CHALMERS
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Replacing Parking with Mobility Services?

A Study of Gothenburg's Flexible Parking Requirements and Work with Mobility Agreements

Master's thesis in Master Programme Infrastructure and Environmental Engineering

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Abstract

For decades urban planning has revolved around prioritizing the private car, and cities are therefore facing major environmental and social challenges. One possible tool to address these challenges is to reduce the number of residential parking spaces, and instead offer mobility measures that can act as an alternative to the private car. In Sweden, this work is usually governed by agreements between municipalities and developers. The city of Gothenburg introduced such agreements, called *mobility agreements*, in 2018, and are now seeking to understand how concerned stakeholders are experiencing the work related to the mobility agreements. There is also a desire to understand how to evaluate developments with low parking requirements and mobility measures. Therefore, this study aims to evaluate the work connected to mobility agreements. Furthermore, the study also aims to investigate how Swedish municipalities can evaluate developments with low parking requirements and mobility measures. To fulfill the aim, 14 interviews have been carried out; 10 with developers who have entered mobility agreements and 4 with mobility service actors. The study also includes an analysis of which mobility measures that are included in the agreements, and how the final parking requirements compares to car ownership. Furthermore, a literature study was performed to identify potential evaluation approaches and methods.

Regarding stakeholders' experiences with the mobility agreement, the process is perceived as less flexible than it actually is. It is predicted to be more challenging to work with mobility agreements in condominiums than in tenancies, since the responsibility for managing the measures falls on individuals. In order to avoid that the developers' level of ambition sets the standard of the measures, the requirements for the mobility measures should focus on quality rather than quantity. Furthermore, when selecting measures and assessing the parking ratio, the prerequisites in the area should be considered to a greater extent. In some projects, the mobility agreement has contributed to reducing the parking ratio to a level which is below the current car ownership in the surrounding area. How municipalities should evaluate depends on what the purpose of evaluation is; verifying the compliance of the parking requirements and/or mobility measures, checking the usage level of the measures, or assessing the measures effect on the parking demand.

Keywords: Parking management, parking requirements, mobility management, mobility services, flexible parking requirements, urban planning, evaluation.

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Sammanfattning

I decennier har stadsplanering kretsat kring personbilen, och städer står nu inför stora utmaningar kopplade till miljö och social hållbarhet. Ett möjligt verktyg för att hantera dessa utmaningar är att minska antalet parkeringsplatser för bostäder, och istället erbjuda mobilitetsåtgärder som kan fungera som ett alternativ till personbilen. I Sverige styrs detta arbete genom avtal mellan kommuner och exploatörer. Göteborgs Stad införde sådana avtal, kallade *mobilitetsavtal*, år 2018. Staden önskar nu förstå hur berörda aktörer upplever arbetet med mobilitetsavtalen, och hur de på sikt kan följa upp projekt med låga parkeringstal och mobilitetsåtgärder. Denna studie syftar därför till att utvärdera arbetet med mobilitetsavtalen, samt att undersöka hur kommuner kan utvärdera projekt med låga parkeringstal och mobilitetsåtgärder. För att uppnå syftet har 14 intervjuer genomförts; 10 med exploatörer som har ingått i mobilitetsavtal och 4 med mobilitetsleverantörer. Studien inkluderar också en analys av vilka mobilitetsåtgärder som ingår i avtalen, och hur de slutliga parkeringstalen förhåller sig till bilinnehavet i projektområdena. Vidare har en litteraturstudie gjorts för att identifiera potentiella tillvägagångssätt för uppföljning.

Gällande aktörernas erfarenheter av mobilitetsavtalet så upplevs processen mindre flexibel än vad den faktiskt är. Det förutspås bli mer utmanande att arbeta med mobilitetsavtal i bostadsrätter än i hyresrätter, eftersom ansvaret för att hantera åtgärderna hamnar på individerna i bostadsrättsföreningens styrelse. För att undvika att exploatörernas ambitionsnivå sätter standarden på åtgärderna så bör kraven för mobilitetsåtgärderna fokusera på kvalitet snarare än kvantitet. Vidare bör områdets förutsättningar beaktas i större utsträckning vid val av åtgärder och bedömning av parkeringstal. I vissa projekt har mobilitetsavtalet bidragit till att minska parkeringstalet till en nivå som är lägre än det nuvarande bilinnehavet i det omkringliggande området. Hur kommuner ska följa upp beror på vad syftet med uppföljning är; kontrollera efterlevnaden av avtalen, mäta användargraden för åtgärderna, eller utvärdera om arbetet bidrar till att minska parkeringsbehovet.

Nyckelord: Mobility management, parking management, parkeringstal, flexibla parkeringstal, mobilitetstjänster, stadsplanering, uppföljning, utvärdering.

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Emma Johansson & Nicole Rosendahl
Gothenburg, June 2021

Glossary

Building permit - Bygglov

Condominiums - Bostadsrätter

Condominium association - Bostadsrättsförening

Condominium board - Bostadsrättsföreningens styrelse

Detailed development plan - Detaljplan

Developer - Exploatör

Mobility agreement - Mobilitetsavtal

Mobility measure - Mobilitetsåtgärd

Mobility service - Mobilitetstjänst

Multi-family residential buildings - Flerbostadshus

Parking utilization rate - Parkeringsbeläggning

Stand-alone houses - Småhus

Tenancies - Hyresrätter

Urban Transport Administration - Trafikkontoret

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1
Introduction

This first chapter presents the background of the study, and provides an introduction to parking and mobility as these are the core subjects in the thesis. The chapter also presents the study's aim, research questions, delimitation and the outline of the report.

1.1 Background

Since the 1950s the car has had a central role in urban planning (Lundin, 2008). The car has since then been seen as the main solution to personal travel, resulting in a transportation system dominated by the private car. The prioritization of cars in urban planning has caused cities to spread out, which further has increased the car dependency. Today we are facing the consequences caused by this type of planning, for example global warming, local emissions, congestion and health issues (Newman & Kenworthy, 2015). Cities around the world are now trying to transition towards a more sustainable transportation system to address these challenges.

While technical solutions such as electrification play an important role in reducing the environmental impact from cars, those innovations will not be able to stand on their own (Graham-Rowe et al., 2011). Reducing the amount of vehicle kilometers traveled by car, or replacing those kilometers with other transportation modes such as public transportation, bicycling and walking, are also necessary. Cities are therefore seeking to make the private car a less attractive mode of transport, while simultaneously offering other mobility solutions that can act as alternatives to private car ownership (Steg, 2007). Such solutions could include for example car sharing, good conditions for bicycling, or facilitating home delivery services.

Some common measures for reducing the attractiveness of owning a private car includes congestion charges and taxation of fuel (Gallo & Marinelli, 2020). These types of policies focus on cars when they are moving, but in fact cars remain parked around 95 percent of the time, making parking management an important tool for reducing car ownership (D. Shoup, 2011). Several studies have shown that availability of parking influences the car ownership (C. T. McCahill et al., 2016; Guo, 2013b; Guo, 2013a). By limiting the supply of residential parking, it is therefore possible to reduce the car ownership.

In Sweden, parking became a larger part of urban planning during the 1950s when the car ownership increased in a rapid rate (Lundin, 2008). This created a urgent need for regulations on how to arrange parking in new house construction. Parking norms inspired by American conditions, where car ownership was considerably higher, was therefore introduced. A few years later the already high parking norm was increased even further, despite surveys indicating that the current norm was higher than required to meet the car ownership. The parking norm have since then characterized urban planning and car ownership in Sweden. Since parking spaces take up a lot of space, approximately 15-30 m^2 per parking space (Duvanova et al., 2016), these type of parking requirements are a barrier to creating denser cities. A dense city is often highlighted as an important strategy for increasing the share of trips that are done with more sustainable transportation modes (Newman & Kenworthy, 1996). Therefore more surface efficient alternatives like underground garages are desirable. However, this increases the construction cost drastically which also means that the housing cost for residents increases (D. Shoup, 2011). In the end, this cost will be distributed between all the residents, even those who do not own a car.

Today, parking in Sweden is governed by law through the Swedish Planning and Building act, which states that the municipalities should ensure that a site is built so that sufficient amount of parking is provided on or nearby the site (SFS 2010:900). A recent Swedish Government Official Report did however suggest that the legislation should be revised so that focus is shifted from offering parking to offering opportunities for mobility (Samordning för bostadsbyggande, 2021). Many municipalities have already started to work with mobility in new residential construction by transitioning from fixed minimum parking requirements to *flexible parking requirements* (Boverket, 2018b). Flexible parking requirements means that the number of parking spaces are determined by assessing the parking requirements for each development depending on for example location, accessibility and target group. Many municipalities also allow for further reductions of parking spaces if the residents are offered mobility measures that can act as an alternative to owning a private car.

As many mobility measures are non-physical measures, the municipalities are not able to regulate them in the detailed development plan (Boverket, 2018a). Therefore, mobility measures are usually regulated in some type of agreement between the developer and the municipality. Such agreements have been implemented in the City of Gothenburg, where new mobility and parking guidelines were adopted in 2018 (Göteborgs Stad, 2018). The city refers to these agreements as *mobility agreements* and until now (January 2021) around 60 agreements have been established. Only a few of the developments with mobility agreements have been completed and therefore it is too early to evaluate whether the mobility measures have contributed to more sustainable travel habits among the residents. However, it is relevant for the city to evaluate how the concerned actors are experiencing the work related to the agreements, in order to improve the agreement and the guidelines.

Although evaluation of the effects of the mobility measures is not possible yet, it is important that the city of Gothenburg prepares for how such evaluation processes could look like. Studies on parking and mobility management emphasize that monitoring the effect of the measures is important because more knowledge is needed about if the combination of low parking requirements and mobility services eventuate in more sustainable travel behavior (Persson & Larsson, 2021; Sprei et al., 2020). The evaluation process can however be more challenging than expected, and municipalities seem to be unsure about how to evaluate these developments in a strategic manner (Samordning för bostadsbyggande, 2021; Franzon, 2018). Hence, simple methods and indicators along with clear routines and responsibilities are needed (Roth et al., 2018).

1.2 Aim and Research Questions

The aim of the study is to evaluate the City of Gothenburg's new mobility and parking guidelines. The evaluation will focus on how concerned actors are experiencing the work related to the mobility agreements. Furthermore, the study aims to investigate how municipalities can follow up and evaluate developments with flexible parking requirements and mobility measures. In order to fulfill the aims, the following research questions will be investigated:

1. How do stakeholders experience the mobility agreement process in new residential developments? (RQ1)
2. What impact do mobility agreements have on the parking requirements in new residential developments? (RQ2)
   (a) What are the final parking requirements in developments with mobility agreements, and how does it compare to car ownership?
   (b) Which mobility measures are included in the established mobility agreements and why?
3. How can municipalities follow up and evaluate developments with flexible parking requirements and mobility measures? (RQ3)

1.3 Delimitation

The study focuses on evaluating the City of Gothenburg's mobility and parking guidelines in regards to off-street parking. The mobility and parking guidelines includes parking requirements for both cars and bicycles. Furthermore, parking requirements are given for residential and other facilities such as offices and schools. This study will however only include parking requirements for cars in residential developments.

1.4 Outline of the Report

- Chapter 1, *Introduction:* Presents the background of study as well as the study's aim, research questions and delimitation.
- Chapter 2, *Mobility and Parking Management:* Provides essential theory for the study's topic such as mobility and parking management.
- Chapter 3, *Methodology:* Describes how the study was conducted in terms of research design, research process, data collection and data analysis. The chapter also discusses ethical concerns and reflects on the study's chosen methodology.
- Chapter 4, *Parking- and mobility management in the city of Gothenburg:* This chapter provides an introduction to the current laws connected to parking and mobility for municipalities in Sweden and governing documents about mobility- and parking management in Gothenburg. Furthermore, a detailed description of the mobility and parking guidelines of Gothenburg is presented.
- Chapter 5, *Evaluation Processes:* Presents literature which focuses on the importance of evaluation and it's processes. Examples of evaluation processes in earlier developments are presented, as well as a review on how other municipalities are working with evaluation processes in terms of flexible parking requirements and mobility services.
- Chapter 6, *Result and Analysis:* This chapter presents the result from the different data collections. The main part is the results from interviews with developer and mobility service actors, where the result has been divided into different research categories. The results also includes a compilation of selected mobility measures from the mobility agreements. It also presents the level of parking space reduction each established mobility agreement has resulted in and how this corresponds to the car ownership in the surrounding area.
- Chapter 7 *Discussion:* This chapter contains a discussion of the study's result.
- Chapter 8, *Conclusions:* This chapter present the study's final conclusions and answers the research questions. Recommendations for future research are also included in this chapter.

2

Mobility and Parking Management

This chapter provides descriptions of concepts related to mobility and parking, and how they are correlated. Additional descriptions regarding mobility measures, parking and construction cost as well as parking requirements are presented.

2.1 Mobility

To understand the concept of mobility one needs to understand the definition. A definition of mobility is *"the ease of a movement of a passenger [...], when mobility is high, activities are less constrained by distance"* (Rodrigue, n.d.). Mobility can be provided by different means, on different levels. A basic form of mobility that has always been available to humans is walking. In modern times we have increased our level of mobility significantly using bicycles, cars and planes. Demand for mobility has also increased, as it is more accessible.

Historically, providers of mobility have remained disconnected. Many have covered their mobility needs themselves, using privately owned modes of transport. External providers of mobility such as public transport providers or airlines provide services used by many, but often they do not interact with each other. Today this is changing. An important reason for this is that sustainability is high on the agenda today, requiring more efficient use of resources. Another is that technology now enables new services and combinations of services. (Rodrigue, 2020). Urban planning also plays a role in providing some of the prerequisites for sustainable mobility, since the design and density of the built environment impacts mode choice. The most obvious example is that lower density leads to higher private car use (Serrano-López et al., 2019). The reverse is also true, where the right planning policies allow for higher use of public transport and more trips by foot or bicycle (Hickman et al., 2013). Within the context of urban planning, providing parking is an often used way of creating a prerequisite for mobility using cars or bicycles.

Within urban planning, the term Mobility Management (also called Transportation Demand Management or TDM) is used to describe strategies that increase transportation system efficiency by changing travel behavior. It may affect travel frequency, mode, destination or timing. For example, shifting from peak to off-peak. These strategies includes mobility management measures which are often soft mea-

sures, such as using information or charges to change behavior (Litman, 2021b). A shifted focus within urban planning from parking to mobility can provide benefits for involved parties. Private property owners and developers can also reap benefits from the flexibility this provides. Calculations by Fastighetsägarna (2018), an interest group for property owners, show that it is a cost saving to work with more flexible mobility rather than traditional parking in property projects. In the same way, local governments, and thus tax payers, can benefit in publicly funded projects.

2.1.1 Mobility Measures

Measures designed to increase transportation efficiency are often called *mobility measures*. They can be divided into hard measures, that change the physical environment, or soft measures, that influence behavior using information, charges, subsidies, preferential treatment or other soft means. The former are often part of urban planning since they deal with the physical environment, while the latter are often a result of mobility management (Litman, 2021b). Both the soft and the hard measures are designed to provide additional services for inhabitants, with the aim to make everyday life both simpler and more sustainable. Some encourage people to try something new or different, with the hope of creating a new habit. Others focus on improving conditions such as physical infrastructure to influence choices.

Hard, physical, measures that are part of the urban planning process can be restricting the number of new parking spaces that are constructed within a development. Even temporary structural changes can have a beneficial long term impact since they encourage people to try and possible get a more positive perception of for example public transport and other mobility alternatives (Fujii et al., 2001).

Soft, nonphysical, measures, as part of a mobility management package are then often added to enhance the effect of the physical measure (Samordning för bostadsbyggande, 2021). Examples of such mobility measures are providing access to car sharing services or making public transport more accessible. Studies show that drivers that go from private car ownership to using car sharing services drive shorter distances and on fewer occasion. Each shared car replaces several privately owned cars, thus providing the same mobility with lower use of resources and space for parking. Developments that have been built completely without private car parking show that the residents had lower car ownership than the average in comparable areas (Persson & Larsson, 2021). Another example of a soft measure that provides mobility is providing free public transport for a limited time. In a study (Fujii & Kitamura, 2003) drivers who were given bus tickets used the bus more frequently (20%) and decreased their car usage. It was also shown that the drivers attitude towards traveling by bus changed in a positive direction when they tried it. The study also shown that with repeated habitual behavior, it is more likely that people would perform the new behavior and weaken the former one, if persuaded to try it for a time. Thus measures do not necessarily need to be permanent to have a lasting impact.

Mobility services that provide shared modes of transport, such as cars and bicycles, can be divided into two different categories; public or private. Private services are often connected to a property or a workplace and access is therefore limited to a certain group of people. An example of this is a car pool only accessible to residents in a development. Meanwhile, public services are open to everyone. An example of a public service in Gothenburg is *Styr & Ställ* which is a open bicycle sharing service (Göteborgs Stad, n.d.-a).

2.2 Parking

Every car trip starts and ends at a parking space, thereby parking can be seen as a prerequisite for mobility, or even a mobility measure, since it allows for mobility using private cars. This section provides an overview of parking as a concept, and highlights the role of parking in our cities.

2.2.1 Parking and Construction Costs

Although this study mainly focuses on residential off-street parking, it is important to highlight that there are other types of parking as well. On-street parking is provided by local authorities along public roads (Rye & Koglin, 2014). The local authorities sets guidelines for how the parking can be used, for example by charging a fee or give a maximum number of hours that you may park there. The majority of the parking space in cities are however off-street parking. It can be divided into three categories; public off-street parking, private non-residential off-street parking and private residential parking. Public off-street can be either public or private owned and can be used by anyone as long as they follow the regulations that are stated by the owner. Private non-residential off-street parking includes parking which is associated with a certain development, for example an office or a shopping center. The parking is intended to be used only by the people who work or visit the development which is connected to the parking. Private residential parking includes off-street parking which is associated with flats or houses, and is intended to be used only be the people living in those flats or house.

