

# Shaping car mobility: the urban form of cities influencing future car usage

A study on the future of car mobility in the city of Groningen shaped by neighbourhood development projects

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## **Acknowledgements:**

This thesis has been written as part of the Bachelor's program Spatial Planning and Design at the University of Groningen, within the theme of mobility transitions.

Throughout my bachelor years, I have created a passion towards the design of cities and especially how urban form and mobility relate. Besides this, sustainability is a trending topic in urban designs and is something that sparks my interest. It was therefore nice to be able to write my thesis about a subject related to this.

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## Colophon

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# Table of Contents

<b>Summary</b> .....	<b>3</b>
<b>1. Introduction</b> .....	<b>4</b>
1.1. Background .....	4
1.2. Research problem .....	4
1.3. Structure.....	5
<b>2. Theoretical Framework</b> .....	<b>6</b>
2.1. The rise of car dependency and automobility .....	6
2.2. Breaking the pattern of automobility and car dependency .....	6
2.3. Car-reducing strategies .....	7
2.4. Conceptual Model .....	8
<b>3. Methodology</b> .....	<b>8</b>
3.1. Research strategy .....	9
3.2. Primary data collection .....	9
3.3. Secondary data collection .....	10
3.4. Ethics .....	10
<b>4. Results</b> .....	<b>10</b>
4.1. Case study analysis .....	11
4.1.1. Meerstad .....	11
4.1.2. De Suikerzijde .....	11
4.1.3. Comparison .....	12
4.2. Interviews .....	14
Sustainability .....	14
Mobility .....	15
Urban Design .....	17
Future perspective - uncertainty .....	17
<b>5. Conclusion and discussion</b> .....	<b>18</b>
<b>6. References</b> .....	<b>19</b>

## Summary

There is a world-wide dominance of private-cars in cities all over the world. This pattern of automobility that has been created throughout the years is hard to break. Due to the environmental and spatial problems related to this system of automobility, it is important to reduce car dominance. This bachelor thesis will therefore research how new neighbourhood development projects in Groningen are organising their mobility strategies, with the focus on private cars, and how these strategies will influence the future of car mobility in the city of Groningen. Hence, the main research question of this thesis is: “How are new neighbourhood development projects shaping the future of car mobility in the city of Groningen?”

The research question will be answered with case study analysis of two neighbourhoods located in the city of Groningen: Meerstad and De Suikerzijde (secondary data), and in-depth interviews (primary data). The case study analysis concluded that the two neighbourhoods' differences in urban design such as proximity of facilities lead to a contrast in car usage. Meerstad is a low density neighbourhood where car usage is dominantly present, and De Suikerzijde will be a car-reduced neighbourhood where private-car usage will be discouraged. A difference in parking standards is used as the main strategy to control car usage.

From the interviews it could be concluded that providing parking space on the basis of parking standards are the main strategies that are currently applied to influence car mobility in neighbourhoods. In order to make a transition from car-dominance, the proximity of facilities is an important factor. Additionally, strategies such as mobility hubs, car-sharing, and other good alternatives like a well-organised public transport and bicycle path network, are applied in future projects to discourage private car usage. New neighbourhood developments will implement mobility hubs that will reduce the amount of car usage in a neighbourhood. This strategy will be supported by further development regarding car-sharing. Furthermore, a well-organised network of public transport and a good network of slow traffic modes like cycling and walking will be implemented as alternatives to replace the private car. These strategies will guide the usage of cars into a different direction than it is now and will therefore shape the future of car mobility.

# 1. Introduction

## 1.1. Background

From the 20th century, the car became intertwined in our modern society and became central to the way we travel, build cities, use land, design infrastructure, and many more (Glazener et al., 2022). However, many cities are shifting from this car-oriented passenger mobility towards a more environmentally-friendly and citizen-focused alternative due to the current problems that arise with private car usage and the declared aim to reduce greenhouse gas emissions (Nieuwenhuijsen & Khreis, 2016; Roberts, 2023). Fossil fuel cars are polluting, with road transportation producing 11.9 percent of global carbon emissions in 2016, and electric alternatives are no less polluting due to their production process (Roberts, 2023). Additionally, car mobility contributes to other problems like urban sprawl, air and noise pollution, deaths and injuries related to car crashes, social isolation, and transport poverty (Roberts, 2023). So, in order to create a healthier environment and reduce carbon emissions to save our planet, it is important to drive less (Roberts, 2023).

## 1.2. Research problem

The Industrial Revolution has contributed to the origin of various inventions which essentially changed transportation and therefore the way cities are designed (Freudendal-Pedersen, 2020). The invention of the steam engine, and thus rail transportation, made fast travel over longer distances possible and later the invention of the combustion engine and thereby automobiles increased travel speed and capacity even more (Freudendal-Pedersen, 2020). These inventions needed infrastructure that would support these new and faster modes of transportation and so a whole traffic system of roads, terminals and traffic steering systems emerged, as well as modes of transportation adjusted to these systems, that still influences today's cities to an extent that these infrastructures determine how urban spaces should be arranged (Freudendal-Pedersen, 2020). However, in recent years cities have come to recognize the negative externalities that come with the dominance of motorised traffic that is present in cities, and thus the need to evolve towards a more sustainable urban mobility transition (Franssen et al., 2023).

A method that will help to shift towards this more sustainable form of urban mobility, is the concept of "car-reduced neighbourhoods"; neighbourhoods that have implemented policies and spatial designs that will discourage the usage of private cars (Selzer, 2021). The awareness of positive effects of a car free urban setting is growing worldwide (Marcheschi et al., 2022). However, the built environment is trapped in the path dependency of the car, discouraging the development of car-reduced neighbourhoods (Selzer & Lanzendorf, 2019). When it comes to car-reduced neighbourhoods and its effects on car mobility and car dependency, the amount of research is limited, leading to a gap between the goals of sustainability and actual practices of how cities are applying car-reducing spatial designs and policies when constructing new urban developments.

