# Success factors and barriers in car reduction

## Lessons from European cities

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TU Delft

TNO innovation for life

# Success factors and barriers in car reduction

by

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# Preface

This thesis marks the end of my study in Complex Systems Engineering and Management at Delft University of Technology. It also concludes my time as a student in Delft, which I have very much enjoyed. In the past months, I have learned a lot and would like to thank the people who have helped me in the journey of my graduation.

I would very much like to thank my supervision committee for their trust and support from the very beginning till the end. They have always been happy to make time, were ready to answer any questions I had, and supported me in facing the challenges I ran into. They assisted me in finding the direction of my thesis and determining the research problem this thesis addresses. My first supervisor, Wijnand Veeneman, has provided me with great advice and lots of help during the entire process. Wijnand, from earlier experience, I knew about the guidance you give, and I am very happy it grew even further for my MSc thesis. My second supervisor, Jan Anne Annema, was also always available for questions and helped me think about the research I was doing and alternative directions I could pursue.

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Finally, I very much want to thank my parents, friends, and girlfriend for the past months when I was writing my thesis and during my entire academic career. Over the past months, your company and feedback helped me turn my thesis into what it is now. Over my time as a student, you ensured that I always thoroughly enjoyed myself. While I look back at an amazing time in my life, I am excited for what the future will bring.

*J.C.T. van der Lee*
*Delft, April 2024*

# Summary

Though cars have become ingrained in society, their usage comes at a cost for cities and their residents. Many cities are implementing measures to achieve goals related to livability, such as climate change reduction, air quality improvements, improved living space, improved health and safety and reduced costs. Policies at the local, national, and supranational levels affect the measures that cities can take. This thesis addresses the challenges cities face in implementing car-reducing policies.

Achieving the goals for which local governments are implementing car-reducing policies requires transformational adaptation. This system-wide radical change increases a system's ability to deal with future uncertainty. However, it is challenging for policymakers to destabilize existing regimes. Answering governance questions related to context, power, resources, and legitimacy can help fill the research gap regarding real-world policy examples and aid in the transition towards sustainable mobility. This thesis proposes a framework based on theory and practice to address the challenges that policymakers may face in policy implementation.

Many different car-reducing measures have been implemented across Europe, of which an overview is presented in Table 1. Little is known about the success or failure in the implementation of these measures (Marsden & Reardon, 2017).

**Table 1:** Table: overview car-reducing measures

| Type | Measure | Type | Measure |
|---|---|---|---|
| **Regulation** | **Low emissions zone** | **Land-use planning** | **Multiple centres** |
| | Limited traffic zones | | Division into sections |
| | Car-free zones | | Parking minimums and maximums |
| | Lowering the speed | | Remote parking and shuttle |
| | Parking regulations | Infrastructure | Infrastructure for active mobility |
| Pricing | Congestion charge | | Shared micro-mobility |
| | Distance-based pricing | | Shared cars |
| | Toll roads | | Multi-modal planners |
| | Mobility credits | | Quality of public transport |
| | Parking pricing | Marketing, education, information | Information campaigns |
| | Public transport fare reduction | | |

The main research question this thesis addresses is:

> *What success factors and barriers in the implementation of car-reducing measures are present in European cities, and what are the implications for European cities of the scale of Amsterdam?*

Amsterdam is the reference case selected to contextualise the results of this thesis. It is known as a progressive city in car reduction and has ambitious car-reducing goals. Case studies in cities with comparable population sizes, namely Copenhagen, Barcelona, Bremen, and Milan, with considerable experience in car-reducing measures, provide new insights for policymaking. Understanding the context in which a policy operates has shown to be essential in its success and/or failure.

The leading measure for Copenhagen is the Cycle Superhighways network they have built to connect Copenhagen with the surrounding municipalities, to increase commuter cycling. The Superblock project in Barcelona and the Open Squares project in Milan transform their cities into low-car livable areas. In Bremen, car-sharing reduces the need for privately owned cars.

The main barriers in the implementation are explored with stakeholders involved in policymaking and these cities are shown in Table 2.

**Table 2:** Overview barriers in summary

| Barrier | Definition | Source |
|---|---|---|
| Policy and institutional | Different interests of stakeholders conflict. | (Banister, 2004b; Maat & Louw, 1999) Interviews Mi3, Ba1, Ba2, Br2, Br3 |
| Legal | Existing legal frameworks can cause difficulty in implementing measures. | (Banister, 2004b; Maat & Louw, 1999) Interviews Mi2, Ba1, Ba2, Ba3, Co1, Co2, Br1, Br2, Br3 |
| Resource | A lack of resources, both financial and otherwise, can hinder implementation. | (Banister, 2004b; Maat & Louw, 1999) Interviews Mi1, Mi2, Mi3, Ba2, Ba3, Co1, Br2 |
| Social and cultural | Low societal acceptance of the measure results in political resistance. | (Banister, 2004b; Maat & Louw, 1999) Interviews Mi1, Mi2, Mi3, Ba1, Ba2, Ba3, Co1, Co2, Br1, |
| Path dependence & lock-in | Lock-in can be created when routines, infrastructure or assumptions cause the existing path to be followed. | (Banister, 2004b; Maat & Louw, 1999) Interviews: Mi1, Mi3, Ba2, Ba3, Co1, Br2, Br3 |

Eight different success factors have been identified to overcome the barriers and successfully implement their policies. Six originate from the literature and were confirmed in the interviews. The two final success factors of ‘the inarguability of schools’ and ‘the undeniability of hard evidence’, as presented in Table 3, emerged during the interviews.

**Table 3:** Overview success factors in summary

| Success factor | Definition | Source |
|---|---|---|
| Combining sticks and carrots | Policymakers increase societal acceptance of a measure that is experienced negatively by including measures that are experienced positively. | (Sørensen et al., 2014) Interviews Mi3, Ba2, Br1 |
| Showing openness and flexibility in negotiations | Policymakers are open to changes in implementing the measure to increase acceptability. | (Sørensen et al., 2014) Interviews: Mi1, Mi2, Mi3, Ba1, Ba2, Ba3, Co1, Co3, Br1, Br2, Br3 |
| Trials to create legitimacy and acceptance | Demonstrating the measure in a pilot creates experience with the measure. | (Sørensen et al., 2014) Interviews Mi1, Mi2, Mi3, Ba1, Ba2, Ba3, Br1, Br2, Br3 |
| Applying communications strategically | Carefully thinking about what is communicated, how and by who, changes how people perceive the measure. | (Sørensen et al., 2014) Interviews Mi3, Ba1, Ba2, Ba3, Co1, Co2, Br1, Br2, Br3 |
| Timing and windows of oppportunity | A measure can only be implemented at the right moment when all streams align. | (Sørensen et al., 2014) Interviews Mi1, Mi2, Mi3, Ba1, Ba2, Ba3, Co1, Co2, Br2, Br3 |
| Organising responsibility and set-up | Sometimes a new working unit helps to implement the measure. | (Sørensen et al., 2014) Interviews Mi1, Mi3, Ba1, Ba2, Ba3, Co1, Co2, Br2, Br3 |
| The inarguability of schools | Resistance around unpopular measures reduces if the health and safety of children improves. | Interviews Mi1, Ba1, Ba2, Ba3 |
| The undeniability of hard evidence | Publishing data about the effectiveness of a measure increases acceptance. | Interviews Mi2, Ba1, Ba2, Co1, Co2 |

These stakeholders identified the links between these factors and barriers, as shown in Figure 1 and how the success factors can reduce the barriers. Figure 1 shows that the success factors of 'showing openness and flexibility' and 'pilots/trials to create legitimacy' can lower most barriers. Combined, these success factors can influence all barriers and are, therefore, most important.

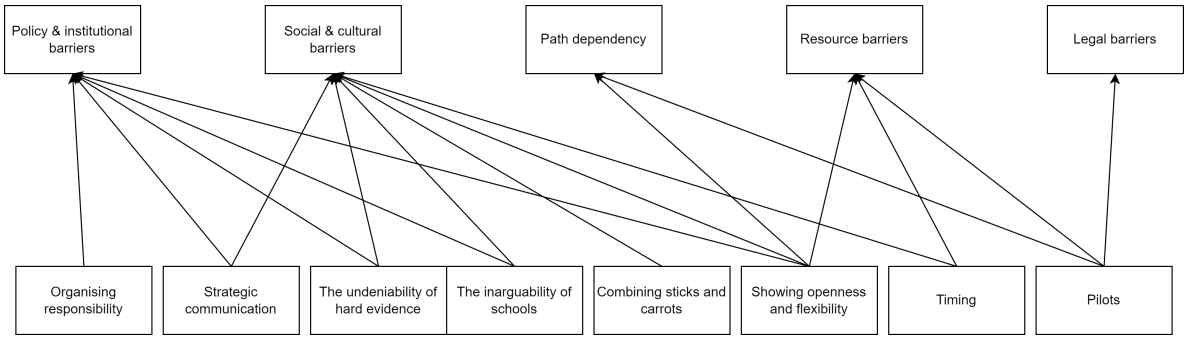


**Figure 1:** Links from success factors

The analysis of the case studies and the comparison with the literature results in lessons for cities looking to implement car-reducing policies. An in-depth analysis is performed for Amsterdam, looking at the success factors and barriers present in implementing their 'low-car agenda'. Three main lessons of the studied cases stand out for Amsterdam. The first is to have a more structured approach to collecting proposals for neighbourhood redesign and implement them tactically so fewer resources are needed. The second is to begin such transformations in school communities. The third is to create, identify and utilise windows of opportunity more.

For other cities looking to implement car-reducing policies, four general lessons have been determined:

1. Continuously explore new possibilities for policymaking.
2. Be aware of the context and stakeholders' needs to select appropriate measures and adjust them according to the context.
3. Create and identify windows of opportunity and be ready when that window opens.
4. Test new measures before implementing them permanently to select the optimal location and collect data on the measure's impact.

The four general lessons are closely related to the three-streams model by Kingdon and Stano (1984). Comparing the lessons with the model and making them more concrete helps policymakers to contextualise them. For the first lesson, the goal is to determine the policy stream and contact European cities with experience with achieving the goals set out by policymakers. The second lesson is related to the problem stream and the context needed to explore new possibilities. This is formed by organising events to involve all stakeholders, including citizens, before and during the implementation phases. In the third lesson, the streams are combined, forming a window of opportunity. This is achieved by being watchful of opportunities and a quick response. Finally, the newly designed measures should be tested to experience the effects of implementation. Data about the effectiveness of the intervention should be gathered.

This thesis adds to the literature of real-world policy examples and includes issues of governance that policymakers may run into. The novelty is in the framework of success factors and barriers, based on the experiences of Western European cities with a population size similar to that of Amsterdam. It develops lessons for policymakers seeking to implement such policies that can directly be used to address the challenges faced during implementation.

Determining the generalizability of case studies can be challenging. Though the framework used in this research is based on literature and empirical research, further research on the connections between the success factors and barriers can increase the validity. Also, an analysis of the influence of

the category of stakeholders on the analysis may be valuable.

In conclusion, the framework of success factors and barriers proposed in this thesis can be used by policymakers to address the challenges they may face in policy implementation. Using the framework and the four general lessons during the design of their policies, may significantly reduce the barriers they face and ensure successful implementation.

# Contents

# Glossary

## Framework of success factors and barriers

**Table 4:** Overview success factors

| Success factor | Definition |
|---|---|
| Combining sticks and carrots | Policymakers increase societal acceptance of a measure that is experienced negatively by including measures that are experienced positively. |
| Showing openness and flexibility in negotiations | Policymakers are open to changes in implementing the measure to increase acceptability. |
| Trials to create legitimacy and acceptance | Demonstrating the measure in a pilot creates experience with the measure. |
| Applying communications strategically | Carefully thinking about what is communicated, how and who can change how people perceive the measure. |
| Timing and windows of oppportunity | A measure can only be implemented at the right moment when all streams align. |
| Organising responsibility and set-up | Sometimes a new working unit can help to implement the measure. |
| The inarguability of schools | Resistance around unpopular measures reduces if the health and safety of children improves. |
| The undeniability of hard evidence | Publishing data about the effectiveness of a measure can increase acceptance. |

**Table 5:** Overview barriers

| Barrier | Definition |
|---|---|
| Policy and institutional | This barrier arises when the different interests of stakeholders result in conflict. |
| Legal | Existing legal frameworks can cause difficulty in implementing measures. |
| Resource | A lack of resources, both financial and otherwise, can hinder implementation. |
| Social and cultural | This barrier arises when societal acceptance of the measure is low, also resulting in political resistance. |
| Path dependence & lock-in | Lock-in can be created when routines, infrastructure or assumptions cause |

# 1 Introduction

The twentieth century has been described as the century of the car, and the car has become ingrained in most Western countries (Gilroy, 2020). Cars provide the highest mobility share and have brought increased mobility and economic prosperity (Khreis et al., 2016). However, their usage comes at a cost for cities and their residents, especially with respect to livability. The challenge for local governments is to balance accessibility and livability. Many cities have implemented measures restricting car use, and many more are looking to implement measures for the same purpose. This chapter introduces why cities are implementing car-reducing measures and on which policy levels these measures can be implemented. This leads to the research problem, the research questions, the approach and the thesis structure.

## 1.1. Why reduce the number of cars?

The goal of implementing car-reducing measures is, in fact, not to reduce the number of cars but to achieve one of many goals related to 'livability'. The definition of this term is controversial and used in many different settings. In the most literal form, it means suitability for human living (Ahmed et al., 2019). Car usage is also related to social inequality as low-income people, women and children are most negatively affected by a car-centred transportation system. Lack of transportation makes accessing employment and other basic necessities difficult, and a dependency on motorized transport makes independent movement difficult for children (Pettinga et al., 2009). There are several frequently mentioned goals that can be achieved by reducing the number of cars while focusing on livability. These are climate change, air quality, improved living space, and health and safety.

### 1.1.1. Climate change

Human-induced climate change has caused global warming beyond natural variability. The current increase of 1.1 degrees Celsius has caused losses and damages to nature and people, with the most vulnerable people being disproportionally affected. Global warming reaching 1.5 degrees Celsius will have irreversible impacts on human and natural systems, with the risks becoming more severe at 2 degrees Celsius (Intergovernmental Panel on Climate Change (IPCC), 2023). To keep the increase in temperature well below 2 degrees Celsius, 196 Parties adopted the legally binding international treaty on climate change known as the Paris Agreement (United Nations Climate Change, n.d.). The European Union aims to be climate-neutral by 2050 to achieve the goals set out under the Paris Agreement. As part of the EU strategy, EU Member States must develop long-term national strategies to reduce greenhouse gas emissions. One important sector responsible for a significant share of emissions is mobility. Transport emissions represent around 25% of the EU's total greenhouse gas emissions, of which road transport accounts for 76% (European Environment Agency, 2023c; European Environment Agency, 2023b). The requirement for member states to reduce emissions and the high share that mobility has in those emissions, shows one of the reasons that many cities are implementing car-reducing measures.

### 1.1.2. Air quality

Emissions from road transport have other negative effects besides global warming. European cities currently face high levels of air pollution. 96% of the European urban population is exposed to levels of fine particulate matter that exceed the WHO guidelines. According to the European Environment Agency (2022), 238,000 people died prematurely in 2020 in the EU due to air pollution. Air pollution also causes various medical conditions, such as heart, lung and respiratory diseases (World Health Organization, 2022). Urgent action needs to be taken to reduce further emissions (Sicard et al., 2021). Though tailpipe emissions resulting from a combustion engine are most known and regulated, tyres and brakes emit a higher percentage of particle emissions. Combined, they are responsible for 52% of the annually produced particle emissions. Globally, this is 6.6 million tonnes, of which 82% finds its way into water and 18% into the air (Tan et al., 2023).

### 1.1.3. Improved living space

Though the issues related to emissions from the engine are likely to reduce with emission standards becoming stricter and the number of electric cars increasing, car usage has other negative effects. Traffic causes noise pollution. Though that noise will slightly reduce if electric cars replace combustion engines, most of the noise above speeds of 30-50 km/h comes from tyres rolling on pavement (Maffei & Masullo, 2014). These traffic-related noise levels have been shown to result in psychological and medical conditions (Khreis et al., 2016). Fritschi et al. (2013) find that over a million healthy life years are lost every year from traffic-related noise in the western part of Europe. However, if space that is currently dedicated to road infrastructure is used for green space, many health benefits can be achieved (Lee & Maheswaran, 2011). In fact, increased availability of green space within a municipality may contribute to a reduction in antidepressant prescriptions (Helbich et al., 2018).

### 1.1.4. Health and safety

Road traffic injuries are expected to be the seventh leading cause of death by 2030 worldwide (World Health Organization, 2018), and within the European Union, 20,600 people were killed in road crashes in 2022. Though this shows a decrease compared to 2019, more must be done to reach the UN target of halving the number of road deaths by 2030 (European Commission, 2023c). Physical inactivity resulting from less active travel is another cause of significant health problems and maybe the biggest public health problem of the 21st century (Blair, 2009) resulting in 2.1 million global deaths annually (Forouzanfar et al., 2015) and many medical issues (Blair, 2009). Switching to active modes of transport will provide substantial health benefits (Mueller et al., 2015).

### 1.1.5. Reduced cost

The high costs of cars for both the owner and society are often underestimated by policymakers and car owners (Gössling et al., 2022). In fact, consumers estimate that their cost is nearly half of the actual cost, and Andor et al. (2020) conclude that if drivers knew the true cost of driving, it would reduce car ownership by 37%. Gössling et al. (2022) estimated the costs for different types of vehicles in Germany and discovered that the cost for society, compared to that for the owner, ranges from 29-41%, or 11,000 - 18,000 euros annually. This includes, among others, the infrastructure cost, parking and pollutants. It does not include the cost of wasted time for commuters in congestion. The cost for inefficiencies in urban mobility, particularly traffic congestion, has been estimated at 110 billion euros per year for the EU (European Court of Auditors, 2019). The total costs, including all external costs and infrastructural costs, are estimated at 375 billion euros per year (CE Delft, 2019). Addressing the inefficiencies that result from car use can save society a significant amount of money.

## 1.2. Levels of policy

Policies regarding car usage can be made on various governmental levels. The MSc research on which this thesis reports is part of the XCARCITY project in which the cities of Amsterdam, Rotterdam and Almere participate. Amsterdam is used as a reference case in this thesis, as it is deemed exemplary for many other cities. The project is discussed in more detail in Section 1.2.3. This section describes the different governmental levels on which policies can be implemented to discover which decisions can be made on each level and which decisions have already been made.

### 1.2.1. Supranational level: Europe

The main power of the European Union relevant to this thesis is the legislative power. With this power, the EU can make regulations to which the nations must adhere, or they can make directives stating the goals they need to reach. Nations can make their own legislation necessary to reach these goals (European Parliament, n.d.). The goal of being climate-neutral by 2050 is an example of a regulation. It addresses the goal and the steps needed to achieve that goal (European Commission, 2023a). Another example of a regulation relates to the European emission standards. Standards for passenger and heavy-duty vehicles are regularly updated to achieve a 100% reduction for cars and vans from 2035. To check if manufacturers adhere to this legislation, the European Commission collects data on cars and vans using onboard fuel consumption monitoring devices to decrease the gap between lab and real-world emissions. If manufacturers exceed their emission targets, they have to pay an excess emissions premium for each new vehicle that does not meet the requirements (European Commission, 2020). An example of a European directive is the fuel quality directive. It establishes minimum requirements for several pollutants with the requirement to monitor and report these values but does not specify how these should be met (European Commission, 2023b).

### 1.2.2. National level: the Netherlands

Besides implementing laws to meet European directives, countries can set their own goals and implement legislation. In the Netherlands, new laws begin in the House of Representatives and require approval from a relevant committee and the Senate. The Netherlands has implemented various laws. Examples of these are the $CO_2$ tax for industry and the Dutch Climate Act (Ministerie van Algemene Zaken, 2021; Ministerie van Economische Zaken, 2020). It is necessary to address air pollution and reduce climate change, as within the country, 3000 people die prematurely every year as a result of air pollution (National Institute for Public Health and the Environment, n.d.) and an increased sea level from climate change can flood the country (Ministerie van Infrastructuur en Waterstaat, 2010).

National laws and culture can affect the success of local regulations. For example, the Netherlands is Europe's leading country in cycling, with 43% of respondents cycling daily and 26% never cycling (i&o research et al., 2021). Due to the country having nearly no hills, the cycling conditions are excellent. Dutch laws and infrastructure are adapted to meet the cyclists' needs. However, walking is far less common. This is different when compared to Great Britain or Spain, where cycling is more difficult, and a large part of the population enjoys walking (Statista, 2022).

### 1.2.3. Regional level: Amsterdam

Cities can implement local regulations and frequently do. The first city to announce the goal of being private car-free was Hamburg in 2014, followed by Oslo (Nieuwenhuijsen & Khreis, 2016). Though they have not yet reached their goals, their changes have caused a significant modal shift, resulting in fewer emissions and fewer road injuries (Mayors of Europe, 2022; Köllinger, n.d.). A car-free city is clearly challenging, but low-car may be more achievable. There is not a single definition for low-car, but they have a common element of restricting private car use and allowing public cars (emergency services, public buses, delivery vehicles and shared vehicles) (Melia et al., 2011; Loo, 2018).

In the Netherlands, cities are implementing various measures to improve their livability. Examples of such cities are Rotterdam, Almere and Amsterdam. Rotterdam is implementing measures to reduce

the amount of through traffic in the centre and make streets more attractive for pedestrians, cyclists and public transport (Gemeente Rotterdam, 2020). Almere is developing a new district and is exploring possible mobility solutions (Gemeente Almere, 2023). Finally, Amsterdam seeks to reduce its emissions and create more space by becoming a low-car city (Gemeente Amsterdam, 2019).

Amsterdam is already known as a progressive city in car reduction and is attributed as being a global leader in sustainable mobility with more than 60% of all journeys undertaken by active modes of transportation (Deloitte, 2018) and 63% of the people from Amsterdam using a bicycle on a daily basis (Technical University of Munich, 2021). Amsterdam has the lowest number of cars per household in the country (Centraal Bureau voor de Statistiek, 2020), and one of the lowest in Western Europe (Eurostat, 2023). Each day, 10 kilometres are driven by car on average per person in Amsterdam (Gemeente Amsterdam, 2021), which is less than a third of the Dutch national average (Centraal Bureau voor de Statistiek, 2019). However, the number of cars in the city is growing (Gemeente Amsterdam, 2021). This has contributed to Amsterdam having the worst air quality of all Dutch cities (European Environment Agency, 2023a). Therefore, the Municipality of Amsterdam has set the goal of meeting the World Health Organization (WHO) standards by 2030 by reducing traffic emissions, mainly in the city centre. Another goal of the city is to improve the livability. Several measures have already been taken to meet their goals, and they are actively searching for more measures. The measures discussed in the agenda 'Amsterdam Low-car' can be divided into four categories: more and cleaner transport; fewer cars on the road; fewer parking places, more public space; and comfortable public space (Gemeente Amsterdam, 2021). Due to the city's ambitious car-reducing goals, high commitment to implement measures and willingness to explore new possibilities, Amsterdam is selected as a city to contextualize the results of this thesis.

#### XCARCITY

To achieve their car-reducing goals and address the challenges related to reducing the number of cars in the city, the municipality of Amsterdam is participating in the XCARCITY project, an NWO funded 'Perspectief Grant', together with The Metropolitan Region Rotterdam The Hague and Almere. The project focuses specifically on the challenge of reducing cars in the city centre and the related dilemmas. XCARCITY aims to make urban regions sustainably accessible whilst increasing livability with seven work packages and thirty-two partners. Among these partners are TNO and TU Delft (NWO, 2023). During six years and beginning in 2023, the project assists municipalities, developers, civil society organisations and transport operators in pursuing optimal mobility solutions for a livable city (TU Delft, 2022). This thesis is embedded in the project, seeking to discover the success factors and barriers in implementing car reduction measures.

## 1.3. Research problem

Over the past years, European cities have taken measures to limit the number of cars in the city to ensure accessibility while balancing mobility and complicating factors related to livability, such as climate change and pollution. Many measures have led to significant challenges in the implementation process. Their experience can be used by other cities looking to achieve similar goals. The issues they have encountered can be translated into success factors and barriers, drawing practical lessons around the introduction of a specific measure (Rose, 2005).

A definition of policy is: "a rule formulated by some governmental authority expressing an intention to influence the behaviour of citizens, individually or collectively, by use of positive and negative sanctions" (Lowi, 1985, p. 70). However, policy is more complex than that. The landscape in which policy is made is difficult to control and changes rapidly. Instead of seeing policy implementation as a top-down process to achieve a clear goal, it is a complex system with individuals adapting to their environment (Cairney, 2012). The process of policymaking is a "chaos of purposes and accidents" (Sutton, 1999, p. 5) and not a linear model (Thomas & Grindle, 1990). It depends on many factors and stakeholders and how they interact over time.

Experience from others can prove useful in easing the policy selection and implementation process. Governments can learn from each other, both within and outside their country. The issues of metropolitan areas cross boundaries, and many (local) governments are dealing with similar issues. Though many problems are similar, their responses are not. The strengths and weaknesses of their solutions can be analysed to draw practical lessons and improve public policy (Rose, 2005). Local government departments often have an international orientation and are interested in learning (Salskov Iversen, 2006). When drawing lessons, policymakers often assume that a policy will be successful in a different country. However, research by Dolowitz and Marsh (2000) suggests that three factors significantly affect policy failure: uninformed transfer, incomplete transfer or inappropriate transfer. To successfully transfer knowledge between foreign cities, this thesis explores these factors with respect to the success of the policy transfer, together with how the policy operates and the context in which it is implemented.

Marsden and Reardon (2017) found that most transportation policy papers do not engage with real-world policy examples or focus on quantitative analysis alone, ignoring important governance questions. The distance between research and reality is too large in the field, and aspects such as context, power, resources and legitimacy are not included sufficiently. These issues seem comparable to those found by Dolowitz and Marsh (2000). Marsden and Reardon (2017) suggests researching three topics to fill the research gap around governance:

- How and why policies are chosen
- How and why policies are framed as they are
- How the policies survive and evolve over time with competing priorities

Answering these questions can aid in solving the problem of the current significant gaps in the literature regarding transitions towards sustainable mobility (Nikulina et al., 2019). This thesis will use these three questions to address real-world policy examples.

### Research objective

The chaotic policy implementation process can be assisted by drawing lessons from the experiences of other governments while ensuring all elements and the context are included. Including real-world policies and the questions surrounding governance can address the current literature gaps, to be introduced in Chapter 2.

This thesis aims to discover why and how specific car-reducing measures have been implemented across different European cities and what barriers and success factors have arisen during the process. By embracing the complexity of factors that combined lead to the implementation of car-reducing measures, lessons can be learned about the policymaking process for other cities. Furthermore, the landscape in which cities implement their policies must be identified to explain their effectiveness. This in turn can be used in the selection and implementation of measures by other cities looking to achieve their goals.

This thesis focuses on cities in Western Europe. Experiences in cities in other regions of the world are often difficult to compare due to cultural and socio-economic differences, and policy documents and policy results are not always documented in English in publicly available sources.

### Research context

The thesis is written as written to complete the MSc Complex Systems Engineering and Management (CoSEM) programme. CoSEM focuses on designing interventions in complex socio-technical environments. This thesis explores how mobility systems work and analyses interventions based on the experiences of different stakeholders to increase understanding of the complicating factors in implementing car-reducing measures. Cities, their transportation networks, and the many stakeholders involved are complex, and this thesis addresses the challenge of policy analysis in these multi-actor systems. The design of these interventions in complex socio-technical systems will be supported by scientific theories combined with experiences from experts and stakeholders in various cities. This research provides an excellent opportunity to use the skills gained from the CoSEM programme in practice and gain new

insights to make changes in the current institutional setting. This, however, entails balancing often conflicting values with complexities in transport infrastructure, urban planning, connectivity and social justice. Understanding the perspectives and exploring the complex systems together with the stakeholders is essential for this project.

## 1.4. Research questions

To complete the objectives, this thesis focuses on several research questions. The main research question addresses the goal of the entire research, and the sub-questions contribute to that goal as their answers provide the necessary information. These questions are presented in this section, together with some additional explanations.

### 1.4.1. Main research question

The main research question this research addresses is:

> *What success factors and barriers in the implementation of car-reducing measures are present in European cities, and what are the implications for European cities of the scale of Amsterdam?*

The experiences of European cities with a population size comparable to that of Amsterdam in implementing car-reducing measures may prove valuable to similar cities. The barriers they encounter in the implementation process and the success factors to overcome these barriers are used to create lessons for policymakers. Several of these success factors and barriers are based on the literature, and additions are determined based on interviews. These interviews are combined with grey-and-white literature to form in-depth case studies that include the relevant context. The framework, dependencies, lessons, and next steps can help policymakers implement similar measures.

### 1.4.2. Sub-questions

Five sub-questions help to answer the main research question. Their answers provide the necessary information to complete the research. The sub-questions are:

- What are the relevant success factors and barriers in implementing car-reducing policies?
- Which Western European cities are leading in car-reducing measures, and which measures have they taken?
- What are relevant aspects of the context in which these measures are implemented?
- Which success factors and barriers are present in the selected countries, and what effect do these have in the formulation and implementation of policy?
- What are the lessons regarding the process for other cities looking to implement car-reducing measures?

## 1.5. Research approach

The focus of the research is on the experiences of various European cities. A literature study is performed to discover which cities have introduced car-reducing policies and which cities are leading. Interviews are performed to discover which factors resulted in a successful implementation. The case study research approach utilizes this context. Case studies are used to explain, describe or explore events or phenomena in the everyday contexts in which they occur. They can explain why one implementation strategy may be chosen over another. “The case study approach allows in-depth, multi-faceted explorations of complex issues in their real-life settings” (Crowe et al., 2011, p. 1). Policy analysis can help contextualize the definition of the problem and illuminate policy-relevant questions. It can provide insight into a broader range of phenomena (Pal, 2005). A difficult decision is laid out, and methods to assess and address the situation are discussed (University of Oxford, 2020). Case studies are important tools for solving complex development challenges, especially concerning implementing policies

and projects (Asis & Widner, 2022). There are several limitations to a case study. The first is that generalising the results to other cities can be difficult, therefore making it difficult to replicate. Also, the researchers' bias may influence the study (Mcleod, 2023).

The case studies in this thesis are performed to explore the implementation of car-reducing measures in European cities. Implementation strategies are discussed with stakeholders involved in policy-making, together with the contextualisation of the city and the landscape in which the policy operates. To address the limitations of the method, an attempt is made to remove the context-specific elements and determine generalisable elements that can be used by other cities looking to implement similar measures. Eliminating bias is difficult, but an attempt is made by including multiple perspectives per case and letting the interviewees review the summary of the conversation. Triangulation with people who have a different perspective is an important validity strategy necessary to generalize the qualitative case study to a broader theory (Creswell, 2009).

The purpose of the case studies in this thesis is to understand the success factors and barriers in implementing car reduction policies in several Western European cities and their effect on the outcome. The success factors and barriers are gathered from the literature, and their effects are determined through triangulation of the experiences of relevant stakeholders.

In this research, several cities are selected as case studies. Various actors are interviewed within these cities to gather different perspectives on the implementation process. Methods are discussed to address the challenge of car reduction and provide information that can be used in other cities. An attempt is made to assess how much their experiences can be generalized. An overview of factors that played a role in the implementation can assist policymakers in this assessment.

## 1.6. Research structure

This thesis is divided into eight chapters. Chapter 2 performs a literature review to identify the success factors and barriers in the literature. An overview of car-reducing measures is provided, together with the cities with experience implementing these measures. Chapter 3 further discusses the method of the research and makes a selection of the cities for analysis. Chapter 4 provides background information on the selected cities. Chapter 5 presents the analysis and results of the interviews. Chapter 6 shows the lessons for other cities. Finally, Chapter 7 and Chapter 8 show the discussion and conclusion.

# 2

# Literature review

This chapter analyses the literature to explore the questions regarding governance. The focus is on transformation theory to understand how policymakers can implement radical changes in the existing environment. Next, the success factors and barriers influencing the implementation of car-reducing policies are discussed. Finally, an overview is provided of car-reducing measures taken across Europe and the cities that have implemented these measures.

## 2.1. Transformations

Transformations are changes so radical that the nature of the system is fundamentally altered. Some of the goals stated in Section 1.1 may require such a fundamental change. One of these is climate change. Climate change provides such significant challenges that a system transformation is likely required in how society makes use of resources (Nelson et al., 2007). Transformations go hand in hand with adaptations. Adaptations are changes that deal with developments without undergoing significant changes in the nature of the system. An example of a goal requiring the system to adapt is the high level of emissions in the transport sector. The system will need to retain the same function and structure but will need to adapt to new requirements. This section will go into what transformations and adaptations are and how to go about transformational adaptation.

### 2.1.1. Transformation

To better explain how radical a transformation is, a comparison between a transformation and an incremental change is made. Incremental changes are framed as complicated, smaller, within the system and with greater control of the outcome. Management of such changes focuses on current conditions and seeks to keep the present system in operation. In transformations, the nature of a system is fundamentally changed when the existing conditions become untenable or undesirable. Transformations are framed as complex across systems and focus on long-term changes with less control (Lonsdale et al., 2015). Due to the complexity involved, the urgency to respond to a system requiring a transformation may be played down (Marshall, 2015). A successful transformation requires three capacities: First, the current situation and the decisions leading up to it must be understood. Exploring why existing systems operate as they do, given the policy, can provide insights about improvements. Second, policymakers must be willing to invest in long-term goals while maintaining an awareness of the bigger picture. They should also identify challenges and encourage system-wide participation. Third, learning from practice can help create opportunities. Testing in 'real life' can deepen the understanding and participation of people in a system (Lonsdale et al., 2015).

### 2.1.2. Adaptation

Adaptation and the capacity to adapt are related to the decision-making process and actions to deal "with future change without undergoing significant changes in function, structural identity or feedback of

that system while maintaining the option to develop" (Nelson et al., 2007, p. 397). Adaptation is related to resilience. Resilience is the adaptive capacity and the ability to deal with future uncertain change. It is the amount of change a system can undergo while retaining the same function and structure and having options to develop. Today's management decisions not only determine the outcome but also have implications for future flexibility. Both the decision-making process and the decisions themselves should be explored further (Nelson et al., 2007).

### 2.1.3. Transformational adaption

Transformational adaptation brings these two together, although the definition of transformational adaptation is somewhat vague and defined in different ways (Mustelin & Handmer, 2013). However, it is characterised by system-wide change, has a focus on the future, and directly questions the effectiveness of existing systems, social injustices and power imbalances. Transformational adaptation is often described as a series of four distinct phases: pre-development at a small scale; take-off when the existing regime is destabilised; acceleration when a structural transformation occurs; stabilisation when the new state turns into an equilibrium (Lonsdale et al., 2015) (see Figure 2.1). Recognizing these phases in transformational policy can possibly be why certain changes are incremental and others fundamental. Some phases are more open to specific types of change (Mulgan & Leadbeater, 2013), and innovation theory suggests that most influence can be exerted between phases in transition.

Transformation adaptation results in a radical change and may provoke strong reactions from those invested in the current system (Béné et al., 2012). These strong reactions are something to be aware of and take into account when initiating a transformation. Humans are most comfortable when they feel their future is predictable and controllable (Cork et al., 2007) and may perceive change as a threat. People respond strongly to threats with a simple cause, especially if others can be blamed (Hamilton & Kasser, 2009). This response is important for policymakers as implementing radical policies will likely result in opposition from opposing political parties and from the public.

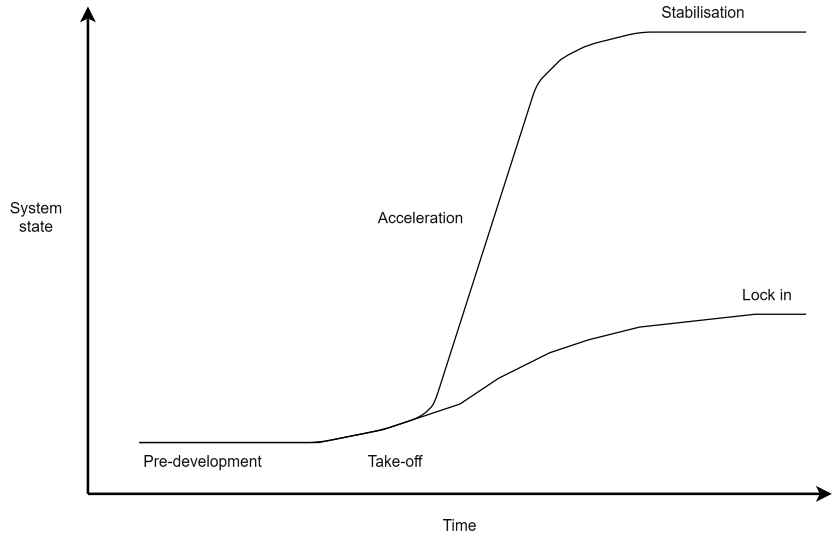


**Figure 2.1:** Phases transition theory, adapted from (Loorbach & Rotmans, 2006)

### 2.1.4. Research gap and relevance

The challenges that cities are facing regarding mobility require transformational adaptation. The current system is undesirable, and the complex, cross-system challenges require building an adaptive and resilient transport sector. It is likely that those involved will react strongly to radical changes. Understanding the current situation and learning from practice can help to create opportunities for implementing policies to transform the existing system. This thesis explores transformational adaptations in

transportation. The three required capacities are addressed in the conclusion. This literature review continues with other factors that influence the implementation of transformational policies.

## 2.2. Path dependence

Transition management theory recognizes opportunities to start a transformation. However, a risk when implementing changes is that large-scale investments are made that only fit the existing system (Rotmans et al., 2001). This path dependency creates a 'lock-in', as shown in Figure 2.1. Lock-in theory, developed by Arthur (1989), explains why a technology, product or practice prevails while better alternatives exist. Once lock-in has been created, entering a new path requires dislodging a long-lasting equilibrium (Hensley et al., 2014). An example is the transition to low-emission and climate-resilient development set about by countries across the globe (United Nations, 2022). To prevent lock-in, transition management theory refrains from making investments that only fit into the existing system (Rotmans et al., 2001).

Path dependency can also result in the 'sailing ship effect' where organisations have the tendency to react to new technology by improving the old technology because the new technology does not align with their existing strategy. However, incumbents may enjoy second-mover advantages by strategically waiting for organisations to enter the market and copy or buy them while learning from their successes and failures. This does result in the risk of waiting too long and being too late (Annema, 2022). In policy design, local governments can wait for other cities to try new measures. The second-movers then use the experience of the cities that experimented with the new measures, reducing the risk of unforeseen complications. However, waiting too long to implement a new policy may result in it being less effective or becoming outdated. Specifically for transport, Low and Astle (2009) find three factors that create path dependencies in transport planning and decision-making:

- *Institutional factors* relating to practices, routines and methods applied by key organisations and the relationships between the actors in those organisations (Hrelja & Rye, 2023). They influence the processes that lead to the outcomes. Organisations can be rigid, and processes reflect past choices, standard operating procedures and the costs of changing direction (Hensley et al., 2014).
- *Technical factors* relating to fixed infrastructure serving societal functions (Hrelja & Rye, 2023). In the area of urban planning and transport, technical path dependence can be the physical form of the city with a dependence on a particular mode of transport (Low & Astle, 2009). Building high-quality roads and low-density suburbs makes it difficult to change plans (Hensley et al., 2014).
- *Discursive factors* relating to assumptions, justifications or beliefs within an organisation shaping its practices (Hrelja & Rye, 2023). Storylines are created to explain and identify issues that a policy is trying to address. Storylines identify the solutions, are self-reinforcing and are often used by organisational leaders to justify decisions (Low & Astle, 2009). Discussion with stakeholders can reveal how different disciplines can have different storylines (Low et al., 2006).

To create a transition without path dependence, the government should take a leading role by inspiring and encouraging other actors to explore new technologies. Participatory decision-making helps to create support for policies. This can be in a top-down or a bottom-up manner through local support. The combination takes advantage of the heterogeneity of society by allowing collective learning to take place. Governments have the task of creating boundary conditions and adjusting the direction of development (Rotmans et al., 2001).

### 2.2.1. Research gap and relevance

Cities are locked into the current system of transportation. After years of lock-in, policymakers are seeking measures to transform the city and achieve the goals as discussed in section Section 1.1. To prevent future lock-in, they need to refrain from making large-scale investments that only fit the current system. Besides investments, there are other factors in transport planning that can create lock-in. These are institutional, technical and discursive factors. This thesis determines for real-world cases if lock-in creates a barrier and from which factors they result.

## 2.3. Barriers

Path dependence is an important reason that policy changes are difficult to implement. Zografos et al. (2020) list several barriers in the climate change adaptation literature that limit transformations, including cognitive limitations. Looking specifically at transport reduction measures, Maat and Louw (1999) research the barriers that policymakers can run into, reducing the success of a promising measure. These barriers are the same as in those found by Banister (2004b) for implementing a measure in its ideal form. They distinguish policy and institutional barriers, legal barriers, resource barriers, social and cultural barriers and side effects. These barriers can reduce the potential of a measure or make implementation impossible and are discussed below. To illustrate the barriers, the case of the Copenhagen congestion charge, as analysed in existing literature, is used. Relevant information about the case is shown in Table 2.1.

**Table 2.1:** Copenhagen congestion charge case

| **Copenhagen congestion charge** |
|---|
| Between 2001 and 2003, the AKTA Road Pricing Experiment was set up to determine the effectiveness of three road pricing schemes. The first was a km-based system with zones closer to the centre increasing in price and the cost in peak hours doubling. The second had similar zones to that of the first but only charged in peak hours, and all costs were halved. The third scheme had fixed charges when travellers crossed the zones, increasing prices closer to the centre. The effect was greatest in the first scheme and lowest in the second, whereas the payment per day was greatest in the third. They also discovered that the GPS did not perform as well as expected. It was a relatively new technology with various technical issues (Nielsen & Sørensen, 2008). In the same year, a report was published detailing the results from a model with a cordon charge dependent on the time of day. They suggested investing the returns in public transport, cycling, park and ride and road improvements (Wilson, 2011b). This resulted in a discussion about implementation, and in 2011, when a centre-left coalition was elected, there was sufficient support for a congestion charge (Wilson, 2011a). The elected party promised to implement the charge and reduce fares of public transport by up to 40%. They planned to fit the entire process into one election cycle to achieve their goals. However, in a later analysis, revenue was estimated to be less than half of the original estimation (Buley, 2012). Another issue was the lack of an Environmental Impact Assessment and a lack of an analysis of alternative road-pricing options (CPH post, 2012). The municipal elections were held less than two years after the national election. In the towns and suburbs around Copenhagen, parties were elected that did not support the scheme (Hamilton, 2012). As a result, the other political parties joined to block the policy. The elected party invested in improved public transport with reduced fares to keep part of the promise when elected. However, these investments did not come close to the original promise (Buley, 2012). |

### 2.3.1. Policy and institutional barriers

Policy and institutional barriers relate to problems with actions between different organisations or levels of government and to conflicts with other interests and between interested parties (Banister, 2004b). Different parties, both private and public, can have different goals that do not align, causing conflicts that can halt the implementation of measures (Maat & Louw, 1999). Many public and private bodies are involved in transportation, making it difficult to coordinate action (Banister, 2004b). A lack of intersectoral coordination and inadequate institutional structures have been found to hamper policy implementation (Kalaba, 2016). This can be due to cultural differences, the distribution of legal powers or the lack of capability within an organisation (Banister, 2004b). In their analysis of successful transport policy packages, W. Yang et al. (2020) found that the institutional setup is a vital factor for successful transport policy. Governments operate on various levels and scales, as discussed in Section 1.2. Though the national government is often seen as the dominant policy-making unit, policy formulation and implementation take place at several levels (Marsden et al., 2014). Policy development is an interaction between all levels of government, and their actions are often mutually dependent. However, they do not necessarily coordinate their actions (Veeneman & Mulley, 2018). A lack of coordination and cooperation among sectors can lead to conflicting policies, hampering shared goals (Kalaba, 2016). Other elements, such as the goals of their agency, their ability to raise taxes and overall funding levels, can determine the results of the complex interactions between different levels of government (Veeneman & Mulley, 2018).

In the analysis of road pricing schemes and the paths to public acceptance, Hamilton (2012) identifies several points related to this barrier. One of the challenges he ran into when analysing the Copenhagen congestion charge is the order of priority between revenue and congestion mitigation. If municipal politicians prioritise tax revenues over congestion mitigation, that will influence the design of the scheme. This can lead to a conflict of interest between both the population and the policymakers and among policymakers. The goal of implementing the congestion charge should be to mitigate congestion, not to provide the government with additional income. Hamilton's final point also confirms that it matters who has the power to spend revenues. In Copenhagen, the national government had the power to spend the income from the charge, but the municipalities had to agree to the implementation. This conflict between public parties led to the charge not being implemented. However, in Göteborg, a congestion charge was successfully implemented. A big difference is that the revenue could be spent by the municipality, providing a much larger incentive for them to implement the measure.

### 2.3.2. Legal barriers

Fitting new measures into the existing legal frameworks can be difficult. New technologies or ideas may not be possible in the existing context of the law when introduced (Maat & Louw, 1999). Non-supportive legal frameworks can constrain policy implementation (Kalaba, 2016), requiring adjustment of laws and regulations (Banister, 2004b). Changing laws will take a long time and may not always be possible (Maat & Louw, 1999). When good implementation of a measure requires changes in rules or regulations, more effort must be put to facilitate these changes (Banister, 2004b).

Examples of legal barriers can be found in the implementation of the Stockholm congestion tax. More information about this scheme can be found in Table 2.3. The implementation as a tax instead of a charge resulted in the national government being responsible, requiring a different implementation. Also, difficulty in finalising the required legislation caused a delay in the implementation (Sørensen et al., 2014; Gullberg & Isaksson, 2009).

### 2.3.3. Resource barriers

Resource barriers exist when finding sufficient resources proves problematic for policymakers. This includes financial and organisational backing and the availability of land and material resources (Maat & Louw, 1999). These resources are needed in the short term but also in the long run. If these resources are unavailable, either in time or in the right amount, implementation will be delayed (Banister, 2004b). "Insufficient funding undermines the implementation of proposed activities" (Kalaba, 2016, p. 42) and financial support is required to implement transport policies (W. Yang et al., 2020).

In the implementation of road pricing measures, Hamilton (2012) found that institutional weakness relating to the difficulty of recording, processing, pricing, collecting and enforcing the charging of all vehicles is one of the two main difficulties. This governmental lack of resources can result in issues in the implementation.

### 2.3.4. Social and cultural barriers

Social barriers appear when the level of acceptance is low among those concerned. It is based on tension and opposition resulting from government policy. This can take place in the market sector or the population (Maat & Louw, 1999). The effectiveness of measures is minimal if the public does not accept their implementation (Banister, 2004b). Multiple researchers, such as W. Yang et al. (2020), have analysed these barriers. Some policies are not implemented due to lack of political will, especially in the run-to elections as politicians seek to entice voters (Kalaba, 2016).

These barriers are related to two barriers found by Hamilton (2012). He finds that public and political resistance comes from a fee being added to what was previously free of charge for the user, causing negative reactions. Banister (2004b) also finds that pull measures tend to be more popular than push measures that may limit the perceived freedom. Hamilton (2012) also notes that political acceptance

differs from public acceptance, such as in the cases of Copenhagen and Göteborg. In Copenhagen, the public wanted the congestion charge, but there was no political majority, whereas in Göteborg, a majority of the public was against the measure, but there was no political opposition. The difference in political majority resulted from the difference in which level of government had the power to spend revenue, as described in Section 2.3.1.

### 2.3.5. Side effects

Side effects or undesired effects can cause the measure to have a different outcome than intended (Maat & Louw, 1999). If the implementation of a measure has serious side effects on other activities, implementation may become too complicated, even if these effects do not influence the success of the measure itself. It may be difficult to anticipate all side effects, but they are important in the implementation of a measure (Banister, 2004b).

An example can be found in vehicle taxation in Norway. A new taxation scheme was introduced where differentiation was based on $CO_2$ emissions. This scheme resulted in more diesel vehicles with lower $CO_2$ emissions but with higher $NO_X$ and $PM_{10}$ emissions being purchased. This example shows an unknown, counter-intentional side effect. Effects can be known or unknown, and intentional, counter-intentional or secondary (Gudmundsson & Sørensen, 2010). Another example is in traffic calming. Though traffic calming results in a reduced speed of cars, it also can inconvenience public transport (Banister, 2004b).

## 2.4. Success factors

Several researchers, such as Cervero (1998), have found strategies to overcome barriers. Sørensen et al. (2014) explore three road pricing measures and identify six barrier management strategies based on the experiences from the case studies combined with policy-making theory. Deployment of these strategies can be seen as using success factors. These success factors are (a) combining sticks and carrots, (b) showing openness and flexibility in negotiations, (c) trials to create legitimacy, (d) applying communication strategically, (e) timing and windows of opportunity and organising responsibility and set-up. These are listed as success factors. To illustrate the success factors, the cases of the London congestion charge and Stockholm congestion tax, as analysed in existing literature, are used. Relevant information about the cases is shown in Table 2.2 and Table 2.3.

**Table 2.2:** London congestion charge case

| **London Congestion Charge** |
| --- |
| This policy was formulated in 1964 and was found viable and even economically profitable (Smeed, 1964). This report was made for the United Kingdom government to alleviate the congestion problems that existed since the rapid growth of motor traffic in central London was perceived as a major problem in the late 1950s. It would take until 2003 before the congestion charge was implemented. A new narrative was born by using the revenue of the charge for public transport improvements. The number of winners grew when the current public transport users also benefitted, helping the perception of the charge being a solution to multiple problems. The Mayor of London promised to implement the Congestion Charge. He refused to hold a referendum but linked the Congestion Charge to his political fate. If he were re-elected after implementation, residents would be satisfied with the charge, and if he was not re-elected, the scheme was a failure, and he suffered political consequences. This gave the public the feeling of control and forced the Mayor to ensure quick implementation. The first studies showed decreased traffic, congestion and accidents after the scheme was implemented, resulting in a positive public opinion and his re-election. He coupled the political stream with the other streams and took the opportunity in the policy window (Banister, 2003). |

**Table 2.3:** Stockholm congestion tax case

| **Stockholm congestion tax case:** |
| --- |
| The discussion about the Stockholm congestion tax resulted from noise, air pollution and congestion. As no legislation existed, it was unclear if it would be a charge or a tax. Eventually, it was determined to be a tax, which meant that the national government was responsible for the implementation. In 2002 the Green Party had the congestion tax as a key element in their programme, and when they won the election, heavy opposition formed against the project. The leader in Stockholm had promised not to implement the charges if she was elected. That resulted in opposition from political parties, trade and commerce organisations, local businesses, and neighbouring municipalities. To meet critical remarks, exemptions were made for cars with alternative fuels, taxis, and cars for the disabled residents of certain areas. However, this was insufficient, and there was a high demand for a public referendum. After a trial, the local coalition held the referendum so the public could experience the proposed tax. The trial began in 2006, and revenues were used for public transport investments. The delay in implementation was due to the difficulty in finalising the legislation. The scheme rested on an agreement between three different parties with different interests. Within the City of Stockholm, a new unit was created that was responsible for implementing the project. The trial resulted in a significant reduction in congestion, traffic and emissions and the results were made clear to the public. Public support grew from the positive results, and with a slender majority, the tax was passed in the referendum (Gullberg & Isaksson, 2009; Sørensen et al., 2014). |

### 2.4.1. Combining sticks and carrots

People evaluate outcomes of situations in terms of gains and losses (Kahneman et al., 1986), and if they perceive a direct link between increasing costs and compensation for the costs, people feel more compensated (Geller, 1989). This forms the basis for the success factor of 'combining sticks and carrots'. Adding a benefit, the carrot, could increase the societal acceptance of an unpopular measure, the stick (van Wee, 2009). A requirement for increased acceptance is clear communication to the public so they are aware of the carrot (Odeck & Bråthen, 2002). Carrots can be used to gain public support for controversial actions in the implementation of car reduction measures. By linking the public sense of fairness to public policies, policies reducing the ability to travel or increasing the cost of travelling by private car may have a higher likelihood of success (M. D. Meyer, 1999). A frequently researched example of sticks and carrots is road pricing and redistributing revenue. Improving infrastructure and services increases the acceptance of the measure. In particular, using it to improve public transit is seen positively (Schade & Schlag, 2003; Jaensirisak et al., 2005). Gärling and Schuitema (2007) performed an analysis into the acceptability of transport pricing policies. They found that allocating revenues to reduce car taxes increases the acceptability most, followed by investments in alternative transportation.

Combining sticks and carrots is an example of policy packaging. Policy packaging combines policy instruments to increase the possibility of success by providing options that can be implemented in coordination. Policy packaging can improve the effectiveness of policies, reduce political and public obstacles (Givoni, 2014), the acceptance of single measures, eliminate their negative effects and produce larger synergy effects. Therefore, policy packaging has attracted attention in both professional practice and academia (W. Yang, 2021). Policy packaging may lead to new problems as a package is more difficult to communicate and involves the risk of more aspects to be criticised (Malmsten & Persson, 2001) as referenced by (Sørensen et al., 2014).

Examples of the stick and carrot combination can be found in London and Stockholm. In London, a congestion charge was implemented to alleviate the congestion problems. Though the effectiveness of the charge was known for a long time, sufficient support was only realised once a new narrative was created. The revenue generated from the charge was used for extra buses and priority schemes. This provided the benefit of increased service for existing public transport users and for people switching from their private cars. The improvements were made before the charge was implemented (Banister, 2003), making it possible for travellers to adjust their travel habits. A similar strategy was used in Stockholm. A congestion tax was introduced with a trial to gain public support. Before the tax was implemented, new bus lines, higher frequencies of existing bus lines and more and longer trains helped to gain public support. The generated revenues were used to further improve public transport (Sørensen

et al., 2014). The improvements increased the public acceptability of the congestion tax, and the use of public transport significantly increased as well. However, a city with a lower initial public transport share may have to expect weaker support for a road-charging scheme (Kottenhoff & Brundell Freij, 2009). The local context is important in determining the effectiveness of a success factor.

