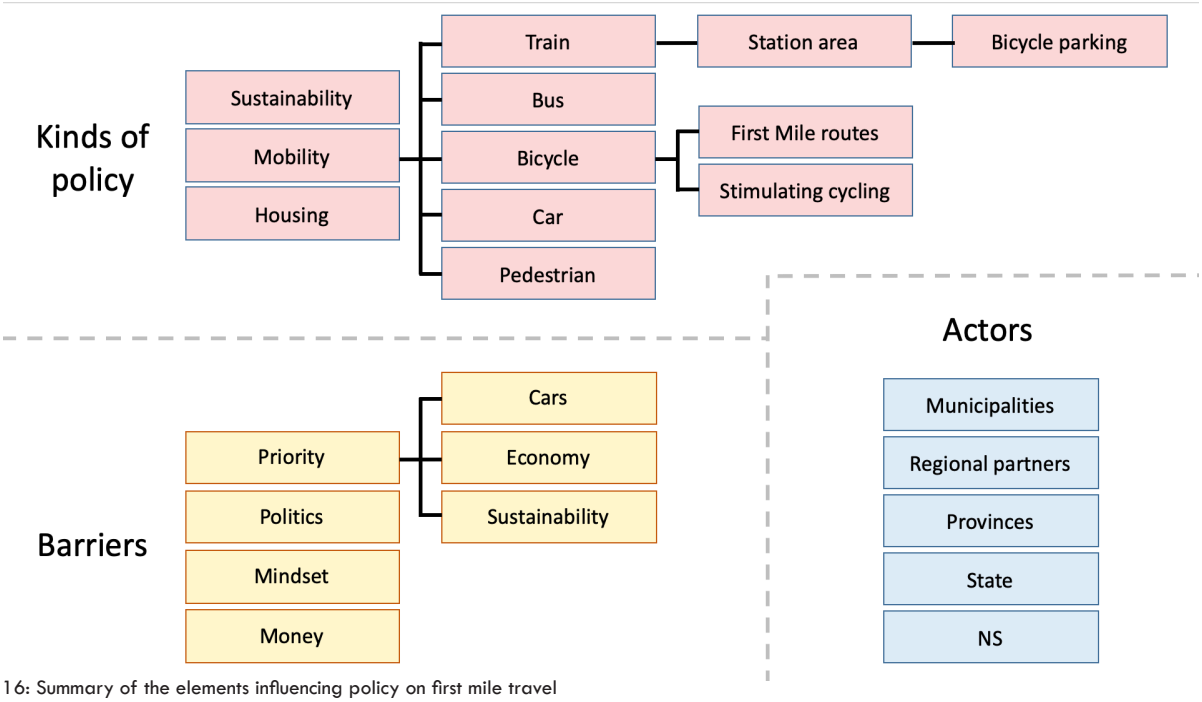


Figure 16: Summary of the elements influencing policy on first mile travel

Haarlem infrastructure

Accessibility

As stated in the case description, the shape of Haarlem has got a dominant north-south structure. Therefore, it is more likely that not all citizens are able to get to a train station by bicycle within 15 minutes. For the analysis regarding the residential areas and the train stations in Haarlem, station Heemstede-Aerdenhout has been included as well. Even though this train station is not located in Haarlem, it is located close to the city and it concerns an intercity station. Therefore, this station is likely to attract inhabitants of Haarlem.

In figure 17, the isochrones of 5, 10 and 15 minutes cycling to one of the three stations in Haarlem is shown. The indicated areas only include residential areas within the city. **Station Haarlem has the largest area of influence in the city when looking at these isochrones.** It is therefore the most accessible station, as many people are able to travel to the station within 15 minutes cycling. The areas of influence of station Spaarnwoude and Heemstede-Aerdenhout cover 75% and 60% of the residential areas, respectively. That means that in the case of station Spaarnwoude, about 25% of the inhabitants of Haarlem takes longer than 15 minutes to cycle to this train station.

When transforming these isochrone maps into a division of the residential areas regarding the shortest travel time by bicycle to one of the three stations (figure 18), it is clear that based on travel time, **station Haarlem is the most accessible station for most inhabitants of Haarlem.** While the division between the stations at the

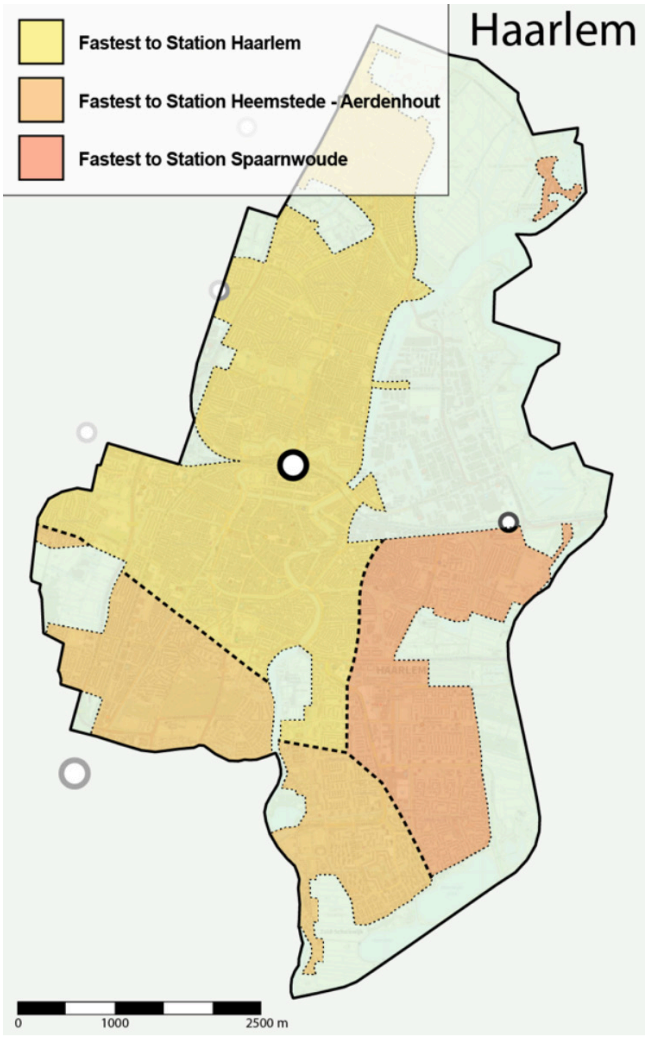


Figure 18: The residential areas of Haarlem regarding the shortest travel time by bicycle to one of the train stations

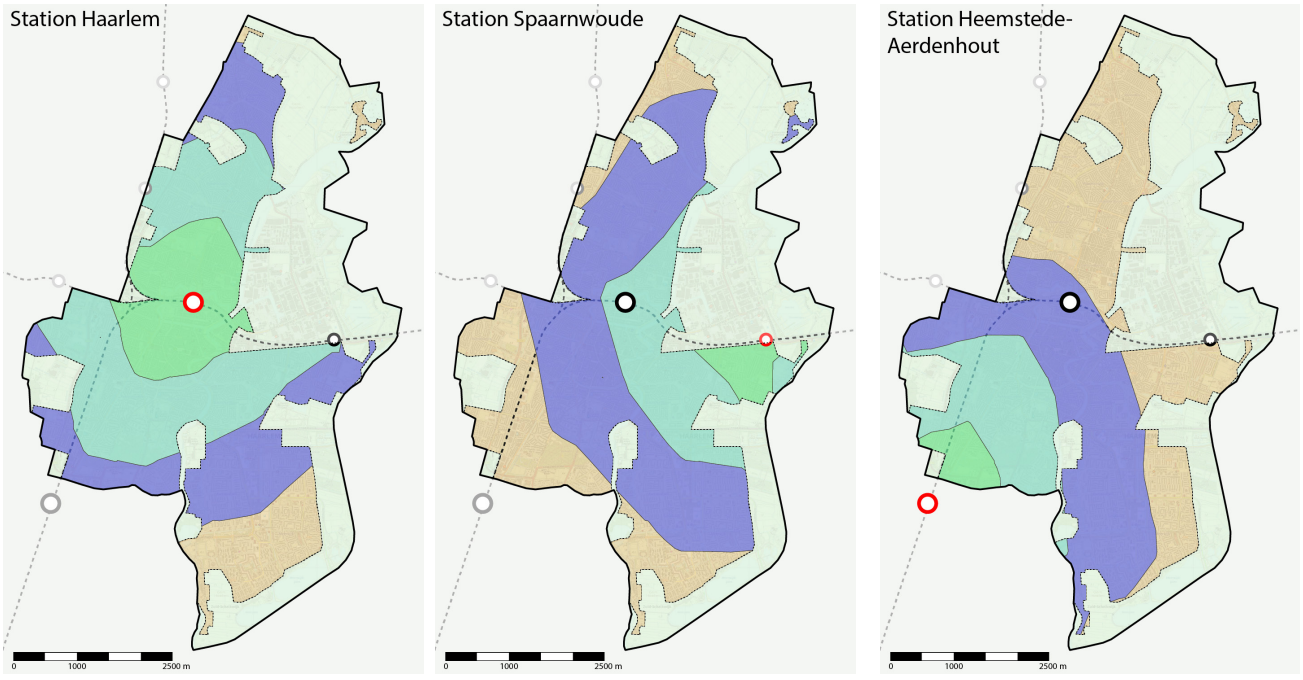


Figure 17: The isochrones of 5 (green), 10 (light blue), 15 (dark blue) minutes cycling towards the train station in Haarlem

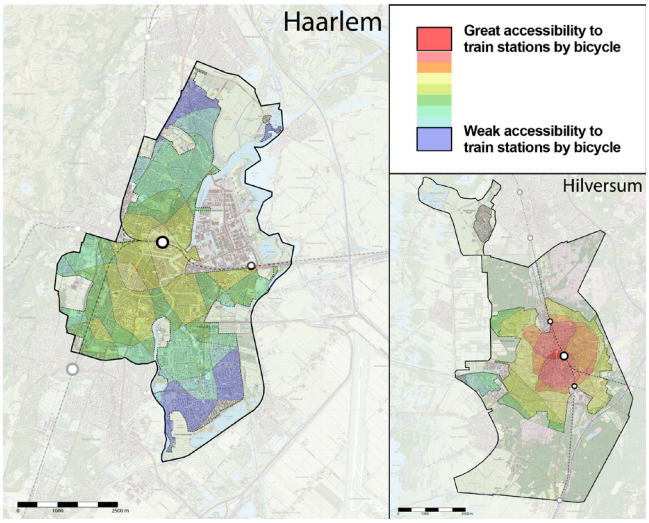


Figure 19: The degree of accessibility to train stations by bicycle in Haarlem. Hilversum has been added for comparison.

south side of station Haarlem is quite evenly divided, all residents of the northern part of Haarlem are likely to cycle towards station Haarlem when looking at first mile travel time. However, travel time is the main reason for picking a train station for only 47% of people (Debrezion, Pels & Rietveld, 2007). Another important element is the Intercity status of a train station, as this indicates that more locations can be reached faster and more frequent. When taking this into account, the actual influence of station Haarlem will be even bigger than in figure 18. In 2018, station Haarlem had been the access or egress station to 42.000 travellers per day (NS, 2019). Compared to the two other stations, that is 79,1% of the total travellers of these three stations. Although these numbers also contain the travellers that used the stations as egress station, it shows that station Haarlem is by far the most popular train station in the area. The actual station preference of the train users has been researched in this study, too. These results can be found in the section 'Usage surveys'.

When combining the isochrones of the three train stations in Haarlem, a certain 'accessibility score' can be assessed to the residential areas within Haarlem. These scores can be found in figure 19. This map shows the level of accessibility of certain areas within the city. This includes the number of stations and the time it takes to reach the station. For example: a certain location in Haarlem is less than 5 minutes away from station Haarlem, and less than 15 minutes away from the other two stations. Then the accessibility is indicated light green on the map; a relatively high score in Haarlem. When a location is less than 15 minutes away from station Spaarnwoude, but more than 15 minutes away from the other two stations, the area is indicated dark blue, which is a low score. Within the city itself, the results are not that spectacular; as expected, the most central areas of Haarlem are the most accessible ones. However, it does get interesting when comparing the results to the results of Hilversum (more information about this analysis can be found in 'Hilversum infrastructure'). Where the best accessibility within Haarlem is on the yellow level, Hilversum contains areas that are indicated in bright red, which means that three stations are accessible within 5 minutes cycling. This shows that **the potential of the first mile in terms of travel time is much higher in a smaller, compact city like Hilversum, than in a larger, less centric shaped city like Haarlem.**

Assessment

By analysing the mobility-related policy documents of Haarlem, and through the suggestions given by the interviewee and inhabitants through the survey, the researcher has identified the main cycling routes within the city (figure 20). Based on this map and the input from the interview and survey, the researcher has cycled the routes that were most likely to be possible first mile routes towards station Haarlem from every part of the city. The map of the observation route and the suggestions given through the survey can be found in appendix 4 and 6, respectively. The routes have been assessed on four characteristics: Safety, directness, comfort and attractiveness. To broaden the perspective, the researcher has also looked at the speed, availability and quality of the bicycle routes, which are complementary traits to the characteristics listed above. The findings can be found in the sections below. In the 'Findings infrastructure' section, scores will be given to each of the four elements per city.

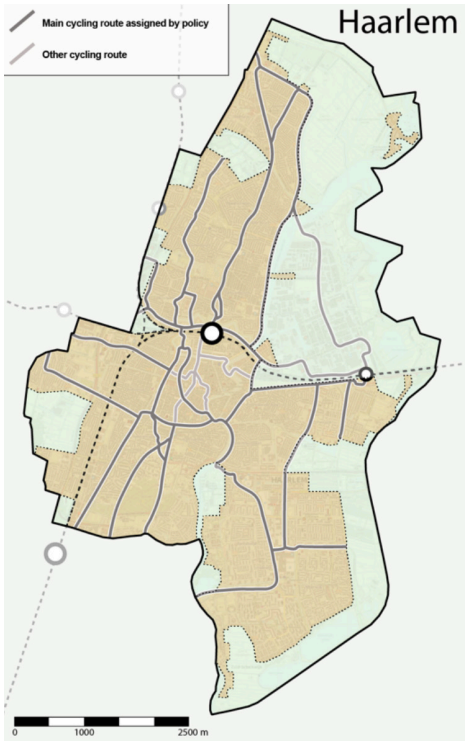


Figure 20: Cycling routes in Haarlem

Safety

Overall, the first mile routes to the train station in Haarlem are quite safe. Many routes contain broad, high quality paths with a smooth surface, and most importantly: the paths are often separated from car traffic (Figure 21; photo 1). Most intersections are safe due to the regulation by traffic lights (Photo 2). However, there are also some routes that contain narrow paths (Photo 6), even though the use of these routes can be very high (IHa). Therefore, the small size of the path does not match its high bicycle use.

Directness

The directness in Haarlem is not bad, and not good. Although the routes are quite direct, the speed on the routes can often be improved; there are many traffic lights, which can cost the cyclists 2 minutes of cycling time to the station (Photo 5). **The abundance of traffic lights is one of the biggest issues concerning the quality of the first mile routes in Haarlem.**

Comfort

The comfort of the first mile mainly concerns the amenities; bicycle parking and additional infrastructure to improve the route. **Bicycle parking at the train station is a growing problem in Haarlem** (IHa). The storage is often full, while the demand is growing. On the other hand, there are some amenities that really improve the cycling experience, such as a bicycle tunnel to avoid a crossing with a large road (Photo 3).

Attractiveness

The attractiveness of the first mile routes in Haarlem is very good. It feels nice to cycle through the city, considering the overall quality of the bicycle paths and the network as a whole. **Many of the routes are very lively and improve the liveability of the city Haarlem.** Even though there are some major problems that need improvement, the quality of the first mile routes is good. The routes that need improvements and the major problems are indicated on the map on the next page.

In Haarlem, most of the routes with room for improvement can be found in or around the city centre. This concerns intersections with traffic lights and bicycle paths with lack of space to take over. On three locations, this leads to a major problem. On the route through the city centre, cyclists share the road with pedestrians. This may lead to unsafe situations and a delay in the trip time. In the Barteljorisstraat (most southern major problem), cyclists are not allowed to use the bicycle during opening times of the local shops, which either leads to further delay due to a detour, or a more unsafe situation due to cyclists ignoring the rules. Just north of station Haarlem, the next major problem is located. Here, the waiting times at the intersection may surpass 2 minutes. On top of that, there is not enough space for cyclists to wait for the traffic light, as the path is too narrow. From this point up to about 500 metres north is the last major problem: The bicycle paths are too narrow, and the quality is too low, especially considering the large number of cyclists on this route. Based on the analyses of the local infrastructure, the researcher has made recommendations to improve first mile travel in Haarlem through infrastructural interventions. These recommendations can be found in the chapter 'Conclusion'.

