

The effect of flexible parking norms on car use and car ownership in new residential development: a multiple-case study of Malmö, Gothenburg and Copenhagen.

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Abstract

Municipal parking requirements have been used to accommodate the demand for parking in new residential developments for decades. However, a shift in parking policy is under way in cities around Scandinavia due to externalities of the automobile system such as congestion and air pollution. This shift in policy entails the use of flexible parking norms where the required amount of parking is lowered if e.g. specific sustainable mobility services are implemented by the developer. Despite this change in parking policy, knowledge about the influence of flexible parking norms on residents' everyday life is scarce. In this article the effect of flexible parking norms is investigated through a multiple-case study of three housing developments in Malmö and Gothenburg in Sweden and Copenhagen in Denmark. The three cases are used to discuss how flexible parking norms are to be applied to reduce car use and car ownership in new housing. The results of the study suggest that the influence of flexible parking norms on the daily lives of residents can vary. In the case of urban densification in already existing neighborhoods the findings show that the consequences of the flexible parking norms are small due to multiple parking options in adjacent areas. Overall, this study suggest that flexible parking norms can be an influential policy tool affecting the transport choices of residents but only in combination with other policies. The distance to parking facilities and residential parking with a high cost appear to be just as influential on car use and ownership, as a limitation of the supply of parking and access to car sharing ensured by flexible parking norms. Parking policy must be an integrated part of a systematic approach to transport planning in future residential development if spill-over to abundant parking space in neighboring areas is to be avoided and alternatives for a life without a car implemented. Otherwise the influence of flexible parking norms on car use and car ownership might be minor.

Preface

This article has been initiated as a part of a student internship in the Swedish consultancy agency Trivector. In the fall of 2017 an internship assignment was formulated between Trivector Traffic and study program Sustainable Cities at Aalborg University in Copenhagen regarding the effect of flexible parking norms. Trivector Traffic is a consultancy firm which primary work is to advice and analyze sustainable transport systems.

1. Introduction

Municipal parking requirements have provided sufficient parking for residents in new urban development for decades. The challenges facing automobility in cities, such as congestion and health issues, have however changed the purpose of the parking requirements in many Scandinavian municipalities. Today new flexible parking norms are used in urban planning to reduce car use and car ownership among the inhabitants of the city. This article deals with the influence of flexible parking norms on residents' car use and car ownership in new housing development. The study has been initiated on behalf of Swedish sustainable transport consultancy *Trivector* in a collaboration with the *Sustainable Cities* Master Program of Aalborg University in Copenhagen. *Trivector* has experienced an increase in assignments asking about the effect of flexible parking norms in their consultancy capacity. The influence of flexible parking norms is yet an underdeveloped field of research.

Parking prevents alternative land use and competes with other functions and services for space in many cities (Ison & Mulley 2014). Developers of residential housing often have no incentive to build on-site parking, because it is not as profitable as real-estate and the cost of parking has to be subsidized through the property prices. A typical strategy for municipal planners have therefore been to require a specific amount of parking space from the developer to ensure that the demand for parking is met. This have resulted in the use of standard parking norms implemented either in the entire city or in central city districts. Parking norms are a policy instrument that often requires a minimum amount of parking for new residential sites (Andersson et al. 2016; Shoup 2015; Shoup & Manville 2010).

In the past decade, the use of minimum parking norms has been questioned by several studies. According to Andersson et al. (2016) a minimum parking norm increases the rent with 2.4% in suburban housing and decreases the housing stock by 1.2% by occupying valuable space. This suggest that minimum parking norms are becoming an issue in the continued densification of cities and in construction of affordable housing. Furthermore, studies of New York City show a strong correlation between free home parking and car ownership among the residents (Weinberger 2012; Weinberger et al. 2008; Guo 2013a). According to Christiansen et al. (2017) access to private parking near the home triples the likelihood of car ownership. Private residential parking does not increase trip frequency among the residents, but it increases car use in their daily life (Christiansen et al. 2017). The easy access to private parking at home affects the travel choices of the residents and increases car use as there is no hassle in finding a parking lot when returning from a trip (Weinberger 2012; Weinberger et al. 2008; Guo 2013a). The shorter the distance is between the home and the parking space the more car use is increased in the modal share (Christiansen et al. 2017).

Requiring a minimum of car parking in new residential housing seems to pose a paradox, as research suggests it is a direct opposite to the goal of a sustainable transport system in many cities. Using minimum parking requirements is a tradition rooted in the development of the automobile city and is based on a "predict and provide" approach which has dominated transport planning in past decades (Shoup 2001; Sheller & Urry 2006; Lundin 1971; Bannister 2008). Critics therefore call for a paradigm shift and propose that parking norms are used as a

policy instrument, to affect the demand and reduce car use and ownership, instead of a tool to supply the demand (Shoup 2001; Wilson 2013).

Different approaches to reform the minimum parking norm have been suggested. One proposal is the use of maximum parking norms which sets an upper limit on the required parking in contrast to the current policy where a minimum of parking is required of the developer (Shoup 2015). One example where maximum parking norms are utilized is in experiments with car-free residential areas. Here a low maximum requirement has been found to enhance the share of sustainable transport in residential areas, but risk a spill-over of parking to adjacent neighborhoods (Melia 2014). Another proposal is the use of flexible parking norms which in general entails a reduction in the standard parking requirement. Local conditions or specific mobility management measurements can give a reduction in the parking requirement because they offer an alternative to car ownership and car use in an area (Engel-Yan & Passmore 2013; Smith 1983). Prior research of flexible parking norms is scarce. One study suggests that the effect of lowering the parking requirement on car ownership depends on the access to public transport (Liebling 2014). While another study found a correlation between low car ownership and a flexible parking norm involving car sharing (Engel-Yan & Passmore 2013). The effect of lowering parking requirements and of parking policy in general is however an underdeveloped field of study (Weinberger 2012; Marsden 2006). The aim of this study is therefore to investigate the effect of flexible parking norms on car use and ownership among residents in new residential housing and thereby add to the current knowledge and literature.

1.1 Flexible parking norms

In recent years, many Scandinavian municipalities have begun to change their parking requirements (Hanssen et al. 2014). A review of the parking norm policy in the 10 largest cities in Denmark, Norway, and Sweden shows that a majority have implemented flexible parking norms, see table 1. In 2013 a research project undertaken by the national Swedish transport planning agency (Trafikverket) recommended municipalities to implement flexible parking norms instead of using minimum parking requirements if they wish to influence car use and ownership (Envall 2013). The municipalities in Sweden seem to have implemented this new strategy concerning parking requirements in residential housing, as all the largest cities now use flexible parking norms.

Table 1 shows a change in practice in the municipalities where many new and different approaches are applied when using a flexible parking norm. Few studies of the effect of the new flexible parking norms on car use and ownership exist despite the change in parking policy. As table 1 illustrates the flexible parking norms in each municipality offer different reductions and measurements. To my knowledge, no study exists where the effect of different flexible parking norms has been compared.

A comparison of parking norms (cars) in the 10 largest cities of Norway, Sweden and Denmark

Municipality	Minimum norm	Maximum norm	Flexible	Reduction in norm
Sweden				
Stockholm Stad	0.3 space/housing unit	0.6 space/housing unit	+	10 % - 25 % depending on mobility management implementations, eg. car sharing, bikesharing ect.
Gothenburg	0.54 space/housing unit		+	10 % if proximity to public transport
Malmö	0.5 space/housing unit		+	30 % depending on mobility management implementations
Uppsala	1 space/125 sq.m		+	1 space/200 sq.m if proximity to public transport or a reduction depending on mobility management implementations
Västerås	1 space/125 sq.m		+	10-20 % depending on mobility management implementations
Örebro	0.5 space/housing unit		+	1 space/250 sq.m if mobility management measurements are implemented, eg. car sharing gives a 20 % reduction.
Linköping	1 space/125 sq.m		+	25 % if car sharing is implemented
Helsingborg	0.1-0.75 space/housing unit ¹		+	15 % if car sharing is implemented
Jönköping	1 space/125 sq.m		+	15 % if mobility plan is developed, eg. car sharing and other measurements are implemented
Norrköping	0.2-0.5 space/housing unit ²		+	15 – 30 % depending on mobility management implementations or proximity (300 m.) to public transport
Denmark				
Copenhagen	1 space/200 sq.m	1 space/100 sq.m	+	1 space /250 sq.m if proximity (300 m.) to public transport
Frederiksberg	1 space/housing unit		-	
Aarhus	0.5 space/housing unit			Norm varies after local conditions

¹ Norm depending on size of the apartment

² Norm depending on the number of rooms

Aalborg	0.5 space/housing unit		+	Reduction can be obtained if car sharing or shared parking is implemented
Odense	0.5 space/housing unit		+	Reduction can be obtained if measurements to lower car ownership is implemented
Esbjerg	0.5 space/housing unit		-	
Horsens	0.5 space/housing unit		-	
Randers	1 space/housing unit		+	10 % - 30 % reduction if shared parking is implemented
Vejle	1 space/housing unit		+	Reduction if area have good connections to public transport
Kolding	1 space/housing unit		-	
Norway				
Oslo	0.29 space/housing unit	0.57 space/housing unit	+	5% if shared parking is implemented and -4 spaces per car sharing vehicle
Bergen	1 space/100 sq.m	1.2 space/100 sq.m	-	
Stavanger	0.9 space/housing unit		+	Reduction can be obtained with shared parking
Trondheim			+	10 % if shared parking is implemented
Drammen	0.6 space/housing unit		-	
Frederikstad			-	
Porsgrunn	2 space/housing unit		+	1 space/housing unit if parking facilities is gathered in a common parking lot
Kristiansand	0.5 space/housing unit		-	
Ålesund	1 space /housing unit	1.5-2 space/housing unit depending on the number of rooms	-	
Tønsberg	0.5 space/100 sq.m	1 space/100 sq.m	-	

Table 1 Parking space requirements in city center or urban development districts. The table has been composed during a literature review of each municipality's parking norm policy. It shows the current parking requirements for cars in residential developments. See reference list "Parking norms" for sources.

2. Multiple-case study

Several types of flexible parking norms exist; giving reductions in parking because of access to public transport, giving reductions because residents and business can share space in a mixed function area, or giving reductions against different mobility management measures are offered to the residents, see table 1. To gain insight in the influence of flexible parking norms on residents' car use and ownership several different cases are investigated in this study. The case study enables in depth research of groups' reaction to change and the effect of contextual factors. In other words, a case study allows us to understand how parking policy affect the everyday life of residents and how it might be interlinked with the local conditions (Flyvbjerg 2006; Yin 2009).

Despite the tendency of planning with flexible parking norms in current municipal policy in Scandinavia few examples exist of developed residential areas where the effect of the new requirements can be measured. In this study three cases are examined because they fulfill the following criteria of 1) having had residents for a couple of years at least, so the influence of the norms can be measured, 2) being located in a dense urban neighborhood with services and alternative transport options so a life without a car is possible, 3) being a large area with more than 500 residents where a lower parking norm has been applied. The number of

residents minimizes the influence of outliers in a quantitative survey and the size of the area is assumed to reduce the influence of surrounding areas parking policies. Each case provides unique insight into different types of flexible parking norms and the effects hereof. In multi-case studies, cross-case conclusions can be drawn to discover general characteristics (Yin 2009). The findings from the three cases will therefore be compared in the end of the analysis to determine general tendencies and assess the effect of flexible parking norms as a planning instrument. The case areas studied are three newly build residential sites in three different cities in Denmark and Sweden, see figure 1. *Porslinsfabriken* in Gothenburg, *Ørestad City* in Copenhagen, and *Fullriggaren* in Malmö are all residential areas where municipal planners have revised and experimented with the municipal parking requirements or "flexible parking norms".

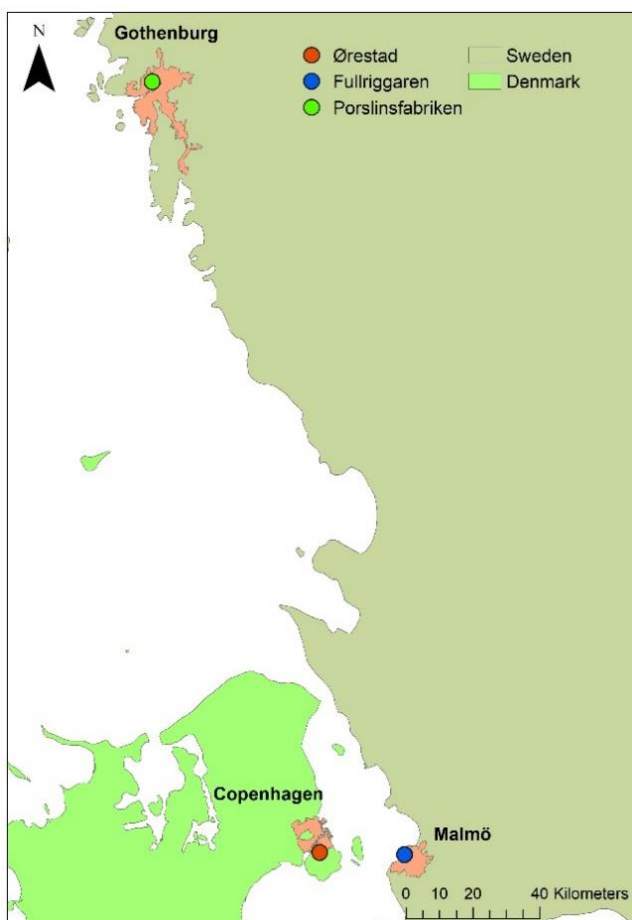


Figure 1 Map showing the location of the three case areas in Denmark's capital Copenhagen, in Sweden's second largest city Malmö, and third largest city Gothenburg. Own production. Source: Geodatastyrelsen.

2.1 Introducing the three cases

Each of the three areas had at the time of the planning and development phase the lowest parking requirements in the individual municipalities and among some of the lowest in Scandinavia in general, see table 2 (Hanssen 2014; Antonson et al. 2016; Stadsbyggnadsnämnden 2014; Appendix A3). The objective of the applied parking requirements in each case was to reduce car use and encourage the use of public transport and other more sustainable transport modes (Antonson et al. 2016 ; Transportrådet 2002 ; Malmö Stad 2014). The flexible parking norm is used differently in each case and reductions in parking are given on different conditions, see table 2. The three cases are some of the most developed and ambitious examples of flexible parking norm policy in Scandinavia which make them relevant for analysis.

<i>Parking space requirements</i>			
	Ørestad City	Fullriggaren	Porslinsfabriken
Parking norm	1 space/200 m2	0.7 space/housing unit	0.52 space/housing unit
Parking requirements in municipality at the time	1 space/100 m2	1 space/housing unit	1 space/housing unit ³
Reduction	50 %	30 %	48 %
Reasons for reduction	Proximity to PT and shared parking	Mobility management measures implemented	Proximity to PT and city center

Table 2 The reduction in parking requirements and the reason behind in the three studied areas. Based on data in (Antonson et al. 2016 ; Stadsbyggnadsnämnden 2014; Bygge & Teknik Forvaltningen 2000).

2.1.1 Ørestad City

Ørestad City is a district in the new urban developing area Ørestaden in Copenhagen. The area Ørestaden is planned to house 25.000 Copenhageners around the year of 2040. The first residents moved to Ørestaden in 2004 and today the district Ørestad City is the most developed part of Ørestaden with 5074 inhabitants (By & Havn n.d. a ; Appendix A1). A new metro line is the backbone of the development as Ørestaden is planned on a Transit Oriented Development principle, where the construction of residential housing first began after the public transport was in place. In Ørestaden the vision of an urban neighborhood relying on public transport is reflected in the parking policy of the area. The municipal requirement for parking is lowered in the area due to proximity to public transport and shared parking facilities between residents and businesses (Transportrådet 2002 ; Bygge & Teknik Forvaltningen 2000; Appendix A3). Currently, Copenhagen municipality works with a flexible parking norm where parking requirements can be set from 1 space per 100m2 to 1 space per 250 m2. The norm is set according to the local conditions in every development project. However, Ørestaden is as of yet the largest developed project in the city with a lower parking requirement (Appendix A3).

³ No single requirement in the whole municipality of Gothenburg, but 1 space/housing unit was most common in Sweden at the time (Usterud Hanssen et al. 2014).