### 2.4.2. Showing openness and flexibility in negotiations

Policymakers can use the strategy of flexibility around the implementation of policy to gain support. Allowing negotiations, exemptions and adjustments can increase the likelihood of implementation (Sørensen et al., 2014). A risk in this strategy is that an approach that is too flexible can result in a watered-down policy (Banister, 2004a). Still, a crude scheme may be better than no scheme (Langmyhr & Sager, 1997) as after its implementation, it may be adjusted to achieve the original goal (Sørensen et al., 2014).

After public and stakeholder consultation and discussion for the London Congestion Charge, negotiations resulted in adjustments to the policy to increase acceptance. Exemptions were made for taxis, bus and coach operators and private hire cars. The Stockholm congestion tax had similar exemptions and added those for cars with alternative fuels and residents of certain areas. They now benefit from the congestion reduction without paying the tax (Banister, 2003; Sørensen et al., 2014).

### 2.4.3. Trials to create legitimacy and acceptance

Demonstrations and pilots are a promising approach for breaking a political deadlock and generating experiences from implementing temporary policies (Sørensen et al., 2014). This success factor presents a concrete experience of how a policy will work (Sørensen et al., 2014). Odeck and Bråthen (2002) find that acceptability is enhanced by demonstrating the advantages. If the public is clearly informed about the effectiveness and that of alternatives, they are more likely to accept a change. This is linked to the Multi-Level Perspective theory that aims to address questions relating to the origin of the lock-in or how to escape from undesired lock-ins as those discussed in Section 2.2 (Annema, 2022). Three levels of governance are distinguished in the Multi-Level Perspective theory. The micro-level, the niches, acts as an incubation room for radical innovations. This is an environment with high uncertainties. If a window of opportunity is created by the ongoing processes at the meso level, the current socio-technical regime/patchwork of regimes, radical innovations can break out. Once established, a new socio-technical regime may contribute to changes on the macro-level, the landscape developments (Kemp et al., 1998; Geels, 2002). The theory underlying new technologies in the niches can be compared to trials in policy implementation. In both cases, the locked dominant regime is changed by an innovation that began on a lower level in a protected environment. The tax in Stockholm faced heavy opposition, and only 33% of residents agreed to implement the congestion tax. To gain public acceptance, the measure was piloted before a referendum. Residents experienced the proposed tax and its effects of reduced congestion, resulting in 52% of them voting for the tax (Sørensen et al., 2014). Though a pilot can be used to demonstrate the advantages of a measure, its temporary nature can also be seen as a reason not to invest, as changing routines for a limited time can be costly (Nordtømme et al., 2015).

### 2.4.4. Applying communication strategically

Communicating strategically with opponents of a policy is essential in transport policy-making (Sørensen et al., 2014). “Strategic communication is the process of integrating issues of audience and stakeholder perception into policy-making, planning and operations at every level” (Cornish et al., 2011, p. 4). It is meaningful when the objectives and intermediate objectives are stated down to the operational level, and it enables understanding of target audiences and can promote and sustain particular types of behaviour(Cornish et al., 2011). Communication should be an integral part of policy design procedures (Grenna et al., 2003), both internally and externally (Michalski et al., 2023). “A strategic communications framework must be intrinsic to strategic planning and policy preparation and implementation” (Cornish et al., 2011, p. viii). Strategic communication includes stakeholder participation and ensures that policies are properly designed. It reduces the risks of poor implementation and poor results. During the implementation, a strategy should exist to transmit and receive feedback from each stakeholder

(Grenna et al., 2003). This two-way process relays the reactions and views of the involved audiences. In communication, the diversity in audiences and their different motivations, interests and ideas should be recognized (Cornish et al., 2011). Clear and professional communication of information should be done through a 'neutral' authority. A 'neutral' authority can make it easier to take responsibility for communication and to establish cooperation on the implementation with stakeholders opposing the measure (Sørensen et al., 2014).
The large consultation process for the London Congestion Charge served as communicative and participatory strategies. Informing the public of the results of the Stockholm congestion tax trial was also important in the implementation process (Sørensen et al., 2014). Tolls should not be communicated as a single strategy to reduce congestion but should be marketed as part of a wider scheme. Other changes that complement the measure should be strategically communicated (Odeck & Bråthen, 2002).

### 2.4.5. Timing and windows of opportunity

Based on the theory of Kingdon and Stano (1984), a window of opportunity needs to open for policy to be implemented. The window opens when the problem, policy and political streams come together. 'The problem stream' is created by problem entrepreneurs who define a situation and put it on the governmental agenda. Some problems develop slowly based on information provided over time. Other problems develop suddenly as a result of sudden events, such as a stock crash or natural disaster. 'The policy stream' is led by policy entrepreneurs who have a solution created by experts that they believe is useful in almost any situation. Often, policy entrepreneurs have an ideological focus and have solutions looking for a problem to solve. A combination of the social sentiment leads 'the political stream', the elected officials and interest groups. A policy window may open when these streams join, when a defined problem exists, along with an acceptable solution and political will to make a change. Advocates and policy entrepreneurs can use these windows of opportunity to implement their solutions. Waiting for a window to open requires a long-term commitment from policymakers and a quick response before the policy window is closed as it can be quite a long time before a similar opportunity presents itself (Hoefer, 2022). The success factor of timing and windows of opportunity lies in policy entrepreneurs using the window of opportunity.

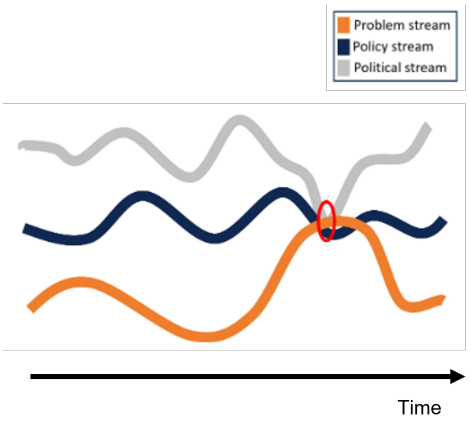


**Figure 2.2:** Policy streams

In the political economy model of Feitelson and Salomon (2004), they state that a policy innovation will only be adopted if it meets all four of the feasibility criteria: technical, economical, social, and political feasibility. 'Social feasibility' consists of the perceived effectiveness of the innovation, the perceived distribution of benefits and costs of the innovation, the perceived problem, the role of non-business interest groups and the sanctioned discourse. Social feasibility is the only criterion that does not directly influence the adoption of innovations, it influences political feasibility.
The policy for the London Congestion Charge had been formulated in 1964 and was found viable and even economically profitable (Smeed, 1964). This report was made for the government of the United Kingdom to alleviate the congestion problems that existed since the rapid growth of motor traffic in cen-

tral London was perceived as a major problem in the late 1950s. Though the problem and the policy streams collided, the political stream did not. It would take until 2003 before the congestion charge was implemented (Dudley, 2013). This happened when a new narrative was born by using the revenue of the charge for public transport improvements. The number of people who benefit grew when current public transport users also benefitted, helping the perception of the charge being a solution to multiple problems. The Mayor of London promised to implement the Congestion Charge. He refused to hold a referendum but linked the Congestion Charge to his personal political fate. If he was re-elected after implementation, residents were satisfied with the charge, and if he was not re-elected, the scheme was a failure, and he suffered political consequences. This gave the public the feeling of control and forced the Mayor to ensure quick implementation. The first studies showed a decrease in traffic, congestion and accidents after the scheme was implemented, resulting in positive public opinion and his re-election. He coupled the political stream with the other streams and took the opportunity in the policy window (Banister, 2003). This process shares similarities with the final relevant point by Hamilton (2012) for decision-making: the influence of electoral cycles and timing of elections in relation to the announcement and implementation of measures. Political parties can make use of this cycle. This strategy is found in the Stockholm congestion tax case when the Green Party won, with the congestion tax being a key part of their programme and aiming to implement the scheme within their term.

### 2.4.6. Organising responsibility and set-up

Sometimes, it could be wise to establish new organisations. A working unit with a clear mandate can shift responsibility from existing organisations and ensure implementation. This is related to overcoming the institutional and discursive factors in path dependence as stated by Low and Astle (2009) and described in Section 2.2. New institutions can create new paths that are in line with the new goals instead of locking into the existing system. Banister (2004b) has the decentralisation of powers and responsibilities for transport as one of the conditions for successful policy implementation. If power is concentrated at the centre, little incentive is given to innovate locally. The power, responsibilities and resources or revenue raising powers should be given to the local authorities to use in determining their own priorities. The location of responsibility and ownership can influence the implementer's commitment and their ability to maintain the focus on an initiative from beginning to end (Giacchino & Kakabadse, 2003).
For London, the Transport for London organisation served this function (Sørensen et al., 2014). In Stockholm, a new unit was also created for the implementation of the congestion tax (Gullberg & Isaksson, 2009).

## 2.5. Car-reducing measures

To achieve the benefits of car reduction as described in Section 1.1, cities across the globe have implemented various measures. These measures and their effectiveness contain valuable lessons. In some research, such as that of Müller and Reutter (2022), the effectiveness of car-reducing measures is modelled. In other research, such as that of Nieuwenhuijsen and Khreis (2016) and Kuss and Nicholas (2022), the effectiveness of measures is based on previous experiences. Travel/Transportation Demand Management (TDM) describes strategies that improve efficiency in transportation problems and promote rational use of the automobile, discouraging unnecessary use. This can be achieved by promoting more effective, healthy and environmentally friendly modes of transport (Broaddus et al., 2009). The effectiveness of these car-use-reducing measures is the subject of research, e.g. Gärling and Schuitema (2007). Measures are often divided into push measures and pull measures. Push or stick measures seek to change behaviour by punishing travellers who use their private cars. Pull or carrot measures seek to change behaviour by making alternatives more attractive. Combinations of these measures are most effective and ensure accessibility (Müller & Reutter, 2022; Kuss & Nicholas, 2022). Simply implementing pull measures will result in little modal shift, whereas only implementing push measures will frustrate travellers (Broaddus et al., 2009).

This section presents car reduction measures found in the literature. A report by the author of this thesis on 22 measures that are used by various cities to reduce car use in the city centre analysed

each measure in its effectiveness in reducing traffic and emissions, its cost of implementation and its fairness (van der Lee, 2023). These measures are categorised by the classification used by van Wee (2009). van Wee (2009) classifies car-reducing measures in regulation, prices, land-use planning, infrastructure and marketing, education, information and communication. The European cities that have experience with these measures are determined. Please note that this list is not exhaustive. Information is collected through Google Scholar, local, national and supranational governments and reputable news sources. News articles, such as those from The New York Times, The Washington Post and The Guardian, are an important part of the academic publishing landscape (E. T. Meyer, 2018).

### 2.5.1. Regulation

In this category, measures are included that regulate access of vehicles into certain areas of the city. It only includes push measures. This limited entry can be based on the level of emission, time of day or mode of transport. Regulations also include speed and parking regulations. Cars are typically parked for nearly 23 hours each day (RAC Foundation, 2021). Parking management is used to reduce these effects of congestion and emissions from car traffic. The cost of implementing car-reducing measures is highly dependent on the situation and the existing parking regulations.

#### Low emissions zones

Low emissions zones (LEZs) are areas where cars must meet certain emission standards to enter. In Europe, there were 320 active zones in 2022, with a rapid increase of 58% expected in 2025 (Azdad et al., 2022). Zones can be used to limit heavy-duty traffic and passenger vehicles, with a further distinction among petrol and diesel engines. Bigger zones are more expensive to implement but also more effective. Depending on the level of restriction, they can quickly improve the air quality. The level of restriction can also be adjusted relatively easily (van der Lee, 2023). An issue with this measure is the discrepancy between stated and real-world emission levels. For standard Euro 6, which was introduced in 2014 (ACEA, 2022), only 10% of the Euro 6 cars meet the $NO_X$ limits with an average of 4.5 times the legal level. This discrepancy originates from the European tests not simulating real-world driving conditions (Baldino et al., 2017) and thereby greatly reducing the effectiveness of the LEZ (Holman et al., 2015). Another downside is that it may be more difficult for individuals with a low income to purchase a car that complies with the restrictions (Flanagan et al., 2022). Financial support schemes and subsidies are most effective to combat this issue (Sheldon & Dua, 2019).

Low-emission zones are implemented in many European countries. Italy (172) and Germany (78) have the most zones, combined with more than 75% of the total number. They are followed by the United Kingdom (17), the Netherlands (14), France (8), Sweden (8), Austria (6), Denmark (4), Spain (3), Belgium (3), Norway (3), Czechia (1), Finland (1), Greece (1) and Portugal (1). The cities of London (UK), Oxford (UK), Paris (FR), Bergen (NO), Oslo (NO), Copenhagen (DK), Berlin (DE) and Amsterdam (NL) have plans for Zero-Emission Zones (Cui et al., 2021).

#### Limited traffic zones

Limited traffic zones (LTZs) are used to reduce the number of cars in an area, often the city centre. Besides improving air and noise quality, LTZs are often used to protect historical buildings from pollution (DeRobertis & Maurizio, 2016; Fensterer et al., 2014). Not all traffic is banned in an LTZ, and it is not always active. Authorized vehicles, such as those of residents, taxis and emergency vehicles, are permitted to enter during active hours. Other vehicles are only allowed to enter outside of active hours. LTZs operate during certain hours during the day to minimize traffic. They can also be active at night to reduce noise pollution in the city. Their effectiveness depends on the size of the area, the active hours and the number of authorized vehicles. This poses a challenge for policymakers between increased accessibility for car drivers when more cars are allowed and effectiveness when more cars are restricted. Different cities make different decisions in which vehicles are authorized (DeRobertis & Maurizio, 2016).

Limited traffic zones are also most frequently implemented in Italy, with over 400 zones. Spain (22), Portugal (9), France (5), Poland (2), and the United Kingdom (1) have also implemented such zones

(Urban Access Regulations, n.d.).

### Car-free zones

Car-free zones are areas where cars are banned, and pedestrians and cyclists make up most of the traffic. Car-free streets can have parks, bicycle lanes, fountains and benches to increase attractiveness and improve the living environment (Figg, 2021). Noise and emission levels decrease in the area, and the total amount of traffic in the city also decreases (Roberts, 2019c). The number of pedestrians increases significantly as the area becomes more livable. The exact effect on the surrounding areas is unclear, as it depends on many different factors, such as urban design. This measure is often combined with other traffic-reducing measures, such as road pricing (Sánchez et al., 2021). People are given time to adapt to change by slowly making the area car-free (Global Designing Cities Initiative, n.d.; Rapid Transition Alliance, 2018).

Car-free zones are similar to the other entry-restricting measures implemented in many European cities. The author found no frequency statistics to determine which countries have car-free zones. Venice, Hamburg, Madrid and Oslo are known for their efforts (Cathcart-Keays, 2015; Nieuwenhuijsen & Khreis, 2016), together with Barcelona (Roberts, 2019c), Ghent (Pelckmans, n.d.), Strasbourg, Nuremberg (Rydningen et al., 2017; Topp & Pharoah, 1994) and recently Heidelberg (Urban Access Regulations, n.d.). In the Netherlands, cities like Amsterdam and Groningen also have pedestrianized areas (Jiacheng et al., 2019).

### Lowering the speed

Lowering the speed often entails a decrease from 50 to 30 km/h in city centres. The main motivation for implementing this measure is increased safety as the survival rate for a pedestrian in a collision with a car significantly increases (Röth et al., 2022; Arato, 2023). Emissions are also reduced (Int Panis et al., 2011; Röth et al., 2022; Jang et al., 2022; Balgaranov, 2021). The cost of lowering the speed cost, such as changing the signage, will be returned within several years from savings in health and absentee costs (Transport and Environment, 2001). The fairness of the measure is quite high as the effects are equal for all travellers, and the majority of the population seems to be in favour (Veilig Verkeer Nederland, 2023; Arato, 2023).

Lowering the speed is another frequently implemented measure in Europe. A 30 km/h European advocacy group counted 150 cities/towns in fifteen European countries: Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxemburg, the Netherlands, Poland, Slovenia, Spain, Sweden, Switzerland and the United Kingdom (Eugent, 2015). Graz, Austria, was the first city to implement the measure. Other notable experiences are that of Helsinki, where the measure was slowly rolled out, Brussels, where the speed restriction immediately covered the entire city and Zürich, where parts of the city had a maximum speed limit of 30 km/h; and the city residents voted to reduce the speed limit in larger streets. Germany has laws that prohibit municipalities from implementing speed restrictions on federal roads, leading to an unanswered demand from the Association of German Cities to have freedom in establishing these zones (Arato, 2023).

### Parking regulations

Parking regulations restrict which vehicles can be parked when, where, and for how long. Regulations can favour specific vehicles such as low emission vehicles, shared vehicles, public transport or those of residents or people with a disability (Cairns et al., 2010; Gemeente Amsterdam, n.d.; Car parking, n.d.; Directorate-General for the Environment, 2021). During specific times, waste collection vehicles and market stalls can be prioritized (Directorate-General for the Environment, 2021). By limiting the amount of time people can park their cars, specific types of visitors will be attracted and restricted. If people cannot park in a certain location, for a certain amount of time, or with specific vehicles, they will have to seek alternative modes of transport. If these alternatives are available, they become more attractive.

Parking regulations have been in place throughout Europe for a long time. In the past years, more has been experimented with combining different uses. Examples are in Ede, where a noise barrier

is also used as a parking garage; Rotterdam, where an underground garage can be used as water storage; or Copenhagen, where the same spaces are used for bicycle parking and car parking during different times (Mingardo et al., 2015). In Salzburg, all spaces were transformed into short-duration spaces (Pitsiava–Latinopoulou et al., 2012).

### 2.5.2. Pricing

Pricing policy includes both push and pull measures, such as subsidies on public transport, charges for vehicle entry and parking fees. Road pricing includes measures that set fees for travelling by car. These fees can be upon entering a certain area or per distance travelled. Though such measures are very effective, they are expensive to implement and affect low-income households more than high-income households.

#### Congestion charge

Congestion charges are cited as the most effective measure to reduce car traffic by Kuss and Nicholas (2022). Three cities across the world have implemented the charge. Each imposes a charge when the vehicle crosses a border into the city. Some cities have a variable charge depending on the time of day and level of congestion (Chin, 2005), whereas others have a fixed fee (Leape, 2006). Some also have a discount for residents. While the main goal of the charge is to reduce congestion, it also reduces the total amount of car traffic, thereby also reducing the level of emissions and the number of accidents, and increases public transport use (Leape, 2006; Anas & Lindsey, 2011) and the average speed (Nieuwenhuijsen & Khreis, 2016). The system is expensive to implement. However, it returns a profit quite quickly and provides high social benefits in congestion and emission reduction (Eliasson, 2009). The main issue is regarding fairness. Low-income groups pay more in relation to their income. Though a price correction is fair to compensate for the otherwise unpaid social cost resulting from the health effects of their vehicle use, the charge is higher than just the unpaid costs (Eliasson, 2009). If the revenue is spent on benefitting the accessibility of low-income groups, it may be less controversial (Kristoffersson et al., 2017).

Within Europe, the congestion charge has only been implemented in Stockholm (Sørensen et al., 2014), Götheborg (Hamilton, 2012) and London (Banister, 2003). As discussed in Section 2.3.1, various other cities have at some point considered implementing the charge but did not succeed (Nielsen & Sørensen, 2008).

#### Distance-based pricing

Distance-based pricing is can be used to replace the income from fuel taxes that is lost when cars are mostly electric (Ministerie van Algemene Zaken, 2022). A per-km charge has high potential effectiveness as the underlying economic theory suggests that an increase in price will result in a decrease in travel (van Meerkerk et al., 2015). A distance-based charge will likely reduce emissions significantly but is unlikely to be cost-effective. It will also influence congestion less than a time-dependent charge (van Meerkerk et al., 2015). Similarly to other road pricing measures, the cost increase of travelling will likely impact low-income households most and reduce the distance they can travel (Francke & Kaniok, 2013). Offering improved alternatives can address this inequality.

Distance-based pricing has not been implemented anywhere in the world. However, it is currently being researched in the Netherlands (Ministerie van Algemene Zaken, 2022), and the Mayor of London has stated that it may be the successor to their congestion charge (Mayor of London, 2018). The city of Valletta in Malta has a charge based on the time in the city centre. An automated number plate recognition system calculates the duration of the visit and bills visiting car owners accordingly (Urban Access Regulations, n.d.).

#### Toll roads

Toll roads are roads with a charge along a specific route. As toll roads require little infrastructural changes, a return is often made on the investment. Often, the road is built and maintained by a pri-

vate company (Grant, 2003). Local governments can also implement toll roads to compensate for their investment in roads on a difficult terrain (Odeck & Bråthen, 2002). Furthermore, it can be a way for foreign car drivers who do not pay taxes in the country to pay for road use (The German Way, 2013). Toll roads can be used to make driving on that road less attractive, possibly reducing the total number of trips (Evans et al., 2003). As there is less traffic, there will be less congestion. Thus, increasing the price will increase the average driving speed and give priority to the most urgent trips. To compensate, revenues should be invested in improving public transport (Roth, 2018).

Toll roads exist throughout Europe (Carpintero, 2010; Carpintero, 2011). France had the first European toll road (Estache et al., 2000) and currently has the highest proportion of toll roads in Europe, followed by Italy, Spain and Portugal (Albalate et al., 2009). Norway has an unusual agreement where the government retains responsibility for design, construction and maintenance, but concession companies are used to collect tolls (Estache et al., 2000). Certain countries, like the Czech Republic, have exemptions for electric or hydrogen-powered vehicles (Čondl, n.d.).

### Mobility credits

Mobility credits do not necessarily imply extra costs for travellers and can even result in a profit for people who make sustainable trips. All residents of a specific area receive equal credits that can be spent on travelling or sold to others. Credits can be divided per household or per individual (Provoost et al., 2023). Credits can be charged per road or connection (H. Yang & Wang, 2011), when entering a zone (Shirmohammadi & Yin, 2016), per distance travelled (Cirrincione et al., 2022), or per litre of fuel (Raux et al., 2015). Similar to a congestion charge, the number of credits can also vary during the day (Provoost et al., 2023). The price for selling credits can be fixed by the government or left to the market (H. Yang & Wang, 2011; Nie, 2012; Tian & Chiu, 2015). Some see mobility credits as the successor to the congestion charge (Li & Robusté, 2021). The programme can be self-financing (H. Yang & Wang, 2011) and effective in reducing traffic (Dogterom et al., 2018; Ramazzotti et al., 2012; Raux et al., 2015). Though the tradable credit schemes increase the income distribution as low-income groups, with a lower value of time, can sell their credits to high-income groups (H. Yang & Wang, 2011), social feasibility is low as people find the system unfair. Also, they are not willing to spend time trading their credits (Krabbenborg et al., 2021).

Mobility credits have not been implemented anywhere. However, there have been several pilots. The largest was in Bologna in 2012 (Ramazzotti et al., 2012). In the West Midlands in the United Kingdom, a pilot was launched in 2021 (Transport for West Midlands, 2021) and Amsterdam is looking to set such system (Kuipers, 2021).

### Parking pricing

Parking pricing can be used to make parking in specific areas more or less attractive. This can be done for geographical areas, such as the city centre compared to suburbs, and for physical areas, such as on-street parking compared to parking garages (Gonzalez et al., 2022). Also, prices can be determined based on vehicle and owner characteristics. For example, parking permit fees are often lower, benefitting residents (Wright & Egan, 2000). Shared vehicles can also be exempted from parking fees, making them an attractive alternative (Cairns et al., 2010). Vehicle characteristics, such as level of emissions and weight, can be used to set the parking price (Ngoma, 2023). How the parking price increases over time can be used to encourage or discourage shorter and longer stays. There is a strong relation between cost and the number of cars (Litman, 2023a; Vaca & Kuzmyak, 2005; Gonzalez et al., 2021). With performance-based pricing, optimal occupancy can be achieved (Shoup, 2006). Setting the prices based on the type of vehicle and owner decreases the attractiveness of parking in an area and thus travelling to that area.

Parking pricing is currently in nearly every European city. Amsterdam has the highest on-street tariffs in the world (Parkopedia, 2022). Rotterdam and Madrid have fees dependent on the demand, and London, Madrid and Paris have fees dependent on the level of emissions (Mingardo et al., 2015; Bencekri et al., 2019).

#### Public transport fare reduction

Public transport fare reduction is thought of by many to be the best way to improve urban transport (Provoost et al., 2023). Temporary fare removal can significantly improve public transport usage even after the fare is reinstated (Volinski, 2012; Thøgersen, 2009). Removing fares for particular population groups, such as students (van Goeverden et al., 2006; De Witte et al., 2006; Inturri et al., 2020), commuters (Stumpel-Vos et al., 2013), ederly (Mackett, 2015) and low-income groups (Provoost et al., 2023) have similar effects. Complete fare removal also causes an increase in public transport usage. However, as with other fare-reducing measures, most trips would have otherwise been done with an active mode, and many trips would otherwise not have been made. The high cost and the low modality switch from cars is why most fare removal programmes have ended (Provoost et al., 2023). Reducing fares can be used to increase equality and provide more options for all travellers. However, subsidizing this mode of transport uses contributions from all taxpayers; also those not making use of that modality.

Public transport fare reduction has also been implemented throughout Europe. Many cities give a discount to specific population groups, often based on income or age. However, some countries or cities have removed the fares completely. Luxembourg was the first country in the world where public transport was made free in 2020 (Symons, 2023) and Malta followed in 2022 for their buses (Tallinja, 2022). Other countries, such as Spain, have temporary free public transport (Frost, 2022) and others, such as Germany (Buckley, 2022) and Austria (Jones, 2021), had nearly-free public transport passes.

### 2.5.3. Land-use planning

The land-use planning can impact travel distances, traffic volumes and modal choice. Building in high densities can theoretically reduce travel distances and building offices close to public transport stations can increase its usage. The way that areas are designed, can help cities achieve their mobility goals.

#### Multiple centres - X-minute city

Creating multiple centres is a measure where the city is designed to meet every resident's needs by bicycle/foot in an X-number of minutes. In such neighbourhoods, emissions are reduced, and social cohesion is improved. It increases social equity as access to services is provided and public health improves (Logan et al., 2022). Though designing cities with a low distance between residents and amenities requires a transformation of the urban structure, it reduces travel costs, fuel costs, maintenance and emissions (Moreno et al., 2021). An issue X-minute projects are facing is a large number of conspiracy issues with claims that policymakers are trying to keep residents in specific neighbourhoods, resulting in protests in areas where local governments have tried to implement the measure (Baker & Weedon, 2023). Therefore, effective communication with residents and perhaps a different name is advised. Also, it is advised to determine which facilities should be accessible within a specific travel time/distance and through which mode of transport (Logan et al., 2022; Deichmann, n.d.) Evaluating performance with statistics and sharing them with residents ensures that no residents are overlooked (Logan et al., 2022).

Multiple city centres - X-minute city was popularised in cities such as Paris (Pozoukidou & Chatziyiannaki, 2021), and 15-minute city analyses have been performed for cities such as Naples (Gaglione et al., 2022), Barcelona (Ferrer-Ortiz et al., 2022), Krakow (Noworól et al., 2022) and Dutch non-urban areas (Poorthuis & Zook, 2023). The idea of a functional mix where destinations could be reached by foot has been implemented in the last century by cities such as Copenhagen, Amsterdam and London (Gaglione et al., 2022). European cities like Milan, Copenhagen, Glasgow, Paris and Madrid are also transforming their cities according to the concept (Logan et al., 2022).

#### Division into sections

Dividing the city into sections is a measure that creates separate areas that are only accessible by car from the ring road. Car drivers cannot directly travel from one neighbourhood to another. However, cyclists and pedestrians can. Multiple cities have implemented such schemes, and some are always active (Dienst Mobiliteit Leuven, 2019), some only during the day (Oxfordshire County Council,

2022). Such schemes are very effective in reducing car use and increasing the number of cyclists and pedestrians (Lelong, 2022; Dienst Mobiliteit Leuven, 2019). Though accessibility by car is decreased, improving public transport and building Park and Ride (P+R) locations connected to public transportation, travellers are stimulated to use different modes (Dienst Mobiliteit Leuven, 2019). The cost of implementation is dependent on how the changes are made, but it is likely that the investment will have a positive return from the fines (Matthys, 2021; Bill Cotton, 2022). The main problem with the implementation of this measure is the protests from residents. Clear communication of decisions and the reasoning behind them is crucial, together with a trial before definitive implementation.

Several cities across Europe have experience in dividing the city into sections. The circulation plan is most used in Belgian cities, such as Ghent (Rezende Amaral et al., 2018; Pelckmans, n.d.), Leuven (Heijlen & Crompvoets, 2019) and Brussels(Chini, 2023) and in the Dutch cities of Groningen (Zee, 2015; Tsubohara, 2007) and Houten (van Dam, 2018). Birmingham in the United Kingdom is also considering implementing the measure (Reid, 2020).

#### Parking minimums and maximums

Parking minimums and maximums are used to manage the number of cars that are permitted to park in a certain area. This measure specifically targets residents and restricts the number of cars they can own. Housing development is required to adhere to certain minimum parking standards that set the minimum number of parking spaces per household. City planners can decide to lower this standard, enabling developers to build less car dependent residences. Cities could also look at sharing parking spaces among residences and businesses. Instead of lowering the minimum standards, city planners can decide to lower the parking limits in an area. Limiting the number of permits that residents can apply for enables city planners to control the number of on-street parked vehicles (Litman, 2023b). Both measures mainly target new residents. Lowering the minimum makes it more difficult for car-dependent households to find housing with a parking place, likely increasing the cost. Lowering the maximums makes it more difficult for residents to apply for new on-street parking permits, possibly leading to long waiting lists (Wijnhout & Dorgelo, 2022).

Parking minimums and maximums are implemented in various countries. Examples can be found in Antwerp, Munich, the Netherlands, Zürich (Mingardo et al., 2015), Ghent (Bencekri et al., 2019) and Stockholm (Lower & Szumilas, 2021).

#### Remote parking and shuttle service

Remote parking and shuttle service lets travellers park further from their destination, often at the edge of the city, and travel to their location with a shuttle or by public transport. Cities often stimulate this by offering combined parking and public transit tickets for a reduced price. Businesses can also offer parking spaces at the edge of a business district with shuttles going toward the company. This measure can be implemented by itself to offer more and less expensive alternatives but is often combined with other measures that limit entry to the city (Litman, 2023b; Directorate-General for the Environment, 2021).

Remote parking and shuttle services exist throughout Europe. The Netherlands currently has over 400 P&R locations, with most around Rotterdam. England is expanding the number of P&Rs as well (Mingardo et al., 2015).

### 2.5.4. Infrastructure

Infrastructure provisioning involves determining if and where road and rail networks will be built. These networks influence the distribution of traffic. Infrastructure provisioning also includes provisioning for shared vehicles and public transport quality improvements. Not only does public transport offer good connections for short distances, improving public transport can be necessary to provide an alternative over larger distances when discouraging car usage.

### Infrastructure for active modes

Infrastructure for active modes can be improved to stimulate walking and cycling. These healthy and emission-free modes of transport reduce other traffic and emissions and improve the health of travellers. The cost is dependent on the existing infrastructure but is likely to return a profit resulting from health benefits (Hjuler, 2020). Separate bicycle lanes, bicycle parking spots, intersection modifications and light adjustments can be combined with changing facilities at certain (work-)locations to incentivise travellers (University of Reading, 2016; Cornago et al., 2019; Cairns et al., 2010; Litman, 2023a). As this measure improves alternatives to cars, it scores high in fairness. If more people replace motorized transport by cycling or walking, everybody benefits from decreased emissions and traffic, and the people who travel actively have more health benefits (Hjuler, 2020).
Infrastructure for active modes is increasing in most European countries. The Union Cycliste Internationale (UCI) (2023) rewards cities that host cycling events and invest in developing cycling infrastructure with their Bike City label. Copenhagen was the first city to win it in 2008. Other major cities that have won it are Bergen, Glasgow and Paris. Bartzokas-Tsiompras et al. (2023) configured a Micro Walkability Index for most European cities. The top 3 cities are Barcelona, Bilbao and Oslo.

### Shared micro-mobility

Share micro-mobility includes bicycles, mopeds and scooters and can be station-based or dockless (DeMaio, 2009). Such vehicles are frequently used across the world. However, they mostly replace walking and public transportation. Private cars are rarely replaced. This may be due to the nature of micromobility only being used for short trips, for which the car is used less in Europe. However, if integrated with public transport, it can serve a complementary last-mile usage, encouraging the use of public transport (Aguilera-García et al., 2021). Another issue in the feasibility of shared micro-mobility is the fact that most companies offering the service have not yet made a profit (Green, 2023; van de Wiel, 2023). For municipalities looking to integrate this mode of transport, the viability may be a complication. Finally, unregulated free-floating bicycles, scooters, and mopeds clutter the streets. Users of shared vehicles frequently drive recklessly, causing frustration among residents. Several cities are therefore banning these vehicles (Bellan, 2023). Setting rules discussed with residents, the municipality and the operators of the shared micro-mobility before the vehicles are deployed may resolve the issues.

Shared micro-mobility is present in more than 600 towns and cities across Europe. Germany is the largest market for shared e-kickscooters (Heineke et al., 2022). The uptake in micro-mobility has stressed the need to re-plan cycle lanes in cities like Munich and Paris (EIT Urban Mobility, 2021).

### Shared cars

Shared cars can be deployed in several forms that either include a base (area) or are dockless (Glotz-Richter, 2016; Diana, 2020). The combination can attract new users and continue usage. If shared vehicles are implemented in line with the demands of the required stakeholders, such as citizens, politicians, public transport operators and car-sharing operators, car-sharing has the potential of emission reduction and take up a lot less street space (Diana, 2020; Nijland et al., 2015). Also, shared car users drive significantly fewer kilometres (Amatuni et al., 2020).

Shared cars are across many cities in Europe. Germany is the biggest car-sharing market in Europe (Schiller et al., 2017). Switzerland, the United Kingdom and the Netherlands follow. Cities in eastern, southeastern and central Europe have a lower usage of car sharing with high private car ownership. In the German city of Bremen, car sharing was implemented in an integral approach by implementing infrastructure, launching campaigns and changing regulations. This led to a significant number of users and replaced cars, making it a forerunner city for sustainable transport (Glotz-Richter, 2016).

### Multi-modal planners

Multi-modal planners are used to facilitate multi-modal journeys as a simplified way to access different transport services (**european_environment_agency_eu_body_or_agency_transport_2022**). These Mobility as a Service (MaaS) platforms assist travellers in using new services and travel more

easily (Goodall et al., 2017), making alternatives more attractive. They have the potential to reduce trips and emissions significantly (**european_environment_agency_eu_body_or_agency_transport_2022**). There are several reasons for the lack of a worldwide roll-out of MaaS platforms. Revenue models are difficult to design, and the current brokerage fees are insufficient to make the platforms profitable (Krauss et al., 2022). Furthermore, a platform where travellers receive updated travel information and can buy single tickets for multiple modalities requires cooperation between all relevant actors, both public and private (Goodall et al., 2017).

Multi-modal planners originated in Finland, and Helsinki remains a frontrunner in such systems. With laws requiring transport providers to make ticketing available to third parties and opening up the data of public transport organisations, they enable MaaS providers to set up systems that provide extensive services (Sakai, 2019). The system originating in Helsinki is now also available in Antwerp, Switzerland, Turku, Vienna and the West Midlands. The Transport Authority of London has taken a similar approach in opening up its Application Programming Interface (API) feeds to developers (Goodall et al., 2017). Currently, MaaS applications are available across Europe, in cities such as Madrid, Berlin, Göteborg and Manchester, with pilots available in more cities (Mitropoulos et al., 2023).

#### Quality of public transport

Improving the quality of public transport requires crucial improvements for achieving a more sustainable mobility system and encouraging a modal shift (Gori et al., 2012). Increased frequency, distances, comfort, accessibility and reliability can attract new users and should be communicated and demonstrated to ensure a positive perception (Redman et al., 2013; Litman, 2023a). Research finds that public transport is necessary to ensure that these travellers do not travel by car (Anderson, 2014), but it is difficult to attract new users, and improvements seem to attract more latent demand (Ministerie van Infrastructuur en Waterstaat, 2009; Litman, 2023a). Research in the Netherlands shows that only improvements in high-frequency lines have a positive benefit-cost ratio (Ministerie van Infrastructuur en Waterstaat, 2009).

Quality of public transport improvements are made throughout Europe, with countries regularly improving their services. The European Union also has funding available, as seen in projects in Spain, France, Italy, Poland and Portugal (European Court of Auditors, 2014). There are also plans to improve the trans-national public transport network (European Commission, 2021).

### 2.5.5. Marketing, education, information and communication

The independent role of such measures is limited but can have a role in supporting other policies. Information provision may influence the modal choice of travellers.

#### Information campaigns

Information campaigns do not require physical changes but can help to stimulate travel behaviour. Different approaches can be used in reducing car use through information campaigns. Policymakers can choose to address short-term or long-term car usage (Wright & Egan, 2000), different types of trips and different levels of scale. Personalized travel plans can increase equality by providing assistance. This measure is quite cost-effective and can help to change the behaviour of specific groups of people (Civitas, 2009; Civitas, 2015).

Information campaigns are implemented all across Europe, and it is difficult to find a complete overview. Examples of information campaigns can be found in the United Kingdom (Cairns et al., 2004), Spain (Civitas, 2015) and the Netherlands (Civitas, 2009).

## 2.6. Concluding framework

Several research gaps are identified, as are success factors and barriers in the implementation of car-reducing policies. These success factors and barriers provide a framework to assess the reasons that

such measures may or may not be implemented, specifically looking at the process of implementation.

The first research gap focuses on transformations. The challenges that cities are facing, as stated in section Section 1.1, require transformation adaptation. The system-wide change needed to transform the current mobility system will likely face resistance. Analysing real-life processes and the actions used to begin transformations increases understanding of system change and enables other cities to achieve similar goals. The second research gap focuses on the factors that influence the implementation of car-reducing measures. There is insufficient research about the process of implementation of such measures and the challenges that policymakers face. The first potential barrier that policymakers may run into when transforming the system, is that of path dependence and lock-in. Through existing practices, infrastructure, assumptions or investments, it may be difficult to implement large-scale changes, and it is important for policymakers to prevent future lock-ins. Other barriers are policy and institutional barriers, legal barriers, resource barriers, and social and cultural barriers. These barriers and their definitions are shown in Table 2.4 and in the Glossary. Six success factors have been identified from the literature to overcome the barriers and implement policies. These are combining sticks and carrots, showing openness and flexibility in negotiations, trials to create legitimacy and acceptance, applying communication strategically, timing and windows of opportunity, and organising responsibility and set-up. These success factors and their definitions are the first six shown in Table 2.5 and in the Glossary.

**Table 2.4:** Overview barriers

| Barrier | Definition |
|---|---|
| Policy and institutional | This barrier arises when the different interests of stakeholders result in conflict. |
| Legal | Existing legal frameworks can cause difficulty in implementing measures. |
| Resource | A lack of resources, both financial and otherwise, can hinder implementation. |
| Social and cultural | This barrier arises when societal acceptance of the measure is low, also resulting in political resistance. |
| Path dependence & lock-in | Lock-in can be created when routines, infrastructure or assumptions cause the existing path do be followed |

**Table 2.5:** Overview success factors

| Success factor | Definition |
|---|---|
| Combining sticks and carrots | Policymakers increase societal acceptance of a measure that is experienced negatively by including measures that are experienced positively. |
| Showing openness and flexibility in negotiations | Policymakers are open to changes in implementing the measure to increase acceptability. |
| Trials to create legitimacy and acceptance | Demonstrating the measure in a pilot creates experience with the measure. |
| Applying communications strategically | Carefully thinking about what is communicated, how and who can change how people perceive the measure. |
| Timing and windows of oppportunity | A measure can only be implemented at the right moment when all streams align. |
| Organising responsibility and set-up | Sometimes a new organisation can help to implement the measure. |

The framework of success factors and barriers is used to analyse the process of implementing car-reducing measures. Knowing which measures can be implemented and which cities have experience with these measures helps to find cities that are researched in this thesis. Furthermore, it helps policymakers and researchers to find relevant measures that can be further analysed. Knowing the measures that cities are using to address their challenges can prove valuable to discover new possibilities. An overview of car-reducing measures is shown in Table 2.6.

**Table 2.6:** Table: overview car-reducing measures

| Type | Measure | Type | Measure |
|---|---|---|---|
| **Regulation** | **Low emissions zone** | **Land-use planning** | **Multiple centres** |
| | Limited traffic zones | | Division into sections |
| | Car-free zones | | Parking minimums and maximums |
| | Lowering the speed | | Remote parking and shuttle |
| | Parking regulations | Infrastructure | Infrastructure for active mobility |
| Pricing | Congestion charge | | Shared micro-mobility |
| | Distance-based pricing | | Shared cars |
| | Toll roads | | Multi-modal planners |
| | Mobility credits | | Quality of public transport |
| | Parking pricing | Marketing, education, information | Information campaigns |
| | Public transport fare reduction | | |

# 3
# Method

This thesis, its research problem and the research questions are focused on the implementation of car-reducing policies. This policy-oriented nature makes the results most interesting for policymakers. Also, as most transportation policy papers do not focus on qualitative real-world examples and ignore questions of governance (Marsden & Reardon, 2017), this thesis provides a relevant addition to the literature. To make this thesis practically applicable for policymakers, a focus is placed on this target group. Examples are in the stakeholder selection in Section 3.4 and how the lessons in Chapter 6 are formulated.

This chapter describes the method of research used in this thesis. First, the general research procedure is described in Section 3.1. This is followed by a further explanation of the case studies in Section 3.2, city selection in Section 3.3, stakeholder selection in Section 3.4 and interview procedure in Section 3.5.

## 3.1. Research procedure

Based on the research gaps discovered in the literature, the research problem, and the research questions, the case study approach is selected. The framework of success factors and barriers from the literature review, as shown in the Glossary, lies at the basis of this analysis. Based on the overview of car-reducing measures in Section 2.5 and additional desk research, European cities are selected that have notable experience with implementing such measures. Between these cities, a further selection is made based on their size compared to Amsterdam. Amsterdam is known as a progressive city in car reduction and local policymakers are implementing car-reducing measures to improve the city's air quality and livability. Policymakers are also actively exploring further possibilities and are eager to discover additional measures. Therefore, Amsterdam is used as to contextualize the results of this thesis. More information about the selection of Amsterdam is presented in Section 1.2.3 and Section 1.2.3. The cities that are comparable to Amsterdam in size are contacted based on the categorisation of stakeholders. Based on the stakeholder responses, four cities are selected for case studies. The framework of success factors and barriers is used to form the interview procedure as determined in Section 2.4 and Section 2.3. With this procedure, the stakeholders are interviewed. Combined with the context of the selected cities in Chapter 4, the interviews result in Chapter 5 and four completed case studies. The results are used to determine the lessons in Chapter 6. This chapter includes both general lessons and lessons for Amsterdam to show how the results of this thesis can be applied. The answer to the main research question is given in Chapter 8.

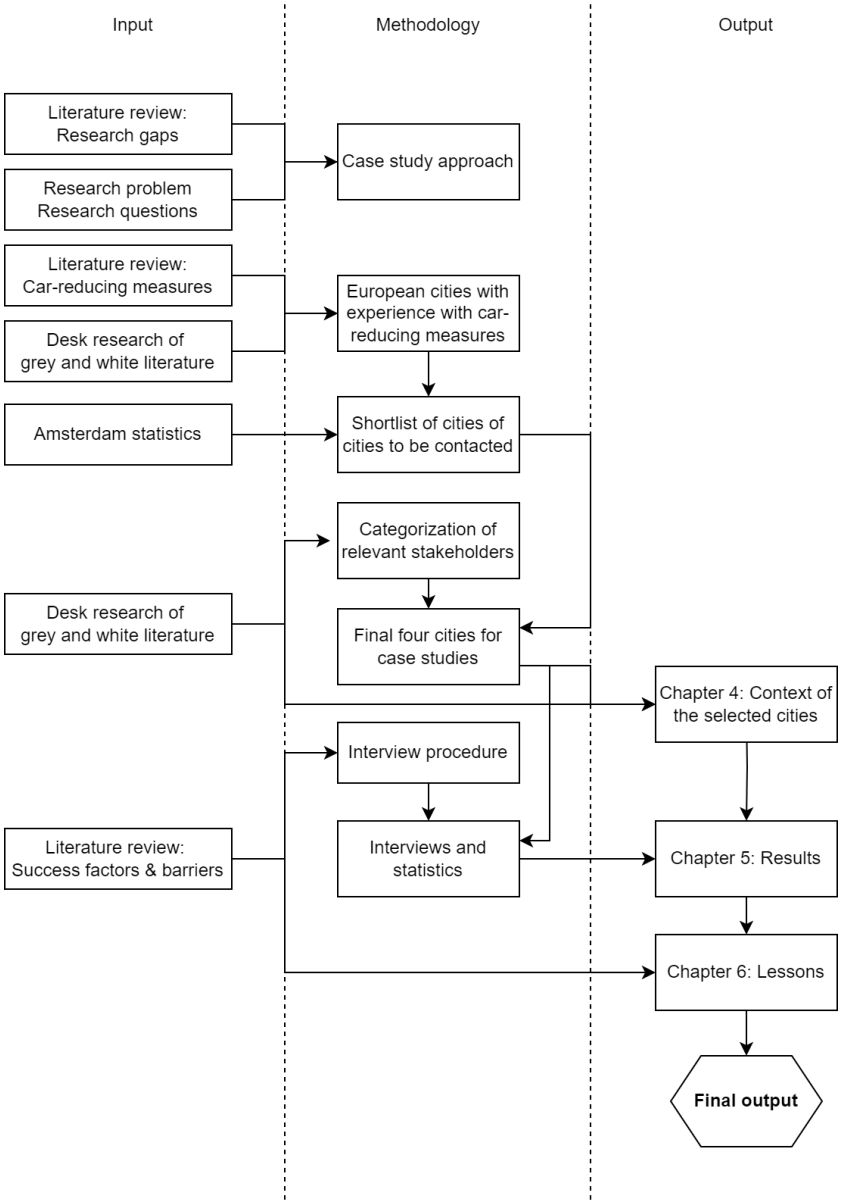


**Figure 3.1:** Research flow diagram

## 3.2. Case study approach

The goal of this thesis is to understand the factors influencing policy implementation by interviewing stakeholders. This is an example of qualitative research, of which the aim is to “provide in-depth insights and understanding of real-world problems” (Moser & Korstjens, 2017, p. 271). From qualitative research, pattern theories are developed that are grounded in information from participants (Strauss & Corbin, 2003; Lincoln & Guba, 1985). Case studies are a form of this postpositivistic form of research (Creswell, 2009). In this thesis, stakeholders connected to policy implementation are interviewed to gain a situational understanding of the influence of the environment and organisational context. In case studies, the researcher explores a programme, event, activity, process or individual(s) by collecting detailed information (Creswell, 2009). In this thesis, the focus is on specific car-reducing policies in selected European cities and detailed information is collected by performing desk research and interviews. The focus is to answer ’how’ and ’why’ questions when the researcher cannot manipulate the behaviour of those involved and contextual conditions are relevant to the phenomenon (Yin, 2007). In this thesis, these questions are posed in the interviews to discover how and why the measure was implemented. The environment in which the policies are implemented cannot be manipulated, so the

research for this thesis is performed to understand the environment and the process. The boundaries between the phenomenon under investigation and the real-life context are not clearly evident, requiring empirical inquiry (Woodside & Wilson, 2003). The context in which the policy is implemented affects the outcome. By performing empirical inquiries, the relation between these two is determined in this thesis.

A differentiation can be made in types of case studies. In this thesis, four cities are analysed to identify the factors that influence policy outcomes. Exploring the differences, similarities and case-unique factors between different cases is done in a multiple-case, or multicase, study (Stake, 2008). In such studies, the context is different in each case (Baxter & Jack, 2015), but the cases must be similar in some ways. Because each case belongs to a collection of cases, each case is interesting. First, a focus is on the workings of each individual case, followed by the relationship to others. In this focus, the scope is limited to studying a few features thoroughly, and data is gathered through direct observation or learning from the observations of others. Understanding the relationship, or the umbrella, that connects each case is the research goal. This 'quintain', as called by Stake (2008), consists of complex and situated relationships. Within the multicase study, the goal is not to compare cases, but these selected instances are used for a better understanding of the quintain.

One of the main difficulties of case studies is determining the extent to which the results can be generalised. Creswell (2009) has determined several validity strategies. First, triangulation between different sources of information by converging perspectives from participants can add to the study's validity. This is done by interviewing multiple stakeholders per case. Providing rich and detailed descriptions by including multiple perspectives can transport the reader to the setting, further increasing the validity. Next, it is important to not only provide the information that confirms the theory or perspective but also the discrepant information. Contradictory information makes the analysis more realistic and valid. Finally, each researcher has a bias and reflection by clarifying the bias shaped by the researcher's background is important in qualitative research (Creswell, 2009). If researchers study additional cases and generalise findings to the new cases, case study results can be generalised to a broader theory (Yin, 2007).

In this thesis, the case studies provide information about the landscape in which the policies are implemented. They help to answer the three questions by Marsden and Reardon (2017) as posed in Section 1.3. The interviewees have participated in the policy implementation process and can explain how and why the policies were chosen and framed. The interview framework assists in finding the answers to these questions and the question of how the policies have survived and evolved over time, especially with the competing priorities of other stakeholders. The case studies include background information from grey literature and the interviews.

## 3.3. City selection

This section covers the selection of cities that are used in the case studies. The cities mentioned in Section 2.5 are included in a full overview of 31 cities in 12 different countries, together with the measures they have implemented. They are compared on two criteria: leadership and population size. Leadership is determined by performing Google searches and estimating the experience of the cities based on the results. Population size is used to select cities of comparable sizes. By doing so, success factors and barriers are found for cities with similar attributes. According to Stake (2008), case studies should consist of 4-10 cases. Most cities are a cold contact with their details based on information found online. Therefore, it is unclear beforehand how many stakeholders will respond and how many case studies may be performed. To meet the range of 4-10 cases, 8-10 cities are contacted for a final selection of at least four case studies.

### 3.3.1. Presence of measures and leader determination

In this selection, cities are distinguished based on their experience with the measures. Doing so, helps to select the measure for each city that is interesting to analyse further. The distinction is made by categorising the measures in each city. The three categories are having plans to implement the mea-

sure, having implemented the measure but not being a leader in the measure, or having implemented the measure and being a leader. This is determined through searches in Google. These searches are performed with similar terms for each city and the cities are given an equal number of search results to provide any information about the measure. Also, the criteria to make a city leader for a particular measure are predetermined. This method of performing Google searches may not include all relevant information. However, as the goal of this section is to provide an indication of the measures that cities have experience with and to select the measure that is interesting for further analysis which each city, this method is sufficient.

To determine which measures are present in the cities mentioned in Section 2.5, searches are performed with each combination of city and measure. The cities are placed in alphabetical order of country and city within each country. Each measure is labelled with a letter in the order of presentation, as shown in Section 2.5. The legend is shown in Table 3.1. Measure F, parking regulations, and measure N, quality of public transport, have not been determined for each city as assessment for these measures is not comparable. Parking regulations and quality of transport can be assessed in many different ways. Each city may have their own way of implementing this measure, making them difficult to assess with a single search query.

Searches are performed in Google Scholar, Google Search and Google News with the following beginning terms *measure* AND *City*. Different combinations and exclusions are used for each measure. As an example, the search for parking pricing in Copenhagen was: “parking price” OR “parking fee” AND “Copenhagen” -airport -hotel. As different websites and articles use different terms and hotel and airport prices are irrelevant, the search term is adjusted. Between cities, the search term for each measure remains equal. The search terms for each measure can be found in Table A.1 in Appendix A. The first two pages of results in the three search platforms are viewed to determine if the results show measures that confirm the existence of the measure in that city. Though this method does not provide definitive results, it is a sufficient estimation for the city selection and interviews. This results in Table 3.2, with Table 3.1 as a legend for each measure. In Table 3.2, a distinction is made between the three categories as described at the beginning of this section. The cities that have announced their plans to implement the measure are marked with ‘(X)’. The cities that have implemented the measure but are not leaders are marked with ‘X’. Finally, the cities that have implemented the measure and are leaders in that measure are marked by ‘**X**’. Leaders are defined differently for each measure. For example, for measure A, Low emissions zone, the cities planning to turn their low emissions zone into a zero-emissions zone are marked as leaders. A complete overview of how each leading city is determined is found in table Table A.1 in Appendix A.