Figure 21: Photographs of cycling routes in Haarlem

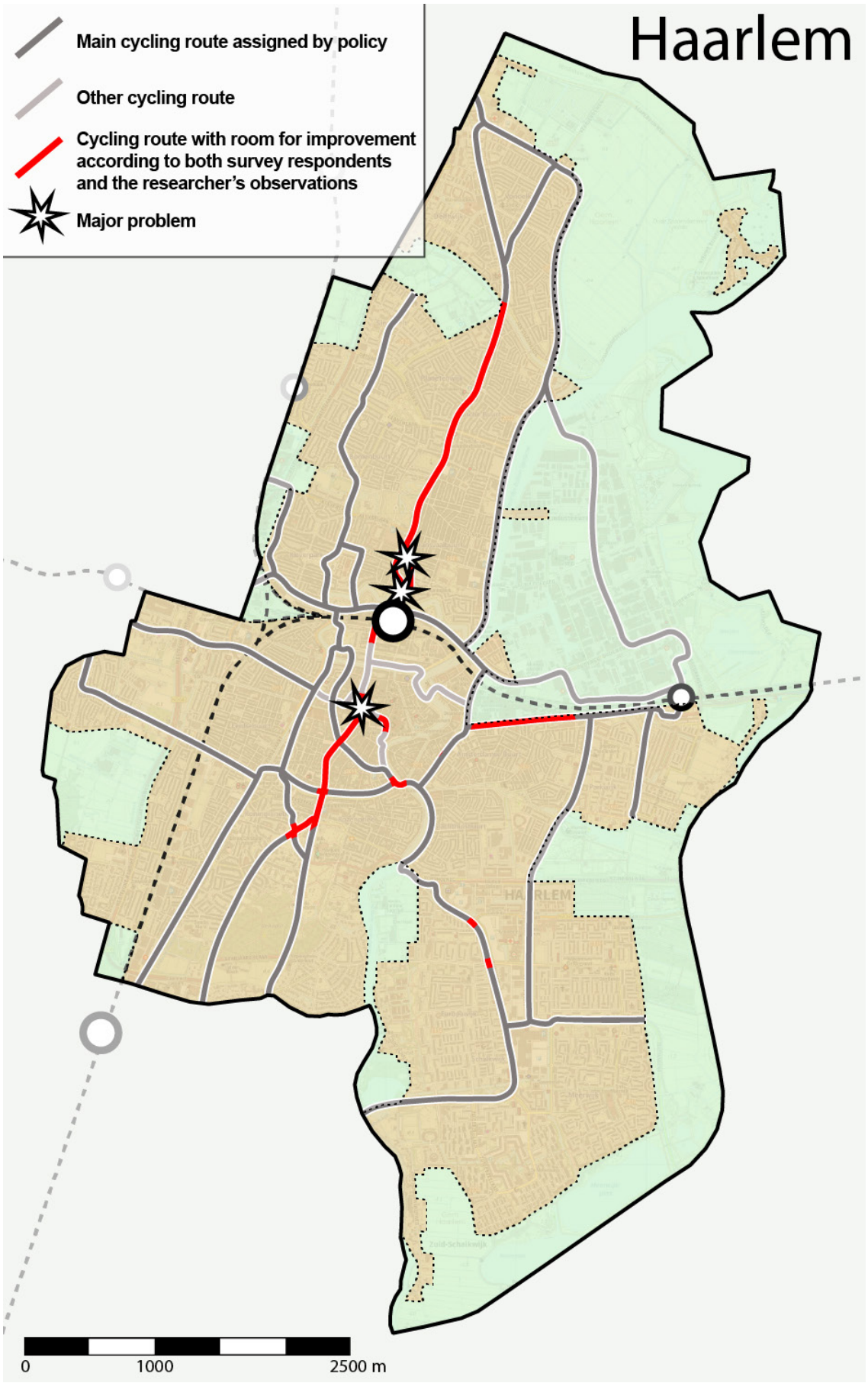


Figure 22: The main cycling routes in Haarlem. The routes with room for improvement are marked red

Hilversum infrastructure

Accessibility

As stated in the case description, Hilversum is a compact centric city with a diameter of about 5 kilometres. Due to its relatively small size, almost every inhabitant of Hilversum is able to get to a train station by bicycle within 15 minutes. In this analysis, the neighbourhood 'Hilversumse Meent' has not been included, because geographically, this area is located much closer to Bussum and to the train stations Naarden-Bussum and Bussum Zuid. People living here are therefore not likely to use the train stations located in Hilversum.

In figure 23, the isochrones of 5, 10 and 15 minutes cycling to one of the three stations in Hilversum is shown. The indicated areas only include residential areas within the city. Station Hilversum and station Sportpark both have a very large area of influence in the city when looking at these isochrones. About 99% of the inhabitants are able to travel to one of these stations within 15 minutes cycling. The area of influence of station Media Park covers about 95% of the residential areas. That means that practically **every citizen is able to choose between the three train stations located in Hilversum.**

In figure 24, the isochrone maps shown above are transformed into a division of the residential areas regarding the shortest travel time by bicycle to one of the three stations. **The city is almost divided into three equal parts when looking at the travel time.** The area corresponding to station Media Park is 27% of all residential areas, station Hilversum serves 38% and station Sportpark serves 35% of the residential areas when looking at the fastest travel time. As stated in the previous section, travel time is the main reason for picking a train station for about 47% of people (Debrezion, Pels & Rietveld, 2007). Another important element is the Intercity status of a train station, as this indicates that more locations can be reached faster and more frequent. When taking this into account, the actual influence of station Hilversum will be bigger than the area visualised in figure 24. In 2018, station Hilversum had been the access or egress station to 26.700 travellers per day (NS, 2019). Compared to the two other stations, that is 68,7% of the total travellers of these three stations. Station Sportpark had been used daily by 19,8%, station Media Park by 11,5% of all station users in Hilversum. Although these numbers also contain the travellers that used the stations as egress station, it shows that s**tation Hilversum is by far the most popular train station in the area.** The actual station preference of the train users has been researched in this study, too. These results can be found in the section 'Usage surveys'.

When combining the isochrones of the three train stations in Hilversum, a certain 'accessibility score' can be assessed to the residential areas within Hilversum. These scores can be found in figure 25. This map shows the level of accessibility of certain areas within the city. This includes the number of stations that can be reached and the time it takes to reach the station. For example: a certain location in Hilversum is less than 5 minutes

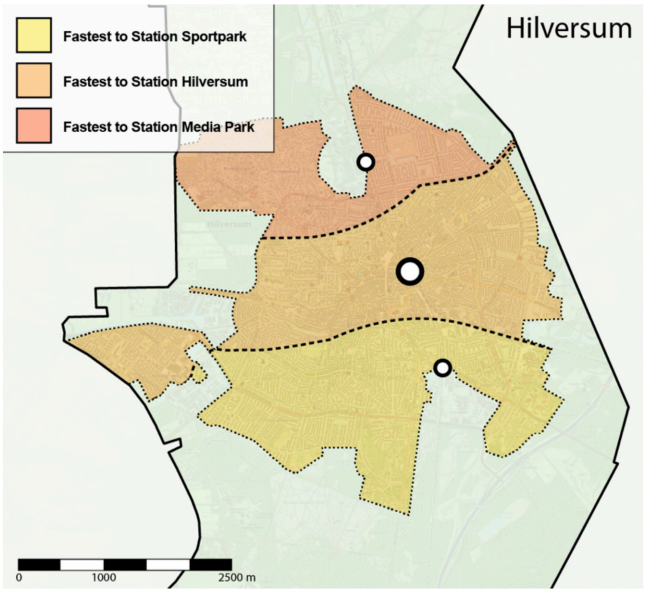


Figure 24: The residential areas of Hilversum regarding the shortest travel time by bicycle to one of the train stations

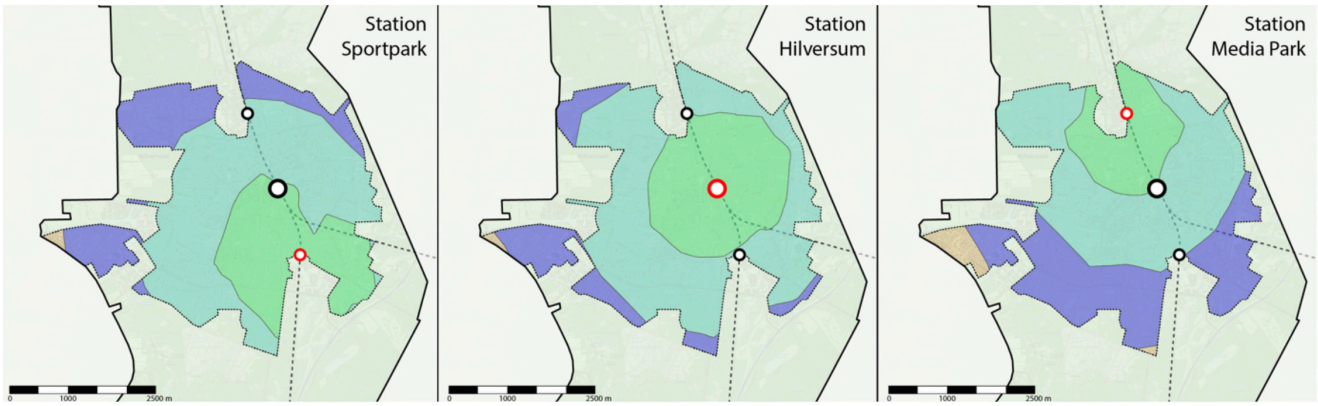


Figure 23: The isochrones of 5 (green), 10 (light blue), 15 (dark blue) minutes cycling towards the train station in Hilversum

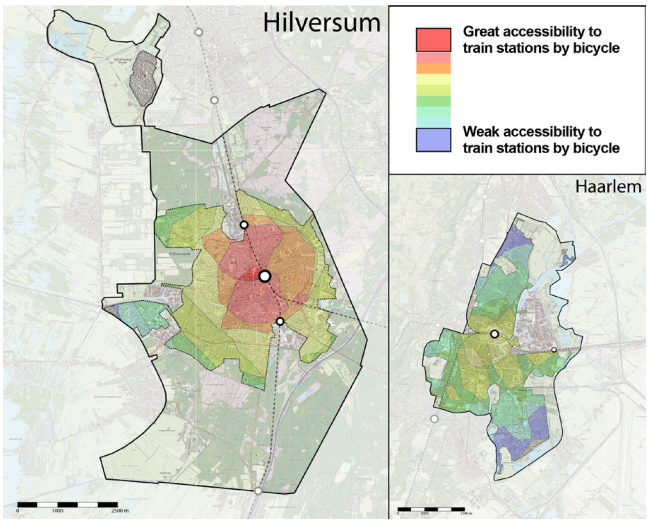


Figure 25: The degree of accessibility to train stations by bicycle in Hilversum. Haarlem has been added for comparison.

away from station Hilversum and station Media Park, and less than 10 minutes away from station Sportpark, then the accessibility is indicated light red on the map; a relatively high score in Hilversum. When a location is less than 15 minutes away from station Hilversum and station Sportpark, but more than 15 minutes away from station Media Park, the area is indicated light blue, which is a low score. **The most remarkable phenomenon on the map is the high level of accessibility between the three stations.** Because the distances between the three stations are very small (1,4km and 1,2km), everyone living in between these stations can always get to one of the train stations within 1 kilometre, which is a walking distance. These high scores are even more interesting when comparing the results to the results of Haarlem (more information about this analysis can be found in 'Haarlem infrastructure'). When comparing the two cities, it appears that Hilversum has a great score for almost the whole city, whereas in Haarlem, there are many blue and green areas, which indicate that the accessibility is not that great. Therefore, assuming that Hilversum also has a very high score when compared to other medium-sized cities, **the potential of successful first miles in Hilversum is very high in terms of travel time to the station.**

Assessment

Now that it is clear that the geographical characteristics of Hilversum are very much in favour of a good first mile, the infrastructure itself can be assessed. By analysing the mobility-related policy documents of Hilversum, and through the suggestions given by the interviewee and inhabitants through the survey, the researcher has identified the main cycling routes within the city (figure 26). Based on this map and the input from the interview and survey, the researcher has cycled the routes that were most likely to be possible first mile routes to station Hilversum from every part of the city. However, these routes were not very clear, as there is no explicit document available indicating the main routes towards the train station. Therefore, the researcher has observed as many routes as possible, to get a good view of the possible first mile routes. The map of the observation route and the suggestions given through the survey can be found in appendix 4 and 6, respectively. The routes have been assessed on safety, directness, comfort and attractiveness. In the 'Conclusions infrastructure' section, scores will be given to each of the four elements per city.

Safety

The safety of the bicycle infrastructure in Hilversum is not good. M**any roads do not have separated bicycle paths, and the available unseparated paths along the road are often quite narrow** (figure 27; photo 1, 2). However, this only leads to unsafe situations on busy roads. Due to the village-like character of many streets in the city (photo 5), separated paths are not needed on the calm roads which are not used by through traffic. The pavement of the separate paths often consists of tiles (photo 3), which does not improve safety.

Directness

In terms of orientation, many of the routes in Hilversum towards station Hilversum are quite direct lines. However, when crossing main car roads, especially on the inner and outer rings, the cyclist has to wait for quite a long time due to traffic lights and right of way for cars (Photo 4). Therefore, **even though the distances are short, the actual travel time may still be longer than 15 minutes** for some inhabitants living on the edge of the city.

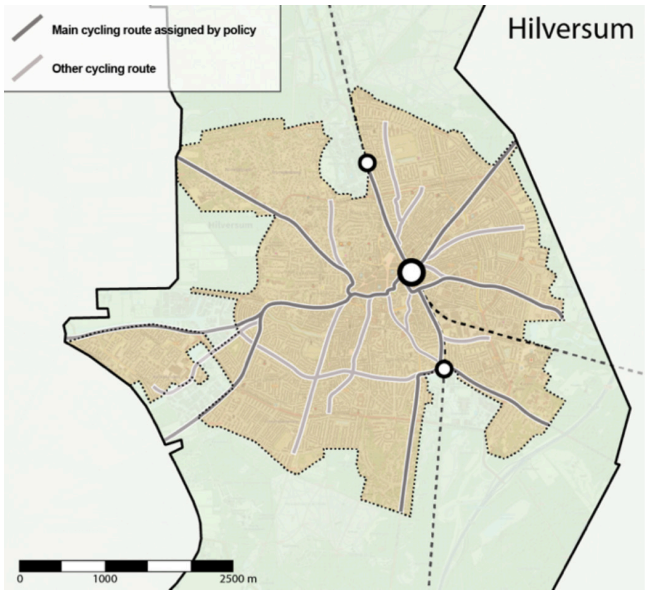


Figure 26: Cycling routes in Hilversum

Comfort

Hilversum scores very good when it comes to comfort; that is when the current improvement of the bicycle parking of station Hilversum is being taken into account. If that project is finished, bicycle parking is not a problem anymore for the coming years. **The routes also score well considering human scale due to the village-like feel of many of the streets.**

Attractiveness

The attractiveness is both good and bad. Considering maintenance and the experience of the physical infrastructure, the routes are unattractive due to the low quality of either the pavement or width of the path. **The context, however, is very nice in Hilversum.** Many streets are full of trees (Photo 5) and streets are quite lively. The main issue is the street itself; the division is very focused on the car (Photo 1). More improvements such as the bicycle street on photo 6 would improve the attractiveness, comfort and safety of the first mile routes. Therefore, **the street designs and the prioritisation at intersections are the main issues in Hilversum.** The routes that need improvements and the major problems are indicated on the map on the next page.

In Hilversum, most of the routes with room for improvement can be found south west of station Hilversum. This often concerns roads facilitating through car traffic while not protecting the cyclist, and the waiting times at intersections. On three locations, this leads to a major problem. On the Emmastraat (most southern major problem), the unseparated cycling path is very narrow, while the road is one of the main through traffic roads towards the city centre. The intersection of Beatrixtunnel and Schapenkamp (major problem closest to the central station), the waiting times to cross the streets for cyclists are very long, which is bad for the speed of the trip. On the Vaartweg (most western major problem), a combination of both problems occurs; a through traffic road with very narrow unseparated bicycle paths, in combination with a long waiting time for cyclists due to traffic lights. Based on the analyses of the local infrastructure, the researcher has made recommendations to improve first mile travel in Hilversum through infrastructural interventions. These recommendations can be found in the chapter 'Discussion'.