2.1.2 Fullriggaren

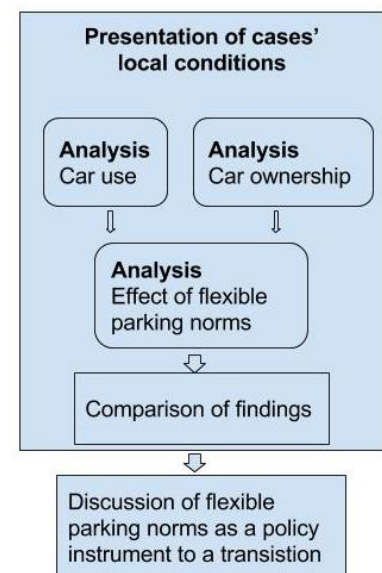
Fullriggaren is as well a district within an urban renewal site in Malmö's Western Harbor. *Fullriggaren* is a sustainable experiment in the urban regeneration of Västra Hamnen and the first residents moved to the district in 2011 (Malmö Stad n.d.). The area is one of the first residential districts in Scandinavia where a flexible parking norm using mobility management has been applied. The parking requirements in the district have been lowered after negotiations with the contractors in return for mobility management services. Car sharing, bike sharing, and a personal counsel on transport choices are offered to the new residents. Meanwhile, the parking norm has been reduced with 30 % and the area has 230 parking spaces less than usual (Stadsbyggnadsnämnden 2014 ; Malmö Stad 2014). Malmö municipality is still working with flexible parking norms in the city and has a parking policy document describing the percentages of parking reduction possible if different mobility measures are implemented in residential housing (Malmö stadsbyggnadskontor 2010).

2.1.3 Porslinsfabriken

Porslinsfabriken is a brownfield development in an already existing part of the city of Gothenburg. The demolishing of the old porcelain factory cleared space for new residential housing north of the city center and in 2009 the first residents could move in. The municipality of Gothenburg works with a flexible parking norm determined by the local conditions in each developing project. In the case of *Porslinsfabriken* the proximity to services and public transport lowered the requirements for parking compared with the usual parking norm. (Antonson et al. 2016).

2.2 Methodology

The local conditions of each case set the frame for an analysis of the flexible parking norms influence on the everyday life of the residents. The areas proximity to functions and services, socioeconomics, and parking supply is therefore presented in the following section. Each case is broken down into three different analytic segments assessing change in car use, car ownership and if there is a correlation with the flexible parking norm. Changes in car use is measured differently from case to case and is based on either; 1) vehicles on the road in the area, 2) daily car use of the residents or 3) the car use of the residents before and after the move to the area. Changes in car ownership is measured by 1) number of vehicles per household, 2) access to a car before and after the move or 3) demand for car sharing in the area. The final part of the analysis attempts to find a correlation between potential changes in car use and ownership and the flexible parking norm used in the area. This is done by assessing 1) where people park, 2) the occupation rate of the parking in the area and 3) residents' satisfaction with the parking supply in the area. Finally, the findings of the analysis will be compared and the relevance of flexible parking requirements as a policy tool will be discussed.



The specific methods chosen to analyze the effect of the flexible parking norm on car use and ownership varies from case to case. Two of the three case areas are analyzed through a literature study of several evaluation documents and a report of the areas parking policy. The flexible parking norm in *Fullriggaren* and *Porslinsfabriken*, has been evaluated by the municipality of Malmö and by the Swedish National Road and Transport Research Institute (VTI). In *Porslinsfabriken* a survey was distributed among the residents asking about transport patterns, parking and car ownership before and after the move. Additionally, several interviews with the residents have been carried out alongside a mapping of the area's parking facilities. In *Fullriggaren* the planning department in Malmö municipality has made a survey as well to evaluate on the residents' car use and car ownership. Here the survey asked about daily car use, place of parking and usage of the provided car sharing vehicles. The knowledge achieved in the two evaluations will in this study be compared in a literature study with the development in the surrounding neighborhoods and in the municipality, to spot potential different tendencies in the case areas. In *Ørestad City* no evaluation exists on the current parking policies effect on mobility patterns and car ownership of the residents. Therefore, a literature study was not possible to conduct in the same way as in the two other cases and several different methods have been applied to achieve knowledge of the effect of the flexible parking norms. Specifically, a change in car use have been analyzed using municipal traffic counts in the area, and interviews with two families residing in *Ørestad City*. Furthermore, a change in car ownership is measured using municipal data from the area, through interviews with mentioned residents, and an interview with a car sharing operator in the area. The effect of the flexible parking norm has been assessed through occupation rates provided by the responsible parking contractor in the area (By & Havn), interviews with the residents, and a literature search examining the public reaction in the area. In order to get an overview of the total amount of parking, car sharing vehicles, and parking areas, observation and mapping have been done of the area as well. A municipal planner responsible for the parking requirements was interviewed to provide background information about Ørestaden. The interview gave a more general perspective of the development in the area which resulted in a deeper understanding of the findings in each analysis. The four semi-structured interviews lasted between 30-60 minutes and were either done over the phone or in person, see more in appendix A2-A6. The interviews add an analytical depth to the analysis by presenting different viewpoints on how the flexible parking norm effects the residents in the area.

Changes in car ownership and car use are measured differently in the three cases due to the difference in the cases policy but also because different parties have collected the data. The different context of the cases and use of methods make it difficult to compare the results directly but the findings from each case give some common pointers about the influence of flexible parking norms.

3. Contextual conditions

The three cases are in three separate cities with a difference in size and type of public transport. Each of the three case areas are however located outside of the city center but with good public transport connections, see table 3. Furthermore, the areas all have an extensive bicycle infrastructure with separate lanes and bicycle parking. In *Porslinsfabriken* and *Ørestad City* the residents have less than 1 kilometer to a retail area with plenty of shops and services. In *Fullriggaren* in Malmö the residents have access to grocery shops and restaurants, other services are located in the city center which is around 2 kilometers away.

<i>Transport options in the areas</i>			
	<i>Ørestad City</i>	<i>Fullriggaren</i>	<i>Porslinsfabriken</i>
Distance to city center	6.5 kilometers	2.4 kilometers	2.7 kilometers
Time to city center	1.20 minute walk	30 minute walk	34 minute walk
	23 minutes on bicycle	9 minutes on bicycle	13 minutes on bicycle
	15-20 minutes with public transport	10-15 minutes with public transport	10-15 minutes with public transport
	15 minutes with car	13 minutes with car	13 minutes with car
Type of public transport	Bus, Train and Metro	Bus	Bus, Tram

Table 3 Distances and transport infrastructure in the three studied areas. The table is constructed based on distances found in google maps.

When considering the socioeconomic parameters there seems to be a tendency towards higher income levels and higher education among the residents in the newly built areas compared to the municipal average, see table 4. However, the case areas have different prerequisites and cannot be directly compared as the type of housing, the size of the area, the distance to the city center, the public transport options, and the socioeconomics of the residents in the districts are different, see table 3 & 4. These differences between the studied case areas have in prior research been found to affect car use and car ownership in a neighborhood (Newman & Kenworthy 2015; Jensen 1997). The lessons from each case can therefore give a valuable insight of how different parameters in a neighborhood influence car dependency.

<i>Housing and residents</i>			
	Ørestad City	Fullriggaren	Porslinsfabriken
Number of adult residents	3882	1322 ⁴	782
Number of apartments	2811	645	509
Type of housing	6 % rental, 1 % housing cooperatives, 93 % privately-owned housing	80 % rental, 6 % housing cooperatives and 14% privately-owned housing	100 % housing cooperatives
Average size of apartment	3 or 4 rooms ⁵ Less than 10 % of the apartments are smaller than 60m ² .	2 or 3 room apartments most common	2 room apartments most common. 89% of the apartments is between 1-3 rooms.
Age group	20-35 years is a more dominant age group in the whole of Ørestaden, and there are more children under 5 than the rest of the city.	20-39 years is the more dominant age group in Västra Hamnen. 27 % have children in the household of <i>Fullriggaren</i> (of them 60 % has one child)	25-44 years is the more dominant age group. 13 % of the households have children (almost all have 1 child).
Income group	Majority have an income of 53.730-67.160 EUR/year per person, which is more than the Copenhagen average.	In Västra Hamnen the income group with 48.870 EUR/year is most common and is more than the average income in Malmö.	Majority with 24.435-48.870 EUR/year per person. Higher income than the rest of the neighborhood, lower income than the inner city of Gothenburg
Education	Majority have a university education		Majority have a university education. 8 % of the residents are students.

Table 4: The socioeconomic parameters in the three studied areas. Composed by data from: (Malmö Stad n.d. ; Malmö stadsbyggnadskontor 2017 ; By & Havn 2010 ; Appendix A1 ; Københavns Kommune n.d ; Antonson et al. 2016; Stadsbyggnadskontoret 2013).

⁴ Own calculation based on an average of 2.05 adults per household in Fullriggaren (Stadsbyggnadskontoret 2013).

⁵ Based on calculations in Ørestad City Nord (Pohl 2007; Rasmussen 2008; Pasternak 2009; Finne 2007).

3.1 Residential parking supply

Guo (2013b) argues that parking policy can be more influential on transport choices than the socioeconomics of a neighborhood. The type, price, and amount of parking varies in the different case areas. All the districts have a majority of the residential parking in off-street parking facilities and residents often have limited access to street parking inside of the residential area. In the three case areas the chosen parking norms and policies are different and they each propose different solutions to affect car use and car ownership. The influence of parking conditions on the residents' transport choices will be discussed and compared later in section 5.

3.1.1 Ørestad City

In *Ørestad City* four different types of parking options are available for the residents in the area. Nearly, all parking in the neighborhood should be in multi-story car parks when the neighborhood has been fully developed (Appendix A3; By & Havn n.d. b). However, while the district is being built temporary parking space is also created on the surface, see figure 2.

Therefore, the residents in the area have the choice to get a residential parking license and park in one of the multi-story car parks in the area or in one of the off-street surface parking lots. The parking in the multi-story car parks is placed so residents have between 200-300 meters to a parking facility (Appendix A3). The unbundled parking, where the cost of residential parking is separated from the rent, has a monthly fee, see table 5. The parking facilities are shared between residents and businesses with a parking license to the area. At the moment, the number of employees with access to the facilities are double the number of residents with access to the parking area (Appendix A7). Guests can park in *Ørestad City's* parking facilities for 1,07-2,15 EUR an hour or maximum 20,15 EUR a day.

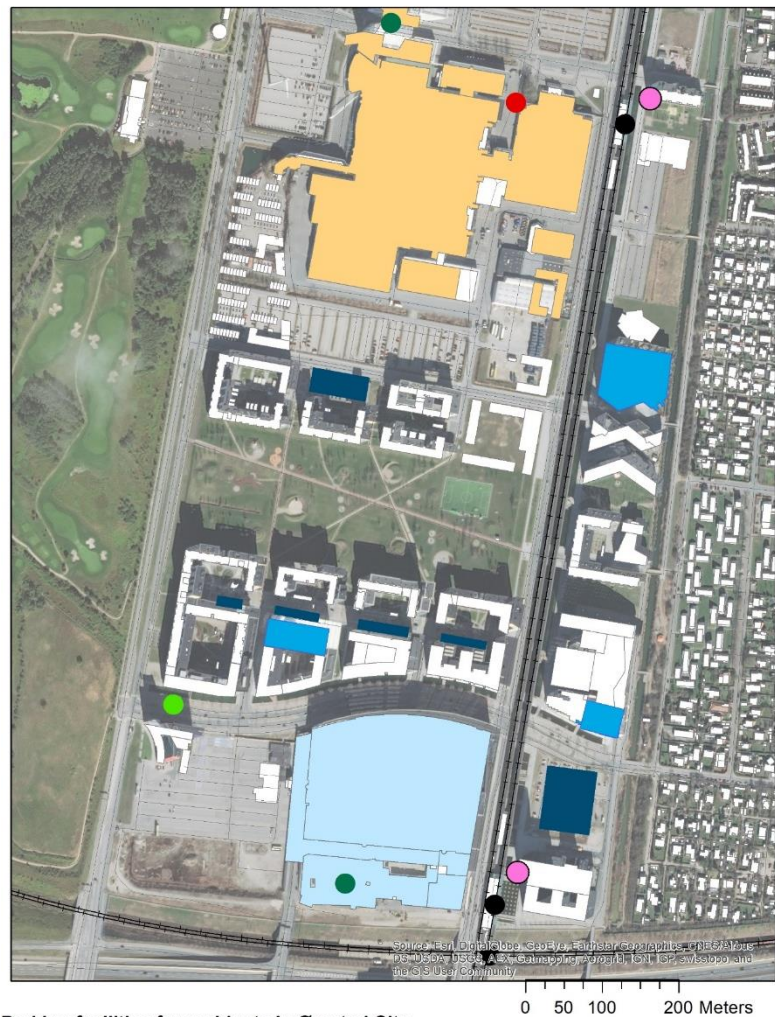


Figure 2 Map of parking supply and mobility offers in *Ørestad City*. Own production. Source: Observations in the area and ESRI contributors.

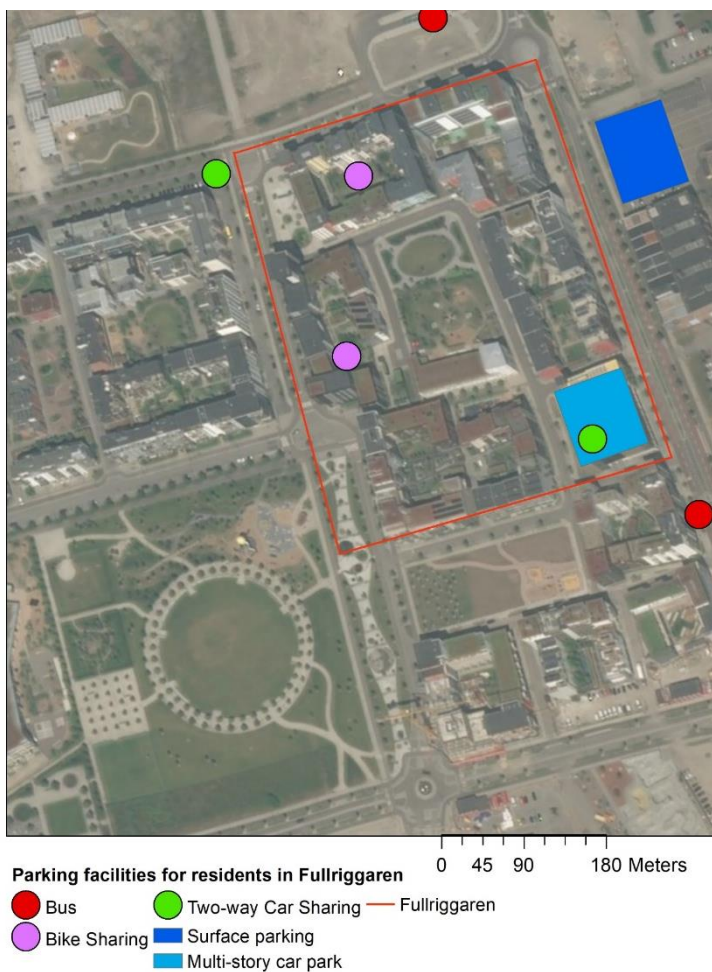
Parking facilities for residents in Ørestad City

- | | | |
|--|---|---|
| ● Bike sharing | ● Two-way car sharing | ■ Conference center |
| ● One way carsharing (hotspots) | ● Metro station | ■ Multi-story car park |
| ● Bus | ■ Shopping mall | ■ Surface parking |

Furthermore, around 5500 parking lots are available in the retail area by the local shopping center and around the conference and event center in *Ørestad City*, see table 5. Guests and employees pay more for parking than the residents in the area. The amount of street parking is limited, and the area only have a few time restricted parking spots located in the streets.

<i>Parking supply and price in Ørestad City</i>			
	Number of parking spaces	Price	Price per hour
Residential Multi-storey car park	1687	131.2 EUR/month	0.19 EUR/h
Residential Off-street car parking on surface	535	131.2 EUR/month	0.19 EUR/h
Businesses parking	Shared with residents	191.2 EUR/month	0.27 EUR/h
Guest parking in <i>Ørestad City</i>	Shared with residents	20.15 EUR/ day	1.07-2.15 EUR/h
Private guest parking Shopping mall	3000	20.15 EUR/day	1.34 EUR/h
Private guest parking Conference center	2500	10.75 EUR/day	2.69 EUR/h

Table 5 The different types of parking in *Ørestad City*. Composed by observation in the area and data from (By & Havn n.d. c).