**Table 3.1:** Measure legend

| **Measure** | **Letter** | **Measure** | **Letter** |
|---|---|---|---|
| Low emissions zone | A | Multiple centres - X-minute city | L |
| Limited traffic zone | B | Division into sections | M |
| Car-free zone | C | Parking minimums and maximums | N |
| Lowering the speed | D | Remote parking and shuttle service | O |
| Parking regulations | E | Quality of public transport | P |
| Congestion charge | F | Infrastructure for active modes | Q |
| Distance-based pricing | G | Shared micro-mobility | R |
| Toll roads | H | Shared cars | S |
| Mobility credits | I | Multi-modal planners | T |
| Parking pricing | J | Information campaign | U |
| Public transport fare reduction | K | | |

**Table 3.2:** Presence of measures in cities

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Antwerp** | X | | X | X | - | | | X | | X | | | (X) | X | X | - | | X | X | **X** | X |
| **Brussels** | X | X | X | X | - | | (X) | | | X | X | | X | X | X | - | | X | X | X | X |
| **Ghent** | X | X | X | X | - | | | | | X | | | X | | X | - | **X** | X | X | | X |
| **Leuven** | | | X | X | - | | | | | X | | | X | X | X | - | | X | X | | X |
| **Copenhagen** | **X** | | X | X | - | | | | | X | | **X** | | X | X | - | **X** | X | X | | |
| **Helsinki** | X | | X | X | - | | | | | X | | | | | X | - | | X | X | **X** | |
| **Paris** | **X** | (X) | X | X | - | | | X | | **X** | | **X** | | X | X | - | **X** | X | X | X | |
| **Strasbourg** | X | X | X | X | - | | | X | | X | | | | | X | - | | **X** | X | | |
| **Berlin** | **X** | | X | X | - | | | | | X | | | | **X** | X | - | | **X** | X | **X** | |
| **Bremen** | X | | X | X | - | | | | | | | | | | X | - | | X | **X** | | |
| **Hamburg** | | | **X** | X | - | | | | | X | | | | | X | - | | X | X | | |
| **Heidelberg** | X | | X | | - | | | | | | | | | | X | - | | X | X | | |
| **Nuremberg** | | | **X** | | - | | | | | | | | | | X | - | | X | X | | |
| **Bologna** | X | X | **X** | X | - | | | X | X | **X** | | | | | X | - | | X | X | (X) | X |
| **Milan** | X | X | X | (X) | - | | | X | | (X) | | **X** | | | X | - | X | X | X | (X) | |
| **Venice** | X | X | **X** | | - | | | X | | X | | | | | X | - | | | X | | |
| **Valletta** | | | | | - | | X | | | (X) | X | | | | X | | | X | X | X | |
| **Amsterdam** | **X** | | X | X | - | | | | (X) | **X** | | | | X | X | - | X | X | X | X | |
| **Groningen** | | | X | X | - | | | | | X | | X | X | X | X | - | | X | X | (X) | |
| **Houten** | | | | X | - | | | | | | | | **X** | X | X | **-** | | | X | | |
| **Utrecht** | X | | X | X | - | | | | | X | | X | | X | X | - | | X | X | (X) | |
| **Bergen** | **X** | | X | | - | X | | | | | | | | | | - | **X** | **X** | X | | |
| **Oslo** | **X** | | **X** | X | - | | | X | | X | (X) | | | X | X | - | **X** | X | X | (X) | |
| **Barcelona** | X | X | X | X | - | | | X | | | X | X | | | X | - | **X** | X | X | X | |
| **Bilbao** | (X) | | X | X | - | | | X | | | X | X | | | X | - | **X** | X | X | (X) | X |
| **Madrid** | X | | **X** | X | - | | | X | | X | X | **X** | | | X | - | | **X** | X | X | |
| **Götheborg** | X | | X | X | - | X | | | | | | | | | X | - | X | **X** | X | X | |
| **Stockhom** | X | | **X** | X | - | X | | | | X | | | | | X | - | X | **X** | X | X | |
| **Zurich** | | | X | X | - | | | X | | X | | | | **X** | X | - | X | **X** | X | X | |
| **Birmingham** | X | | (X) | X | - | | | X | | X | X | (X) | X | X | X | - | | X | X | (X) | |
| **Glasgow** | X | | X | X | - | | | | | X | X | X | | | X | - | **X** | X | X | | |
| **London** | **X** | | X | X | - | X | (X) | X | | X | | | | **X** | X | - | | **X** | X | (X) | X |
| **Oxford** | **X** | | X | X | - | | | X | | X | X | (X) | X | X | X | - | | X | X | | X |

## 3.3.2. Finding comparable cities

The main selection of cities is based on the population statistics of each city. An overview of all cities and their populations is presented in Table 3.3. Further information about the size, density, Gross domestic product (GDP) and car ownership is shown in Table A.2 in Appendix A. In many cities, a distinction is made between city centre, city, municipality and metropolitan area. In this table, population statistics are included of what is classified as 'city'. Not all cities make these distinctions. That is why Berlin has a higher number of residents than Paris, even though the population of the metropolitan area of Paris is far greater. This decision is made to scope down the size of large cities. Local policymakers who operate on this level are often more powerful than policymakers on the metropolitan level. Therefore, the population statistics are given of the level of governance that likely has the most power to implement such car-reducing measures on a local level. A potential risk is that cities are compared that differ severely in governance and power structures and in local context.

**Table 3.3:** Population statistics

| City | Population | City | Population | City | Population |
|---|---|---|---|---|---|
| Antwerp | 530,630 | Heidelberg | 159,245 | Oslo | 709,037 |
| Brussels | 188,737 | Nuremberg | 510,632 | Barcelona | 1,627,559 |
| Ghent | 265.086 | Bologna | 387,971 | Bilbao | 345,749 |
| Leuven | 102,236 | Milan | 1,354,196 | Madrid | 3,277,451 |
| Copenhagen | 644,431 | Venice | 250,369 | Götheborg | 596,841 |
| Helsinki | 664,028 | Valletta | 5,157 | Stockhom | 984,748 |
| Paris | 2,145,906 | Amsterdam | 921,468 | Zurich | 427,487 |
| Strasbourg | 290,576 | Groningen | 238,179 | Birmingham | 1,144,919 |
| Berlin | 3,677,472 | Houten | 50,580 | Glasgow | 1,026,880 |
| Bremen | 563,290 | Utrecht | 367,951 | London | 8,799,728 |
| Hamburg | 1,853,935 | Bergen | 289,330 | Oxford | 162,041 |

Based on the population statistics, cities comparable to Amsterdam are selected. Amsterdam has a population of around 900,000 with a density of around 5,000 people / $km^2$. Therefore, cities are selected with a population of 500,000 - 1,500,000. Different selection criteria could have been used, but due to its objective measurability and ease of data access, the population size is a straightforward criterion. The cities that match this range are Antwerp, Copenhagen, Helsinki, Bremen, Nuremberg, Milan, Oslo, Götheborg, Stockholm, Birmingham and Glasgow. Despite being outside the range, Barcelona is also included in the analysis. It is located in a different country than the other included cities and its experience with low-car zones is notable. It does not deviate too much from the selection criterion as it still falls within a 10% margin: 450,000-1,650,000.

A further selection is made based on the country of each city. From the literature review, institutional context is likely to be a major part of why specific measures have been implemented. To include a variety of institutional contexts, only cities located in a unique country are selected. Several of the above-determined cities that fall within the population range are in the same country: Bremen and Nuremberg, Götheborg and Stockholm and Birmingham and Glasgow. As this research continues with only one city from each country, a selection needs to be made. The selection between these cities is mostly based on their leading measures. Bremen is leading in shared cars, and Nuremberg in its car-free zone. No other city is leading in shared cars, however, both Oslo and Stockholm are leading in car-free zones, so Bremen is selected. Götheborg is not leading in any measure and Stockholm in car-free zones, so Stockholm is selected. Finally, both Birmingham and Glasgow are not leading in any measures. However, Birmingham has implemented more measures than Glasgow, which are also more unique. Therefore, Birmingham is selected. This results in the final city selection: Antwerp, Copenhagen, Helsinki, Bremen, Milan, Oslo, Barcelona, Stockholm and Birmingham. The measures implemented in these cities, together with some population statistics, are shown in Tables 3.4 and 3.5. As a reference case for comparative analysis, Amsterdam is also included in the tables. As these are nine cities, the goal of 8-10 cities to contact has been met.

**Table 3.4:** Measures in selected cities

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Antwerp** | X | | X | X | - | | | X | | X | | | | X | X | - | | X | X | **X** | X |
| **Copenhagen** | **X** | | X | X | - | | | | | X | | **X** | | X | X | - | **X** | X | X | | |
| **Helsinki** | X | | X | X | - | | | | | X | | | | | X | - | | X | X | **X** | |
| **Bremen** | X | | X | X | - | | | | | | | | | | X | - | | X | **X** | | |
| **Milan** | X | X | X | (X) | - | | | X | | (X) | | **X** | | | X | - | X | X | X | (X) | |
| **Amsterdam** | **X** | | X | X | - | | | | (X) | **X** | | | | X | X | - | X | X | X | X | |
| **Oslo** | **X** | | **X** | X | - | | | X | | X | (X) | | | X | X | - | **X** | X | X | (X) | |
| **Barcelona** | X | X | X | X | - | | | X | | | X | X | | | X | - | **X** | X | X | X | |
| **Stockhom** | X | | **X** | X | - | X | | | | X | | | | | X | - | X | **X** | X | X | |
| **Birmingham** | X | | (X) | X | - | | | X | | X | X | (X) | X | X | X | - | | X | X | (X) | |

**Table 3.5:** Population statistics of selected cities

| | Population | Size ($km^2$) | Density (population/$km^2$) | GDP per capita | Passenger cars / 1000 inhabitants |
|---|---|---|---|---|---|
| **Antwerp** | 530,630 | 205 | 2,595 | 46,900 | 494 |
| **Copenhagen** | 644,431 | 88.25 | 7,302 | 86,489 | 202 |
| **Helsinki** | 664,028 | 214 | 3,099 | 53,665* | 320 |
| **Bremen** | 563,290 | 318 | 1,772 | 54,826 | 438 |
| **Milan** | 1,354,196 | 182 | 7,454 | 50,786** | 510 |
| **Amsterdam** | 921,468 | 188.3 | 4,894 | 92,461 | 247 |
| **Oslo** | 709,037 | 426.3 | 1,663 | 73,854** | 499 |
| **Barcelona** | 1,627,559 | 99.1 | 16,422 | 29,942 | 350 |
| **Stockhom** | 984,748 | 187 | 5,260 | 62,815 | 398 |
| **Birmingham** | 1,144,919 | 267.8 | 4,275 | 32,231 | 357 |

### 3.3.3. Leading measure selection

This thesis focuses on the measures for which a city is a leader. This is based on the results found in Table 3.4. An overview is shown in Table 3.6. For Antwerp, this is their unsuccessful division into sections or the circulation plan. Copenhagen is known for its cycling infrastructure, and discovering how the success factors, barriers and culture influence the implementation is an interesting addition to the theory. Helsinki has invested in its MaaS system, which is currently being rolled out in various different countries. Analysing the success factors and barriers in implementing this system is interesting, especially given their leading role. Bremen is leading in their shared car system. They have convinced many car owners to switch to shared mobility, significantly decreasing the number of cars in the city. Milan is focusing on becoming a fully carbon-neutral and a cycle-pedestrian city by 2050 (European Institute of Innovation & Technology, 2022). The Strade Aperte plan includes low-cost temporary cycle lanes, new and widened pavements, 30km/h speed limits and new pedestrian and cyclist priority streets (Observatory of Public Sector Innovation, 2020). Oslo and Stockholm are both known for creating large car-free areas with ambitions for them to grow even further. Their leading ambitions provide helpful insights for other cities seeking similar goals. Barcelona is also reducing the number of cars in its city but with a different approach. The change that politicians and residents are going through is the basis for an interesting analysis. Finally, Birmingham is one of the few cities outside of Belgium where a circulation plan is being planned.

**Table 3.6:** Cities and their leading measures

| City | Leading measure |
|---|---|
| Antwerp | Dividing into section |
| Copenhagen | Infrastructure for active mobility |
| Helsinki | Multi-modal planners |
| Bremen | Shared cars |
| Milan | Infrastructure for active mobility |
| Oslo | Car-free zone |
| Barcelona | Limited traffic zone |
| Stockholm | Car-free zone |
| Birmingham | Dividing into sections |

## 3.4. Relevant stakeholders

After selecting the cities for the case study, the next step is to select which stakeholders to interview. The goal is to perform an in-depth case analysis into the implementation of the key measures of each city. This requires interviewing stakeholders from different categories involved in the policy-making or implementation process. Within each city, 3-5 stakeholders are interviewed that are relevant for the decision-making process of specific measures. A single interview will likely give a one-sided view, and if the answers from the second interview differ, a third interview will be necessary for an additional perspective. As the diversity of perceptions is of interest, using multiple perspectives keeps misunderstandings to a minimum (Stake, 2008). This triangulation is an important validity strategy necessary to generalize the qualitative case study to a broader theory (Creswell, 2009). Their varying perspectives are essential in providing an in-depth analysis of each case. Interviewing more than five stakeholders per case will be difficult due to time constraints. Therefore, this selection is made.

Various categories of actors are interesting stakeholders to interview in this thesis. Wieczorek and Hekkert (2012) list categories of actors that play a role in innovation systems: civil society, government, Non-Governmental Organisations (NGOs), companies, knowledge institutes and others (legal organisations, financial organisations, knowledge brokers and consultants). This list is further concretised for policy implementation by specifying certain actors from civil society to residents and government to governments on various levels. Politicians and those who implement the measures are also added. For larger groups, such as residents, advocates may be better suited to interview. Each stakeholder's perspective on the policy implementation process is used to perform an extensive case study. Based on these categories and criteria, contact is sought with each selected city. As the focus of this thesis is on policy implementation and lessons for policymakers, policymakers are also the main stakeholders for the case studies. They are included in the analysis of each case. Depending on the case and analysed measure, stakeholders from other categories are also included. Some initial contact details are retrieved from TNO and AMS institute. Other contact details are acquired by searching for contact details of people or organisations and LinkedIn profiles online. After the first interviews, new interviewees are found through recommendations from the earlier interviewees.

## 3.5. Interview procedure

The next step is to determine the interview protocol after determining the cities for the case studies and the stakeholders to interview within each case. According to (Yin, 2007), qualitative researchers need to document the procedures of their case studies. This requires a protocol. Starting a case study without a plan is a road to failure (Stake, 2008). Therefore, each stakeholder is interviewed with the same protocol to complete an in-depth case study and to determine the success factors and barriers. In this protocol, the key moments in the implementation process are focused on. This individual and group behaviour through time results in a sequence of paths of events, which is one of the core variables of case studies (Woodside & Wilson, 2003). Attention is also paid to answering the questions in Section 1.3. Asking how and why policies are chosen, how and why they are framed and how policies survive and evolve over time may provide explanations about context, power, resources and legiti-

macy in governance. It may also help to understand uninformed, incomplete or inappropriate transfers of policies or ensure they do not happen when learning from the case studies discussed in this research.

### 3.5.1. Structure and questions

Semi-structured interviews are conducted to complete an in-depth case study. A semi-structured approach is used as the blend of closed- and open-ended questions allows for the interviewer to improvise follow-up questions based on the participant's responses. It requires background knowledge of the research topic area. These interviews each follow a similar protocol and offer a focused structure to explore the research area (Kallio et al., 2016). This protocol is shown in Appendix B. First, general questions are asked about the measures and the implementation process. This process and the key moments are used to construct a timeline. Finding which stakeholders were present and what the consequences of problems they ran into are helps to determine the context. Several of the questions are similar, and in none of the interviews all questions were asked to the interviewees. Often, interviewees provided answers to the questions without asking them. The questions in the protocol helped to check if all answers were provided.

Next, the moment of initial involvement in the project is determined. This helps to validate their answers and experiences. Often, interviewees know about what happened before they joined the team, but those who were present can provide more details. The success factors and barriers are discussed after the process, and its most important moments are clear. The interviewer provides an explanation of each factor to provide an understanding. If this is insufficient, an example from earlier interviews or from the literature review is provided. Similarly to the beginning of the interview, not all questions below the factors are asked. They are guidelines to ensure the required information is provided for each factor. The interviews end with asking about other undiscussed car-reducing measures and referrals to other experts. A summary of the interview is sent to each interviewee afterwards for validation.

### 3.5.2. Interviewees and their responses

In total, 14 interviews were conducted. Tables 3.7 and 3.8 describe the categorisation of the interviews. As the goal of the interviews is to know more about the policy implementation process, governmental policymakers are most relevant. Therefore, stakeholders from the government are included in each city. In Table 3.7, each row represents a different interviewee. The date that the interview took place is shown, together with the city and the organisation.

**Table 3.7:** Interviewee coding

| Interviewee ID | Date | City | Role | Organisation |
|---|---|---|---|---|
| Co1 | 19 December 2023 | Copenhagen | Public | Office of Cycle Superhighways |
| Co2 | 8 January 2024 | Copenhagen | Private | Design company |
| Co3 | 31 January 2024 | Copenhagen | Public | Office of Cycle Superhighways |
| Br1 | 19 December 2023 | Bremen | Public | Municipality: sustainable mobility |
| Br2 | 22 January 2024 | Bremen | Public | Municipality: mobility and city development |
| Br3 | 26 January 2024 | Bremen | Public | Municipality: Ministry of Construction, Urban Development and Transportation |
| Mi1 | 14 December 2023 | Milan | Public | Municipality: Mobility & Environment |
| Mi2 | 14 December 2023 | Milan | Public | Municipality: Mobility & Environment |
| Mi3 | 24 January 2024 | Milan | Public | Municipality: Housing & Neighbourhood |
| Ba1 | 18 December 2023 | Barcelona | Public | City Council: Urban strategy |
| Ba2 | 21 December 2023 | Barcelona | Public | City Council: Urban strategy |
| Ba3 | 10 January 2024 | Barcelona | Public | City Council: Urban strategy |
| Bi1 | 24 January 2024 | Birmingham | Public | Municipality: Transport strategy |
| Am1 | 22 February 2024 | Amsterdam | Public | Municipality: Team low-car |

**Table 3.8:** Stakeholders from each city

| City | Residents | Governments | Politicians | NGOs | Companies | Knowledge institutes | Implementers | Others |
|---|---|---|---|---|---|---|---|---|
| Antwerp | | | | | | | | |
| Copenhagen | | Co1, Co3 | | | Co2 | | | |
| Helsinki | | | | | | | | |
| Bremen | | Br1, Br2, Br3 | | | | | | |
| Milan | | Mi1, Mi2, Mi3 | | | | | | |
| Amsterdam | | Am1 | | | | | | |
| Oslo | | | | | | | | |
| Barcelona | Ba2 | Ba1, Ba2, Ba3 | | | | | | |
| Stockholm | | | | | | | | |
| Birmingham | | Bi1 | | | | | | |

Table 3.9 provides some general information about the interviews. As many of the teams or departments to which the interviewees belong are small, the general information of all interviewees is combined to reduce the likelihood of identification. The age of the interviewees is based on the estimation that they started studying when they were 18. The year they started studying is retrieved from their LinkedIn profile. Two interviewees do not have such a profile. Their age is estimated based on their appearance and position within their organisation. Nearly all interviewees are in the age group of 30-50. This makes them old enough to have worked within the organisation when the measure began implementation, increasing the validity of this thesis. The ratio of male/female is similar, providing an equal representation and thus perspective.

Finally, the total response rate is provided. In total, around 65 requests for interviews were sent. To begin with, emails and LinkedIn messages were sent and online contact forms were filled out for each of the nine cities originally selected for analysis. The messages were sent to general contact addresses for organisations and those for specific people. In some municipalities, the contact details of individuals were provided online. These people were then messaged based on whether they seemed involved in online policy implementation. At the end of each message was the request to recommend a colleague if the addressee was not the right person to contact or did not have time. This resulted in several recommendations. In Table 3.10, the division between the contacted people and organisations is visible. In boxes where two numbers are given, the first shows the number of initially contacted people and the second the people who were contacted based on a recommendation. So, for Bremen, two governmental stakeholders were contacted, who recommended two more.

**Table 3.9:** General statistics interviewees

| Statistic | Frequency |
|---|---|
| Response rate: no response/response no interview/interview | 45/9/14 |
| Ratio male/female | 7/7 |
| Age groups (estimated): 18-30, 30-50, 50-65, 65+ | 0,12,1,1 |

**Table 3.10:** Categorized interview requests sent

| City | Residents | Governments | Politicians | NGOs | Companies | Knowledge institutes | Implementers | Others |
|---|---|---|---|---|---|---|---|---|
| Antwerp | | 2 | 1 | | | | | |
| Copenhagen | | 9 + 1 | | 2 | 2 + 1 | | | |
| Helsinki | | 2 | | | 2 | 4 | | |
| Bremen | | 2 + 2 | 1 | 2 | 2 + 2 | | | |
| Milan | | 6 + 1 | | 1 | | 2 | | |
| Amsterdam | | 2 | | | | | | |
| Oslo | | 3 | | | | | | |
| Barcelona | | 1 + 4 | | | | | | |
| Stockholm | | 4 | 1 | | | | | |
| Birmingham | | 4 | | | | | | |

Though the interviewees are mostly from the government, the interview requests were also sent to stakeholders in other categories. Unfortunately, most did not respond, and those who did were often unavailable for an interview. The policymakers who were interviewed often recommended other interviewees from the same (governmental) organisation. These two factors likely caused the overrepresentation of governmental interviewees.

### Interviewee saturation

Per studied case in Copenhagen, Bremen, Milan and Barcelona, three people were interviewed. This is in line with the goal of 3-5 interviewees per case, and it seems that this number of interviewees is sufficient. The first interviewee explained the general implementation of the policy, which made it possible to ask questions about some of the missing elements in the second interview. The third interview was used to check contradictory information or add missing elements. It rarely resulted in completely new information but often provided more examples of what was previously discussed. From Birmingham, only one stakeholder was interviewed. Due to time constraints, no additional interviewees were sought. Therefore, Birmingham is left out of the further analysis. In Amsterdam, only one stakeholder was interviewed. Interviews with stakeholders from that municipality could only take place after the other interviews were performed. Due to time constraints, it was impossible to perform more interviews with stakeholders in Amsterdam.

# 4

# Context of the selected cities

In this chapter, the context of the cities is discussed, for which an interview is performed, together with an analysis of Amsterdam. In each city, the structure, population, mobility, mobility policy and governance are discussed. For the four case studies, background information about the analysed measures in each city is also provided, together with a timeline. This information is mainly based on the interviews. All interviewees were asked what key moments were in implementing the measure. Within the section that discusses the leading measure, these key moments are highlighted in **bold**. Not all interviewees were able to identify these moments. For example, in interview Co3 it was noted that such a project is slow, and there are no pivotal moments. An overview of the population statistics of the cities in the case studies is shown in Table 4.1.

**Table 4.1:** Population statistics of case studies

| | Population | Size ($km^2$) | Density (population/$km^2$) | GDP per capita | Passenger cars / 1000 inhabitants * | Population age <18 & >65 | Life expectancy |
|---|---|---|---|---|---|---|---|
| **Copenhagen** | 644,431 | 88.25 | 7,302 | 86,489 | 202 | 26% & 15% | 79-83 |
| **Bremen** | 563,290 | 318 | 1,772 | 54,826 | 438 | 17% & 21% | 77-82 |
| **Milan** | 1,354,196 | 182 | 7,454 | 50,786** | 510 | 15% & 23% | 81-85 |
| **Amsterdam** | 921,468 | 188.3 | 4,894 | 92,461 | 247 | 19% & 13% | 79-82 |
| **Barcelona** | 1,627,559 | 99.1 | 16,422 | 29,942 | 350 | 14% & 21% | 83 |

## 4.1. Amsterdam

In this thesis, Amsterdam is used as an initial case with which the others are compared to contextualise the results. Therefore, information is collected in this selection that is used to discover the effect of the success factors and barriers and how the lessons can be applied in Amsterdam. Amsterdam has implemented various car-reducing policies and is often attributed as being a global leader in sustainable mobility, with more than 60% of all journeys undertaken by active modes of transportation (Deloitte, 2018) and 63% of the people from Amsterdam using a bicycle on a daily basis (M Cube & TUM, 2021).

### 4.1.1. Population

Amsterdam has a population of 900,000 residents in an area of 188 $km^2$. The city has a GDP per capita of 92,000, which is the highest of the analysed cities. 13% of the population is 65 and older, and 19% is younger than 20 (Gemeente Amsterdam, 2022a). The life expectancy is 79-82 (Gemeente Amsterdam, 2020b).

### 4.1.2. Governance

Amsterdam is the capital city of the country but not the capital of the province of Noord-Holland, where it is located. Citizens of each province choose the members of the Provincial Council (Provinciale Staten).

Amsterdam is a part of the Amsterdam Metropolitan Area (Metropoolregio Amsterdam). This is a collaboration between the provinces of Noord-Holland, Flevoland, 30 municipalities and the Transport Authority Amsterdam (Vervoerregio Amsterdam). It is the financial centre of the country. Amsterdam is run by the Municipal Council (Gemeenteraad), which is chosen through elections every four years and is chaired by the mayor. The Municipal Executive (College van Burgemeester en Wethouders) is the executive board of the municipality and is responsible for executing the policies made by the Council. The mayor is the chairperson. The Council elects members. Amsterdam is traditionally a left-wing municipality. Since 1946, all mayors have come from a left party. Amsterdam is divided into eight boroughs. This system was developed in the 1980s to improve local governance. They are run by district committees (Stadsdeelcommissie) for whom residents can vote during the same elections. An executive board (Dagelijks Bestuur) executes the local tasks in the borough.

### 4.1.3. Mobility

Amsterdam is a busy city growing in numbers of residents, commuters and visitors. The bicycle is a popular mode of transport and the number of cars currently stands at 0.43 cars per household or 230 per 1000 inhabitants, which is the lowest in the country and one of the lowest in Western Europe. However, the number of cars in the city is growing. Within the municipality, 13 million kilometres are travelled each day by residents and visitors combined, which is more than 10 kilometres per person (Gemeente Amsterdam, 2021). This is a bit more than in London in 2019 (Transport for London, 2015), but less than a third of the Dutch national average (Centraal Bureau voor de Statistiek, 2022). The modal split for residents and visitors combined is 25% PT, 27% cars, 26% cycling, 19% walking and 1% moped. For residents, this is 19% PT, 19% cars, 25% cycling and 24% walking. Mainly for trips entering and leaving Amsterdam, the car is a popular mode of transport. 58% of these trips are done by car by residents (Heijnen, 2019).

The tasks regarding mobility are divided over several different layers. The Transport Authority Amsterdam is a collaboration between 14 municipalities and is responsible for car, public transport and cycling infrastructure. It also grants the public transport concessions. The municipality also sets mobility goals for the city. To use the public space most efficiently, the municipality has decided to reduce the number of cars in the city. This is realised with a number of decisions. These are focused on five goals: more living space, more space for services, more space for car alternatives, less air and noise pollution and increased safety, and an inclusive city (Gemeente Amsterdam, 2020a). To achieve these goals, the “Agenda Autoluw” (Gemeente Amsterdam, 2020a) has been created encompassing many measures categorised in:

- More clean and active movements
- Fewer cars on the road
- Fewer parking places, more public space
- Comfortable public space

One of the measures recently implemented in Amsterdam is the ‘Weesperstraat knip’ (Weesperstraat cut). As part of the second category of measures, the Weesperstraat was blocked for through traffic in a 6-week pilot. The Weesperstraat is a street in the middle of Amsterdam. The original street was expanded in the 60s to an arterial road into the city. Since the beginning of the twenty-first century, the municipality has considered narrowing the road or slowing down traffic. However, they never did. Instead, the street remained a 4-lane road into the centre and one of the few streets where cars can drive 50 km/h. Piloting a cut was included in the Gemeente Amsterdam (2020a). In June 2023, the municipality decided to close the road to through traffic, together with three surrounding streets. The pilot was implemented to discover the effects on accessibility, livability and air quality in the Weesperstraat and the surrounding areas. During the pilot, 18% fewer cars travelled in the area, and air quality increased by 14%. 3% fewer cars travelled in the other parts of Amsterdam, without a notable difference in air quality. However, on the streets used as a diversion route, traffic increased by 40% and air quality decreased (Gemeente Amsterdam, 2024b). The pilot was extremely controversial. It frequently made newspaper headlines, and the Mayor was under a lot of pressure to end the pilot. Though a few adjustments were made, the pilot remained for the six-week period. After it ended, the municipality

evaluated the experiment and concluded that in future pilots, they should involve more stakeholders. The three options they are currently considering, following the pilot, are reducing the speed to 30 km/h, narrowing the street, or only granting certain vehicles entry (interview Am1).

### Parking

Reducing the number of parking spaces is one of the categories in the Agenda Autoluw. The city has already taken several notable measures related to this topic over the years and therefore deserves further attention.

#### Parking prices

Amsterdam is already the most expensive city in the world to park on-street, and the Netherlands is the most expensive country for off-street parking (Parkopedia, 2022). From 2023, the prices were raised further, and drivers now pay for parking in more areas than before. Also, times of day when parking was cheaper or free are shortened or removed. Parking permits have also become more expensive (Hielkema, 2022).

To test the effects of increasing parking prices in Amsterdam, research showed that an increase of 66% in on-street parking prices, with off-street parking prices following closely, led to a reduction of 14% of total parking and a reduced traffic flow of 2.5%. The effect in arrivals and exits is more than twice as large in the afternoon peak hour compared to the morning peak (Ostermeijer et al., 2022).

#### Parking permits

Every half year, the maximum number of permits is reduced by 750 in the busiest neighbourhoods. In total, there are around 130,000 permits in Amsterdam. This does not affect current owners of permits but makes sure that freed permits are not redistributed. The municipality expects that waiting times for a new permit could increase to two years by 2026 (Koops, 2019). In 2021, Amsterdam started an experiment to incentivize residents to hand in their permits: Experiment Autodelen. People could sign up in pairs to share parking permits in different areas. One permit is handed in, and the remaining car gets to park in both areas while only paying for a single (the most expensive of the two) permit. The experiment ran till the end of 2023. The goal of this experiment is not to reduce parking places but to reduce cars on the street (Gemeente Amsterdam, 2022b).

#### Parking spaces

Currently, parking places in the city are being removed. The goal is to remove 11.200 places by 2025 (4% of the total) and make 30 km/h normal within the city. Since the announcement of the plans to reduce parking places in 2019, more than 4000 parking places have already been removed (Grannetia, 2023). However, an often neglected fact is that some of the parking spaces are removed from the street, not from the city. The city is building more underground parking garages. Since 2015, eight new parking garages have been planned (z24, 2015).

#### Shared vehicles

Amsterdam has a long history of shared vehicles. Back in 1965, the ‘Witte Fietsenplan’ was introduced by the anarchistic protest movement Provo to reduce emissions and increase livability. The idea was to have white bicycles without locks throughout the city to be used by everybody. However, not locking bicycles was illegal, and all bikes were confiscated (de Wildt, 2015). The creator of the idea was elected to the local council and proposed to legalise the plan to fix abandoned bikes and paint them white. The rest of the council did not agree. In 1968, he introduced a shared electric car, the ‘witkar’. In 1974, the first of five charging stations was opened. Users paid 20 guilders annually and 20 cents per minute. At the station, they scanned their key and entered their destination. The next car became available, and once it made contact with the charging station at the destination, the trip ended. In 1988, the project was cancelled. According to the creators, the municipality was to blame as they did not hand out sufficient permits for new stations (Historiek, 2023). In 2000, a new experiment for shared bicycles was set up together with the local transport operator. This project ended after a couple of months as the bicycles kept being stolen.

Structure
Amsterdam was founded on the mouth of the Amstel River, and the land was reclaimed with dams. It kept expanding and flourished during the Golden Age when the Dutch East India Company and the West India Company were founded. They also opened the world's first stock exchange. During the Industrial Revolution, the Amsterdam-Rhine Canal and the North Sea Canal were dug to give Amsterdam a direct connection to the Rhine and the North Sea. Amsterdam now has more than 100km of canals. Since 1977, a metro has started running. Between 2003 and 2018, a new metro line was built, which was often halted due to it going over budget and fears of damage to buildings.

## 4.2. Copenhagen

Copenhagen is the capital of Denmark and the first case study. It is leading in its cycling infrastructure, and the analysed measure is the network of Cycle Superhighways that is being built. Most of these cycle superhighways facilitate commuters cycling towards Copenhagen. A timeline of the implementation of the Cycle Superhighways is given in Figure 4.1.

### 4.2.1. Population

Copenhagen has a population of 644,000 residents in an area of 88.25 $km^2$. In the greater Copenhagen area, 15% of residents are 65 and older, and 26% are younger than 18 (City Population, 2022). Residents have a life expectancy of 79-83 (Statistics Denmark, 2022). The GDP per capita is 86,000, which is one of the highest of the analysed cities.

### 4.2.2. Governance

Denmark went from the 13 county division (amter) into a five region (regioner) division in 2007. An elected regional council governs each region; their main responsibility is healthcare. With the national organisational change, many municipalities were combined. Road authority over highways remained with the State: the Danish Road Directorate (Vejdirektoratet). However, each municipality received authority over their bicycle paths because of the shorter distances.

Copenhagen is located in the Capital Region of Denmark (Region Hovedstaden). The Capital Region has 28 municipalities. Four of these municipalities constitute Copenhagen municipality (Københavns Kommune), and the City of Copenhagen (København) is the largest of these municipalities. Finally, Greater Copenhagen (Hovedstadsområdet) consists of 18 municipalities). The government of the City of Copenhagen consists of the City Council and seven standing committees. Since 1938, the mayors of Copenhagen have been from the same political party: the Social Democrats.

The environmental and energy policies during the last decades have allowed for the reduction of $CO_2$ emissions by 25% between 1990 and 2009 and a further reduction of 20% in 2015. They aspire to become the greenest capital in Europe. This results from wind energy production policies, energy savings and the district heating system. The heating system is one of the most advanced heating systems in the world and covers 99% of Copenhagen's heat consumption.

### 4.2.3. Mobility

Copenhagen has 202 passenger cars per 1000 inhabitants. This has increased significantly in the last ten years. The number of bicycles has as well. There were 1165 bicycles per 1000 inhabitants in 2020. For all trips to, from and in Copenhagen, the modal split is 13% PT, 31% private cars, 30% walking and 26% cycling. 54% of the area between buildings is allocated to roads and car parking. 11% to bicycle paths and parking, 25% to pavements and 11% to squares and marketplaces (City of Copenhagen, 2021).

In the 1980s, the country was "paralysed by the oil crisis" (interview Co2). The state had no money to spend on motorways so they started building bicycle lanes. That is why the currently have so much

bicycle infrastructure. The government also put a massive tax on new cars of up to 180%, depending on the weight and emissions. This kept the car sales rates level for many years. Two governments ago, a right-wing government took power and lowered the taxes. This made buying cars accessible to more people in Denmark. As a result, Denmark has been breaking car sales records for the past 6-7 years. As many people in Denmark work in Copenhagen, they travel to the centre. For the past 30 years, Copenhagen Mayors have reduced car parking by 2-3% each year. However, the government that reduced the car taxes has also started putting back parking spaces as there was no space to park for all the new cars (interview Co2).

In 1995, the world's first city bike was introduced in Copenhagen. It was free of charge and worked with a refundable coin to unlock the bicycle. Their experiences served as an example for many cities in Denmark and outside. In 2012, the system was replaced with e-bikes: Bycyklen. However, this system was costly to develop and operate, and demand was lower than expected. Last year, it was permanently shut down.

### 4.2.4. Structure

The Copenhagen Metropolitan Area has been developed according to the 1947 'Finger plan'. Central Copenhagen remained the centre with most of the jobs and services. New urban development is concentrated along the five 'fingers' along the radial commuter railway lines (S-train). Between the fingers, land should remain undeveloped to ensure that Copenhageners are close to farmland and forests (Hermansson, 1999). This transit-oriented development is unique and still remains one of the most visionary urban development plans in the world (interview Co2). However, due to urban sprawl, the fingers have become much longer and larger than was originally intended (De Freitas Falcão Dos Reis, 2009).

Besides the good S-train connection, Copenhagen has a large bus network and a recently built metro to connect the southern suburbs of Copenhagen to the S-train (De Freitas Falcão Dos Reis, 2009). In 2010, the regional trains made it free to take your bike on the train and new compartments made it easier. The goal was to connect cyclists over larger distances. However, it resulted in cyclists using the train over distances that they otherwise would have cycled (interview Co2).

### 4.2.5. Leading measure

In 2006, the Mayor of the Technical and Environmental Committee requested ambitious cycling projects from his cycling office consisting of around 30 people (interview Co2). In 2008, an analysis from hired consultants showed the potential for long-distance bike commutes in the Capital Region. With the Lord Mayor, in 2009, the Mayor for the Technical and Environmental Committee introduced Copenhagen's goal of having 50% of commuter traffic by bike, which matched the overall goal of growing as a cycling city. They hoped to reduce car traffic and the resulting congestion and air pollution. However, due to the organisational reform two years earlier, the municipalities were responsible for their bicycle paths. These were no longer centrally organised, so the city could not go to the regional authority. This posed a challenge for the city.

Copenhagen joined forces with 16 municipalities and the Capital Region the same year. The Region dedicated a budget for cycling infrastructure. In 2010, the Region decided to grant money to develop an annual cycling collaboration. Every several years, they make **a national infrastructure agreement** that determines the infrastructure in which they want to invest. Municipalities can then apply for funding. In 2011, the Office for Cycle Superhighways began with a "let's see how it goes mentality" (interview CO1). It started with one employee. Over time, students and new employees were hired (interview Co3). Currently, the Office is a team of five: the head of Office, the head of communications, the head of data and monitoring and three people responsible for the routes.

The Office has a steering committee: one representative from each municipality, usually the head of the traffic department. They meet 2-3 times a year. Based on the items set on the agenda by the Office, the committee members make high-level decisions. The project committee includes representatives from each municipality who are responsible for implementing the routes. They also meet 2-3 times

a year to discuss the day-to-day operations and, more often, in smaller groups regarding a specific route (interview Co1). Getting people to work together who are from different departments within their municipalities can be difficult (interview Co3).

The Office mainly works together with other municipalities. Sometimes, they work with larger employers to promote cycling and encourage their employees to cycle. However, this is very time-consuming and can only be done in areas with a high density. They rarely have contact with individual commuters. If users of the bicycle paths have complaints, they can go to the Office, but as the municipality has more power in how the design and implementation of the routes, residents contact them more often. Therefore, the Office does not know how many complaints there are in total.

In 2012, **the first Cycle Superhighway was launched**. Following its opening, the plans for the number of cycle highways expanded. They began with 28 and now have over 60 routes planned, with a combined distance of 850km (interview Co1). The first routes were the most obvious commuter routes (interview Co2). The cycle highways were planned as corridors between work and residential areas where commuters cycle for the largest part of their journey on the highways and find other roads for the remainder of their commute (interview Co1). In 2013 came the next route, and in 2016, the third. Another five followed in 2017. The routes originated from the municipalities. Municipalities propose new ideas in their vision plans, to be further specified later (interview Co1). In 2018, **the first bicycle count** showed the positive effects of the Cycle Superhighways on cycling traffic and reduced sick days and emissions. This provided important argumentation for the project and why municipalities should keep working on it. Over the years, the Cycle Superhighways improved. People do not want to cycle or walk for more than 30 minutes, so the city of Copenhagen implemented a green wave where cyclists do not have to wait for traffic lights. This increased cycling by 60-70% in Copenhagen. Lights were also added so cyclists feel less vulnerable in the dark. These lights now turn off when there are no cyclists nearby, so animals are less affected (interview Co2).

The Capital Region finances the Office for several years at a time. **Each time they do so**, they set the frame and possibilities. The willingness to continue support is uncertain leading up to that moment. In the same period that the collaboration began, a different project stopped. For many years, politicians tried to implement a congestion charge around Copenhagen following a successful trial. However, in 2012, the idea definitively stopped. Still, they had the momentum to change traffic behaviour. The existing municipal collaboration that had formed around the congestion charge was a starting point for creating the Cycle Superhighways. This helped in pushing the cycle highways further (interview Co1).

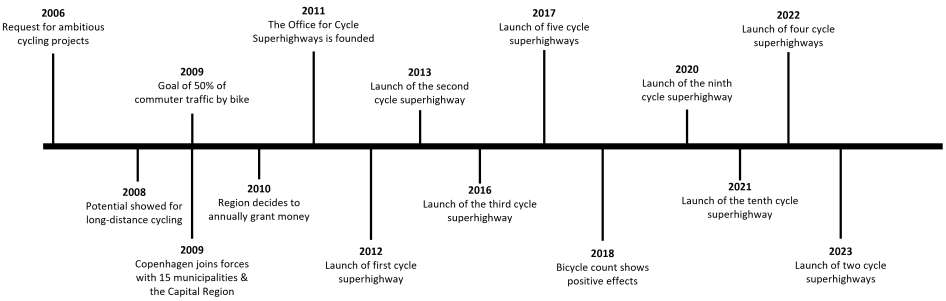


**Figure 4.1:** Timeline Cycle Superhighways Copenhagen

## 4.3. Barcelona

Barcelona is the capital city of Catalonia, Spain, and the second-largest city in the country. The analysed measure of Barcelona, in which it is leading, is its Superblocks. These are areas in a grid of houses where car traffic is reduced with tactical interventions that reduce through traffic and improve living space. A timeline of the implementation of the Superblocks is given in Figure 4.4.

### 4.3.1. Population

Barcelona has over 1.6 million residents in an area of 102.16 $km^2$ and ranks in the top 10 European cities with the highest density. With 29,942, its GDP per capita is the lowest of the analysed cities. Residents have a life expectancy of 83 (Borgato et al., 2021). 21% of the residents is over 65 years old and 14% is younger than 18 (City Population, 2023a).

### 4.3.2. Governance

Catalonia has a history of fighting for independence. Limited autonomy was granted in 1977, and full autonomy in 1979. In 2006, Catalonia was granted 'nation' status, which was struck down in 2010 by Spain's Constitutional Court, making Catalonia a 'nationality' instead of a 'nation'. Since then, there have been several attempts and unsanctioned referenda for independence from Spain (Rodriguez, 2024).

Barcelona's current governance model originates from the first democratic elections in 1977. Votes are cast for a municipality-wide list of candidates who are members of political parties and headed by each party's nominee for the post of mayor. Mayors, normally the head of the majority party, are elected by members of the full council (Blakeley, 2005). From 1997 to 2007, the Socialist Party was in power. Then, the Catalan European Democratic Party had power until 2015. The new left-wing political party defeated them "Barcelona en Comú", launched a year early to defend social justice and promote participatory democracy. It was led by the anti-eviction activist Ada Colau. In 2019, she won again but had to form a coalition to form a majority. She then focused on two strategies: (1) How to adapt the city to climate change impacts after the city declared a climate emergency in 2020 and (2) How to take care of and focus on the people living in the city after focusing on promoting the city on a global scale (interview Ba1). In 2023, she lost the elections to the Socialist Party.

### 4.3.3. Mobility

Barcelona has 350 passenger cars per 1000 inhabitants and a modal split of 18% PT, 35% private motorized, 47% active modes in 2019 (Borgato et al., 2021). In 2021, journeys by car accounted for 47% of all trips. Barcelona allocates 60% of its public space for the use of cars, and due to the high density, there are 6,000 cars per $km^2$, twice as many as in Madrid or Paris (ACN Barcelona, 2021). Due to its climate and dense construction, walking is a popular mode of transport, accounting for nearly all active modal trips. In Barcelona's Urban Mobility Plan, greater importance is put on pedestrians and cyclists, increasing the use of public transport (PT) and reducing the use of private vehicles (Rueda & Franzen, n.d.).

During the 60s, Barcelona's car fleet doubled and public space was dedicated to cars. In the 70s, they realized that this was a problem and started to reduce that number. Currently, the amount of public space they had before has not returned (interview Ba2). In 2007, Barcelona implemented a bicycle-sharing system promoted by the City Council: Bicing. The system was received with great enthusiasm, and several neighbouring cities have asked for the service to be expanded to their cities. In fact, in the beginning, it was too successful, with 1,000 users in the first year, resulting in unavailable bikes. In the years after that, they increased the number of available bikes and added e-bikes, helping people realise how good car alternatives can be (interview Ba2). In 2023, a new bicycle-sharing system was launched for the Barcelona Metropolitan Area, including all municipalities: AMBici. The system will merged with the existing Bicing scheme (LEVA EU, 2022).

Besides the Superblock project discussed in the following section, the municipality began a different project: Let's protect the schools. This started after a child was killed by a motorbike in front of his school. The Mayor wanted a programme so that would never happen again. They started by identifying the most dangerous areas surrounding their 600 schools. From those schools, they selected 200 to perform tactical interventions and increase safety (interview Ba1). Now, they have transformed the area around eight schools and removed parking spots. "Schools are powerful" (interview Ba1). The mistake they made here was presenting the project as a whole. Though they only removed several spots here and there, combined, they removed many spots. This resulted in resistance, though less strong due to the fact that the safety around schools is improved (interview Ba1). Under the new government, this project, and projects like building more bicycle paths, have been stopped. The person in charge is now designing public toilets; "that's the future of our technical staff" (interview Ba2). The power of schools can also be seen in a different project where the municipality added speed cameras so drivers would respect the new 30 km/h speed limit. The lobby for car drivers complained about most, except the cameras in front of schools as they cannot argue against those.

### 4.3.4. Structure

Barcelona is an old city with settlements dating back to 5,000 BC. Instead of the sprawl seen in many newer cities, Barcelona's expansions have been carefully designed. After the walls surrounding the inner city were torn down in 1854, an architect was appointed to design the new city. He wanted to ensure that all residents had enough water, clean air, sunlight, ventilation and space. Each block was to have identical proportions and have its own shops and civic facilities. The blocks were oriented northwest to southeast to maximize daily sun exposure. Shops were designed for the bottom floor of each building, the bourgeoisie were to live on the floor above and workers on the upper floors. This maximized equality. He designed the streets to be wide enough for the free flow of pedestrians, goods and commerce. Though cars were not around yet, he anticipated city steam trams and designed the roads to be sufficiently broad and provide sufficient space in corners for them to turn. However, the city was not built entirely according to his design. The roads were narrowed in response to criticism, so there was more room for commerce, and much of the designed green and open space was filled with housing. Instead of 50%, the buildings occupied 90% of the block's area. This resulted in 90% of the blocks violating the 1872 design (Roberts, 2019b).

### 4.3.5. Leading measure

The increased number of residents, cars, and tourists has caused the city to become polluted in terms of both noise and air quality. In the 1980s, research showed that for the city to meet the recommended noise level of 65 decibels, through traffic should be removed from neighbourhoods. That is when the idea of the superblock was born. The Superblocks (Superillas) are areas within a 3x3 block, or approximately 400m x 400m, with around 5000-6000 residents, where non-residential through traffic is blocked. The goal is to reverse car dependency and design "sustainable, healthy, compact, and connected spaces with a mixed land-use and a high potential for social capital" (Fabris et al., 2020, p. 387). The first superblock was built in 1993 in the historic city centre. The rundown area filled with crime gentrified after removing car traffic and filled with boutiques and hotels. Due to its existing narrow streets, it was less of a challenge. In 2003, the next two Superblocks were built. These Superblocks were not yet in line with the design as described above. In some streets, traffic was blocked, but in most streets, cars were still allowed, only at a lower speed (Roberts, 2019b). In 2012, the newly elected Mayor decided to design a new mobility plan for the city (Roberts, 2019a). In this mobility plan, Superblocks were developed by collaborating with Barcelona City Council and the Urban Ecology Agency (Fabris et al., 2020). The 2015 final plan included 500 Superblocks, covering 70% of Barcelona. Later that year, a new Mayor was elected. For the annual project organised by the architecture schools in Catalonia, the Superblock was designed and built by 100 students with a budget of 70,000 euros (interview Ba2).

The **first pilot in Poblenou** can be seen in Figure 4.2 and Figure 4.3. Before the superblock was implemented, traffic could cross the area on the roads in the grid, similar to any other road. Since the superblock is built, only residents can enter the area and drive at 10 km/h. Also, they cannot drive through the superblock, and the roads loop back. Within the superblock, this creates space for res-

idents to cycle, walk and enjoy the comfortable outdoor living space. In the streets surrounding the block, buses and car traffic circulate at a higher speed.

Though residents enjoy the superblock's benefits, this has not always been the case. The Poblenou superblock resulted in a lot of pushback. It was designed to be a three-week project ending on the European car-free day. This meant that the superblock was implemented at the beginning of September. This was a problem for several reasons. First, many people returned home from vacation in that period and were barely notified. Second, the annual feast of the streets was in that period, so many other roads were blocked. Finally, there were roadworks around the area. "It was probably the worst moment to do that" (interview Ba2). After the three weeks ended, everything was removed. The area where the superblock was built had only been transformed from an industrial area into housing five years earlier, and neighbours did not know each other. This newly designed area was the perfect living lab as it only had 2,000 people in the nine blocks, compared to 10,000 in busier parts. Together with the students who designed the three-week experiment, residents organised meetings and set up WhatsApp and Facebook groups with people who wanted to continue the project. Within several months, the people in favour had united in an association. Together with the Deputy Mayor, who also favoured keeping the superblock, regular meetings were held for three months, and new materials were ordered to reinstate the superblock. Residents and local businesses who were against it started protesting and collecting signatures against it (interview Ba2). Tyres that were placed for children to play on were burned at night (interview Ba3). Because the area had only recently been transformed, on-street parking was not yet regulated, and car dealers could use the streets as their showrooms (interview Ba2). Every day, the municipality had emergency meetings (interview Ba3). This changed when the superblock was implemented. Furthermore, though the feast of the streets and the roadworks were happening simultaneously, the superblock was blamed for the increase in traffic. Later, it was proven that the superblock did not cause the traffic. Within the first six months, the superblock was at serious risk of being removed. **The Deputy Mayor and the district managed to resist the pressure and continue with the project** (interview Ba2). "It was more a Deputy Mayor project [than a project by the Mayor]" (interview Ba3). Over time, opinions changed as residents got used to the calm areas and trees and tables were added (Roberts, 2019a). Many residents who live in a superblock never want to live without (Roberts, 2019a). It took two years for the Mayor to get behind the project and in her second term, when she discovered that by improving public space, everyone's quality of life can be affected, she pushed the programme.

By 2017, 13,350 $m^2$ was pedestrianized, 538 $m^2$ for playgrounds, 212 new trees and over 300 benches. In the streets surrounding the superblock, traffic increased by 2.6%, but inside the superblock, it dropped by 58% (Fabris et al., 2020). The total cost for the first superblock was 3.5 million euros, requiring a significant budget for the next entire plan to build new Superblocks. The Europen Investment Bank provided 95 million euros to promote urban regeneration with a focus on the environment and to boost the economic recovery in the wake of the pandemic. Up to 25% of this funding was to implement Superblocks (European Investment Bank, 2020). The new circulation plan in the Poblenou superblock resulted in problems for companies in the area. They felt isolated. Learning from this, a consensus must be reached with everybody involved in the following Superblocks. This led to a slower but better process in the later Superblocks, such as that in Sant Antoni. Following the success of the first superblock, another two **pilots started in Sant Antoni** and Horta, followed by another two in Les Corts and Hostafrancs (Benavides, 2019). Because of the new participatory process designed for the Sant Antoni superblock, it was a huge success. This helped the superblock project a lot (interview Ba2). This area was a real residential area and had more engagement before building the Superblocks (interview Ba1).

The next step in the city design was to connect the five Superblocks with Supermanzanas: **green axes and squares** where the pedestrian has priority. **With positive data** from the first two Superblocks, they scaled the project up for the entire city, not only the easy-to-transform areas (interview Ba1). This began in the Eixample district with 21 green streets and 21 green squares, of which four big squares of about 2,000 $m^2$ each. Combined, they consist of 334,000 $m^2$ of new pedestrian areas and 66,000 $m^2$ of greenery. This provides all residents of the Eixample access to pedestrian public spaces within 200m from their homes (Alberti & Radicchi, 2022) by connecting the existing Superblocks. This new strategy

was smarter and quicker. In the Eixample district, more than 60% of traffic is on foot, but because it is connected and has underground parking, it is used by commuters travelling through the area. By removing through traffic, traffic in the entire city decreases.
A network of green axes was also being created in the Sant Martí district. On the green axes, the separate streets and sidewalks are turned into equally level shared streets, cars can only drive 10 km/h and need to give way to pedestrians, asphalt is replaced by granite and concrete, the current 1% green is turned to 14%, and new street furniture is added. (Ajuntament de Barcelona, 2022).
The newly elected government does not like the superblock programme and has started to undo the progress, turning sidewalks into car parks (interview Ba2). Still, the EU is obliging them to combat air pollution and there is a demand from residents for Superblocks. The new politicians may stop using the superblock name, but “the need for transforming the city unstoppable” (interview Ba1).

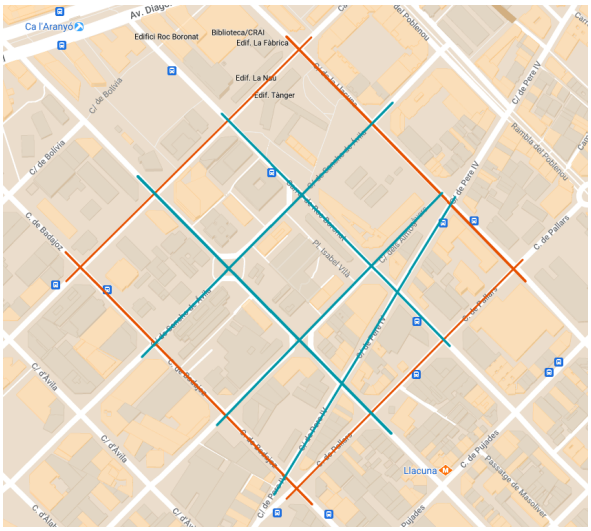


**Figure 4.2:** Before superblock Barcelona


**Figure 4.3:** After superblock Barcelona

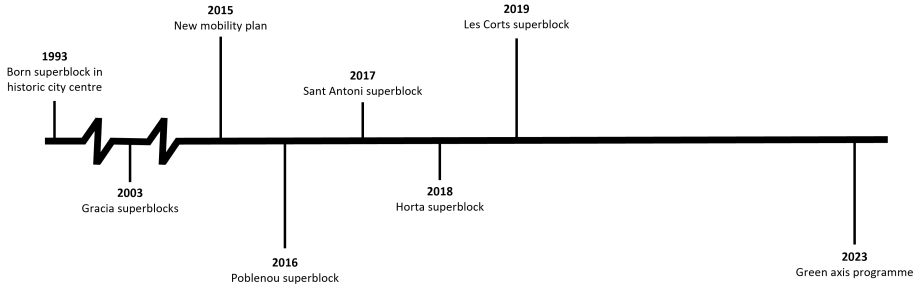


**Figure 4.4:** Timeline Barcelona

## 4.4. Bremen

Bremen is the 11th largest city in Germany and the second largest city in Northern Germany. It is known for, and leading in, its shared car scheme and is therefore included in this research. The shared car scheme was one of the earliest in Europe and has grown ever since, replacing a significant number of cars and helping Germany become Europe’s biggest car-sharing market (Deloitte, 2017). A timeline of the implementation of shared cars is given in Figure 4.5

### 4.4.1. Population

Bremen has a population of 563,000, making it the city with the smallest population included in this analysis. It covers an area of 326 $km^2$ and has a GDP per capita of 55,000. 21% of the residents is 65 years and older and 17% is younger than 18 (City Population, 2021). Residents have a life expectancy of 77-82 (Destatis, 2022b).