Figure 27: Photographs of cycling routes in Hilversum

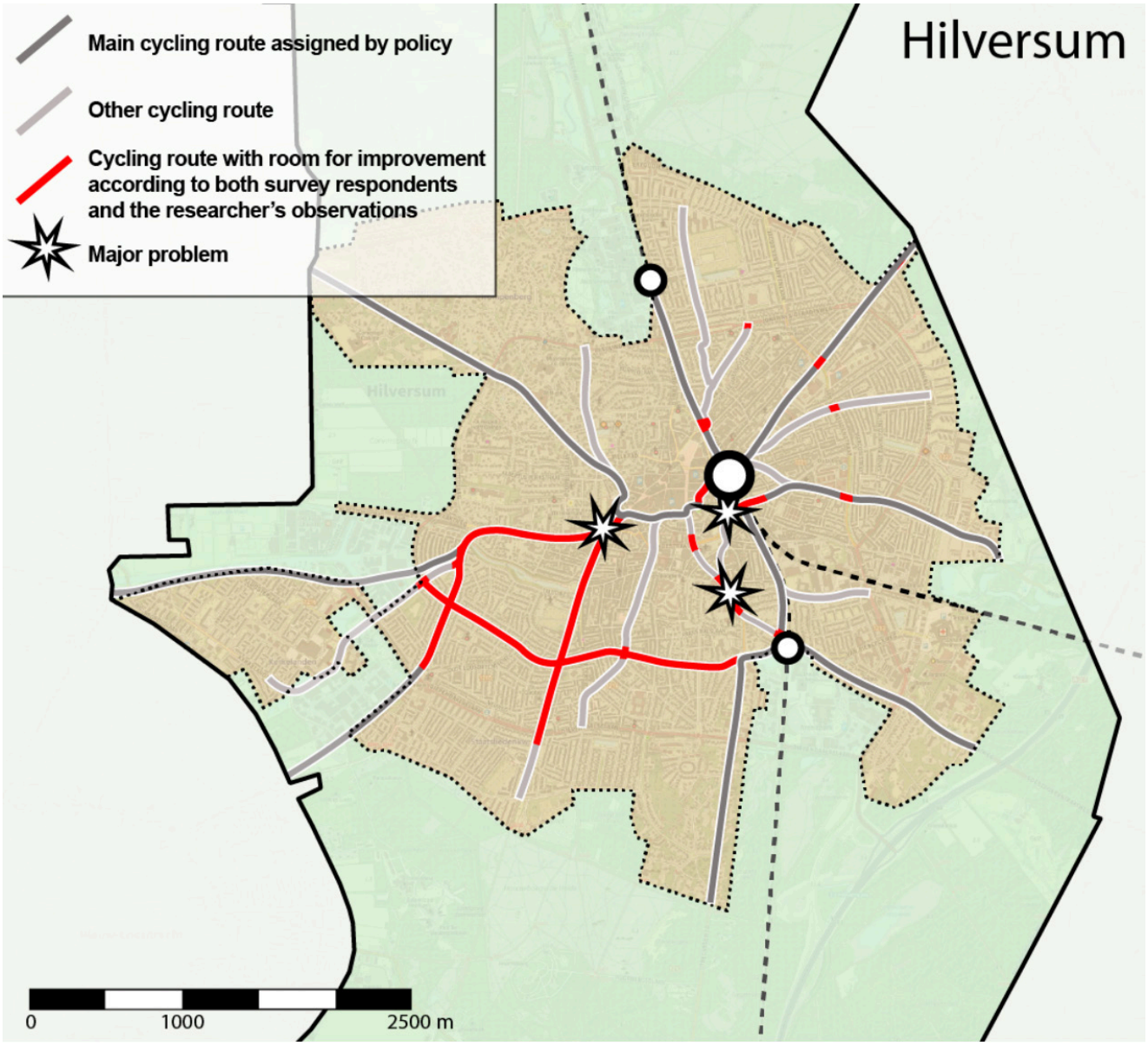


Figure 28: The main cycling routes in Hilversum. The routes with room for improvement are marked red

Findings infrastructure

Infrastructure is the physical element that can attract people to use the bicycle, also as a mode to travel to the train station. Therefore, routes need to be in great shape and the experience should be pleasant, but most importantly, it must be safe and direct. To make this happen, broad, separate paths must be facilitated, and cyclist should get right of way at intersections. Only then, the bicycle and the bicycle-train combination will be able to compete to the journey by car.

Accessibility

The cities of Haarlem and Hilversum have both got a great potential to develop successful first mile routes to train stations. Due to its size, Hilversum has a larger potential in terms of the accessibility of the train stations by bicycle; although in both cities almost all residential areas are closer than 15 minutes from a train station, the inhabitants of Hilversum live, on average, closer to a train station than the inhabitants of Haarlem. This is due to Haarlem's 'stretched' north-south oriented shape.

Quality of the first mile infrastructure

In terms of current infrastructure, Haarlem is already a few steps ahead of Hilversum. A large part of the network fits a city of the size of Haarlem, with many separated paths, and more and more broad, high quality paths as well. Although there are several routes that need attention concerning the safety and directness of the routes, especially regarding traffic lights. Bicycle parking is also a point of attention, as the storages are overcrowded. In Hilversum, the infrastructure is mainly focused on the car, with narrow, often unseparated bicycle paths and priority for cars at intersections. This negatively impacts the safety, directness and attractiveness of first mile travel by bicycle. Therefore, Hilversum has a lot of potential to improve the first mile travel by bicycle. The scores for both cities concerning the four criteria for bicycle infrastructure can be found in figure 29.

Scores

According to its importance in the model by Scheltema (2012), each element has been given a corresponding multiplier. When scoring the four elements per city, these multipliers are applied to each score. The scores show that Haarlem has a better overall score, but the city has room for improvement concerning the directness and comfort of their bicycle infrastructure. The bicycle infrastructure in Hilversum has a lower score overall. The main issues address the safety, attractiveness and directness of their bicycle infrastructure.

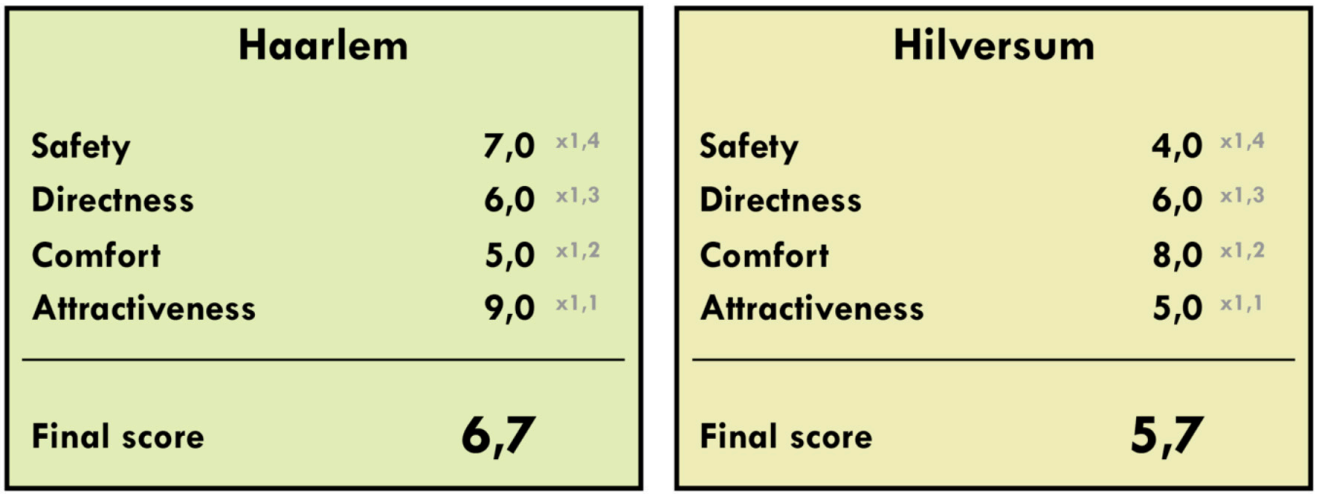


Figure 29: The scores for the four relevant elements in first mile infrastructure

Usage ODiN 2018

In this section, the results of the collected relevant data of the ODiN 2018 dataset will be discussed. This contains data about the Netherlands, medium-sized cities in the MRA, Haarlem and Hilversum. For all of these areas, the respondents who have used the train while departing from their home have been taken into account and compared to the total number of respondents for this area. For the Netherlands this concerns a sample of 384.040 of 15.934.134 respondents. For medium-sized cities in the MRA, this concerns 30.914 of 655.501 respondents. For Haarlem, this concerns 6,989 of 144.806 respondents. For Hilversum, this concerns 5.681 of 83.528 respondents.

The focus of this section is put on the situation in medium-sized cities in the MRA compared to the rest of the Netherlands. That is to clearly show the differences between data concerning medium-sized cities and data for a whole country. For some variables, Haarlem and Hilversum are included as examples to get an insight in how the usage may differ between cities in the MRA.

Modal split for commuters

The modal split is the only variable with different numbers of respondents for each case. This is due to the fact that the goal of the trip must be to get to work, while the main mode of transportation is not limited. For the Netherlands, the number of respondents is 3.693.611. For medium-sized cities in the MRA, this concerns 158.044 respondents. For Haarlem and Hilversum, this concerns 34.728 and 17.549 respondents, respectively.

Netherlands

In the Netherlands, the car is the most popular mode of transportation to travel to work with a share of 54.6%. The train is only used by 7.4% of the respondents, while the bicycle has a share of 25,6%. The use of bus/tram/metro (BTM) is low, with a share of 4.1% (figure 30).

MRA

In medium-sized cities in the MRA, the car-share is slightly lower with 52.6%. The train on the other hand is more popular; 13.1% of the respondents travels to work by train. The bicycle share of 17.8% is lower than the rest of the country. The use of BTM is higher, with a share of 8.4%. **The higher use of the train and BTM is likely to be a consequence of a better facilitation of these modes compared to the rest of the country.**

Haarlem

In Haarlem, the car share is relatively low with 43.2%. The train is even more popular than in the rest of the medium-sized cities in the MRA, with a share of 18.2%. The bicycle share of 20.5% is quite average. The use of BTM is quite high, with a share of 12.1%. This is likely due to the successful R-net bus lines between Haarlem and Amsterdam.

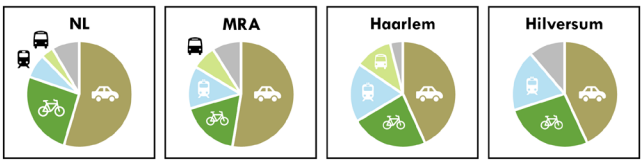


Figure 30: The modal split for the Netherlands, medium-sized cities in the MRA, Haarlem and Hilversum

Hilversum

The modal split of Hilversum is comparable to the modal split of Haarlem. 43.4% of the respondents uses the car, while 18.3% takes the train. The differences can be found in the cycling share of 28.3% and the BTM share of 0%. While the cycling share is very high compared to other medium-sized cities in the MRA, the use of the bus to get to work is negligible.

Mode of transportation

The mode of transportation during the first mile is a key variable in this study. In addition to the analysis of the variable itself, the variable has been compared to the variables concerning the personal characteristics such as age and education, to find out who exactly uses the first mile, and how they use it.

Netherlands

In the Netherlands, the bicycle is the most used mode of transportation when going from home to a train station. Of all trips below 7,5 km, 55.4% is travelled by bicycle. 29.2% comes on foot, which means that 84.6% of train users comes to the station on a sustainable mode of transportation in the Netherlands.

MRA

In medium-sized cities in the MRA, the bicycle is also the most used mode to get to the train station, but with a share of 52.3%, it is a little lower than the rest of the country (Figure 31). The share of pedestrians is higher: 34,4%. This is most likely due to the shorter distances to the train stations within these cities.

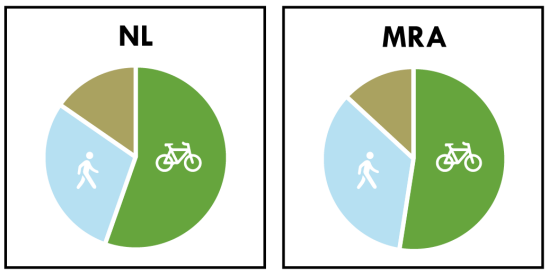


Figure 31: The usage share of cycling, walking and other modes during first mile travel in the Netherlands and medium-sized cities in the MRA

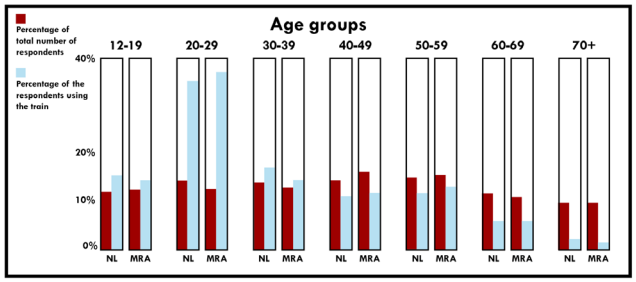


Figure 32: The train use share per age group compared to the total shares per age group in the Netherlands and medium-sized cities in the MRA

Age

For this variable, the researcher has collected data for the different age groups per 5 years (e.g. 20-24, 25-29 years old). Per area, the age groups with first mile use that differ from the other age groups are highlighted in the elaborations below. For the overview (figure 32), the age groups have been merged into groups per 10 years.

Netherlands

In the Netherlands, people aged 45-54 cycle most to the train station, with a share of 66.8%. People aged 20-29 have the lowest cycling share of all age groups, with 51.5%. This is also the group that makes use of BTM the most with a share of 9.5%. People aged 20-39 walk most to the train station, with an average share of 32%.

MRA

In medium-sized cities in the MRA, there is a high use of first mile travel by people aged 20-29. Of all train travellers, this group has a share of 37.1%. The people aged 25-29 travel to the train station more often on foot (54.1%) than by bicycle (34.9%). **Age can therefore be seen as a key variable concerning first mile usage.**

Gender

Netherlands

In the Netherlands, the train use between men and women is equally divided. However, there are some differences in the way they travel to the train station (figure 33). Men cycle more often (57.8%) than women (52.9%). Women use BTM more often (9.3%) than men (5.4%) and travel more often by car (8% vs. 4.9%).

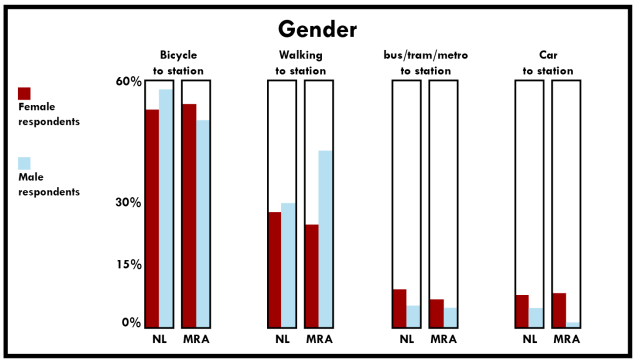


Figure 33: The share of female and male travellers during first mile travel per modality in the Netherlands and medium-sized cities in the MRA

MRA

In medium-sized cities in the MRA, the car use by women is still higher (8.4%) than by men (1.3%). However, the cycling share has changed: women cycle more (54.2%) than men (50.6%). Another difference is the share of male pedestrians which is very high (43%), also when compared to female pedestrians (25%).

Income

For this variable, the researcher has collected data for the different income groups per 10% of the total population of the Netherlands (e.g. 1st 10% is the group with the lowest income, 10th 10% is the group with the highest income). Per area, the shares of respondents from the different income groups using the train is compared with the total share of each income group for that area. By doing so, the relative use of the train per income group can be determined. The groups that score highest or lowest per area are stated below.

Netherlands

In the Netherlands, the train is used most by the 1st and 10th income groups. Groups 4 – 8 have a lower use of the train per group. The respondents of groups 9 and 10 cycle most to the train station, with an average share of 63.3%. Of the respondents in groups 6 and 7, less than 50% cycles to the train station. Therefore, **it can be stated that the midium income group uses the train less than the other income groups.**

MRA

In the medium-sized cities in the MRA, groups 1, 6 and 10 use the train the most. Groups 3, 4 and 8 use the train the least. Therefore, the situation is comparable to the rest of the Netherlands, although here it cannot be stated that the complete medium income group uses the train less than the high and low income groups. (figure 34).

Education

For this variable, the researcher has collected data for lower educated, medium educated and higher educated respondents. Per area, the shares of respondents from the different education levels using the train is compared with the total share of each education group for that area. By doing so, the relative use of the train per education level can be determined. The groups that score highest or lowest per area are stated below.

Netherlands

In the Netherlands, the train is used most by higher educated people. While 33% of the total respondents

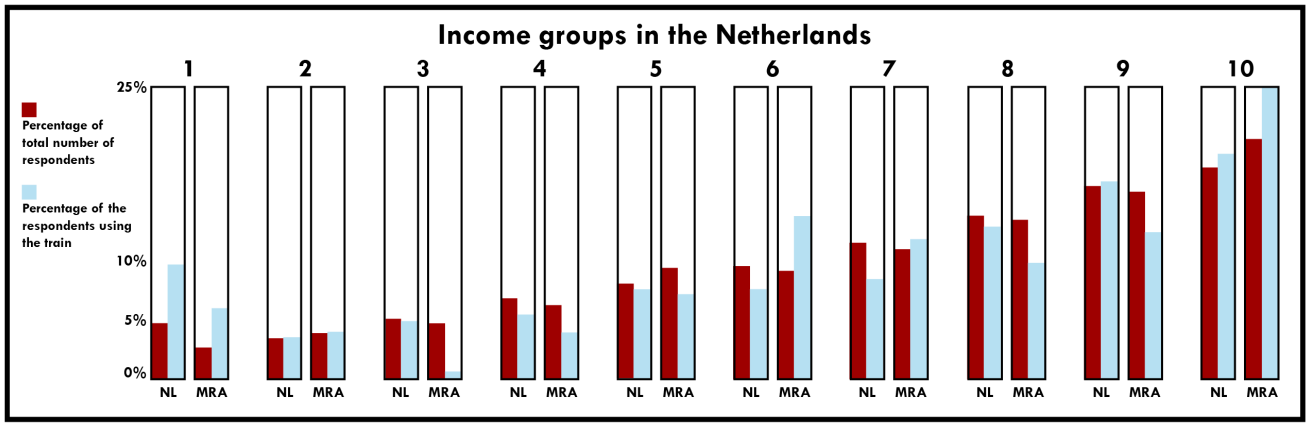


Figure 34: The train use share per income group compared to the total shares per income group in the Netherlands and medium-sized cities in the MRA

are higher educated, their share is 56.6% when it comes to train use. Lower educated people make less use of the train. This may be due to the difference in the accessibility by train of the different types of jobs. Higher educated people also cycle more often to the train station (59%) than medium or lower educated respondents (50.4%).

