TOWARDS CARFREE CITIES

Looking for effective and feasible policies for municipalities to convert towards a carfree or low-car city

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Movares
adviseurs & ingenieurs

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by

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Preface

"A good city is like a good party, people don't want to leave early. —Jan Gehl

Over the past few years, my interest in cities has grown. I find it fascinating how our cities have developed and the role mobility has played in this. How can we design vibrant, inclusive and sustainable cities? There is no easy answer to that, but it is important to keep asking that question. With this thesis I conclude my Master of Science in Complex Systems Engineering and Management with the specialisation track Transport and Logistics at the University of Technology in Delft. It was a pleasure to write this thesis in this context of carfree cities. Although it had its highs and lows, I enjoyed working on this study in the past five months. I would like to take this opportunity to express my sincere thanks to a number of people.

At first, many thanks to the people of Movares, to provide me the opportunity to conduct my research in an inspirational environment. Although Corona threw a spanner in the works, I really appreciated being part of the Movares community. I would like to thank Fabian Wegewijs for his guidance, feedback and support throughout the process. He provided me access to a network of experts and the readability of this thesis has increased considerably because of him. I would like to thank Wijnand Veeneman for his constructive criticism, expertise and support. I admire his skills in drawing a schematic sketch of a research design within 2 minutes. I would like to thank my first supervisor, Jan Anne Annema, for his support and insight throughout my thesis. I really appreciated his help in the formulation of my early ideas, his constructive feedback, prompt replies and focus on solutions. My gratitude goes to the eight interviewees, for their cooperation, and the interesting insights they provided. I would also like to thank all the wonderful people who were willing to review (parts of) my thesis.

Finally, I am very grateful for all the family and friends that were there along the way, during my time here in Delft. Thanks for your support and encouragement.

Matthias Floor
Delft, July 2020

Executive summary

Cities are on the rise. In recent years, cities have faced an increase in economic growth, employment rates and population numbers. As a result, the accessibility of cities and the accessibility within cities are under pressure which is mainly the result of an increase in the number of cars. This results in effects like an increase of congestion, as well as a number of other negative impacts concerning the environment, social life and public health. One of the possibilities to cope with this problem is to free existing cities of cars, resulting in 'carfree cities'. The potential benefits of such carfree cities are tremendous, and include a reduction of noise, stench and danger of cars, and an improvement of the quality of life. As these proposed benefits are high, it is important to find out whether there is a need for these carfree cities; to find out a what the added value of such carfree cities is; which policies are successful in this transition to carfree cities, and under what requirements and challenges this transition can take place.

We identified a knowledge gap regarding the following three issues: 1) A clear overview of the characteristics and expected results of a carfree city, 2) a list of possible effective and feasible policies of municipalities towards low-car or carfree cities, and 3) an evaluation of how these policies can contribute in achieving carfree cities. Therefore, the following research question has been defined:

"Which government policies have shown or are regarded by experts to be effective and feasible in contributing to the realisation of low-car or carfree cities and what are thereof the implications in achieving carfree cities?"

This thesis aimed to fill the current knowledge gaps regarding carfree cities and to come up with a research into effective and feasible policies for municipalities to convert to a carfree or low-car city. Our study consists of four parts:

1. A literature review into the characteristics and desired results of a carfree or low-car city;
2. A search into potential policies towards a low-car or carfree city, with use of a desk study based on literature and policy documents;
3. An evaluation of the effectiveness and feasibility of these policies, based on scientific literature; a comparison between cities with and without a certain policy intervention; a correlation analysis and semi-structured interviews with experts;
4. A case study in order to examine the implications of implementing a package of policy measures in practice.

Main findings

With our literature review we analysed several characteristics and desired results of carfree or low-car cities. We found that carfree or low-car cities may contribute to a wide scale of desired effects, often related to the liveability of cities, and often covering multiple goals. In the next step we identified many potential policies applied, and intended to be applied, by municipalities to achieve a low-car or carfree city. We categorised these into eleven groups. Although for a few cases we know something about their effectiveness and feasibility, this is 1) often only the case regarding some separate interventions and 2) the comparability of the effectiveness and feasibility of these measures is often low.

After the identification of policies, we evaluated three groups of measures in-depth. For all these groups we carried out an analysis into the effectiveness of this group of measures, based on literature, a comparison between cities with and without this intervention, and a correlation analysis between the modal share and indicators for the implementation of the intervention. We conducted interviews with two policy-makers, two experts-in-the-field and two academics to analyse the feasibility of the groups of measures. For all three groups we reported both the effectiveness and the feasibility. In general the group of 'price measures and

restraining cars' can be seen as very effective, but challenging when it comes to social and political feasibility. Regarding the group of measures focused on 'Improvement and innovation of collective transport services', we found that the feasibility of this group of measures is high. However, although the expected effectiveness of this group of measures is promising, solid justification is often lacking. For the last group, 'Making slow traffic more attractive', we found that the feasibility of this group is regarded as (very) high, but convincing evidence of the effectiveness is lacking, or shows only a limited effect on the decrease of modal share of cars. An overview of the findings of this evaluation can be found in figure 1.

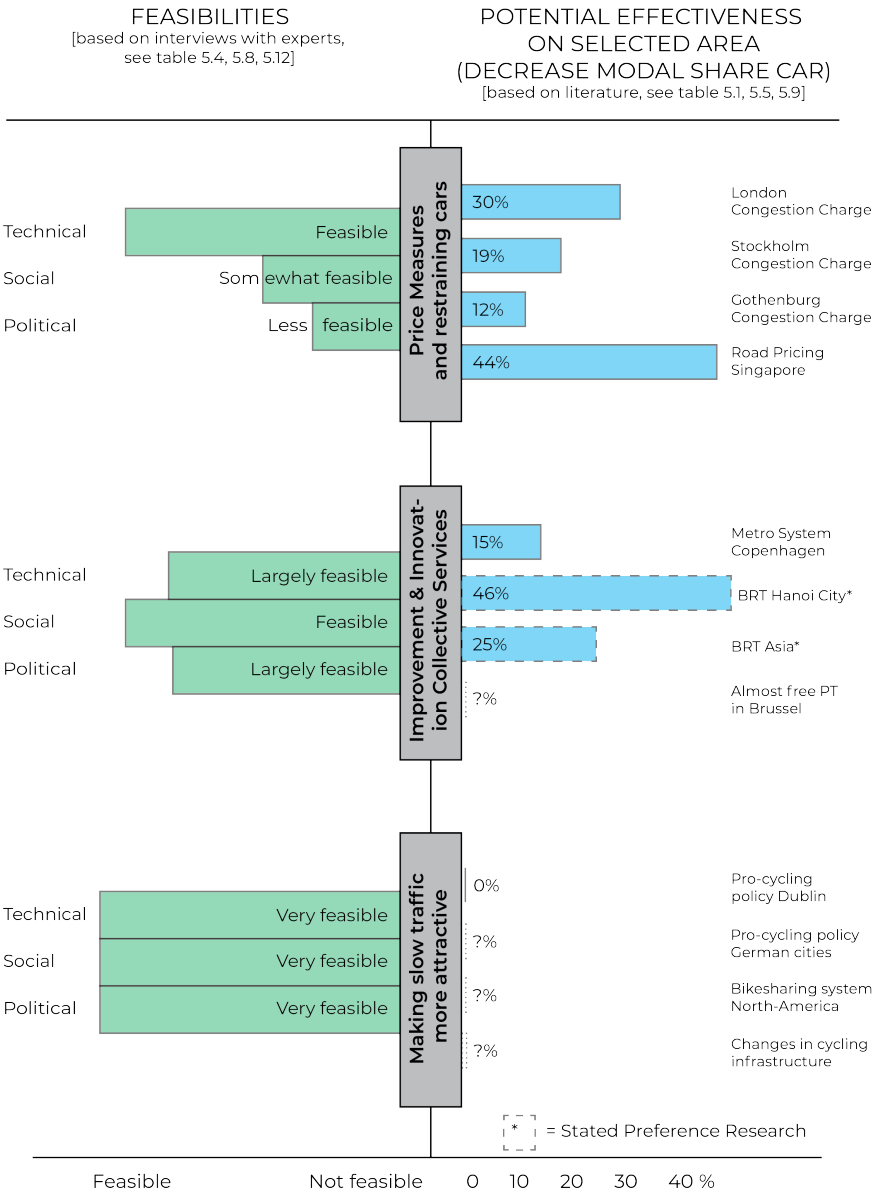

Figure 1: Overview of feasibilities and potential effectiveness

Finally, we analysed the implications of these findings for municipalities in achieving low-car or carfree cities. An important conclusion here is the need for packages; Packages are considered to be necessary to successfully achieve a low-car or carfree city. This brings up the question whether this combination of measures entails changes with regard to feasibility. In our case study, we conclude that most of the feasibility issues we found also recur with the introduction of such a package of measures. The same goes for ways to improve feasibility. We conclude that it is recommended for municipalities to implement policy measures to achieve a low-car or carfree city in a package, in which push and pull measures are combined, good alternatives are offered and the liveability benefits are emphasised.

Answering main research question

We conclude that the terms 'carfree' and 'low-car' are broad and comprehensive, and the same goes for the desired results and goals. There is a wide scale of potential effects; historically often with aims as tackling congestion, nowadays often related to an increase of the liveability of cities. In our search we found a wide variety of possible policy measures to contribute to the goals of a low-car or carfree city. As effectiveness and feasibility play an important role in successful implementation of these measures, we evaluated groups of measures on these two aspects. One of the main findings in this evaluation, is that the measures that seem to be very effective (e.g. pricing) also seem to be the less feasible ones. On the other hand, the effectiveness of the measures that are highly feasible (e.g. investing in slow traffic), seems to be low, uncertain or unknown. In practice, we see this complexity too: In our analysis we found that municipalities frequently opt for 'honey'-based measures, like stimulating public transport (PT), cycling and walking. From a political point of view, this choice is explainable, after all, feasible measures will encounter less resistance during implementation. However, our study shows that it is questionable whether these measures contribute to the desired goals. At the same time, (very) effective measures, such as pricing (e.g. a toll zone), are rarely seen in policy documents, except for parking fees. This mechanism between effectiveness and feasibility demonstrates the complexity for policymakers to implement measures to achieve carfree cities, but also exposes the importance to emphasise these two elements in policy proposals. After all, an evidence-based approach, based on feasibility and effectiveness, can help to avoid wasting limited resources and failures that may undermine public support.

One of the main ways to counter this complexity according to literature and our interviews, is the introduction of packages of measures, which seems to be an important key in achieving carfree or low-car cities. After all, these packages lead to the combination of 'sweet' and 'sour'; to a fairer distribution of burdens and benefits; and to synergy by combining measures and a potential higher acceptance. However, these packages also come with some issues: The number of people involved increases; the process becomes more complex; and communication and support become more important. On top of that, much remains unknown about the effectiveness and feasibility of measures when combined in packages, so attention on these two aspects is needed. It is up to policymakers to cope with these issues, but this research has given a first start on an evaluation of feasibility and effectiveness of groups of measures and does provide some tools to increase the feasibility. However, this study also concludes that there remains a lack of clear data on the effectiveness of (groups of) measures regarding the decrease of modal share of car, and certainly when it comes to the combined effectiveness in mobility packages. In order to support policymakers in the near future, in which the demand and the need for policy measures into carfree cities seems to become increasingly important, the effectiveness of these (packages of) measures is an important point of attention for further research.

Reflection and theoretical framework

With this study into the characteristics of carfree cities, a structured overview of possible measures, and an evaluation on effectiveness and feasibility, we offer policymakers tools to take a first step towards a carfree or low-car city. We developed a framework to evaluate policies, based on effectiveness and feasibility, for both policymakers as researchers. We also provided a first understanding of both the effectiveness as feasibility of measures and packages of measures, and a broader perspective on how such measures work out in practice. Our framework proved to be very useful in providing a structured overview of the feasibility and effectiveness. However, points of attention are the indicators used (modal share and car ownership are very insightful, but will not suffice in all cases), a more extensive evaluation of feasibility, and further research into the relationship between feasibility and effectiveness.

Recommendations

When municipalities consider efforts for a carfree or low-car city, it is recommended to start with an analysis and clear description of the goals and desired results of this carfree city. After that, it is recommended to pay attention to the effectiveness of policy measures; to combine measures and propose mobility packages and to continuously outline the context of policy measures and ensure long-term investment into a change of mobility behaviour. Besides the recommendations for municipalities, there are some recommendations for future research as well, including clear before-and-after evaluations of policy measures; further research into clear, comparable indicators; research into measures to stimulate cycling and walking; research into the change of effectiveness by introducing measures as a package; and further research into the relationship between feasibility and effectiveness.

Contents

1

Introduction and Background

Cities are on the rise: Recent years, cities have faced an increase in economic growth, employment rates and population numbers. The Statistical Office of the European Communities (2016) estimates that nowadays 75% of the European population live in urban areas and the United Nations Environment Programme (2009) states that the current wave of urbanisation is the largest wave of urban growth in human history. Although this urbanisation has a number of positive impacts, it has a downside as well: the accessibility of cities and the accessibility within cities is under pressure, mainly due to an increase in the number of cars (e.g. KiM, 2018; Ministerie van Infrastructuur en Waterstaat, 2019). In 2016 CROW estimated the costs resulting from this increasing congestion in Dutch cities; The traffic problem in the cities may lead to an economic damage of almost 1.7 billion euros in 2021 if this problem persists (Voerknecht, 2016). In addition to this congestion, there are a number of negative impacts concerning environment, social life and public health that can be attributed to the increase of car travel and usage (T. Gärling, A. Gärling, and Johansson, 2000; Khreis, May, and Nieuwenhuijsen, 2017; Lucas et al., 2016; Nieuwenhuijsen, Bastiaanssen, et al., 2018).

In literature a number of measures can be found that claim that they can deal with this problem of growing numbers of cars in cities. Van Oort, Van Der Bijl, and Verhoof (2017) see investing in public transport as one of the ways to deal with this problem, as it has a number of advantages in dealing with rising traffic demand. Others see stimulating other modes of transport like bicycles as a way to deal with this problem (e.g. Dill and Carr, 2003; Hamilton and Wichman, 2018). Municipalities already introduced several measures as well, for example by encouraging cycling and walking, or the introduction of environmental zones (e.g. Gemeente Amsterdam, 2019a; Kruyswijk, 2019b). Crawford (2000) came up with a more radical approach; In his book 'Carfree Cities' he proposes a plan for cities without cars.

The benefits of such carfree cities are tremendous, according to Crawford. A reduction of noise, stench and danger of cars, trucks, and buses. Improvement of the quality of life for individuals and communities, as result of lively, attractive streets and saving energy and preserving the environment. His expectations are high. However, at the moment there are very few cities completely carfree (e.g. Venice). Since these benefits are high, it is important to find out whether there is a need for these carfree cities and to find out what the added value of such carfree cities is. If both the need and the added value are high, then it is important to find out which policies or strategies are successful in this transition to carfree cities, and under what requirements and challenges.

1.1. History and context

First a short introduction in the history of the concept of carfree cities. Reducing the number of cars in cities has a long history. At the end of the twentieth century there were many cities that started to ban cars from their city centres in order to make them more pedestrian-friendly. They aimed to make their city more welcoming, resulting in a positive boost for the local economy (Topp and Pharoah, 1994; Hass-Klau, 2014). In figure 1.1 some events can be found that guided transitions towards carfree cities, with for example the introduction of a 'Woonerf' and the rise of carfree neighbourhoods. After the year 2000 numerous other

events happened, like the introduction of a congestion charge. In 2003 the city of London introduced this charge, in order to reduce the private use of passenger cars and to stimulate (and invest in) public transport (Leape, 2006).

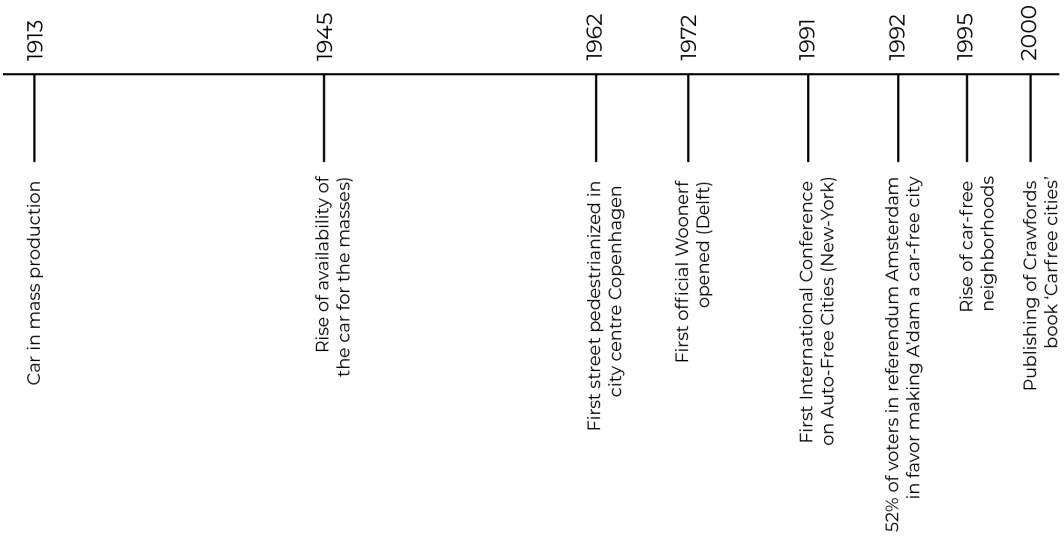

Figure 1.1: Timeline of some historic events towards carfree cities

Over the years, the car increasingly became an important part of our transport system. It has brought a number of positive effects, like increased mobility and economic prosperity. However, cars came with several negative effects as well, regarding issues like congestion, environmental damage, and impacts on social life and public health. Transport in general accounts for approximately 23% of current global energy-related CO2 emissions, where nearly 75% of these emissions are generated by road transport (International Energy Agency, 2020). Besides these effects on climate, there are effects on liveability as well: Hart (2008) found that streets with high numbers of (motorised) traffic reduced social connectedness and increased people's perception of danger. At the same time, it is hard to design cities with a good urban liveability, as result of the car dependence of people (Falconer, Newman, and Giles-Corti, 2010). Car traffic also causes air and noise pollution, causing a number of adverse effects on health (Giles-Corti et al., 2010). Although there are a lot of other effects as well, last one to mention is the effect on safety, as car traffic causes numerous injuries and fatalities for all different transport modes each year (e.g. Ndiaye, Chambost, and Chiron, 2009; Nilsson et al., 2017; Fredriksson, Rosén, and Kullgren, 2010). Schroten et al. (2014) came up with a quantitative analysis of the external and infrastructure costs of traffic and calculated all the costs of transport, including costs of infrastructure, climate effects, air pollution, spatial utilisation, noise, accidents, emissions, effect on nature and landscape and more: Both absolute as relative to modes like cycling and walking, cars have a major impact on our environment.

Over the years several policy measures have been proposed and implemented that aim to reduce the use of cars. Loukopoulos et al. (2005) distinguish two ways of reducing the demand for private car use. On the one hand travel demand management (TDM) measures and on the other hand mobility management measures. Litman (2003) came up with an extensive list of measures; an online TDM Encyclopedia, in which they describe five categories of measurements, improved transport options, incentives to shift mode, land use management, policy and planning reforms and support programs. However, these measures are meant to decrease the number of cars in total. This thesis focuses on reducing the number of cars in cities. In Dutch cities, multiple policy measures have been proposed of the last years, often including the stimulation of cleaner and environment friendlier modes of transport, like cycling and walking instead of the use of cars. Cities like Amsterdam, The Hague, and Rotterdam, formulated policy documents in which they express their ambitions in reducing the number of cars in cities in order to make these cities more liveable (e.g. Gemeente Amsterdam, 2019a; Gemeente Rotterdam, 2019; Gemeente Den Haag, 2019c).

As stated before, Crawford (2000) came up with a more radical approach. He proposes a plan for cities

without cars. In his vision these carfree cities ought to be a solution to all of the negative impacts of cars in cities. Although this sounds promising, first let us analyse what has been written about this topic in literature.

1.2. Embedding in literature

Crawford (2000) describes this concept in his book 'Carfree cities'. Crawford believes that sustainable development can only be achieved by ending car use within cities, which means not only a low-car city or carfree areas within a city, but a complete carfree city (like Venice). In his view transport of goods should be carfree as well, for example by rail traffic. A complete overview of the state-of-the-art literature can be found in chapter 3. However, we will mentions some findings here to give some context around carfree cities, including some main concepts. Steven Melia (2014) concludes that the use of the term 'carfree' is quite diffuse, and proposes 'Traffic free', as being a more accurate term. However, as carfree is a widely used concept in the literature, this term is often used. Besides the complete carfree cities, the low-car or carfree city centre is also on the rise (e.g. Rydningen, Høynes, and Kolltveit, 2017). It is important that a distinction is made between a carfree city and a carfree city centre or -area, as they have their own characteristics. Where complete carfree cities are a rarity, the number of carfree city centres and -areas are rising (Steven Melia, 2014). Although a variety of actors will be involved in getting to a carfree city, one of the main stakeholders will be the municipality, as they will play an important role in decision-making and have a number of instruments available to achieve a carfree city. In that respect, 'government policies' can most of the time be seen as policies started by municipalities to come to a (partly) carfree city.

The conclusion that can be drawn by comparing the scope of several studies into carfree developments (Carfree city, -city centre or -area), is that very few studies analyse completely carfree cities. This is also in line with one of the findings of Nieuwenhuijsen, Bastiaanssen, et al. (2018) which describes that several studies describe city centres as parts of cities being carfree, but not many describe completely carfree cities. Many of the carfree concepts are achieved by policies that are aimed at the reduction of car-use, but only few directly switched to completely carfree. Therefore, in this thesis we choose to focus on both carfree, as well as low-car developments.

1.3. Research question and objective

An extensive literature review leading to the knowledge gap can be found in chapter 3. The main conclusion is that there is a knowledge gap regarding the following three issues: 1) A clear overview of the characteristics and expected results of a carfree city, 2) a list of possible effective and feasible policies of municipalities towards low-car or carfree cities, and 3) an evaluation of how these policies can contribute in achieving carfree cities. Therefore, the following research question has been defined:

Main research question

"Which government policies have shown or are regarded by experts to be effective and feasible in contributing to the realisation of low-car or carfree cities and what are thereof the implications in achieving carfree or low-car cities?"

Aim of this thesis is to fill the current knowledge gaps regarding carfree or low-car cities and to come up with a research into effective and feasible policies for municipalities to convert to a 'carfree city'. With use of a literature review, desk research and interviews this thesis will identify potential effective policies for municipalities to transform towards carfree or low-car cities, including an analysis of the implications of these policies. With the finding recommendations can be done towards municipalities in transforming towards carfree or low-car.

1.3.1. Sub questions; what to research

The first step is to analyse carfree cities as a concept. What is a carfree city, is there a need for carfree cities, which problems does it solve, and what is the added value? This will be analysed by questioning the characteristics and desired results of a carfree city. As described, the next step is to identify possible policies

that contribute in achieving carfree or low-car cities. A selection of these policies will be evaluated on basis of their effectiveness and feasibility. After that, the implications of these findings will be assessed: What does this mean for policies of municipalities and other stakeholders? What can be learned? These steps are described by the following sub questions.

1. What are the characteristics and desired results of a carfree city?
2. What are applied and intended policies by municipalities to achieve a low-car or carfree city?
3. What is the effectiveness and feasibility of these policies?
    - Technological level
    - Social level
    - Policy level
4. What are implications of these findings for municipalities in achieving low-car or carfree cities?

1.3.2. Relevance and CoSEM perspective

Carfree cities may contribute in the improvement of the accessibility and liveability of cities, leading to benefits for current citizens and visitors of cities; for businesses within these cities, as for policymakers in order to enhance their cities. In order to achieve carfree cities, it is important to find out whether the policies to achieve this are effective and feasible. Complexity of the problem is in the number of people and parties that is involved and the diversity of fields that is involved (technical details, economical aspects, law, organisational science, behavioural science). With the findings of this study recommendations may be made toward policymakers to improve their cities.

1.4. Thesis outline

The thesis report is divided into seven chapters. The following chapter (2) describes the methodology and research approach of this thesis. Chapter 3 describes the literature review we conducted into carfree cities, including our theoretical framework. In chapter 4 government policies contributing to the realisation of low-car or carfree cities are identified and presented, after which in chapter 5 three groups of policy measures are evaluated on both their effectiveness as feasibility. A synthesis of these policies can be found in chapter 6, including a case study into Agenda Amsterdam Autoluw. The report concludes in chapter 7, which includes the main findings, an answer to the main research question, limitations, recommendations and a reflection on the scientific and social relevance.

2

Methodology

This chapter describes the methodology of this thesis. In order to be able to answer the research question, a research approach and methodology has to be defined. Our research consists of four parts: 1) A literature review into the characteristics and desired results of carfree or low-car city; 2) A search into potential policies towards a low-car or carfree city; 3) An evaluation of the effectiveness and feasibilities of these policies and 4) A case study in order to find out whether our findings correspond to applications in practices. In order to be able to answer the different research questions, they all have their own methodology which are described below.

2.1. Methodology: Literature review

Over the years a lot has been written about carfree cities, in all kind of forms. Although the number of sources is extensive, an unambiguous and directly applicable overview lacks. Hence, in order to get a structured overview about carfree cities a literature review has been conducted. This literature review will analyse what the characteristics of carfree cities are; to what extent and in what forms these carfree cities are applied; what the desired results are; and whether or not effective and / or feasible strategies are known to develop such carfree cities. Van Wee and Banister (2015) recommend to describe the methodology of the review, and to be explicit on the selection of the material to use for the review. In order to come up with a shortlist of papers to include in the review, a number of steps has been conducted. At first, a broad search has been carried out using Scopus and Google Scolar, with keywords like carfree; low-car; and car restraining, only in the English language, in different forms of writing and with the use of Boolean operators. This search provided over 30.000 (not unique) results. Besides search engines Scopus and Scolar, back- and forward-referencing has been used to find suitable literature.

Table 2.1 shows the search terms used, as well as a motivation for the terms and the number of results after the different steps in the selection mechanism. In order to be able to do a proper literature review a selection has to be made. The main criteria to make this selection includes: 1) The study is about 'carfree cities', or 2) the study includes multiple aspects of 'carfree cities' or 'low-car cities', or 3) The study includes processes or policies in the shift towards carfree or low-car cities or 4) The study describes relevant historical processes in the shift towards car reducing measures. With these criteria it is expected that we will find relevant and insightful sources to conduct a literature review. At first a broad search has been carried out with use of the search terms and Boolean operators. After that a selection has been made on base of the titles (in which all of the Scopus articles have been scanned, and the first 150 articles provided by Scolar), after which the sources that did not have any citations (provided by the Scopus or Scolar search result) were deleted, unless the source was published in or after 2018, in order to be able to include recently published papers. Next step was to screen the abstract of the sources, followed by reading the remaining papers in total, resulting in final removals as well.

After this selection process the combined databases provided 54 sources, including 24 duplicates. After deleting these duplicates 30 sources remained, which will be included in the literature review.

Search terms & Motivation	**Selection mechanism**		
		Scopus	Scolar
"carfree" OR "car-free" OR "car free" *Core concept, in different forms of writing*	Metadata	147	16500
	Title	46	56
	Year <2018 & Citations >= 1	33	46
	Abstract	25	32
	Full text	19	23
		Scopus	Scolar
"low car" OR "low-car" *Strong connection with carfree, regularly used in the same or similar context*	Metadata	128	14100
	Title	12	15
	Year <2018 & Citations >= 1	8	13
	Abstract	4	2
	Full text	2	2
		Scopus	Scolar
"car-restrain*" OR "car restrain*" *Not about carfree, but important search term in one of the first phases to get to carfree*	Metadata	86	32
	Title	8	3
	Year <2018 & Citations >= 1	7	3
	Abstract	3	0
	Full text	1	0
		Scopus	Scolar
("car-reduc*" OR "car reduc*") AND "cit*" *Not about carfree, but important search term in one of the first phases to get to carfree*	Metadata	11	0
	Title	1	0
	Year <2018 & Citations >= 1	1	0
	Abstract	1	0
	Full text	1	0
		N/A	
Back- and forward referencing	Full text	6	
Subtotal	54		
Duplicates	24		
Total	**30**		

Table 2.1: Search terms, selection and number of results

2.1.1. Selection of aspects to review

In order to be able to describe the characteristics and desired results of a carfree city, the literature has been reviewed based on a number of aspects. For each of the 30 articles, the following aspects have been reviewed.

- **Definition of 'carfree city':** What does the concept include, what is meant by a carfree city?
- **Theoretical or application?:** Is carfree or low-car a theoretical construct or is it being applied in practice?
- **Area:** If applied, in what kind of area? Complete cities, or just streets?
- **Desired result:** What are the desired results of going carfree or low-car?
- **(Proposed) strategies/ policies:** Are there (proposed) strategies or policies to go carfree or low-car?
- **(Expected) effectiveness:** What is known about the effectiveness of policies?
- **(Expected) feasibility:** What is known about the feasibility of policies?
- **New knowledge gaps/ further research mentioned:** What are the remaining or emerging knowledge gaps concerning carfree cities?

Although this list of aspects is limited, we expect this list to be able to obtain a sufficient overview to answer the first research question.

2.2. Methodology: Finding policies

Next step is to identify which policies have been applied or are intended to be applied by municipalities to achieve a low-car or carfree city. This has been done with use of a desk research and interviews. The main focus is possible interventions aiming to change the modal split by decreasing the use of cars.

2.2.1. What and where to search

The first step is to describe what we are looking for. The measures, policies and ideas that have been developed in history in order to change the use of cars, are limitless. Hence, first-off we set our research scope. The first criterion follows from the main research question; We are looking for *policies that contribute to the realisation of low-car or carfree cities*. This means we exclude policies that a) have a goal other than low-car or carfree and b) do not focus on cities. As mentioned before, we will look into predominantly structural interventions, so we excluded policies like carfree days. Though we focus on Dutch cities, we did include 'foreign' interventions described by literature and potentially implementable in Dutch cities, but we have not extensively analysed policy documents of foreign cities. So in short we look for policies:

- With a goal to achieve low-car or carfree cities
- That aim to achieve a structural change
- That are able to be implemented in Dutch cities
- That are able to be implemented by municipalities

Three main sources to find and identify potential policies include scientific literature, policy documents by municipalities and interviews with experts. All these three will be used to in order to find suitable policies. This process is visually represented in figure 2.1 and will be described in the following subsections.

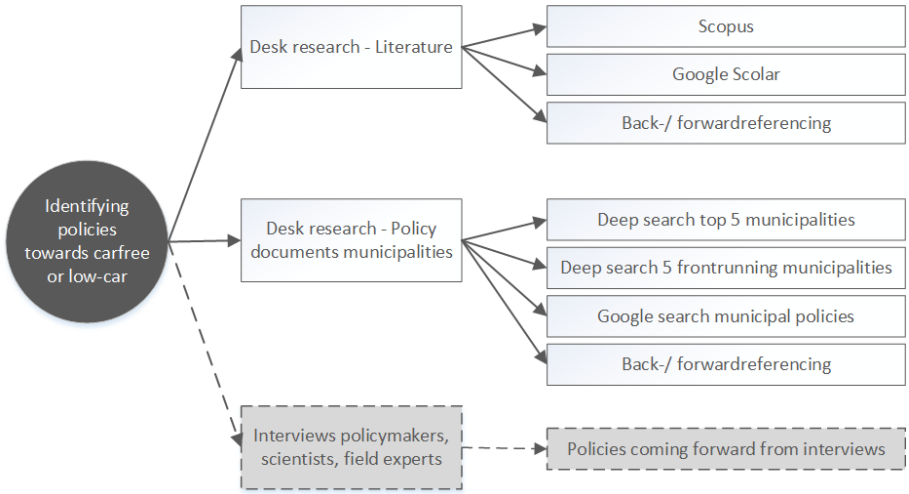

Figure 2.1: Schematic representation search process policies

2.2.2. Identification policies from scientific literature

For the scientific literature, we have used the search engines Scopus and Google Scolar, supplemented by back- and forward referencing. With search terms like 'car', 'use', 'ownership', 'reduction', 'cities', 'low-car', 'carfree', 'policies' in different forms of writing and with the use of Boolean operators, we have tried to include as many policies as possible. However, this analysis does not aim to include all potential policies in the world (which are almost limitless), but aims to provide a rough overview of the policies possible. This search provided 180 articles that may be relevant. From this list, potential policies were abstracted into a table (see Appendix C, table C.1).

Urry et al. (2017) came up with a very short but insightful introduction in the several measures to achieve a carfree system. They distinguished several subgroups of policies: Restrictions on car movement; Restrictions on parking cars; Making other modes more attractive through sharing technologies; Innovating new mobilities; Improving bicycle infrastructure and services; Improving pedestrian infrastructure; Sustainable housing; Revive social functions of streets; and Information campaigns to promote sustainable travel. To begin, we used these groups to sort the potential policies, in order to get an insightful and structured overview. Some other policies that did not fit into this framework came up as well. Therefore we rearranged the groups and added some new groups.

2.2.3. Identification policies from policy documents

For the second search method, the desk research, we did a content analysis (determination of the presence of certain words, themes, or concepts within some given qualitative data) into policy documents from several Dutch cities. As it is hardly possible to include all Dutch cities or municipalities[1] (more than 350 in number), we chose to analyse the five Dutch cities with the highest number of inhabitants (Amsterdam, Rotterdam, Den Haag, Utrecht, Eindhoven). Some other front running municipalities will be analysed in depth as well (Houten, Groningen, Delft, Almere, Gent[2]) (see e.g. Foletta and Henderson, 2016; De Jong, 2020; Kruyswijk, 2019a). This has been supplemented by a Google search into policy documents regarding a shift to carfree or low-car and back- and forward referencing where possible. The policies that we extracted from these municipalities have been put in a table as well (see appendix C).

2.2.4. Identification policies with use of interviews

The last source includes interviews. However, these are not conducted solely for this step, but are combined with the interviews that are conducted for answering the next sub question (see 2.3), in which a number of policies are evaluated in detail. This step includes an analysis that uses interviews with policymakers,

[1] Important to note is the difference between cities and municipalities; Although we are looking for information about cities, the main decisions in these cities are made by the municipalities, so we include information from municipal documents.

[2] Although not a Dutch city, Gent is often seen as one of the front runners in the field of carfree cities, so we chose to analyse this Belgian city as well.

academics and experts in the field. Although the main purpose of those interviews is not to identify new policies but to evaluate some of them in detail, we used the opportunity to ask them questions about possible other policies, so that we can discover new policies as well. Questions about this part will be elaborated on in the interviews protocol (see Appendix D). In section 2.3 (Methodology: Evaluation of Policies) we elaborate on the interviewees and the method for these interviews.

2.2.5. Quick assessment

After the identification of policies, we also assess them on a number of aspects. In the literature section we evaluated them according to the following aspects:

- Does the source have a clear evaluation of the effectiveness of the policy?;
- Do the authors asses, value or consider the policy as effective, or not?;
- Does the source have a clear evaluation of the feasibility of the policy?;
- Do the authors asses, value or consider the policy as feasible, or not?;
- Does the author mention that this policy is already implemented?;
- Does the author mention cities in which this policy has been implemented?
- What is the expected implementation effort of the measure? Complex, time-consuming, costly and impactful, or just a small intervention?
- Can the policy be seen as a honey- or a vinegar measure (i.e.: Is the policy positive incentive/ rewarding-based or negative incentive/ sanction -based)?

In the policy documents we evaluated them according to the following aspects:

- Does the source have a clear evaluation or expectation of the effectiveness of the policy?;
- Does the source have a clear evaluation or expectation of the feasibility of the policy?;
- Does the author mention that this policy is planned to be implemented?;
- Does the author mention that this policy has already been implemented?
- What is the implementation effort of the measure? Complex, time-consuming, costly and impactful, or just a small intervention?
- Can the policy be seen as a honey- or a vinegar measure (i.e.: Is the policy positive incentive/ rewarding-based or negative incentive/ sanction -based)?

As we expect municipalities to implement policies that they perceive as effective and feasible, we did not evaluate this with a separate analysis as we did in the literature section. In general, we expect this list of criteria to be satisfactory to obtain an overview of the potential policies.

2.3. Methodology: Evaluation of Policies

After identification of possible policies, the next step is to analyse how these policies contribute to achieving a carfree city. After a broad search into policies in sub question 2, some of these policies have been evaluated in more detail, based on two aspects; effectiveness and feasibility. This subsection describes the methodology of this evaluation.

2.3.1. Approach and theoretical framework

In order to fill the knowledge gap (see 3.2), we want to find out which effective and feasible policies can be applied to achieve carfree or low-car cities. The potential policies have been identified in chapter 4. Next step is to evaluate three groups of policies in-depth. In order to do so, we developed a theoretical framework in section 3.3 (Theoretical Framework), based on the work of Feitelson & Salomon (Beuthe et al., 2004) and Nieuwenhuijsen, Bastiaanssen, et al. (2018). The development and background for this framework, including a substantiation for choosing Feitelson & Salomon as foundation, can be found in section 3.3 (Theoretical Framework). Here, we will describe the method to apply this framework. As described in section 4.2 (Policies to include), we chose to evaluate the following three policies into detail: 'Price measures and restraining cars'; 'Improvement and innovation of collective transport services'; and 'Making slow traffic more attractive'.

Evaluation effectiveness - Desk research

Following our theoretical framework, we will evaluate effectiveness based on modal split and car ownership. Although these two indicators do not catch all of the underlying goals of municipalities to achieve a low-car or carfree city, these indicators do have strong relations with many other goals (e.g. increased livability, less traffic accidents, less noise, better air quality, see section 3.3). In order to do so, we first compare a city that implemented the policy in question, with two cities that did not implement this intervention. An overview of the selected cities can be found in table 2.2. In appendix E (Analysis into effectiveness policies) an explanation can be found why we chose for these cities.

Though this analysis will provide some insights in the differences between these cities, it will not be possible to draw conclusions about the effectiveness in all the three groups of measures, as we will not be able to correct for all the different factors that play a role (like income, PT-accessibility, education, age distribution and more). Therefore we will also research the relation between the quality of public transport, cycling and walking facilities and -policy in cities and the modal share of these cities. We used four indicators for this, the first includes the 'average speed of Public Transport in the morning peak' (with use of data from CROW (2015)), and the other three includes the 'grades per mode for the Facilities and Policy' (for the modes Walking, Cycling and PT), which has been assessed by CE Delft (2018b). They came up with a benchmark of 30 municipalities, and graded these municipalities. For walking the grades were based on the amount of separated walking paths and pedestrian area and the percentage of 15 km/h roads and 30 km/h roads. For cycling the grades were based on the number of public transport bicycles (OV-fietsen), amount of separated cycle paths, number of guarded and unguarded bicycle parking spaces at the station, and the relative accessibility of bicycle versus car. For Public Transport the grade was based on the number of public transport bicycles (OV-fietsen), number of guarded and unguarded bicycle parking spaces at the station, the air pollution of the buses and the relative accessibility of PT versus car. The complete indicators and the weighting of the factors can be found in CE Delft (2018b). Although these indicators do no provide a complete overview of the quality of the groups of measures, it does give an indication. With use of SPSS the Pearson's correlation, the corresponding p-value and the sample size have been calculated and reported.

#	City with intervention	Benchmark city 1 (without intervention)	Benchmark city 2 (without intervention)
Pricing measure (urban toll)	London	Birmingham	Amsterdam
Collective services	Almere	Haarlem	Tilburg
Slow traffic (pro-cycling)	Houten	Nieuwegein	Zeist

Table 2.2: Cities for comparison

Evaluation feasibilities - Semi-structured interviews

Through semi-structured interviews, it is possible to get an in-depth overview of the feasibilities of the different policies. With the use of several interviewees we identified and described the requirements, challenges and limitations of these three different feasibilities. The interview protocol can be found in Appendix D. This interview protocol is built on our theoretical framework. Therefore the three feasibilities of Feitelson & Salomon form the main structure of the protocol. It includes both general questions, as well as specific questions for each type of feasibility. As all the interviewees are Dutch, the interviews are conducted in Dutch. The interviews were all coded, and the interviewees received this coded (and summarised) version of

their interview and were able to revise them if needed. These coded versions have been included as Appendix (see Appendix D).

In order to get a broad and multi-disciplinary overview, we chose to interview both policymakers, academics, and experts in the field. In table 2.3 the groups are described. These three groups have an extra focus on one of the feasibilities, based on the characteristics of the group. In the interviews more attention went out to this specific feasibility. However, we also asked them about the other forms of feasibility. We interviewed two people per group. Although this will not provide a complete overview of the feasibilities, we expect this amount of interviewees to be sufficient to be able to answer this sub question. The list of interviewees can be found in table 2.4.

The interviews have been coded, and for each of the three policies an analysis on the following questions has been carried out:

- What are the requirements, challenges and limitations, regarding the technological feasibility?
- What are the requirements, challenges and limitations, regarding the social feasibility?
- What are the requirements, challenges and limitations, regarding the political feasibility?

Generic reflection: Comparison and desirability of packages
Next to an analysis into the feasibility of the groups of measures, we also asked the interviewees to provide us with a general overview about the desired goal and results of carfree or low-car cities; a comparison between the groups of policy measures; the perceived effectiveness of groups of measures; and the desirability of mobility packages.

#	Group	Reason	Extra focus
2	Policymakers	Responsible for implementing policies	Political feasibility
2	Academics	In-depth knowledge of characteristics policies	Technical feasibility
2	Experts in the field	Experience and knowledge in implementation of policies including participation-process	Social feasibility

Table 2.3: Characteristics of interviewees

	Interviewee	Position	Organisation
1	Respondent A	Alderman	Gemeente Utrecht (policy officer on behalf of alderman)
2	Respondent B	Alderman	Gemeente Delft
3	Respondent C	Full professor	Delft, Technology, Policy and Management
4	Respondent D	Full professor	University of Amsterdam, Social and Behavioural Science
5	Respondent E	Consultant	Movares, department Mobiliteit & Ruimte
6	Respondent F	Consultant	Goudappel, department Mobiliteit & Ruimte

Table 2.4: List of interviewees

2.4. Methodology: Case study

With use of a case study the implications of implementing a package of policy measures in practice are examined. With our case study (into Agenda Amsterdam Autoluw) we first investigate whether our findings regarding feasibility issues and ways to improve feasibility are consistent with practice. After that, we translate the findings from the policy makers in our case and the analysis of the meeting of the city council into lessons for policy makers elsewhere, in order to successfully implement a package of measures. In this case study we choose to use a holistic single case design (which is according to Yin (2003) eminently justifiable under certain conditions, for example when the case represents a representative or typical case or it is a rare

or unique circumstance). This study is used in an explanatory way: We try to explore the way in which this implementation of a combination of policies has happened, whether that is in line with our earlier findings and what lessons we can draw from this case.

This case study involves the the city of Amsterdam. The city of Amsterdam came up with a comprehensive plan to make the city more carfree (Agenda Amsterdam Autoluw). In this case study we analysed the feasibility of a package of measures in practice and we analysed whether our findings can be found in practice as well. We use two sources for this: At first we will analyse the meeting of the city council regarding the debate and voting for approval of the proposal (Gemeente Amsterdam, 2020), with use of a content analysis. Secondly we will interview two policy advisers of the Municipality of Amsterdam, who were involved in the creation of the Agenda. In table 2.5 the interviewees, as well as their function, can be found. We chose to interview both someone responsible for the process and participation (respondent H), as well as someone responsible for the design of (some of) the measures (respondent G). Although we get a limited picture with only two interviewees, we assume that this provides us with sufficient information for an initial indication whether we see our findings reflected in practice.

#	Interviewee	Position	Organisation
1	Respondent G	Senior Policy Advisor Public Transport	Gemeente Amsterdam
2	Respondent H	Process manager Agenda Amsterdam Autoluw	Gemeente Amsterdam

Table 2.5: Interviewees for Case study

3

State-of-the-art knowledge carfree cities, knowledge gap and theoretical framework

This chapter provides the background knowledge of the concept of carfree cities. It includes an analysis into the background and characteristics of a carfree city, as well as the desired results and goals, based on literature. The appropriate method for this analysis is a literature review, in order to obtain an up-to-date and well-structured overview of the literature in this field and get insight in what is known and unknown in this field (Van Wee and Banister, 2015). With the findings the first sub question can be answered and it provides background information and sources for the analysis of potential policies in chapter 4 (Potential Policies).

3.1. Literature review carfree cities

In section 2.1 the method of this literature review has been described. As mentioned, the 30 papers have been reviewed with use of eight aspects. The in-depth analysis can be found in appendix B (Table Literature Review). This sections describes the findings on these aspects.

3.1.1. Definition of 'carfree city'

To come up with a clear definition of a 'carfree city' may seem easy: What else than a city without cars? However, in literature the ways to describe a carfree city vary widely. What to think of emergency vehicles, transportation of goods and electric vehicles? Does this also include low-car areas? Although the term carfree is being widely used, the ideas of this concept differ greatly.

In general two ways of defining the term carfree can be distinguished; Some of the papers provide a more theoretical description of the term (e.g. Crawford, 2000; Foletta and Henderson, 2016; Steven Melia, 2014; Nieuwenhuijsen and Khreis, 2016), others provide a definition of the term based on the way in which the carfree concept has been applied in practice (e.g. Bieda, 2016; Coates, 2013; Ornetzeder et al., 2008). Although the latter may bring interesting insights in the several ways in which carfree concepts have been introduced, the first (theoretical) approach is more insightful as it provides a more general definition. One of the ways to choose for a definition is to pick the most often used or cited definition. In that case, one of the definitions of Melia (Steven Melia, 2010; Steven Melia, Barton, and Parkhurst, 2013; Steven Melia, 2014) will be favourable as the definition which is used in those papers is often cited. Steven Melia (2010) defines Carfree Development as: *"Carfree developments are residential or mixed use developments which: 1) Normally provide a traffic free* [1] *immediate environment, and: 2) Offer no parking or limited parking separated from the residence, and: 3) Are designed to enable residents to live without owning a car."* However, this

[1] Note that Melia uses 'traffic free' as a term in his definition. However, there is also a lot to be discussed here as well, while Melia does not elaborate on this much further. One can wonder to what extent pedestrians and cyclists are included; and whether, according to his definition, certain areas can ever be seen as carfree development like pedestrianised shopping streets (as it still contains large flows of people moving, which can be seen as traffic). However, based on his paper, we expect that with this he means an environment free from all kinds of traffic, except pedestrians, cyclists and similar modes of transport (like skating, autoped, etc). We do not know what Melia's viewpoint is regarding high flows of cyclists.

is about developments, and not about a carfree city. For a carfree city the literature review only provides four quite clear definitions (Crawford, 2000; Nieuwenhuijsen, Bastiaanssen, et al., 2018; Patel, Gandhi, and Bhatt, 2016; Wright, 2005), which are focused on the following idea of a carfree city: *Motorised vehicles are banned from all parts of the cities, although a few possible exceptions are possible such as emergency vehicles.* Nieuwenhuijsen, Bastiaanssen, et al. (2018) have a vision which differ a little bit; they define a carfree city as a city without *private* cars.

These different definitions and ideas show that it is not easy to provide one clear definition. In that light, it would make more sense to show the possible interpretations of carfree. Wright (2005) provides an overview of the Carfree spectrum with possible interpretations, see 3.1. On the left side we see the 'lite' measures, on the right the more impactful measures. At the downside papers from the literature review are connected to the terms (if possible). Although carfree days have had quite some impact in history we choose to leave this outside our scope, as result of the temporarily character. Although the car-lite measures are interesting as they may be a first start of a transformation to carfree, papers with these measures has not been included in this review, since we focused on carfree cities in the search terms. However, in a later stadium (see chapter 4 (Potential policies), these kinds of measures will be included.

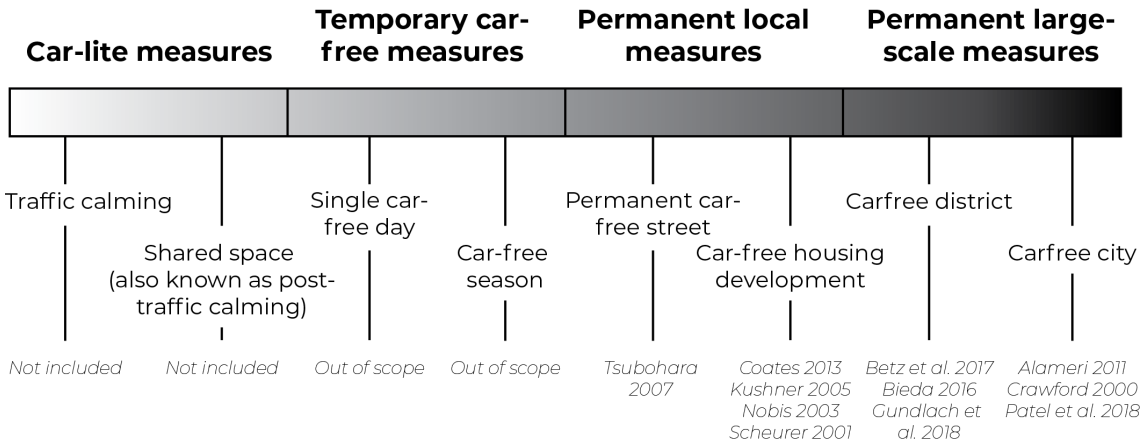

Figure 3.1: Carfree Spectrum (Adapted from Wright, 2005)

For now we choose to adopt the definition of for example Patel, Gandhi, and Bhatt (2016) to describe a carfree city, being: *"a city where a ban on motorised vehicles from all parts of the towns is in practice with only a few possible exceptions such as emergency vehicles"*. However, as the application of this phenomenon can be seen as a rarity, we will also focus on carfree development, which is defined by Steven Melia (2010) as: *"Residential or mixed-use developments which: a) Provide a traffic free (see footnote 1) or nearly traffic free immediate environment, b) Are designed to facilitate movement by non-car means, and c) Offer no parking for residents or limited parking separated from the dwellings."*

Examples

Venice (Italy) can be seen as a carfree city in one of the purest forms. Venice is attached to the mainland (Mestre) by a long bridge on which cars may travel, but cars can only get to the Piazzale Roma, a square at the edge of the city. From there people have to continue on foot, water taxi or boat.

Vuaban (Freiburg, Germany) is an example of a carfree development. Vauban's streets are completely 'carfree', except for the main thoroughfare, where the tram to downtown Freiburg runs as well as a few streets on one edge of the area. Residents are allowed to own a car, but there only two places to park at the edges of the area.

3.1.2. Theoretical or application?

This aspect is meant to analyse whether carfree cities should be seen as theoretical constructs, idealistic and not applied yet, or as proven and widely applied method. First point to notice, is that answering this question is strongly related to the definition of carfree. As mentioned, these definitions vary widely. According to one of the sources with a far reaching definition, the one of Crawford (2000) (no cars, only emergency vehicles), there is only one city that we are aware of in which carfree is (almost) completely applied, being Venice. However, the book of Crawford itself is mainly theoretical; there is a lack of applied examples. We also have the paper by Alameri (2011), which describes the application of the carfree city concept to the city of Masdar (United Arab Emirates): *"One of the first attempts to create a modern urbanised area of these dimensions that is completely free of privately-owned vehicles"*. However, although in the first concepts of this city the traffic system would be build on a personal rapid transit system (PRT) for internal mobility, this idea has been scaled back, and shared (electric) cars were introduced (PRT Consulting, 2010). Concerning carfree developments, the practical examples are numerous, and several sources used case studies to analyse these examples (e.g. Bieda, 2016; Bonnel, 1995; Coates, 2013; Foletta and Henderson, 2016; McKenzie, 1999; Ornetzeder et al., 2008). What we can conclude is that theoretical frameworks to design carfree cities are available (e.g. Crawford, 2000; Crawford, 2009; Wright, 2005); that the application of complete carfree cities (i.e. carfree, except emergency services) is limited; but that there are both theoretical frameworks as well as widely applied examples to get to low-car areas (e.g. Scheurer, 2001; Tight, Rajé, and Timms, 2016; Rydningen, Høynes, and Kolltveit, 2017; Foletta and Henderson, 2016).

Examples

Masdar City (Abu Dhabi, United Arab Emirates) is an example of a carfree designed city, built as sustainable city, using solar energy and other sustainable energy. Originally this city was designed to be entirely car free, although a small amount of vehicles can now be found roaming its streets.

GWL-wijk (Amsterdam, the Netherlands) is a Dutch example of a carfree development. The idea behind this area was to become a carfree and environmentally friendly residential area. Not only focused on car use (the streets in the GWL area are carfree), but on car ownership as well – the only parking spaces available were created on the edge of the GWL-area.

3.1.3. What areas?

Now we have found that carfree developments have been applied in practice, next step is to find out in what context these developments have been applied. Does this include complete cities, or more often areas or city centres? As mentioned before, complete carfree cities are scarce. Although several papers analysed the theoretical aspect of these carfree cities (e.g. Crawford, 2000; Crawford, 2009; Minh, 2016; Nieuwenhuijsen, Bastiaanssen, et al., 2018), there are very few cities in which this complete carfree concept has been implemented (Alameri, 2011). However, the number of cities that reduced the number of cars in their city centres is way higher. Starting at the end of the twentieth century many cities started to ban cars from their city centres (Topp and Pharoah, 1994). Where this often started with limited measures and policies, are these nowadays more impactful, like the city of Oslo which planned to "make the city centre (...) pedestrianised during the council period[2]" (Rydningen, Høynes, and Kolltveit, 2017). The areas in which carfree developments have been applied are even bigger in number. This often includes residential areas (like GWL-area Amsterdam, Vauban in Freiburg, Hammarby Sjöstad in Stockholm) (Foletta and Henderson, 2016), but could also include a city park (Tsubohara, 2007) or a former airport (Kushner, 2005).

In order to get an idea of the three main forms of carfree areas and how often these forms occur, figure 3.2 shows the different forms. Although it is not possible to count all possible cases, a list of carfree places in the world is being maintained with use of crowd sourcing (*List of car-free places - Wikipedia* n.d.). The numbers under the three forms give an indication of how many examples there are per form, in the world. Broadly speaking we can conclude that, although straight forward, the more far reaching the intervention (like a carfree city), the lower the number of applied examples. Most of the papers describe car reducing or low-car developments, which showed to be easier implementable.