3.1.2 Fullriggaren

In *Fullriggaren* three types of parking are available for the residents in the district. The residents can rent a parking lot in the area's multi-story car park or in an underground parking garage in the building, see table 6. There is also an option of renting a parking space on a off-street surface parking lot in a nearby neighborhood, see map in figure 3. Guest parking in the area's parking facilities cost 1.83-2.85 EUR an hour and maximum 16.29 EUR for a whole day. Few street parking spaces exist as the area is planned to have all parking in off street parking facilities.

Figure 3 Map of the parking supply and mobility offers in *Fullriggaren*. Own production. Source: (Stadsbyggnadskontoret 2013) and ESRI contributors.

Parking supply and price in <i>Fullriggaren</i>			
	Number of parking spaces	Price	Price an hour
Residential	420	91.6 EUR/month	0.13 EUR/h
Multi-storey car park			
Residential	90 - 100 ⁶	112 EUR/month	0.16 EUR/h
Car parking in buildings garage (underground)			
Guest parking	Shared with residents	16.29 EUR/day	1.83-2.85 EUR/h
Surrounding neighborhood			
Residential	380	69.2 EUR/month	0.1 EUR/h
Off-street surface parking			

Table 6 The different types of parking in *Fullriggaren*. Composed with data from (*Parkering Malmö n.d.*).

3.1.3 *Porslinsfabriken*

In *Porslinsfabriken* all residential parking exists in underground garage facilities or on the surface in an off-street parking lot. When the residents have rented a parking space it is not available to others, see table 7. *Porslinsfabriken* is developed in an already existing neighborhood and a variety of parking options exists within a few minutes walk from the area. Around 100 parking spaces exist in the adjacent streets and the cost for parking is between 0-1 EUR. Out of the 100 parking spaces around 24 lots are free but parking is restricted to two hours. Furthermore, around 350 spaces in the adjacent neighborhood is available in off-street surface car parking areas, not including the 3500 parking lots in the retail area close to *Porslinsfabriken*, see map in figure 4. (Antonson et al. 2016).

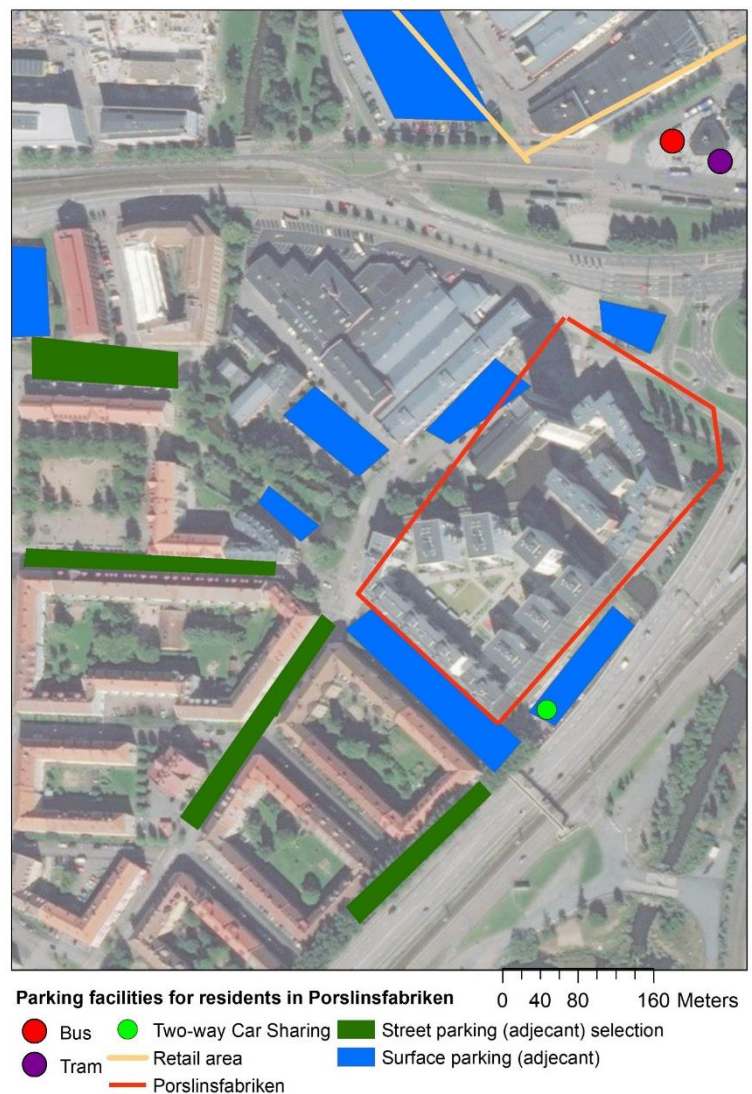


Figure 4 Map of parking supply and mobility offers in *Porslinsfabriken*. Own production. Source: (Antonson et al. 2016) and ESRI contributions.

⁶ Estimate based on the parking norm and the parking supply in the area

<i>Parking supply and price in Porslinfabriken</i>			
	Number of parking spaces	Price	Price per hour
Residential Car parking in buildings garage (underground)	226	101.8 EUR/month	0.14 EUR/h
Residential Off-street car parking on surface	63	50.9 EUR/month	0.07 EUR/h
<i>Surrounding neighborhood</i>			
Time restrictive parking (2 hours)	43		0 EUR/h
Public street parking	74		0.1 – 1 EUR/h
Public off-street surface parking	345		0.1 – 1 EUR/h
Retail area “Backaplan” (3 hours restriction)	3500		0 EUR/h

Table 7: The different type of parking in Porslinsfabriken. Based on findings in Antonson et al. 2016.

4. Case analysis

The data and material from each case will be presented one by one and then the effects of the flexible parking norms found in each case will be compared and discussed in section 5.

4.1 Ørestad City

In 2017 the district *Ørestad City* has been inhabited for nearly 13 years. The effect of the flexible parking norm is investigated by using a variety of data from Copenhagen Municipality, developing company By & Havn, and through interviews with different actors in the area.

4.1.1 Change in car use

Since 2010 a series of traffic counts have been performed by the municipality of Copenhagen at different locations in *Ørestad City*. Based on the traffic counts in the area the private car is the most dominating transport mode followed by walking and public transport, see figure 5. The effect of the flexible parking norm on the residents' car use in *Ørestad City*, is however hard to assess as the traffic counts in the area are not limited to the residents in the district but also account for people traveling through. The registered car ownership in the area is low (see next section 4.1.2.) and it might indicate that the dominating car traffic in the area is caused by other factors. Both the retail area *Fields*, which is Scandinavia's largest shopping Centre, and the conference and event area *Bella Center*, with a capacity of 20.000 visitors, might create a lot of the car traffic in the neighborhood.

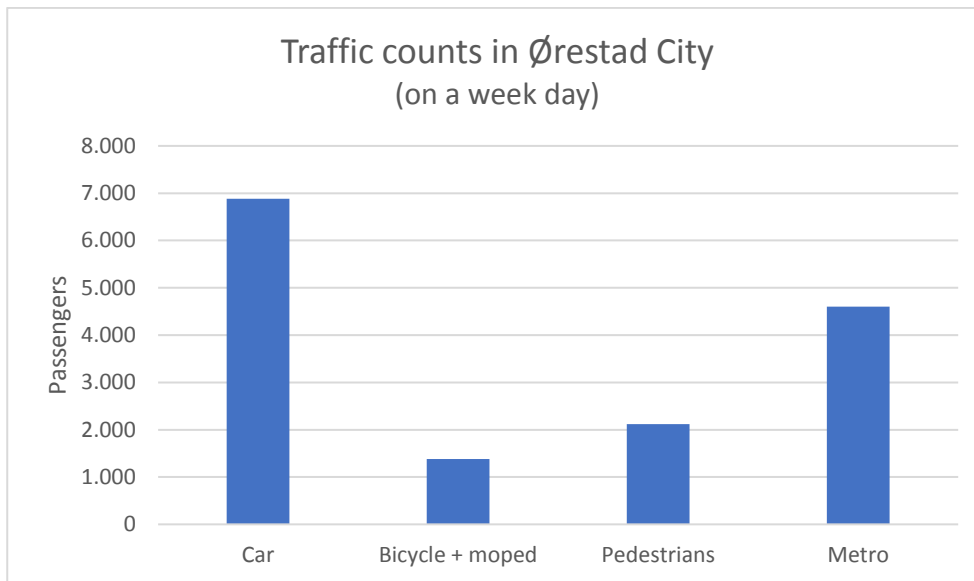


Figure 5 The figure show traffic counts from 5 different locations in Ørestad City made in 2014, 2015 and 2016. The number of pedestrians and passengers by metro is an average of different counting stations. The traffic counts have been made on a weekday and account for number of passengers between 7 AM and 7 PM. The figure is based on data from: (Center for trafik 2014 a ; Center for trafik 2014 b ; Center for Trafik og Byliv 2016 ; Metroselskabet 2015).

In 2016 about 29 % of all trips made by Copenhageners were travelled by car while a majority of trips were made by bicycle (32%) (Københavns Kommune 2016). Therefore, the share of passengers by bicycle seem rather low in Ørestad City based on the traffic counts in the area, see figure 5. One explanation for the difference in travel behavior can be the distance to the city center, which is more than 6 kilometers. The district Ørestad City is still being developed and the capacity in the metro is still far from reached in the area (Center for byudvikling 2009 ; Metroselskabet 2015). Even so, the metro alone in the area seems to generate a higher share of passengers than the Copenhagen average of 14 % of trips made by public transport, see figure 5.(Københavns Kommune 2016).

Ørestaden is placed in a transit node of public transport with trains, metro and busses to Copenhagen city center, Sweden and the rest of Zealand. However, the area also has a highly developed road infrastructure with a freeway connecting to Sweden and the rest of Zealand. According to municipal planner Katrine Westphall the car use in Ørestaden might be higher than other areas in Copenhagen as the area have developed differently than original planned and is well connected to the freeway. Ørestaden is planned as a district of mixed functions where work and retail areas are close to home (Appendix A3). In 2016 around 9500 residents were living in Ørestaden in approximately 4700 households while 976 businesses with around 20.000 work places were in place in 2015 (Københavns Kommune 2017a; By & Havn n.d.a; Appendix A1, A7). The original plan for Ørestaden was a district with a majority of office buildings and businesses and only around 20 % of residential areas (By & Havn n.d. c). According to the municipal planner, the development in Ørestaden has so far led to more residential constructions and fewer workplaces than expected. Therefore, the residents might have to commute to other areas for work, and maybe by car, as the district is located in the outskirts of the city (Appendix A3). However, traffic counts from the same central street in Ørestad City show that the number of passengers by car is the same level from 2010 to 2016

despite the increase in inhabitants. The number of passengers by bicycle has on the other hand drastically increased from around 200 passengers a day to 1400 passengers a day 6 years later (Center for Trafik 2010 a; Center for Trafik 2010 b; Center for Trafik og Byliv 2016).

Interviews with two families in *Ørestad City* were made to assess if the travel patterns of the residents have changed after they moved, see appendix A5, A6. The findings suggest that both families drive less than before they moved to the district. S's family did not own a car before because they lived in the central part of a smaller Danish city (Esbjerg) but they used rental car more often than they do in *Ørestad City*. The family mostly walk to work, shopping, and the children's school in their everyday life. On weekends and in their leisure time they use public transport, mainly the metro to go to the city center.

"We chose (to live in) Ørestaden first and foremost because it is very close to work. I work in Rambøll so I can just walk to work. Before Ørestaden we lived in Esbjerg and there I could walk to work as well. So when we moved I wanted to keep walking to work so Ørestaden was a good place to move to." (S)

A couple of times a year the family uses a car sharing vehicle to go outside of the city or shopping for furniture. Before they moved to *Ørestad City* they used rental cars at least 7 times a year.

M's family also drive less than in the beginning of their time in *Ørestad City* because they sold their private car, changed to car sharing, and now have to plan their trips in advance when they book a vehicle. *"We drive less I think, because we need to plan it but also because we have a child. It affects you that you cannot just take the car."* M's family still have a company car that her boyfriend uses in his business every day for work. M mostly walks because everything is close such as their child's kindergarten and shopping. Sometimes she uses the metro when she has errands in the city. Since M has moved to *Ørestad City* she no longer bikes, because of the improvement in public transport and the proximity to services. The family uses car sharing a couple times a month to visit family and friends outside of the city.

"When you are going to the city the metro is convenient and easy (...) but if we need to visit our family it would take 1 to 1.5 hour and then we would need to change metro, train, and bus. So, when you have a tired child and all you're stuff it's much easier to take a car and get there in 15 minutes." (S)

Both families have moved closer to Copenhagen city center and have more services and public transport options than at their prior resident. They both explain that a private car is unnecessary in their everyday life as everything is in walking distance now.

"Pretty much everything has changed. It's not so boring living in Ørestaden as it is living in Esbjerg. In Esbjerg you need a car if you want to do stuff even though you live in the city center. But in Copenhagen much more is close by. So, you don't need a car if you're bored of Ørestaden, then you can just jump on the metro and be in central Copenhagen in 15 minutes and just do other stuff there." (S)

Both families explain how their transport patterns have changed since they moved to *Ørestad City*. Their change in car use especially seem to be affected by the proximity to services and improved public transportation. One of the families have even chosen to live in *Ørestad City* to have work, services and shopping within a walking distance.

4.1.2 Change in car ownership

In *Ørestad City* 25 % of the inhabitants are registered as car owners. In average the area had 0.35 cars per household in 2016 (Appendix A1). Compared to other new developments in Copenhagen such as Sluseholmen and Amerika Plads, where more than half of the residents own a car, the car ownership is low (By & Havn 2010). The car ownership in the district is even low compared with the municipal average of cars per 1000/inhabitants, see figure 6.

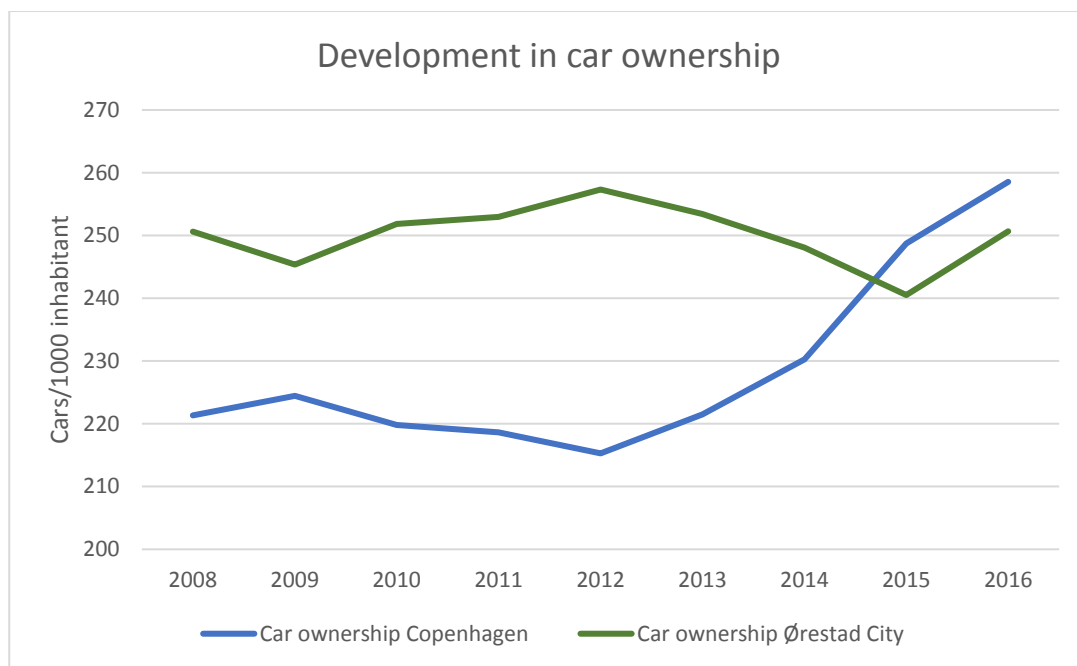


Figure 6 The recent development in cars per 1000 inhabitants in *Ørestad City* and in Copenhagen. The figure is constructed by data from Copenhagen municipality, see Appendix A1 and (Danmarks Statistik 2017a; Danmarks Statistik 2017b).

The car ownership in *Ørestad City* has developed differently than in the rest of Copenhagen. While the car ownership per inhabitant in the rest of the city have been increasing since 2012, the ownership in *Ørestad City* have been decreasing and is on the same level in 2016 as eight years before in 2008, see figure 6. The figure shows that the development in car ownership in *Ørestad City* in the last eight years has been relatively stable while the general tendency in city has been an increase. While the rest of the Copenhageners are buying more cars, it seems that residents in *Ørestad City* are doing the opposite. The interviews with the two families in *Ørestad City* indicate that car ownership is kept low because of the high parking cost and limited parking supply in the area, but also that selling a car can be caused by changes in life situations such as starting a family or getting a new job.