MRA

In the MRA, the train is also used a lot by both higher educated respondents, but in these cities, medium educated respondents also use the train a lot (figure 35). **Lower educated respondents make less use of the train.**

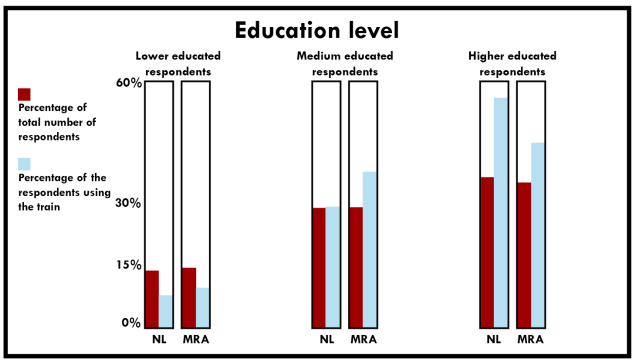


Figure 35: The train use share per education level compared to the total shares per education level in the Netherlands and medium-sized cities in the MRA

Household structure

Netherlands

In the Netherlands, there are no substantial differences between the different households considering first mile travel. However, the cycling share of pairs with children is highest, with 60,4%. Households without children cycle less, and walk more to the train station, with an average share of 33.4%.

MRA

In medium-sized cities in the MRA, the findings are comparable to the findings above. 1-person households walk even more to the train station, with a share of 41.7%.

Origin

Netherlands

In the Netherlands, people with a migration background make slightly more use of the train than people with a Dutch background, who cycle more often to the train station (58.2%) than people with a western (51.2%) or non-western background (42.3%). People with a non-western background also use BTM much more to get to the train station (18.1%) than other groups.

MRA

In medium-sized cities in the MRA, the findings are more or less comparable to the findings above. The largest difference is the total share of people with a Dutch background in the MRA (73.6% instead of 80%). The share of people with a non-western background is larger in the MRA (16.5%) than in the rest of the country (11.2%). The differences between the groups considering train use are quite small (figure 36).

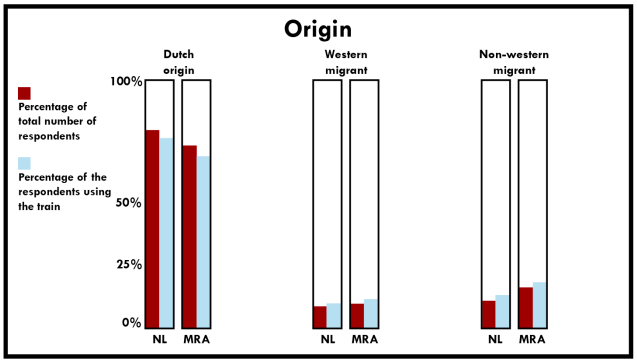


Figure 36: The train use share per origin compared to the total shares per income group in the Netherlands and medium-sized cities in the MRA

Goal of the journey

Netherlands

In the Netherlands, 51.9% uses the train to get to work and 26.4% uses the train to get to an educational facility. Therefore, 78.3% of the respondents in the Netherlands are likely to be frequent train travellers during the daily commute.

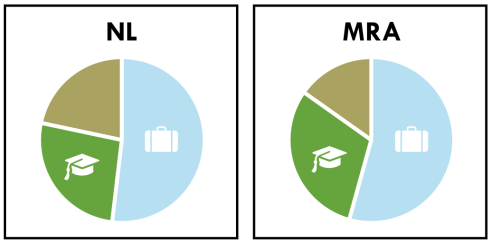


Figure 37: The shares of respondents using the train for work, school or other activities in the Netherlands and medium-sized cities in the MRA

MRA

In medium-sized cities in the MRA, 54.3% uses the train to get to work and 30.5% uses the train to get to an educational facility. Therefore, **84.8% of the respondents in the Netherlands are likely to be frequent train travellers during the daily commute.** This share is higher than in the rest of the country (figure 37).

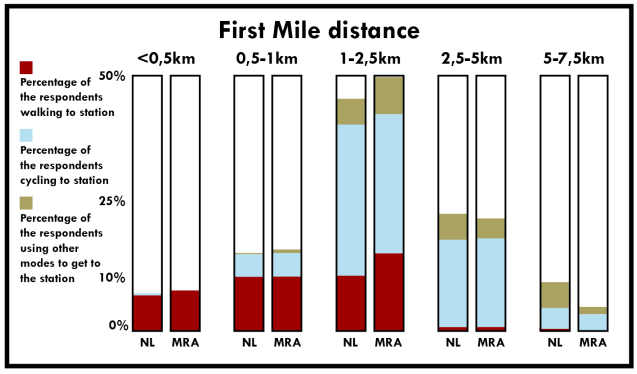


Figure 38: The travelled first mile distances during first mile travel and the corresponding mode of transportation during this trip.

Distance first mile trip

Netherlands

The first mile distance is divided into four distances: below 1 km, between 1 and 2.5 km, between 2.5 and 5 km and between 5 and 7.5 km. In the Netherlands, 22.6% travels less than 1 km to the train station. 45.3% travels 1-2.5km, 22.8% travels 2,5-5 km and 9.3% travels 5-7.5 km. The bicycle shares are 64.9% (1-2.5), 73.9% (2.5-5) and 44.1% (5-7.5)

MRA

In medium-sized cities in the MRA, 23.8% travel less than 1 km to the train station. 49.7% travels 1-2.5km, 21.9% travels 2.5-5 km and 4.6% travels 5-7.5 km. The bicycle shares are 54.7% (1-2.5), 79.8% (2.5-5) and 71.7% (5-7.5). That means that **in the MRA, people travel less far to the train station compared to the rest of the country,** and for distances up to 2.5 km, the share of pedestrians is higher (figure 38).

Haarlem

In Haarlem, 15.1% travel less than 1 km to the train station. 60.6% travels 1-2.5km, 21.2% travels 2.5-5 km and 3% travels 5-7.5 km. That means that in the Haarlem, many people travel even shorter distances than in the rest of the medium-sized cities in the MRA.

Hilversum

In Hilversum, 35% travel less than 1 km to the train station. 40% travels 1-2.5km, 25% travels 2.5-5 km and none of the respondents travels 5-7.5 km. That means that in the Hilversum, the first mile travel distances are very short, which may be a logical consequence of its compact shape.

Travel time first mile trip

Netherlands

In the Netherlands, 55.2% of the respondents arrive within 10 minutes at the train station from their home. 18.6% is taking longer than 15 minutes to get to the train station.

MRA

In medium-sized cities in the MRA, 57.8% of the respondents arrive within 10 minutes at the train station from their home. 17.3% is taking longer than 15 minutes to get to the train station. Therefore, people in the MRA are travelling slightly faster to the train station than the rest of the country. This is in line with the finding that people in the MRA are travelling shorter first mile distances.

Haarlem

In Haarlem, 60.6% of the respondents arrive within 10 minutes at the train station from their home. 21.2% is taking longer than 15 minutes to get to the train station. That means that many people in Haarlem are travelling even faster to the train station than in other medium-sized cities in the MRA, although there are more travellers taking longer to get to the train station as well. This may be due to the stretched north-south orientation of the city.

Hilversum

In Hilversum, 60% of the respondents arrive within 10 minutes at the train station from their home. 10% is taking longer than 15 minutes to get to the train station. That means that respondents living in Hilversum are travelling even faster to the train station than in other medium-sized cities in the MRA, and there are less people travelling for more than 15 minutes, which is in line with the shorter first mile distances.

Travel time total journey

Netherlands

The total journey time for train travellers can be classified into four timeframes: shorter than 45 minutes, between 45 and 60 minutes, between 60 and 90 minutes and

more than 90 minutes. Of the train travellers in the Netherlands, 15.7% travels shorter than 45 minutes, 21.1% travels 45-60 minutes, 36.7% travels 60-90 minutes and 26.6% travels more than 90 minutes.

MRA

Of the train travellers in medium-sized cities in the MRA, 15.9% travels shorter than 45 minutes, 28.5% travels 45-60 minutes, 37.7% travels 60-90 minutes and 17.9% travels more than 90 minutes. The total journey time for people living in medium-sized cities in the MRA is often shorter than in the rest of the country.

Haarlem

Of the train travellers in Haarlem, 9.1% travels shorter than 45 minutes, 48.5% travels 45-60 minutes, 37.7% travels 60-90 minutes and 18.2% travels more than 90 minutes. The high share of 45-60 minutes may be due to the average travel time from Haarlem to Amsterdam, which is likely to be found within this range.

Hilversum

Of the train travellers in Hilversum, 5% travels shorter than 45 minutes, 20% travels 45-60 minutes, 60% travels 60-90 minutes and 15% travels more than 90 minutes.

Usage surveys

In this section, the results of the collected relevant data of the conducted surveys will be discussed. This contains data about inhabitants of Haarlem and Hilversum. For Haarlem, this concerns 36 respondents. For Hilversum, this concerns 44 respondents. However, not all respondents have answered all questions. Therefore, there is limited number of inhabitants concerning several variables. For these variables (see table 4), there is a reduction of 6 respondents for Haarlem and a reduction of 9 responses for Hilversum. Although the number of respondents in both surveys is relatively small, there are several analyses that indicate the usage of first mile travel and especially the opinion of the inhabitants in these cities. The survey questions can be found in Appendix 5.

Mode of transportation first mile

Haarlem

In Haarlem, 63.3% of the respondents uses the bicycle to get to the train station. 16.7% goes on foot, and 16.7% uses the bus. There are various reasons why people use a certain mode to get to the train station. **The most common reason is the speed (46.7%) of the mode, which is most often the bicycle (92.9%).** 'Easy', 'cheap' and 'nearby' are other reasons for choosing a mode. 20% of the respondents state that the bad quality of the bicycle parking is a reason not to go by bicycle. This mainly concerns a lack of space, but also bicycle theft.

Analysed variables: ODiN 2018
Personal characteristics
Age
Gender
Income
Education
Household structure
Origin
Trip characteristics
Mode of transportation
Goal of the trip
Distance First Mile trip
Time First Mile trip
Time total journey
Modal split for commuters

Table 3 (left): The analysed variables in the ODiN 2018 dataset

Analysed variables: Surveys	
Personal characteristics	
Age	
Gender	
Home address area	
Cycling frequency	
Frequency train use	*
Trip characteristics	
Mode of transportation	*
Goal of the trip	*
Choice of train station	*
Opinion on bicycle infra	
Reason using mode of transportation First Mile	*
Reason choosing train station	*
Satisfaction availability of cycling infrastructure	
Satisfaction quality of cycling infrastructure	
Satisfaction safety of cycling infrastructure	
Satisfaction speed of cycling infrastructure	
Importance availability of cycling infrastructure	
Importance quality of cycling infrastructure	
Importance safety of cycling infrastructure	
Importance speed of cycling infrastructure	
Satisfaction quantity of bicycle parking	*
Satisfaction quality of bicycle parking	*

* This variable has a reduced number of respondents

Table 4 (right): The analysed variables in the surveys.

Hilversum

In Hilversum, 74.3% of the respondents uses the bicycle to get to the train station. 22.9% goes on foot, and only 2.9% comes by bus. The speed of the mode is the most popular reason (51.4%) for choosing a mode, which is most often the bicycle (94.7%). 'Nearby', 'easy', 'bad bicycle parking' and 'cannot park my car' are other reasons for (not) choosing a mode.

Goal of the trip

Haarlem

When looking at the goal of the train journey, 50% of the respondents in Haarlem uses the train to get to work or school. This mainly concerns people who use the train at least twice a week (73.3%). **The respondents who use the train at least twice a week also use the bicycle more often** (81.8%) to get to the train station. The frequent train users in Haarlem are most likely to be 18-30 years old, and women use the train more often (1.5 days per week) than men (3 times per month).

Hilversum

In Hilversum, 57.1% of the respondents uses the train to get to work or school. Slightly more than half of them (55%) use the train at least twice a week. In Hilversum, more male respondents frequently use the train (2 days per week) then female respondents (3 times per month).

Station choice

Haarlem

In Haarlem, there are three main train stations to choose from: station Haarlem, station Spaarnwoude and station Heemstede-Aerdenhout. Of these stations, Haarlem and Heemstede-Aerdenhout are intercity stations. The respondents most often chose Haarlem as their most used station (60%), followed by Spaarnwoude (26.7%) and Heemstede-Aerdenhout (13.3%). **The most common reason to choose a train station is the proximity to respondents' homes (70%).** The intercity status is only

a reason for 16.7% of the respondents. As the proximity of the train station is very important, the researcher also asked where the respondents live. In the area north of station Haarlem, 87.5% uses station Haarlem most often, which is also the most nearby. In the area south of this station, 70% uses station Haarlem, and 30% uses station Heemstede-Aerdenhout. Due to the position between these two stations, that is a very logical result. In the area east of the river Spaarne, 63.6% of the respondents uses station Spaarnwoude, whereas only 27.3% uses station Haarlem. **Proximity is clearly an important determinant in Haarlem when it comes to stations choice.**

Hilversum

In Haarlem, there are also three main train stations to choose from: station Hilversum, station Media Park and station Sportpark. Only station Hilversum has the intercity status, which is also the most used station according the respondents with a share of 85.7%. **Although the proximity is an important reason as well in Hilversum (65.7%), the intercity status is a lot more important than in Haarlem: 48,60%.** All respondents living northwest or east of the city centre chose station Hilversum as their most used station. In the area southwest of the city centre, the share of station Hilversum is 80%, 13.3% uses station Sportpark, which may be closer to the homes of these respondents. In addition, 82.6% of the respondents who use a train station due to its proximity are using station Hilversum. Therefore, this station is most popular among residents.

Importance of bicycle infrastructure

To get an insight in the opinion of respondents on their opinion about the local bicycle infrastructure, the researcher asked respondents from both cities how important several variables are to the respondents on a scale of 1 to 5.

Haarlem

In Haarlem, the state of the local bicycle infrastructure is very important with an average score of 4,28. **Safety on the cycling routes is most important (4,61)**, followed by the quality of the infrastructure (4,39), the availability of cycling infrastructure (4,11) and the speed of the cyclist on the cycling routes (4,03). Concerning quality, there is a difference between the opinion of men (4,09) and women (4,52). Concerning speed, there is a difference between people aged below 45 (3,75) and aged above 45 (4,25).

Hilversum

In Hilversum, the state of the bicycle infrastructure is also important, but with an average score of 4,08, it is found less important than in Haarlem. Here, the same order of importance can be found considering safety (4,49), quality (4,14), availability (3,86) and speed (3,84). Concerning speed, there is a difference between people aged 31-45 (4,3) and other respondents (3,7).
Satisfaction of bicycle infrastructure and parking

As a follow-up question on the importance, the researcher asked the respondents about their current satisfaction of the same variables concerning bicycle infrastructure. In addition, the researcher asked for their satisfaction of the quality and availability of bicycle parking.

Haarlem

In Haarlem, respondents gave a mediocre score to the current state of the bicycle infrastructure in Haarlem (2,85). Availability of the infrastructure scored best (3,36), followed by the safety (3,0), quality (2,61) and speed (2,44). Concerning speed, there is a difference between people aged below 45 (2,69) and aged above 45 (2,25). Therefore, people aged over 45 are less satisfied with the speed on the routes, which is also an important element to them. With an average score of 2,54, respondents in Haarlem are not very satisfied with the current state of the bicycle parking near the train stations. This concerns the number of available spaces to park the bicycle (2,32) and the overall quality of the storage (2,76). Concerning the quality, there is a difference between the opinion of men (2,11) and women (2,9).

Hilversum

In Hilversum, the respondents are more positive about the current state of the local cycling infrastructure (3,28). Here, the order is different from the order in Haarlem: Availability and quality score highest (3,62), followed by safety (3,05) and speed (2,84). With an average score of 2,88, the respondents in Hilversum have a mediocre satisfaction for the current state of the bicycle parking near the train stations. The number of available spaces to park is scored a little lower (2,69) than the overall quality (3,07). Concerning the available spaces, there are differences between the scores of men (3,75) and women (2,83) and between people aged 31-60 (2,86) and people aged older or younger than this group (3,57). Concerning the quality of the storage, there are differences between the group aged 31-45 (2,5) and people aged older or younger than this group (3,24). When looking at the overview of the results in figure 39, it becomes clear that the aspects that are found important, are often aspects that score lower on satisfaction. This concerns safety, speed, and for Haarlem, also the quality of the bicycle infrastructure. These three variables can therefore be seen as the most important variables according to the respondents of the surveys.