For now, only the inner city centre of Groningen is mostly car-free. However, further projects and policies are being developed to keep car emissions out of the city as much as possible and to create a better environment for cyclists and pedestrians (Gemeente Groningen, 2023). Relating this future prospect with the aforementioned research gap, it would be interesting to investigate to what extent the new neighbourhood developments in the city of Groningen execute practices that would lead to reduction of car use, and explore which

policies and spatial arrangements regarding a low-car neighbourhood developments will be implemented that will contribute to shape the future of the system of car mobility in the city of Groningen. Therefore, the main research question is:

- *How will new neighbourhood development projects shape the future of car mobility in the city of Groningen?*

With the following subquestions:

- How do urban characteristics of a neighbourhood influence car mobility?
- Which strategies regarding car-reduction are applied in new neighbourhood development projects in the city of Groningen?

### 1.3. Structure

The structure of the thesis will be as follows;

The next chapter will provide the theoretical framework of this research and will elaborate on the relevant theories and concepts. First it is explained how car dependency has arisen and how this has led to the system of automobility, and an explanation of its definition. Then it is described how it might be possible to break this pattern of car mobility and dependency, followed by strategies that are applied to counter car dependency.

The third chapter will describe the data collection and the methodology. Outlined here is the explanation of research methods, as well as an overview of interview participants.

In the fourth chapter, the results of the case studies analysis and the interviews are explained and discussed. First, the results of the case studies analysis of Meerstad and De Suikerzijde will identify the aims and characteristics of the neighbourhoods. This is followed up by the results of the interviews that were conducted for this research.

Lastly, chapter five will discuss the conclusion of this research and will include a discussion and reflection.

## 2. Theoretical Framework

### 2.1. The rise of car dependency and automobility

Today, the car is the single most important influence in urban planning (Freund & Miller, 1993). With the increase of automobiles in the 1910s, the problem of congestion on urban streets deteriorated (Brown, 2005). The implementation of certain traffic control measures brought temporary relief, but these strategies were too little for the increasing number of cars (Brown, 2009). Due to the flexibility and speed of the car, urban development was no longer dependent on fixed-track systems, allowing urban development to extend to wherever roads could be built. Therefore, the opportunity for transit city corridors was replaced by continuous suburbs first in cities of the USA, Australia and Canada, followed quickly by many other cities around the world, creating a new automobile-based urban fabric (Newman et al, 2016). These automobile cities with low-density and continuous urban sprawl encouraged car usage and provided limited support from public transport, and within a generation these areas generated the basis of car dependency and the *system of automobility* (Freund & Miller, 1993; Newman et al, 2016).

Urry (2004) defines automobility as a self-organising autopoietic, nonlinear system, where this system generates the preconditions for its own self-expansion. Explained by Kent (2022) and Haarstad et al. (2022) as well, automobility is a term used to describe the complex self-reinforcing relationship between car-dependent infrastructure and car travel.

As the consumption of cars rapidly increased, the spatial and social patterns of society changed as well and the sites of the daily rounds of social life became more dispersed, transforming the car from a choice into a requirement (Freund & Miller, 1993). Still today, a lot of social life cannot be undertaken without the flexibility of the car (Urry, 2004). However, this flexibility is necessitated by automobility. Home, work, business and leisure were historically integrated together, but have become unbundled by the urban environment (Urry, 2004). Therefore, automobility is a system that forces people into an intense flexibility (Sheller & Urry, 2000). The layout of cities became to substantiate a static architectural design that is interspersed with “ways” of mobility, such as bridges, expressways, bypasses, etcetera (Sheller & Urry, 2000). Closed off by this physical infrastructure of mobility, urban architecture has become a function of movement (Sheller & Urry, 2000).

### 2.2. Breaking the pattern of automobility and car dependency

As explained by Urry (2004), this system of automobility is shaped by the path-dependency of the car, which signifies that car-related changes in the 20th century have led to today's society to be dependent on the car. This has led to the system of automobility “locking in” an unsustainable society in which the built infrastructure, culture and norms prevent the transition to a more sustainable form of mobility (Urry, 2004; Haarstad et al., 2022).

The growth of automobility mainly involves new movement and not the replacement of public transport by the car (Urry, 2004). The car encourages individual journeys to be made, and most of the journeys made by cars were never made by other modes of transport in the first place (Urry, 2004). Therefore, as an irreversible consequence, Urry (2004) states that some car usage is inevitable and any post-car-system *will* involve individualised movement.

According to Newman and Kenworthy (2015), cities within the world can be divided into three categories: walking cities, transit cities and automobile cities, with most cities having a mixture of all three. The problem with the past 65 years in town planning was the belief that



there was only one type of planning: the automobile city. The rediscovery of the other city types has been a fundamental factor in the reduction of car dependence as a paradigm in urban planning (Newman and Kenworthy, 2015).

Besides, Newman & Kenworthy (2015) stated the exponential relationships between public transit and car use; by increasing public transit use per capita, the use of cars per capita is predicted to go exponentially down.

Added to this, Newman & Kenworthy (2015) and Freund & Miller (1993) concluded that there is an empirical correlation between urban density and auto-dependence. If density increases then car usage will decrease exponentially (Newman & Kenworthy, 2015). *“As cities begin to regenerate and to redevelop existing areas faster than they are opening up new areas further out, a range of car-use-reduction mechanisms begin to kick in: distances become shorter; walking, cycling, and public transit all become more viable due to time savings, and businesses begin to locate nearer to the people who have shifted. This is density leverage”*, (Newman & Kenworthy, 2015, p. 24). So, if urban areas wish to reduce car-dependency, the land-use density needs to be increased (Freund & Miller, 1993).

### 2.3. Car-reducing strategies

To break the current pattern of car dependency and automobility and thus decrease private car usage, certain strategies can be applied, such as car-restrictive policies. However, restricting car policies are limiting themselves and are likely to fail, unless they are combined and integrated with other modes of transport. In order to reduce automobility, whole transport systems and related infrastructures need to be rearranged (Freund & Miller, 1993). One way to start adapting infrastructure to reduce private car usage, is by designing *car-reduced neighbourhoods*; neighbourhoods that will limit the usage of private cars by their policies, spatial design and provided facilities, and thus stimulate other modes of transport (Selzer, 2021). Like Urry (2004), Selzer & Lanzendorf (2019) also state that private car usage is inevitable, hence the term “car-reduced” instead of “car-free”.