"We used it (the private car ed.) in the beginning when we lived in Ørestaden. We used the car every day. But then I got pregnant and stopped working and we

used the private car less and less. But the private car still cost us 5000 DKK a month with insurance, gasoline and all that stuff and the parking costs are insane, you pay minimum 1000 DKK a month for parking. And there aren't enough parking spaces, so sometimes you don't even have a parking space, even though you paid for it. There are never enough parking spaces for residents, so people practically line up to get a space. (...) We ended up selling it (the private car ed.) and joined LetsGo car sharing instead. It is not feasible with the cost for a private car when we can use car sharing instead. "(M)

M explains how the cost and lack of available parking in the area have led to the selling of the family's car while S's family did not have a car when they moved to Ørestad City as they have always prioritized living close to the workplace.

"No, I have no car and I do not need a car when I live in Ørestad. It's great because you have access to the metro, train, and bus. So it is actually really easy to get to and if you need a car you can always just rent one. There are several car sharing vehicles in Ørestaden, so if you really want or need a car you can use those. "(S)

Both families do not consider owning a private car while they live in Ørestad City. The price and availability of parking affect this decision but also the fact that they do not need a car in their daily life due to proximity to public transport, work, the kids school and kindergarten and retail areas.

"If we moved at some point then it might be nice or necessary with a car, but when we live so close to work and live in Ørestaden then it is not. (...) If you live further away from the city or further away from my work place and if it becomes difficult using public transport then you might have an excuse to get a car. (...) but so far because everything is so close and in walking distance then it does not make sense to have a car. Especially not in Ørestaden where it is crazy expensive to park." (s)

Both families would consider a car if they had to move to another area further away from the city but both families are happy to live in Ørestaden and plan to live there the next couple of years.

"We have talked about getting a car again because of us getting a second child (...) but it is still the price that argues against it, the maintenance cost is expensive. (...) (With car sharing ed.) you do not have to fight for a parking space and we know more people are moving out here. I hope more parking spaces will be built, but I doubt it. Nobody wants a car when you cannot park it and it is just so expensive to park. (...) If we are getting a car it is because we move, and more parking exist there. We have talked about moving to a bigger place (...) if we move further out then we need a car, so I am not stuck. Here I have the metro and further out there is a risk of a single bus going seldom. Here (in Ørestad City) everything is within walking distance." (M)

The interviews suggest that the parking policy in the area do affect car ownership as the residents use words such as “crazy” and “insane” about the prices of parking.

4.1.3 Access instead of ownership

Both families explain that “it does not make sense” for them to own a car when the public transport and service is as good as they are and because car sharing in the area is much more convenient and cost effective as you do not have to pay for and find parking. At the same time both families do not live without access to a car as they both use car sharing in the area. M explains that they would probably still have had their private car if the car sharing was not an option and in the recent years M and her family have felt an increased demand of the car sharing vehicles in the area because new residents have moved to the district.

Five car sharing operators are present in Ørestad City with about 19-23 cars in the area. 2 free floating one way operators, Green Mobility and Drive Now, and 2 two-way operators, LetsGo and Hertz car sharing. Furthermore, a peer-2-peer car sharing scheme also exists in the area through the virtual platform provider GoMore, see table 8. In Copenhagen municipality a total of 6 car sharing schemes are operating.

<i>Providers in the area Ørestad City</i>	<i>Number of cars</i>
LetsGo	2
Hertz	1
Greenmobility	4-8
Drive Now	2
GoMore	10

Table 8: Green mobility have two hotspots in the area, four in total in Ørestaden (Appendix A4.) while Drive Now, Hertz & LetsGo vehicles was observed parked in the area 26 October 2017 kl 11-12. The number of P2P vehicles in the area was found by a count on Gomores webpage the 31 of October 2017.

In an interview with Torben Andersen, CEO of Green Mobility he explains that the limited amount of parking in Ørestaden have made it necessary for them to establish “hotspots” where their users can park the cars. They seldom have designated parking spots as it is expensive to rent lots and contradicts the idea of a free floating car. However, the users trouble with finding a space to park have required the operator to implement a new strategy. The operator has leased 4 parking areas in Ørestaden so the users always have a spot to park in (Appendix A4).

Resident M explains how the car sharing service LetsGo in the last year have become more difficult to use as more members book them on weekends. According to her you have to book months in advanced in some periods to get a car. Hertz Car Sharing experiences that 1 car per 50 household is able to provide a good service and is feasible for them as a provider (Delebilen Hertz n.d.). In Ørestad City only 35 % of the household have access to a private car, this might suggest that 65 % of the households in the area are potential car sharing users, making it 120 households per car sharing vehicle in the area. Torben Andersen explains that their hotspot at the retail area Fields in Ørestad City is experiencing a higher usage than many of their locations in the city center. He estimates that their cars make 40-50 trips to and from the shopping mall every day. One-way car sharing in Copenhagen are often short trips (7 km and 22 min) while two-way car sharing that M and her family use are long trips over several days (Appendix A4 ; DTU Transport 2014 ; Garrett & Nielsen 2015). The existence of both type of car sharing in the area and the high demand for the services suggest a need for alternative solutions to owning a private car in Ørestad City.

4.1.4 Effect of flexible parking norm

In the interviews with the residents in Ørestad City both families express that the parking situation affect the car ownership and car use in the neighborhood. In M's family they have made a deal with the local golfing club to park for free with the company car, but she is not satisfied with the residential parking in the area.

“It (the parking policy ed.) is a really big debate out here. As far as I know it has been on the news several times and it has also been discussed in the owners union several times that people are dissatisfied. It is simply too expensive. I think it is the reason why people choose not to have a car out here because you simple cannot afford it.(...) There are many that doesn't have a car in our building, you just have to look in our bike shed, there are cargo bikes all over. The ones who own a car probably have it because of work, you know it is a necessity. It's not just to be able to drive a cozy little trip once in a while and that is because it is so expensive I think.” (M)

According to M the parking policy directly affects the choice of the residents to own a car and both families explain how some of their neighbors have sold their car because of it. The municipal planner from Copenhagen explains that they have received several complaints about the price of the parking license in Ørestaden (Appendix A3). The local residents are often dissatisfied with the fact that it is more expensive to buy a parking license in Ørestaden than in the rest of the city, see table 9.

Residential parking license	
Ørestad City	Central Copenhagen
131.2 EUR/ month	6.7 EUR/month
0.19 EUR/hour	0.01 EUR/hour

Table 9 The difference in price of residential parking licenses in studied area and central Copenhagen. Based on data from: (By & Havn n.d.c; Københavns Kommune n.d.a).

A protest union have even been created by local citizens that want cheaper and more parking in the area. And just recently several citizens have begun a lawsuit against the municipality because of the “extraordinary” expensive parking (Abolhosseini 2017 ; Yang 2017 ; Dreyer 2017 ; Ørestadsparkeringsforening n.d). In the case of Ørestad City, it seems evident that the parking norm and policy affect car use and ownership in the residents' everyday life. S explains that he is satisfied with the strict parking policy but he would guess that the majority of the residents in the area does not feel the same way.

“If it were up to me then I would say it is fine that it is so expensive to park here in Ørestad. Because I think it is actually nice that we do not have so many cars here. Some of our neighbors have chosen to sell their car because they can see it does not make any sense. It is fine when you have public transport and then instead of owning a car they rent a car, such as a car sharing vehicle instead. So

it (the parking situation ed.) makes much more sense and creates much more tranquility in this part of the city. We don't need any traffic jams with a 100 or more cars in Ørestaden just because it will be cheaper to park. (S)

The interviews suggest that the change in car use and ownership is influenced by the low parking norm in the area as well. Both the provision of parking and the price of parking play a role in the everyday lives of the inhabitants. Municipal planner Katrine Lundbye Westphall explains how the limited parking provision in Ørestaden has created a spill-over effect to neighboring areas. If the free residential parking in the neighboring areas is compared with the occupation of the parking areas in Ørestad City it is clear that the area is at full capacity. The occupation rate at 91-109 % along the free parking lots in the neighboring areas seems to confirm the spill-over effect, see table 10. However, for the residents in Ørestad City the free parking is between 400-1000 meters away, and along the free street only 135 parking lots are available. M's family has never used the free parking in the adjacent neighborhood as it is simply too far away.

<i>Occupation rate in Ørestad City (2016-2017)</i>			
Type	Parking area	Average (%)	Average maximum (%)
Multi - story car park	Edvard Thomsens Vej	45	50
Off-street surface parking	Edvard Thomsens vej		76
Multi - story car park	Bjerget	36	44
Off-street surface parking	C.F. Møllers Allé	79	91
Off-street surface parking	Kay Fiskers Plads	19	50
Multi - story car park	Kay Fisker	22	47
Total		40	60
<i>Neighboring areas (spring 2017)</i>			
Free street parking	Kongelundsvejen (East from Ørestad)	91	109
Time restricted off-street surface parking	Suburban area (East from Ørestad)	35	37

Table 10 Occupation of parking space in Ørestad City and adjacent neighborhoods. Based on own observations concerning off-street surface parking at Edvard Thomsens vej, see Appendix A8 and (Københavns Kommune 2017b).

The occupation rate of the parking facilities in Ørestad City is low in the multi-story car parks with an average of 35 % suggesting that there is an abundance of parking in the area, see table 10. However, the residents in the interviews still explain how difficult it is to find a parking space close to home. The parking lots on the surface closest to the developed residential area experience an occupation rate between 79-91 % in peak hours, see map in figure 7. Despite the supply of parking in the area the convenience of having a car is reduced when the residents must carry groceries, small children etc. 300 meters from the nearest multi-story car park, where the price for parking is the same as in the off-street surface lot close to home. The spill-over of cars to the neighboring areas and the pressure on the parking areas close to the residential buildings confirm the influence of the parking policy on car use and car ownership in Ørestad City.

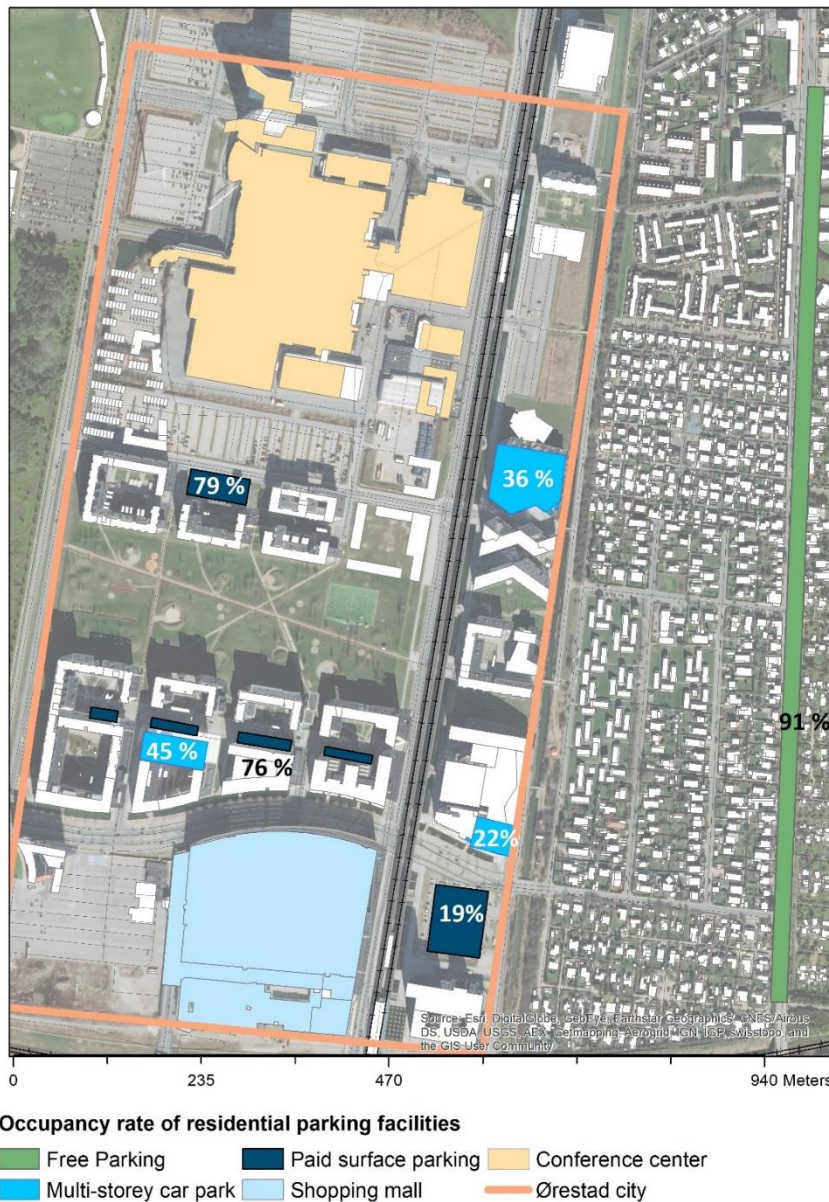


Figure 7 Map of occupation rate of the parking space in Ørestad City and adjacent neighborhood. Own production. Source: By & Havn data, see Appendix A8 and. (Københavns Kommune 2017 b) own observations and ESRI contributions.

Despite the dissatisfaction in the area with the parking provision, both interviewed families agree that people like living in the district and that they personally would like to stay for a long time. From the interviews it is clear that the parking situation affects the everyday lives of residents who as an example have sold their car and changed their daily routines. The analysis therefore indicates that the low car ownership in the area is caused by the flexible parking norm, lowering supply of parking, and cost of parking in the area. Both interviewed families agree that the move to Ørestad City have given them more possibilities than the parking policy have limited them and the change in car use and ownership is partly

affected by the proximity to services and public transport. The residential protests in the area against the parking norm and parking cost might discourage other planners for this type of policy. But overall the residents in the interview are happy to live in the area and have found a way to change their everyday life without a car. If nothing else the discontent clearly shows how the lower parking norms and the policies of unbundled parking can affect residents.

4.2 Fullriggaren

In 2012 the sustainable district *Fullriggaren* had been inhabited for a year and an evaluation survey of the residents' car use, parking choices and car ownership was distributed in the neighborhood. The following analysis is based on the findings in the survey from 2012 where 25 % of the inhabitants answered, a travel pattern analysis in Västra Hamnen, and statistics from Malmö municipality.

4.2.1 Changes in car use

In *Fullriggaren* around half (53 %) of the households own a car and the survey showed that 69 % of them use it several times a week, whereof 42 % use it each day. Half of the residents (49 %) who own a car mainly use it for the commute to work or during their workday, while the other half (42 %) of the car owners need a car in their leisure time and 31 % use their car a few times a week or less (Stadsbyggnadskontoret 2013).

Based on the survey made by Malmö Municipality it is difficult to determine if moving to *Fullriggaren* have affected the residents' car use. Compared to the average distribution of trips in the neighborhood Västra Hamnen the car was used for 45 % of all trips in 2013 (STADSBYGGNADSNÄMNDEN 2014), which is higher than the 40 % of trips made by car in Malmö in general in 2013 (SWEKO 2014). This tendency to a higher car use might however not be the case for the district *Fullriggaren* as only around 35 % of the residents use a car several times a week. The amount of cycling in *Fullriggaren* is high with 69 % of the residents using their bicycle several times a week. In the district nearly every household (93 %) own one bike or more (Stadsbyggnadskontoret 2013), while only 74 % of the inhabitants in Malmö Municipality have access to a bike (SWEKO 2014). In *Fullriggaren* 39 % of the residents use their bike daily, while 22 % of the inhabitants use their car daily (Stadsbyggnadskontoret

2013). Compared with Västra Hamnen only 25 % of the trips were made by bike in 2013, which might indicate that the share of car usage is lower and bike usage higher in *Fullriggaren* than in the surrounding neighborhood and the city in general, see figure 8.