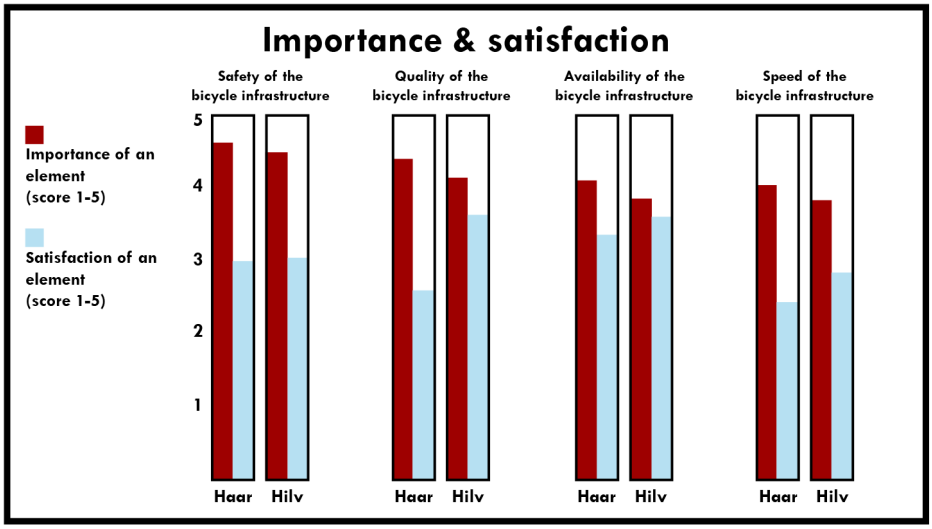


Figure 39: The importance and satisfaction scores of the local bicycle infrastructure in Haarlem and Hilversum

Findings usage

When it comes to usage of the first mile and the train for commuting, three elements are important to take into account: Personal characteristics, travel characteristics and the opinions of inhabitants of the relevant city.

Personal characteristics

For personal characteristics, the variables age and education are crucial, as there are significant differences between the groups within these variables. Gender, income and origin may also be important variables, but not as crucial as there are no large differences.

Travel characteristics

When it comes to travel characteristics, it is important to gain information about the used mode for the first mile trip, the goal of the journey of the train user, the distance and time related to the first mile trip, the overall modal split of the city, and the choice of the train station. All of these variables are important to look into when creating a strategy to stimulate the inhabitants of a specific context (city) to use the bicycle and the bicycle-train mode.

Opinions

All of these data are useful, but they are worth much more with an elaboration from the people who experience these journeys and trips. It concerns information about why people choose for a certain mode during the first mile trip, or why people pick a certain train station over another. Additionally, information about the inhabitants' opinion on the importance and satisfaction of various aspects of the first mile trip can give an insight in the local wishes of the inhabitants concerning safety, speed, quality and also the state of the bicycle parking facilities.

These results show that gaining insight in the characteristics and opinions may generate useful knowledge that can be used to conduct interventions that adapt to these types of data.

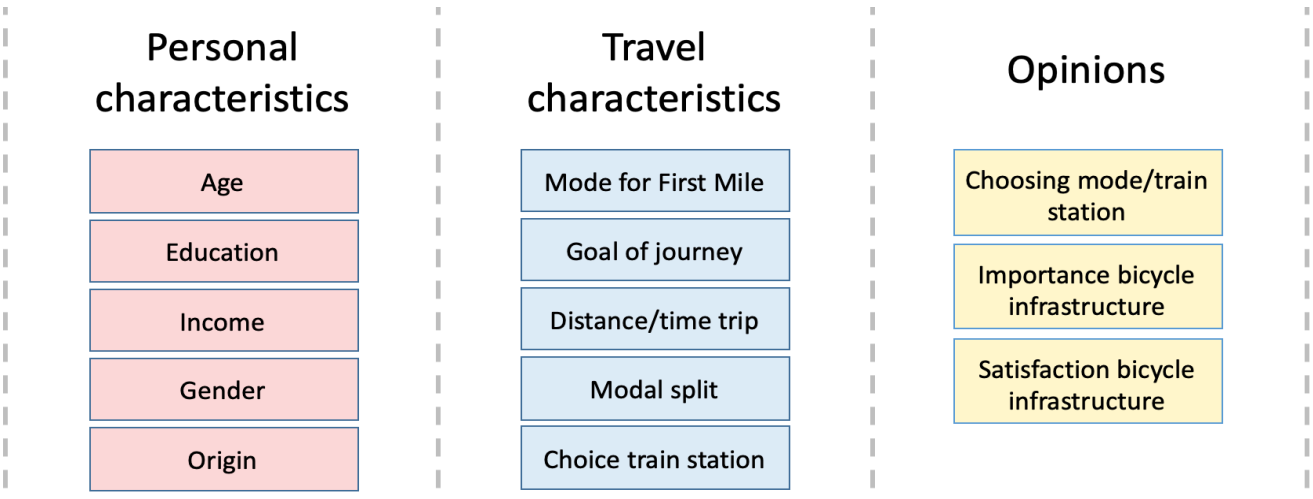


Figure 40: The relevant variables when collecting data about first mile usage.

Discussion

Within this research the influential factors on first mile travel in medium-sized cities in the MRA have been studied through the PIU model, which had been constructed in the first research phase of this thesis. The PIU model states that policy, infrastructure and usage are the main influential factors concerning first mile travel, while also creating a feedback loop; the three factors influence each other which forms a theoretically infinite cycle of interrelations. This model has been applied by studying the three factors in the context of medium-sized cities in the MRA and more specifically, the context of the cities Haarlem and Hilversum. Therefore, the context of medium-sized cities had already been integrated within the model through the addition of the growth of the daily commute and the ongoing mobility transition on various policy levels. In this chapter, the results are reflected back on the PIU model, to get an insight in the influence of each factor, and the interrelations. Additionally, a reflection on the literature used for this thesis is given.

The PIU model in perspective

Existing research on the influencing factors on first mile travel, and the relationships between these factors is very thin. Therefore, these factors and the feedback loops between policy, infrastructure and usage should be studied in more detail to understand these relationships better (Van Mil et al., 2020). Based on scientific literature, the researcher constructed the PIU model (figure 41), which forms the basis for generating new information to this research gap. By applying the model to the MRA and the sub-contexts Haarlem and Hilversum, the researcher can reflect on the constructed model based on the results of the research. The reflection on the PIU model is discussed below.

Policy

According to the elaboration on the PIU model, there are several actors involved in policymaking. Although

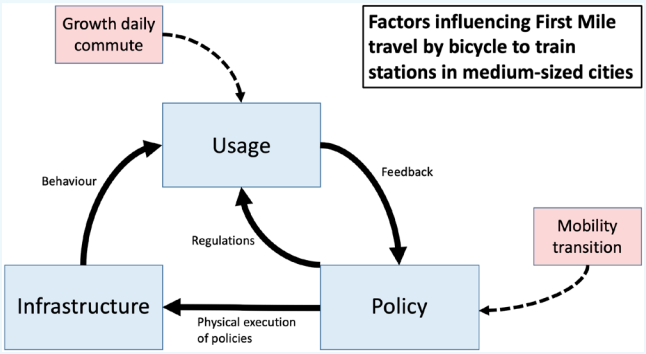


Figure 41: The adapted PIU model: Factors influencing first mile travel by bicycle to train stations in the MRA

municipalities are responsible of policies to improve the door-to-door rail journey, governmental bodies such as the state or regional governments may provide coordination, policy guiding and especially funding to contribute to the municipalities (Harms et al., 2016; Pucher & Buehler, 2008). Therefore, national and regional policies are important to take into account when improving first mile travel on a local scale. This has been fully confirmed by the results of the conducted research. In addition, municipalities can also collaborate with each other to create regional plans, which often leads to more support and funding.

Policy initiatives mostly concern safety, environmental, liveability and accessibility issues (Harms et al., 2016). This includes transport, land-use, urban development, housing, environmental, taxation and parking policies (Pucher & Buehler, 2008). Thus, the factor 'policy' goes beyond just cycling policy; it includes every policy that can influence cycling levels in a city. This is confirmed by the research, with the addition that the policy on non-mobility themes such as housing and sustainability are policies which can be used to improve the mobility of the city. Mobility is a theme that very often must be taken into account in other projects. For example, a large housing development often requires a different use of space in the city, which means that there is less space for cars, and a higher use of bicycle and train should be stimulated. This is a chance to improve first mile travel through these kinds of policy.

Policy may include policies that improve infrastructure and public space and by policies that include regulations. This includes policies for bicycle and car parking, traffic calming, separate cycling facilities and priority for certain modes at intersections. The most successful policies include a combination of both pull (making cycling more attractive) and push (making the car unattractive) factors (Brons & Rietveld, 2009; Harms et al., 2016; Rietveld & Daniel, 2004). This is confirmed by the research, and this is also familiar information to the municipalities. However, to really choose for the bicycle and to discourage car use is a very big step, especially when it comes to the actual implementation of the infrastructure and regulations. Additionally, expanding the width of the cycling path is a crucial intervention in both case cities, especially when a certain route is used by many cyclists.

The effectiveness of cycling policy can be positively influenced by setting measurable and verifiable goals, including a high degree of adaptability in certain policies and allowing high levels of citizen participation in the process (Fishman, 2016; Harms et al., 2016).

This statement is partly confirmed by this research. Even though the municipal vision on cycling can be very ambitious, it is still hard to translate this vision into actual policy. Citizen participation is an important element, mainly to get an insight in what stimulates or bothers inhabitants when it comes to using the bicycle and the train. When combining this information with measured data about usage, it really helps improving first mile travel in the specific context. This is also where policy must be influenced by usage; studying the current usage and the current opinions of inhabitants can steer policy in the right way. It is therefore crucial that policymakers collect and make use of these data. Without this, the feedback loop is very weak, which means that the potential to indirectly create a stronger public transport system is wasted (Kager & Harms, 2017).

Infrastructure

According to the PIU model, the quality and quantity of bicycle infrastructure increases cycling levels and therefore has an effect on first mile travel. Additionally, train ridership can be substantially increased when improving the quality of the bicycle routes and bicycle parking (Geurs, La Paix & Van Weperen, 2016). This has been confirmed by the conducted research, although the conclusion of the research actually stated this the other way around; when the quality and quantity of the bicycle infrastructure and parking is not good, people will not use the bicycle for first mile travel, which can cause people to not use the bicycle-train mode at all. This conclusion also emphasises the effect of infrastructure on usage, as it has the ability to change travel behaviour.

An additional focus of this research has been put on the characteristics of the quality of the bicycle infrastructure. High quality infrastructure means that the complete cycling route is safe, direct, comfortable and attractive. These are variables stated by Scheltema (2012), of which the order of importance has been confirmed by this research. Safety has also been found to be the most important variable. This mainly includes the width of the path, especially when it concerns an unseparated path, and the right of way at intersections. Although directness is found less important than the other variables by inhabitants of Haarlem and Hilversum, it is also the variable they are least satisfied with. An interesting finding is that safety, directness and attractiveness can all be enhanced by the same intervention. For example: Expanding the width of a bicycle path from 1 metre to 2 metres will improve safety, because there is a smaller chance to get in contact with motorised traffic. It also improves directness, as it opens the opportunity to take over other cyclists, which is especially important when cycling during the daily commute, or when using an electric bicycle. It also improves the attractiveness, as it improves the experience when cycling; by feeling safer due to the enhanced distance to motorised traffic, the cyclist is able the enjoy the trip more than before. Therefore, infrastructure can have a large impact on first mile travel in medium-sized cities in the MRA.

Usage

According to the PIU model, usage consists of personal characteristics like age, gender, income, education and household size; and travel characteristics like mode of transportation, the goal of the trip and choice of train station (Jonkeren et al., 2019; Rietveld & Daniel, 2004; Van Mil et al., 2020). Although the importance of these groups of characteristics are confirmed by this research, the impact of these variables on first mile travel is not that large for each of them. According to this research, the most important variables are age, education and income, followed by gender and origin. This research could not confirm a significant influence of the respondents' household size on first mile travel. The importance of travel characteristics has been confirmed by this research; in addition to the variables stated above, the distance and time of the first mile trip has also been found as an important variable to get an insight in the behaviour of travellers.

There are many differences between population groups, Dutch cities, and also within the cities itself (Van Mil et al., 2020). These differences can be found by identifying the user and travel characteristics of the Dutch population. This has also been confirmed by this research. The Netherlands has different personal and travel characteristics than medium-sized cities in the MRA, and even between these cities, some large differences have been found. This research also emphasises that information about the usage and the (non-)users of the bicycle-train combination is likely to be valuable in creating services and policies that encourage the use of the combined mode, which has also been stated in the PIU model (Shelat et al, 2018).

Apart from the quantitative data such as the ODiN 2018 dataset, there are some usage characteristics that can be better understood using qualitative methods. This concerns variables such as reasons why people show certain behaviour, or their opinion about the current infrastructure. As these questions involve personal experiences, answers can vary depending on where and to whom they are asked (Van Mil et al., 2020). This has been confirmed by this research. The opinion of the inhabitants is crucial to understand why and where improvements should be made. This also includes reasons why people behave in a certain way, such as their station choice or their choice for a certain mode to get to the train station. The information is even more valuable

when it can be combined by usage data such as the number of users per station, the first mile trip distances, and most importantly, bicycle counts in the city. When collecting and using a combination of these quantitative and qualitative data, it may strengthen the justification of bicycle-related interventions.

Reflection on scientific literature

For this thesis, it was not possible to use an existing conceptual model or theoretical framework that focused on the factors influencing first mile travel. Therefore, the conceptual framework (PIU model) has been shaped by the researcher himself, to provide a perspective and to enable the researcher to study the current state of First Mile travel in case study settings. The construction of this conceptual framework has leaned upon existing literature concerning first mile travel, the bicycle-train combination, and policy, infrastructure and usage. In this section, the researcher reflects on several frequently used sources in respect to his conducted research.

The bicycle-train combination

For the necessary information about the bicycle-train combination, the work of Kager et al. (2016) has been used as a key source. In their work, the authors treat the bicycle-train mode as one integrated mode instead of two separate modes to understand the specifications of this travel option. During this research, the researcher has not adopted the same perspective. Instead, the focus has been put more on the bicycle trip as a means to generate more train users. The researcher acknowledges that the two modes are intertwined within the bicycle-train combination but believes that it is important to keep studying them as two separate modes as well. The main argument is that the first mile trip by bicycle concerns policy and infrastructure which does not only serve this purpose. First mile policy is often part of a larger, overall bicycle policy, or even part of projects which do not concern the bicycle in the first place, such as housing developments. First mile infrastructure can also be used by recreational cyclists, or for doing groceries, visiting friends and family or for getting to work or school by a sole bicycle trip. The researcher thinks that is useful to keep this multifunctionality in mind, especially because policymakers may need several arguments to justify interventions in favour of successful first mile trip.

The researcher has also been inspired by the paper of Kager et al. (2016), due to their recommendations to conduct case studies, data collection and knowledge development of the bicycle-train combination, which they refer to as a high-potential transport mode. By using the case of medium-sized cities in the MRA, studying the local contexts of Haarlem and Hilversum in detail and by constructing a new conceptual framework for a part of the bicycle-train combination, the researcher has aimed to respond to these recommendations.

The factors influencing first mile travel

The factors used to construct the PIU model (policy, infrastructure and usage) have been adapted from the factors influencing the bicycle-train combination, specified by Shelat et al. (2018). In their paper, the authors state that the influencing factors are policy, infrastructural facilities, user characteristics and travel characteristics. On top of that, they claim that from these factors, the travel and user characteristics are 'quite important', suggesting that they might be more important than the other two factors. In this thesis, the researcher has come to the opposite conclusion for two reasons. First, the separate factors 'travel characteristics' and 'user characteristics' do not have the same impact on first mile travel as either policy or infrastructure according to the theory and results of this research. Therefore, the researcher combined them as one factor in the PIU model; usage. By doing so, the impact of the travel and user characteristics has been combined, elevating it to the same level of importance as the other two factors. Additionally, it would have been impossible to apply both factors in the PIU model; by treating them as separate factors, the researcher would be unable to create a model including a full feedback loop; according to the researcher, there is no direct relation between the user and travel characteristics. Moreover, infrastructure influences both travel and user characteristics, while these characteristics can both influence policy through feedback.

The feedback loop

The PIU model suggests that through the interrelations between policy, infrastructure and usage, a feedback loop is created, which has the ability to either improve or decrease first mile travel in each cycle. A more elaborated perspective on such a feedback loop has not been given before in scientific literature. Van Mil et al. (2020) have touched upon it but have not researched it in their paper. They state that the factors influencing the bicycle-train combination alone can never capture the complexity of the subject. They therefore recommend further scientific research which identifies these potential feedback loops. In this thesis, the researcher aimed to do this in the perspective of First Mile travel. However, an example of the actual feedback loop itself has not been identified within this research, as it would take a longer period of time to follow the interrelations of all three factors of one full feedback loop.

Conclusion

In this chapter, the conclusion of the research is formulated by answering the main research question. Then, the researcher elaborates on the recommendations for further research based on the findings in this study. Additionally, the limitations of this research are discussed to put the methods and execution of the research in perspective, followed by recommendations for further research. Finally, recommendations to improve first mile travel in medium-sized cities (in the MRA) are given based on this research.

The influence of policy, infrastructure and usage on first mile travel

This research explored how first mile travel by bicycle to train stations in the MRA is influenced. Therefore, the main research question is:

How is the first mile by bicycle to train stations influenced in medium-sized cities in the Metropolitan Region of Amsterdam?

After conducting this research, it can be concluded that the main factors influencing first mile travel by bicycle to train stations are policy, infrastructure and usage. Apart from their influence on first mile travel, these factors also influence each other, creating a feedback loop. In this conclusion, the way every factor influences first mile travel and one or more other factors is shortly discussed.