[2] 2015–2019

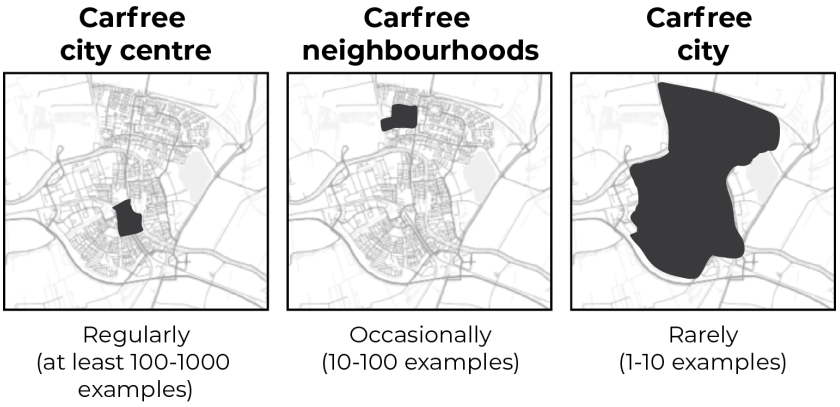

Figure 3.2: Carfree areas examples

3.1.4. Desired results

To find out why a carfree city may be desired, an investigation into the drives or motivations to realise carfree developments is needed. Why are carfree developments desired? Which results should be achieved? A quick look into the different desired results provides a varied picture; the desired results strongly differ per paper. However, some groups can be distinguished. At first an important group is the results that have to do with liveability or attractiveness of an area, several papers mention these effects (e.g. Betz, Prottung, and Lienkamp, 2017; Kushner, 2005; McKenzie, 1999; Minh, 2016; Ornetzeder et al., 2008; Orski, 1972). An other group that can be distinguished are the factors related to congestion and reducing the number of cars in areas to counter this congestion (e.g. Bonnel, 1995; C. Nobis, 2003; Tsubohara, 2007). Environmental results are quite often mentioned, with effects like countering the carbon emissions caused by traffic. What may have been expected is that issues concerning safety would be mentioned often. However, although this is referred to in some of the papers (e.g. Loo, 2018), this is not often seen as one of the main desired results. The majority of the sources mention different combinations of the before mentioned desired results, as well as some additional concepts like improving *Vibrant city life*, enhancing *Social functions of streets* and counter *Space constraints*. Table 3.1 shows how often different terms as desired result are mentioned in the literature review.

count	word	count	word	count	word
8	green	6	space	4	transport
7	environment	5	air	3	carbon
6	noise	5	congestion	3	community
6	pollution	4	environmental	3	development
6	public	4	sustainable	3	emissions
6	quality	4	traffic	3	social

Table 3.1: Word count of desired results

To conclude we can say that the desired effects are numerous, and are not limited to just one or two fields but cover several fields, from environmental to social. Most of the possible interventions have desired results connected to a wide variety of positive effects. However, these effects are often *desired*, but that does not mean they will appear as well. If these interventions are both feasible and effective, carfree is very promising, but whether that is the case, is not always known yet and sometimes questionable.

3.1.5. (Proposed) strategies or policies

One of the first observations to be made, regarding the (proposed) strategies or policies to achieve a carfree city, is the statement of Nieuwenhuijsen, Bastiaanssen, et al. (2018): "*Despite emerging initiatives and a growing awareness of the environmental, health and social benefits of carfree cities, the academic literature on how to make this transition (...) remains scarce.*" However, this statement is strongly related to the way in which carfree cities are defined. Out of this literature review, we indeed can conclude that there are not many clear strategies to make the transition to a carfree city. Alameri (2011) describes shortly in which way

they designed a carfree city (Masdar), but that cannot be seen as the description of a clear policy. Another interesting observation is the one of Steven Melia, Barton, and Parkhurst (2013), which mentions that all of their analyses refer to new developments: "a literature search failed to produce any examples of the removal of cars and vehicular access to a comparable extent from existing residential areas".

However, when it is not about carfree cities but about carfree developments, there are some (proposed) strategies or policies. At the same time, most of these strategies or policies stick to some high-level ideas of how to get to low-car, such as forbidding car access to city centre, urban toll, restrain use of cars and promote public transport (e.g. Bonnel, 1995). Although districts like Vauban (Freiburg) are often described and mentioned as an example of carfree housing (e.g. Coates, 2013; Foletta and Henderson, 2016; C. Nobis, 2003; Scheurer, 2001), these sources do not include a clear evaluation of the followed strategy or policy in order to come to such a carfree housing project. However, what is noticeable, is the attention for a good participatory process, mentioned by multiple sources (Coates, 2013; Foletta and Henderson, 2016; Minh, 2016; Nederveen et al., 1999; Nieuwenhuijsen, Bastiaanssen, et al., 2018; Scheurer, 2001; Wright, 2005).

We can conclude by stating that the literature which come up with a clear description of policies or strategies to achieve carfree cities remain scarce. There has been written quite a lot about developments towards low-car, and several policies and strategies can be identified. However, this often stops at the introduction of the policy and does not include elaborate analyses on proposed strategies.

3.1.6. (Expected) effectiveness of policies

Now that we know that there are some strategies or policies to achieve low-car areas, next question is: What do we know about their effectiveness? First observation is that it is hard to answer this question. What is effectiveness? How is effectiveness in this context defined? Although there are several successfully implemented carfree developments, there is not always a clear evaluation of the effectiveness of these policies. This already starts by an evaluative framework; When is a development perceived as effective? What are the goals to be achieved? What are the indicators? Although a lot of the sources mention desired results, there is not always a clear assessment whether these desired results are achieved. Wright (2005) is helpful in this, he comes up with an evaluative framework, based on aspects like affordability; attractiveness; comfort; connectivity; convenience; legibility; safety and sociability. However, the sources in the literature review do not use this, or a similar framework, in a structured way.

That does not mean effectiveness is not mentioned at all. Several papers use the change in modal split as a good indicator to see the effectiveness of the interventions (e.g. Foletta and Henderson, 2016; Tight, Rajé, and Timms, 2016; Topp and Pharoah, 1994). Tight, Rajé, and Timms (2016) mention a reduction of car use in Münster (Germany) from 40,5% in 2011 to 29% in 2013. Topp and Pharoah (1994) show that in Lubeck (Germany) out of those who formerly drove by car into the city centre 12% switched to public transport, cycling and walking. Next to this effectiveness described in a quantitative way, substantiated with numbers, multiple papers assess the carfree developments in a certain way as (partly) effective in a qualitative manner (e.g. Bonnel, 1995; Foletta and Henderson, 2016; Loo, 2018; Nederveen et al., 1999; Orski, 1972; Wright, 2005). However, to conclude with these papers that carfree developments can be seen as effective is not possible. There is a lack of clear evaluation indicators, frameworks and data. Although the various policies mentioned by the authors may be seen to a greater or lesser extent as effective, no hard conclusions can be drawn about this effectiveness.

3.1.7. (Expected) feasibility of policies

Beside effectiveness, feasibility is an important factor in successful adaptation of interventions to achieve carfree developments. After all, promising interventions that turn out not to be feasible in practice are useless. However, equal to effectiveness, feasibility is quite a broad and extensive term. The different papers in the literature review use feasibility as a term multiple times, but a clear definition is not given. One could say that interventions showed to be feasible if the intervention did turn out to be applicable in practice. In that light, multiple sources show interventions to be feasible as they analyse case studies with carfree developments like Vauban (Freiburg-Germany), GWL-area (Amsterdam-Netherlands), Bologna (Italy) and Lubeck (Germany) (e.g. Coates, 2013; Foletta and Henderson, 2016; C. Nobis, 2003).

Very few papers in this literature review evaluate cases based on feasibility. There are, however, some

reasons to expect feasibility: The results of Gundlach et al. (2018) indicate a general acceptance of carfree city centers; The experience of European carfree projects show that this has been feasible according to Kushner (2005); and potential demand for carfree developments does exist (Steven Melia, Barton, and Parkhurst, 2013). However, a number of issues regarding to feasibility can be found as well; Minh (2016) mentions some difficulties regarding to social aspects and planning and design. The participatory process is mentioned as well by several papers, being helpful or a requirement for successful implementation (e.g. Coates, 2013; Foletta and Henderson, 2016; Minh, 2016; Nederveen et al., 1999; Nieuwenhuijsen, Bastiaanssen, et al., 2018; Scheurer, 2001).

As result of a lack of clear evaluation frameworks, main conclusion is that the feasibilities of several potential policies mentioned or analysed in these papers, is unknown. In general, although this may be deducted from the fact that some of them are applied in practice, these papers do not provide enough information to be able to draw a clear conclusion about the feasibilities.

3.1.8. New knowledge gaps/ further research mentioned

The authors come up with a ranch of topics for further research. They vary from the need to research the *"health- or economic impacts of carfree development"* (Steven Melia, 2014), to the need to *"create good and feasible strategies and scenarios, and further research evidence which can facilitate the move towards more sustainable, healthier and inclusive cities"* (Nieuwenhuijsen, Bastiaanssen, et al., 2018). Steven Melia, Barton, and Parkhurst (2013) found: *"A literature search failed to produce any examples of the removal of cars and vehicular access to a comparable extent from existing residential areas"*. Findings of Nieuwenhuijsen, Bastiaanssen, et al. (2018) include: "*Despite emerging initiatives and a growing awareness of the environmental, health and social benefits of car-free cities, the academic literature on how to make this transition (...) remains scarce.*" Although maybe straightforward, Nieuwenhuijsen and Khreis (2016) recommends the following: *"Further research and research synthesis [about carfree cities] are needed to build a good evidence base"*.

3.2. Knowledge gap

What can be concluded from the literature review is that carfree and low-car developments are on the rise. There is an increasing number of initiatives, and literature describing those initiatives is on the rise as well. However, this still remains an underexposed field of knowledge. This is especially the case when we speak about carfree cities in a way authors like Crawford see it (Motorised vehicles are banned from cities, although a few possible exceptions are possible such as emergency vehicles). For carfree developments there is more and more information available, but large areas of knowledge still remain undiscovered.

One of the conclusions is that we find a lack of clear policies or strategies to achieve more carfree areas. The policies and strategies mentioned are often high level or stick to just basic recommendations, the sources barely include a clear evaluation whether the policy can be assessed as successful. Nieuwenhuijsen, Bastiaanssen, et al. (2018) came up with a start by describing prerequisites to facilitate the transition towards becoming carfree, but primarily mentioned some possible ideas and ways of thinking. In order to achieve carfree cities, it is expected that a variety of both existing as innovative measures is needed. Feitelson & Salomons (2004) came up with a framework for analysing the adoption of transport innovations. They distinguish three kinds of feasibility; The technical feasibility, the political feasibility and the social feasibility as requisites for adaptation (Beuthe et al., 2004). One of the important factors that influence this feasibility is the perceived effectiveness. Although a number of measures are already being taken into getting (partly) carfree or reduce car traffic (e.g. Andersen, 1993; Cullinane, 2003; Friman, Larhult, and T. Gärling, 2013; T. Gärling, A. Gärling, and Johansson, 2000), their perceived effectiveness and feasibility is often unknown. As several municipalities have intentions and plans for interventions towards carfree or low-car, or have already implemented such interventions (e.g. Kruyswijk, 2019a; Voermans, 2019; Gemeente Amsterdam, 2019a; Kruyswijk, 2019b; Gemeente Rotterdam, 2019), it is important to know how municipalities can get to such a carfree city and what effective and feasible policies or strategies can be applied to achieve this.

3.3. Theoretical framework

We have concluded that it is important to know how we can get to carfree or low-car cities, and what effective and feasible policies or strategies can be applied to achieve this. First step is the identification of potential policies in chapter 4. After that, we will evaluate some of these policies in detail, but in order to do so, we need a theoretical model to guide this evaluation. We want to build our model based on other existing theories. As we want to look for future policies that will be implemented in cities, we can describe these policies as innovations; new methods or ideas to be introduced in cities. In order to be successful, these innovations need to be adopted. Therefore we will first dive into possible frameworks that describe the adoption of innovations.

3.3.1. Theories for adoption of innovations

In literature, there are several frameworks that describe the adoption of innovations. We have Rogers (2003) Diffusion of Innovations Theory, in which he describes diffusion as a process by which an innovation is communicated over time among participants in a social system, in which he identifies four elements influencing the spread an innovation: the innovation itself, communication channels, time, and a social system. Ajzen (1985) Theory of Planned Behaviour describes the use of an innovation as the process in which attitudes of people, their perceived behavioural control and the subjective evaluation of their behaviour predict intentions to engage in a particular behaviour. The Technology Acceptance Model (Davis, 1989), is an information systems theory that models how users come to accept and use a technology, based on the perceived usefulness and the perceived ease of use. The framework of Feitelson & Salomon (Beuthe et al., 2004) describes the adaptation of innovations, they identify three kinds of feasibility (technical, political, social) as requisite for the adaptation of transport innovations.

Although all these frameworks have their own characteristics and advantages, we choose for the framework of Feitelson & Salomon as framework for this part of the study. This framework fits well in a context in which many of these policies are implemented: It is often about socio-technical innovations, which often arise as results of problems in society, where the effectiveness and feasibility of the innovations are often unsure. The innovations often are not tangible, concrete tools, but more often policy concepts, like regulations or incentives. Lastly, these policies are not driven by market, but are often ideologically and politically-driven, resulting in the political and social feasibility being even more important.

Political economy model for transport innovations

Feitelson & Salomons' (2004) framework describes the adaptation of transport innovations, and can be useful to assess whether these policies or measures will successfully be adopted. Feitelson & Salomon distinguish three kinds of feasibility; The technical feasibility, the political feasibility and the social feasibility (Beuthe et al., 2004). The technical feasibility is often determined by experts. The social feasibility is suggested to be a combination of the public perception of problems as well as the perceptions of the effectiveness of the suggested innovation in solving these problems. The political feasibility is influenced by several factors, which include the social feasibility (as politicians do want to represent their voters), but is influenced by things like other interest groups and decision making procedures as well. Worth to mention is the fourth feasibility, the economic, which is not shown in figure 3.3, but is mentioned as a separate feasibility in the chapter of Feitelson and Salomon, which is meant as the benefits which must outweigh the costs.

One of the important aspects they describe is the perceived effectiveness; which they define as 'The perception of the effectiveness of the proposed innovation in addressing the problem (which can be seen as the 'public perception of the problem')'. Although there a several measures introduced to reduce car traffic in cities, the perceived effectiveness as well the feasibility of these measures is often unknown. With use of this framework policies to achieve a carfree city can be evaluated, both on feasibility as on (perceived) effectiveness.

Limitations of this framework include that the framework is static, it does not include changes over time. Besides that, it is quite generic. To meet the last limitation, we add a theory from Khreis, May, and Nieuwenhuijsen (2017) as well, which described the prerequisites for the implementation of carfree cities.

Prerequisites for the implementation of carfree cities

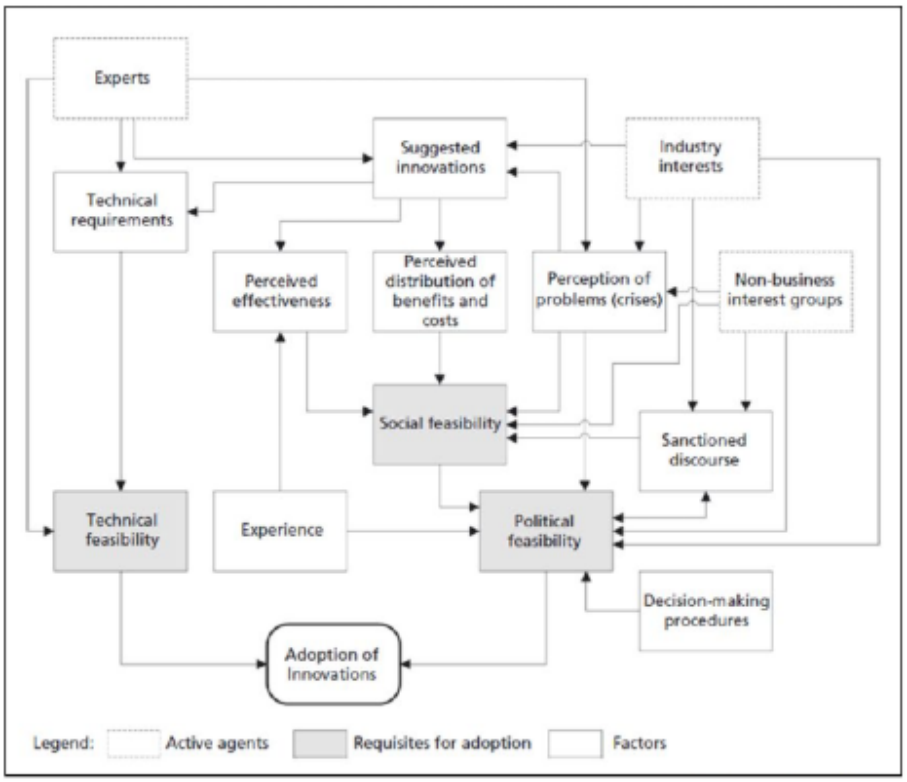

Figure 3.3: Political economy model, Feitelson & Salomon (Beuthe et al., 2004)

The findings of Khreis, May, and Nieuwenhuijsen (2017), which described the prerequisites for the implementation of carfree cities (see 3.4), are strongly in line with the framework of Feitelson and Salomon. Although they mention concepts like 'political vision and leadership' and 'Dedicated funding', which are not included in Feitelson and Salomon's framework, they do identify several factors which are in line with the feasibility and effectiveness as well; The need of 'stakeholders involvement and support' is mentioned, 'public involvement and acceptability' and an 'evaluation of the status and a post evaluation of the impacts' as well. Hence, we can state that evaluating the feasibility and effectiveness of possible interventions is helpful to fulfil these prerequisites for the implementation of a carfree city.

3.3.2. Definition and measuring effectiveness

However, both effectiveness and feasibility can be seen as umbrella concepts, they include several aspects which depend on the context. So first step is to define these concepts. Beuthe et al. (2004) describes effectiveness as 'The perception of the effectiveness of the proposed innovation in addressing the problem'. However, as we will see in the Literature Review about carfree cities (see 3.1.4), the desired results (which are related to the problem perception), are very broad and numerous. There is no clear definition to be drawn about what actors consider as 'effective'.

The paper of Bojković, Petrović, and Parezanović (2018) aimed to come up with indicators outlining prospects to reduce car use. However, the number of indicators they come up with is numerous as well, from an 'urban sprawl index', 'commercial speed of public network' to the 'length of cycling network'. Although these indicators will be very insightful, the availability of data is often questionable. One clear indicator that is recurring from most of the papers in the literature review (see section 3), is the *modal split change* (in number of trips). This indicator describes the way in which people shift between the different modalities. We choose to include this indicator, as it provides a clear and objective insight in the use of cars. However, although the reduction in the number of kilometres travelled by car is often a goal, this does not automatically have an effect on the number of cars in the environmental surroundings. There still may remain several cars on the streets which are not in use, but do still claim space in the surroundings. Therefore, another indicator we use is the *car ownership*. This indicator is measured by the number of cars per household.

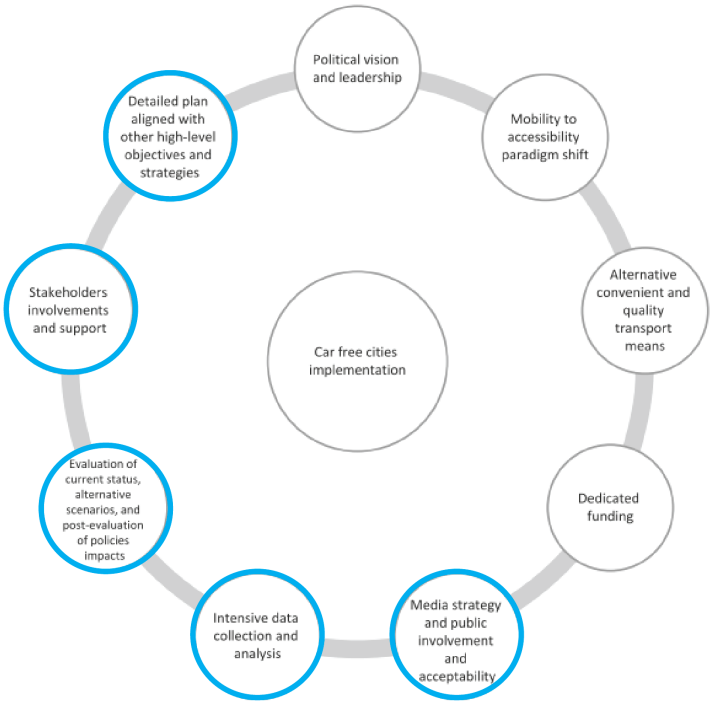

Figure 3.4: Prerequisites of carfree cities, adapted from Khreis, May, and Nieuwenhuijsen (2017)

These two measures are in line with the framework of Krizek, S. L. Handy, and Forsyth (2009) (see figure 3.5), in which they related an increase in walking, cycling and PT, as well as a decrease in car ownership, like reduced pollution and enhanced liveability. Because we know these indicators will lead to these benefits, we do not have to measure all of the separate benefits, but will suffice with these two indicators.

These two indicators will be used to evaluate the effectiveness of the policies. Ideally, one would measure a before and after situation. As mentioned by Nieuwenhuijsen and Khreis (2016), the reviews carried out into carfree measures often have a lack of before and after evaluation to test the impacts of a specific intervention. Although this kind of evaluation would probably give the most objective results, it is not possible to carry out this kind of analysis in this thesis. However, in order to get useful results, there is another method as well: In order to evaluate the effectiveness we will compare the indicators between a city with the policy intervention implemented and a city that did not implement this intervention. Although this may come with some 'noise', this will provide insightful results whether the intervention can be evaluated as effective or not.

3.3.3. Definition and measuring feasibility

Feasibility can be seen as umbrella concept as well, but Feitelson & Salomon already distinguished three kinds of feasibility; The technical feasibility, the political feasibility and the social feasibility. With the technical feasibility we will assess whether the policy is technical feasible, i.e. is it possible to implement the policy in Dutch cities, and under what requirements, challenges and limitations. We will asses the social feasibility on base of the public perception of problems and their perception of the effectiveness of the policy, will the policy be implemented by society? The political feasibility will be assessed by an analysis of the political environment, are there clear majorities, how are political parties affected by interest groups, what is their role in decision making? Measuring these feasibilities is hardly possible in a quantitative way, therefore we will use a qualitative manner being semi-structured interviews.

3.3.4. Theoretical evaluation framework

A visual representation of the structure of the evaluation described above can be found in figure 3.6. Note the connection between effectiveness and feasibility (dotted line). There are arguments to assume that there

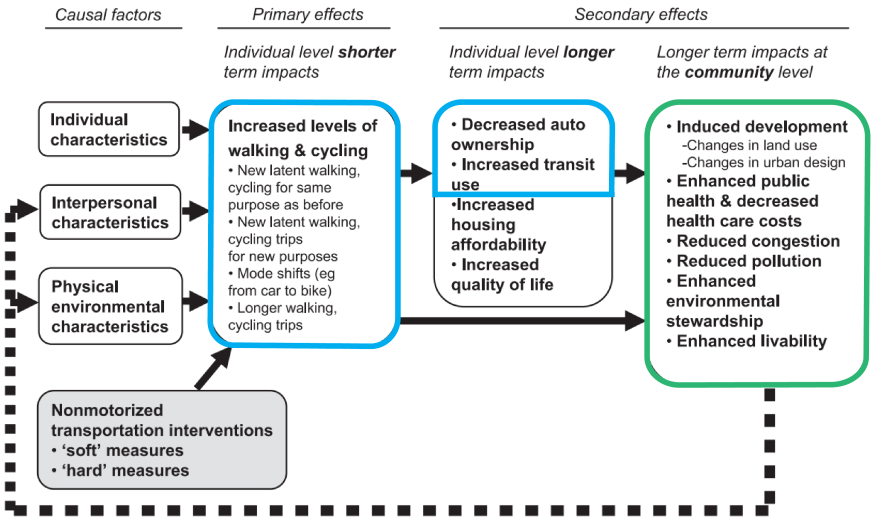

Figure 3.5: Framework modal share and car ownership and long-term impacts on community level, adapted from Krizek, S. L. Handy, and Forsyth (2009)

is a link here. However, that cannot be stated with complete certainty. Therefore, this possible relation is represented by a dotted line. This relationship is elaborated on in subsection 5.4.3.

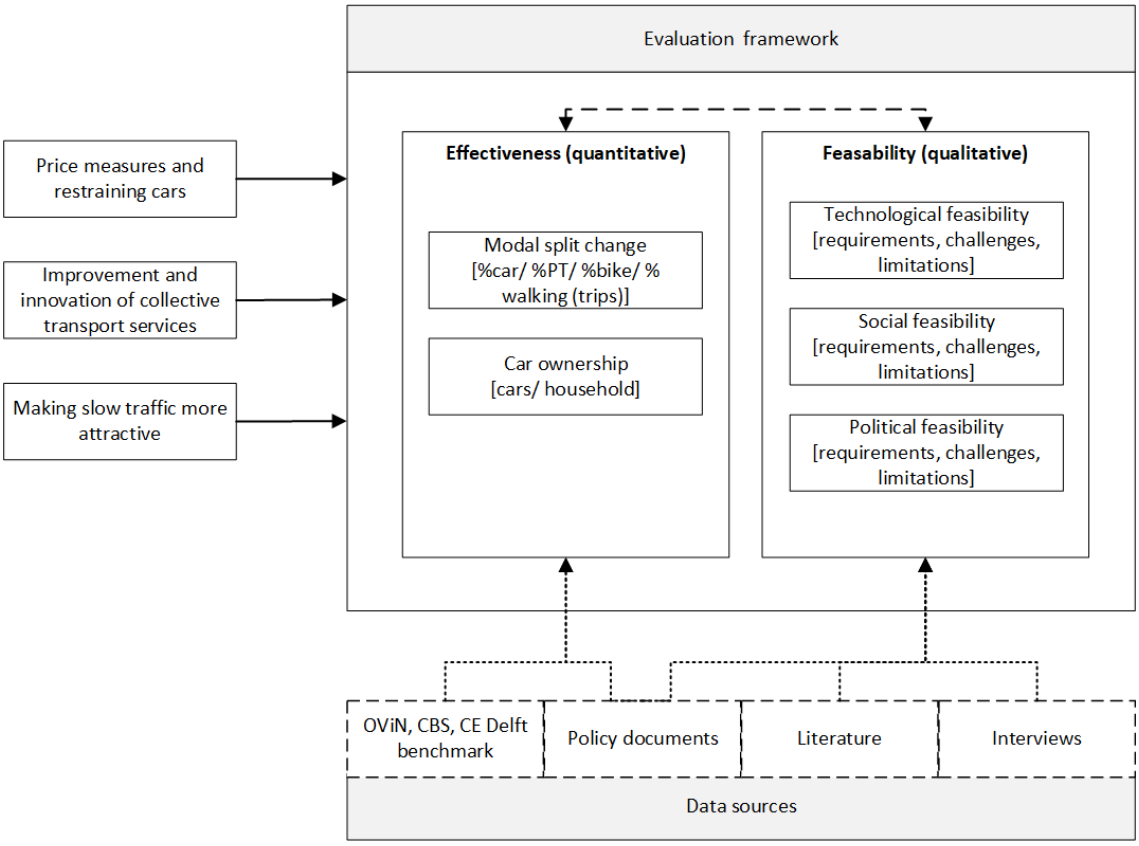

Figure 3.6: Evaluation framework: Structured representation evaluation policies

4

Potential policies

This chapter aims to identify government policies contributing to the realisation of low-car or carfree cities. In order to come up with a list of potential policies a search has been conducted with use of scientific literature, policy documents and interviews. Section 2.2 describes the methodology to find these policies, including the search process and assessment of the policies.

4.1. Results of a broad search into policies

As described in the methodology section (see 2.2), we carried out a search into policies with use of three methods. At first we analysed scientific literature, secondly we analysed policy documents of ten municipalities (selection process of municipalities can be found in the methodology section, 2.2). Lastly, we used the interviews with experts to find policies. Goal of this search was to find policies that contribute to the realisation of low-car or carfree cities. The search into scientific literature provided almost 60 (unique) policy measures based on 90 sources. The search into policy documents provided over 225 (not unique) policy measures based on approximately 64 sources. It is important to emphasise that 'a policy' is broadly interpretative. The policies found vary from abstract (stimulate use of public transport) to more specific (public campaign to bring children to school by bike or foot instead of car) policies.

We analysed the policies found in literature based on a number of aspects: We evaluated whether the sources provided a clear evaluation of the effectiveness and the feasibility of the policy; We evaluated whether the authors assessed, valued or considered the policy as effective and as feasible or not?; and we evaluated whether this policy is already implemented, and if so, in which city. The policies found in the policy documents have been evaluated on the following aspects: Does the source have a clear evaluation or expectation of the effectiveness and feasibility of the policy; Does the author mention that this policy is planned to be implemented; And does the author mention that this policy has already been implemented. We made an estimation about the expected implementation effort of the policy (high/ medium/ low) as well as the nature of the policy (honey or vinegar, i.e. reward- or sanction-based), for both the policies found by literature as policy documents.

In order to get more insight, we grouped the several measures into eleven groups. The findings of this search are represented in two overview-tables, which can be found in Appendix D. Here we first discuss the eleven groups, followed by an overview table of the groups of policies, an analysis of the policies, a comparison between the policies from Literature and the Policy documents as well as some 'other findings'.

4.1.1. Groups of measures

This subsection provides a short overview of the characteristics and contents of the groups of policy measures.

Restrictions on car movement

When one thinks of policies which contribute to the realisation of low-car or carfree cities, this group of measures will probably be one of the first concepts which come to mind. There is a list of various forms that can be described as a restriction on car movement, varying from car restrictions in city centres to high

occupancy vehicle lanes, in which only cars with more than two people in it are allowed to use this lane. However, most of these measures include a restriction for cars on a certain street or in a certain area. In literature this measure is often perceived as effective. Although in just a few papers based on numbers (e.g. Nijland and Meerkerk, 2017; Tight, Rajé, and Timms, 2016; Simićević, Vukanović, and Milosavljević, 2013), several of the papers mentions positive impacts of these measures. Feasibility is not always clear described, however, some papers mention that these measures are feasible, like the introduction of traffic calming zones in Delft and Darmstadt. Looking at policy documents, there are several cities which have plans for these kinds of measures, including traffic calming areas, low-car city centres and stricter access for cars in parts of the cities. Some of them are quite easy to implement (car restriction in a city park, Groningen), others are much more difficult to realise (Improvement of sector-model with an inner and outer ring, Groningen). This group of measures can often be described as being quite effective, relatively easy to implement and intervening directly into the reduction of car traffic.

Restrictions on car movement	**Literature**	**Policy documents**
Number of measures identified	18	15
# effectiveness evaluated (# of which perceived effect.)	10 (6)	0 (n/a)
# feasibility evaluated (# of which perceived feas.)	6 (3)	0 (n/a)
# honey vs # vinegar	1 / 17	0 / 8

Table 4.1: Search results group 'Restrictions on car movement'

Restrictions on parking cars

With restrictions on the possibility to park cars, several sub goals are achieved. On one hand, these restriction are ought to lead to fewer cars parked on the streets, resulting in more space for recreation and a pleasant living environment. At the same time, this restriction is ought to lead to fewer car-movements; After all, when it will take a lot of time and effort to park your car, people are more likely to consider other modes of transport. The measures that are described in literature include measures like residents parking programs and the reduction of parking supply. Although some of these sources mention the effectiveness (like "parking supply can significantly determine household car ownership decisions", based on stated preference (Guo, 2013)), it is not possible to draw a clear conclusion about to what extent such kinds of policies lead to the realisation of low-car or carfree cities. Feasibility of these kinds of measures is not mentioned at all in these papers. When we look at the policies of municipalities, these kinds of measures play an important role: Several municipalities are planning to tighten the parking policies. The norms for parking places (parkeernormen) in new developments are often seen as an important method to get to low-car areas. However, none of these policy documents mention the perceived effectiveness of these measures; Or to what extent this measure will lead to fewer cars the streets. Although some of them speak about some aspects of feasibility (like need of Public Transport in the surroundings), none of them provides a clear evaluation framework of the feasibility including the impacts. Although the papers in the literature mentions some good results for effectiveness, it is unsure whether the stricter parking-standards in Dutch cities will lead to similar effects. In general, these kinds of measures are promising, but much is unknown about the effects and impacts of these kinds of measures.

Restrictions on parkings cars	**Literature**	**Policy documents**
Number of measures identified	3	10
# effectiveness evaluated (# of which perceived effect.)	2 (2)	0 (n/a)
# feasibility evaluated (# of which perceived feas.)	0 (0)	0 (n/a)
# honey vs # vinegar	0 / 3	1 / 9

Table 4.2: Search results group 'Restrictions on parking cars'

Price measures

Strongly related to the first two groups of measures (Restrictions on car movement and parking), is the

group of price measures. These kinds of measures do no restrict the use of cars, but makes the use of a car unattractive by increasing the costs. One of the main ways to do so is the use of congestion or urban tolls. The idea is simple: When many people want to use a certain place of road, the price to use this spot will be higher. The objective of this policy is using the price mechanism in order to make people aware of the fact that they create additional congestion, to make them pay for the additional congestion and negative externalities they create, and making them aware of their impact on the environment. The same principle can be used when it is about the parking of cars by using parking fees. In literature these kinds of measures are described quite elaborately, including some interesting examples like the London and Stockholm congestion charge. Even the feasibility of the Stockholm and London congestion charges are described by some papers (e.g. Leape, 2006; Eliasson et al., 2009), and were assessed as being feasible. However, when we look at Dutch municipalities, we found no clear examples of a congestion charge or urban toll. This is interesting, as the perceived effectiveness by literature is high, and these kinds of measures are seen as feasible. Reasons can be that these kinds of measures are seen as 'vinegar' measure, citizens will experience this measure as restricting, making this an unpopular measure. Besides that, a congestion charging like London has a big impact and will take a lot of time and effort to be implemented, which may have a negative impact in the willingness to implement this measure. Other reasons may be the regularly recurring national discussion about road pricing (kilometerheffing), possibly leading to reluctance of municipalities to take local measures. On the other hand, what we do see in Dutch cities is the use of parking fees in order to influence the use of cars. However, although these kinds of measures are expected to be feasible, the policy documents do no provide clear evaluations of the perceived effectiveness of the policy measures. Only few literature sources evaluate the effectiveness, for example Simićević, Vukanović, and Milosavljević (2013), who modelled the price elasticity of parking (i.e. higher fee, lower demand). In general, price measures can be considered as effective, however, the implementation of these kinds of measures in Dutch cities is (except for parking fees) remarkably low.

Price measures	**Literature**	**Policy documents**
Number of measures identified	18	3
# effectiveness evaluated (# of which perceived effect.)	14 (12)	1 (n/a)
# feasibility evaluated (# of which perceived feas.)	6 (2)	0 (n/a)
% honey (vs vinegar)	2 / 16	0 / 3

Table 4.3: Search results group 'Price measures'

Sharing initiatives and intermodality

This group of measures is based on methods to use cars more efficiently, by introducing sharing initiatives and stimulating intermodality. In both literature as the policy documents this group is described quite elaborately. Over the past years several ways have been introduced, in first instance mainly based on carpooling, later on with stronger focus on car-sharing, and more recently with the introduction of Mobility-as-a-service (MaaS), which is a mobility concept, in which the consumer uses different means of transport via one subscription. In literature these kinds of measures are often seen as effective, although they often lack clear results or numbers about the extent in which these measures realise low-car or carfree cities. In policy documents we see that almost all cities have (multiple) forms of sharing initiatives in their cities, and that MaaS is often mentioned as one of the methods that is expected to play an important role in the 'mobility transition'. However, at the same time we notice that the supply of different forms of sharing initiatives is way higher in the bigger cities like Amsterdam (several suppliers, several modalities like e-scooters as well, mobility hubs), than in the smaller cities like Helmond. Main goal of these concepts is to seduce car drivers to get rid of (one of) their own car(s) or reducing the number of kilometres they drive, and seduce them to choose for a shared solution instead. Although this concept is on the rise, it is still questionable to what extent this revolution will lead to low-car or carfree cities.

Making Public Transport more attractive

An important way of realising and enabling a low-car or carfree city, is to make other modes of transport more attractive, in order to seduce car drivers to make a shift in their way of travelling. This group of measures is an important example in doing so: Making Public Transport more attractive. However, although these

Sharing initiatives and intermodality	Literature	Policy documents
Number of measures identified	10	18
# effectiveness evaluated (# of which perceived effect.)	7 (5)	0 (n/a)
# feasibility evaluated (# of which perceived feas.)	0 (0)	0 (n/a)
% honey (vs vinegar)	9 / 0	18 / 0

Table 4.4: Search results group 'Sharing initiatives and intermodality'

kinds of measures are quite elaborately described in literature and are often implemented in cities, it is still not completely clear to what extent this leads to a change of modal split. Satiennam et al. (2016) report an effective introduction of a Bus Rapid Transit system and Eriksson, Nordlund, and Garvill (2010) reports an effective improvement of the Public Transport transit design, but numbers that substantiate the modal split change by upgrading or expansion of the public transport system in cities that are similar to Dutch cities are hard to find. Although reports like the one from Hoen et al. (2019) states that investing in public transport and bicycle accessibility has a higher return than investing in car accessibility, the effect in large cities is more limited due to their current good public transport accessibility, and that report still does not provide clear figures as to what this means for the modal split change. We find the same, when we look at the policy documents: Several measures are mentioned to improve Public Transport, but the expected effectiveness is not mentioned. At the same time many of these measures have a high impact: It is often difficult and costly to improve the public transport network, especially when it comes to railways. At the same time this group of measures may be considered to be a key element in the shift towards carfree or low-car cities, which is probably the reason we see numerous measures in policy documents that are about improvements of Public Transport.

Making PT more attractive	Literature	Policy documents
Number of measures identified	11	45
# effectiveness evaluated (# of which perceived effect.)	7 (4)	0 (n/a)
# feasibility evaluated (# of which perceived feas.)	1 (0)	0 (n/a)
% honey (vs vinegar)	11 / 0	45 / 0

Table 4.5: Search results group 'Making Public Transport more attractive'

Making walking and cycling more attractive

Strongly related to 'making Public Transport more attractive', is this group of policy measures: Making walking and cycling more attractive. There is a very wide variation in possibilities to achieve this; Varying from the improvement of pedestrian crossings and quality of cycle paths, to improvement of regional cycling connections, to expansion of the capacities of bicycle parkings. The number of measures found in policy documents is high: Almost 100 measures. To a large extent the same applies here as in investing in public transport: Many governments use this policy measure; it is often seen as necessary in the mobility transition; but at the same time, the effectiveness is hardly known, both in literature as in policy documents. What applies to Public Transport also applies here: These measures can be seen as honey measures; Positive incentives are provided to convince car drivers to switch. These measures are therefore popular by policy-makers. Almost all municipalities are investing in such kinds of measures, some already for decades (e.g. Houten), others took in recent years the big leap (e.g. The Hague). The fact remains that although it is plausible that focusing on bikes and pedestrians results in fewer car kilometres, measurable results are often lacking. Only a few municipalities try to come up with a good substantiation of the expected effectiveness of the package of measures (such as the municipality of The Hague, see also the measures under 'packages' below). However, the expected effect on modal split is not known for any of the individual measures. Here, too, we conclude: Making walking and cycling more attractive can be seen as promising, but it is difficult to properly substantiate its effectiveness and feasibility.

Information campaigns to promote sustainable travel

This group of measures is one of the easiest ways to try to realise a shift towards carfree or low-car cities, at least, when we look at the effort it takes to implement these kinds of measures. It does not require huge

Making walking and cycling more attractive	Literature	Policy documents
Number of measures identified	9	92
# effectiveness evaluated (# of which perceived effect.)	4 (3)	0 (n/a)
# feasibility evaluated (# of which perceived feas.)	2 (2)	0 (n/a)
% honey (vs vinegar)	9 / 0	78 / 0

Table 4.6: Search results group 'Making walking and cycling more attractive'

investments and probably does not result in public disagreement. At the same time, both literature as policy documents do not have a clear evaluation or conclusion whether these kinds of measures can be regarded as effective. Something like a public campaign to promote public transport may sound interesting and easy to implement, but when the effectiveness is unknown is questionable whether these kinds of initiatives are worth implementation. On the other hand, it is also not substantiated that these interventions do not have any effect: They may be beneficial, as stand-alone measure or in combination with other measures.

Information campaigns to promote sustainable travel	Literature	Policy documents
Number of measures identified	4	8
# effectiveness evaluated (# of which perceived effect.)	0 (0)	0 (n/a)
# feasibility evaluated (# of which perceived feas.)	0 (0)	0 (n/a)
% honey (vs vinegar)	2 / 0	8 / 0

Table 4.7: Search results group 'Information campaigns to promote sustainable travel'

Sustainable housing

This group is somewhat different than all others: Where many of the other measures are aimed at reducing car use afterwards using a repressive approach, this group has a more preventive approach. With sustainable housing, neighbourhoods are designed and developed carfree or low-car, which reduces both car ownership and car use. Although Sustainable housing is quite a broad concept, we focus on one of its aspects; Carfree Neighbourhoods. This phenomena is described quite broadly in literature. Several example are mentioned, in countries like Germany (Vauban), the Netherlands (Amsterdam), and Austria (Vienna). Both the effectiveness as feasibility is evaluated quite well, with convincing results. The carfree neighbourhoods mentioned showed to be both effective as feasible. The impact of these kinds of developments are high, the example neighbourhoods show that it take quite a lot to develop such a neighbourhood, on both the legal side, participatory side, organisational side as political side. However, when we look at the policy documents, sustainable housing has less attention. There is just one example of planned development of a carfree neighbourhood, being the Merwede Kanaal Zone in Utrecht. Although we know that Amsterdam has a carfree neighbourhood as well (GWL-terrain), this kind of policy is hardly applied in Dutch cities, which is interesting, as the expected effectiveness is quite high. Remark that has to be made is the concept of *'self-selection'*; it may be the case in these examples that people that already live carfree are inclined to live in these kinds of neighbourhoods, which may mean that the effect on the modal split change is relatively small.

Sustainable housing	Literature	Policy documents
Number of measures identified	6	1
# effectiveness evaluated (# of which perceived effect.)	4 (4)	0 (n/a)
# feasibility evaluated (# of which perceived feas.)	2 (2)	0 (n/a)
% honey (vs vinegar)	6 / 0	0 / 0

Table 4.8: Search results group 'Sustainable housing'

Low-car design of cities

This group is related to both Sustainable housing as Restrictions on car movement. Examples of this group

are intervening in the built environment; increasing densities; reducing street width; densification of the inner city and Transport Oriented Development. The impact of these interventions is often high: It takes a lot to come to higher densities in cities. At the same time, these kinds of interventions may be essential when it comes to carfree development in cities. However, there are no clear conclusions that can be drawn from the literature about the effectiveness of these kinds of measures. Several municipalities mention interventions related to a low-car design of cities, but most of them are more high-level future visions than concrete measures. Although these policy measures may strongly contribute to low-car or carfree cities, there often remains a lot of work to be done for these municipalities.

Low-car design of cities	**Literature**	**Policy documents**
Number of measures identified	8	11
# effectiveness evaluated (# of which perceived effect.)	2 (1)	0 (n/a)
# feasibility evaluated (# of which perceived feas.)	0 (0)	0 (n/a)
% honey (vs vinegar)	1 / 5	2 / 0

Table 4.9: Search results group 'Low-car design of cities'

Freight

Although the distribution of freight play quite an important role in getting to carfree, the search in both literature and policy documents yielded only limited concrete policy measures on this field. What is mainly mentioned are innovative forms of urban distribution, for example through hubs around the city from where distribution continues with smaller carts or bicycles. However, the effectiveness and feasibility is still uncertain. Although this is an important part of the transition to carfree or low-car, cities mainly seem to focus first on the reduction of private cars.

Side note/ Example

Forms of city logistics do not yet seem to be widely adopted in Dutch cities. Although several cities have set up a variety of forms of urban distribution over the last years, still most of the goods are transported with traditional trucks and vans (Wiegerinck, 2019). At the same time, there is an increase in market-driven initiatives. Two examples: 1) **CoolblueFietst**: The delivery of Coolblue orders by bicycle, in a paper bag. 2) **DHL Cityhub**: A customised trailer which can carry up to four containers for the DHL Cubicycle (a cargo bicycle).

Freight	**Literature**	**Policy documents**
Number of measures identified	3	9
# effectiveness evaluated (# of which perceived effect.)	0 (0)	0 (n/a)
# feasibility evaluated (# of which perceived feas.)	1 (1)	0 (n/a)
% honey (vs vinegar)	1 / 0	8 / 0

Table 4.10: Search results group 'Freight'

Packages of Measures

Although the search into policy in literature did not provide packages of measures, these packages may be seen as one of the major ways to get to a low-car of carfree city. Although there are numerous policies described above, only few will be implemented solely. Therefore we also analysed some of the packages introduced in the policy documents. This often included a mobility plan, with numerous policy measures introduced in the same document. Others include a Bike Action Plan (Utrecht) or a traffic circulation plan (Gent). Although it was probably hard for municipalities to describe the expected effectiveness of individual measures, the city of The Hague tried to come up with an evaluation of the expected effectiveness of their mobility plan, which is evaluated every two years. On one hand these packages are not very useful for other

municipalities, as they are a customised product, specifically made for a certain municipality. On the other hand, these packages may provide interesting insights and inspiration for other municipalities. On top of that, it is plausible that a complete transition towards low-car of carfree can only be realised with a package of different measures, rather than individual measures.

Packages	**Literature**	**Policy documents**
Number of measures identified	0	5
# effectiveness evaluated (# of which perceived effect.)	n/a	2 (n/a)
# feasibility evaluated (# of which perceived feas.)	n/a	1 (n/a)
% honey (vs vinegar)	n/a	0 / 0

Table 4.11: Search results group 'Packages of Measures'

4.1.2. Analysis of policies

This subsection includes a short analysis into some of the characteristics of the policies, based on the aspects on which the policy measures have been analysed (see section 2.2). A summary of the findings per group can be found in table 4.12, including the averaged response to the different aspects.

Effectiveness

There is a number of observations that can be made. At first, it is remarkably that in almost all policy documents a clear evaluation or assessment of the (expected) effectiveness is missing. Although the reports expect the policy interventions to be effective, this is not substantiated with numbers. Remark that has to be made is that we only analysed policy documents, it is possible that behind these policy documents analyses have been carried out by civil servants or mobility consultancies about the effectiveness. At the same time it stands out that several (impactful) decisions have been made by city councils based on these documents, without clear evaluation or expectation of the effectiveness.

In the literature review (see chapter 3) we found that there where hardly any clear analyses or evaluations of ways to achieve carfree cities. Now we looked into policy measures that may contribute in the achievement of low-car or carfree cities, more information about effectiveness is available (mainly due to the fact that we now analysed individual measures instead of 'ways to achieve a carfree city'). At the same time, we must conclude that effectiveness is being seen as very broad concept. Although these papers often speak about interventions being effective, there are just a few that mention clear effects on for example car ownership or kilometres travelled (Like *"We found over 30% less car ownership amongst car sharers and they drove 15% to 20% fewer car kilometres than prior to car sharing"*, (Nijland and Meerkerk, 2017), *"A reduction of car use in Münster (Germany) from 40,5% in 2011 to 29% in 2013"* (Tight, Rajé, and Timms, 2016)). Most of the papers describe that the proposed measures are successful (or effective), but there are not always indicators to conclude this or the indicators are not easy comparable. That makes a good comparison based on effectiveness difficult, especially when we use our definition in which we look at modal split change.

Other point to mention is that about 20% of our analysed literature papers were based on Stated Preference (SP) techniques. Although SP has great advantages due to its flexibility, it is based on hypothetical choices, potentially leading to bias. Revealed preference data have the advantage that they reflect actual choices. There are only a few studies in the literature we used that used an ex-post evaluation of policy measures (e.g Eliasson et al., 2009; Washbrook, Haider, and Jaccard, 2006).

Although it may be beneficial for municipalities to take a look into the scientific literature to substantiate their proposed policy interventions, it seems like this is not happening much yet. Possibly on the one hand because this always involves a lot of customisation to the specific municipality, or on the other hand because the literature does not always provide unambiguous and easy interpretative numbers regarding effectiveness.

Feasibility

Only a few of the studies found in literature come up (in one way or another) with an evaluation of the feasibility. As well as effectiveness, feasibility is a broad concept, too. However, this feasibly does not always

Group of measures		Effectiveness evaluated?	Perceived effective by authors?*	Feasibility evaluated?	Perceived feasible by authors?	Implemented?	Implementation effort?	Honey/ Vinegar?
Restrictions on car movement	*Literature*	Yes	Yes	No	n/a	Yes	M	V
	Policy documents	No	-	No	-	Yes	L	V
Restrictions on parking cars	*Literature*	Yes	Yes	No	n/a	Yes	L	V
	Policy documents	No	-	No	-	Yes	L	V
Price measures	*Literature*	Yes	Yes	Yes	n/a	Yes	M	V
	Policy documents	No	-	No	-	Yes	M	V
Sharing initiatives and intermodality	*Literature*	Yes	n/a	No	n/a	Yes	M	H
	Policy documents	No	-	No	-	Yes	L	H
Making PT more attractive	*Literature*	Yes	n/a	No	n/a	Yes	M	H
	Policy documents	No	-	No	-	Yes	M	H
Making walking and cycling more attractive	*Literature*	Yes	Yes	No	n/a	Yes	M	H
	Policy documents	No	-	No	-	Yes	M	H
Information campaigns to promote sustainable travel	*Literature*	No	n/a	No	n/a	Yes	L	H
	Policy documents	No	-	No	-	Yes	L	H
Sustainable housing	*Literature*	Yes	Yes	Yes	Yes	Yes	H	n/a
	Policy documents	No	-	No	-	n/a	H	n/a
Low-car design of cities	*Literature*	n/a	n/a	No	n/a	Yes	M	V
	Policy documents	No	-	No	-	Yes	H	n/a
Freight	*Literature*	No	n/a	No	n/a	Yes	M	H
	Policy documents	No	-	No	-	Yes	M	H
Packages of measures	*Literature*	-	-	-	-	-	-	-
	Policy documents	Yes	-	No	-	Yes	H	H

* Note that effectiveness can be seen as a very broad concept; we did not asses whether the interventions can be evaluated as effective in our terms (i.e. getting to carfree or changing modal split), but were regarded, seen as or evaluated by the authors as effective, including their definition of 'effectiveness'.

Table 4.12: Overview Policies

come to the attention. It is rarely included as a separate concept in the analyses, and preconditions or requirements for feasibility are rarely mentioned. This is the case in both the studies we found in the literature as in the policy documents. This is remarkable, especially since feasibility can be seen as a precondition for the successful roll-out of policy measures. At the same time, it is important to emphasise that many of these interventions are government-driven. In this sense, feasibility may sometimes be less relevant than when it comes to interventions in the private market, where these interventions have to be adopted by customers. Although this also applies to the government in a sense, the government can also impose measures. Certainly when it comes to so-called 'vinegar' measures, although the feasibility may be debatable, yet the government can oblige such policy measures to society.

In any case, although many of the policies found have already been applied in reality, the feasibility of these measures does not always seem to have been thoroughly investigated. At the same time, it can be assumed that many of these measures are copies of measures that have already been applied elsewhere, and that the implementation in practice may also be seen as a feasibility test in some of the cases.

Implementation in cities
Almost all of the policies we found have already been implemented in one or some cities. We have not been able to find a lot of innovative or new kinds of policies, except for some interventions regarding to the last-mile delivery of freight in cities. On one hand that may be logical, as many municipalities will rather choose for proven interventions instead of unproven innovations. At the other hand this is a pity, as several Dutch municipalities have great ambitions in this area and new innovations maybe useful and insightful for other municipalities.

Implementation effort
The main observation here is that the policies found greatly vary in terms of the impact of their implementation. Some are simple and can be implemented immediately, others cost much more time and effort. What we do see is that municipalities mainly opt for relatively many low impact measures. Impact-rich development such as Transport Oriented Development is in some documents referred to, but in these policy documents this mainly remains a vision and is not yet made concrete any further. At the same time, it also makes more sense to elaborate such measures in proposals like zoning plans or long-term development visions.

Honey/ Vinegar measure
In general we see two groups of measures, on one hand we have a group of measures that has a goal to counter the use and ownership of cars often by restrictions and discouraging (vinegar measures), on the other hand we have the group of measures that has a goal to seduce or convince with positive incentives or rewards to choose for alternatives (honey measures). Measures from the latter group are often more attractive to implement, as citizens will not experience restrictions and prohibitions but advantages and positive incentives instead. We see that both of these groups are represented in our list of potential policies. The first group (vinegar) often targets car drivers, the other group (honey) is often based on Public Transport or cycling and walking, in order to try to let car drivers switch their mode of travel. For some measures it is debatable whether the intervention can be seen as honey or vinegar: Sustainable housing is seen by many as a positive incentive when they have free choice to live there, but this is different when people are obliged to live in this form of housing.

A quick look at a comparison between measures being honey or vinegar and their effectiveness might indicate that vinegar measures are regarded to be more effective, but the way in which we did analyse this data does not provide enough evidence to be able to conclude this.

4.1.3. Literature versus policy documents

In this subsection a comparison will be made between findings in the literature versus the findings in the policy documents. Some observations:

- Honey versus vinegar. When comparing vinegar versus honey measures, in literature we see that a small majority of the policies we found is honey-based (approximately 55%), but looking at the policy measures we found in the policy document the vast majority is honey-based (almost 90% versus

10% vinegar-based). This seems to indicate that Dutch policymakers prefer to propose honey-based measures.

- Dutch policymakers also seem to have a strong preference for proposing measures that aim to encourage cycling and walking. Here we also see a difference between the number of measures we found related to biking or walking in the policy documents (35% of total) versus the ones we found in literature (15% of total). At the same time, this can also be explained by the characteristic features of the Netherlands, being cyclists- and pedestrians-friendly and the historically developed preference for biking and walking.
- There is also a remarkable difference when it is about the pricing measures: We see this in abundance in literature, but we can hardly discover these kinds of policy measure in the Netherlands. Certainly when it concerns congestion charging or an urban toll, this is discussed quite extensively in the literature, but we hardly see this in the Dutch policy documents.
- As mentioned earlier, we hardly see any substantiation of the expected effectiveness of the proposed measures by municipalities.
- The feasibility is also often underexposed in the Dutch policy documents.
- Finally, we see that especially in recent years, more and more extensive mobility plans and visions have been presented by Dutch municipalities. Almost all of them include extensive attention and commitment to stimulating public transport, bicycle and pedestrian.

4.1.4. Other findings

In this subsection some additional findings will be described.

- Although the goal of most of the policies found is the realization of fewer cars in one way or another; the underlying goals often vary widely. Improved quality of life is mentioned, reduction of traffic accidents, better air quality, CO2 reduction, PM10 reduction, and so on. This makes it difficult to define effectiveness as an indicator, as the underlying goals differ considerably. It is therefore important to keep an eye on the underlying reasons or needs to strive for a carfree city.
- In some cases, potential goals and outcomes of policies may even been contradictory, e.g. *"Based on our study, active- and public-transport commuters are often at risk of higher air pollution and noise exposure than private car users"* (Okokon et al., 2017). It is therefore important to keep the goals or aims in mind when municipalities choose certain policy measures.
- As stated by Nieuwenhuijsen and Khreis (2016), *"generally, these reviews reveal a lack of before and after evaluation to test the impacts of a specific intervention"*. This is also the case in the policies we found, ideally, analyses would have been carried out using a before and after situation, but this is rarely the case.
- As stated above under the 'packages' group, probably one of the key elements to achieve a low-car or carfree city is to carry out a package of measures. Although there are only a few documents that describe such kind of packages, this may be an important element into the achievement of carfree cities. Therefore in chapter 6 we will analyse combinations of policies.