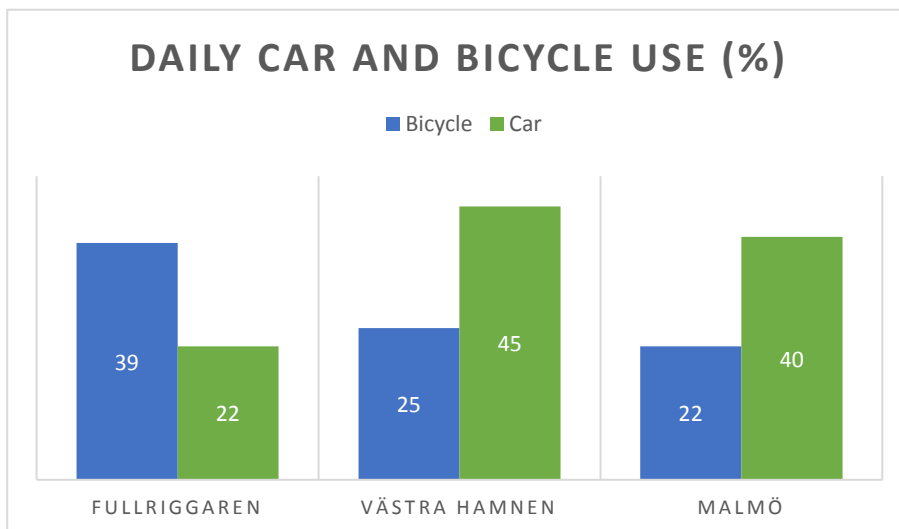


Figure 8 Comparison of car use in Malmö. The modal split of Västra Hamnen (STADSBYGGNADSNÄMNDEN 2014) and Malmö (SWEKO 2014) show the share of daily trips made by car and bicycle. The data from Fullriggaren is based on how many inhabitants who use a bicycle or a car every day. (Stadsbyggnadskontoret 2013) Be aware that some of the residents in Fullriggaren might use both transport options daily.

The evaluation of the flexible parking norm in *Fullriggaren* made by Stadsbyggnadskontoret in Malmö Municipality have not researched the mobility patterns of the residents before they moved to *Fullriggaren*. A change in car use is therefore difficult to verify, but measured on parameters such as daily car trips it seems that *Fullriggaren* might have a lower share than adjacent neighborhoods.

4.2.2 Changes in car ownership

The survey from 2012 indicates that 53 % of the households own a car and that the area have 0.6 cars per household (Stadsbyggnadskontoret 2013). In 2012 a mobility management information campaign by Malmö Municipality registered that 58 % of the households in the area owned a car. The campaign reached more households in the area (40%) compared to the survey (25%) and the car ownership might therefore be closer to 58 % (STADSBYGGNADSNÄMNDEN 2014). If the majority of the households in *Fullriggaren* own one car as the survey suggest 0.6 cars per household seems an accurate estimate. In 2014 a new survey in *Fullriggaren* was completed, and it suggested that the car ownership had increased to 0.7 per household. (Malmö Stad 2014b) The car ownership in the district therefore seems to fit the actual parking norm for the area which was set at 0.7 cars per housing unit.

Compared with the rest of Västra Hamnen the car ownership in Fullriggaren is low. In the neighboring districts 77 – 90 % of the households own a car in 2008 and 2011 (STADSBYGGNADSNÄMNDEN 2014). The car ownership in *Fullriggaren* is closer to the average in Malmö Municipality of 0.62 cars per household in 2016. To assess if the car ownership is affected by the parking supply in the area the residents who did not own a car was asked if they had considered buying one after moving to *Fullriggaren*. 11 % of the residents who did not own a car are considering buying one but because of shifts in their work- or family life. Only 2 % would buy one if more parking options were available and the majority (74 %) are not considering buying a car (Stadsbyggnadskontoret 2013).

4.2.3 The effect of the flexible parking norm

In *Fullriggaren* the adjacent neighborhoods temporary off-street parking lot has a cheaper residential parking cost than the parking facilities on the site. When evaluating how the residents park in the area 42 % use parking facilities outside of the district, 10 % use the multi-story car park, and 48 % use the parking garages. The most common explanations for these choices are to have a low parking cost or to be as close to the home as possible. 75 % of the residents are satisfied with the parking in the area (Stadsbyggnadskontoret 2013). The fact that nearly half of the residents do not use *Fullriggaren's* parking facilities and seem to cut parking cost in adjacent neighborhoods might be why only 2 % of the residents answered that they do not own a car because of the parking situation in the area (Stadsbyggnadskontoret 2013). It might suggest that the reduction in ownership compared with the rest of the neighborhood is not created by the restrictive parking norm but by other factors.

One of the key elements to the reduction of the parking norm in *Fullriggaren* was that different mobility management strategies were to be implemented. A total of 12 two-way car sharing vehicles are available and placed in either the multi-story car park or in parking garages in *Fullriggaren*. The car sharing service is available for the 645 apartments in *Fullriggaren* and about 40 % of the residents had signed up for the car sharing system in 2014. (Malmö Stad 2014a) Of the members assigned to the service 23 % had used the shared cars. It is free to be a member of the car sharing service for all the residents. According to the survey in 2012, the car sharing vehicles is mainly (61%) used a couple of times a month or on special occasions during the year by the residents in the survey. Many of the members write that they have not

yet had the need to use a car (Stadsbyggnadskontoret 2013). Furthermore, an experiment with bike sharing of different types of cargo bikes has been started in the neighborhood, where 40 % of *Fullriggarens* residents had access. In 2014 only 4 % of the residents had used the cargo bikes and 23 % knew of the possibility to use it. Bicycle facilities and do it yourself repair/ service shop have been established in the neighborhood as well (Malmö Stad 2014b). A third measure was a mobility management information campaign in 2012 to advice the residents on transport choices. About 40 % of the residents was reached in the campaign and a month free public transit card was offered to the residents who wanted to try a change to public transport. The possibility to join the car and bike sharing was offered as well (Stadsbyggnadsnämnden 2014).

The evaluation of the flexible parking norm in *Fullriggaren* suggests that the parking policy with unbundled parking in the area have not been restrictive enough to cause a lower car ownership and reduce car use alone, as 42 % of the residents find cheaper places to park in the neighboring areas. The reduction in car ownership and use might have been influenced more by the mobility management measures required in the experiment with a more flexible parking norm. Few studies of the effects of mobility management on car use and car ownership in residential areas exist. Two-way car sharing is one of the most studied measurements and a literature review shows a great variation in effects. However, all studies show a decrease in car ownership at residential sites where car sharing is available, se table 11.

<i>Car sharing in residential housing – reductions on a building scale</i>				
City	Malmö, <i>Fullriggaren</i>	Montreal	Toronto	San Francisco
System	Two-way (B2C)	Two-way (B2C)	Two-way (B2C)	Two-way (B2C)
Car ownership (vehicles/household in housing with car sharing)	0.6-0.7	0.13	0.5	0.76
Car ownership (vehicles/household in buildings without access to car sharing)	0.8	0.89	1.07	1.03
Reduction	13-25 %	88 %	53 %	26 %

Table 11 A literature review comparing the effects of car sharing in residential areas. The table have been composed based on findings in (Schure, et. al. 2012; Sioui et al. 2013 ; Engel-Yan & Passmore 2013)

Car sharing and the transport consultation are the measurements that seem to have been used by the highest share of residents. It is however unclear if it is a combination of the different mobility management measurements or one specific that influence the car ownership of the residents. The low car ownership in *Fullriggaren* can also be due to the high share of rental apartments. *Fullriggaren* have a higher share of rental and smaller apartments than the neighboring areas in Västra Hamnen and in Malmö in general (Malmö Stad n.d. ; Malmö stadsbyggnadskontor 2017). The size of household, family type and other socioeconomic factors can be part of the reason for the low car ownership in *Fullriggaren* (Jensen 1997).

4.3 Porslinsfabriken

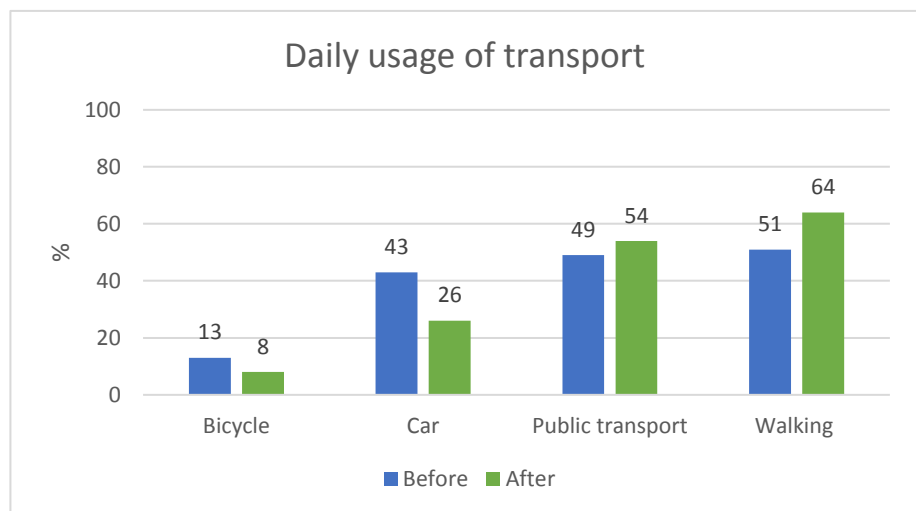
In 2015 a survey among the residents in *Porslinsfabriken* asked about the use of parking, car ownership, and prior and current transport patterns of the residents. The survey was initiated by the Swedish National Road and Transport Research Institute 3 years after the residential area had been constructed. About 46 % of the residents participated in the study which was followed by 15 interviews to assess the parking norms effect on the residents' daily lives. The analysis of the flexible parking norms effect on the car use and ownership in *Porslinsfabriken* will be based on Antonson et al.(2016) findings and a travel pattern analysis from Gothenburg Municipality in 2016.

4.3.1 Change in car use

Only 26 % of the residents in *Porslinsfabriken* use a car daily, (Antonson et al. 2016) which might indicate a lower car use in the neighborhood than in the rest of the city where 48 % of all trips was made by car in 2011 (Traffikkontoret 2016). In the survey from 2015 a majority of the residents in *Porslinsfabriken* answered that they use public transport and/or walk every day, even though 61 % of the households in *Porslinsfabriken* have access to their own car (Antonson et al. 2016). About 33 % of the residents with access to a car, use their car for work daily. However, nearly half (40 %) of the car drivers never use a car for work but in their leisure time instead. If leisure time activities are investigated the majority (55%) of the car drivers use it for shopping every week and around 40 % use it on vacation every month or every second month.

The evaluation of *Porslinsfabriken* from 2015 suggests that the share of walking and public transport have increased in the residents' daily transport use after they moved to the district, see figure 9. and 24 % uses public transport more often after they moved. The share of cycling on the other hand have decreased and 60 % of the residents never use a bicycle as a means of transportation. It seems that the car use has been affected by the move as well. The residents who drive every day have decreased by 40 %, see figure 9. though 65 % of the residents drive the same as before they moved.

Figure 9 The figure shows the residents in *Porslinsfabriken* daily use of transportation before and after they moved. Based on the findings in (Antonson et al. 2016).



In interviews with the residents the decrease in car use is often connected with proximity to services in the surrounding area and better public transport connections to the city center at *Porslinsfabriken* than their former homes (Antonson et al. 2016).

When the transport patterns of the residents in *Porslinsfabriken* are compared with the development in Gothenburg some of the same tendencies are apparent. In the central part of Gothenburg where *Porslinsfabriken* is located the car use has decreased the last 30 years and from 2011 to 2016 the car use decreased by 15 %. The city experiences a stagnation in the usage of biking and only 5 % of the trips in Gothenburg Municipality was by bicycle in 2016. Furthermore, an increase in walking and public transport is evident in 2016, just as the development seen in *Porslinsfabriken* (Trafikkontoret 2016). The similarities between the area in *Porslinsfabriken* and the city as a whole suggest that some of the changes in car use might be triggered by changes on a bigger scale than the parking norm in a new residential area.

4.3.2 Change in car ownership

61 % of the households in *Porslinsfabriken* own a car and the area have a higher car ownership than regulated by the parking norm, see table 12. The average of 0.7 cars per household in the district is high compared with the ownership in the rest of city at 0.57 cars.

Cars per household		
<i>Porslinsfabriken</i>	Parking Norm <i>Porslinsfabriken</i>	Gothenburg municipality
0.7 in 2015	0.52	0.57 in 2016

Table 12 Vehicles per household in studied area and the city in general. Based on the findings in (Antonson et al 2016) and on own calculations using municipal data from (SCB 2016; Trafikanalys 2016).

According to the survey 78 % of the residents have not been affected in car ownership after they moved to the area and have the same access to a vehicle as before (Antonson et al 2016). There are 2 car sharing vehicles just next to *Porslinsfabriken* operated by the B2P two-way service Sunfleet. Despite the presence of a car sharing scheme only 3 % of the households have access to more cars after they moved and 19 % have access to fewer cars ending with a total decrease in car ownership of 16 % in the area (Antonson et al 2016). Car ownership has decreased in Gothenburg from 2011 to 2013 and to 2015 the development has stayed at the same level (Trafikkontoret 2016).

4.3.3 The effect of the flexible parking norm

According to the evaluation of *Porslinsfabriken*, some of the inhabitants have been influenced by their move to the new residential area as the car use in total have decreased and the access to cars has been reduced. The survey shows that 25 % of the residents used their car less after they moved because of the parking provision and 3 % drove more because of the parking in the area. In regard to car ownership 16 % have access to fewer cars after they moved to *Porslinsfabriken* because of the parking situation in the area. However, the majority's car ownership (78%) have not been affected by the new parking conditions in the area and 53 % of the residents have not changed their car use after they moved (Antonson et al. 2016).

The interviews with the residents imply that the change in car ownership and use is caused by more than the parking policy in the area. The move to a more urban neighborhood with access to services and public transport have instigated a decrease in car use. The reduction in car ownership in the area is according to the interviews especially affected by the cost of parking and not the supply of parking. Among residents with a low income the price of the unbundled

parking seems to have a bigger effect on their choice to sell a car. The area's good public transit infrastructure combined with the cost of parking motivates the residents to sell their car or avoid buying one. The residents with a lower income perceive the cost of parking high compared with higher income groups. No difference exists in car ownership if you rent a parking space in the area or not. The interviews and survey suggest that the majority of the residents, especially those with a high income, are not affected by the cost of parking or the parking norm in the area (Antonson et al. 2016).

In *Porslinsfabriken* 0.52 cars per household was the municipal requirement to the residential area but the study of the area suggests a car ownership at 0.7 per household. The majority of the residents do not seem to be influenced by a lack of parking as this high car ownership logically would entail and the majority are satisfied with the parking situation. According to the survey 20 % of the residents who own a car, park in the surrounding areas where they pay less a month for a parking space than in *Porslinsfabriken* (Antonson et al. 2016). The earlier mapping of the area, see figure 4, shows an abundance of parking space surrounding the area and the survey shows that the residents use it frequently to cut costs (Antonson et al. 2016). The supply of parking in the area surrounding the residential site let the residents choose between parking spaces and they are not obliged to use the parking facilities in *Porslinsfabriken*. The cost of parking in *Porslinsfabriken* does not affect most of the residents which may imply that it is too low if the goal is to influence car ownership or that it is too easy to find cheaper parking elsewhere. The parking fees in the area and the supply of parking might have been more influential on car ownership and use, if parking prices and occupation rates in the surrounding areas had been assessed in the process of setting the parking norm. The abundance of parking in the surrounding area could have been included as parking space for the residents, actively counting on a spill-over effect, and the parking requirements might have been lowered further making it more difficult for residents to find a cheap parking spot.

5. Findings

In all of the cases above car use and ownership tends to be reduced. Lower parking requirements ensured by flexible parking norms thereby appear to reduce car ownership and car use among the residents in new housing. However, the reduction in each case might be attributed to other factors such as proximity to the city center, a developed public transport infrastructure, and services in walking distance, which seems to be influential factors in the everyday lives of the residents.

5.1 The effect of a reduced parking supply and higher parking costs

In the three cases parking supply and parking costs are used as tools to reduce car use and ownership. In the two Swedish cases, *Porslinsfabriken* and *Fullrigaren*, the supply and cost have been difficult to control and have had a limited effect on the everyday lives of the residents.