### 4.4.2. Governance

Bremen is located in the Free Hanseatic city of Bremen (Freie Hansestadt Bremen). This is the smallest federal state of Germany. This state consists of two separate cities, Bremen and Bremerhaven, and is fully surrounded by the state of Lower Saxony. Since 1358, it has been a member of the Hanseatic League, and since 1646, it has been recognized as sovereign. In 1827, Bremen bought land from the Kingdom of Hanover and built a new seaport: Bremerhaven. Since then, they have formed one administrative and economical free port. The Stadtbürgerschaft is responsible for the Hanseatic city and is elected mostly by the city of Bremen and partly by Bremerhaven. Due to Bremen's port and related industries, there is a large and unionised working class, which has traditionally translated into support for the Social Democrats. Since 1945, all mayors have been from the Social Democratic Party and have formed coalitions with The Greens (Die Grünen) and The Left (Die Linke) since 1987.

### 4.4.3. Mobility

Bremen has a long history of public transport. This began with a horse-drawn tram, which has now become a network of tram lines, bus lines and the S-Bahn. Bremen also invented the cycle street, founded the National Cyclist Federation (ADFC) and was the first city with a Car-Sharing Action Plan after introducing car sharing in 1990 (interview Br1).

Bremen has 438 passenger cars per 1000 residents, which is a bit lower than the 580 in Germany as a whole (Destatis, 2022a), and 71% of all households have a car. The modal split for all travel in Bremen is 17% PT, 38% private car, 15% walking and 20% cycling. Bremen shows the highest share of cycling (25% for residents) of all large German cities, though most of these trips replace public transport trips, and the percentage of car trips remains similar to other German cities (Der Senator für Umwelt, Bau und Verkehr, 2014). Due to the industrial nature of the city, it has a relatively high amount of commercial and heavy-duty vehicles (ULaaDS, 2022).

In its 2014 Sustainable Urban Mobility Plan, Bremen clearly oriented towards sustainable modes and innovative participatory concepts, earning it the EU's SUMP award. The department responsible for the SUMP has been a well-known partner in European projects.

### 4.4.4. Structure

The city of Bremen lies on both sides of the Weser, a river that ends in the North Sea at Bremerhaven. Bremen is also well connected by railway and road (ULaaDS, 2022). This rail and sea connection meant Bremen had an important role in trade with the Americas, Europe, and Africa. During the Second World War, Bremen was heavily bombed, and afterwards, the US appointed a Social Democrat as mayor who ensured Bremen remained independent. A statue and cathedral survived the bombing, but little effort was put into restoring other buildings as priority was given to building much-needed houses and restoring the industry and transport.

### 4.4.5. Leading measure

Following examples in Switzerland and Berlin, a group of people (Ökostadt) requested funding from the municipality for a workshop for car sharing in Bremen in 1990. This funding was granted; from the event, a car club (StadtAuto Bremen) started with 28 members and three cars (interview Br1). The goal was to provide an alternative, not to make money (interview Br3). The club has been growing since then. In 1995, the idea came to use car sharing to reduce the number of cars in the neighbourhood. A collaboration with the transport operator started but ended with no car space near the public transport stations. It was difficult to reserve public space for car sharing because no official definition existed.

In 1995/1996, the Blue Angel label was proposed to recognize good car sharing. However, they encountered resistance from the Eastern provinces, who stated the system was “socialism through the back door”. East and West Germany had only recently been unified, and this was a sensitive topic. 1.5 years later, the ministers unanimously agreed to the ecolabel. Up till then, the system worked mostly through trust. This changed when the smart card and online options were introduced in 1998. This helped with unlocking the potential of car sharing and getting European funding. However, as they still had no legal basis for reserving public street space for car-sharing, the senator asked for a working solution (interview Br1). In 2003, the team started with the **on-street stations as a pilot**. Labelling it as a pilot resulted in a lower barrier. The signage was called a construction project for which they applied for building permits. Through this creativity, they got some legal stability, though the reallocation of public space did cause the fear of being sued (interview Br3). In 2005, an evaluation showed that a shared car replaced 9.5 private cars, much higher than the expected five cars. With the positive results, they approached the federal government with a Parliamentary Decision of the Bundestag, calling for a framework allowing car-sharing stations. However, the deputy minister for economy vetoed it, stating it was against the motor industry. In the following years, the project won several national and international prizes. In 2009, the **Bremen car-sharing plan** was passed, which included the goal of 20,000 users by 2020. This resulted in lots of publicity as it was significantly more than the 5,000 users they had at the time (interview Br1). In 2013, their **approach switched from large centralized stations to smaller decentralized stations** for 2-3 cars in neighbourhoods. Since then, the municipality has tried to build with a maximum distance of 300m between stations. This made it easier to find space and helped people find cars with which to begin their journey (interview Br3). These stations are also cheaper, at around 5,000 euros, to build and have space for shared bicycles, e-scooters, and, if possible, private bicycles (interview Br2). For a car-sharing operator to use the stations, they pay rent and build private stations. This combination results in the desired density (interview Br2). The collaboration between the operator and the municipality is good. By communicating clearly, there is no competition (interview Br2). In 2017, the **German car-sharing law was finally passed**. It did not include the goal of reducing parking pressure, their main objective, and it required accompanying regulations on the state level. In 2019, **Bremen passed its car-sharing law**, thus finally providing the municipality with a strong legal foundation. In 2021, **the original goal of having 20,000 users was achieved**. It was a year later than planned, but this was due to COVID (interview Br1). In 2022, a new law was passed in Bremen (Mobilitäts-Bau-Ortsgesetz), requiring all new building developments to implement mobility management measures (interview Br3). These can include bicycle sharing, scooter sharing and repair stations (interview Br1).

The location for a new station can be selected in three ways. The first is by integrating a station in a new housing development, according to the new law. The second is when the municipality selects an area. Due to parking pressure in the centre, cars often park on the sidewalks, blocking the road for emergency vehicles. As shared cars reduce the number of private cars, placing a station can solve the issue. Finally, the municipality can ask neighbourhood committees if they have suggestions for new stations. Based on their ideas, the municipality makes a ranking (interview Br2).

Over the years, they have discovered several factors that influence success. The first example is that people appreciate the reliability of the station-based system. Free-floating cars can supplement the station-base system, but are unreliable as an only option. The density of the stations is also important. Furthermore, policymakers need to accept that people need to use a car every now and then (interview Br1). Therefore, it is not sufficient to improve alternatives, such as bicycle paths. The goal is to reduce car ownership, which is why car sharing is necessary (interview Br2). People do not dispose of their cars as soon as car sharing is available. During specific events, such as when they receive high repair costs for their car or when they move, people are willing to make changes. If the physical stations are then present and recognized, they may switch (interview Br1).

## 4.5. Milan

Milan is a global city, the regional capital of Lombardy, and the second-largest city in Italy. There are two analysed measures in which Milan is leading. The first is the open squares programme, where

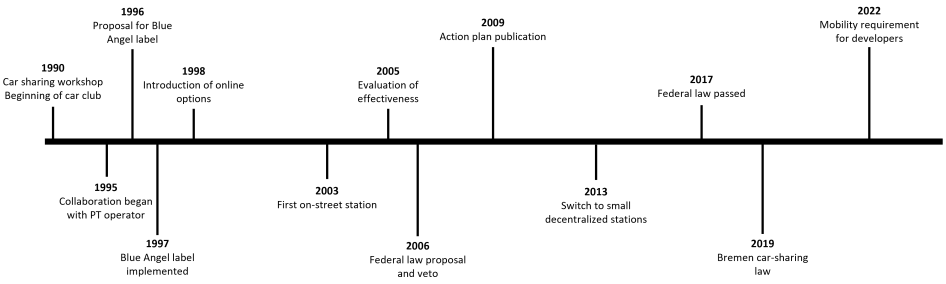


**Figure 4.5:** Timeline Bremen

car-centric public space is transformed to improve livability and become more attractive to pedestrians. The second is the open streets programme, where low-cost bicycle paths are built on roads previously dedicated to cars. Both projects are implemented temporarily and designed to be experimented with different options. A timeline of the implementation of the projects is given in Figure 4.7

### 4.5.1. Population

Milan has a population of 1.3 million residents in an area of 182 $km^2$ and a GDP per capita of 50,786. It is the wealthiest city in the country and the third-largest economy in EU cities after Paris and Madrid, making it the wealthiest non-capital city. Residents have a life expectancy of 81-85. 23% of the population is 65 or older and 15% is under 18 (City Population, 2023b).

### 4.5.2. Governance

Milan's municipality is run by the City Council (Consiglio Comunale), elected every five years. The municipality of Milan is divided into nine Borough Councils (Consigli di Munipio). Milan is the capital of the Metropolitan city of Milan. Milan is also the capital of Lombardy, the most populated region in Italy. A Regional Council governs this region. As of January 2015, the Mayor of Milan is also the Mayor of the Metropolitan city, presiding over a Metropolitan Council formed by 24 mayors of municipalities. The Metropolitan City has the administrative powers of a province to coordinate the provisions of basic services better. Since 1993, the Mayor has been chosen by direct election instead of by the City Council. Between 1946 and 1993, the mayors were members of social-democratic parties. Since then, mayors have been right-wing conservatives or independents.

For mobility, the Agenzia Mobilità Ambiente Territorio (AMAT) is responsible for the designs. It is a company completely owned by the municipality with a scope of mobility, decarbonisation, energy efficiency, circular economy, urban planning and regeneration (REMY, 2021).

### 4.5.3. Mobility

Compared to other European cities, Milan has had a high usage of private automobiles for transport. 61% of trips were attributed to cars and motorcycles. Milan has 510 passenger cars per 1000 residents, the highest of the analysed cities. Inside the city, the modal split is 56% PT, 30% car. Walking and cycling have a similar percentage.

In 2008, the city committed to cut 20% of greenhouse gases by 2020 and implemented a congestion charge scheme based on the level of emissions in the same year: Area C. The goal was to improve the living conditions of those who live, work, study and visit the city. Access is restricted; only vehicles meeting certain emission standards can enter during the weekday daytime after paying a fee. This measure has resulted in 28% less traffic and significantly less emissions. Income has been reinvested in public transport, the bike-sharing system and IT management (Berrini, 2014). In that same year, Milan launched its bike-sharing system, BikeMi. It was the world's first bike-sharing system that combines traditional and electric bicycles (Berrini, 2014). In 2009, a plan was published explaining how they would

reach that goal by improving cycling infrastructure as one of the main focuses (Bartling, 2023). In 2012, the new city master plan, which included eighty-eight local identity cores, was published (Fabris et al., 2020). In 2013, the city adopted a sustainable urban mobility plan (SUMP) to reshape Milan's overall mobility. The strategies included a regional rail service, underground & tram extensions, and bus rapid transit. Safety was given priority in public space, 30 km/h zones and a focus on walking and cycling. In 2016/2017, a general masterplan was developed. In 2018, a new SUMP was published. That was followed by a quality of air plan and a neighbourhood plan. The neighbourhood plan is a specified version of the general master plan where, for each of the 88 neighbourhoods, a transformation is planned. Currently, they are working on the 30 km/h city, closing the city centre for cars (interview Mi2) and implementing a LEZ (interview Mi3).

### 4.5.4. Structure

Milan is divided into nine boroughs (quartieri) of which eight surround the centre. The centre borough includes the historical centre, which is surrounded by the Spanish walls, and everything within the second ring road. Surrounding the first zone are radials leading toward the other eight zones.

### 4.5.5. Leading measure

In 2015, the city transformed a congested street into a pedestrianized space using removable barricades and planters to accommodate the large numbers of visitors to the city during the world exhibition. The Bloomberg administration inspired them by the 2009 New York pedestrianization of Broadway. Surveys revealed that residents enjoyed the pedestrianization, and the change became permanent (Bartling, 2023). Bloomberg Associates, the philanthropic consultancy that advises cities, used their experience in New York in Milan.

Following the decades of car-centric design where public space was traded in for roads and parking spaces, the Mayor of Milan decided to launch the Piazze Aperte initiative in 2018, 18 months before the pandemic (Bartling, 2023). This plan was part of the neighbourhood plans where economic resources were allocated to local intervention (Fabris et al., 2020). The program was developed by Agenzia Mobilità Ambiente Territorio (AMAT), together with Bloomberg Associates and the Global Designing Cities Initiative (Bartling, 2023). Using paint and planters, benches and ping-pong tables, public space was reclaimed. The goal was to bring urban spaces back into public life, improve safety, encourage collaboration between residents and implement low-cost transformations before addressing permanent interventions (Comune di Milano, 2022). An example of such transformation is shown in Figure 4.6. In 2018, the first two piazza were implemented (Maletti, 2020). The car circulation was modified, the number of lanes and intersections was reduced, and parking lots were removed. The areas were enclosed with potted plants, benches, table-tennis tables, bike-sharing stalls and other urban furniture. The streets were painted with a dot pattern (Fabris et al., 2020). In 2019, another 13 piazza followed. The first six piazze that were implemented were important for different reasons. They discovered how the municipality could go about such a transformation and defined the toolkit (interview Mi1). The following demonstration projects showcased the new methodology (Alberti & Radicchi, 2022). The design kit comprises basic and low-cost elements with a central role given to citizens constantly involved in the design process (Maletti, 2020). Given the successful implementation, monitored over two years, three temporary squares were turned into permanent projects (Alberti & Radicchi, 2022).

The city then launched the Piazze Aperte in Ogni Quartiere in 2019 to identify new spaces to be transformed as proposed by associations and residents (Prati, 2022). The organiser suggested 52 areas, but citizens proposed 15 extra areas (Bordin et al., 2022), resulting in 65 suggestions being made by 800 residents, 75 businesses and other organisations (Alberti & Radicchi, 2022). After suggesting locations, citizens were asked to propose functions, aesthetics and furniture transformations. In the final phase, citizens were involved in a common design process to refine their proposals and fulfil the regulations (Bordin et al., 2022). Resulting from the open call, 22 piazze were implemented between 2020 and 2021 (Huang, 2023), beginning in the first weeks of the pandemic (Fabris et al., 2020). In total, the 35 interventions made between 2018 and 2021 resulted in 22,000 $m^2$ of new pedestrian space created with 250 benches and 380 bike racks. It is estimated that each intervention comes at the cost

of 50,000 - 150,000 euros (Fabris et al., 2020). As of May 2022, the Municipality implemented almost 40 interventions (Huang, 2023) with half of the Milanese residents having a square within 800m from their home. These interventions are temporary in nature, allowing cities to try out solutions that can be reversed if needed before investing in permanent infrastructure (Comune di Milano, 2022; Prati, 2022). These light, fast and cheap interventions to improve the quantity and quality of public areas often work by closing areas for vehicular circulation or parking by placing urban furniture and plants or ground paintings and markings (Fabris et al., 2020). They showed at one of the piazza that the transformation resulted in a 50% increase in the flow of pedestrians, 72% of the people spent more time in the square and 84% of the people were in favour of making the interventions permanent (Bordin et al., 2022).

In 2022, the municipality launched the third phase of the project: Open plazas for every school. They found that school communities were most engaged with the projects, so they asked schools to apply for new tactical urbanism projects. They received 87 proposals with 110 projects. In the next three years, the municipality plans to implement at least 30 projects and include separate requests from neighbourhoods (interview Mi1).

Through collaboration agreements between the City and its residents, the aims and expected results are defined with the goal of addressing the management and maintenance (Comune di Milano, 2022; Prati, 2022). The municipality guarantees the supply of the design kit, interventions from professionals, periodic cleaning, and extraordinary maintenance. Citizens periodically organise events, initiatives, and everyday management (Maletti, 2020). After building the tactical interventions, they need to be made permanent. Currently, six have been made permanent, and another four will follow in 2024 (interview Mi1).

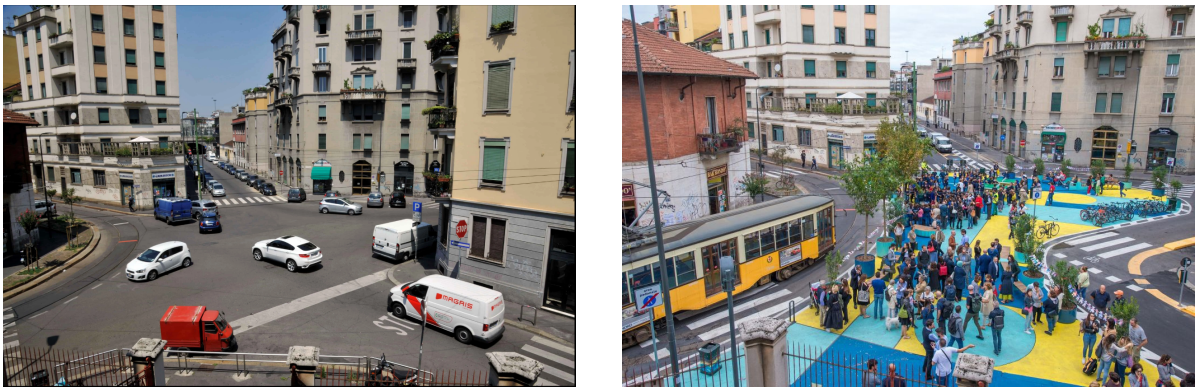

**Figure 4.6:** Before and after Piazze Aperte (Bloomberg Associates, n.d.)

Besides the Piazze Aperte, Milan introduced another plan: the Strade Aperte. During the pandemic, in 2020, the plan to implement emergency cycling-related measures for post-pandemic mobility was launched. Within the municipality, there was a concern that travellers would be hesitant to return to public transport after the pandemic due to viral transmission. Municipal officials worried that this hesitance would result in a modal shift to private automobiles. Micromobility, such as bicycles and scooters, could provide the necessary distance to prevent new infections. They called for doubling the number of cyclists, from 8,000 to 16,000, and even more for the number of electric scooters, from 2,250 to 6,000 (Nalmpantis et al., 2021). Milan officials implemented experiments without regular public consultations to enable this increase in active mobility users. This caused some pushback from opponents who saw the pandemic as an excuse to push the infrastructure. However, the officials argued that the infrastructure could be reversed if necessary.

The plan consisted of three parts. The first was to increase space for cyclists and pedestrians and other recreational and commercial use (Bartling, 2023). The second was to convert 35km of roads into bike paths and pedestrian areas over the summer during the coronavirus lockdown. The third was to include an expansion of a 30 km/h zone and dedicated areas for micromobility (Bartling, 2023; Sposini, 2020). Research by Abdelfattah et al. (n.d.) showed that 21% of Milan's sidewalks were unfit

for social distancing and required direct expansion or integration within strategic street reclamation efforts. Where physical conditions are restrictive, transformation into shared space between users was recommended. The shared street model provides higher safety for all users and can support local restaurants, especially with reduced indoor capacity during the pandemic. Between 2020 and 2021, 68km of new cycling lanes were created (Comune di Milano, 2022). New streets and intersections are selected based on accident data. If there is a dangerous intersection, they change it. Now, after three years, most of the interventions have become permanent. During this process, they check the data and determine if the number of cyclists is increasing. They also receive feedback from cyclists about how they feel about safety (interview Mi2).

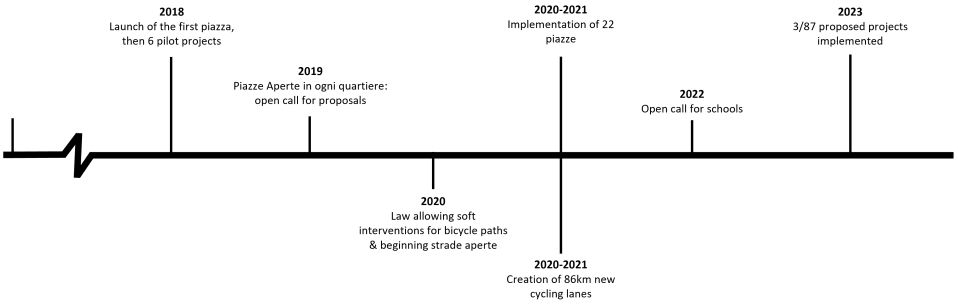


**Figure 4.7:** Timeline Milan

# 5

# Results

To determine the influence of success factors and barriers in the implementation of car-reducing measures, 14 semi-structured interviews were held with stakeholders in several European cities. Stakeholders from nine cities were contacted with the goal of performing 4-5 case studies with 3-5 interviewed stakeholders per case study. In the end, four case studies that met that criterion were performed. One interview was held with a stakeholder from the municipality of Amsterdam.

An overview of the definitions of the success factors and barriers is shown in the Glossary. Success factors are classified as present, somewhat, or not, as indicated in Table 5.1. Certain success factors are clearly present, and others are less. A similar classification is used for the barriers, as shown in Table 5.2.

**Table 5.1:** Overview presence success factors

| City | Sticks and carrots | Openness and flexibility | Trials |
|---|---|---|---|
| Barcelona | Somewhat, space is transformed so the stick is reducing car space and the carrot is increasing living space. | Yes, changes to the design of the Superblock are made to increase the acceptability in that area. | Yes, the first Superblock was built as a three-week project to explore what would happen. |
| Copenhagen | No, the responsible office only wants to work on a positive product and not include sticks. | Yes, municipalities are free to implement the Cycle Superhighways and the standards are only guidelines. | No, the first Cycle Superhighway was completely built without a trial. |
| Bremen | Somewhat, parking space is used for car sharing stations but this strategy is not used purposefully. | Yes, residents and local politicians can make changes to the design and placement of the stations. | Somewhat, the first stations were built as pilots and officially the stations were all trials for the first 14 years. |
| Milan | Somewhat, space for cars is transformed into living space for pedestrians and cyclists. | Yes, residents send applications for new transformations and help in the design. | Yes, before the open call, the first six transformed squares were pilots to test the technique and methodology. |

| | Strategic communications | Timing | Organising responsibility |
|---|---|---|---|
| Barcelona | Yes, residents are included in the design process and a communication team involves the community. | Yes, the new Mayor was open to the measure but did not want to implement it herself. | Yes, a new office was established in a later phase of the project and having the team together made it easier. |
| Copenhagen | Yes, by the Cycle Superhighways are recognisable and results are communicated to municipalities. | Somewhat, willingness to implement the superhighways was boosted by the end of the congestion charge. | Yes, to begin the project, a new office was set up to coordinate tasks between the municipalities. |
| Bremen | Yes, residents receive information about car-sharing and the municipality uses specific terms. | Somewhat, the first shared cars came after convincing the municipality but it was a long process to implement. | No, though they would like a separate department, it has not yet been established. |
| Milan | Somewhat, residents are involved in the design process but there is less of a communication strategy. | Yes, the programme was boosted significantly during COVID when transformations were easier. | Yes, a new working unit was set up later in the programme. It helps to plan and receive recognition. |

In this section, the results of the interviews are discussed and the experiences of the case studies are analysed per success factor and barrier. From this, a comparison is made with the literature as presented in Chapter 2. Finally, general lessons are determined based on the comparison with the literature. These lessons are directly related to the interviews and literature and are therefore a part of this chapter. Further analysis and lessons are determined in Chapter 6.

**Table 5.2:** Overview presence barriers

| City | Institutional | Legal | Resource |
|---|---|---|---|
| Barcelona | Yes, political conflicts of interest caused departments to defer from helping implementation of the Superblocks. | Somewhat, court cases were initiated after the programme stopped to remove the interventions. | Somewhat, tactical interventions are implemented at a low cost but making them permanent requires more funding. |
| Copenhagen | Yes, Mayors from different municipalities have different interests but they are all needed for a route. | Somewhat, the recognisable signage that the office wanted was not allowed by the road directorate. | Yes, municipalities often cannot participate or adhere to the standards due to financial priorities. |
| Bremen | Somewhat, national policymakers were hesitant to allow car sharing stations on public land. | Yes, the national law did not allow public space to be used for car sharing stations. | Somewhat, the municipality has difficulty finding space for the stations. |
| Milan | Somewhat, other departments within the municipality were not keen on helping. | Somewhat, tactical interventions for bicycle paths were not allowed under the existing laws. | Somewhat, tactical interventions are implemented at a low cost but making them permanent requires more funding. |

| | Social | Path dependence |
|---|---|---|
| Barcelona | Yes, public opinion about the Mayor is not positive and the project is connected to her political party. | Yes, residents and municipality departments are used to designing around cars. |
| Copenhagen | Somewhat, public acceptance about cycling is not always positive, causing municipalities to not invest. | Somewhat, the existing ideas of prestigious projects hinder the Cycle Superhighways. |
| Bremen | Yes, residents like owning a car and convincing them to use shared cars is difficult. | Yes, developers were afraid to reduce parking spaces because they thought residents expected them. |
| Milan | Yes, owning a car is part of the culture, resulting in resistance when parking spaces are removed. | Yes, people assume cars are a good use of space and changing that is difficult. |

## 5.1. Success factors

The following section discusses six different success factors. Following each interview, the success factors are determined and how their presence influences the policy implementation. This is separately evaluated for each factor. If a certain success factor is not present in a city, that may also be interesting. Certain success factors relate to how the policy was designed and some to how it was executed.

### 5.1.1. Combining sticks and carrots

The first discussed success factor is sticks and carrots. This entails combining measures that are experienced as positive and negative. By including measures that benefit the public, the acceptability of restrictive measures increases. In the literature review, various examples were found of cities that implemented this factor. The London congestion charge added a fee to entering the city by car, and the money was used to improve public transport. Research shows that this combination increases the acceptability of the charge.

#### Presence in cities

The interviews did not show a decision of policymakers to combine sticks and carrots. Most cities find their measure to be a carrot without a stick. If the combination is present, it is seen as an inherent aspect of the policy instead of a decision by the policymaker.

*Bremen*

Car sharing in Bremen adds an alternative travel mode. It is not restrictive, it is increasing mobility options (interview Br2). Though some parking spaces are removed, more space is created by people switching to car sharing and removing their private cars. The cost of car ownership and parking difficulty is an inherent stick in car ownership and “car sharing is a tasty carrot” (interview Br1).

*Copenhagen*

In Copenhagen, the governmental organisation responsible for the Cycle Superhighways decided to only work on a positive product from the beginning. They let the municipalities add sticks to limit car traffic if they want to do so, but the superhighways only present carrots. The resulting benefits are improved ease of cycling to work, increased daily exercise resulting in mental and physical health benefits and reduced air pollution (interview Co1).

*Barcelona & Milan*

The governments of Barcelona and Milan cannot simply add an alternative. Their measures are related to the use of public space and redesigning roads. As stated in (interview Ba2), the stick reduces car parking, and the carrot creates more space for people and bicycles. They always go together. However, using the newly created space and showing residents the benefits is important. After the area was cleared of cars, nothing new was immediately implemented. “It turned into a dessert. Why remove cars if you don’t do something new?” (interview Ba2). This shows that the acceptability of the measure increases if residents notice a benefit from the implementation. Something similar was said in the interviews for Milan. A use must be removed to add a new use of shared streets (interview Mi3). “If you are removing cars [...] and changing mobility habits, it is better if you have a clear benefit” (interview Ba3). Reducing parking spots is a negative aspect. The positive aspect is that they are increasing safety and improving air quality (interview Mi3). Decisions about priorities must be made in a limited space where not everything can be done. It takes time for residents to realise the improvements.

### Comparing literature and cases

Literature shows that if policymakers deliberately add a benefit to an unpopular measure, the acceptance of policies by the public increases (i.e. (Odeck & Bråthen, 2002; van Wee, 2009)). Several articles discuss the presence of this success factor in road pricing measures and how its use may help implement car-reducing policies successfully ((Banister, 2003; Sørensen et al., 2014). However, the interviewees did not experience their measure as a stick. This is partly because there was barely a stick, such as in Copenhagen, where a transport alternative is built that barely impacts other travellers. It is also partly because they see the downsides of the measure as a consequence of implementation. In Bremen, Barcelona and Milan, space for private cars, mainly for parking, is reduced.

The conscious decision to add a positive aspect to a measure that is experienced negatively, as described in the literature (Banister, 2003), was not visible from the interviews in the studied cases. However, an argument can be made for the presence of this success factor. One of the main reasons for implementing the measures in each city was to reduce the number of cars and give space back to the city’s residents. Removing space for private cars is then the stick, and giving that space back, either for car sharing or as living space, the carrot. When residents in Barcelona did not notice improvements as a benefit after cars were removed in the first Superblock, they protested. When they see new green areas are added, and children can play outside, they do not mind as much.

Another dimension of the sticks and carrots success factor is the question of who handles the sticks and carrots. In the literature, it is stated that the carrot can increase societal acceptance of an unpopular measure (van Wee, 2009). The policymaker purposefully adds a benefit to a restrictive measure. Increasing societal acceptance implies that the measure is directed at the general public. However, the Copenhagen case shows that policy can also be directed at a different level of government. Working on a positive product may increase acceptance from residents, but the Office mainly needs to convince Mayors to participate in the Cycle Superhighways. The Mayors are then free to add measures that restrict car use. To convince the Mayors to participate, they decided not to add a restriction to car usage. This makes it politically easier for the Mayors to build Cycle Superhighways.

Some of the barriers can also be seen as sticks. In Barcelona, it could be seen as a stick for politicians to agree with a measure that originated from an opposing political party, but a carrot if the results are positive. In Copenhagen, it could be seen as a financial and political stick to invest in cycle infrastructure. The stick and carrot could also be directed from residents toward the policymakers, as shown in Barcelona. Residents who did not like the measure or certain aspects of the measure protested and set tyres on fire. When they did like the measure, they organised activities in the transformed areas.

### Lessons learned

Applying the stick and carrot success factor in the studied cases is challenging. Though the analogy works well in specific cases, such as the various congestion charges as described in the literature

(Banister, 2003; Gullberg & Isaksson, 2009), the situations in the cases are more complex. None of the policymakers designed their measures as stated in the literature, but the inherent effects of their measures are similar. There are also other questions raised by the success factor, such as who handles the sticks and carrots, to whom they are directed and what the sticks and carrots are exactly. If the success factor is used as described in the literature (i.e. (Gärling & Schuitema, 2007), then it is used to increase the societal acceptance of restrictive policies. As most of the questions are answered by other success factors and barriers, the sticks and carrots analogy is not expanded to include them. However, to address the inherent sticks and carrots, policymakers should think about both the positive and negative effects of their policies and make the public aware of the advantages from the very beginning.

### 5.1.2. Showing openness and flexibility in negotiations

The next success factor is showing openness and flexibility in negotiations. This entails allowing negotiations, exemptions and adjustments to increase the likelihood of implementation.

#### Presence in cities

Showing openness and flexibility is clearly present in all interviews. Each interviewee expresses the necessity of allowing exceptions.

*Barcelona*

In Barcelona, the implementation process of the Superblock project changed over the years. After the first Superblock, the municipality realised a different implementation process would work better. For the following Superblocks, a participatory process was held where residents could help in design workshops. Experts from the municipality determined the technical details, but the rest was open for the residents to design. The main topics of discussion were regarding the placement of street furniture. After it was implemented, the municipality maintained contact with the residents, and changes remained possible (interview Ba1). Exceptions other than in furniture were made in several Superblocks as "there is always flexibility" (interview Ba2). Changes included changing the design to allow through traffic, making Superblocks of different sizes, allowing traffic to enter the car park (interview Ba1), allowing last-mile deliverers (interview Ba2) and allowing more parking spaces in low-income areas (interview Ba3). Policymakers emphasise the importance of being aware of the local context and and being flexible. and that it can be difficult to include everyone's opinion. After removing cars, new noise complaints came as a result of people drinking on the benches at night. However, others wanted to keep them for enjoyment during the day (interview Ba1).

*Milan*

The participatory design process is similar to that in Barcelona. After the pilot projects, an open call was launched for residents to hand in draft versions of redesigned squares. They then held a workshop with the presidents of each of the nine boroughs of Milan, and schools, children and the submitters of the proposals were invited. The proposals were then presented at tables to all 300-400 attendees, and together, the proposals were prioritized. If the municipality selected an application, a co-design phase began where residents were free to use the available toolkit and furniture. "It is not a fixed procedure; it is very flexible" (Interview Mi1). They have some standard templates, but they work with the community. They always suggest 1-2 options, and if they have less engagement, a more standard design is used (interview Mi3). Not all stakeholders were involved in the application, so the goal was to involve them soon after by letting them organise events. Traditionally, the first event is painting the road and pavement. Residents cannot influence everything in the square. Similarly to Barcelona, the technical mobility scheme was determined internally by experts from the municipality (Interview Mi1). However, though polluting cars are removed, a new issue arises. Similarly to Barcelona, the municipality receives noise complaints from staying on the squares at night (interview Mi3).

The bicycle path project in Milan works a bit differently. The public does not accept these paths well, so the bottom-up approach does not work. The routes are designed by the AMAT and based on accident data. Then, the plans are discussed with local politicians and stakeholders who can influence the

project. They have weekly meetings where proposals are presented to the municipality, and together, they decide what the best option is. This is both from a technical and a political perspective. If there is no political acceptance, people will protest, After the concept is defined, they present it to the local government and residents. After adjusting the designs according to collected opinions, the final design is made and handed to the municipality. Such an adjustment was made for delivery trucks. Parking spaces for these trucks were added as they could no longer park on the roadside if the bicycle path were built.

*Copenhagen*
In Copenhagen, the organisation for the implementation of the Cycle Superhighways is organised differently than in the other cities. The Office for Cycle Superhighways supports municipalities in implementing bicycle paths. They do this by organising meetings and supplying documentation, such as the building standards. However, these standards are guidelines. It can be difficult to convince a municipality to participate in the project, and a bicycle path that does not meet the standards is better than no bicycle path, so the Office accepts that the quality is not ideal. Based on user feedback, the steering committee evaluates each route and gives recommendations to the municipalities. “The roads can always be upgraded later” (interview Co1). However, the reduced quality does influence the traveller’s experience. Certain parts of the route, such as crossings, can be dangerous and delay the trip (interview Co2). During every meeting, even now, there are discussions about the standards and the pros and cons of the cycle highways. “There are 1000 exceptions or negotiations” (interview Co3). The municipalities do not want to disappoint travellers, but “if you dictate a very high standard and are not flexible with your standards, you would have no municipalities left in that collaboration” (interview Co3). It does raise the question: “How [far can you lower your standards] before you don’t want to call it a Cycle Superhighway?” (interview Co3). When is no longer a Cycle Superhighway but just a bicycle path with a sign? (interview Co3).

*Bremen*
Finally, Bremen also has negotiations about placing the car-sharing stations and the requirements for car-sharing operators. Bremen was one of the first cities to implement car sharing, and it has become more known and accepted over the years (interview Br1). Especially in the beginning, there was a lot of backlash. Even though the parking spaces are public, people feel the parking spaces are their property. The municipality decides, together with the car-sharing operator, where public stations will be placed. Operators must meet certain (quality) standards, such as having family-friendly vehicles, to use the stations (interview Br1). After selecting an area, it is publicly discussed with local politicians, who can then suggest changes. They also inform the neighbourhood with a letter, informing them about what will happen and when it should be done.

Especially since car-sharing has become more common, the problem is not that car-sharing is being implemented; it is about the specifics, like on which side of the road the station is placed. Another example is when, after input from the politicians, the cargo bike space was removed from a station last year to keep some regular car parking spaces. This “was a compromise” (interview Br2). In previous years, bigger changes have been made. For example, a station was moved to a different street after residents had started a petition, calling the policymakers ‘eco-dictators’ and making a new design themselves (interview Br2). By agreeing to the protesters, the municipality showed that they were flexible and open to suggestions, and the new location turned out to be better than the one selected before (interview Br3).

Besides residents and politicians, other departments within the municipality, such as the environmental department, wastewater department and planning department, can suggest changes. Everyone is included in the planning process (interview Br2).

### Comparing literature and cases
In all four cases, the success factor of showing openness and flexibility is crucial in the implementation and gaining acceptance. In Barcelona, Bremen and Milan, residents can give their opinion on the implementation of the measure. Especially in Barcelona and Milan, residents can propose areas and

collaborate with policymakers to redesign them. In Copenhagen, the responsible department does not collaborate directly with citizens but with municipalities. Allowing municipalities freedom in how they implement the measure increases the likelihood of participation. In the literature, the risk of a watered-down scheme was shown (Banister, 2004a), though different authors noted that a crude scheme is better than no scheme (Langmyhr & Sager, 1997), and adjustments can always be made after implementation (Sørensen et al., 2014). This shows nearly the exact mentality of the Office for Cycle Superhighways in Copenhagen, where employees actively pressure municipalities to improve the cycle paths after implementation. Designing the area with residents falls outside of the scope of the Office. However, a participatory process may prevent mistakes and can be a part of the toolkit supplied to municipalities.

Another aspect of flexibility is the question of when policymakers are open to changes and when they stop being open (see Table 5.3). Once the measure has been implemented definitively, it can become more expensive and difficult to make changes. This can be seen in Bremen, where politicians, residents and governmental departments are included in the design process of the stations. Once the stations are placed, they are rarely changed or updated. In Milan, residents propose transformations that are further designed in a participatory process. As the measures are first implemented tactically, changes can be made later. However, this has not happened yet. It is also interesting to see in Milan that the municipality was not immediately open for changes. They first ran several pilot projects that were designed top-down before allowing residents to make proposals for future projects. In Barcelona, the Superblocks are also designed with a participatory process after the initial three-week pilot. The Superblocks are updated as policymakers discover what does and does not work. This was especially the case for the initial Superblocks. Building tactically extends the period in which changes can be made before changes to the permanent intervention become expensive and difficult. The routes of the Cycle Superhighways in Copenhagen are carefully designed with the municipalities before being built. Though the route through a municipality is less important, they do need to align at the municipal borders. Making such changes would require large investments in both time and money. However, the flexibility in the quality of implementation is purposefully kept open. This allows municipalities to upgrade the routes later. In fact, the office of Cycle Superhighways regularly reminds municipalities that they are still open to upgrade the routes.

**Table 5.3:** Overview openness and flexibility in cities

| | **Barcelona** | **Copenhagen** | **Bremen** | **Milan** |
|---|---|---|---|---|
| Flexibility during design | Participatory process, including many stakeholders | Proposal by participating municipality, design with all municipalities | Proposal from municipality which can be adjusted by politicians and residents | Participatory process originating from proposal by residents with templates that can be adjusted |
| Flexibility after implementation | Only during tactical intervention | Little for location, a lot for route quality | Little | Only during tactical intervention |

### Lessons learned

The cases perfectly showed the presence and effectiveness of this success factor. For policymakers need to be open to suggestions and adjustments from those involved, including the public. Each city has a different procedure for collecting stakeholders' opinions, but they all seem to work. The main lesson is that having a procedure for receiving feedback and representatives that stakeholders can address increases acceptance. If changes are made to the physical environment in neighbourhoods, a participatory process is advised so residents are involved and can make suggestions based on their local expertise. Including their suggestions should be done early in the design phase as it requires a lower investment to make changes in the design phase than later in the process. However, it may be advised to wait before opening up to suggestions. By first implementing an initial version of the measure, the experience can be used in future participatory projects. The period in which making changes can be implemented at lower investment, can be extended by building interventions tactically before making them permanent. If improvements do not require a redesign but are mainly additions to existing infrastructure, they can be implemented with a lower investment after the project has been built.

### 5.1.3. Trials to create legitimacy and acceptance

Most cities that were interviewed implemented trials before rolling out a measure. These pilots were completed for the municipality to gain experience with the measure and for the public to get used to the change.

#### Presence in cities

Most cities set up a pilot of their measure before implementing it on a larger scale. Only Copenhagen immediately did not consider their first project to be a trial. But it was described as a proof of concept (interview Co2).

*Milan*

In Milan, the pilots were essential to the measure. The city had a clear path for implementing the open squares. In the first phase, six pilot projects were launched to design the methodology. This was a top-down decision from the municipality to discover how they should go about such a transformation and to develop a toolkit. They also learned how to collaborate with residents and other stakeholders and show them the potential of tactical urbanism. A year later, the municipality set up an open call for residents to apply for an open square in their neighbourhood. The process shifted to a bottom-up process where the municipality simply facilitated the conversation between neighbours (interview Mi1).

Each tactical project can also be seen as a trial. The option of changing it back allows them to be more radical (interview Mi1). They then do not have to respect the rules for the historic city centre, such as material usage (interview Mi3). With the bicycle paths, that approach also works. Several months after the intervention, it is accepted. It improves the safety, so there is no reason to reverse the project (interview Mi2).

*Barcelona*

The Superblock project in Barcelona followed a different path. The project began when the architecture schools of Catalonia decided to test the Superblock model. A developing and lower-density area was selected for the pilot. After the pilot, the neighbourhood and the Deputy Mayor pushed to continue with the project (interview Ba2). The Superblock was rebuilt to learn more about the implementation process and to increase acceptance from the public and the city council (interview Ba3). The build of this Superblock was a more top-down process. “You will never get the engagement and support you need, so [...] you always need to be bold and try to start” (interview Ba1). The design process was changed for the following Superblocks and became much more participatory (Interview Ba1). They learned many lessons from the first project and included the public much more. They also gained experience with specific elements, like the materials and pavements that should be used (interview Ba3).

*Bremen*

The car-sharing pilots in Bremen were unique. In 2003, the first two stations were built as a trial. However, German law did not allow for public space to be used for car sharing. During the project, the municipality feared they would be sued, or private cars would park in shared spots (interview Br2). During the 14 years it took to pass the new federal law allowing car-sharing stations on public property, the stations were all classified as pilots. The signage was classified as a construction project and was placed with building permits. The project became official when the new law was passed after 14 years. Though all the stations had officially been pilots up to then, they did actually experiment in that period and are still doing so. There were pilots with touchscreens at the stations, stations in lower-income areas and stations with charging infrastructure for electric cars (interview Br3).

*Copenhagen*

Copenhagen is the only city where there were no trials. The first Cycle Superhighway route was selected because there was sufficient support from the relevant municipalities. Also, most of the infrastructure was already in place. It only required adding communication materials (interview Co2). Still, it was a compromise in ambition as it was difficult for the participating municipalities to gain sufficient political support and create solutions for this route. From this, they learned a lot about designing the routes and how they were received. Certain choices, such as building the route close to housing (interview

Co1), next to a school, or thinking that they could create a shared space for cyclists and pedestrians (interview Co3), were not received positively. Still, it did show the idea worked, and the cycle highways were rolled out further (interview Co1).

### Comparing literature and cases

Literature shows that pilots can help gain experience with the measure (Sørensen et al., 2014), and by communicating its effectiveness, the public is more likely to accept it (Odeck & Bråthen, 2002). Trials can also help break political deadlocks and lock-ins in the existing regimes (Sørensen et al., 2014). This description matches that of the first Superblock in Barcelona very well. The political deadlock showed little chance of changing by itself. Though the sitting Mayor and the Mayor before had agreed to implement the Superblock, they were not planning on actually doing so. The demonstration of the Superblock by the architecture universities helped to show them, and the public, the benefits and was the beginning of a shift on a higher level. The experience they gained after implementing the Superblock was used to design the participatory process for the following Superblocks.

In Milan, pilots were a clear part of the implementation strategy. They used the pilots to gain experience and design tools for the following squares. The pilots showed the effectiveness of the project and helped to increase acceptability by the public so the future projects began from bottom-up proposals. Each intervention in Barcelona and Milan can be seen as a trial. They first implement each intervention tactically by making temporary changes. Changes can then be made before it is implemented permanently later. Due to legal issues, Bremen had a less clear distinction between pilots and non-pilots. However, they did use their experience to keep improving later projects. In Copenhagen, none of the interviewees regarded the first Cycle Superhighway as a pilot. Immediately, they built the full route and continued building others. However, they did learn from their experiences and designed following cycle highways differently.

These cases raise the question about the definition of a pilot. The interviewees in Barcelona, Milan and Bremen all saw the first projects as pilots, and the interviewees in Copenhagen all did not. However, in each case, they began with the first projects and learned from those to build the following instances. Barcelona shows the best example of a pilot. However, depending on who is asked, the pilot was the first three weeks started by the university or the entire first Superblock project after it was continued. If the three-week experiment is used, a clear distinction between the pilot and the rest of the project is seen. If the full completion of the first Superblock is used, then there is little difference between building the first instance of a project and learning from it in future instances, like in Copenhagen. Therefore, the following definition of a trial when used in this success factor is suggested: *A trial must have a final moment determined before it begins and have the goal to gain experience with implementing the measure and gathering results*. Before it begins, the trial or pilot must have an end. This can be a specific date, such as in the first pilot in Barcelona, or a moment before the implementation clearly changes, such as in Milan. Under this definition, the shared car project in Bremen is not a pilot. The municipality began building the stations and iteratively upgraded them. Though they were legally required to call most of the stations pilots, they did significantly change the project when the pilots ended. The goal of the trial must be to gain experience with implementing the measure and gather results. The tactical interventions in Barcelona and Milan do not meet this criterion, as their main goal is to make the design optimal for the specific location it is implemented in a cost-efficient manner.

Finally, the role that different stakeholders have in pilots is analysed. Policymakers designed the Milan pilots to gain experience with the implementation of the measure. Knowledge institutes initiated the Barcelona pilot. This shows that though policymakers from the municipality do need to be involved, they do not need to begin the pilot. The pilots were designed relatively top-down and involved the residents much less than when the measure was implemented later, not as a pilot. Their experience from the pilot was used to design a method for future implementation with larger stakeholder involvement.

### Lessons learned

Using pilots can help policymakers to experiment with a measure. They can gather experience and results within a predetermined period and use that to implement the measure fully elsewhere. Doing

so can be useful in increasing acceptance for both the public and politicians and breaking deadlocks. Though naming the first version of the measure a pilot may help to implement it in the existing context, it is only a pilot if the implemented measure is designed to end and has the goal of gathering results.

### 5.1.4. Applying communication strategically

Strategic communication can influence perceptions to achieve particular behaviour. Most cities pay special attention to communicating the measure and its effects to the public.

#### Presence in cities

All cities applied a form of strategic communication. This included both communication to the public and internal communication within governmental layers. Integrating the perceptions of relevant parties is being done in Barcelona and Milan by organising workshops.

*Copenhagen*

In Copenhagen, communication is crucial in the implementation of the measure. “Communication is a big part of the success” (interview Co1). In fact, work within the office of Cycle Superhighways is divided into five pillars. One of these pillars is communication. It is a big part of challenging people’s behaviour and shifting from car to bicycle.

Especially in the beginning, the Cycle Superhighways consisted largely of existing routes with small improvements and signage. Through recognisable elements, the roads were communicated as Cycle Superhighways. Through marketing, it was made to look like a great invention, but it was really building on existing infrastructure: “[it] is like 90% marketing and 10% infrastructure” (interview Co2). This became clear when a route that existed since the 60s had an increase of 68% in users after it became a Cycle Superhighway (interview Co1). Other municipalities, mainly Copenhagen, try to present the Cycle Superhighways as a more innovative project and brand it like that. They have branded railings and footrests and experiment with other techniques to improve the experience (interview Co2).

The communication of the Cycle Superhighways already begins it its name. The Danish name translates to Super Cycle Paths, so it has no connotation to highways. Even though its more of a regional coherent route for commuters, the super cycle paths show an intention. This works well politically, and commuters then expect a higher standard (interview Co3).

Not only the routes but also the results were communicated strategically. The Mayors of the participating municipalities need to feel like they are a part of something big with good results. The office of Cycle Superhighways collaborates with universities and cycling associations to learn more about the behavioural, social and economic effects. These results are then strategically communicated to the public. To make the cycle highway project more attractive, various elements were placed “in a catalogue to inspire the reluctant Mayors” (interview Co1). However, the presentation of these results can be questioned. One of the presented results was a 150% increase in usage. This sounds a lot better than the actual increase of 6,000 to 10,000. 4,000 extra people riding their bicycles is not that much and is not really a good return on investment. It was a little “too much hype” (interview Co2).

*Bremen*

The municipality of Bremen also views frequent communication as a part of the measure’s success, as car users are not yet used to it. Their communication strategy consists of billboards, cinema commercials, postcards, and even children’s books that can be picked up for free. Their mascot, UDO, an acronym for ‘Use it, Don’t Own it’, is featured actively (interview Br 2). Further strategic communication is around building the stations. These are very recognisable, and when a new station is placed, all neighbours receive a leaflet with an explanation. Municipal policymakers also meet with neighbourhood committees and partake in debates.

They also try to refrain from using the term ‘car-free’. ‘Human-friendly’ is better. It is about gaining space and opportunities and reducing costs (interview Br1). Another strategically communicated item

is in the financing of the stations. The municipality noticed that by communicating to the public that car-sharing operators need to pay rent to be able to use the stations, acceptance increased. Just like car drivers need to pay to park, operators also need to pay (interview Br2).

*Milan & Barcelona*
After the initial pilot projects, both Milan and Barcelona started including residents in designing the car-low areas. In Milan, this is where the communication stopped. It is a project that the city does for citizens. Residents can submit proposals (interview Mi2). Over time, the communication increased in Barcelona. Within the Superblock team, a communication team was formed. Not having a communication team from the beginning "was one of the mistakes they made" (interview Ba3). During the first Superblock, civil servants were on the streets informing travellers about changes. There were also weekly meetings with the pro- and anti-Superblock associations to implement changes (interview Ba3). Residents organised activities to make people aware of the possibilities of the newly created area (interview Ba1). "It's not only about changing physical things but also to start a new social dynamic in public space" (interview Ba1). The government also pushed them to do things which they found quite annoying. They did not want to be politically used to show the Superblocks worked, they wanted to organise things of their own free will. It should be spontaneous from the people, only sponsored financially by the government, and politicians should be patient (interview Ba2). In Barcelona, residents could also submit proposals for Superblocks. From the six or seven proposals they received, three were selected by voting by residents (interview Ba2).

After the pilot project, a huge effort was made to communicate everything about the Superblock before building it. In the final four years, a team of informers was hired who were always on the street, visiting retail and being absolutely transparent (interview Ba1). Representatives from all stakeholders and neighbourhood councils were involved in meetings and could suggest improvements. This tactic was effective because when the active people in the community were on board, they suggested improvements and spread the message. In Barcelona's digital platform, updates were placed about the Superblocks. Still, most people only realise changes when street works begin. They may have worked with 300 people, but in one block, there are already 3,000 people, so they cannot reach everyone (interview Ba3). Incorrect ideas kept spreading in the news and other (social) media, such as that roads would be blocked off completely for cars. On the municipality website, they tried to address that in a FAQ (interview Ba2).

### Comparing literature and cases

Some form of strategic communication is visible in all cases. As recommended by Sørensen et al. (2014), Barcelona hired an independent communication team for the first Superblock to be on the streets and talk to residents and local businesses. Also, in the later Superblocks, communication was an important part of the design and implementation of the Superblocks. In Copenhagen, communication is one of the five main pillars of the office, and the first person hired for the team had communication as the main task. In Bremen there is nobody in the team dedicated to communication, but they have hired people for communicating the project and have had various campaigns in the past. Finally, the communication in Milan mainly exists of including stakeholders in the participatory design process.

Literature states that a strategic communication strategy can increase understanding if the objectives are stated and reduce the risks of poor results (Cornish et al., 2011). The strategy should recognise the diversity of the target audience (Grenna et al., 2003). The target audience differs between the studied cases. In Copenhagen, the team mainly communicates the effectiveness of the Cycle Superhighways to the public and to policymakers to improve the perception of the project and ensure routes are built and upgraded. In Barcelona communication is also used to improve public perception of the programme, but with the goal of increasing awareness and decreasing resistance. In Milan, the main goal is to increase the participation of residents in designing proposals for transformations. As the measures are more radical, policymakers put more effort into explaining the measures and the reasons for implementation. The reasons for communication are very different when compared to Bremen. There, communication is mostly directed at increasing the number of car-sharing users. This requires a different type of campaign. It targets the general public as well but with the goal of changing their behaviour

instead of their opinion.

The strategy should not only focus on achieving the communication goals, but also on the process of communication and the perception by the public. In Copenhagen, a team member is tasked with communication. In Milan, it seems that communication is not given special attention and is seen as part of the programme. In Bremen, policymakers hire bureaus for their communication campaigns and in Barcelona, and independent team is responsible for communication.

#### Lessons learned

The less clear and professional communication in Milan, may reduce the acceptance by residents. In Bremen, the interviewees noticed an increased acceptance during campaigns, but as they do not always have enough time to organise them, the campaigns are not as consistent as they would like. Therefore, policymakers should integrate communications into the strategy as done in Copenhagen and Barcelona and as recommended by the literature (Cornish et al., 2011). The positive effects on the audience help the general acceptance and ease of implementation. The goal of communication may also influence the type of strategy and the selection of the communication team. Policymakers should think about how they want their communication to be perceived. If the goal is to convince the public to think or act in a specific way, campaigns from the government may be presented as such. Whereas a campaign designed to facilitate conversation and assist in decreasing resistance may be best carried out by an independent team.