The construction cost for off-street parking is highly dependent on which type of parking facility that is constructed. In Sweden the estimated construction cost per parking space is 10 000 - 15 000 SEK for ground parking, 50 000 - 100 000 SEK for multistorey car parks and 350 000 - 450 000 SEK for an underground garage (SOU 2021:23). To receive full cost recovery for the construction cost, developers will typically distribute the cost between the residents as a part of the housing cost, which means that even those who do not own a car has to pay for parking (D. Shoup, 2011). Developers are not able to charge the full cost for the parking spaces, as this would result in too low revenues, since residents are not willing to pay the full cost (Larsson et al., 2018). The low willingness to pay the full cost for parking, is partly due to that other types of parking are underpriced (D. Shoup, 2011).

2.2.2 Parking Requirements

In general the local authorities will have parking requirements which regulates how much off-street parking that should be built in new developments (Rye & Koglin, 2014). Other commonly used terms for parking requirements are parking standard, parking norm or parking ratio (Mingardo et al., 2015). For residential developments the requirements are usually given as the number of parking spaces that should be arranged per apartment, room or bed, but they can also be given as parking spaces per unit of floor area (C. McCahill & Garrick, 2014). Minimum parking requirements has historically been the most common policy tool used to regulate off-street parking in new developments (D. C. Shoup, 1999). They state the minimum number of parking that should be arranged, and aims to meet the peak demand for parking and avoid spillover to on-street parking (C. McCahill & Garrick, 2014). However, they often result in excessive amounts of parking which is higher than the actual demand (Litman, 2008). During the last decades, minimum parking requirements have received critique for subsidizing cars, causing urban sprawl, deteriorate urban design, increase development costs, et cetera (D. Shoup, 2019).

An alternative to minimum parking requirements are maximum parking requirements which instead specifies the maximum number of parking spaces that can be arranged at a site (Litman, 2021a). Maximum requirements can also be used to limit the parking supply in an area, in which case it is called Parking caps. Maximum requirements can be considered as unnecessary since it is usually the removal of the minimum parking requirements that has the largest impact on the parking supply(Litman, 2021a). They can however be helpful to speed up the process towards a more balanced parking supply. Others advocate for a market based approach were minimum parking requirements are abandoned, and cities instead regulate the pricing of on-street parking to find a balance between supply and demand (D. Shoup, 2019).

Another option is to use flexible parking requirements which means that the requirements are adjusted based on different factors (Litman, 2021a). Examples of factors which commonly are used to adjust the requirements are geographic location, accessibility to public transportation, car sharing services onsite or nearby, housing tenure, demographics, walkability and bikeability, or if certain parking management strategies are adopted. Parking management strategies can include for example unbundling, sharing or increasing the price for the parking. Approximate adjustments for these factors are presented in Table 2.1. Unbundling means that the cost for parking is reported separately instead of being included in the monthly housing cost (Manville & Pinski, 2020). Sharing means that the parking facility is shared by different users whom preferably have different peak demand periods. For example a parking facility can be used by residents during nighttime and weekends, and by office staff during day time (Litman, 2021a). To ensure that parking spaces can be used by others, the residents are therefore provided with a parking permit instead of receiving a personal parking space (Larsson et al., 2018). The parking requirements can also be reduced if the developer finances different mobility measures which can reduce the car ownership (Boverket, 2018a). The construction cost for parking is

thereby exchanged for the cost of mobility measures, which means an economic saving for the developer.

Table 2.1: Examples of factors which can be used to adjust the parking requirements, and typical adjustments for these factors. (Table adapted from Litman, 2021a)

Factor	**Typical adjustment**
Geographic location	Requirements are adjusted to reflect the actual vehicle ownership
Accessibility to public transportation	Requirements are reduced with 10 % if less than 400 meters to frequent bus service
Car sharing services onsite or nearby	Residential requirements are reduced with 10-20 % if car sharing vehicles are located onsite, or 5-10 % if located nearby.
Housing tenure	Requirements are reduced with 20-40 % in rentals versus owner-occupied housing.
Demographics	Requirements are reduced with 20-40 % if the residents are young (under 30) or elderly (over 65).
Walkability and bikeability	Requirements are reduced with 5-15 % in areas with very high walkability and bikeability
Pricing	Requirements are reduced with 10-30 % if cost recovery prices are used, and 10-20 % if parking cost is unbundled.
Sharing	Depends on the peak demand for other types of land use, but reductions of 20-40 % reductions are often possible

3
Methodology

This chapter describes how the study was conducted in terms of research design, research process, data collection and data analysis. The chapter also includes a discussion about ethical concerns and reflections on the chosen methodology.

3.1 Research Design

This study has utilized a mixed method research approach since both qualitative and quantitative data is required to answer the research questions. According to Creswell (2006), mixed method research provides a better understanding of the problem compared to using qualitative and quantitative approaches on their own. Mixed method research can also create a synergistic effect which gives a better overview of the outcomes of the mobility agreements (Hesse-Biber, 2017). In this study, the qualitative part included semi-structured interviews and a literature review. The quantitative part of the study included analysis of established mobility agreements and car ownership data. How each method has contributed to the research questions is illustrated in Figure 3.1. The qualitative and quantitative data sets have been managed in parallel during the research process.

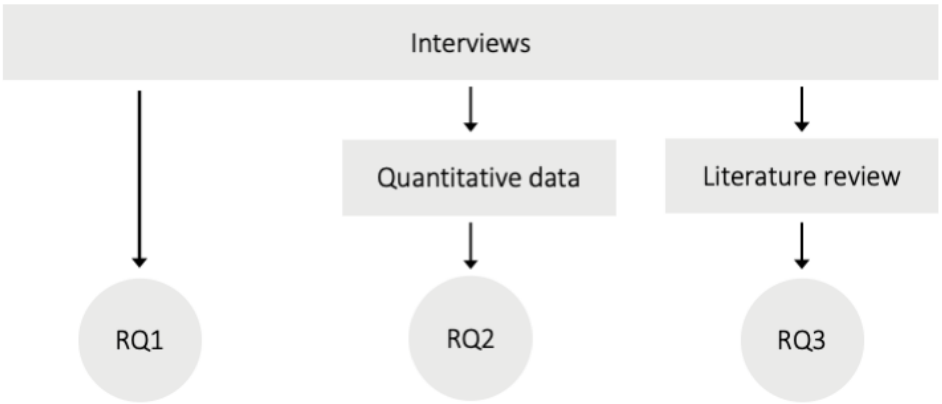

Figure 3.1: Overview of the utilized methods and how they contribute to each research question.

3.2 Research Process

The topic for this thesis was proposed by the Urban Transport Administration of Gothenburg. In January the topic was developed to make it more suitable for an academic report. In parallel with this an initial literature review was conducted to gain knowledge about the topic and previous research. In February a methodology for the study was developed. During this time, selection of interviewees was determined and an interview guide was developed. Thereafter, interviews were held with the different stakeholders. Additional literature review, as well as collection and analysis of quantitative data, was conducted in parallel with the interviews. Once the interviews had been analyzed, all the collected data was used to form a discussion with the aim of answering the research questions and eventuate in our conclusions. In June, the thesis was presented and opposed at Chalmers University of Technology, and the report was thereafter finalized.

3.3 Data Collection and Analysis

The primary data for this study was collected using semi-structured interviews, and by compiling quantitative data from established mobility agreements and mobility and parking investigations. The mobility and parking investigations provides a more detailed description on how the parking ratio for a development is determined based on location, project specific conditions and mobility measures. This is further described in Section 4.3. To complement the primary data, secondary data was collected. The secondary data included a literature review, and data on car ownership and number of dwellings in different areas in Gothenburg. Bryman and Bell (2011) states that secondary data collection is a beneficial method for research projects with time restriction and limited data availability. Due to this study's mixed research method, the data collection and data analysis were conducted in different ways. This will be further described in the sections below.

3.3.1 Literature Review

An initial literature review was performed to identify different concepts about parking and mobility. During the literature review different sources were utilized including government reports, books and scientific publications. To find relevant literature in research databases key words such as *mobility management*, *parking management*, *flexible parking requirements* and *mobility services* were used. The literature review also included a detailed study of the City of Gothenburg's documents on parking and mobility management.

Furthermore, 17 other Swedish municipalities parking and mobility guidelines were reviewed to identify if they mentioned anything about evaluation. The selection of municipalities was based on a recent review by Envall and Johansson (2020). The authors studied 16 large Swedish municipalities to identify their requirements for parking and mobility in new residential developments. 15 of the studied municipalities enabled a parking ratio reduction if mobility measures were included in the

development, and these municipalities were included in our review. We also included two other municipalities (Haninge and Sunbyberg) which were identified as interesting after speaking to a supervisor and attending to a webinar about mobility and parking.

To further gain knowledge about how developments with flexible parking requirements and mobility measures can be evaluated, previous evaluations of such developments were studied to identify what methods they utilized. Based on a review of developments with low parking requirements by Sprei et al. (2020), 5 Swedish developments which included some kind of mobility service were selected for further studies. 2 of these developments were evaluated in the same article, meaning that 4 evaluation documents/articles were reviewed.

3.3.2 Interviews

According to Bell and Bryman (2011), qualitative research is mainly conducted through interviews. In this study, semi-structured interviews were used. Semi-structured interviews allows for follow-up questions and adjusting the questions according to the situation (Bryman & Bell, 2011). Since the subject this thesis explores has not been studied much previously it was hard to predict answers or in what direction the interviews would lead. Being able to adjust and follow up during the interviews was therefore important. At the same time, having a structure made sure we started out following the same themes for all interviews, making it possible to compare when analyzing.

To determine which developers that were relevant for interviews, the study utilized the qualitative data about the established mobility agreements. According to Bell and Bryman (2011), this is a common way of using quantitative research to facilitate qualitative research. In addition to the data described in Section 3.3.3, more detailed information about projects were a mobility agreement had been established was collected. This included which phase the projects currently were in, if the apartments were rentals or condominiums, and how many apartments that were included. This data was mainly collected by studying the developers websites. The aim when selecting which developers to interview was to include both private and public developers. Furthermore, both large and small projects, as well as tenancies and condominiums were included in the study. It was considered favorable if the developer had entered into several agreements since this could allow them to share experiences from more than one project. In total 10 developers were interviewed. These are presented in Table 3.1, along with if they are a public or private organisation, and if they build condominiums and/or tenancies. The developers were also given a number, which was used when compiling the results to ensure anonymity.

Table 3.1: Summary over the interviewed developers, type of organisation (Public or Private) and type of tenure (Rentals, Condominiums or a combination).

Developer	Organisation	Type of tenure
Respondent 1 (R1)	Public	Tenancies
Respondent 2 (R2)	Public	Tenancies
Respondent 3 (R3)	Public	Tenancies
Respondent 4 (R4)	Private	Tenancies
Respondent 5 (R5)	Private	Condominiums
Respondent 6 (R6)	Private	Tenancies/Condominiums
Respondent 7 (R7)	Private	Tenancies/Condominiums
Respondent 8 (R8)	Private	Tenancies/Condominiums
Respondent 9 (R9)	Private	Tenancies/Condominiums
Respondent 10 (R10)	Private	Tenancies/Condominiums

During the interviews with the developers, questions concerning mobility actors and their role was brought up. Therefore the researchers also decided to interview mobility actors, to get a better understanding of how these actors are experiencing the work related to the mobility agreements. The actors included were the public transportation authority Västtrafik, a car sharing company, a bicycle sharing company and one company which offered both car and bicycle sharing. This ensured that not only one company's opinions were addressed, but still kept the number of interviews fairly low due to limited amount of time. The sharing service companies were companies which were known to offer their services to developers or condominium associations in Gothenburg. The mobility actors that were interviewed are presented in Table 3.2, along with what services they offer. The car and bicycle sharing actors were also given a number, which was used when compiling the results to ensure anonymity. Actor 1 and Actor 2 focuses on private sharing services, while Actor 3 only offer public sharing services.

Table 3.2: Summary over the interviewed mobility service actors and the type of service the offer.

Mobility service actor	Service
Actor 1	Bicycle sharing (Private sharing)
Actor 2	Bicycle and car sharing (Private sharing)
Actor 3	Car Sharing (Public sharing)
Västtrafik	Public transportation authority

The developers and actors were approached through e-mail. The e-mail included the background to the study, what type of topic the interview would include and more practical aspects of the interview. A couple of days before the interview the interviewees received the question by e-mail. The interview guide was initially written in Swedish as all of the interviews were held in Swedish. The questions where

discussed with both the Urban Transport Administration and the supervisors. The interview questions are presented in Appendix A. Due to the Covid-19 pandemic the interviews were conducted digitally. All the interviews were therefore conducted through Microsoft Teams, except for one interview with a car sharing company who instead answered the questions by e-mail. The Teams interviews lasted between 30 to 60 minutes. The interviews were recorded in order to be able to focus on the interviewee and relevant follow-up questions. Before the interviews started, the interviewees were asked if they approved that the interview was recorded.

The recordings were used to analyse the data collected during the interviews. Conventional content analysis was used to analyse the data and divide the result into different content categories. According to Shannon and Hsieh (2005) this approach is a good method for studies with limited amounts of earlier research. It is also favorable when having interviews with open-ended questions, or when the direction of the interviews isn't known beforehand. Since the data itself provides the basis for finding themes, key concepts and categories there is no risk of creating limitations from categories set by previous theory. The analysis was conducted in two steps. First listening through the interviews as a whole to get an overview, taking notes of important information in each interview or recurring information. Then in the second step a more detailed analysis based on both the original interviews and the notes taken for each interview taken together as a whole. In this second step themes, categories and key concepts were identified.

3.3.3 Quantitative Data

When the study started in January 2021, the Urban Transport Administration had recently made a compilation of all of the mobility agreements that had been established until then. In total the compilation included 47 agreements concerning residential development projects. The compilation included data such as which project that each mobility agreement concerns, name of the developer or property owner who signed the agreement, date for signing the agreement, which mobility measures that were chosen, and the parking ratio reduction due to the mobility measures. The data about which mobility measures that had been selected in the established agreements was used to illustrate how frequently each measure had been selected. By combining these results with the interviews, it was possible to gain a better understanding on why certain measures are selected more or less frequently than others. For one of the larger projects which involved 15 blocks, the developer had signed one mobility agreement for each block, but the mobility measures were the same in each to agreement. These 15 agreements were therefore counted as only 1 when analyzing which measures that were selected most frequently. Another project also included 2 agreements with the same measures, and was therefore also counted as 1 agreement. This meant that 32 projects were analyzed.

To assess the final parking ratio for the projects it was necessary to collect data from mobility and parking investigations. The investigations provided data about the parking ratio reduction in each analysis step and the final parking ratio. The

investigations were usually publicly available on the municipality's website, but for some projects the Urban Transport Administration had to assist by searching for them in their internal systems. For some projects the mobility and parking investigation followed the old parking and mobility guidelines, and the mobility agreement had been established at a later stage. However, since the study focused on the new guidelines, only projects which followed the new guidelines were included when assessing the final parking ratio. It is also important to address that in some cases the parking ratio data was hard to find. This is mainly due to the fact that there is no designated administration that is responsible for the parking issue. For some projects it was therefore not possible to determine the parking ratio. In total, parking ratios for 15 projects with mobility agreements were collected.

To enable comparison of the final parking ratio and the current car ownership, data about car ownership and number of dwellings were collected. The data was retrieved from the City of Gothenburg's website for statistics (Göteborgs Stad Statistikdatabas, 2020a; Göteborgs Stad Statistikdatabas, 2020b). The car ownership data included leased cars but did not include company cars (Representative from the "Statistics and analysis" at the municipality of Gothenburg, personal communication, May 26, 2021). The dwelling data was divided into 4 different residential types; multi-family residential buildings, stand-alone houses, special dwellings (e.g. student dwellings and retirement homes) and other houses (buildings not aimed for residential purposes). The multi-family residential buildings, stand-alone houses, special dwellings were summarized to achieve the total number of dwellings. The data was available for different types of area divisions and for this study the second most detailed division was used, called *Primärområde*. In total Gothenburg is divided into 96 *Primärområden*. For each of the 15 developments where the final parking ratio could be determined, the corresponding *Primärområde* was identified. For each *Primärområde*, the car ownership was divided with the total number of dwellings. The data is presented in in Appendix B.

3.4 Ethical Considerations

The study has been conducted according to Chalmers University of Technology's regulations for master thesis projects, *Föreskrifter för examensarbete på civilingenjörs-, arkitekt- och masterprogram* (Chalmers Univerity of Technology, 2016). According to the regulations the students should consider that the study is performed in an ethical way. The ethical aspects have mainly been considered during the interview process, to make sure that the interviews were carried out without causing any harm to the interviewees.

The interviewees voluntarily accepted whether they wanted to participate in the study or not. Furthermore, all of the interviewees and the company which they represented were kept anonymous in the report. In addition to anonymizing everyone in the report, the interviewees were also anonymized towards the Urban Transport Administration. This was in order to ensure that the interviewee's would answer the question honestly and not feel uncomfortable to address uncertainties about

the agreements. The interviewees were informed about the anonymization when they approved to participate in the study and right before the interview started. Västtrafik, the public transportation authority in Gothenburg, was however not possible to keep anonymous since Västtrafik is the transit authority in the region. Finally, all of the recordings from the interviews will be deleted once the thesis has been approved.

3.5 Reflections about Chosen Methodology

This study included used several types of quantitative data, and it is important to address that this comes with several uncertainties. The data over the selected mobility measures was provided by the Urban Transport Administration of Gothenburg in January 2021, and changes in the agreements may have taken place since then. Furthermore, additional mobility agreements have probably been established during the months when the thesis was written, and the selection frequency might therefore have changed during this time. With regards to the parking ratios for the 15 developments, it is not certain that the collected data is the real outcome, since changes might occur before the developments are completed. The quality of the car ownership data could also be questioned since the data did not include company cars, meaning that the car ownership most likely is underestimated. On the other hand, an underestimation could be considered as better than an overestimation, since we were interested in seeing if the parking number was lower than the car ownership.