4.2. Policies to include in evaluation chapter 5

One of the main conclusions of our search into potential government policies contributing to the realisation of low-car or carfree cities, is that the possibilities are almost endless. Each of these policies have their own characteristics and advantages, and although we divided the policy measures into groups there is still some variation within the groups. However, unfortunately we did not find clear evaluations of the effectiveness and feasibilities of these policy measures. Therefore we will analyse some of these policy measures in more detail in the next chapter.

Ideally we would thoroughly analyse all groups of measures. However, for practical reasons such as time limitations (as this is a student thesis) we made the decision to only include three groups of policies (in which the amount of three is an arbitrary number, motivated by practical reasons such as keeping the interviews

manageable). Although in the end the choice which of the three policies to include is an arbitrary choice as well, the underlying aim is that we choose policies whose evaluation is expected to provide valuable insights for Dutch municipalities. Next to that, we try to cover as much of the possible methods as possible. Boundary condition is that the effectiveness of the policy can be quantified by comparing municipalities with and without the policy intervention. An analysis of reasons why (not) to include policies can be found in table 4.13. We choose to analyse the following main groups in-depth: Price measures, making Public Transport more attractive and Making walking and cycling more attractive. However, we choose to broaden these group to some extent, for two reasons: 1) We see in practice that there is not always a clear separation between groups of measures, but that they complement each other (for example; combining sharing-initiatives like MaaS and Public Transport provide synergy). 2) With the in-depth evaluation we try to cover as many of the policies as possible, by broadening the groups we are able to cover more of the potential policies.

Group of measures	**Reason (not) to include**	**Include**
Restrictions on car movement	Already often used in the Netherlands. Lower chance of new insights, and difficult to make a quantitative comparison between municipalities with and without this intervention.	
Restrictions on parking cars	Already often used in the Netherlands. Lower chance of new insights. Much is unknown in changing parking standards (parkeernormen), but it is difficult to quantitatively compare between municipalities.	
Price measures	Expected effectiveness and feasibility of price measures are regarded as high. At the same time we do not know any examples of an urban toll zone in the Netherlands. New insights may arise.	V
Sharing initiatives and intermodality	More and more is becoming known about this policy and can be seen as promising, but it is difficult to make a quantitative comparison between municipalities with and without this intervention.	
Making PT more attractive	Since long many municipalities see investing in Public Transport as an important tool in the reduction of the use of cars, or even as prerequisite for a successful low-car city. At the same time, investments in PT are often expensive and take some time. The effect of investing in PT on a modal split change is not always clear.	V
Making walking and cycling more attractive	Especially in recent years Dutch municipalities have high ambitions when it is about stimulating walking and cycling in their cities. Although a number of investments are being made, there is often a lack of clear evaluations of the expected effectiveness and feasibility of these investments. Does this policy live up to its expectations and what is still lacking?	V
Information campaigns to promote sustainable travel	It is difficult to quantify the effects of these measures and the impact for municipalities is expected to be relatively low.	
Sustainable housing	Not expected to be a main focus-group for municipalities. On top of that difficult to quantify effects as residential self-selection may play an important role.	
Low-car design of cities	Useful for municipalities to include, but hard to compare the effect of measures like densification and TOD between municipalities.	
Freight	Emerging and insightful for municipalities, but at the same time a clear quantitative comparison is difficult because there are still few clear examples implemented.	
Packages of Measures	Groups of measures, therefore too broad to properly evaluate.	

Table 4.13: Overview policies (not) to include in in-depth evaluation chapter 5

The following three groups of policies will be evaluated in-depth:

- **Price measures and restraining cars:** As described, price measures and especially toll zones, are not often used in the Netherlands. As price measures have link with other forms of car restrictions, we will look at price measures and other forms of restraining cars in cities.
- **Improvement and innovation of collective transport services:** This group includes policies to make Public Transport more attractive, but also includes other forms of collective transport like Mobility as a Service or shared e-scooters.
- **Making slow traffic more attractive:** Last group to analyse are policies to make low-traffic more attractive, for example by improvement of the walking and cycling network, facilities or a low-car design of cities.

These groups will be described more elaborately in chapter 5. With these groups of measures we have a varied range of interventions. Interventions within these groups may require both low as high effort to be implemented; include both 'vinegar' as 'honey' measures; one is car-focused, two other focus on other modalities; and these interventions could be implemented by almost any Dutch municipality.

5

Evaluation of policies

This chapter aims to evaluate the policy measures based on both their effectiveness as feasibility. We chose to evaluate three groups of measures in-depth (see subsection 4.2 for substantiation), including *'Price measures and restraining cars'*, *'Improvement and innovation of collective transport services'*, and *'Making slow traffic more attractive'*. For this evaluation we use our evaluation framework, which we have developed in section 3, see figure 3.6. According to this framework, we evaluate on both the effectiveness and the feasibility, based on data from Statistics Netherlands (CBS, OViN), a CE Delft benchmark (CE Delft, 2018b), policy documents, scientific literature and interviews with experts. An elaboration on the methodology used for this analysis can be found in subsection 2.3.

5.1. Evaluation Price measures and restraining cars

First a short introduction into the context and background of price measures and restraining cars. This group includes numerous sorts of measures, as we found in chapter 4. Examples include for example measures like parking fees or congestion charges, but may include restrictions like restricted access to a city centre or traffic calming zones as well. However, when we evaluate the effectiveness we will try to isolate one of the measures, in order to get a clear overview of the potential effectiveness. Here we choose to focus on price measures, and urban toll zones specifically. These kinds of measures aim to reduce the car use in specific areas, by making the use of a car unattractive by increasing the costs of it. One of the main ways to do so is the use of congestion or urban tolls. The idea is simple: When many people want to use a certain place or road, the price to use this spot will be higher. The objective of this policy is using the price mechanism in order to make people aware of the fact that they create additional congestion, to make them pay for the additional congestion and negative externalities they create, and making them aware of their impact on the environment (e.g. Button, 1993; K. Small, 1998; K. A. Small, Verhoef, and Lindsey, 2007).

It is important to emphasise that there are different forms of price measures, both in type of area (e.g. road, district, ring, corridor, highway, parking lot) as in form (e.g. congestion-dependent, time-dependent, fixed price) (Löchl, 2006). Although for cities it is not necessary to have a congestion-dependent charge when they strive for carfree or low-car (as a fixed price will also decrease car use), this congestion charging is the most commonly used and described form of an urban toll. In addition, this concept seems to be very suitable in striving for a carfree or low-car city. In that light, we choose to evaluate the 'congestion charge'; a system which make road users pay a toll for using a congested road or for entering a congested area, resulting in drivers choosing alternative roads, other times or other modes of transport (Downs, 2005). Congestion charges have already been implemented in cities like London, Stockholm, Singapore, Milan and Gothenburg.

Examples

Several successful examples of the introduction of a congestion charge can be found:

London introduced the London Congestion Charge. Although urban congestion pricing schemes were thought to be unworkable in first instance, in 2003 London imposed a daily charge for driving or parking a vehicle on public roads within central London (Leape, 2006). A day pass for London city centre costs around €13 (from Monday-Friday) (Transport for London, 2020)

Stockholm introduced in 2006 its time-of-day dependent cordon-based congestion charging system. Ten years later, in 2006, the system was extended significantly by increasing the peak charge with 75% and including all car traffic between the north and south part of Stockholm (Börjesson and Kristoffersson, 2018). Entering Stockholm city centre costs about €1-€4 nowadays, depending on time and day (Transport Styrelsen, 2020).

5.1.1. Effectiveness

In the Methodology section (3.3), we discussed the way in which effectiveness can be described: Although several definitions and aspects can be identified, we chose to focus on both the modal split as the car ownership rate (see section 3.3). In this subsection we will analyse these two factors, by two main steps. At first, we will carry out a search into the literature to see what has been written about the effectiveness of the price measures. After that, we compare cities who did implement these kinds of measure with cities who did not, supplemented by an analysis into the modal split before and after the introduction of congestion charge in London. We chose to pick one example of this group in particular (being the urban congestion zone). This is a (fairly) clear demarcated measure, which has been the subject of several research papers and includes a clear before- and after- situation.

Literature about effectiveness

A search into literature provides a quite clear image (see table 5.1): In all cases the traffic volume decreases after the introduction of a congestion charge. The size of this reduction strongly differs between the different cities, but in general it can be concluded that in the literature we found (including several congestion charges, e.g. London, Stockholm, Gothenburg, Singapore) the traffic volume of cars decreases, where the the traffic volumes of Public Transport and bikes increases. This means that we see a modal shift from car to PT, bike, and walking as well.

Several papers (e.g. Chin, 2009) describe the price elasticity of the congestion charges. However, this is strongly dependent on numerous factors, like income, travel time and more. Only few studies researched the effect of an urban toll zone on the car ownership rates. Ubbels et al. (2008) found that 2% of the people they interviewed were (very) likely willing to sell their car after an introduction of road pricing. However, the method they used was a stated choice interview. No evaluative studies have been found, analysing the revealed changes in car ownership before- and after introduction of an urban toll.

With this look into literature we can conclude that the introduction of price measures in the past have led to changes in modal share and that based on these examples it is plausible that congestion charging may result in a positive impact on the modal split.

Comparison modal split between cities with and without intervention

Next step is to compare cities that did implement this intervention, with cities who did not. The findings can be found in table 5.2, but some remarks have to be made. The London toll zone area has been compared with similar areas in Birmingham (largest city in U.K. after London) and Amsterdam (Largest Dutch city). We see some interesting differences, like the relatively low share of private cars in London when compared to Birmingham, as well as a very low car ownership rate. Nevertheless, it not possible to draw clear conclusions. On one hand the comparability is questionable: In total, the population of London is way higher than those of Birmingham and Amsterdam. Historically there are some important distinctions between Amsterdam and London as well (like the embedding of cycling in Dutch culture). There are also other factors that may play a role, that we did not correct for (income, PT network, etc). This leads to the finding that no conclusions

Author and year	**Method. quality** *	**Intervention strategy**	**Indicator**	**Results**
Leape, 2005	High	London congestion charge	Change in traffic volume (in vkm, %)	%Cars: -34%; %Vans: -5%; %Trucks: -7%; %Buses: +21 %Bicycles: +28%
Börjesson et al., 2012	High	Stockholm congestion charge	Change in traffic volumes over cordon (%) Change of non-exempt traffic across cordon (%)	-19% -29,8%
Börjesson et al., 2015	Medium	Gothenburg congestion charge	Change in traffic volumes over cordon (%) Change of number of trips (%), Commute	Charged hours: -12%. Uncharged hours: -2% Car: -9%; Public Transport: +24%; Bicycles: -36%
		Note: Authors attribute drops of cycling and PT to cold weather in 2013	Change of number of trips (%), Discretionary	Car: -7%; Public Transport: -8%; Bicycles: -13%
Chin, 2009	Low	Manual Road Pricing Singapore	Change of traffic volumes entering cordon (%)	Initially -44%, in 1988 -31%.
		Electronic Road Pricing Singapore	Change of traffic volumes entering cordon (%)	-10% to -15%
Ubbels et al., 2008	Medium	Road pricing in general	Car ownership, people (very) likely willing to sell their car (%)	2%

* Assessment of methodological quality source (e.g. thoroughness of analysis, stated vs. revealed, quality of substantiation)

Table 5.1: Literature about effectiveness of London Congestion Charge

about effectiveness can be drawn from this comparison.

Although it is not possible to draw conclusions from our analysis between cities with and without this intervention, there is another method of analysing what the potential effect is on the modal split. Both Leape (2006) as Transport for London (2010) came up with numbers about the modal shares before and after the introduction of the congestion charge (2002 and 2003). With these numbers, we calculated the modal shift (in %) (see 5.3). Although they used different classifications of modes of transport, there are some clear differences between the before (2002) and after (2003) situation. As we have seen before, the use of the car in both complete London as the toll zone declined. This decline has been compensated by Public Transport, as well as by other modes. Although the urban toll zone had impact on both the area itself, as the travel behaviour in complete London, the effect on the use of bike and walking is quite high in the toll zone area, but can not be found in entire London as well.

These numbers clearly show the impact of the introduction of the toll zone in London: People shift from using their car to other modes of travel. Together with our earlier findings from the literature, and the comparison between cities, this intervention can be considered as effective, based on modal split.

	London City (toll zone area)	**Birmingham City Centre**	**Amsterdam City Centre**
Characteristics			
Population	136.000	27.000	87.000
Area (km2)	21	7,7	8
Population density (persons/ km2)	6.500	3.506	10.900
Mode share for all trips			
Car (private)	19,6%	32%	16%
Public transit	37,6%	42%	24%
Biking	4,4%	2%	60%
Walking	38,4%	24%	n/a
Car Ownership			
Cars per 1000 residents	190	290	248
%people with access to car	43%	46%	52,6%

Table 5.2: Comparison of mode shares and car ownership number between cities, for substantiation, see Appendix E.

	London toll zone mode shares (vkm-based)			**Entire London mode shares (trip-based)**		
	2002	2003		2002	2003	
Cars	47%	35%	-34%	46%	44%	-5%
Vans	18%	19%	5%			
Trucks	4%	5%	20%			
Taxis	16%	21%	24%			
Buses	3%	5%	40%			
Motorcycles	8%	9%	11%			
Bicycles	4%	6%	33%	1%	1%	0%
Public Transport				29%	31%	6%
Walk				24%	24%	0%

Table 5.3: Modal change after introduction London Congestion Charge, for London Toll Zone area (adapted from Leape (2006) and for Entire London (adapted from Transport for London (2010)). Note that for the toll zone only vkm-based numbers were available.

5.1.2. Feasibility

Findings interviews - requirements, challenges and limitations
We asked the interviewees several questions regarding the three forms of feasibility, for all of the three groups. The coded interviews can be found in Appendix D. Here we discuss the findings, regarding the most desirable form of implementation of this group of measures; the technical feasibility; the social feasibility and the political feasibility.

A wide range of examples came up, when we asked interviewees what they perceived to be a desirable form of implementation, regarding this group of policy measures. On one hand pricing measures were mentioned, like a toll zone (respondent C, D, F) or parking fees (respondent A), on the other hand measures like restricting cars in city centres (respondent B) or measures that aim to decrease the car-accessibility of parts of the city were mentioned (respondent D, E, F). A question that arose by respondents C and D, was what the goal of this intervention would be. They mentioned that a carfree city will not be achieved by a toll zone, therefore more restricting measures are needed. However, they indicated that a toll zone may be of great value when it is about countering congestion or reducing the number of cars in a city.
When it is about technical feasibility, in general the interviewees did not see many concerns, problems or

limitations. Although several practical challenges were mentioned that may arise, pricing or restriction measures themselves will not be impossible due to technical constraints. Respondent C mentioned several of these possible practical implications: For example the number of entry points to a city (the more points, the more difficult); The balance between costs, effectiveness, susceptibility to fraud and social acceptance; and increasing collection costs due to a complex system (e.g. London). What contributes to good feasibility when it is about road-restrictions according to Respondent E, is the current message that is communicated by the public space in a certain place (in function, form, use). Is it designed as a transit function? Then restrictions will be difficult. Is it additional infrastructure, built later on? Then restrictions will be easier. Technical limitations are currently still in place; Respondent A mentioned the example of pricing polluting transport in the city of Utrecht; a proper classification of cars is not possible yet, but here too, development is taking place.

Social feasibility is a bit more difficult. Respondents A, B and F mention residents, which often initially have a negative attitude towards these kinds of interventions, which can be challenging. However, as respondent F refers to, although these measures are often perceived as negative, it does change car use of citizens. A factor that is often mentioned by interviewees is the problem perception (respondent A, B, E). As the problem of the amounts of cars may be greater or may be experienced as greater in large cities, this may lead to a higher acceptance in these large cities. Factors mentioned that may increase the social feasibility includes proper communication towards citizens (Respondent E, F) and a right way of framing (Respondent B, D, F), i.e.: Road-restrictions or pricing is considered as negative, upgrading the environment is seen as positive.

Feasibilities Price measures and restraining cars

Technical	**Social**	**Political**
Feasible	Somewhat feasible	Less feasible
Mainly practical challenges (4x)	Residents often initially negative (3x)	Politicians have a perception that residents are against (1x)
	Support increases with perceived urgency (problem perception) (3x)	Subject often politicised (1x)
	Increase feasibility by: Good communication (2x) Good framing (3x)	Frame-and-claim behaviour politicians obstruct support for support (1x)
		Increase feasibility by: good framing (pro-liveability) (3x), offering good alternatives (3x); link with positive impulse for economy (2x); good revenue allocation (1x).

Table 5.4: Feasibilities Price measures and restraining cars - Factors, and frequency being mentioned by interviewees

Like the social feasibility, interviewees mention some problems or challenges with political feasibility as well. There are several factors that are mentioned. According to respondent C, politicians seem to have a perception that residents are against pricing measures, leading towards fear for introduction of such measures, while this perception often lacks solid substantiation. This respondent also mentions that the subject has been politicised in The Netherlands; there has been a lot of commotion in the past about a national pricing system, which have led to outspoken supporters and opponents, in which the media also plays a role. Respondent F mentions the frame-and-claim behaviour by politicians, obstructing the search for support, i.e. right-wing and left-wing political parties that frame plans being anti-car or pro-sustainability, sometimes leading to a loss of support by counter parties. Factors that are mentioned to increase feasibility includes a good way of framing (pro-liveability)(mentioned by respondent B, D, F), offering good alternatives (respondent A, D, F), linking plans to a positive impulse for economy (respondent F) or good revenue allocation (respondent C).

What stands out is the contrast between the different feasibilities. In general, this group is technically feasible. There are some problems in terms of social feasibility, but the political feasibility in particular is low. This appears to be a major obstacle to the introduction of this group of measures.

5.2. Evaluation Improvement and innovation of collective transport services

First a small introduction in what we mean by the *'Improvement and innovation of collective transport services'*. One of the main ways to do so, is to increase the attractiveness of Public Transport (also see chapter 4). However, this group is not limited to Public transport, but it also includes other forms of collective transport, like Mobility as a Service (MaaS) or e-scooters. There are several ways in which municipalities can implement this group of measures, on several levels. The possibilities are almost endless, but to mention some of the possibilities: Municipalities can invest in public transport themselves by improving the PT-network, they can facilitate or support new forms of collective transport or they can subsidise collective transport in various ways.

5.2.1. Effectiveness

As described before we chose to focus on both the modal split and the car ownership rate as a way to analyse the effectiveness (see Methodology section 3.3). In this subsection we analyse these two factors, by two main steps. At first, we will carry out a search into the literature to see what has been written about the effectiveness of measures to improve collective services. After that, we compare a city with a strong collective services-focused design, with similar cities that are more car-oriented. We supplement this with an analysis into the relation between the quality of public transport facilities and policy in cities and the modal share of these cities.

Examples

Several (successful) examples of the Improvement and innovation of collective transport services can be found:

Mobility hubs are an example of an innovation in the mobility sector. They provide a focal point in the transportation network, seamlessly integrating different modes of transportation. These hubs also enable the opportunity to accelerate public transport, by stretching routes between intersections (removing these routes from residential areas and village centres and shifting these routes to the main roads), and also maintaining the accessibility of public transport. They contribute to first– and last mile connectivity and offer a multi-modal supportive infrastructure, bringing together modalities like (e-)bikes, (e-)cargo bikes, (e-)scooters and/or (e-)cars, offering users a wide range of options to experiment and use in various situations. Examples can be found in various cities, including cities like Amsterdam, Utrecht and Delft.

Schaalsprong OV is another example of a policy to improve collective transport services. With Schaalsprong OV, the Municipality of The Hague aims to expand the role of public transport in the urban area in and around The Hague. Examples are improvements in timetables and network developments, as well as mobility measures such as bicycle parkings at stops and mobility hubs, and multimodal transport (ketenmobiliteit). The policy rests on two pillars: 1) Realising a future-proof, more differentiated and demand-proof mobility system and 2) Renewed focus on public transport with central PT-axles.

Literature about effectiveness

First, we take a closer look into the literature we found in section 4 (potential policies), in order to find out what has been written about the effectiveness of these kinds of measures. We supplemented this with

Author & date	Method. quality*	Intervention strategy	Indicator	Effect
Batty et al, 2015	Medium	'Almost free' Pt passes provided to the students in Brussel	% of participants using PT for journeys previously made by foot or bike	26%
		Abolishment of PT fares in for all of 68,000 residents of Hasselt	Increase in usage of the bus services (%)	After 1 year: +428%, after 10 years: 1319%
		Improvements of comfort, cleanliness and safety	% increase in the number of trips made over a 5-year period	5%
Katoshevski-Cavari, 2018	Medium	A free park-and-ride facility with a free shuttle service	% of the current riders that have shifted from commuting by car to this service (survey)	>50%
Satiennam, 2016	Low	Change current public Transport to Bus Rapid Transport (with equal travel time and fare)	% of car users that would switch to BRT (survey)	25%
Tuan, 2015	Low	Introduction of a Bus Rapid Transit and Mass Rapid Transit system	Reduction of modal share motorcycle and car users (%) (survey)	-46% to - 49%
Vedagiri et al, 2009	Low	Introduction of Bus Priority System	Probability of shift of car users, when bus has 10% lower travel time (survey)	0,22
Vuk, 2005	Medium	Introduction Metro System Copenhagen	Modal shares (in %) before and after introduction (survey)	Car: -15%; Bus: -13%; Train: +30%, Metro: +∞ (From 0 to 9,6%)

* Assessment of methodological quality source (e.g. thoroughness of analysis, stated vs. revealed, quality of substantiation)

Table 5.5: Literature about effectiveness of measures into improvement and innovation of collective transport services

other relevant papers that we found (see table 5.5).

We found several evaluations of implemented measures, but it is hard to compare those measures. The evaluation criteria are not always clear and similar, and there is often a lack of a clear before- and after evaluation. Especially on the indicators we chose (modal split and car ownership), we found only few papers with clear results. Batty, Palacin, and González-Gil (2015) for example report an increase in the usage of bus services (+428%) as result of offering free Public Transport, but they did not report what the corresponding effect was on the decrease of car usage. Tuan (2015) is one of the few examples that reported a reduction of the modal share of motorcycles and car users (between -46% and -49%) as a result of the introduction of a Bus Rapid Transit System (BRT). However, this was a stated choice survey, instead of an revealed evaluation. Another good example is the paper of Vuk (2005). He reported a decrease of 15% in car usage after the introduction of a Metro system in Copenhagen. In general, the results these papers show are promising when it is about reducing the car usage. However, it includes individual measures, and does not yet provide a clear conclusion as to whether investing in public transport can be seen as effective.

Comparison modal split between cities with and without intervention

Next step is a comparison between a city with a strong collective services-focused design, and similar cities that are more car-oriented. The findings can be found in table 5.6. We find a higher number of PT-share for Almere when compared to Haarlem and Tilburg. This is in line with our expectations, as we expected Almere to have to a higher share of Public Transport, resulting from the PT-oriented design of Almere. However, thus concluding that an PT -oriented design leads to a higher modal share of PT would be premature, as there are also other factors that may play a role, that we did not correct for (income, quality of road network, etc). Although this finding is in line with our expectations, we will have to substantiate this with more data.

	Gemeente Almere	**Gemeente Haarlem**	**Gemeente Tilburg**
Characteristics			
Population	213.000	161.000	217.000
Area (km2)	129	29	116
Population density (persons/ km2)	1650	5560	1870
Mode share for all trips			
Car (private)	50,0%	37,6%	50,5%
Public transit	12,6%	7,8%	3,6%
Biking	18,0%	35,6%	27,3%
Walking	19,4%	19,0%	18,6%
Car Ownership			
Cars per 1000 residents	370	359	397
%people with access to car	n/a	n/a	n/a

Table 5.6: Comparison of mode shares and car ownership number between cities with and without PT-oriented design, for substantiation, see Appendix E.

Analysis correlation between quality PT and modal share

One way to do so is to analyse the relation between the quality of public transport facilities and policy in cities and the modal share of these cities. We used two indicators to this, both the average speed of Public Transport in the morning peak and a grade for the Public Transport Facilities and Policy (assessed by CE Delft (2018b), only 30 municipalities were assessed). We found no significant correlation between this grade and the modal shares (see table 5.7). We did find a very weak positive correlation (0,140) between the average speed of Public Transport and the PT-share, and we found a weak negative relation (-0,242) between the average PT speed and Car-share. The directions of these relations are in line with our expectations,

however, the strength of this correlation is very low. We can conclude that it is likely that the increase of PT-speed will lead to a higher PT-share, but we can not prove how strong this relation is. On top of that, this is just one of the possible indicators, it is still unknown what a specific indicator may contribute to this average speed and what the effect of those measures are on other indicators.

		Modal share Car	**Modal share PT**
Avg speed Public Transport morning peak (linear distance)	Pearson Corr.	-0,242	0,140
	Sig. (2-tailed)	0,000	0,007
	N	379	379
Grade Public Transport Facilities & Policy (benchmark CE Delft, 2018)	Pearson Corr.	*-0,302*	*0,065*
	Sig. (2-tailed)	*0,105*	*0,733*
	N	*30*	*30*

Table 5.7: Correlation between quality PT services and modal shares

5.2.2. Feasibility

Findings interviews - requirements, challenges and limitations
We asked the interviewees several questions regarding the three forms of feasibility, for all of the three groups. The coded interviews can be found in Appendix D. Here we discuss the findings, regarding the most desirable form of implementation of this group of measures; the technical feasibility; the social feasibility and the political feasibility.

When we asked the interviewees about their most desired form of implementation when it is about the 'improvement and innovation of collective transport services', they came up with different ideas. Fixing the bottle necks regarding current capacity was mentioned (by respondent C); as well as the expansion and improvement of the national train network (respondent F); improvement of PT-facilities (respondent B); the implementation of complete packages of collective transport services that improve PT as an addition to cycling and walking (respondent E); a package of smaller interventions to increase comfort and flexibility including a strong link between bicycle and public transport (respondent D); and the introduction of mobility hubs (respondent A).

The feasibility of these interventions is perceived as being largely feasible. Although there are some limiting factors, like spatial limitations (mentioned by respondent B, C, D) and current PT lines that are already on their maximum (mentioned by respondent C, D), it is expected that these challenges can be solved as well. According to respondent B these spatial limitations include for example the space available for bike parkings: Several cities are experiencing problems with huge amounts of bikes that want to be shed in the near location of a PT hub. These cities often encounter serious problems, as the demand for parking is high and the space available is scarce. Respondent B mentioned some solutions as well, like limiting the maximum parking duration or spreading. When it is about new infrastructure, respondent C mentions reclaiming space allocated to cars as an important way to solve this issue. Both of the two policymakers interviewed (respondent A and B), mentioned that they were willing to transit their PT-structure from a radial- to a tangential structure, what will results in some technical challenges as well. Although this may be challenging, they perceive this as probably technical feasible. Main requirement and challenge, is the financial feasibility which may be problematic.

As respondent C mentioned, the PT-demand is often the reason why governments invest in solving bottlenecks in Public Transport, (almost) directly leading to social acceptance as people will directly benefit from those investments. One of the social challenges mentioned by respondent F is inclusivity, how to safeguard travel by PT for all groups (like elderly, or lower income groups). He mentioned: Investments in improvement of the main PT network (which is a bit more frequently used by higher incomes) often leads to a decline in the supply and investments in the first and last mile services (like tram, metro and bus, which is a bit more frequently used by lower incomes). This may lead to a widening of the gap between the 'have's' and 'have not's'. Social feasibility also depends on the problem perception (according to respondent A and

E), the support of citizens increases when they experience more bottlenecks or problems regarding to PT-facilities. Feasibility can be increased by offering supplementing features (respondent A) (for example with mobility hubs including several news forms of travel, like (e)-cargo bikes or (e)-scooters) or fixing bottlenecks (respondent C).

Interviewees see this group of measures as largely political feasible. As respondent E said: There is no political party against Public Transport. According to respondent C: This group of measures is honey-based, which leads to a higher political feasibility as well, as politicians will face less resistance during implementation. However, one of the main restrictions is the financial feasibility, which has been mentioned by five out of the six interviewees (respondent A, B, C, E, F). Investments in PT often come at a high price. Together with long lead times (respondent B) and a lot of coordination needed between regional and central governments (respondent A, B, F) implementation is often difficult. The main way to increase feasibility mentioned, is including and emphasising the liveability benefits of investments in public transport (respondent B, E, F).

Feasibilities Improvement and innovation of collective transport services

Technical	**Social**	**Political**
Largely feasible	Feasible	Largely feasible
Limiting factors: Spatial limitations (3x), PT frequencies already maximised (2x)	Support increases with perceived urgency (problem perception) (2x)	Financial feasibility limiting factor (5x)
Increase feasibility by: Exchange space allocated to car (1x), shared-mobility solutions (1x)	Fairness issue is a challenge, who will benefit? (1x)	Honey measure, so more feasible (2x)
	Increase feasibility by: Offering supplementing features and fixing bottlenecks (2x)	Long lead times and coordination between regional and central government difficult (3x)
		Increase feasibility by: Include and emphasise liveability benefits (3x)

Table 5.8: Feasibilities Improvement and innovation of collective transport services - Factors, and frequency being mentioned by interviewees

5.3. Evaluation Making slow traffic more attractive

First a small introduction in what we mean by 'Making slow traffic more attractive'. In chapter 4 we discussed several ways to do so, varying from new cycling connections, improvement of the network, adding pedestrian crossing or increasing the space allocated to pedestrians. However, this group includes more far-reaching interventions as well, like a re-design of spatial planning or the realisation of more liveable and sociable city areas. Municipalities have several instruments to make these forms of slow traffic more attractive, for example by facilitating, stimulating, or regulating initiatives or interventions.

Examples

Several successful examples of ways to make slow traffic more attractive can be found:

The Leefstraat was originally initiated in Ghent, but has many successors nowadays. A Leefstraat is a street that is temporarily made carfree, leading to a new 'purpose' for the neighbourhood. Local residents furnish their street in a creative and liveable way, in which both spontaneous and organised activities can take place. This results in more space for meeting, relaxing and playing. Every street and neighbourhood resident can participate or enjoy the Leefstraat.

Fietsactieplan. In recent years, various Dutch municipalities (e.g. Utrecht, Rotterdam, Haarlem, Delft) have launched a Bicycle Action Plan. The purpose of these plans is often to encourage residents to cycle more. The measures in these plans are are numerous and very diverse, ranging from more bicycle parking spaces to the construction of new bicycle connections to the colour of the asphalt.

5.3.1. Effectiveness

As described before we chose to focus on both the modal split and the car ownership rate as a way to analyse the effectiveness (see Methodology section 3.3). In this subsection we analyse these two factors, by two main steps. At first, we will carry out a search into the literature to see what has been written about the effectiveness of measures to improve the attractiveness of slow traffic. After that, we compare a city with a strong cycling-friendly infrastructure (Houten), with similar cities that are more car-oriented. We supplement this with an analysis into the relation between the quality of walking and cycling facilities and policy in cities and the modal share of these cities.

Literature about effectiveness

First, we take a closer look into the literature we found in section 4 (potential policies), in order to find out what has been written about the effectiveness of these kinds of measures, supplemented by other relevant papers that we found (see table 5.9).

The papers we analysed in the potential policies section (4) provided very few clear figures about the modal share and car ownership changes as result of these interventions. Therefore we did a small search into literature about the effectiveness of potential interventions. This yields a varied picture of a range of interventions. Caulfield (2014) found an effect on modal split as result of a very pro-cycling policy in the city of Dublin. Although the effect was only limited (an increase of the modal share for cycling of 1%-point[1]) and it decreased mainly the modal share of PT and walking, he proves that investing in cycling may result in a changing modal split. A similar research was conducted in German cities, showing that in cities that promoted cycling showed an increase of modal share of cycling between +0,4%-point to +3,9%-point, where the general modal shift in German cities only noted an increase of 0,9%-point. At the same time Stewart, Anokye, and Pokhrel (2015) reports studies in which no significant effect was found as results of pro-cycling interventions on hand. On the other hand, two studies did show a (small) increase of modal share as result of new cycling infrastructure[2]. It is important to note that measuring this effectiveness can be regarded as complex. Harms et al. (2016) analysed the performance of municipal cycling policies in Dutch cities, but although they came up with some lessons (e.g. set measurable and verifiable goals; allow for experimental measures and showing strong leadership), they also note that the way and context in which cycling policy is implemented seems to be important and external circumstances (e.g. demographic trends) also seem to influence cycling policy outcome. They are therefore able to name generic success factors, but are not able to provide one-to-one relationships between a certain policy intervention and the corresponding effectiveness. S. Handy, Van Wee, and Kroesen (2013) reviewed the research needs and challenges regarding to the promotion of cycling, and mention several challenges, like interaction effects between factors; bidirectional

[1] Note that earlier findings often reported a percentage instead of percent-points. Ideally, we would have chosen the same unit, but the source does not provide enough data to properly convert these numbers.

[2] Note that there are differences in perception here, the extent to which measures are taken varies greatly. The realisation of just one cycle path may be seen as revolutionary in Milan, but the effect on the modal shift is very minimal. In a city like Copenhagen, at least an addition of 100 kilometres of cycle paths is needed to be called revolutionary, but does sort out a strong effect on modal share.

effects between factors and cycling; before and after measurement; Separating strategy effects from other factors; and transferability of results. These studies show that conclusions can be drawn on a global level, but that much research remains regarding direct effects between a certain interventions and its corresponding effectiveness.

In general, these findings can only substantiate the observation that measures that promote slow traffic may lead to a higher modal share of cycling or walking. However, to generalise this observation a large-scale literature study is required.

Author & date	**Method. quality***	**Intervention strategy**	**Indicator**	**Results**
Caulfield (2014)	Medium	Pro-Cycling policy, e.g. financial incentives, infrastructure, share bicycle scheme (Dublin)	Change in modal share (in %-point) before and after introduction of policies (2006–2011)	**Note! %-point**; Walk: -1%-p; Cycle: +1%-p; Car: -%-p; PT: -2%-p
Lanzendorf and Busch-Geertsema (2014)	Medium	Promotion of Cycling in German cities	Change in modal share cycling (in %-point) before and after pro cycling policy (2002–2008)	%modal share of cycling cities with intervention: +0,4% -point to +3,9%-point. %modal share of cycling Germany overall: +0,9%-point
Shaheen, Martin, and Cohen (2013)	Low	Bike sharing system	Change in Vehicle Ownership	-1,9% (Minnesota) to -3,6% (Montreal)
			Respondents Driving Less Often	25,4% (Toronto) to 52,4% (Minnesota)
Stewart, Anokye, and Pokhrel (2015)	Medium	Workplace travel plan(s)	Percentage usually cycling to work	No significant effect
		Workplace; self-help pack, activity diary	Percentage cycling to work	No effect
		Building cycle-bridge	% increase in the number of cyclists	+47,5%
		Whole city approach (pro-cycling)	Increase in cycling to work compared with matched towns	+0,69 %-point
		Changes in cycle infrastructure	Increase in bicycle modal share	+0,493 %-point

* Assessment of methodological quality source (e.g. thoroughness of analysis, stated vs. revealed, quality of substantiation)

Table 5.9: Literature about effectiveness of measures into making slow traffic more attractive

Comparison modal split between cities with and without intervention

We also compared cities with a pro-cycling design (Houten), with cities that are less bicycle-oriented. The findings can be found in table 5.10. Although we find a modal share for cycling that is quite high (34,1%), the differences with Nieuwegein are not that high. Another important observation is that the mode share for car in Houten is the highest of the three cities compared (47,7%), but the relative differences with

the benchmark cities are quite low (Nieuwegein, 47,2%; Zeist, 45,7%). Although people in Houten often use their bike, this does not seem to be at the expense of the car, but mainly at the expense of walking and public transport. What also seems to play an important role here is that public transport in Houten is not or hardly suitable for use within Houten, while Nieuwegein does have a good public transport system for use within the city. This is reflected in the higher percentage of public transport in Nieuwegein (6,4% vs 3,2%). However, it is important to realise that other important factors will play an important role as well (for example quality of PT-network or average income) which we did not correct for, so with these findings we can not fully conclude that a bicycle-oriented design of a city automatically leads to a high modal share for bike instead of car.

	Gemeente Houten	**Gemeente Nieuwe-gein**	**Gemeente Zeist**
Characteristics			
Population	50.000	63.000	63.900
Area (km2)	55	24	49
Population density (persons/ km2)	908	2681	1318
Mode share for all trips			
Car (private)	47,7%	47,2%	45,7%
Public transit	3,2%	6,4%	4,5%
Biking	34,1%	27,3%	33,5%
Walking	15,0%	19,0%	16,3%
Car Ownership			
Cars per 1000 residents	408	425	414
%people with access to car	n/a	n/a	n/a

Table 5.10: Comparison of mode shares and car ownership number between cities with and without bicycle-oriented design, for substantiation, see Appendix E.

Analysis correlation between quality slow traffic facilities and modal share

We tried to analyse the relation between the quality of cycling and walking facilities and policy in cities and the modal share of these cities. We used two indicators to this; both grades for the Facilities and Policy for cycling and walking (assessed by CE Delft (2018b). However, only 30 municipalities were assessed. We did not found significant correlations between the grades and the modal shares (see table 5.11). Therefore we can't draw conclusions based on this analysis.

This in turn, leads to a conclusion that we found earlier: It is difficult to draw clear conclusions about the effectiveness of investing in walking and cycling. The underlying reasons for this are in line with the findings of Gaffron (2003): "Authorities will find it difficult to ascertain whether their implementation activities are actually helping to increase modal share for two reasons: not enough information exists on the baseline against which developments can be compared and insufficient provisions are made for actually monitoring such developments."

5.3.2. Feasibility

Findings interviews - requirements, challenges and limitations

We asked the interviewees several questions regarding the three forms of feasibility, for all of the three groups. The coded interviews can be found in Appendix D. Here we discuss the findings, regarding the most desirable form of implementation of this group of measures; the technical feasibility; the social feasibility and the political feasibility.

There are two recurring themes, when we ask interviewees what measures they see as desired form of implementation of this group of measures (making slow traffic more attractive). The first is a complete

		Modal share Car	Modal share Cycling	Modal share Walking
Grade Cycling Facilities & Policy (benchmark CE Delft, 2018)	Pearson Corr.	*-0,147*	*0,255*	*-0,229*
	Sig. (2-tailed)	*0,438*	*0,175*	*0,224*
	N	*30*	*30*	*30*
Grade Walking Facilities & Policy (benchmark CE Delft, 2018)	Pearson Corr.	*0,076*	*-0,050*	*-0,135*
	Sig. (2-tailed)	*0,689*	*0,795*	*0,476*
	N	*30*	*30*	*30*

Table 5.11: Correlation between quality walking and cycling facilities and policy and modal shares. Note: Results not significant.

redesign of public space: Designed for people, where liveability is important, with space for active modes (pedestrian, cyclist) as well as place for greenery and recreation (mentioned by respondent B, D, F). The other group includes very simple but effective ways of stimulating actives modes, like a better adjustment of the traffic lights in favour of slow traffic or assigning cyclists separate space on the road by colouring the asphalt of their road section red (mentioned by respondent C, E). Other interventions have been mentioned as well, such as bicycle streets, improvement of cycle routes, and good bike storage facilities (respondent A).

In general the interviewees perceive this group of measures as technically very feasible, with very few limitations. According to respondent C: Interventions are often very simple, the existing facilities are already high-level, and there already is a lot of experience with this group of measures. One of the problems are the spatial limitations (as mentioned by respondent A, B, E), but they indicate there is plenty of space, only thing that has to be done is to minimise the space allocated to cars[3], as well as clear choices between cars and bikes. However, as both of the policymakers (respondent A & B) indicate: With the success of cycling new technical difficulties arises, as there are a lot of conflicts arising between pedestrians and cyclists, and bike parkings are overcrowded. Solutions are mentioned as well, like spreading of cyclists by offering multiple cycle routes (respondent A, B) and by encouraging a shift from bike to pedestrian (respondent A). Respondent A elaborated on the problems with rising numbers of bikes: In a city like Utrecht new choices arise; like should a bus lane be given up to make space for the bicycle or are there other solutions? These issues are mentioned as challenges for the near future.

Socially this group of interventions is perceived as very feasible. According to respondent C and E: Cycling is embedded in Dutch culture, many citizens have a positive attitude towards cycling and there are few people against cycling or walking. The major challenge that is mentioned (by respondent A, E, F), is the change of habits that is needed: Although many have a positive attitude towards cycling and a a lot of interventions may be implemented, people still tend to use their car, as it is part of their habits. It takes time to get out of the car-mindset, and it is not sure what the most effective way to do so is (respondent F). Respondent E mentions life-events to be important turning points, respondent F mentions our post-modern time as helping, as a transition is happening from car ownership to a demand for mobility. Although interviewees see this group of measures as promising, there are some limiting factors as well. As mentioned by respondent B and C; local businesses sometimes expects these interventions to be negative for their business; there are pro-car lobbyists (respondent E); and inclusivity is a factor as well (respondent D and F), for some people the accessibly to their own car or moped is very important. To increase social feasibility it is helpful to prove and emphasise the liveability and economic benefits to entrepreneurs (respondent B, D), and continue to invest in slow traffic consistently and taking the time to break free from a car-oriented mindset (C, F).

Interviewees see the political feasibility as high as well. According to respondent C: Investing is cheap and citizens are positive about cycling. Political challenges include entrepreneurs who are afraid of loosing business (respondent C, D, E), habits of people that need to be changed (respondent E, F), and inclusivity (not everyone has access to a bike) (respondent F). Feasibility is higher in cities with a city council that is more in favour of sustainability, but over the last years right-wing politicians are paying more and more attention to bicycles as well (mentioned by respondents B, C). Funding may be difficult sometimes for the

[3]Note the strong connection to the group of pricing measures and restraining cars, a recurring theme in the interviews is that making active modes more attractive often involves restraining cars

larger projects (tunnel or bridge) (respondent A, B, C), but many of the investments are relatively cheap (respondent C). Feasibility can be increased by emphasising the liveability benefits (respondent D, E) and by long-term investment in slow-traffic friendly environments (respondent E, F).

Feasibilities Making slow traffic more attractive

Technical	**Social**	**Political**
Very feasible	Very feasible	Very feasible
Conditions: Clear choices / removing space from car (3x)	Embedded in culture -> positive for feasibility (2x)	Funding may be difficult. Although investing is relatively cheap (1x), funding large projects may be difficult (3x)
Success of cycling arises new technical difficulties, solvable by spreading and shift to pedestrian (2X)	Changing habits is a major challenge (3x) Inclusivity point of attention, (include "have not's") (2x)	Depending on the composition of the coalition (2x), support will increase over time (1x)
Increase feasibility by: Focus on cyclists / pedestrian perspective in spatial planning (1x)	Increase feasibility by: Convincing entrepreneurs by showing positive effect (2x)	Increase feasibility by: Emphasising liveability benefits (2x), long-term investment (2x)

Table 5.12: Feasibility's Making slow traffic more attractive - Factors, and frequency being mentioned by interviewees

5.4. Generic reflection: Comparison and desirability of packages

At the end of the interviews, we also asked the interviewees about more generic information: What are aims and expected effects of striving for carfree cities, how do the groups of measures compare with each other, and what do interviewees think of the introduction of packages of measures.

5.4.1. Desired goal and results of carfree or low-car cities

All of the six interviewees mentioned the same desired goal of getting towards a low-car of carfree city: Liveability. One of academics (respondent C) noticed that we are facing a transition at the moment. Several years ago the main goal was often the counteracting of environmental impacts, but nowadays liveability is seen more and more as the main goal. This liveability was often described as creating vibrant space, high quality of living, vitality, inclusivity, greenery or a healthy space. Respondent A stated that this also leads to a safe space for the less traffic-able participants (elderly, kids). At the same time, reducing car use in cities is not focused on just one aspect, but serves multiple goals at the same time. Another important goal mentioned by respondents A, B, C and D is an efficient utilisation of the scarce space. Dutch cities are facing a rapid growth, so reducing car use makes it possible to realise efficiency improvements regarding space-utilisation, and thus to facilitate growth ambitions.

5.4.2. Comparison groups of policy measures

We asked the interviewees how they would rank the several groups of measures per kind of feasibility. Several interviewees mentioned that implementation by a combination of measures is essential (mentioned by respondent A, C, E, F). Nonetheless, most of them came up with rankings that in general were quite similar to one another (except for respondent A, who indicated that she was unable to rank these measures, as they should all be packaged by definition). The averaged results can be found in table 5.13. Concerning the technical feasibility, three of them (respondents C, D, E) regarded making slow traffic more attractive as most feasible. Respondent B rated all of them equally, and respondent F assessed collective services to be most feasible. Pricing measures and collective services where often ranked second or third. Some financial feasibility issues regarding the collectives services where mentioned (respondent E), as well as some technical issues (e.g. with privacy) regarding pricing measures (respondent C). However, overall the differences between the groups where small. All of the interviewees mentioned that in the end all groups of measures

were technically feasible, but that the difficulties mainly depended on the specific form of implementation.

Regarding both the social and political feasibility, all of the interviewees unanimously ranked the groups in exactly the same order. They often also referred to the connection between social feasibility and political feasibility (which is line with the framework of Feitelson and Salomon (2004)). The main argument mentioned, is that slow traffic is already widely accepted, just like public transport. Pricing comes with several difficulties regarding social acceptance. However, if pricing leads to a direct increase in liveability, the social feasibility increases (respondent B). Regarding political feasibility; this also depends on the number of municipalities to be involved (according to respondent B); whether direct results arise from the intervention (respondent B) and the composition of the coalition in the city council (respondents A, B). In general pricing is often seen by interviewees as a vinegar measure and is politically sensitive. Here too, the interviewees indicate that almost every group of measures is feasible in the end, but that it strongly depends on the final manner in which it will be introduced.

Ranking feasibilities by interviewees

	Technical		**Social**		**Political**
1	Slow traffic	1	Slow traffic	1	Slow traffic
2	Collective services	2	Collective services	2	Collective services
3	Price measures and restraining cars	3	Price measures and restraining cars	3	Price measures and restraining cars

Table 5.13: Ranking feasibility's groups of measures by interviewees

5.4.3. Perceived effectiveness by experts and relation with feasibility

We asked our interviewees which of these measures they considered to be most effective. Some of them (respondent C, F) referred to the dependence on the goal or aim that has to be achieved. In which, as example stated by respondent C, pricing is helpful in keeping the city accessible, but investing in active modes is helpful in keeping cities liveable, especially when combined with reducing car use. Most of the interviewees perceived a form of pricing to be most effective in reducing car use (respondents B, C, D, F). At the same time, one of the aldermen (respondent B) emphasised that the possible negative effects on the local economy should not be neglected. Respondent E also related to the earlier observation that this may also be the least feasible measure. This also relates to our earlier observation (section 3.3), that there are arguments to assume that there is a link between the effectiveness and feasibility of measures. As can be derived from the findings of the interviews and the findings in chapter 5 (Evaluation of Policies, also see figure 5.1), it appears to be that the most feasible measures seem to be the least effective, and that the most effective measures seem to be the least feasible. Further research is needed to confirm this relationship.

5.4.4. Desirability of mobility packages

When we asked how interviewees thought about combining measures in packages, we got quite similar answers: Necessary (respondent E, F), essential (respondent A, D) and highly desirable (respondent C). The measures are complementary, respondent C mentioned; feasibility increases by combining push and pull, and synergy effects arise. In the words of respondent F: Public transport without good bicycle facilities leads to under-utilisation and car measures without a redesign of public space will lead to modal split change, but less surplus value for society. The combination of push and pull measures also leads to a higher acceptance, according to respondents A, C and D. Respondents B, E and F emphasised the need to outline a broader context: Not just separate interventions, but policymakers should sketch an ideal image or vision of a liveable and vibrant area. Then a package of measures should be presented that can achieve this, in which policymakers should focus on the yields, instead of the restrictions. An integrated story is needed about sustainable mobility.

The experts-in-the-fields (respondents E & F) mention several problems: Nowadays too many small interventions are proposed, including quick-fixes and fast solutions, as the result of politicians being too focused

on one-liners and media attention. Another issue mentioned is the sectoral thinking within departments of municipalities and the lack of visionary politicians.

Limitations of the implementation of packages are often process-based. According to respondent F: Not everyone oversees the connections and relationships between the measures in a package. Good communication is essential, with insightful and understandable plans. Respondents C identifies one of the challenges: The preventing of hobby horses from politicians (long-cherished, individual wishes) from the packages. He also mentions that decision-making becomes more complex, and that the chance of 'negotiated nonsense' increases. Lastly, good timing is essential (mentioned by respondents C & E), including phasing of measures and informed decisions on a time horizon.

We can conclude that the desirability of mobility package is very high. Although combining measures may bring new problems or challenges, the advantages of combining outweighs these new challenges. Respondents assess the combination of measures in mobility package as very important, and indicate that this increases support and feasibility.

5.5. Overview findings effectiveness and feasibility

Now that we have looked at the individual groups of measures, we will come up with an overview. First we will look at the recurring themes and factors in the assessment of the feasibilities, in order to find out whether there is overlap between the groups of measures. This also allows us to find out whether more generic conclusions can be drawn about the feasibilities, which will contribute in case of applying these groups of measures in packages. Secondly, we will look at the effects and feasibilities per group of measure, in order to get a simple overview about the feasibility of a group of measures on the one hand, and the possible effectiveness (regarding decrease of modal share of car) of the group on the other hand.

Recurring issues and increase of feasibility

First we looked at the recurring themes and factors in the assessment of the feasibilities. On one hand we analysed the main issues mentioned, regarding the feasibilities. On the other hand we analysed the factors mentioned to increase feasibility. The findings can be found in table 5.14. In general, the numbers of issues mentioned regarding technical feasibility are relatively low. The recurring themes include both spatial limitations as current maximum capacities. Manners to resolve these issues include the exchange of space allocated to car; innovative solutions or an integral focus on the cyclists/ the pedestrian perspective.

Regarding the social feasibility, recurring issues include inclusivity, differing problem perceptions between parties involved and the change of habits. Several factors can resolve (parts of) these issues, like a good communication towards stakeholders during the design and implementation of (groups of) measures. To get stakeholders on board, offering supplementing features can be used as well. Lastly, framing is important. By emphasising the economic and/ or liveability benefits and framing the plan as pro-liveability instead of slogans like 'anti-car', 'removal of rights' or 'restricting', feasibility can be increased as well.

Concerning the political feasibility, recurring themes include the financial feasibility, accompanied by perception of the public and politicians, as well as framing. The issue of problem perception can be found under social feasibility too, on one hand this perception often strongly differs between stakeholders, on the other hand successful implementation of measures strongly relies on this problem perception: When people or politicians do not experience any problems, they will experience less urge to implement policies. Lastly, framing (pro/ against) is a recurring issue as well. Politicians tend to describe proposed policy measures in their own way, to leave their mark on the plan and to show their followers how they assess the plans. However, this often leads to a form of polarisation: The differences are emphasised, which often comes at the expense of the political feasibility. Ways to increase this feasibility include the offer of good alternatives for citizens (e.g. new forms of mobility); Long-term investment (continuous focus on transition towards low-car); and use of framing, by emphasising the economic and/ or liveability benefits, and showing the link with a positive impulse for local economy.

In general, several ways to increase feasibility can be used. Some of them are directly related to coping

with the main issues (e.g. spatial limitations, framing), others do not resolve the issues, but do increase support or accelerate the adoption of policy measures (e.g. good communication, offering good alternatives). In any case, some of the issues will remain during the introduction of (groups of) measures (e.g. inclusivity). It is important that attention is being paid to these issues and that consideration is given to manners of tackling those issues. Since this will not solve all issues, efforts must be made simultaneously to increase the feasibility using the aforementioned factors.

Recurring issues and increase of feasibility

	Technical feasibility	**Social feasibility**	**Political feasibility**
Issues	Spatial limitations Maximum capacities	Inclusivity (fairness issue) Changing habits Differing problem perceptions	Financial feasibility Framing (pro/ against) Public/ politicians' perception
Increase feasibility by	Exchange space allocated to car Integral focus on cyclists/ pedestrian perspective Innovative solutions (e.g. shared-mobility)	Offer supplementing features Emphasise economic/ liveability benefits Framing (pro-liveability) Good communication	Link with positive impulse for economy Emphasise economic/ liveability benefits Framing (pro-liveability) Offering good alternatives Long-term investment Revenue allocation

Table 5.14: Recurring issues and How to increase feasibility, according to experts

Overview of feasibilities and effectiveness

After analysing the various groups of measures and examining the recurring issues and ways to increase feasibility, the next step is to provide an overview of the feasibilities and effectiveness. In figure 5.1 an overview of these feasibilities and potential effectiveness can be found. This figure includes the three different groups we analysed in this chapter. On the left side the feasibilities can be found, based on the interviews with experts, extracted from the tables 5.4, 5.8 and 5.12. On the right side the potential effectiveness can be found (on a selected area, measured by the decrease of modal share of car). These numbers are extracted from tables 5.1, 5.5 and 5.9. Note that this is a first step in comparing the effectiveness of groups of measures on the one hand, and the feasibility on the other. The data used is only limited, leading to relatively low explanatory power. However, this analysis is useful for a first impression of the effectiveness and feasibility of groups measures. Further research is needed to elaborate on this.

Regarding the feasibilities, 'slow traffic' can be seen as the most feasible group of policy measures. The 'improvement and innovation of collective services' can be seen as largely feasible, as some issues may arise concerning the technical and political feasibility. Concerning the 'price measures and restraining cars', the feasibilities are lower. Although the technical feasibility is high, there are issues with the social and political feasibility. Although this will strongly depend on the final form of implementation, there are several challenges and issues that have been identified (e.g. residents often being initially negative, frame-and-claim behaviour politicians, subject being politicised), all leading to a lower feasibility.

When we look at the effectiveness, we find some clear results in the group of 'price measures'; a toll zone potentially leads to a decrease of the modal share of the car of over 40%. The same goes for measures in the 'collective services', which may also lead to high decreases of the modal share of the car, but note that most of these studies are stated preference studies instead of (revealed) evaluation studies. However, this is not the case concerning the group of 'slow traffic'. There are only limited numbers available: One of the sources that did provide a clear analysis, showed a decrease of circa 0%[4]. Other sources did not report clear numbers on the decrease of modal share of car.

[4]Note that this source did report an increase of modal share of bike, but mainly at the expense of public transport and pedestrians

However, some remarks have to be made:

1. In the analysis into the effectiveness of groups of measures, we chose to use modal share as indicator (also see the methodology section, 2.3). In order to obtain a fair comparison, we decided to include the effects on the decrease of modal share of car. However, several papers we included did report an effect on the modal share of one of the non-car modalities, but did not include numbers on the decrease of modal share of car. This is especially evident in the 'slow traffic' groups, and to a lesser extent in the 'collective transport' group. This leads to a distorted picture in the 'slow traffic' group. In itself, the figures we found in the group 'slow traffic' do not seem to indicate very large shifts in the modal share of the car. However, with the numbers we present in figure 5.1, we can only conclude that the effectiveness of 'making slow traffic more attractive' is uncertain and unknown.