Policy

Policy is a crucial element to make sure that first mile travel can be improved. First, there are several actors who play a role in these developments. Municipalities are in the lead but can collaborate with regional partners and the Province. The Province and the state can also provide subsidies to stimulate improvements in bicycle parking and infrastructure. There are a lot of different policies that can be used to improve first mile travel. Some are obvious, like policy on bicycle routes and the station area, but other themes, such as sustainability and housing, can have a large impact on the opportunities to improve first mile travel on policy level. Apart from the chances policy offers, there are barriers that can stand in the way of developing the right policies. While the lack of money is a barrier that involves many actors such as the state and the Province, other barriers such as politics, mindset and especially priority must be overcome on municipal level. The mindset is very important. The municipality and the inhabitants of the city must understand that a modal shift is needed to keep the mobility system running and to make the city more liveable. Therefore, improvements through bicycle policy are very much needed. When it comes to priority, municipalities must stand behind their ambition to stimulate cycling and the bicycle-train combination. Other priorities can make sure that bicycle-related improvements are postponed or even cancelled. Policy also directly influences infrastructure and usage due to improvements that concern the development of local infrastructure, or regulations that change the use of cyclists or car drivers. Therefore, policy is a very complex element, which has the power to make or break the success of first mile travel by bicycle in medium-sized cities in the MRA.

Infrastructure

Infrastructure is the main factor that determines whether people choose to use the bicycle or not. It mainly depends on the quality and quantity of the bicycle infrastructure. High quality infrastructure means that the complete cycling route is safe, direct, comfortable and attractive. Out of these four categories, safety has been found to be the most important variable for cycling in the city. Infrastructure is also very context-specific; apart from the design of the routes and bicycle paths, the shape of the city itself is also important, as this determines where people come from and thus the distance and their accessibility to the train station. Therefore, infrastructure influences the people's travel behaviour. This concerns the trip distance, and the quality and quantity of the infrastructure; when the quality and quantity of the bicycle infrastructure and parking is not good, people will not use the bicycle for first mile travel, which can cause people to not use the bicycle-train mode at all. Therefore, infrastructure can have a large impact on first mile travel in medium-sized cities in the MRA.

Usage

Usage is the factor that concerns information about the personal characteristics, travel characteristics and the opinions of the inhabitants in a certain context. This information is unique for the population of each city. Therefore, it emphasizes that there is no 'golden standard' for improving first mile travel. There are many differences between cities in the MRA, and also within the cities itself. These differences can be found by identifying the user and travel characteristics of the local population. This has also been confirmed by this research. The Netherlands as a whole has different personal and travel characteristics than medium-sized cities in the MRA, and even between these cities, some

large differences have been found. This research also emphasises that information about the usage and the (non-)users of the bicycle-train combination is likely to be valuable in creating services and policies that encourage the use of the combined mode. Therefore, information about the personal characteristics, travel characteristics and the opinions of the inhabitants is very useful input for policymaking, especially when the variables of these characteristics and opinions can be compared. This information educates policymakers on the current users and usage, which helps improving first mile travel in the specific context, focused on the local audience.

Together, these factors influence each other in a feedback loop, which is a constant cycle of interrelations between the three factors. This affects the quality of the first mile travel in each cycle, encouraging or discouraging first mile travel by bicycle. When policy positively adapts to the usage of the local context and users, this feedback loop has the potential to indirectly create a stronger public transport system for the city, which is beneficial for the attractiveness of the complete bicycle-train combination.

Limitations

In this section, the limitations of this research are discussed to put the methods and execution of the research in perspective.

This research is a mixed method, dual case study with an exploratory character. As the influence of policy, infrastructure and usage on first mile travel is a rather large and diverse subject, this has had consequences for the way this research has been conducted. First, the research included seven means of data collection to study all three factors: A qualitative literature study, Policy document analyses, semi-structured interviews, GIS analyses, observations, surveys and analyses of the ODiN 2018 data. Although this costed a lot of effort from the researcher to conduct within the time frame of seven months, all data collections could have been done more thoroughly.

For example, the researcher conducted six interviews with six different parties. That means that the statements and opinions of one person had a large influence on the way the researcher understood the situation of that party. The data analysis of the ODiN 2018 dataset could also have been done more thoroughly by further analysing the data of Haarlem and Hilversum, or by analysing more variables to verify the conclusions. The collected data from the surveys have also been limited, although this has not been due to a time constraint. Due the Covid-19 pandemic, the researcher was unable to physically question travellers nearby train stations to conduct the surveys. Therefore, he was forced to try to get as many respondents as possible through the internet, which resulted in a rather low number of respondents.

Another limitation is that the researcher was unable to focus on all aspects of first mile travel due to time constraints. This mainly concerns the analysis of bicycle parking near train stations, which is now shadowed by the amount of information about the first mile routes. The same goes for the analysis of the actors concerning policy. The researcher has left out the role of employers and companies concerning stimulating cycling or discouraging the use of the cars for their employees.

Recommendations for further research

Currently, the amount of research on the bicycle-train combination and especially the first mile by bicycle is still very thin. This research aimed to contribute to the existing information by providing an exploration of the influence of infrastructure on first mile travel in a specific context. Additionally, the PIU model has been created, which can be used as a perspective to research first mile travel, especially in medium-sized cities. That also introduces the first recommendation for further research: The development of the PIU model. The modal has so far only been used for this research, but it might have the potential the be further developed when adapted to related research on first mile travel. This can include other medium-sized cities in the world, but the model could also be adapted to larger cities like Amsterdam or London.

In addition, this research has only 'scratched the surface' when it comes to the influence of policy, infrastructure and usage on first mile travel. Although it provides a good basis, a more in-depth research per factor would be very useful to increase the understanding of the influence of these factors on first mile travel. This would concern conducting more interviews with relevant actors, conducting more, and more thorough analysis of the current infrastructure in a specific context, or diving deeper in the usage data concerning ODiN research data (a larger focus on the different cities) and surveys among a larger number of respondents.

The same research could also be applied to a different context. The specific characteristics of the MRA, and especially Haarlem and Hilversum have been taken into account for this study, but it would be interesting to explore whether the same study in a different context would result in more or less the same findings, and if not, what are the context-specific variables that influence first

mile travel? With this research, and the PIU model as a basis, many studies can be applied to the topic of first mile travel.

Recommendations to improve first mile travel in the MRA

Based on the results and the discussion, the researcher can provide recommendations for municipalities of medium-sized cities in the MRA about how to improve first mile travel in their city. The recommendations for medium-sized cities in the MRA considering policy, infrastructure and usage are discussed below. To give more valuable recommendations for infrastructure, knowledge on the context-specific infrastructure is necessary in addition to the general recommendations. By choosing Haarlem and Hilversum as subcases for this research, the researcher has collected information about the local circumstances concerning infrastructure. This knowledge has been translated into a context-specific suggestion for a spatial redesign of a current first mile bottleneck in both cities.

It is possible to use the PIU model as an approach to improve first mile travel in a medium-sized city. This implies that policymakers look at the task from three perspectives and work on improving all three of them, and most of all make use of the potential they offer. In a sense, it does not matter which one of the three factors policymakers start analysing, as long as they can understand the interrelations, and the effect each factor has on the others. For example, when starting with analysing the local infrastructure, policymakers can understand how this influences behaviour when analysing the current usage. After analysing the current usage, policymakers can understand what is needed (usage), where (infrastructure) and for who (usage).

Policy

Based on this research, the researcher has formulated eight recommendations for policymakers to improve their local first mile travel through policy. These recommendations are elaborated below.

1. Stand for your ambition

For most cities, the ambition regarding sustainable mobility is already there or is being shaped at the moment. The problem is that actually implementing this vision for the bicycle, and therefore discouraging car use within the city, is quite a big step. Municipalities really need to choose for the bicycle; other priorities, including the facilitation of car use, should not stand in the way of the cycling ambition of the municipality. When possible, the different (sustainable) themes should be combined, but this will not be possible in every location. Therefore, compromises on city level are needed; choosing for infrastructure in a certain place, and choosing for climate adaptation, bus lines or local shop owners in other places.

2. Frame it well

Because replacing car infrastructure in favour of bicycle infrastructure often causes political friction within the council and among the inhabitants, it is important to frame the intervention well; show what the inhabitants are receiving instead of their car parking spaces. This can be high-quality bicycle infrastructure, but also additional green space and other alternatives with a positive impact on the local liveability.

3. Make use of other projects

It can be advantageous to implement mobility-related interventions as a part of a bigger programme, such as housing programmes around transit nodes. Including sustainable mobility often fits the new development, especially when the amount of public space is getting scarcer. Then, first mile routes can be improved as a part of a bigger picture. This saves on mobility-specific expenses and it justifies improving first mile routes.

4. Make use of every penny

Concerning money, it is important to look out for opportunities to receive subsidies from the province, state, or other parties like the MRA. It is often advantageous to collaborate with neighbouring municipalities, especially when improvements are implemented on a regional scale, such as fast cycling routes. Being creative with funds is also a valuable recommendation; when a large investment such as the expansion of a bicycle storage near the train station is not possible due to a lack of money, find out whether the problem can be tackled in a few stages rather than waiting to raise the funds to execute the whole project in once.

5. Choose routes for cyclists

When improving first mile routes, invest in routes that give the cyclist the opportunity to travel safely, directly and pleasantly. More importantly, invest in routes cyclists already like to cycle on, instead of focusing on improving routes along main motorised roads, which is bad for the attractiveness, and reduces the chance of gaining something more than just a proper cycling path.

6. Adapt to the local users

Therefore, it is important to adapt to the current usage of the local cyclists. Get an insight in usage data, opinions of inhabitants on infrastructure and related facilities, and use it to your advantage. By doing so, it also strengthens the justification of the interventions towards the council and inhabitants.

7. More than just mobility
When improving infrastructure, it is important to keep in mind that such an intervention can do more than just improve the mobility of the inhabitants. Infrastructure projects, especially concerning cycling, have the opportunity to also improve other themes, such as climate adaptation or the liveability in a neighbourhood.

8. Share the knowledge
Lastly, make sure to share the available knowledge on sustainable mobility, the bicycle-train combination and the first mile by bicycle. By sharing the knowledge, all people within the municipality are aware of the advantages, which increases the chances to improve first mile travel in all kinds of municipal projects.

Infrastructure
Based on the theory and results of this research, the researcher can give several general recommendations to improve first mile infrastructure.

Infrastructural interventions
The most important variables concerning infrastructure are safety, directness, comfort and attractiveness. When improving bicycle infrastructure, municipalities should make sure that these variables are taken into account. This can be done by separating the path from the road, expanding the width of the path, smoothening the surface of the path and by clearly signifying the path through colour. However, not only the path itself should be taken into account. Improving first mile infrastructure also includes giving the cyclists right of way at intersections and roundabouts and enhancing the scenery of the route. Lastly, the safety and attractiveness of the route can be improved by reducing the car use on the designated first mile routes. This can be done by removing car parking spots, decreasing the speed limit and implementing bicycle streets where cars are a 'guest'.

Adapt to the usage
Additionally, first mile infrastructure should be planned from the perspective of the cyclist. That means that it is important to gather information about where the cyclists come from, where they go, and which routes they (would like) to take. It is therefore useful to look into the usage aspect as well.

Usage
Based on the studied usage characteristics, the researcher has been able to provide useful information about the usage of first mile travel in medium-sized cities in the MRA. This information has been translated into recommendations, which can be found below.

The modal split
In the medium-sized cities in the MRA (Haarlem, Hilversum, Hoofddorp, Lelystad, Purmerend, Zaanstad), the modal split during the daily commute is still very much in favour of the car with a share of 52.6%, while the train has a share of only 17.8%. Therefore, there is still much room for improvement when it comes to the sustainable daily commute. When looking at the people using the train, 52.3% already uses the bicycle to get to the train station, in addition to 34.4% pedestrians. That means that 86.7% of the train users in the medium-sized cities in the MRA already travels a sustainable first mile; the focus therefore needs to go to the people who do not use the train yet.

The potential of train stations
A lot of potential can be found in a range of 2.5-5 km to the train station. In this area, the train use is much lower than in the area closer to the station, even though it concerns a cycling distance. One of the push factors for using the train might be the busy train stations during rush hour; as 84.4% of the train users uses the train to get to work or to school, the capacity of the stations or trains might be an issue. Therefore, it might be interesting to see whether people can be attracted to smaller train stations instead of Intercity stations. Luckily, proximity to the train station is a more important element for choosing a train station than the Intercity status according to the respondents of the surveys. Therefore, improving first mile routes towards these stations may also help to decrease the pressure on intercity stations during rush hour.

The users
When it comes to who the train users are, it mainly concerns people aged below 30, medium or higher educated people and people with either a low or high income. Therefore, it might be interesting to see how the municipality can stimulate people over 30 years old, lower educated people and people with a middle-income. Additionally, 8.4% of female train users uses the car to get to the train station. This is a target group that can be stimulated to use the bicycle to get to the train station more often.

Importance and satisfaction
Lastly, it is important to look at the urgency to improve the various aspects concerning first mile routes. In this research, this has been done by combining the data on importance and satisfaction. According to the inhabitants of Haarlem and Hilversum, Safety is the most important aspect to look at, followed by the quality of the path and the directness/speed of the route. Availability is the least urgent aspect, as most cities in the MRA will have many bicycle paths throughout the city. The focus should therefore go to the design of the bicycle routes to improve first mile travel.

Infrastructure: Detailed recommendations

In addition to the recommendations above, the researcher provided context-specific recommendations. Because each city has a unique shape, size and infrastructural network, each city needs a different perspective on first mile infrastructure. The way infrastructure should be redesigned also depends on several aspects from the policy and usage factors, such as the priority of different themes and the current usage of the routes. The context-specific locations used for the recommendations are based on the major infrastructural problems in Haarlem and Hilversum which have been identified in the results of this research. The most urgent problems in both cities are used as a context to provide context-specific recommendations in this section. In Haarlem, this concerns the Schoterweg north of the central station (figure 41). In Hilversum, this concerns the intersection of Vaartweg and Havenstraat (Figure 42).

Haarlem

In Haarlem, the most frequently used bicycle route from Haarlem North towards the central station is along the Schoterweg. The last 500 metres of this route are far from ideal; the road is split in two routes due to a lack of space, with bicycle paths that are narrow and uneven. On top of that, the roads are used by many cars and busses.

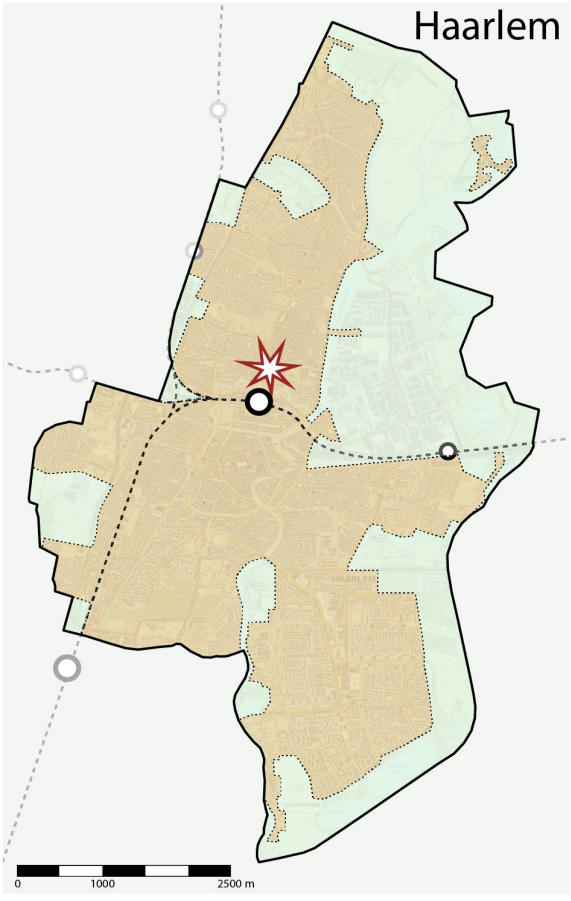


Figure 42: The location of the major infrastructural problem in Haarlem

Considering the low quality and the high use of this route, it can be useful to look how this route can be improved in favour of the cyclist. The two streets are very narrow, with a varying total width of 8-16 metres. Two sections of the current situation can be found in figure 43. As shown in the sections, a large share of the space is reserved for motorised traffic, while bicycle paths are only 1,5 metres in width. An additional variable increasing the complexity in the left section is the presence of trees. Although trees improve the attractiveness of the route, it decreases the amount of space available to the cyclist.

Hilversum

Due to its centric shape, there are multiple routes to the city centre and central station from every part of the city. In this research, it has already been compared to 'spokes in a wheel' (figure 15 page 35), referring to the fast cycling routes which will be constructed in the future. Although many of the current 'spokes' are taken into account, one route is missing, which is Bosdrift-Havenstraat. This route is neither a fast cycling route, nor a route for through traffic. Therefore, it has the potential to be transformed into a green corridor for cyclists and pedestrians. The most interesting part can be found near the intersection with Vaartweg. Here, the street is narrow, and the division of the available space is a more complex issue, as the current design includes space for pedestrians, cyclists, parked cars, busses and trees (figure 44, left). A comparable complex situation can be found on Vaartweg near the intersection with Havenstraat. Here, the width of the street is even smaller, while it should also be open to through traffic to and from the city centre. The current design is too small (bicycle paths of 0,6m wide), which causes a chaotic and unsafe environment (figure 44).