To answer research question 2 about the mobility agreements impact on the parking ratio, we chose to look at actual data from 15 developments were mobility agreements had been established. Another option could have been to solely look at the potential outcomes in the different zones (see Figure 4.2). This could have saved us a lot of time since it was quiet time consuming to find the parking ratios for the developments. For the purpose of this study, we did however found it more interesting to look at the actual outcomes since we had no prior knowledge on how the actual outcomes would look compared to potential outcomes. We were however only were able to collect parking ratio data for 15 developments. If more data had been collected, more general conclusions could possibly have been drawn.

Furthermore, to increase the synergy effect of using both qualitative and quantitative approaches, an alternative could have been to only interview the developers behind the projects were parking ratio data was collected. We did however find it more important to get a wide variety of respondents, and at the time when the interviewees were selected we were not aware of the difficulties in finding the parking ratios. Furthermore, it is not sure that the developers behind the 15 studied developments would have wanted to participate in the interviews.

Since the focus of the study primarily has been on stakeholder's experiences, the result will inevitably be somewhat angled to their point of view. The Urban Transportation Administration has been able to comment on some of the issues raised during the interviews during the research process, but these comments are in most

cases not a part of the report. It is therefore of importance that the reader understands that there is more than one side to this matter. Furthermore, the developers who have been more satisfied with the mobility agreement might not be as visible as developers with many objections. An alternative way of collecting the stakeholder's opinions would have been to use a survey. This could have enabled us to reach out to more developers. However, since the ambition was to gain a deeper understanding of an unexplored topic, interviews were considered to be more suitable. Furthermore, since it is an unexplored subject, we were not aware of exactly which questions that were relevant to ask. Therefore semi-structured interview was used to provide the opportunity to adapt the questions during the interview.

4

Mobility and Parking Management in the City of Gothenburg

This chapter provides an introduction to the current laws and processes connected to parking and mobility for municipalities in Sweden. Further, it describes governing documents about parking- and mobility management in Gothenburg.

4.1 Swedish National Physical Planning Laws

In Sweden, the parking issue is governed by law through the Swedish Planning and Building act (SFS 2010:900). It states that each municipality is responsible to ensure that sufficient parking is provided on or nearby the site. What is considered as sufficient is decided by the municipality, and is often defined through a parking policy. The law further states that the property owner is responsible for meeting the parking requirements. The requirements are defined by the municipality during the planning process based on the amount of parking that the use of the property gives rise to. This means that it is the municipality's responsibility to plan for sufficient parking, but not to physically arrange it, unless the municipality itself is the property owner. In some cases, a third party is also involved, for example an external actor that offers mobility services. Some parts of the division of responsibility may need to be regulated by agreements. Figure 4.1 visualizes the relationships between the parties.

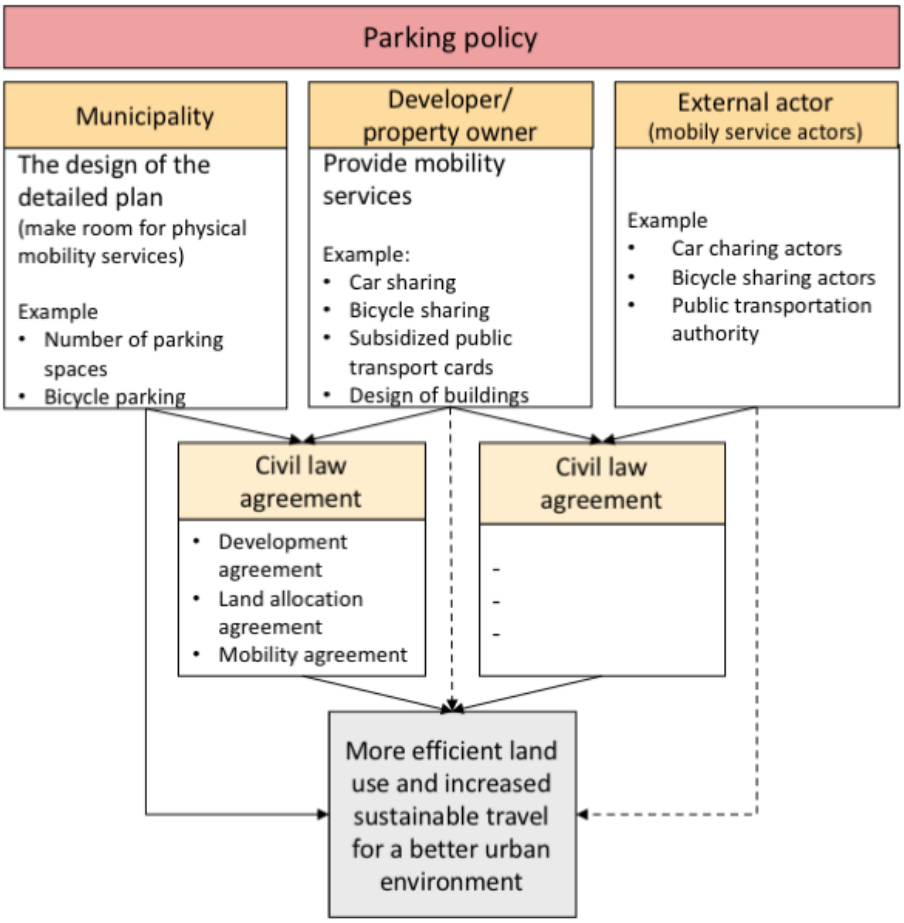

Figure 4.1: Illustration over the relationship between the parties. (Figure adapted from Boverket, 2018a).

4.2 Documents Governing Parking in Gothenburg

The City of Gothenburg has several strategical and political documents concerning spatial planning. One important document regarding urban planning is the Strategy for development planning (Göteborgs Stad, 2014), which aims to strive for density in the city. The traffic strategy is corresponding document for transportation planning. The document is based, among other things, on an increased proportion of users of public transport, cycling and walking with a reduced number of car journeys as a result (Trafikkontoret, 2014).

Gothenburg's parking policy is another important document (Göteborgs Stad, 2009). The policy was developed to provide Gothenburg a more focused approach to how to manage parking issues in the city. The policy includes guidelines for parking regarding cars, bicycles and commercial traffic, on both streets and properties. The

main goal with the policy is to contribute with accessibility for everyone in the city. Moreover it should encourage people into more sustainable transportation modes, such as public transportation and biking. The policy also includes several measures where the aim is to steer the city towards these goals. Examples of mentioned measures are; promotion of car sharing services, regulation through parking fees and prioritization of urban environment instead of providing parking opportunities.

On an operational level, there are two other documents that are of importance. The first is *Guidelines for mobility and parking in the city of Gothenburg*, which were adopted in 2018 and thereby replaced the previous version from 2011 (Göteborgs Stad, 2018). In addition the guidelines, there is also a document with more detailed instructions called *Instruction for Guidelines for mobility and parking in the city of Gothenburg* (Göteborgs Stad, 2019). The instructions provides additional support on the application of the guidelines. Although the guidelines and instructions are two separate documents, this thesis will use the term *guidelines* to refer to both the guidelines and the instructions. The guidelines are supposed to form the basis for assessment of appropriate mobility measures and appropriate area for parking of bicycles and cars (Göteborgs Stad, 2018). With the guidelines, it is ensured that the mobility and parking aspect is handled in a similar matter, and that the parking ratio is flexible and project specific. What mainly distinguishes the most recent guidelines from the old version is the option for developers to reduce the number of parking spaces by implementing different types of mobility measures. This is further described in Chapter 4.4.

How to handle the question about parking and mobility in a new development project can be raised either in the detailed development plan process, or during the building permit process (Göteborgs Stad, 2019). This usually means that a *Mobility and parking investigation* is performed for the project. The municipality can however decide that the project can qualify as an exception and therefore proceed without a proper mobility and parking investigation. An exception can be made only if the project fulfils a number of different criteria, for example being located in central areas, being a complement to existing buildings and include a maximum of 30 apartments. If the projects qualifies as an exception, the project is given a parking ratio of zero and the developer has to sign a mobility agreement where they commit to provide mobility measures according to the *Base package*, see Section 4.3.4.

4.3 Mobility and Parking Investigation

The purpose of the mobility and parking investigation is to assess suitable mobility measures and suitable amount of parking space for cars and bicycles (Göteborgs Stad, 2019). The mobility and parking investigation includes four steps: *Normal range*, *Assessment of location*, *Project adaptation* and *Mobility measures*. The following subsections explains how the parking ratio for cars is adjusted in each step. Figure 4.2 illustrates the potential parking ratio for each zone depending on which adjustments that are made in each step. Easily accessible car parking for people with

disabilities should always be arranged in addition to the parking requirements that are determined during the parking- and mobility investigation. The opportunity to arrange loading and unloading must also always be fulfilled.

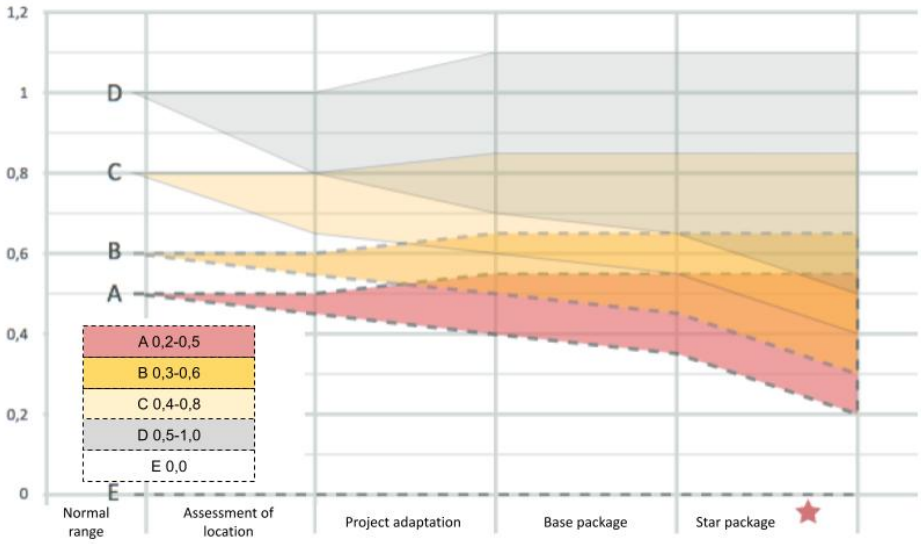

Figure 4.2: Illustration over the potential parking ratio in the different zones. (Figure adopted from Göteborgs Stad, 2019).

4.3.1 Step 1: Normal Range

The first analysis step determines which parking ratio that will be used as a starting point for the assessment (Göteborgs Stad, 2019). This is determined based on where in the city the planned development will be located. The municipality is divided into five zones, A-E, shown in Figure 4.3.

A. The inner city including Älvstaden, the extended inner city and strategic nodes (Angered centrum, Gamlestaden och Frölunda torg) (0.2-0.5)
B. Prioritized development areas in the intermediate city (0.3-0.6)
C. The rest of the intermediate city (0.4-0.8)
D. Other parts of Gothenburg's mainland (0.5-1.0)
E. Archipelago without physical connection to the mainland (0.0)

The parking ratio for each zone is given as a range where the upper value in the range should be used as the start value (Göteborgs Stad, 2019). This value is approximately in line with the car ownership among households living in apartment buildings in the specified zone. The lower value in the range represents the minimum potential ratio after performing analysis step two, three and four. Visitor parking is included in the normal range. If the project area overlaps several zones, the general rule is to select the zone with the lowest starting ratio. Exceptions can however be made if a very large project area is overlapping the border of several zones.

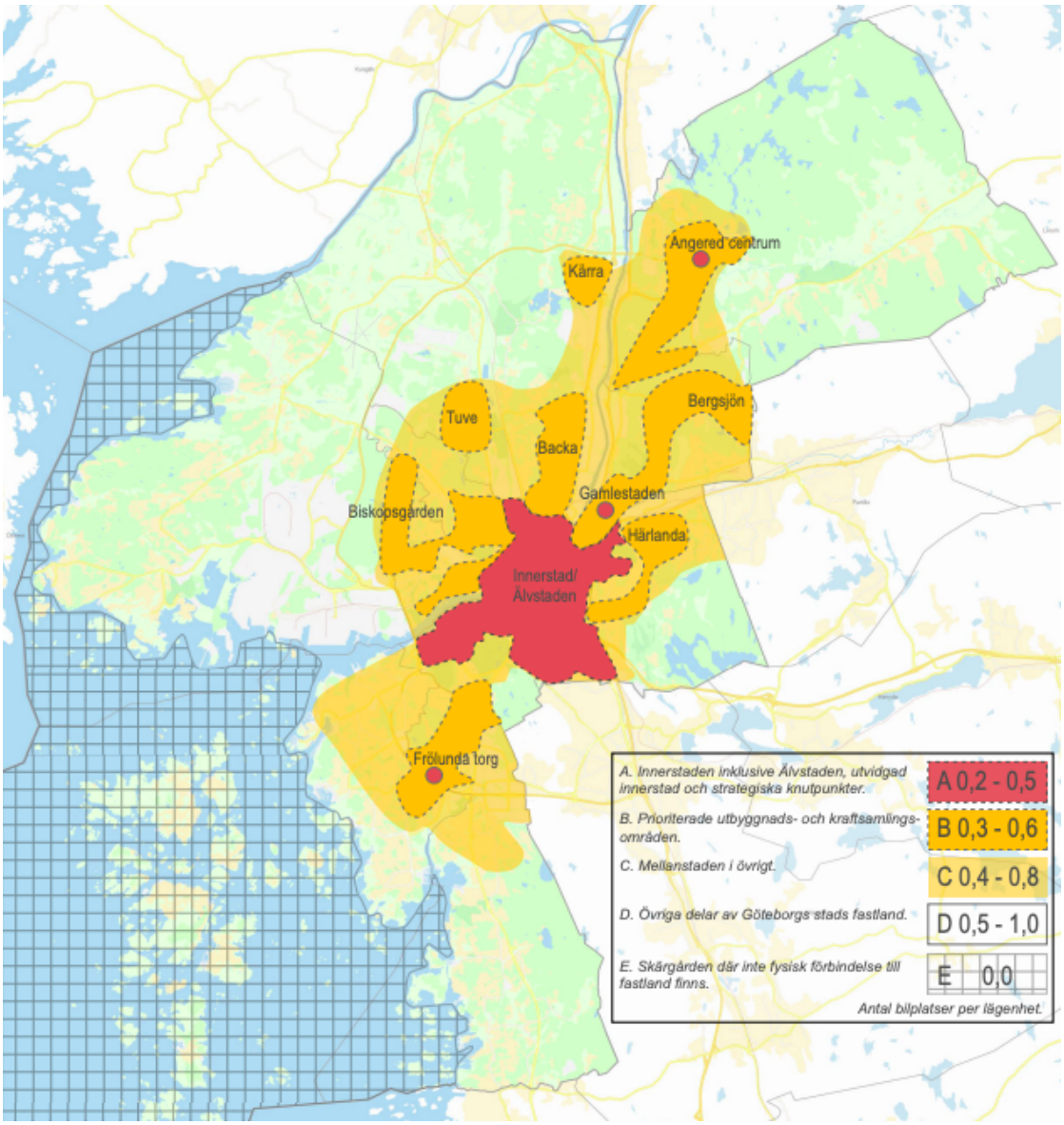

Figure 4.3: Overview of the different parking zones and the corresponding normal parking range for residential housing (Göteborgs Stad, 2019)

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4.3.2 Step 2: Assessment of Location

The second analysis step includes a more detailed assessment of the location of the development (Göteborgs Stad, 2019). If the overall accessibility in the development area is good the parking ratio can be reduced, otherwise it remains at the same level as in step 1. According to the guidelines good accessibility includes good availability to good public transportation, good bicycle infrastructure, services and other urban activities, or other conditions that contributes to good mobility, for example car sharing services in the surrounding area. All of these aspects should be met in order for the project to qualify for a reduction. Typically, a radius of around 400 meters around the development is used when assessing the level accessibility. The assess-

ment should be based on future changes in the area, and not the current situation.

The location assessment can provide a reduction of the parking ratio in two steps (Göteborgs Stad, 2019). If the location assessment shows that the overall accessibility is good, zone A and B are given a reduction of 0.05 compared to the initial value, and zone C and D are given a reduction of 0.1 compared to the initial value. For Zone C and D an additional reduction is possible if the project is located close to a large central district area (*Stadsdelscentrum*). In that case, a reduction of 0.05 is made for zone C and 0.1 for zone D.

4.3.3 Step 3: Project Adaptation

The third step includes an analysis of project specific conditions (Göteborgs Stad, 2019). This includes the composition and size of the apartments and the opportunities for co-usage of parking spaces. This step can result in either a reduction, increase or remain unchanged against the parking number. The parking ratio is reduced when the apartments are predominantly small, either studio apartments or one bedroom apartments. A reduction if also possible when the project provides extra good opportunities for shared use of parking spaces or if there are other conditions that can result in lower car parking demand. The number of parking spaces is increased if the predominant proportion of the apartments are large or if there are particularly poor opportunities for shared parking spaces. The reduction or addition depends on which zone the project is located in. In zone A, B and C the parking ratio is either increased or reduced with 0.05, and in zone D the parking ratio is increased or reduced with 0.1.

4.3.4 Step 4: Mobility Measures

The fourth analysis step includes proposing different solutions to obtain good mobility (Göteborgs Stad, 2019). This step is voluntarily for the developer, and enables an even further reduction of the parking requirements. The more mobility measures that are implemented by the developer, the greater the reduction. It is the developer's responsibility to carry out the mobility measures. The purpose of mobility measures are to provide new opportunities for mobility and reduce the need for owning and using a car. Furthermore, the purpose is to contribute to the conditions for a good economy in housing construction and attractive urban environments.

The mobility measures are divided into different categories; Information, Public transportation, Bicycle, Car and Other (Göteborgs Stad, 2019). Examples of mobility measures that are included are free public transportation cards, car sharing vehicles and bicycle service rooms. It is also possible to propose own measures. The city is open to new innovative mobility solutions and to applications of *Mobility as a Service*. The mobility measures are divided into two different packages, the *Base package* and the *Star package*. All developers who wants to use mobility measures to reduce the parking ratio needs to implement all of the measures that are included in the *Base package*, see Table C.1 in Appendix C. This results in a reduction of 0.05

parking spaces per apartment. Thereafter, it is possible to select measures from the *Star package* to further reduce the parking ratio, see Table C.2 in Appendix C. Some of the measures in the *Star package* are marked with a star (*). These measures are more demanding and provides higher incentives for sustainable travel behavior. The selection of measures from the *Star package* is performed in three steps where each step contributes to a reduction of 0.05 parking spaces per apartment. This means that the maximum reduction that mobility measures can provide is 0.2, see Figure 4.4.