The evaluation of the *Porslinsfabriken* shows that half of the residents own a car but only around 1/5 of the residents changed their car use and ownership due to the parking situation in the area. Mainly the residents with a lower income were influenced by the price of the unbundled parking and 20 % of the residents parked outside of the neighborhood to find

cheaper parking. The car ownership in *Porslinsfabriken* is at 0.7 cars per household which suggest that the parking supply off 0.52 cars per household has not been restrictive enough to influence the residents' car ownership. The analysis indicate that supply and price of parking have been ineffective tools as the area around the new residential site has an abundance of cheap parking. The same tendency is apparent in *Fullriggaren*, where 40 % of the residents park in surrounding neighborhoods at a lower parking cost, reducing the effect of the areas internal parking facilities supply and cost. The low car ownership and change in car use in *Fullriggaren* seem to be influenced more by the socioeconomic profile in the area and by the mobility offers than the parking norm and unbundled parking. In both *Porslinsfabriken* and *Fullriggaren* the distance to the city center, services and the access to public transport, and other mobility services seem to be a more influential factor, and the cause for change in car use and ownership among the residents, than the cost and supply of parking in the area.

The influence of proximity to services and the city center on car use and ownership seen in *Fullriggaren* and *Porslinsfabriken* might suggest that a change in *Ørestad City* would be more difficult than in the Swedish cases. If the location of the three areas are compared *Ørestad City* is far away from the city center, see table 13. Furthermore, the residents in *Ørestad City* have bigger apartments and have a higher share of privately owned housing compared with the other two areas, factors which have been known to increase car use and ownership (Jensen 1997). But despite the absence of mobility management such as seen in *Fullriggaren*, the distance to the city center and the socioeconomics of the residents, *Ørestad City* seems to have a bigger reduction in car ownership than in the two Swedish cases, see table 13. The analysis of *Ørestad City* indicates, that parking norms and price for parking do not only influence car ownership, but also that it might have a bigger effect than the socioeconomic parameters. The car ownership is lower in *Ørestad City* than in the rest of Copenhagen, despite the amount of privately owned housing and the higher income group in the area. Other newly developed areas in Copenhagen have a much higher car ownership, and car ownership in Copenhagen is in general increasing more than the inhabitant development while it in *Ørestad City* has been stable since 2008. In both *Fullriggaren* and *Porslinsfabriken* the car ownership per household is bigger than the cities average, see table 13.

It seems that the residents feel affected by the parking norm in *Ørestad City* because they experience a lack of parking space in the off-street surface parking lots close to home. At the same time, the area is big enough that the families in the interviews find the distance to the neighboring free parking too far away. The spill-over to other parking areas as seen in *Fullriggaren* and *Porslinsfabriken* might therefore not be on the same level in *Ørestad City* and the residents are forced to pay the full price for parking in the area. The occupation percentage of the free street parking in the neighboring area shows a spill-over effect to some extent from *Ørestad City*. But compared with the other two areas the amount of free parking is limited, see table 13 and the free street already experiences overcapacity in some periods making it difficult to find an available parking space outside of *Ørestad City*.

<i>Comparison of cases</i>			
	<i>Ørestad City</i>	<i>Fullriggaren</i>	<i>Porslinsfabriken</i>
Monthly cost of residential parking	131.2 EUR	69.2-112 EUR	50.9-101.8 EUR
Distance to city center	6.5 kilometers	2.4 kilometers	2.7 kilometers
Parking norm	1 space per 200 m ² ~ 0.5 space per unit	0.7 space per unit	0.52 space per unit
Car ownership per household	0.35	0.6 – 0.7	0.7
Average municipal car ownership per household	0.48	0.62	0.57
Change in car use	Indication of decrease	Only 22 % use their car every day	25 % used their car less after they moved to the area
Reduction in car ownership	27 % compared with city average	13-25 % compared with adjacent neighborhood	16 % of the residents have access to fewer cars
Parking in adjacent area	135 lots 400 – 1200 meters away	380 lots 50 – 400 meters away	419 lots 100 – 400 meters away

Table 13 Comparison of findings in the three studied areas. Constructed of the results in the previous case analysis.

The crucial difference between the cases and how parking supply and cost effect the inhabitants seems to be the size of the area and thereby the distance to cheaper and available parking. If the area is big enough, in *Ørestad City* it seems that 400-1000 meters is too far, the residents find it too troublesome to walk to adjacent neighborhoods parking facilities and must pay the actual parking price in the new residential area where they live. In contrast to the two Swedish examples, only one price for parking exist for the residents in *Ørestad City*. The price is the same no matter if the parking is in a multi-story car park or on a temporary surface parking lot which makes it impossible to cut parking cost in the area as the residents do in *Fullriggaren* and *Porslinsfabriken*. The findings of the analysis suggest that cost for parking and supply of parking can be very effective tools to reduce car use and ownership if the spill-over to other areas can be avoided. In order to avoid the tools becoming insufficient a certain size of the new residential area is necessary. Unbundled parking and a reduced parking norm

can therefore also be difficult tools to use in smaller densification projects such as *Fullriggaren* and *Porslinsfabriken*, where the parking condition in already existing adjacent neighborhoods might be different and close by.

5.2 Car sharing and flexible parking norms

Car sharing is present in the three studied areas, even though it has not been secured through a flexible parking norm and municipal intervention in *Porslinsfabriken* and *Ørestad City*. In *Ørestad City* it seems that cost of parking and a limited supply of convenient parking space have created profitable conditions for car sharing. In many Swedish municipalities the policy is to give reduction in the parking requirement, if developers offer the residents car sharing vehicles. In the case of *Ørestad City* it seems that price and limited supply of parking influence the residents' car ownership and create a market and a demand for car sharing on its own. In *Fullriggaren* car sharing and other mobility management measurements have been ensured by a flexible parking norm but the analysis indicates that these offers have not had the same amount of success as the cost and supply policy in *Ørestaden*. This might suggest that the use of flexible parking norms to ensure available car sharing is not worth the while in cities with established car sharing operators, as car sharing will be a natural outcome of unbundled and limited parking in an area.

The presence of car sharing seems to be an important element in reducing car ownership. Earlier studies suggest that some car sharing schemes affect car ownership and use in an area, see table 14. Overall, studies of two-way car sharing have shown that one car sharing vehicle can replace from 4-13 private cars with fewer cars in Europe than in North America, see table 14.

<i>International studies of the effect of car sharing on car ownership</i>						
City / County	Bremen	Lisbon	Belgium	Switzerland	London	US and Canada
System	Two-way (B2C)	Two-way (B2C)	Two-way (B2C)	Two-way (B2C)	Mixed	Two-way (B2C)
Cars replaced (per car sharing vehicle)	7-10	8 % sold their car	4-6	22 % chose not to buy a car	10.5	9-13

Table 14 Literature review of the effect of two-way car sharing. Based on the findings in the following studies: (MOSES 2005; Baptista et al. 2015; Haefeli et al. 2005; Carplus 2016; Martin et al. 2010).

The residents in *Ørestad City* highlights the importance of having access to a car even though they do not need to use one daily. Together with the restricting parking supply and the price for parking in the area, car sharing supports the selling of a private car for one of the families in the interviews.

In *Fullriggaren* and *Porslinsfabriken* more than 1/3 of the car owning residents seem not to need a car for work or in their everyday lives. In *Porslinsfabriken* 40 % of the residents mainly used their car for leisure purposes and far from every day. In Copenhagen a recent study found that ¼ of the cars in parts of the central city are parked in the same spot from Monday to Friday (COWI 2017) and the interviewed families in *Ørestad City* explain how many residents sell their car because they do not need it in their daily lives. Overall, owning a car in a city

does not necessarily seem to imply a daily or even weekly need of a car. This tendency among a part of the car owning inhabitants in Gothenburg, Malmö and Copenhagen could indicate a huge potential to reduce car ownership further. A combination of high parking cost, limited parking supply, and car sharing could encourage these “leisure time” car owners to sell their car as seen in *Ørestad City*.

6. Discussion and policy implications

Parking norms have for decades been used to ensure available car parking and have thereby been part of an automobile regime in the city (Shoup 2001). Increasing landscape influences such as global warming and congestion have however led to a change in planning practices in many cities (Newman & Kenworthy 2015; Bannister 2008). Flexible parking norms have been proposed as a possible policy instrument to support a transition towards a more sustainable transport system (Smith 1983) and are already in place in many Scandinavian municipalities. A flexible parking norm is an interesting tool in a transition perspective, as it is set and controlled by local planning authorities. Municipalities have the authority to regulate the parking supply and the cost for parking in the city and are thereby in a position to create a change.

6.1 Flexible parking norms as a tool to support transitions to sustainability

According to Geels (2004) increasing external and internal pressure on a regime can create disruption or windows of opportunity for new solutions to transform or replace the existing regime. Flexible parking norms seem to be a disruptive element in the everyday lives of the residents in *Ørestad City*. The residents do not seem to understand the actual cost of parking because it has been subsidized in the past. In Denmark the construction cost for one parking lot is between 4000-47.000 EUR depending on the type of parking facility (Realdania By 2014). The parking policy in Ørestaden visualizes the actual cost of space in the city and is met with public protests. The public response in the area illustrates that changing the rules of parking creates a reaction in the automobile regime. In *Ørestad City* the flexible parking norm combined with a high parking cost appear to create a window of opportunity. The convenience of owning a car is pressured in the area and some of the residents therefore choose alternative transport solutions.

In *Porslinsfabriken* and *Fullriggaren* flexible parking norms do not seem to have been a disruptive policy to the same extent as in *Ørestad City*. Even though the supply of parking is reduced in the two areas residents cut costs and find available parking elsewhere. The use of flexible parking norms does not appear to support a transition towards sustainable travel patterns in *Fullriggaren* and *Porslinsfabriken*. The parking facilities of adjacent neighborhoods provided more parking than required by the parking norms for the developing site in both areas. The parking supply and policy in the surrounding area of a new residential development thereby affect the influence of flexible parking norms. Many Scandinavian municipalities use flexible parking norms, see table 1, but the standard parking requirement is often set so the demand for parking is met on the developers own lot. This tradition has initially been fashioned to reduce the possible spill-over to other areas by covering the demand for parking on the developing site (Barter 2009). The figure 10 suggests that around 1/3 of the biggest

municipalities in Sweden and Denmark meet the entire demand for car parking on developing sites in the central city. Instead of including the surroundings parking facilities in adjacent neighborhoods sufficient parking for the residents is created by the building.

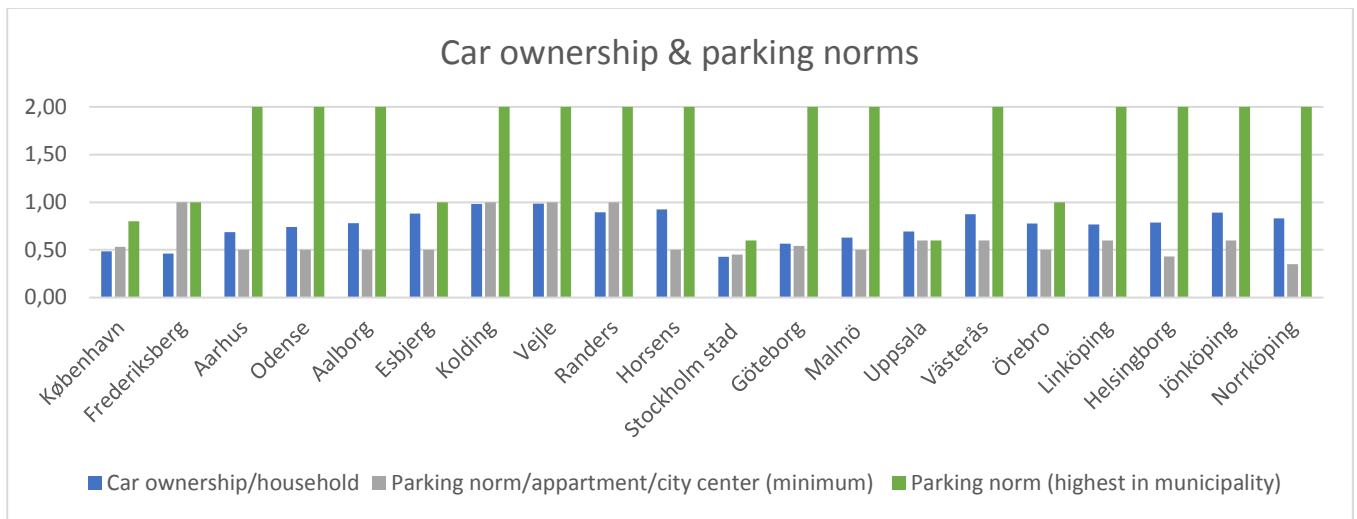


Figure 10 The car ownership of the entire municipality compared with the parking requirements in residential housing in city center and rest of municipality. The figure is produced on data from Statistic Denmark, Statistics Sweden (SCB), the Swedish agency Transport Analysis, and parking norm documents from each municipality, see reference list. (Danmarks Statistik 2017b; Danmarks Statistik 2017a; SCB 2016; Trafikanalys 2016)

This practice provides residential parking close to the home and might even create a higher car ownership than planned for. In *Porslinsfabriken* the residents used parking in nearby streets and the car ownership was higher than the available parking permitted on the site. Despite the attempt to manage and affect the demand for cars, through e.g. mobility management measurements, flexible parking norms still ensures available parking close to home. This fact might suggest that the concept of flexible parking norms is too closely aligned with an automobile regime to generate a transition.

6.2 Policy implications

If a holistic planning method is not in place the use of flexible parking norms can result in spill-over to other areas where parking is cheaper or easier to access, leaving it without an effect. The findings of this study suggest that flexible parking norms can work as a transition tool but only if they are combined with other factors, such as high parking cost in the whole area or proximity to public transport and services.

To operationalize the notion of flexible parking norms many municipalities have chosen to give a fixed percentage of reduction in the standard requirement depending on the implementation of different mobility measurements. This practice might however be too simple as the effect of the mobility measurement will vary depending on the local conditions in the different city districts. As an example, car sharing has been proven to have various effects on car ownership and car use in Scandinavia. Some studies of schemes in Copenhagen even suggest that some types of car sharing increase car use and ownership, see table 15.

<i>Scandinavian case studies of the effect of car sharing on ownership</i>						
City	Copenhagen region	Copenhagen city	Copenhagen city	Malmö	Gothenburg	Stockholm
System	Two-way (B2C)	One-way (B2C)	Two – way (P2P)	Two-way (B2C)	Two-way (B2C)	Two-way (B2C)
Cars replaced (per car sharing vehicle)	4.6 – 6.2	None	None, cars added	3.9	5.8	5.2

Table 15 The table is based on a literature review of the following case studies: (Trivector 2014; Trivector 2015; Garrett & Nielsen 2015; DTU Transport 2014; Haustein & Nielsen 2015; Haustein & Sick 2015; Wrolblewski et al. 2013; Eriksen et al. 2017)

In *Porslinsfabriken* only 4 % of the residents had access to car sharing even though two vehicles were in proximity to the site while 23 % of the residents in *Fullriggaren* were using car sharing vehicles. In *Ørestad City* two-way car sharing have been given parking privileges on the street, making it easier and cheaper to find parking for residents when using car sharing than using their own car. Here, car sharing seems to be a byproduct of the strict parking policy and support a reduction in car ownership. This might indicate that some car sharing schemes does not reduce ownership significantly if not combined with a strict parking policy in the area.

In flexible parking norms a reduction can often be achieved if the parking facilities can be shared between residents and employees, see table 1. This notion might also need to be re-considered depending of the context of the city. The idea behind shared parking is that employees use the parking facilities by day when the residents have commuted to work leaving a parking spot empty. However a general tendency in Copenhagen is a decrease in car use but an increase in ownership among the residents, see figure 11. Each car is therefore driven less in the city and a study shows that 25 % of the cars in the central city districts is parked from Monday to Friday (COWI 2017). In *Ørestad City* shared parking has been implemented and the parking requirements lowered. If the expensive residential license had not ensured that car ownership was kept low in the area it might had caused a capacity problem to use shared parking. The tendency in Copenhagen suggest that car use can be decoupled from car ownership on a population level. In cities where the share of sustainable transport is increasing residents might still choose to own a car. This could pose a problem to shared parking between different groups because the parking spots might be occupied by residents for days or an entire week.