There are numerous spatial designs and policy strategies that will contribute to create a car-reduced environment in neighbourhoods. For example, the implementation of *new urban models*; infrastructural constructs that will help to diminish private car usage (Nieuwenhuijsen, 2021). A number of these new urban models are implemented in various cities to introduce a better use of the new and existing public spaces, such as the Superblocks, the low traffic neighbourhood, 15 Minute city, Car free city or a combination of these (Nieuwenhuijsen, 2021). These concepts all aim to reduce private car use and increase public transportation, walking, and cycling (Nieuwenhuijsen, 2021).

Besides this, parking management is another key factor in reducing private car usage (Kirschner & Lanzendorf, 2020). Different kinds of parking-related policy options that demotivate private car usage or stimulate other transport modes are an important tool for municipalities to manage urban mobility (Kirschner & Lanzendorf, 2020). The residential parking location and availability is connected to the car ownership and car usage of a household, and requirements for creating a certain amount of parking spaces are commonly used to ensure the availability of car parking spaces in new housing (Kirschner & Landendorf, 2020; Johansson et al., 2019). These so-called minimum parking requirements became institutionalised in many countries in the world in the 20th century and onwards, but had many downsides and therefore policies are slowly shifting from a focus on vehicles and traffic flows towards people, accessibility, and mobility (Johansson et al., 2019).

Another car-reducing strategy is car-sharing (Glott-Richter, 2016). Car sharing offers a car to your disposal without ownership and has therefore the potential of reducing the amount of private cars without reducing individual mobility (Glott-Richter, 2016). This car-sharing is often combined with the concept of a “Mobility hub” that offers sustainable mobility options from one spot so citizens can abstain from their private cars (Miramontes et al., 2017). Overall, when implementing car-reducing strategies, the concept of “Carrot and Stick” policies is often applied and recurring (Pucher & Buehler, 2008). “The carrot” are measurements promoting other modes of transport (i.e. mobility management, cycling campaign, and investments in public transport) and “the stick” are car-restrictive policies (i.e. parking management scheme and environmental zone) (Pucher & Buehler, 2008; Miramontes et al., 2017). The combination of these two policy approaches will stimulate alternative transport modes like cycling and reduce the amount of private cars in the city (Pucher & Buehler, 2008).

#### 2.4. Conceptual Model

The future of car mobility of future neighbourhoods will be influenced by the mobility strategies that will be implemented in these new neighbourhood development projects. These mobility strategies are connected to the pattern of car-dependency and how the car is dominant in urban designs.

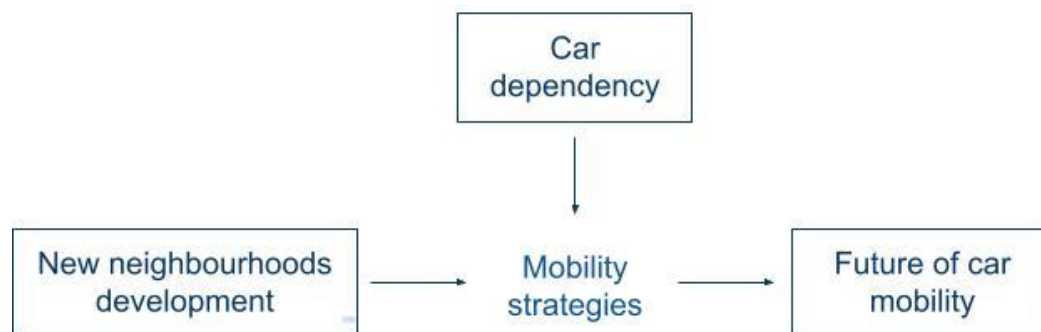


Figure 1: conceptual model

### 3. Methodology

In this chapter, the methodology will be described. This will include the research strategies applied and the data collected. Besides this, the participants of the interviews are introduced and the ethics regarding data collection are outlined.

#### 3.1. Research strategy

To investigate to what extent newly developed neighbourhoods contribute to shaping car mobility, a combination of primary and secondary data collection will be applied. Since the focus will be on the city of Groningen and literature on the future prospects of the relation between urban form and car usage has its limitations, in-depth interviews with experts that have knowledge about car mobility will be the main source of information (primary data collection). To give more guidance to these interviews and link it to the city of Groningen, a two case study analysis of new neighbourhood developments located in the city of Groningen, **Meerstad** and **De Suikerzijde**, will be compared due to their contrasting approach of private cars (secondary data collection).

#### 3.2. Primary data collection

As the main data collection method, primary data will be collected by means of interviews. These interviews will help to investigate the predictions for the future of car mobility and car dependency in the city of Groningen and which strategies will be implemented in new neighbourhood developments that will contribute to potential changes in the system of car mobility. Therefore, experts on the field of urban planning and/or project development who have a (close) relation to the projects of Meerstad and/or De Suikerzijde were approached for the interviews. Knowledge collected with these interviews will provide the main information for constructing the conclusion. In total, 10 experts from 8 organisations were interviewed, and are specified in the following scheme (see table 1). The list of questions asked during the interviews can be found in appendix 1. After conducting the interviews, the interviews were transcribed and coded. With the resulting codes, key words and themes were found that formed the basis of the results.