- The *Base package* gives a reduction of 0.05.
- Additional reduction of 0.05 if three measures from the *Star package*, out of which at least one is starred, are implemented.
- Additional reduction of 0.05 if two measures from the *Star package*, out of which at least one is starred, are implemented.
- Additional reduction of 0.05 if one starred measures from the *Star package* is implemented.

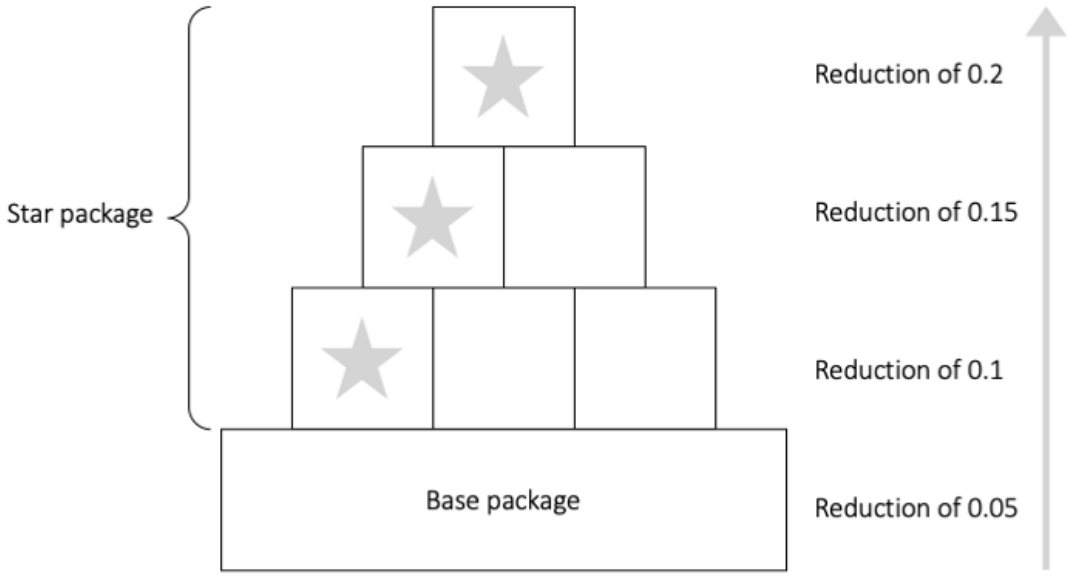

Figure 4.4: Illustration on how the selection of mobility measures if performed (Göteborgs Stad, 2019)

4.4 Mobility Agreement

Mobility measures are regulated in a agreement, called *mobility agreement* (Göteborgs Stad, 2019). The agreement is an addition to the detailed development plan and building permit, since these only allow for regulation of physical measures such as the area that is assigned for parking. The mobility agreement is signed between the municipality of Gothenburg through the traffic committee and the developer with the property rights, as the mobility agreement must follow the property. The agreement period should be at least 10 years, in order to ensure that the measures can contribute to accelerating the transition toward sustainable transportation. The

agreement shall be an appendix to an agreement on land lease or a development agreement. The agreement must also be included in the building permit application. If for some reason there is a breach of agreement, the *Mobility agreement* states that *"If a mobility agreement is not complied the city has the opportunity to take actions as specified in the mobility agreement".*

The first adoption of mobility agreements began before the new guidelines were adopted in 2018 during the planning process for the initiative *Bostad 2021* (D. Backelin, personal communication, February 11, 2021). Bostad 2021 is the name of a collaboration that started in 2014 between the City of Gothenburg and 27 building companies (Göteborgs Stad, n.d.-b). The aim with this initiative was to build 7000 new homes, in addition to the regular production, until 2021. Developers which were involved in *Bostad 2021* projects wanted the option to reduce the number of parking spaces by offering mobility measures, and thereby being able to increase the number of apartments being built (D. Backelin, personal communication, February 11, 2021). Based on this request, the Urban Transport Administration developed a mobility agreement, in order to ensure that developers would implement and maintain the mobility measures. The developers requested that the requirements should be quantitative, for example stating the number of bicycles that should be included in a bicycle sharing system, and the municipality therefore tried to fulfill that request. In 2018, when the new parking and mobility guidelines were adopted, the option of establishing a mobility agreement became a permanent addition.

In the agreement, there are additional explanations for some of the measures, for example what a physical gift could be. Additional information regarding renegotiation is also included, where the developer has the possibility to renegotiate once a year. The property owner's responsibilities as well as what happens if the agreement is not fulfilled are also included in the agreement, to clarify to the partners what the agreement entails.

4.4.1 Evaluation of Mobility Agreements

According to the guidelines, it is important to evaluate how the mobility measures work in order to gradually increase the knowledge (Göteborgs Stad, 2018). To understand how various measures affect the demand for cars and parking spaces, the city therefore seeks to evaluate the mobility agreements. The Urban Transport Administration is responsible for evaluating the compliance with the mobility agreements. There are today no clear directives on how the evaluation should be applied in practice, but according to the guidelines the evaluation should include:

- Survey on completed mobility measures and car parks received the intended standard and duration.
- Statistics on vehicle ownership and where vehicles are parked at the property.
- Fee levels for car parking on the property and in its immediate area.
- Satisfaction among residents and tenants with mobility measures.

In terms of evaluation in regards to the developers responsibility, some mobility measures in the *Base package* and the *Star package* should be evaluated annually to make sure the demand is met (Göteborgs Stad, 2019). These are:

- *Parking spaces for car sharing vehicles*
- *Parking spaces for cargo bicycles*
- *Bicycle sharing with special bicycles*
- *Car sharing vehicles*

5
Evaluation

This chapter aims to present the importance of evaluation in regard to spatial development and which evaluation methods that is being used in residential developments. Furthermore evaluation in other municipalities in regards to their mobility and parking management is presented.

Evaluation is important in policy making since knowledge of what policies work and how, informed by evaluation and thus based in evidence, is essential when governing complex social systems (Sanderson, 2002). It is also important to remember that evaluation is as much about identifying good practice as that which does not work. Especially when policies or programs evolve into new areas, trying new concepts as pilot studies or even prototyping concepts the need for clarity is great. In these cases developing an evidence base though evaluation, preferably long-term, is essential to understanding the impact of the policies. In this case, regarding mobility measures in the City of Gothenburg, which it could be argued is prototyping, a form of evaluation close to the practitioners focusing on how implementation can be improved would be a reasonable model of policy evaluation and learning.

5.1 Evaluation in Residential Developments

This section presents which evaluation approaches and methods that have been used in the five Swedish developments that have been studied. The names of these developments are: Viva (Lund, 2020), Porslinsfabriken (Antonson et al., 2017), Fullriggaren (Stjärnkvist, 2013), Haninge and Älvsjö (Johansson et al., 2019). The purpose is to highlight certain indicators which have been studied, and how the data has been collected.

In terms of evaluation methods all of the studied evaluations have used residential surveys as an evaluation tool (Lund, 2020; Antonson et al., 2017; Stjärnkvist, 2013; Johansson et al., 2019). In Viva, Porslinsfabriken, Älvsjö and Haninge the evaluations also included interviews with the residents. This enabled them to gain additional insight and opinions from the residents. The surveys often start with background information such as apartment size, age, gender, family situation, level of education and occupation and income. In the evaluation of Porslinsfabriken they also collected data from Gothenburg's statistics website, comparing the demographics with the surroundings and the whole city (Antonson et al., 2017).

The five surveys have a fairly low response rate, in the studied evaluations it ranges from 19 % to 55 % . In two of the developments, Viva and Fullriggaren, the propensity to respond seemed to be higher among those who owned a car. Stjärnkvist (2013) suggested that this could be due that those who own a car feel more concerned about the topic of the survey, and Lund (2020) stated that car owners in general are older and older people tend to answer surveys to a higher extent. One should therefore be careful when drawing conclusions from surveys.

5.1.1 Travel Habits

The evaluations often aim to identify if the residents have changed their travel habits when moving to the new development, or if their travel behavior is more sustainable than average. In the case of Haninge and Älvjö this was done by sending out two surveys; one before the residents had moved in and one after (Johansson et al., 2019). The authors also highlighted that they sent out the pre- and post-survey during the same time of the year, in order to be able to compare the results. They also made sure that they could track which respondents that answered both surveys. In the evaluation of Viva, the author also used both a pre- and post-survey, but were not able to see which respondents that answered both surveys (Lund, 2020). In Porslinsfabriken and Fullriggaren the authors only used a post-survey (Antonson et al., 2017; Stjärnkvist, 2013).

In the evaluations of Haninge and Älvsjö the respondents were asked to report their travel behavior in a travel diary where the respondent reported all of their trips during a week (in the pre-survey) or a day (in the post-survey) (Johansson et al., 2019). The survey used to evaluate Porslinsfabriken included questions about how often they traveled with different modes both before and after moving to Porslinsfabriken (Antonson et al., 2017). In Fullriggaren the evaluation did not include travel patterns (Stjärnkvist, 2013).

The evaluation of Viva used an app-based travel survey to assess the travel behavior after moving in (Lund, 2020). 15 % of the adults in the condominium association participated and shared data about their travel habits in the app. The results from the app survey was compared to Gothenburg's travel survey. However, Lund (2020) highlights that Gothenburg's travel survey is performed using paper surveys, compared to Viva which used an app. In general app-based travel surveys will capture more trips, especially trips by foot where up to four times more trips can be registered.

5.1.2 Car Ownership

A common theme in all of the residential surveys is to investigate car and/or bicycle ownership among the residents, both before and after moving in. In Haninge and Älvsjö the respondents were also asked if they had access to a car in some other way than owning one (Johansson et al., 2019), and in Viva (Lund, 2020) and Fullriggaren (Stjärnkvist, 2013) they also asked the residents about future plans about car

ownership. In Viva, the response rate in the post-survey was fairly low and therefore the car ownership was also assessed by searching for addressees on the website ratsit.com where private individual car ownership is available (Lund, 2020). This data did however not include leased car and company cars which means that car ownership is likely to be higher than what is reported in the evaluation. The number of cars per person in Viva was compared to the average number of cars per person in Gothenburg using data from *Statistics Sweden (SCB)*. In Porslinsfabriken, the car ownership among the residents was compared with statistics on car ownership for the surrounding area and for the whole city of Gothenburg (Antonson et al., 2017). In this case, Gothenburg's largest area division at the time of the evaluation was used, called *Stadsdelsnämndsområden)*.

5.1.3 Parking Habits and Costs

As previously mentioned, one of the purposes of a minimum parking requirement is to ensure that the parking supply is enough to avoid spillover (C. McCahill & Garrick, 2014). Therefore, a common theme in evaluations where the parking requirements are lower is to assess if the residents park their cars on parking spaces outside the residential development. In Porslinsfabriken the residents were asked where they parked by pointing it out on a map, what they paid for the parking space/spaces, and general opinions about the parking situation (Antonson et al., 2017). They were also asked about the amount of time they searched for parking, and the distance between their home and the parking space before and after moving to Porlinsfabriken. 22 % of the respondent utilized parking facilities outside Porslinsfabriken, and most of these respondents were not on the waiting list for a parking space within Porslinsfabriken. It was also found that those who used parking which belonged to Porslinsfabriken paid more than twice as much than those who parked outside Porslinsfabriken. The evaluation of Porslinsfabriken also assessed the parking supply in the surrounding area and compared the costs for these parking facilities. This data was collected by searching in the city of Gothenburg's parking maps, contacting the parking companies and visiting the area. The evaluations of Haninge and Älvsjö investigated how many residents were on the waiting list for a parking space, and where those on the waiting list parked instead (Johansson et al., 2019). In Fullriggaren the residents were also asked about where they parked their bicycles (Stjärnkvist, 2013).

In Viva there are no parking spaces at all, but the evaluation still found there were 32 cars registered on the addresses belonging to the condominium association (Lund, 2020). The survey data and GPS-positions was used show where these car owners parked. In the survey for Fullriggaren the respondent where asked were they parked their car and why they had chosen that parking solution(Stjärnkvist, 2013). 42 % of the respondents parked in other parking spaces than the ones belonging to the property, and in most cases this was due to lower cost.

5.1.4 Usage of Mobility Measures

The surveys also sometimes included questions about satisfaction with mobility services, if the residents are members in the service and self-reported usage (Stjärnkvist, 2013; Lund, 2020; Johansson et al., 2019). The degree of usage of services is also often reported using data from the booking systems. In the evaluations of Viva, Älvsjö and Haninge the number of bookings per month were reported (Lund, 2020; Johansson et al., 2019). In the evaluation of Fullriggaren the mobility service usage was only based on the post-survey, where the respondents were asked whether they had joined the car sharing service and how frequently they used it (Stjärnkvist, 2013). In Viva residents had access to a *Mobility as a Service* app where they could purchase public transportation tickets (Lund, 2020). Therefore it was possible to see how many tickets that were purchased. However, most residents purchased tickets though the regular public transportation app.

5.2 Evaluation in Swedish Municipalities

This section provides a summary of what each of the 17 studied municipalities' mobility and parking guidelines state about evaluation. All of the municipalities have some kind of flexibility in their parking requirements, and enables a parking ratio reduction if mobility measures are implemented. The reduction is not always specified, but if given, it is often given as a percentage (Envall & Johansson, 2020). A summary of what is said about evaluation in each municipality's guidelines is presented in Table 5.1.

Most of the studied municipalities mention evaluation in some way in their guidelines, but the level of detail differs a lot. A few municipalities highlight the importance of evaluation, or that they need a routine for the evaluation process, but does not explain how this should be realized (Uppsala, Eskilstuna, Nacka). The responsibility for evaluation differs between the municipalities. Some address that it is the municipality's responsibility to evaluate and be responsible for the whole process (Täby, Borås). Most municipalities mention that the property owner is completely or partly responsible for evaluation of mobility measures. Some of them do not specify how the property-owner should perform the evaluation (Lund, Västerås, Linköping, Helsingborg), while some mention more specifically which indicators that should be evaluated (Norrköping, Örebro, Sundbyberg, Haninge). Malmö also puts the responsibility on the property owner, but provides the property owner with an evaluation template. Stockholm also has a system with a template which should be filled in. Based on available information the template however focuses on what parking ratios and mobility measures that are included and not the effects of these.

The aim of the evaluation also differs between the municipalities. In some cases the compliance of the parking requirements and/or mobility measures are of interest (Eskilstuna, Västerås, Linköping, Haninge). Several municipalities also mention that the mobility measures should be evaluated (Lund, Västerås, Linköping, Helsingborg, Malmö, Sundbyberg, Haninge), for example Sundbyberg addresses that the usage

level of car and bicycle sharing services should be evaluated. Some municipalities also mention in some way that they aim to understand to what extent low parking requirement and mobility measures are able to reduce car dependency and/or the demand for parking (Uppsala, Malmö, Haninge). Furthermore, Örebro mentions that the car ownership should be evaluated if a car sharing service is implemented, and Sundbyberg mentions that the parking utilization rate should be evaluated. These two evaluation approaches can also be considered to increase the knowledge about how the parking demand is affected.

Some municipalities also specify the evaluation frequency (Lund, Helsingborg, Malmö, Haninge). In Helsingborg it is only specified that the usage of car sharing services should be evaluated after five years, while Lund states that evaluation should performed be annually for ten years for all of the mobility measures. In Haninge the evaluation frequency is set to 1, 3 and 5 years and then a continuous dialogue. Malmö specifies even further by setting the frequency to 1, 3, 5 7 and 10 years after finalization of the development.

Table 5.1: Summary of what 17 Swedish municipalities mobility and parking guidelines mentions about follow-up or evaluation.