### 5.1.5. Timing and windows of opportunity

The timing of the introduction of a policy can be crucial for its success. Sometimes, a policy can only be implemented if all the circumstances are right. The problem, policy and political streams need to join for the window to open. A policy entrepreneur can use the policy window to implement their solution. This success factor is present in each city, and the moment that the window opens can be clearly identified in three of the cases.

#### Presence in cities

The effect of timing in the political landscape is clearly visible in Barcelona and Milan. The circumstances need to be right for the policy to succeed. In Bremen and Copenhagen, the window was open for a longer period.

*Barcelona*

The need for a policy window is very clear in Barcelona. The three streams can be easily identified and are visible in Figure 5.1. The problem stream is high air and noise pollution and a lack of public space. After the car fleet doubled in the 60s, the car problem was known since the 70s. However, little progress had been made. The policy was made in the early 2000s by the Urban Ecological Agency. They designed the Superblock concept and built the first one in 2006 in the medieval centre. Its narrow streets made it a logical location, but it still resulted in significant conflict from people defending the parking spots. Finally, the political stream caused the window to be opened. In 2013, all parties under the right-wing government approved the Urban Mobility Plan. However, “They weren’t brave enough to implement it” (interview Ba2). In 2015, a new left-wing government wanted to implement the Superblocks. Though this government was more open to the idea, the Deputy Mayor convinced the Mayor to continue with the project: “If we stop now, we stop the project” (interview Ba2). She was a policy entrepreneur. In 2016, the first Superblock was built (interview Ba1).

Policymakers also need to think tactically about when they implement a controversial measure. Once elected, it should be implemented in the first two years so residents have time to get used to the new situation. The Mayor responsible for the Superblocks started too late, and the outcome of the recent elections may have been different if it had been implemented earlier (interview Ba2).

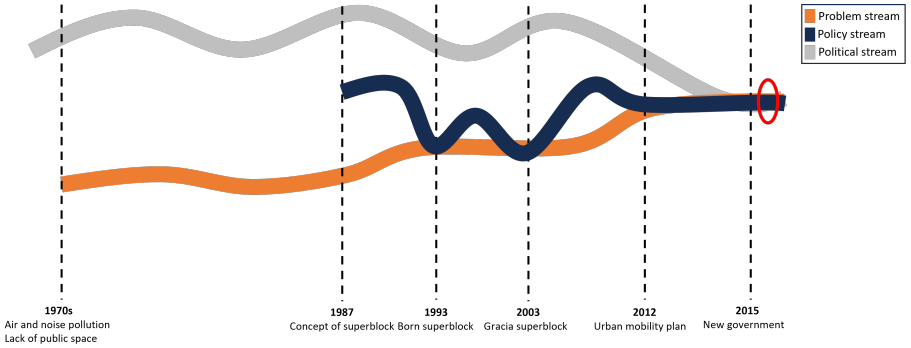


**Figure 5.1:** Policy streams Barcelona

*Milan*

In Milan, the streams were somewhat different and visible in Figure 5.2. The plans published from 2016 onward showed the political willingness to make changes. These plans highlighted the problems and solutions on various levels and topics, focused on transforming public space (interview Mi1). The solution came from Bloomberg Associates. They had previous experience transforming New York public space and were searching for a new project (interview Mi3). Finally, the problem stream was the impact of private cars on public space and air quality. Though it has one of the fewer cars per person in Italy, it still is one of the highest in Europe. The combination of these three streams caused the open squares project to begin in 2018 with several pilots (Interview Mi1). In 2020, COVID hit, and the problem stream became a lot more significant. People realised the importance of having outdoor space, which changed acceptance (interview Mi3). “During COVID, everything was really fast, [...] let’s make it! Before that, it was really: [...] see if everyone agrees and if not, rethink the project” (interview Mi1). They managed to implement many more projects than before, and though they are still quicker than before, the speed they had during COVID has not returned (interview Mi3). The pilots they had before the pandemic had proven the tools worked, so during COVID, the projects could be implemented quickly (interview Mi1).

Other factors, such as no other traffic being on the road or the meetings being online, also played an important part (interview Mi3). The effect of COVID was even clearer for the open roads project. People did not like using public transport during the pandemic and switched to private vehicles. If everyone started using cars, the city would be a problem. To reduce that effect, the municipality started developing cycle lanes. The policy for this solution had already been proposed in one of the plans in 2018. Due to a change in legislation in 2020, they were allowed to use soft interventions to build bicycle paths.

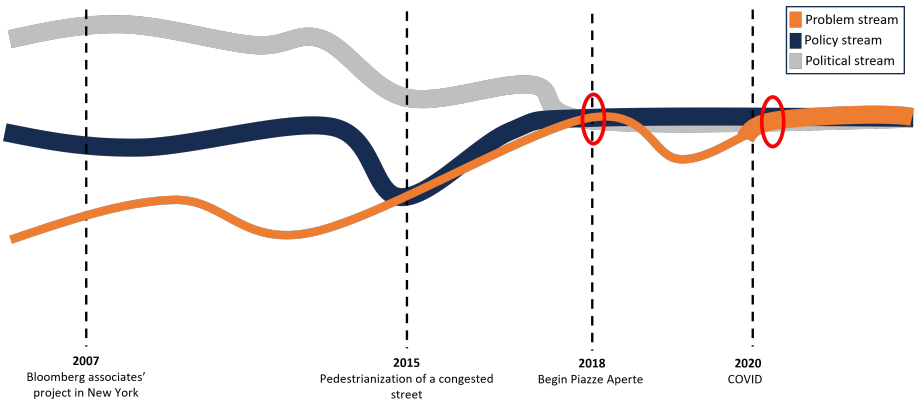


**Figure 5.2:** Policy streams Milan

*Copenhagen*

Copenhagen had a different combination of streams. In 2006, Copenhagen had a dedicated bicycle

office. The city's Mayor of the Technical and Environmental Committee wanted to improve the cycling infrastructure and had the budget. A different politician suggested the idea of a coherent cycling network, and the idea for the project began (interview Co2). In 2009, the city stated its goal of having 50% of commuter traffic travelling by bicycle and started working with its neighbouring municipalities to create plans for a network of Cycle Superhighways. In 2012, the plug was pulled on the promised congestion charge due to public objections and insufficient political will after years of preparation and research. Leading up to that moment, the collaboration had the momentum to address traffic behaviour and the collaboration was a starting point for the superhighways. It was cheaper and more positive (interview Co1). In 2011, the Office for Cycle Superhighways launched, and in 2012, the first superhighway was opened. Since then, the main challenge has been to keep municipalities part of the project. It is more difficult to precisely determine the different streams and their effects on the Cycle Superhighways (interview Co1). The problem, policy and political streams were present from the beginning and had met earlier. Still, it took several years to build the superhighways. "One thing is the goal, [...] another thing is translating it into actions" (interview Co3). Within the whole region, there were discussions about dealing with traffic more effectively, but it took time to figure out what they were exactly going to do, how to get everybody on board and how to finance it (interview Co3). Therefore, the moment that the congestion charge definitively ended and the office launched is the window of opportunity. The political willingness grew, increasing momentum. The entire process, beginning in 2006, is also marked as a window of opportunity. The streams were aligned, but the political willingness was not large enough for a rapid implementation.

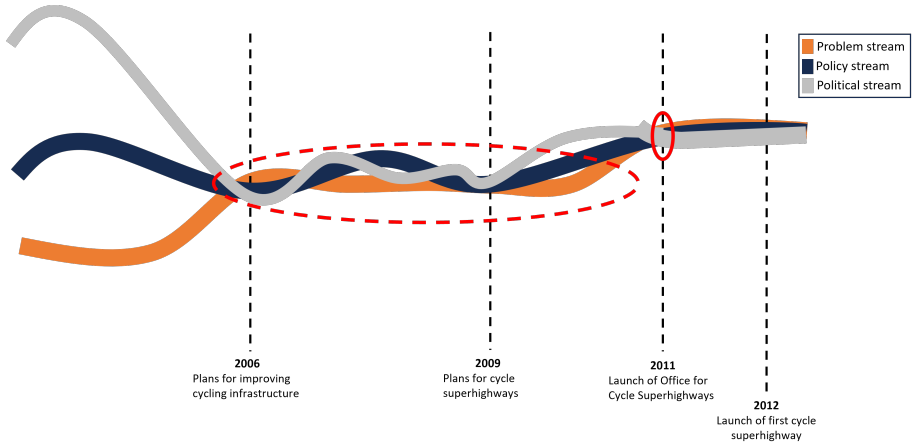


**Figure 5.3:** Policy streams Copenhagen

*Bremen*

Finally, the streams in the Bremen car sharing met early on in the policy implementation. After car-sharing initiatives from other cities inspired several residents, they organised a workshop. The municipality agreed to facilitate the workshop as they were facing car-use-related challenges. A car club followed from the workshop. Assisted by the municipality, the initiative slowly grew. While increasing in members, the car club occasionally faced political and public resistance. Though it slowed them down, the car club continued operating. As one of the interviewees said, they created windows of opportunity for other cities to implement car-sharing. "As a pioneer [...], there is no window of opportunity as people don't know what you're talking about. You have to create it. It makes it easier for others" (interview Br1). The general concept was successful because they were engaging people. The need for climate action and car sharing is now visible. Climate change provides a good window (interview Br2). However, it can still be difficult to get the timing right for placing mobility hubs in certain areas (interview Br3). In the outskirts and in the North of the city, there is more discussion when placing new hubs (interview Br2). Figure 5.4 shows the policy streams in Bremen. The initial workshop was held in a window of opportunity, and the policies regarding the blue angel label, car-sharing and mobility solutions for developments were also implemented during windows of opportunity.

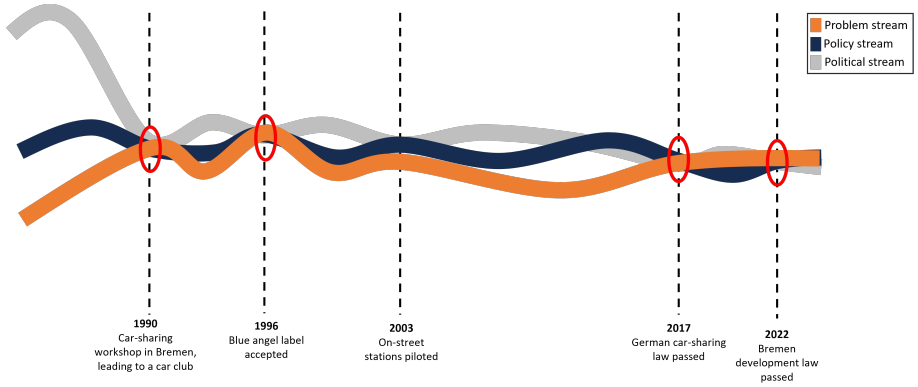


**Figure 5.4:** Policy streams Bremen

### Comparing literature and cases

According to literature, the problem, policy and political streams need to come together for a window of opportunity to open and a policy to be implemented (Kingdon & Stano, 1984). This is mainly led by a policy entrepreneur who thinks they have a useful solution. In Barcelona, timing was important. A window of opportunity opened when the new Mayor was elected, and the architecture universities used that to begin the pilot. Then, the Deputy Mayor convinced the Mayor to continue the project and eventually make it a success. There was a defined problem: the high air and noise pollution and the number of cars. There was an acceptable solution: the Superblock model that had been worked on for many years. Finally, there was political will: politicians had signed the intention to build Superblocks, and the Deputy Mayor wanted to implement it. In Milan, the project started in 2018 but really took off in 2020 when COVID hit, and the problem became much more apparent. The problem stream intensified, and the municipality was able to implement many more open squares than it had before.

The windows of opportunity are less sudden in Copenhagen and Bremen. In Copenhagen, a boost was given to the project when the congestion charge did not succeed, but the government had worked on it for a while. In Bremen, the stakeholders worked on the project for a while, and the collision of the streams and opening of the policy windows happened multiple times to allow different aspects of the programme to succeed. The technical, economic, social and political feasibility criteria are also met. Car-sharing was technically and economically feasible, as shown in other cities. The social feasibility, as shown in the workshop, was sufficient to begin, and the financing by the municipality showed political feasibility.

Perhaps there is another element to the success factor of timing: the element of controversy. In Barcelona, policymakers were not willing to implement the measure as it was found to be controversial among the public. Getting the streams to line up was challenging and required an entrepreneur to use the window of opportunity to push the measure. In Milan, the project was significantly sped up when its controversy was reduced during the pandemic. In Bremen and Copenhagen, the policymakers did not experience the measure as controversial and were willing to implement it as soon as it was suggested. They did not require an entrepreneur to use a momentarily opened window, as they were immediately accepting of the policy to solve the problem.

In the literature, the effect of electoral cycles was also discussed (Hamilton, 2012). Politicians can time the announcement and implementation of measures in relation to the elections to their advantage. This advice was also given in several interviews. If politicians implement a controversial immediately, people have had time to adjust to the new situation when the next election starts.

### Lessons learned

A distinction is then made between two types of measures. This is shown in Figure 5.5. The first are measures that are experienced as controversial. In this case, the politicians in power are not convinced about the problem or policy and require an entrepreneur to use the moment that the problem, policy

and political streams collide. As stated in the literature (i.e. (Hoefer, 2022)), a long-term commitment is required by the entrepreneurs and policymakers who quickly need to respond when the window opens. If politicians expect resistance, policymakers should begin implementation soon after the election so people have time to get used to the measure. The second type of measure is less controversial and does not require an entrepreneur to use the open policy window. Policymakers are aware of the problem, and when a policy appears, they agree to its implementation. The timing is less relevant for these measures.

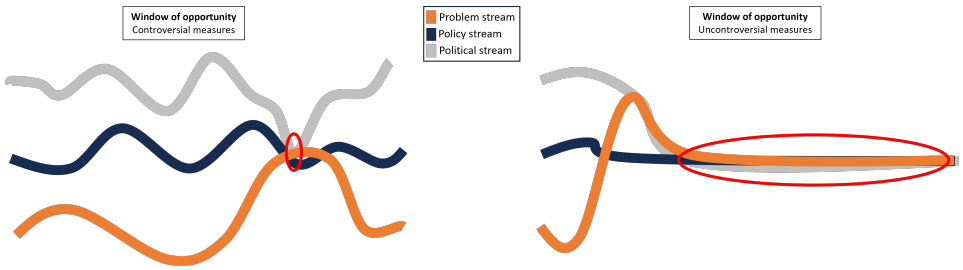


**Figure 5.5:** Controversial vs uncontroversial policy streams

### 5.1.6. Organising responsibility and set-up

New organisations can be established if it is likely that existing ones may repel new ideas. A new working unit can shift responsibility and ensure implementation.

#### Presence in cities

In three of the four analysed cities, a new working unit was set up to implement the measure. In Barcelona, Copenhagen and Milan, a different department was set up to support the successful implementation of their measures. Afterwards, they noticed the positive effect it had. Bremen has not managed to set up a new working unit but would like to do so.

*Copenhagen*

Before the project began, there was already a team dedicated to bicycle paths. All 30 people worked together there. When Copenhagen started to collaborate with its surrounding municipalities, the Capital Region of Denmark quickly participated and financed the Office of Cycle Superhighways. This office started in a new room with colleagues from the existing departments. They hired the first employee to begin the communication team. Since then, financing has continued, and the office has grown to its five current employees (interview Co2). The office facilitates the collaboration of the member municipalities by setting up meetings for the routes, collecting data, providing communication and helping with politics (interview Co1). They form a cohesive front for municipalities to contact with questions and to discuss with politicians and the road directorate (interview Co2).

Within the municipalities, the person responsible for cycling also has many other responsibilities. They state that without the office, the routes would not exist as they do not have the resources to plan, collaborate and gain the political will. Bicycle usage is increasing, contrary to the country-wide decrease (interview Co1).

Though their organisation works, they see that there are more stable alternatives. In the Central Denmark Region, the ten easternmost municipalities established the “Cycle Superhighway Collaboration” in 2021 to connect the cycle path networks between municipalities. They are more politically oriented instead of having a steering group. Also, in other countries, there is more national involvement. This provides more certainty of funding and coordination. In the Copenhagen collaboration, the municipal collaboration takes on regional and national responsibilities when they should not be expected to do so (interview Co1).

*Barcelona*

When the Superblock project began in Barcelona, six departments worked on it. The urban strategy department was responsible for the project and decided on the implementation, strategy and processes. The urban project department designed the project, and the technicians also helped. A new office was established when the green corridors were designed in the project's second phase, around 2020-2021 (interview Ba3). The public project coordinator became the office coordinator (interview Ba2). The people who worked on it before from different departments in the city were in this Superblock office (interview Ba3). It included people from the green team, mobility, strategy and public space (interview Ba1). Working together made it easier for people from different specialities to do their jobs. This office was also responsible for communication and was seen as an easy stakeholder to talk to (interview Ba3). After an international tender, they contracted eight private teams, and every Monday morning, there was a meeting with all teams and the Superblock office (interview Ba1).

*Milan*

In Milan, the project began with the Urban Planning Department, although it had more connections with the Neighbouring Department. Later, a new working unit was set up to handle these projects. "Without the new structure, it wouldn't be possible" (interview Mi3). They now also have people who can work on the tactical project. The new department plans the intervention and helps by visibly having someone in charge. Also, by recognising it as a goal and project for the city, other departments are more willing to help. It is not labelled as a project of a specific department anymore. Another advantage is that the project will still exist if people leave, whereas if you attach it to a specific person, it can disappear if that person leaves (interview Mi3).

*Bremen*

In Bremen, a new office is on the agenda: "It would be great if we have a new working unit" (interview Br2). The department responsible for the planning is (now called) the Ministry for Construction, Mobility and Urban Development. Several people within the ministry work on car-sharing. However, everyone has tasks other than car-sharing. Combined, their time equates to one full-time equivalent. Some tasks, like communication, are now not fulfilled as well as they would like. A different department does the construction (interview Br2).

### Comparing literature and cases

Literature states that establishing a new organisation can help overcome fixed practices and create paths that are in line with the new assumptions (Low & Astle, 2009). All four cases confirm this. In Milan, it helped to create a common goal. The interviewees from Barcelona and Bremen stated that having a new organisation helped, or would help, to have all employees together and work on the project full-time. The literature also states that the decentralisation of power, responsibilities and resources should be given to local authorities (Giacchino & Kakabadse, 2003). However, the new Office in Copenhagen was established to deal with the difficulties arising from that decentralisation, and they found that countries with less decentralisation work more efficiently. This shows a difference between literature and real-life experience. The literature stated that decentralisation is one of the conditions for successful transport policy implementation. It provides a greater incentive when local authorities can determine their own priorities (Banister, 2004b). However, Copenhagen's experience shows that different local priorities can conflict, making collaboration more difficult.

The main difference between the cases is the moment that their office was established. Before the project could start, a new office was required in Copenhagen. The collaboration between the municipalities would not have worked otherwise. In Barcelona and Milan, a separate office was established once the project had been running for a while, and they discovered that the implementation would work better if the existing departments and municipal workers did not do it. Bremen, the longest-running project, has not yet established a new office but agrees that it would work more efficiently if they did.

### Lessons learned

The interviewees from all four cases found that establishing a new organisation to ensure the implementation was useful or would be useful. Therefore, policymakers should think about how the depart-

ments that handle the implementation are structured and what the best moment would be to set up a new organisation. Also, the level of decentralisation should be taken into consideration. For cross-governmental collaboration, it may be advised to have an organisation with the power to implement policies facilitating the collaboration.

## 5.2. Barriers

This section discusses the five different barriers. These originate from the literature (Maat & Louw, 1999; Banister, 2004b; Arthur, 1989; Rotmans et al., 2001). For each city, the presence of the barrier is discussed. Then a comparison with the literature is made and lessons are learned to overcome the barriers, based on the experiences in the cases.

### 5.2.1. Path dependencies & lock-in

Routines, fixed infrastructure or assumptions can cause a certain route to be followed while better alternatives exist. A lock-in can occur when large-scale investments that only fit the current situation are made. This can be prevented by encouraging participatory decision-making.

#### Presence in cities

Path dependence is most visible in Bremen. Copenhagen shows some signs of lock-in, and Barcelona and Milan are preventing future lock-in.

*Bremen*

An example of path dependence is in Bremen's integration of car sharing into new building developments. In 2001, a pilot ran, allowing the first developer to replace car parking with car sharing. The evaluation was positive. Instead of placing big parking lots for private cars, they could place much smaller mobility hubs. This saved both space and money. In 2012, the municipality changed regulations about the parking requirements for developers. The municipality "expected developers to come queuing after giving them the option not to have car parking" (interview Br1). However, the developers assumed customers expected car parking and were afraid to reduce the number of spaces. "You think [that customers expect car parking], did you ask them?" (interview Br1). They did not realise that building parking spaces creates demand for them (interview Br3). From the evaluation, it was clear that a better alternative existed. However, their assumption had made consideration impossible. It took another five or six years for developers to realise this and implement mobility management (interview Br1).

The municipality also showed some signs of path dependency. Their assumptions about the areas where people are likely to use car-sharing were not always accurate. Objective factors, such as level of education, income, and density, are not good predictors of the success of a new mobility hub. This has caused the implementation to be delayed in areas where they would have been successful sooner (interview Br2).

*Milan & Barcelona*

Milan and Barcelona score similarly in path dependence. They both address fixed infrastructure and assumptions surrounding car use. Public space is designed around cars, and people, even those without a car, defend cars and the right to park. "When you have cars, nobody asks if it's efficient. But when you remove them, it becomes an issue" (interview Ba2). In Barcelona, 60% of the space is occupied by cars. This needs to be transformed into a more equal model to give back space to people (interview Ba1). People choose the easiest option, so you need to create a context where the alternative is easier than the car (interview Ba2). Such a large transformation in the followed route poses a significant challenge. Also, other departments, such as technicians, faced resistance: "We have always done it like that, it can't be different" (interview Ba3).

In Barcelona and Milan, an effort is made to avoid a future lock-in by designing through a participatory process and tactical interventions. "You don't know what will work. That is why tactical urbanism is

a good thing. You don't spend a lot of money. It's better to test" (interview Ba3). Tactical urbanism entails implementing temporary and cheap interventions designed and adjusted based on feedback from residents and local businesses. In Barcelona and Milan, the redesigned areas are first done tactically so different setups can be tried without making far-reaching and expensive changes that must follow regulations. The first Superblock began by putting trash bags over the traffic lights and painting the road (interview Ba2). It also helps justify the intervention against opponents. If the intervention does not work, it can easily be changed back. In Milan, residents accept the the intervention and none have had to be reversed. "Through temporary transformation, we can be more radical" (interview Mi1).

*Copenhagen*
In Copenhagen, path dependence poses less of a challenge. As cycling has been part of the culture for decades, infrastructure and assumptions are not one of the main problems. Still, several examples were mentioned in the interviews where standardized processes work negatively for bicycle paths. A new light rail network is being developed in the greater Copenhagen area. The office for Cycle Superhighways tried to include a Cycle Superhighway in the project as it is already a single long route, and building them together would be more efficient. However, the superhighway was so cheap compared to the light rail that the transport minister neglected it. The bicycle paths cannot compete with more prestigious and expensive projects (interview Co1). Instead of being open to change, the fixed ideas of importance caused the measure not to be implemented. Another example is explained in the legal barriers. The existing system of tax discounts stimulates travelling by car instead of by bicycle. Cycling is not seen as a mode of transportation.

### Comparing literature and cases
In the literature, three factors were noted that cause path dependence: institutional, technical and discursive factors (Low & Astle, 2009). The path dependence in Bremen shows a clear example of how discursive factors influence the outcome. Assumptions within the organisations of developers shape their practices and are self-reinforcing. building parking spaces for new residents implicitly encourages residents to buy cars and require parking. The same discursive factor is visible for the municipality and their assumptions about which areas would use car-sharing. In both cases, interacting with other stakeholders, such as potential future customers or residents in certain neighbourhoods, can help them discover that their beliefs are incorrect.

In both Milan and Barcelona, all three factors are visible. Technical factors relate to fixed infrastructure causing car dependence. Car parking is available everywhere and roads designed for cars instead of alternatives strengthens traveller preference for cars. Institutional factors relate to the standard operating procedures and routines in organisations. This factor is strongly visible in the quote by the technician in Barcelona about the routine not being able to change. Discursive factors can be seen in the residents who complain about the inefficient use of public space. The belief that car parking is a good way of using space, but an empty space is not, influences the policy's acceptability.

In Copenhagen, institutional factors result in cyclists not receiving a fair tax discount when compared to car drivers. Discursive factors cause the transport minister to not find a Cycle Superhighway prestigious enough.

None of the interviewees stated that they were currently undertaking action to prevent future path dependence and a lock-in. However, possibly without realising, the municipalities of Barcelona and Milan are minimizing the likelihood of path dependence by supporting participatory decision-making. By using the heterogeneity of society under the conditions of the municipality, future support can be created.

### Lessons learned
A form of path dependence is visible in every case and is likely to be present during most changes. Dislodging the status quo will always result in resistance, as people and systems are not always able to change easily. The beliefs of both the public and policymakers can decrease acceptability. Physical

infrastructure and the way systems operate likely benefit the existing situation. Policymakers need to think about the path-dependent resistance they are likely to encounter and prepare for that. To ensure that path dependence will not happen in the future, they should include stakeholders with different views in the decision-making process.

### 5.2.2. Policy and institutional barriers

Conflicts in interests between interested parties can halt the implementation of measures. These can include private and public organisations and departments. In all four cities, politics posed a barrier to implementing the measures. This is discussed more in-depth in Section 5.2.5. Some of the political unrest resulted in conflicts of interest between stakeholders. Those are discussed in this section.

#### Presence in cities

In Barcelona and Copenhagen, there are clear conflicts between interested parties. Bremen and Milan show this to a lesser extent.

*Barcelona*

Barcelona shows the best example of the result of a political conflict of interest in implementing the measure. The Superblock project started when the elected Mayor in 2012 was “brave” enough to begin it (interview Ba2). After several years, the Mayor politicised the project and attached it to her and her campaign for reelection. By doing so, the competing political parties and their members opposed it. Barcelona’s mobility department consisted of opposing political party members, who started refusing to attend the weekly meetings regarding the Superblocks (interview Ba2). They also tried to slow the faster and bolder proposals down and include car lobbies’ opinions (interview Ba1). This resulted in conflicts between managers. To continue the project, the municipality contracted an external consultancy team for mobility (interview Ba2). Another example of an internal conflict of interest was between the Superblock Office and the police department. There were discussions about how order can be maintained in public spaces and the routes for emergency vehicles.

Between departments in the municipality, there was conflict about how the project was implemented. The technicians were opposed to the first Superblock because they knew there were a lot of mistakes and unsolved issues. However, the politicians decided that the project should continue, and the technicians had to build it. With regular meetings, they learned how to make it better. Looking back, it was a good way to force solutions instead of continuing discussions. Mistakes are made and then fixed. It is an advantage of tactical projects (interview Ba3).

*Copenhagen*

Copenhagen shows several examples of policy and institutional barriers. The main issue is between conflicting interests of municipalities in building a cycling route. For a route to be successful, all municipalities that the route crosses must participate. If a municipality is of the opinion that the cycle highway is too expensive or unimportant, the entire route will be unfinished. Most of the time, the other municipalities in the route pressure the hesitant municipalities into participating in the project (interview Co1). However, there are still dark spots on the map where they were unsuccessful. When cycling on routes crossing these municipalities, the cycle highway stops, and travellers continue on regular bicycle paths through towns (interview Co2). This conflict can delay or hinder the completion of the measure.

Another example of an institutional barrier is between the Office and the national road directorate. When the project began, the Office and the participating municipalities wanted recognisable signage and road markings. The engineers at the road directorate did not want the signage to change; reaching a compromise was a long process. The signs and thermoplastic logos were permitted, but the orange line was not. Still, in one of the municipalities that disagreed with the directorate, the line was painted on their part of the superhighway. On the other hand, some roads owned by the road directorate do not have signs (interview Co2). This conflict of interest shows how the measure’s implementation can be delayed and altered.

Other examples of institutional barriers are related to the financing of the measure. After Copenhagen started working with other municipalities to create a network of Cycle Superhighways, the Capital Region of Denmark financed the Office of Cycle Superhighways and has continued to do so with the member municipalities. The capital region finances the Office for several years at a time: sometimes one, often three or four. They then set the frame and the possibilities for the Office. Leading up to that moment, there is uncertainty about if they will continue support (interview Co1). This is an example of how various governmental layers and departments can have conflicting interests. The Office would like to continue building the Cycle Superhighways, but the capital region may make the project less of a priority.

This conflict of interest can also be seen between the national government and the Office in the investment by national politicians in cycling infrastructure. Sometimes, they decide to make funding available for which municipalities can apply. Municipalities build more cycle highways when funding is available, whereas when it is not available, they wait for it to become available (interview Co1).

Finally, the political tension between the city of Copenhagen and its surrounding municipalities could be a problem for the collaboration. “Copenhagen is a big arrogant thing that forgets its backyard” (interview Co2). As stated in (interview Co2), it’s a surprise the project is still going on. The project started out to reach Copenhagen’s goals, and municipalities have questioned before why they should participate and spend money when the infrastructure is mainly used to benefit Copenhagen. That is why the office purposefully presents itself as a collaboration between all municipalities and not only a project for Copenhagen. Though Copenhagen is the largest municipality, all municipalities are treated equally, and all voices are equally important. Also, while the Cycle Superhighways do go towards Copenhagen, participating municipalities do benefit from the reduced emissions (interview Co1) and improving their infrastructure is relatively inexpensive (interview Co2).

*Milan*
The main issue regarding institutional barriers that Milan is facing is also a conflict of interest between municipal departments. The project was begun by the Deputy Mayor, and the Department for Housing and Neighbourhoods is now responsible for it. However, they do need help from other departments in the city. As the project is not labelled as their project, these departments are less keen on helping. To create a different perception, the Mayor must recognise it as a goal for the entire city, not just a single department (interview Mi2).

*Bremen*
Bremen also faced some institutional resistance. The national law did not allow public space for car-sharing. When they approached the federal government with an evaluation of the effect of their pilots, they expected the law to change so municipalities could build the necessary stations. However, the deputy minister for economy vetoed it, stating it was against the motor industry. This conflict of interest caused the law to be delayed by 12 years. They also faced resistance in the implementation of their ecolabel. Around 1995, this label was designed to distinguish good car sharing. Car-sharing operators with labels can use publicly available car-sharing stations. It was proposed to all the German ministers of the environment. However, the ministers from the Eastern provinces opposed the label, stating that it was socialism through the backdoor. This was a sensitive topic as the East and West had only recently been unified. 1.5 years later, the ministers unanimously agreed to the ecolabel (interview Br1).

Another institutional problem comes from the current organisation. For the implementation, the people responsible for the project need to collaborate with the department responsible for cars and streets. However, they do not have the required knowledge for planning and car sharing. Switching this to the department dealing with the public parking spaces would work better (interview Br2).

### Comparing literature and cases
The literature states, it is stated that a lack of coordination between departments and different levels of government can result in conflicts of interest (Kalaba, 2016). Barcelona’s conflicts were a result of the political interests of departments not being in line. It was politically advantageous for the mobility to not

cooperate in the project. The technicians tried to slow the project down so they could work out all the mistakes, which was also not in line with what the team responsible for the Superblocks wanted to do. The conflict of interest on different levels of government is visible in Copenhagen. The main interests of the municipalities are different than those of the Superblock office, which are different from those on a national level. Coordinating this proves to be a difficult task. In Bremen, the policymakers discovered something similar. To implement a car-sharing station in Bremen, they needed the national law to change. The policymakers and ministers had different interests, and it took the Bremen municipal workers a long time to get the approval they needed. Finally, in Milan, departments of the municipality were less willing to help with the project when the project was a part of a different department. To change this, it must be seen as a goal for the entire city.

#### Lessons learned

Conflicting interests between departments and levels of government are likely to cause problems in the implementation of new measures. Not all studied cities have found a solution to solve it. Those that have, are with patience or case-specific tactics. Finding general lessons is difficult. The main advice is to coordinate the complex interactions between departments and motivate them to cooperate.

### 5.2.3. Legal barriers

Existing legal frameworks can make it difficult to introduce new measures or technologies. Policymakers may need to change the existing legislation or adjust their measure.

#### Presence in cities

All researched cities had experience with this barrier. This resulted in a varying degree of delays, depending on the level of legislation that needed to be changed.

*Bremen*

The municipality of Bremen has faced the most significant legal barriers. The first is regarding the car-sharing stations. In 2003, the municipality of Bremen installed its first station. However, due to federal laws (the German Highway Code), they could not allocate public space for car-sharing. This was only permitted as a pilot project. Over the years, they kept placing the stations as pilot projects. In 2005, the municipality performed an independent evaluation of the effects of the stations. It performed much better than expected, and they discovered that one shared car could replace 9.5 private cars. With these figures, the municipality approached the federal government expecting changes in federal laws to permit the stations. Due to the veto by the deputy minister of economy, the new law was delayed. In 2017, they managed to get the law passed. This law did not include the municipality's objective of reducing parking pressure. This still requires accompanying regulations on the state level (interview Br1). In 2019, Bremen passed its car-sharing law (interview Br3), setting an example for other German cities (interview Br1). The next legal challenge was implementing mobility management in new developments. In 2001, the first developer could replace car parking with car sharing. In 2012, the municipality passed a new law allowing developers to replace private car parking spots with mobility management. After a two-year process, a law was passed in 2022 requiring all new builds to provide mobility management. This can include car-sharing memberships, stations and public transport tickets (interview Br3).

*Milan*

In Milan, there were no laws that posed a problem for implementing the open squares. However, for the bicycle lanes, there was an issue. The national traffic rules did not allow tactical, temporary bicycle lanes. Before the Strade Aperte programme could begin, Milan's city council asked the national government to make changes to the law. Once the pop-up bicycle lanes were legalised in 2020, the programme could begin. Before the change in legislation, only permanent projects were allowed. These take years to complete (interview Mi2).

*Barcelona*

In Barcelona, the existing laws did not increase the difficulty for the city to implement the Superblocks.

The legal issues they ran into were afterwards. Two court cases were started to have parts of the Superblocks removed. The first case was by the former chief architect. He claims that the Superblocks are against the metropolitan plan from 1976 stating that accessibility is required in all streets (interview Ba2). The court concluded that this did not hold up (interview Ba3) as the project only changes the amount of space, it does not add barriers (interview Ba2). The court case was simply to penalise the former Mayor (interview Ba1), wasting time and money (interview Ba2). The Commercial Association for Tourism initiated the second court case. There, the judge ruled in their favour, stating that all works that were not finished in the summer had to be removed. However, the prosecutors changed their minds, and the project was allowed to remain. This case was simply to worsen the public opinion of the former Mayor (interview Ba1).

*Copenhagen*

The Office of Cycle Superhighways in Copenhagen did not run into any major legal barriers. However, one issue was that the road directorate did not permit the signs with which the Office wanted to signify the Cycle Superhighways. The municipalities also wanted a bright orange line on the asphalt to easily recognise the Cycle Superhighway. Though the road directorate did not allow this line, there was a municipality that had its own employees paint the line (interview Co2). Another issue is that the Danish tax system refunds commuters who travel by car. This is not the case for cyclists. The Office has worked hard to change the economic benefits, though it is facing resistance from policymakers who consider bicycles a toy or something used for fun, not for transport (interview Co1).

#### Comparing literature and cases

Non-supportive legal frameworks can constrain policy implementation and may require the lengthy and burdensome process of changing legislation, which is not always possible. Bremen showed the best example of constraining laws. Building car-sharing stations was legally not allowed, and it took them seven years to change the national legislation and another two for the required law to be passed in Bremen. The policymakers did manage to continue with the programme by labelling all stations a pilot. For the bicycle path programme to begin in Milan, laws also had to be changed. Though it is unclear how long that took, it was quicker than in Bremen. In Copenhagen, the legislation did impact how the measure was implemented. Signage rules did not allow for the orange line they designed on the asphalt. Finally, in Barcelona, laws did not hinder the measure being implemented, but court cases did provide a challenge after implementation.

#### Lessons learned

Laws can cause significant challenges for cities looking to implement changes if the measure is not permitted. Changing the law can take a lot of time, so if policymakers discover that they will need to change legislation, policymakers should begin the process as soon as possible. Also, if the process takes a long time, they should find a way to continue with the project that fits within the existing legal framework to minimise the delay.

### 5.2.4. Resource barriers

Resource barriers exist when policymakers cannot find sufficient financial and organisational backing or have insufficient land or material resources.

#### Presence in cases

In some of the cities, the resource barriers caused the measure to be implemented a bit differently than envisioned.

*Copenhagen*

In Copenhagen, financial resources limit the implementation of the Cycle Superhighways. As the existence of the Office of Cycle Superhighways is based on a ‘gentleman’s agreement’, municipalities can decide to enter and leave whenever they like. Each municipality pays a contribution based on the

number of residents. This contribution caused lower-income municipalities to wait before joining the project. They first wanted to see proof of concept. When the bicycle count showed positive results on the return on investment and public health, these municipalities decided to participate. However, if the local politicians decide that their financial priorities do not fit the collaboration, they leave. This has happened in the past, and another municipality has left last year for that reason (interview Co1).

If the municipalities do decide to be a part of the collaboration, they need to agree on financing the part of the routes running through their municipality. For the municipalities, the cycle routes are expensive (interview Co1). Therefore, they have used the funding provided by the State for each cycle highway. This state funding can only be spent on specific parts of the cycle highways. It does not fund new surfacing. When cycling over the paths, the quality of the asphalt can differ between areas depending on whether the municipality has sufficient funds available (interview Co3). The State could finance the entire network for the price of a few kilometres of car highway (interview Co1).

The final challenge is in the standards of implementation. If the municipalities have different financial priorities, they can decide to build the roads according to their budget and upgrade them later (interview Co1). Many municipalities do try to meet the standards so they look good in the collaboration, but they do not always manage. The Office then keeps applying pressure to slowly upgrade (interview Co3).

*Barcelona & Milan*

In Barcelona and Milan, the projects have similar budget issues. To quickly redesign the urban landscape, both cities are making tactical changes. These tactical interventions require significantly less time and money and allow for experimentation. In Milan, the government is working together with private organisations that donate urban furniture (interview Mi3). Though the quality of the public space and greenery is lower, the effects on noise and air quality, accidents and use of public space are similar. There are many things that you do not know ahead of time when changing things. Some things work, others do not. With tactical urbanism, you do not spend a lot of money; the technique is better for testing (interview Ba3). There is a downside to these quick and cheap transformations. The usual, structural transformations take so long to build that people have changed their behaviour before the transformation is completed. Tactical transformations happen so quickly that people do not get used to the change and are then upset (interview Ba2).

The main financial barrier arises when the tactical transformations become structural. There is not sufficient funding to make all transformations permanent. This requires “real money” (interview Mi3). Structural interventions are about 10 times as expensive (interview B2). Another point to consider is that people expect the structural interventions to be properly maintained. This requires structural financing (interview Mi3). In Milan, the bicycle lanes were funded by the regular maintenance budget from the municipality as they are “really cheap” (interview Mi2). Last year, the national government gave millions to the municipality for cycling lanes. The budget is decreasing, so now they are looking for new funding. They apply tactical changes as they are cheaper and quicker, but on big streets and intersections, it is worth it to make more permanent changes (interview Mi2). The squares used to be funded from the same budget, which was one of the reasons they could start the programme so fast. Now have a specific budget (interview Mi1). The lack of a budget for permanent solutions is why the policymakers in Barcelona have started to make combinations. The squares where the mobility is changed are made structural, and less crucial parts of the streets are made tactical (interview Ba2).

*Bremen*

In Bremen, the barrier is less financial. They did have to be creative and get money from different funds within the municipality, such as car safety, and integrate it into infrastructure renovation projects. The stations used to also be co-funded by the EU. For three years, they have had a fixed budget for the public car-sharing stations (interview Br2). Still, if the German government provides more funding for car-sharing stations, the city would feel more pressure as they would then need to spend the funding. For the government, the stations have a high return on investment. The network of stations has cost the municipality 1-2 million euros and has replaced 8,000 cars. These cars would have otherwise been a 150-200 million euro investment in street space. There are a few projects with a return of around 150 (interview Br1). Especially underground parking is expensive at 40,000-60,000 per spot. When

developing new buildings, 10-20% of the construction cost is spent on housing vehicles. Parking, and especially underground parking, is a lost investment (interview Br1).

The main resource barrier is space (interview Br2). In 2013, the municipality decided to switch to a decentralised, smaller station. These stations take up less space, thus making them easier to place. To ensure availability for car-sharers, a dense network of stations is being realised. Having a maximum distance of 300m between each station requires many locations. This poses a challenge (interview Br3). That is one of the reasons that operators are required to build their own stations on private land. They do not wait for the municipality to expand, but they are engaged in finding their own locations. This can also be cheaper for them as the rent they pay in Bremen is high when compared to other German cities. Still, the rent is insufficient to maintain the station.

#### Comparing literature and cases

Resources are needed in the long term and short term, and the unavailability can cause the implementation to be delayed. The difficulty of finding resources and the effect that the lack of financial resources has is most visible in Copenhagen. The Office of Cycle Superhighways and the available funding for the municipalities are uncertain and have a high impact on how the measure is implemented. Without funding, the municipalities will not build a Cycle Superhighway. In Barcelona and Milan, the municipalities need funding to make the tactical interventions permanent. For the short term, this raises a barrier to completing the transformation, but also a long-term for maintenance. Besides funding, the Bremen municipality has difficulty finding space to build the stations they need to meet the dense network they wish to have.

#### Lessons learned

Sufficient resources are a challenge in each analysed case. The cities mainly experience a lack of financial resources, but also in space to implement the measure. The interviewees stated that finding sufficient funding became easier when the municipality allocated them a separate budget for the project. Therefore, policymakers should communicate their financial needs clearly to the appropriate levels of government and the consequences if the needs are not met. Until that budget is allocated, the interviewees managed to begin the implementation by creatively using the money from other budgets.

### 5.2.5. Social and cultural barriers

When the level of acceptance is low among those concerned, it can result in public and political resistance. Such resistance can form a barrier to implementing policy.

#### Presence in cities

Social and cultural barriers are an issue in each city. The public's perception of a measure and the problem it is trying to solve can influence a project's outcome.

*Bremen*

In Bremen, the "main barrier is still the mindset" (interview Br1). Car ownership is a status symbol, which is linked to education level and income (interview Br1). Over the years, residents have started to accept the stations more. When the project began, the municipality had to keep justifying the stations (interview Br2). To place a station, they usually removed residential car parking, which they justified by the new service and a higher relief in street space (interview Br1). Now, people are wondering why the number of hubs is growing so slowly. An independent survey showed that about a third of the new car-sharing users gave up car ownership, and young people go straight to car-sharing instead of buying a new car after getting their license (interview Br1). It also showed that 70% of the respondents thought car sharing was a good thing. However, only 20% thought it was something for them. Convincing these people to try car sharing is the next challenge for the municipality. They will need to show advantages other than financial to convince people. They do not make rational choices (interview Br3).

Politicians and the media also understood the positive effects. It was seen as a tool to deal with illegal parking on narrow streets and use the expensive space more efficiently. “Car sharing is one of the core answers” to improve non-market drive parking garages (interview Br1). Also, a quarter of the cars are not moved within three working days, showing they are not necessary for work (interview Br1).

The political landscape in Bremen has changed after the last elections. The new conservative ministry halted many measures that would change public space to avoid conflicts. This included the mobility hubs. It was especially frustrating for the department planning the hubs as they had just received approval to build new hubs in a specific area where they had been trying for the past 10 years. “That’s the downside of being a public servant, you’re at the will of politicians” (interview Br3).

*Milan*

This car-owning culture can also be seen in Milan. The challenge in Milan is a matter of culture, it is not a technical barrier. “It’s not just about transforming the city, it’s about transforming habits” (interview Mi1). When you turn 18, you receive a car. That culture is affecting the city space (interview Mi1). People love using their cars. This results in a lot of resistance when parking lots are removed, even if they know that it is necessary for cities to become greener. People need to be educated about reducing car usage. Once they see the transformation, they understand the beauty of green spaces for children. There is a transformation in the mentality of people. However, the resistance is also becoming clear politically. The project has been tied to the current political party, and it is unclear if they will be able to continue the project after the 2026 elections (interview Mi3).

*Barcelona*

In Barcelona, the municipality has already run into this issue. Convincing people it is possible to live without cars is the main challenge as they “have cars in our veins” (interview Ba1). Public transport is not good enough, and people think bikes are for the working class (interview Ba1). Since the Superblock project started, there has been a change in resistance. Studies have shown that air pollution and a lack of green are affecting the residents’ health and that of their children. COVID also showed that with fewer cars, the air quality improves (interview Ba3).

Though residents initially objected when their neighbourhood was transformed, a majority of the residents in the Superblocks voted for the Mayor in the 2019 elections, showing that people liked the transformation (interview Ba1). Outside of these areas, the Mayor lost in the 2023 elections. Other issues, such as economic discussions, were important in the elections, and the general opinion about her was not positive (interview Ba1). Unfortunately, the project has been strongly connected to her political party (interview Ba2). It became a brand of the government, and they used the word for everything (interview Ba1). Instead, they should have given more space to other political parties to use the Superblocks (interview Ba2). The new political party is against the Superblock project. The new Mayor stated they are stopping the Superblocks. The Superblock Office has been removed, and the plans to develop 21 green axes have stopped (interview Ba1). To prevent the first Superblock from being reversed easily, the entry/exit points were made permanent, replacing the tactical intervention. A painted sidewalk has been converted into car parking, and they are thinking about reversing the bus & cycling lanes (interview Ba2).

*Copenhagen*

The biggest problem for the Cycle Superhighways in Copenhagen is prosperity. Due to the decreased taxes resulting from a changing political landscape, Denmark has been breaking records in car sales. Commuters travel into the city centre by car, where there is no space to park (interview Co2). The interviewees disagree on the public acceptance of the cycle highways. Interview Co2 stated that 67% of motorists like the cycle highways. Even those who do not ride a bike want more bicycle infrastructure, as those who sit in traffic wish that more people would ride a bicycle. Between 2006 and 2017, Copenhagen invested 286 million euros in bicycle infrastructure. In comparison, a 3 km extension of the motorway costs 280 million euros. Interview Co1 stated that there is a fear of fast cyclists, and cyclists deserve more credit from the car-focused media. Instead, the public acceptance of non-car drivers in traffic is decreasing, and people are quite harsh: “How can you change the free will of car drivers?” (interview Co1). The Office does notice that the mindset of municipalities is changing. They

are starting to see that commuters can cycle to work over longer distances (interview Co1).

#### Comparing literature and cases

This barrier is present when the public or market sector does not accept a measure. To entice voters, politicians also then tend to disagree with it. Not only is this barrier present in each case, but at least one interviewee from each city stated that it, or something related to it, is the biggest problem in the implementation of the measure. Cars are popular among the cities' residents, and convincing them to switch habits proves to be a difficult task. Even though cars and the space allocated to them are expensive, it is a part of the culture to use them. In Barcelona and Milan, policymakers discovered that by showing residents the advantages, such as the increased amount of green public space benefiting them and the children, public acceptance increases. In Bremen, policymakers noticed that the financial benefits were insufficient to convince potential users. The reduced effort of not having to worry about a private car works better. In Copenhagen, the benefits of the Cycle Superhighways are less noticeable for non-cyclists. This impacts the acceptability.

In Bremen and Milan, the project has been tied to a political party, and its future is uncertain. In Barcelona, it has already ended due to a different political party winning the elections. In Copenhagen, the existence of the Office depends less on politics as it has not been tied to a specific party. The fact that it impacts the space and accessibility of cars may also make it less controversial. However, the cooperation of the municipalities is dependent on the willingness of the Mayor in power at that moment. This does significantly affect the measure's implementation.

#### Lessons learned

It is very likely that any project that reduces the accessibility by car, runs into public and political resistance. It is important for the policymakers to show the benefits of the project and clearly communicate it to residents. The difference between controversial and uncontroversial measures has been mentioned before in Section 5.1.5. The distinction between these types of measures can be made for social and cultural barriers. Controversial measures like those in Barcelona and Milan have a high risk of not being fully implemented. The public may resist such measures too much. Social barriers pose a lesser risk of ending the measure in less controversial measures, like those in Copenhagen and Bremen. However, in these cities, the risk is that they are given insufficient priority. Politicians and the public do not have as strong opinions about the measure, which can slow down implementation.

To ensure the continuation of the measure, the measure and its success should not be tied to the responsible political party. By making the goal that the measure is trying to achieve a common goal for the city and not tying it, and its success, to a party, it is more likely to be publicly and politically accepted in the future.

## 5.3. Expanding on the framework

The success factors and barriers determining the implementation of the measures have been divided and categorised according to the discussed literature (i.e. (Sørensen et al., 2014; Maat & Louw, 1999). However, in reality, they cannot be divided this easily, and there are dependencies between the success factors and barriers. Also, there are success factors not mentioned in the literature that did play an important role. This section will go into these two important aspects.

### 5.3.1. Dependencies

Though the success factors and seem independent when applied to the framework, as found in the literature, several dependencies have been found within the studied cases. These are listed in Table 5.4, and visualisation is shown in Figure 5.6.

**Table 5.4:** Dependencies of factors

| Factor 1 | Factor 2 | Factor 3 | City | Explanation |
|---|---|---|---|---|
| SF: Strategic communication | B: Policy & institutional | | Copenhagen | The Office strategically communicates to the municipalities that they are also important and the project is not only about Copenhagen. |
| SF: Sticks & carrots | SF: Strategic communication | | Copenhagen | The Office communicates to the public that the measure is positive and does not include any sticks. |
| SF: Trials | SF: Strategic communication | B: Resource | Copenhagen | When the first Cycle Superhighway showed positive results, these were communicated to low-income municipalities so they would participate. |
| SF: Showing flexibility | SF: Strategic communication | B: Resource | Copenhagen | Being flexible allows lower-income municipalities to participate, but lowering the standards makes communicating the cycle "super" highways more difficult. |
| SF: Strategic communication | B: Social | | Copenhagen | Calling the Cycle Superhighways "super" makes them sound more positive and thus politically easier. |
| B: Policy & institutional | B: Resource | B: Social | Copenhagen | To build the Cycle Superhighways, funding is required from the national government and regional administrations. Municipalities and their politicians also need to be convinced. |
| SF: Organising responsibility | B: Policy & institutional | | Copenhagen | The Office was set up to facilitate the conversation between municipalities and help them to collaborate. |
| SF: Timing | B: Social | | Barcelona | Societal demand can open a policy window. Also, the timing of other factors, such as COVID, can cause public opinion to change. Implementation should be started as quickly as possible so people have time to adapt |
| SF: Timing | B: Resource | | Barcelona | External factors, such as COVID, can result in a change in funding. |
| SF: Trials | SF: Showing flexibility | B: Resource | Barcelona & Milan | Tactical interventions are implemented first as they are cheaper and allow for changes before making the final design. |
| B: Policy & institutional | B: Path dependency | | Barcelona | Departments have always done it a certain way, and want to continue doing so. |
| B: Resource | B: Social | | Barcelona | Politicians decide how money is spent. |
| SF: Trials | B: Path dependence | | Bremen | Developers do not dare to trial a reduced number of parking spots. |
| SF: Trials | B: Legal | | Bremen | The municipality was not legally allowed to build stations, so until the law changed, each station was officially a trial. |
| SF: Showing flexibility | B: Resource | B: Social | Bremen | Politicians want to stimulate electrification, but it is difficult to require companies to have electric vehicles if the business model does not support it. |
| SF: Showing flexibility | B: Resource | B: Social | Bremen | Depending on the availability of land and the input of residents, the municipality has to be flexible in finding locations for the stations. |
| SF: Strategic communication | B: Social | | Bremen | Strategically communicating the advantages of car sharing to the public can increase acceptance. |
| SF: Showing flexibility | B: Policy & institutional | | Bremen | Not only can the public suggest changes to the implementation of the stations, other departments can too. |
| SF: Organising responsibility | B: Policy & institutional | | Bremen | By not having a separate department, the success of the project depends on how well the existing departments work together. |
| SF: Trials | B: Path dependence | | Milan & Barcelona | The tactical interventions trial a certain design and help to reduce the risk of a lock-in. |
| SF: Showing flexibility | B: Social | | Milan | As cycling is not commonly accepted, the design phase can not be participatory. As the open squares are, the process is different. |
| SF: Organising responsibility | B: Policy & institutional | | Milan & Barcelona | By setting up a new department and making the project a part of the cities' strategy, other departments are more willing to help. |

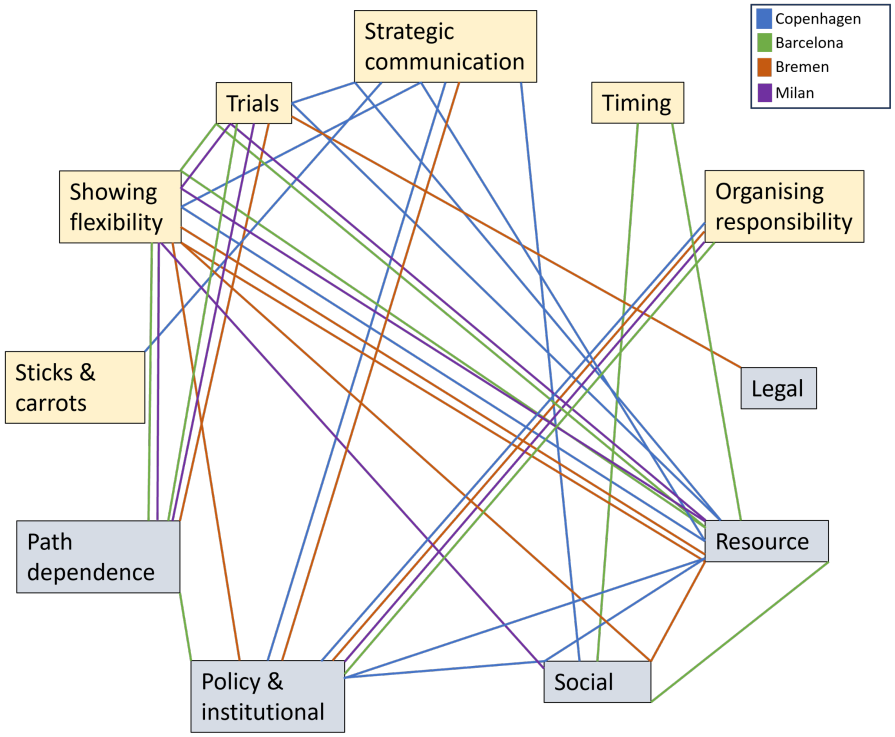


**Figure 5.6:** Dependencies between success factors and barriers

### Notable links

The graph in Figure 5.6 shows that the resource barrier has the most links with other success factors and barriers. This comes as no surprise, as the availability of resources influences how the measure is implemented in each city. Therefore, it affects many other success factors and barriers. The success factor with the second-most links is that of flexibility in negotiations. Interviewees from all cities found that negotiations and exceptions for implementation were crucial for the implementation of their measures. The success factors and barriers tied for the third-most frequent links are the social barrier and the success factor of strategic communication. The social barrier was noted as the biggest barrier, and the lack of public support has an effect on many other aspects of the implementation of new measures. The success factor of strategic communication is present in every city, and the high number of links has to do with cities communicating about different aspects of the policy related to the success factors and barriers.