Name	Organisation	Function	Project
Andries Venema	Nijestee	Project developer	Suikerzijde / Meerstad
Annick van Vliet	De Suikerzijde BV	Area developer	Suikerzijde
Arjen van der Veen	Heijmans	Senior developer	Meerstad
Bart van Leeuwen	De Zwarte Hond	Urban planner	Meerstad
Kees van den Berg	Patrimonium	Real estate manager	Suikerzijde
Kiki Ongering	VanWijnen	Project developer	Meerstad
Marieke Venema	VanWijnen	Sales manager	Meerstad
Rob Brink	Gemeente Groningen	Urban planner	Meerstad
Rob Dijkman	VanWonen	Project developer	Meerstad
Robin Schliephake	De Zwarte Hond	Urban project manager	Suikerzijde

*Table 1: list of interviewees*

### 3.3. Secondary data collection

The in-depth interview will be supported by a case study of the two chosen neighbourhoods Meerstad and De Suikerzijde. This case study will explain the different characteristics of the two neighbourhoods and the differences between them. This is primarily done with the information from Gemeente Groningen and Bureau Meerstad and policy documents that are part of the process of the projects related to Meerstad and De Suikerzijde. These two case studies are neighbourhoods that are currently being developed, with Meerstad already being partly utilised, while the first developments of De Suikerzijde will start soon. Both neighbourhoods are part of the housing market strategies to achieve housing for the enormous housing demand in Groningen (Gemeente Groningen, 2016). Meerstad is a neighbourhood located at the edge of the city of Groningen, and is expected to be car based and thus having a high degree of car dependency. De Suikerzijde is being profiled as a green, mixed-usage neighbourhood where the car is subordinate to other forms of transport (Gemeente Groningen, 2022). Comparing these two cases will give us insight into if and how the new neighbourhood development projects of the city of Groningen take the reduction of car usage into consideration and therefore contribute to shaping the future of car mobility in the city of Groningen.

### 3.4. Ethics

Before conducting the interviews, the respondents were asked permission for recording the interviews, as well as using this information for this research. After transcribing the interviews, the transcripts were sent to the concerning participants so they had the option to edit the transcripts. Also, permission was asked for using the information provided in the transcripts for this research. The transcripts were edited where indicated by the participants and all the participants gave permission for using the obtained information. The transcripts will not be an official appendix for this research but will be a confidential appendix only accessible for authorised persons.

## 4. Results

In this chapter, the results of the case study analysis and the interviews will be discussed. First, the results of the case study analysis are illustrated and the current situation of Meerstad and De Suikerzijde including their aims, urban form, sustainability and traffic/mobility will be discussed. Then, the results from the interviews are given, divided in different subcategories based on the themes that were found with coding. Here will be explained what the current situation regarding mobility and private car usage are in Meerstad and De Suikerzijde, as well as expected mobility strategies and the future perspective on private car usage.

### 4.1. Case studies

In order to give more direction to the interviews, two new neighbourhood developments located in the city of Groningen, Meerstad and De Suikerzijde, were chosen to investigate how usage of private cars is taken into account. These two neighbourhoods are contrasting each other in terms of their location and the dependency on private car usage. Therefore, it is interesting to see the different approaches the city of Groningen has for these projects.

#### 4.1.1. Meerstad

Meerstad is a new residential area located East at the edge of the city of Groningen. It is located at the Woldmeer, close to Slochteren (see figure 2) (Meerstad, 2023). The aim was to create an important living area with a high value for the city of Groningen and its functioning that will give a boost to the whole area, and to add houses in the mid-high price range to counter deflation from the city to other regions (MindScape organisatie adviseurs, 2013; Bureau Meerstad, 2022). It will consist of multiple neighbourhoods that each will have their own living experience and different housing typologies, but all with an emphasis on combining living with nature (Meerstad, 2023). After an artificial lake was constructed in 2005, the construction of the first part of Meerstad called Meerrovers started, followed by Tersluis and in 2019 with De Groenewei and De Zeilen (De Zwarte Hond, 2010, 2018; Gemeente Groningen, 2019).

The next step in the developments of Meerstad is the development of further regions located around the existing part of Meerstad, which will be Eemskanaalzone, Grunopark/De Wierden and the expansion of Harkstede (Bureau Meerstad, 2022)

Originally, Meerstad was supposed to have 10.000 houses, but this was scaled back to 6500 due to the financial crisis (Gebiedsontwikkeling, 2021). However, due to the increasing demand for more housing in Groningen, this is now scaled up to 8000 houses (Bureau Meerstad, 2022).

#### 4.1.2. De Suikerzijde

De Suikerzijde is a future neighbourhood located at the site of the former sugar factory, close to the city centre at the edge of the western side of the city of Groningen (see figure 2) (Gemeente Groningen, 2023).

In the policy document “The Next City”, the area of the former sugar factory is designated as one of the development zones that will realise a share of the 20.000 homes the city of Groningen wants to build in the coming years (Gemeente Groningen, 2018). The vision of

the Suikerzijde consists of four main principles: connecting, street-diversity, generosity and quality of life. De Suikerzijde will aim to have a good connection with the (inner) city of Groningen and its surroundings. The streets will have a variation of housing typologies, an generous urban structure that provides space for mixed usage and a natural decor that creates a healthy living environment (Gemeente Groningen, 2020). De Suikerzijde will facilitate 5000 homes, as well as commercial and social services, creating a mixed-usage environment for everybody (Gemeente Groningen, 2023; De Suikerzijde, 2022). The first constructions of De Suikerzijde began in early 2023 and the building of the first homes is expected in 2024 (Gemeente Groningen, 2023).