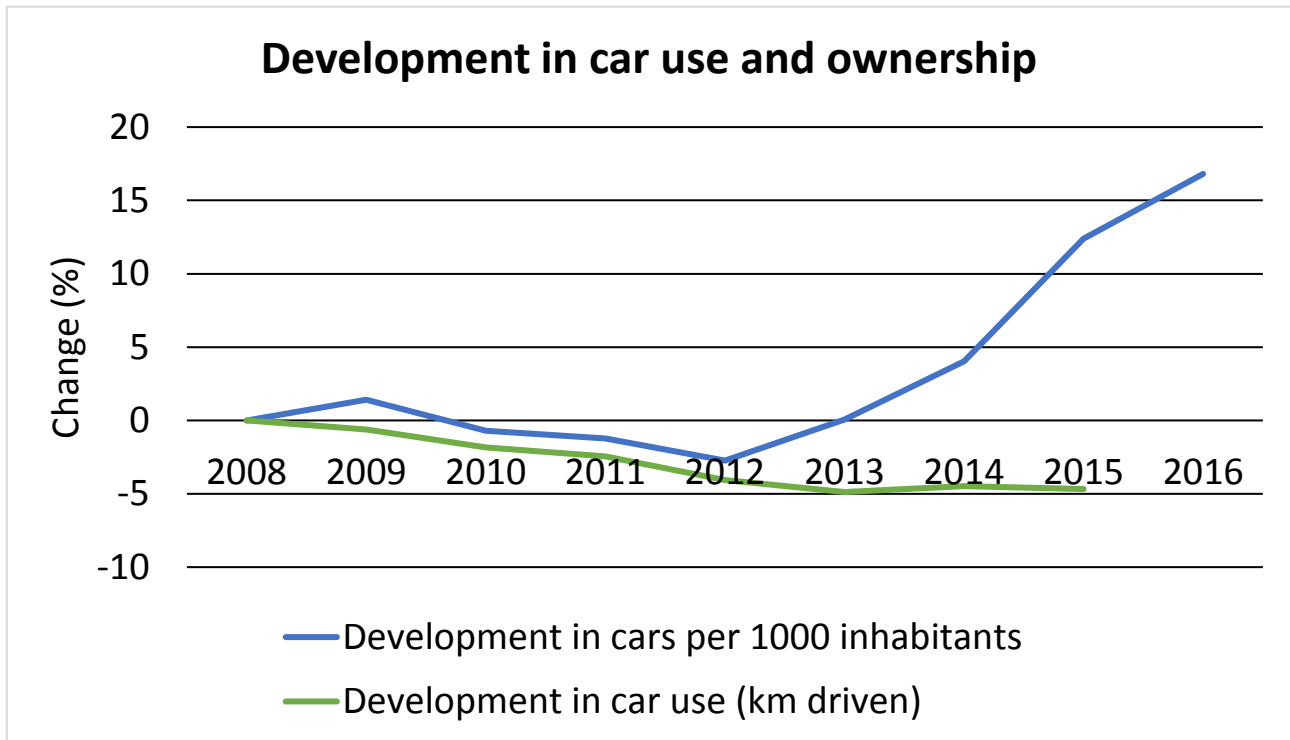


Figure 11 The percentage of change in car use and car ownership in recent years in Copenhagen. The graph is produced by data from Copenhagen municipality and Statistic Denmark (Danmarks Statistik 2017a; Danmarks Statistik 2017b; Teknik- & Miljøforvaltningen 2016).

The influence of context seems to suggest that there is not one good solution when using flexible parking norms but that several factors need to be combined. Independent solutions such as lowering the parking supply or implementing car sharing might not be effective if street parking is free or public transport is not provided. Flexible parking norms needs to be one of several policy instruments to enable a transition and decrease car use and car ownership among residents in new residential housing. The findings of this study suggest that for flexible parking norms to have an effect a holistic and systematic planning approach is needed. To my knowledge no systematic tool or approach combining parking policies, mobility management, public transport etc. exist on a city level. But in Stockholm municipality a new tool called the “mobility index” is being tested in a new residential development project in a part of the city. The purpose of the mobility index is to boost sustainable transport in the neighborhood. The index awards points to developers based on 5 mobility areas; walking, cycling, parking, freight and delivery, and mobility management measurements. Each developer has to achieve a minimum amount of points by implementing different measurements to build in the new area Norra Djurgårdsstaden. Points are awarded the developer if fewer parking lots are being build, if high parking costs are implemented, and if car sharing vehicles are easier to access than the parking facilities to private cars (Stockholm Stad 2015). The idea with a mobility index is to create a more holistic and systematic approach to transport planning in newly developed areas that the use of flexible parking norms never will secure on their own. However, the case study of *Fullriggaren* and *Porslinsfabriken* show that developing a sustainable neighborhood might

not succeed if the context in the surrounding city district is not taken into account. A more substantial policy tool that identify key contextual factors in the city district might therefore work as a more systematic approach in development of new housing. Such a tool could instead of assessing each residential development site, compare the new housing area to the context and the given goals of the city district. The role of flexible parking norms in such a policy approach and how they can be combined systematically with other policy tools enhancing sustainable transport in an area is a topic for future research.

7. Concluding remarks

Different types of flexible parking norms exist and their effect on residents' car use and ownership seem to differ. Despite the differences in the experiments with new flexible parking norms general tendencies are visible across the three Scandinavian cases. If flexible parking norms are to influence car use and ownership, it seems essential with a holistic parking planning where spill-over to free or abundant parking space in neighboring areas is not possible but also to facilitate the necessary alternatives for a life without a car. The analysis has shown that parking policy is just one tool in the planning for a sustainable transport system and that a holistic planning needs to be in place to create a change in car use and ownership. Proximity to services and public transport is essential for a life without a car. The distance to parking and unbundled parking with a high cost seems to be just as important, as a limitation of the supply of parking and access to car sharing ensured by flexible parking norms, to reduce car ownership and car use in new residential areas.

Reference list

- Abolhosseini, F. (2011) *Parkering i Ørestad er 35 gange så dyrt som i Indre By*, *Politiken*, 22 August, Available From: <http://politiken.dk/oekonomi/privatoekonomi/art5475017/Parkering-i-%C3%98restad-er-35-gange-s%C3%A5-dyrt-som-i-Indre-By> [01-03-2018].
- Andersson, M., Mandell, S., Thörn, H., B., & Gomér, Y. (2016) 'The effect of minimum parking requirements on the housing stock', *Transport Policy*, vol. 49, pp. 206-215.
- Antonson, H., Hrelja, R., & Henriksson, P. (2016) 'Parkeringsnormer för bostäder - Porslinsfabriken – ett exempel på samspelet mellan läge, kollektivtrafik och parkeringsutbud', *VTI rapport*, 881.
- Banister, D. (2008) 'The sustainable mobility paradigm', *Transport Policy*, vol. 15, pp. 73–80.
- Baptista, P., Melo, S., & Rolim, C. (2015) 'Car Sharing Systems as a Sustainable Transport Policy: A Case Study From Lisbon, Portugal', in Attard, M. & Shiftan, Y. (ed.) *Sustainable Urban Transport*, pp. 205-227, Emerald Group Publishing Limited.
- Barter, P. A. (2009) 'Three paradigms in parking policy and their relevance to Australian cities'. Paper presented for the 32nd Australasian Transport Research Forum (ATRF), Auckland, New Zealand, Oktober 2009.
- By & Havn, (n.d. a) *Copenhagen Growing – The story of Ørestad*, By & Havn, Copenhagen.
- By & Havn (n.d. b) *Ørestad på 5 minutter*, By & Havn, Available from: http://www.orestad.dk/orestad-fakta/5_minutter.aspx. [01-03-2018].
- By & Havn (n.d. c) *Parkering i Ørestad*, By & Havn, Available from: <http://www.orestad.dk/orestad-parkering.aspx>. [01-03-2018].
- By & Havn (2010) *Statistik vedr. Ørestad, Sluseholmen og Amerika Plads*, By & Havn, Copenhagen.
- Bygge & Teknik Forvaltningen (2000) *Lokalplan nr. 309 Ørestad City Nord*, Plan & Arkitektur, Københavns Kommune, Copenhagen.
- Carplus (2016) *Car clubs in London - Changing the way Londoners travel*, Carplus, Leeds, Available from: <https://www.carplusbikeplus.org.uk/wp-content/uploads/2017/03/Headlines-Carplus-Annual-Survey-of-Car-Clubs-in-London.pdf>. [01-03-2018].
- Center for byudvikling (2009) *Kapaciteten i den nuværende metro*, 2 September 2009, Teknik og Miljøforvaltningen, Københavns Kommune, Copenhagen, Available from: https://www.kk.dk/sites/default/files/edoc_old_format/OEkonomiudvalget/15-09-2009%2015.15.00/Referat/21-09-2009%2010.36.12/4820805.PDF. [01-03-2018].
- Center for Trafik og Byliv (2016) *Center Boulevard s.f. vejlands allé*, Teknik & Miljø Forvaltningen, Københavns Kommune, Copenhagen. Available from: http://kk.sites.itera.dk/apps/kk_trafik/pdf/tABOWOpJpl.pdf [01-03-2018].

- Center for Trafik (2010 a) *CENTER BOULEVARD syd for C.F.Møllers Allé*, Teknik & Miljøforvaltningen, Københavns Kommune, Copenhagen. Available from: http://kk.sites.itera.dk/apps/kk_trafik/pdf/TORu2PFr6v.pdf [01-03-2018].
- Center for Trafik (2010 b) *ØRESTADS BOULEVARD syd for C.F.Møllers vej*, Teknik & Miljøforvaltningen, Københavns Kommune, Copenhagen. Available from: http://kk.sites.itera.dk/apps/kk_trafik/pdf/v4wzfTA19O.pdf [01-03-2018].
- Center for Trafik (2014 a) *Ørestads Boulevard ud for husnr. 75 – Fodgængere*, Teknik & Miljø Forvaltningen, Københavns Kommune, Copenhagen. Available from: http://kk.sites.itera.dk/apps/kk_trafik/pdf/O1Dp2y5FKq.pdf [01-03-2018].
- Center for Trafik (2014 b) *Ørestads Boulevard ud for husnr. 55 - Fodgængere*, Teknik & Miljø Forvaltningen, Københavns Kommune, Copenhagen. Available from: http://kk.sites.itera.dk/apps/kk_trafik/pdf/RhX3wfNFoD.pdf [01-03-2018].
- Christiansen, P., Fearnley, N., Hanssen, U. J., & Skollerud, K. (2017) 'Household parking facilities: relationship to travel behaviour and car ownership' *Transportation Research Procedia*, vol. 25, pp. 4185–4195.
- COWI 2017, *Hvordan bruges p-pladserne i København*, 8 January 2017, Report to Københavns Kommune, Kongens Lyngby.
- Danmarks Statistik (2017a) *FOLK1A: FOLKETAL DEN 1. I KVARTALET EFTER OMRÅDE, KØN, ALDER OG CIVILSTAND*, Danmarks Statistik. Available from: <https://www.dst.dk/da/>. [01-03-2018].
- Danmarks Statistik (2017b) *BIL707: BESTANDEN AF KØRETØJER PR 1 JANUAR EFTER OMRÅDE OG KØRETØJSTYPE*, Danmark statistik. Available from: <https://www.dst.dk/da/>. [01-03-2018].
- Delebil Hertz (n.d.) *Delebilsordning i nybyggeri*, Delebil Hertz, Available from: <https://www.delebil.dk/nybyggeri/> [01-03-2018].
- DTU Transport (2014) *Faktaark om delebilisme i Danmark – DTU transportvaneundersøgelser*, DTU, Lyngby.
- Engel-Yan, J. & Passmore, D. (2013) 'Carsharing and Car Ownership at the Building Scale - Examining the Potential for Flexible Parking Requirements', *Journal of the American planning association*, Volume 79, 2013 - Issue 1.
- Envall, P. (2013) *Parkering i täta attraktiva städer – Dags att förändra synsätt*, Trafikverket, Borlänge. Available From: http://fudinfo.trafikverket.se/fudinfoexternwebb/Publikationer/Publikationer_001701_001800/Publikation_001730/Parkering_i_t%C3%A4ta_attraktiva_st%C3%A4der_100_599_WEBB.pdf [01-03-2018].
- Eriksen, C. H., Rønnov, G. D, De Jager, R. J., Mikkelsen, S. J., Isaksen, E. K., Madsen, K., & Hansen, W. S. (2017) *Peer-to-Peer Car Sharing – Transitional Pathway or Gateway Drug?* Student project, Master program Sustainable Cities, Aalborg University, Copenhagen.
- Finne, P. (2007) *Det Feksible Hus*, Byggeplads dk, Available From: <http://www.byggeplads.dk/byggeri/bolig/flexible-hus> [01-03-2018].

Flyvbjerg, B. (2006) 'Five Misunderstandings About Case-Study Research', *Qualitative Inquiry*, 12(2), pp. 219-245.

Garrett & Nielsen (2015), *Free float carsharing – the case of car2go in Copenhagen*, Master Thesis, Copenhagen University, Copenhagen.

Geels, F.W. 2004, 'From sectoral systems of innovation to socio-technical systems. Insights about dynamics and change from sociology and institutional theory', *Research Policy*, vol. 33, no. 6, pp. 897-920.

Guo, Z. (2013a) 'Residential Street Parking and Car Ownership' *Journal of the American Planning Association*, 79 (1), pp. 32-48.

Guo, Z. (2013b) 'Does residential parking supply affect household car ownership? The case of New York City', *Journal of Transport Geography*, vol. 26, pp. 18-28.

Haefeli, U., Matti, D., Schreyer, C., & Maibach, M. (2006) *Evaluation Carsharing. Final Report*. Study commissioned by the Bundesamt für Energie BFE, Switzerland.

Haustein, S. & Nielsen, T. A. S. (2015a) Deleøkonomi i transport: udvikling, trends og potentiale, DTU Transport, DTU, Lyngby.

Haustein, S. & Nielsen, T. A. S. (2015b) 'Delebilisme: nye koncepter, brugersegmenter og effekter', *Trafik & Veje*, vol. 92, no. 8.

Hanssen, J. U., Aretun, Å., Fearnley, N., Hrelja, R. & Christiansen, P. (2014) *Parkeringsnormer i utvalgte norske og svenske byer: Status og effekter på bilinnehav, adferd og økonomi*. Transportøkonomisk institut (TØI), Oslo.

Ison, S. & Mulley, C. (2014) 'Introduction', in Ison, S. & Mulley, C. (ed.) *Parking Issues and Policies*, Transport and Sustainability, Emerald Group Publishing Limited, vol. 5, pp. 1-9.

Jensen, M. (1997) *Benzin i blodet – Kvantitativ del*, Danmarks Miljøundersøgelser (DMU), Miljø- & Energiministeriet, no. 200.

Københavns Kommune (n.d.) *Socioøkonomisk Københavnerkort*, Københavns Kommune, Available from: <http://kbhkort.kk.dk/spatialmap?&profile=sociokort> [12.08.2017].

Københavns Kommune (n.d. a) *Betaling og priser for parkering i København*, Københavns Kommune, Available From: <https://www.kk.dk/indhold/betaling-parkering-i-k%C3%B8benhavn> [01-03-2018]

Københavns Kommune (2016), *Trafikken i København 2016*, Københavns Kommune, Copenhagen. Available from: https://www.kk.dk/sites/default/files/uploaded-files/trafikken_i_koebenhavn_2016.pdf [01-03-2018]

Københavns Kommune (2017a) *Status på de 5 strategiske erhvervsdistrikter*, Københavns Kommune, Copenhagen. Available from: <https://www.kk.dk/sites/default/files/edoc/e077d6ef-53d2-4d17-9af0-16fb26f59bcb/7758c080-766a-4c63-bde9-cae2c362e11b/Attachments/17561055-22547605-10.PDF> [01-03-2018].

Københavns Kommune (2017b), *Område 67 – optalt forår 2017*, Københavns Kommune, Copenhagen. Available from: http://kk.sites.itera.dk/apps/kk_trafik/pdf/xO5qAtIzWb.pdf [01-03-2018].

Liebling, D. (2014) 'Parking supply and demand in London', *Transport and Sustainability*, vol 5 , pp. 259-289.

Lundin, P. (1971) *Bilsamhället, ideologi, expertis och regelskapande i efterkrigstidens Sverige*, Stockholmia förlag, Stockholm.

Malmö Stad (n.d.) *FULLRIGGAREN – Malmös nya gröna*, Malmö Stad, Malmö. Available from: <http://malmo.se/download/18.29aeafd91411614c896d1ea/1491305468936/Fullriggaren+-+Malmös+nya+gröna+.pdf> [01-03-2018]

Malmö Stad (2014a) *Fullriggaren underlättar för grön mobilitet*, Malmö Stad, Malmö. Available From: http://malmo.se/download/18.12bec02c14db49ab84d9b93/1491305463925/Fullriggaren_mobilitet_150123.pdf [01-03-2018]

Malmö Stad (2014b), *Hållbara städer Malmö - Hållbar stadsutveckling Malmö från Öst till Väst – Slutrapport*, Malmö Stad, Malmö. Available from: <https://www.boverket.se/contentassets/a2867d766c554c57b3baf860a39c8e48/malmo-stad-Fullriggaren.pdf> [01-03-2018].