2. Other remark that has to be made is related to the group of collective services. Although these numbers are promising (e.g. 25% shift, 46% shift), these numbers origin from sources that did use stated preference research. Although SP has great advantages due to its flexibility, it is based on hypothetical choices, potentially leading to bias, and a possible over-estimation of the effects.

3. Lastly, the groups we analysed can be considered to some extent as 'catch all groups'; They include a very wide range of measures. In this analysis we only included a selection of specific measures and their corresponding effectiveness, and although this may give an indication, this certainly cannot be seen as a representative assessment of the entire group.

For these reasons, we only should use this analysis as a first impression of the effectiveness and feasibility of groups measures. When we do so, we find that price measures have a proven effect, but we must also state that they do not necessarily lead to a carfree city. The feasibility of slow traffic measures is high, but the effectiveness is uncertain and unknown. This leads to the observation that the measures that seem to be very effective also seem to be the less feasible ones. On the other hand, the effectiveness of the measures being highly feasible, seems to be low, uncertain or unknown. However, this analysis can only be seen as a very limited initial overview. The main point is that there remains a lack of clear data on the effectiveness of (groups of) measures regarding the decrease of modal share of car. More research is needed to further substantiate these findings.

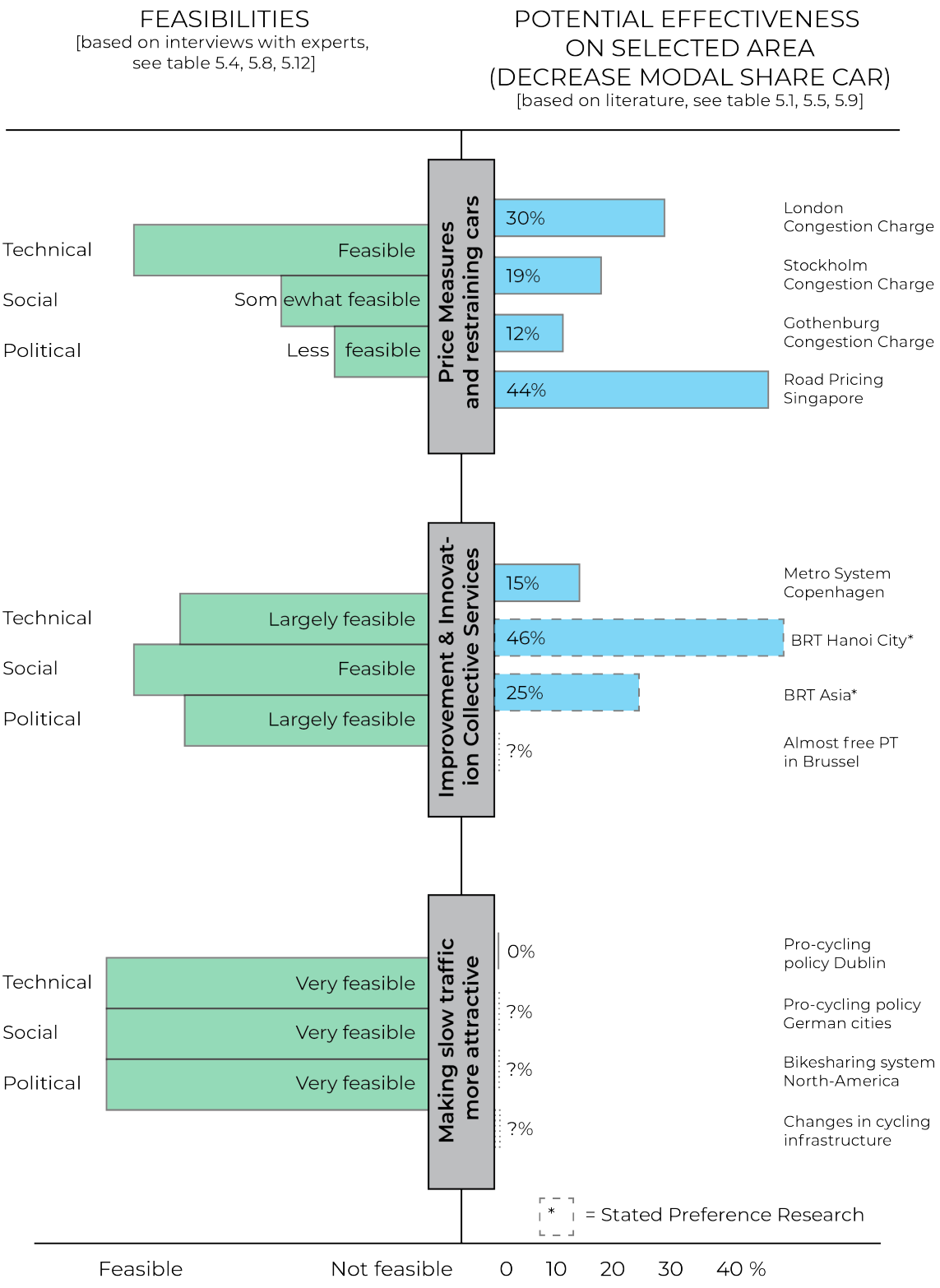

Figure 5.1: Overview of feasibilities and potential effectiveness

6

Case study - Implications in practice

This chapter examines the implications of implementing a package of policy measures in practice with use of a case study. In chapter 5 we isolated the different groups of measures and evaluated them on effectiveness and feasibility. However, both the scientific literature (see chapter 4) and the interviews with experts (see section 5.4.4) show the strong need to implement measures in packages. Therefore, in this chapter we bring the groups of measures back together and we aim to analyse what the implications of the preceding findings are for municipalities in achieving carfree cities. With our case study (into Agenda Amsterdam Autoluw) we first investigate whether our findings regarding feasibility issues and ways to improve feasibility are consistent with practice. After that, we translate the findings from the policy makers in our case and the analysis of the meeting of the city council into lessons for policy makers elsewhere, in order to successfully implement a package of measures.

6.1. Introduction Case study - Agenda Amsterdam Autoluw

Both the scientific literature (see chapter 4) and the interviews with experts (see section 5.4.4) showed that the introduction of measures via mobility packages is highly desirable. The next step is to investigate, with use of a case study, whether these kind of packages are used in practice and what their implementation process entails. In this case study we choose to use a holistic single case design (which is according to Yin (2003) eminently justifiable under certain conditions, for example when the case represents a representative or typical case or it is a rare or unique circumstance). This study is used in an explanatory way: We try to explore the way in which this implementation of a combination of policies has happened, whether that is in line with our earlier findings and what lessons we can draw from this case.

6.2. Selection and description case

At first we have to select a case. Ideally we choose a case in which several groups of measures are already applied or implemented at the same time, as a package. A search for mobility plans or -visions by Dutch municipalities revealed that the Municipality of Amsterdam published its 'Agenda Amsterdam Autoluw' at the end of 2019 (Gemeente Amsterdam, 2019a). This agenda presents measures from all three groups we analysed in chapter 5. On the one hand this provides a lot of information about measures being implemented, and on the other hand this may give a unique opportunity to analyse to what extent the Municipality of Amsterdam has thought about implications when such a package of measures is implemented in real-life.

The Amsterdam Autoluw Agenda contains 27 proposals for measures, pilots and studies for more living space and clean air. The reason for the agenda is the growth and densification of the city. With this program, the municipality of Amsterdam aims to become less dependent on the car and reduce the car's footprint in terms of use of space, emissions and noise. Some of the measures from this agenda are presented in table 6.1. Note that in the group of Price measures and restraining cars there is only one measure that is related to pricing (lower fees and permit rates for shared car), and this measure does not have discouraging effect (making something more expensive) but has an encouraging effect (making shared cars cheaper). This is in line with our earlier observations, namely that policymakers are somewhat hesitant to implement pricing measures. The agenda does include several car restraining measures, both directly mentioned (Pilot

restriction car traffic (knip)) and more indirectly mentioned (grant fewer new parking permits). The agenda includes numerous measures from the groups 'improving collective services' and 'make slow traffic more attractive'.

Examples

One of the high-profile examples from the Agenda is the ambition to **remove 10,000 parking spaces** on the street, with the aim of creating more space for a pleasant and liveable environment. This is expected to be achieved with measures like issuing fewer new parking permits and making better use of the existing parking capacity in garages.

Another example is **creating space for public transport**, with better traffic flow and accessible PT-stops. The aim is to improve the flow of public transport by development of separate bus lanes and rail tracks, and by adjusting the traffic circulation and traffic lights.

Examples of measures in Agenda Amsterdam Autoluw

Price measures and restraining cars	Collective services	Slow traffic
Pilot restriction car traffic (knip)	High frequency PT (FrequentNet)	Improvent of pedestrian facilities
Lower fees and permit rates for shared cars	Extend PT in evening and night (Night metro)	Turning residential into traffic calming areas
Intelligent entrance-access city	Cheaper PT for target groups (like kids and tourists)	Creating space in (city) streets for cyclists and pedestrians
Removal of parking spaces	New PT connections	Bike-sharing at metro stations

Table 6.1: Examples of measures in Agenda Amsterdam Autoluw, per group of measures

6.3. Evaluation effectiveness

Ideally we would evaluate both the effectiveness and the feasibility of implementing a package of measures. However, with the data available from the Municipality of Amsterdam, it is not possible to draw conclusions about the effectiveness. On the one hand, the Municipality of Amsterdam describes the expected effects in its Agenda to a very limited extent. On the other hand, it is too early to draw conclusions: Part of the measures are currently being implemented, and many of the measures will be implemented over the coming years. Therefore in this case study we choose to only evaluate the feasibility of a package of measures.

6.4. Evaluation feasibility

In section 5 we identified several recurring issues regarding feasibility, as well as ways to improve this feasibility. As these issues are recurring across all the three groups of measures, we expect at least these factors to play a role in the introduction of a package of measures, possibly accompanied by other arising issues. These expected issues, as well as possible ways to increase feasibility, can be found in table 6.2. In this section we analyse whether these expected issues can be discovered in the case of the Agenda Amsterdam Autoluw as well. We analysed the political decision making (subsection 6.4.1) and we performed interviews with policy advisers of the Municipality of Amsterdam, who were involved in the process of realisation of the Agenda (subsection 6.4.2). An overview of the findings can be found in tables 6.3 and 6.4, in which we have assessed whether the expected factors can be found in the political debate and interviews with policy officials. At last we will draw a number of lessons from this analysis, the political decision-making process and the interviews with policy officials.

6.4.1. Analysis political decision making

At the end of 2019 this Agenda Amsterdam Autoluw was proposed by the Mayor and Aldermen of the city of Amsterdam (College van B&W). In the meeting of the municipal council on January 22, 2020, this proposal

Mobility package: Expected feasibility issues and ways increase to feasibility

	Technical feasibility	Social feasibility	Political feasibility
Issues	Spatial limitations Maximum capacities	Inclusivity (fairness issue) Differing problem perceptions Changing habits	Financial feasibility Public/ politicians' perception Framing (pro/ against)
Increase feasibility by	Exchange space allocated to car Innovative solutions (e.g. shared-mobility) Integral focus on cyclists/ pedestrian perspective	Offer supplementing features Framing (pro-liveability) Emphasize economic/ liveability benefits Good communication	Link with positive impulse for economy Framing (pro-liveability) Emphasize economic/ liveability benefits Offering good alternatives Long-term investment Revenue allocation

Table 6.2: Mobility package: Expected feasibility issues and ways increase to feasibility

was discussed and approved. A look into this meeting provides us with a lot of information (Gemeente Amsterdam, 2020). In general a number of observations stand out: 1) Political support showed to be quite broad. Although it is a far-reaching proposal, a majority of the parties voted in favour of the proposal, 32 of the 45 seats, including both coalition as oppositions parties.[1] 2) Although not for the proposal itself, the more right-wing parties (VVD, FvD) also vote in favour of various motions which support the proposal.

We analysed whether our expected feasibility issues and ways to increase feasibility were mentioned or got attention in this debate, substantiated by quotes from city councillors. The results of this analysis can be found in Appendix F (Analysis City Council Meeting). Here we briefly discuss the factors, including an indication of whether they were found or not [V or X resp.] and a substantiation.

- **Spatial limitations [V]:**
  One of the main reasons for this Agenda is the lack of space in the inner city of Amsterdam. As expected, this issue of spatial limitations plays an important role in the debate, and is often referred to. One of the clear examples is the following quote by Vroege (D66): "It is busy; there is no space for the cyclists; there is no space for pedestrians."

- **Maximum capacities [X]:**
  We did not find clear examples regarding the capacity issues, for example in public transport. Although sometimes mentioned as a side note (for example that streets are overcrowded), little attention is paid to for example public transport connections that are already at their maximum capacity.

- **Inclusivity (fairness issue) [V]:**
  Inclusivity plays a major role, and is mentioned at various levels, like the elderly (mentioned by Van Soest, Partij van de Ouderen), the poor (Van Lammeren, Partij voor de Dieren), or the people that are car-dependent (Boomsma, CDA).

- **Differing problem perceptions [X]:**
  In the debate one of the parties (PvdA) emphasized that residents experienced the plan as not ambitious enough, whereas another party (VVD) mentioned that many Amsterdam residents were concerned about the plans. Still, the different perceptions of the problem did not seem to be too far apart, as Boutkan (PvdA) put it: "I (...) note that there is a lot of support in this city for this sentiment, to reduce the car's dominance."

[1] It has to be emphasised that Amsterdam has a fairly left-wing political situation. In another city this may turn out very differently.

- **Changing habits [X]:**
  Remarkably, the change of habits did not clearly emerge in the debate. Although many of the measures are intended to do this, it got little attention in the city council meeting.
- **Financial feasibility [V/X]:**
  Concerning the financial feasibility something is mentioned about the financial impact on parking garages, however, the financial aspect plays only a very limited role in this debate.
- **Public/ politicians' perception [V]:**
  It cannot be fully derived from this debate, but the perception of the public and politicians does not seem to differ much. The idea and necessity of a low-car city seems to be widely supported in both the council and in the city.
- **Framing (pro/ against) [V]:**
  We also see framing of both ardent advocates and ardent opponents. The responsible alderman continuously speaks about improvement of liveability, and we see all parties framing the plan in their own way (parties against call it anti-car, parties in favor try to emphasise the positive effects.) Several examples can be mentioned: Vroege (D66): "A brilliant plan by Alderman Dijksma."; Kreuger (FvD): This is "the pillaging of the Urban Mobility Fund by the PvdA, by D66, by GroenLinks and by the SP"; Marttin (VVD): "The focus of this council is to scare off the car". However, it is not clear what role framing played in agreeing to the approval of this proposal.

Regarding the ways to increase feasibility, almost all of the several possibilities were mentioned in the debate, to a greater or lesser extent (see appendix F.3, Analysis City Council Meeting). We did not find the following matters, or only to a very limited extent: 'Integral focus on cyclists/ pedestrian perspective'; 'Offer supplementing features'; 'Link with positive impulse for economy'). We will briefly discuss these missing factors:

- **Integral focus on cyclists/ pedestrian perspective:**
  This factor was not explicitly mentioned in the council meeting. On one hand that may make sense, given that the whole Agenda Autoluw in itself is focused on creating space for pedestrians and cyclists. As Ernsting (GL) mentions: "The integrated approach for these streets throughout the city to get more space for cyclists and pedestrians gives a boost to these streets." On the other hand, the agenda does not mention an integral focus on the cyclists/ pedestrian perspective in any of the involved parts of the municipality-organisation. However, missing this factor does not seem to have had a major impact on feasibility.
- **Offer supplementing features:**
  This factor is also not explicitly mentioned in the debate. Although these supplementing features are regularly mentioned in the proposals in the agenda itself (like new forms of shared-mobility), this is not often highlighted in the debate. The profit is mainly mentioned in terms of increasing quality of life, safety and quality of the environment. Little attention is drawn to these supplementing features. Here too, missing this factor does not seem to lead to a decrease in support.
- **Link with positive impulse for economy:**
  Where historically plans for low-car areas often pay a lot of attention to local businesses and their (in their opinion) expected decline in earnings, this is hardly reflected in this debate. It is difficult to come up with an explanation for this. It could be that entrepreneurs fully agree with these plans or that entrepreneurs are not represented at all. It is therefore hard to assess which role this played in finding support. As a result, it is also difficult to assess how missing this factor has led to more or less feasibility.

6.4.2. Analysis process of drafting the proposal by policy officials

In addition, we also interviewed two policy officials from the Municipality of Amsterdam. Both of the interviewees have been involved in drawing up this Agenda and are currently involved in the realisation and implementation of the measures in this Agenda. Respondent G in the function of Senior Policy Advisor Public Transport, is responsible for the policy measures regarding PT. Respondent H holds the function of Process Manager, which also includes the communication and participation process.

These interviewees were asked whether they saw these expected feasibility issue's and ways to increase feasibility in a Mobility package (table 6.2) reflected in the realisation of the proposal. The coded versions of these interviews can be found in Appendix F.2(Interview responses case study (coded)). In table 6.3 and 6.4 an overview of our findings can be found. Here we briefly discuss the factors, including an indication whether the factors were found or not [V or X] and a substantiation.

- **Spatial limitations [V]:**
  Both of the respondents indicate that this was one of the main starting points for the agenda. As mentioned by respondent G: "There are continuously dilemmas in how to distribute public space", and according to respondent H: "There is a struggle for the scarce public space in the city."
- **Maximum capacities [V]:** This issue is also recognized by both respondents. Solutions are mentioned as well, such as spreading and offering good alternatives (respondent H).
- **Inclusivity (fairness issue) [V]:**
  Inclusivity is an important point of attention for the current city council of Amsterdam, both of the respondents indicate. As a result, this is one of the main priorities in this Agenda as well, also because there are concerns about this point among residents, according to respondent H.
- **Differing problem perceptions [V/X]:**
  Respondent G recognizes this issue in a lesser extent: "Obviously there are different opinions, but in general there was broad support and a broad perception that something had to change". Respondent H also mentions this broad support in general, but also indicates there were sometimes contradictions between resident groups, and the different stake holders all had their own opinions about the required speed of introduction of measures.
- **Changing habits [V]:**
  Mentioned as a major issue by both respondents, "behavioral change is an important component", in the words of respondent H. Both refer to life-changing events as an important part of this.
- **Financial feasibility:**
  Respondent G indicates that it is especially an issue regarding PT-measures, like a multilevel crossing. Respondent H mentions that financial feasibility did play a role, but a relatively minor one. It is a major investment, but financial capacity has already been created in the coalition agreement, and more specific proposals will follow at a later stage.
- **Public/ politicians' perception [X]:**
  Not really recognised by respondents. As mentioned by respondent H: There are (large) differences between politicians and between citizens, but there is only little difference between perception of the public and the politicians as a whole.
- **Framing (pro/ against) [X]:**
  According to the respondents not really an issue: This is a pragmatic approach, leading to the disappearance of ideology (respondent G) and the explicit supporters and opponents mainly brought input for a constructive discussion and a critical look at our plans (respondent H).

Regarding the ways to increase feasibility, almost all of the several possibilities where applied in a greater of lesser extent in the Agenda, according to the respondents (see appendix F.2, Interviews Respondents Case Study (Coded)). We will highlight three of these factors, in which the application had some issues according to the respondents.

- **Integral focus on cyclists/ pedestrian perspective:**
  According to respondent G, the municipality aims to achieve this municipality-wide integral focus, but respondent H also mentions that the gradation is especially important: So pedestrian / bicycle / public transport in first place, the car in second place, thus also emphasising attention for public transport.
- **Emphasise economic/ liveability benefits:**
  Respondent G mentions that this was an important factor: There has been a lot of emphasis on the positive effect on quality of life. Respondent H endorses this, but also mentions that although the

Agenda does address economic benefits, the main approach was mainly the Traffic and Transport aspect. As a side effect this has a positive effect on the economy, but that was not the main goal.

- **Link with positive impulse for economy:**
  Both respondents indicate that this factor had the attention, but that it was not one of the key points. Conversations with entrepreneurs also mainly focused on supply of their businesses as an issue. Providing solutions for this supply did create support among local entrepreneurs, but not necessarily by underlining the positive impulse for the economy.

Additional issues and ways to increase feasibility

Lastly, we asked the interviewees whether they had additions to this list of feasibility issues and ways to improve feasibility. Regarding the feasibility issues, respondent H mentioned mobilisation of all the different stakeholders: Certain groups of citizens (often white, highly educated) were over-represented in the participation process, where it was hard to include other groups as well. This leads to an unbalanced representation and missing input. According to respondent H, they solved this by additional street interviews with the underrepresented groups. Respondent G mentioned the collaboration, interaction and coordination between the parties involved, which can be an issue or challenge. Especially in the combination of several measures into one package this issue emerges.

Regarding the ways to increase feasibility responded H mentioned good timing and a step-by-step approach as helpful and emphasised the need for good communication. Respondent G did not come up with additional ways.

Expected feasibility issues in Mobility package - Occurrence in Agenda		
	Issue in agenda?	
	City council meeting	Policy officials
Spatial limitations	V *	V
Maximum capacities	X	V
Inclusivity (fairness issue)	V	V
Differing problem perceptions	X	V/X
Changing habits	X	V
Financial feasibility	V/X	V
Public/ politicians' perception	V	X
Framing (pro/ against)	V	X

* Colours correspond with [V](green) and [X](red)

Table 6.3: Expected feasibility issues in Mobility package - Do they occur in Agenda Amsterdam Autoluw (V or X)

6.5. 9 Lessons from the case Amsterdam Autoluw

We found that the majority of the expected feasibility issues, and ways to increase feasibility we identified in chapter 5, did play a role in the Agenda Amsterdam Autoluw, to a greater or lesser extent. This demonstrates that our findings seem to correspond with practice. At last, we translate the findings from the policy makers in our case and the analysis of the meeting of the city council into lessons for policy makers elsewhere, in order to successfully implement a package of measures.

1. **See low-car as a means, not an end.** Respondent H states: "With this package of measures we do not aspire to be carfree. We want to take steps to become car-less with the aim of a liveable and accessible city." Similar statements can be found in the city council meeting. Seeing low-car as a means towards an accessible and liveable city seems to have a positive effect on the feasibility: There is broad support for ways to create a liveable city.

Ways to increase feasibility - Application in Agenda		
	Applied in agenda?	
	City council meeting	Policy officials
Exchange space allocated to car	V *	V
Innovative solutions (e.g. shared-mobility)	V	V
Integral focus on cyclists/ pedestrian perspective	X	V
Offer supplementing features	X	V
Framing (pro-liveability)	V	V
Emphasize economic/ liveability benefits	V	V
Good communication	V	V
Link with positive impulse for economy	X	X
Offering good alternatives	V	V
Long-term investment	V	V
Revenue allocation	V	V

* Colours correspond with [V](green) and [X](red)

Table 6.4: Expected ways to increase feasibility in Mobility package - Application in Agenda Amsterdam Autoluw

2. **Framing plays an important role.** The entire agenda seems to be related to pro-liveability; during the city council meeting the alderman often emphasised the positive effects on accessibility and liveability, and in the interviews the policy officials emphasised the liveability benefits being inherent to the main purpose of the plan. This is also explicitly indicated in the interviews (such as 'Amsterdam is low-car, but also mainly public transport-rich', respondent G). Respondent G also indicates that there has been discussion about the name of the agenda (Autoluw), which has a negative connotation in itself. This can also be a dilemma. Sometimes (as in this case) there were few good alternatives and 'low-car' was a clear description, according to respondent G.

3. **Nobody is against a pragmatic approach.** The so-called pragmatic approach (in their own words, which may be seen as a form of 'framing') emerged in both the meeting of the city council and the interview with respondent G. As respondent G indicates: "This agenda is not an ideological discussion, but a pragmatic approach to a problem we are facing that we want to solve. Ideology disappears as a result. This is common sense, the only logical thing to do." This approach seems to have had a positive effect on the feasibility, since only few people in the council are against a pragmatic approach to problems.

4. **There is emerging support for a toll zone.** As previously shown in our study, measures like a toll zone are potentially very effective, but the feasibility is quite low. These kinds of measures are not clearly mentioned and proposed in this Agenda either. However, the support for these kinds of measures seems to be emerging. In the political debate, a motion has been approved which orders the alderman: 1) To map out the possibilities for countering motorised traffic during rush hour; 2) Explicitly investigate the possibility of pricing measures (price differentiation and pay-per-use) (Ernsting et al., 2020). The interview with respondent G also indicates that this is seen as a promising measure, especially as part of this package of measures. According to respondent G the limiting factor in this respect is the central government, who on the one hand want to introduce such a measure on a national scale, but on the other hand is currently very cautious in introducing such a measure.

5. **Combine sweet and sour.** This is emphasised by both of the two interviewees: Combining push and pull measures in a package increases feasibility, and seduces car drivers to switch to other modalities. In the words of respondent H: "Car measures are the best public transport measures. That is why investments in public transport have to go hand in hand with measures to discourage car use."

6. **Packages increase complexity with regard to cooperation**. As mentioned by respondent G, the collaboration, interaction and coordination between the parties involved can be an issue or challenge. When measures are combined, this also leads to complexity in stakeholder management, as the num-

ber of parties and people involved increases. Although surmountable, this is an important point of attention.

7. **Problem perception important factor for support.** What stands out in the case of Amsterdam is that the initial support already seemed to be high (deduced from both the debate of the city council and the interviews). No direct explanation has been given, but respondent H mentions factors like the zeitgeist and the current low car ownership in Amsterdam. Another important factor that seems to have played a role is that the problems were clearly visible to the inhabitants: crowded streets and increased pressure on public space. This problem perception seems to have generated broad support for this package of measures.

8. **Emphasizing a link with a positive impulse is not always necessary.** Historically, entrepreneurs' fear of carfree areas has often been mentioned when talking about carfree areas. It would have a negative effect on local shops as the accessibility diminished (even though various studies have proven otherwise). This factor was also mentioned in the interviews with experts (see chapter 5). What stands out, is that this does not seem to be the case in Amsterdam, or only to a very limited extent. As respondent G mentions: Attention was paid to this factor, but it was not one of the key elements. The need was also lower: entrepreneurs experienced the crowds and the corresponding problems too. On top of that, the economic effect of such a package for inner city entrepreneurs in Amsterdam appears to be lower than for other, smaller cities. The question arises whether this fear by entrepreneurs is still prevalent, or whether this factor has been marginalised nowadays. However, this should be further investigated.

9. **Combining measures can contribute to revenue allocation**. By combining measures, it is easier to control where gains and losses are allocated. As respondent G indicates, they attempted to allocate several benefits in Amsterdam-Noord and Nieuw West as well. With a single measure this is more difficult than with a large package of different measures.

Short reflection on Urban Toll Zone

Earlier in this thesis we concluded that toll zones in the Netherlands are virtually absent, however, this measure seems to appear here. Therefore a brief reflection on this case (also see lesson 4). We found in chapter 5 that price measures such as a toll zone have proven to be very effective, but that feasibility is relatively low. We also found that a toll zone on a larger scale is virtually absent in the Netherlands. Nevertheless, in this city council meeting several parties seem to be willing to opt for a certain form of urban toll, and a majority of the voters approved a motion with this aim (Ernsting et al., 2020). Although this motion is not very far-reaching, and only involves an exploratory investigation, it seems that steps are being taken towards a toll zone.

This is also reflected in our interview with respondent H, in which it was stated that there is already a lot of work going on into intelligent access to certain areas, and that they would ideally opt for a system with payment according to use (i.e. a form of a toll zone). However, according to this respondent, cooperation with the central government is necessary, but at the same very difficult. The central government appeared to be reluctant and cautious in proposing these forms of measures.

How the dependencies and responsibilities between cities and central government are distributed regarding such a toll zone is input for additional research, but a remarkable observation here is that there appears to be rising support from municipalities for a (form of) toll zone, but support from central government seems to be lacking.

7

Conclusions, discussion and recommendations

This final chapter presents the conclusions of the research conducted. First the main findings are presented in a sequential order, answering all the sub-questions. After that, the main research question will be answered. Subsequently, the limitations of our research are discussed, followed by some recommendations for municipalities, as well as recommendations for future research. Lastly, the scientific contribution and social relevance will be discussed.

7.1. Main findings

Starting point of this thesis was the observation that cities are on the rise; The accessibility as well as the liveability within cities is under pressure. In order to deal with the problem of growing numbers of cars in cities, there is a need to find out what government policies are useful. Therefore, the following research question has been defined:

"Which government policies have shown or are regarded by experts to be effective and feasible in contributing to the realisation of low-car or carfree cities and what are thereof the implications in achieving carfree cities?"

The aim of this thesis is to fill the current knowledge gaps regarding carfree cities and to research effective and feasible policies for municipalities to convert towards a 'carfree city'.

7.1.1. Main findings sub questions

First, an extensive literature review has been carried out where we analysed several characteristics and desired results of carfree or low-car cities. We found that carfree or low-car cities may contribute to a wide scale of desired effects, often related to the liveability of cities, and often covering multiple goals. In the next step potential policies have been identified, by using desk research. We found a high amount of potential policies, which we categorised into eleven groups. Regarding the feasibility and effectiveness of these potential policies we found that there often is a lack of a clear assessment of the effectiveness and feasibility. When we compare policy documents with literature, we can conclude the following:

- In literature we see that only a small majority of the policies we found is honey-based, whereas in policy documents the vast majority is honey-based, seeming to indicate that Dutch policymakers prefer to propose honey-based measures;
- Dutch policymakers also seem to have a strong preference for proposing measures that aim to encourage cycling and walking, whereas we can hardly discover pricing measures.
- The expected effectiveness and feasibility of the proposed measures by municipalities are often underexposed.

In conclusion: We have found many potential policies applied and intended to be applied by municipalities to achieve a low-car or carfree city, but although in some cases we know something about their effectiveness and feasibility, this 1) is often only the case regarding some separate interventions and 2) the comparability of the effectiveness and feasibility of these measures is often low.

After the identification of policies, we evaluated three groups of measures in-depth in chapter 5. When we look at price measures and restraining cars, we can conclude that the introduction of price measures in the past have led to (vast) changes in modal share (e.g. a decrease of 34% of mode share of car in London toll zone, vkm-based), and that it is plausible that congestion charging may result in a positive impact on the modal split by decreasing the use of cars, depending on the circumstances. However, problems arise concerning the feasibilities. Technically spoken these kinds of measures do not have to lead to problems, but social resistance arises with plans for price measures and restraining cars. Although support increases with perceived urgency of the problem, initial negative attitudes of citizens will be a challenge for successful implementation. Regarding political feasibility, this group of measures can be seen as less feasible as well. Politicians often have the perception that residents are against these measures, leading to less parties in favour of these kinds of measures. In general, this group of measures can be seen as very effective, but challenging when it comes to social and political feasibility.

Regarding the groups of measures focused on 'Improvement and innovation of collective transport services', the main conclusion is that there is a lack of clear data about the effectiveness of measures in this group. There are only few before-and-after evaluations and several papers come with stated choice research, presenting hypothetical choices. The results are promising (up to 49% reduction of modal share of motorcycle and car), but they often strongly rely on surveys instead of revealed choices. As a result, the question of actual effectiveness remains largely unanswered. At the same time, the feasibility is high. There certainly are limitations and challenges, but the general line is that this group of measures is seen by experts as (largely) feasible. In general, we can conclude that the feasibility of this group of measures is high. However, though the expected effectiveness of this group of measures is promising, solid justification is often lacking.

When we look at the group of measures: 'Making slow traffic more attractive', the main conclusion is that the knowledge on this group of measures is limited. Many sources present non-significant results, others found small effects, but the main finding is that there are only few before-and-after evaluations. The same goes for clear, comparable indicators. Some of the policy measures seem to sort out (some) effect, but no clear indication of the effectiveness of this group of measures can be derived from the literature we found. The opposite applies to the feasibility of this group. The experts unanimously assess the feasibility of this group as (very) high, with few technical limitations, broad social support and political momentum. In general we can conclude that the feasibility of this group of measures is regarded as (very) high, but convincing evidence of the effectiveness is lacking, or shows only a limited effect on the decrease in car modal share.

Lastly, we analysed the implications of these findings for municipalities in achieving low-car or carfree cities. An important conclusion here is the need for packages, which is considered to be necessary to successfully achieve a low-car or carfree city. This leads to the question whether this combination of measures entails changes with regard to feasibility. In our case study, we conclude that most of the feasibility issues we found also recur with the introduction of such a package of measures. The same goes for ways to improve feasibility. We conclude that it is recommended for municipalities to implement policy measures to achieve a low-car or carfree city in a package, in which push and pull measures are combined, good alternatives are offered and the liveability benefits are emphasised.

7.1.2. Answering main research question

We conclude that the terms 'carfree' and 'low-car' are broad and comprehensive, and the same goes for the desired results and goals. There is a wide scale of potential effects; historically often with aims as tackling congestion, nowadays often related to an increase of the liveability of cities. In our search we found a wide variety of possible policy measures to contribute to the goals of a low-car or carfree city. As effectiveness and feasibility play an important role in successful implementation of these measures, we evaluated groups of measures on these two aspects. One of the main findings in this evaluation, is that the measures that seem to be very effective (e.g. pricing) also seem to be the less feasible ones. On the other hand, the effec-

tiveness of the measures that are highly feasible (e.g. investing in slow traffic), seems to be low, uncertain or unknown. In practice, we see this complexity too: In our analysis we found that municipalities frequently opt for 'honey'-based measures, like stimulating Public Transport (PT), cycling and walking. From a political point of view, this choice is explainable, after all, feasible measures will encounter less resistance during implementation. However, our study shows that it is questionable whether these measures contribute to the desired goals. At the same time, (very) effective measures, such as pricing (e.g. a toll zone), are rarely seen in policy documents, except for parking fees. This mechanism between effectiveness and feasibility demonstrates the complexity for policymakers to implement measures to achieve carfree cities, but also exposes the importance to emphasise these two elements in policy proposals. After all, an evidence-based approach, based on feasibility and effectiveness, can help to avoid wasting limited resources and failures that may undermine public support.

One of the main ways to counter this complexity according to literature and our interviews, is the introduction of packages of measures, which seems to be an important key in achieving carfree or low-car cities. After all, these packages lead to the combination of 'sweet' and 'sour'; to a fairer distribution of burdens and benefits; and to synergy by combining measures and a potential higher acceptance. However, these packages also come with some issues: The number of people involved increases; the process becomes more complex; and communication and support become more important. On top of that, much remains unknown about the effectiveness and feasibility of measures when combined in packages, so attention on these two aspects is needed. It is up to policymakers to cope with these issues, but this research has given a first start on an evaluation of feasibility and effectiveness of groups of measures and does provide some tools to increase the feasibility. However, this study also concludes that there remains a lack of clear data on the effectiveness of (groups of) measures regarding the decrease of modal share of car, and certainly when it comes to the combined effectiveness in mobility packages. In order to support policymakers in the near future, in which the demand and the need for policy measures into carfree cities seems to become increasingly important, the effectiveness of these (packages of) measures is an important point of attention for further research.

7.2. Discussion

- This thesis once started with the intention of investigating what it would take to achieve a carfree city. However, will these identified measures ensure a carfree city? No, probably not. What we have seen is that many of the policies analysed are aimed at contributing 'towards' a low-car city. A completely carfree city will probably require far tougher restrictions and an extensive package of measures. Nevertheless, the policy measures mentioned in this research may be of great value. After all, a radical change from a car-minded to a carfree city will be very difficult. It is much more likely that this will be a gradual process in which these measures are important initial steps.
- Technological developments are important in urban mobility, for example in automated driving or e-mobility. Although it is unknown how these developments will evolve, one may wonder whether striving for a carfree or low-car city is still necessary, when issues like noise nuisance and emissions are greatly reduced by these innovations. However, even though automated driving and e-mobility may contribute positively to goals like liveable, vibrant cities with a high quality of the environment, they will not be able to meet these goals completely, as they still claim space and cause hinder like lower road safety. That is why this research into low-traffic or carfree cities will continue to be relevant in the future.
- Regarding effectiveness, this thesis had a strong focus on modal shift (i.e. measures are seen as effective if they shift a trip from car to another modality, e.g. bike or PT). There are many other ways to describe this effectiveness (as also discussed in section 3.3), but more important, a reduction of total traffic demand also strongly contributes to many of the goals and desired results (like fewer and shorter trips). This element remains underexposed in this thesis, but has a potentially very strong contribution towards low-car or carfree cities.

7.3. Reflection and limitations of this thesis

This thesis aimed to fill the current knowledge gaps regarding carfree cities and to research effective and feasible policies for municipalities to convert to a 'carfree city'. In order to achieve this, this study provides

a broad analysis in the backgrounds and characteristics of a carfree city; a large list of potential policies was collected; and a good start in evaluating the feasibility and effectiveness of measures was made, and subsequently analysed in a real-life context.

The main contribution of this thesis includes three points: 1) With a clear overview of the characteristics of carfree cities and a structured overview of more than 200 possible measures we offer policymakers tools to take a first step towards a carfree or low-car city. 2) We developed a framework to evaluate these policies, based on effectiveness and feasibility, for both policymakers and researchers. 3) Finally, we provided a first understanding of both the effectiveness and feasibility of (groups of) measures and packages of measures, and provided a broader perspective on how such measures work out in practice. By doing so, we enable policymakers to quickly gain insight into the complexity of this topic (after all, effective measures seem difficult to achieve and vice versa) on the one hand, as well as possibilities and recommendations to increase the feasibility on the other hand.

In this light, this study is very useful for initial insights and an overview of the background of carfree cities and possible policies to achieve carfree cities on a generic level, with their corresponding effectiveness and feasibility. However, this thesis is not intended to provide detailed information about the characteristics of a certain policy measure. We also often found a lack of convincing substantiation of the effectiveness of many individual measures and groups of measures, and we have not been able to perform an analysis on the effectiveness of a package of measures in practice. We see here that research is reaching its limits: there is virtually no empirical research into full-fledged cases of mobility packages and for quantitative research suitable data sets seem to be lacking. For the effectiveness of packages of measures towards carfree cities in particular, additional research is required, which is also reflected in the following main limitations:

First of all, there are some generic limitations. For example: By definition we did not cover all relevant information about carfree cities in the literature review, nor did we discover all possible policies to achieve a low-car city. For detailed information about specific measures we refer to existing in-depth research on these measures (see table C.1 for suggestions), supplemented by a recommendation for further research in the (numerous) cases where these measures lack a good substantiation of effectiveness and feasibility.

Secondly, ideally we would have generated clear and compelling evidence about the effectiveness of measures, including a clear list of policies and their corresponding effectiveness, as well as the combined effectiveness of packages of measures. Although we applied several ways to achieve this, at the end we were only able to report to a limited extent on the effectiveness of groups of measures. This is in line with previous findings of for example S. Handy, Van Wee, and Kroesen (2013) and Harms et al. (2016) (e.g. effectiveness is also strongly related to the context and external circumstances, and there are many research challenges regarding the effectiveness of cycling interventions) On the one hand, this is due to a lack of literature and clear, comparable indicators. On the other hand, other research methods may be better suited to obtain an in-depth assessment of the (revealed) effectiveness of measures.

Thirdly, in section 4.2 we made a substantiated choice to analyse three groups of measures in chapter 5. Here, two limitations arise. On the one hand, we miss many potentially highly feasible and highly effective measures, as we left many kinds of measures outside the scope (e.g. Transit oriented development, city logistics). On the other hand, these groups were defined quite broadly (i.e. catch-all groups). Although this may bring more insight as the group contains more kinds of measures, this comes at the expense of the explanatory power of the group.

Fourthly, in this thesis we focused on ways to achieve carfree or low-car cities. While there is a lot of similarity between these two terms (carfree and low-car), there are also some significant differences (for explanation, see literature review, chapter 3). Nevertheless, in our analyses in chapter 5, 5 and 6, we have put these two terms together and made no distinction. This is reasonable, as there is so much in common, but in practice this may work out completely different. For example, a price measure will contribute to a low-car city, but this will never be sufficient for a carfree city. Therefore it is important to emphasise that this thesis focused on the first phase towards low-car or carfree. If a city wants to become completely carfree, more far-reaching measures are required.

Reflection on theoretical framework

In chapter 3 we developed a theoretical framework as a basis for our evaluation (see figure 3.6). We used this framework in chapter 5 to evaluate the policies we identified in chapter 4. Here we briefly reflect on this framework, with three points of attention.

- First of all, in our theoretical framework, we opted for two indicators for effectiveness; 'modal share' and 'car ownership'. In themselves these are logical indicators because they are relatively often used in literature, and several existing frameworks show relationships between these indicators and (positive) effects on, for example, congestion or quality of life (e.g. Krizek, S. L. Handy, and Forsyth, 2009). However, the use of these indicators faces two main problems: 1) Relatively little is known about car ownership, which is a fairly specific indicator used for specific policy measures (e.g. parking, pricing), and is less common in evaluations related to measures like cycling. There is also a wide variety in ways of measurement of these two indicators: e.g. trips-/ km-based, whether or not to include vans in car ownership rates. 2) As concluded earlier, the desired results of a carfree city vary greatly. For many cities, these results are of main importance, in which a decrease of the modal share of cars is a means, not an end. Hence, modal share and car ownership are realistic and reliable indicators in this context, but in addition it is important to realise that the modal share indicator provides only an indication of the achievement of these goals. It does not necessarily lead to achieving those goals.
- Secondly, we defined feasibility using the framework of Feitelson, including a distinction between political, technical and social feasibility. This was valuable in this context, as it enabled us to obtain a structured overview of the forms of feasibility. However, this does not fully do justice to the underlying factors that Feitelson describes. In a possible subsequent study that makes use of our framework, it is recommended to pay more attention to the underlying factors (e.g. sanctioned discourse, industry interests), which may lead to a more in-depth assessment of the feasibility.
- Lastly, some reflection on the relationship between effectiveness and feasibility. Earlier, we noted that there are arguments to assume that there is a link between the effectiveness and feasibility of measures. As can be derived from the findings of the interviews and the findings in chapter 5 (Evaluation of Policies, also see figure 5.1), the most feasible measures seem to be the least effective, and the most effective measures seem to be the least feasible. This leads to the observation that our findings seem to support this relation. However, as our research should be seen as initial insights in the effectiveness and feasible of policy measures, further research is needed to elaborate and confirm this relationship.

Short reflections on Case Agenda Amsterdam Autoluw

With these conclusions and discussion in mind we will shortly reflect on the Agenda Amsterdam Autoluw. We find the general line of our conclusions reflected in this Agenda. The effectiveness of many of the measures in the Agenda (Gemeente Amsterdam, 2019c) is barely substantiated in this agenda (i.e. at least in the publicly available documents); the agenda has a strong focus on the more feasible, but less effective measures (e.g. making cycling and walking more attractive); and has very few focus on price measures (with a much higher expected effectiveness).

However, there are also many reasons to be positive about the Amsterdam case. For example, they managed to achieve a broad package of measures, in which push and pull measures are combined, good alternatives are offered and the liveability benefits are emphasised. On top of that, the Agenda has been approved by the city council with broad support among both politicians and citizens.

7.4. Recommendations

Several recommendations are made towards municipal officials and -councils, as well as recommendations for further research. Recommendations for municipalities:

- **Define clear goals and desired results.** We found a wide variety of goals and desired results. A clear definition of these goals leads to better justification and substantiation of choices between measures, which can be helpful in avoiding waste of limited resources and preventing from failures that may reduce public support.

- **Combine and propose mobility packages.** As we found from both literature and interviewees: Packaging of measures is important. There are three key elements to deal with, in effectively implementing packages: 1) Decision-making will become more complex; 2) Prevent 'negotiated nonsense' and addition of 'hobby horses' from politicians'; 3) Good timing is essential, including phasing of measures and informed decisions on a time horizon; clear communication and stakeholders participation.
- **Have attention for effectiveness.** Virtually none of the policy documents provided a clear assessment of the expected effectiveness; and municipalities seem to prefer 'honey'-based measures, of which the effectiveness is often uncertain. Although this lack of attention is explainable (i.e. we showed that there remains a lack of knowledge on effectiveness) it is recommended to: 1) Where possible, use the available scientific knowledge about the effectiveness of measures and an evidence-based approach; 2) Take care of monitoring effects of measures.
- **Outline context and long-term investment.** Experts pointed out the need to outline the context: What is the problem, what do we want to solve and how are we going to do that? This has strong links with framing and emphasising the liveability benefits, but also has links with the observation that measures seem to become more feasible when they are part of a broader context, rather than a loose proposal. Ultimately, a behavioural change is essential in the transition to low-car cities, and this can mainly be achieved by long-term efforts to no longer make the car the standard, but to let people switch to alternatives.

Recommendations for future research:

- **Carry out before and after evaluation of policy measures.** Although many sources are available that report on policy measures that reduce the use of the car, many of these sources lack clear evaluations of their revealed effectiveness. Before and after evaluation of the introduction of these kinds of measures would be beneficial for municipalities in their choice for introducing a certain policy measure.
- **Define and use clear, comparable indicators.** In this study, we encountered a multitude of different indicators (e.g. percentage that cycle more often, respondents driving less often, percentage of car users that would switch), each describing an aspect of a reduction in car use. However, the comparability of such measures turned out to be low because the indicators often differed widely. Research into the compatibility and interchangeability of indicators (such as modal share) would greatly increase the comparability of measures.
- **Research into measures to stimulate cycling and walking.** Despite increasing attention for measures that stimulate walking and cycling, this topic still appears to be underexposed in literature. Further research in this topic is needed.
- **Research into the change of effectiveness by introducing measures as a package.** Through the case study we have been able to investigate the feasibility of a package of measures in practice. However, we were not able to investigate the change on the effectiveness of measures when they are introduced as a package. This is an important topic for further research.
- **Research into the relationship between feasibility and effectiveness.** In this study, a cautious conclusion has been drawn about the possible link between feasibility and effectiveness, where measures with a high potential effectiveness (such as price measures) appeared to have a low feasibility and vice versa. However, more research is needed to substantiate this link.

7.5. Scientific and social relevance

As we showed in our study, carfree cities may contribute to the improvement of the accessibility and liveability of cities, leading to benefits for current citizens, visitors of cities, and businesses within these cities, as well as opportunities for policy-makers to enhance their cities. In this thesis we showed the characteristics and desired results of carfree or low-car cities; we identified potential policies to achieve this and we developed and applied an evaluation framework. By doing so, we contributed to scientific knowledge and developed a theoretical framework (for a detailed reflection see section 7.3) and provided recommendations for municipalities (see section 7.4). Embedding this work in further research and in municipal policies would be a great next step to realise a shift towards carfree or low-car cities.

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A

Scientific paper

Towards Carfree cities - Looking for effective and feasible policies for municipalities to convert towards a carfree or low-car city

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Cities are on the rise: Recent years, cities have faced an increase in economic growth, employment rates and population numbers. As a result, the accessibility and liveability of cities is under pressure, mainly due to an increase in the number of cars. One of the possibilities to cope with this problem is to free existing cities from cars, resulting in 'carfree cities'. However, the effectiveness and feasibility of measures that aim to achieve this, is not always clear. This paper aims to describe the characteristics and desired results of carfree cities and aims to identify effective and feasible policies for municipalities to convert their city into a low-car or carfree city, by answering the question: "Which government policies have shown or are regarded by experts to be effective and feasible in contributing to the realisation of low-car or carfree cities and what are thereof the implications in achieving carfree cities?" With use of a literature review, desk research and interviews we found that there is a wide variety of possible policy measures to achieve a low-car of carfree city, however, often without a clear evaluation of their effectiveness and feasibility. Generally spoken, measures concerning 'Price measures and restraining cars' have a potentially high effectiveness, but low feasibility. There is a lack of clear data about the effectiveness of measures in the group 'Improvement and innovation of collective transport services', but feasibility is regarded as high. Regarding the group 'Making slow traffic more attractive', in general, the feasibility of this group is regarded as (very) high, but convincing evidence of the effectiveness is lacking, or shows only a limited effectiveness. Above all, it is advisable to implement measures as a package, in which push and pull measures are combined, good alternatives are offered and the liveability benefits are emphasised.

Key words: Carfree; Low-car; Cities; Sustainable mobility; Decision-making

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1. Introduction

Cities are on the rise: In recent years, cities have faced an increase in economic growth, employment rates and population numbers. The Statistical Office of the European Communities (2016) estimates that nowadays 75% of the European population live in urban areas and the United Nations Environment Programme (2009) states that the current wave of urbanisation is the largest wave of urban growth in human history. Although this urbanisation has a number of positive impacts, it has a downside as well: the accessibility of cities and the accessibility within cities is under pressure, mainly due to an increase in the number of cars (e.g. KiM, 2018; Ministerie van Infrastructuur en Waterstaat, 2019). In 2016 CROW estimated the costs resulting from this increasing

congestion in Dutch cities; The traffic problem in the cities may lead to an economic damage of almost 1.7 billion euros in 2021 if this problem persists (Voerknecht, 2016). In addition to this congestion, there are a number of negative impacts concerning environment, social life and public health that can be attributed to the increase of car travel and usage (T. Gärling, A. Gärling, and Johansson, 2000; Khreis, May, and Nieuwenhuijsen, 2017; Lucas et al., 2016; Nieuwenhuijsen et al., 2018).

One of the possibilities to cope with this problem is to free existing cities from cars, resulting in 'carfree cities'. The potential benefits of such carfree cities are tremendous according to Crawford (2000), including a reduction of noise, stench and danger of cars, and an improvement of the quality of life. As these proposed benefits are high, it is important to find out whether there is a need for these carfree cities; to find out a what the added value of such carfree cities is; which policies are successful in this transition to carfree cities, and under what requirements and challenges.

1.1. *Research question*

We identified a knowledge gap regarding the following three things: 1) A clear overview of the expected results of a carfree city, 2) a list of possible effective and feasible policies of municipalities towards low-car or carfree cities, and 3) an evaluation of how these policies can contribute in achieving carfree cities. Therefore, the following research question has been defined:

"Which government policies have shown or are regarded by experts to be effective and feasible in contributing to the realisation of low-car or carfree cities and what are thereof the implications in achieving carfree cities?"

This papers aims to fill current knowledge gaps regarding carfree cities and to come up with a research into effective and feasible policies for municipalities to convert to a carfree or low-car city.

2. Methods

Our research consists of four parts, for which the used methods is described below.

A literature review into the characteristics and desired results of carfree or low-car city

In order to come up with a shortlist of papers to include in the review, a number of steps has been conducted. At first, a broad search has been carried out using Scopus and Google Scolar, with keywords like carfree; low-car; and car restraining, only in the English language, in different forms of writing and with the use of Boolean operators. This search provided over 30.000 (not unique) results. Besides search engines Scopus and Scolar, back- and forward-referencing has been used to find suitable literature.

In order to be able to carry out a proper literature review a selection has to be made. The main criteria to make this selection includes: 1) The study is about 'carfree cities', or 2) the study includes multiple aspects of 'carfree cities' or 'low-car cities', or 3) The study includes processes or policies in the shift towards carfree or low-car cities or 4) The study describes relevant historical processes in the shift towards car reducing measures. With these criteria it is expected that we will find relevant and insightful sources to conduct a literature review. At first a broad search has been carried out with use of the

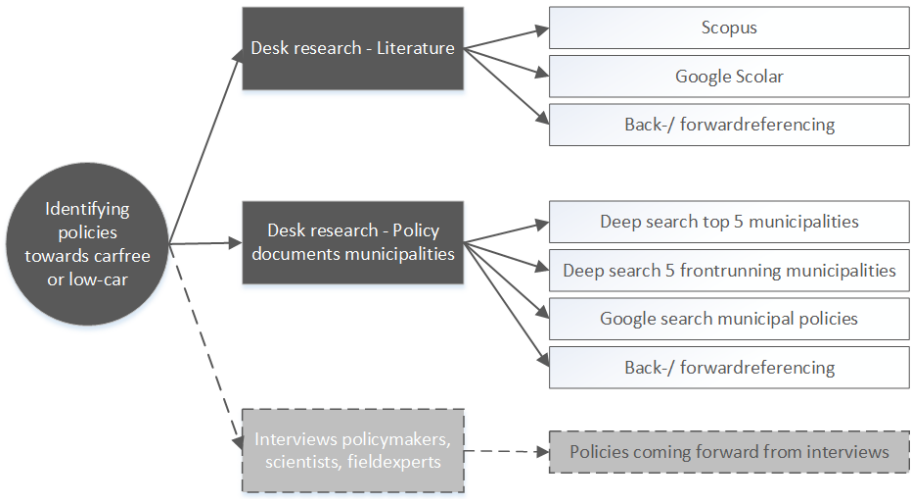

FIGURE 1. Schematic representation search process policies

search terms and Boolean operators. After that a selection has been made on base of the 1) Titles; 2) Number of citations; 3) Abstract of the sources; 4) followed by reading the remaining papers in total. After this selection process the combined databases provided 54 sources, including 24 duplicates. After deleting these duplicates 30 sources remained, which were included in the literature review.

A search into potential policies towards a low-car or carfree city

Three main sources to find and identify potential policies include scientific literature, policy documents by municipalities and interviews with experts. All these three will be used in order to find suitable policies. This process is visually represented in figure 1 and will be described in the following subsections.

- With a goal to achieve low-car or carfree cities
- That aim to achieve a structural change
- That are able to be implemented in Dutch cities
- That are able to be implemented by municipalities

An evaluation of the effectiveness and feasibility of these policies

After a broad search into policies some of these policies have been evaluated in more detail, based on two aspects; effectiveness and feasibility. For this step we developed a theoretical framework based on the work of Feitelson & Salomon (Beuthe et al., 2004) and Nieuwenhuijsen et al. (2018). We chose to evaluate the following three groups of policies into detail: 'Price measures and restraining cars'; 'Improvement and innovation of collective transport services'; and 'Making slow traffic more attractive'. We chose to analyse only three groups because for reasons of scoping, it was not feasible to investigate all possible policies due to time constraints. The choice for these groups is based on consultation with experts; these are commonly used policies where new insights may emerge. We chose to use 'modal share' and 'car ownership' as indicator for the effectiveness, as they are predictors for many of the expected effects of car-free cities (e.g. less noise nuisance, higher quality of environment). In line with Feitelson & Salomon we distinguished three kinds of feasibility; The technical feasibility, the political feasibility and the social feasibility. We have assessed these three forms of feasibility, based on interviews with two policymakers, two experts-in-the-field and two academics.