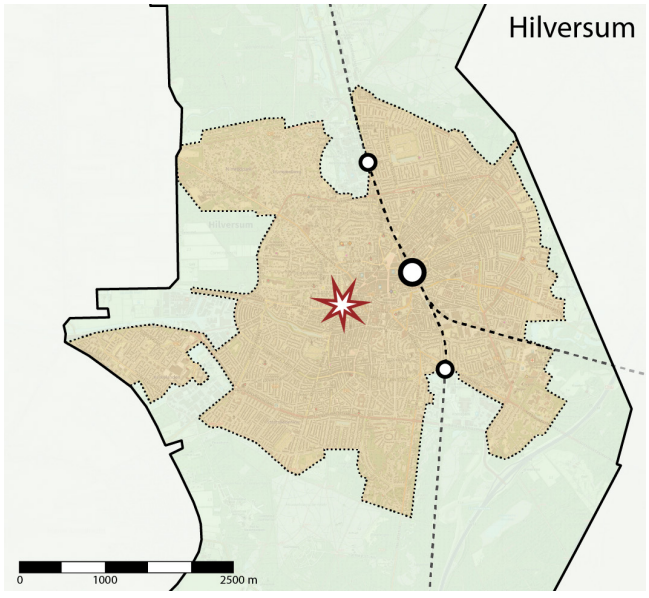
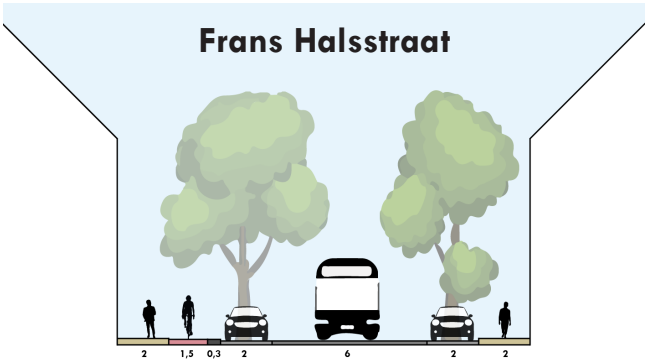


Figure 42: The location of the major infrastructural problem in Hilversum



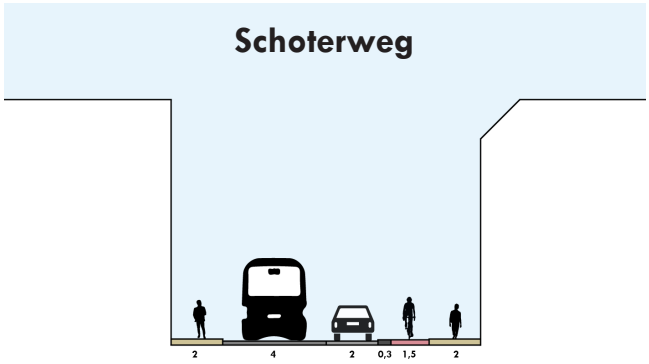
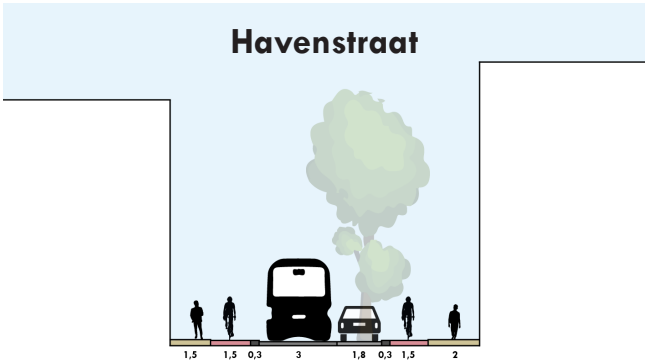


Figure 43: Section of the current situation in Frans Halsstraat and Schoterweg in Haarlem



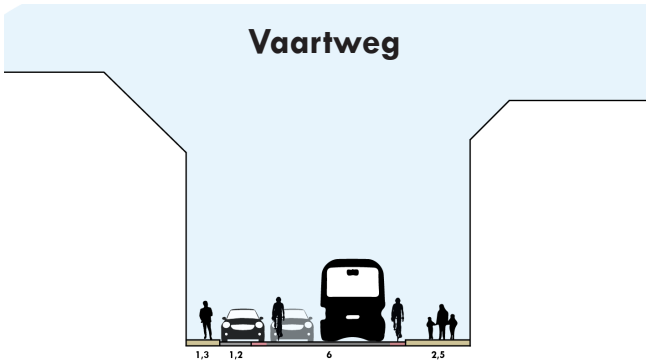
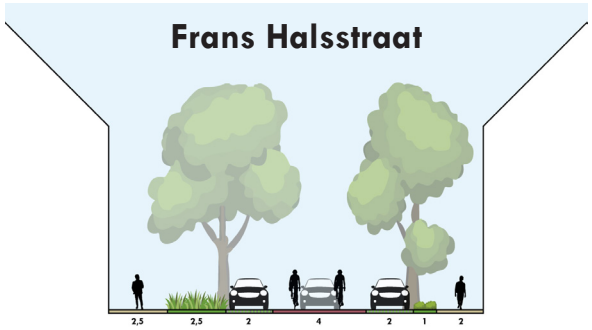


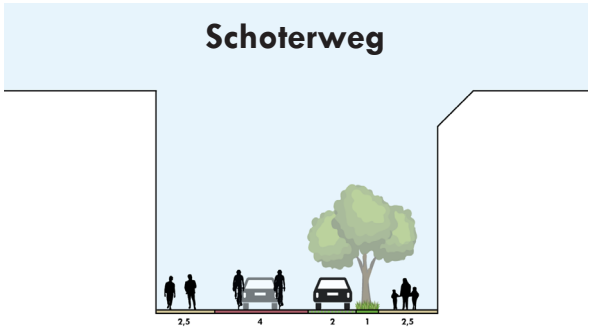
Figure 44: Section of the current situation in Havenstraat and Vaartweg in Hilversum

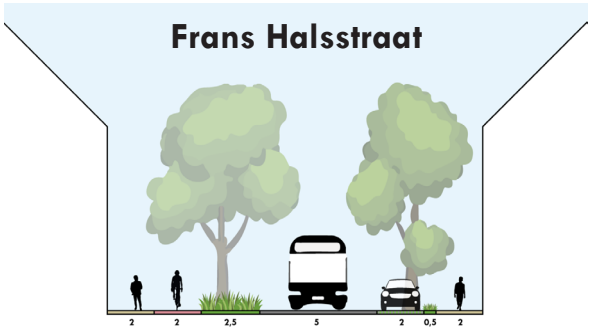
Recommendations

There are multiple ways to improve these streets in favour of the cyclists. In figure Y, two alternatives are given per street in each city. The alternatives show that due to the reduced availability of space, choices must be made; will the bus route keep going through these streets? Can people still park their car in front of their house? How much space is reserved for the cyclist? And is there an opportunity to include more greenery? The relative importance of these variables is up to local policymakers. It shows that policy can play a very large role in the infrastructure of the first mile.

However, some choices can be made in many cases. Car parking spots can be made out of grass tiles, which combines the function of the parking spots with a climate-adaptive design. Another intervention is levelling the paths for pedestrians and cyclists. By doing so, cyclists







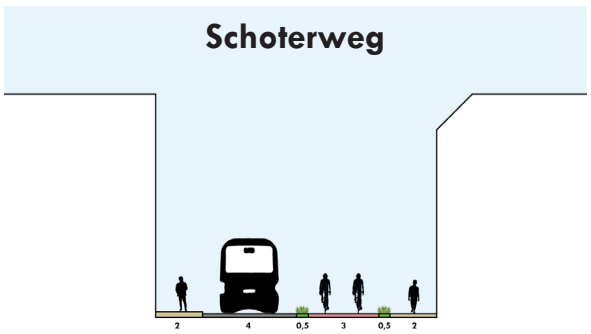


Figure 45: Sections of two possible alternatives in Frans Halsstraat and Schoterweg in Haarlem

are not ‘trapped’ in the width of the cycling path in situations where the width might lead to unsafe situations (e.g. when passing multiple cyclists at once). A third intervention is the implementation of a bicycle street. These streets often require less space than the existing road, creating extra space for pedestrians, green or parking facilities. However, transforming a road into a bicycle street implies choosing for the bicycle, slowing down bus lines and discouraging car use, especially through traffic. Therefore, this will not be a desirable intervention on every route.

The alternative sections for the streets in Haarlem and Hilversum show that it is possible to improve a route in favour of cyclists, even when the local situation is complex and includes multiple interests. Especially on routes with narrow streets, it is important to explore the various options and choose the intervention that fits the local context and ambition best.

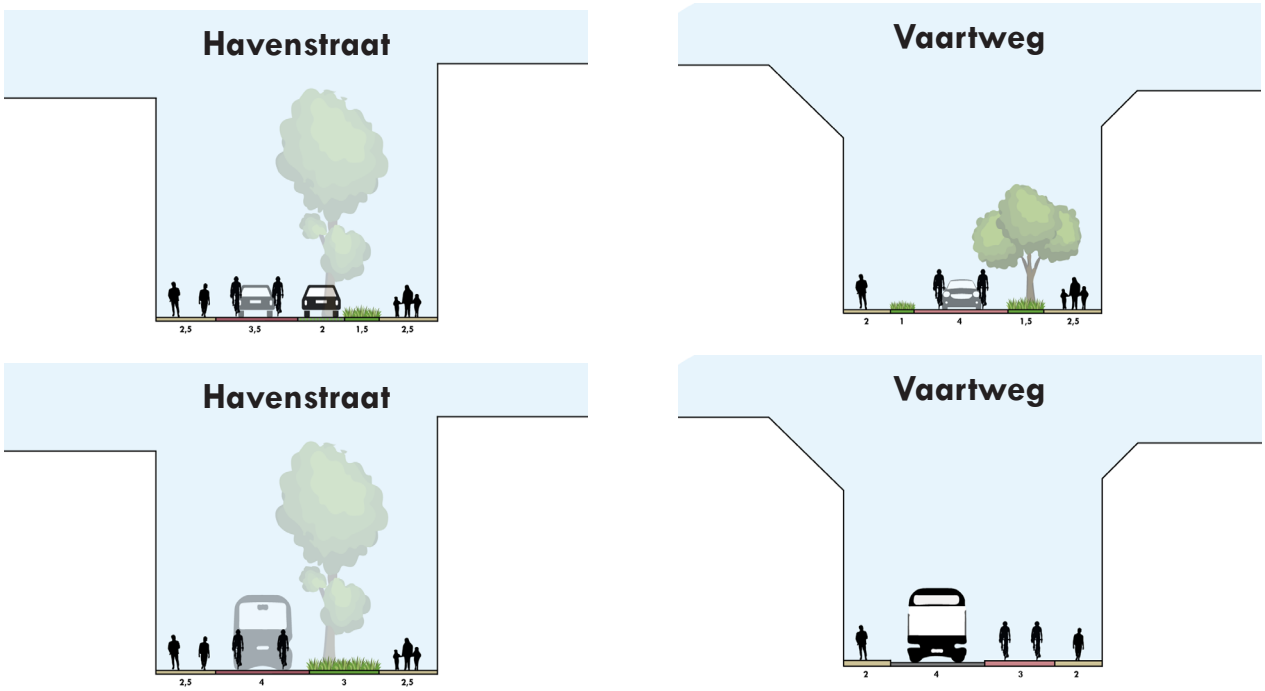


Figure 46: Sections of two possible alternatives in Havenstraat and Vaartweg in Hilversum.

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Figures

Figures without a reference have been created by the author.

Figure 3: Kager, R., Bertolini, L., & Te Brömmelstroet, M. (2016). Characterisation of and reflections on the synergy of bicycles and public transport. Transportation Research Part A: Policy and Practice, 85, 208–219.

Figure 7: Van der Spek & Scheltema (2015), based on Scheltema, N. (2012). Recycle City: Strengthening the bicycleability from home to the Dutch railway station. TU Delft.

Table 2: CBS Statline, 2019. Regionale kerncijfers Nederland

Appendices

1. Analysed policy documents

National Documents

(SD1) Ministerie van Infrastructuur en Waterstaat (2018). Kamerbrief Fiets Juni 2018.

(SD2) Rijksoverheid (2019). Klimaatakkoord.

(SD3) Tour de Force 2020 (2016). Fietsagenda 2017-2020.

Province Documents

(NHD1) Provincie Noord-Holland (2018). Omgevingsvisie NH2050.

(NHD2) Provincie Noord-Hollands (2019). Agenda Mobiliteit, discussienota.

(NHD3) Provincie Noord-Holland (2018). Perspectief Fiets Provincie Noord-Holland.

Haarlem Documents

HaD1: Gemeente Haarlem (2018). Coalitieprogramma Haarlem 2018-2022.

HaD2: Gemeente Haarlem (2017). Structuurvisie openbare ruimte Haarlem 2040.

HaD3: Gemeente Haarlem (2016). Duurzaam ontwikkelingsmodel Mobiliteit en Ruimte Haarlem 2040.

HaD4: Posad Maxwan (2019). Bereikbaarheidsvisie Zuid-Kennemerland 2020.

HaD5: Goudappel Coffeng (2019). Integrale visie Stationsgebied Haarlem, probleemanalyse.

HaD5: Goudappel Coffeng, Uhrhahn & APPM (2019). Oplossingsrichtingen voor toekomstige mobiliteit, op weg naar een integrale visie stationsgebied Haarlem.

HaD5: Gemeente Haarlem (2019). Startnotitie Integrale toekomstvisie 2020-2040 stationsgebied.

Hilversum Documents

HiD1: Gemeente Hilversum (2018). Coalitieakkoord 2018-2022 Hilversum

HiD2: Gemeente Hilversum (2013). Structuurvisie Hilversum 2030

HiD3: Gemeente Hilversum (2016). Structuurvisie verkeer en vervoer 2030 Hilversum

HiD4: Gemeente Hilversum, OKRA landschapsarchitecten & De Zwarte Hond (2019). Stationsgebied Hilversum: de groene loper naar de mediastad

HiD5: Regio Gooi en Vechtstreek (2018). Verkenning Gooi en Vechtstreek 2040

HiD6: Gemeente Hilversum (2019). Bestuurlijk Plan van Aanpak Omgevingsvisie 'Voor een mooier en beter Hilversum'.

HiD6: Antea Group (2019). Omgevingsfoto gemeente Hilversum: Analyse t.b.v. de Omgevingsvisie.

HiD6: Gemeente Hilversum (2019). Notitie Reikwijdte en Detailniveau Omgevingsvisie Hilversum.

HiD6: Commissie voor de Milieueffectrapportage (2019). Omgevingsvisie Hilversum: Advies over reikwijdte en detailniveau van het milieueffectrapport.

2. Interview format

This interview format has been made to guide the researcher during the semi-structured interviews. Additionally, it provides information about the research to the interviewees. The semi-structured fashion leaves room for spontaneous interaction during the interview. Therefore, not all question must be asked during each interview, but the researcher rather picks questions that fit the interviewee and the context of the interview itself. The interview will be recorded so it can be transcribed and analysed by coding the transcription. The transcription will not be published and will only be read by the researcher, the supervisor, the second reviewer and the interviewee of the specific interview. Quotes derived from the transcription will be used with the function and organisation of the interviewees, therefore the interviews stay anonymous.
The draft report will be sent to all the interviewees before finishing the research. This allows the interviewees to check for possible mistakes. The final report will be published and freely available to anyone, through the Wageningen University library.
Since the interviews will be in Dutch, the interview format below will be in Dutch.

Introductie

De thesis wordt geschreven vanuit de Wageningen Universiteit, waar ik ook word begeleid door een docent. Het onderwerp komt voort uit eigen interesse voor duurzame mobiliteit, maar heeft ook een link met Samen Bouwen aan Bereikbaarheid; het uiteindelijke resultaat van het onderzoek is niet alleen een thesisrapport, maar ook een handboek/aanbevelingen voor middelgrote gemeenten in de MRA over de first mile.
Het onderzoek richt zich specifiek op de first mile (voortransport) voor de trein met de fiets. In dit interview ga ik daarom naast de first mile ook in op fiets- en ov-beleid in bredere zin, en over duurzame mobiliteit in het algemeen. De urgentie van een goede first mile zit hem in het feit dat de pendel vanuit middelgrote steden naar grotere steden steeds meer groeit, en dat tegelijkertijd er steeds hogere ambities en doelen zijn m.b.t. duurzame mobiliteit. Een goedkope en efficiënte manier om het gebruik van duurzame mobiliteit te stimuleren is door de first en last mile te verbeteren. In dit onderzoek heb ik gekozen voor maatregelen in de middelgrote steden, waardoor het onderzoek zich focust op de first mile.
Ik onderzoek twee cases; Haarlem en Hilversum. De twee cases heb ik gekozen omdat ze, ondanks dat het beide middelgrote steden zijn met dezelfde opgaven, van elkaar verschillen in hoe ver ze daarin zijn en daarnaast ook in grootte verschillen (90k – 160k). De meeste overige steden zullen tussen de twee cases in zitten qua beleid en inwoneraantal, waardoor het mogelijk is om bevindingen te generaliseren voor middelgrote steden in de MRA. Binnen het onderzoek focus ik me op het beleid, de infrastructuur en het gebruik/de gebruikers van de first mile. Dit interview gaat daarbij over het beleid. Daarvoor heb ik ook een analyse gedaan van de beleidsdocumenten m.b.t. mobiliteit.