Malmö stadsbyggnadskontor (2017) *Västra Hamnen I siffror 2017*, Malmö Stad, Malmö. Available From: <http://malmo.se/download/18.268803ac15ee1ff99c711a4/1507207305425/V%C3%A4stra+Hamnen+i+siffror+2017.pdf> [01-03-2018].

Marsden, G. (2006) 'The evidence base for parking policies—a review', *Transport Policy*, 13 (6), pp. 447-457.

Martin, E., Shaheen, S. A., & Lidicker, J. (2010) 'Impact of carsharing on household vehicle holdings.' *Transportation Research Record:Journal of the Transportation Research Board*, 2143(1), pp. 150-158.

Metroselskabet (2015) *Passagertal per station*, Metroselskabet, Available From: <http://www.m.dk/#!/om+metroen/facts+om+metroen/statistik/passagertal/passagertal+per+station> [01-03-2018].

MOSES (2005) *Mobility services for urban sustainability. User Needs Report*, Work package 2.2, University of Bremen, Germany.

Newman, P. & Kenworthy, J. (2015) 'The Theory of Urban Fabrics: Understanding the End of Automobile Dependence, , in *The End of Automobile Dependence*, pp. 105-140 Island Press, Washington.

Parkering Malmö (n.d.) *Parkering Malmö Karta*, Pakering Malmö, Available From: <https://www.pmalmo.se/> [01-03-2018].

Pasternak, J. (2009) *Ørestadshuset*, Byggeplads dk, Available From: <http://www.byggeplads.dk/byggeri/bolig/oerestadshuset> [01-03-2018].

- Pernille Dreyer (2017), 'Beboere i Ørestad vil sagsøge København for 12.000-kroners parkering', *Berlingske Tidende*, 1 November, Available from: <https://www.b.dk/nationalt/beboere-i-oerestad-vil-sagsoege-koebenhavn-for-12.000-kroners-parkering>. [01-03-2018].
- Pohl, B. (2007) *Horisonten*, Byggeplads dk, Available From: <http://www.byggeplads.dk/byggeri/bolig/horisonten> [01-03-2018].
- Rasmussen, M. L. (2008) *Brohuset*, Byggeplads dk, Available From: <http://www.byggeplads.dk/byggeri/bolig/brohuset> [01-03-2018].
- Realdania By (2014) *Parkering og bykvalitet – Inspirationshæfte*, Realdania By, København V.
- Stadsbyggnadsnämnden (2014) *HÅLLBART RESANDE I VÄSTRA HAMNEN*, Malmö Stad, Malmö. Available From: <http://malmo.se/download/18.5bb0a05f145db1bc43d96ae/1491305011350/Hållbart+resande+i+Västra+Hamnen+%282014%29.pdf> [01-03-2018].
- Stadsbyggnadskontoret (2013) *Parkering i Fullriggaren - Enkätundersökning december 2012*, Malmö Stad, Malmö. Available From: <http://malmo.se/download/18.4fa44f6614775f9cff4d25ef/1491305561309/Unders%C3%B6kning+parkeringar%C3%B6sning+i+Fullriggaren+%282013%29.pdf> [01-03-2018].
- Schure, J., Napolitan, F. & Hutchinson, R. (2012) 'Cumulative Impacts of Carsharing and Unbundled Parking on Vehicle Ownership and Mode Choice', *Transportation Research Record: Journal of the Transportation Research Board*, Transportation Research Board of the National Academies, Washington D.C., no. 2319, pp. 96–104.
- Shoup, D. (2015) 'Putting a Cap on Parking Requirements', *Planning*, vol. 81 (5), pp. 28–30.
- Shoup, D. (2001) *The trouble with minimum parking requirements*, University of California Transportation Center, Los Angeles.
- Shoup, D. & Manville, M. (2010) *The price of unwanted parking*, University of California Transportation Center, Los Angeles.
- Sheller, M. & Urry, J. (2006) 'The New Mobilities Paradigm', *Environment and Planning*, vol. 38, no. 2, pp. 207-226.
- Sioui, L., Morency, C., & Trépanier, M. (2013). *How Carsharing Affects the Travel Behavior of Households: A Case Study of Montréal, Canada*, *International Journal of Sustainable Transportation*, 7(1), 52-69.
- Smith, T. (1983) 'Flexible parking requirements', *American Planning Association* (Planning Advisory Services Report Number 377), Chicago.
- Stockholm Stad (2015) *Mobilitetsindex – värdering av hållbart resande i Södra Värtan*, Stockholm Stad, Stockholm. Available From: <http://www.stockholm.se/> [01-03-2018].
- SWECO (2014) *Resvaneundersökning i Malmö 2013*, SWECO, Malmö. Available From: http://malmo.se/download/18.12e2278a148980ba13a41915/1491302595931/RVU2013_Malm%C3%B6_slutversion.pdf [01-03-2018].

Teknik- & Miljøforvaltningen (2016) *Københavns Miljøregnskab 2015*, Københavns Kommune, Copenhagen. Available From: <https://www.kk.dk/> [01-03-2018].

Trafikkontoret (2016) *Trafik- och resandeutveckling*, Göteborg Stad, Göteborg. Available From: <http://goteborg.se/wps/wcm/connect/866c6249-4a74-4d92-8d3b-36c7b89ca03f/Trafik+och+resandeutveckling+2016+WEBB.pdf?MOD=AJPERES> [01-03-2018].

Trafikverket (2012) *Utvärdering av effektsamband för bilpool*, Trafikverket.

Transportrådet (2002) *Parkeringspolitik i Ørestad - En ny måde at regulere parkering på*, København.

Trivector (2014) *Effekter av Sunfleet bilpool - på bilinnehav, ytanvändning, trafikarbete och emissioner*, Trivector Traffic, Lund. Available From: http://www.trivector.se/fileadmin/user_upload/Traffic/Rapporter/2014_84_Effekter_av_bilpool_v_1.1.pdf [01-03-2018].

Trivector, 2015, *Trafikeffekter av nya former av bilanvändning - Möjliga effekter i Stockholm*, Trivector Traffic, Lund. Available From: <https://insynsverige.se/documentHandler.ashx?did=1844447> [01-03-2018].

Weinberger, R. (2012) 'Death by a thousand curb-cuts: Evidence on the effect of minimum parking requirements on the choice to drive', *Transport Policy*, vol. 20, pp. 93-102.

Weinberger, R., Seaman, M., & Johnson, C. (2008) 'Suburbanizing the City: How New York City Parking Requirements Lead to More Driving', *Transportation Alternatives*, New York.

Wilson, R. (2013) *Parking reform made easy*, Island Press, Washington.

Wroblewski, M.S., Lyng Hansen, D., Booker Nielsen, M. & Buhl Simonsen, S. (2013) *Delebilisme - sundt, økonomisk og miljøvenligt? En evaluering af delebilisme i hovedstadsregionen*, Student Project, Roskilde University, Roskilde.

Yang, S. 2017, 'Beboere i Ørestad vil sagsøge København for dyr parkering', *TV Lorry*, 2 November, Available From: <https://www.tv2lorry.dk/artikel/beboere-i-oerestad-vil-sagsoege-koebenhavn-dyr-parkering> [01-03-2018].

Yin, R. K. (2009) 'Designing Case Studies: Identifying Your Case(s) and establishing the logic of your case study', in *Case study research: design and methods*, chapter 2, pp. 25-66, 4th edition, SAGE publications, California.

Ørestadsparkeringsforening (n.d) *Fair priser for parkering i Ørestaden*, Ørestadsparkeringsforening, Available From: <https://www.oerestadsparkeringsforening.dk/>. [01-03-2018].

Parking norms

Center for byudvikling (n.d.) *Parkering - Normer for bilparkering og cykelparkering*, Københavns Kommune. Available From: <https://kp15.kk.dk/artikel/parkering> [01-03-2018].

Frederiksberg Kommune (2017) *Kommuneplan 2017 – Hovedstruktur*, 19 June, Frederiksberg Kommune, Frederiksberg. Available From: http://soap.plansystem.dk/pdfarchive/11_3438208_1498549984931.pdf [01-03-2018].

Trafik & Veje (2013) *Retningslinjer for anlæg af parkeringsarealer*, Aarhus Kommune, Viby. Available From: <https://www.aarhus.dk/~media/Dokumenter/Teknik-og-Miljoe/Trafik-og-Veje/Parkering/Retningslinjer-for-anlaeg-af-parkeringsarealer-2012-web.pdf> [01-03-2018].

Aalborg Kommune (n.d.) Bilag F – Parkeringsnormer, Aalborg Kommune. Available From: <http://www.aalborgkommuneplan.dk/bilag/bilag-f0.aspx> [01-03-2018].

Odense Kommune (2016) *Kommuneplan 2016-2028 for Odense Kommune*, 22 June, Odense Kommune. Available From: http://soap.plansystem.dk/pdfarchive/11_3022573_1468394836538.pdf [01-03-2018].

Esbjerg Kommune (n.d.) *REGULATIV FOR PARKERING I INDRE BY*, Esbjerg Kommune. Available From: <http://www.esbjergkommune.dk/borger/bolig-byggeri-flytning/byggeri-og-grunde/parkeringsregulativ-for-esbjerg-indre-by-ribe-og-bramming.aspx> [01-03-2018].

Horsens Kommune (n.d.) *PARKERINGSNORM FOR PERSONBILPARKERING*, Horsens Kommune. Available From: <http://sektorplaner.horsens.dk/dk/parkeringsstrategi/handlingsplan/ny-parkeringsnorm-i-horsens-kommune/parkeringsnorm---personbil/> [01-03-2018].

Randers Kommune, (2017) *Kommuneplan 2017*, Randers Kommune, Randers. Available From: http://soap.plansystem.dk/pdfarchive/11_3154388_1498810053423.pdf [01-03-2018].

Vejle Kommune (2013) *Rammer for boligområder*, Vejle Kommune. Available From: http://vejle-kp13.cowi.webhouse.dk/dk/kommuneplan2013/by_erhverv/generelle_maal_og_rammer/generelle_maal_og_rammer_for_boligomraader/rammer_for_boligomraader.htm [01-03-2018].

Kolding Kommune (2017) *Rammer for lokalplanlægning*, Kolding Kommune, Kolding. Available From: https://www.kolding.dk/images/dokumenter/Borger/Planer_projekter/Kommunalplaner/Kommuneplan_2017-2029/Rammer_for_lokalplanlaegning_Forslag_til_kommuneplan_2017-2029.pdf [01-03-2018].

Stockholm Stad (2015) *Riktlinjer för projektspecifika och Gröna parkeringstal i Stockholm för bilparkering*, 19 oktober, Stockholm Stad, Stockholm.

Stadsbyggnadskontoret (2011) *VÄGLEDNING TILL PARKERINGSTAL VID DETALJPLANER OCH BYGGLOV 2011*, 31 Oktober, Göteborg Stad. Available From: https://goteborg.se/wps/wcm/connect/a89d9ba9-c93d-4f36-89a4-f4a1af9ee056/OPA_Vagledningparkstal.pdf?MOD=AJPERES [01-03-2018].

Malmö stadsbyggnadskontor (2010) *Parkeringspolicy och Parkeringsnorm för bil, mc och cykel i Malmö*, Malmö Stad, Malmö. Available From:

<http://malmo.se/download/18.4027ea8b12af75326fc80003818/1491301815368/Parkeringspolicy+och+parkeringsnorm+slutligt+f%C3%B6rslag+antagen+av+KF.pdf> [01-03-2018].

Plan- och byggnadsnämnden (2016) *Parkeringstal för Uppsala -Riktvärden för parkering på kvartersmark*, 27 Oktober, Uppsala kommun, Uppsala. Available From: https://www.uppsala.se/contentassets/1648921614f0416b9ad63c41ddc1dc66/parkeringstal_antagande-med-datum_utan-vattenstempel.pdf [01-03-2018].

Västerås Stad (2015) *Riktlinjer för parkering i Västerås*, 5 November, Västerås Stad, Västerås. Available From: <https://www.vasteras.se/download/18.5f819766152655444b513f/1453714658382/Riktlinjer+f%C3%B6r+parkering+beslutad+5+november+2015+layoutad.pdf> [01-03-2018].

Örebro kommun (2016) *Flexibla parkeringstal - Parkeringsnorm för Örebro kommun*, 4 February, Örebro Kommun, Örebro. Available From: <http://www.orebro.se/download/18.242f1fb1556288bfbf1814a/1467967586788/Flexibla+parkeringsstal.+Parkeringsnorm+f%C3%B6r+%C3%96rebro+kommun.pdf> [01-03-2018].

Linköpings Kommun (2012) *Parkering i planering och bygglov*, 15 February, Linköpings Kommun. Available From: <http://www.linkoping.se/contentassets/91ed37c8facc4bdfb98b220093a893cc/parkering-i-planering-och-bygglov-sbn-120215-bmn-120216.pdf> [01-03-2018].

Helsingborg Stad (2016) *Parkeringsnorm - för cykel och bil i Helsingborgs stad*, 20 September, Helsingborg Stad. Available From: https://styrning.helsingborg.se/wp-content/uploads/sites/53/2016/09/parkeringsnorm_2016.pdf [01-03-2018].

Jönköpings Kommun (2016) *Parkeringstal för Jönköpings kommun Riktlinjer för att anpassa nya fastigheters och stadsdelars parkeringsbehov till morgondagens resvanor*, 16 June, Jönköpings Kommun. Available From: https://www.jonkoping.se/download/18.56ac98861555437aa26b1f9/1467895766294/Parkeringstal_2016.pdf [01-03-2018].

Norrköpings Kommun (2011) *Riktlinjer för parkering i Norrköpings kommun*, Norrköpings Kommun. Available From: <http://www.norrkoping.se/download/18.3ef6b1d158f1bd46e11f345/1490350621799/Bilaga-5-Parkeringsriktlinjer-%28samradforslag%29.pdf> [01-03-2018].

Plan- og bygningsetaten (2017) *Revidering av parkeringsnormer for bolig, næring og offentlig tjenesteyting for Oslo kommune*, Oslo Kommune. Available From: <http://www.ohf.no/wp-content/uploads/2017/06/parkeringsnorm.pdf> [01-03-2018].

Bergen Kommune (2013) *BESTEMMELSER OG RETNINGSLINJER TIL KOMMUNEPLANENS AREALDEL 2010*, Bergen Kommune. Available From: https://www.bergen.kommune.no/bk/multimedia/archive/00184/Bestemmelser_og_ret_184189a.pdf [01-03-2018].

Stavanger Kommune (2014) *Kommuneplan 2014-29*, Stavanger Kommune. Available From: <http://www.stavanger.kommune.no/Documents/Kommuneplan/Kommuneplan%2014-29/Godkjent%20plan/Kommuneplan%202014-29%20trykkeversion.pdf> [01-03-2018].

Trondheim Kommune (2012) *Krav til parkering - veileder, Kommuneplanens arealdel 2012-2024, Vedlegg 15*, Trondheim Kommune.

Drammen Kommune (2014) *Pakeringsveileder*, Drammen Kommune. Available From: <https://www.drammen.kommune.no/Global/Arealdelen%20-%20kommuneplanen%202014%20-%202036/Vedlegg/17-Parkeringsveileder.pdf>

Porsgrunn Kommune (2015) *Kommuneplanens arealdel 2014-2025*, 26 March, Porsgrunn Kommune. Available From: <https://www.porsgrunn.kommune.no/PageFiles/3062/Planbestemmelser,%20Kommuneplanens%20arealdel%202014-2025.pdf> [01-03-2018].

Kristiansand kommune (2011) *Styrke i muligheter - Kommuneplan 2011-2022, Arealdelen*, Kristiansand Kommune.

Ålesund Kommune (2017) *Krav til parkeringsplasser*, Ålesund Kommune. Available From: http://www.alesund.kommune.no/aktuelt/144-trafikk-reiser-og-samferdsel/index.php?option=com_content&view=article&id=490:parkeringsvedtekter&catid=528&Itemid=1266#forhindre-u%C3%B8nsket-parkering-p%C3%A5-offentlige-veger-og-gater [01-03-2018].

Tønsberg Kommune (2016) UTFYLLENDE BESTEMMELSER OG RETNINGSLINJER, 3 Oktober, Tønsberg Kommune. Available From: <http://innsyn.v-man.no/tbg/wfdocument.ashx?journalpostid=2016065065&dokid=807659&versjon=1&variant=A&> [01-03-2018].