A case study in order to find out whether our findings correspond to

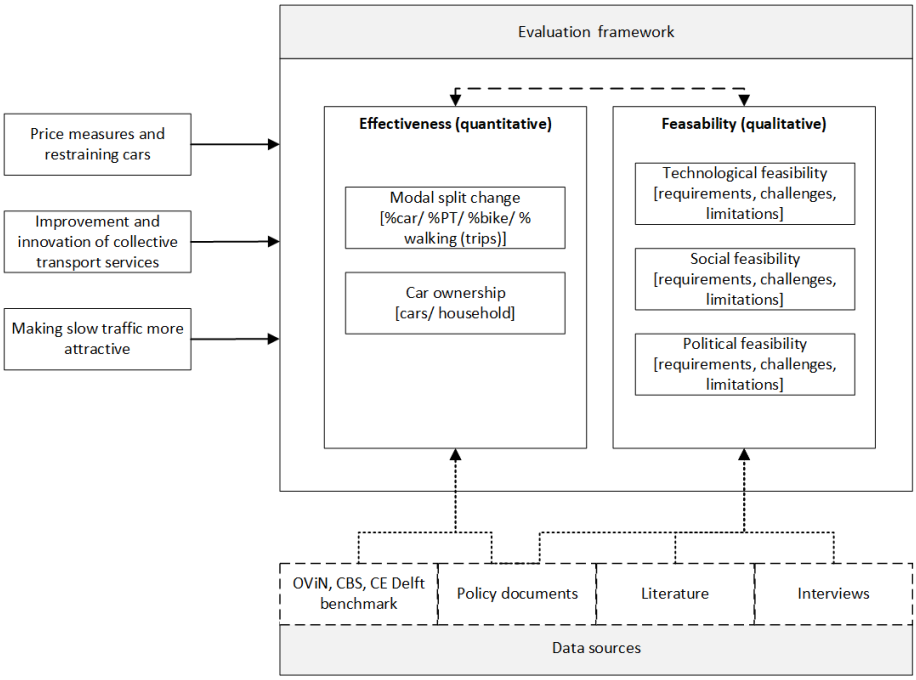

FIGURE 2. Structured representation evaluation policies

applications in practice.
Through a case study into Agenda Amsterdam Autoluw we analysed the feasibility of a package of measures in practice and we analysed whether our findings can be found in practice as well. We used two sources for this: At first we analysed the meeting of the city council regarding the debate and voting for approval of the proposal (Gemeente Amsterdam, 2020), with use of a content analysis. Secondly we interviewed two policy advisers of the Municipality of Amsterdam, who were involved in the creation of the Agenda. We chose to interview both someone responsible for the process and participation (respondent H), as well as someone responsible for the design of (some of) the measures (respondent G).

3. Results

3.1. *Findings literature review carfree cities*

First, an extensive literature overview has been carried out into the characteristics and desired results of a carfree city. We found that there is no single, universal definition of carfree. In literature several definitions have been used, varying from cities without private cars, to cities without motorised traffic, except for emergency services. That makes it difficult to describe the characteristics, as each type of carfree has its unique properties. However, some universal characteristics can be mentioned. Nowadays complete carfree cities are a rarity, but carfree and low-car developments are on the rise. Earlier developments often included temporary measures, traffic calming streets or carfree city centres, later on this has been extended with carfree neighbourhoods and further expansion of low-car zones in cities. Literature which come up with a clear description of policies or strategies to achieve carfree cities remain scarce. The same goes for clear evaluations of effectiveness and feasibility for policies towards carfree or low-car cities. This is mainly because very few complete packages are introduced and evaluated which aim to achieve a car-free or low-car city. About the desired results, we conclude that several 'traditional' results are mentioned, such as reducing congestion

and improving air quality. However, we also find several results that has to do with liveability, like goals mentioned that have to do with the liveability of cities, like a vibrant city life, greenery and enhancing social functions of streets. In general we can conclude that the desired effects often are numerous; They are not limited to just one or two fields but cover several fields.

3.2. *Findings finding potential policies*

After the literature review, we did an analysis into applied and intended policies by municipalities to achieve a low-car or carfree city. With use of a desk research we analysed multiple sources, including both literature as policy documents. We found an immense amount of potential policies, which we categorised into eleven groups. We found measures in groups that are restriction based (e.g. restrictions on car movement or parking cars), groups that are focused on other modalities (e.g. making PT or walking and cycling more attractive), as well as some other groups (e.g. focused on freight or sustainable housing). Mainly in policy documents we found some Packages of Measures as well. Regarding the feasibility and effectiveness, we noticed something that we also found in the literature review: There is often a lack of a clear assessment of the effectiveness and feasibility, certainly concerning groups of measures. Individual interventions often provide us with some more insights, especially in literature. However, it is still unclear which measures are effective and feasible and which are not. When we compare policy documents with literature, we can draw conclusions as well: 1) In literature we see that a small majority of the policies we found is honey-based, where in policy documents the vast majority is honey-based, seeming to indicate that Dutch policymakers prefer to propose honey-based measures; 2) According to the number of proposals in plans by Dutch municipalities, Dutch policymakers also seem to have a strong preference for proposing measures that aim to encourage cycling and walking, where we can hardly discover pricing measures. 3) The expected effectiveness and feasibility of the proposed measures by municipalities are often underexposed. In conclusion: We have found many potential policies applied and intended to be applied by municipalities to achieve a low-car or carfree city, but although we know in some cases something about their effectiveness and feasibility, this 1) often only is the case regarding some separate interventions and 2) the comparability of the effectiveness and feasibility of these measures is often low.

3.3. *Findings Evaluation Policies*

After the identification of policies, we evaluated three groups of measures in-depth regarding effectiveness and feasibility. When we look at price measures and restraining cars, we can conclude that the introduction of price measures in the past have led to (vast) changes in modal share (like a decrease of 34% mode share of car in London toll zone, vkm-based), and that it is plausible that congestion charging may result in a positive impact on the modal split by decreasing the use of cars, depending on the circumstances. We also notice not only an effect on the area in which the price measure is introduced; surrounding areas experience a decrease as well. However, problems arise concerning the feasibility's. Technically spoken these kinds of measures do not have to lead to problems, but social resistance arises with plans for price measures and restraining cars. Citizens often initially have a negative attitude towards these measures. Although support increases with perceived urgency of the problem, these attitudes will still be a challenge for successful implementation. Regarding political feasibility,

this group of measures can be seen as less feasible as well. Politicians often have the perception that residents are against, leading to less parties in favour of these kinds of measures. Frame-and-claim behaviour by politicians as well as the subject often being politicised in the Netherlands are not helpful as well. Feasibility may be increased by a good framing (pro-liveability) and offering good alternatives, but finding political majorities can still be seen as challenging. In general, this group of measures can be seen as very effective, but challenging when it comes to social and political feasibility.

Regarding the groups of measures focused on 'Improvement and innovation of collective transport services', main conclusions is that there is a lack of clear data about the effectiveness of measures in this group. There are only few before-and-after evaluations and several papers come with stated choice research, presenting hypothetical choices. The results are promising (up to 49% reduction of modal share of motorcycle and car), but they often strongly rely on surveys instead of revealed choices. As a result, the question of what the actual effectiveness is remains largely unanswered. At the same time, the feasibility is high. There certainly are limitations and challenges, but the general line is that this group of measures is seen by experts as (largely) feasible. In general, we can conclude that the feasibility of this group of measures is high. However, the expected effectiveness of this group of measures is promising, but solid justification is often lacking.

When we look at the group of measures: 'Making slow traffic more attractive', main conclusion is that the knowledge on this group of measures is limited. Many sources present non-significant results, others found small effects, but main finding is that there are only few before-and-after evaluations, and the same goes for clear, comparable indicators. Some of the policy measures seem to sort out (some) effect, but no clear indication of the effectiveness of this group of measures can be derived from the literature we found. The opposite applies to the feasibility of this group. The experts unanimously assess the feasibility of this group as (very) high, with few technical limitations, broad social support and political momentum as well. In general we can conclude that the feasibility of this group of measures is regarded as (very) high, but convincing evidence of the effectiveness is lacking, or shows only a limited effect on the decrease in car modal share.

3.4. *Findings synthesis policy measures*

At last we analysed the implications of these findings for municipalities in achieving low-car or carfree cities'. First we found that municipalities should be aware of their goals and the desired effects they want to achieve, as there are a multitude of goals and factors that low-car or car-free may contribute to. We see that a historical shift has taken place: From focus on reducing congestion and air pollution towards liveability benefits. Once these desired goals are clear, it is important to consider whether measures to reduce traffic will actually contribute to this.

Two important aspects to take into account, are the expected effectiveness and feasibility. After all: Not feasible measures are difficult to implement, ineffective measures will sort out little effect. Here too, we conclude that measures regarding making slow traffic more attractive are very feasible, but the expected effectiveness is questionable. The opposite is true for pricing measures, which is seen as effective, but less feasible. An important conclusion here is the need for packages, which is considered

Recurring issue's and increase of feasibility

	Technical feasibility	**Social feasibility**	**Political feasibility**
Issues	Spatial limitations Maximum capacities	Inclusivity (fairness issue) Differing problem perceptions Changing habits	Financial feasibility Public/ politicians' perception Framing (pro/ against)
Increase feasibility by	Exchange space allocated to car Innovative solutions (e.g. shared-mobility) Integral focus on cyclists/ pedestrian perspective	Offer supplementing features Framing (pro-liveability) Emphasize economic/ liveability benefits Good communication	Link with positive impulse for economy Framing (pro-liveability) Emphasize economic/ liveability benefits Offering good alternatives Long-term investment Revenue allocation

TABLE 1. Recurring issue's and How to increase feasibility, according to experts

to be necessary to successfully achieve a low-car or carfree city.

With that, the question arises whether this combination of measures entails changes with regard to feasibility. In our case study, we found that most of the feasibility issues we found also recur with the introduction of such a package of measures. The same goes for ways to improve feasibility. Municipalities can play a major role in the way in which they implement such packages. Some of the main contributions to the feasibility include 'seeing low-car as a means, not an end'; 'a correct way of framing, with emphasis on the benefits for quality of life'; 'a pragmatic approach'; and 'combining sweet and sour measures'. The strong emphasis on the link with a positive impulse for local economy does not seem to be necessary anymore nowadays. In general, although this may be evident, the support for measures is highly dependent on the problem perception. We conclude that it is, according to interviewed experts, strongly recommended for municipalities to implement policy measures to achieve a low-car or carfree city in a package, in which the aforementioned factors will contribute to the feasibility of the plans.

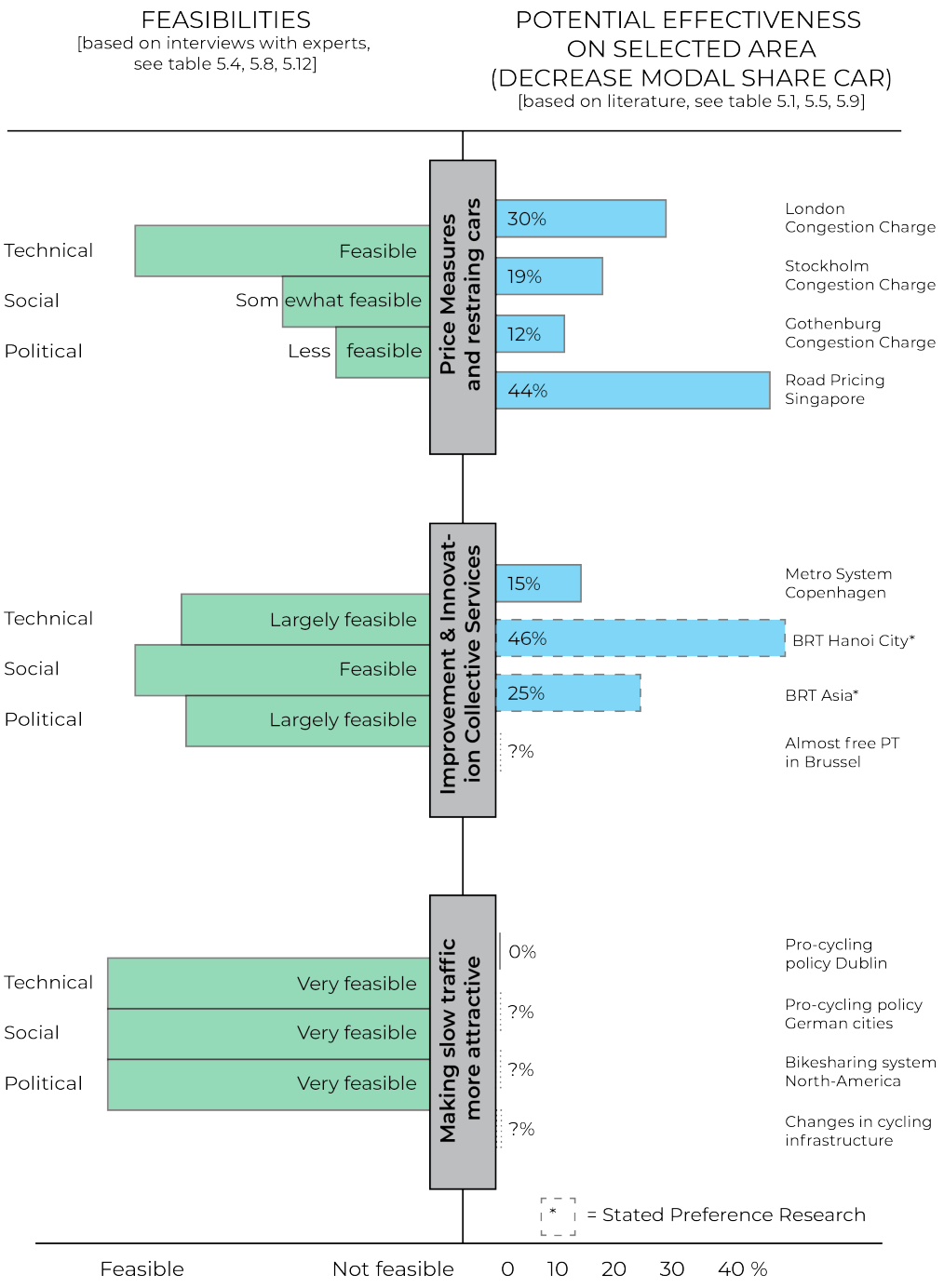

FIGURE 3. Overview of feasibilities and potential effectiveness

4. Conclusion

We conclude that the terms 'carfree' and 'low-car' are broad and comprehensive, and the same goes for the desired results and goals. There is a wide scale of potential effects; historically often with aims as tackling congestion, nowadays often related to an increase of the liveability of cities. In our search we found a wide variety of possible policy measures to contribute to the goals of a low-car or carfree city. As effectiveness and feasibility play an important role in successful implementation of these measures, we evaluated groups of measures on these two aspects. One of the main findings in this evaluation, is that the measures that seem to be very effective (e.g. pricing) also seem to be the less feasible ones. On the other hand, the effectiveness of the measures that are highly feasible (e.g. investing in slow traffic), seems to be low, uncertain or unknown.

In practice, we see this complexity too: In our analysis we found that municipalities frequently opt for 'honey'-based measures, like stimulating PT, cycling and walking. From a political point of view, this choice is understandable, after all, feasible measures will encounter less resistance during implementation. However, our study shows that it is questionable whether these measures contribute to the desired goals. At the same time, (very) effective measures, such as pricing (e.g. a toll zone), are rarely seen in policy documents, except for parking fees. This mechanism between effectiveness and feasibility demonstrates the complexity for policymakers to implement measures to achieve carfree cities, but also exposes the importance to emphasise these two elements in policy proposals.

One of the main ways to counter this complexity according to literature and our interviews, is the introduction of packages, which seems to be an important key in achieving carfree or low-car cities. After all, these packages lead to the combination of 'sweet' and 'sour'; to a fairer distribution of burdens and benefits; to synergy by combining measures and a potential higher acceptance. However, these packages also come with some issues: The number of people involved increases; the process becomes more complex; and communication and support become more important. On top of that, much remains unknown about the effectiveness and feasibility of measures when combined in packages, so attention on these two aspects is needed. It is up to policymakers to cope with these issues, but this research has given a first start on an evaluation of feasibility and effectiveness of groups of measures and does provide some tools to increase the feasibility. However, this study also concludes that there remains a lack of clear data on the effectiveness of (groups of) measures regarding the decrease of modal share of car, and certainly when it comes to the combined effectiveness in mobility packages. In order to support policymakers in the near future, in which the demand and the need for policy measures into carfree cities seems to become increasingly important, the effectiveness of these (packages of) measures is an important point of attention for further research.

Discussion

There are some remarks that have to be made. It is questionable whether a complete carfree city will be achieved by a number of measures we found in our analysis. A completely carfree city requires probably far tougher restrictions and an extensive package of measures. Nevertheless, the policy measures mentioned in this research may be of great value. After all, a radical change from a car-minded to a carfree city will be very difficult. It is much more likely that this is a gradual process in which these measures are important initial steps. Furthermore, technological developments play an important role in urban mobility, in for example automated driving or e-mobility. Although it is unknown how these developments will evolve, one may wonder whether striving for a carfree or low-car city is still necessary, when things like noise nuisance and emissions are greatly reduced by these innovations. However, especially with goals like liveable, vibrant cities with a high quality of the environment, automated driving and e-mobility may contribute positively, but still will not be able to meet these goals, as they still claim space and cause hinder like lower road safety. That is why this research into low-traffic or car-free cities will continue to be relevant in the future. At last, regarding effectiveness, this paper has a strong focus on modal shift (i.e. measures are seen as effective if they shift a trip from car to another modality, e.g. bike or PT). On the one hand there are many other ways to describe this effectiveness, but more important, a reduction of total traffic demand also strongly contributes to many of the

goals and desired results (like fewer and shorter trips). This element has a potentially very strong contribution towards low-car or carfree cities.

Reflection and limitations

This study provides a broad analysis in the backgrounds and characteristics of a carfree city; we collected a large list of potential policies; and we made a good start in evaluating the feasibility and effectiveness of measures, which we subsequently analysed in a real-life context. The main contribution of this study includes three points: 1) With a clear overview of the characteristics of carfree cities and a structured overview of more than 200 possible measures we offer policymakers tools to take a first step towards a carfree or low-car city. 2) We developed a framework to evaluate these policies, based on effectiveness and feasibility, for both policymakers as researchers. 3) Finally, we provided a first understanding of both the effectiveness as feasibility of (groups of) measures and packages of measures, and provided a broader perspective on how such measures work out in practice. In this way, we enable policymakers to quickly gain insight into the complexity of this topic (after all, effective measures seem difficult to achieve and vice versa) on the one hand, as well as possibilities and recommendations to increase the feasibility on the other hand.

In this light, this study is very useful as a good initial insight and overview of the background of carfree cities and possible policies to achieve carfree cities on a generic level, with their corresponding effectiveness and feasibility. However, this study is not intended to provide detailed information about the characteristics of a certain policy measure. We also often found a lack of convincing substantiation of the effectiveness of many individual measures and groups of measures, and we have not been able to perform an analysis on the effectiveness of a package of measures in practice. We see here that research is reaching its limits: there is virtually no empirical research into full-fledged cases of mobility packages and for quantitative research suitable data sets seem to be lacking. For the effectiveness of packages of measures towards carfree cities in particular, much more research is therefore required, which is also reflected in the following main limitations:

First of all, there some generic limitations, for example: By definition we did not cover all relevant information about carfree cities in the literature review, nor discovered all possible policies to achieve a low-car city. Second. Ideally we would have generated clear and compelling evidence about the effectiveness of measures, including a clear list of policies and their corresponding effectiveness, as well as the combined effectiveness of packages of measures. Although we applied several ways to achieve this, at the end we were only able to report to a limited extent on the effectiveness of groups of measures. Third. We made a substantiated choice to analyse three groups of measures. Here two limitations arise. On the one hand, we miss a lot of potentially highly feasible and highly effective measures, as we left many kinds of measures outside the scope. On the other hand, these groups were defined quite broadly. Although this may bring more insight as the group contains more kinds of measures, this comes at the expense of the explanatory power of the group. Fourth. In this study we focused on ways to achieve carfree or low-car cities. While there is a lot of similarity between these two terms (carfree and low-car), there are also some significant differences, as mentioned before. However, in our analyses we have put these two terms together and made no distinction. This is understandable, as there is so much in common, but in practice this may work out completely different. It is therefore important to emphasise that this paper is focused on

the first phase towards low-car or carfree. If a city wants to become completely carfree, much more far-reaching measures are required.

Reflection on theoretical framework

We developed a theoretical framework as a basis for our evaluation of the policies we identified (see figure 2). Our framework proved to be very useful in providing a structured overview of the feasibility and effectiveness. However, points of attention are the indicators used (modal share and car ownership are very insightful, but will not suffice in all cases); a more extensive evaluation of feasibility and further research into the relationship between feasibility and effectiveness.

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B

Table Literature Review

This appendix includes the table with the literature review. The first column presents the author(s) of the source, the second column presents the title of the paper and the third the aim of the study in order to get a quick insight in the contents of the paper. The other columns describe the several aspects as mentioned in section 2.1.

TABLE A.1 - LITERATURE REVIEW

Author(s)	Title	Aim of study	Definition	Carfree city, -city centre or -areas?	Theoretical or application?	Desired result	Proposed strategies?	Effectiveness	Feasibility	New knowledge gaps mentioned
Alameri (2011)	The car free city model	The aim of this paper is identifying the urban fabric looking for a direct relation between human beings and the urban spaces rather than a man-car-space relation, where the car stands between man and the living	No clear definition, but describe it as: free of privately-owned vehicles	Masdar: the car free city	Applicated in Abu Dhabi	Reduce carbon dioxide emissions, noxious gases, and provide a safer pedestrian and human friendly environment while reducing resident carbon footprints which contribute to global warming.	Applied strategy: - The Masdar project is one of the first attempts to create a modern urbanized area of these dimensions that is completely free of privately-owned cars. - The principle driving the transportation strategy is designing a city around people's needs and not around the needs of cars as many modern cities do. - Main aspects: Personal Rapid Transport system, shared space and integration with five different powered modes (PRT, GRT, e-taxis, LRT and Metro)	Not mentioned.	Not mentioned.	Masdar is intended (…) as an example that will demonstrate, test and evaluate new ways of doing things, so these can be tested, evaluated and then adopted in other places where appropriate.
Betz, Prottung, & Lienkamp (2017)	An evaluation of the car-free city potential for the city of Munich regarding	This paper presents an evaluation of the car free city potential for the city of Munich regarding collected mobility data.	Refers to Topp and Pharoah (1994): This does not imply that conventional vehicle concepts are fully prohibited, regulations in these areas are, for	Carfree areas	Practical, case study, but not applied in real-life.	Refers to Topp and Pharoah (1994): Goal is to increase inner cities attractiveness and improve	None mentioned, paper is hypothetical; Is carfree possible?	Hypothetical case study, but conclusion is that car-free zones in Munich are possible when looking at mobility data.	Hypothetical case study, but conclusion is that car-free zones in Munich are possible when looking at mobility data.	The investigation of transportation and logistics companies with this data. A possible method to change the transportation not only in specific areas but for whole Munich is applying concepts

	mobility data		instance, more ecological mobility concepts (bicycles, tram), the relocation of parking lots or restrictions for the maximum velocity.			the ecological inner city.				combined with distribution terminals.
Bieda, 2016	Car-free cities: urban utopia or real perspective ?	The paper attempts to answer the question if, and how, future changes towards sustainable mobility, may influence urban form, and in particular, how car-free residential areas in future cities may look like.	No clear definition, describes different example of car restraining areas, but mentions two The visions of a future "Post Automobile City": a radical Car-free City model entirely devoid of automobile and – less radical - a Sustainable Mobility City, offering diverse modes of movement and related diverse life styles.	Carfree areas	Practical cases of car restraining areas (Walkable neighborhood Stockholm, traffic calmed street Darmstadt, etc)	Countering the effect of car oriented development: Reduced accessibility by other means of movement; pedestrian, biking, public transport. Lesser opportunities for social exchange, and for uses other than residential.. Most unprivileged are those without easy access to car: children, elderly, disabled persons.	Not clear mentioned. Author expects development to be adapted to local situation: Diversity at each level and dimension will be its characteristic feature.	Not mentioned.	A post-automobile city still remains a "wishful thinking" vision – an urban utopia	None mentioned.
Bonnel (1995)	Urban car policy in Europe	In order to get a better idea of the different policies and their effects, we have gathered data on the urban travel management policy (public transportation, use of private cars, car parking) of different cities in Europe representing a type of policy.	None mentioned	Not mentioned, mainly about some car use discouraging policies.	Evaluative, based on applied practices	Counter the problems of urban travel management; like congestion, pollution, public deficits, etc. Many more possible aims mentioned, but mainly about aims for urban travel policy in general	Five groups of policies mentioned: 1) Free choice of mode of transport, 2) deregulation of Public Transport, 3) Car access to city centre forbidden, 4) urban toll, 5) use of cars restrained and public transport promoted.	1) Free choice of mode of transport: No clear conclusion 2) Deregulation of Public Transport: (…) the results of deregulation are far from being impressive. (…) the original objectives have not been reached. 3) Car access to city centre forbidden:	No clear evaluation of feasibilities, but the evaluated policies appeared to be feasible (as they have been implemented)	None mentioned.

						(like fight against congestion; Promote walking and cyclinq; Improve protection of the environment; Improve living environment		Seems to be effective: “it has had positive effects on car traffic in the ‘banned zones’. (…) the number of vehicles entering the prohibited area has been reduced. There is however a certain amount of negative fall-out in the neighbouring areas, especially as far as parking is concerned. “ 4) urban toll: Partly effective: “Car traffic has changed only slightly since the introduction of the toll. It has therefore achieved the aim of its designers, i.e. to collect funds and not to regulate demand.” 5) use of cars restrained and PT promoted: Expected to be effective: “ the abundant supply of public transport coupled with the restrictive policies for car uses, gives very satisfactory results.”		
Coates (2013)	The sustainable Urban district of Vauban in Freiburg, Germany	This paper presents a comprehensive description of Vauban as a successful example of participatory design and development, as well as social, economic, architectural and technological sustainability	No clear definition, but idea of Vauban is: “Residents (or future residents) have to agree that they do not and will not own a car”, regulated with use of a membership construct (Vauban Club for Car-Free Living)	Carfree area (neighbourhood)	Practical, case study.	The city (of Freiburg) decided to develop the (Vauban) site as a new sustainable urban district, creating a development corporation to plan the site, prepare infrastructure	Vauban was (mainly) built from scratch, in which participatory design and development had an important role.	Paper is positive about the implemented ‘car-free’ policy, but the effectiveness is not clearly described. Author calls the Vauban initiative ‘remarkably successful’, based on his proposed ’10 Theses for Sustainable Urban Development’.	Feasibilities are not clearly described, however, a participatory process seems to be helpful.	None mentioned.

						and oversee development of the project. In 1993 students and ecologically and socially minded citizens, (..) hoped that Vauban might be developed by means of a participatory process as an ecologically friendly, highly energy efficient, solar powered and largely car-free urban community.				
Crawford (2000)	Carfree cities	Outlining a city structure carefully designed to maximize the quality of life for individuals and communities worldwide, giving practical suggestions for gradually implementing the reference design in existing cities, and for creating new ones.	No use of cars. However, ordinary ambulance, fire, and police emergency vehicles are able use the streets. Freight will be transported by metro, push carts and battery-powered forklifts and other slow, small vehicles.	Carfree city	Theoretical	A city free from the noise, stench, and danger of cars, trucks, and buses. All basic needs within a five-minute walk of every doorstep. Commute takes no more than 35 minutes from door to door, provided by a fast, cheap, safe, comfortable public transport system.	Full of proposals, ideas, designs and examples. Less attention for clear strategies or policy measures.	Theoretical book. Expected effectivity is high, effectiveness in practice is unknown.	Theoretical book. Crawford expects it to be feasible, substantiated with designs, ideas, proposals and examples. However, practical feasibility is unknown.	Not really mentioned.

Crawford (2009)	Carfree design manual	Showing how to design carfree districts that are places to build a satisfying and sustainable life.	Sequel on Carfree Cities, same definition/ idea: No use of cars. However, ordinary ambulance, fire, and police emergency vehicles are able use the streets. Freight will be transported by metro, push carts and battery-powered forklifts and other slow, small vehicles.	Carfree city	Theoretical, attempt for a design manual for practical implementation	Sequel on Carfree Cities, same definition/ idea: A city free from the noise, stench, and danger of cars, trucks, and buses	Strong focus on the design of carfree cities, continues on urban planning principles from his book Carfree cities, but less attention for the ways (strategies/ policies) to achieve such carfree cities.	Sequel on Carfree Cities: Theoretical book. Expected effectivity is high, practical effectiveness is unknown.	Sequel on Carfree Cities: Theoretical book. Crawford expects it to be feasible, practical feasibility is unknown	Not really mentioned
Foletta & Henderson (2016)	Low car(bon) communities: Inspiring car-free and car-lite urban futures	This book poses to be an invaluable benchmark for gauging the success of sustainable urban futures.	"Car-free developments are blocks, neighborhoods or districts in which automobile traffic is heavily restricted. Restrictions may be full- or part-time and often include exceptions for delivery vehicles or persons with disabilities. The developments typically provide high-quality pedestrian and bicycle facilities to encourage walking and biking. Furthermore, to discourage residents from owning cars, housing developments often provide measures such as priced or rationed parking"	Carfree city and areas.	Application, uses 7 case studies.	Author mentions the reduction in carbon and other greenhouse gas (GHG) emissions by limiting and discouraging car use and car ownership as main drive. However, the case studies mentions some other desired results as well (like a safe environment for pedestrian or a sense of community)	A number of process identified: Car-free declaration; residents association; citizen advisory committee; mobility management; educational programs	"As we have shown in each of the case studies, the policy and design measures to reduce automobile dependency are generally working. Car ownership rates, mode share, car usage and transport-related emissions are lower in the case study developments than in comparable reference sites." "These communities show that it is possible to create car-free and car-lite communities where people want to live." Several modal split changes in the case studies are mentioned, realizing a shift from car to other modes.	Not elaborately discussed, but can be deducted from the fact that this are existing cases. Some conclusions are drawn; The process is important, success factors include "participatory planning"; "educate and inspire".	We not only need to make more low car(bon) communities, but we need to make sure they are inclusive. We are figuring out how the environmental sustainability component of cities works, but there is work to be done on the socioeconomic dimension of sustainability.

Gundlach et al. (2018)	Investigating people's preferences for car-free city centers: A discrete choice experiment	This paper aims to measure the potential of car-free city centers quantitatively	Mentions definitions of other papers, i.e. Melia (2014, p. 213) who sees car-free areas as “residential or mixed use developments which provide a traffic free or nearly traffic free immediate environment (1), designed to facilitate movement by non-car means (2), and offer no parking for residents or limited parking separated from the dwellings (3)”.	Carfree areas	Combination: discrete choice experiment to investigate preferences for car-free city centers Human	Not mentioned	Not specifically mentioned, however, could be deducted from experiment: Improve road network for cyclists; Walking distance to closest public transport stops; Frequency of public transport; Park and ride facilities at public transport stops bordering the car-free city center; Additional recreation areas; Price for public transport.	No specific effectiveness mentioned, but: Our results indicate general acceptance of car-free city centers. Keeping the current infrastructural services constant, approximately 60% of our respondents would choose a car-free city center. This probability increases to above 90% once the bicycle Infrastructure is improved and public transportation fees are reduced.	No specific feasibilities mentioned, however: “Our results indicate a general acceptance of car-free city centers.”	Further research on people’s preferences should be encouraged and supported by policy makers. Ideally, research should be multidisciplinary and linked to actual or potentially planned policy option.
Kushner (2005)	Car-Free Housing Developments: Towards Sustainable Smart Growth and Urban Regeneration Through Car-Free Zoning, Car-Free Redevelopment, Pedestrian Improvement Districts, and New Urbanism	Three characteristics of these projects (= European car-free and car-reduced housing projects) merit further study and support their replication as models for urban housing development.	The concept of car-free housing involves the marketing of housing to a population that desires to live without an automobile and in a community whose residents share that ecological goal. Residents of these communities often share broader ecological values, and typically the design of these projects includes various physical planning elements, architectural design, and building materials and components that reduce water, heating, and	Carfree areas	Combination, use of case studies in order to create a theory.	The projects present an improved quality of life due to superior open and green spaces. In addition, the projects integrate the best elements of "green architecture," seeking to use less electricity and water through the use of building materials, insulation, and special elements such as green roofs, solar	Some kind of policies mentioned: Car-sharing services; Car-free zoning; new urbanism; tax-increment-based redevelopment; pedestrian improvement districts	Not really mentioned, author claims: In both developed and developing communities, car-free living can be extended as a residential choice through a number of urban revitalization mechanisms, such as car-free zoning, new urbanism, car-free redevelopment, and pedestrian improvement districts.	Not really mentioned, although the experience of these European car-free projects show that it has been feasible.	None mentioned.

			electrical consumption.			generation of power, and the reuse of surface water.				
Loo (2017)	Realising car-free developments within compact cities	Analyzing the experience of Discovery Bay, Hong Kong, to demonstrate that car-free development can and has happened in compact cosmopolitan cities like Hong Kong since the 1980s.	Car-free development (…) typically refers to the banning or severe restriction of the use of private cars within specified boundaries. Refers to Nieuwenhuijsen and Khreis (2016)	Carfree areas	Application	Reduce environmental harm; reduce or elimination of motor vehicle crashes; freeing up of more spaces in the city	Some mentioned, e.g. "Develop positive measures to fulfil people's various needs without private cars and reinforcing the pleasantness of the car-free environment to live and to raise a family, rather than focusing mainly on the control measures such as restrictions on parking, high parking charges, control of density and the banning of private cars."	"This paper demonstrates and shows that car-free development in a high-density city has actually existed in Hong Kong for more than 35 years in Discovery Bay. (…) The car-free population living there have risen from zero to more than 12.000 in 2014 "	Not specifically mentioned, but can be deducted from the conclusion that this car-free development has actually existed.	None mentioned.
McKenzie (1999)	Car-Free Cities - Myth or Possibility? Exploring the boundaries of sustainable urban transport	Exploring the types of initiatives that are being considered under the 'car-free city' movement	No clear definition, but a distinction between a radical and conservative interpretation of the Car-Free City.	Carfree cities, centres & areas	Application, case-studies	Several: e.g. improve economic opportunities in the inner historic or commercial core; improving environmental quality for both inhabitants and users of the inner city; expand shopping or tourism opportunities.	Some high-level strategies, like: "Develop clear long-term economic development objectives " and "Creating New Structures for Radical Sustainable Development and Ecological Modernisation"	Not specifically mentioned.	Not specifically mentioned.	None mentioned.
Melia (2010)	Carfree, Low-Car - What's the Difference?	This paper aims to propose a definition and typology of carfree development and to assess the benefits and problems associated with it. It aims to contrast these with the	Author comes up with overview of definitions, concludes with the following definitions:	Carfree cities, centres & areas	Theoretical	Numerous. Among others: Better air quality; less noise; more green space; more viable local	Only high level, i.e. exclusion of vehicles and reduction in car ownership	Not really mentioned	Not really mentioned, although authors expect that there are places where carfree developments are feasible (The evidence reviewed in this article suggests that where	- More research is needed to establish the specific factors which enable people to choose carfree living in different locations. - The effects of traffic and traffic-removal on property values are not generally considered,

		concept and practice of 'low car' development.	Carfree Development: Carfree developments are residential or mixed use developments which: 1) Normally provide a traffic free immediate environment, and: 2) Offer no parking or limited parking separated from the residence, and: 3) Are designed to enable residents to live without owning a car. Low Car Development: Low car developments are residential or mixed use developments which: 1) Offer limited parking, and: 2) Are designed to reduce car use by residents.			services; increased fitness and reductions in associated disease; improved mental health; reduced congestion; retention of more green land			feasible, carfree developments offer significant benefits to policymakers – a wider range of benefits than low car developments)	as there is little evidence on this from within the UK
Melia, S., Barton, H., & Parkhurst (2013)	Potential for carfree development in the UK	Assess the potential consumer demand for housing in carfree developments in the UK and the circumstances under which it might be feasible	Refers to Melia et al. (2010): Carfree development can be defined as residential or mixed-use developments which: (a) provide a traffic-free or nearly traffic-free immediate environment (b) are designed to facilitate movement by non-car means (c) offer no parking for residents or limited parking separated from the dwellings.	Carfree areas	Theoretical	Not mentioned	Some minor mentioned, like: "Successful carfree developments would need to be built at relatively high densities".	Not specifically mentioned, however, conclusions include: Where feasible, carfree developments can reduce traffic generation and the concentration of traffic in dense urban areas. They promote modal shift, active travel and greater independence among children.	Not specifically mentioned, however, conclusions include: - Potential demand does exist, concentrated mainly in the inner areas of larger cities.- There were no other reasons why the different types of carfree development found across Europe could not be implemented in the UK, although further research would be needed to establish other aspects of feasibility, such as effects on property prices and more	"Further research would be needed to establish other aspects of feasibility, such as effects on property prices and more specific locational opportunities and constraints." "More research into the supply-side issues could help to address the apparent reluctance of the house building industry to satisfy this niche market."

									specific locational opportunities and constraints. - The availability of sites large enough to provide a traffic-free environment would be a constraint within the inner cities	
Melia (2014)	Carfree and low car development	Defining and describing the different types of carfree and low-car development found in the United Kingdom and continental Europe, analysing the benefits and problems they bring and their implications for parking policy.	Author comes up with overview of definitions, but one the main definitions he uses is the one from Melia et al. (2010), which define carfree development as residential or mixed-use developments which: - Provide a traffic free or nearly traffic free immediate environment, - Are designed to facilitate movement by non-car means, and: - Offer no parking for residents or limited parking separated from the dwellings.	Carfree centres & areas	Theoretical/ practical	Several mentioned, e.g. redevelop in areas where road capacity was limited; reduce environmental problems	Mainly challenges instead of strategies, but comes up with three main forms: Less land for roads and parking; Less car use; more walking and cycling.	Not really mentioned.	Not really mentioned, but: the advantages of carfree (or to a lesser extent low car) development are greatest in densely populated urban areas with limited road space.	None mentioned
Minh (2016)	Application of "car-free city" and "city of short walks" to living quarters in Hanoi towards sustainable mobility and logistics	The paper aims to develop a new traffic-and-service planning concept to help protect the living environment and enhance the quality of life for the city dwellers.	“Car-free city” does not mean living completely without cars or stopping using cars (…) people can still drive in the city but will not park at home or near home. Instead, they park somewhere else on the way home which they find easy to reach and convenient to use”	Car-free city	Practical	Help protect the living environment and enhance the quality of life for the city dwellers	Some broad lessons are mentioned: - The living quarter should not be very large - An effective system of public transport means for external traffic should be established - An optimal network of internal traffic for pedestrians and bicyclists should be based on zoning - Social facilities, amenities and everyday life services are planned along the main axes	Unknown	Some feasibility issues mentioned: The biggest difficulties while developing car-free city and city-of-short-distance concepts in Hanoi can be seen (…) in social aspects, such as the level of management of the authority, the awareness and coation of the public together with the cooperation between people and their representatives for specific purposes and towards common	None mentioned

									future goals, etc., rather than in planning and design or in technical solutions.	
Nederveen, Sarkar, Molenkamp, Van De Heijden, & Van (1999)	Importance of Public Involvement A Look at Car-Free City Policy in The Netherlands	Representatives of some of the residential neighborhoods were interviewed, and parking-related problems and issues that these residential neighborhoods face are summarized. Solutions are offered to mitigate the problems faced by the cities.	No clear definition, but guidelines Groningen include:1) Banned parking from central market square 2) Access priority was given to public transport in the downtown area. 3) Through-traffic in the city center was discouraged, and all downtown through-routes were blocked. 4) Ingenious traffic circulation with one-way streets made it difficult to drive to the downtown market square, but it was relatively easy to get out. 5) Parking garages were built within walking distance from the shopping center.	Carfree areas	Theoretical/ application	The primary goal of this initiative is to improve quality of life	More recommendations than strategies E.g. Decisions to expand car-free areas should involve not only the residents in those areas but also others who will be affected by such policies; the paid-permit-parking policy should be developed and implemented with active participation and support from the residents	The policy was a great success, and the quality of life within the city center improved significantly.	Not clearly mentioned, authors deem car-reducing measures as feasible	None mentioned
Nieuwenhuijsen, Bastiaansen, Sersli, Waygood, & Khreis	Implementing car-free cities: Rationale, requirements, barriers and facilitators	We aimed to describe rationale, prerequisites, barriers and potential strategies for creating car free cities.	Here we consider a car-free city as a city without private cars but one that may still have buses, lorries, taxis, emergency vehicles, motor bikes or even shared cars as necessary to move goods and people. The characteristics we envisage are that the largest mode share is taken by public and active transport and that	Carfree cities and areas	Theoretical	Several mentioned, e.g. increase green space and green networks in cities, which can lead to beneficial health effects.	Some strategies are described, but in a limited and concise way (e.g. slow incremental changes to restrict traffic in certain areas/roads; big bang approach; road user charging; regulatory restrictions; land use to support public transport; parking charges	Refers to Khreis et al. (2017): An overview on these measures, performance and their likely impacts on public health can be found in. Mainly focussed on health.	No clear evaluation, but several barriers, prerequisties are mentioned. E.g. political vision and leadership; Mobility to accessibility paradigm shift; Dedicated funding; Stakeholders involvements and support	There are yet many uncertainties in terms of acceptability and behaviour change when introducing the car-free city and also the likely changes in terms of air pollution, noise, temperature, social cohesion and physical activity. This will entail evaluations of health impacts of (planned) interventions in cities, including changes in perceptions and attitudes and health impact modelling of future scenarios. Further research and research

(2018)			these are also the modes at the top of the hierarchy for transport planning and engineering. Furthermore, the motor vehicles remaining on the roads should be as sustainable and healthy as possible—e.g. by being electric, having speed restrictions as well as other restrictions in terms of time and areas of the city they can be.							synthesis are needed to build a good evidence base, which is currently nonexistent. It is also vital to better understand how mobility patterns change with the introduction of car-free measures.
Nieuwenhuijsen & Khreis (2016)	Car free cities: Pathway to healthy urban living	"We aimed to describe the plans for private car free cities and its likely effects on public health."	No clear definition	Carfree areas	Theoretical	Several mentioned: e.g. more green space, reduction in air pollution/ noise/ temperature; reduced premature mortality	Some trivial strategies, like: "Citizen and business participation is essential"	The effectiveness of these policies (Ensuring public transport availability, cycling infra-structure etc) for encouraging modal alternatives and shifting away from car use varies. There is however (scarce) evidence on the effectiveness of relevant interventions as several reviews aimed to describe the impact of bicycle infrastructure on bicycle use for example. Also refers to Topp and Pharoah (1994), who reported on the effectiveness of car free zones in bringing about a mode shift, which could be seen as effective.	No clear finding on feasibility, in general: Perhaps the same (.. as banning of smoking in public places) may apply to banning cars from the city, which although may seem as a radical solution, could be also embraced and have significant benefits on the public's health.	Further research and research synthesis are needed to build a good evidence base. It is also vital to better understand how mobility patterns change with the introduction of car free measures, evaluations of health impacts of (planned) interventions in cities, assessing people's perceptions, attitudes and acceptability and HIA modeling of future scenarios.

Nobis (2003)	The impact of car-free housing districts on mobility behaviour - Case study	This paper reports on the traffic concept implemented in the district as well as the positive effects for the district that could be reached by reducing the number of cars.	No clear definition	Carfree area	Application	Counter congestion, traffic noise, pollution and space constraints for motorised individual traffic.	Town planning measures, like case study used (Vauban), which is a new developed area, with a low-car design.	The investigation demonstrates that low-car projects are an effective way to reduce the number of vehicle trips, and to promote or to stabilise klong-term mobility behaviour based on sustainable modes of transport.	Not clearly described, but Vauban case showed to be feasible.	None mentioned.
Ornetzeder et al. (2008)	The environmental effect of car-free housing: A case in Vienna	Evaluate whether people living in a car-free model housing project have more 'sustainable lifestyles' than people living in comparable buildings in Vienna. Another aim was to identify the lifestyle characteristics and household activities which significantly influence the environmental impact of the residents of the car-free housing project and a control group.	Author defines car-free as: "the tenants are contractually bound to not own a car and instead have the option to participate in a car-sharing scheme."	Carfree area	Application	Car-free housing projects are seen as a way of getting away from frequent car use and developing more liveable, pedestrian cities with more public recreational space	Not mentioned, car-free housing can be seen as strategy.	Households from the car-free settlement have substantially lower environmental impacts in the categories of ground transportation and energy use; their CO2 emissions of these two categories are less than 50% of those living in the reference settlement. The households in the car-free settlement have somewhat higher emissions in the categories air transport, nutrition, and 'other' consumption, reflecting the higher income per-capita.	Not mentioned	None mentioned
Orski (1972)	Car.free zones and traffic restraints: tools of environmental management	This paper relates the effect of vehicle-free zones on air pollution levels.	No clear definition, often refers to the exclusion of (motor) vehicles.	Carfree areas	Theoretical/ practical	Countering the declining quality of the urban environment.	- (Area-wide) traffic bans - partial traffic restraints	The recently introduced ban on cars in the inner city of Vienna has lowered carbon monoxide levels by 54% and lead levels by 67%. In Tokyo auto exclusion produced equally impressive results.	Available experiences show that traffic bans are operationally feasible and commercially successful.	None mentioned

Ortego-Sanchez, Popan, & Tyler (2017)	Car-free Initiatives from around the World: Concepts for Moving to Future Sustainable Mobility	Analysing more than 200 'car-free' city initiatives, from 95 different cities around the world, aimed at refocusing car-based transport and urban planning towards sustainable transport and as a strategy to create more liveable places	Refers to Melia et al (2010) and Melia (2014) which define car-free areas as residential or mixed-use developments which: i) Provide a traffic free or nearly traffic free immediate environment, ii) Are designed to facilitate movement by non-car means, and iii) Offer no parking for residents or limited parking separated from the dwellings (limited peripheral parking)	Carfree cities, centres & areas	Practical, case study	Five main rationales are identified: i) making car costlier or less convenient; ii) making other transport modes more attractive and convenient; iii) revive social functions of streets; iv) comprehensive sustainable housing developments and residential areas improvement; v) reduce air pollution	Several mentioned, e.g. - Charges for entering car-free or car-reduced areas and driving restrictions; - Parking regulations; - Improvement of bicycle infrastructure and service; Technology and sharing schemes	Is being discussed to a certain degree per policy, but does not include clear overall results of effectiveness.	No clear evaluation of feasibilities.	As technology adoption is often coming as a direct result of regulation, what is there to be done to guarantee that regulations focus on asking the difficult questions and pushing the public sector, which is responsible for the oversight of the wellbeing of society and the planet?
Patel, Gandhi, & Bhatt (2016)	A Detailed Study on Car-Free City and Conversion of Existing Cities and Suburbs to the Car-Free Model	This document discusses alternative means to resolve those problems regarding replacement of cars by introducing the rapid economic, public transport.	Car-free city: a city where a ban on motorised vehicles from all parts of the towns is in practice with only a few possible exceptions such as emergency vehicles.	Carfree cities and areas	Theoretical	Decrease petroleum dependency, automobile crashes, noise pollution, air pollution, GHG emissions, and traffic congestion to a considerable extent.	Mentions six considerations: 1) Gradual Implementation; 2) Incentives to Reduce Car Traffic; 3) Better Public Transport; 4) Faster service; 5) Better Biking/ Bicycling; 6) Increase Density and Reduce Street Width	Not discussed or not extensively substantiated (like: Car-free cities will also improve the health of people with fresh air and exercise from a daily walk)	Not discussed	Specific design principles need to be derived from local circumstances to convert an existing urban area into a car-free region. While planning such a region, planners will need to overcome the common objections.

Rydningen, Høynes, & Kolltveit (2017)	OSLO 2019: A car-free city centre	Through comparison with other cities that are partially car-free, we have described some consequences that must be taken into account when implementing the green policy	Several case are described, conclusion of the authors is: “From the cities visited, we have observed that a car-free centre is not completely car-free. There will always be exceptions for certain user groups and stakeholders. The same must be true in Oslo, this is also evident from the Oslo city council’s declaration providing exceptions for certain user groups and stakeholders.”	Carfree city centres	Application	A more vibrant city life, cleaner air, more bike paths and better public transport.	Some high level recommendations (e.g. pay attention to the most affected stakeholders)	Not extensively discussed. .	Authors conclude that a carfree Oslo may be feasible, but there will always be exceptions for certain groups, and a good planning process as well as paying attention to the most affected stakeholders is needed.	None mentioned
Scheurer (2001)	Urban ecology, innovations in housing policy and the future of cities: Towards sustainability in neighbourhood communities	This dissertation highlights the interplay of metropolitan and neighbourhood physical form and technology with community-oriented planning, design and governance as well as individual efforts to contribute to sustainability goals.	Does not come up with a clear definition, but mainly speaking about Carfree Housing: “Carfree or carreduced neighbourhoods, will enforce physical and/or administrative limits to parking provision.” And “Hence, carfree housing generally stops short of eliminating all car use in their residents' lives: it is common practice to include a limited number of parking spaces for shared vehicles, supplied by a commercial or in-house car sharing organisation.”	Carfree areas	Theoretical and application	Citizen oriented; Citizens want to practice a 'sustainable and pleasurable model for future urban living'	Mainly policies for carfree housing; e.g. extensive consultation and participation of the later residents; tie residents tied to non-car ownership by their lease or purchase contract; a regime of resident-only parking permits throughout the district to excludes residents; reduce number of on-site parking bays	Dissertation does not have a strong focus on effectiveness, but mentions “It is unrealistic to expect 100% compliance with the carfree objectives in a given development.”; “(..) residents, under certain circumstances, appear to be ready to forego the freedom of car ownership in return for other benefits (…).”	Author has a focus on Resident Participation when it is about feasibilities, and concludes: “To achieve urban ecology innovations in urban neighbourhoods, it is necessary to depart from deterministic, hierarchically controlled planning practices and embrace more democratic and open-ended processes designed to attract and invigorate, rather than regulate or repel, input of stakeholders and users.” and “The ongoing involvement of users in their inception, operationalisation and practical evolution on the ground is crucial to ensure their continuous success”	Recommendations for further research are numerous, to mention some: - Instead of a evaluation at one specific point in time, a continuous evaluation - provide a comprehensive and objective view of success and failure in neighbourhood-based mobility management programmes - assist policy makers in the conception of such schemes and their continuous improvement. - Future dissemination of mobility-conscious neighbourhood design into practical and workable policies

Tight, MR, Rajé, Timms, & PM (2016)	Car-free urban areas – a radical solution to the last mile problem or a step too far?	This paper suggests an alternative and, arguably, more comprehensive definition of the last mile as a personal travel concept. This characterization of the last mile is used as a catalyst for discussion of a radical urban car free vision to explore how such urban areas might operate in practice	No clear definition. Possible vision described by authors: Car use in urban areas has been largely curtailed through personal choice, the positive appeal of significantly enhanced alternative modes of travel and through supportive government actions. Most people do not own or use a car (..).	Carfree areas	Theoretical	A rebalanced, less congested, urban public space in a more sustainable future which promotes equity and well-being.	Numerous policies are mentioned, e.g. provision of bike parking, discounts for cyclists in local shops and establishment of an office to promote cycling; integrated policies favouring pedestrians, cyclists and public transport; reducing the on street parking and returning the public space to pedestrians; the establishment of a pedestrian network; etc	Paper shows that the modal split in cities with measures to reduce car use have led to a modal split change. "One of the most successful cities in achieving a comprehensive mode shift towards less carbon-dependent travel overall is Münster in Germany." By a reduction of car use from 40,5% in 2011 to 29% in 2013.	Not discussed	It is unclear how far it is possible to go to car-free urban areas and whether such change might happen on a more widespread basis.
Topp & Pharoah (1994)	Car-free city centres	Analyzing the lock-out of unnecessary car traffic, not being an isolated measure, but part of a pull- and-push approach.	Defines the term car-free city centre as: "a city centre, where motor traffic is limited by an area-wide ban to that which is considered to be functionally necessary."	Carfree city centre	Practical, case studies	Increase the attractiveness and economic vitality of their city centres by reducing the presence of parked and moving vehicles, and encouraging access by "urban compatible" means of travel.	Proposed strategy: Instead of introduction as an isolated measure, let intervention be part of a pull- and-push approach	Several conclusions: - For traffic reduction in the whole city, car bans are not sufficient - Different case studies used: Bologna has shown that success is possible: the total number of vehicles entering and leaving the old town was reduced by about 50% . Same goes for Lubeck: After installing the car ban, 40% to 80% less cars (depending on the time of day) were counted on the access points to the city centre. Out of those who formerly drove by car into the city centre, 12% switched to public transport, cycling and walking. Aachen: Decrease from 44 to 36% in	Not broadly discussed, cases show that is was feasible, however, "the lock-out of unnecessary traffic must not be an isolated measure, but one important one within the push-and-pull-association of many conceptually integrated measures.	Researching the effects of limiting car traffic volumes not only in the city centre, but eventually within the entire city and the region.

								car use for travel to the centre. - Experience with car-free (or, strictly, car-limited) city centres so far shows positive effects in terms of improving the quality of public spaces.		
Tsubohara (2007)	The social and political background to car-free Noorderplantsoen - Traffic planning in Groningen in the 1980's (3)	This paper will analyse the planning process of traffic plans for the northern neighbourhoods and Groningen-north, and the succeeding process that led to closing Noorderplantsoen to cars, in terms of the social and political background, particularly paying attention to the party framework of the PvdA. Through this work, this paper will try to understand the decisive factor in closing the park.	No clear definition	Carfree area	Application	Solve issues related to traffic planning. The idea of excluding cars from this park, originated from residents of Noorderplantsoenbuurt, during the neighbourhood restoration project early in the 1970s.	No clear strategies discussed	Not discussed	Feasibility is debatable; "the only measure that survived through this process was the closure of Noorderplantsoen to cars". The process itself was complex, resulted in a number of conflicts and took over 10 years.	None mentioned
Wright (2005)	Sustainable Transport: A Sourcebook for Policy-makers in Developing Cities, Module 3e: Car-Free Development.	This Sourcebook on Sustainable Urban Transport addresses the key areas of a sustainable transport policy framework for a developing city and provides policy tools appropriate for application in a range of developing cities.	Car-free city: Motorised vehicles are banned from all parts of the cities, with only a few possible exceptions such as emergency vehicles.	Carfree cities, centres & areas	Theoretical	Several motivations mentioned, e.g. the need to retain historical character; create a attractive environment; returning a community to its residents; environmental objectives; as mechanism towards	Does not come up with clear policies, but does describe aspects to take in mind when developing carfree ideas. Steps include: Project leadership; Institutional and legal issues; Stakeholders; Participatory processes; Financing a car-free project; Implementation issues	Mentions several effective projects, comes up with an evaluation framework (Affordability; Attractiveness; Comfort; Connectivity; Convenience; Legibility; Safety and security; Sociability) and states that carfree developments contribute in the following objectives: Congestion reduction; Road & parking savings;	No clear evaluation of feasibilities, but report mentions that "a car-free district or even a car-free city is more feasible than this initial reaction (..normal life would be unthinkable without motorised access) implies. Report mention also some successful introduced initiatives.	No clear recommendations for further research

		greater social equality	Consumer savings; Transport choice Road safety; Environmental protection; Efficient land use; Community Livability

C

Overview Potential policies

C.1. Overview Potential policies from literature

As described in the methodology section (see 2.3), first step is to analyse potential policies to get to carfree or low-car cities. The findings of the analysis into literature can be found in table C.1. The several policies are grouped. In several cases the same policies can be found in several sources (e.g. congestion toll), in that case the several sources with their characteristics are mentioned as well.