De onderzoeksvraag luidt: Hoe wordt de first mile rit naar treinstations met de fiets beïnvloed in middelgrote steden in de MRA?

Vragen

De geïnterviewde persoon

Wat is je functie binnen *organisatie*?

De organisatie

- Hoe gaat de organisatie om met de opgaven rondom klimaatadaptatie?
- Wat is de visie op duurzame mobiliteit van de organisatie?
- Wat zijn de grootste opgaven m.b.t. mobiliteit voor de organisatie?
- Wat is er de laatste jaren veranderd qua beleid m.b.t. fiets/ov/auto/duurzame mobiliteit?
- Wat zijn de grootste barrières om het fietsbeleid te verbeteren?
- Is er genoeg kennis binnen de organisatie om de opgaven m.b.t. duurzame mobiliteit aan te pakken? Zo niet, waarover is meer kennis nodig?

Beleid verschillende modaliteiten

- Wat zijn de ambities van de organisatie m.b.t. de fiets?
- Wat zijn de ambities van de organisatie m.b.t. ov (bus én trein)?
- Is er beleid voor de gehele deur-tot-deurreis (woon-werkverkeer)?
- Is er beleid voor de first mile met de fiets naar het station? (Welk beleid? / waarom niet?)
- first mile opgesplitst in: Woning > centrumring / centrumring > station / station > perron
- Wat is het beleid m.b.t. autoverkeer, specifiek t.o.v. fietsers?

Samenwerking en rollen

- Hoe gaat de samenwerking met andere partijen op het gebied van de deur-tot-deurreis en mobiliteit?
- Wat is de rol van de organisatie in het verbeteren van de deur-tot-deurreis / first mile / fietsbeleid in middelgrote steden?

Mening en extra vragen

- Wat vind jij dat er nu moet gebeuren om de situatie rondom duurzame mobiliteit te verbeteren?
- Zijn er nog zaken rondom fietsbeleid die we niet hebben benoemd, maar wel belangrijk kunnen zijn voor dit onderzoek?

3. Interviewees

For this research, all interviewees have contributed anonymously to this research. A list of the organisations where the interviewees worked at the time of the conduction of the research is given below.

Interview 1: Gemeente Hilversum (1)
Reference: IHi

Interview 2: Gemeente Haarlem (1)
Reference: IHa

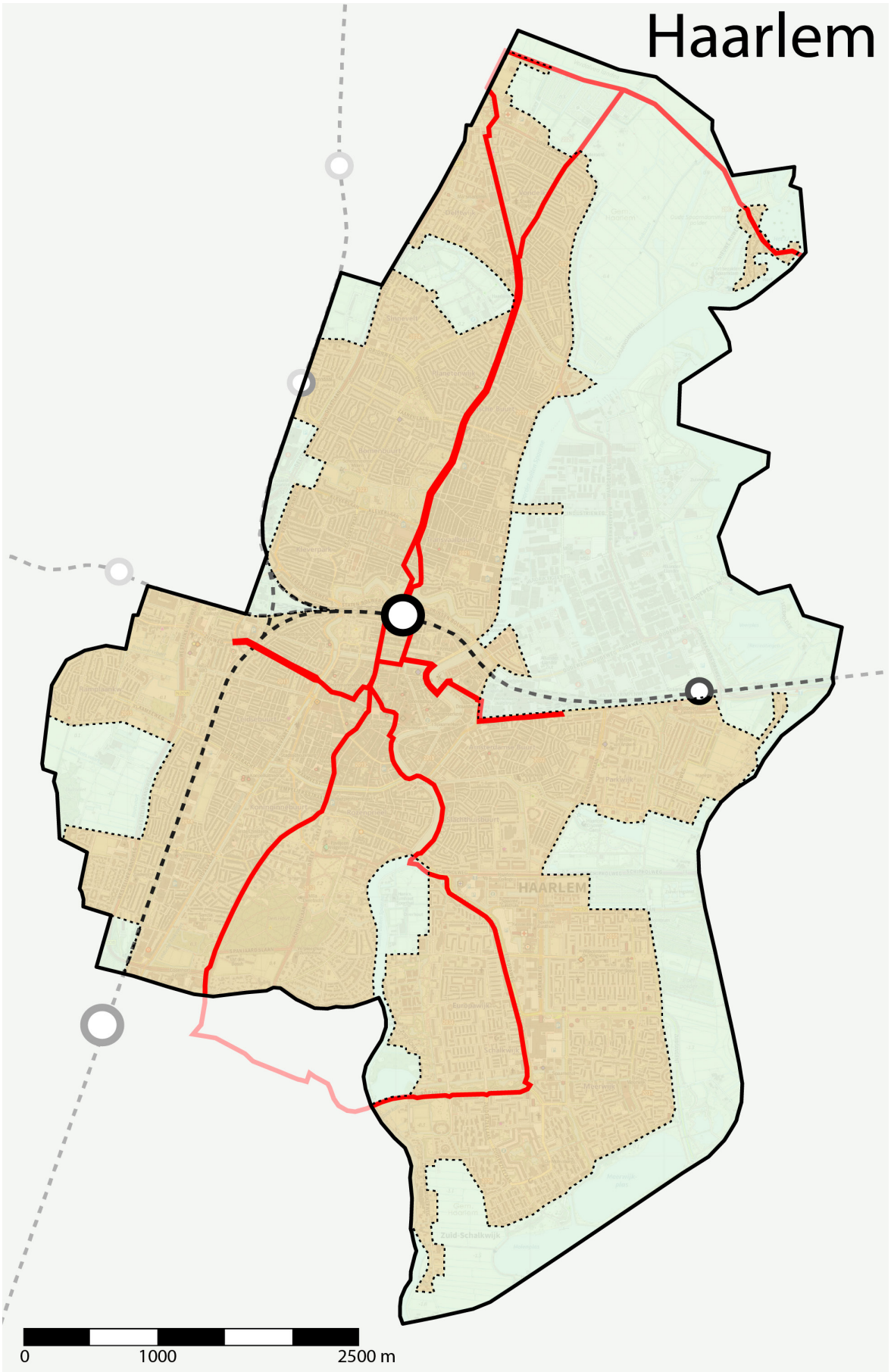
Interview 3: Provincie Noord-Holland (1)
Reference: IPNH

Interview 4: Ministerie van Infrastructuur en Waterstaat (1)
Reference: IIW

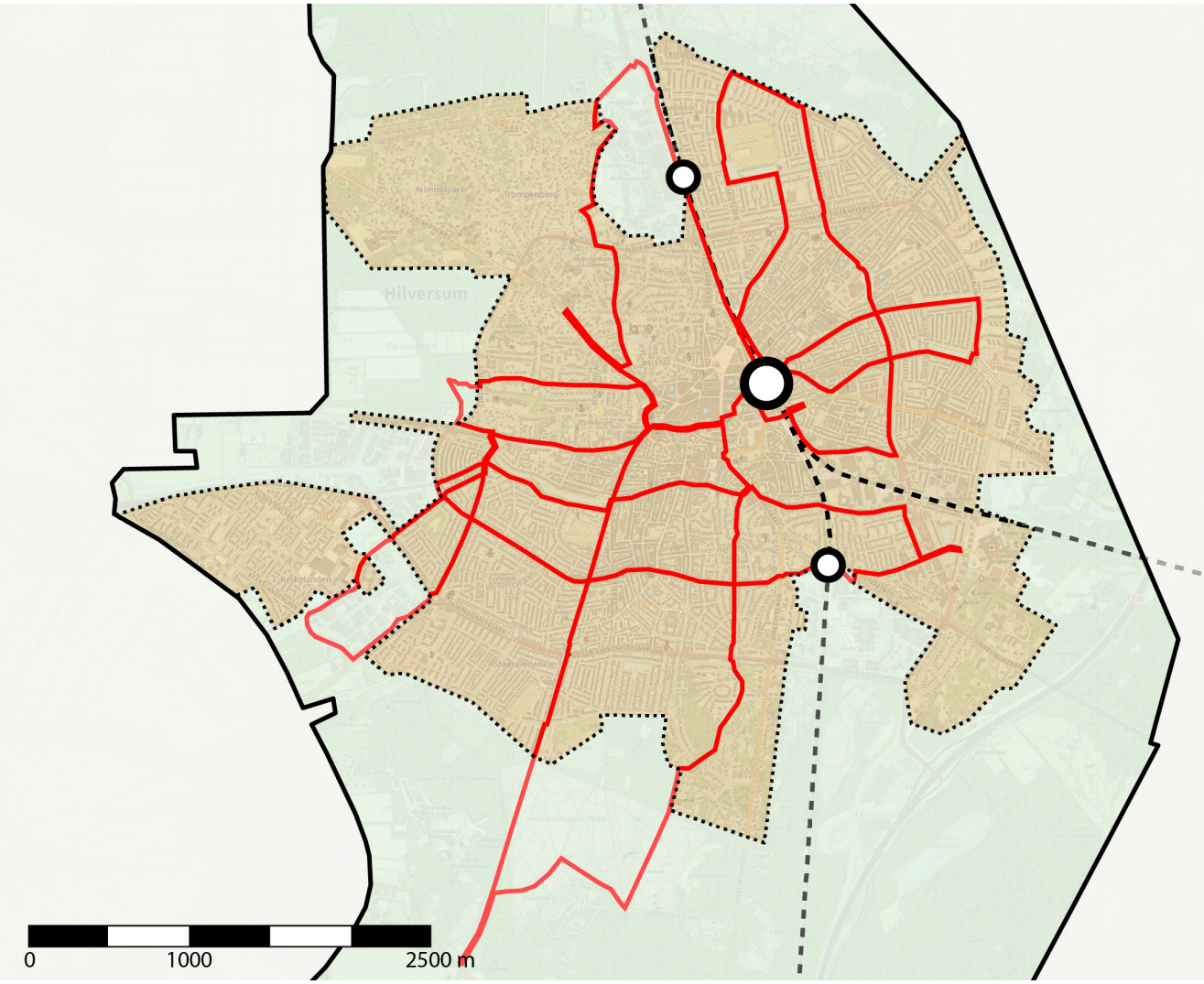
Interview 5: NS (2)
Reference: INS

Interview 6: Regio Gooi en Vechtstreek (2), Gemeente Hilversum (1)
Reference: IRGV

4a. Route for observations: Haarlem



4b. Route for observations: Hilversum



5. Survey questions

The targeted respondents for the surveys were mainly people who speak Dutch. Therefore, the survey questions are given in Dutch.

Introduction

Onderzoek fietsen naar het station in Haarlem/Hilversum.

Fijn dat u wilt meewerken aan dit onderzoek!

Deze enquete bevat vragen over het gebruik van fiets- en treinvoorzieningen in Haarlem/Hilversum.
Om een goed beeld te krijgen van de gebruikers van de voorzieningen, wordt ook naar enkele persoonlijke kenmerken gevraagd.

Ga bij het beantwoorden van deze enquete uit van de situatie voor de coronacrisis.

Individuele antwoorden in deze enquete worden niet aan derden verstrekt en uw deelname is geheel anoniem. Mocht u vragen hebben over dit onderzoek, dan kunt u contact opnemen door te mailen naar jerom.marseille@wur.nl

Questions

1. Wat is uw geslacht?

2. Wat is uw leeftijd?

3. Bent u woonachtig in Haarlem/Hilversum?

4. In welk gebied in Haarlem/Hilversum woont u? (respondents can choose area A, B or C on a map)

5. Hoe vaak fietst u per week?

6. Met welk doel maakt u gebruik van de fiets?

7. Hoe tevreden bent u over de fietspaden in Haarlem/Hilversum op het gebied van hoeveelheid, kwaliteit, veiligheid en snelheid?

8. Hoe belangrijk vindt u de de hoeveelheid, kwaliteit, veiligheid en snelheid van de fietspaden in Haarlem/Hilversum?

9. Kunt u aangeven op welke plek(ken) in Haarlem/Hilversum u vindt dat er een fietspad mist?

10. Kunt u aangeven op welke plek(ken) in Haarlem/Hilversum u vindt dat de kwaliteit van het fietspad verbeterd moet worden?

11. Kunt u aangeven op welke plek(ken) in Haarlem/Hilversum u vindt dat de fietsroute onveilig is?

12. Kunt u aangeven op welke plek(ken) in Haarlem/Hilversum u vindt dat de fietsrit te veel vertraging heeft?

13. Hoe vaak maakt u gebruik van de trein?

14. Met welk doel maakt u gebruik van de trein?

15. Van welk treinstation maakt u het meest gebruik?

16. Waarom maakt u het meest gebruik van dit station?

17. Op welke manier komt u het vaakst van uw woning naar het treinstation?

18. Waarom kiest u voor dit vervoersmiddel om naar het treinstation te komen?

19: Hoe tevreden bent u over de hoeveelheid en kwaliteit van de fietsparkeervoorzieningen bij het station dat u het meest gebruikt?

6. Survey suggestions

In the schemes below, the locations and the problems suggested by the respondents of the surveys can be found.

HAARLEM	Lacking -	Quality -	Safety -	Speed
Amerikaweg				1x
Amsterdamsevaart	1x		1x	
Bazellaan, Beatrixplein	2x			
Boerhaavestraat near hospital		1x		
Bolwerk - Verspronckweg			1x	
Briandlaan		1x	1x	
City centre	2x	2x	4x	3x
Churchilllaan	1x			
Donkere Spaarne	1x		1x	
Dreef		1x	1x	
Large Intersections				1x
Large Intersections Schalkwijk				1x
Hofmanweg		1x		
Houtplein		1x	2x	
Jansweg			1x	
Intersection oudeweg - Gedempte Oostersingel - Spaarndamseweg				1x
Intersection Schalkwijkerstraat				1x
Leidsevaart		2x	2x	
Nassaulaan richting Kenaupark			1x	
Everywhere – narrow paths, long waiting times traffic lights				2x
Prins Bernhardlaan				1x
Prins Bernhardlaan/Bazellaan			1x	
Raaksbrug				2x
Rijksstraatweg - Schoterweg		13x	3x	1x
Around church (Riviervismarkt, Damstr, Lange Veerstr)			1x	
Schipholweg	1x			
Station Haarlem	1x	1x	1x	3x
Van Goghlaan/ Leonard Springerlaan	1x	2x	2x	
Van Zeggelenplein	1x			
Veerpolder	1x			
Vergierdeweg			1x	
Vondelweg		1x	1x	
Waarderpolder - te lang wachten stoplichten				1x
Wagenweg		1x	1x	
Wagenweg - Florapark		1x		
Wagenweg/Houtplein		1x		
Wilhelminastraat – Raamvest		1x	1x	2x

HILVERSUM	Lacking -	Quality -	Safety -	Speed
Beatrixtunnel		1x		
Beatrixtunnel/Schapenkamp				6x
bosdrift – city centre			1x	
city centre	2x			1x
Diependaalselaan		2x		
Emmastraat		7x	2x	1x
There are only cycling paths along the main roads	1x			
Cycling paths are too narrow		1x		
Gijsbrecht - neuweg – roundabout			1x	
Gijsbrecht		4x		
Godelindeweg – Insulindelaan		1x		
Groest		1x		
J Geradtsweg/J Van Campenlaan				1x
J vd Heijdenstraat	1x		1x	
J vd Heijdenstraat/Micklerstraat				1x
J. Geraedtsweg			1x	
Kleine drift, Minckelersstraat			1x	
Kleine spoorbomen	1x		3x	2x
Koningsstraat	1x			
Intersection Diependaalselaan - J de Wittstraat				1x
Intersection Gijbrecht-Hindelaan			1x	
Intersection Neuweg-Langestr		1x	1x	
Intersection Oosterengweg - oude Amersfoortseweg			1x	
Intersection Stadhouderslaan - Soestdijkerstraatweg			1x	
Intersection stationsfietstunnel - schapenkamp			1x	
Intersection Vaartweg Havenstraat			1x	1x
Intersection Zuiderweg-Kleine drift			1x	
Intersections Mickelersstr, kleine drift, prof. Kochstr (beatrixtunnel)		1x		
Intersections with two traffic light when going left				1x
Market	1x			
Larenseweg			2x	
Loosdrechtseweg - Esso/Gijsbrecht			1x	
Lorentzweg	1x			
Marktplein		1x		
Melkpad		1x	1x	
Neuweg - Langestraat/Gijsbrecht		1x		
Noorderweg between kleine spoorbomen and station			1x	
Oosterengweg / van Riebeeckweg				1x
Oosterspoorplein			1x	
Every road that is not a main road			1x	
Path to heathlands from Bosdrift		2x		
Roundabout Gijsbrecht/Vreelandseweg			1x	
Roundabout Groest			1x	
Route Kerkelanden-station			1x	
Schapenkamp-stationsstraat		1x		
Crossing train tracks Riebeeck	1x			
Station Hilversum			1x	
Stationsstraat - marktplein			1x	
Utrechtseweg		2x		
Vaartweg		1x	2x	
Many paths with an uneven surface		1x		
Everywhere				1x
Intersections with traffic lights				1x
Vaartweg - Van Mesdagweg				2x