Municipality	**Comments**
Borås	The municipality should evaluate and revise the parking regulations every third year. (Borås stad, 2020)
Eskilstuna	Mentions that it is important that the municipality has a follow-up routine to ensure that the requirements about parking are fulfilled and works in practice after a few years. (Eskilstuna kommun, 2016)
Haninge	Evaluation is not mentioned in the regular parking guidelines (Haninge kommun, 2017). In the car-free development guidelines several possible evaluation activities are suggested, for example satisfaction among resident, travel habits, car ownership and where private cars are parked, comparisons with a "regular" development project with regards to energy, material and cost savings. Physical measures are controlled during the building permit application, meanwhile nonphysical measures is controlled in the end of the project. Suggested frequency for evaluation activities, after 1, 3 and 5 years, thereafter continuous dialog. Both the developer and municipality is responsible, the allocation of responsibilities is defined in an agreement. (Haninge kommun, 2020)
Helsingborg	The property owner should evaluate car sharing services five years after introduction of the service or final inspection. Five years is the minimum amount of time that the car sharing service should be offered. (Helsingborgs stad, 2021)
Jönköping	Evaluation not mentioned. (Jönköpings kommun, 2016)

Linköping	Mobility measures should be offered for at least 10 years, and the property owner should evaluate regularly and report their efforts to the municipality. The topicality, compliance och relevance of the guidelines should be evaluated in the beginning of each term of office. (Linköpings kommun, 2020)
Luleå	Evaluation not mentioned. (Luleå kommun, 2016)
Lund	The property owner should contribute to annual follow-up and evaluation of mobility measures for at least 10 years. For developments which are close to car-free the property owner should show how parking spaces can be arranged in case evaluation shows that the demand for parking has not shrunk according to the expectations. (Lunds kommun, 2018)
Malmö	Highlights that evaluation is necessary to gain knowledge about how mobility measures affect car ownership and travel behavior. The property-owner is responsible for performing the evaluation, a template for evaluation is provided by the municipality. Evaluation should occur 1, 3, 5, 7 and 10 years after finalization of the development. (Malmö stad, 2020; Malmö stad, 2021)
Nacka	Mentions that the knowledge about how mobility measures can reduce the demand for parking is limited, only a few proper follow-ups have been performed. (Nacka kommun, 2016)
Norrköping	If parking purchase is adopted, the demand should be evaluated once the agreement has expired. If needed a new agreement should be established. (Norrköping kommun, 2011)
Stockholm	Evaluation is not mentioned in the parking guidelines (Stockholms stad, 2015). The city does however have a digital system for follow-up of sustainability related requirements (Samordning för bostadsbyggande, 2021). The aspects that are followed-up with regards to transportation includes for example the parking ratio for bicycles, number of parking spaces for bicycles inside and outside, type of parking construction for cars, which mobility measures that the projects includes, number of car sharing vehicles and if the car sharing service is public or closed.
Sundbyberg	The property owner should provide the municipality with an annual follow-up which includes: Parking utilization rate for cars and bicycles, usage level of bicycle and car sharing services, usage of the mobility measures proposed by the developer and how information about mobility have been communicated. (Sundbybergs stad, 2018)
Täby	The municipality should do an annual follow-up of the availability of parking, price levels, and degree of shared use within the municipality. Parking purchases should also be followed-up. The follow-up is integrated with Täby's other methods for handling quality assurance. (Täby kommun, 2013)

Uppsala	Mentions that they need to establish a system for how property owners whom have used flexible parking numbers should measure and follow-up the demand for parking. It is also important to gain knowledge about how factors such as car sharing affects the demand for parking, in order to able to adjust the reduction factor. (Uppsala kommun, 2018)
Västerås	In the building permit, the developer should provide a plan for annual follow-up of mobility management measures. Operation and maintenance of facilities and inventory should be reported in the follow-up. Furthermore, it is stated that the effects of the new parking requirement should be followed-up in 2018 and 2020, and this follow-up should also study the outcomes of development with flexible parking numbers. (Västerås stad, 2015)
Örebro	If car sharing service is implemented, the property owner or developer should do an annual follow-up of the car ownership. (Örebro kommun, 2016)

6
Results and Analysis

This chapter presents the study's results and findings. Section 6.1 and Section 6.2 are based on the interviews with developers and mobility service actors. These two sections aims to answer research question 1; "How do stakeholders experience the mobility agreement process in new residential developments". Section 6.3 aims to answer research question 2 and its sub questions; "What impact do mobility agreements have on the parking requirements in new residential developments?", "What are the final parking requirements in developments with mobility agreements, and how does it compare to car ownership?", and "Which mobility measures are included in the established mobility agreements and why?"

- Section 6.1: Interviews with Developers
- Section 6.2: Interviews with Mobility Service Actors
- Section 6.3: Mobility Measures and Parking Requirements

6.1 Interviews with Developers

This section includes the result from the interviews with the developers, which aims to explore their experiences with the mobility agreements and its connected processes in new residential developments. The result have been divided into categories, which provides detailed information of the subject. The categories and the main findings from each category are presented in Table 6.1.

Table 6.1: Categories and the main findings from each category from interviews with developers.

Categories	Main findings
Drivers for entering mobility agreements	Economic saving, limited space, ability to build more apartments, avoid building underground garages.
Selection of mobility measures	Decision often based on cost, simplicity in implementation and management. Decision is sometimes based on the location of the property.
Implementation of mobility measures	Some questions about interpretation, and where to "set the bar". The most challenging measures seems to be public transportation cards and bicycle sharing service.
Management of mobility measures	Difficult to predict costs in the long run. Uncertainties about the responsibility, especially for condominium associations.
Evaluation of mobility agreements	Unclear what to evaluate towards the city. Planning to evaluate some of the measures themselves, for example the usage of sharing services.
Mobility agreement	Mobility measures are still perceived as a high cost for several developers.
Parking requirements	Differences between developers in terms of the satisfaction with the parking requirements. Some think they are to high, while some think that they are good. Differences occurs between the ones that builds in central areas compared to others.

6.1.1 Drivers for Entering Mobility Agreements

The main driver for entering a mobility agreement according to the respondents is the possibility to lower the parking ratio for projects. There are many different reasons why the developers want to lower the parking ratio. Several respondents state that it is because of the economic savings that are possible when building fewer parking spaces (R1, R2, R9). They also said that they want to avoid building garages and car parks due to their high cost, in particular underground garages are undesirable as they cannot be demolished or rebuilt for other uses in the future. Some developers also mentioned that with a lower parking ratio it is possible to increase the number of the apartments that are built (R1, R5). Respondent R4 highlights that in Gothenburg there is shortage on housing not on parking and therefore reasonable to lower the requirements (R2, R4) Limited space for parking within a project is also a mentioned reason (R5). In addition to these practical and economic reasons the public developers gave being part of creating a more sustainable city as a reason.

6.1.2 Selection of Mobility Measures

During several interviews it was explained that the agreement was signed a long time ago, or that another person than the one who was interviewed selected the measures. Several developers highlighted that therefore it is important that the municipality can be flexible and allow for renegotiation, since a lot can happen from the time when contract is signed until the residents move in (R1, R6, R8, R9). Respondent 9 also mentioned that since the agreement often is signed at an early stage of the planning process when for example target group is unknown, it can be difficult to consider such factors when selecting measures. Furthermore, three respondents mentioned that the person who selected the measures probably not thought about the long-term management of the measures and the competence that is needed to ensure high quality of the measures (R1, R3, R4). However, these respondents also addressed that nowadays they try to keep the long-term management in mind by involving the management department in the decision. Respondent 3 also mentioned that they nowadays have a better understanding about the purpose of the mobility measures, and thereby selects measure which they believe can contribute to more sustainable mobility.

Respondent 7 stated that they solely picked the most inexpensive measures, as they do not believe in their ability to reduce the demand for parking. The respondent also argued that the measures entails worse properties, as money could have been spent on better measures such as high quality bicycle storage, for example bicycle cabinets. The same respondent did however highlight that it is positive that the guidelines includes other measures that promotes bicycling. Other respondents also addressed that bicycle measures are perceived as good measures, or are relatively simple to implement (R6, R9). Respondent 6 highlighted that the guidelines currently are more targeted towards tenancies, and therefore aims to select measures which are easy to manage for a condominium board. Respondent 5, who also builds condominiums, addressed that for them it is easier to select measures that can be included in blueprints, rather than measures of non-physical character which requires more management. Other criteria that are taken into account when selecting measures are cost efficiency (R2, R10), ease of management (R2, R6) and ease of fulfillment (R9).

Three respondents mentioned that several mobility measures already are implemented in their ordinary business, or are easy to combine with already existing activities (R2, R4, R8). Some developers already have digital information displays in their entrances, and therefore it i easy to include *Real time displays for public transportation*. On the other hand, Respondent 7 stated that real time displays are useless and outdated, but still select it because it is simple and inexpensive. Respondent 6 also thought that real time displays are a poor measure, and therefore avoid selecting this measure. The *Annual mobility activity* is also considered to be fairly easy to combine with already existing annual activities. In terms of the *Free 90 days public transportation card for new residents*, Respondent 5 said that since the *Base package* already includes a 30 day card, it was simple to select the extended version since it would not require any additional work.

Several respondents mention that they try to select measures based on the location of the project (R2, R4, R7, R8, R10). Respondent 4 and 7, who both had developments in *Zone A*, mentioned that they chose to offer a discount on car rental services as *Property owner's proposals*. They argued that in this area, car rental is more suitable than car sharing, as most everyday errands do not require a car. Being able to rent a car for longer periods, such as weekend activities, is however more desirable for residents in these areas. Some respondents (R5, R7, R8) also addressed that it can feel redundant to implement mobility measures in an area which already have good prerequisites for sustainable mobility:

> *"If it is close to the bus [stop] it will not matter if you get a public transportation card or not. If there is accessible car sharing services around the city it is not necessary to provide free memberships, those who wants to use the service will do it anyway".*
>
> -Respondent 5

Respondent 7 therefore argued that it would be more reasonable if it was possible to credit services that already are available in the area, rather than placing a car sharing vehicle in a residential underground garage. Respondent 10 mentioned that when building in the city center the space is very limited and it might not be possible to fulfill certain requirements, in such cases the municipality has to be flexible and open for discussion. It would also be desirable with a wider selection of measures, which can suit both larger developments with courtyards, and smaller developments which only consists of single buildings in highly exploited areas. Respondent 6 suggested that increasing the cost for parking spaces could be an alternative measure. While most respondents highlighted the challenges with mobility measures in central areas, Respondent 1 also mentioned that it might not be suitable to select measures such as bicycle sharing in vulnerable areas, since the property owner might get a lot of problem with vandalism and stealing. Some respondents expressed that they would prefer if they could come up with own solutions for how to solve their residents mobility, based on their costumers needs (R7, R9). Respondent 3 also said:

> *"There are people who have the competence to challenge the Urban Transportation Administration in shaping their own content, it should not have to be the case that it is Urban Transportation Administration that has all the knowledge about what constitutes good mobility. So far we follow the lists, but the future probably contains something else. If we can show that we want something and want to contribute to this, why not open up for that?"*
>
> -Respondent 3

Respondent 5 mentioned that mobility services such as car sharing can increase the value of the development, and even could be decisive for the person purchasing the apartment. The public developers mentioned that they initially were not able to select measures which included car sharing services as they had to await a framework agreement for car sharing services. Two private developers with condominiums addressed that they have chosen to not include certain mobility measures as a part

of the agreement, but will most likely still implement the measures anyway since they are good services (R5, R6). By not including the measures in the agreement, they avoid forcing the condominium board to continue manage the service if the measure is not utilized. Respondent 5 only included the car sharing membership measure in the agreement, but is still planning to place a car sharing vehicle in the garage. Respondent 6 is planning to introduce a bicycle sharing system despite that it is not included in the agreement:

> *"We will most likely introduce a bicycle sharing system outside of the agreement and use the number of bicycles and charges that we believe in, but if it does not work out the condominium association can decide to remove it"*
>
> -Respondent 6

6.1.3 Implementation of Mobility Measures

With regards to implementation of measures some respondents mentioned that although the agreement was signed several years ago, the planning and implementation has not yet begun. It is now, when the developments are in its final stages that these issues are addressed. Respondent 7 and 10 had projects were some of the properties were finished and the residents had moved in, but most respondents were in the planning or construction phase and had not yet started to work with the implementation of the mobility measures.

Some of the developers have raised questions about interpretation of the agreement, and where to "set the bar" to fulfill the agreement. For the measure *Bicycle service room* it is not clearly stated which equipment to include (R4). Furthermore, the requirements does not state that an oil separator has to be included to enable washing of bicycles, which was discovered by one actor when it was too late to install on (R1). Another respondent questioned how to interpret requirements which are given per 100 apartments when building fewer apartments (R4). Respondent 6 which recently had signed a mobility agreement for condominiums was currently working with a lawyer to revise the agreement in order to clarify what is expected from the condominium association. Respondent 9 whom currently were building on an existing parking area also raised question about a formulation in the agreement that said that the measures should be offered to all properties that are subject to a new parking ratio.

Many measures in the *Base package* are considered to be fairly easy to implement, and several are already implemented in the developers business. This includes *Start package for new residents*, *Offer extra good bicycle parking*, *Limitation of personal parking spaces* and *Parking cost is reported separately.* However, Respondent 6 mentioned that *Limitation of personal parking spaces* is difficult to manage since they cannot control who uses the parking spaces and thereby needs more monitoring to ensure that non-residents park correctly. They will also need to provide the residents with parking permits. Therefore, they wish that is was possible to exchange this

measure for something else. The measure in the *Base package* that most respondents are concerned about is the public transportation cards, as it means a lot of administration and a high cost. Respondent 7 and 8 have interpreted the agreement as if it is enough to offer cards to the residents, and will thereafter purchase cards for those who wants it. Respondent 4 and 5 were concerned that the cards might end up on the secondary market, or are given away to friends or relatives.

Physical cards are one option when distributing the cards, but according to Respondent 1 which recently had been in contact with Västtrafik, it is difficult since the cards have a limited activation time of 30 days from the day they are made. The residents might therefore have a very limited amount of time to activate their card once they receive it. Another option is to provide the residents with a digital code which they can activate in the public transportation app *Västtrafik ToGo*, but according to the same respondent as above this causes issues with personal data. Due to the difficulties with the physical card, Respondent 10 mentioned that they from now on will use vouchers corresponding to the value of the card. The vouchers have longer activation time, which makes it a better option. Several respondents are surprised that Västtrafik does not seem to have been informed that measures related to Västtrafik's services are included in the mobility agreement. Most of the developers would prefer a digital solution with a code that can be activated in the *Västtrafik ToGo* app, preferably in a manner that enables the developer to only pay for the codes that are activated.

In the *Star package* the most problematic measure seems to be the *Bicycle sharing with special bicycles*. The impact of the service is unclear, and the investment comes with larger risks compared to car sharing services. All of the public developers described that they initially were unsure about whether they had to provide three different types of special bicycles, but after speaking to the Urban Transport Administration they got approval to only use cargo bicycles. Respondent 2 also mentioned that if you want to save space, and thereby money, the most efficient would be to only select folding bicycles as they require less space than cargo bicycles.

Several respondents have or are planning to hire an external bicycle sharing actor that can be responsible for the service. Although this is more expensive, the advantages in terms of higher quality of the service and easier management outweighs the cost. Respondent 6, whom has experience of bicycle sharing systems in previous condominium projects, also emphasized the importance of informing the residents about how the system and bicycles work. In previous pilot projects they have been able to be involved in this work, but in future projects they might have to ensure that the actor who is responsible for the sharing service takes on this task. Respondent 10 suggested that instead of providing a closed bicycle sharing service for the residents, an alternative could be to help finance a new station of for example the public bicycle sharing service in Gothenburg, *Styr & Ställ*.

Some developers have chosen to implement their own bicycle sharing system. Respondent 7 argued that there currently are no good systems for bicycle sharing on

the market and that hiring an external actor which can provide a technical system and maintenance is very costly. Therefore they have chosen to simply purchase three bicycles and will let the condominium association handle it however they want to, which according to the respondent probably means that they will not bother taking care of it. According to the same respondent, most condominiums associations thinks that the residents can purchase their own bicycles. Respondent 10 initially investigated the feasibility of solving the bicycle sharing service without an external actor, but though it was too difficult to solve in practice. Respondent 3 also addressed several challenges with bicycle sharing services:

> *"Messy measure, many actors have tried to enter the market but no one has survived. It is easy to select this measure because it sounds good, but no one can get business in it. We have had to create our own solution, but the insurance companies are not used to insure a product used by a third party. If it [the bicycle] is stolen or damaged during usage you have to try to include it in the residents own home insurance."*
>
> -Respondent 3

There are also challenges connected to car sharing services. Respondent 7 mentioned that in one project they reached out to a car sharing actor at an early stage and were given an offer which was too expensive which resulted in that they chose another actor. However a few years after the residents had moves in, the first actor reached out to the condominium board and were willing to place one of their cars on their property for free and offer the residents a discount. The fact that the municipality wants the services to be arranged before the residents move in can therefore cause unnecessary expensive agreements for developers.

6.1.4 Management of Mobility Measures

Almost all of the respondents are concerned about how they should manage the measures during ten years and who should be responsible. Many of the projects are still in development and the decisions regarding responsibility and how to manage the measures are still in progress. The respondents are also concerned about the long-term cost for managing the mobility measures, as it is difficult to estimate the costs. Including external actors to handle the management of the sharing services can be favorable as there needs to be an interest for the measure to work and operate correctly.

In general, developers who build tenancies feel more confident about the management of the measures since they already have a department which is responsible for management. However, several of the respondents who builds tenancies still addressed that they are unsure about whom within the management department that should be responsible. Respondent 2 suggested that it might be necessary to introduce a new role which aims to coordinate and be responsible for mobility within the development:

> *"You cannot only implement a lot of mobility services, you also have to learn how to work with the management."*
>
> -Respondent 2

Developers who build condominiums will eventually hand over the responsibility for the property and the mobility measures to a condominium association. These developers are concerned about if the individuals in the condominium board will be able to manage the measures properly, or if they even will have the interest to do so. Respondent 7 highlighted that it is important that the condominium board understands the purpose of the measures, otherwise they might not bother to manage them. Furthermore, Respondent 10 mentioned that it is already difficult to collect members to the condominium board, and the mobility measures results in even higher work load for the board. After all, the board members are ordinary private individuals. Respondent 6 suggested that the developers could propose to the board that they should create a role which includes responsibility for the mobility measures.

Developers who build condominiums will include the cost for the mobility measures in the condominium association's budget, in the same way as for example heating or electricity. Respondent 5 however mentioned that it will be challenging to estimate the cost for certain measures, for example public transportation cards and physical gifts, since it depends on how many residents that will move in and out during the upcoming 10 years. Two respondents mentioned that measures which can be managed by an external actor, such as car and bicycle sharing, can be favorable when developing condominiums (R6, R10). Respondent 8 and 10 both have larger developments which includes a combination of tenancies and condominiums. They will therefore have a joint management between the condominiums and tenancies, which means that they will continue to be involved in the management of the whole development. Respondent 8 therefore sees no problem in maintaining the measures for 10 years. In the case of Respondent 10, they built new condominiums in connection to their already existing tenancies, and will therefore enable their existing tenants to utilize the car and bicycle sharing services. Respondent 1 also addressed that existing tenants in a nearby development would be able to use the car sharing service, but would not be provided with a free membership.

6.1.5 Evaluation of Mobility agreements

Some developers addressed that they have a personal interest in evaluating their developments and the mobility measures, especially the public developers. For example they are interested in assessing the usage level of sharing services (R1, R2, R5, R6), see if it is possible to build with such low parking requirements (R5), which cost the measures have resulted in (R4), the satisfaction among the resident (R2, R4), the parking utilization rate (R2) and increasing their knowledge about mobility (R2). Respondent 3 also highlighted that evaluation is an important tool in order to identify if something does not work out, in which case it might be necessary to renegotiate the agreement. If the evaluation shows that the services are not utilized, it is also important that services or vehicles can be removed (R2, R6, R8). Some respondents see the opportunity to evaluate in connection with their annual mobility

activity, or along with their annual satisfaction survey among the residents (R4, R6, R10). Four respondents mentioned that they have evaluated the car sharing usage in previous developments, or development with mobility agreements that have been finalized, and have seen a high degree of usage (R5, R6, R7, R10).