All the policies have been analysed with use of six criteria (next to mentioning the name and source of the policy). The criteria include:

- **Implementation effort** *(L/ M/ H)* What is the impact or effort of the implementation of the measure? It is complex, time-consuming and costly to implement, or is just a small intervention? (Low, Medium, High)
- **Honey/ Vinegar** *(H /V)* Can the policy be seen as a honey- or a vinegar measure, in other words: Is the policy positive incentive/ rewarding or negative incentive/ sanction -based)
- **Effectiveness evaluated?** *(- / + / ++)* Does the source have a clear evaluation of the effectiveness of the policy?
- **(Perceived) effective?** *(Yes /No/ NA)* Asses, value or see the authors the policy as effective or not?
- **Feasibility evaluated?** *(- / + / ++)* Does the source have a clear evaluation of the feasibility of the policy?
- **(Perceived) feasible?** *(Yes/ No/ NA)* Asses, value or see the authors the policy as feasible or not?
- **Implemented?** *(Yes/ No/ NA)* Does the author mention that this policy is already implemented?
- **City(ies)?** *(City/ NA)* If the policy is already implemented somewhere, does the author mention cities in which this policy has been implemented?

Note that effectiveness and feasibility are fluid concepts, their meaning depends on the context (also see the methodology section, 2.3). We did not evaluate these sources on one clear definition, but evaluated whether these papers did have a clear description and analysis of and evaluation of these two concepts, and whether the author reported positively or negatively about the (perceived) effectiveness and feasibility. When the author did not provide information on one of the criteria, or that information was multi interpretative, a n/a was inserted.

It is important to emphasise that this overview is not meant to be a complete overview of all potential relevant policies available, but is just meant to give insight in the numerous policies that have been implemented or are planned to be implemented.

	Implem. effort?	H/V	Eff. eval.?	Perc. Eff.?	Feas. eval.?	Perc. feas.?	Impl.?	City(ies)?	Source
Restrictions on car movement									
Driving restrictions	L	V	+	N	-	n/a	Y	Wuhan, etc.	Chen, 2020
			+	N	-	n/a	Y	Mexico City	Gallego, 2013
			+	n/a	-	n/a	Y	Lanzhou	Zhang, 2019
Forbidden car access to city centre	M	V	+	Y	-	n/a	Y	Bologna, etc.	Bonnel, 1995
			+	Y	+	Y	Y	Brighton	Melia, 2016
			-	n/a	+	n/a	n/a		Rydningen, 2017
			+	Y	+	Y	Y	Bologna, etc.	Topp, 1994
Introduction Low Emission Zone (LEZ)	M	V	-	Y	-	n/a	Y	Bristol	Barnes, 2015
Introduction traffic calming zones	L	V	-	Y	-	Y	Y	Delft, etc.	Bieda, 2016
Restrain use of cars by design of network	M	V	+	Y	-	n/a	Y	Bern, Zurich	Bonnel, 1995
High occupancy vehicle lanes	M	H	-	n/a	-	n/a	n/a		Krheis, 2017
Car-free zones and traffic restraints	L	V	+	Y	-	n/a	Y	Vienna	Orski, 1972
Reduce space allocated to cars	M	V	-	n/a	-	n/a	n/a		Ortegon-Sanchez, 2017
Restrictions on car production	M	V	-	n/a	-	n/a	n/a		Ortegon-Sanchez, 2017
Partial pedestrianisation of streets	L	V	+	n/a	+	n/a	Y	Brighton	Shergold, 2018
Car restrictions in city centre	M	V	-	n/a	+	Y	Y	Cracow	Szarata, 2017
Car-free urban areas	L	V	+	Y	-	n/a	Y	Seville, etc.	Tight, 2016
			-	n/a	+	n/a	Y	Groningen	Tsubohara, 2007
Restrictions on parking cars									
Parking restrictions	L	V	+	Y	-	n/a	Y	Auckland, etc.	O'Fallon, 2004
Residents parking programme	M	V	-	n/a	-	n/a	Y	Bristol	Barnes, 2015
Reduce parking supply	M	V	+	Y	-	n/a	n/a		Guo, 2013
Price measures									
Congestion/ urban tolls	H	V	+	Y	-	n/a	Y	Oslo	Bonnel, 1995
			-	n/a	-	n/a	Y	Palermo	Catalan, 2008
			+	Y	-	n/a	Y	Vancouver	Washbrook, 2006
			+	n/a	-	n/a	Y	Stockholm	Daunfeldt, 2009
			+	Y	+	n/a	Y	Stockholm	Eliasson, 2009
			+	Y	+	Y	Y	Stockholm	Eliasson, Hultkrantz 2009
			+	Y	+	Y	Y	London	Leape, 2006
			+	Y	-	n/a	n/a		Ramos, 2017

Table C.1 continued from previous page

	Impact	H/V	Eff.. eval.?	Perc. Eff.?	Feas. eval.?	Perc. feas.?	Impl.?	City(ies)?	Source
			+	Y	+	n/a	Y	London, etc.	Santos, 2005
			+	Y	-	n/a	Y	London	Santos, 2004
			-	n/a	+	N	Y	n/a	Schade, 2003
Parking fees	M	V	+	Y	-	n/a	Y	Nanjing	Boa, 2010
			-	n/a	-	n/a	Y	Palermo	Catalano, 2008
			+	Y	-	n/a	Y	Bogota	Guzman, 2020
			+	Y	-	n/a	Y	n/a	Simićević, 2013
Replacing parking charges by road user charges	H	V	+	n/a	+	n/a	N		Bonsall, 2010
Employer bonus for carpooling or taking PT	M	H	+	Y	-	n/a	Y	n/a	Baldassare, 1998
Economic compensation for not using car	M	H	-	n/a	-	n/a	n/a		Ortegon-Sanchez, 2017
Discourage car use/ ownership									
Carsharing iniatives	M	H	-	n/a	-	Y	Y	Bristol	Barnes, 2015
			++	Y	-	n/a	Y	n/a	Nijland, 2017
Free-floating carsharing	M	H	+	Y	-	n/a	Y	Berlin, etc.	Giesel, 2016
			-	n/a	-	n/a	Y	Madrid	Ampudia-Renuncio, 2018
			-	n/a	-	n/a	Y	Ulm	Firnkorn, 2015
Carpooling and carsharing	M	H	+	Y	-	n/a	Y	Dublin	Caroll, 2017
Encourage shift from private car use to active or public transport modes	L	H	+	N	-	n/a	Y	n/a	Okokon, 2017
			+	Y	-	n/a	Y	Barcelona	Rojas-Rueda, 2012
			+	Y	-	n/a	Y	n/a	Woods, 2017
Automated vehicles	H	-	+	N	-	n/a	N	n/a	Ostermeijer, 2019
Making PT more attractive									
Promotion of Public Transport by lower price	M	H	+	n/a	-	n/a	Y	Bern, Zurich	Bonnel, 1995
			-	n/a	-	n/a	Y	Frankfurt	Carroll, 2017
Improve design of PT transit (increase transit travel speed, frequency and reliabilty)	H	H	+	Y	-	n/a	n/a		Chakrabarti, 2017
			+	Y	-	n/a	n/a		Eriksson, 2010

Table C.1 continued from previous page

	Impact	H/V	Eff.. eval.?	Perc. Eff.?	Feas. eval.?	Perc. feas.?	Impl.?	City(ies)?	Source
Deregulation of Public Transport	H	H	+	N	-	n/a	Y	Cardiff, etc	Bonnel, 1995
Public transport reform	H	H	+	N	+	n/a	Y	Santiago	Gallego, 2013
Free park-and-ride with a free shuttle service	M	H	+	Y	-	n/a	Y	Tel Aviv	Katoshevski-Cavari, 2018
Developers Contribution: Payment (or levy) to support certain infrastructure	M	H	-	n/a	-	n/a	n/a		Krheis, 2017
Urban traffic control; Reduction of idling, stop start driving, prioritize PT	M	H	-	n/a	-	n/a	n/a		Krheis, 2017
Facilitate intermodality individual modes and public transport	M	H	-	n/a	-	n/a	n/a		Ortegon-Sanchez, 2017
Introduction of Bus Rapid Transit (BRT)	H	H	+	Y	-	n/a	Y	Khon Kaen	Satiennam, 2016
Making walking and cycling more attractive									
Bicycle sharing systems	M	H	+	Y	-	n/a	Y	Sao Paulo	Benedini, 2019
			+	Y	-	n/a	Y	Lyon, etc.	Fishman, 2014
Increase cycle lane continuity	M	H	+	N	-	n/a	Y	Auckland, etc.	O'Fallon, 2004
Urban design focused on bicycles	H	H	++	Y	+	Y	n/a	Houten	Foletta, 2016
Segregated cycle facilities	M	H	-	n/a	-	n/a	n/a		Krheis, 2017
Provision of signage and better quality footpaths	L	H	-	n/a	-	n/a	Y	Adelaide, etc.	Carroll, 2017
Improve pedestrian crossings	L	H	-	Y	-	n/a	n/a		Krheis, 2017
Increase of space allocated to pedestrians	M	H	-	n/a	-	n/a	n/a		Ortegon-Sanchez, 2017
Introduction of official bicycles (for civil servants)	L	H	-	n/a	+	Y	Y	Nanjing	Shi, 2019
Information campaigns to promote sustain/able travel									
Awareness Campaign about public health / air quality / etc	L	H	-	n/a	-	n/a	Y	Bristol	Barnes, 2015;
Company travel plans	L	-	-	n/a	-	n/a	n/a		Khreis, 2017
School travel plans	L	-	-	n/a	-	n/a	n/a		Khreis, 2017

Table C.1 continued from previous page

	Impact	H/V	Eff.. eval.?	Perc. Eff.?	Feas. eval.?	Perc. feas.?	Impl.?	City(ies)?	Source
Socialization/ information to promote sustainable travel	L	H	-	n/a	-	n/a	n/a		Ortegon-Sanchez, 2017
Sustainable housing									
Carfree Neigbourhoods	H	-	-	Y	-	Y	Y	Vauban	Bieda, 2016
			-	Y	-	Y	Y	Amsterdam	Coates, 2013
			++	Y	+	Y	Y	Stockholm	Foletta, 2016
			+	Y	-	n/a	Y	Vauban	Nbis, 2003
			+	Y	-	n/a	Y	Vienna	Ornetzeder, 2008
			+	Y	+	Y	Y	A'dam, etc.	Scheurer, 2001
Low-car design of cities									
Low-car/ Carfree City Planning	M	V	-	n/a	-	n/a	Y	Bristol	Barnes, 2015
Off street parking, freeing up space	M	V	-	n/a	-	n/a	n/a		Khreis, 2017
Design city as car-free	H	V	-	Y	-	Y	Y	Masdar (VAE)	Alameri, 2011
Dense, walkable, public transport, cycle and people oriented developments	M	V	-	n/a	-	n/a	n/a		Ortegon-Sanchez, 2017
Increase density and reduce street width	M	V	-	n/a	-	n/a	n/a		Patel, 2016
Land use policies to achieve high density housing	H	-	+	Y	-	n/a	Y	Burgos, Spain	Serrano-López, 2019
High quality public transport nearby to reduce car parkings	M	H	+	n/a	-	n/a	Y	Melbourne	De Gruyter, 2020
Intervening in Built Environment	H	-	-	Y	-	n/a	n/a		Ding, 2017
Freight									
Urban Freight Consolidation Centre	M	H	-	n/a	-	n/a	Y	Bristol	Barnes, 2015
Distribution centers with integration of brands	M	-	-	n/a	+	Y	n/a		Oliveira, 2016
Rationalized good distribution (Microdistribution, etc)	M	-	-	n/a	-	n/a	n/a		Ortegon-Sanchez, 2017

Table C.1: PotPoliciesLiteratureReview

Sources used:

The sources that have been used for this overview of policies from literature:

S. Chen et al. (2020), Gallego, Montero, and Salas (2013), Zhang, Long, and H. Chen (2019), Bonnel (1995), Steven Melia and Shergold (2016), Rydningen, Høynes, and Kolltveit (2017), Topp and Pharoah (1994), Barnes et al. (2015), Bieda (2016), Bonnel (1995), Khreis, May, and Nieuwenhuijsen (2017), Orski (1972), Ortegon-Sanchez, Popan, and Tyler (2017), Shergold and Steve Melia (2018), Szarata et al. (2017), Tight, Rajé, and Timms (2016), Tsubohara (2007), O'fallon, Sullivan, and Hensher (n.d.), Barnes et al. (2015), Guo (2013), Catalano, Casto, and Migliore (2008), Washbrook, Haider, and Jaccard (2006), Daunfeldt, Rudholm, and Rämme (2009), Eliasson (2009), Eliasson et al. (2009), Leape (2006), Ramos et al. (2017), Santos (2005), Santos and Shaffer (2004), Schade and Schlag (2003), Bonsall and Young (2010), Guzman, Arellana, and Alvarez (2020), Simićević, Vukanović, and Milosavljević (2013), Bonsall and Young (2010), Baldassare, Ryan, and Katz (1998), Nijland and Meerkerk (2017), Giesel and Claudia Nobis (2016), Ampudia-Renuncio, Guirao, and Molina-Sanchez (2018), Firnkorn and Müller (2015), Carroll, Caulfield, and Ahern (2017), Okokon et al. (2017), Rojas-Rueda et al. (2012), Woods and Masthoff (2017), Ostermeijer, Koster, and Ommeren (2019), Chakrabarti (2017), Eriksson, Nordlund, and Garvill (2010), Gallego, Montero, and Salas (2013), Katoshevski-Cavari, Bak, and Shiftan (2018), Satiennam et al. (2016), Benedini, Lavieri, and Strambi (2019), Fishman, Washington, and Haworth (2014), Foletta and Henderson (2016), Shi (2019), Bieda (2016), Coates (2013), C. Nobis (2003), Ornetzeder et al. (2008), Scheurer (2001), Alameri (2011), Patel, Gandhi, and Bhatt (2016), Serrano-López, Linares-Unamunzaga, and Muñoz San Emeterio (2019), De Gruyter, Truong, and Taylor (2020), Ding et al. (2017), and L. K. D. Oliveira, G. F. D. Oliveira, and Vieira (2016)

C.2. Overview Potential policies from policy documents

As described in the methodology section (see 2.3), first step is to analyse potential policies to get to carfree or low-car cities. The findings of the analysis into policy documents can be found in the table below.

All the policies have been analysed with use of six criteria (next to mentioning the name and source of the policy). The criteria are:

- **Implementation effort** *(L/ M/ H)* What is the impact or effort of the implementation of the measure? It is complex, time-consuming and costly to implement, or is just a small intervention? (Low, Medium, High)
- **Honey/ Vinegar** *(H/ V)* Can the policy be seen as a honey- or a vinegar measure, in other words: Is the policy positive incentive/ rewarding or negative incentive/ sanction -based)
- **Effectiveness reported?** *(Yes/ No/ NA)* Does the source have a clear evaluation or expectation of the effectiveness of the policy?
- **Feasibility reported?** *(Yes/ No/ NA)* Does the source have a clear evaluation or expectation of the feasibility of the policy?
- **Planned** *(Yes/ No/ NA)* Does the author mention that this policy is planned?
- **Implemented?** *(Yes/No/NA)* Does the author mention that this policy is implemented?

As we expect municipalities to implement policies that they perceive as effective and feasible, we did not evaluate this with a separate analysis like in the literature section. Note that effectiveness and feasibility are fluid concepts, their meaning depends on the context (also see the methodology section, 2.3). We did not evaluate these sources on one clear definition, but evaluated whether these sources did have a clear description and/ or analysis of the expected effectiveness and feasibility. When the author did not provide information on one of the criteria, or that information was multi interpretative, a NA was inserted.

It is important to emphasize that this overview is not meant to be a complete overview of all potential relevant policies available, but is just meant to give insight in the numerous policies that have been implemented or are planned to be implemented by municipalities.

Measure	Implem. effort?	H/V	Effec. rep.?	Feas. rep.?	Planned	Impl.	City	Sources
Restrictions on car movement								
Intelligent access systems for entrance to low-car zone	M	V	n	n	Yes	NA	Amsterdam	Gemeente Amsterdam, 2019
Transform streets to low-car	L	V	No	No	Yes	Yes	Amsterdam	Gemeente Amsterdam, 2019
Traffic calming areas	L	-	No	No	Yes	NA	Rotterdam	Gemeente Rotterdam, 2019
Low-car city centre	M	-	No	No	Yes	NA	Rotterdam	Gemeente Rotterdam, 2016
Making streets low-car	L	-	No	No	Yes	NA	Rotterdam	Gemeente Rotterdam, 2016
Car restrictions in city parks	M	V	No	No	Yes	NA	Eindhoven	Van Zijl, 2008
Realization of carfree urban areas	L	-	No	No	Yes	NA	Eindhoven	Gemeente Eindhoven, 2011
Introduction Low-Car zones	L	-	No	No	Yes	Yes	The Hague	Gemeente Den Haag, 2008
Restrictions on car use in areas of inner city (expansion of Verkeerscirculatieplan)	M	V	No	No	Yes	NA	Groningen	Gemeente Groningen, 2019
Improvement of sector-model with an inner and outer ring	M	-	No	No	Yes	NA	Groningen	Gemeente Groningen, 2019
Lowering speed limits in city	L	V	No	No	Yes	NA	Groningen	Gemeente Groningen, 2019
Lowering speed limits in neighbourhoods (to 30km/h)	L	V	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2016
Transforming areas to low-car (Oude Dorp)	L	-	No	No	Yes	NA	Houten	Gemeente Houten, 2019
Stricter access policy for vehicles to enter pedestrian zones	M	V	No	No	Yes	NA	Gent	Stad Gent, 2015
Stricter policy for access of coaches to the city	L	V	No	No	Yes	NA	Gent	Stad Gent, 2015
Preventing (semi-) through traffic by traffic cut (verkeersknip)	M	V	No	No	Yes	NA	Gent	Stad Gent, 2016
Preventing through traffic by introduction of 'city streets' (stadsstraten)	H	V	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Restrictions on parking cars								
Reduce number of parking permits	L	V	No	No	Yes	NA	Amsterdam	Gemeente Amsterdam, 2019

Table C.2 continued from previous page

Measure	Implem. effort	H/V	Effec. rep.?	Feas. rep.?	Planned	Impl.	City	Sources
Stricter parking policy (parkeernormen)	M	V	No	No	Yes	NA	Amsterdam	Gemeente Amsterdam, 2017
Removal of parking spots	M	V	No	No	Yes	Yes	Rotterdam	CE Delft, 2018
Stricter parking policy (parkeernormen)	M	V	No	No	Yes	NA	Rotterdam	Gemeente Rotterdam, 2016
Stricter parking policy (expansion of areas, higher fees)	M	V	No	No	Yes	NA	Eindhoven	Gemeente Eindhoven, 2017
Stricter parking policy (parkeernormen)	M	V	No	No	Yes	NA	The Hague	Gemeente Den Haag, 2019
Stricter parking policy (parkeernormen)	M	V	No	No	Yes	NA	Groningen	Gemeente Groningen, 2018
Transforming visitor-parkings in city center into residents- / bike parkings	M	V	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2017
Stricter parking policy (parkeernormen)	M	V	No	No	Yes	NA	Utrecht	Linde et al., 2018
Stricter parking policy	M	H	No	No	Yes	NA	Gent	Stad Gent, 2014
Stricter parking policy	M	V	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Price measures								
Increase of parking fees	M	V	Yes	No	Yes	NA	Amsterdam	Gemeente Amsterdam, 2017
Extension paid parking zones	M	V	No	No	Yes	NA	The Hague	Gemeente Den Haag, 2011
Higher parking fees in city centre	M	V	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2017
Discourage car use/ ownership								
Improve supply of car-sharing initiatives	M	H	No	No	Yes	NA	Amsterdam	Gemeente Amsterdam, 2019
Allow Mobility-as-a-Service (MaaS) experiments	L	H	No	No	Yes	NA	Amsterdam	Gemeente Amsterdam, 2019
Facilitation of carsharing	L	H	No	No	Yes	NA	Amsterdam	Gemeente Amsterdam, 2015
Stimulating new and innovative forms of mobility	L	H	No	No	Yes	NA	Rotterdam	Gemeente Rotterdam, 2016
Stimulating shared-mobilities in new developments	L	H	No	No	Yes	NA	Eindhoven	Gemeente Eindhoven, 2017

Table C.2 continued from previous page

Measure	Implem. effort	H/V	Effec. rep.?	Feas. rep.?	Planned	Impl.	City	Sources
Facilitating MAAS	L	H	No	No	Yes	NA	Eindhoven	Gemeente Eindhoven, 2017
Implementation of 'mobility hubs'	M	H	No	No	Yes	NA	The Hague	Gemeente Den Haag, 2019
Stimulating car-sharing initiatives	L	H	No	No	Yes	NA	The Hague	Gemeente Den Haag, 2019
Facilitating MAAS	L	H	No	No	Yes	NA	The Hague	Gemeente Den Haag, 2019
Facilitating MAAS	L	H	No	No	Yes	NA	Groningen	Gemeente Groningen, 2019
Stimulating car-sharing initiatives	L	H	No	No	Yes	NA	Groningen	Gemeente Groningen, 2013
Stimulating car-sharing initiatives/ MAAS	L	H	No	No	Yes	NA	Helmond	Gemeente Helmond, 2019
Stimulate and facilitate car-sharing initiatives	L	H	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2015
Stimulating car-sharing initiatives	L	H	No	No	Yes	NA	Houten	Gemeente Houten, 2015
Expansion of carpool-meeting spots	L	H	No	No	Yes	NA	Houten	Gemeente Houten, 2019
Facilitating Smart mobility/ MAAS	L	H	No	No	Yes	NA	Houten	Gemeente Houten, 2019
Encourage intermodality as an alternative to long-term parking in the city	L	H	No	No	Yes	NA	Gent	Stad Gent, 2014
Facilitating car-share initiatives	L	H	No	No	Yes	NA	Gent	Stad Gent, 2014
Facilitate forms of shared mobility	L	H	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Making PT more attractive								
Improving frequency Public Transport	M	H	n	n	Yes	NA	Amsterdam	Gemeente Amsterdam, 2019
Cheaper Public Transit	H	H	n	n	Yes	NA	Amsterdam	Gemeente Amsterdam, 2019
Improve Park and Ride facilities	M	H	No	No	Yes	NA	Amsterdam	Gemeente Amsterdam, 2019

Table C.2 continued from previous page

Measure	Implem. effort	H/V	Effec. rep.?	Feas. rep.?	Planned	Impl.	City	Sources
Improvement of connection rail, metro and urban PT	M	H	No	No	Yes	NA	Amsterdam	Gemeente Amsterdam, 2015
Improvement of Park and Ride facilities	M	H	No	No	Yes	NA	Rotterdam	CE Delft, 2018
Improvement of PT network	H	H	No	No	Yes	NA	Rotterdam	Gemeente Rotterdam, 2016
Cheaper/ free public transport	H	H	No	No	Yes	NA	Eindhoven	Gemeente Eindhoven, 2014
Realization of High-quality public transport (HOV) -lanes	H	H	No	No	Yes	NA	Eindhoven	Gemeente Eindhoven, 2014
Offering public transport arrangements	L	H	No	No	Yes	NA	Eindhoven	Gemeente Eindhoven, 2017
Adding Park and ride locations	M	H	No	No	Yes	NA	Eindhoven	Gemeente Eindhoven, 2017
Improvement of PT network	H	H	No	No	Yes	NA	The Hague	CE Delft, 2018
Improvement of Park and Ride facilities	M	H	No	No	Yes	NA	The Hague	Gemeente Den Haag, 2020
Improvement of quality of Public Transport equipment	H	H	No	No	Yes	NA	The Hague	Gemeente Den Haag, 2011
Adding new Public Transport lines	H	H	No	No	Yes	NA	The Hague	Gemeente Den Haag, 2011
Improvement accessibility of Public Transport	M	H	No	No	Yes	NA	The Hague	Gemeente Den Haag, 2011
Focus on fast and high-quality public transport	M	H	No	No	Yes	NA	The Hague	Gemeente Den Haag, 2019
Making car alternatives more attractive (PT/Cycle)	M	H	No	No	Yes	NA	The Hague	Gemeente Den Haag, 2019
Realization of high quality P+R's and HUBs	H	H	No	No	Yes	NA	Groningen	Gemeente Groningen, 2019
Development of customizable PT (OV op maat)	M	H	No	No	Yes	NA	Groningen	Gemeente Groningen, 2019
Improvement train network: New connections	H	H	No	No	Yes	NA	Groningen	Gemeente Groningen, 2013
Improvement bus network: New bus tunnel under railwaystation	H	H	No	No	Yes	NA	Groningen	Gemeente Groningen, 2013
Improve Park and Ride facilities	M	H	No	No	Yes	NA	Helmond	Gemeente Helmond, 2016

Table C.2 continued from previous page

Measure	Implem. effort	H/V	Effec. rep.?	Feas. rep.?	Planned	Impl.	City	Sources
Offering free / cheap bus transport	H	H	No	No	Yes	NA	Helmond	Gemeente Helmond, 2008
Expansion of PT network	H	H	No	No	Yes	NA	Utrecht	Bestuur Regio Utrecht, 2012
Improvement of PT network	H	H	No	No	Yes	NA	Utrecht	Bestuur Regio Utrecht, 2012
Implementing separate bus lanes	H	H	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2016
Expansion of PT-network	H	H	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2016
Improvement of quality and supply of PT services	H	H	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2016
Improvement of Park and Ride facilities	M	H	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2017
Improving last mile through development of service network (PT)	M	H	No	No	Yes	NA	Houten	Gemeente Houten, 2020
Improvement of Park and Ride facilities (bikesharing, smart mobility)	M	H	No	No	Yes	NA	Houten	Gemeente Houten, 2019
Adding new PT connections	H	H	No	No	Yes	NA	Houten	Gemeente Houten, 2018
Improvement quality and service/ further development of PT	M	H	No	No	Yes	NA	Houten	Gemeente Houten, 2017
Increasing frequency of PT to business locations	M	H	No	No	Yes	NA	Houten	Gemeente Houten, 2011
Adding new train stations	H	H	No	No	Yes	NA	Gent	Stad Gent, 2015
Development and realization of new tram lines	H	H	No	No	Yes	NA	Gent	Stad Gent, 2015
Improvement of PT network	H	H	No	No	Yes	NA	Gent	Stad Gent, 2015
Explore options for passenger transport by water	M	H	No	No	Yes	NA	Gent	Stad Gent, 2015
Improvement Park and Rides facilities	L	H	No	No	Yes	NA	Gent	Stad Gent, 2016
Adding new Park and Ride facilities	M	H	No	No	Yes	NA	Gent	Stad Gent, 2016
Pop-up park and rides during events	L	H	No	No	Yes	NA	Gent	Stad Gent, 2014
Introduction Park&boat (transport by water)	M	H	No	No	Yes	NA	Gent	Stad Gent, 2014

Table C.2 continued from previous page

Measure	Implem. effort	H/V	Effec. rep.?	Feas. rep.?	Planned	Impl.	City	Sources
Expanding bus network and ensure higher utilization	H	H	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Improve current Train/ bus connections	H	H	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Focus on fast bus- and intercity connections to region	M	H	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Increase quality of stay around PT nodes	H	H	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Expand Park and Ride facilities	M	H	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Renovation station, bicycle parking and surroundings	M	H	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Making walking and cycling more attractive								
Improving Pedestrian facilities	M	H	n	n	Yes	NA	Amsterdam	Gemeente Amsterdam, 2019
Bikesharing	M	H	n	n	Yes	Yes	Amsterdam	Gemeente Amsterdam, 2019
Creating space in streets for cyclists and pedestrians	M	-	n	n	Yes	NA	Amsterdam	Gemeente Amsterdam, 2019
Improvement bicycle network	M	H	No	No	Yes	Yes	Amsterdam	Gemeente Amsterdam, 2019
Expansion of number of pedestrian zones	M	-	No	No	Yes	NA	Amsterdam	Gemeente Amsterdam, 2015
Realization of new bicyle parkings	M	H	No	No	Yes	NA	Amsterdam	Gemeente Amsterdam, 2015
Improvement of cycling network	M	H	No	No	Yes	NA	Rotterdam	Gemeente Rotterdam, 2019
Creating more space for cyclists	M	-	No	No	Yes	NA	Rotterdam	Gemeente Rotterdam, 2019
Creating space in streets for cyclists and pedestrians	M	-	No	No	Yes	NA	Rotterdam	Gemeente Rotterdam, 2016
Improvement of cycle network	M	H	No	No	Yes	NA	Rotterdam	Gemeente Rotterdam, 2016
Improvement of cyle connections via waterways	M	H	No	No	Yes	NA	Rotterdam	Gemeente Rotterdam, 2016

Table C.2 continued from previous page

Measure	Implem. effort	H/V	Effec. rep.?	Feas. rep.?	Planned	Impl.	City	Sources
Realization of new and improvement of bicyle parkings	M	H	No	No	Yes	NA	Rotterdam	Gemeente Rotterdam, 2016
Improvement of quality of cycle paths	M	H	No	No	Yes	NA	Rotterdam	Gemeente Rotterdam, 2016
Traffic lights more biker-friendly	L	-	No	No	Yes	NA	Rotterdam	Gemeente Rotterdam, 2016
Stimulating cycling	M	H	No	No	Yes	NA	Eindhoven	Gemeente Eindhoven, 2014
Improvement of cycling network	M	H	No	No	Yes	NA	Eindhoven	Gemeente Eindhoven, 2014
Realization of fast-cycle lanes (Snelfietspaden)	M	H	No	No	Yes	NA	Eindhoven	Gemeente Eindhoven, 2014
Improving Pedestrian facilities	M	H	No	No	Yes	NA	Eindhoven	Gemeente Eindhoven, 2014
Realization of new and improvement of bicyle parkings	M	H	No	No	Yes	NA	Eindhoven	Gemeente Eindhoven, 2014
Improvement of cycling network	M	H	No	No	Yes	Yes	The Hague	Gemeente Den Haag, 2019
Improvement of conflicting zones for cyclists and pedestrians	M	H	No	No	Yes	NA	The Hague	Gemeente Den Haag, 2019
Creating more space for cyclists	M	H	No	No	Yes	NA	The Hague	Gemeente Den Haag, 2019
Improvement of bikeparking facilities	M	H	No	No	Yes	NA	The Hague	Gemeente Den Haag, 2019
Improvement transfer between bicycle and public transport / car	M	H	No	No	Yes	NA	The Hague	Gemeente Den Haag, 2019
Improvement of quality cycle paths (asphalt)	M	H	No	No	Yes	NA	The Hague	Gemeente Den Haag, 2011
Creating space for walking, cyclists and Public Transport	M	-	No	No	Yes	NA	Groningen	Gemeente Groningen, 2019
Introduction of cycle-streets (fietsstraten)	M	H	No	No	Yes	NA	Groningen	Gemeente Groningen, 2019
Designing development areas walking-, cycling- and PT-friendly	M	H	No	No	Yes	NA	Groningen	Gemeente Groningen, 2019
Realizing attractive walking, cycling and public transport connections	M	H	No	No	Yes	NA	Groningen	Gemeente Groningen, 2019

Table C.2 continued from previous page

Measure	Implem. effort	H/V	Effec. rep.?	Feas. rep.?	Planned	Impl.	City	Sources
Traffic lights: Prioritize bicycle, pedestrian and PT	L	-	No	No	Yes	NA	Groningen	Gemeente Groningen, 2019
Development of 'fast lane' for cycling	M	H	No	No	Yes	NA	Groningen	Gemeente Groningen, 2015
Adding new cycling connections to network	M	H	No	No	Yes	NA	Groningen	Gemeente Groningen, 2015
Adding bike parkings	M	H	No	No	Yes	NA	Groningen	Gemeente Groningen, 2015
Improvement of cycling network	M	H	No	No	Yes	NA	Groningen	Gemeente Groningen, 2015
Implementing a Bicycle Effect Analysis (FEA) for new spatial developments	M	H	No	No	Yes	NA	Groningen	Gemeente Groningen, 2015
Apps for advice on the smartest, fastest, shortest and safest cycle route	L	H	No	No	Yes	NA	Groningen	Gemeente Groningen, 2015
Exchanging car parkings for bicycle parkings	M	-	No	No	Yes	NA	Groningen	Gemeente Groningen, 2015
Improvement of cycling network	M	H	No	No	Yes	Yes	Helmond	Gemeente Helmond, 2019
Adding bike parkings	M	H	No	No	No	Yes	Helmond	Gemeente Helmond, 2019
Introduction of cycle-streets (fietsstraten)	L	H	No	No	Yes	NA	Helmond	Gemeente Helmond, 2019
App to connect cyclists with traffic lights	L	H	No	No	Yes	NA	Helmond	Gemeente Helmond, 2019
Prioritizing cyclists in city centre where possible	M	H	No	No	Yes	NA	Helmond	Gemeente Helmond, 2016
Improve the cycling accessibility of traffic hubs	M	H	No	No	Yes	NA	Helmond	Gemeente Helmond, 2016
Improve bicycle parking facilities	M	H	No	No	Yes	NA	Helmond	Gemeente Helmond, 2016
Improvement and expansion of cycling network	M	H	No	No	Yes	NA	Helmond	Gemeente Helmond, 2016
Supporting bicyle sharing initiatives	L	H	No	No	Yes	NA	Helmond	Gemeente Helmond, 2016
Improve accessibility of city center by bicycle	M	H	No	No	Yes	NA	Helmond	Gemeente Helmond, 2016
Improvement attractiveness bike parkings	M	H	No	No	Yes	NA	Helmond	Gemeente Helmond, 2009

Table C.2 continued from previous page

Measure	Implem. effort	H/V	Effec. rep.?	Feas. rep.?	Planned	Impl.	City	Sources
Improving cycling facilities at public transport stops	M	H	No	No	Yes	NA	Utrecht	Bestuur Regio Utrecht, 2012
Improve adjustment of traffic lights in favor of cyclists	L	-	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2015
Improve quality of cycle paths	M	H	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2015
Expansion of bicycle parking capacity	M	H	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2015
Improve the quality and service of bicycle parking spaces	M	H	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2015
Better disclosure of information about bicycle routes and bicycle parking facilities to the public	L	H	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2015
Prioritization of cyclists and pedestrians in policy	M	H	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2016
Improvement of cycling network	M	H	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2016
Improvement of cycle routes (doorfietsroute)	M	H	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2016
Adding bicycle/ pedestrian connections across waterways	H	H	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2016
Improvement pedestrian routes	M	H	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2016
Optimizing bicycle facilities at public transport stations	M	H	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2016
Implementing popup bicycles parkings	L	H	No	No	-	Yes	Utrecht	Gemeente Utrecht, 2019
Living Lab method' to introduce shared bicycles	L	H	No	No	-	Yes	Utrecht	Gemeente Utrecht, 2019
Adding new bicycle connections	M	H	No	No	Yes	NA	Houten	Gemeente Houten, 2020
Prioritizing bike as a policy objective	M	-	No	No	Yes	NA	Houten	Gemeente Houten, 2019
Setting up a policy for bicycle parking standards (fietsparkeernormen)	L	-	No	No	Yes	NA	Houten	Gemeente Houten, 2019
Improvement of cycling network	M	H	No	No	Yes	NA	Houten	Gemeente Houten, 2019

Table C.2 continued from previous page

Measure	Implem. effort	H/V	Effec. rep.?	Feas. rep.?	Planned	Impl.	City	Sources
Adding bicycle connections	M	H	No	No	Yes	NA	Houten	Gemeente Houten, 2019
Improvement quality cycle paths	M	H	No	No	Yes	NA	Houten	Gemeente Houten, 2019
Expansion of bike parkings	M	H	No	No	Yes	NA	Houten	Gemeente Houten, 2019
Adding bicycle/ pedestrian connections across waterways	H	H	No	No	Yes	NA	Houten	Gemeente Houten, 2018
Development of facilities for e-bikes	L	H	No	No	Yes	NA	Houten	Gemeente Houten, 2015
Municipal-wide spatial planning focused on bicycle	H	-	No	No	-	Yes	Houten	Gemeente Houten, 2014
Giving cyclists priority over cars (almost) municipality-wide	M	-	No	No	-	Yes	Houten	Gemeente Houten, 2014
Improvement of pedestrian network	M	H	No	No	Yes	NA	Houten	Gemeente Houten, 2011
Realization of an area-wide pedestrian network	M	H	No	No	Yes	NA	Gent	Stad Gent, 2015
Extension of the pedestrian zones	M	H	No	No	Yes	NA	Gent	Stad Gent, 2015
Enabling initiatives for the temporary use of street space as a recreation area	M	H	No	No	Yes	NA	Gent	Stad Gent, 2015
Development of a regional bicycle network	M	H	No	No	Yes	NA	Gent	Stad Gent, 2015
Improvement of cycle network	M	H	No	No	Yes	NA	Gent	Stad Gent, 2015
Adding new bicycle connections	M	H	No	No	Yes	NA	Gent	Stad Gent, 2015
Adding bicycle/ pedestrian connections across waterways	H	H	No	No	Yes	NA	Gent	Stad Gent, 2015
Developing innovative concepts for alternative bicycle parking facilities	L	H	No	No	Yes	NA	Gent	Stad Gent, 2015
A neighborhood-specific active screening for opportunities for new public bicycle parking facilities	L	H	No	No	Yes	NA	Gent	Stad Gent, 2015

Table C.2 continued from previous page

Measure	Implem. effort	H/V	Effec. rep.?	Feas. rep.?	Planned	Impl.	City	Sources
Reinforced commitment to multimodal solutions focussed on bike (park & ride; park & bike, loan bikes)	L	H	No	No	Yes	NA	Gent	Stad Gent, 2015
Development of new cycling infrastructure	M	H	No	No	Yes	NA	Gent	Stad Gent, 2015
Implementation of 'pedestrian streets'	L	-	No	No	Yes	NA	Gent	Stad Gent, 2016
Encourage bicycle use by developing a differentiated range of bike parking facilities	L	H	No	No	Yes	NA	Gent	Stad Gent, 2014
Create findable and recognizable walking routes	L	H	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Making cycling routes socially safer	L	H	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Improving the findability of bicycle routes	L	H	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Improving existing bicycle routes	M	H	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Construction of new bicycle routes	M	H	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Improve regional cycling connections	M	H	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Improving bicycle parking facilities at stations	M	H	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Prioritizing walking and cycling in mobility policy	M	-	No	No	Yes	NA	Almere	Gemeente Almere, 2019
Allow shared e-scooter intiatives	L	H	No	No	Yes	NA	Amsterdam	Gemeente Amsterdam, 2019
Information campaigns to promote sustainable travel								
Intensification of employer's approach to reduce car use	L	H	No	No	Yes	NA	Eindhoven	Gemeente Eindhoven, 2017

Table C.2 continued from previous page

Measure	Implem. effort	H/V	Effec. rep.?	Feas. rep.?	Planned	Impl.	City	Sources
Agreements with employers and institutions about promoting cycling and public transport	L	H	No	No	Yes	NA	Groningen	Gemeente Groningen, 2019
Encourage bicycle use through information, education and campaigns.	L	H	No	No	Yes	NA	Helmond	Gemeente Helmond, 2019
Communication strategy to further stimulate bicycle use	L	H	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2015
Public campaign to bring children to school by bike or foot instead of car	L	H	No	No	-	Yes	Utrecht	Gemeente Utrecht, 2019
Public campaigns to promote public transport	L	H	No	No	Yes	NA	Houten	Gemeente Houten, 2019
Rewarding programs to encourage citizens to cycle	L	H	No	No	Yes	NA	Houten	Gemeente Houten, 2011
Conducting communication and awareness campaigns about bicycle policy and bicycle use	L	H	No	No	Yes	NA	Gent	Stad Gent, 2015
Sustainable housing								
Introducing car-low or carfree neighbourhoods (Merwede Kanaal)	H	-	No	No	Yes	NA	Utrecht	Linde et al., 2018
Low-car design of cities								
Densification of inner city	H	-	No	No	Yes	NA	Rotterdam	Gemeente Rotterdam, 2016
Increasing density of urban areas	H	-	No	No	Yes	NA	The Hague	Gemeente Den Haag, 2019
Introduction of Transport Oriented Development (TOD) with high densities	H	-	No	No	Yes	NA	Groningen	Gemeente Groningen, 2019
Focus on low-car areas in new developments	M	-	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2016
Implementation of carfree areas	L	-	No	No	Yes	NA	Gent	Stad Gent, 2016
Drawing up bicycle parking standards (normen) for new developments	L	-	No	No	Yes	NA	Almere	Gemeente Almere, 2020

Table C.2 continued from previous page

Measure	Implem. effort	H/V	Effec. rep.?	Feas. rep.?	Planned	Impl.	City	Sources
Focus on smart city planning through location policy and hub development to avoid unnecessary traffic	H	H	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Densification of city around traffic nodes (TOD)	H	-	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Development of carfree areas	L	-	No	No	-	Yes	Almere	Gemeente Almere, 2020
Stimulating new forms of mobility in new urban developments and transformations	L	H	No	No	Yes	NA	Almere	Gemeente Almere, 2019
Compacting the functions near public transport nodes (TOD) and no new ground-floor dwellings (grondgebonden)	H	-	No	No	Yes	NA	Almere	Gemeente Almere, 2019
Freight								
Innovation in city logistics: sustainable hub/ distribution center	M	H	No	No	Yes	NA	The Hague	Gemeente Den Haag, 2019
Innovations in urban distribution	M	H	No	No	Yes	NA	Eindhoven	Gemeente Eindhoven, 2014
Pilot city hubs for city distribution	L	H	No	No	Yes	NA	Groningen	Gemeente Groningen, 2019
Stimulating deliveries to the city center by bicycle	L	H	No	No	Yes	NA	Groningen	Gemeente Groningen, 2015
Innovations in urban distribution	M	H	No	No	Yes	NA	Helmond	Gemeente Helmond, 2016
Innovations in urban distribution/ city logistics	M	H	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2016
Innovative urban/ city logistics (bundled transport, freight bikes, by water)	M	H	No	No	Yes	NA	Gent	Stad Gent, 2019
Innovative urban/ city logistics (hub)	M	H	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Introduction of fully automatic underground waste system	H	-	No	No	-	Yes	Almere	Gemeente Almere, 2020

Table C.2 continued from previous page

Measure	Implem. effort	H/V	Effec. rep.?	Feas. rep.?	Planned	Impl.	City	Sources
Packages								
Package of Measures (mobility Plan)	H	-	Yes	Yes	-	Yes	The Hague	Gemeente Den Haag, 2018
Package of Measures (mobility plan)	H	-	Yes	No	-	Yes	Utrecht	Gemeente Utrecht, 2016
Package of Measures (Action plan Bike)	H	-	No	No	-	Yes	Utrecht	Gemeente Utrecht, 2015
Package of Measures (Traffic Circulation Plan)	H	-	No	No	Yes	NA	Gent	Stad Gent, 2016
Package of Measures (Mobiliteitsvisie)	H	-	No	No	Yes	NA	Almere	Gemeente Almere, 2020

Measure	Impact	H/V	Effec. rep.?	Feas. rep.?	Planned	Impl.	City	Sources
Restrictions on car movement								
Traffic calming areas	L	-	No	No	Yes	NA	Rotterdam	Gemeente Rotterdam, 2019
Low-car city centre	M	-	No	No	Yes	NA	Rotterdam	Gemeente Rotterdam, 2016
Making streets low-car	L	-	No	No	Yes	NA	Rotterdam	Gemeente Rotterdam, 2016
Car restrictions in city parks	M	V	No	No	Yes	NA	Eindhoven	Van Zijl, 2008
Realization of carfree urban areas	L	-	No	No	Yes	NA	Eindhoven	Gemeente Eindhoven, 2011
Introduction Low-Car zones	L	-	No	No	Yes	Yes	The Hague	Gemeente Den Haag, 2008
Restrictions on car use in areas of inner city (expansion of Verkeerscirculatieplan)	M	V	No	No	Yes	NA	Groningen	Gemeente Groningen, 2019
Improvement of sector-model with an inner and outer ring	M	-	No	No	Yes	NA	Groningen	Gemeente Groningen, 2019
Lowering speed limits in city	L	V	No	No	Yes	NA	Groningen	Gemeente Groningen, 2019
Lowering speed limits in neighbourhoods (to 30km/h)	L	V	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2016
Transforming areas to low-car (Oude Dorp)	L	-	No	No	Yes	NA	Houten	Gemeente Houten, 2019

Table C.3 continued from previous page

Measure	Impact	H/V	Effec. rep.?	Feas. rep.?	Planned	Impl.	City	Sources
Stricter access policy for vehicles to enter pedestrian zones	M	V	No	No	Yes	NA	Gent	Stad Gent, 2015
Stricter policy for access of coaches to the city	L	V	No	No	Yes	NA	Gent	Stad Gent, 2015
Preventing (semi-) through traffic by traffic cut (verkeersknip)	M	V	No	No	Yes	NA	Gent	Stad Gent, 2016
Preventing through traffic by introduction of 'city streets' (stadsstraten)	H	V	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Restrictions on parking cars								
Stricter parking policy (parkeernormen)	M	V	No	No	Yes	NA	Amsterdam	Gemeente Amsterdam, 2017
Removal of parking spots	M	V	No	No	Yes	Yes	Rotterdam	CE Delft, 2018
Stricter parking policy (parkeernormen)	M	V	No	No	Yes	NA	Rotterdam	Gemeente Rotterdam, 2016
Stricter parking policy (expansion of areas, higher fees)	M	V	No	No	Yes	NA	Eindhoven	Gemeente Eindhoven, 2017
Stricter parking policy (parkeernormen)	M	V	No	No	Yes	NA	The Hague	Gemeente Den Haag, 2019
Stricter parking policy (parkeernormen)	M	V	No	No	Yes	NA	Groningen	Gemeente Groningen, 2018
Transforming visitor-parkings in city center into residents- / bike parkings	M	V	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2017
Stricter parking policy (parkeernormen)	M	V	No	No	Yes	NA	Utrecht	Linde et al., 2018
Stricter parking policy	M	H	No	No	Yes	NA	Gent	Stad Gent, 2014
Stricter parking policy	M	V	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Price measures								
Increase of parking fees	M	V	Yes	No	Yes	NA	Amsterdam	Gemeente Amsterdam, 2017
Extension paid parking zones	M	V	No	No	Yes	NA	The Hague	Gemeente Den Haag, 2011
Higher parking fees in city centre	M	V	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2017

Table C.3 continued from previous page

Measure	Impact	H/V	Effec. rep.?	Feas. rep.?	Planned	Impl.	City	Sources
Sharing initiatives and intermodality								
Allow Mobility-as-a-Service (MaaS) experiments	L	H	No	No	Yes	NA	Amsterdam	Gemeente Amsterdam, 2019
Facilitation of carsharing	L	H	No	No	Yes	NA	Amsterdam	Gemeente Amsterdam, 2015
Stimulating new and innovative forms of mobility	L	H	No	No	Yes	NA	Rotterdam	Gemeente Rotterdam, 2016
Stimulating shared-mobilities in new developments	L	H	No	No	Yes	NA	Eindhoven	Gemeente Eindhoven, 2017
Facilitating MAAS	L	H	No	No	Yes	NA	Eindhoven	Gemeente Eindhoven, 2017
Implementation of 'mobility hubs'	M	H	No	No	Yes	NA	The Hague	Gemeente Den Haag, 2019
Stimulating car-sharing initiatives	L	H	No	No	Yes	NA	The Hague	Gemeente Den Haag, 2019
Facilitating MAAS	L	H	No	No	Yes	NA	The Hague	Gemeente Den Haag, 2019
Facilitating MAAS	L	H	No	No	Yes	NA	Groningen	Gemeente Groningen, 2019
Stimulating car-sharing initiatives	L	H	No	No	Yes	NA	Groningen	Gemeente Groningen, 2013
Stimulating car-sharing initiatives/ MAAS	L	H	No	No	Yes	NA	Helmond	Gemeente Helmond, 2019
Stimulate and facilitate car-sharing initiatives	L	H	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2015
Stimulating car-sharing initiatives	L	H	No	No	Yes	NA	Houten	Gemeente Houten, 2015
Expansion of carpool-meeting spots	L	H	No	No	Yes	NA	Houten	Gemeente Houten, 2019
Facilitating Smart mobility/ MAAS	L	H	No	No	Yes	NA	Houten	Gemeente Houten, 2019
Encourage intermodality as an alternative to long-term parking in the city	L	H	No	No	Yes	NA	Gent	Stad Gent, 2014
Facilitating car-share initiatives	L	H	No	No	Yes	NA	Gent	Stad Gent, 2014

Table C.3 continued from previous page

Measure	Impact	H/V	Effec. rep.?	Feas. rep.?	Planned	Impl.	City	Sources
Facilitate forms of shared mobility	L	H	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Making PT more attractive								
Improvement of connection rail, metro and urban PT	M	H	No	No	Yes	NA	Amsterdam	Gemeente Amsterdam, 2015
Improvement of Park and Ride facilities	M	H	No	No	Yes	NA	Rotterdam	CE Delft, 2018
Improvement of PT network	H	H	No	No	Yes	NA	Rotterdam	Gemeente Rotterdam, 2016
Cheaper/ free public transport	H	H	No	No	Yes	NA	Eindhoven	Gemeente Eindhoven, 2014
Realization of High-quality public transport (HOV) -lanes	H	H	No	No	Yes	NA	Eindhoven	Gemeente Eindhoven, 2014
Offering public transport arrangements	L	H	No	No	Yes	NA	Eindhoven	Gemeente Eindhoven, 2017
Adding Park and ride locations	M	H	No	No	Yes	NA	Eindhoven	Gemeente Eindhoven, 2017
Improvement of PT network	H	H	No	No	Yes	NA	The Hague	CE Delft, 2018
Improvement of Park and Ride facilities	M	H	No	No	Yes	NA	The Hague	Gemeente Den Haag, 2020
Improvement of quality of Public Transport equipment	H	H	No	No	Yes	NA	The Hague	Gemeente Den Haag, 2011
Adding new Public Transport lines	H	H	No	No	Yes	NA	The Hague	Gemeente Den Haag, 2011
Improvement accessibility of Public Transport	M	H	No	No	Yes	NA	The Hague	Gemeente Den Haag, 2011
Focus on fast and high-quality public transport	M	H	No	No	Yes	NA	The Hague	Gemeente Den Haag, 2019
Making car alternatives more attractive (PT/Cycle)	M	H	No	No	Yes	NA	The Hague	Gemeente Den Haag, 2019
Realization of high quality P+R's and HUBs	H	H	No	No	Yes	NA	Groningen	Gemeente Groningen, 2019
Development of customizable PT (OV op maat)	M	H	No	No	Yes	NA	Groningen	Gemeente Groningen, 2019
Improvement train network: New connections	H	H	No	No	Yes	NA	Groningen	Gemeente Groningen, 2013

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Measure	Impact	H/V	Effec. rep.?	Feas. rep.?	Planned	Impl.	City	Sources
Improvement bus network: New bus tunnel under railwaystation	H	H	No	No	Yes	NA	Groningen	Gemeente Groningen, 2013
Improve Park and Ride facilities	M	H	No	No	Yes	NA	Helmond	Gemeente Helmond, 2016
Offering free / cheap bus transport	H	H	No	No	Yes	NA	Helmond	Gemeente Helmond, 2008
Expansion of PT network	H	H	No	No	Yes	NA	Utrecht	Bestuur Regio Utrecht, 2012
Improvement of PT network	H	H	No	No	Yes	NA	Utrecht	Bestuur Regio Utrecht, 2012
Implementing separate bus lanes	H	H	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2016
Expansion of PT-network	H	H	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2016
Improvement of quality and supply of PT services	H	H	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2016
Improvement of Park and Ride facilities	M	H	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2017
Improving last mile through development of service network (PT)	M	H	No	No	Yes	NA	Houten	Gemeente Houten, 2020
Improvement of Park and Ride facilities (bikesharing, smart mobility)	M	H	No	No	Yes	NA	Houten	Gemeente Houten, 2019
Adding new PT connections	H	H	No	No	Yes	NA	Houten	Gemeente Houten, 2018
Improvement quality and service/ further development of PT	M	H	No	No	Yes	NA	Houten	Gemeente Houten, 2017
Increasing frequency of PT to business locations	M	H	No	No	Yes	NA	Houten	Gemeente Houten, 2011
Adding new train stations	H	H	No	No	Yes	NA	Gent	Stad Gent, 2015
Development and realization of new tram lines	H	H	No	No	Yes	NA	Gent	Stad Gent, 2015
Improvement of PT network	H	H	No	No	Yes	NA	Gent	Stad Gent, 2015
Explore options for passenger transport by water	M	H	No	No	Yes	NA	Gent	Stad Gent, 2015
Improvement Park and Rides facilities	L	H	No	No	Yes	NA	Gent	Stad Gent, 2016
Adding new Park and Ride facilities	M	H	No	No	Yes	NA	Gent	Stad Gent, 2016

Table C.3 continued from previous page

Measure	Impact	H/V	Effec. rep.?	Feas. rep.?	Planned	Impl.	City	Sources
Pop-up park and rides during events	L	H	No	No	Yes	NA	Gent	Stad Gent, 2014
Introduction Park&boat (transport by water)	M	H	No	No	Yes	NA	Gent	Stad Gent, 2014
Expanding bus network and ensure higher utilization	H	H	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Improve current Train/ bus connections	H	H	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Focus on fast bus- and intercity connections to region	M	H	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Increase quality of stay around PT nodes	H	H	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Expand Park and Ride facilities	M	H	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Renovation station, bicycle parking and surroundings	M	H	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Making walking and cycling more attractive								
Expansion of number of pedestrian zones	M	-	No	No	Yes	NA	Amsterdam	Gemeente Amsterdam, 2015
Realization of new bicyle parkings	M	H	No	No	Yes	NA	Amsterdam	Gemeente Amsterdam, 2015
Improvement of cycling network	M	H	No	No	Yes	NA	Rotterdam	Gemeente Rotterdam, 2019
Creating more space for cyclists	M	-	No	No	Yes	NA	Rotterdam	Gemeente Rotterdam, 2019
Creating space in streets for cyclists and pedestrians	M	-	No	No	Yes	NA	Rotterdam	Gemeente Rotterdam, 2016
Improvement of cycle network	M	H	No	No	Yes	NA	Rotterdam	Gemeente Rotterdam, 2016
Improvement of cyle connections via waterways	M	H	No	No	Yes	NA	Rotterdam	Gemeente Rotterdam, 2016
Realization of new and improvement of bicyle parkings	M	H	No	No	Yes	NA	Rotterdam	Gemeente Rotterdam, 2016