The success factors and barriers that have a high number of links between them are also of importance. The highest number of links is between the resource barrier and the success factor of showing openness and flexibility in negotiations, and the resource barrier. This results from the availability of finances and other resources for the municipalities to implement the measures, requiring the flexibility to make changes in the implementation. If there are fewer funds available than expected, changes need to be made to the design. The second highest number of links is between trials to create legitimacy and acceptance and the resource barrier. The availability of resources also influences if and how trials are designed, but also if the trials are necessary.

Diving into the dependencies a bit further reveals key connections between success factors and barriers that are present in multiple cities. All four cities have a connection between the success factor of showing openness and flexibility in negotiations and the resource barrier. In Copenhagen, this is visible in the flexibility that the Office offers to participating municipalities in meeting the standards of the Cycle Superhighways, thereby lowering the barrier. The Bremen municipality wants to turn the shared car fleet electric but remains flexible for the operators to find a business model. Also, they have to be flexible in finding land to put the stations on. Based on the availability of space and feedback from residents, municipal departments and operators, they need to find locations that meet the minimum requirements of their grid. The tactical interventions in Barcelona and Milan focus on flexibility based on available resources. Before this style of intervention was adopted, projects were implemented permanently immediately. This was a much more expensive and slower way to build. If they had continued with that method, the progression of the project would not be close to where it is now. Another key connection is between the policy and institutional barrier and the success factor of organising responsibility. Barcelona, Milan and Copenhagen set up new organisations to have people from different departments work together on the project without being limited by the official sectioning of their work. This has not yet been done in Bremen, but the people responsible in the municipality would like it to happen. Another key connection is between the success factor of trials to create legitimacy and acceptance and the resource barrier. The first Cycle Superhighway and the results that it generated helped to show other municipalities that the Cycle Superhighways are a good investment, thereby reducing the cost barrier. The trials in Barcelona and Milan are a low-cost method of implementing the Superblock, open squares and open roads programmes.

Many of the links in Barcelona and Milan can be explained by the method of tactical interventions they used. This method was introduced to the cities for the implementation of these measures. The links to path dependence are explained by tactical interventions reducing the risk of path dependence. The links to flexibility are explained by tactical interventions being easier to adjust. Finally, the links to the resource barrier are explained by the lower cost that tactical interventions have.

### Success factors to overcome barriers

Another important finding is between the types of factors that are linked. Most links connect a success factor and a barrier, which implies that the success factor can be used to lower or even overcome the barrier. This demands another look at the dependencies with a different perspective.

To address the path dependency barrier, two success factors are linked: trials and showing flexibility. Trials can both help in reducing the likelihood of a lock-in and overcome existing path dependence. In Barcelona and Milan, trials helped to show the effectiveness of the project, convincing residents and policymakers to cooperate. By beginning with a trial, they accepted the measure. As the measures' positive effects were demonstrated, stakeholders changed their mindsets. Flexibility can help prevent a lock-in through a participatory and flexible design process. If multiple stakeholders can include their perspectives, a more resilient implementation can prevent being locked into a single point of view.

The policy and institutional barrier has links with three success factors. The strongest connection is with organising responsibility. In all four cities, a new department was set up or recognised to facilitate inter-departmental and -governmental cooperation. The barrier also links to the success factor of strategic communication. The Office is careful about how they present the project to the municipalities. To include them, the Office communicates their importance in the project. The Office also hired a company to attractively present the results of the first cycle highway so municipalities would understand the advantages. Finally, there is a link with the success factor of showing flexibility as other departments with other interests and priorities can suggest adjustments to the measure implementation.

The social and cultural barrier also links to three success factors. The first is timing and windows of opportunity. Demand from society can open a policy window or keep it open. When the Mayor wanted to end the Superblock trial in Barcelona, demand from local residents helped to restart the project and keep it when faced with resistance. Also, external factors like COVID and climate crises can cause public opinion to change, like they did in Barcelona and Milan. Where the projects had little support at the beginning, support grew as people became more aware of the effect that cars had on livability in the city. As people need time to adjust to a new measure, the implementation should begin early in the term. When the term is finished, people have gotten used to the new situation and are less upset. The second success factor is strategic communication. Carefully communicating to the public about a measure is important. In Bremen, this is done through various channels such as advertisements and children's books. In Copenhagen, the Cycle Superhighways are labelled 'super' to make them sound positive and imply a certain quality. The final linking success factor is showing flexibility. In all four cases, showing flexibility increased the level of acceptance for the measure. However, one of the reasons for the Milan municipality to not make the design process of the bicycle paths participatory was the low level of acceptance by the public. The participatory design process in the Superblock and open squares projects in Barcelona and Milan only began after there was a demand from residents to implement the measure.

The resource barrier has links with four success factors. The strongest is with showing flexibility, followed by trials. As discussed in Figure 5.3.1, being flexible can help in dealing with a lack of resources, and trials are a low-cost way to gain experience with the measure. The third success factor is strategic communication. In Copenhagen, the results of the first Cycle Superhighway were communicated strategically to other municipalities so they would cooperate in the project. The final success factor is timing and windows of opportunity. In Barcelona, external factors like COVID increased the available funding for the project. As awareness of the importance of health and livable outdoor space increased, more funding was made available.

The legal barrier has only one link. It is with the success factor of trials. To overcome the legal framework not allowing the municipality of Bremen to build car-sharing stations on public land, they labelled all stations pilots until the law changed. As pilots, the car-sharing stations were allowed to be placed, though the public space was still not officially reserved for the parking of shared cars.

### 5.3.2. Missing factors

Besides the success factors discussed in the literature (Sørensen et al., 2014), two other success factors were notable from the case studies. The framework derived from the literature did not cover these, but they did affect the implementation of the measures. The two missing success factors are discussed in this section, together with the lessons learned from the cities' experiences.

### The inarguability of schools

Interviewees from the cities of Barcelona, Milan and Bremen mentioned that schools and the children travelling to school provide an opportunity to implement car-reducing measures. Policymakers face significant resistance from residents and politicians when measures are implemented that affect the accessibility by car in cities. However, interviewees from these cities discovered that when children's safety and health are in the discussion, even the most pro-car associations cannot argue with the measure.

*Barcelona*

In Barcelona, referring to the safety of children helped in increasing the acceptability of the Superblocks. Parents could play outside with their children, and people without children could play with their young family members or see other people doing so. In the media, medical studies were discussed that proved that the lack of green spaces and air pollution affects children (interview Ba3). This helped the project, and parents and schools organised themselves to help with increasing acceptance of Superblocks in the neighbourhood by suggesting improvements (interview Ba2). The reduced number of cars also improves safety for children, especially around schools. After a child was killed in a traffic accident outside his school, the Mayor began a programme to prevent this from happening in the future. In this 'Let's protect the schools' programme, dangerous areas surrounding 200 schools have been identified, and policymakers have begun the transformation for eight schools (interview Ba1; interview Ba2). Feedback has been positive as it is difficult to argue with the safety of children. "It is a good idea to start by transforming the area around schools to improve the entire city" (interview Ba1). Schools help a lot as they are more likely to agree with changes (interview Ba3). It even works post-hoc, as the acceptability of the first Superblock increased after a school was built (interview Ba2). The difference between areas near a school and areas that are not became extremely apparent when the 30 km/h zone was introduced in the city, and the municipality hung cameras to fine car drivers who did not adhere to the new rules. The largest motorist association protested against many of the cameras, except those surrounding schools (interview Ba1). Since the municipality has a new Mayor, its administration has begun removing some of the tactical interventions made for the Superblocks. However, they will likely not reverse the interventions around schools, though the programme has stopped (interview Ba2).

*Milan*

Policymakers in Milan also discovered that school communities were most engaged in the projects and that projects, where they are actively participating, are more successful. Parents have a stronger connection to the neighbourhood and other residents are more conscious of the children in their direct area. That is why policymakers decided to focus the third part of the project on transforming the area around schools. The municipality asked schools to submit proposals for transformations. This resulted in 87 proposals (interview Mi1). After the proposals were submitted, schools and their communities were invited to a workshop to further discuss their designs. Schools and parents of young children are now pressuring the municipality to make more interventions (interview Mi3). Though there is resistance to the project, "nobody can say no to kids" regarding air quality, quality of life and independence in the route from home to school (interview Mi1). Having a parked car in front of the house does not weigh into that (interview Mi1). After an area is transformed, people understand the beauty of the transformation when they see green spaces for children to play in (interview Mi2).

*Bremen*

Though the shared car stations in Bremen have little to do with children, some interviewees did reference them. Policymakers who were designing the requirements that car-sharing operators need to meet before they can use the stations included a share of family cars so they were usable for a larger audience (interview Br1). They also noticed that the stations received more public acceptance by improving the safety of children on their way to school (interview Br2).

**Lessons learned**

Improving the safety and health of children increases the acceptance of a car-reducing measure. This works in two ways. If possible, policymakers should begin implementing the measure around schools. Politicians and the public cannot argue with measures that improve this area, and school communities are active and willing to help. The second way is by communicating the benefits a measure has on

children. If residents know about the effect it has, they are more likely to accept it.

### The undeniability of hard evidence

This factor is related to the factor of strategic communication but emphasises the effect of hard evidence. In the literature, strategic communication helps to integrate perceptions while planning a measure and promoting particular behaviour (Cornish et al., 2011). However, from the cases, it becomes clear that the communication should not end there. After the measure is implemented, results should be published stating the exact effect it had. Therefore, data must be collected before and after implementation.

*Copenhagen*

The Office of Cycle Superhighways in Copenhagen has as one of the main tasks to collect data. They started doing this for the first routes. Analysing the number of cyclists before and after the route became a Cycle Superhighway helped calculate figures about the increase in traffic and the effect that it has on the health of cyclists and air quality (interview Co1). Strong evidence-based facts help to convince governments to cooperate and finance the project (interview Co3). Data from the first Cycle Superhighway were crucial in convincing other municipalities to participate in the project. Data needs to keep being collected so the Mayors of each municipality know the effect their investment has, and it helps them to feel like they are a part of something big (interview Co2).

*Barcelona*

After the first Superblock was built, the city council kept monitoring the area. “The best way to defend that kind of transformation is to provide data to people to show if it’s working or not” (interview Ba1). Not only was it possible to show the positive effect it had on the environment, but it also helped them to show that the Superblock did not cause traffic disruptions. When the Superblock was implemented, road works and festivities blocked the streets, but everybody blamed the Superblocks. Later, the municipality could prove that the increased traffic was not caused by the Superblock (interview Ba2). The data collection continued when the following Superblocks were implemented.

*Milan*

Data is collected for both the open squares project and the bicycle paths. To decide where they should build a new bicycle path, municipal policymakers check accident data and transform the most dangerous intersections first. After building bicycle paths, the data shows that more people cycle on those roads and that people feel safer (interview Mi2).

*Bremen*

Data has always been important in the implementation of car-sharing stations in Bremen. To convince national policymakers to change the German law, people from the Bremen municipality collected data about the number of private cars that a shared car replaces. This exceeded expectations and helped eventually pass the changes. Several years later, they released an action plan that included a high goal of the number of car sharers that they would reach. Publishing the goal and reaching it resulted in a lot of attention from the press. Quantifying the number of cars they replace and the cost savings associated with those cars also helps in proving the success of the measure (interview Br1).

**Lessons learned**

Data is collected about the effects the measure has in each city. Registering the situation before and after the measure is implemented can help increase acceptance and decrease barriers. It also helps to prove claims about its effectiveness and disprove claims by opponents of the measure. Therefore, it is strongly recommended for policymakers to collect data and communicate it to the public. This data can also be used to make calculations and estimations about further effects it has, such as on air quality and health benefits for the population.

# 6

# Lessons for Amsterdam and other Western European cities

Cities can learn from the analysed success factors and barriers in the case studies and the dependencies, missing success factors, and lessons that followed. Applying the newly gained knowledge and insights can be challenging as the real-life situation can differ from generalised theories in the literature, and from the experiences that other cities have. In this chapter, the success factors and barriers in Amsterdam are analysed first. Next, the lessons for Amsterdam are determined. Finally, general lessons for other Western European cities are determined based on the lessons for Amsterdam.

## 6.1. Amsterdam

The success factors and barriers, combined with the surrounding knowledge, are applied to the city of Amsterdam to determine the practical usability and contribute directly to the XCARCITY project. In Chapter 5, the context of Amsterdam is determined. That context is combined with interview Am1, and additional grey and white literature is used in this chapter to determine the effect that the presence of certain success factors and barriers and what potential solutions are.

### 6.1.1. Background

The low-car agenda (agenda autoluw) was released in 2019 and followed the implementation agenda mobility (uitvoeringsagenda mobiliteit). This implementation agenda includes regulations, such as a different circulation of traffic, intelligent access, and parking measures. For the low-car agenda, the implementation of the measures began well. However, during COVID, the city missed parking revenue. Also, the city did not want to restrict its residents further, so measure implementation was halted.

### 6.1.2. Barriers

All of the five barriers are present in some form in Amsterdam. This section dives deeper into how these barriers limited measure implementation and which barriers still pose a challenge.

#### Path dependencies & lock-in

The barrier of path dependency is inherent to car use among car owners. People are used to a level of convenience, and removing that causes discomfort. Residents appreciate transformed low-car streets, but adjusting behaviour is difficult.

#### Policy and institutional barriers

The policy and institutional barrier is noticeable in conflicting interests between (governmental) departments. The municipality has changed the maximum speed limit from 50 to 30 km/h to increase safety and decrease emissions. However, they want public transport to drive at higher speeds to ensure a good connection. Another dilemma is between redesigning streets for more living space and less space for cars and leaving room for emergency services to drive fast. Finally, the low-car team is trying to reduce the number of cars, but the car-sharing team is trying to increase the number of shared vehicles. Though more shared cars may eventually lead to a reduced total number of cars, it will initially cause an increase. To deal with these dilemmas, they try to resolve them internally as colleagues. If that does not work, they leave the decision to politicians.

#### Legal barriers

The legal barrier does not pose a problem on a municipal level, as such regulations can easily be changed. However, legal frameworks are more difficult to change on a national level. The municipality of Amsterdam would like the national government to implement distance-based pricing, with an increased fee when entering cities and during rush hours. However, the national government wants to implement a flat fee. Another example is that the municipality would like to regulate electric micromobility, which is impossible due to national regulations. Finally, the public prosecutors have determined that fines can only be handed out to scooters and moped drivers if the road clearly shows that it is not safe. The municipality would like to be able to do that sooner.

#### Resource barriers

Resource barriers pose a challenge in finances, technology and time. Up to five years ago, the available finances seemed endless. However, during COVID, the municipality lost significant income from parking fees. Since then, certain expensive measures have not been possible to implement, and there has also been less finances available to transform areas where the number of cars has been reduced. The technological barrier is visible in that the municipality would like to have access to license-plate databases that often do not exist. They could use these databases for intelligent access in certain streets. The street would then be closed off except for specific people and companies. Finally, they receive requests from residents who want their streets transformed. However, the municipality does not have the required time to address all these requests.

#### Social and cultural barriers

Social and cultural barriers are clearly present in the city. Most residents would like the number of cars to reduce in the city but do not want to reduce their comfort level. Another part of the problem is that low-car is seen as a measure designed by the wealthy elite. People who can afford a big house can also afford shared cars and taxis. However, an affordable personal car is cheaper and necessary for the others. To address this issue, the municipality has handed out free public transport tickets for children and is trying to improve economic stability and invest more in the neighbourhood by creating more local services.

### 6.1.3. Success factors

All success factors are also present in Amsterdam. This section dives deeper into how they address the presence of the barriers.

#### Combining sticks and carrots

The municipality sees the carrot as an inherent benefit of making streets low-car. Cars are not removed to simply annoy car drivers, they are removed to create more living space and make the area more attractive. After cars are removed, there is more space for children, pedestrians, cyclists and green. There is an example of where the municipality is combining sticks and carrots. After the speed limit was reduced on many streets in the city, they added a ‘spaarpaal’ (saving pole) that will remain for 10

weeks. Each time a car driver passes, 5 ct is added to the neighbourhood fund, up to 10,000 euros. This money will be spent on a local charity (Gemeente Amsterdam, 2024a). Residents do appreciate the transformations now, as they can still park their cars nearby. It is questionable if they will still think as positively about the transformation if all the streets are transformed and they need to park their car at the edge of the city or use shared cars.

### Showing openness and flexibility in negotiations

When designs are made for transforming streets, residents and local companies are invited to their neighbourhood centre. They can then help make specific decisions regarding using the newly available space. This can include space for bicycles, green areas or perhaps a parking spot for a company van. The low-car team receives requests from residents frequently to transform streets. However, these are difficult to implement as every street has residents who actively try to prevent such measures from being implemented. The municipality does not have the time or resources to address each request. Now, they arbitrarily select which request to honour. From the recent 'Weesperstraat knip' section 4.1, the municipality realized that they should also be more flexible when implementing such large measures. Certain population groups were affected disproportionately and the municipality should have collaborated with them in preparation of the implementation.

### Trials to create legitimacy and acceptance

The municipality frequently implements pilots to explore potential measures and determine their effectiveness. An example is the 'Weesperstraat knip', commissioned by the municipal council to discover what would happen if this arterial road into the city was closed. This is discussed further in Section 4.1.3. Other pilots are intelligent access to specific areas, closing access to streets or alternative modes of city logistics.

### Applying communication strategically

The city has a dedicated communications team that thinks about how the measures can be communicated. For example, they try not to emphasize that cars are removed but that the streets are now too crowded and that they will become even busier. By communicating this, people know why cars are removed.

### Timing and windows of opportunity

In the years before 2017, the municipality had implemented several car-reducing measures, the 'Low hanging fruit'. These measures did not impact car drivers too much. When in 2018, a new mayor was elected, she planned to take more extreme measures as she does not think the city is for car drivers. Though not all ambitions have been met, many changes have been implemented. However, since then, the window of opportunity may have closed. Five years ago, people were more positive towards low-car. This may be due to some of the implemented measures, resulting in a less positive attitude from the public. After the 'Weesperstraat knip', the deputy mayor may think twice about a similar pilot or measure. Another aspect of timing that the low-car team tries to utilize is already-planned roadwork. If a road needs to be rebuilt, the team tries to redesign it and reduce space for cars. These are more coincidental transformations.

### Organising responsibility and setup

The municipal organisation can be quite cumbersome, so a new cross-organisational team was made for the city's low-car ambitions. This is quicker than working on common goals from existing organisations as governmental employees will think from their existing environments and will be less innovative.

#### The inarguability of schools

Schools frequently propose transformations in the area, and the municipality is implementing more 'school streets' where the school is closed to car traffic by the school twice a day during drop-off and pick-up hours.

#### The undeniability of hard evidence

It helps to be able to show data when determining which measure to implement. It would be a good starting point for discussions if the municipality could show what traffic drives on certain streets, posing questions such as: 'Is all the traffic in the area desirable, or should specific traffic, such as taxis, be blocked?'. However, data is not always the solution. Though data from the 'Weesperstraat knip' shows that the amount of traffic in the entire city has reduced, it may not be sufficient to implement the measure as it is too controversial.

### 6.1.4. Remaining barriers

The municipality seems to be able to address the legal and policy and institutional barriers well through internal structures and practices. The challenges regarding path dependence are similar to those determined by social and cultural barriers. Therefore, the main barriers that still exist are resource barriers, mainly regarding time, finances and technology, and social & cultural barriers. The municipality has implemented various success factors as strategies to overcome these barriers. These are compared to the success factors that were used to overcome the barriers, as analysed in the case studies. Section 5.3.1 links success factors to barriers according to the strategies used in case studies.

#### Resource barrier

As determined in the case studies, the resource barrier has links with four success factors: flexibility, trials, strategic communication and timing. The municipality has a level of flexibility when transforming streets and making them low-car. Residents can help to make decisions regarding the newly created public space. However, the flexibility does not seem to address the issues they have regarding resources. Whereas the flexibility in the case studies allows the measures to be implemented with fewer resources, this is not the case in Amsterdam. The trials in Amsterdam aim to increase experience with implementing measures and determine the implementation's effects. Though the trials result in new information, they are not seen as a low-cost way of implementing measures. The measure implementation also does not seem to be strategically communicated to increase funding. Finally, timing, and in particular COVID, had a negative effect on funding. While the pandemic was used to increase awareness and thus the funding availability in the studied cases, it had the opposite effect in Amsterdam.

#### Social and cultural barrier

The case studies showed that the social and cultural barrier has links with three success factors: timing, strategic communication, and flexibility. The pandemic negatively affected politicians' willingness to implement the low-car programme. Timing was used as a reason to limit implementation instead of as an opportunity to speed up the programme. Amsterdam is strategically communicating the project to residents. They have a separate communication department that carefully decides on communication strategies to influence how the project is perceived. Finally, the flexibility that the municipality has in designing low-car areas likely influences the social and cultural barrier. It helps to show openness so residents can adjust the design to their needs. However, on the one hand, not all residents agree with implementing low-car areas. On the other hand, some residents would like more low-car areas implemented.

### 6.1.5. Lessons for Amsterdam

Three lessons from the case studies and literature analysis are derived for Amsterdam. The first lesson is on structured tactical interventions, the second is on the use of school communities, and the third is on timing and windows of opportunity.

### Amsterdam lesson 1: Structured tactical interventions

The two remaining barriers of resources and social and cultural can be addressed by further utilising the success factors of flexibility and trials. Both Barcelona and Milan have experience with effectively implementing the combination of these two success factors. Especially the programme in Milan bears a significant resemblance to that of Amsterdam. In both cases, the city would like to reduce the space allocated to cars and increase the amount of public living space and is facing resistance from residents. However, as they show the effectiveness and increased livability of the transformations, demand increases for more transformed areas. The main difference between the execution of the programmes is the degree of structure. The Milan municipality began with a two-phase programme where they first increased acceptance in a trial to show its effects. In the second phase, residents can propose transformations they designed with their neighbourhood. In a big workshop, the municipality and the district councils decide with residents which projects are prioritised. For Amsterdam, the submission process is not as structured, and projects are selected almost randomly.

If the municipality of Amsterdam would make a place where residents could submit their proposals that they have designed together with others in their neighbourhood, the municipality could systematically address these potential transformations. The time resource barrier would then be reduced, as the municipality would not need to make the designs and would spend less time consulting and convincing neighbours. The finance resource barrier could be reduced by performing tactical interventions. These low-cost and quick solutions allow for more radical changes, which can always be undone if necessary. This also addresses the social and cultural barrier as neighbours are more likely to accept changes that are not immediately permanent and where they can collaborate in the design process instead of it being a top-down decision. The municipality can provide specific furniture and design elements for residents to use in their proposals. A risk of this strategy is that insufficient funds are available to make the tactical transformations permanent. Therefore, the municipality should keep the need for permanent transformation in mind while implementing tactical interventions. Similarly to Barcelona, it may be advised to strategically make parts of the transformations permanent, such as the exit and entry to the redesigned areas.

### Amsterdam lesson 2: Using school communities

In Barcelona, Milan and Bremen, the municipalities stated that school communities are much more accepting of car-reducing policies. In Milan, a third phase was added to their programme so schools and their communities could propose transformations. Similarly to these three cases, the municipality of Amsterdam should include schools and parents to transform their neighbourhoods first. As the area's safety is improved for children, they are much more likely to accept transformations and may actively participate in the redesign. Also, people outside of the school community will likely find it difficult to disagree with improving the safety of children. As data about the effectiveness of these measures is created and communicated, other neighbourhoods may also be more accepting of future transformations.

### Amsterdam lesson 3: Benefiting from windows of opportunity

When COVID hit Amsterdam, the municipality and its politicians decided to be lenient with its residents and car drivers and postpone several car-reducing measures. Also, more expensive measures could not be implemented due to reduced income from parking. Though sincere, this decision did not advance the implementation of the low-car agenda. In comparison, the cities of Bremen and Barcelona used COVID to show that the air quality improved with fewer cars. In Milan, the municipality used the pandemic to implement many more instances of the programme, a boost that they had not had before. They used the reduced number of cars on the road as an opportunity to implement the measure quicker than before. A pandemic will hopefully not return, but the mindset of using environmental changes will be useful under different circumstances. The municipality is already utilising road works strategically by applying transformations that aid the low-car goals when possible. However, the public acceptance of such measures is decreasing as more radical measures are being implemented and piloted. Instead of the positive effects seen in other cities, controversial measures seem to have more adverse effects in Amsterdam. Better coordination of such measures and a systematic approach to the implementation

and communication of the measures may help in creating, identifying and utilising windows of opportunity.

## 6.2. General lessons

Besides Amsterdam, other cities can benefit from the results and contextualisation of this thesis. The lessons that follow the comparison of success factors and barriers between literature and case studies in Section 5.1 and Section 5.2 are used to understand the success factors and barriers better. In Section 5.3.1, the success factors are used to overcome the barriers. This section combines all previous results in four key lessons for cities looking to implement car-reducing policies. Within each lesson, the relevant success factors and barriers are discussed, together with the contextualisation and next steps for policymakers. It is important to note that these lessons should be continuously used to evaluate and adapt policies and the implementation process and that they should be used together and not independently.

### 6.2.1. Lesson 1: Continuously explore new possibilities

Cities comparable to Amsterdam should continuously explore new possibilities for policy implementation to achieve their car-reducing goals. Cities across the world are implementing innovative policies. They can use new technologies, such as the system used for shared cars in Bremen and new techniques, such as tactical urbanism in Milan. The potential of new ideas can be explored by keeping in contact with other cities about policies and their effectiveness. It will highly depend on the context if a measure that is effective in one city will work in another. Policymakers should compare the context-dependent factors that are relevant to the success of a policy.

Building superblocks in Barcelona and transforming streets with more livable public space in Milan works in their streets as they were originally designed to be wide with space for cars and trams. However, cities like Bremen have narrow streets, making such open squares where cars can still pass impossible to build. This makes the available space and layout an important aspect to consider for policymakers. The Cycle Superhighways in Copenhagen work well because they connect to a network of bicycle paths in Copenhagen and the surrounding municipalities. Such large bicycle paths would not work in cities that do not have existing infrastructure, as the roads are not built to deal with large numbers of cycling commuters. When exploring potential new measures, policymakers should determine if the existing infrastructure is compatible with the measures they seek to implement. The existing context may also benefit cities implementing a similar measure. Legislation in Bremen made it difficult for the municipality to build shared car stations. However, this legislation may not exist in other cities, removing one of the largest barriers they experienced. Going over the potential barriers and contextual prerequisites for each measure and the success factors to overcome the barriers should help policymakers determine if a measure is suitable for implementation in their city. Cities should also contribute to the knowledge exchange by communicating their experiences. Most interviewed policymakers were eager to share their experiences and curious about the conclusions and lessons from this thesis.

#### Relevant success factor: Organising responsibility & setup

New possibilities can be explored by policymakers in existing departments. In Barcelona, Milan and Bremen, policymakers in existing departments designed and implemented the measures. However it may be advised to begin a new working group. In Copenhagen, Barcelona and Milan, policymakers emphasized the added value that the reorganisation into new departments has.

#### Relevant barriers: path dependence & lock-in

Innovators will likely face resistance when implementing policies that dislodge and radically change the existing systems. This can be due to large investments that only fit the current system. This is seen in the amount of space that housing developers in Bremen dedicate to car parking that cannot be used for anything else. There may also be dependencies in the system that support the current path to be continued. In Milan, public space has mostly been dedicated to car use, and residents have become

dependent on their cars to travel. Redesigning public space becomes a bigger challenge due to this dependence. Being open to new possibilities reduces the risk of path dependence and lock-in. This is shown in the flexibility that all cities show in the implementation of their measures. Understanding how other cities implement measures and what the effects are of that implementation can increase the flexibility of institutional, technical and discursive factors, reducing the likelihood of future lock-in.

#### Contextuality and next steps

The flexibility required to explore and implement new possibilities is closely related to the second lesson and the success factor of showing openness and flexibility. Stakeholders must be aware of the context and the needs of stakeholders when exploring new possibilities. If the goal is to transform public space dedicated to cars in the city centre into green space, it is more valuable to explore the possibilities suggested by cities working on similar challenges, such as Barcelona, Milan and Amsterdam, than cities tackling other issues, such as car sharing in Bremen or long-distance cycle networks in Copenhagen. Not only the goals, but also the context are relevant when exploring possible measures. Measures that are implemented in one city may not work in another. Certain aspects, such as available space and existing infrastructure, may make it impossible to implement measures and other aspects, such as existing legislation, may slow the implementation down.

Using the model by Kingdon and Stano (1984), the goal of this lesson is to find the policy stream. Therefore, this lesson of continuously exploring new possibilities is connected to the third lesson. A window of opportunity can only be created if all three streams are present and connected. Identifying innovative policies is essential for policymakers. The next step, following from this lesson, is to use the overview of cities and measures shown in Table 3.2 to find European cities that have experience in implementing measures of interest. If there has been no previous contact, the online available details can be used to initiate contact and collaboration. In this contact, policymakers should seek to understand the context in which the measure was implemented. If crucial elements do not exist in their city, it may not be a suitable measure, or it may need to be adapted. Cities should also be open to such contact from policymakers in other cities. On their contact or general information page, they can place a form or dedicated mail address for this purpose.

### 6.2.2. Lesson 2: Be aware of the context and stakeholders' needs

Awareness of all stakeholders' needs and interests is important when implementing new measures. This includes directly affected stakeholders, such as residents and local businesses, but also the policymakers themselves. For the superblocks in Barcelona, governmental employees had weekly meetings with residents to discuss the implementation and make adjustments to the implementation of the measure. In Bremen, the municipality not only needed to consider the needs of local stakeholders, but also the interests of national policymakers. These national policymakers resisted changing legislation that would enable dedicating public space to shared cars. Being aware of their interests can help to form a policy that the stakeholders support. It is not only about setting goals and finding a way to implement the measures that support this goal. It is about transformational adaptation as discussed in Section 2.1. Existing ideas about city design and transportation need to be transformed and this is only achieved if stakeholders agree. Instead of talking to other stakeholders and convincing them, policymakers should understand them and include their challenges. When the first superblock was introduced in Barcelona as a pilot, residents felt that the freedom to use their private car was attacked. However, talking to them and finding ways to retain this freedom but also improve the livability of the public space, made them proponents of the measure. Adjusting and framing the measure so the stakeholders' needs are met will increase the likelihood of implementation. If residents have difficulty parking their cars, such as in Bremen, shared car stations can solve that problem by reducing the number of privately owned cars. If residents cannot play outside with their children, transforming the area can help to create more living space, such as in Barcelona.

The municipality should determine their goals and those of other stakeholders. Doing so can help select the measure appropriate to the local context. Each situation is different and policymaking must be adapted in accordance. In Copenhagen, the city introduced the goal of growing as a cycling city and

having 50% of commuter traffic by bike. They have implemented the car-reducing measure of improving active mobility. Many other car-reducing measures would be unsuitable. Defining the exact goal that policymakers seek to achieve helps in selecting the most appropriate measure. Besides stakeholders' needs, there are other factors that determine the context, such as the legal framework or available resources. In Milan, the legislation did not allow for tactically designed bicycle paths. Awareness of the context can help explore and utilise new possibilities and quick implementation during windows of opportunity. As soon as the legislation changed in Milan to allow such tactical bicycle paths, they were able to use the window of opportunity created by the COVID pandemic. When the needs and interests are known, policymakers should be willing to adjust their policies to increase acceptance while keeping their goals in mind. Most interviewees noted that this flexibility is key to success.

Relevant success factor: Showing openness and flexibility in negotiations
By showing openness and flexibility, policymakers allow negotiations, exemptions and adjustments to increase the likelihood of implementation. Flexibility allows stakeholders to voice their opinions, and listening to their wishes can increase acceptability. For Copenhagen, the network of bicycle paths would not have existed if municipalities could not have built them according to their financial possibilities. All studied cases confirmed the importance of this success factor. A participatory design and implementation process helps to involve residents. The system of proposing measures in Milan ensures that local stakeholders are involved in the measure's design. Flexibility can allow measures to be implemented even if the desired quality standards are not met, such as in Copenhagen.

Relevant success factor: Applying communication strategically
Strategic communication should be integral in policy design procedures as it reduces the risks of poor implementation and poor results. Policymakers can influence public perception of the measures and behaviour of residents. Policymakers in Bremen were careful to present shared cars as a cheaper and low-effort solution compared to owning a car. Instead of a campaign against private cars, it is viewed as an attractive decision. Communication strategies are present in most of the studied cases and increase the general acceptance and ease of implementation.

Relevant barriers: Policy & institutional
Conflicts of interest between stakeholders can influence the acceptance and implementation of a measure. Cooperation may be challenging if organisations, departments or people in crucial positions have different interests. This posed significant challenges in the case studies. In Barcelona, certain municipal departments were not willing to collaborate due to political reasons, requiring policymakers to collaborate with other organisations. Policymakers should be aware of the fact that not all stakeholders will agree with the policies and may have conflicting interests. Efforts will be required from policymakers to coordinate all interests and to achieve cooperation. The extent of these efforts is shown in the Bremen case. It took the Bremen municipal workers 11 years to convince national policymakers to agree with the change in legislation.

Relevant barriers: Legal
Non-supportive legal frameworks can constrain policy implementation. Though laws can be changed, it may be a lengthy process, depending on the level of policy that is required to change. The cases show that laws on the municipal level may be changed easily, posing less of a barrier. However, changing laws on a national level may not be easy. In Bremen, national policy had to change, taking up to 11 years. In Milan, municipal policy had to be changed, which did not pose a problem.

Relevant barriers: Resource
If cities have insufficient resources, it may affect policy implementation. In the studied cases of Copenhagen, Barcelona and Milan, this resulted in policymakers deciding to implement a cheaper version of the policy and to wait for sufficient funds to implement them according to the desired standards. This

barrier is not purely financial and may also result from space or organisational insufficiencies. In Bremen, the municipality collaborates with car sharing operators so privately owned space can be used as there is insufficient public space available.

#### Relevant barriers: Social and cultural

If the level of acceptance is low among stakeholders, resistance may hinder policy implementation. It may also result in political resistance, further obstructing implementation. The cities from the case studies all noted that the car culture and mindset present in their cities obstruct implementation. Residents "have cars in their veins" (interview Ba1). With low public acceptance, politicians are likely to oppose implementation, which has ended implementation in Barcelona and may do so in Milan and Copenhagen.

#### Contextuality and next steps

Being aware of the context and the needs of stakeholders is crucial for the success of the policy. This lesson is related to the other lessons as knowing the context and understanding stakeholders' needs is necessary to explore new possibilities, as shown in general lesson 1 in Section 6.2.1, and to implement pilots, as shown in general lesson 4 in Section 6.2.4. It can also be seen as the problem stream in the Kingdon and Stano (1984) model. Fully understanding the problems of all stakeholders and the context is crucial for identifying and creating windows of opportunity, as stated in general lesson 3 in Section 6.2.3.

The next step for policymakers is to reach out to local stakeholders to discover and understand the issues that are present. Media can give a one-sided view, so initiating the conversation can include different perspectives. There are several options for contact with stakeholders. Workshops, such as in Milan, are advised in the design phase to include stakeholders' perspectives and needs and to discuss proposals. Potential designs can also be discussed in local councils, like they did in Bremen. During the implementation, on-street teams, such as those in Barcelona, can help to explain the necessity of projects and make adjustments according to local context.

### 6.2.3. Lesson 3: Create and identify windows of opportunity

To successfully implement or pilot a measure, policymakers need more than a policy (as defined in general lesson 1 in Section 6.2.1), a problem and political willingness (as defined in general lesson 2 in Section 6.2.2). They also need an opportunity to implement the measure when these three streams meet. Policy entrepreneurs, such as the universities that initiated the pilot in Barcelona, and politicians, such as the Deputy Mayor who turned the pilot into a permanent transformation, can identify and create windows of opportunity. Policymakers also have the power to implement the possibilities they explored, as seen in Milan. When a window opens, they must be prepared to implement their designed policies. Depending on the type of measure, the windows may open briefly or for a longer time. For controversial measures such as those in Barcelona and Milan, policymakers must act quickly to use the window to their advantage and implement the measure. Being prepared for such situations and knowing the requirements will help to utilize these windows. For less controversial measures, such as those in Bremen and Copenhagen, the windows open and close less abruptly, giving policymakers time to improve the design.

#### Relevant success factor: Timing & windows op opportunity

In the three-stream model, the political, problem and policy streams exist independently and can meet in a window of opportunity. This window may be created by entrepreneurs looking to achieve their personal goals. As seen in Bremen, where residents required resources and support from the municipality to begin their car-sharing club. The framework is somewhat generic, and it is easier to determine afterwards what the window of opportunity was. In Barcelona, a change in the political party in power made it possible for entrepreneurs to open the window of opportunity. In the case of Milan, COVID changed the environment, allowing the measure to suddenly be implemented far quicker than before. In Bremen and Copenhagen, there was no sudden change but entrepreneurs managed to combine the

three streams that previously did not meet.

#### Relevant success factor: Sticks & carrots

To increase the acceptability of policies, policymakers may consider combining measures that are experienced negatively by the public with measures that are experienced positively. Designing policies with this strategy in mind may increase the perceived fairness and thus the acceptability, as seen in the London congestion charge in Table 2.2. For policies that do not allow for the explicit combination of positive and negative measures, recognising positive aspects can help in communication towards stakeholders. In Bremen, policymakers recognised the positive and negatively perceived aspects of the shared cars and steered the narrative toward a hassle-free alternative instead of a limit for personal cars.

#### Contextuality and next steps

The third general lesson is related to the first, in Section 6.2.1 and the second in Section 6.2.2 in several ways. The explored possibilities and context are combined with a political willingness to form a window of opportunity. Success factors and barriers in these lessons are also dependent on each other. After the inherent sticks and carrots of a measure are determined, strategic communication is required to convey them to stakeholders. The context of stakeholders' needs should be included in the design to create political willingness and reduce opposition. In Bremen, the network of shared car stations is being expanded, and assumptions about how specific demographics of residents use the cars turn out to be incorrect. Though policymakers have the opportunity to build new stations, these assumptions may cause the measure to be implemented differently than if they had understood the stakeholders' needs. This lesson on creating and identifying windows of opportunity is also linked to the fourth lesson on testing new measures, as windows of opportunity can be used for both implementing the measure and implementing pilot projects. Sometimes, a window of opportunity is only sufficient for a pilot but may in the future be expanded to a more permanent transformation, as in Barcelona.

The next steps for policymakers are somewhat of a mindset to use changes in the environment to advance personal goals related to the implementation of car-reducing policies. The possibilities and context, as determined in the previous lessons, can be used to be watchful of opportunities for implementation. Policymakers should determine the requirements for implementing their desired measures and seek to fulfil these requirements. This fulfilment can either happen through sudden changes in the environment, such as the increased importance of clean air during the pandemic in Milan, or through created opportunities, such as the shared car workshop in Bremen.

### 6.2.4. Lesson 4: Test new measures

The final lesson for European cities of the scale of Amsterdam is to test the newly designed measures before implementing them permanently. Piloting the measures allows policymakers to experience the effects of implementation and allows for changes to the design, as shown in the superblocks in Barcelona. It also enables stakeholders to experience the measure before full implementation and allows for more radical experimentation. Policymakers can experiment with such measures when stakeholders' willingness is low to break path dependence and demonstrate the advantages of alternatives to the existing system. Communicating to opponents of the measure that the transformations of the open squares in Milan are tactical and can be changed if needed allows for more radical transformations. After determining the car-reducing measure, adjusting it according to the context and having the opportunity to implement it, policymakers should consider testing it before full implementation. Not all measures are suitable for deployment on a small scale. The main challenge for the first cycle superhighway in Copenhagen was setting up the required collaboration. Once achieved, they decided to implement it fully. However, especially if the measure is considered controversial, policymakers may implement their measure with a predetermined ending moment.

#### Relevant success factor: Trials to create legitimacy

Demonstrating new measures in pilots or trials can be used for the municipality to gain experience with a policy and for the public to get used to the change. In the cities of Barcelona, Bremen, and Milan, policymakers considered the first iteration of their policy to be a pilot. In Barcelona and Milan, the initial implementation or initial phase of the implementation was designed with a predetermined moment of ending. The existence of this moment allowed policymakers to be more radical whilst maintaining public acceptance. In Bremen, policymakers were legally allowed to implement measures as pilots that they otherwise could not have done.

#### Relevant success factor: The inarguability of schools

When testing or implementing new measures, policymakers may begin around school neighbourhoods. These communities are more accepting of measures that reduce cars as they give higher importance to, or are more aware of, the safety of children. In the analysed cases of Milan, Barcelona and Bremen, policymakers noted the opportunity that schools provide for new policies.

#### Relevant success factor: The undeniability of hard evidence

During trials, and after the final implementation of the measure, cities should collect data about the effect that the change has. If this data is not collected, stakeholders will form their opinions based on their feelings. This was visible in Barcelona after the implementation of the first superblock. Residents thought that the transformation caused the increased amount of traffic. However, measurement data could prove later that unrelated road-works caused the traffic. Data is undeniable and may, therefore, help argumentation. The increase in cyclists along the cycle superhighways in Copenhagen, helps the Office of Cycle Superhighways to convince municipalities to participate in the project. If data does not show the results expected by policymakers, communicating this may increase public trust in policymakers. In these cases, policymakers in Copenhagen, Milan and Barcelona noted the importance of collecting data before implementing a new measure and comparing it with data collected afterwards.

#### Contextuality and next steps

This final lesson of testing new measures relates to the three previously described general lessons. If policymakers or other stakeholders are hesitant to implement a measure they explored, piloting it may be an acceptable alternative. This enables policymakers to experiment with more radical possibilities. The measure can be adapted to stakeholders' needs, and its effectiveness in fulfilling those needs can be determined. In Milan, the pilots served both purposes. Policymakers gained experience with the measure and the methodology of implementation. Residents got used to the transformed streets and were more accepting of radical changes. To determine which measures are suitable for piloting, policymakers need to determine if the effectiveness of the pilot is comparable to that of a full-scale deployment. In Barcelona and Milan, the pilot transformed the area in a similar way, but not up to the same quality standard. The impact on car traffic and livability is comparable. "The quality of the public space and greenery is much higher [if the measure is built permanently when compared to a pilot], but the other impacts are not very different. The noise, air quality, accidents, and use of public space are similar" (interview Ba2). In Bremen, a single car-sharing station or several low-quality stations would not convince residents to start using the system. In Copenhagen, a shorter or low-quality bicycle path would also not result in the desired results.

The next step for policymakers is to consider implementing measures as a pilot before full implementation. As shown in Barcelona and Milan, this helps to prove the effectiveness of controversial and radical measures and helps policymakers gain experience testing the implementation method. Collecting data and responses from stakeholders can help in communicating its effectiveness and making adjustments to increase the effectiveness once the measure is fully implemented.

### 6.2.5. Context and dependencies

The four general lessons should not be seen as a four-step plan to be executed independently. These lessons are highly related to each other and are in no particular order. Policymakers should continu-

ously communicate with stakeholders about their needs and challenges and adjust measures accordingly. Stakeholders' needs are crucial when exploring new possibilities. The case-dependent context determines the success of a measure, and policymakers should seek measures that fit their municipality. Only then will windows of opportunity open to implement the measure, and will stakeholders be accepting of the car-reducing measures. Testing the measure can help to increase the acceptance of a new or controversial measure for policymakers and other involved stakeholders. Keeping the dependencies of these lessons in mind and iteratively using them in combination with each other can increase the success of implementation.

# 7

# Discussion

In this thesis, four different case studies are performed in Western European cities to determine the success factors and barriers in implementing car-reducing measures. The presence of these factors and barriers is compared to the literature, and the dependencies between the factors and barriers are determined, together with missing factors. This results in lessons for other municipalities looking to implement similar measures. This chapter discusses the validity of the results, the study's limitations, recommendations for future research and recommendations for policymakers.

## 7.1. Contribution of the research

This thesis analyses how and why specific car-reducing policies have been implemented in four different Western European cities and what barriers and success factors have arisen during the process. This results in lessons for policymakers in other cities regarding the implementation process. The case study approach explores events in everyday contexts and explains why one implementation of a car-reducing strategy may be chosen over another. This thesis addresses the knowledge gap and lack of research into real-world qualitative policy analysis. Much of the literature does not engage with actual cases, thereby increasing the distance between theory and reality. This thesis addresses the influence of governance, context, power, resources and legitimacy on policy implementation. More specifically, the governance questions of how and why policies are chosen and framed and how they evolve are addressed. Solving these gaps can aid the transition toward sustainable mobility through transformational adaptation.

## 7.2. Comparison with the literature

Achieving the goals for which local governments are implementing car-reducing policies requires transformational adaptation. This system-wide radical change increases the system's ability to deal with future uncertainty (Nelson et al., 2007; Lonsdale et al., 2015). Transformational adaptation has four distinct phases: pre-development at a small scale, take-off, acceleration, and stabilisation (Loorbach & Rotmans, 2006; Lonsdale et al., 2015). These phases can be recognised in the analysed cases in this thesis. In Milan and Barcelona, the measures were implemented as a pilot before large-scale implementation. This pre-development on a small scale helped to gain experience with the measure and method. The pre-development in Bremen was the organised workshop to begin the car-sharing club. The Office for Cycle Superhighways was set up in Copenhagen, and contact was initiated with the municipalities. The take-off destabilised the existing regime in Bremen when the first car-sharing stations were built, and policymakers managed to bypass the existing legal framework. In Barcelona and Milan, the existing regimes were destabilised when their projects continued after the pilots ended. In Copenhagen, the existing car-focused regime was destabilised, resulting in a shift in attention to the importance of long-distance bicycle paths.

Destabilising existing regimes may provoke strong reactions from those invested in the current system (Béné et al., 2012). If stakeholders do not have control of their environment, they may perceive changes as a threat (Cork et al., 2007), possibly blaming others (Hamilton & Kasser, 2009). This is clearly visible in the case of Barcelona. Policymakers and politicians who are members of the opposing political party were invested in the previous system, and residents lost control of their environment. This resulted in anger and opposition toward the government responsible for implementing the new measure. Discussing the implementation and allowing residents to suggest changes possibly made them feel more in control and increased acceptance. In Milan, residents propose all new transformations, putting local stakeholders fully in control. The third phase of transformational adaptation is take-off. In Milan, this is clearly marked by their system of transformation proposals and the boost in the programme resulting from the pandemic. That acceleration has now decreased, and the programme is starting to stabilise. However, the programme for bicycle paths is still accelerating. Some have been built, but there are still many to go. In Copenhagen, the most apparent cycle superhighway routes have been built. The number of municipalities participating has also stabilised. In Bremen, the municipality is expanding and increasing the network density, but the initial acceleration has decreased. Finally, the superblock project was accelerating in Barcelona but was cancelled due to a political change. Opposition is reversing the transformation toward the previous path.

Once such a lock-in has been created through large-scale investments, it is difficult to enter a new path (Arthur, 1989; Rotmans et al., 2001). Organisations may respond by improving the existing system instead of implementing real transformations (Annema, 2022). Though less controversial, it may also be insufficient to address the challenges faced. Many cities are implementing improvements, such as low emissions zones and increased parking prices. However, as the cases show, more radical transformations are required to change existing systems. For new technologies, local governments may be tempted to wait for other cities to implement the measure before doing so themselves to reduce the risk of unforeseen complications (Annema, 2022). By doing so, they may risk the technology being less effective or outdated. There are only a few cities across the world that have implemented a congestion charge, one of which is London. Other cities, such as Milan, are now implementing the charge or considering doing so. However, the Mayor of London has stated that their flat charge has become outdated, and they are considering new possibilities (Banister, 2003). Cities implementing the charge now may have waited too long. Instead, governments should lead by inspiring stakeholders to explore new technologies. A bottom-up approach could take advantage of the heterogeneity of society (Rotmans et al., 2001), as seen in the design of the Barcelona superblocks.

For a successful transformation, Lonsdale et al. (2015) lists three required capacities: policymakers should understand the current situation and the decisions leading up to it; they should encourage system-wide participation and be willing to invest in long-term goals; and should test measures in real life to deepen understanding and increase participation. These required capacities share similarities with the four general lessons determined for cities that are looking to implement car-reducing policies: continuously explore new possibilities, be aware of the context, create windows of opportunity, and test new measures. Adding the three-stream model by Kingdon and Stano (1984) is the main difference. Their theory plays an important role throughout this thesis. The problem stream is led by problem entrepreneurs who define a situation and put it on the governmental agenda. The goals achieved by implementing car-reducing measures, as described in Section 1.1, are examples of such problems in the studied cases. Bremen had the problem of cars not fitting in the narrow historical streets and was looking for a solution. Understanding the problems, the context and the stakeholders' needs is what follows from the second general lesson. The second stream is the policy stream. Policy entrepreneurs often have an ideological focus on implementing the solution they created. The proposed car club in Bremen is an example of such a policy entrepreneur, as are the universities and the Deputy Mayor in Barcelona. Following the second general lesson and being open to new possibilities can help to discover such solutions and the entrepreneurs suggesting them. The third political stream comprises social sentiment, elected officials and interest groups. Though the problem and policy were known in Barcelona, a newly elected Mayor was required to implement the pilot and to continue the project. Combining the three streams leads to the third general lesson of policymakers creating and using windows of opportunity. It requires a long-term commitment of policymakers and a quick response before the window is closed (Hoefer, 2022).

As Nelson et al. (2007) states, both the decision-making process and the decisions themselves should be explored further. This thesis explores the decisions by first determining the goals achieved by implementing the policy. These are climate change reduction, air quality improvements, improved living space, improved health and safety, and reduced cost. This is followed by the three levels in which such policies are implemented: supranational, national, and regional. Finally, 21 different car-reducing measures are determined and categorised by the classification used by van Wee (2009): regulation, prices, land-use planning, infrastructure, and marketing, education, information and communication. However, the main focus of this thesis is on the implementation process. Implementation is the final phase of the decision-making process (Teisman, 2000). The factors contributing to the implementation process are analysed in four case studies, resulting in lessons for policymakers looking to implement car-reducing measures.

## 7.3. Applicability and limitations of results

This section discusses the framework on which this thesis is based and the methods that are used to collect results. Doing so, can determine its validity and value. First, the selection of the success factors and barriers are discussed in Section 7.3.1. This is followed by a discussion about the city selection in Section 7.3.2 and the influence this has on the generalisability of this thesis in Section 7.3.3. Finally, the interviewee selection and its consequences are discussed in Section 7.3.4.

### 7.3.1. Success factors and barriers selection

At the beginning of this thesis, selecting the appropriate success factors and barriers for the framework was challenging. The literature included many factors, not all of which have been included in the framework this thesis proposes. Combining existing barriers and success factors in the implementation of car-reducing measures from the literature (i.e. (Cervero, 1998; Maat & Louw, 1999)) accomplished its goal. Once the interviewees had described the context in which they had implemented their measures, together with the factors of influence, the framework was used to explore other possible factors. Interviewees were asked afterwards if they could think of any other factors that had influenced the measure's implementation. However, none of the interviewees did so. In fact, several were impressed by how exhaustive the list was. Many interviewees noted that all relevant aspects of the policy's implementation, supported by the framework, had been discussed at the end of the hour. The two additional success factors regarding the importance of schools and hard data were mentioned frequently in the interviews and, therefore, added to the framework.

### 7.3.2. City selection

This thesis is written as part of the XCARCITY project, in which three Dutch cities participate to determine their possibilities of reducing the number of cars in the city to increase livability and accessibility. Of these three cities, the city of Amsterdam is selected as a reference case due to its commitment to the project and experience with implementing car-reducing policies. Western European cities that are found to be leading in specific car-reducing measures are selected for potential further analysis. This selection is based on searches in Google and Google Scholar. Though this search method likely does not provide a comprehensive overview, it indicates the measures cities implement. For other cities looking to implement car-reducing measures, the results of this thesis will likely be useful. Though some of the relations between success factors and barriers may be more specific to the analysed cases and similar cities, the general framework is not.