With regards to evaluation against the municipality, most of the respondents stated that they are waiting for the city to specify what they are expected to evaluate and report to the city. Respondent 7 and 10 suggested that some kind of short questionnaire that the property owners could fill in would be suitable, otherwise it will be difficult for the municipality to administrate it. It is important that the process is simple, especially to ensure that tenant owner associations are able to handle it (R5, R10). Respondent 6 however addressed that the city cannot come later with demands about evaluation, if the developers were not informed about what the evaluation should include when signing the agreement. Usage data for the car and bicycle sharing service could easily be reported if there is an external actor involved (R1), and Respondent 9 said that data over the number of activated public transport cards could be reported. Respondent 2 however addressed that they will need to figure out how to evaluate the usage in their own bicycle sharing service.

With regards to evaluation of whether the property owners have fulfilled the agreement or not, two respondents mentioned that an option could be to make some kind of report or documentation with picture that shows what they have done (R4, R8). Alternatively that someone from the municipality visits the development to check for example the bicycle service room (R8). Respondent 7 argued that with the current requirements it is impossible for the city to check if the agreement is fulfilled. According to Respondent 7, the city should ask the developers to specify how they intend to solve the mobility measures by for example showing were to measures should be located on blueprints, rather than just ask them to undertake the measures.

6.1.6 Mobility Agreement

Mobility agreements as a way of reducing parking requirements are received very differently by the developers. Some claim that the mobility agreement is a good policy tool since it steers developers to take responsibility for mobility issues and contribute to societal development. Respondent 5 and 7 mentioned that the mobility agreements is a great thought, but the design of the agreement and the outcomes from it might not be the desirable. Therefore, Respondent 5 suggested that the city should have consulted concerned stakeholders before the guidelines where adopted. Respondent 10 mentioned that it is good to have a governing agreement based on legislation and policy, which they can refer to and justify to their residents why they are working with these issues. On the other hand, Respondent 6 questioned whether there is evidence that the mobility measures work and actually can reduce the demand for parking.

With regards to the agreement period, Respondent 6 highlighted that it is good

that the municipality does not require that a 10 year agreement with a car sharing company is attached when the agreement is established. The respondent prefers to work with shorter agreements in case better options comes along, and it is also inconvenient to establish an agreement several years before the residents are moving in. Respondent 10 also addressed that they prefer to not hand over long-term agreements to a condominium board. They rather start with shorter agreements of two to three years, and thereafter the condominium board has the possibility to search for better options.

Even if the main motive to enter a mobility agreement is to reduce the parking ratio and thereby save money, some developers still emphasize that mobility measures are expensive (R7, R9, R10). Some respondents also highlight that in the end, the cost for the mobility measures will be included in the rent or the sales price (R4, R6, R7), and thereby it is the residents that will pay for the measures. Respondent 4 said that this makes it somewhat unfair, since the residents who did not intend to get a car from start has to pay measures that they may not want to utilize. Respondent 6 suggested that the reason why the mobility measures are perceived as expensive could be because the cost becomes visible in the management phase instead of being an investment cost:

> *"Mobility measures are still considered quite costly, perhaps because they become an annual cost, unlike parking spaces which are seen more as an investment cost."*
>
> -Respondent 6

Respondent 7, whom desired to have an even lower parking ratio than the guidelines provides, argued that that for them the final cost will still be greater than it could have been if they were allowed to build the amount of parking spaces that they desired. Therefore they do not see the mobility agreement as a financial gain, since they have to pay for parking spaces which they will not be able to rent out, and for the mobility measures.

6.1.7 Parking Requirements

The developers who build in central areas are in general the ones who think that the parking ratio is too high, and express that the demand for parking in these areas is very low (R4, R7). Two respondents also mentioned that they have newly built garages were they currently have vacancies (R7, R9). Furthermore, Respondent 7 stated that they do not think the current parking requirements are flexible, they rather experience them as a minimum standard. Two of the respondents addressed that they would rather see that the market could decide the parking supply, since they know what will be required for their projects and the customers (R7, R9). Respondent 5 said that it would be good if the market could control, but some kind of control is needed, otherwise the results would probably be lots of housing but no parking spaces.

Some respondents think that the parking requirements are good and set on good terms (R2, R3, R6). Most respondents are however uncertain about the number of parking spaces and points out that the project's conditions, for example access to public transportation, service, apartment type, play a major role for the parking demand. Some respondents also addressed that the type of tenure has an impact on the demand for parking (R8, R10). For example Respondent 5 highlighted that in condominiums, access to parking can be an important sales argument.

Some respondent mentioned that they sometimes build on existing parking lots, which means that they will have to replace these parking spaces with new ones (R2, R3, R9, R10). Respondent 2 and 3 both stated that the current requirements about how many of the removed parking spaces that should be replaced in such cases are too high:

> *"If we build on existing parking lots, the new guidelines also state that we must ensure what the parking utilization and rental has looked like previously, and then it must be restored. It does not reflect the future."*
>
> -Respondent 2

Respondent 2 and 3 therefore pointed out that they wish to have the possibility to use mobility agreements for existing developments, since efforts to reduce the demand for parking in the existing stock does not currently yield anything in terms of reduced parking requirements. Two other respondent raised that the possibility to get parking requirements of 0 by entering an agreement with the *Base package* when building in for example attics is very good, and important for adding housing in existing areas where adding more parking isn't possible (R4, R8). Respondent 9 also addressed that when they build on their own existing parking lots, their old tenants also become subject to the new, often lower, parking ratio. It can be challenging to communicate this to the existing tenants, for example that a family no longer can have two cars within the household. Respondent 2 mentions that the pricing of car parking and the costs of having a car must be clarified better as well. Many residents believe that car sharing services are expensive, while the cost of owning your own car is harder to measure and compare in the same way. Thus it is often seen to be less expensive to own a car than using these services in the long run. Respondent 2 also thinks that in addition to the work with mobility services it is also necessary to have a more holistic approach regarding parking in Gothenburg, the car can for example not be subsidized as it is today.

6.2 Interviews with Mobility Service Actors

This section present the result from the interviews with the mobility service actors. The respondents were from a bicycle sharing company, a car sharing company, a company that provides both car and bicycle sharing services, and the public transportation authority in Gothenburg.

Table 6.2: Summary over the main findings from the interviews with the mobility service actors.

Mobility service actors	Main findings
Bicycle sharing actors, (Actor 1 and 2)	Requirements regarding number of bicycles is not optimal, requirements based on availability is desired. The service cannot be free of charge.
Car sharing actors, (Actor 2 and 3)	Requirements over number of cars needs to be increased, membership period is too long, the services needs to be heavily marketed in order to get residents to use it.
Public transportation authority	Were not informed about mobility agreement from the start. Working on simplifying the processes with the public transportation cards.

6.2.1 Bicycle Sharing Actors

Actor 1 described that when they started to develop their service, they saw a need for private bicycle sharing services. People are in general more interested in sharing within a small group, since larger groups can result in high maintenance costs and the users do not feel as much commitment. With regards to number of bicycles the guidelines currently states that the bicycle sharing system should include 3 bicycles per 100 apartments. Actor 1 highlighted that with this formulation, the requirements are fulfilled as soon as you place the specified number of bicycles in the property. This means that developers who only seeks to fulfill the requirements, but are not interested in if people cycle, simply can purchase 3 bicycles and then not bother about the management. In order to make the bicycle sharing service work properly it is important to have a booking system, marketing of the service and a proper plan for maintenance. According to the respondent a better option would therefore be to set requirements based on availability rather than number of bicycles:

> *"Set requirements based on availability in terms of that the bicycles are functioning and that there are bicycles to book for a specified amount of time, rather than the number of bicycles".*
>
> -Actor 1

A better formulation of the requirements would therefore be that *70% of the time there should be 1 functioning bicycle.* The respondents also addressed that it is better to start with fewer bicycles, for example two, and then increase the number bicycles if the demand increases. Actor 1 also raised the importance of which types of bicycles that are included. Most people already own a regular bicycle, but the bicycle sharing system can act as a complement to fulfill special needs. Cargo bicycles and electric bicycles are example of bicycles that can act as a good complement to the residents own bicycles.

Currently the guideline states that the bicycle sharing service should be free of

charge. According to Actor 1 this usually results in that people start to use the bicycles as if they were their own, and that people are not careful when using the bicycles. The best solution according to the respondent is to offer one or two hours which are free of charge, but if the residents wants to use the bicycle for a longer time a small fee of approximately 10 SEK per hour is charged. Actor 2 also highlighted that it is important to charge a small hourly fee. They had previously tried to offer the first 20 kilometers free for their car sharing service, but this resulted in that the users misused the system by restarting the booking once they reached 20 kilometers. The respondents however claimed that it is important that the membership is free, otherwise the residents will not join. If a bicycle is damaged, it is also important to have a process were the person who caused the damage has to pay for it. Damages should therefore be reported, meaning that the user checks for damages before and after the usage.

6.2.2 Car Sharing Actors

The demand on the car sharing actors and their service has increased in the last couple of years according to both of the interviewed actors. Actor 2 states that this demand comes specifically from new house constructions, while in existing residential the demand is lower since the service is considered to be an expense rather than an investment.

Actor 3 addressed that they think that the number of cars per apartment is too low. They recommend 1 car per 50 apartments, instead of "at least 1 per 100" as the requirements currently state. The other actor thinks that in general the requirements are more focused on quantity than quality and suggested that the requirements should focus more on accessibility rather than having a large number of different services. The requirements for the subsidized memberships differs between Gothenburg and other municipalities according to actor 3. They addressed that most municipalities require 60 months of subsidized membership for the residents, which the City of Gothenburg also did before the new guidelines for mobility and parking in the City of Gothenburg were adopted. They think that a requirement of 120 months of subsidized membership is too long considering that the field of mobility is developing quickly.

Both of the actors addresses that car sharing services needs to be heavily marketed both before the residents move in, at key collection, and continuously at meetings and gatherings. Actor 2 explains that they offer coupons and discount for the residents from the start to get them to try and use the service. When asked about if they prefer public or private car sharing services, the actors have different opinions. Actor 2 argued that private stations are better since the service then is used more frequently since the service is more accessible. Meanwhile Actor 3 believes in a dynamic and open station network. They want to avoid having stations that only contain one car and instead advocate larger stations where more cars of mixed model based on the actual demand from users is available.

With regards to the type of tenure and its impact on the car sharing service, Actor 2 said that according to them it has no impact. However, they say that a car sharing service can be more of an incentive in condominiums than in tenancies. The other actor answered the question from a more functional point of view;

> *"Our experience is that a progressive long-term property owner who owns and manages tenancies and who works in a structured way with communication to the residents through different types of platforms is what results in generating the best result."*
>
> -Actor 3

6.2.3 Public Transportation Authority

The Public transportation authority, Västtrafik, started to receive request from developers who wanted to purchase public transportation cards for their residents in the early 2020, and since then the demand has increased even further. Västtrafik were initially not aware of the existence of mobility agreement, but recently they have been in contact with the Urban Transport Administration. The respondent addressed that it is a bit odd that the 90 day card and 365 day card gives the same parking ratio reduction.

Currently there are three options when it comes to distributing the cards; physical cards, voucher and digital tickets which are sent to you phone and activated in the public transportation app *Västtrafik ToGo*. Physical cards currently only have a activation time of 30 days from the day they are made, which makes the it quiet inconvenient. These days, vouchers are therefore more commonly used since they have longer activation time than the cards. Most developers are however interested in digital tickets, but some are concerned about how to handle personal data related issues. The respondent hopes that the digital solution can be developed even further. Västtrafik also aims to investigate a solution which allows the developer to only pay for the cards, vouchers or tickets which are activated. The respondent also raised the importance of taking into account that older generations might not have access to a smartphone. With regards to how the usage can be evaluated the possibilities are currently somewhat limited. It is currently only possible to see which tickets that have been activated and not the usage.

6.3 Mobility Measures and Parking Requirements

This section presents the quantitative data result and analysis. Section 6.3.1 illustrates how the different steps in the mobility and parking investigation have contributed to the final parking ratio. The final parking ratios are thereafter compared to car ownership data. Section 6.3.2 presents how frequently the mobility measures in the *Star package* have been selected. This result is also analysed based on the interview findings in Section 6.1, in order to answer why certain measures have been selected.

6.3.1 Final Parking Requirements

Figure 6.1 illustrates the initial parking ratio, the reduction in each analysis step and the final parking ratio for the 15 developments that have been analyzed. The Figure also includes the current car ownership, given as the number of cars per housing unit, in the surrounding area of each development. The data used to calculate the car ownership is included in Appendix B. Each development has been given a number based on which zone it is located in.

According to Figure 6.1, the mobility agreements have accounted for the main reduction of the parking ratio, compared to the location assessment and project adaptation. There is no clear connection on how the reduction from the mobility agreement is affected by the reduction in previous steps. However, the mean reduction from the mobility agreements is slighter lower in *Zone A* (0.137) compared to mean reduction in the other zones (B=0.15, C=0.175, D=0.15), in which the percentage of the reduction in previous steps has been lower. If instead considering the percentage reduction that the mobility agreement have contributed to, the reduction will however be higher in central zones since the start value is lower there. Percentage wise, the mobility agreement have contributed to reducing the parking requirements with 14 % (C2) to 40 % (B1), after considering the location assessment and project adaptation.

In *Zone A*, there is no development where the reduction from the mobility agreement is maximum (0.2), however in *Zone B* and *Zone C* this occurs. In *Zone B*, there are two developments with maximum reduction due to the mobility agreement (B1 and B2). In both of these developments there has been reductions in both location assessment and project adaptation. In *Zone C* none of the developments have been able to reduce the parking ratio based on project adaptation. Three out of four developments in *Zone C* have chosen a maximum reduction via mobility agreements, two of these developments have no reduction in the two other steps. In *Zone D*, no pattern can be seen due to only having data for one development in this zone. However, similarly to the developments in *Zone C* there is no reduction via project adaptation step in development D1. Worth noticing is that as explained in Section 4.3.2, *Zone C* and *Zone D* are able to reduce the parking ratio via location assessment to a higher extent than *Zone A* and *Zone B*.

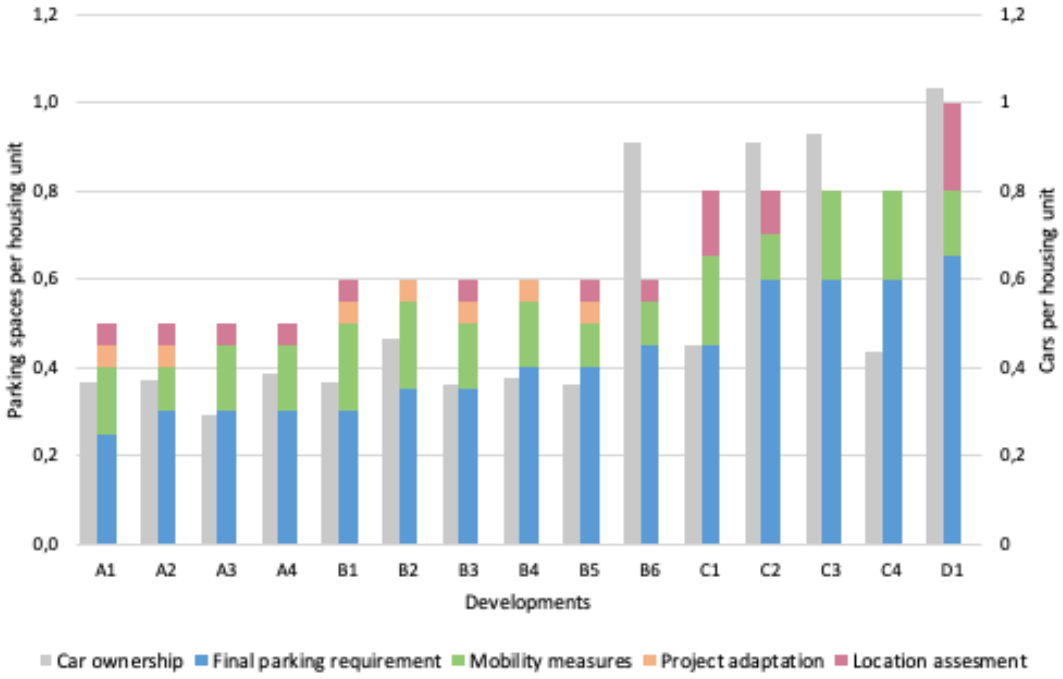

Figure 6.1: The graph illustrates the initial parking ratio, the reduction in each analysis step (pink, orange and green) and the final parking ratio (blue) for 15 developments. The graph also includes the current car ownership (grey) in the surrounding area of each development. Each development has been given a number based on which zone it is located in.

In 5 of the 15 developments, the parking reduction via mobility agreements has been maximum (0.2). In 2 out of these 5 developments, the parking ratio has not been reduced in the other analysis steps. There is no clear pattern when developers chooses the maximum reduction or not in regards to the reduction via the mobility agreement. This means that the mobility agreement is not only used when it is important to reduce the parking ratio as low as possible. It is important to address that this data does not represent all developments where mobility agreements have been established, and the sample is too small to draw any general conclusions.

With regards to the final parking ratios for the developments, it can be seen that developments in *Zone A* and *Zone B* can have equivalent parking numbers. The same applies to developments in *Zone C* and *Zone D*. The average final parking ratio for each zone is:

- *Zone A*: 0.29 parking spaces/apartment
- *Zone B*, 0.38 parking spaces/apartment
- *Zone C*, 0.56 parking spaces/apartment
- *Zone D*, 0.65 parking spaces/apartment

Figure 6.1 also illustrates how the car ownership, given as cars per housing unit, compares to the final parking ratios. In 10 of the developments the final parking

ratio is lower than the current car ownership. This could be expected since the start values are based on the current car ownership in multi-family residential buildings, and all of these developments has reduced the parking ratios. In the majority of the developments in *Zone A* and *Zone B*, the mobility agreement has been crucial in order to reduce the parking ratio to a level which is similar to or lower than the current car ownership. Hence, by establishing mobility agreements, the developers and the municipality contributes to a target-based planning approach.