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Measure	Impact	H/V	Effec. rep.?	Feas. rep.?	Plan ned	Impl.	City	Sources
Improvement of quality of cycle paths	M	H	No	No	Yes	NA	Rotterdam	Gemeente Rotterdam, 2016
Traffic lights more biker-friendly	L	-	No	No	Yes	NA	Rotterdam	Gemeente Rotterdam, 2016
Stimulating cycling	M	H	No	No	Yes	NA	Eindhoven	Gemeente Eindhoven, 2014
Improvement of cycling network	M	H	No	No	Yes	NA	Eindhoven	Gemeente Eindhoven, 2014
Realization of fast-cycle lanes (Snelfietspaden)	M	H	No	No	Yes	NA	Eindhoven	Gemeente Eindhoven, 2014
Improving Pedestrian facilities	M	H	No	No	Yes	NA	Eindhoven	Gemeente Eindhoven, 2014
Realization of new and improvement of bicyle parkings	M	H	No	No	Yes	NA	Eindhoven	Gemeente Eindhoven, 2014
Improvement of cycling network	M	H	No	No	Yes	Yes	The Hague	Gemeente Den Haag, 2019
Improvement of conflicting zones for cyclists and pedestrians	M	H	No	No	Yes	NA	The Hague	Gemeente Den Haag, 2019
Creating more space for cyclists	M	H	No	No	Yes	NA	The Hague	Gemeente Den Haag, 2019
Improvement of bikeparking facilities	M	H	No	No	Yes	NA	The Hague	Gemeente Den Haag, 2019
Improvement transfer between bicycle and public transport / car	M	H	No	No	Yes	NA	The Hague	Gemeente Den Haag, 2019
Improvement of quality cycle paths (asphalt)	M	H	No	No	Yes	NA	The Hague	Gemeente Den Haag, 2011
Creating space for walking, cyclists and Public Transport	M	-	No	No	Yes	NA	Groningen	Gemeente Groningen, 2019
Introduction of cycle-streets (fietsstraten)	M	H	No	No	Yes	NA	Groningen	Gemeente Groningen, 2019
Designing development areas walking-, cycling- and PT-friendly	M	H	No	No	Yes	NA	Groningen	Gemeente Groningen, 2019
Realizing attractive walking, cycling and public transport connections	M	H	No	No	Yes	NA	Groningen	Gemeente Groningen, 2019
Traffic lights: Prioritize bicycle, pedestrian and PT	L	-	No	No	Yes	NA	Groningen	Gemeente Groningen, 2019

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Measure	Impact	H/V	Effec. rep.?	Feas. rep.?	Planned	Impl.	City	Sources
Development of 'fast lane' for cycling	M	H	No	No	Yes	NA	Groningen	Gemeente Groningen, 2015
Adding new cycling connections to network	M	H	No	No	Yes	NA	Groningen	Gemeente Groningen, 2015
Adding bike parkings	M	H	No	No	Yes	NA	Groningen	Gemeente Groningen, 2015
Improvement of cycling network	M	H	No	No	Yes	NA	Groningen	Gemeente Groningen, 2015
Implementing a Bicycle Effect Analysis (FEA) for new spatial developments	M	H	No	No	Yes	NA	Groningen	Gemeente Groningen, 2015
Apps for advice on the smartest, fastest, shortest and safest cycle route	L	H	No	No	Yes	NA	Groningen	Gemeente Groningen, 2015
Exchanging car parkings for bicycle parkings	M	-	No	No	Yes	NA	Groningen	Gemeente Groningen, 2015
Improvement of cycling network	M	H	No	No	Yes	Yes	Helmond	Gemeente Helmond, 2019
Adding bike parkings	M	H	No	No	No	Yes	Helmond	Gemeente Helmond, 2019
Introduction of cycle-streets (fietsstraten)	L	H	No	No	Yes	NA	Helmond	Gemeente Helmond, 2019
App to connect cyclists with traffic lights	L	H	No	No	Yes	NA	Helmond	Gemeente Helmond, 2019
Prioritizing cyclists in city centre where possible	M	H	No	No	Yes	NA	Helmond	Gemeente Helmond, 2016
Improve the cycling accessibility of traffic hubs	M	H	No	No	Yes	NA	Helmond	Gemeente Helmond, 2016
Improve bicycle parking facilities	M	H	No	No	Yes	NA	Helmond	Gemeente Helmond, 2016
Improvement and expansion of cycling network	M	H	No	No	Yes	NA	Helmond	Gemeente Helmond, 2016
Supporting bicyle sharing initiatives	L	H	No	No	Yes	NA	Helmond	Gemeente Helmond, 2016
Improve accessibility of city center by bicycle	M	H	No	No	Yes	NA	Helmond	Gemeente Helmond, 2016
Improvement attractiveness bike parkings	M	H	No	No	Yes	NA	Helmond	Gemeente Helmond, 2009
Improving cycling facilities at public transport stops	M	H	No	No	Yes	NA	Utrecht	Bestuur Regio Utrecht, 2012

Table C.3 continued from previous page

Measure	Impact	H/V	Effec. rep.?	Feas. rep.?	Planned	Impl.	City	Sources
Improve adjustment of traffic lights in favor of cyclists	L	-	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2015
Improve quality of cycle paths	M	H	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2015
Expansion of bicycle parking capacity	M	H	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2015
Improve the quality and service of bicycle parking spaces	M	H	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2015
Better disclosure of information about bicycle routes and bicycle parking facilities to the public	L	H	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2015
Prioritization of cyclists and pedestrians in policy	M	H	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2016
Improvement of cycling network	M	H	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2016
Improvement of cycle routes (doorfietsroute)	M	H	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2016
Adding bicycle/ pedestrian connections across waterways	H	H	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2016
Improvement pedestrian routes	M	H	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2016
Optimizing bicycle facilities at public transport stations	M	H	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2016
Implementing popup bicycles parkings	L	H	No	No	-	Yes	Utrecht	Gemeente Utrecht, 2019
Living Lab method' to introduce shared bicycles	L	H	No	No	-	Yes	Utrecht	Gemeente Utrecht, 2019
Adding new bicycle connections	M	H	No	No	Yes	NA	Houten	Gemeente Houten, 2020
Prioritizing bike as a policy objective	M	-	No	No	Yes	NA	Houten	Gemeente Houten, 2019
Setting up a policy for bicycle parking standards (fietsparkeernormen)	L	-	No	No	Yes	NA	Houten	Gemeente Houten, 2019
Improvement of cycling network	M	H	No	No	Yes	NA	Houten	Gemeente Houten, 2019
Adding bicycle connections	M	H	No	No	Yes	NA	Houten	Gemeente Houten, 2019

Table C.3 continued from previous page

Measure	Impact	H/V	Effec. rep.?	Feas. rep.?	Planned	Impl.	City	Sources
Improvement quality cycle paths	M	H	No	No	Yes	NA	Houten	Gemeente Houten, 2019
Expansion of bike parkings	M	H	No	No	Yes	NA	Houten	Gemeente Houten, 2019
Adding bicycle/ pedestrian connections across waterways	H	H	No	No	Yes	NA	Houten	Gemeente Houten, 2018
Development of facilities for e-bikes	L	H	No	No	Yes	NA	Houten	Gemeente Houten, 2015
Municipal-wide spatial planning focused on bicycle	H	-	No	No	-	Yes	Houten	Gemeente Houten, 2014
Giving cyclists priority over cars (almost) municipality-wide	M	-	No	No	-	Yes	Houten	Gemeente Houten, 2014
Improvement of pedestrian network	M	H	No	No	Yes	NA	Houten	Gemeente Houten, 2011
Realization of an area-wide pedestrian network	M	H	No	No	Yes	NA	Gent	Stad Gent, 2015
Extension of the pedestrian zones	M	H	No	No	Yes	NA	Gent	Stad Gent, 2015
Enabling initiatives for the temporary use of street space as a recreation area	M	H	No	No	Yes	NA	Gent	Stad Gent, 2015
Development of a regional bicycle network	M	H	No	No	Yes	NA	Gent	Stad Gent, 2015
Improvement of cycle network	M	H	No	No	Yes	NA	Gent	Stad Gent, 2015
Adding new bicycle connections	M	H	No	No	Yes	NA	Gent	Stad Gent, 2015
Adding bicycle/ pedestrian connections across waterways	H	H	No	No	Yes	NA	Gent	Stad Gent, 2015
Developing innovative concepts for alternative bicycle parking facilities	L	H	No	No	Yes	NA	Gent	Stad Gent, 2015
A neighborhood-specific active screening for opportunities for new public bicycle parking facilities	L	H	No	No	Yes	NA	Gent	Stad Gent, 2015
Reinforced commitment to multimodal solutions focussed on bike (park & ride; park & bike, loan bikes)	L	H	No	No	Yes	NA	Gent	Stad Gent, 2015

Table C.3 continued from previous page

Measure	Impact	H/V	Effec. rep.?	Feas. rep.?	Planned	Impl.	City	Sources
Development of new cycling infrastructure	M	H	No	No	Yes	NA	Gent	Stad Gent, 2015
Implementation of 'pedestrian streets'	L	-	No	No	Yes	NA	Gent	Stad Gent, 2016
Encourage bicycle use by developing a differentiated range of bike parking facilities	L	H	No	No	Yes	NA	Gent	Stad Gent, 2014
Create findable and recognizable walking routes	L	H	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Making cycling routes socially safer	L	H	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Improving the findability of bicycle routes	L	H	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Improving existing bicycle routes	M	H	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Construction of new bicycle routes	M	H	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Improve regional cycling connections	M	H	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Improving bicycle parking facilities at stations	M	H	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Prioritizing walking and cycling in mobility policy	M	-	No	No	Yes	NA	Almere	Gemeente Almere, 2019
Allow shared e-scooter intiatives	L	H	No	No	Yes	NA	Amsterdam	Gemeente Amsterdam, 2019
Information campaigns to promote sustainable travel								
Intensification of employer's approach to reduce car use	L	H	No	No	Yes	NA	Eindhoven	Gemeente Eindhoven, 2017
Agreements with employers and institutions about promoting cycling and public transport	L	H	No	No	Yes	NA	Groningen	Gemeente Groningen, 2019
Encourage bicycle use through information, education and campaigns.	L	H	No	No	Yes	NA	Helmond	Gemeente Helmond, 2019

Table C.3 continued from previous page

Measure	Impact	H/V	Effec. rep.?	Feas. rep.?	Planned	Impl.	City	Sources
Communication strategy to further stimulate bicycle use	L	H	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2015
Public campaign to bring children to school by bike or foot instead of car	L	H	No	No	-	Yes	Utrecht	Gemeente Utrecht, 2019
Public campaigns to promote public transport	L	H	No	No	Yes	NA	Houten	Gemeente Houten, 2019
Rewarding programs to encourage citizens to cycle	L	H	No	No	Yes	NA	Houten	Gemeente Houten, 2011
Conducting communication and awareness campaigns about bicycle policy and bicycle use	L	H	No	No	Yes	NA	Gent	Stad Gent, 2015
Sustainable housing								
Introducing car-low or carfree neighbourhoods (Merwede Kanaal)	H	-	No	No	Yes	NA	Utrecht	Linde et al., 2018
Low-car design of cities								
Densification of inner city	H	-	No	No	Yes	NA	Rotterdam	Gemeente Rotterdam, 2016
Increasing density of urban areas	H	-	No	No	Yes	NA	The Hague	Gemeente Den Haag, 2019
Introduction of Transport Oriented Development (TOD) with high densities	H	-	No	No	Yes	NA	Groningen	Gemeente Groningen, 2019
Focus on low-car areas in new developments	M	-	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2016
Implementation of carfree areas	L	-	No	No	Yes	NA	Gent	Stad Gent, 2016
Drawing up bicycle parking standards (normen) for new developments	L	-	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Focus on smart city planning through location policy and hub development to avoid unnecessary traffic	H	H	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Densification of city around traffic nodes (TOD)	H	-	No	No	Yes	NA	Almere	Gemeente Almere, 2020

Table C.3 continued from previous page

Measure	Impact	H/V	Effec. rep.?	Feas. rep.?	Planned	Impl.	City	Sources
Development of carfree areas	L	-	No	No	-	Yes	Almere	Gemeente Almere, 2020
Stimulating new forms of mobility in new urban developments and transformations	L	H	No	No	Yes	NA	Almere	Gemeente Almere, 2019
Compacting the functions near public transport nodes (TOD) and no new ground-floor dwellings (grondgebonden)	H	-	No	No	Yes	NA	Almere	Gemeente Almere, 2019
Freight								
Innovation in city logistics: sustainable hub/ distribution center	M	H	No	No	Yes	NA	The Hague	Gemeente Den Haag, 2019
Innovations in urban distribution	M	H	No	No	Yes	NA	Eindhoven	Gemeente Eindhoven, 2014
Pilot city hubs for city distribution	L	H	No	No	Yes	NA	Groningen	Gemeente Groningen, 2019
Stimulating deliveries to the city center by bicycle	L	H	No	No	Yes	NA	Groningen	Gemeente Groningen, 2015
Innovations in urban distribution	M	H	No	No	Yes	NA	Helmond	Gemeente Helmond, 2016
Innovations in urban distribution/ city logistics	M	H	No	No	Yes	NA	Utrecht	Gemeente Utrecht, 2016
Innovative urban/ city logistics (bundled transport, freight bikes, by water)	M	H	No	No	Yes	NA	Gent	Stad Gent, 2019
Innovative urban/ city logistics (hub)	M	H	No	No	Yes	NA	Almere	Gemeente Almere, 2020
Introduction of fully automatic underground waste system	H	-	No	No	-	Yes	Almere	Gemeente Almere, 2020
Packages								
Package of Measures (mobility Plan)	H	-	Yes	Yes	-	Yes	The Hague	Gemeente Den Haag, 2018

Table C.3 continued from previous page

Measure	Impact	H/V	Effec. rep.?	Feas. rep.?	Plan ned	Impl.	City	Sources
Package of Measures (mobility plan)	H	-	Yes	No	-	Yes	Utrecht	Gemeente Utrecht, 2016
Package of Measures (Action plan Bike)	H	-	No	No	-	Yes	Utrecht	Gemeente Utrecht, 2015
Package of Measures (Traffic Circulation Plan)	H	-	No	No	Yes	NA	Gent	Stad Gent, 2016
Package of Measures (Mobiliteitsvisie)	H	-	No	No	Yes	NA	Almere	Gemeente Almere, 2020

Sources used:

The sources that have been used for this overview of policies from policy documents:
Gemeente Amsterdam (2019b), Gemeente Amsterdam (2015), Gemeente Amsterdam (2017), CE Delft (2018a), Gemeente Rotterdam (2019), Gemeente Rotterdam (2016a), Gemeente Rotterdam (2016b), Gemeente Rotterdam (2016c), Van Zijl (2008), Gemeente Eindhoven (2011), Gemeente Eindhoven (2014a), Gemeente Eindhoven (2014b), Gemeente Eindhoven (2017), Gemeente Eindhoven and Staps (2017), Gemeente Den Haag (2019c), Gemeente Den Haag (2008), CE Delft (2018a), Gemeente Den Haag (2019b), Gemeente Den Haag (2020), Gemeente Den Haag (2011), Gemeente Den Haag (2019a), Gemeente Den Haag (2018), Gemeente Groningen (2019a), Gemeente Groningen (2019b), Gemeente Groningen (2019c), Gemeente Groningen (2019d), Gemeente Groningen (2015b), Gemeente Groningen (2015a), Gemeente Groningen (2013a), Gemeente Groningen (2018), Gemeente Groningen (2013b), Gemeente Helmond (2019b), Gemeente Helmond (2019a), Gemeente Helmond (2016b), Gemeente Helmond (2016a), Gemeente Helmond (2008), Gemeente Helmond (2009), Bestuur Regio Utrecht (2012), Gemeente Utrecht (2015b), Gemeente Utrecht (2015a), Gemeente Utrecht (2016b), Gemeente Utrecht (2016a), Gemeente Utrecht (2017), Linde et al. (2018), Gemeente Utrecht (2019), Gemeente Utrecht (2016b), Gemeente Utrecht (2015a), Gemeente Houten (2020), Gemeente Houten (2019a), Gemeente Houten (2019b), Gemeente Houten (2018), Gemeente Houten (2017), Gemeente Houten (2015), Gemeente Houten (2014), Gemeente Houten (2011), Stad Gent (2015), Stad Gent (2019), Stad Gent (2016), Stad Gent (2014), Gemeente Almere (2020b), Gemeente Almere (2020a), and Gemeente Almere (2019)

D

Interview protocols and responses for research into feasibilities

This section describes the interview protocols with the questions to be asked in order to research the feasibilities, and responses as well.

D.1. Questionnaire for research into feasibilities

Each of the three sub groups (policy makers, academics, experts in the field) have their own questionnaire.

D.1.1. Questionnaire Policy Makers

Name: ……
Function: ……
Organisation: ……
Date: ……

Introductie

- Introductie en uitleg doel, achtergrond en context
- Praktisch: Interview duur is 45 minuten, interview wordt achteraf gecodeerd, informed consent formulier
- Is het akkoord dat ik dit interview opneem en uw naam gebruik als referentie?
- Introductie van het onderzoek: Master thesis, CoSEM, TU Delft en achtergrond interviewer
- Interview format: Semi-structured, eerst generieke vragen, gevolgd door vragen over de verschillende soorten van haalbaarheid (technisch, sociaal en politiek)

Generieke vragen

- Kunt u iets over uzelf, uw achtergrond en uw organisatie vertellen?
- Heeft uw gemeente ervaring met beleidsmaatregelen om steden autovrij of autoluw te maken?
- Met welke beleidsmaatregelen om autovrije of autoluwe steden te realiseren heeft u goede ervaringen?
- Wat ziet u als belangrijkste resultaten als het gaat om het autovrij of autoluw maken van steden?

De drie beleidsmaatregelen worden gepresenteerd: Het beprijzen en beperken van autoverkeer; Het verbeteren en innoveren van collectieve diensten en het aantrekkelijker maken van langzaam verkeer.

- In welke mate bent u bekend met deze maatregelen?
- In welke mate heeft u ervaring met het implementeren van deze maatregelen?

Voor wat betreft het beprijzen en beperken van autoverkeer:

- Welke vorm of maatregel ziet u als meest gewenste implementatie van deze groep maatregelen?

Technische haalbaarheid

- Denkt u dat het technisch mogelijk is deze beleidsmaatregel toe te passen in Nederlandse steden of uw stad? Waarom wel/ niet?

Sociale haalbaarheid

- Denkt u dat uw inwoners deze maatregel zullen omarmen en hierdoor minder gaan rijden?

Politieke haalbaarheid

- Denkt u dat deze maatregel politiek haalbaar is in Nederlandse steden of uw stad? Waar hangt dat van af? Heeft uw voorbeelden van soortgelijke maatregelen die wel of niet politiek haalbaar bleken?
- Als u denkt aan zo'n vorm van beprijzen, zijn er randvoorwaarden, waaronder dit al dan niet politiek haalbaar is?
- Wie of wat ziet u als belangrijkste factoren om deze maatregel politiek haalbaar te laten zijn?

Voor wat betreft het verbeteren en innoveren van collectieve (vervoers)diensten:

- Welke vorm of maatregel ziet u als meest gewenste implementatie van deze groep maatregelen?

Technische haalbaarheid

- Hoe ziet u de technische haalbaarheid van het verbeteren van collectief vervoer, is dit mogelijk? Wat is er voor nodig om dit technisch haalbaar te laten zijn?

Sociale haalbaarheid

- Wat is er in uw mening voor nodig om inwoners deze maatregel te laten omarmen en hierdoor de auto vaker in te ruilen voor OV?

Politieke haalbaarheid

- Denkt u dat deze maatregel politiek haalbaar is in Nederlandse steden of uw stad? Waar hangt dat van af? Heeft uw voorbeelden van soortgelijke maatregelen die wel of niet politiek haalbaar bleken?

- Als u denkt aan het aantrekkelijker maken van collectief vervoer, zijn er randvoorwaarden, waaronder dit al dan niet politiek haalbaar is?
- Wie of wat ziet u als belangrijkste factoren om deze maatregel politiek haalbaar te laten zijn?

Voor wat betreft het aantrekkelijker maken van langzaam verkeer:

- Welke vorm of maatregel ziet u als meest gewenste implementatie van deze groep maatregelen?

Technische haalbaarheid

- Hoe ziet u de technische haalbaarheid van het aantrekkelijker maken van langzaam verkeer in uw stad, is dit mogelijk? Wat is er voor nodig om dit technisch haalbaar te laten zijn?

Sociale haalbaarheid

- Wat is er in uw mening voor nodig om inwoners deze maatregel te laten omarmen en hierdoor de auto vaker in te ruilen voor de fiets?

Politieke haalbaarheid

- Denkt u dat deze maatregel politiek haalbaar is in Nederlandse steden of uw stad? Waar hangt dat van af? Heeft uw voorbeelden van soortgelijke maatregelen die wel of niet politiek haalbaar bleken?
- Als u denkt aan het aantrekkelijker maken van langzaam verkeer, zijn er randvoorwaarden, waaronder dit al dan niet politiek haalbaar is?
- Wie of wat ziet u als belangrijkste factoren om deze maatregel politiek haalbaar te laten zijn?

Afsluitend

- Dan over deze maatregelen ten opzichte van elkaar. Wat is uw nummer 1-2-3 op technische haalbaarheid? Op sociale haalbaarheid? Op maatschappelijke haalbaarheid? Wat ziet u daarin als cruciale barrière?
- Welke maatregel ziet u als meest effectief?
- Hoe denkt u over het combineren van deze maatregelen in pakketten? Welke bezwaren ziet u?
- Heeft u verder nog aanvullingen die nog niet besproken zijn in dit interview?

D.1.2. Questionnaire Academics

Name: ……
Function: ……
Organisation: ……
Date: ……

Introductie

- Introductie en uitleg doel, achtergrond en context (Master thesis, CoSEM, TU Delft en achtergrond interviewer)
- Praktisch: Interview duur is 45 minuten, interview wordt achteraf gecodeerd, informed consent formulier
- Is het akkoord dat ik dit interview opneem en uw naam gebruik als referentie?
- Interview format: Semi-structured, eerst generieke vragen, gevolgd door vragen over de verschillende soorten van haalbaarheid (technisch, sociaal en politiek)

Generieke vragen

- Kunt u iets over uzelf, uw achtergrond en uw organisatie vertellen?
- Heeft uw ervaring of kennis van beleidsmaatregelen om steden autovrij of autoluw te maken? Zo ja, kunt u goede ervaringen noemen?
- Wat ziet u als belangrijkste resultaten als het gaat om het autovrij of autoluw maken van steden?

De drie beleidsmaatregelen worden gepresenteerd: Het beprijzen en beperken van autoverkeer; Het verbeteren en innoveren van collectieve diensten en het aantrekkelijker maken van langzaam verkeer.

- In welke mate bent u bekend met deze maatregelen?
- In welke mate heeft u ervaring met het implementeren van deze maatregelen?

Voor wat betreft het beprijzen en beperken van autoverkeer:

- Welke vorm of maatregel ziet u als meest gewenste implementatie van deze groep maatregelen?

Technische haalbaarheid

- Denkt u dat het technisch mogelijk is deze beleidsmaatregel toe te passen in Nederlandse steden? Waarom wel/ niet?
- Wat zijn daarbij voor u randvoorwaarden? Welke uitdagingen ziet u?
- Heeft u voorbeelden van Nederlandse steden waar iets dergelijks is geprobeerd? Waarom lukte dit wel/ niet?

Sociale haalbaarheid

- Denkt u dat uw inwoners zo'n vorm van beprijzing zullen omarmen en hierdoor minder gaan rijden?

Politieke haalbaarheid

- Denkt u dat deze maatregel politiek haalbaar zou zijn in Nederlandse steden? Waar hangt dat van af?

Voor wat betreft het verbeteren en innoveren van collectieve (vervoers)diensten:

- Welke vorm of maatregel ziet u als meest gewenste implementatie van deze groep maatregelen?

Technische haalbaarheid

- Wat zijn wat u betreft aandachtspunten als het gaat om technische haalbaarheid als we kijken naar het aantrekkelijker maken van collectieve vervoersdiensten in Nederlandse steden?
- Welke succesvolle voorbeelden hiervan kent u?
- Wat waren daarbij de succesfactoren als het gaat om technische haalbaarheid? Wat zouden wat u betreft randvoorwaarden zijn voor geslaagde invoering? Welke uitdagingen ziet u?

Sociale haalbaarheid

- Denkt u dat uw inwoners deze maatregel zullen omarmen en hierdoor de auto vaker in zullen ruilen voor collectief vervoer?

Politieke haalbaarheid

- Hoe ziet u de politieke haalbaarheid van het verbeteren en innoveren van collectief vervoer in steden? Tot waar gaat die politieke haalbaarheid en waar hangt dat van af?

Voor wat betreft het aantrekkelijker maken van langzaam verkeer:

- Welke vorm of maatregel ziet u als meest gewenste implementatie van deze groep maatregelen?

Technische haalbaarheid

- Wat zijn wat u betreft aandachtspunten als het gaat om technische haalbaarheid als we kijken naar het aantrekkelijker maken van langzaam verkeer in Nederlandse steden?
- Welke succesvolle voorbeelden hiervan kent u?
- Wat waren daarbij de succesfactoren als het gaat om technische haalbaarheid? Wat zouden wat u betreft randvoorwaarden zijn voor geslaagde invoering? Welke uitdagingen ziet u?

Sociale haalbaarheid

- Denkt u dat uw inwoners deze maatregel zullen omarmen en hierdoor de auto vaker in zullen ruilen voor langzaam verkeer?

Politieke haalbaarheid

- Hoe ziet u de politieke haalbaarheid van het investeren in langzaam verkeer in steden? Tot waar gaat die politieke haalbaarheid en waar hangt dat van af?

Afsluitend

- Dan over deze maatregelen ten opzichte van elkaar. Wat is uw nummer 1-2-3 op technische haalbaarheid? Op sociale haalbaarheid? Op maatschappelijke haalbaarheid? Wat ziet u daarin als cruciale barrière?
- Welke maatregel ziet u als meest effectief?
- Hoe denkt u over het combineren van deze maatregelen in pakketten? Welke bezwaren ziet u?
- Heeft u verder nog aanvullingen die nog niet besproken zijn in dit interview?

D.1.3. Questionnaire experts in the field

Name: ……
Function: ……
Organisation: ……
Date: ……

Introductie

- Introductie en uitleg doel, achtergrond en context (Master thesis, CoSEM, TU Delft en achtergrond interviewer)
- Praktisch: Interview duur is 45 minuten, interview wordt achteraf gecodeerd, informed consent formulier
- Is het akkoord dat ik dit interview opneem en uw naam gebruik als referentie?
- Interview format: Semi-structured, eerst generieke vragen, gevolgd door vragen over de verschillende soorten van haalbaarheid (technisch, sociaal en politiek)

Generieke vragen

- Kunt u iets over uzelf, uw achtergrond en uw organisatie vertellen?
- Heeft uw ervaring of kennis van beleidsmaatregelen om steden autovrij of autoluw te maken? Zo ja, kunt u goede ervaringen noemen?
- Wat ziet u als belangrijkste resultaten als het gaat om het autovrij of autoluw maken van steden?

De drie beleidsmaatregelen worden gepresenteerd: Het beprijzen en beperken van autoverkeer; Het verbeteren en innoveren van collectieve diensten en het aantrekkelijker maken van langzaam verkeer.

- In welke mate bent u bekend met deze maatregelen?
- In welke mate heeft u ervaring met het implementeren van deze maatregelen?

Voor wat betreft het beprijzen en beperken van autoverkeer:

- Welke vorm of maatregel ziet u als meest gewenste implementatie van deze groep maatregelen?

Technische haalbaarheid

- Denkt u dat het technisch mogelijk is deze beleidsmaatregel toe te passen in Nederlandse steden of uw stad? Waarom wel/ niet?

Sociale haalbaarheid

- Denkt u dat de maatschappij zo'n soort van beprijzing zal omarmen en daardoor minder zal gaan rijden?
- Wat ziet u als bepalende factoren waarom burgers deze maatregel al dan niet zullen accepteren?

- Heeft u voorbeelden van soortgelijke maatregelen waarbij u heeft bijgedragen aan de introductie? Wat ging er goed en wat ging er minder goed, kijkend naar de acceptatie door burgers?
- Denkt u dat de maatschappelijke baten van een dergelijke interventie opwegen tegen de maatschappelijke kosten?
- Welke uitdagingen ziet wanneer het gaat om sociale acceptatie? En ziet u gelijkenissen met soortgelijke projecten die u uit heeft gevoerd?

Politieke haalbaarheid

- Denkt u dat deze maatregel politiek haalbaar zou zijn in Nederlandse steden? Waar hangt dat van af?

Voor wat betreft het verbeteren en innoveren van collectieve (vervoers)diensten:

- Welke vorm of maatregel ziet u als meest gewenste implementatie van deze groep maatregelen?

Technische haalbaarheid

- Hoe ziet u de technische haalbaarheid van het aantrekkelijker maken van collectieve vervoer in steden, is dit mogelijk? Wat is er voor nodig om dit technisch haalbaar te laten zijn?

Sociale haalbaarheid

- Denkt u dat de maatschappij door een verbetering van collectieve (vervoers)diensten de auto vaker in zal wisselen?
- Wat ziet u als bepalende factoren waarom burgers extra investeringen in collectieve diensten al dan niet zullen accepteren?
- Heeft u voorbeelden van soortgelijke maatregelen waarbij er werd geinvesteerd in collectief vervoer waarbij u heeft bijgedragen aan de introductie? Wat ging er goed en wat ging er minder goed, kijkend naar de acceptatie door burgers?
- Denkt u dat de maatschappelijke baten van investeren in aantrekkelijker collectieve vervoer opwegen tegen de maatschappelijke kosten?
- Welke uitdagingen ziet wanneer het gaat om sociale acceptatie? En ziet u gelijkenissen met soortgelijke projecten die u uit heeft gevoerd?

Politieke haalbaarheid

- Hoe ziet u de politieke haalbaarheid van het investeren in OV in steden? Tot waar gaat die politieke haalbaarheid en waar hangt dat van af?

Voor wat betreft het aantrekkelijker maken van langzaam verkeer:

- Welke vorm of maatregel ziet u als meest gewenste implementatie van deze groep maatregelen?

Technische haalbaarheid

- Hoe ziet u de technische haalbaarheid van het aantrekkelijker maken van langzaam verkeer in uw stad, is dit mogelijk? Wat is er voor nodig om dit technisch haalbaar te laten zijn?

Sociale haalbaarheid

- Denkt u dat de maatschappij door het aantrekkelijker maken van langzaam verkeer de auto vaker in zal wisselen voor een vorm van langzaam verkeer?
- Wat ziet u als bepalende factoren waardoor burgers extra investeringen in langzaam verkeer al dan niet zullen accepteren?
- Heeft u voorbeelden van soortgelijke maatregelen waarbij er werd geinvesteerd langzaam verkeer waarbij u heeft bijgedragen aan de introductie? Wat ging er goed en wat ging er minder goed, kijkend naar de acceptatie door burgers?
- Denkt u dat de maatschappelijke baten van het aantrekkelijker maken van fietsen opwegen tegen de maatschappelijke kosten?
- Welke uitdagingen ziet wanneer het gaat om sociale acceptatie? En ziet u gelijkenissen met soortgelijke projecten die u uit heeft gevoerd?

Politieke haalbaarheid

- Hoe ziet u de politieke haalbaarheid van het investeren in langzaam verkeer in steden? Tot waar gaat die politieke haalbaarheid en waar hangt dat van af?

Afsluitend

- Dan over deze maatregelen ten opzichte van elkaar. Wat is uw nummer 1-2-3 op technische haalbaarheid? Op sociale haalbaarheid? Op maatschappelijke haalbaarheid? Wat ziet u daarin als cruciale barrière?
- Welke maatregel ziet u als meest effectief?
- Hoe denkt u over het combineren van deze maatregelen in pakketten? Welke bezwaren ziet u?
- Heeft u verder nog aanvullingen die nog niet besproken zijn in dit interview?

D.2. Interview responses (coded)

Respondent A		
Achtergrond: Programmamanager Parkeren Gemeente Utrecht (namens wethouder mobiliteit, energie, groen en dierenwelzijn)		
Categorie	**Vraag**	**Gecodeerd antwoord**
Generiek	Belangrijkste resultaten	- Verblijfsklimaat aantrekkelijker maken - Slim omgaan met ruimte - Creëren goede verblijfruimte ook voor minder verkeersvaardige deelnemers
	Goede voorbeelden van beleidsmaatregelen	- Prioriteren van voetganger en fiets - Bepaalde delen slechter bereikbaar maken voor auto's (knips en knijps)
	Algemene opmerkingen	- Achtergrond Utrecht: Groeiende stad, fiets en voetganger op 1. Streven is geen toenemende automobiliteit. - In Utrecht nu vooral aandacht voor voetganger
Beprijzen en tegengaan autoverkeer		
	Kanttekeningen/ algemeen	-
	Meest gewenste vorm implementatie	- Betaald parkeren, tarifering en mogelijk prijsdifferentiatie - Beprijzen vervuilend vervoer
Haalbaarheid	Technisch	- Beprijzen vervuilend vervoer kent technische haken en ogen in classificering, goede differentiatie is nog niet mogelijk - Betaald parkeren is bewezen technisch haalbaar
	Sociaal	- Urgentie voor bewoners moet hoog genoeg zijn - Bewoners vinden soms eigen vrijheid belangrijker dan eventuele overlast - Haalbaarheid te verhogen door nadelen te compenseren - Ondernemers huiverig, denken dat economisch effect negatief is - Van tevoren zijn bewoners en ondernemers vaak negatief, achteraf regelmatig verbaasd over positieve effect
	Politiek	- Tolzone lastiger dan betaald parkeren, want betaald parkeren is al bekend. Verandering is moeilijk. - Haalbaarheid te verhogen door alternatief goed op orde te hebben. Wat krijgen bewoners terug. - Blijven lastige discussies - Hangt sterk af van politieke kleur raad en college - Manier van bekostiging speelt een rol. Als er voor elke parkeerplek die verdwijnt ruimte moet worden gezocht in begroting daalt haalbaarheid. Amsterdam heeft losstaand parkeersysteem, maakt plannen makkelijker.

Verbeteren en innoveren van collectieve diensten		
	Kanttekeningen/ algemeen	- Utrecht heeft bijzondere positie t.o.v. OV. Voor toekomst kijken hoe schaalsprong toegepast kan worden. Kiezen niet voor ontsluiten centrum zelf, maar verbeteren knooppunt rand centrum. Ringstructuur rond Utrecht.
	Meest gewenste vorm implementatie	- Deelhub/ mobiliteitshub in parkeergarages.
Haalbaarheid	Technisch	- Vergt aanpassingen, maar prima technisch haalbaar - Vooral nog onbekend, maar niet onhaalbaar - Verbeteren OV is grote opgave, o.a. door veranderen spin-structuur naar ring-structuur.
	Sociaal	- Cijfers nog niet helemaal bekend, maar gebruik is lijn met verwachting - Voorwaarde: Moet toevoeging zijn. Moet passen bij inwoners wijk. - Succesfactoren: Gemak, gebruiksgemak app, meerwaarde door bieden nieuwe vormen, simpel toegankelijk - Draagvlak is groter als mensen eigen straat als vol en onveilig ervaren.
	Politiek	- Zeer haalbaar. - Ook mede afhankelijk van rol gemeente (faciliteren) - Investeren in Schaalsprong vooral heel duur, dat staat politieke haalbaarheid soms in de weg. Overeenstemming regio in financiering belangrijk.

Verbeteren en innoveren van langzaam verkeer		
	Kanttekeningen/ algemeen	- Al jaren beleid bij Gemeente Utrecht, voetganger en fiets op 1
	Meest gewenste vorm implementatie	- Goede fietsstraten, doorfietsroutes, goede stallingsvoorzieningen, goed netwerk, etc.
Haalbaarheid	Technisch	- Succes fiets zorgt voor nieuwe technische moeilijkheden. Fiets gaat zorgen voor overlast. - Wel ruimte om technische haalbaarheid op te lossen, spreiding, shift naar voetganger. - Ruimte is beperkt. Herinrichten is belangrijk. Duidelijke keuzes maken. Steeds vaker ten koste van auto of OV.
	Sociaal	- Nu ook uitdaging om fiets naar voetganger te krijgen. Lastig, maar wel te doen door te verleiden. - Kwestie van prioriteren, logischere routes tussen herkomst en bestemming. - Gewenning heeft belangrijk negatief effect op haalbaarheid.
	Politiek	- Soms is kostentechnische haalbaarheid lastig. Nieuwe brug of tunnel is duur.

Generiek	1-2-3 qua technische haalbaarheid?	- Niet te zeggen. Gaat écht om combinatie van maatregelen. - Makkelijk starten kan niet, ook weghalen parkeervakken moet gepaard gaan met aantrekkelijk alternatief.
	1-2-3 qua sociale haalbaarheid?	- Inzetten op fiets en voetganger blijft belangrijke, en heeft hoge haalbaarheid. Vooral lastig dat binnen slow traffic ook conflicten ontstaan, reizigersstromen worden te groot.
	1-2-3 qua politieke haalbaarheid?	- Gaat écht om combinatie van maatregelen. Ook voor draagvlak in politiek is combineren van maatregelen belangrijk.
	Welk ziet u als meest effectief?	- Parkeermaatregelen, ontnemen bestemming.
	Hoe staat u tegenover combineren?	- Essentieel. Altijd in pakketten uitvoeren. - Bekostiging in pakketten kan lastig zijn, parkeerplekken weghalen haalt inkomsten weg die gecompenseerd moeten worden. - Ook binnen pakketten kunnen conflicten ontstaan, bijvoorbeeld tussen fiets en voetganger of fiets en bus. - Belangrijk voor combineren: Alternatieven op orde hebben. Keuzes durven maken. - Zoet met zuur combineren.
	Aanvullingen?	- Extra mogelijkheden vooral ook in spreiding, bijvoorbeeld via venstertijden. Minder omstreden, met goede resultaten. Met techniek kunnen we spreiding in tijd en ruimte gaan regelen. - Coronaperiode is Window of Opportunity.

Respondent B

Achtergrond: Wethouder Ruimtelijke ordening, Mobiliteit en Dienstverlening Gemeente Delft		
Categorie	**Vraag**	**Gecodeerd antwoord**
Generiek	Belangrijkste resultaten	- Leefbaarheid, leefkwaliteit, gezondheid. - Meerzijdig: Goed voor kwaliteit van leven, maar ook slim met ruimte omgaan & groeiambities kunnen faciliteren.
	Goede voorbeelden van beleidsmaatregelen	- Goede manier met ruimte omgaan, door weghalen auto ook ruimte creëren.
	Algemene opmerkingen	- Delft is nu bezig met Mobiliteitsplan. Grote update. - Niet per se op zoek naar autovrij, wel naar autoluw.
Beprijzen en tegengaan autoverkeer		
	Kanttekeningen/ algemeen	- Voor Delftse binnenstad was noodzaak laag, er was al bereidheid om in parkeergarages te parkeren.
	Meest gewenste vorm implementatie	- Tegengaan autoverkeer door beperkingen toegang binnenstad
Haalbaarheid	Technisch	- Goed haalbaar.
	Sociaal	- Draagvlak groter als burgers (positieve) eindresultaat zien - Kentering gaande. Urgentie stijgt, leefbaarheid staat onder druk dus stijgend draagvlak. - Ondernemers verwachten negatief effect dus zijn soms huiverig.
	Politiek	- Draagvlak stijgt. - Vaak ook toename extern verkeer (niet-inwoners), als dat geweerd kan worden willen bewoners ook wel wat inleveren. - Acceptatie auto neemt af, leefbaarheid staat onder druk. - Afhankelijk van framing: Verbieden auto of verbeteren leefbaarheid. Voor verbeteren leefbaarheid staan partijen open. - Iets als Corona Crisis is window of opportunity.
Verbeteren en innoveren van collectieve diensten		
	Kanttekeningen/ algemeen	- In Delft interstedelijk. Intra-stedelijk gebeurt vooral door fiets+ lopen+ auto.
	Meest gewenste vorm implementatie	- Verbeteren OV-voorzieningen (looproutes station, fietsstallen, deelfietsen)
Haalbaarheid	Technisch	- Grotendeels goed haalbaar. - Beperking zit vooral in beschikbare ruimte (zoals voor fietsenstalling) - Oplossingen bijvoorbeeld in deelfietsen.

		- Verbeteren busnetwerk met minder overstappen is lastig vanwege bestaande spin-structuur (middelpunt station).
	Sociaal	- Stijgt door Vervoer op Maat via Delfthopper, voor ouderen grote meerwaarde
	Politiek	- Kostenaspect belangrijk. Geen sluitende businesscase. - Belangrijk om leefbaarheidsbaten meer onder voetlicht te brengen - Wel wens voor fijnmaziger structuren, maar lange doorlooptijden, veel actoren betrokken

Verbeteren en innoveren van langzaam verkeer		
	Kanttekeningen/ algemeen	- Al lang beleid in Delft. Vanaf 1970 al langzaam verkeers-systeem opgebouwd.
	Meest gewenste vorm implementatie	- Ruimte maken voor fietser + voetganger, inclusief logische routes
Haalbaarheid	Technisch	- Prima haalbaar. Al lang beleid ook. - Wel soms ruimte weghalen bij auto - Corona is Window of Opportunity voor fietsstraten, ruimte voor voetganger, etc. - Soms fysieke barrières (lantaarnpaal op voetpad, uitstalling), oplosbaar, maar nog wel slag te slaan. Ontwerpen vanuit fietser/ voetganger perspectief helpt - Succes fiets brengt nieuwe problemen mee, o.a. qua ruimtegebruik
	Sociaal	- Ondernemers zijn soms huiverig voor weren auto's, maar in het algemeen zijn burgers positief - Soortgelijke mentaliteitsverandering nodig als bij auto: Fiets zomaar overal neer kunnen zetten kan niet meer
	Politiek	- Afhankelijk van kleur coalitie, nu goed haalbaar - Wel ook prijskaartje, funding vinden is lastig - Financiële aspect belangrijk onderdeel politieke haalbaarheid

Generiek	1-2-3 qua technische haalbaarheid?	- Vrijwel gelijkwaardig, afhankelijk van uiteindelijke implementatie
	1-2-3 qua sociale haalbaarheid?	- 1. Langzaam verkeer - 2. Collectieve diensten - 3. Beprijzen & tegengaan - Factoren: Als beprijzen leidt tot directe stijging leefbaarheid, stijgt sociale haalbaarheid.

	1-2-3 qua politieke haalbaarheid?	- 1. Langzaam verkeer - 2. Collectieve diensten - 3. Beprijzen & tegengaan - Factoren: Aantal gemeentes betrokken; zijn er concrete resultaten.
	Welk ziet u als meest effectief?	- Beprijzen. Maar potentieel wel negatief economisch effect.
	Hoe staat u tegenover combineren?	- Context schetsen. - Ideaalbeeld schetsen. Dan pakket maatregelen presenteren die dat kan bereiken. - Als beleidsmaker is schetsen context, toekomstbeeld en dilemma essentieel. - Focus op opbrengst, niet op wat er moet worden ingeleverd.
	Aanvullingen?	- Gebrek aan geld is beperkende factor in Delft. - Concepten als mobiliteitshubs in Delft lijken veelbelovend te zijn.

Respondent C		
Achtergrond: Professor Transportbeleid aan de Technische Universiteit Delft, faculteit Technologie, Bestuur en Management.		
Categorie	**Vraag**	**Gecodeerd antwoord**
Generiek	Belangrijkste resultaten	- Transitie doorgemaakt. - Vroeger traditionele milieuproblemen. - Tegenwoordig leefbaarheid. - Ook efficiencyverbetering m.b.t. ruimtegebruik.
	Goede voorbeelden van beleidsmaatregelen	- Richting compleet autovrij zijn harde restricties nodig. - Autovrij afdwingen via regelgeving. - Autoluw bereiken door andere mix van verkeerskundige maatregelen zoals inrichting van wegen die gebruik auto moeilijk maakt.
	Algemene opmerkingen	- Pricing en MaaS zorgen wel voor minder verkeer, maar maken stad niet autovrij. - Onderscheid pull en push maatregelen- Pull maatregelen maken in de regel een stad niet autoluw of -vrij.
Beprijzen en tegengaan autoverkeer		
	Kanttekeningen/ algemeen	-
	Meest gewenste vorm implementatie	- Sterk afhankelijk van doel. - *Eerlijkheid:* Idealiter heel NL- Landelijk systeem alle autokilometers beprijzen, schrappen motorrijtuigenbelasting. - *Weren auto's stedelijk:* Urban toll zone of verhandelbare rechten.
Haalbaarheid	Technisch	- Zeker haalbaar. Wel uitdagingen. - Factoren: - Aantal entreepunten van een stad, minder maakt het makkelijker. - Keuze voor techniek: Afweging tussen kosten, effectiviteit, fraudegevoeligheid, sociale acceptatie, toekomstige technologische innovatie. - Inningskosten kunnen hoog zijn (zoals London)
	Sociaal	- Minder rijden is gedragseffect. Beprijzen heeft effect op mobiliteitsgedrag - afname autogebruik. - Wordt niet per se ervaren als positief, maar autogebruik verandert wel. - Maatschappelijke kosten baten analyse laat vaak zien dat saldo vaak positief is, maar hangt sterk af van factoren die worden meegenomen.

		- Draagvlak hangt ook af probleemperceptie. Zou in grote steden groter kunnen zijn doordat probleem groter is en/ of wordt ervaren. - Residential self-selection. Daardoor haalbaarheid in grote steden mogelijk groter.
	Politiek	- Cruciale factor. - Perceptie die politici hebben ten aanzien van maatschappelijke haalbaarheid lijkt cruciale factor te zijn: Politici denken dat automobilisten het niet willen. - Onderwerp is gepolitiseerd, media hebben kant gekozen. - Vermeende eerlijkheidseffecten spelen rol. - Haalbaarheid kan verbeteren door te variëren met waar opbrengsten terecht komen (revenue allocation)

Verbeteren en innoveren van collectieve diensten		
	Kanttekeningen/ algemeen	- Kwaliteit en aanbod collectieve diensten NL is hoog. - Overschat belang OV in meeste steden niet. Alleen in 4 grote steden + Maastricht hoog, verder is fiets vaak veel belangrijker. - MaaS vooral als aanvulling gebruiken, zal niet zomaar reguliere stromen vervangen.
	Meest gewenste vorm implementatie	- Knelpunten m.b.t. capaciteit oplossen, als aanvulling op andere maatregelen.
Haalbaarheid	Technisch	- In het algemeen technisch haalbaar om uit te breiden. Soms fysiek niet meer haalbaar frequenties te verhogen. - Als het lastig is, is het vaak door huidig ruimtegebruik voor auto. Die kan ingewisseld. - Limiet zou zijn capaciteit transportsysteem, maar ook die limiet zou nog gecounterd kunnen worden door bijvoorbeeld auto minder prioriteit te geven.
	Sociaal	- Vraag is vertrekpunt. Veronderstel dat die vraag er al is, we lossen knelpunten op omdat er zoveel vraag naar is.
	Politiek	- Goed haalbaar. - Honing maatregel, dus haalbaarder. - Effectiviteit is betwijfelbaar. - Kostenaspect kan aandachtspunt zijn.

Verbeteren en innoveren van langzaam verkeer		
	Kanttekeningen/ algemeen	- Active modes in Nederland al zeer goed ontwikkeld - Als we willen inbreiden, moeten we van auto's naar active modes - Active modes hebben belangrijke gezondheidsbaten

	Meest gewenste vorm implementatie	- Pakket aan goedkope verkeerskundige ingrepen (VRI-afstelling, kleur asfalt)
Haalbaarheid	Technisch	- Heel goed haalbaar. - Vrijwel altijd zeer simpel. - Weinig voorstellen die technisch niet haalbaar. Bij grote fietsprojecten is financiële haalbaarheid soms lastig.
	Sociaal	- Hoog - Fietsen is bekend. Veel burgers zijn positief over fietsen. - Limiet: Als het ten koste gaat van auto soms lastiger.
	Politiek	- Hoog - Investeren is heel goedkoop - Bij grote fietsprojecten is financiële haalbaarheid soms lastig. - Lastig in steden met rechtse signatuur, met name als het ten koste gaat van auto's. Ook bij rechtse politici neemt aandacht voor fiets toe. - Beperkingen: Als ten koste van automobilist; en ondernemers zijn soms huiverig (terwijl onderzoek positief effect laat zien voor ondernemers). - Negatieve perceptie kan rol spelen.

Generiek	1-2-3 qua technische haalbaarheid?	Alle drie technisch haalbaar. - 1. Active modes - 2. Collectief vervoer - 3. Beprijzing (als geavanceerd systeem) Vooral technische hobbels, niet onoverkomelijk.
	1-2-3 qua sociale haalbaarheid?	- 1. Active modes - 2. Collectief vervoer (vooral kostenaspect) - 3. Beprijzing
	1-2-3 qua politieke haalbaarheid?	- 1. Active modes - 2. Collectief vervoer - 3. Beprijzing Sterke samenhang met sociale haalbaarheid.
	Welk ziet u als meest effectief?	- Hangt sterk af van doel. Congestiebestrijding -> beprijzing; bereikbaar houden stad -> active modes; leefbaarheid steden -> combinatie active modes met terugdringen autogebruik.
	Hoe staat u tegenover combineren?	- Zeer zeker overwegen. - Maatregelen zijn complementair! - Synergie effecten - Door combinatie push pull stijgt haalbaarheid - Uitdaging: Voorkomen hobby horses van politici. Ieder onderdeel apart wegen. - Beperking: besluitvorming wordt complexer, kans op negotiated nonsens wordt groter

	-	Uitdaging: Goede fasering van maatregelen in pakketten.
Aanvullingen?	-	Voor vergaand autoluw/ autovrij zijn deze maatregelen niet voldoende.

Respondent D

Achtergrond: Professor aan de Universiteit van Amsterdam, Faculteit der Maatschappij- en Gedragswetenschappen, Programmagroep: Urban Planning, tevens directeur Centre for Urban Studies.

Categorie	Vraag	Gecodeerd antwoord
Generiek	Belangrijkste resultaten	- Bijdragen duurzaamheid, wel in brede zin (ook daling verkeersongelukken, gezondheid mensen, grondgebruik) - Efficiënt grondgebruik met hoge kwaliteit openbare ruimte (leefbaarheid, groen, ontmoeting))
	Goede voorbeelden van beleidsmaatregelen	- Autovrije superblocks Barcelona - Leefstraten Gent
	Algemene opmerkingen	- Technologie niet genoeg om nadelen auto's op te vangen. Emissievrije auto kan zorgen dat remmen los worden gelaten, leidend tot nog veel meer problemen mbt ruimtegebruik. Autonome auto kan zorgen voor nog veel minder ontmoeting, totale cocon in stad, gaat ten koste van interactie stadsbewoners.
Beprijzen en tegengaan autoverkeer		
	Kanttekeningen/ algemeen	- Altijd als pakket invoeren, combinatie push/ pull , carrot/ stick. Altijd alternatieven geven.
	Meest gewenste vorm implementatie	- Hangt af van situatie. Kan zijn tollzone (toegang tot stad beprijzen), kan ook zijn straten autovrij maken.
Haalbaarheid	Technisch	- Haalbaar. In tal van steden al gedaan. - Voorwaarde is wel niet te kiezen voor te complex systeem, ook al is die minder perfect.
	Sociaal	- Uitdagingen: Inclusiviteit, rechtvaardigheid. Sommigen zijn afhankelijk van auto. Niet iedereen kan alternatief auto veroorloven. - Uitdaging: Gewoontegedrag en onbekendheid met alternatieven - Voorwaarden: Positieve effecten zichtbaar maken; Bieden alternatieven - Haalbaarheid verhogen door starten met experimenten
	Politiek	- Kwestie van ervaring opdoen, je moet ergens beginnen. Misschien eerst in paar steden, pas later overal. - Haalbaarheid stijgt met duidelijke koppeling opbrengsten, daarom lokale maatregel vaak haalbaarder. - Haalbaarheid verhogen door: Haalbaarheid als startpunt te nemen, waar is draagvlak voor; Eerst experimenteren; Met simpel systeem beginnen.

Verbeteren en innoveren van collectieve diensten		
	Kanttekeningen/ algemeen	- Ook denken aan 'minder reizen', thuiswerken, dichterbij werken.
	Meest gewenste vorm implementatie	- Kleinere interventies om comfort en flexibiliteit te verhogen en sterke koppeling fiets en OV.
Haalbaarheid	Technisch	- Nog verbeteringen mogelijk in bieden platform reisinformatie, maar niet onhaalbaar - Ruimtebeperking, maar is geen probleem maar bewijs succes. Oplossingen ruim voorhanden. - Beperkingen soms in maximale capaciteit huidige OV-verbindingen, technisch oplosbaar, vergt alleen grote investeringen.
	Sociaal	- Mensen stappen vooral over als auto ontmoedigd wordt, daarom zeker ook in combinatie uitvoeren.
	Politiek	- Prima haalbaar, zeker als het gaat om kleinere OV-investeringen in eerste deel keten (= voor- en natransport, kan dus ook geen OV zijn)

Verbeteren en innoveren van langzaam verkeer		
	Kanttekeningen/ algemeen	-
	Meest gewenste vorm implementatie	- Ruimte weghalen bij auto en terug te geven aan mensen.
Haalbaarheid	Technisch	- Kleine delen stad naar autovrij is prima haalbaar - Bij grootschalige verandering in hele stad: Goed nadenken over regionaal mobiliteitsnet en impact. Zorgen voor minder verkeer.
	Sociaal	- Veel draagvlak - Maatregel laat direct winst zien (ruimte voor winkelen, rust, ruimte). Daardoor haalbaarheid hoog. - Beperkende factor is dat er niet alleen winnaars zijn, ook ondernemers of mensen slecht ter been die tegen zijn. - Uitdaging: Inclusiviteit en eerlijkseffect (Ouderen die minder bezoek krijgen, mensen moeilijk ter been)
	Politiek	- Voorwaarde: Politiek leiderschap - Uitdaging: Ondernemers meekrijgen, opbrengst benadrukken.