The analysed cities clearly showed the presence of all barriers. Additional case studies could provide more examples of these barriers but will likely not change the outcome of this thesis. It seems that a level of saturation has been achieved. This was not the case for the success factors. Policymakers did not use the success factor of sticks and carrots in any of the cases. Also, other cities may have given greater importance to other success factors. Additional case studies may have increased the importance of using sticks and carrots, as it was clearly present in cases in the literature review.

Therefore, the success factors were not entirely saturated. For future research, it would be interesting to discover if this success factor is used in implementing car-reducing measures in other case studies.

### 7.3.3. City generalisability

As stated in the research question, the goal of this thesis is to determine the success factors and barriers, as well as their implications for European cities. In analysing cities with experience in reducing cars, mainly Western European cities appeared, and the four studied cases were also from this region. Various explanations are possible for this pattern. Western European cities may more actively pursue car-reducing goals or they may publish more (English) documents about their experiences. The cause is not the topic of this thesis. However, it is relevant to determine if it affects the generalisability of the results to cities outside of this region. Also, cities were selected based on their population size. Determining if cities outside of this range can also use the lessons is relevant for policymakers in such cities.

First comes the generalisability to cities outside of Western Europe. The most likely difference between cities in this area and outside is how these governments implement policies. Though there were some differences between cases in the amount of power the levels of government have, they all have a similar structure. Other governments may have a more centralized or decentralized power or have other priorities. Though policymakers in the case studies faced opposition in implementing their policies, most of them often agreed with the car-reducing goals, making it possible to implement the measures. Applying lesson 1 of exploring possible measures will be much more difficult in a different context. Policy failure will likely occur when the transfer is unsuccessful (Dolowitz & Marsh, 2000). It is important to understand stakeholders' needs in every context, as stated in lesson 2. However, if they differ too much from each other or completely oppose that of the policymakers, a complete transformation of the existing system will be difficult. This also increases the difficulty of applying lesson 3 and finding windows of opportunity. Lesson 4 remains and may help to reduce the increased barriers. Cities outside the scope of the case studies should be careful in implementing measures from cities with different structures and contexts. They should compare their differences and determine the impact that these differences may have on the outcome.

Next is the generalisability to cities inside of Western Europe, but with a different population size. Similarly to the previous issue of generalisability, the governance structure and contexts may differ. To apply lesson 2, policymakers should fully understand stakeholders' needs and include them in the policy design and implementation. This may be easier in cities like Bremen than cities the size of London. The workshop held in Milan, which included all representatives from many stakeholders, would be a lot more difficult in larger cities with more stakeholders and different opinions. This increased difficulty may depend on the measure. If a single street is transformed, including all stakeholders would still be possible. However, the time needed for this inclusive step-wise approach would be significantly more in large cities. This is an issue that the cities of Barcelona and Milan already ran into. Such differences in context make it difficult to apply lesson 1, as not all measures can be implemented easily in varying circumstances. Smaller cities, on the other hand, may find it easier to approach all stakeholders. However, they may experience a bigger risk of path dependence with fewer people and potentially fewer new ideas. Several measures will be more difficult to implement on a small scale, and others easier. The barriers that cities of different sizes face are likely very different. Therefore, a similar conclusion to the one in the previous paragraph follows. If policymakers in cities outside of the population range of the case studies would like to implement the lessons learned from this thesis, they should carefully compare the differences in context between the cities and the effect that this may have on the success factors and barriers in the implementation.

### 7.3.4. Interviewee selection

Three people were interviewed for each case studied in Copenhagen, Bremen, Milan, and Barcelona. The first two interviews generally provided new information, whereas the third was used to check contradictory information or to add missing elements. As the third interview rarely added crucial new information, a fourth interview from a municipal policymaker seems unnecessary to confirm the presence of

the success factors and barriers. Added value may lie in having longer interviews, possibly in person, to understand better the city context in which the policies are implemented. Three 1-hour interviews are insufficient to fully understand all relevant complexities in each city that have contributed to the selection and implementation of each policy and its success. Not all context-dependent factors may have been included, of which the importance was emphasised by Dolowitz and Marsh (2000). However, the lessons based on the information gathered in the case studies are sufficient to answer the research question and include valuable insights.

Interviews with stakeholders outside of the municipality may provide an additional interesting perspective. The two stakeholders interviewed for this thesis, who were from a different category than the government, were still closely related to the government. Therefore, it is difficult to estimate if a different perspective would have changed the results of this thesis based on the performed interviews. However, this may not be a problem as this thesis is designed for policymakers. This perspective may provide policymakers with the most useful advice. However, in line with the second general lesson, knowing other stakeholders' needs is important when determining a policy's implementation strategy.

There are still several complicating factors for this target audience. One is the risk-averse nature of governmental organisations, potentially resulting in the sailing-ship effect as described by Annema (2022). The Amsterdam policymaker stated that the city has not yet implemented technologies that can distinguish different types of car owners due to the novelty of the technology (interview Am1). Similarly, one of the reasons that distance-based pricing has not yet been implemented in the Netherlands is due to the lack of international experience with the technology. This may affect the first general lesson of continuously exploring new possibilities. What policymakers experience as a possibility may be limited by their risk-adversity. They may not consider new technologies viable and sufficiently developed. This could be addressed with the fourth general lesson of testing new measures and determining its potential.

Another complicating factor is that the governmental bias in the responses may result in an overly positive perspective toward implementing car-reducing measures. Many interviewees stated that residents and other stakeholders opposed the implementation but agreed later or were likely to agree after getting used to it. This line of thinking seems to suffer from some form of confirmation bias. Implementation of the measures has ended in Barcelona, and the future of the projects in Milan and Copenhagen is uncertain, all at least partially due to political controversy. This shows that the public is less positive toward the measures than the policymakers implied. This may make finding windows of opportunity, as described in the third lesson, more difficult. The effect of this bias, and potential other biases, may be limited by including the second lesson and being aware of the context and stakeholders' needs.

## 7.4. Limitations

Though this thesis has several important contributions, as discussed in this chapter, it is also important to discuss the limitations. The first limitation is inherent to the research method of a case study. The limitations regarding case studies were briefly addressed in Section 1.5 and Section 3.2. The main difficulty in case studies is the generalisability. As specific cases are researched, it is difficult to determine if the lessons learned are also relevant to other cases. Multiple perspectives and cases are included to increase the validity of the research. Also, the interviewees had the opportunity to check the author's written interpretation of the interview to reduce the researchers' bias. However, certain success factors and barriers, the links between them, and the strategies to overcome their challenges are based on single-case observations. This causes uncertainty when determining their generalisability. They may not be present in other cities. Section 7.5 addresses this potential limitation by determining if the framework from this thesis also applies in other cities.

The second limitation concerns the interviewees and the categories of stakeholders interviewed. Though stakeholders from different categories were contacted, mainly governmental employees responded to interview requests and were then interviewed. This was further reinforced as governmental employees often recommended other governmental employees for interviews. Their perspectives are

important and valuable to the research as they were involved in the policy implementation process. However, it may give a one-sided perspective as other stakeholders did not share their experiences. Policymakers may be more positive about the policies they designed and implemented.

## 7.5. Recommendations for future research

This analysis of this thesis is directed at Western European cities with a population range of 450,000 - 1,650,000, based on that of Amsterdam. This increases the possibility of comparing and drawing lessons for cities of that size. Building on this thesis, researchers can expand their knowledge in the field of success factors and barriers.

The first suggestion for future research is to statistically validate the presence of the factors and barriers in more cities. A more quantitative analysis could show the presence of these success factors and barriers in more cities within this range. This could also confirm if stakeholders in other cities recognise the two new success factors. Validation could be performed in a structured interview, such as a questionnaire.

The second suggestion for future research is to perform similar research to this thesis outside of (Western) Europe. It is important to determine if policymakers from other parts of the world face the same success factors and barriers or if their environment adds a different complexity.

The third suggestion for future research is to perform a similar analysis to this thesis for cities with a different population range or different selection criteria. It is possible that other types of cities have different complexities, and it is unclear what the implications of this research are for smaller or larger cities. The literature used to determine the success factors and barriers is not limited to the criteria used in this thesis and is likely also relevant to other cities. However, additional factors and barriers may appear, together with different dependencies.

The final suggestion for future research is to compare the measures' perception between policymakers and other stakeholders. In this research, policymakers were mostly interviewed. This may give a one-sided perspective of the measure, and discovering the difference in how policymakers view it compared to the people directly affected by it will add different perspectives. An analysis of the differences, perhaps also over time, may give more context and validity to the statements made by the policymakers.

## 7.6. Recommendations for policymakers

The framework has been developed to support the policy design phase. Besides addressing gaps in scientific research, analysing real-world cases can assist policymakers in designing and implementing car-reducing policies in their own context. The framework this thesis proposes can be used to determine potential barriers and the success factors to address these barriers and to increase the likelihood of successful implementation. Going through the five barriers carefully may help to discover previously unnoticed potential barriers. Next, the success factors that address these barriers can be used to design a strategy for implementing car-reducing policies, keeping the goal that these policies address in mind. Accounting for the potential barriers before they materialise and including the already-known ones will increase implementation strategies' effectiveness. Based on the analysis of the implementation process and the influence that the process has on the resulting effectiveness, policymakers should not only determine goals and the measures to reach those goals. The design process using the determined lessons should include the process and methods to overcome barriers.

# 8

# Conclusion

The need for car-reducing policies is well recognised (i.e. (Fritschi et al., 2013; Tan et al., 2023)), requiring policies at multiple different levels and more research into real-world policy implementation and governance (Marsden et al., 2014; Dolowitz & Marsh, 2000). This thesis focuses on the level of municipalities, particularly four European cities comparable to Amsterdam in population size, that have experience implementing car-reducing policies. An overview of such policies is shown in Table 8.1. The cases are used to analyse their implementation.

**Table 8.1:** Table: overview car-reducing measures

| Type | Measure | Type | Measure |
|---|---|---|---|
| **Regulation** | **Low emissions zone** | **Land-use planning** | **Multiple centres** |
| | Limited traffic zones | | Division into sections |
| | Car-free zones | | Parking minimums and maximums |
| | Lowering the speed | | Remote parking and shuttle |
| | Parking regulations | Infrastructure | Infrastructure for active mobility |
| Pricing | Congestion charge | | Shared micro-mobility |
| | Distance-based pricing | | Shared cars |
| | Toll roads | | Multi-modal planners |
| | Mobility credits | | Quality of public transport |
| | Parking pricing | Marketing, education, information | Information campaigns |
| | Public transport fare reduction | | |

A framework of success factors and barriers, as shown in the Glossary, has been developed based on the literature and the case studies. This was used to find the dependencies and context to address the main research question.

***Main research question: What success factors and barriers in the implementation of car-reducing measures are present in European cities, and what are the implications for European cities of the scale of Amsterdam?***

The sub-questions are:

- *What are the relevant success factors and barriers in implementing car-reducing policies?*
- *Which Western European cities are leading in car-reducing measures, and which measures have they taken?*
- *What are relevant aspects of the context in which these measures are implemented?*
- *Which success factors and barriers are present in the selected countries, and what effect do these have in the formulation and implementation of policy?*
- *What are the lessons regarding the process for other cities looking to implement car-reducing measures?*

The relevant success factors and barriers in implementing car-reducing policies (SQ 1) are identified in the framework. The case studies chosen from European cities that are leading in the implementation of such policies Table 3.6 (SQ2), identified relevant aspects of the context in which these measures were implemented Chapter 4 (SQ 3 & 4).

The case studies showed that the barriers can cause significant delays in policy implementation or can even halt implementation completely. The success factors can assist policymakers in addressing the barriers. The links between the success factors and barriers are shown in Figure 8.1. For the implementation of policies, policymakers can learn from such experiences when designing and developing new policies. The challenges that are faced indicate the need for transformational adaptation. Four lessons are identified for policymakers to address these challenges: continuously explore new possibilities, be aware of the context and stakeholders' needs, create and identify windows of opportunity, and test new measures (SQ 5). Applying the four lessons learned for policymakers is essential to its success.

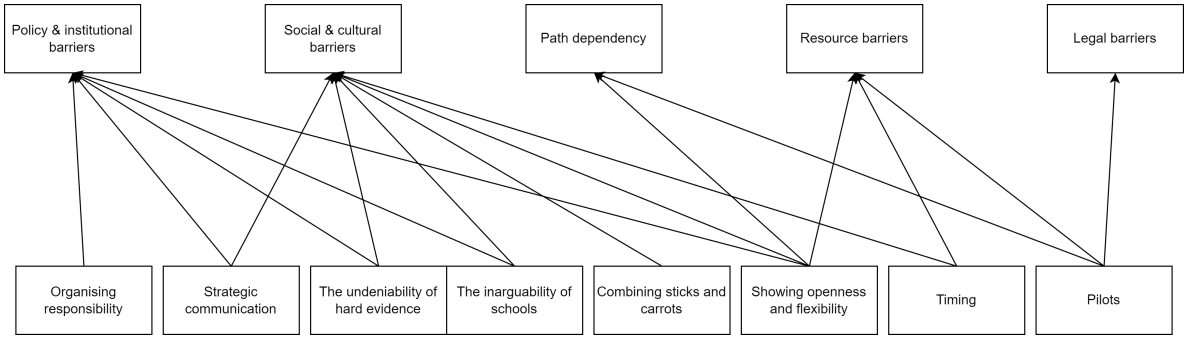


**Figure 8.1:** Links from success factors

## Next steps

In the analysed cases we have seen that policymakers face different challenges in the implementation of car-reducing measures. We have learned that there are strategies to address these challenges. Policymakers should not be hesitant in radically changing the existing systems to achieve ambitious, but highly necessary, car-reducing goals. Luckily, these policymakers are not alone. Considering only Europe, there are many local governments with similar goals that have experience with implementing measures and are also looking to gain new insights. Therefore, policymakers from different cities should reach out to each other, identify their differences and similarities, and work together to address these challenges. There are many different measures that cities can implement to achieve their car-reducing goals. These are shown in Table 8.1. To find European cities with experience in implementing such measures, an overview is shown in Table 3.2. This overview provides a basis to start the exploration.

Policymakers should not forget that they are not alone in the process of designing and implementing policies. Really understanding and involving local stakeholders helps to create successful policies that meet their demands and creates a broader acceptance. Successful policies should therefore not simply be copied between cities. There are many context-dependent factors that significantly impact the implementation of a policy. Experimenting with the measures and experiencing their effects can help to make adjustments before full-scale introduction.

I hope this thesis leaves you inspired to collaborate with others and improve the livability of cities throughout Europe. Transformation is a difficult but rewarding challenge. If we work together, learn from each other and create opportunities in which we dare to make radical changes, I believe we can overcome all barriers and make cities an even better place to live.

# References


Abdelfattah, L., Bazzoni, F., Choubassi, R., Gorrini, A., Presicce, D., & Zuretti, M. (n.d.). Sizing up post-pandemic sidewalk potential.

ACEA. (2022, November). *Fact Sheet 'Euro' pollutant emission standards* (tech. rep.). https://www.acea.auto/files/Fact-sheet_Euro-7_VII.pdf

ACN Barcelona. (2021, November). Half of journeys in Barcelona by car, up 23 points since before pandemic, study says [Section: Society]. Retrieved January 16, 2024, from https://www.catalannews.com/society-science/item/half-of-journeys-in-barcelona-by-car-up-23-points-since-before-pandemic-study-says

Aguilera-García, Á., Gomez, J., Sobrino, N., & Vinagre Díaz, J. J. (2021). Moped Scooter Sharing: Citizens' Perceptions, Users' Behavior, and Implications for Urban Mobility. *Sustainability*, *13*(12), 6886. https://doi.org/10.3390/su13126886

Ahmed, N. O., El-Halafawy, A. M., & Amin, A. M. (2019). A Critical Review of Urban Livability [Number: 1]. *European Journal of Sustainable Development*, *8*(1), 165–165. https://doi.org/10.14207/ejsd.2019.v8n1p165

Ajuntament de Barcelona. (2022). Així serán los nuevos ejes verdes y plazas del Eixample | Superilles. Retrieved December 12, 2023, from https://ajuntament.barcelona.cat/superilles/es/content/asi-seran-las-nuevas-plaza-y-ejes-verdes-eixample

Albalate, D., Bel, G., & Fageda, X. (2009). Privatization and Regulatory Reform of Toll Motorways in Europe. *Governance*, *22*(2), 295–318. https://doi.org/10.1111/j.1468-0491.2009.01436.x

Alberti, F., & Radicchi, A. (2022). The Proximity City: A comparative analysis between Paris, Barcelona and Milan. *TECHNE - Journal of Technology for Architecture and Environment*, 69–77. https://doi.org/10.36253/techne-12151

Amatuni, L., Ottelin, J., Steubing, B., & Mogollón, J. M. (2020). Does car sharing reduce greenhouse gas emissions? Assessing the modal shift and lifetime shift rebound effects from a life cycle perspective. *Journal of Cleaner Production*, *266*, 121869. https://doi.org/10.1016/j.jclepro.2020.121869

Anas, A., & Lindsey, R. (2011). Reducing Urban Road Transportation Externalities: Road Pricing in Theory and in Practice. *Review of Environmental Economics and Policy*, *5*(1), 66–88. https://doi.org/10.1093/reep/req019

Anderson, M. L. (2014). Subways, Strikes, and Slowdowns: The Impacts of Public Transit on Traffic Congestion. *American Economic Review*, *104*(9), 2763–2796. https://doi.org/10.1257/aer.104.9.2763

Andor, M. A., Gerster, A., Gillingham, K. T., & Horvath, M. (2020). Running a car costs much more than people think — stalling the uptake of green travel [Bandiera_abtest: a Cg_type: Comment Number: 7804 Publisher: Nature Publishing Group Subject_term: Policy, Climate sciences, Environmental sciences, Society]. *Nature*, *580*(7804), 453–455. https://doi.org/10.1038/d41586-020-01118-w

Annema, J. A. (2022). Transport innovation theories: A brief overview. In *Innovations in transport: Success, failure and societal impacts*. Edward Elgar Publishing.

Arato. (2023, February). None of the European cities that lowered the speed limit to 30 km/h regrets it. Retrieved October 5, 2023, from https://www.europeandatajournalism.eu/cp_data_news/none-of-the-european-cities-that-lowered-the-speed-limit-to-30-km-h-regrets-it/

Arthur, W. B. (1989). Competing Technologies, Increasing Returns, and Lock-In by Historical Events. *The Economic Journal*, *99*(394), 116. https://doi.org/10.2307/2234208

Asis, M. G. d., & Widner, J. (2022). Connecting Case Studies to Policy and Practice: Practical Lessons from Operational Experience. In J. Widner, M. Woolcock, & D. Ortega Nieto (Eds.), *The Case for Case Studies: Methods and Applications in International Development* (pp. 280–303). Cambridge University Press. https://doi.org/10.1017/9781108688253.014

Azdad, Z., Stoll, B., & Müller, J. (2022). *The development trends of low- and zero-emission zones in Europe* (tech. rep.). Clean Cities. Washington. https://cleancitiescampaign.org/wp-content/uploads/2022/07/The-development-trends-of-low-emission-and-zero-emission-zones-in-Europe-1.pdf

Baker, N., & Weedon, A. (2023). A 12-year-old girl has become a champion of the latest 'surreal' conspiracy theory. *ABC News*. Retrieved October 16, 2023, from https://www.abc.net.au/news/2023-02-27/the-15-minute-city-conspiracy/102015446

Baldino, C., Tietge, U., Muncrief, R., Yoann, B., & Mock, P. (2017, September). *Road tested: Comparative overview of real-world versus type-approval NOx and CO2 emissions from diesel cars in Europe* (White Paper). The International Council on Clean Transportation. https://theicct.org/sites/default/files/publications/ICCT_RoadTested_201709.pdf

Balgaranov, D. (2021, December). Low-speed zones in Berlin: An air quality success story. Retrieved October 5, 2023, from https://www.themayor.eu/en/a/view/low-speed-zones-in-berlin-an-air-quality-success-story-9689

Banister, D. (2003). Critical pragmatism and congestion charging in London. *International Social Science Journal*, *55*(176), 249–264. https://doi.org/10.1111/1468-2451.5502006

Banister, D. (2004a). Implementing the possible? [ISBN: 1464-9357 Publisher: Taylor & Francis]. *Planning Theory & Practice*, *5*(4), 499–501.

Banister, D. (2004b). Overcoming barriers to the implementation of sustainable transport 1 [Num Pages: 15]. In *Barriers to Sustainable Transport*. Routledge.

Bartling, H. (2023). Rethinking Urban Mobility Under COVID-19: Milan's Strade Aperte. In M. Arslanagić-Kalajdžić, N. Ademović, & T. Tufek-Memišević (Eds.), *Interdisciplinary Advances in Sustainable Development II* (pp. 97–113). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-46692-2_8

Bartzokas-Tsiompras, A., Bakogiannis, E., & Nikitas, A. (2023). Global microscale walkability ratings and rankings: A novel composite indicator for 59 European city centres. *Journal of Transport Geography*, *111*, 103645. https://doi.org/10.1016/j.jtrangeo.2023.103645

Baxter, P., & Jack, S. (2015). Qualitative Case Study Methodology: Study Design and Implementation for Novice Researchers. *The Qualitative Report*. https://doi.org/10.46743/2160-3715/2008.1573

Bellan, R. (2023, April). Paris votes overwhelmingly to ban shared e-scooters. Retrieved October 10, 2023, from https://techcrunch.com/2023/04/02/paris-votes-overwhelmingly-to-ban-shared-e-scooters/?guccounter=1

Benavides, L. (2019, April). Barcelona prepara tres nuevas supermanzanas. Retrieved December 12, 2023, from https://www.elperiodico.com/es/barcelona/20190408/tres-nuevas-supermanzanas-barcelona-7396385

Bencekri, M., Ku, D., Na, S., Lee, S., & Lee, S. (2019). Parking policies review: Europe study case. *Int. J. Transp*, *7*, 1–10.

Béné, C., Wood, R. G., Newsham, A., & Davies, M. (2012). Resilience: New Utopia or New Tyranny? Reflection about the Potentials and Limits of the Concept of Resilience in Relation to Vulnerability Reduction Programmes [_eprint: https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.2040-0209.2012.00405.x]. *IDS Working Papers*, *2012*(405), 1–61. https://doi.org/10.1111/j.2040-0209.2012.00405.x

Berrini, M. (2014). *The challenge: Transform the Urban Mobility model to make Milano a more Livable city* (tech. rep.). Agency for Mobility, Environment, Territory. Milan. https://na.eventscloud.com/file_uploads/d23dc9cc58635262e5d20a4e48f4d087_MILANO_LONG.pdf

Bill Cotton. (2022, November). *Oxford Traffic Filters* (tech. rep.). Oxfordshire City Council. Oxford. https://mycouncil.oxfordshire.gov.uk/documents/s63530/CA_NOV2922R06%5C%20Core%5C%20Schemes%5C%20Traffic%5C%20Filters%5C%20ETRO%5C%20Approach.pdf

Blair, S. (2009). Physical inactivity: The biggest public health problem of the 21st century. *British Journal of Sports Medicine*, *43*(1), 1. http://bjsm.bmj.com/content/43/1/1.abstract

Blakeley, G. (2005). Local Governance and Local Democracy: The Barcelona Model. *Local Government Studies*, *31*(2), 149–165. https://doi.org/10.1080/03003930500031959

Bloomberg Associates. (n.d.). Reimagining Milan's Piazzas. Retrieved February 9, 2024, from https://associates.bloomberg.org/cities/milan/reimagining-milans-piazzas/

Bordin, G., Toso, E., & Carvalho, A. (2022). Creative Activism and Tactical Urbanism. *UXUC-User Experience and Urban Creativity*, *4*(1), 53–71.

Borgato, S., Fermi, F., Chirico, F., & Bosetti, S. (2021, October). *Study on costs and benefits of the sustainable urban mobility transition - Preliminary Simulation for Barcelona (ES)* (tech. rep.). EIT Urban Mobility. Milan. https://www.eiturbanmobility.eu/wp-content/uploads/2021/11/2021-11-05_EIT_City-Factsheet_Barcelona.pdf

Broaddus, A., Litman, T., & Menon, G. (2009, April). *Transportation Demand Management* (tech. rep.). Deutsche Gesellschaft für Technische Zusammenarbeit. Eschborn. http://city2030.org.ua/sites/default/files/documents/GIZ_SUTP_TM_Transportation-Demand-Management_EN.pdf

Buckley, J. (2022, August). Germany's railways offered a month of unlimited rides for $9. Here's what happened. Retrieved October 19, 2023, from https://www.cnn.com/travel/article/germany-9-euro-ticket-ending/index.html

Buley, J. (2012). Congestion charge battle ends with proposal in rubbish bin. *Jyllands-Posten*. https://jyllands-posten.dk/uknews/article4640156.ece

Cairney, P. (2012). Complexity Theory in Political Science and Public Policy [Publisher: SAGE Publications]. *Political Studies Review*, *10*(3), 346–358. https://doi.org/10.1111/j.1478-9302.2012.00270.x

Cairns, S., Newson, C., & Davis, A. (2010). Understanding successful workplace travel initiatives in the UK. *Transportation Research Part A: Policy and Practice*, *44*(7), 473–494. https://doi.org/10.1016/j.tra.2010.03.010

Cairns, S., Sloman, L., Newson, C., Anable, J., Kirkbride, A., & Goodwin, P. (2004). The Influence of Soft Factor Interventions on Travel Demand. *Department for Transport: London, UK*.

Car parking. (n.d.). Parking Bologna - Cheap Car Parking Spots - Free Advice. Retrieved October 5, 2023, from https://www.car-parking.eu/italy/bologna

Carpintero, S. (2010). Toll Roads in Central and Eastern Europe: Promises and Performance. *Transport Reviews*, *30*(3), 337–359. https://doi.org/10.1080/01441640903017380

Carpintero, S. (2011). THE COMPETITIVE ADVANTAGES OF THE SPANISH COMPANIES IN THE INTERNATIONAL TOLL ROAD INDUSTRY / ISPANIJOS įMONIŲ KONKURENCINIS PRANAŠUMAS TARPTAUTINIAME MOKAMŲJŲ KELIŲ SEKTORIUJE. *Journal of Civil Engineering and Management*, *17*(4), 483–493. https://doi.org/10.3846/13923730.2011.625632

Cathcart-Keays, A. (2015). Will we ever get a truly car-free city? *The Guardian*. Retrieved October 17, 2023, from https://www.theguardian.com/cities/2015/dec/09/car-free-city-oslo-helsinki-copenhagen

CE Delft. (2019). *Sustainable Transport Infrastructure Charging and Internalisation of Transport Externalities* (tech. rep.). CE Delft. Delft. https://transport.ec.europa.eu/system/files/2018-12/2018-year-multimodality-external-costs-ce-delft-preliminary-results.pdf

Centraal Bureau voor de Statistiek. (2019). Hoeveel reisden inwoners van Nederland en hoe? [Last Modified: 07-09-2023T01:10:34]. Retrieved November 2, 2023, from https://www.cbs.nl/nl-nl/visualisaties/verkeer-en-vervoer/personen/hoeveel-reisden-inwoners-van-nederland-en-hoe-

Centraal Bureau voor de Statistiek. (2020). Afstand tot het station en autobezit per gemeente. [Last Modified: 25-02-2023T00:57:19]. Retrieved November 2, 2023, from https://www.cbs.nl/nl-nl/maatschappij/verkeer-en-vervoer/ov-monitor/hoe-bereikbaar-is-het-ov/afstand-tot-het-station-en-autobezit-per-gemeente-

Centraal Bureau voor de Statistiek. (2022). StatLine - Mobiliteit; per persoon, verplaatsingskenmerken, vervoerwijzen en regio's. Retrieved January 22, 2024, from https://opendata.cbs.nl/statline/#/CBS/nl/dataset/84708NED/table?ts=1695720812277

Cervero, R. (1998). *The Transit Metropolis: A Global Inquiry*. Island Press. https://books.google.nl/books?id=0xC8BwAAQBAJ

Chin, K.-K. (2005, March). *Road Pricing - Singapore's 30 years of experience* (tech. rep.). CESifo. Munich. https://www.ifo.de/DocDL/dicereport305-forum3.pdf

Chini, M. (2023, August). One year of Good Move: Brussels sees car traffic drop by over 25%. Retrieved October 17, 2023, from https://www.brusselstimes.com/brussels/647239/one-year-of-good-move-brussels-sees-car-traffic-drop-by-over-25

Cirrincione, L., Di Dio, S., Peri, G., Scaccianoce, G., Schillaci, D., & Rizzo, G. (2022). A Win-Win Scheme for Improving the Environmental Sustainability of University Commuters' Mobility and Getting Environmental Credits. *Energies*, *15*(2), 396. https://doi.org/10.3390/en15020396

City of Copenhagen. (2021). *Mobility facts and figures* (tech. rep.). https://radkompetenz.at/wp-content/uploads/2022/03/Copenhagen-Mobility-facts-and-figures-2021.pdf

City Population. (2021). Bremen. Retrieved January 16, 2024, from https://www.citypopulation.de/en/germany/bremen/bremen/04011000__bremen/

City Population. (2022). Kobenhavn. Retrieved January 16, 2024, from https://www.citypopulation.de/en/denmark/hovedstaden/k%C3%B8benhavn_albertslund_/01100__kobenhavn/

City Population. (2023a). Barcelona. Retrieved January 16, 2024, from https://www.citypopulation.de/en/spain/cataluna/barcelona/08019__barcelona/

City Population. (2023b). Milano. Retrieved January 18, 2024, from https://www.citypopulation.de/en/italy/lombardia/milano/015146__milano/

Civitas. (2009). *Travel Planning* (tech. rep. No. 11.3). Norwich. https://civitas.eu/sites/default/files/11-320norwich.pdf

Civitas. (2015). *Personalised Travel Plans* (tech. rep. No. 34). Donostia-San Sebastián. https://civitas.eu/sites/default/files/arc_mert_34_f_dss_personalisedtravelplans.pdf

Comune di Milano. (2022). *Piazze Aperte* (tech. rep.). City of Milan. Milan. https://www.comune.milano.it/documents/20126/409775564/Piazze+aperte+-+A+public+space+program+for+Milan.pdf/fcefa9da-98c3-baa5-7bd9-ad1554c61658?t=1653560401192

Čondl, T. (n.d.). Motorway tolls and vignettes in Europe. Retrieved October 19, 2023, from https://www.tolls.eu/

Cork, S. J., Eckersley, R., & Walker, B. (2007). *Rapid and Surprising Change in Australia's Future: Anticipating and Preparing for Future Challenges and Opportunities on the Way to a Sustainable Australia*. Australia 21 Limited.

Cornago, E., Dimitropoulos, A., & Oueslati, W. (2019, February). *Evaluating the impact of urban road pricing on the use of green transport modes: The case of Milan* (tech. rep. No. JT03442748). Organisation for Economic Co-operation and Development. https://one.oecd.org/document/ENV/WKP(2019)2/En/pdf

Cornish, P., Lindley-French, J., & Yorke, C. (2011). *Strategic communications and national strategy*. Chatham House, The Royal Institute of International Affairs.

CPH post. (2012). Opposition demands study on congestion charge effects. *CPH post*. https://cphpost.dk/2012-02-03/news/politics/opposition-demands-study-on-congestion-charge-effects/

Creswell, J. W. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches* (3. ed., [Nachdr.]). SAGE Publ.

Crowe, S., Cresswell, K., Robertson, A., Huby, G., Avery, A., & Sheikh, A. (2011). The case study approach. *BMC Medical Research Methodology*, *11*(1), 100. https://doi.org/10.1186/1471-2288-11-100

Cui, H., Gode, P., & Wappelhorst, S. (2021, September). A global overview of zero-emission zones in cities and their development progress. Retrieved October 16, 2023, from https://theicct.org/publication/a-global-overview-of-zero-emission-zones-in-cities-and-their-development-progress/

De Freitas Falcão Dos Reis, J. P. (2009). *Urban Structures and Mobility* [Doctoral dissertation, Universidade Do Porto]. https://repositorio-aberto.up.pt/bitstream/10216/58033/1/000136714.pdf

De Witte, A., Macharis, C., Lannoy, P., Polain, C., Steenberghen, T., & Van De Walle, S. (2006). The impact of "free" public transport: The case of Brussels. *Transportation Research Part A: Policy and Practice*, *40*(8), 671–689. https://doi.org/10.1016/j.tra.2005.12.008

Deichmann, J. (n.d.). Nordhavn: Blueprint for a 5-minute city - Ramboll group. Retrieved October 16, 2023, from https://www.ramboll.com/projects/real-estate/nordhavn-blueprint-for-a-5-minute-city

Deloitte. (2017). *Car Sharing in Europe* (tech. rep.). Deloitte. Germany. https://www2.deloitte.com/content/dam/Deloitte/de/Documents/consumer-industrial-products/CIP-Automotive-Car-Sharing-in-Europe.pdf

Deloitte. (2018). *Deloitte City Mobility Index Amsterdam* (tech. rep.). Deloitte. London. https://www2.deloitte.com/content/dam/insights/us/articles/4331_Deloitte-City-Mobility-Index/city-mobility-index_AMSTERDAM_FINAL.pdf

DeMaio, P. (2009). Bike-sharing: History, Impacts, Models of Provision, and Future. *Journal of Public Transportation*, *12*(4), 41–56. https://doi.org/10.5038/2375-0901.12.4.3

Der Senator für Umwelt, Bau und Verkehr. (2014). *Sustainable Urban Mobility Plan Bremen 2025* (tech. rep.). Freie Hansestadt Bremen. Bremen. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwj8--O93-aDAxUKxQIHHVphAOQQFnoECBMQAQ&url=https%3A%2F%2Fbau.bremen.de%2Fsixcms%2Fmedia.php%2F13%2FSUMP_Bremen2025_web.pdf&usg=AOvVaw2QmfYsNXPakn4mgIxeeWkF&opi=89978449

DeRobertis, M., & Maurizio, T. (2016). The Most Widespread Traffic Control Strategy You've Never Heard Of: Traffic-Restricted Zones in Italy. *86*(12), 44–49. https://www.ite.org/publications/ite-journal/

Destatis. (2022a). Car density at record high in 2021. Retrieved January 16, 2024, from https://www.destatis.de/EN/Press/2022/09/PE22_N058_51.html

Destatis. (2022b). Life Expectancy. Retrieved January 16, 2024, from https://www.destatis.de/EN/Themes/Society-Environment/Population/Deaths-Life-Expectancy/Tables/life-expectancy-laender-male.html

de Wildt, A. (2015). Witte fietsenplan. Retrieved January 22, 2024, from https://hart.amsterdam/nl/page/49069/witte-fietsenplan

Diana, M. (2020, April). *How to introduce carsharing in your city?* (Tech. rep. No. 2009694). Politechnico di Torino. Torino. http://stars-h2020.eu/wp-content/uploads/2020/05/STARS-Toolbox_D5.2.pdf

Dienst Mobiliteit Leuven. (2019). Circulatieplan. https://www.leuven.be/circulatieplan

Directorate-General for the Environment. (2021). *Reclaiming city streets for people* (tech. rep.).

Dogterom, N., Ettema, D., & Dijst, M. (2018). Behavioural effects of a tradable driving credit scheme: Results of an online stated adaptation experiment in the Netherlands. *Transportation Research Part A: Policy and Practice*, *107*, 52–64. https://doi.org/10.1016/j.tra.2017.11.004

Dolowitz, D. P., & Marsh, D. (2000). Learning from Abroad: The Role of Policy Transfer in Contemporary Policy-Making. *Governance*, *13*(1), 5–23. https://doi.org/10.1111/0952-1895.00121

Dudley, G. (2013). Why do ideas succeed and fail over time? The role of narratives in policy windows and the case of the London congestion charge. *Journal of European Public Policy*, *20*(8), 1139–1156. https://doi.org/10.1080/13501763.2013.771090

EIT Urban Mobility. (2021, October). *Integrated and safe: How innovation can increase micromobility end user adoption* (tech. rep. No. 4). EIT Urban Mobility. Barcelona. https://eit.europa.eu/sites/default/files/eitum-urbanmobilitynext4.pdf

Eliasson, J. (2009). A cost–benefit analysis of the Stockholm congestion charging system. *Transportation Research Part A: Policy and Practice*, *43*(4), 468–480. https://doi.org/10.1016/j.tra.2008.11.014

Estache, A., Romero, M., & Strong, J. (2000). The long and winding path to private financing and regulation of toll roads. *Available at SSRN 630759*.

Eugent. (2015, November). TRENDSETTERS for 30 km/h – research with surprising results. Retrieved October 17, 2023, from https://en.30kmh.eu/2015/11/27/trendsetters-for-30-kmh-research-with-surprising-results/

European Commission. (2020). CO emission performance standards for cars and vans. Retrieved November 1, 2023, from https://climate.ec.europa.eu/eu-action/transport/road-transport-reducing-co2-emissions-vehicles/co2-emission-performance-standards-cars-and-vans_en

European Commission. (2021, December). New transport proposals. Retrieved October 19, 2023, from https://ec.europa.eu/commission/presscorner/detail/en/ip_21_6776

European Commission. (2023a). European Climate Law. Retrieved February 13, 2024, from https://climate.ec.europa.eu/eu-action/european-climate-law_en

European Commission. (2023b). Fuel Quality. Retrieved February 13, 2024, from https://climate.ec.europa.eu/eu-action/transport/fuel-quality_en

European Commission. (2023c, February). Road safety in the EU. Retrieved November 1, 2023, from https://ec.europa.eu/commission/presscorner/detail/en/ip_23_953

European Court of Auditors. (2014). *Effectiveness of EU-supported public urban transport projects*. Publications Office. Retrieved October 19, 2023, from https://data.europa.eu/doi/10.2865/30848

European Court of Auditors. (2019, April). *Urban mobility in the EU* (tech. rep.). European Union. https://www.eca.europa.eu/lists/ecadocuments/ap19_07/ap_urban_mobility_en.pdf

European Environment Agency. (2022, November). Air quality in Europe 2022. Retrieved November 1, 2023, from https://www.eea.europa.eu/publications/air-quality-in-europe-2022

European Environment Agency. (2023a, April). European city air quality viewer. Retrieved November 2, 2023, from https://www.eea.europa.eu/themes/air/urban-air-quality/european-city-air-quality-viewer

European Environment Agency. (2023b, October). Greenhouse gas emissions from transport in Europe. Retrieved November 1, 2023, from https://www.eea.europa.eu/en/analysis/indicators/greenhouse-gas-emissions-from-transport

European Environment Agency. (2023c, October). Transport and mobility. Retrieved November 1, 2023, from https://www.eea.europa.eu/en/topics/in-depth/transport-and-mobility

European Institute of Innovation & Technology. (2022, June). A new air and climate plan for Milan | EIT. Retrieved November 21, 2023, from https://eit.europa.eu/news-events/news/new-air-and-climate-plan-milan

European Investment Bank. (2020, August). EIB to provide €95 million to finance 40 climate action projects in Barcelona. Retrieved December 12, 2023, from https://www.eib.org/en/press/all/2020-215-eib-to-provide-eur95-million-to-finance-40-climate-action-projects-in-barcelona

European Parliament. (n.d.). Ordinary legislative procedure. Retrieved February 13, 2024, from https://www.europarl.europa.eu/infographic/legislative-procedure/index_en.html

Eurostat. (2023, May). Number of cars per inhabitant increased in 2021. Retrieved November 2, 2023, from https://ec.europa.eu/eurostat/web/products-eurostat-news/w/ddn-20230530-1

Evans, J., Bhatt, K., & Turnbull, K. (2003). *Road Value Pricing* (tech. rep. No. 95). Transit cooperative research program. Washington. https://trb.org/publications/tcrp/tcrp_rpt_95c14.pdf

Fabris, L. M. F., Camerin, F., Semprebon, G., & Balzarotti, R. M. (2020). New healthy settlements responding to pandemic outbreaks: Approaches from (and for) the global city [ISBN: 2611-7487 Publisher: Maggioli SpA Publishing Group's]. *The plan journal*, *5*(2), 385–406.

Feitelson, E., & Salomon, I. (2004). The Political Economy of Transport Innovations [Series Title: Advances in Spatial Science]. In M. Beuthe, V. Himanen, A. Reggiani, & L. Zamparini (Eds.), *Transport Developments and Innovations in an Evolving World* (pp. 11–26). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-540-24827-9_2

Fensterer, V., Küchenhoff, H., Maier, V., Wichmann, H.-E., Breitner, S., Peters, A., Gu, J., & Cyrys, J. (2014). Evaluation of the Impact of Low Emission Zone and Heavy Traffic Ban in Munich (Germany) on the Reduction of PM10 in Ambient Air. *International Journal of Environmental Research and Public Health*, *11*(5), 5094–5112. https://doi.org/10.3390/ijerph110505094

Ferrer-Ortiz, C., Marquet, O., Mojica, L., & Vich, G. (2022). Barcelona under the 15-Minute City Lens: Mapping the Accessibility and Proximity Potential Based on Pedestrian Travel Times. *Smart Cities*, *5*(1), 146–161. https://doi.org/10.3390/smartcities5010010

Figg, H. (2021, May). Oslo – Promoting Active Transport Modes. https://www.eltis.org/resources/case-studies/oslo-promoting-active-transport-modes

Flanagan, E., Malmqvist, E., Gustafsson, S., & Oudin, A. (2022). Estimated public health benefits of a low-emission zone in Malmö, Sweden. *Environmental Research*, *214*, 114124. https://doi.org/10.1016/j.envres.2022.114124

Forouzanfar, M. H., Alexander, L., Anderson, H. R., Bachman, V. F., Biryukov, S., Brauer, M., Burnett, R., Casey, D., Coates, M. M., Cohen, A., Delwiche, K., Estep, K., Frostad, J. J., Kc, A., Kyu, H. H., Moradi-Lakeh, M., Ng, M., Slepak, E. L., Thomas, B. A., … Murray, C. J. (2015). Global, regional, and national comparative risk assessment of 79 behavioural, environmental and occupational, and metabolic risks or clusters of risks in 188 countries, 1990–2013: A systematic analysis for the Global Burden of Disease Study 2013. *The Lancet*, *386*(10010), 2287–2323. https://doi.org/10.1016/S0140-6736(15)00128-2

Francke, A., & Kaniok, D. (2013). Responses to differentiated road pricing schemes. *Transportation Research Part A: Policy and Practice*, *48*, 25–30. https://doi.org/10.1016/j.tra.2012.10.002

Fritschi, L., Brown, L. A., Kim, R., Schwela, D., & Kephalopoulos, S. (2013). *Burden of disease from environmental noise. Quantification of healthy life years lost in Europe. Geneva: World Health Organization 2011*.

Frost, R. (2022, October). Spain: Free train travel scheme extended until December 2023. Retrieved October 19, 2023, from https://www.euronews.com/travel/2022/10/04/spain-short-and-medium-distance-trains-will-be-free-this-autumn-thanks-to-a-windfall-tax

Gaglione, F., Gargiulo, C., Zucaro, F., & Cottrill, C. (2022). Urban accessibility in a 15-minute city: A measure in the city of Naples, Italy. *Transportation Research Procedia*, *60*, 378–385. https://doi.org/10.1016/j.trpro.2021.12.049

Gärling, T., & Schuitema, G. (2007). Travel Demand Management Targeting Reduced Private Car Use: Effectiveness, Public Acceptability and Political Feasibility. *Journal of Social Issues*, *63*(1), 139–153. https://doi.org/10.1111/j.1540-4560.2007.00500.x

Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: A multi-level perspective and a case-study. *Research Policy*, *31*(8-9), 1257–1274. https://doi.org/10.1016/S0048-7333(02)00062-8

Geller, E. S. (1989). Applied behavior analysis and social marketing: An integration for environmental preservation [ISBN: 0022-4537 Publisher: Wiley Online Library]. *Journal of social issues*, *45*(1), 17–36.

Gemeente Almere. (2023). Almere Pampus. Retrieved February 16, 2024, from https://almere20.nl/almere-2050/almere-pampus/

Gemeente Amsterdam. (2019, October). *Actieplan schone lucht* (tech. rep.). Gemeente Amsterdam. Amsterdam.

Gemeente Amsterdam. (2020a). *Agenda Amsterdam Autoluw* (tech. rep.). Gemeente Amsterdam. Amsterdam. https://www.amsterdam.nl/verkeer-vervoer/agenda-amsterdam-autoluw/maatregelen-amsterdam-autoluw/

Gemeente Amsterdam. (2020b). Ziekte en gezondheid in cijfers. Retrieved February 20, 2024, from https://onderzoek.amsterdam.nl/artikel/ziekte-en-gezondheid-in-cijfers

Gemeente Amsterdam. (2021). Monitor Autoluw. Retrieved November 2, 2023, from https://openresearch.amsterdam/nl/page/68385/monitor-autoluw

Gemeente Amsterdam. (2022a). Dataset: Stand van de bevolking Amsterdam. Retrieved February 20, 2024, from https://onderzoek.amsterdam.nl/dataset/stand-van-de-bevolking-amsterdam

Gemeente Amsterdam. (2022b). *Wegwijzer autodelen* (tech. rep.). Gemeente Amsterdam. Amsterdam. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwib2rHDtvGDAxV4-wIHHZpeDEUQFnoECBAQAQ&url=https%3A%2F%2Fassets.amsterdam.nl%2Fpublish%2Fpages%2F973967%2Fwegwijzer_autodelen.pdf&usg=AOvVaw3K6XSpWbU5m5gM4wvKRSvz&opi=89978449

Gemeente Amsterdam. (2024a, January). Meedenken spaarpaal Meeuwenlaan [Last Modified: 2024-01-23 Publisher: Gemeente Amsterdam]. Retrieved February 23, 2024, from https://www.amsterdam.nl/stadsdelen/noord/nieuws/meedenken-spaarpaal-meeuwenlaan/

Gemeente Amsterdam. (2024b, February). Proef afsluiting Weesperstraat: Wat leverde het op, en hoe gaan we verder? [Last Modified: 2024-02-12 Publisher: Gemeente Amsterdam]. Retrieved February 29, 2024, from https://www.amsterdam.nl/nieuws/nieuwsoverzicht/proef-afsluiting-weesperstraat/

Gemeente Amsterdam. (n.d.). Geen parkeervergunning voor vervuilende auto [Last Modified: 2023-10-05 Publisher: Gemeente Amsterdam]. https://www.amsterdam.nl/parkeren/parkeervergunning/parkeervergunning-vervuilende-auto/

Gemeente Rotterdam. (2020). Mobiliteitsaanpak. Retrieved February 16, 2024, from https://www.rotterdam.nl/mobiliteitsaanpak

Giacchino, S., & Kakabadse, A. (2003). Successful Policy Implementation: The Route to Building Self-Confident Government. *International Review of Administrative Sciences*, *69*(2), 139–160. https://doi.org/10.1177/0020852303069002002

Gilroy, P. (2020). Driving while black. In *Car cultures* (pp. 81–104). Routledge.

Givoni, M. (2014). Addressing transport policy challenges through Policy-Packaging. *Transportation Research Part A: Policy and Practice*, *60*, 1–8. https://doi.org/10.1016/j.tra.2013.10.012

Global Designing Cities Initiative. (n.d.). Pedestrian Only Streets: Case Study | Stroget, Copenhagen. https://globaldesigningcities.org/publication/global-street-design-guide/streets/pedestrian-priority-spaces/pedestrian-only-streets/pedestrian-streets-case-study-stroget-copenhagen/

Glotz-Richter, M. (2016). Reclaim Street Space! – Exploit the European Potential of Car Sharing. *Transportation Research Procedia*, *14*, 1296–1304. https://doi.org/10.1016/j.trpro.2016.05.202

Gonzalez, J. N., Gomez, J., & Vassallo, J. M. (2022). Do urban parking restrictions and Low Emission Zones encourage a greener mobility? *Transportation Research Part D: Transport and Environment*, *107*, 103319. https://doi.org/10.1016/j.trd.2022.103319

Gonzalez, J. N., Perez-Doval, J., Gomez, J., & Vassallo, J. M. (2021). What impact do private vehicle restrictions in urban areas have on car ownership? Empirical evidence from the city of Madrid. *Cities*, *116*, 103301. https://doi.org/10.1016/j.cities.2021.103301

Goodall, W., Fishman, T. D., Bornstein, J., & Bonthron, B. (2017). *The rise of mobility as a service* (tech. rep. No. 20). Deloitte. https://www2.deloitte.com/content/dam/Deloitte/nl/Documents/consumer-business/deloitte-nl-cb-ths-rise-of-mobility-as-a-service.pdf

Gori, S., Nigro, M., & Petrelli, M. (2012). The impact of land use characteristics for sustainable mobility: The case study of Rome. *European Transport Research Review*, *4*(3), 153–166. https://doi.org/10.1007/s12544-012-0077-6

Gössling, S., Kees, J., & Litman, T. (2022). The lifetime cost of driving a car. *Ecological Economics*, *194*, 107335. https://doi.org/10.1016/j.ecolecon.2021.107335

Grannetia, C. (2023, January). Update Amsterdam: 10.000 parkeerplaatsen verwijderen. Retrieved January 22, 2024, from https://ruimtevoorlopen.nl/2023/01/parkeerplaatsen/

Grant, T. (Ed.). (2003). *International directory of company histories. Vol. 55 / ed.: Tina Grant* (Vol. 55). St. James Press [u.a.]

Green, S. (2023, February). Lime Profitability a Breakthrough for Share Sector. Retrieved October 10, 2023, from https://micromobilityreport.com.au/infrastructure/bike-scooter-share/lime-profitability-a-breakthrough-for-share-sector/

Grenna, L., Calabrese, D., & Santucci, F. M. (2003). Strategic communication for the design of agricultural policies and for their implementation [Publisher: World Bank Group].

Gudmundsson, H., & Sørensen, C. H. (2010). Limits to and unintended effects of transport policies. *Proceedings of the ETC*.

Gullberg, A., & Isaksson, K. (Eds.). (2009, January). *Congestion Taxes in City Traffic: Lessons Learnt from the Stockholm Trial*. Nordic Academic Press. https://doi.org/10.2307/jj.919475

Hamilton, C., & Kasser, T. (2009). Psychological adaptation to the threats and stresses of a four degree world [Publisher: Oxford University Oxford, UK]. *Four degrees and beyond*.

Hamilton, C. (2012). *Implementing road pricing: Standards, institutions, costs, and public acceptance* [OCLC: 882567365]. KTH.

Heijlen, R., & Crompvoets, J. (2019). The smart city of Leuven. In *Smart City Emergence* (pp. 83–104). Elsevier. https://doi.org/10.1016/B978-0-12-816169-2.00004-3

Heijnen, M. (2019). *Mobiliteit* (tech. rep. No. 6). Gemeente Amsterdam. Amsterdam. https://openresearch.amsterdam/image/2020/7/15/6_mobiliteit_2019_staat_van_de_stad_x_4.pdf

Heineke, K., Kloss, B., & Scurtu, D. (2022, June). What Germany can teach the world about shared micromobility. Retrieved October 19, 2023, from https://www.mckinsey.com/features/mckinsey-center-for-future-mobility/mckinsey-on-urban-mobility/what-germany-can-teach-the-world-about-shared-micromobility

Helbich, M., Klein, N., Roberts, H., Hagedoorn, P., & Groenewegen, P. P. (2018). More green space is related to less antidepressant prescription rates in the Netherlands: A Bayesian geoadditive quantile regression approach. *Environmental Research*, *166*, 290–297. https://doi.org/10.1016/j.envres.2018.06.010

Hensley, M., Mateo-Babiano, D., & Minnery, J. (2014). Healthy places, active transport and path dependence: A review of the literature: Healthy places, active transport and path dependence. *Health Promotion Journal of Australia*, *25*(3), 196–201. https://doi.org/10.1071/HE14042

Hermansson, J. (1999). Greater Copenhagen" The Finger Plan. *Paper for TRANSLAND project*.

Hielkema, D. (2022, November). Parkeertarieven vanaf volgend jaar omhoog: Gratis parkeren wordt lastig in Amsterdam. Retrieved January 22, 2024, from https://www.parool.nl/amsterdam/parkeertarieven-vanaf-volgend-jaar-omhoog-gratis-parkeren-wordt-lastig-in-amsterdam~bedb0d45/

Historiek. (2023, April). De Witkar – Elektrische auto's delen in de jaren zeventig. Retrieved January 22, 2024, from https://historiek.net/witkar-elektrische-deelauto-amsterdam/151314/

Hjuler, S. B. (2020, September). Cycle Superhighways: How we built an inter-municipal network in Denmark. Retrieved October 10, 2023, from https://www.c40knowledgehub.org/s/article/How-

we-built-an-inter-municipal-cycle-superhighway-network-across-the-Capital-Region-of-Denmark?language=en_US

Hoefer, R. (2022). The Multiple Streams Framework: Understanding and Applying the Problems, Policies, and Politics Approach. *Journal of Policy Practice and Research*, *3*(1), 1–5. https://doi.org/10.1007/s42972-022-00049-2

Holman, C., Harrison, R., & Querol, X. (2015). Review of the efficacy of low emission zones to improve urban air quality in European cities. *Atmospheric Environment*, *111*, 161–169. https://doi.org/10.1016/j.atmosenv.2015.04.009

Hrelja, R., & Rye, T. (2023). Decreasing the share of travel by car. Strategies for implementing 'push' or 'pull' measures in a traditionally car-centric transport and land use planning. *International Journal of Sustainable Transportation*, *17*(5), 446–458. https://doi.org/10.1080/15568318.2022.2051098

Huang, J. (2023). Urban street experiments in Milan and Shanghai: Transforming streets in a tactical and experimental approach.