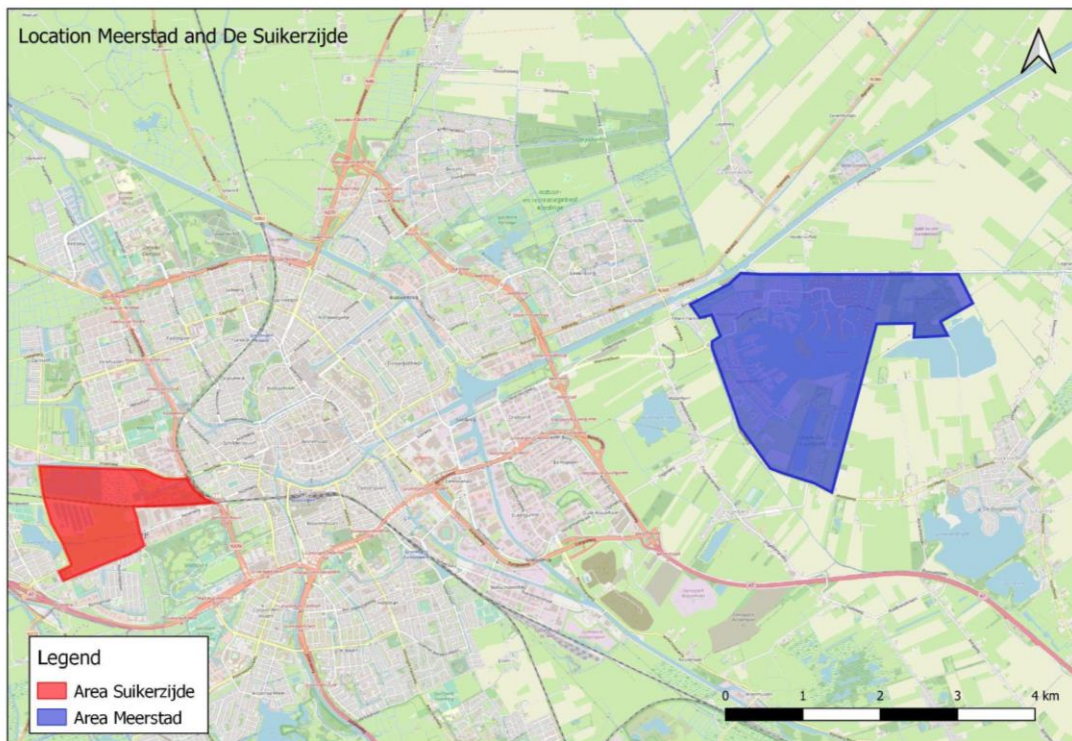


Figure 2: Location of the area of Meerstad and De Suikerzijde in the city of Groningen

#### 4.1.3. Comparison

##### *Urban design*

When it comes to urban design, the two neighbourhoods are contrasting in nature. Meerstad is located at the edge of Groningen. It has spacious residential areas and spacious plots interspersed with a lot of nature (Bureau Meerstad, 2022). Overall, Meerstad has a low building density (Laos Landschapsarchitect, n.b.). In the original plan, the focus was on creating more houses in the mid-high to expensive price range. In further expansion of Meerstad, indicated in the “Agenda voor de Toekomst” (2022), this focus is shifting towards mixing different housing typologies with its own character. Eemskanaalzone will therefore have smaller buildings and more stacked houses, the Eastern part around Harkstede will have a more rural character with spacious plots and Grunopark/ De Wierden will be a mixture of both (Bureau Meerstad, 2022).

Right now, the only available facilities in Meerstad are a supermarket, primary school with daycare, and a health centre (Meerstad, 2023). This creates a low proximity of facilities in

Meerstad. In the future, it is aiming towards more facilities and mixed usage (Bureau Meerstad, 2022).

Contrasting to Meerstad, De Suikerzijde will have a high building density, though consisting of different housing typologies as well. It was a strategic choice to accommodate growth of the city within the existing city. Due to this location, the design of De Suikerzijde adheres to the concept of the compact city and aiming high proximity. It will be a mixed usage neighbourhood with an urban character and a good relationship between living, business, education and recreation (Gemeente Groningen, 2022)

#### *Sustainability:*

Both Meerstad and De Suikerzijde are making certain aims when it comes to sustainability. In multiple policy documents regarding the developments of the different neighbourhoods in Meerstad it is stated that the neighbourhoods will be sustainable on all aspects of sustainability, such as energy, ecology, mobility and general quality of life. In terms of energy and ecology, this is for example done by removing the gas network to reduce the usage of fossil fuels and carbon emissions, and encouraging the usage of solar collectors, green roofs and heat pumps. To support the nature in the area, nesting stones or roof tiles are integrated into the design and green roofs and facades are encouraged (De Zwarte Hond et al., 2018). However, the previously mentioned mobility in terms of sustainability has not been further mentioned. The only way sustainability in mobility is attempted, is by working with sustainable materials and creating roads with a green character (De Zwarte Hond et al, 2018). Mentioned in "Agenda voor de Toekomst" (2022), Meerstad will have more focus on sustainable mobility in the future in a way that it is trying to minimise the carbon emissions, but currently, there is not a focus on car-reduction.

A similar approach to sustainability can also be seen in De Suikerzijde. The municipality of Groningen is striving to achieve high sustainability in public spaces and infrastructure, with the aim of 16m<sup>2</sup> public green space per home, and neighbourhood green within a radius of 250 metres and parks within 750 metres (Gemeente Groningen, 2020). Besides this, the energy and heat used in the neighbourhood should originate from renewable resources (Sweco, 2020). Contrasting to Meerstad is that De Suikerzijde will try to reduce its private car usage and replace them with more sustainable alternatives like public transport, cycling and walking. Interesting to see is that this goal of a car-reduced environment is often mentioned in the context of quality of life, and not in the context sustainability (Gemeente Groningen, 2020).

#### *Traffic and mobility:*

When it comes to mobility, Meerstad and De Suikerzijde have similar approaches, despite their difference in location. In Meerstad, there is one main route for car traffic which is the Vossenburglaan. From here, the various neighbourhoods can be reached by car (De Zwarte Hond et al., 2020). Similarly, De Suikerzijde will also have a main axis for car traffic from where the streets in the neighbourhood can be reached. Just like Meerstad, these connecting streets to this main road will mainly be destination traffic (Gemeente Groningen, 2020). In this urban layout, there is not much difference between these two neighbourhoods. However, the car will be subordinate to walking, cycling and public transport in De Suikerzijde (De Suikerzijde, 2022). This difference between Meerstad and De Suikerzijde is done by parking strategies. Unlike in Meerstad, De Suikerzijde will not allow cars parked in public spaces. Cars will need to be parked in a shared parking hub or on private property



(De Suikerzijde, 2022). Besides this, De Suikerzijde will implement a lower parking standard than Meerstad to try to reduce private car usage. In Meerstad, semi-detached and detached houses have a parking standard of 2.0 per home, meaning a house needs to have 2 parking spots. For visitors, this parking standard is 0.3 (Gemeente Groningen, 2022). In De Suikerzijde, the expected parking standard is 1.0 per house and 0.3 for visitors (Sweco, 2021).