In development B6, C2, C3 and D1 the current car ownership is considerably higher than the parking ratio. In development C3 and D1 this can be explained by the fact that these areas include a high share of stand-alone houses (68% for C3 and 67% for D1, see Appendix B), where the car ownership most likely is higher. If only the car ownership in multi-family residential buildings had been included, the difference between the parking ratio and the car ownership would most likely have been smaller. Development B6 and C2 are located in an old industrial areas were the number of dwellings and cars currently are very low, see Appendix B which makes the data unreliable.

In development A3, B4, B5 and C4 the parking requirement is a higher than the current car ownership. In A3, B4 and B5 the difference is small but for C4 the difference is fairly large. This can be explained by the fact that C2 is located on the border between *Zone B* and *Zone C*, but in the mobility and parking investigation it was decided that the parking ratio should be based on the start value for *Zone C*, which has a higher start value than *Zone B*.

6.3.2 Selected Mobility Measures

As stated in the guidelines, see Section 4.3.4, the mobility agreement offers the possibility to reduce the parking requirements in different steps. It is possible to either enter into an agreement with only mobility measures from the *Base package*, or an agreement with mobility measures from both the *Base package* and the *Star package*. Out of the 32 residential development projects where mobility agreements have been established, 27 included mobility measures from both the *Base package* and the Star package. The remaining 5 agreements only included measures from the *Base package*. 3 of these agreements were developments with special conditions that qualifies as exceptions with parking requirements set to 0.

How frequently each measure from the *Star package* has been selected is illustrated in Figure 6.2. The Figure only includes measures from the *Star package*, since the measures in the *Base Package* are mandatory. The four most frequently selected measures are related to the categories *Bicycle* or *Information*. This includes *Annual mobility activity*, *Bicycle sharing*, *Bicycle service room* and *Real time information display about public transportation*. These are then followed by *Limitation of personal parking spaces*, *Free 90 day public transportation ticket* and *Car sharing vehicles*. A few developers have brought up own proposals for measures, this includes for example discount on car rental services, bicycle cabinets, publicly available bicycle

pumps and public bicycle information spots. No one has selected the measure *Public transportation purchase*.

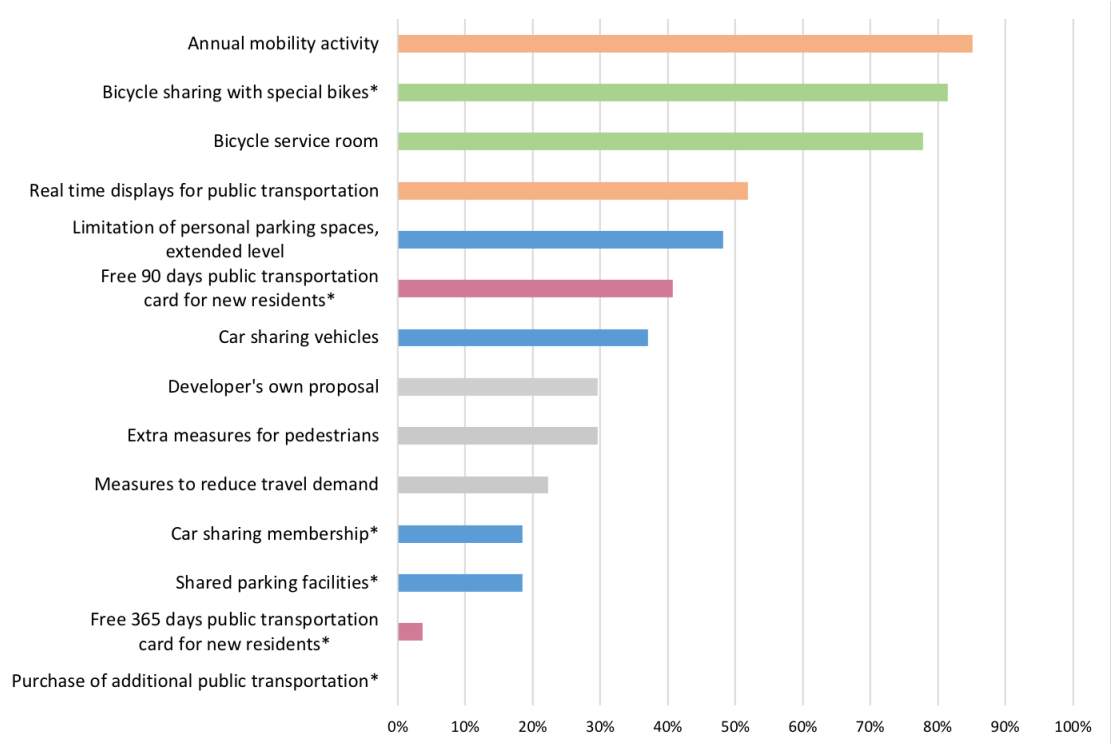

Figure 6.2: The graph illustrates how frequently mobility measures from the *Star package* have been selected. The percentage value states the percentage of agreements (n=27) that includes the specific measure. The colours represent the different categories explained in Section 4.3.4, where Orange = Information, Green = Bicycle, Blue = Car, Pink = Public Transportation and Grey = Other. The measures marked with a star (*) are more demanding and provides higher incentives for sustainable travel behavior, see Section 4.3.4.

As seen in Figure 6.2, the mobility measures *Annual mobility activity* and *Real time displays for public transportation* are chosen often by developers. During the interviews, several developers addressed that they already implement these measures in their business, and therefore they are easy to include. They are also considered to be cost efficient. *Limitation of personal parking spaces, extended* is not chosen to the same extent as *Annual mobility activity* and *Real time displays for public transportation*, but the reason for selecting this measures goes in line with the other two measures.

The *Free 90 days public transportation card for new residents* is also selected quiet frequently. One developer addressed that they selected this measure since the *Base package* already includes a 30 day card, and therefore it was perceived as simple to just add 60 more days as it would not require any additional work. This type of reasoning could possibly also be applied to the *Limitation of personal parking spaces, extended*, since the *Base package* already includes this measure to some extent.

The measures connected to bicycles, *Bicycle service room* and *Bicycle sharing with special bicycles*, have both been selected very frequently. Several developers addressed in some way that measures related to bicycles are perceived as positive, or are easy to fulfill, which explains why these measures are selected more frequently. With regards to the car sharing related measures, four developers mentioned that they had positive experiences from including car sharing services in their developments. One developer also said that it could be a good sales argument for condominiums.

Only 30 % of the developers have selected *Developers own proposal*, even though many developers asks for flexibility when selecting measures. Two developers mentioned that they had included a discount on car rental services as their own proposal, instead of including measures related to car sharing services. Both of these developers had developments in *Zone A*, and argued that in this area it is more favorable for the residents to rent a car for longer periods, than using car sharing vehicles for everyday errands.

The low selection frequency of the measure *Free 365 days public transportation card for new residents* could be explained by the fact that it has the same reduction as the measure *Free 90 days public transportation card for new residents*, but comes with a four time higher cost. Although several developers mentioned that good access to public transportation is one of the most important aspects if they should reduce the parking supply, the measure *Purchase of additional public transportation* has not been selected at all. No one spoke about this measure specifically, but it can be assumed that it is seen as too expensive.

7
Discussion

This chapter includes discussion of the results presented in Chapter 6, and the findings from the literature review. The discussion is divided into 3 sections related to the research questions.

- Section 7.1: Stakeholders' Experience with Mobility Agreement Processes
- Section 7.2: The Impact of Mobility Measures and Parking Requirements
- Section 7.3: Evaluation Approaches for Municipalities

7.1 Stakeholders' Experience with Mobility Agreement Processes

Many stakeholders are in some way affected by the municipality's governing documents on mobility and parking. Except for the stakeholders that have been interviewed, individuals in condominium boards will have a great responsibility in maintaining the mobility agreement. Insurance companies are also involved, but according to one developer they are currently not used to insure products used by a third party, which might inhibit the usage of sharing services. In terms of car and bicycle sharing actors, their business is favored by mobility agreements, but the requirements stated by the municipality may not always contribute to a high quality service. The public transportation authority can also benefit from the mobility agreement, but since they were not informed about how the mobility agreement would affect them beforehand, their ability to easily distribute public transportation cards is somewhat limited today. The work with mobility agreements is at an early stage, and developers are currently learning how to work with mobility in other ways than building parking spaces. As more agreements are established, and developments are finalized, the knowledge on how to work with mobility will increase.

Although the majority of the developers have good intentions when entering into a mobility agreement, the process would benefit from clearer requirements to ensure that the measures will have a similar standard independent of the developer. The *Bicycles sharing with special bicycles* is a measure which is a clear example of when the level of ambition can result in different standards of the service. Respondent 7 planned to only exhibit three bicycles without having any ambition to take care of them, while for example Respondent 10 had chosen to bring in an external bicycle

sharing actor to ensure that the service is well taken care of. Despite the different levels of ambition, these solutions of bicycle sharing services will still contribute to the same parking ratio reduction. Some of the mobility service actors also emphasized the importance of well written requirements, since the current guidelines can lead to that developers who only are interested in reducing the parking ratio agrees to implement services, but does not bother about ensuring that the service is attractive for the users. The requirements for the measures should therefore be more focused on ensuring high quality of the services. Clearer requirements would also reduce the number of questions about interpretation, which close to all developers have faced. Furthermore, it could also favor the evaluation process, by simplifying for the municipality when they want to ensure that the agreement is fulfilled. In other words, a clear set of requirements can be a template for possible follow-up and evaluation.

Most developers emphasized that the mobility agreement process has to be flexible. For example by being able to remove or replace services if they do not work out, renegotiate the agreement if the project conditions change, and being able to come up with own concepts on how to solve their residents mobility needs. Two respondents who built condominiums also addressed that they were planning to implement mobility services without including them in the mobility agreement, to ensure that the condominium board can remove the services if they do not work out. This highlights the importance of flexibility in the agreement.

Our impressions is that to some extent the work process related to the mobility agreements is experienced as more inflexible than it actually is, maybe because it is called *agreement*. For some of the mobility measures it is stated that *The demand should be evaluated and met annually* (Göteborgs Stad, 2019), which can be interpreted both as if the quantity of a service should be increase if the demand is high, but also that the quantity should be reduced if the demand is low. Furthermore, with the current guidelines it is possible to come up with several own suggestions, ("*The property owner proposes one or several measures*") (Göteborgs Stad, 2019), but most developers do not seem to understand to what extent they are able to do this. However, we believe that it could be relevant to further consider how much each measure should be able to contribute to the parking ratio reduction, to ensure that more ambitious measures are rewarded. This is of course difficult, since the effects the measures to some extent are unknown, but currently a public transportation display (which some developer combine with existing information displays) is "worth" equally as much as a car sharing vehicle which may seem a bit skewed.

Some developers also ask for more flexibility with regards to which area the development is located in, especially those with developments in central areas. In such areas mobility measures are sometimes considered redundant, since there already are good prerequisites for sustainable mobility. Some respondents therefore suggested that developers rather should be able to credit services such as bicycle and car sharing if these already are available in the surrounding area. The problem with such an alternative could be that it is not possible to ensure the long-term existence of the

services. Other measures as alternatives to the ones in the agreement is also something that some developers ask for, which they consider to be better suitable for the development and the area and their residents. However, surrounding services such as access to public transportation and car sharing services are already taken into account to some extent in the *Location assessment*. It might however be necessary to enable a larger parking ratio reduction than what currently is possible. In the current guidelines, the issue of accessibility can also be considered to be fairly binary, either the development has good accessibility or it does not, and more nuanced assessment of the accessibility might therefore be necessary.

The results from the interviews with the developers also highlights the importance of whether the development includes tenancies or condominiums. The overall impression is that most respondents agree that the guidelines currently are more geared towards tenancies where a proper management function already exists. The car sharing actor (Actor 3) also raised that their experience is that a developer who manages tenancies generate the best result in terms of management of sharing services. It is however important to highlight that the concerns about how a condominium board will manage to handle the mobility measures are predictions, and the outcomes might be different. Therefore, it is important that the municipalities follow up this concern, to identify how condominium boards manages the maintenance of the measures. The goal should not be to incriminate the condominium boards, but rather to learn about the potential problems that the board faces. Selecting measures for condominiums might also require another type of mindset, which some developers already have when they select measures. Some developers mentioned that measures where an external actor handles the management, or measures which can be included in blueprints and require less management are preferable for condominiums. Another suggestion was financing a new *Styr & Ställ* station. The city of Gothenburg also mentions areas for working from home or facilitating home deliveries as possible measures to reduce travel demand in their current guidelines (Göteborgs Stad, 2019). These types of measures might also more suitable for condominiums.

The differences between condominiums and tenancies also becomes relevant when discussing the parking requirements. Three developers highlighted that the demand for parking varies between condominiums and tenancies, and in condominiums it is often an important selling point. According to Litman (2021a), the parking requirements can be reduced with 20-40 % if the development includes tenancies instead of condominiums. However, one can question whether it is fair to make such a division, since it allows those who can afford to purchase an apartment to own a car to a higher extent. On the other hand, if the demand for parking spaces is lower in tenancies, it is advantageous for these tenants since they avoid paying for parking spaces which they do not utilize. Furthermore, the type of tenure might not be known when the parking ratio is determined, and it might also change during the life cycle of the building. In future evaluations, it might however be relevant to assess how the parking demand varies between tenancies and condominiums, in order to assess if this should be a part of the *Project adaptation*.

Although the aim with flexible parking requirements is to give developers the option of building fewer parking spaces in exchange for implementing mobility measures, which means large economic savings for the developers (Boverket, 2018a), some of the interviews still revealed that the mobility measures in general are perceived as expensive. This especially applies if the developer, despite having implemented mobility measures, have not been able to reach a parking ratio which they consider appropriate. Thereby they still build more parking spaces than they are able to rent out. Concerning the cost, it is also important to highlight that similarly to how the cost for parking spaces will be distributed between the resident, the same is valid for the mobility measures. Thereby, it is possible to argue that it is equally "unfair" that the residents who do not own a car pays for parking, and that people who do not seek to utilize the measures will have to pay for those.

The type of mobility and parking guidelines that have been studied in this thesis are aimed at new residential developments, and does not include existing parking spaces. Construction of residential developments stands for a small part of the entire housing stock, and therefore investment in reducing the amount of parking spaces in the city will take a long time. This was highlighted especially among the public developers, who wish that the municipality would enable them to work with reducing the amount existing parking spaces by for example establishing mobility agreements for existing developments. This also raises questions about how this will affect the city, as new apartments will have reduced access to parking spaces, while the remaining households will have the same accessibility as before. On the other hand, residents in new residential developments will instead have access to mobility services. However, if the mobility services are not sufficient, resident who live in these new developments might park in nearby areas where additional parking is available.

Limiting the parking supply in existing developments can however be challenging. For example, one developer highlighted that residents might be upset since their travel habits will be affected. The opportunity for them to access other services that replaces the car will therefore be important. Those who choose to move into a property with a low parking ratio have actually chosen to do so, but the already existing residents have not. An important argument in the discussion is also that when it comes to Gothenburg, the housing shortage is a fact, and the lack of parking is not a general concern. It is difficult to deal with this issue at present, but one solution could be to regulate the demand of car parking with pricing. Another solution could also be to establish more shared parking facilities, which then in a more fair way handles residential parking by having a common area and conditions for all the concerned residents.

7.2 The Impact of Mobility Measures and Parking Requirements

Both the car sharing actor and the bicycle sharing actor addressed that they have seen an increased demand for their services in recent years. Mobility agreements in urban developments can therefore be seen as something positive to establish these services in cities since they are more resource efficient than private ownership. The fact that the demand for services is increasing with the help of agreements such as mobility agreements helps the market for these actors, which means that companies can survive and establish themselves in more places. Increasing accessibility in cities for these services is one step to make them more attractive than owning a car.

Another important aspect is whether the sharing services are open to the public or private. Public sharing services enables all citizens to utilize the services, while private services only are addressed for the residents in the specific property. The mobility agreement in Gothenburg does not specify whether the sharing services should be public or private. In theory this could mean that only private sharing services are established, and residents in existing stocks do not get the same opportunities to use these services. According to one car sharing actor it is also more difficult to establish services in existing stocks, due to in these households it is only seen as a cost, rather than an investment as it is perceived in new residential developments.

The car and bicycle sharing actors worked in different ways with their sharing services. Actor 3 solely worked with public stations to meet a wider demand. Actor 1 and 2 only works with closed stations and argued that this makes the service more attractive since the accessibility becomes greater, and people are in general more interested in sharing within a small group. Actor 1 also highlighted that they saw an additional need than the public bicycle sharing services in the city. This indicates that both options are needed in cities. It is however possible to question whether private services are fair, since only citizens in new residential developments will be offered the services. Municipalities should therefore consider whether to require sharing services to be public or private. With other services such as home deliveries it is just as important to keep this issue in mind.

In Gothenburg the parking ratio reduction generated by the implementation of mobility measures is given as the actual parking ratio reduction. This means that the mobility services will contribute to a greater share of the reduction in more central areas, since the start values in central areas are lower. In other municipalities the reduction is sometimes given as a percentage which is equally as big in different areas (Envall & Johansson, 2020). It is difficult to answer if one approach is better than another, but Gothenburg's approach can be considered to better ensure that mobility measures are implemented to the same extent in all areas. In *Zone A* the maximum potential reduction generated by the mobility measures is up to 50 % (given that the location assessment and project adaptation have generated maximum reductions), and such a high reduction might not be desirable in outer areas since some developers highlighted that they often do not strive to reduce the

parking ratio to the same extent in outer areas. Therefore, it is possible to argue that with percentage reductions, developments in outer areas might not be offered with the same amount of mobility measures.