Int Panis, L., Beckx, C., Broekx, S., De Vlieger, I., Schrooten, L., Degraeuwe, B., & Pelkmans, L. (2011). PM, NOx and CO2 emission reductions from speed management policies in Europe. *Transport Policy*, *18*(1), 32–37. https://doi.org/10.1016/j.tranpol.2010.05.005

Intergovernmental Panel on Climate Change (IPCC). (2023). Summary for Policymakers. In *Climate Change 2022 – Impacts, Adaptation and Vulnerability: Working Group II Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 3–34). Cambridge University Press. https://doi.org/10.1017/9781009325844.001

Inturri, G., Fiore, S., Ignaccolo, M., Caprì, S., & Pira, M. L. (2020). "You study, you travel free": When mobility management strategies meet social objectives. *Transportation Research Procedia*, *45*, 193–200. https://doi.org/10.1016/j.trpro.2020.03.007

i&o research, Fietsersbond, & Dutch cycling embassy. (2021). *Jaarlijkse Fietsmonitor Nederland 2021* (tech. rep.). https://065.wpcdnnode.com/ioresearch.nl/wp-content/uploads/2021/10/2021-vdcefiets-jaarlijkse-fietsmonitor-nederland-definitief.pdf

Jaensirisak, S., Wardman, M., & May, A. D. (2005). Explaining variations in public acceptability of road pricing schemes [ISBN: 0022-5258 Publisher: Journal of Transport Economics and Policy]. *Journal of Transport Economics and Policy (JTEP)*, *39*(2), 127–154.

Jang, S., Wu, S., Kim, D., Song, K.-H., Lee, S. M., & Suh, W. (2022). Impact of Lowering Speed Limit on Urban Transportation Network. *Applied Sciences*, *12*(11), 5296. https://doi.org/10.3390/app12115296

Jiacheng, J., He, S., & Zeng, X. (2019). An investigation into European car-free development models as an opportunity to improve the environmental sustainability in cities: The case of Pontevedra., 84–91.

Jones, B. (2021, October). The $3.50 go-anywhere ticket to fight climate change. Retrieved October 19, 2023, from https://www.cnn.com/travel/article/austria-klimaticket/index.html

Kahneman, D., Knetsch, J. L., & Thaler, R. (1986). Fairness as a constraint on profit seeking: Entitlements in the market [ISBN: 0002-8282 Publisher: JSTOR]. *The American economic review*, 728–741.

Kalaba, F. K. (2016). Barriers to policy implementation and implications for Zambia's forest ecosystems. *Forest Policy and Economics*, *69*, 40–44. https://doi.org/10.1016/j.forpol.2016.04.004

Kallio, H., Pietilä, A.-M., Johnson, M., & Kangasniemi, M. (2016). Systematic methodological review: Developing a framework for a qualitative semi-structured interview guide [_eprint: https://onlinelibrary.wiley.com/doi/ *Journal of Advanced Nursing*, *72*(12), 2954–2965. https://doi.org/10.1111/jan.13031

Kemp, R., Schot, J., & Hoogma, R. (1998). Regime shifts to sustainability through processes of niche formation: The approach of strategic niche management. *Technology Analysis & Strategic Management*, *10*(2), 175–198. https://doi.org/10.1080/09537329808524310

Khreis, H., Warsow, K. M., Verlinghieri, E., Guzman, A., Pellecuer, L., Ferreira, A., Jones, I., Heinen, E., Rojas-Rueda, D., Mueller, N., Schepers, P., Lucas, K., & Nieuwenhuijsen, M. (2016). The health impacts of traffic-related exposures in urban areas: Understanding real effects, underlying driving forces and co-producing future directions. *Journal of Transport & Health*, *3*(3), 249–267. https://doi.org/10.1016/j.jth.2016.07.002

Kingdon, J. W., & Stano, E. (1984). *Agendas, alternatives, and public policies* (Vol. 45). Little, Brown Boston.

Köllinger, C. (n.d.). Hamburg aims for 4 out of 5 trips to be carried out without private car in 2030 | Eltis. Retrieved March 17, 2023, from https://www.eltis.org/in-brief/news/hamburg-aims-4-out-5-trips-be-carried-out-without-private-car-2030

Koops, R. (2019, March). Ruim 10.000 parkeerplaatsen verdwijnen voor 2025. Retrieved January 22, 2024, from https://www.parool.nl/amsterdam/ruim-10-000-parkeerplaatsen-verdwijnen-voor-2025~b8496335/

Kottenhoff, K., & Brundell Freij, K. (2009). The role of public transport for feasibility and acceptability of congestion charging – The case of Stockholm. *Transportation Research Part A: Policy and Practice*, *43*(3), 297–305. https://doi.org/10.1016/j.tra.2008.09.004

Krabbenborg, L., Molin, E., Annema, J. A., & Van Wee, B. (2021). Exploring the feasibility of tradable credits for congestion management. *Transportation Planning and Technology*, *44*(3), 246–261. https://doi.org/10.1080/03081060.2021.1883226

Krauss, K., Moll, C., Köhler, J., & Axhausen, K. W. (2022). Designing mobility-as-a-service business models using morphological analysis. *Research in Transportation Business & Management*, *45*, 100857. https://doi.org/10.1016/j.rtbm.2022.100857

Kristoffersson, I., Engelson, L., & Börjesson, M. (2017). Efficiency vs equity: Conflicting objectives of congestion charges. *Transport Policy*, *60*, 99–107. https://doi.org/10.1016/j.tranpol.2017.09.006

Kuipers, T. (2021). DIT4TraM. Retrieved October 19, 2023, from https://www.ams-institute.org/urban-challenges/smart-urban-mobility/dit4tram/

Kuss, P., & Nicholas, K. A. (2022). A dozen effective interventions to reduce car use in European cities: Lessons learned from a meta-analysis and transition management. *Case Studies on Transport Policy*, *10*(3), 1494–1513. https://doi.org/10.1016/j.cstp.2022.02.001

Langmyhr, T., & Sager, T. (1997). Implementing the improbable urban road pricing scheme [ISBN: 0197-6729 Publisher: Wiley Online Library]. *Journal of advanced transportation*, *31*(2), 139–158.

Leape, J. (2006). The London Congestion Charge. *Journal of Economic Perspectives*, *20*(4), 157–176. https://doi.org/10.1257/jep.20.4.157

Lee, A. C. K., & Maheswaran, R. (2011). The health benefits of urban green spaces: A review of the evidence. *Journal of Public Health*, *33*(2), 212–222. https://doi.org/10.1093/pubmed/fdq068

Lelong, J. (2022, April). Vijf jaar na het verguisde circulatieplan is Gent 'een referentiepunt geworden' [Section: In het nieuws]. Retrieved October 5, 2023, from https://www.demorgen.be/nieuws/vijf-jaar-na-het-verguisde-circulatieplan-is-gent-een-referentiepunt-geworden~b0f858bd/

LEVA EU. (2022, October). Barcelona unveils fully electric bike-sharing service for 2023. Retrieved January 16, 2024, from https://leva-eu.com/barcelona-unveils-fully-electric-bike-sharing-service-for-2023/

Li, S., & Robusté, F. (2021). From urban congestion pricing to tradable mobility credits: A review. *Transportation Research Procedia*, *58*, 670–677. https://doi.org/10.1016/j.trpro.2021.11.088

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Sage Publications.

Litman, T. (2023a, September). *Evaluating Public Transit Benefits and Costs* (tech. rep.). Victoria Transport Policy Institute. https://www.vtpi.org/tranben.pdf

Litman, T. (2023b, March). *Parking Management* (tech. rep.). Victoria Transport Policy Institute. https://www.vtpi.org/park_man.pdf

Logan, T. M., Hobbs, M. H., Conrow, L. C., Reid, N. L., Young, R. A., & Anderson, M. J. (2022). The x-minute city: Measuring the 10, 15, 20-minute city and an evaluation of its use for sustainable urban design. *Cities*, *131*, 103924. https://doi.org/10.1016/j.cities.2022.103924

Lonsdale, K., Pringle, P., & Turner, B. (2015). Transformative adaptation: What it is, why it matters and what is needed [ISBN: 1906360111].

Loo, B. P. Y. (2018). Realising car-free developments within compact cities. *Proceedings of the Institution of Civil Engineers - Municipal Engineer*, *171*(1), 41–50. https://doi.org/10.1680/jmuen.16.00060

Loorbach, D., & Rotmans, J. (2006). Managing Transitions for Sustainable Development. In X. Olsthoorn & A. J. Wieczorek (Eds.), *Understanding Industrial Transformation: Views from Different Disciplines* (pp. 187–206). Springer Netherlands. https://doi.org/10.1007/1-4020-4418-6_10

Low, N., & Astle, R. (2009). Path dependence in urban transport: An institutional analysis of urban passenger transport in Melbourne, Australia, 1956–2006. *Transport Policy*, *16*(2), 47–58. https://doi.org/10.1016/j.tranpol.2009.02.010

Low, N., Gleeson, B., & Rush, E. (2006). A multivalent conception of path dependence: The case of transport planning in metropolitan Melbourne, Australia. *Environmental Sciences*, *2*(4), 391–408. https://doi.org/10.1080/15693430500405146

Lower, A., & Szumilas, A. (2021). Parking Policy as a Tool of Sustainable Mobility-Parking Standards in Poland vs. European Experiences. *Sustainability*, *13*(20), 11330. https://doi.org/10.3390/su132011330

Lowi, T. J. (1985, December). 3. The State in Politics: The Relation Between Policy and Administration. In R. G. Noll (Ed.), *Regulatory Policy and the Social Sciences* (pp. 67–110). University of California Press. https://doi.org/10.1525/9780520313651-005

M Cube & TUM. (2021). *European Mobility Venture* (tech. rep.). Munich. https://www.mos.ed.tum.de/fileadmin/w00ccp/ftm/05-Lehre/05-9-Internationale_Studentenprojekte_globalDrive/euMOVE_2021_Report_fun_size_compressed.pdf

Maat, K., & Louw, E. (1999). Mind the Gap: Pitfalls of Travel Reduction Measures. *25*(2), 151–161. https://www.jstor.org/stable/23288534

Mackett, R. (2015). Improving accessibility for older people – Investing in a valuable asset. *Journal of Transport & Health*, *2*(1), 5–13. https://doi.org/10.1016/j.jth.2014.10.004

Maffei, L., & Masullo, M. (2014). Electric Vehicles and Urban Noise Control Policies [Number: 3]. *Archives of Acoustics*, *39*(3), 333–341. https://doi.org/10.2478/aoa-2014-0038

Maletti, M. (2020). Tactical planning: Long-term vision for new public spaces [Publisher: Italy].

Malmsten, B., & Persson, M. (2001). *Dennispaketet: Låsningar och lösningar*. Regionplane-och trafikkontoret.

Marsden, G., Ferreira, A., Bache, I., Flinders, M., & Bartle, I. (2014). Muddling through with climate change targets: A multi-level governance perspective on the transport sector [Publisher: Taylor & Francis _eprint: https://doi.org/10.1080/14693062.2014.905823]. *Climate Policy*, *14*(5), 617–636. https://doi.org/10.1080/14693062.2014.905823

Marsden, G., & Reardon, L. (2017). Questions of governance: Rethinking the study of transportation policy. *Transportation Research Part A: Policy and Practice*, *101*, 238–251. https://doi.org/10.1016/j.tra.2017.05.008

Marshall, G. (2015). *Don't even think about it: Why our brains are wired to ignore climate change*. Bloomsbury Publishing USA.

Matthys, C. (2021, March). Circulatieplan bracht Gent 23 miljoen euro op in vier jaar tijd: "Verrassend dat er nog zoveel boetes worden uitgeschreven" [Section: Gent]. Retrieved October 5, 2023, from https://www.hln.be/gent/circulatieplan-bracht-gent-23-miljoen-euro-op-in-vier-jaar-tijd-verrassend-dat-er-nog-zoveel-boetes-worden-uitgeschreven~ae05e015/

Mayor of London. (2018, March). *Mayor's Transport Strategy* (tech. rep.). Greater London Authority. London. https://www.london.gov.uk/sites/default/files/mayors-transport-strategy-2018.pdf

Mayors of Europe. (2022, April). The car-free future of cities: Story from Oslo. Retrieved November 2, 2023, from https://mayorsofeurope.eu/top-stories/the-car-free-future-of-cities-story-from-oslo/

Mcleod, S. (2023, July). Case Study Research Method in Psychology [Section: Research Methodology]. Retrieved November 2, 2023, from https://www.simplypsychology.org/case-study.html

Melia, S., Parkhurst, G., & Barton, H. (2011). Carfree, low-car - what's the difference. *World Transport Policy & Transport*, *16*(2). Retrieved February 21, 2024, from https://uwe-repository.worktribe.com/output/970345/carfree-low-car-whats-the-difference

Meyer, E. T. (2018). The Scholarly Impacts of Newspapers: The Guardian, Washington Post, Wall Street Journal, and New York Times. *Washington Post, Wall Street Journal, and New York Times (May 2, 2018)*.

Meyer, M. D. (1999). Demand management as an element of transportation policy: Using carrots and sticks to influence travel behavior. *Transportation Research Part A: Policy and Practice*, *33*(7-8), 575–599. https://doi.org/10.1016/S0965-8564(99)00008-7

Michalski, T., Syvak, T., Dombrovska, S., Stanishevskiy, V., & Servetskiy, I. (2023). Place and Role of Strategic Communications in Public Management System. In *National Security Drivers of*

*Ukraine: Information Technology, Strategic Communication, and Legitimacy* (pp. 135–149). Springer.

Mingardo, G., Van Wee, B., & Rye, T. (2015). Urban parking policy in Europe: A conceptualization of past and possible future trends. *Transportation Research Part A: Policy and Practice*, *74*, 268–281. https://doi.org/10.1016/j.tra.2015.02.005

Ministerie van Algemene Zaken. (2021, January). CO2-heffing voor industrie [Last Modified: 2023-12-22T16:59 Publisher: Ministerie van Algemene Zaken]. Retrieved February 13, 2024, from https://www.rijksoverheid.nl/onderwerpen/milieubelastingen/co2-heffing-voor-industrie

Ministerie van Algemene Zaken. (2022, June). Plannen kabinet met betalen naar gebruik - Belasting op auto en motor [Last Modified: 2023-10-06T15:48 Publisher: Ministerie van Algemene Zaken]. Retrieved October 9, 2023, from https://www.rijksoverheid.nl/onderwerpen/belastingen-op-auto-en-motor/plannen-kabinet-met-betalen-naar-gebruik

Ministerie van Economische Zaken. (2020, January). Wat is het Klimaatakkoord? [Last Modified: 2020-01-22T12:40 Publisher: Ministerie van Algemene Zaken]. Retrieved February 13, 2024, from https://www.rijksoverheid.nl/onderwerpen/klimaatverandering/klimaatakkoord/wat-is-het-klimaatakkoord

Ministerie van Infrastructuur en Waterstaat. (2009, March). Het belang van openbaar vervoer: De maatschappelijke effecten op een rij [Last Modified: 2017-01-19T16:30 Publisher: Ministerie van Infrastructuur en Waterstaat]. Retrieved October 10, 2023, from https://www.kimnet.nl/publicaties/rapporten/2009/03/02/het-belang-van-openbaar-vervoer-de-maatschappelijke-effecten-op-een-rij

Ministerie van Infrastructuur en Waterstaat. (2010, September). Klimaatverandering en gevolgen [Last Modified: 2023-04-26T16:47 Publisher: Ministerie van Algemene Zaken]. Retrieved February 16, 2024, from https://www.rijksoverheid.nl/onderwerpen/klimaatverandering/gevolgen-klimaatverandering

Mitropoulos, L., Kortsari, A., Mizaras, V., & Ayfantopoulou, G. (2023). Mobility as a Service (MaaS) Planning and Implementation: Challenges and Lessons Learned. *Future Transportation*, *3*(2), 498–518. https://doi.org/10.3390/futuretransp3020029

Moreno, C., Allam, Z., Chabaud, D., Gall, C., & Pratlong, F. (2021). Introducing the "15-Minute City": Sustainability, Resilience and Place Identity in Future Post-Pandemic Cities [Number: 1 Publisher: Multidisciplinary Digital Publishing Institute]. *Smart Cities*, *4*(1), 93–111. https://doi.org/10.3390/smartcities4010006

Moser, A., & Korstjens, I. (2017). Series: Practical guidance to qualitative research. Part 1: Introduction. *European Journal of General Practice*, *23*(1), 271–273. https://doi.org/10.1080/13814788.2017.1375093

Mueller, N., Rojas-Rueda, D., Cole-Hunter, T., de Nazelle, A., Dons, E., Gerike, R., Götschi, T., Int Panis, L., Kahlmeier, S., & Nieuwenhuijsen, M. (2015). Health impact assessment of active transportation: A systematic review. *Preventive Medicine*, *76*, 103–114. https://doi.org/10.1016/j.ypmed.2015.04.010

Mulgan, G., & Leadbeater, C. (2013). Systems innovation. *London: Nesta*.

Müller, M., & Reutter, P. O. (2022). Course change: Navigating urban passenger transport toward sustainability through modal shift. *International Journal of Sustainable Transportation*, *16*(8), 719–743. https://doi.org/10.1080/15568318.2021.1919796

Mustelin, J., & Handmer, J. (2013). Triggering transformation: Managing resilience or invoking real change? Retrieved February 24, 2024, from https://www.semanticscholar.org/paper/Triggering-transformation%3A-Managing-resilience-or-Mustelin-Handmer/902572a1ac0d6b02b60e43d871de93c99407e344

Nalmpantis, D., Vatavali, F., & Kehagia, F. (2021). A review of the good practices of active mobility measures implemented by European cities due to the COVID-19 pandemic. *IOP Conference Series: Earth and Environmental Science*, *899*(1), 012057. https://doi.org/10.1088/1755-1315/899/1/012057

National Institute for Public Health and the Environment. (n.d.). Air. Retrieved November 2, 2023, from https://www.rivm.nl/en/air

Nelson, D. R., Adger, W. N., & Brown, K. (2007). Adaptation to environmental change: Contributions of a resilience framework [ISBN: 1543-5938 Publisher: Annual Reviews]. *Annu. Rev. Environ. Resour.*, *32*, 395–419.

Ngoma, L. (2023, May). Lyon: First city in France to penalize parking for the heaviest and most polluting vehicles [Section: MOBI'NEWS]. Retrieved October 5, 2023, from https://m2050.media/en/lyon-first-city-in-france-to-penalize-parking-for-the-heaviest-and-most-polluting-vehicles/

Nie, Y. ( (2012). Transaction costs and tradable mobility credits. *Transportation Research Part B: Methodological*, *46*(1), 189–203. https://doi.org/10.1016/j.trb.2011.10.002

Nielsen, O. A., & Sørensen, M. V. (2008). *Proceedings: 9-11 September 2002, Homerton College, Cambridge ; final version* [OCLC: 255655631]. AET.

Nieuwenhuijsen, M. J., & Khreis, H. (2016). Car free cities: Pathway to healthy urban living. *Environment International*, *94*, 251–262. https://doi.org/10.1016/j.envint.2016.05.032

Nijland, H., van Meerkerk, J., & Hoen, A. (2015, July). *Impact of car sharing on mobility and CO2 emissions* (tech. rep. No. 1842). PBL Netherlands Environmental Assessment Agency. https://www.pbl.nl/sites/default/files/downloads/PBL_2015_Note_Impact_of_car_sharing_1842.pdf

Nikulina, V., Simon, D., Ny, H., & Baumann, H. (2019). Context-Adapted Urban Planning for Rapid Transitioning of Personal Mobility towards Sustainability: A Systematic Literature Review. *Sustainability*, *11*(4), 1007. https://doi.org/10.3390/su11041007

Nordtømme, M. E., Bjerkan, K. Y., & Sund, A. B. (2015). Barriers to urban freight policy implementation: The case of urban consolidation center in Oslo. *Transport Policy*, *44*, 179–186. https://doi.org/10.1016/j.tranpol.2015.08.005

Noworól, A., Kopyciński, P., Hałat, P., Salamon, J., & Hołuj, A. (2022). The 15-Minute City—The Geographical Proximity of Services in Krakow. *Sustainability*, *14*(12), 7103. https://doi.org/10.3390/su14127103

NWO. (2023). XCARCITY? Retrieved November 2, 2023, from https://www.nwo.nl/en/researchprogrammes/perspectief/perspectief-grants/xcarcity

Observatory of Public Sector Innovation. (2020, April). Milan's scheme to reduce car use after lockdown. Retrieved November 21, 2023, from https://oecd-opsi.org/covid-response/milans-scheme-to-reduce-car-use-after-lockdown/

Odeck, J., & Bråthen, S. (2002). Toll financing in Norway: The success, the failures and perspectives for the future. *Transport Policy*, *9*(3), 253–260. https://doi.org/10.1016/S0967-070X(02)00030-6

Ostermeijer, F., Koster, H., Nunes, L., & van Ommeren, J. (2022). Citywide parking policy and traffic: Evidence from Amsterdam. *Journal of Urban Economics*, *128*, 103418. https://doi.org/10.1016/j.jue.2021.103418

Oxfordshire County Council. (2022). Traffic filters. Retrieved October 5, 2023, from https://www.oxfordshire.gov.uk/residents/roads-and-transport/connecting-oxfordshire/traffic-filters

Pal, L. A. (2005). Case Study Method and Policy Analysis. In I. Geva-May (Ed.), *Thinking Like a Policy Analyst* (pp. 227–257). Palgrave Macmillan US. https://doi.org/10.1057/9781403980939_12

Parkopedia. (2022). *Global Parking Index* (tech. rep.). Parkopedia. https://5540406.fs1.hubspotusercontent-na1.net/hubfs/5540406/Global%20Parking%20Index%202022/Global%20Parking%20Index%202022%20-%20Final%20Version.pdf?__hsfp=2442824485&__hssc=91933061.1.1668536682424&__hstc=91933061.11a98665e14bbe5626406086da2cb98e.1668536682423.1668536682423.1668536682423.1

Pelckmans, D. (n.d.). *Ghent: A circulation plan as a step to the cycling heaven?* (Tech. rep.). Municipality of Ghent. Ghent. https://ecf.com/sites/ecf.com/files/Pelckmans.D_Ghent_A_circulation_plan_as_a_step_to_the_cycling_heaven.pdf

Pettinga, A., Rowette, A., Braakman, B., Pardo, C., Kuijper, D., Jong, H., Spapé, I., Zuidgeest, M., Wittink, R., Kager, R., Schepel, S., & Goodefrooij, T. (2009, January). *Cycling Inclusive Policy Development: A Handbook*.

Pitsiava–Latinopoulou, M., Basbas, S., Papoutsis, K., & Sdoukopoulos, E. (2012). Parking Policies for Supporting Sustainable Mobility. *Procedia - Social and Behavioral Sciences*, *48*, 897–906. https://doi.org/10.1016/j.sbspro.2012.06.1067

Poorthuis, A., & Zook, M. (2023). Moving the 15-minute city beyond the urban core: The role of accessibility and public transport in the Netherlands. *Journal of Transport Geography*, *110*, 103629. https://doi.org/10.1016/j.jtrangeo.2023.103629

Pozoukidou, G., & Chatziyiannaki, Z. (2021). 15-Minute City: Decomposing the New Urban Planning Eutopia. *Sustainability*, *13*(2), 928. https://doi.org/10.3390/su13020928

Prati, F. (2022). Piazze Aperte: How Milan Gave its Piazze Back to the People. Retrieved December 11, 2023, from https://globaldesigningcities.org/update/piazze_aperte_report-en/

Provoost, J., Cats, O., & Hoogendoorn, S. (2023). Design and classification of tradable mobility credit schemes. *Transport Policy*, *136*, 59–69. https://doi.org/10.1016/j.tranpol.2023.03.010

RAC Foundation. (2021). Cars parked 23 hours a day. Retrieved February 22, 2024, from https://www.racfoundation.org/media-centre/cars-parked-23-hours-a-day

Ramazzotti, D., Liguori, G., & Dziekan, K. (2012). Civitas MIMOSA Project. Mobility Credit System in Bologna. *Procedia - Social and Behavioral Sciences*, *48*, 1568–1577. https://doi.org/10.1016/j.sbspro.2012.06.1132

Rapid Transition Alliance. (2018, February). Reclaiming the streets: The increasing trend of pedestrianisation around the world. https://rapidtransition.org/stories/reclaiming-the-streets-the-increasing-trend-of-pedestrianisation-around-the-world/

Raux, C., Croissant, Y., & Pons, D. (2015). Would personal carbon trading reduce travel emissions more effectively than a carbon tax? *Transportation Research Part D: Transport and Environment*, *35*, 72–83. https://doi.org/10.1016/j.trd.2014.11.008

Redman, L., Friman, M., Gärling, T., & Hartig, T. (2013). Quality attributes of public transport that attract car users: A research review. *Transport Policy*, *25*, 119–127. https://doi.org/10.1016/j.tranpol.2012.11.005

Reid, C. (2020). How a Belgian port city inspired Birmingham's car-free ambitions. *The Guardian*. Retrieved October 17, 2023, from https://www.theguardian.com/environment/2020/jan/20/how-a-belgian-port-city-inspired-birminghams-car-free-ambitions

REMY. (2021, August). AMAT. Retrieved February 9, 2024, from https://liferemy.eu/partners/amat/

Rezende Amaral, R., Šemanjski, I., Gautama, S., & Aghezzaf, E.-H. (2018). Urban Mobility and City Logistics – Trends and Case Study. *PROMET - Traffic&Transportation*, *30*(5), 613–622. https://doi.org/10.7307/ptt.v30i5.2825

Roberts, D. (2019a, April). Barcelona wants to build 500 superblocks. Here's what it learned from the first ones. Retrieved December 8, 2023, from https://www.vox.com/energy-and-environment/2019/4/9/18273894/barcelona-urban-planning-superblocks-poblenou

Roberts, D. (2019b, April). Barcelona's remarkable history of rebirth and transformation. Retrieved December 11, 2023, from https://www.vox.com/energy-and-environment/2019/4/8/18266760/barcelona-spain-urban-planning-history

Roberts, D. (2019c, June). *Superblocks: Barcelona's plan to free itself from cars* (tech. rep.). Kleinman Center for Energy Policy. Pennsylvania. https://kleinmanenergy.upenn.edu/wp-content/uploads/2020/08/Superblocks-1.pdf

Rodriguez, v. (2024). Catalonia. Retrieved January 16, 2024, from https://www.britannica.com/place/Catalonia

Rose, R. (2005). *Learning from comparative public policy: A practical guide* [OCLC: 252890643]. Routledge.

Roth, G. (2018, February). Tolls Can Fund Infrastructure and Reduce Congestion. Retrieved October 9, 2023, from https://manhattan.institute/article/tolls-can-fund-infrastructure-and-reduce-congestion

Röth, K., Koljensic, P., & Kuipers, T. (2022, May). Blog #3: Reducing the Speed Limit to 30 km/h for More Livable Streets. Retrieved October 5, 2023, from https://www.ams-institute.org/news/blog-3-reducing-the-speed-limit-to-30-kmh-for-more-livable-streets/

Rotmans, J., Kemp, R., & Van Asselt, M. (2001). More evolution than revolution: Transition management in public policy. *Foresight*, *3*(1), 15–31. https://doi.org/10.1108/14636680110803003

Rueda, D. R., & Franzen, H. (n.d.). *Facts on Active Mobility Barcelona / Spain* (tech. rep.). European Union. https://www.pastaproject.eu/fileadmin/editor-upload/sitecontent/Publications/documents/AM_Factsheet_Barcelona_WP2.pdf

Rydningen, U., Høynes, R. C., & Kolltveit, L. W. (2017). Oslo 2019: A car-free city centre [ISBN: 1784662313 Publisher: WIT press]. *WIT Transactions on Ecology and the Environment*, *226*, 3–16.

Sakai, K. (2019). MaaS trends and policy-level initiatives in the EU. *IATSS Research*, *43*(4), 207–209. https://doi.org/10.1016/j.iatssr.2019.11.001

Salskov Iversen, D. (2006). Learning across borders: The case of Danish local government. *International Journal of Public Sector Management*, *19*(7), 673–686. https://doi.org/10.1108/09513550610704699

Sánchez, J. M., Ortega, E., López-Lambas, M. E., & Martín, B. (2021). Evaluation of emissions in traffic reduction and pedestrianization scenarios in Madrid. *Transportation Research Part D: Transport and Environment*, *100*, 103064. https://doi.org/10.1016/j.trd.2021.103064

Schade, J., & Schlag, B. (2003). Acceptability of urban transport pricing strategies. *Transportation Research Part F: Traffic Psychology and Behaviour*, *6*(1), 45–61. https://doi.org/10.1016/S1369-8478(02)00046-3

Schiller, T., Scheidl, J., & Pottebaum, T. (2017, June). *Car Sharing in Europe* (tech. rep.). Deloitte.

Sheldon, T. L., & Dua, R. (2019). Measuring the cost-effectiveness of electric vehicle subsidies. *Energy Economics*, *84*, 104545. https://doi.org/10.1016/j.eneco.2019.104545

Shirmohammadi, N., & Yin, Y. (2016). Tradable Credit Scheme to Control Bottleneck Queue Length. *Transportation Research Record: Journal of the Transportation Research Board*, *2561*(1), 53–63. https://doi.org/10.3141/2561-07

Shoup, D. C. (2006). Cruising for parking. *Transport Policy*, *13*(6), 479–486. https://doi.org/10.1016/j.tranpol.2006.05.005

Sicard, P., Agathokleous, E., De Marco, A., Paoletti, E., & Calatayud, V. (2021). Urban population exposure to air pollution in Europe over the last decades. *Environmental Sciences Europe*, *33*(1), 28. https://doi.org/10.1186/s12302-020-00450-2

Smeed, R. J. (1964). Road pricing: The economic and technical possibilities. *The Smeed Report, Ministry of Transport. London*.

Sørensen, C. H., Isaksson, K., Macmillen, J., Åkerman, J., & Kressler, F. (2014). Strategies to manage barriers in policy formation and implementation of road pricing packages. *Transportation Research Part A: Policy and Practice*, *60*, 40–52. https://doi.org/10.1016/j.tra.2013.10.013

Sposini, R. (2020, May). Strade Aperte, how Milan plans to reduce cars as coronavirus restrictions are eased [Section: Lifestyle]. Retrieved December 11, 2023, from https://www.lifegate.com/strade-aperte-milan

Stake, R. E. (2008). *Multiple case study analysis*. The Guilford Press.

Statista. (2022). Europe: Walking as primary mode of transport 2022. Retrieved February 16, 2024, from https://www.statista.com/statistics/1399469/walking-primary-mode-of-transport-europe/

Statistics Denmark. (2022). Life expectancy. Retrieved January 16, 2024, from https://www.dst.dk/en/Statistik/emner/borgere/befolkning/middellevetid

Strauss, A. L., & Corbin, J. M. (2003). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (2. ed., [Nachdr.]). Sage Publ.

Stumpel-Vos, P., Oostrom, C., & van den Berg, V. (2013, February). *Focus Measure Evaluation Results* (tech. rep. No. 4.1). Civitas. Utrecht. https://civitas.eu/sites/default/files/measure_evaluation_results_4_1_mobility_management_policy.pdf

Sutton, R. (1999). *The policy process: An overview*.

Symons, A. (2023, March). The world's richest country made public transport free: Here's what happened next. Retrieved October 19, 2023, from https://www.euronews.com/green/2023/03/22/the-worlds-richest-country-made-public-transport-free-heres-what-happened-next

Tallinja. (2022). Free Travel. Retrieved October 19, 2023, from https://www.publictransport.com.mt/en/free-travel

Tan, Z., Berry, A., Charalambides, M., Mijic, A., Pearse, W., Porter, A., Ryan, M., Shorten, R., Stettler, M., & Tetley, T. (2023). Tyre wear particles are toxic for us and the environment.

Technical University of Munich. (2021). *European Mobility Venture* (tech. rep.). European Mobility Venture. Munich. https://www.mos.ed.tum.de/fileadmin/w00ccp/ftm/05-Lehre/05-9-Internationale_Studentenprojekte_globalDrive/euMOVE_2021_Report_fun_size_compressed.pdf

Teisman, G. R. (2000). Models For Research into Decision-MakingProcesses: On Phases, Streams and Decision-Making Rounds [_eprint: https://onlinelibrary.wiley.com/doi/pdf/10.1111/1467-9299.00238]. *Public Administration*, *78*(4), 937–956. https://doi.org/10.1111/1467-9299.00238

The German Way. (2013, February). Autobahn Tolls in Austria and Switzerland. Retrieved October 9, 2023, from https://www.german-way.com/travel-and-tourism/driving-in-europe/driving/autobahn/driving-on-the-autobahn/autobahn-tolls-in-austria-and-switzerland/

Thøgersen, J. (2009). Promoting public transport as a subscription service: Effects of a free month travel card. *Transport Policy*, *16*(6), 335–343. https://doi.org/10.1016/j.tranpol.2009.10.008

Thomas, J. W., & Grindle, M. S. (1990). After the decision: Implementing policy reforms in developing countries. *World Development*, *18*(8), 1163–1181. https://doi.org/10.1016/0305-750X(90)90096-G

Tian, Y., & Chiu, Y.-C. (2015). Day-to-Day Market Power and Efficiency in Tradable Mobility Credits. *International Journal of Transportation Science and Technology*, *4*(3), 209–227. https://doi.org/10.1260/2046-0430.4.3.209

Topp, H., & Pharoah, T. (1994). Car-free city centres. *Transportation*, *21*(3), 231–247. https://doi.org/10.1007/BF01099212

Transport and Environment. (2001). *Lower Urban Speed Limits* (tech. rep.). Brussels. https://www.transportenvironment.org/wp-content/uploads/2021/05/11-01-T30.pdf

Transport for London. (2015). *Travel in London report 15* (15). Transport for London. London. https://board.tfl.gov.uk/documents/s19181/Travel/%20in%20London/%2015/%20Overview.pdf

Transport for West Midlands. (2021). Mobility credits. Retrieved October 19, 2023, from https://www.coventry.gov.uk/mobility-credits-1

Tsubohara, S. (2007, May). *A plan to make residential areas car-limited* [Doctoral dissertation, University of Groningen]. https://core.ac.uk/download/pdf/6924833.pdf

TU Delft. (2022, December). NWO-subsidie voor onderzoek naar leefbare stad zonder privéauto's. Retrieved February 14, 2024, from https://www.tudelft.nl/2022/citg/nwo-subsidie-voor-onderzoek-naar-leefbare-stad-zonder-priveautos

ULaaDS. (2022). *Bremen* (tech. rep. No. 3). Urban Logistics as as on-Demand Service. https://ulaads.eu/wp-content/uploads/2022/03/ULaaDS_City-Profile_Bremen.pdf

Union Cycliste Internationale (UCI). (2023). What is the UCI Bike City Label. Retrieved November 16, 2023, from https://www.uci.org/bike-city-label/1LNLr3tV8qojqvAMcGJ2Hh

United Nations. (2022, November). *Long-term low-emission development strategies* (tech. rep.). https://unfccc.int/sites/default/files/resource/cma_2022_08.pdf

United Nations Climate Change. (n.d.). The Paris Agreement. Retrieved November 1, 2023, from https://unfccc.int/process-and-meetings/the-paris-agreement

University of Oxford. (2020, June). *How to write case studies for public education* (tech. rep.). Blavatnik school of government. https://www.bsg.ox.ac.uk/sites/default/files/2020-06/Note%20-%20How%20to%20write%20case%20studies%20for%20public%20policy%20education%20-%20June%202020.pdf

University of Reading. (2016). *University travel survey 2016 results* (tech. rep.). University of Reading. Reading. https://sites.reading.ac.uk/sustainability/wp-content/uploads/sites/15/2017/04/Travel-Survey-2016-report-webv1.pdf

Urban Access Regulations. (n.d.). Home. Retrieved October 16, 2023, from https://urbanaccessregulations.eu/

Vaca, E., & Kuzmyak, R. (2005). *Parking Pricing and Fees* (tech. rep. No. 95). Transit cooperative research program. Washington. https://www.trb.org/publications/tcrp/tcrp_rpt_95c13.pdf

van der Lee, J. (2023, August). *Learning from Car Reduction Policies* (tech. rep.). TU Delft.

van de Wiel, A. (2023, May). Kunnen Felyx en Go Sharing winstgevend worden? Retrieved October 10, 2023, from https://mtsprout.nl/groei/felyx-go-sharing-deelscooter

van Dam, K. (2018). Welcome to cycle heaven: Why we moved our family to the Netherlands. *The Guardian*. Retrieved October 17, 2023, from https://www.theguardian.com/cities/2018/may/16/welcome-cycle-heaven-moved-family-netherlands-houten-utrecht

van Goeverden, C., Rietveld, P., Koelemeijer, J., & Peeters, P. (2006). Subsidies in public transport. (32), 5–25. https://www.openstarts.units.it/server/api/core/bitstreams/0470975a-34ff-41a2-8875-5cf1cfe1bb35/content

van Meerkerk, J., Verrips, A., & Hilbers, H. (2015, October). *A Social Cost Benefit Analysis of Road Pricing in the Netherlands* (CPB Background Document). CPB Netherlands Bureau for Economic Policy Analysis. https://www.cpb.nl/sites/default/files/publicaties/download/cpb-background-document-social-cost-benefit-analysis-road-pricing-netherlands.pdf

van Wee, B. (2009). Transport policy: What can it and what can't it do?, 1–17.

Veeneman, W., & Mulley, C. (2018). Multi-level governance in public transport: Governmental layering and its influence on public transport service solutions. *Research in Transportation Economics*, *69*, 430–437. https://doi.org/10.1016/j.retrec.2018.07.005

Veilig Verkeer Nederland. (2023, April). Tweederde van alle weggebruikers is bereid zich te houden aan aangepaste snelheid van 30 km/uur. Retrieved October 5, 2023, from https://vvn.nl/nieuws/tweederde-van-alle-weggebruikers-is-bereid-zich-te-houden-aan-aangepaste-snelheid-van-30

Volinski, J. (2012). *Implementation and Outcomes of Fare-Free transit Systems* (tech. rep. No. 101). Transit cooperative research program. Washington. https://cvtdbus.org/wp-content/uploads/2018/09/2012-07-TCRP-fare-free-report.pdf

Wieczorek, A. J., & Hekkert, M. P. (2012). Systemic instruments for systemic innovation problems: A framework for policy makers and innovation scholars. *Science and Public Policy*, *39*(1), 74–87. https://doi.org/10.1093/scipol/scr008

Wijnhout, T., & Dorgelo, G. (2022, July). *Evaluatie autoluwe zone Amersfoort* (tech. rep. No. 22.0074). Gemeente Amersfoort. Amersfoort. https://amersfoort.notubiz.nl/document/12065518/1/Bijlage_1_bij_collegebericht_2022-200_Evaluatieonderzoek_Autoluwe_Binnenstad

Wilson, S. (2011a, October). Copenhagen congestion charge looks likely with change in government. http://roadpricing.blogspot.com/2011/10/copenhagen-congestion-charge-looks.html

Wilson, S. (2011b, August). Copenhagen debates road pricing. http://roadpricing.blogspot.com/2011/08/copenhagen-debates-road-pricing.html

Woodside, A. G., & Wilson, E. J. (2003). Case study research methods for theory building. *Journal of Business & Industrial Marketing*, *18*(6/7), 493–508. https://doi.org/10.1108/08858620310492374

World Health Organization. (2018). Road traffic mortality. Retrieved November 1, 2023, from https://www.who.int/data/gho/data/themes/topics/topic-details/GHO/road-traffic-mortality

World Health Organization. (2022). Air pollution. Retrieved November 1, 2023, from https://www.who.int/health-topics/air-pollution

Wright, C., & Egan, J. (2000). De-marketing the car. *Transport Policy*, *7*(4), 287–294. https://doi.org/10.1016/S0967-070X(00)00029-9

Yang, H., & Wang, X. (2011). Managing network mobility with tradable credits. *Transportation Research Part B: Methodological*, *45*(3), 580–594. https://doi.org/10.1016/j.trb.2010.10.002

Yang, W., Veeneman, W., de Jong, M., & Song, Y. (2020). Integrated transport management: Lessons from a Chinese city. *Research in Transportation Economics*, *83*, 100918. https://doi.org/10.1016/j.retrec.2020.100918

Yang, W. (2021). *Moving in sync: Designing and implementing transport policy packages* [Doctoral dissertation, Delft University of Technology]. https://doi.org/10.4233/uuid:aa022541-52aa-4287-ace1-1773e10e3d79

Yin, R. K. (2007). *Case study research: Design and methods* (3. ed., [Nachdr.]). Sage.

z24. (2015, April). Amsterdam krijgt er acht nieuwe ondergrondse parkeergarages bij in centrum. Retrieved January 22, 2024, from https://www.businessinsider.nl/amsterdam-krijgt-er-acht-nieuwe-ondergrondse-parkeergarages-bij-in-centrum-554240/

Zee, R. v. d. (2015). How Groningen invented a cycling template for cities all over the world. *The Guardian*. Retrieved October 17, 2023, from https://www.theguardian.com/cities/2015/jul/29/how-groningen-invented-a-cycling-template-for-cities-all-over-the-world

Zografos, C., Klause, K. A., Connolly, J. J. T., & Anguelovski, I. (2020). The everyday politics of urban transformational adaptation: Struggles for authority and the Barcelona superblock project. *Cities*, *99*, 102613. https://doi.org/10.1016/j.cities.2020.102613

# A

# City selection

## A.1. Search operators and Leader determination

In table A.1, the search operators to determine if a measure is present in a city are presented, together with the leadership criteria of each measure.

## A.2. Expanded population statistics

Besides statistics about the size of the population, the size, density, GDP per capita and car ownership are determined by each city. When possible, the statistics have been taken from the websites of governmental institutes or policy documents. For the population and density, the most recent data/estimates are selected, mostly from 2022. For the GDP per capita, data from 2021 is used. In most cities, data about the GDP per capita for only the city is unavailable. The greater municipality, province or region is then used. For cities with a singular * this data is not available and the national statistics are used. For cities with **, data from a different year is used. For the Italian cities, data from 2019 is used. For the Norwegian cities the data is from 2015 and for Oxford from 2018.

**Table A.1:** Search operators and Leader determination

| | **Search operator** | **Leader definition** |
|---|---|---|
| A | ”low emissions zone” AND ”city” | Clear plans to become a ZEZ |
| B | ”limited traffic zone” OR ”traffic limited zone” AND ”city” | Exceptionally large zone |
| C | ”car-free zone” OR ”car free zone” OR ”car-free area” OR ”car free area” AND ”city” | Sectioned from the beginning |
| D | ”30 km/h” AND ”city” | |
| E | - | - |
| F | ”congestion charge” OR ”congestion fee” OR ”congestion tax” AND ”city” | |
| G | ”distance based pricing” OR ”distance-based pricing” AND ”city” | |
| H | ”toll roads” AND ”city” | |
| I | ”mobility credits” AND ”city” | |
| J | (1) ”parking price” OR ”parking fee” OR ”parking charge” OR ”parking rate” AND ”city” -airport -hotel<br>(2) city parking price increase | Unique characteristics of fee or exceptionally high |
| K | ”public transport” AND ”fee reduction” OR ”fare reduction” AND ”city” | |
| L | ”x-minute” OR ”15-minute” AND ”city” | Clear marketing of X-minute ciy |
| M | ”circulation plan” OR ”circulatie plan” AND ”city” | |
| N | (1) ”parking minimums” AND ”city”<br>(2) ”parking maximums” AND ”city” | Exceptionally early and high thoroughness |
| O | ”P&R” OR ”P+R” AND ”city” | |
| P | - | - |
| Q | (1) Union Cycliste Internationale<br>(2) Micro Walkability Index | Cities that have won the UCI award and the top 3 MWI cities |
| R | ”shared micromobility” OR ”shared micro mobility” OR ”shared bicycles” OR ”shared scooters” AND ”city” | |
| S | ”shared cars” AND ”city” | |
| T | ”MaaS” OR ”mobility as a service” OR ”multi-modal planners” AND ”city” | Advanced and finished platform |
| U | ”information campaign” AND ”car reduction” AND ”city” | |

**Table A.2:** Population statistics all cities

| | Population | Size $(km^2)$ | Density (population/$km^2$) | GDP per capita | Passenger cars /1000 inhabitants |
|---|---|---|---|---|---|
| **Antwerp** | 530,630 | 205 | 2,595 | 46,900 | 494 |
| **Brussels** | 188,737 | 32,6 | 5,789 | 66,200 | 428 |
| **Ghent** | 265.086 | 156 | 1,697 | 36,300 | 408 |
| **Leuven** | 102,236 | 56,6 | 1,806 | 51,731 | 812 |
| **Copenhagen** | 644,431 | 88.25 | 7,302 | 86,489 | 202 |
| **Helsinki** | 664,028 | 214 | 3,099 | 53,665* | 320 |
| **Paris** | 2,145,906 | 106 | 20,321 | 65,200 | 430 |
| **Strasbourg** | 290,576 | 78.3 | 3,713 | 42,000 | 668* |
| **Berlin** | 3,677,472 | 891 | 4,127 | 45,074 | 337 |
| **Bremen** | 563,290 | 318 | 1,772 | 54,826 | 438 |
| **Hamburg** | 1,853,935 | 755 | 2,455 | 70,620 | 435 |
| **Heidelberg** | 159,245 | 109 | 1,463 | 58,819 | 580* |
| **Nuremberg** | 510,632 | 186 | 2,739 | 62,997 | 580* |
| **Bologna** | 387,971 | 141 | 2,754 | 38,981** | 535 |
| **Milan** | 1,354,196 | 182 | 7,454 | 50,786** | 510 |
| **Venice** | 250,369 | 416 | 602 | 30,208 | - |
| **Valletta** | 5,157 | 0.840 | 6,139 | 33,037* | 621* |
| **Amsterdam** | 921,468 | 188.3 | 4,894 | 92,461 | 247 |
| **Groningen** | 238,179 | 185.6 | 1,283 | 50,734 | 354 |
| **Houten** | 50,580 | 54.94 | 920.6 | 60,987 | 508* |
| **Utrecht** | 367,951 | 93.83 | 3.921 | 60,987 | 300 |
| **Bergen** | 289,330 | 445 | 650.2 | 44,670** | 516* |
| **Oslo** | 709,037 | 426.3 | 1,663 | 73,854** | 499 |
| **Barcelona** | 1,627,559 | 99.1 | 16,422 | 29,942 | 350 |
| **Bilbao** | 345,749 | 41.4 | 8,353 | 33.715 | 430 |
| **Madrid** | 3,277,451 | 606 | 5,410 | 34,821 | 518 |
| **Götheborg** | 596,841 | 448 | 1,333 | 59,060 | 280 |
| **Stockhom** | 984,748 | 187 | 5,260 | 62,815 | 398 |
| **Zurich** | 427,487 | 88 | 4,859 | 100,162 | 350 |
| **Birmingham** | 1,144,919 | 267.8 | 4,275 | 32,231 | 357 |
| **Glasgow** | 1,026,880 | 274 | 3,741 | 42,720 | 370 |
| **London** | 8,799,728 | 1,572 | 5,597 | 65,019 | 350 |
| **Oxford** | 162,041 | 45.6 | 3,553 | 49,900 | 340 |

# B

# Interview protocol

*Thesis Johannes van der Lee – Success factors and barriers from car reduction*
Thank you for agreeing to this interview for my thesis at the TU Delft regarding success factors and barriers in the implementation of car reducing measures. Before we begin, is it okay if I record the meeting?
In this research, I will be performing case studies on 4 different European cities and interviewing different relevant stakeholders in the policy implementation in each city. I will asking several questions regarding your experiences in the process.

1. How does your city look at the current number of cars in the city?
   (a) Which measures?
   (b) Why have these measures been selected?
2. Online I found that your city has implemented these car-reducing measures, namely *those in section B.1*.
   (a) Is that correct, have these measures been taken? Have I missed any?
   (b) Why have these other measures been selected?
3. Please tell me about these moments and processes of implementation of these measures.
   (a) Where did the measures originate?
   (b) Take me through the implementation process, what happened?
   (c) What are key moments in the implementation?
   (d) What happened during these key moments?
   (e) Which stakeholders were involved in each key moment and what was their position?
   (f) What caused the outcome in each key moment?
   (g) What were the problems during each key moment?
   (h) How did you overcome these problems?
4. How long did it take to implement the measures?
   (a) When did it begin and from when were you involved?
   (b) What happened when you were involved, what were issues?
5. In the literature I have found several other success factors that can be present in the implementation of such measures. Do you find that they also existed in the implementation of your measures?
   (a) **Sticks and carrots** entails combining measures that are experienced as positive and negative. By including measures that benefit the public, the acceptability of restrictive measures increases.
      - Did you use a strategy of sticks and carrots?
      - What would you define as the carrot?
      - How was the carrot defined?

  - Which stakeholders were involved?
  - What was the timeline in communicating and implementing the sticks and carrots?
  - How was the funding organised for the sticks and carrots?
- Did it work? Did the people who receive the stick also receive the carrot?
  - Were they satisfied with the carrot?

(b) **Showing openness and flexibility in negotiations** entails allowing negotiations, exemptions and adjustments to increase the likelihood of implementation.

- Are there parts of the measures that you would have liked to be different?
- How did these parts end up in the final implemented measures?
  - Which stakeholders were involved?
  - What was the timeline? When were the stakeholders involved and when were these decisions made?
- Was there a negotiation? How did that go?
  - Which stakeholders were involved?
  - When was that negotiation held?
  - What did the stakeholders think of the outcome?

(c) **Trials to create legitimacy and acceptance** includes both demonstrations and trials to create experience with the policy and increase acceptance.

- Was the measure implemented at once or did it happen in phases or at a smaller scale first?
  - Why/why not?
  - Who was involved in that decision?
  - When was that decision made?
- What was different about the first implementation when compared to the final version?
  - What was the timeline?
- How was the first version received?
  - By who/which stakeholders?
- What caused the measure to be implemented further?
  - How was it received then?
  - Do you think the gradual implementation had an effect when compared to an immediate full implementation?

(d) **Applying communications strategically** to promote particular behaviour and integrate the perceptions of relevant parties. This can be done through a consultation process.

- When were the other stakeholders involved in the process of implementation?
  - How were they informed/involved?
  - Why were they involved at that time?
  - What were they told?
  - Why were they told that?
  - What were their responses about the measure and the timing?
- When was the public informed of the measure?
  - How were they informed/involved?
  - Why were they involved at that time?
  - What were they told?
  - Why were they told that?
  - What was their response?

(e) **Timing and windows of opportunity** can be crucial in the success of a policy. Sometimes a policy can only be implemented if all the circumstances are right.

- Was the measure proposed earlier?
  - What was the response?
  - What was different about the situation then, causing it not to be implemented?
- Was the measure implemented immediately or did something else need to happen before?
  - What happened and why did that make the difference?

- How were the politics regarding the issue and the solution? Did politicians immediately recognize the problem and the solution?
  - What changed in order to implement the measure?
  - Who was involved in that change?
- How long before the measure was implemented, was it known to the stakeholders?
  - Why was it not implemented earlier?

(f) **organising responsibility and set-up** is done by establishing new organisations if it is expected that existing organisations may repel new ideas. A new working unit can shift responsibility and ensure implementation.

- When it was decided to implement the measure, who was responsible?
  - Were the tasks divided?
  - Why were they responsible?
  - How was that decided?
  - Did all involved stakeholders agree?
- Were the responsible stakeholders capable of handling all tasks surrounding the measure?
  - Did they manage to complete their tasks?
- - Were the traditional/original organisations/divisions kept or were organisational changes made?
  - Why was that?

6. In the literature I have found several other barriers that can be present in the implementation of such measures. Do you find that they also existed in the implementation of your measures?

   (a) **Path dependencies** where routines, fixed infrastructure or assumptions can cause a certain route to be followed while better alternatives exist.
   (b) **policy & institutional barriers** where conflicts in interests between interested parties can halt the implementation of measures.
   (c) **Legal barriers** where existing legal frameworks can make it difficult to introduce new measures or technologies. Also, who gets to manage the budget.
   (d) **Resource barriers** exist when policymakers cannot find sufficient financial and organisational backing, or have insufficient land or material resources.
   (e) **Social and cultural barriers** appear when the level of acceptance is low among those concerned, resulting in public and political resistance.

7. Besides the discussed measures that were successfully implemented, do you know of any measures that were proposed but not successfully implemented?

   (a) Can you tell me more about how the process went?
   (b) What do you think caused the non-fulfilment?
   (c) Did the barriers that I found in literature also exist?

   - **Path dependencies** where routines, fixed infrastructure or assumptions can cause a certain route to be followed while better alternatives exist.
   - **policy & institutional barriers** where conflicts in interests between interested parties can halt the implementation of measures.
   - **Legal barriers** where existing legal frameworks can make it difficult to introduce new measures or technologies. Also, who gets to manage the budget.
   - **Resource barriers** exist when policymakers cannot find sufficient financial and organisational backing, or have insufficient land or material resources.
   - **Social and cultural barriers** appear when the level of acceptance is low among those concerned, resulting in public and political resistance.

8. Who were involved in the implementation process?

   (a) Who else should I speak to about it?

9. We have reached the end of my questions. Are there any questions I missed or is there anything else I should know, perhaps regarding the implementation process?

Thank you very much for your participation. I will send you a summary of our conversation and you can send me a message if you would like to make any changes. Can I contact you later if I discover that I missed anything important?
Also, feel free to reach out if you would like to add anything.

**Table B.1:** Cities and their leading measures

| **City** | **Leading measure** |
|---|---|
| Antwerp | Dividing into section |
| Copenhagen | Infrastructure for active mobility |
| Helsinki | Multi-modal planners |
| Bremen | Shared cars |
| Milan | Infrastructure for active mobility |
| Oslo | Car-free zone |
| Barcelona | Limited traffic zone |
| Stockholm | Car-free zone |
| Birmingham | Mobility credits |