Interesting is that the parking space for cars in Meerstad must be realised on private property, preferably behind the buildings and out of sight, to minimise the impact of cars parked on the street (De Zwarte Hond, 2018).

When it comes to cycling, the Vossenburglaan has a fast and safe cycle route (De Zwarte Hond et al., 2018). Most of the cycle paths and pedestrian paths present in Meerstad will be alongside the car roads, with Tersluis and Groenewei hardly containing any separate cycle paths (De Zwarte Hond, 2015; De Zwarte Hond et al., 2018). A bicycle lane will be constructed towards Slochterdiep, as well as passages (“*doorsteken*”) to make a better connection with this area (De Zwarte Hond et al., 2020).

De Suikerzijde will have a well-developed network of separate cycling paths (Gemeente Groningen, 2022). Right now, a fast-cycle lane is under construction to connect De Suikerzijde with the inner city of Groningen (Groninger Internet Courant, 2021).

Public transport has similarities but will be a bit more developed in De Suikerzijde. In Meerstad, various bus stops will be located along Vossenburglaan (De Zwarte Hond et al., 2020). Besides a bus line that will go through De Suikerzijde, there is the desire to include an OV-hub with a train station in the future, which will take pressure off of taking the car (Gemeente Groningen, 2020).

## 4.2. Interviews

As main research methods for this thesis, 8 in-depth interviews were conducted with 10 participants. All the participants are experts in the field of urban planning. In the interviews, a total of 12 to 14 questions - depending on the case study the participant was more focussed on - were asked about the situation regarding car-mobility and car-dependency in the neighbourhoods Meerstad and De Suikerzijde, and the future prospective on these topics. An overview of the questions can be found in Appendix 1. The most important questions of the interviews were how private car usage is taken into consideration in the current situation of the two case studies and how the participants expect car-usage in cities will be shaped in the future, and the strategies new neighbourhood developments will implement regarding car-dependency.

After coding the interviews, three main themes were found; sustainability, mobility and urban design. Within these three themes, multiple recurring key words/ concepts were found that were mentioned often in these interviews. The main concepts recurring within these themes were car dependency, alternative modes of transport like public transport and car sharing, and parking policies such as parking standards and parking hubs. A fourth theme, *uncertainty*, could slightly be distinguished. However, this was more related to the future prospect of car mobility.

## *Sustainability*

The overall overarching theme of the interviews was *sustainability*. It is more an overarching theme than a stand-alone one, since the main points talked about in the interview were done within the thought of making cities as sustainable as possible and doing this mostly with scaling down private car usage. Groningen is very consciously working on reducing car usage and encouraging less use of the car. Both in Meerstad and De Suikerzijde, there is a trend going on towards climate adaptation and trying to be as sustainable as possible. Furthermore, the participants of the interviews linked reducing private car usage as a means to respond to the upcoming trend of sustainability. In De Suikerzijde, these things will be implemented on the forehand by implementing strategies that will reduce private car usage overall and will stimulate other modes of transport that are more sustainable. In order for the car-reduced neighbourhoods to work, most of the participants indicated that in general good alternatives need to present:

*“If you have set yourself the goal of getting rid of cars, then you first have to work out very good alternatives”, (Brink, Gemeente Groningen).*

*Car dependency* will only be able to be reduced if there is a good alternative that can be used instead, such as *“good bicycle connections, well-organised public transport, and the possibility for shared cars, combined with discouragement policy, for example by setting a very strict parking standard or by keeping parking away from the neighbourhood”* (Dijkman, VanWonen). These alternatives will be further explained below.

In Meerstad, the houses are built to be as sustainable as possible. However, in the current situation Meerstad has not implemented policies to reduce private car usage as a sustainable option, and participants of the interviews have indicated that it is hard to implement these in the existing Meerstad. Replacing fossil fuelled cars with electric vehicles was mentioned by multiple participants as something that is currently trending to sustain mobility. This trend was not necessarily mentioned as something that will be an achievable solution for reducing climate change in the future, and its remarks were made clear: *“If we all keep private cars, then also that the entire float must all be electrified; that is not possible at all. There is not enough electricity and material available to achieve this”,* (Venema, Nijestee). However, it can be a solution for places where it would be hard to achieve a car-reduced environment, like Meerstad; *“But I also think that we should not deny that people still drive a car. And I think it's a good step that it's sustainable.”* (Venema, VanWijnen).

## *Mobility*

Another theme indicated throughout the interviews was *mobility*. As mentioned earlier, three main alternative mobility strategies - public transport, car-sharing and a well organised cycle network - were mentioned as a necessity for a car reduced environment to work and were therefore often suggested in the interviews. Besides this, *parking* was mentioned as a main factor of private car usage in Meerstad and De Suikerzijde.

When being asked in which way private car usage is taken into account within Meerstad and/or De Suikerzijde, all the participants replied that the *parking standards* are the main element that needs to be taken into consideration. Most participants said these parking standards are the main influence of usage of private cars in their projects, for both Meerstad

and Suikerzijde. These parking standards “*not only depend on the location, but also on the type of housing*”. (Brink, Gemeente Groningen). Therefore, the parking standard for Meerstad as a suburb of Groningen was 1 to 2 parking places per home, and De Suikerzijde as an inner city neighbourhood is aiming for a lower parking standard than this.