Generiek	1-2-3 qua technische haalbaarheid?	- 1. Aantrekkelijk maken Langzaam verkeer - 2. Beprijzen auto - 3. Verbeteren collectief vervoer Idealiter in pakket. Wel afhankelijk van situatie.
	1-2-3 qua sociale haalbaarheid?	- 1. Aantrekkelijk maken Langzaam verkeer - 2. Verbeteren collectief vervoer - 3. Beprijzen auto

	1-2-3 qua politieke haalbaarheid?	- 1. Aantrekkelijk maken Langzaam verkeer - 2. Verbeteren collectief vervoer - 3. Beprijzen auto Sterke koppeling met sociale haalbaarheid
	Welk ziet u als meest effectief?	- Combinatie
	Hoe staat u tegenover combineren?	- Essentieel. Altijd in pakketten uitvoeren. - Combineren van push/ pull - Zorgen dat opbrengst (toename leefbaarheid) duidelijk wordt - Beperkende factor: Te weinig politiek leiderschap - Beperkende factor: Directe relatie kan niet altijd, soms effecten en opbrengsten pas later of elders zichtbaar. - Goede communicatie richting inwoners noodzakelijk - Voorwaarden: Schetsen brede context, op een goede manier verhaal vertellen - Combineren ook meer haalbaar door burgers meer te betrekken in keuzes en dilemma's, niet alleen vanuit individuele consument maar ook vanuit burgerschap en collectieve verantwoordelijkheid.
	Aanvullingen?	-

Respondent E

Achtergrond: Senior stedenbouwkundige bij ingenieursbureau Movares.		
Categorie	**Vraag**	**Gecodeerd antwoord**
Generiek	Belangrijkste resultaten	- Creëren leefruimte voor mensen
	Goede voorbeelden van beleidsmaatregelen	- Stad anders inrichten, focus op microbereikbaarheid
	Algemene opmerkingen	- Veel opdrachten gedaan die bijdragen aan autoluw, maar slechts weinig hadden stad autovrij maken als doel
Beprijzen en tegengaan autoverkeer		
	Kanttekeningen/ algemeen	- Maatschappij accepteert in te grote mate auto als standaard - Beprijzen is achteraf, liever vooraf slim inrichten
	Meest gewenste vorm implementatie	- Stadsdelen minder bereikbaar maken voor auto's door andere inrichting openbare ruimte
Haalbaarheid	Technisch	- Geen enkel probleem. - Belemmeringen bij tegengaan kan zijn zaken als ophalen huisvuil en hulpdiensten, maar technisch zeker niet onmogelijk.
	Sociaal	- Grosso modo draagvlak. - Wel NIMBY. Auto's mogen weg maar niet in mijn buurt. - Goede communicatie richting bewoners key. - Draagvlak afhankelijk van wijze waarop gecommuniceerd wordt. Inbedden in grotere context. - Autovrij binnensteden succesvol voorbeeld. - Voorwaarden: Consistent plan, lange termijn planning, integrale aanpak - Succes afhankelijk van urgentie
	Politiek	- Groot. Als negatieve effect auto voldoende worden gezien.
Verbeteren en innoveren van collectieve diensten		
	Kanttekeningen/ algemeen	-
	Meest gewenste vorm implementatie	- Uitvoeren als collectief vervoerspakket en als aanvulling op fiets&lopen
Haalbaarheid	Technisch	- Prima haalbaar - Idealiter geïntegreerde collectief vervoersapp. Technisch mogelijk, implementatie door integratie systemen soms lastig.
	Sociaal	- Draagvlak voor uitbreiden OV is er. Voor MaaS concepten is draagvlak opkomend. - Acceptatie hangt af van probleemperceptie, bij ervaren knelpunten stijgt draagvlak.

		- Synergie bij combinatie fiets + OV
	Politiek	- Geen partijen tégen het OV. - Kostenaspect barrière. - Te weinig harde keuzes, óf OV, óf auto. Niet beetje van beiden. - Positief effect op leefbaarheid benadrukken - Auto prioriteren is automatisme, daardoor historisch meer aandacht voor auto.

Verbeteren en innoveren van langzaam verkeer		
	Kanttekeningen/ algemeen	- Meest kansrijk - Meest haalbaar op korte termijn
	Meest gewenste vorm implementatie	- VRI's meer pro-fiets instellen
Haalbaarheid	Technisch	- Zeer haalbaar - Hoge kwaliteit huidig netwerk - Voorwaarde: Ruimte weghalen bij auto
	Sociaal	- Zeer haalbaar - AI ingebed in cultuur - Niemand is tégen fietsen - Wel vertraagd effect, dus consistent blijven investeren - Life-events belangrijk turning point - Gewoontegedrag grootste uitdaging - Uitdaging: Lobbygroepen (auto-industrie, etc) - Succesvol geïmplementeerd: Treinstations, binnensteden. Reden? Functionele opdruk groot, logisch autovrij.
	Politiek	- Zeer haalbaar - Uitdagingen: Meekrijgen ondernemers - Inzetten op lange termijn, we moeten naar nieuwe manier van denken over mobiliteit - Limiterende factors: Wenkend perspectief onvoldoende in beeld; Gewoontes te groot.

Generiek	1-2-3 qua technische haalbaarheid?	- Zijn allemaal prima haalbaar - 1. Langzaam verkeer - 2. Beprijzen & tegengaan - 3. OV systeem Kostenaspect zorgt voor lagere haalbaarheid. Vooral OV verbeteringen zijn technisch wat lastiger.
	1-2-3 qua sociale haalbaarheid?	- 1. Langzaam verkeer - 2. OV systeem - 3. Beprijzen & tegengaan Langzaam verkeer is al breed geaccepteerd. OV ook. Beprijzen komt met moeilijkheden.

	1-2-3 qua politieke haalbaarheid?	- 1. Langzaam verkeer - 2. OV systeem - 3. Beprijzen & tegengaan Langzaam verkeer want goedkoop. Investeren in OV is al bekend, combineert men makkelijk met investeren in auto & niemand tegen. Beprijzen is azijnmaatregel en politiek gevoelig.
	Welk ziet u als meest effectief?	- Auto tegengaan, weren uit openbare ruimte. Ook degene die het moeilijkst haalbaar is. - Inzetten op OV minst effectief, belangrijke drivers als reistijd, comfort, onzekerheid minimaliseren is erg lastig.
	Hoe staat u tegenover combineren?	- Combineren is noodzaak - Integraal verhaal over duurzame mobiliteit. - Uitdaging: Kijken naar tijdshorizon, wanneer wat. - Momenteel te veel losse plannetjes. Reden: Politiek te veel gefocust op oneliners en quick-fixes - Vooral ook politieke uitdagingen: Sectoraal denken binnen afdelingen gemeentes; politiek te weinig visionair
	Aanvullingen?	- Nog te veel focus op oplossen huidige verkeerskundige probleempjes -> we moeten naar integrale, gedragskundige transitie waardoor auto niet meer de standaard is maar ruimte komt voor leefbaarheid. - Nieuwbouw opgave sterker koppelen aan mobiliteit - Ruimtelijke ordening herintroduceren. Steden structureel anders inrichten, met prio voor OV, fiets, voetganger. - Uitdaging is duidelijk laten zien van samenhang tussen winst op verschillende beleidsterreinen, duidelijk toekomstbeeld en goede voorbeelden ontbreken. - Doel is niet autovrij, maar selectiever om laten gaan met auto. Dat draagt al sterk bij aan leefbaarheid.

Respondent F

Achtergrond: Adviseur mobiliteit & ruimte Goudappel Coffeng en Programma Directeur Excellent Cities		
Categorie	**Vraag**	**Gecodeerd antwoord**
Generiek	Belangrijkste resultaten	- Leefbare stad (levendigheid, kwaliteit, vitaliteit, inclusiviteit)
	Goede voorbeelden van beleidsmaatregelen	- Her-ontwerp openbare ruimte. Niet mobiliteit centraal, maar de gebruiker centraal (mens)
	Algemene opmerkingen	- Belangrijk naar totaalplaatje te kijken, niet apart naar modaliteiten, maar mobiliteit als geheel. - Autoluw of autovrij niet per se als doel stellen. Stad inrichten voor gebruiker, gevolg is waarschijnlijk minder auto's, maar doel is leefbare stad.
Beprijzen en tegengaan autoverkeer		
	Kanttekeningen/ algemeen	- Onderscheid tussen mobiliteitsmaatregelen en routekeuze maatregelen. - Beprijzen heeft weinig zin om aantrekkelijker stad te maken, vooral effectief voor modal split shift of tegen congestie
	Meest gewenste vorm implementatie	- Afhankelijk van doel. Tegen congestie: Beprijzen. Leefbare stad: afsluiten wegen.
Haalbaarheid	Technisch	- Technisch kan vrijwel alles. - Maar vooral haalbaar op later toegevoegde wegen. - Factor: Wat communiceert openbare ruimte (in functie, vorm, gebruik). Doorgangsfunctie? Dan is afsluiten lastig.
	Sociaal	- Framing is doorslaggevende factor. Afsluiten wegen = negatief. Opwaarderen omgeving = positief. - Belang omwonenden en algemene belangen goed tegen elkaar afwegen. - Vrijwel alles sociaal haalbaar, mits goed gecommuniceerd.
	Politiek	- Beperkend: Frame-en-claim gedrag politici. Door plan als pro-fiets of anti-auto te framen daalt draagvlak. - Stimulerend: Sterk verband leggen met positieve effect voor economie. - Wat helpt: Integrale aanpak met context schetsen.
Verbeteren en innoveren van collectieve diensten		
	Kanttekeningen/ algemeen	-
	Meest gewenste vorm implementatie	- Uitbreiding treinverbindingen, met name versterken hoofdnet
Haalbaarheid	Technisch	- Prima technisch haalbaar. - Knelpunt is financiële haalbaarheid.

	Sociaal	- Sociaal issue: Eerlijksheideffecten. Verbetering hoofdnet (meer gebruikt door hogere inkomens) leidt vaak tot verschraling first- en lastmile diensten (meer gebruikt door lagere inkomens). - Vaak in brede zin positief saldo/ effect. Wel dan ook effecten in heel brede zin meenemen.
	Politiek	- In toenemende mate haalbaar. - Knelpunt is financiering. Inkomsten gaan naar Rijk, die verdeelt, maar sluit niet altijd aan bij wensen gemeentes. - Uitdaging is meenemen achterban.

Verbeteren en innoveren van langzaam verkeer		
	Kanttekeningen/ algemeen	-
	Meest gewenste vorm implementatie	- Anders inrichten openbare ruime, meer verblijfskwaliteit (groen, ruimte)
Haalbaarheid	Technisch	- Zeer goed haalbaar. - Wel kwestie van maatvoering.
	Sociaal	- Hoog. - Gaat om directe leefomgeving mensen die je verbetert. - Waardering directe leefomgeving stijgt door Corona crisis (Window of Opportunity), daarmee stijgt draagvlak. - Sociaal issue: Niet iedereen heeft beschikking over fiets - Het kost tijd om uit auto-mindset te komen. - Transitie gaande: Postmoderne tijd vereist minder bezit auto, meer vraag naar mobiliteit. Langzaamaan gaan we die transitie faciliteren. - Uitdaging: Van wie is de stad: Voor groepen is scooter heel belangrijke vervoerswijze. Inclusiviteit is aandachtspunt.
	Politiek	- Hoog haalbaar. - Inclusiviteit wel waarborgen. Dus combineren met beschikbaarheid tot fiets. - Langjarige mindset verandering nodig. - Voorwaarde is maatwerkoplossing.

Generiek	1-2-3 qua technische haalbaarheid?	- 1. Versterken hoofdsysteem OV - 2. Langzaam verkeer - 3. Auto weren

	1-2-3 qua sociale haalbaarheid?	- 1. Langzaam verkeer - 2. Versterken hoofdsysteem OV - 3. Autobeprijzen/ tegengaan Vooral door breed draagvlak voor investeren in langzaam verkeer
	1-2-3 qua politieke haalbaarheid?	- 1. Langzaam verkeer - 2. Versterken hoofdsysteem OV - 3. Autobeprijzen/ tegengaan Ook door hoge acceptatie voor 1 & 2
	Welk ziet u als meest effectief?	- Herinrichting openbare ruimte meest effectief, daarna auto-maatregelen en als laatst Versterken hoofdsysteem OV
	Hoe staat u tegenover combineren?	- Noodzakelijk. OV zonder fiets leidt tot onderbenutting. Automaatregelen zonder herinrichting openbare ruimte leidt tot modal split verandering, maar weinig maatschappelijke meerwaarde. - Herinrichten vraagt om meer capaciteit OV. - Maar: Lastig. Want niet iedereen ziet verbanden en relaties. Daardoor goede communicatie nodig, inzichtelijk en begrijpbaar, afgestemd op doelgroep. - Procesmatige oplossingen nodig. Goede procesgangen, elkaars belangen goed kennen.
	Aanvullingen?	- Belangrijk goed te analyseren wat echte drivers zijn achter modaliteitsplan. Echte drivers zijn vaak economie, klimaattransitie en sociale component.

E

Analysis into effectiveness policies

In this chapter two analyses can be found. At first a comparison between cities that implemented an intervention, with cities that not did not implement that intervention. Secondly an analysis into the relation between the quality of facilities and policy of a group of measures in cities with the corresponding modal shares in those cities.

E.1. Comparison cities

First we will discuss why we choose the following cities to analyse, for the three groups of measures.

Price Measures and restraining cars

We chose to select London as city that implemented a price measure, being a congestion charge. There are multiple statistics available about this congestion charge and this is one of the successful examples of implementation. Cities to compare are quite hard to find, as London is quite unique. However, we chose to compare with a city with similar size in England, to be able to make a comparison with as many factors being the same (like U.K. culture, city size, number of inhabitants, and other metropolitan characteristics). Birmingham is the second largest city of England, and although there are numerous different, Birmingham is one of the U.K. cities that is relatively similar to London. As we have a focus on dutch Municipalities, we chose to include Amsterdam as well. Although the size is completely different, the culture is difference's, and there are many differences more, this is the Dutch city probably coming closest by.

Improvement and innovation of collective transport services

Almere is one of the Dutch cities that was built quite recently (from 1975 on). Public transport has received a lot of attention during the design of this city, partly inspired by its orientation towards Amsterdam. Discussions with experts also showed that Almere is a good example of a city with a strong design-focus on Public Transport. That's why we chose to take this city for a comparison. We compare this city with Haarlem and Tilburg, both similar in number of inhabitants. Haarlem is a city which has a similar location nearby Amsterdam. Tilburg has geographically a completely different location, but is interesting to compare as it is not part of the Randstad as well, and has other similarities as well, like the average asking price for housing (E397.000 vs E376.000).

Making low traffic more attractive

We chose to select Houten as city to compare, as Houten is known for its cycle-friendly design since long. It has the advantage of being designed with the bicycle in mind from the start, car traffic is primarily resigned to a "ring road" that encircles the area. Within this ring, a network has been established of low-speed streets meant primarily for cyclists and pedestrians. We chose Nieuwegein and Zeist as cities to compare with. Both have a similar number of inhabitants, have a similar geographical orientation, near by Utrecht, and the signature of these cities is comparable as well (many people who go for work and recreation to Utrecht but want to live in a quieter area, similar characteristics of a sub urban city). Although there are a number of differences as well, we chose to compare with these two cities as they are quite similar to Houten.

Findings analyses

In this analysis we have looked at general characteristics, like population and density; we have looked at the modal shares, and we have looked into statistics about the car ownership. Table E.1 till table E.3 show the statistics and substantiation for the cities concerning the price measures. Table E.4 till table E.6 show the statistics and substantiation for the cities concerning the collective services. Table E.7 till table E.9 show the statistics and substantiation for the cities concerning slow traffic.

London City (toll zone area)		Year	Indicator	Note	Source
Characteristics					
Population	136.000	n/a	# residents		https://en.wikipedia.org/wiki/London_congestion_charge
Area (km2)	21	2018	km2		https://theconversation.com/london-congestion-charge-what-worked-what-didnt-what-next-92478
Population density (persons/ km2)	6.500	n/a	persons/ km2	Calculated using population and area	-
Mode share for all trips					
Car (private)	19,6	2018/19	Mode share of trips by inner London residents (%)		Travel in London - Report 12 Data (https://tfl.gov.uk/cdn/static/cms/documents/travel-in-london-report-12-data.xlsx)
Public transit	37,6	""	""		""
Biking	4,4	""	""		""
Walking	38,4	""	""		""
Car Ownership					
Cars per 1000 residents	194,33	2011	Cars per 1000 residents	Calculated using Cars per household inner London (480) and average household size London	http://content.tfl.gov.uk/long-term-trends-in-travel-behaviour-cross-sectional-cohort-analysis.pdf and https://www.london.gov.uk/what-we-do/planning/london-plan/current-london-plan/london-plan-chapter-one-context-and-strategy-5
%households with access to car	43	2011	Percentage of households with access to a car or van, Inner London		https://www.london.gov.uk/sites/default/files/health_impact_of_cars_in_london-sept_2015_final.pdf

Table E.1: Statistics London

Birmingham City Centre						
Characteristics						
Population	27000		2011	# residents	Postal areas B1-B5	http://www.nomisweb.co.uk/query/asv2htm.aspx
Area (km2)	7,7		2020	Km2		https://www.daftlogic.com/projects-google-maps-area-calculator-tool.htm#
Population density (persons/ km2)	3506,5	n/a		persons/ km2	Calculated using population and area	
Mode share for all trips						
Car (private)	31,68		2011	Mode share of trips by city centre residents	No clear numbers available, these numbers are an estimation based on the limited data available in the report	https://www.birmingham.gov.uk/downloads/file/4210/bmap_green_paper_full_document
Public transit	42					
Biking	2					
Walking	24,31					
Car Ownership						
Cars per 1000 residents	289,62		2011	Cars and vans per 1000 residents	Calculated. Note: Also vans! and numbers of Ladywood, the district that largely covers the city centre	https://www.birmingham.gov.uk/download/downloads/id/4568/census_2011_key_statistics_quick_ward_profile.xls and https://www.birmingham.gov.uk/downloads/file/4589/census_2011_ks404_car_or_van_availa
%households with access to car	45,546		2011	Calculated.	Calculated. Note: These are the numbers of Ladywood, the district that largely covers the city centre	https://www.birmingham.gov.uk/download/downloads/id/4568/census_2011_key_statistics_quick_ward and https://www.birmingham.gov.uk/downloads/file/45

Table E.2: Statistics Birmingham

Amsterdam City Centre					
Characteristics					
Population	87310	2020	residents		https://nl.wikipedia.org/wiki/Amsterdam-Centrum
Area (km2)	8,04	2020	km2		https://nl.wikipedia.org/wiki/Amsterdam-Centrum
Population density (persons/ km2)	10900	2020	persons/ km2	Calculated using population and area	-
Mode share for all trips					
Car (private)	16	2016/17	Modal split per stadsdeel, percentage van alle verplaatsingen door bewoners op een gemiddelde werkdag (#trips)		Amsterdamse Thermometer van de bereikbaarheid 2019
Public transit	24	""	""		""
Biking	60	""	""		""
Walking	n/a				
Car Ownership					
Cars per 1000 residents	248,11	2019	Cars per 1000 residents	Calculated, based on number of citizens stadsdeel Centrum (86862) and Aantal Personenauto's in stadsdeel Centrum (21551)	Jaarboek Amsterdam in cijfers 2019
%households with access to car	52,6*	2015	Percentage of households owning a car	No data available for A'dam city. Generalized number, very high urbanized dutch regions.	https://opendata.cbs.nl/statline/#/CBS/nl/dataset/81845NED/table?dl=385C8

Table E.3: Statistics Amsterdam

Gemeente Almere		Year	Indicator	Note	Source
Characteristics					
Population	212.965	2020	# residents		https://nl.wikipedia.org/wiki/Almere
Area (km2)	129	2020	km2		https://nl.wikipedia.org/wiki/Almere
Population density (persons/ km2)	1650	2020	persons/ km2		Calculated
Mode share for all trips					
Car	50,0	2015	Mode share of trips (%)		OViN 2012-2015 http://www.crow.nl/documents/databestanddashboards
Public transit	12,6	""	""		""
Biking	18,0	""	""		""
Walking	19,4	""	""		""
Car Ownership					
Cars per 1000 residents	370	2014	Registered passenger cars (private) registered per 1000 inhabitants		CBS (via https://www.binnenlandsbestuur.nl/Uploads/2014/8/Personenauto.pdf)
%households with access to car	n/a				

Table E.4: Statistics Almere

Gemeente Haarlem				
Characteristics				
Population	161.265	2019	# residents	https://nl.wikipedia.org/wiki/Haarlem
Area (km2)	29	2019	km2	https://nl.wikipedia.org/wiki/Haarlem
Population density (persons/ km2)	5560	2019	persons/ km2	Calculated
Mode share for all trips				
Car	37,6	2015	Mode share of trips (%)	OViN 2012-2015 http://www.crow.nl/documents/databestanddashboards
Public transit	7,8	""	""	""
Biking	35,6	""	""	""
Walking	19,0	""	""	""
Car Ownership				
Cars per 1000 residents	359	2014	Registered passenger cars (private) registered per 1000 inhabitants	CBS (via https://www.binnenlandsbestuur.nl/Uploads/2014/8/Personenauto.pdf)
%households with access to car	n/a			

Table E.5: Statistics Haarlem

Gemeente Tilburg				
Characteristics				
Population	217.259	2019	# residents	https://nl.wikipedia.org/wiki/Tilburg_(gemeente)
Area (km2)	116	2019	km2	https://nl.wikipedia.org/wiki/Tilburg_(gemeente)
Population density (persons/ km2)	1870	2019	persons/ km2	Calcutaled
Mode share for all trips				
Car	50,5	2015	Mode share of trips (%)	OViN 2012-2015 http://www.crow.nl/documents/databestanddashboards
Public transit	3,6	""	""	""
Biking	27,3	""	""	""
Walking	18,6	""	""	""
Car Ownership				
Cars per 1000 residents	397	2014	Registered passenger cars (private) registered per 1000 inhabitants	CBS (via https://www.binnenlandsbestuur.nl/Uploads/2014/8/Personenauto.pdf)
%households with access to car	n/a			

Table E.6: Statistics Tilburg

Gemeente Houten		Year	Indicator	Note	Source
Characteristics					
Population	49.911	2019	# residents		https://nl.wikipedia.org/wiki/Houten
Area (km2)	55	2019	km2		https://nl.wikipedia.org/wiki/Houten
Population density (persons/ km2)	908	2019	persons/ km2		https://nl.wikipedia.org/wiki/Houten
Mode share for all trips					
Car	47,7	2015	Mode share of trips (%)		OViN 2012-2015 http://www.crow.nl/documents/data bestanddashboards
Public transit	3,2	""	""		""
Biking	34,1	""	""		""
Walking	15,0	""	""		""
Car Ownership					
Cars per 1000 residents	408	2014	Registered passenger cars (private) registered per 1000 inhabitants		CBS (via https://www.binnenlandsbestuur.nl/Uploads/2014/8/Personenauto.pdf)
%households with access to car	n/a				

Table E.7: Statistics Houten

Gemeente Nieuwegein				
Characteristics				
Population	63.036	2019	# residents	https://nl.wikipedia.org/wiki/Nieuwegein
Area (km2)	24	2019	km2	https://nl.wikipedia.org/wiki/Nieuwegein
Population density (persons/ km2)	2681	2019	persons/ km2	https://nl.wikipedia.org/wiki/Nieuwegein
Mode share for all trips				
Car	47,2	2015	Mode share of trips (%)	OViN 2012-2015 http://www.crow.nl/documents/data bestanddashboards
Public transit	6,4	""	""	""
Biking	27,3	""	""	""
Walking	19,0	""	""	""
Car Ownership				
Cars per 1000 residents	425	2014	Registered passenger cars (private) registered per 1000 inhabitants	CBS (via https://www.binnenlandsbestuur.nl/Uploads/2014/8/Personenauto.pdf)
%households with access to car	n/a			

Table E.8: Statistics Nieuwegein

Gemeente Zeist				
Characteristics				
Population	63.934	2019	# residents	https://nl.wikipedia.org/wiki/Zeist
Area (km2)	49	2019	km2	https://nl.wikipedia.org/wiki/Zeist
Population density (persons/ km2)	1318	2019	persons/ km2	https://nl.wikipedia.org/wiki/Zeist
Mode share for all trips				
Car	45,7	2015	Mode share of trips (%)	OViN 2012-2015 http://www.crow.nl/documents/data bestanddashboards
Public transit	4,5	""	""	""
Biking	33,5	""	""	""
Walking	16,3	""	""	""
Car Ownership				
Cars per 1000 residents	414	2014	Registered passenger cars (private) registered per 1000 inhabitants	CBS (via https://www.binnenlandsbestuur.nl/Uploads/2014/8/Personenauto.pdf)
%households with access to car	n/a			

Table E.9: Statistics Zeist

E.2. Analysis correlation quality and modal share

With use of SPSS we did an analysis into the correlations between the quality of Public Transport, cycling and walking facilities and policy in cities and the modal share of these cities. We used multiple indicators to do this; grades for the Facilities and Policy for PT, cycling and walking (assessed by CE Delft (2018b) as well as the average speed of Public Transport in the morning peak (CROW, 2015)). CE Delft (2018b) assessed 30 municipalities. The average speed and the modal shares were available for all Dutch municipalities (cities that have been merged were left out). The data can be found in table E.10. The results, including the Pearson's correlation, the corresponding p-value and sample size, can be found in table 5.7 and 5.11.

	Cijfer Wandel	Cijfer Fiets	Cijfer OV	Snelheid OV ochtendspits	% auto	% OV	% Fiets	% Lopen	% Totaal
Alkmaar	7	9	3	21,2	41,4%	4,7%	37,0%	16,9%	1
Almere	7	7	5	21,1	50,0%	12,6%	18,0%	19,4%	1
Amersfoort	7	7	7	23,8	43,6%	4,8%	34,5%	17,1%	1
Amsterdam	6	7	7	22,2	25,0%	14,3%	34,5%	26,2%	1
Apeldoorn	8	6	6	23,7	48,9%	2,2%	32,8%	16,2%	1
Arnhem	6	6	6	21,8	45,2%	7,2%	24,3%	23,3%	1
Breda	6	6	5	22,4	48,1%	3,6%	28,0%	20,3%	1
Delft	7	6	6	17,9	31,1%	9,4%	40,9%	18,6%	1
Den Bosch	6	8	7	22,2	41,4%	4,7%	35,2%	18,8%	1
Den Haag	5	6	5	24,2	46,8%	7,4%	27,2%	18,6%	1
Deventer	6	7	6	24,9	47,1%	4,2%	29,8%	18,9%	1
Dordrecht	5	6	5	20,5	53,9%	1,6%	31,2%	13,3%	1
Eindhoven	7	6	7	17,7	43,3%	3,4%	36,0%	17,3%	1
Emmen	6	6	6	23,1	29,6%	5,7%	44,5%	20,2%	1
Enschede	6	7	6	23,2	37,6%	7,8%	35,6%	19,0%	1
Groningen	6	6	7	16,1	56,1%	5,1%	11,6%	27,2%	1
Haarlem	5	5	5	19,2	43,7%	2,7%	36,2%	17,4%	1
Heerlen	6	6	7	22,7	40,8%	3,0%	35,4%	20,8%	1
Hengelo	6	8	6	22,8	30,0%	8,1%	41,2%	20,7%	1
Leeuwarden	6	4	6	17,1	43,2%	4,3%	27,3%	25,3%	1
Leiden	6	6	7	17,8	42,2%	2,6%	39,1%	16,1%	1
Maastricht	4	6	7	19,7	38,3%	5,7%	33,5%	22,5%	1
Middelburg	6	6	6	21,6	37,2%	13,8%	22,2%	26,7%	1
Nijmegen	6	3	6	22,5	37,8%	11,8%	25,1%	25,4%	1
Rotterdam	6	6	6	23,1	50,5%	3,3%	26,0%	20,2%	1
Tilburg	5	5	7	18,9	50,5%	3,6%	27,3%	18,6%	1
Utrecht	5	5	8	26,3	31,8%	10,6%	35,1%	22,5%	1
Zaanstad	7	5	5	19,5	46,9%	7,3%	27,5%	18,3%	1
Zoetermeer	6	4	4	16,5	50,9%	6,1%	23,4%	19,6%	1
Zwolle	5	5	6	25,0	36,6%	2,9%	44,5%	16,0%	1

Table E.10: Data for correlation analyses

F

Case study - Interview protocols, responses and analysis city council meeting

This section describes the interview protocol with the questions to be asked for our case study, the responses and the analysis of the city council meeting in which the Agenda Amsterdam Autoluw has been discussed and approved.

F.1. Questionnaire for case study

F.1.1. Questionnaire city officials

Name: ……
Function: ……
Organisation: ……
Date: ……

Introductie

- Introductie en uitleg doel, achtergrond en context (Master thesis, CoSEM, TU Delft)
- Praktisch: Interview wordt achteraf gecodeerd, informed consent (u mag altijd stoppen/ vragen niet beantwoorden/ etc)
- Is het akkoord dat ik dit interview opneem om het achteraf te kunnen coderen? De opname zelf wordt verwijderd
- Interview format: Semi-structured.

Generieke vragen

- Kunt u iets over uzelf en uw achtergrond vertellen?
- Op welke manier bent u betrokken geweest bij de Agenda Amsterdam Autoluw?

Specifieke vragen

Vanuit interviews met verschillende experts en betrokkenen is er een aantal issues naar voren gekomen met betrekking tot de haalbaarheid, net zoals een aantal factoren waarmee die haalbaarheid verhoogd kan worden:

Recurring issue's and increase of feasibility

	Technical feasibility	Social feasibility	Political feasibility
Issues	Spatial limitations Maximum capacities	Inclusivity (fairness issue) Differing problem perceptions Changing habits	Financial feasibility Public/ politicians' perception Framing (pro/ against)
Increase feasibility by	Exchange space allocated to car Innovative solutions (e.g. shared-mobility) Integral focus on cyclists/ pedestrian perspective	Offer supplementing features Framing (pro-liveability) Emphasise economic/ liveability benefits Good communication	Link with positive impulse for economy Framing (pro-liveability) Emphasise economic/ liveability benefits Offering good alternatives Long-term investment Revenue allocation

Table F.1: Recurring issues and How to increase feasibility, according to experts and actors

Ik hoor graag van u of u deze issues en manieren om de haalbaarheid te verhogen herkent, of u er voorbeelden van heeft, en of deze manieren in het geval van de Agenda Autoluw al dan niet werkten.

Issues
Herkent u de volgende issues, in de totstandkoming van de agenda autoluw? Heeft u voorbeelden?

- Ruimtelijke beperkingen
- Capaciteitsissues (nu al aan maximale capaciteit)
- Inclusiviteit (eerlijkheidseffect, wie profiteert?)
- Verschillende probleempercepties
- Veranderen van gewoontes
- Financiële haalbaarheid
- Perceptie van publiek / politici
- Framing (pro / tegen)
- Mist u in dit lijstje belangrijke issues, als het gaat om de haalbaarheid van zo'n pakket aan maatregelen om tot een autoluwe stad te komen?

Manieren om de haalbaarheid te verhogen
Herkent u de volgende manieren om de haalbaarheid te verhogen? Heeft dit ook effect gehad? Heeft u voorbeelden? Waarom werkte het wel/ niet?

- Weghalen van ruimte bij de auto
- Innovatieve oplossingen (bijv. deel-mobiliteit)
- Integrale focus vanuit fietsers/ voetganger perspectief
- Aanbieden aanvullende functies
- Framing (pro-leefbaarheid)
- Benadruk economische / leefbaarheidsvoordelen
- Goede/ duidelijke communicatie

- Link leggen met positieve impuls voor economie
- Aanbieden van goede alternatieven (voor auto)
- Langdurig blijven investeren in transitie
- Opbrengstverdeling (/revenue allocation, waar landen de baten)
- Mist u in dit lijstje belangrijke manieren om de haalbaarheid te verhogen, als het gaat om zo'n pakket aan maatregelen om tot een autoluwe stad te komen? Wat zijn volgens u goede voorbeelden?

Afsluitend

- Heeft u verder nog aanvullingen die nog niet besproken zijn in dit interview of wilt u zaken onderstrepen?

F.2. Interview responses case study (coded)

Respondent G

Achtergrond: Senior beleidsadviseur Openbaar Vervoer Gemeente Amsterdam	
Categorie: Generiek	
Vraag	**Gecodeerd antwoord (voorbeelden, context, waarom wel/niet)**
Op welke manier bent u betrokken geweest bij de Agenda Amsterdam Autoluw?	Mede verantwoordelijk voor uitwerken Openbaar Vervoers-maatregelen voor Agenda, al 1,5 jaar betrokken.

Categorie: Main issues		
Issue	**Issue bij Agenda?**	**Gecodeerd antwoord**
Ruimtelijke beperkingen	V	Continu dilemma's (doorstroming, verkeersveilig, groen inpassen, etc). Nu al conflicten tussen verkeersmodaliteiten. Veel ruimtelijke claims, OV is één van de velen.
Capaciteits-issues	V	Issues mbt capaciteit OV, kan verhoogd, maar dure investeringen nodig.
Inclusiviteit	V	Speerpunt van dit college, veel aandacht voor. Tegelijk breed concept, uitgewerkt in speerpunten. Belangrijk aandachtspunt.
Verschillende probleempercepties	X	Vanzelfsprekend verschillende meningen, maar in het algemeen breed draagvlak en breed gedragen perceptie dat er wat moest veranderen.
Veranderen van gewoontes	V	Zeker issue. Deel inwoners switcht makkelijk, maar groot deel moet overtuigd worden. Life-changing events zijn belangrijk moment daarin; Corona is ook Window of Opportunity.
Financiële haalbaarheid	V	Alles is maakbaar, maar financiële haalbaarheid soms lastig, zoals ongelijkvloerse kruisingen OV of metrolijnen.
Perceptie van publiek / politici	X	Lag in Amsterdam aardig op één lijn.
Framing (pro / tegen)	X	Niet echt issue. Dit is pragmatische aanpak en benadering. Ideologie valt daardoor weg. Common sense, verandering is logisch.
Mist u in dit lijstje belangrijke issues, als het gaat om de haalbaarheid van zo'n pakket aan maatregelen om tot een autoluwe stad te komen?		Samenwerking, interactie en afstemming tussen betrokken partijen kan soms issue of uitdaging zijn.

Categorie: Manieren om haalbaarheid te verhogen		
Manier	**Toege-past?**	**Gecodeerd antwoord (voorbeelden, context, waarom wel/niet)**
Weghalen van ruimte bij de auto	V	Doel 10.000 parkeerplaatsen weghalen. Moet in praktijk wel via participatie, maatwerk en gebiedsgericht, maar wel haalbaar en draagt bij.

Innovatieve oplossingen	V	Intelligente toegang tot bepaalde gebieden, idealiter naar betalen naar gebruik (tolzone) maar samenwerking Rijk noodzakelijk en nog lastig.
Integrale focus vanuit fietsers/ voetganger perspectief	V	Grote organisatie met veel afdelingen dus praktijk is soms lastig, maar er wordt gestreefd naar deze gemeente-brede integrale focus.
Aanbieden aanvullende functies	V	Belangrijk onderdeel. Niet per se concreet genoemd in Agenda maar zat al in veel bestaande beleidsdocumenten.
Framing (pro-leefbaarheid)	V	Veel focus en lukt goed. Zoals: 'Amsterdam is autoluw maar ook vooral OV-rijk'. Ook discussie geweest over naam Agenda (autoluw): Idealiter andere framing gekozen, maar weinig goede alternatieven en autoluw was duidelijk, uiteindelijk wel ook goed subtitel gekozen.
Benadruk economische/ leefbaarheidsvoordelen	V	Hangt samen met framing, veel nadruk geweest op positieve effect op leefbaarheid en wegnemen druk op de stad.
Goede/ duidelijke communicatie	V	Breed op ingezet, goed gelukt (o.a. via communicatieteam, stadsgesprekken, burgerparticipatie). Wel ook tegelijk ander 'hot topic' dat speelde, daardoor minder media aandacht.
Link leggen met positieve impuls voor economie	X	Wel wat aandacht voor, maar niet grootste verhaal. Noodzaak was ook lager, ondernemers zagen ook drukte en probleem, daarbij lijkt economisch effect van zo'n pakket voor binnenstadondernemers Amsterdam geringer dan bij kleinere steden.
Aanbieden van goede alternatieven (voor auto)	V	Vanuit wethouder veel aandacht voor gevraagd. Focus op OV-rijk. Zowel zuur als zoet, met in debat ook vooral aandacht voor alternatieven.
Langdurig blijven investeren in transitie	V	Wordt zeker gedaan. Al veel langer bezig met autoluw maatregelen, dit is vervolg en past in die lijn, zorgt op langere termijn voor omschakeling.
Opbrengstverdeling (/revenue allocation)	V	Zeker geprobeerd, zoals baten laten landen in Noord en Nieuw-West. Uitvoering soms lastiger, want rendabiliteit binnen Ring is hoger, maar wel de ambitie. Heeft ook bijgedragen aan creëren draagvlak.
Mist u in dit lijstje belangrijke manieren om de haalbaarheid te verhogen, als het gaat om zo'n pakket aan maatregelen om tot een autoluwe stad te komen? Wat zijn volgens u goede voorbeelden?		-

Categorie: Generiek	
Vraag	**Gecodeerd antwoord**
Heeft u verder nog aanvullingen die nog niet besproken zijn in dit interview of wilt u zaken onderstrepen?	Automaatregelen zijn beste OV-maatregelen. Daarom investeringen in OV gepaard laten gaan met maatregelen om autogebruik te ontmoedigen. Daarom nu ook bezig met mobiliteitsplannen voor randgebieden. Door goede automaatregelen wordt gebruik OV hoger. Uiteindelijk ook maatregelen samen op laten gaan.

Respondent H

Achtergrond: Procesmanager Agenda Amsterdam Autoluw - Gemeente Amsterdam	
Categorie: Generiek	
Vraag	**Gecodeerd antwoord**
Op welke manier bent u betrokken geweest bij de Agenda Amsterdam Autoluw?	Procesmanager Agenda Amsterdam Autoluw, inclusief volledige communicatie- en participatietraject. Nu ook betrokken bij uitvoeringsprogramma.

Categorie: Expected feasibility issues		
Issue	**Issue in Agenda?**	**Gecodeerd antwoord (voorbeelden, context, waarom wel/niet)**
Ruimtelijke beperkingen	V	Strijd om schaarse openbare ruimte in stad. Stad groeit, veel druk op openbare ruimte, gaat knellen.
Capaciteitsissues	V	Issue, maar sterk gerelateerd aan alternatieven op orde hebben; Is op te lossen door spreiding en aanbieden goede alternatieven.
Inclusiviteit	V	Mensen zijn soms afhankelijk van auto, slecht ter been, ouderen, ouders met kinderen, etc. Voor gemeentebestuur is inclusie belangrijk issue, inclusie is als randvoorwaarde gesteld. Ook zorgen vanuit bewoners dat toegankelijkheid zou afnemen, maar zo veel als mogelijk geprobeerd te waarborgen in Agenda.
Verschillende probleempercepties	V	Bewonersgroepen die soms tegenover elkaar staan, over hoe openbare ruimte in te vullen. In het algemeen echter breed draagvlak voor verminderen ruimte auto. Temporisering wel aandachtspunt, deel wil sneller, deel gaat het te snel.
Veranderen van gewoontes	V	Mensen zijn gewend aan auto. Gedragsverandering is belangrijke component. Proberen te verleiden. Life changing events belangrijk.
Financiële haalbaarheid	V	Wel issue, maar relatief kleine rol. Grote investeringsopgave, maar al ruimte voor gemaakt in coalitieakkoord en specifieke uitwerking moet nog volgen. Voor voorstellen in agenda sowieso ook al globale check op geweest, niet-haalbare maatregelen hebben Agenda niet gehaald.
Perceptie van publiek / politici	X	Wel (grote) verschillen binnen politiek en binnen publiek, maar weinig verschil tussen perceptie publiek en politici als geheel.
Framing (pro / tegen)	V/X	Wel uitdrukkelijke voor- en tegenstanders, maar zorgde in participatie juist ook voor voeding voor constructief gesprek en kritische blik op en aanscherping van Agenda.
Mist u in dit lijstje belangrijke issues, als het gaat om de haalbaarheid van zo'n pakket aan maatregelen om tot een autoluwe stad te komen?		Alle verschillende stakeholders mobiliseren. Selecte groep (vaak wit, hoogopgeleid) oververtegenwoordigd in participatie, bepaalde doelgroepen lastiger te bereiken. Daardoor mis je soms input. Opgelost door extra interviews op straat met ondervertegenwoordigde groepen.

Categorie: Manieren om haalbaarheid te verhogen		
Manier	**Toege-past?**	**Gecodeerd antwoord (voorbeelden, context, waarom wel/niet)**
Weghalen van ruimte bij de auto	V	Tussen nu en 2025 tussen 7.000-10.000 parkeerplaatsen op straat opheffen. Hierdoor ruimte vrijspelen voor ander doel (container, groen, breed fietspad). Wel flankerende maatregelen nodig (als parkeerbehoefte omlaag brengen)
Innovatieve oplossingen	V	Via zaken als deelmobiliteit, vaak ook bij last-mile oplossingen. Gekoppeld aan bieden alternatief.
Integrale focus vanuit fietsers/ voetganger perspectief	V/X	Vooral gradatie: Voetganger/ Fiets/ OV staat op één. Daarna auto. Want draagt bij aan leefbare stad.
Aanbieden aanvullende functies	V	Oog en aandacht voor, via stimuleren buurt-initiatieven, deelvervoer, huurbakfietsen en meer.
Framing (pro-leefbaarheid)	V	Autoluw geen doel an sich. We willen bereikbare en leefbare stad, dit draagt daar aan bij.
Benadruk economische / leefbaarheidsvoordelen	V/X	Leefbaarheidsvoordelen inherent aan hoofddoel. Economische voordelen genoemd, maar insteek was portefeuille verkeer en vervoer. Autoluwe stappen stimuleren goed vestigingsklimaat, maar niet hoofddoel.
Goede/ duidelijke communicatie	V	Traject van 4 maanden van communicatie en participatie met velerlei stakeholders, daardoor veel opbrengst als input voor Agenda en breder draagvlak. En participatie en communicatie gaat door binnen uitvoeringsprojecten.
Link leggen met positieve impuls voor economie	V/X	Uit gesprek met ondernemers kwam vooral bevoorrading/ logistiek naar voren als issue. In de agenda daarom ook vooral aandacht voor ondernemers door ruimte te maken voor laden en lossen, wat helpt bij meekrijgen ondernemers.
Aanbieden van goede alternatieven (voor auto)	V	Essentieel. Alternatieven moeten concurrerend worden voor auto, alternatieven zijn nog niet altijd even prettig als auto. Hierdoor gedragsverandering bereiken.
Langdurig blijven investeren in transitie	V	Agenda heeft insteek van maatregelen Nu/ Straks/ Later, maar ingebed in lange termijn visie, met stap voor stap maatregelen.
Opbrengstverdeling (/revenue allocation)	V	Stakeholders gaven aan dat er ruimte nodig is voor gebiedsgerichte aanpak. Grote verschillen tussen opgave centrum en A'dam Noord of Zuidoost. Voorgestelde gebiedsgewijze aanpak zorgt voor opbrengstverdeling daar waar die passend is. Wat opgave grootst is wel zijn maatregelen steviger, dus eerlijke verdeling van lasten (en lusten).

Mist u in dit lijstje belangrijke manieren om de haalbaarheid te verhogen, als het gaat om zo'n pakket aan maatregelen om tot een autoluwe stad te komen? Wat zijn volgens u goede voorbeelden?	- Goede temporisering, stapsgewijze aanpak. - Er was al veel bestaand draagvlak, o.a. door tijdsgeest, relatief lage autobezit Amsterdammers. - Duidelijke concrete communicatie belangrijk: Grote verschillen tussen autovrij, parkeervrij, autoluw. Stakeholders kunnen hier verschillende percepties bij hebben. - Autoluw is geen doel, maar middel voor prettige, leefbare en bereikbare stad.

Categorie: Generiek	
Vraag	**Gecodeerd antwoord**
Heeft u verder nog aanvullingen die nog niet besproken zijn in dit interview of wilt u zaken onderstrepen?	1) Autoluw is middel geen doel. We ambiëren geen autovrij, we willen stappen zetten om autoluwer te worden met als doel leefbare en bereikbare stad. Daar draagt Agenda aan bij. Maatregelpakket om footprint auto te verminderen, in zowel ruimte, uitstoot als geluid. 2) Agenda is opgesplitst in drie delen. Nu, straks, later. Stapsgewijs, kijken wat werkt en bijsturen als nodig.

F.3. Analysis city council meeting

In this case study we use the Agenda Amsterdam Autoluw as case. The city of Amsterdam came up with this comprehensive plan to make the city more carfree). Here we analyse the feasibility of a package of measures in practice, and whether our findings can be found in practice as well. Next to the interviews with policy officials we analyse the meeting of the city council regarding the debate and voting for approval of the proposal (Gemeente Amsterdam, 2020), with use of a content analysis (determination of the presence of certain words, themes, or concepts within some given qualitative data). We analysed whether our expected feasibility issues and ways to increase feasibility were mentioned or got attention in this debate, substantiated by quotes from city councillors.

Analyse raadsvergadering Gemeenteraad Amsterdam		
Categorie: Expected feasibility issues		
Issue	**In politieke behandeling?**	**Voorbeelden**
Ruimtelijke beperkingen	**V**	Ernsting (GL): "De integrale aanpak voor stadsstraten door de hele stad heen om daar meer ruimte voor fietsers en voetgangers te krijgen en een impuls te geven aan deze belangrijke straten."
		Boomsma (CDA): "Een aanzienlijk deel van Amsterdam is gemaakt voor voetgangers in alle soorten en maten, voor boten, voor paarden, voor koetsen maar niet voor auto's. En die auto's leggen een te groot beslag op de schaarse openbare ruimte. Dat gaat ten koste van de leefbaarheid en van de schoonheid."
		Vroege (D66): "(..) zijn er toch daadwerkelijk problemen in de binnenstad van Amsterdam. Het is druk; er is geen ruimte voor de fietsers; er is geen ruimte voor de voetgangers en dat willen we allemaal wel."
		Ernsting (GL): "De druk op het gebied is gewoon te groot. Er zijn teveel auto's en teveel fietsers voor de beperkte infrastructuur dus je zult iets moeten doen aan de infrastructuur."
Capaciteitsissues	**X**	
Inclusiviteit	**V**	Van Lammeren (PvdD)(over beprijzing): "Dat is pure lastenverzwaring waarbij mensen die het kunnen betalen, wel met de auto naar de stad gaan – wat niet goed is – en de mensen die het niet kunnen betalen, dus wel worden geweerd door u."
		Van Soest (Partij van de Ouderen): "Ik ben blij dat wethouder Kukenheim er ook is als wethouder Ouderenbeleid. (…) Wij hebben Age friendly city aangenomen. Mijn vraag aan u is, is die getoetst aan deze voorstellen?"
		Boomsma (CDA): "Tegelijkertijd worden auto's steeds schoner en zijn er nog altijd veel mensen die die auto nodig hebben en ervan afhankelijk zijn."
Verschillende probleempercepties	**X**	Ceder (CU): "De stad moet autoluwer. Ik denk dat bijna alle partijen het daarover eens zijn."
		Van Lammeren (PvdD): "De insteek (van de agenda) is prima. We zitten gewoon in een verdichtende stad en dat betekent dat je meer rekening met elkaar moet houden en dat je ook de stad in beweging moet houden."
		Marttin(VVD): "Ik heb de afgelopen periode heel veel berichten ontvangen van bezorgde Amsterdammers en bewonersgroepen."
		Boutkan (PvdA): "Ik constateer dat flink wat Amsterdammers die ik heb gesproken en die hier hebben ingesproken, wat harder zouden willen gaan dan deze Agenda en soms ook wat harder dan wellicht mogelijk is. Maar ik constateer ook dat er heel veel draagvlak is in

		deze stad om het sentiment, om die dominantie van de auto terug te dringen."
Veranderen van gewoontes	**X**	Marttin (VVD): "Wij willen mensen dus verleiden tot ander gedrag en dat bereik je onder andere door de alternatieven positiever te maken."
Financiële haalbaarheid	**V/X**	Boomsa (CDA): (over de bouw van ondergrondse parkeergarages) "Je zou bovengronds echt ruimte kunnen winnen door meer ondergronds te creëren. Hoewel dat duur is in Amsterdam, denk ik dat het dat meer dan waard is."
		Motie Van Lammeren (PvdD): "Verzoekt (..) de gevolgen van Amsterdam Autoluw in kaart te brengen voor de huidige en nog te bouwen parkeergarages op verwachte bezetting (bezoekers en abonneehouders) en de daarbij behorende financiële effecten op o.a. de exploitatie en eventuele gevolgen voor de financieringskosten in beeld te brengen."
Perceptie van publiek / politici	**V**	Wethouder Van Doorninck: "Wat ik heel mooi vind om te merken, is dat ook het idee van een autoluwe stad om welke reden dan ook – het is luchtkwaliteit of ruimte, meer fietsen of meer spelen – heel breed wordt gedragen in de raad en in de stad."
		Ernsting (GL): "Bewonersorganisaties zeggen eigenlijk, het kan beter en het kan sneller. Ze willen autoluw beter en sneller en ze zeggen dat het volume van het totaal aantal auto's omlaag moet door alleen nog bestemmingsverkeer in de stad te laten komen. Ook in de commissiebehandeling vorige week, een mooie vergadering, bleek dat door de oppositie ook een aantal uitgangspunten werd gedeeld."
Framing (pro / tegen)	**V**	Vroege (D66): "Een briljant plan van wethouder Dijksma."
		Kreuger (FvD): "Het tweede is en daarover hebben we het gehad, dat is het plunderen van het Stedelijk Mobiliteitsfonds door de PvdA, door D66, door GroenLinks en door de SP. Die hebben allemaal bezuinigingen doorgevoerd op kwetsbare buurten."
		Marttin(VVD): "Als Amsterdamse VVD vinden wij de Agenda Autoluw eerlijk gezegd een set maatregelen zonder overkoepelende visie. De focus van het bestuur ligt op het wegjagen van de auto."
		Kreuger (FvD): "Voor de rust, ruimte en het tuintje van de een moet de ander bloeden, keihard bloeden. En hoewel iedereen dat stiekem weet, kiest het college bestaande uit GroenLinks, D66, de PvdA en de SP er bewust voor de andere kant op te kijken."
		Ernsting (GL): "Het is logisch dat die partijen er ook zo in staan, want van links tot rechts weet eigenlijk iedereen in Amsterdam wel dat in een verdichtende stad voor auto's steeds minder plek is."

Categorie: Manieren om haalbaarheid te verhogen		
Manier	**In politieke behandeling?**	**Voorbeelden**
Weghalen van ruimte bij de auto	**V**	Boomsma (CDA): "Het is goed nu echt stappen te gaan zetten om die ruimte terug te winnen voor groen, spelen, fietsen en wandelen en daarover is ook brede overeenstemming in de raad."
		Ernsting (GL): "Toen ik paar jaar geleden begon over het opheffen van 10.000 parkeerplaatsen voor meer ruimte voor mensen, werd ik meewarig aangekeken (…) en nu is het beleid."
		Ernsting (GL): "De pilot voor de knip in de Weesperstraat, de parkeermaatregelen, 10.000 parkeerplekken weg, al die ruimte wordt teruggegeven aan de Amsterdammers."
Innovatieve oplossingen	**V**	Marttin(VVD): "De slimme innovatieve oplossingen. Wij willen namelijk heel graag dat we niet alles zo maar afsluiten, dat we niet een harde knip maken, dat we niet de problemen verleggen naar andere straten. Wij willen dat het verkeer zich beter spreidt en dat kun je doen op allerlei innovatieve wijzen. We hebben daarvoor een paar suggesties in onze laatste motie."
		Motie Marttin(VVD): "Verzoekt het college van burgemeester en wethouders: - straten in Amsterdam niet definitief door te knippen en zo de drukte te verplaatsen maar gebruik te maken van innovatieve oplossingen om verkeer te sturen en hiermee de drukte te verspreiden; voor het reguleren van de verkeersstromen tevens te kijken naar innovaties(..)"
		Motie Marttin(VVD): "Verzoekt het college (..) in te zetten op het creëren van deelmobiliteithubs met een volledig en hoogwaardig aanbod van verschillende vormen van deelmobiliteit"
Integrale focus vanuit fietsers/ voetganger perspectief	**X**	Ernsting (GL): "De integrale aanpak voor stadsstraten door de hele stad heen om daar meer ruimte voor fietsers en voetgangers te krijgen en een impuls te geven aan deze belangrijke straten."
Aanbieden aanvullende functies	**X**	
Framing (pro-leefbaarheid)	**V**	Vroege (D66): "Dus het is niet alleen goed voor de duurzaamheid, voor de bereikbaarheid, maar ook voor de gezondheid van onze kinderen en van onze toekomstige Amsterdammers."
		Wethouder Van Doorninck: "Wat ik heel mooi vind om te merken, is dat ook het idee van een autoluwe stad om welke reden dan ook – het is luchtkwaliteit of ruimte, meer fietsen of meer spelen – heel breed wordt gedragen in de raad en in de stad."
		Ernsting)GL): "Er is voor het eerst een Agenda Autoluw, een pakket maatregelen om meer ruimte vrij te spelen die voor

		iedereen toegankelijk is, voor schonere vervoersmiddelen, voor fietsers en voor voetgangers en voor meer inclusiviteit, voor jonge en oude mensen die zich vrijer en veiliger kunnen voortbewegen. Meer OV, sneller OV, goedkoper OV, het staat erin."
		Boomsma (CDA): "Het is goed nu echt stappen te gaan zetten om die ruimte terug te winnen voor groen, spelen, fietsen en wandelen en daarover is ook brede overeenstemming in de raad."
Benadruk economische / leefbaarheidsvoordelen	**V**	Ernsting (GL): "Er is voor het eerst een Agenda Autoluw, een pakket maatregelen om meer ruimte vrij te spelen die voor iedereen toegankelijk is, voor schonere vervoersmiddelen, voor fietsers en voor voetgangers en voor meer inclusiviteit, voor jonge en oude mensen die zich vrijer en veiliger kunnen voortbewegen."
Goede/ duidelijke communicatie	**V**	Wethouder van Doorninck: "Dat pakket maken we dus ook samen met de bewoners voor wie we speciale avonden gaan organiseren en waarbij we kijken wat er allemaal nodig is."
		Boomsma (CDA): "Maar dat heb je sowieso altijd wel. Ik denk dat het belangrijk is duidelijkheid te scheppen. Dus dat je duidelijk maakt dat die stad er in de eerste plaats is voor mensen die er wonen of werken."
Link leggen met positieve impuls voor economie	**X**	
Aanbieden van goede alternatieven (voor auto)	**V**	Vroege (D66): "De Agenda Autoluw is nadrukkelijk de wortel en de stok. We bieden alternatieven goedkoop aan de rand van de stad, maar we beprijzen ook zodat het gebruik van de openbare ruimte moet worden betaald met de prijs die het waard is."
		Boutkan)PvdA): "Als je een goed alternatief wilt hebben voor autoluw, dan vind ik ook dat je een betaalbaar alternatief moet hebben namelijk via het openbaar Vervoer."
		Boomsma (CDA): "Tot slot, voorzitter. Als we willen dat Amsterdammers de auto laten staan, heb je wel de zware plicht om de alternatieven daadwerkelijk aantrekkelijk te maken."
Langdurig blijven investeren in transitie	**V**	Ernsting (GL): "Het bijzondere namelijk is dat ook de stad een enorme ommekeer heeft gemaakt. Waar voorheen de teneur nog wel eens was bij dit soort maatregelen dat vooral de auto toch alle ruimte moest blijven houden, is dat nu precies andersom."
Opbrengstverdeling (/revenue allocation)	**V**	Van Lammeren (PvdD): "In dit plan is niet elke Amsterdammer even belangrijk, ten minste, als ik kijk naar de gevolgen. (…) Maar mensen in Kattenburg, mensen in de Diemerstraat, mensen aan de S 100 hebben te lijden als dit plan zo doorgaat."
		Kreuger (FvD): "Wij vinden dat niet alleen de gemiddelde leefbaarheid moet verbeteren, maar dat voor iedereen de leefbaarheid moet verbeteren. Dat is wat er aan de hand van deze Agenda absoluut niet gebeurt."

	Wethouder van Doorninck: “Toen is ook gezegd dat we voor die buurten die last gaan krijgen van maatregelen op een andere plek, mitigerende maatregelen zouden gaan nemen.”

Cities have the capability of providing something for everybody,
only because, and only when, they are created by everybody.

– Jane Jacobs, The Death and Life of Great American Cities

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