In several of the studied developments, the results indicate that the mobility agreement was crucial in reducing the parking ratio to a level which is below the current car ownership. This indicates that this type of parking management can be effective if a goal-oriented planning approach is desired. However, such approach is dependent on if developers actually chooses to enter a mobility agreement. This study has not looked into how many developments that have not entered a mobility agreement, but with our results in mind, it is likely that developments without mobility agreements have parking ratios which are higher than the current car ownership. Thus, these developments do not contribute to the municipality's goal about moving towards a less car dependency. Additionally, it is important to address that it is still unknown if the provided mobility measures will be able to "replace" the gap between the current car ownership and the parking supply. Therefore it is important to evaluate if the parking supply is sufficient, otherwise it might be necessary to consider if there are ways were the mobility measures can be further developed.

7.3 Evaluation Approaches for Municipalities

As seen in Section 5.2, municipalities mention evaluation in many different contexts. We consider there to be three different evaluation approaches: verify the compliance of the agreement by checking the parking requirements and mobility measures, evaluate specific mobility measures in terms of for example usage level, and finally if the measures actually replace the demand for parking. If the aim of the evaluation is to evaluate the compliance of the agreement, it is as previously mentioned important that the requirements actually state the expected standard of the measure so it is clear when a measure fulfills the agreement. The compliance of measures of more physical character, can be included in blueprints, and therefore checked already during the building permit application. This was suggested by one of the interviewed developers, and Haninge municipality (2020) municipality also aims to check the compliance in this manner. The compliance of measures of non-physical character could be checked by submitting a list where the property owner takes the responsibility that they have ensured that the agreement is or still being followed. The list could be supplemented with appendices with for example pictures if relevant.

Several of the studied municipalities, including Gothenburg, mentions that the property owner should evaluate the mobility measures regularly. Some of the developers which were interviewed said that they also have a personal interest in evaluating the usage level of measures such as bicycle and car sharing services. Among the studied municipalities it was only one, Sundbyberg, which mentioned that usage data for these services should be reported to the municipality (Sundbybergs stad, 2018). We see that there are several purposes for municipalities to collect this data. First of all, to see if services are used at all, and if not the municipality should perhaps revise the guidelines and not include that service in the agreements. If the municipality

see that there is a sufficiently large demand for these services, then perhaps the sharing market can manage on its own, without the property owner having to pay or subsidize the service. However, including services that could survive without subsidies can still be beneficial though, if it means providing those services in new areas or to more people. The studied evaluations assessed usage of mobility measures both through collecting usage data from booking systems, and through questions in surveys. Although it is easier to collect usage data from the booking system, the survey approach will of course enable to get a better understanding on for example if the residents who use the service owns a car or not.

Finally, it is relevant for municipalities to see if the mobility measures actually can reduce demand for parking spaces, which then can provide a better understanding of how much each measure should contribute to reducing the parking ratio. In such cases, the follow-up process becomes more complex, and it becomes important to consider who should bear the responsibility. In the studied evaluations, it was found that residential surveys often was used. However, one cannot demand that a property owner should be solely responsible for such surveys. It is probably more reasonable for the municipality to conduct or provide such a survey that can be used in all projects. The property owner may be able or required to help with, for example, distributing the survey, but the municipality should be responsible for the interpretation of the results. It is also important to address that the surveys often resulted in a relatively low response rate, and that those who responded often owned a car to a higher extent (Stjärnkvist, 2013; Lund, 2020; Antonson et al., 2017; Johansson et al., 2019).

Since some developers highlighted that they have vacancies in newly constructed parking facilities, it can also be relevant for municipalities to collect such data. If the situation is the opposite, it is instead relevant to report how many residents that are on the waiting list for a parking space, which was the case when the projects Haninge and Älvsjö were evaluated (Johansson et al., 2019). However, in all of the studied evaluations, the authors found that many residents parked on other parking spaces than those that belonged to the property. Thus, it is also necessary to ask the residents where they park their car and why, in order to not judge the parking demand incorrectly. Then, a survey is once again needed, and as previously mentioned the response rate can then be a limiting factor. Car ownership on the other hand, can be assessed without conduction a survey and be an important indicator on car dependency in the city and in the development. Therefore data on car ownership could be important for municipalities to investigate.

8

Conclusion

This chapter presents the final conclusions, where the study's research questions are being answered. Furthermore, discussion on how this study contributes to practice and theory is discussed and concluding recommendation for future researchers are presented.

8.1 Answering Research Questions

How do stakeholders experience the mobility agreement process in new residential developments? The agreement enables developers to reduce the parking requirements, but the process is in some aspects perceived as quite rigid. The developers therefore seek for more flexibility. However, the process is most likely perceived as more inflexible than it actually is, due to the current formulations in the agreement. Developers also seek for more area adaptation with regards to parking requirements and selection of mobility measures, especially in central areas. They also want to be able to credit existing services in the nearby area to a greater degree. Some developers experience the mobility measures as costly, probably because they become an annual cost rather than an investment. The work connected to the mobility agreement is expected to be more challenging in condominiums than in tenancies, since the responsibility for managing the measures falls on individuals instead of an organisation with management responsibilities. The requirements for some mobility measures are currently written in a way which does not ensure high quality of the measures, which means that the developer's level of ambition determines the quality of the services. Further, selecting more ambitious measures do not always provide a greater parking ratio reduction, meaning incentives are limited.

What impact do mobility agreements have on the parking requirements in new residential developments? In the 15 studied developments, the mobility agreements have contributed to reducing the parking ratio by 14 % to 40 %, after considering the location assessment and project adaptation. In several of the studied developments, the mobility agreement has contributed to reducing the parking ratio to a level which is below the current car ownership in the surrounding area. This indicates that this type of parking management can be effective if a goal-oriented planning approach is desired. However, this is only possible if developers chooses to establish mobility agreements, otherwise the parking ratio might be greater than the car ownership in the specific area.

How can municipalities follow up and evaluate developments with flexible parking requirements and mobility measures? Neither interviews, literature nor a study of other municipalities policies has given a clear answer to how follow up and evaluation should be conducted. They have however provided insight on a number of aspects that needs to be taken into account when designing an evaluation process. One such aspect is that how municipalities should evaluate the developments depend on the purpose of the evaluation, which can be divided into three approaches: check the compliance of the parking requirements and/or mobility measures, assessing the usage level of the measures, and finally if the measures can reduce demand for parking. How the compliance should be evaluated depends on if the measures are physical or non-physical. Most stakeholder have a personal interest in assessing the usage level of the measures, and this is relatively easy to evaluate as long as a proper booking system is used. Evaluating if the measures can reduce the demand for parking is more complex and a detailed assessment might not be possible in each development. However, factors such as parking utilization rate, parking behavior among residents, and car ownership, could be relevant for the municipality to analyze. Regardless of what the aim of the evaluation is, it is important that the municipality is clear about how the property owner is expected to contribute to the evaluation.

8.2 Recommendation for Future Research

This study has resulted in a few interesting topics which could be interesting for future research. First of all, since none of the developments with mobility agreements had been completely finalized when the study started, residents experiences were excluded from the scope of the study. However, how the residents feel about the parking situation and the mobility measures could be considered to be one of the most important aspects, and therefore it is of importance that future studies includes this group of stakeholders as well. We especially want to highlight the importance of speaking to condominium boards of developments with mobility agreements, as there role has been questioned during several interviews. The study also excluded mobility agreements in other facilities such as offices, and similar evaluations on how these stakeholders are affected could also be relevant for future research.

Furthermore, the study has highlighted the importance of working with parking and mobility issues in the existing housing stock. Research on how municipalities are planning to tackle this challenge, and how they currently work with replacement parking, would therefore be an interesting topic to investigate further. As mentioned in the discussion, this study only looked at parking ratios in developments with mobility agreements, and has not investigated parking ratios in developments without mobility agreements. It was found that the mobility agreement contributed to reducing the parking ratio to a level which is below the current car ownership, but this only happens if the developers actually chooses to establish a mobility agreement. It would therefore be interesting to investigate what share of new developments that includes mobility agreements, versus how many of the new developments that do not include a mobility agreement.

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A

Appendix: Interview Guide

Interview guide: Developers

Background

- What is your role within the company?
- How have you been involved in the work with mobility agreements?
- What stage is the project/projects in at the moment?

Driving forces

- Is there an overall strategy for mobility issues within the company?
- What are/were the driving forces for signing a mobility agreement?
- How did you choose which mobility measures to included in the mobility agreement? If "Developer's own proposal" was selected, what type of measure did you include?
- Did you want to lower the parking ratio even further?

The agreement

- Is it clear in the agreement what the mobility measures mean? Have any questions arisen regarding how the content of the agreement should be interpreted?
  - Are the requirements specific enough? Or are they too specific?
  - Can the agreements be developed or improved?
- How has the contact with the municipality regarding the mobility agreement worked?

Implementation

- How do you ensure that the measures are implemented, or how do you plan to do so?
- Have you faced any issues with regards to implementation of the mobility measures?
- Have you or will you sign agreements with external actors for measures such as car sharing actors or bicycle sharing actors, or do you have your own solutions?

Management

- How can compliance of the mobility agreement be ensured throughout the agreement period?
  - What will your responsibility look like in the long run?
  - Is the responsibility for managing measures divided between different parties?
- Can difficulties arise when another actor takes over the responsibility for the property and thus the agreement?

Evaluation

- Do you intend to follow up the effects of the implemented mobility measures when the property is taken into use and if so, how do you intend to do this? If not, do you have any suggestions on how to do this?
- What can the city's role in evaluation of the mobility agreements look like?
  - Do you think that the city should in any way ensure that mobility measures have been implemented in projects with mobility agreements?

Interview guide: Bicycle sharing actors

When the interview questions were sent to the respondent, they also received an attachment which included the requirements for measures related to bicycle sharing services, in case they were not aware of these.

- Have you seen an increased demand for bicycle sharing services from developers, as a result of many municipalities having revised their guidelines for parking and mobility? How are you affected by these guidelines?

- Do you think that the requirements that the city of Gothenburg has set regarding bicycle sharing services enables a good bicycle sharing solution? If not, what should the requirements state instead?

- What are your experiences of establishing and operating a bicycle sharing service linked to a specific property?

  - Do you have any experience of how it works in the long run?

  - Does the tenure type have an impact on how well the service works?

Interview guide: Car sharing actors

When the interview questions were sent to the respondent, they also received an attachment which included the requirements for measures related to car sharing services, in case they were not aware of these.

- Have you seen an increased demand for car sharing services from developers, as a result of many municipalities having revised their guidelines for parking and mobility? How are you affected by these guidelines?

- Do you think that the requirements that the city of Gothenburg has set regarding car sharing services enables a good car sharing solution? If not, what should the requirements be instead?

- What are your experiences of establishing and operating a car sharing service linked to a specific property?

  - Do you have any experience of how it works in the long run?

  - Does the tenure type have an impact on how well the service works?

- All property owners who sign a mobility agreement undertake to designate at least 1 parking space for car sharing vehicles per 100 apartments. Are you looking for such places to establish yourself and what makes such a place attractive to you?

  - If you establish yourself in such a place, is your interest to have an open or closed car sharing service?

Interview guide: Public transportation authority

- Have you seen an increased demand for public transport cards from developers who wants to offer free public transportation cards to their residents?

- Have you been informed by the municipality about that this measures is included in their mobility and parking guidelines?

- What do you think about the requirements that the city of Gothenburg has set regarding public transportation cards?

- What options with regards to distribution of cards do you currently offer when developers/property owners want to offer free public transportation cards to their residents??

B

Appendix: Car Ownership Statistics

Table B.1: The table presents the data used to calculate the car ownership in the surrounding area of the 15 studied developments. For the corresponding *Primärområde* of each project, the number of housing units for each residential type, and the percentage share of the total number of housing units is presented. Furthermore, the total number of cars in each area is presented, and finally the number of cars per housing unit (*Cars* divided by *Total number of housing units*.)

Development	Multifamily residential	Stand-alone houses	Special dwellings	Total number of housing units	Cars	Car per housing unit
A1	4206 (98 %)	2 (0 %)	70 (2 %)	4278	1569	0.37
A2	6315 (93 %)	0 (0 %)	452 (7 %)	6767	2513	0.37
A3	6556 (64 %)	332 (3 %)	3302 (32 %)	10190	2952	0.29
A4	2008 (99 %)	7 (0 %)	19 (1 %)	2034	784	0.39
B1	6974 (90 %)	551 (7 %)	200 (3 %)	7725	2836	0.37
B2	4973 (93 %)	277 (5 %)	77 (1 %)	5327	2480	0.47
B3	4690 (95 %)	49 (1 %)	196 (4 %)	4935	1782	0.36
B4	5378 (85 %)	70 (1 %)	875 (14 %)	6323	2372	0.38
B5	4690 (95 %)	49 (1 %)	196 (4 %)	4935	1782	0.36
B6	0 (0 %)	2 (9 %)	20 (91 %)	22	20	0.91
C1	1680 (79 %)	241 (11 %)	203 (10 %)	2124	953	0.45
C2	0 (0 %)	2 (9 %)	20 (91 %)	22	20	0.91
C3	578 (26 %)	1501 (68 %)	142 (6 %)	2221	2067	0.93
C4	6483 (92 %)	396 (6 %)	143 (2 %)	7022	3040	0.43
D1	1641 (31 %)	3521 (67 %)	122 (2 %)	5284	5464	1.03

C

Appendix: Mobility Measures in Base and Star Package

Table C.1: Mobility measures included in the *Base package* (Göteborgs Stad, 2019).

Information	Public transportation	Bicycle	Car
Start package for new residents Everyone that moves into the property during the agreement period should be provided with a mobility package. The package can include information on for example local target points and sustainable travel. The package should also include a physical gift which facilitates travelling without a car. The aim is to encourage residents to travel without a private car. **Ongoing information about mobility** The resident should receive ongoing information about the property's particularly good conditions for sustainable travel. The purpose is to keep the question about mobility alive, in order to assure that the demand for parking spaces does not increase over time.	**Free 30 days public transportation card for new residents** New residents should be offered a free monthly public transportation card. One card per apartment during the whole agreement period. The purpose is to encourage new travel habits and to try out public transportation.	**Offer extra good bicycle parking** Implementation of quality enhancing measures in addition to basic requirements for bicycle parking: A bicycle pump should be located close to the parking spaces and the area should be kept clean and tidy. An annual clearance of old bicycles should take place. The purpose is that as many people as possible should have a positive experience when using and taking care of their bicycle. **Parking spaces for cargo bicycles** Room for at least 4 parking spaces for cargo bicycles per 100 apartments. The demand should be evaluated and met annually. The purpose is for residents to be able to store bulky bicycles.	**Limitation of personal parking spaces** A maximum of 50 % of the parking spaces can be personal. The purpose is to use the parking spaces more effectively. **The parking cost is reported separately** The cost for parking should not be included in the apartment agreement. The cost for parking must be reported separately on agreements and notices. The purpose is to clarify the real cost for owning a car, and moving towards better cost recovery. **Parking spaces for car sharing vehicles** One parking space per 100 apartments should be pointed out for car sharing vehicles. These parking spaces are in addition to the parking requirements for residential housing. The demand should be evaluated and met annually. An expansion may take place on existing parking spaces. The purpose is to provide space for establishing a car sharing service in the area.

Table C.2: Mobility measures included in the *Star package* (Göteborgs Stad, 2019).

Information	Public transportation	Bicycle	Car	Other
Annual mobility activity The property owner should carry out an annual activity related to mobility, preferably during springtime. The arrangement of the activity can vary, but at least free bicycle service should be offered. The purpose is to keep the mobility issues alive.	**Free 90 days public transportation card for new residents*** One card per apartment during the whole agreement period. This measure replaces the 30 day card in the base package. The purpose with the 90 day card is to establish a habit to travel with public transportation among the residents.	**Bicycle service room** The rooms should have automatic doors and suitable equipment. They should be kept in good condition and enable washing and maintenance of personal bicycles. At least one service room per 100 apartments. The purpose is to make it easier for residents to keep their bicycles in good shape and encourage more people to extend their cycling season.	**Limitation of personal parking spaces, extended level** A maximum of 10 % of the parking spaces can be personal. The purpose is to use the parking spaces more effectively.	**Measures to reduce travel demand** The developer implements measures that facilitates home delivery services, offers office facilities, arranges freight lockers in the property etc. The purpose is for the residents to be able to handle everyday needs without travelling.
Real time displays for public transportation Real time displays should be mounted so that they are highly visible for the residents. The displays should be kept in good condition. The purpose is to visualize and facilitate travelling with public transportation.	**Free 365 days public transportation card for new residents*** One card per apartment during the whole agreement period. This measure replaces the 30 and 90 day card. The purpose is that private car ownership should feel close to redundant since the public transportation trips already are paid.	**Bicycle sharing with special bicycles*** A bicycle sharing system with special bicycles such as cargo bicycles should be arranged in an easily accessible location within the project area. The bicycle sharing service should be free of charge for the residents and should include at least three bicycles per 100 apartments. The demand should be evaluated and met annually. The purpose is to enable the resident to run more errands by bicycle.	**Car sharing vehicles** At least one vehicle per 100 apartments should be available in an attractive location within or directly adjacent to the area. The demand for vehicles should be evaluated and met annually. The purpose is give resident access to a car without the requirement of owning a private car or parking space.	**Extra measure for pedestrians** The property owner pays for measures which encourages people to walk to nearby target points throughout the whole year. For example widen or refurbish existing walkways, create new walkways, seating, extra design and maintenance. The purpose is to attract residents and others to walk and reside in the local area all year round.
	Additional purchase of public transportation* The property owner should pay for extension of public transportation services in the area. The purpose is to reward measures that contributes to obtaining good public transportation, and which might still have been implemented for other reasons.		**Shared parking facilities*** At least 50 % of the parking spaces should be located in a shared parking facility outside the residential buildings. The purpose is to create prerequisites high levels of co-usage and reduced car use.	**Property owner's proposals(*)** The property owner proposes one or several measures. The measures should aim at providing incentives for reduce car usage among residents. The municipality decides whether the measure can be considered as a star measures or not.
			Car sharing membership* All residents should be offered a membership as a part of the rent during the whole agreement period. The purpose with the membership is to make car sharing favorable to the extent that residents refrains from private car ownership.	

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