Furthermore, the usage of private cars in Meerstad is discouraged by the implementation of fast and accessible cycle routes from Meerstad to the city centre of Groningen and the implementation of a bus line from Groningen to Meerstad. Besides that, cars are mainly parked out of sight. “*In this way, the design takes into account that the impact of the car on the quality of life is minimised*”, (Van Leeuwen, De Zwarte Hond). However, this will not do anything to reduce car usage: “*the goal of not seeing car ownership on the street is achieved, but the problem of car ownership is still there; it’s just moved*,” (Venema, Nijestee). De Suikerzijde will aim to reduce private car usage by not allowing cars to be parked in public spaces. Therefore, in all probability a parking hub will be constructed where inhabitants of the neighbourhoods need to park their car. Besides this, the concept of car-sharing will be encouraged to reduce the amount of private cars. There will be only one main road for the car; on other roads in the neighbourhood the car will be “a guest”. This reduction of car usage will be enhanced by the train station that will be added. In addition to this public transport system, De Suikerzijde will have a strong cycle path system that will make cycling as nice and as easy as possible.

Mobility is also a strong theme when it comes to the future perspective of car-mobility and car-dependency in neighbourhoods. A system of alternative transport modes that are more sustainable than private cars is necessary in order to reduce private car usage. When being asked how the participants expect the future car mobility will be designed in general as well in the city of Groningen and which strategies are or will be applied to reduce private car usage, the participants were in line that the implementation of parking hubs or mobility hubs will be major in the future:

*“A trending topic is creating residential areas where the car is a guest or is not allowed to enter. So that has to do with the layout of the streets; you don’t make motorways, but different types of paving. Parking is solved in the buildings or in parking hubs. A parking hub is then simply a kind of building stacked where you can park, but you can also add additional facilities, such as parcel points, perhaps a collective bicycle shed; like a neighbourhood centre. Shared mobility could also play a role here”*, (Venema, Nijestee).

It is expected that these mobility hubs will be implemented at the edge of neighbourhoods to provide parking spaces, as well as other facilities. The car will only be used to enter and leave the neighbourhood, making the neighbourhood itself car free. This will reduce the amount of cars in the neighbourhood itself and thus make the neighbourhood less car dependent. “*With mobility hubs, we want to concentrate parking on one spot in a parking building which also has other functions such as parcel services, bicycle storage, things like that, so that you can actually free the rest of your public space. And also above the ground, so no underground parking*”, (Van Leeuwen, De Zwarte Hond). A side note to this solution is that bordering neighbourhoods need to have a certain parking policy as well to prevent inhabitants of car-reduced neighbourhoods from parking in these neighbourhoods (VanWijnen; De Suikerzijde).

Another alternative mentioned to fill the gap that will be created when decreasing private car usage, is a well-functioning *public transport network*. Important here is that the quality of this alternative needs to be good and well accessible in order to work as a good alternative, for example in public transport:

*“If you know you have a seat, that you can get from A to B quickly and it is affordable, cheaper than the car, then people will really consider it. In the Netherlands it is still too often the case that the train journey is more expensive and sometimes twice as long than by car, and sometimes you also have to stand [...] if you promote it, you need to make sure it is well organised up-front”* (Van den Berg, Patrimonium).

*“...[Public transport] is getting more and more expensive and is also being moved further away from residential areas, but more often along the main road. You will have to ensure that public transport is an attractive alternative to the car itself”,* (Brink, Gemeente Groningen).

All of the respondents see an increased focus of *shared cars* in future plans and see shared cars as an alternative to private cars as a solution to reduce car dependency in the city of Groningen. Expected was that sharing cars would only be a good alternative for private cars in inner city regions that are already less car-dependent (Van der Veen, Heijmans) Sharing a car was sometimes also seen as a good replacement for second car ownership (Schliephake, De Zwarte Hond; Van Vliet, Suikerzijde BV). Besides this, shared cars will only work if people will attach less value to the possession of a car (Ongering and Venema, VanWijnen; Brink, Gemeente Groningen) and likely, this car-sharing will be popular among now younger generation (Ongering and Venema, VanWijnen; Van der Veen, Heijmans) since they are already using a lot of similar services such as Swapfiets and Felyx scooters (Ongering and Venema, VanWijnen).

### *Urban Design*

The last theme definable for the interviews was *urban design*. The participants emphasised how specific urban profiles can contribute to car mobility. The participants agreed that the proximity and accessibility to facilities is important if you want to make a city less car-dependent. For example, Van Leeuwen and Schliephake (De Zwarte Hond) stated that they therefore primarily develop new projects on locations where this proximity and accessibility can be achieved:

*“I think you should start with where you develop, so build on locations where you need as few cars as possible. [...] It makes more sense to build homes at locations where you need fewer transport movements in general, for example station areas, so you don't need the car at all”,* (Van Leeuwen and Schliephake, De Zwarte Hond)

It is also indicated in future prospects of Meerstad that the aim is to create more accessibility which will stimulate a reduction of private car usage, as Brink (Gemeente Groningen) added: *“So we have now chosen not to make 1 centre, but to make 3, 4 smaller centres. And the same goes for schools, so that one does not have to take the car for that distance. Meerstad*

*is still a neighbourhood that is known for its spacious plots, but we will try to temper that by placing facilities closer.”*

#### *Future perspective - uncertainty*

Noted by multiple participants however is that it is important to get people used to the idea of a car-reduced environment in order for it to work in the future. *“In neighbourhoods such as De Suikerzijde, the car will probably not be at the front door. But they also get a lot in return. And people need to experience that. That is very unfamiliar for a lot of people.”* (Van den Berg, Patrimonium). To make people more familiar with the idea of car-reduced neighbourhoods, people can be educated more about the idea, but overall it just needs time (Van der Veen, Heijmans).

Overall, emphasised by multiple participants was the expectations regarding car usage in the future will still be uncertain, despite their expectations of a decrease of private car usage in the future of the city of Groningen. Technology is nowadays too unpredictable to give a certain determination of how the future will look like.

## 5. Conclusion and discussion

### 5.1. Conclusion

Since the increase of automobiles since the 1910s, cars have been influencing urban infrastructure and behaviour patterns. Auto-centric cities with low-density and continuous urban sprawl created due to this, encouraged car usage and provided limited support from public transport. Within a generation these areas generated the basis of car dependency and the system of automobility. This system of automobility is a term used to describe the complex self-reinforcing relationship between car-dependent infrastructure and car travel. Even though a car-reduced future is predicted and new projects are taking this into account, it is important to realise that car usage cannot be completely removed or extremely reduced. The world and its infrastructure is designed in such a way that the usage of (private) cars will always be necessary. Still, certain implementations can be applied that will redesign the way cars will be used in the future to a certain extent.

These implementations regarding urban form influences travel behaviour and therefore how we build the city has an impact on our mobility patterns. To examine this, this project has looked into Groningen and in particular two cases: Meerstad and De Suikerzijde; two neighbourhoods that will reflect the future of the city of Groningen. Their contrasting approaches to car usage was interesting to analyse. Due to its location, Meerstad has a low building density and low proximity, making private car usage almost inevitable. De Suikerzijde will aim for a high building density and high proximity due to their location in the city that does not allow expansion. Therefore, a car-reduced environment will be a base principle of this neighbourhood.

This proximity present in urban designs plays an important role when it comes to automobility and the dependency of the car. The more distance from a city centre or facilities in general, the more car dependent a neighbourhood will most likely become. Whenever a neighbourhood has a mixed usage design and has most of its facilities nearby, it would be less necessary to take the car. Nevertheless, well-structured alternatives still need to be present, such as good bicycle or pedestrian paths.

Currently, the only way private car usage is taken into account in the two neighbourhoods is by parking standards that indicate how much parking is allowed per home. When it comes to the future of car mobility in neighbourhood development projects, one of the main developments that are implemented more frequently are parking hubs or mobility hubs. These hubs will be located at the edge of the neighbourhoods to provide parking spaces, as well as other facilities. Private cars need to be parked here and are not allowed into the neighbourhood.

In addition, mobility choices will also be impacted by these mobility strategies. It is therefore important that good alternatives are available in order to stimulate reducing private car usage. These alternatives are a well-organised public transport, a good cycle path network and pedestrian paths, and/or a car-sharing system.

Additionally, car-sharing will more often be implemented in the future. By sharing a car, the amount of private cars necessary will be reduced. Households often have two cars where one of the cars is the second car which is more flexible.

Overall, the city of Groningen will focus more on reducing private car usage and discourage it in its new neighbourhood developments, and thus the car dependency will likely be reduced. The main solutions that will preferably be applied to achieve this are mobility hubs, investing in good alternatives such as car-sharing and a well-functioning public transport network, and increasing the overall accessibility of neighbourhoods and cities so the car will be less necessary for short journeys. These implementations applied in new neighbourhood development projects will shape the car mobility in Groningen in such a way that they become less car dependent, leading to a decrease of car usage in these neighbourhoods in the future.

## 5.2. Discussion and reflection

It is hard to understand the system of automobility and cities have been designed in such a way that breaking car dependency has become a hard task. This was described in the theoretical framework, but could have been more reflected in the rest of the research. Furthermore, the question guide for the interviews could have included more specific questions about Meerstad and De Suikerzijde so it would have been more in line with the case study analysis. Also, since this thesis is about Groningen, the research could have been less general and focused more on characteristics of Groningen, for example how it may differentiate itself from other cities. Nevertheless, the interview guide gave me a well-reflective set of answers that helped construct a conclusion.

It was a good experience to reflect on things that you have learned throughout the study in real life situations and to see how your framework built throughout the bachelor years can be recognised outside of this study. Even though the topic of this thesis was more focused on mobility than on urban form, working on this thesis has made me realise my passion for urban design and I look forward towards gaining more knowledge about this subject.

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#### Appendix 1: List of questions interview

1. Wie bent u en wat is uw functie binnen het bedrijf?
2. U bent werkzaam bij de ontwikkelingen van de Suikerzijde en/of Meerstad. Wat is uw rol bij dit project?
3. Op wat voor manieren is er rekening gehouden met het gebruik van privé-auto's bij de projecten Meerstad en/of De Suikerzijde? Denk aan restrictief beleid, bepaalde stedelijke ontwerpen, transport alternatieven etc.
4. Op welke manieren wordt de mobiliteit ingericht bij deze projecten? Hoe wordt er bijvoorbeeld rekening gehouden met de aanleg van voetpaden en fietspaden? Krijgt dit langzame verkeer ook voorrang t.o.v autowegen?  
Hoe wordt het netwerk van openbaar vervoer?
5. Op wat voor manieren is er rekening gehouden met het gebruik van privé-auto's bij andere projecten waar u aan gewerkt heeft, zowel huidige als voorgaande projecten?
6. Welke strategieën zijn er toegepast om de Suikerzijde autoluw te maken?
7. Stel u hoeft geen rekening te houden met bepaalde eisen en normen, op welke manieren zou u rekening houden met het gebruik van privé-auto's bij een nieuw project?
8. Heeft u in het verleden bij projecten bepaalde strategieën toegepast op gebied van autogebruik en/ of duurzaamheid die uiteindelijk een ander resultaat hadden dan verwacht? Dit kan zowel een negatief als een positief resultaat zijn.
9. Welke strategieën stelt u voor dat het antwoord zou kunnen zijn op het terugdringen van de auto afhankelijkheid in steden?
10. Welke projecten en/ of steden ziet u als een voorbeeld voor de toekomst van autogebruik in steden?

11. Wat verwacht u wat de toekomst van autogebruik en automobilititeit in steden zou zijn? Op welke manieren verwacht u dat auto's wel of niet dominant zullen zijn in steden?
12. Wat verwacht u wat de toekomst van autogebruik en automobilititeit in Groningen zou zijn? Denkt u dat Groningen een voorbeeld gaat zijn voor andere steden? Verwacht u dat projecten zoals Meerstad, Reitdiep en/of De Suikerzijde voorbeelden gaan zijn voor andere wijken?
13. In hoeverre denkt u dat alternatieven voor privé-auto's (deelauto's, AV's, MAAS etc.) een oplossing zullen zijn voor het terugdringen van auto-afhankelijkheid? Wat is uw mening over deze alternatieve oplossingen? v
14. Heeft u verder nog opmerkingen, suggesties of iets anders wat u graag kwijt wil?